

# TNT 1130

## ◆ WORKSHOP MANUAL



Benelli





## Premise

This manual contains an introductory description of the Benelli TnT together with the procedures for control/intervention and revision of the main components.

Information considered generally noted is not included.

This manual will help you to understand the motorcycle better in order to provide the client with a rapid and trustworthy service.

- \* The present manual has been prepared on the basis of state-of-the-art specifications valid at the date of publication. In the case of modifications carried out after this date, differences may exist between the contents of the manual and the motorcycle under review.
- \* The illustrations in this manual are used to highlight the fundamental principles and procedures of basic interventions. They may not show exactly the motorcycle in your possession.
- \* This manual has been written for people who have the knowledge, the technical skill and the instruments, including the special, for servicing Benelli motorcycles. If you do not possess the necessary training and tools, have repairs made at an authorised Benelli concessionaire.



### ATTENTION

Inexpert mechanics or those lacking appropriate instruments and apparatuses may not be able to carry out the operations described in this manual. Incorrect repairs can cause damage to the mechanic and render the motorcycle unsafe for the driver and passenger.





## Introduction

### SYMBOLS

The symbols listed below are all present inside the manual and serve to show those parts which need to be given special attention.



**ATTENTION** - Be aware that you will find death or serious injury, in case the instructions are not observed.



**WARNING** - Possibility of lesions in case the instructions are not observed.

**NOTE** - The aim of this message is trying to avoid any damages to the vehicle, things or environment.



**OILING** - Indicates the type of oil to use.



**TIGHTENING** - Indicates the correct tightness value to carry out.



**SPECIFIC VALUE** - indicates the specific value using precision instruments.



**SPECIFIC INSTRUMENTS** - indicates the specific instruments to use.





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## General Information

### 1 GENERAL INFORMATION

#### ATTENTION/WARNING/NOTE

Read carefully the manual and follow the instructions. To underline special information, the symbols and the words ATTENTION, WARNING and NOTE have specific meanings. Pay particular attention to the messages underlined with the following words and the corresponding signal.



*Shows a possible danger which could cause death or injury.*

#### NOTE:

**Show a particular information which simplifies the maintenance or makes the instructions clearer.**

Please note, that in any case the warnings contained in this manual can not cover all the possible risks concerning the reparation or the missed maintenance of the motorbike. Exceeding the mentioned ATTENTIONS it is necessary to apply the personal judgment and the fundamental principles of safety.

#### GENERAL PRECAUTIONS



- \* Correct maintenance and reparation procedures are important for the mechanic's safety and for the motorbikes safety and reliability .
- \* In case more persons work together, pay attention to the reciprocal safety.
- \* In case it is necessary to start the motor inside a workshop, take care that the exhaust gases are conveyed outside.
- \* When you use toxic or inflammable materials, take care that the working area is well ventilated and follow all the instructions of the material's manufacturer.
- \* Never use petrol as a solvent for cleaning
- \* To avoid burns, do not touch the motor, the motor oil, the COOLER and the exhaust system before they are completely cold.
- \* After an intervention on the fuel system, the oil-circuit, the refrigerant liquid circuit, the exhaust system and the brake system, verify the absence of losses in all the circuits and the accessories connected with the system.





**! WARNING**

- \* In case it will be necessary to replace parts, only use Benelli original spare parts or their equivalents
- \* In case of disassembly of parts to be used again, dispose them in a tidy way in order to reassemble them in the right way and in the correct position.
- \* Be sure to use special tools, when it is required.
- \* Be sure that all the parts to be reassembled are clean. Lubricate at the indicated points.
- \* Use the suggested lubricants, adhesives and sealings.
- \* In case of battery disassembly, first disconnect the positive clamp and then the negative one and replace the CHAP. on the positive clamp.
- \* In case of intervention on the electric parts, if the procedures do not require the use of battery energy, disconnect the negative clamp.
- \* When tightening the bolts and nuts of the cylinder head and the carter, start from the biggest ones. Always screw bolts and nuts diagonally starting from the centre and tighten to the indicated torque.
- \* If you remove oil seals, sealings, O-ring, security washers, self-locking nuts, cotters, elastic rings, and other specified parts, be sure to replace them with new parts. Moreover, before assembling the new parts, remove probable residual material of the contact surfaces.
- \* The elastic rings must not be used a second time. During the installation of a new ring, pay attention to avoid opening the extremities more than necessary to make it sliding on the shaft. After the assembly, always verify it is well fitted in the groove and properly assembled.
- \* Use a torque key to tighten the fixing elements to the mentioned torque. Clean dirty threads from oil and grease.
- \* After assembling verify the tightness and function of the parts.

- \* To respect the environment do not dispose used motor oil and other polluting liquids, batteries and pneumatics illegally.
- \* To protect the environment and natural resources, dispose the motorbike and spare parts in a proper way.





## 1.1 VEHICLE IDENTIFICATION

The identification data are:

- 1) Frame number [on steering casing].
- 2) Number of engine on lower crankcase
- 3) Homologation data [on frame].

## 1.2 IMPORTANT INFORMATION

### • REMOVAL AND DISMANTLING

1. Before carrying out dismantling operations, remove eventual dirt, mud, dust and foreign bodies.
2. Use appropriate instruments and cleaning products exclusively. Refer to the "SPECIAL INSTRUMENTS" paragraph.
3. During dismantling, avoid separating the coupled components, including cylinders, pistons, gears and other parts that have become "coupled" during normal wear. The coupled components must always be re-used or changed without separating them.
4. During dismantling, clean all the components and place them in a bowl, following the order of dismantling.  
This will make the re-mounting operation easier and allow a correct installation of all the components.
5. Keep all the components away from any source of heat.

### • SPARE PARTS

Use original Benelli spare parts exclusively.

Use oils and greases recommended by Benelli to oil the components.

Other products might appear similar in look and function but are inferior in quality.







- **WASHERS, O-RINGS AND OIL SEAL**

1. During the revision of the engine, change all the washers, O-rings and seals. The surfaces of the washers and O-rings, and the lips of the oil seals must be cleaned.
2. Oil all the coupled components and the ball-bearings and grease the lips of the seals, when remounting.

- **ELASTIC SAFETY WASHERS/PLATES AND SAFETY PINS**

After removing, change all the elastic safety washers and safety pins. After tightening the bolts or nuts, bend the tongues of the safety washers/plates and the ends of the safety pins on a flat surface of bolts or nuts.

- **BALL-BEARINGS AND OIL SEALS**



**WARNING:**

*Do not rotate the compressed air ball-bearings as this might damage their surfaces.*

1. Install the ball-bearings and the oil seals so that the Producer brand or data are visible. At the moment of installing the oil seal, oil the lip with a slight layer of grease. The ball-bearings rotate freely if oiled in an appropriate way.

### **1.3 SPECIAL INSTRUMENTS**



**WARNING:**

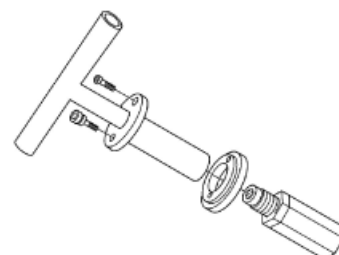
*To avoid errors in ordering the special instruments, refer exclusively to the inherent code.*

For correct maintenance and a perfect set-up use the BENELLI special instruments, avoiding damage as a result of inadequate or technically improvised instruments.

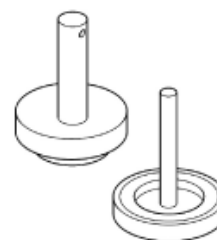


### 1.3.1 SPECIAL ENGINE INSTRUMENTS

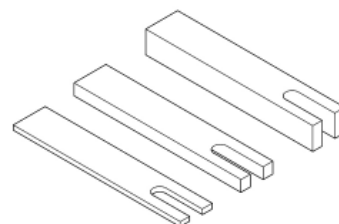
1. *R180197015000*  
GONIOMETER PLUG FOR  
DISTRIBUTION[\*]



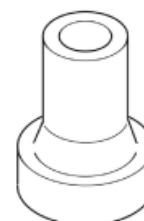
2. *R180197017000*  
INSTRUMENT FOR MOUNTING  
CLUTCH OIL SEAL CASING [\*]



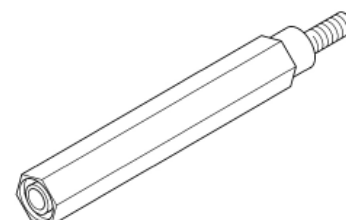
3. *R180197018000*  
CYLINDER MOUNTING SPACERS  
[\*]



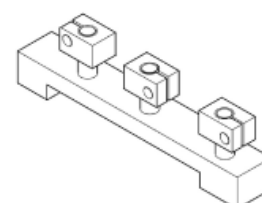
4. *R180197019000*  
SMALL CYLINDER COLUMN  
FIXING SPAN



5. *R180197020000*  
FALSE SPARKING-PLUG



6. *R180197021000*  
PISTON THREAD MEASURER





**7. R180197022000**  
**P.M.S. MEASURER**

**8. R180197023000**  
**CLUTCH COVER OIL SEAL PAD [\*]**

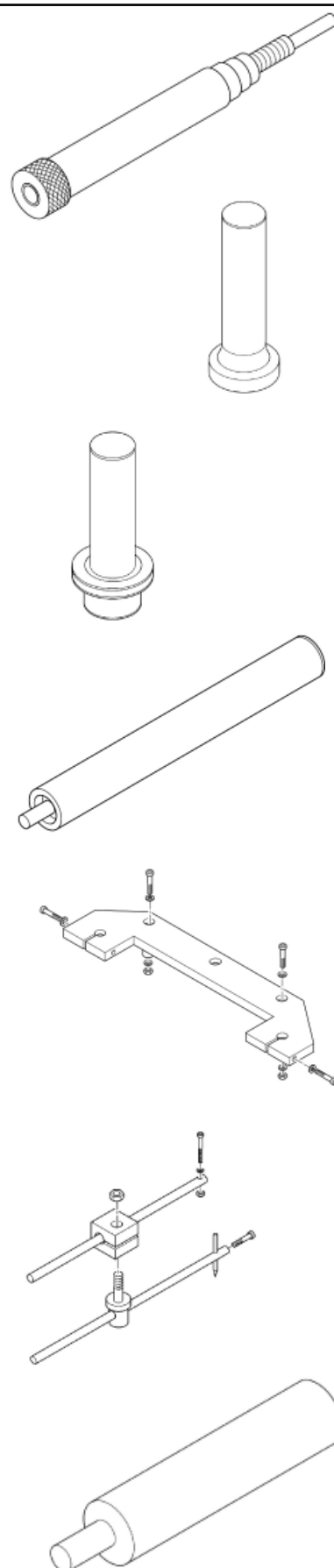
**9. R180197024000**  
**OIL SEAL PINION PAD [\*]**

**10. R180197025000**  
**OIL SEAL VALVE PAD [\*]**

**11. R180197026000**  
**INSTRUMENT FOR CHECKING  
VALVE LIFT**

**12. R180197027000**  
**GONIOMETER INDICATOR**

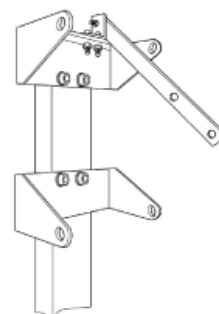
**13. R180197028000**  
**CLUTCH OIL SEAL PAD ON  
FLANGE [\*]**



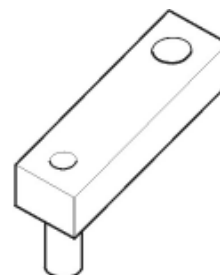


**TNT**

**14. R180197029000**  
**ENGINE SUPPORT**



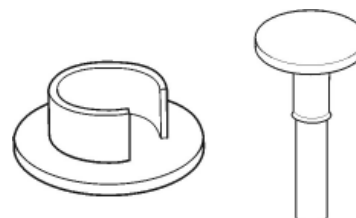
**15. R180197030000**  
**INSTRUMENT FOR CHECKING**  
**ENGINE SHAFT**  
**AXIAL PLAY**



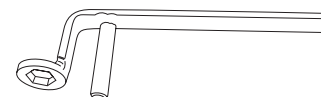
**16. R180197036000**  
**ENGINE MANAGEMENT**  
**DIAGNOSTIC**  
**INSTRUMENT [\*]**



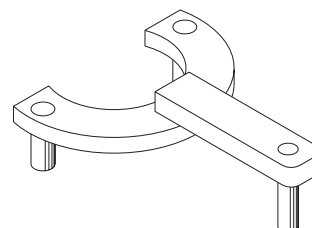
**17. R180100143000**  
**RAPID RELEASE PETROL TUBE**  
**KIT [\*]**



**18. R180297130000**  
**CLUTCH REGULATION KEY**

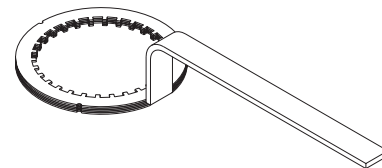


**19. R180297048000**  
**DISMANTLING PINION**  
**INSTRUMENT**





**20. R180297047000**  
**DISMANTLING CLUTCH**  
**INSTRUMENT**



### 1.3.2 SPECIAL FRAME INSTRUMENTS

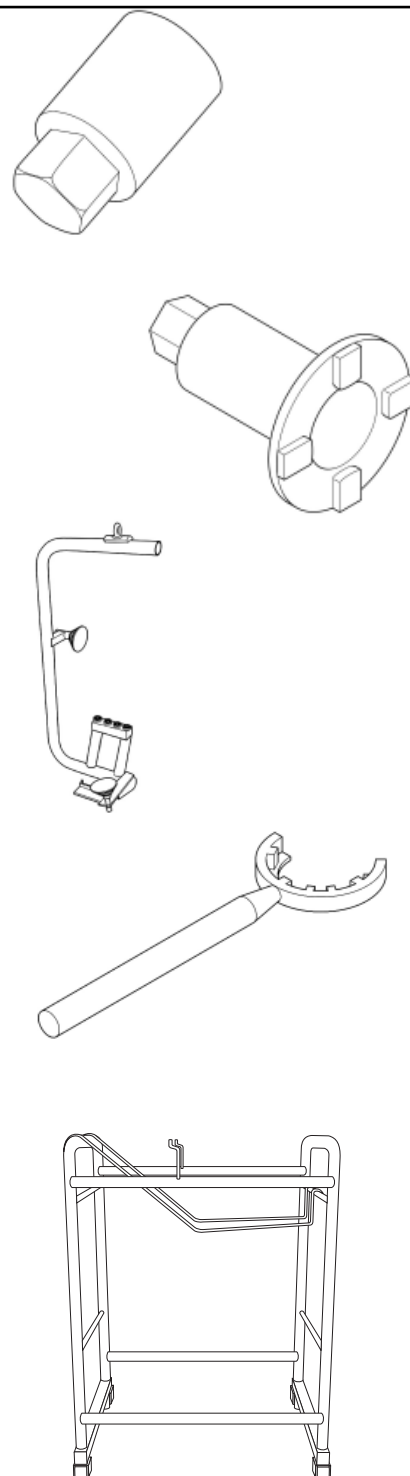
**1. R180197033000**  
**20 ALLEN WRENCH [\*]**

**2. R180197031000**  
**STEERING RING-NUT CLAMPS [\*]**

**3. R180197034000**  
**ENGINE DISMANTLING INSTRUMENT[\*]**

**4. R180197032000**  
**ENGINE SHOULDER ADJUSTMENT CLAMPS [\*]**

**5. R180297049000**  
**COWLING SUPPORT TROLLEY**

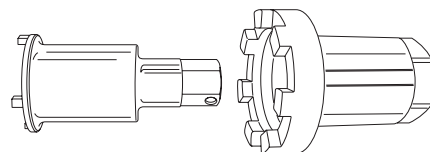




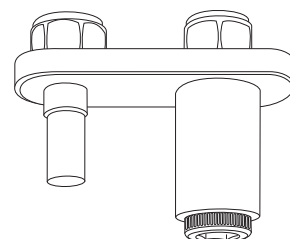


**TNT**

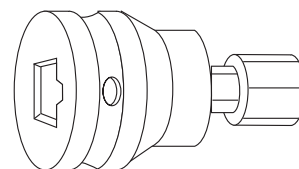
**6. R180297129000**  
**RING NUT REGULATION KEY**  
**AND STEERING LOCK NUT**



**7. R300097147000**  
**CHAIN REGULATION TOOL**



**8. R300097146000**  
**DISASSEMBLY TOOL**  
**STEERING PLATE**



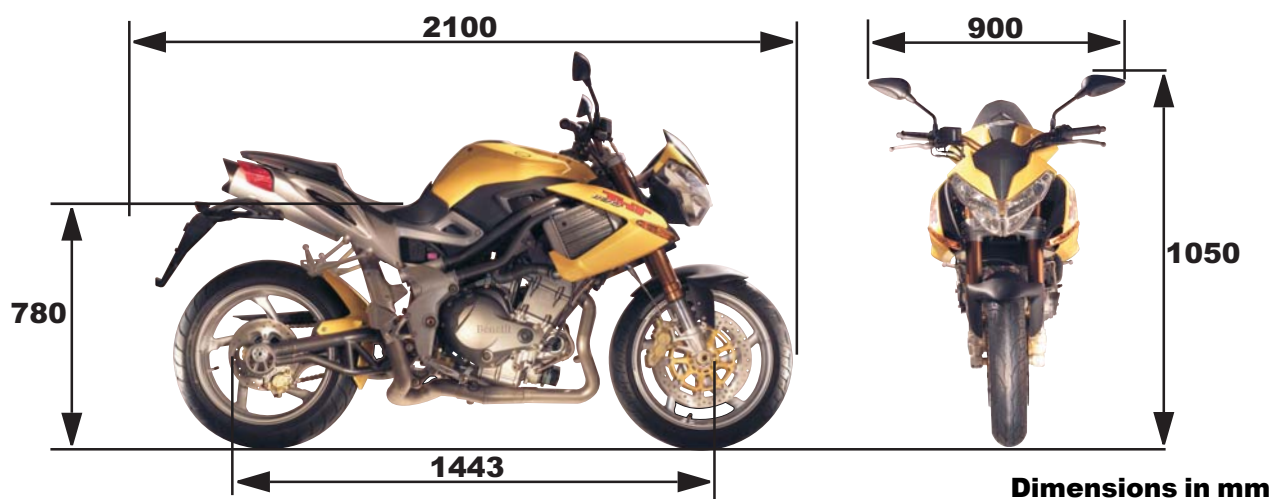




## Specifications

### 2 SPECIFICATIONS

#### 2.1 GENERAL SPECIFICATIONS



DIMENSIONS	STANDARD	LIMITS
Engine length	2100 mm	—
Engine width	900 mm	—
Maximum height	1050 mm	—
Wheelbase	1443 mm	—
Minimum light	100 mm	—
Saddle height	780 mm	—
Weight with oil and full tank	215 kg	—
Weight without oil and full tank	205 kg	—
Maximum load with pilot and load	400 kg	—





## 2.2 TECHNICAL CHARACTERISTICS: ENGINE

ENGINE	
Type	Three four-stroke cylinders in line
Bore	88 mm
Stroke	62 mm
Total displacement	1130 cm <sup>3</sup>
Compression ratio	11,2:1 ± 0,5;1
Max. power at shaft [95/1/EC]	101 kw / 135 cv at 10500 rpm reduced for foreign countries 72 kw / 98 cv
Minimum rotation at full speed	1350 rpm
Maximum at full speed	9500 rpm
Distribution	At 4 valves per 00HC cylinder
Valves	Suction valve diameter: 33 mm Exhaust valve: 29 mm
Distribution diagram [observed data with 1 mm play]	Suction valve opening before P.M.S.: 21° Suction valve closing after P.M.I.: 42° Exhaust valve opening before P.M.I.: 38° Exhaust valve closing before P.M.S.: 21°
Valve lift [observation data with play of 0 mm]	Suction: 0,75 mm Exhaust: 8,75 mm
	The functioning play of the tappets with the engine cool must be: Suction: 0,30-0,35 mm Exhaust: 0,35-0,40 mm
Transmission	Multiple disks oil bath friction: commanded by a cable activated by a lever on the left side of the handlebar. Transmission between engine and primary shaft of the gear-box by straight- toothed gears. Mechanisms of selecting the gears with drum and forks. An articulated lever commands the rotation of the drum. 6 gear gearbox.
	Primary ratio: 44/79 [1:1.795]
	Ratio pinion/crown: 16/36 [1:2.25]
Total ratios:	First gear: 14/39 Second gear: 18/35 Third gear: 21/32 Fourth gear: 22/30 Fifth gear: 24/28 Sixth gear: 25/27





OILING/COOLING	
Oiling	Humid housing with trochoidal circulation pump, opening pressure of the oil circuit valve, 6.5 bar.
Engine oil quantity	With filter: 4.0 l about Without filter: 3.8 l about
Cooling	Liquid, closed pressured circuit with radiator, thermostat and radiator oil air cooling. A centrifugal pump commanded by gears on the primary gearbox shaft circulates the liquid and an expansion tank recovers the thermal expansion of the cooling liquid.
Water radiator capacity.	3.0 l about
Oil radiator capacity.	300 cc.





## 2.3 FRAME CHARACTERISTICS

FRAME	STANDARD	LIMITS
Type	Mixed steel-aluminium frame and structure	
Angle of incidence	24,50°	—
Forward stroke	103,7 mm	—

FRONT WHEEL	STANDARD	LIMITS
Type	Cast	—
Rim	Dimensions: 17 x MT3.50 Material: aluminium	
Wheel span	120 mm	—

REAR WHEEL	STANDARD	LIMITS
Type	Cast	—
Rim	Dimensions: 17 x MT6.00 Material: aluminium	
Wheel span	120 mm	—

FRONT TIRE	STANDARD	LIMITS
Type	Tubeless	—
Dimensions	120/70 ZR17 (58W)	—
Model	D207 F RR	—
Tire pressure cold	250 kPa (2.5 kg/cm, 2.5 bar)	—
Maximum pneumatic pressure	250 kPa (2,5 kg/cm, 2,5 bar)	—
Minimum depth tread	—	1,6 mm





REAR TIRE	STANDARD	LIMITS
Type	Tubeless	—
Dimensions	190/55 ZR17 (73W)	—
Model	D207 RR	—
Tire pressure cold	250 kPa (2,5 kg/cm, 2,5 bar)	—
Maximum tire pressure	250 kPa (2,5 kg/cm, 2,5 bar)	—
Min. depth tread	—	2,0 mm

FRONT BRAKES	STANDARD	LIMITS
Type	Double disk	—
Brake liquid advised	DOT 4	—
Brake disks Diameter x thickness: Min. thickness: Max. deformation:	320 x 4.5 mm — —	— 4.0 mm 0.1 mm
Thickness brake pads	4.5 mm	0.5 mm
Internal cylinder pump diameter	15 mm	—
Internal cylinder clamps diameter	34 mm	—

REAR BRAKES	STANDARD	LIMITS
Type	Single disk	—
Brake liquid advised	DOT 4	—
Brake disks Diameter x thickness: Min. thickness: Max. deformation:	240 x 5 mm — —	— 4.5 mm 0.1 mm
Thickness brake pads	4.3 mm	0.5 mm
Internal cylinder pump diameter	12 mm	—
Internal cylinder clamps diameter	32 mm	—





FRONT SUSPENSION	STANDARD	LIMITS
Type	Telescopic fork with upturned stems	—
Type of front fork	Helical spring/damper oil	—
Front fork stroke	120 mm	—
Spring Spring rate (K1): Spring stroke (K1):	9.5 N/mm 0 ~ 120 mm	— —
Oil advised	SAE 7,5 Marzocchi 19	—
Quantity for stems	710 cc.	—

BAC K SUSPENSION	STANDARD	LIMITS
Type	Oscillating fork	—
Back suspension type	Helical spring/damper gas	—
Back stroke fork	115 mm	—
Spring Spring rate (K1): Spring stroke (K1):	90 N/mm 62 mm	— —
Optional spring available	no	—
Gas/air pressure preload spring	1200 kPat (12 kgf/cm <sup>2</sup> )	—
Adjustment preload spring positions	18 mm	—





OSCILLATING ARM	STANDARD	LIMITS
Free play (at the end of the arm)		
Radial	—	1 mm
Axial	—	1 mm

TRANSMISSION CHAIN	STANDARD	LIMITS
Model:	REGINA 137-ORPB	—
Connection quantities	110	—
Play of the chain	30 ~ 40 mm	—

## 2.4 ELECTRICAL CONNECTIONS

COMPONENTS	STANDARD
Plant tension	12V
Cooling liquid temperature sensor Model: Resistance:	16 TT (JCI) 2500 $\Omega$ at 20°C / 322.5 $\Omega$ at 80°C
Engine control system	VALBRO TDD
Relay group Safety relay Dazzle/anti-dazzle light Ignition relay:	CM1 (NAIS) 12V h.o. 01RA001 (JCI) h.o.
Injector type:	U9122-357 (JCI)
Pick-up type:	01VR001 (JCI)
Engine stepper model: Type:	028M001 (JCI) bi-phase
Ignition coils Model: Primary coil resistance: Secondary coil resistance: Primary coil inductance: Secondary coil inductance: Max. admissible current value:	02IG001 (JCI) 0.6 $\Omega$ 10 K $\Omega$ 2.5 mH (1 kHz 0.3V) 23.5 mH (1 kHz) 7.6 A
Throttle valve sensor Standard resistance:	BMW 13631721456 1,2 k $\Omega$ $\pm$ 20%





COMPONENTS	STANDARD
Loading system Type: Model: Nominal exit:	AC magnet 5-101211-502-1 (DENSO) 13.5V / 48A at 5000 rpm
Tension adjustment (in the alternator) Type: Voltage adjustment:	Semiconductor, FIELD CONTROL 14.5 ± 0.3V (at 5000 rpm, 10A and 25°C)
Battery	YUASA YTZ 14 S
Electrical start system Model: Power:	5-128-330 (DENSO) 0.7 kw
Starter relay Model: Amperage: Coil resistance:	MS5F - 421 (JIDECO) 100A 4.4 Ω at 20°C
Horn Model: Max. amperage:	AB1242/262 O.S.C. 1.5A
Direction indicator relay: Model: Type: Flashing frequency: Wattage:	70.016.70.001.4 Full-transistor 60 ~ 120 rpm (10W+10W+2W) x2
Oil pressure sensor	285520-10 (BITRON)
Fuel pump Model: Max. amperage: Level sensor: Min. resistance: Max. resistance:	BITRON 5A max. at 13.5V in the fuel pump 285 Ω (tank empty) 21 Ω (tank full)
Stand switch (model)	CE75A (ASAHI DENSO)
Radiator fan (model)	VA46-A101-46 S (SPAL)
Neutral Switch	11720.3 (F.M.D.I.)
Speed sensor	23-038/1 (EUROSWITCH)
Air temperature sensor Model: Resistance:	ISTT (JCI) 23.75 Ω at 20°C 19.48 Ω at 25°C 16.07 Ω at 30°C



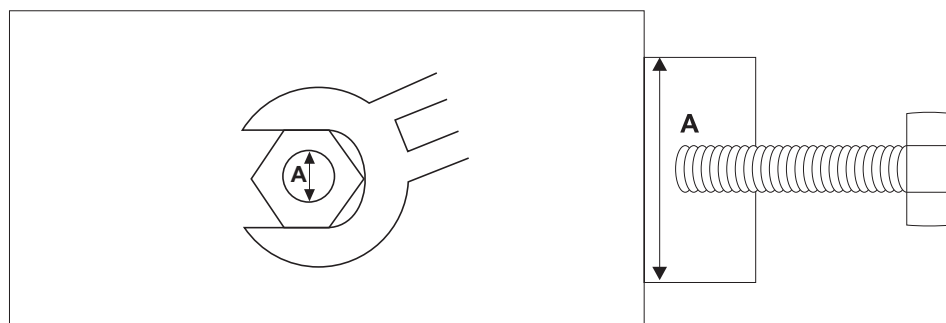


## 2.5 BOLT TORQUE

### 2.5.1 GENERAL BOLT TORQUE

The bolt torques are inserted in the chapters of the manual together with the relative special instructions, if necessary.

If not otherwise specified, the bolts are considered with greased thread, created at environmental temperature.



	A	BOLT TORQUES	
		Nm	kgf·m
1	4 mm	2,3	0,23
2	5 mm	4,5	0,45
3	6 mm	10	1,0
4	8 mm	25	2,5
5	10 mm	45	4,5
6	12 mm	80	8,0
7	14 mm	130	13,0
8	16 mm	200	30,0
9	18 mm	240	24,0





## 2.5.2 BOLT TORQUE FRAME

DESCRIPTION	THREAD	TORQUE (Nm)
<b>ENGINE GROUP:</b>		
ENGINE ON BACK FUSION PLATE RIGHTHAND FRAME WITH LEFTHAND NUT	M12	40
ENGINE SUPPORT ROD ON ENGINE HEAD	M10	40
RIGHTHAND ENGINE ON LOWER CROSSBAR LOWER ENGINE CRANKPIN THROUGH FRAME WITH NUT	M12	40
LOWER CRANKPIN HEAD TORQUE ENGINE ON LOWER FRAME CROSSBAR (CLAMP)	M6	8
ENGINE HEAD ON RIGHTHAND FRAMEWORK WITH NUT	M12	40
RIGHTHAND ENGINE FIXING SCREW HEAD TORQUE ON FRAMEWORK (CLAMP)	M6	10
RIGHTHAND ENGINE HEAD ON LEFTHAND FRAMEWORK WITH NUT	M12	40

<b>FRAME GROUP:</b>		
STEERING FERRULES TORQUE ON LOWER AND UPPER SADDLE POSTS	M8	25
ENGINE FRONT SUPPORT ROD ON STEERING SADDLE POST WITH NUT	M10	40
REAR FORK FERRULES TORQUE ON THE SADDLE POSTS	M8	10
FIXING STEERING WHEEL BLOCK ON FRAME	M6	





<b>SADDLE PILLAR GROUP:</b>		
BACK FRAME	M8	25

<b>HANDLEBAR GROUP COMMANDS:</b>		
FRONT BRAKE PUMP	M6	10
HANDLEBAR CLUTCH LEVER	M6	5
HANDLEBAR PLATE FIXING	M8	18

<b>PEDAL GROUP COMMANDS:</b>		
PILOT FOOTBOARD ON FRAME SUPPORTS	M8	22
GEAR TORQUE COMMAND ON SHAFT	M6	10
DRIVING GEAR ROD ON GEAR COMMAND WITH NUT	M6	10
DRIVING GEAR ROD ON GEAR PEDAL WITH NUT	M6	10
PEDAL BEAT SPRING PIVOT	M5	6
UPPER BRAKE PEDAL SUPPORT	M8	22
LOWER BRAKE PEDAL SUPPORT	M6	10
GEAR COMMAND ON FOOTBOARD SUPPORT	M8	22
BRAKE PUMP ROD GROUP ON BRAKE PEDAL WITH NUT	M6	10





REAR FORK GROUP:		
REAR FORK CRANKPIN SCREW ON REAR FORK CRANKPIN	M18	65
LOWER CHAIN GLIDING SHOE FORK	M4	-
UPPER CHAIN GLIDING SHOE FORK	M6	8
CENTRAL CHAIN GLIDING SHOE FORK	M6	8
FERRULES FOR ASSEMBLY STAND ON REAR FORK	M8	25

FRONT SUSPENSION GROUP:		
FERRULE STEMS ON STEERING BASE	M6	10
FERRULE STEMS ON STEERING HEAD	M8	22
FERRULE HUBS ON FRONT WHEEL CRANKPIN	M8	30
FRONT MUDGUARD SUPPORTS ON FORKS	M5	6
BRAKE CLAMP SUPPORTS ON FORKS	M10	50

REAR SUSPENSION GROUP:		
DAMPER ON FORK WITH NUT (UPPER MOUNT)	M10	35
DAMPER ON ROCKER ARM WITH NUT (LOWER MOUNT)	M10	35
REAR SUSPENSION RODS ON REAR FORK WITH NUT	M10	35
ROCKER ARM ON FRAME	M10	45

FRONT WHEEL GROUP:		
FRONT WHEEL CRANKPIN SCREW	M18	60
FRONT BRAKE DISKS ON WHEEL	M8	25





REAR WHEELGROUP:		
REAR WHEEL CRANKPIN NUT	M24	80
CROWN ON FLEXIBLE COUPLING FLANGE	M10	45
REAR BRAKE DISK ON WHEEL	M8	25
SPEED SENSOR ON CLIP SUPPORT	M5	6

LATERAL ASSEMBLY STAND GROUP:		
HANGER SUPPORT PLATE ON FRAME	M10	35
HANGER CRANKPIN ON FRAME	M10	35
SPRING HOOK ON HANGER	M6	10

ELECTRIC PLANT GROUP:		
INERTIAL SWITCH ON FILTER BOX	M6	1.5
AIR SENSOR ON FILTER BOX	M10	8

COOLING PLANT GROUP:		
LATERAL RADIATOR BOX ON SADDLE PILLAR	M6	3
UPPER FRONT RADIATOR BOX RADIATOR ON SADDLE PILLAR	M6	10
RADIATOR BOX COVER ON BASE	M4	1 1
RADIATOR BOX FASTENINGS THREADS	M6	4
UPPER COVER RADIATOR BOX FASTENINGS	M4	1
LOWER COVER RADIATOR BOX FASTENINGS	M4	1
EXPANSION TANK ON FRAME	M6	3
COOLER FANWHEEL	M6	3
RIGHT WATER COOLER SUPPORT ON FRAME	M6	10
RIGHT WATER COOLER SUPPORT ON COOLER	M6	10
LEFT WATER COOLER SUPPORT ON FRAME	M6	10
LEFT WATER COOLER SUPPORT ON COOLER	M6	10
OIL COOLER SUPPORT ON FRAME	M6	10
OIL COOLER SUPPORT ON COOLER	M6	-





FRONT BRAKING PLANT GROUP:		
PUMP FRONT BRAKE ON HANDLEBAR	M6	10
FRONT BRAKE CLIPS ON RELATIVE SUPPORTS	M10	50
HYDRAULIC CONNECTIONS ON FRONT BRAKE PUMP AND CLIPS	M10	15

REAR BRAKING PLANT GROUP:		
REAR BRAKE PUMP ON RIGHT FOOTBOARD SUPPORT WITH NUT	M6	10
REAR BRAKE CLIP ON SUPPORT	M8	22
HYDRAULIC CONNECTION ON REAR BRAKE CLIP	M10	15
HYDROSTOP ON REAR BRAKE PUMP	M10	15
REAR BRAKE OILTANK ON EXPANSION VASE	M5	4

EXHAUST PLANT GROUP:		
EXHAUST COLLECTORS ON ENGINE HEAD	M8	13
SILENCER SUPPORT ON SADDLE PILLAR	M8	25
SILENCER ON SUPPORT	M10	45
RIGHT "3 IN 1" TUBE SUPPORT PLATE ON FRAME	M6	10
FIXING "3 IN 1" ON SUPPORT PLATE	M10	45

SUPPLY PLANT GROUP:		
COVER ON FILTER BOX	M5	3
FILTER BOX ON STEERING SADDLE POST	M6	10
AIR GUIDE BOX ON FILTER HOUSING	M6	10





PETROL PUMP ON TANK	M5	3
PETROL TUBE ON THROTTLE BODY	M12	25
DISTRIBUTOR ON PLATE	M5	4
GAS CABLES FIXING PLATE ON THROTTLE BODY	M6	10

#### FRONT AND BACK BODYWORK GROUP:

USE STANDARD TIGHTENING TORQUE WITH M6 THREAD FOR BODYWORK: 8Nm±20%





### 2.5.3 BOLT TORQUE ENGINE

DESCRIPTION	THREAD	BOLT TORQUE (Nm)
<b>ENGINE CRANKCASE GROUP:</b>		
CRANKCASE TEF FIXING SCREW	M6	10
CRANKCASE FIXING SCREW	M8	2.5
CRANKCASE BANKS TCEI FIXING SCREW	M10	45
OIL CONDUIT CLOSURE CONICAL DOWEL	M8	10
BALL-BEARING AND CRANKPIN FIXING SCREW	M6	10
SMALL PLATES AND TUBE FIXING SCREW	M6	10
CYLINDRICAL CAP	M6	25
CYLINDRICAL CAP	M6	10
OIL DIAPHRAGM	M10	25
NEUTRAL POSITION SENSOR	M8	10
MIN. OIL PRESSURE SENSOR	M10	25
OIL LOAD CLUTCH SUMP CAP	M24	BY HAND
CLUTCH SUMP PHASE CAP	M40	BY STRIKING
CLUTCH SUMP CAP SCREW	M6	10
SUMP BLOW-BY SCREW	M6	10
COUNTERSHAFT SUMP SCREW	M6	10
OIL EXHAUST SUMP CAP	M14	22
SUMP FILTER FIXING SCREW	M6	10
SUMP FIXING SCREW	M6	10





PRISONNER SCREW HEAD	M10	BY STRIKING
VENT HEAD CONNECTION	M18	15
DOWEL	M8	25
<b>ENGINE GROUP/OILING:</b>		
OIL PUMP FIXING SCREW	M6	8.3
OVERPRESSURE VALVE	M12	25
LARGE EXCHANGER FIXING SCREW	M20	60
OIL TUBE HEAD BORED SCREW	M10	16
OIL HEAD NIPPLE TUBE	M10	20
FILTER	M20	18
<b>ENGINE GROUP/CRANK MECHANISM:</b>		
PHONIC WHEEL FIXING NUT	M8	25
ROD SCREW	M9	25+50°
<b>ENGINE GROUP/CYLINDER-PISTON-HEAD:</b>		
PRISONNER SCREW	M8	12
CONICAL DOWEL	M6	10
CONICAL CAP	M14	30
CAP FIXING SCREW	M6	13
HEAD FIXING NUT	M10	45+100°
TIGHTENER FIXING SCREW	M6	10
CYLINDER CAP SCREW	M6	10
CYLINDER FIXING SCREW	M6	10
<b>ENGINE GROUP/DISTRIBUTION:</b>		
DISTR. ENTRY FIXING SCREW	M6	15
UPPER PAD SUPPORT FIXING SCREW .	M6	15
DISTR. SUMP COIL FIXING SCREW	M6	10
DISTR. SUMP SCREW	M6	10
MOBILE PAD PIN	-	13





LOW CLUTCH ROD HEXAGONAL FIXING NUT	M8	16
CLUTCH SPRING FIXING SCREW	M6	10
CLUTCH HEXAGONAL FIXING NUT	M20	100
CLUTCH CONTROL FIXING SCREW	M6	10
<b>ENGINE GROUP/GEARS:</b>		
ENGINE PINION FIXING NUT	M24	140
<b>ENGINE GROUP/ GEAR COMMAND:</b>		
PLATE FIXING SCREW	M6	10
FORK PINS FIXING SCREW	M6	10
FORK PINS FIXING SCREW	M6	10
SELLET DRUM FIXING SCREW	M6	10
GEAR COMMAND SUMP FIXING SCREW	M6	10
GEAR COMMAND SUMP FIXING SCREW	M6	10
CHAIN COVER SUMP FIXING SCREW	M6	10
GEAR FLANGE FIXING SCREW	M8	20
<b>ENGINE GROUP/COOLING:</b>		
PUMP ROTOR BLIND FIXING NUT	M6	8.3
PUMP COVER FIXING SCREW	M6	10
PURGE SCREW	M6	10
CRANK FIXING SCREW	M6	10
PUMP BODY FIXING SCREW	M6	10
COLLECTOR FIXING SCREW	M6	10
THERMOSTAT CAP FIXING SCREW	M6	10
SMALL COVER FIXING SCREW	M6	10
<b>ENGINE GROUP/IGNITION:</b>		
SPARKING-PLUG	M10	12
COIL ROD FIXING NUT	M10	8
<b>ENGINE GROUP/ELECTRICAL PLANT:</b>		
ELECT. ENGINE FIXING SCREW .	M6	10
ALTERNATOR FIXING SCREW	M8	25





PHONIC WHEEL SENSOR SCREW	M6	8.3
<b>ENGINE GROUP/ SUPPLY:</b>		
THROTTLE BODY FIXING SCREW	M6	10
<b>ENGINE GROUP: SUPPLY:</b>		
FREE WHEEL RING FIXING SCREW	M6	17
ENGINE HEXAG. FLEXIBLE COUPLING SCREW	M10	50
ESAGONAL NUT ENGINE BUMPER	M10	15
TEF INGR. SATELLITE SCREW	M6	10

## 2.6 POINTS TO OIL



### ENGINE OIL

- Ball-bearings
- Piston surface
- Piston segments
- Piston pin
- Shafts, nuts and screws
- Oil pump rotors
- Distribution bowl surfaces



### LOCTITE®



### sustitute the element



### Clean and degrease the surfaces



### MOLYBDENUM BISULFIDE OIL

- Suction and discharge valve stems



### LITHIUM SOAP GREASE

- Sealing ring lips



### TEFLON® SYNTOFLON® PASTE

- Engine shaft pins
- Eccentric shaft pins
- Eccentric shaft u-bolts



### MOLYCOTE® COPPER GREASE

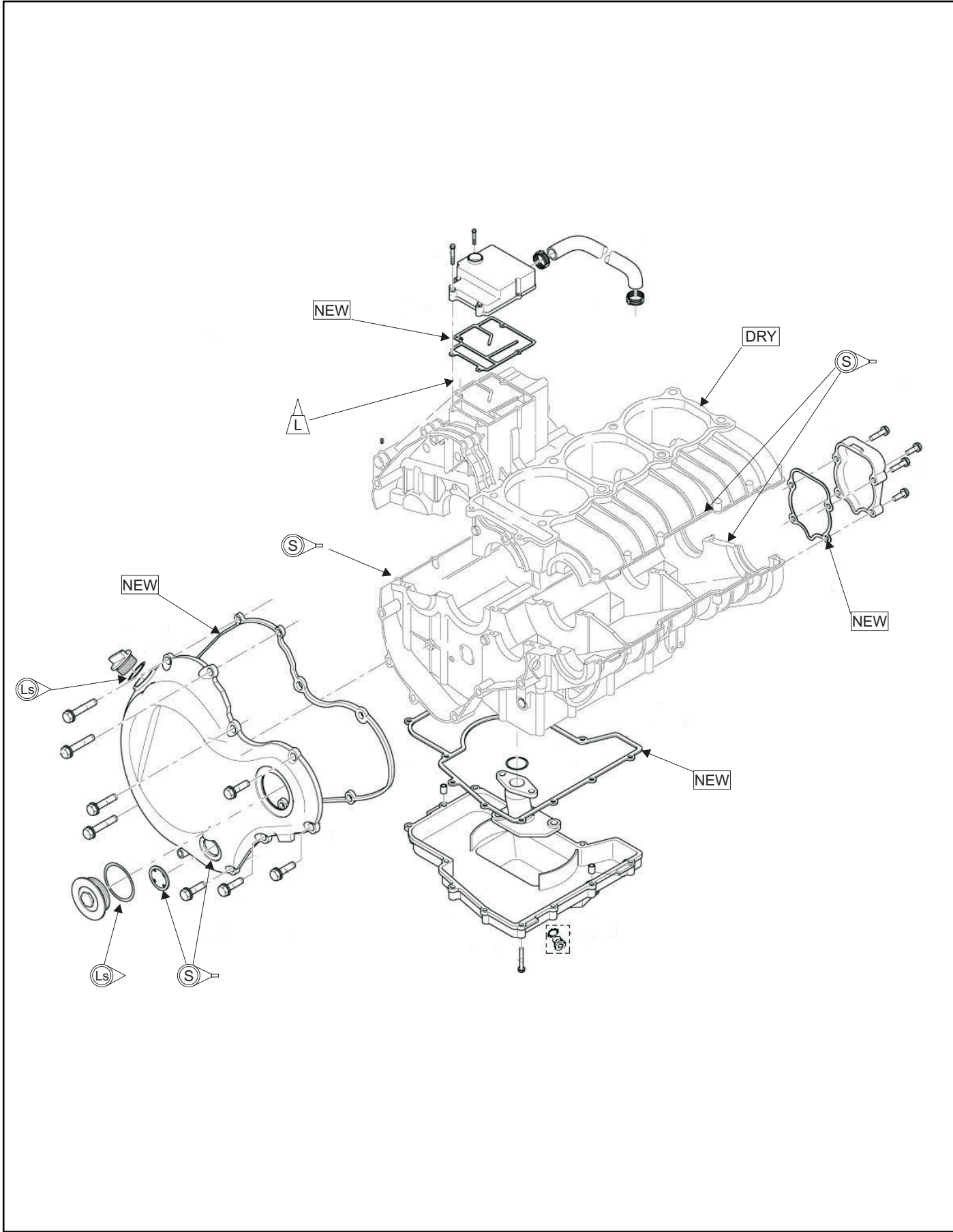
- Engine shaft fixing screws
- Gear flange
- Prisonner head fixing nuts



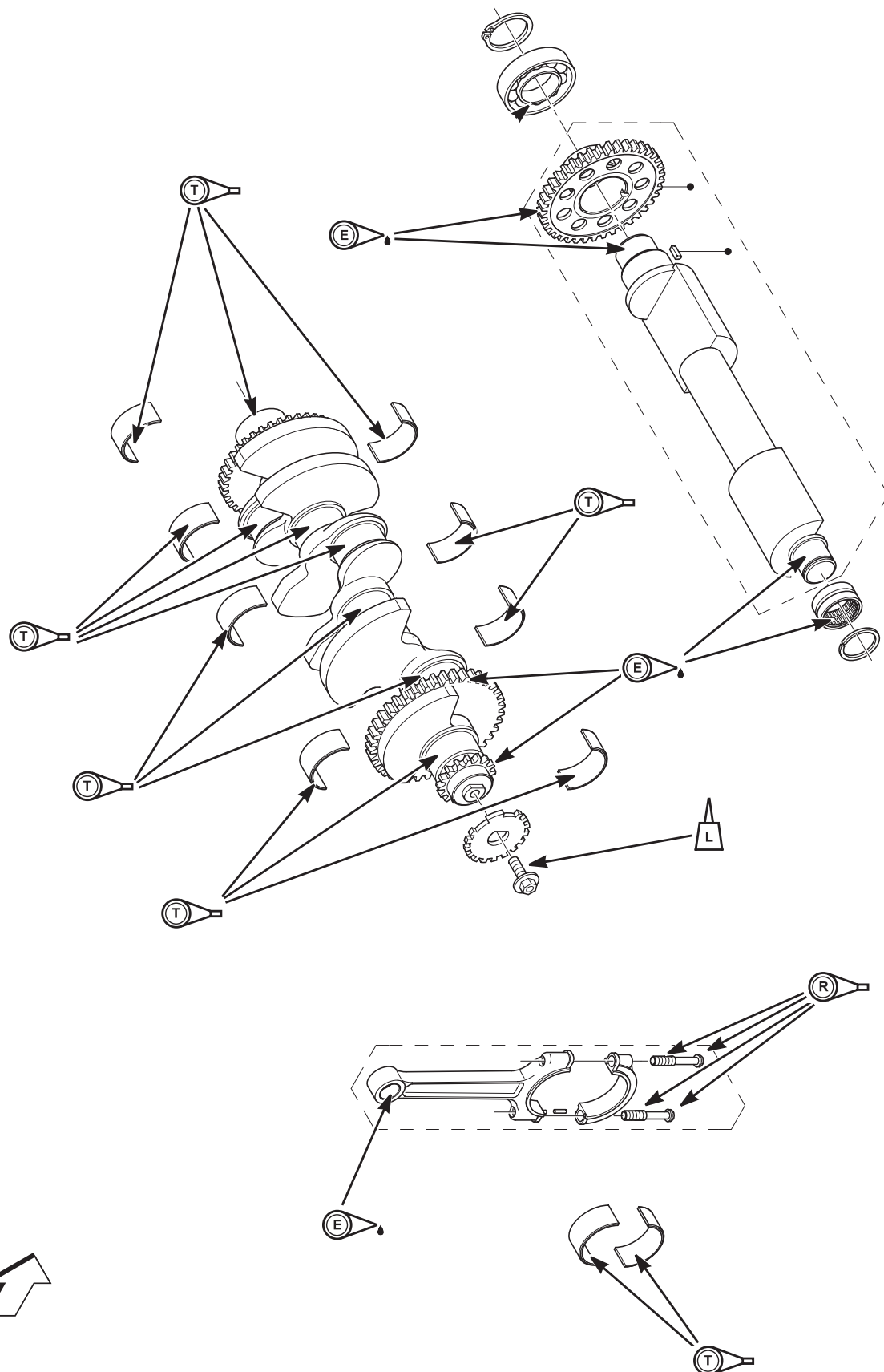
### THREE BOND® 1215 SEALING PASTE

- Casing coupling surfaces
- Casing-cover-gear coupling surfaces
- Casing-oil sump surfaces
- Casing-cover-countershaft surfaces
- Water chamber caps





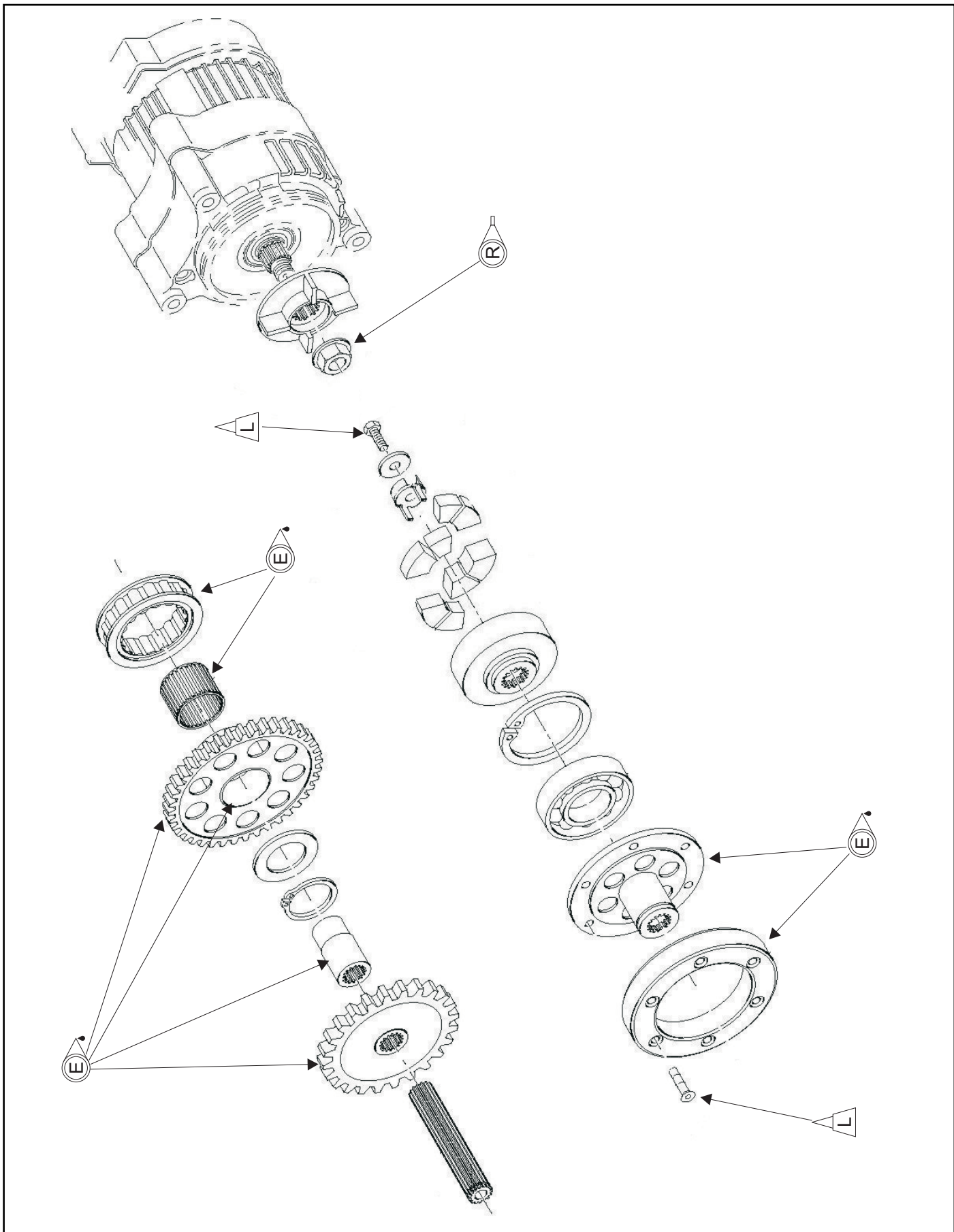












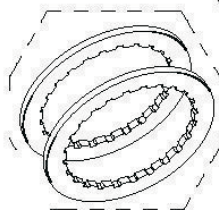




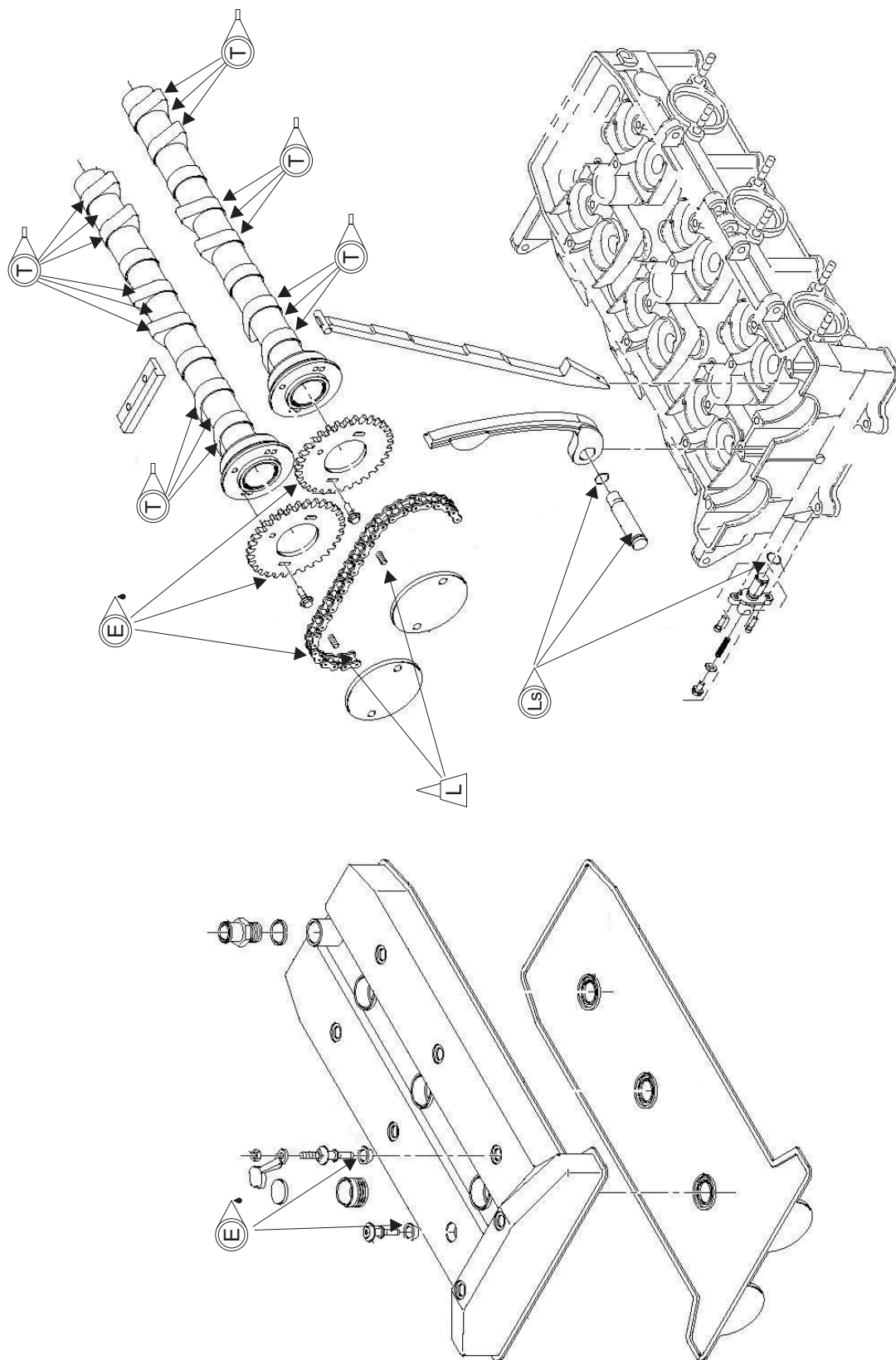




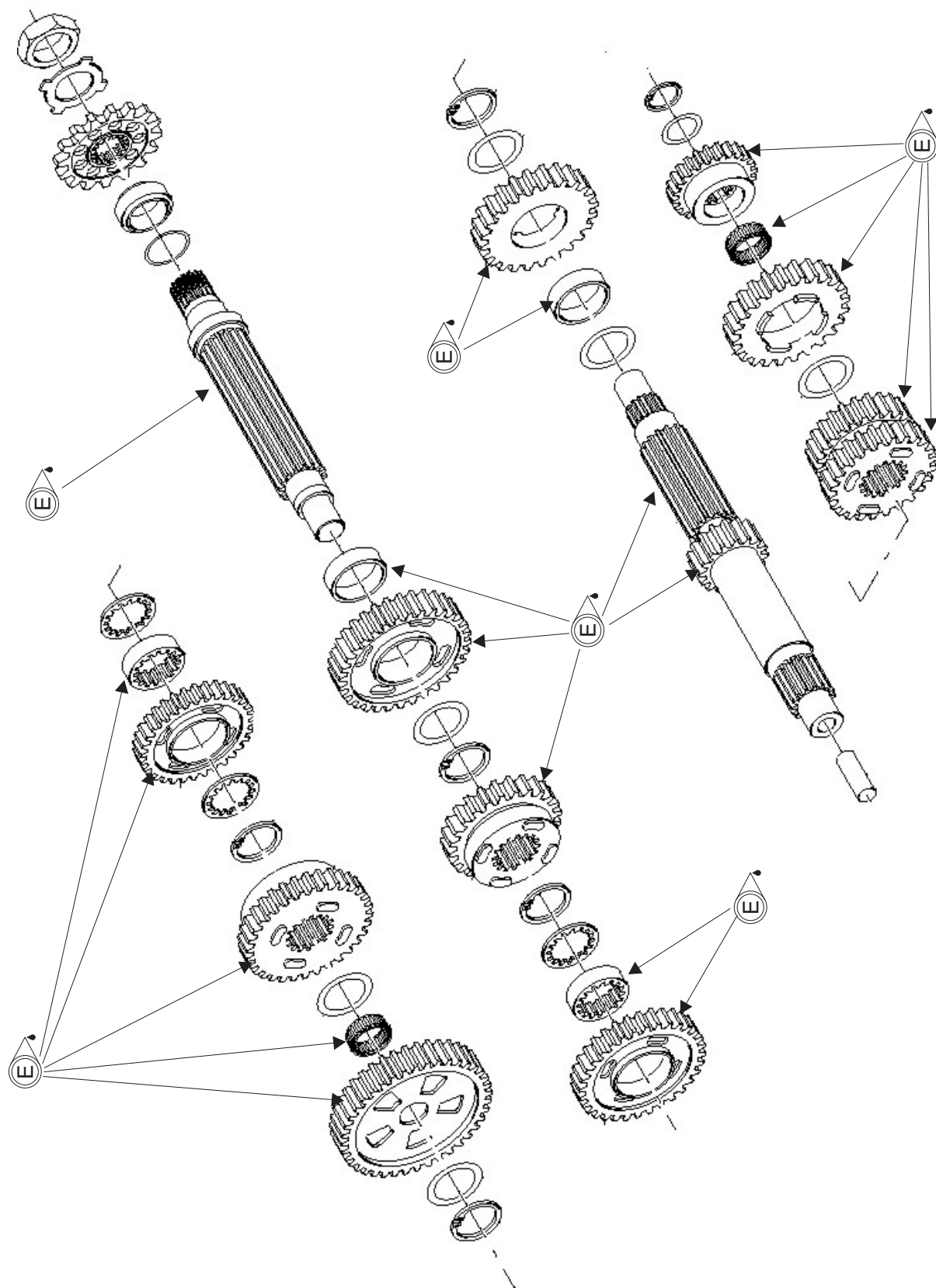




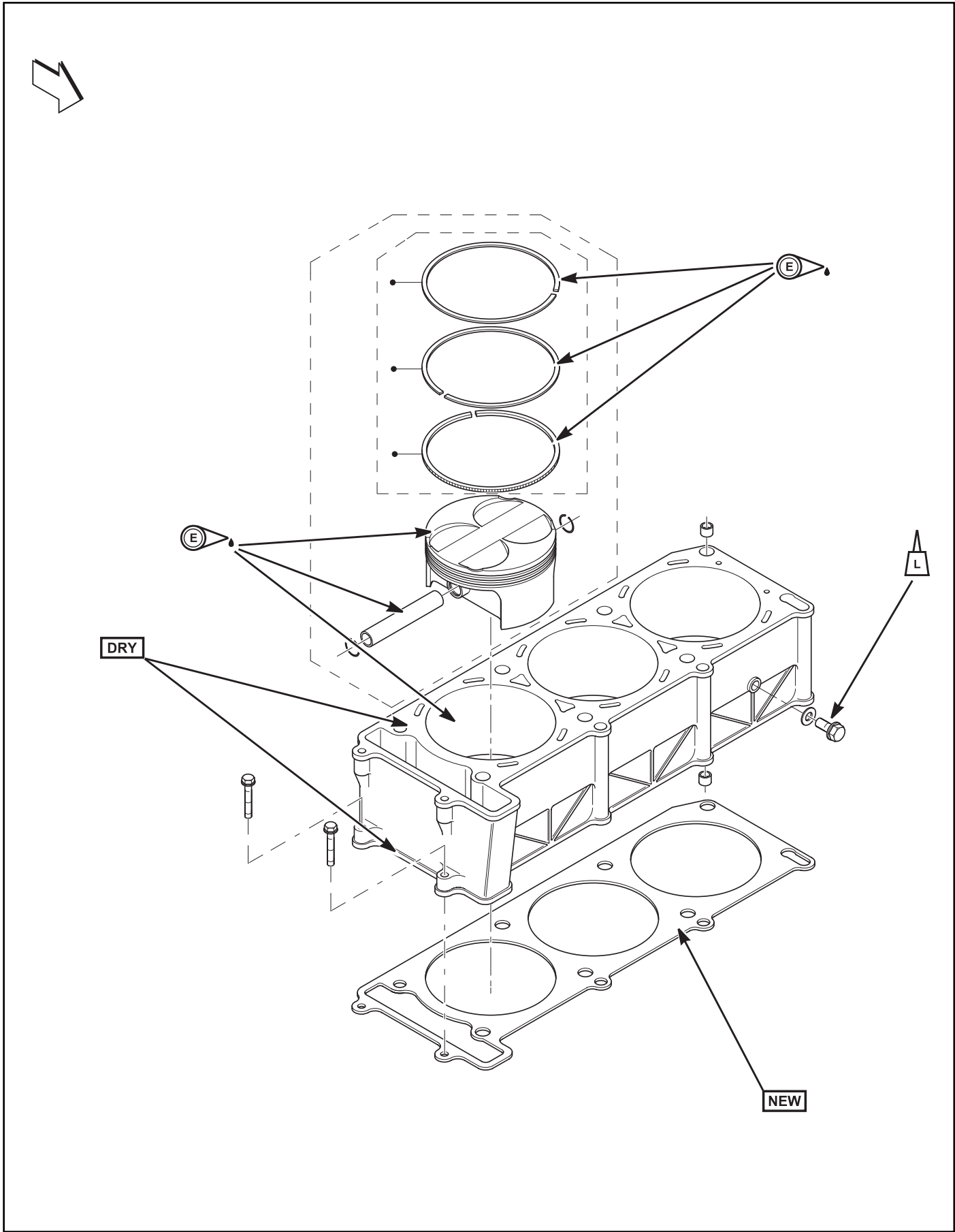




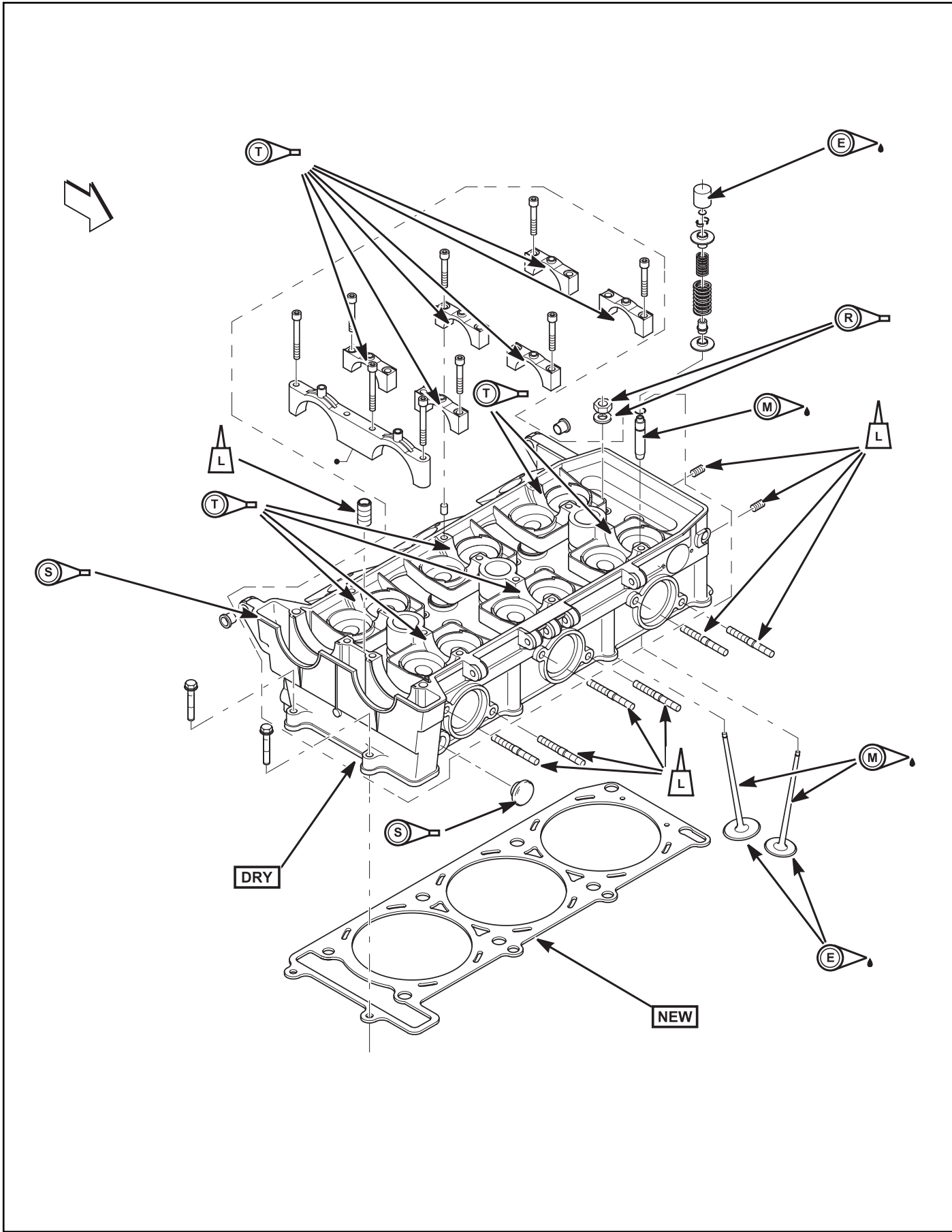




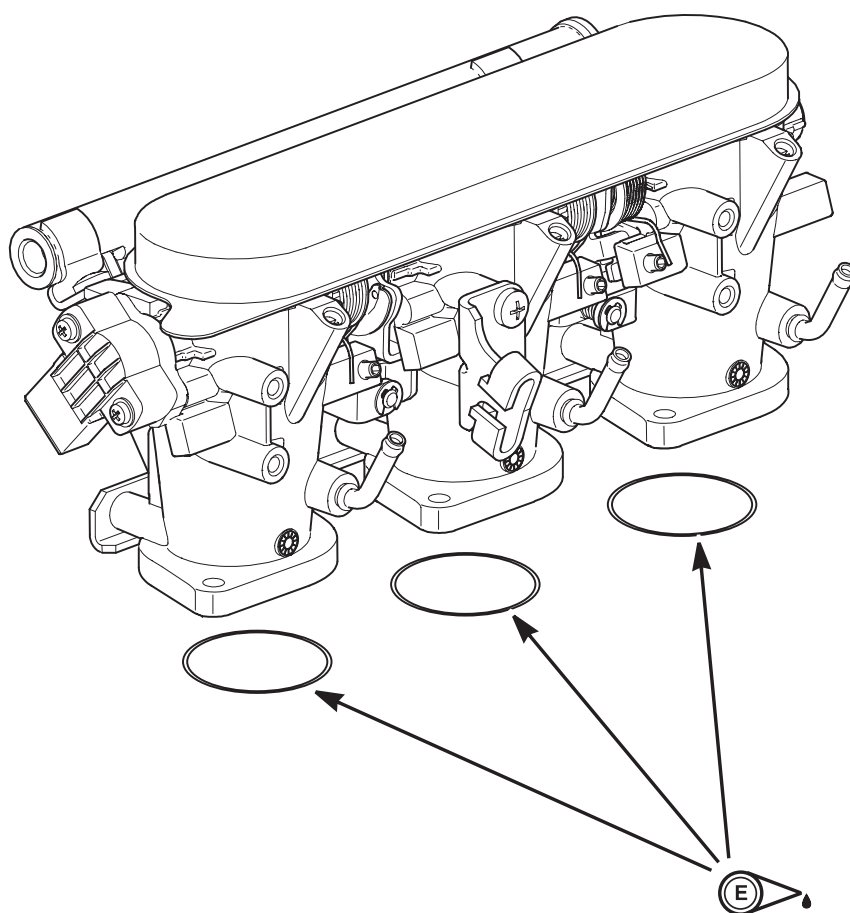




















## Periodical Checks

### 3 PERIODICAL CHECKS AND ADJUSTMENTS



#### 3.1 INTRODUCTION

This chapter includes information about checks and adjustments for better maintenance of the bike's performance.

COMPONENT	OPERATION	MAINTENANCE FREQUENCY			
		0 km (0 mi) before delivery	1000 km (625 mi) running-in 1st Service	6000 km (3750 mi) 2nd Service	11000 km (6875 mi) 3rd Service
Engine oil	Level check	i	Before every use of the vehicle		
	Change		R	i	R
		Every year in any case			
Engine oil filter	Change		R	i	R
		At every change of engine oil in any case			
Cooling liquid	Check/Restore level		i	i	i
	Change	Every 2 years			
Cooling plant	Check losses		i	i	i
Electrofans	Check functioning		i	i	i
Valves	Check/Adjust			i	i
Distribution chain	Check			i	i
	Change	Every 40000 km (24900 mi)			
Distribution mobile pad	Check/Change			i	i
	Change	Every 40000 km (24900 mi)			
		At every change of the distribution chain in any case			
Distribution chain stretcher	Check/Change				i
Sparkign-plugs	Check/Change		i	i	i
	Change				R

#### CODE:

i = inspection and adjustment , cleaning, oiling or change according to need.

R = change

T = tighten





COMPONENT	OPERATION	MAINTENANCE FREQUENCY			
		0 km (0 mi) before delivery	1000 km (625 mi) running-in 1st Service	6000 km (3750 mi) 2nd Service	11000 km (6875 mi) 3rd Service
Petrol filter	Check/Change				R
Throttle body	Check/Change		i	i	i
Air filter	Check/Change		i	i	i
Pinion/Stop washer	Check/Change		i	i	i
	Change	At every change of the transmission chain in any case			
Transmission chain	Check/Adjust		i	i	R
	Oiling	Clean and oil every 1000 km (625 mi)			
Crown	Check/Adjust		i	i	R
	Change	At every change of the transmission chain in any case			
Rear fork pads chain	Check/Change		i	i	i
Frame plate pads chain	Check/Change		i	i	i
Oil circulating tubes	Check defects and losses		i	i	i
	Change	16000 Km Every 3 years in any case			
Brake liquid	Control level		i	i	i
	Change	Every 25000 km (15000 mi)			
		Every 2 years in any case			
Gear command	Check		i	i	i
Brakes	Check functioning		i	i	i
Brake pads	Check/Change		i	i	i
Accelerator command	Check functioning	i	i	i	i
	Check/Adjust play	i	i	i	i
Clutch				i	i

**CODE:**

i = inspection and adjustment , cleaning, oiling or change according to need.

R = change

T = tighten





COMPONENT	OPERATION	MAINTENANCE FREQUENCY			
		0 km (0 mi) before delivery	1000 km (625 mi) running-in 1st Service	6000 km (3750 mi)  2nd Service	11000 km (6875 mi)  3rd Service
Transmissions and flexible commands	Check/Adjust	i	i	i	i
Steering crown saddle post	Check/Adjust	i	T	i	i
Steering saddle post ball-bearings	Check/Adjust	i	T	i	i
	Oil	Every 20000 km (12000 mi)			
Tires	Check pressure	i	i	i	i
	Check wear			i	i
Rear/front wheel ball-bearings	Control			i	i
	Change	Every 50000 km (30000 mi)			
Lateral assembly stand	Check functioning	i	i	i	i
Lateral assembly stand switch	Check functioning	i	i	i	i
Large fork ball-bearings	Change	Every 35000 km (21000 mi)			
	Oil/Check		i	i	i
Rear damper	Check/Adjust		i	i	i
Front fork oil	Change	Every 20000 km (12000 mi)			
Battery connections	Check/Clean		i	i	i
Electrical plant	Check functioning	i	i	i	i
Instrumentation	Check functioning	i	i	i	i
Vision Lights/Signals	Check functioning	i	i	i	i
Horn	Check functioning	i	i	i	i
Front headlight	Check functioning	i	i	i	i
	Adjust	At every variation in the state of the vehicle			
Ignition switch	Check functioning	i	i	i	i

**CODE:**

i = inspection and adjustment , cleaning, oiling or change according to need.

R = change

T = tighten





COMPONENT	OPERATION	MAINTENANCE FREQUENCY			
		0 km (0 mi) before delivery	1000 km (625 mi) running-in 1st Service	6000 km (3750 mi) 2nd Service	11000 km (6875 mi) 3rd Service
Locks	Check/ Functioning	i	i	i	i
Screws and nuts	Check/Tighten	i	T	T	T
Tube clamp straps	Check/Tighten	i	i	i	i
General oiling		i	i	i	i
General test		i	i	i	i

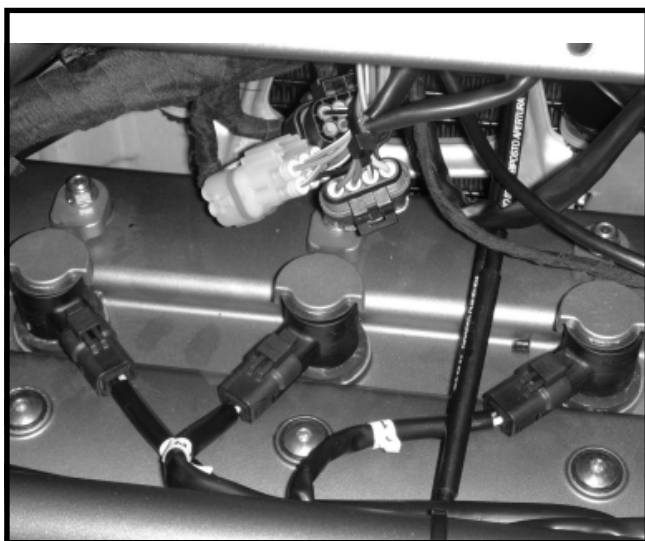
**CODE:**

**i** = inspection and adjustment , cleaning, oiling or change according to need.

**R** = change

**T** = tighten





### 3.2 CHECK SPARKING-PLUGS



**WARNING:**

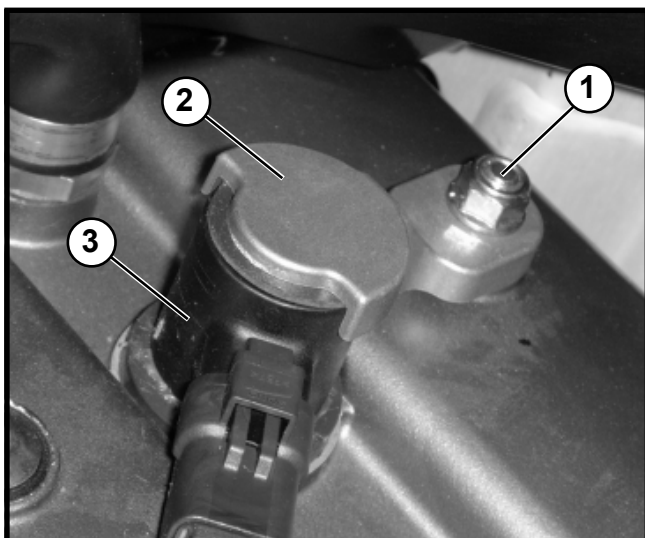
*Changing and checking the sparking-plugs must be carried out with the engine cold.*

Remove the petrol tank (see "DISMANTLE TANK").  
Remove the air box (see "DISMANTLE AIR BOX").  
Remove the resonator.

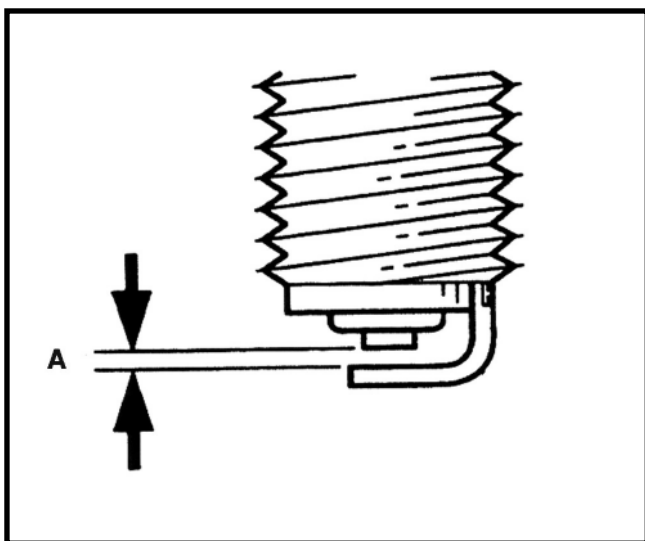


**WARNING:**

*Clean the dirt around the sparking-plugs before removing them.*



Loosen and remove the nut (1).  
Remove the coil support rod (2), Slip off the coil.  
Remove the sparking-plugs beneath.



Sight check the state of the sparking-plugs:

- the isolator must not show any damage
- the electrodes must not be worn out
- the candles must not be burned or discoloured

If the electrodes are contaminated with dirt deposits or rubble, replace the candle.

Replace the candle if the central electrode is rounded.

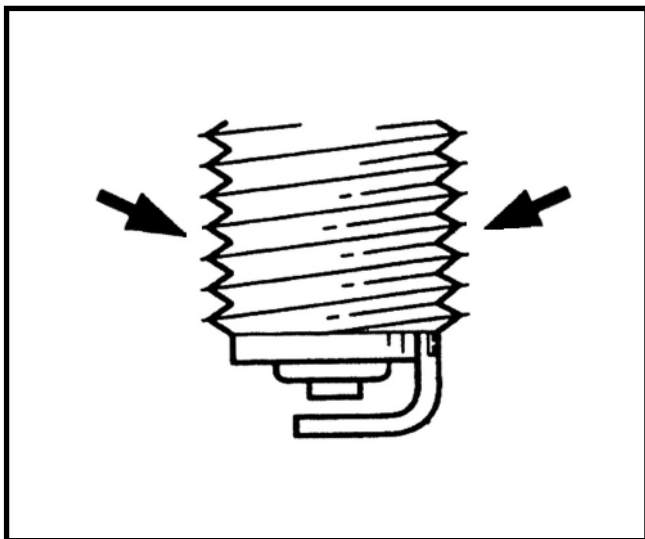
Check the distance (A) between the central and side electrodes with a thickness gauge.



**SPECIFIC VALUE**

**DISTANCE (A) = 0.7 - 0.8 mm**





### 3.2.1 INSTALLING SPARK-PLUGS



Oil the sparking-plug threading, position it in its proper seat and tighten it.

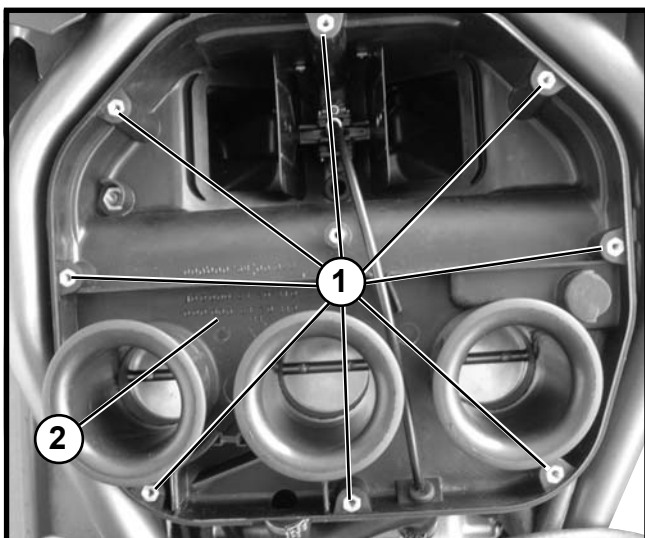
Install the candles on the cylinder head manually screwing them on until you reach the basis, then tighten to the indicated torque.



12 N·m 1,2 Kg-m

#### NOTE:

spark-plugs advised: CHAMPION RG4HC or NGK CR 9E



### 3.3 CLEAN AIR BOX

Remove the tank.

Loosen and remove the eight screws (1) around the air box and the central screw.

Remove the air box cover (2).



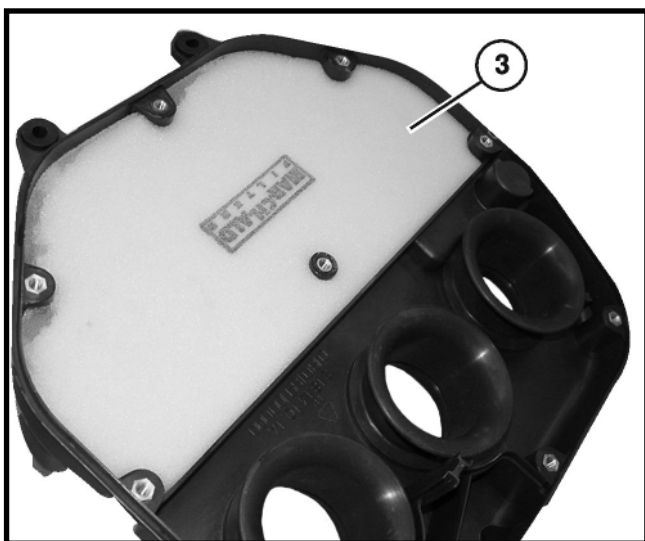
#### ATTENTION:

*If driving on dusty roads, the filtering element must be cleaned often. Using the engine without filter or with a broken filtering element is the surest way of accelerating wear on the engine itself. Make sure that the air filter is always in a good condition. The duration of the engine depends in large part on this component.*



#### ATTENTION:

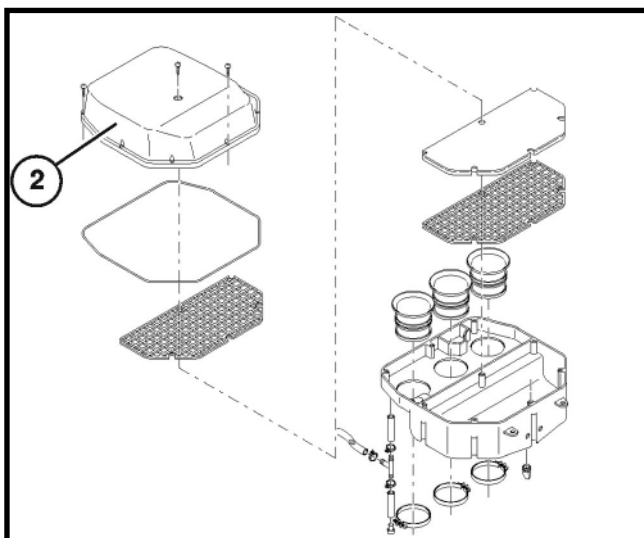
*To avoid the risk of fire or explosion do not use petrol or inflammable solvents in cleaning the filtering element inside the filter box.*



Remove the filtering element (3) situated inside the filter box. Wash the filtering element with solvents specific for this use and leave it to dry in the open air.

Apply a specific oil to the entire surface of the filtering element.





**NOTE:**

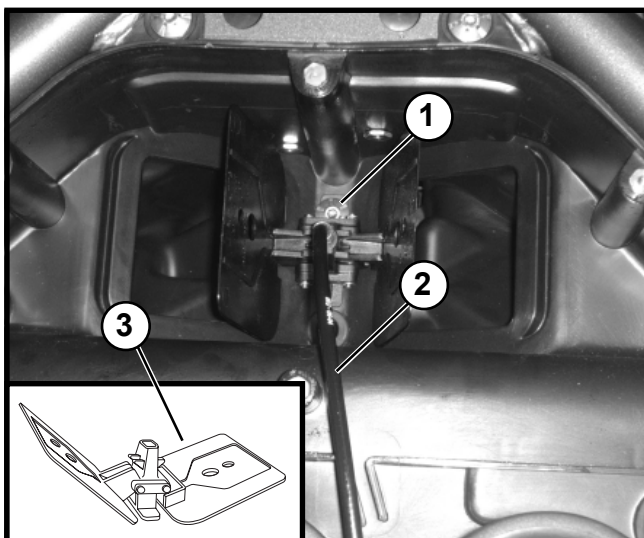
Check that the filtering element is always positioned with its side of major density turned upwards.



**ATTENTION:**

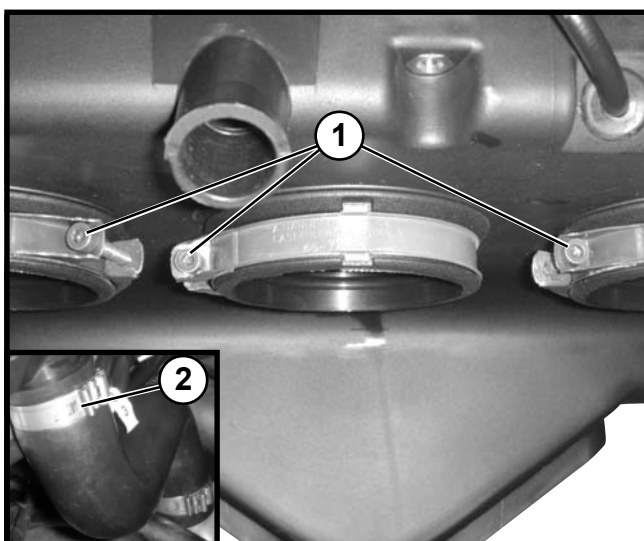
*Before re-inserting the filtering element into the air box, eliminate excess oil by squeezing the element and checking that it is not dripping.*

Reposition the filtering element inside the air box  
Position the air box cover (2) and fix it with the nine screws.  
Mount the tank (see "MOUNT TANK").



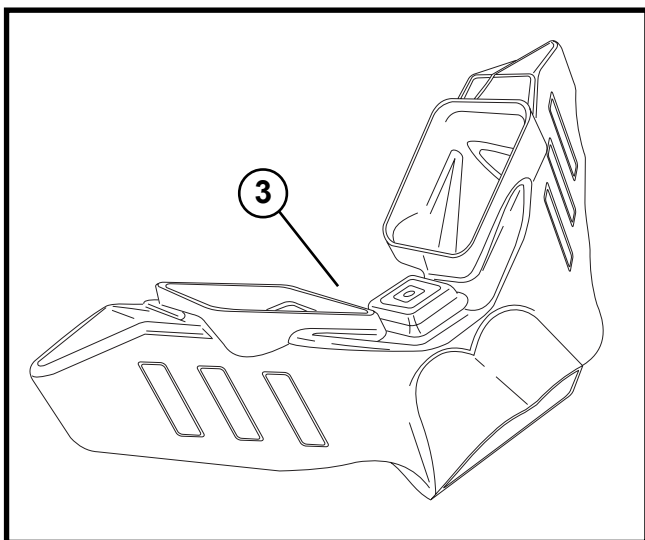
### 3.3.1 REMOVAL OF AIR BOX THROTTLE VALVE AND AIR BOX DUCT

Remove the throttle valve fixing screw (1).  
Take off the recall cable (2) from the throttle.  
Check visually the free run of the paddles (3).

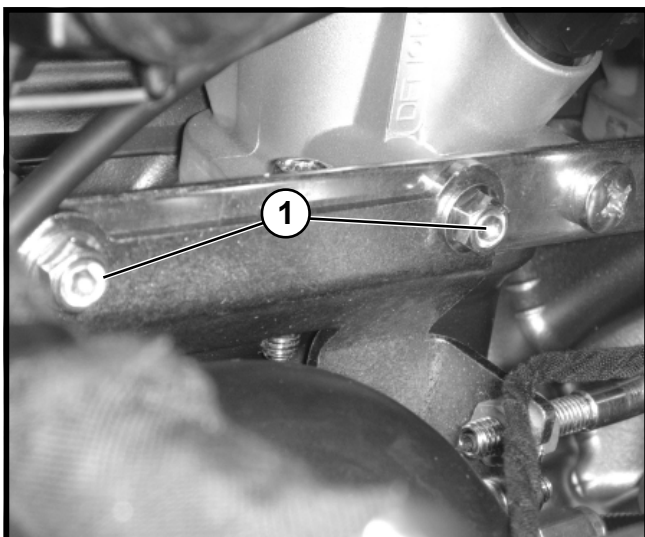


Loosen the screws of the clamps (1) on the throttle bodies.  
Take off the elastic clamp (2) take off the pipe



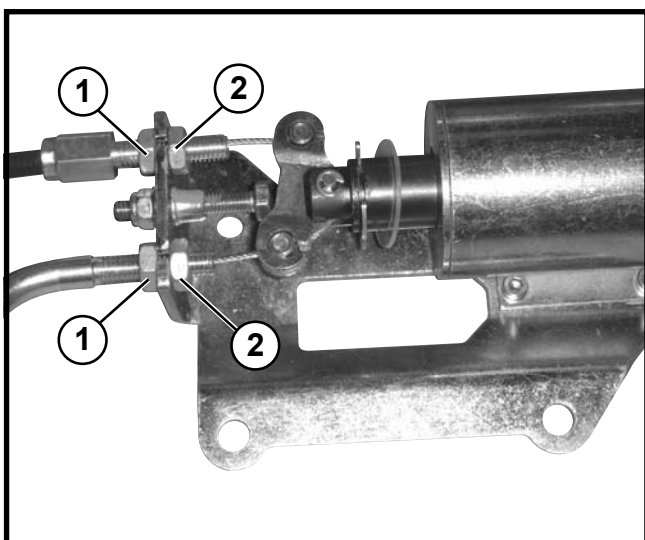


Take off the Air Box base disconnect the air sensor connector below it. Remove the Air Box air duct (3). Check the state of the components visually, if necessary replace them.



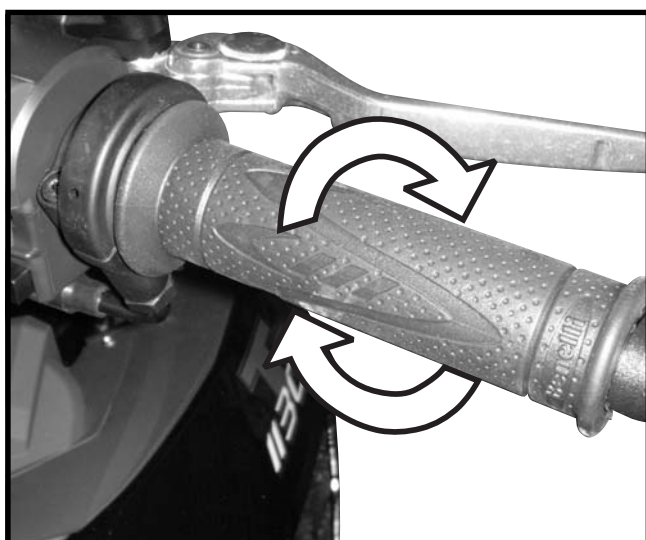
### 3.3.2 SOLENOID MOTOR REMOVAL

Remove the petrol tank.  
Loosen and remove the fixing screws (1).



Loosen the nut (1) and the lock nut (2).  
Take off the recall cables, take off the connector, remove the solenoid.



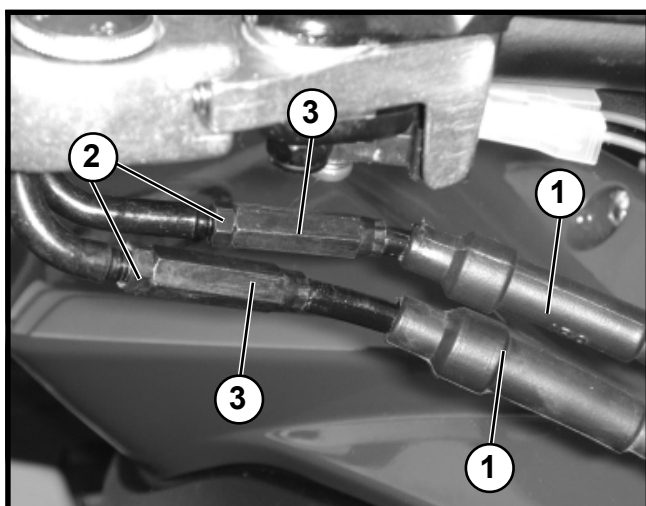


### 3.4 GAS COMMAND PLAY

Check first at 1000 Km and then at every 5000 Km.

The first adjustment is made during the installation of the gas command cables.

Verify that the gas command handle works in a regular way and that reaching the position of maximum opening and that of automatic closing is possible in all the positions of the steering.



Check the cables and replace them if they are worn, twined or damaged.

Lubricate the gas cables if they do not work regularly.

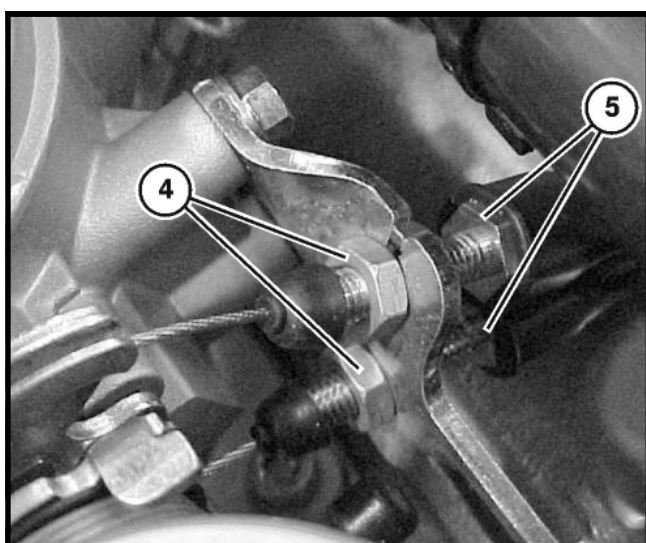
The game of the gas command can be adjusted on both ends of the gas cable.

Small adjustments can be done using the upper adjustment screws.

Move the two rubber protections (1).

Loosen the counter-nut (2).

Carry the adjusters to the bottom of the stroke (3).



Remove the tank (see "tank disassembly").

Remove the air box (see "AIR box disassembly").

Remove the air box duct (see "AIR box disassembly").

Bigger adjustments are made with the lower adjustment screws.

Adjust the play on the nuts (4) and counter-nuts (5).

Adjust the play using the adjusters, turning them clockwise or anti-clockwise.

Clockwise the play diminishes.

Anti-clockwise the play increases.

The value of the gas command play must come within the specific value.



#### ATTENTION:

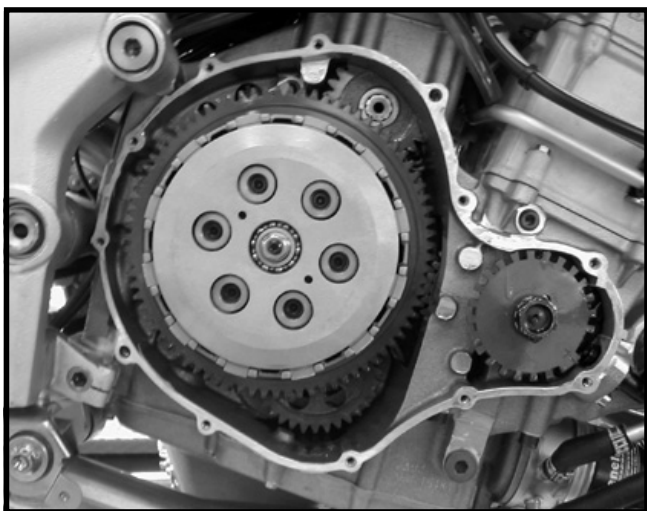
*At the end of adjustment, check that the movement of the handlebar does not cause an increase in the minimum condition and that the accelerator handlebar returns delicately and automatically into position.*



#### SPECIFIC VALUE

**GAS COMMAND PLAY = 0.5 mm**





### 3.4.1 CLUTCH

**NOTE:**

Take the clutch cable off from the lower clutch command before setting the regulation of the clutch pack. Check every 5000 km.

Position the bike onto the lateral stand to avoid oil spilling out when removing the clutch cover.

Remove the clutch cover. (see "clutch removal").

Block the flange of the register screw with the dedicated special tool.

Screw up the register in the clutch lever group completely until it touches.

Unscrew the locknut on the clutch bell plate and unscrew the registering screw two or three turns.

From this position, slowly screw up the registering screw until resistance is felt.

From this position, unscrew the registering screw  $\frac{1}{4}$  of a turn and then tighten the locknut.

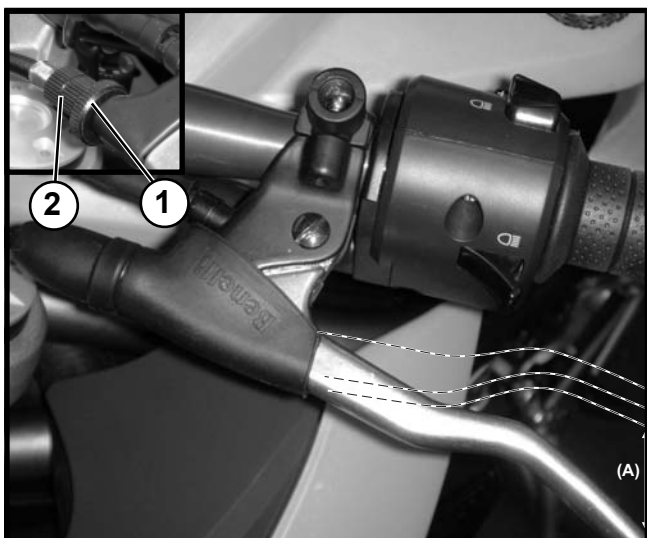
Register the clutch cable on the control lever and try to obtain a play of 0.3-0.5 mm.

**NOTE:**

**Clutch lever play 3-5 mm**

**Clutch disconnection screw  $\frac{1}{4}$  of a turn outward.**



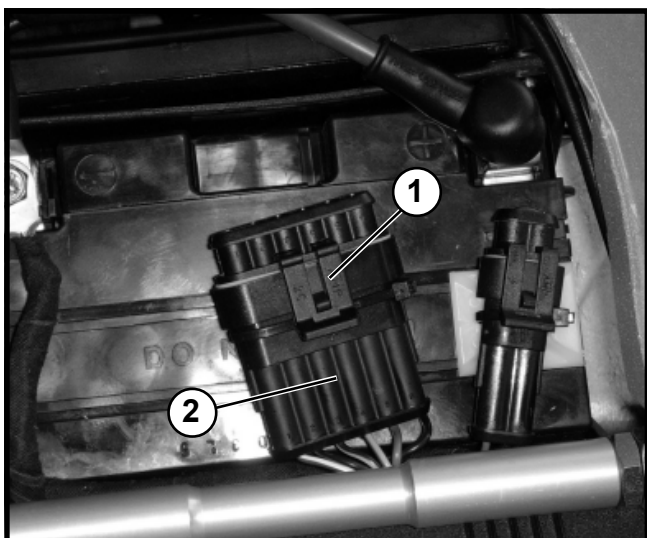


### 3.5 ADJUSTMENT CLUTCH LEVER PLAY

Move the adjustment cover cap.  
Unscrew the crown (1) and restore the clutch lever play by turning the adjuster (2) clockwise or anti-clockwise.  
Clockwise the play diminishes.  
Anti-clockwise the play increases.  
The value of the clutch lever (A) must enter within the specific value.



**SPECIFIC VALUE**  
**CLUTCH LEVER PLAY (A) = 5 mm**



### 3.6 ADJUSTMENT CO



**SPECIFIC INSTRUMENTS**  
**Engine management diagnostic instruments:**  
**R180197036000**



**ATTENTION:**  
**The Axone connection must be carried out with the key on "OFF".**

Removing the driver saddle (see "saddle removal")  
Remove the protective hood (1) of the diagnostic socket, connect the Axone to the diagnostic socket (2) positioned under the passenger saddle.

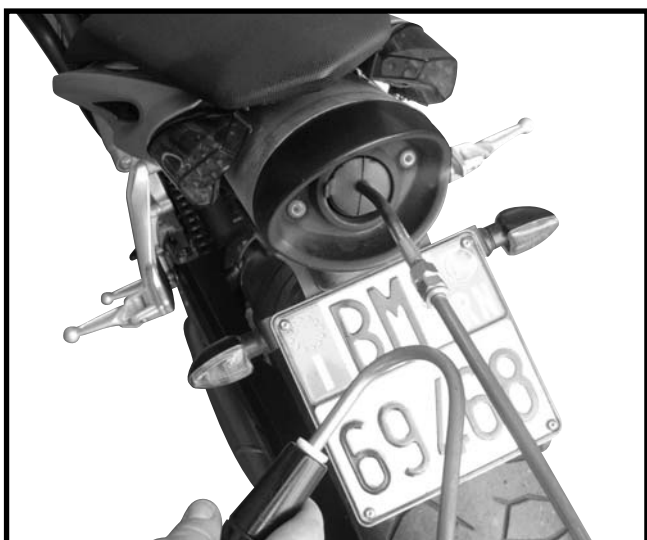


Turn the key to "ON".  
Check that the arrest bike switch on the right command is on "RUN".  
Check that the vehicle is not in any gear.  
Select the options until the indication: engine key "ON".  
Position the ignition key on "ON", choose the desired menu.  
Start the bike engine.





Select on the display of the Axone the engineering parameters icon, then select fuel adjustment minimum, press enter.

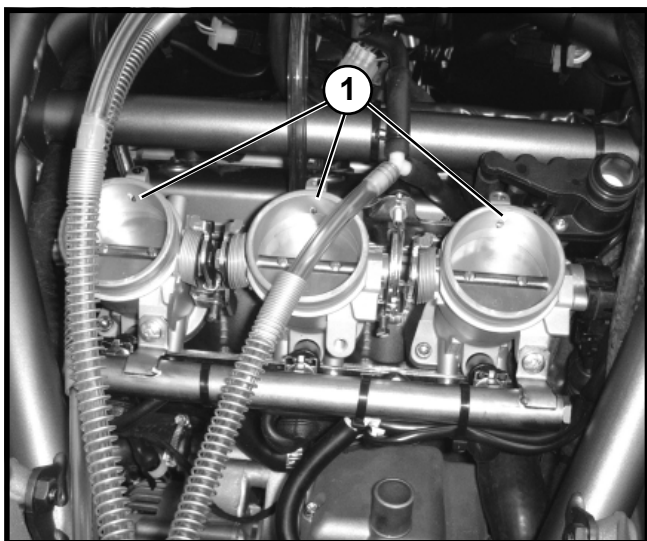


Connect a CO instrument tester to the exhaust plant. Take the engine temperature to 85°/90°C. The operation of adjusting the CO at minimum is recursive and must take into consideration contemporaneously variations in the Stepper position and the strength of the mixture. The position of the Stepper must maintain a value between 10 and 15 pitches. If the value is not correct, select fuel adjustment minimum on the Axone, select icon adjustments (hammer and screwdriver) then take the Stepper to the values mentioned before.



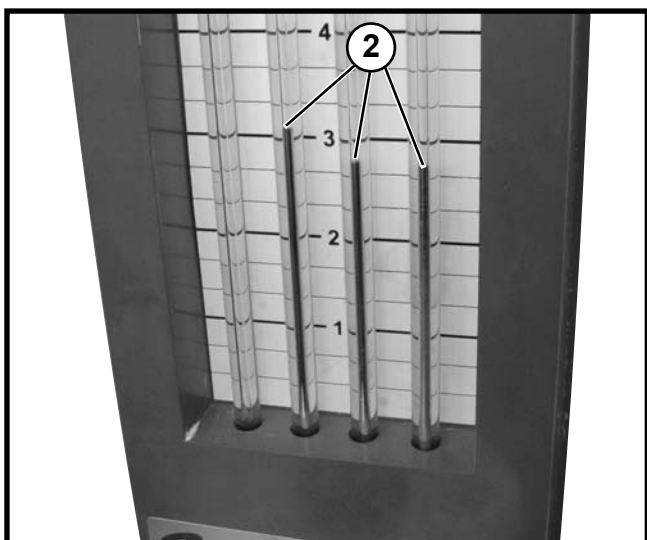
Changing this parameter a CO reading will be obtained on the tester of about 1 MAX 1,5 ( lower values induce possible irregularities to the minimum while superior values, normally up to 3,0-3,5 the performances improve, but increase the polluting gases ).



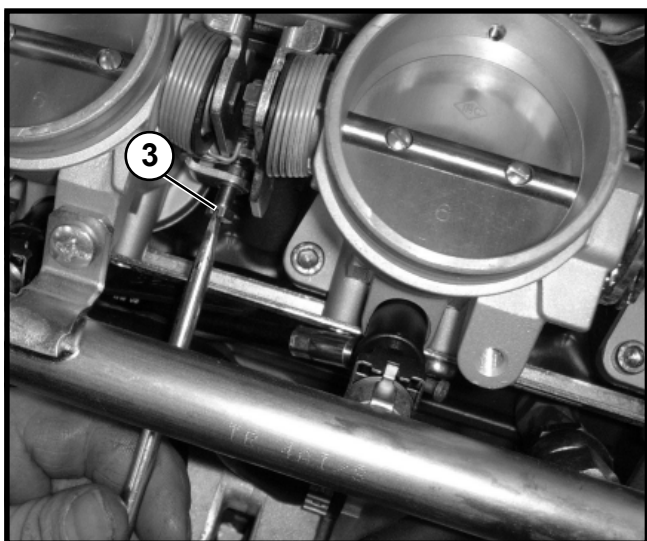


### 3.7 ADJUSTMENT THROTTLE HOUSING

Verify that the cables are assembled correctly and have the right clearance.  
Connect the minimum air ducts (1) of the throttle body to a vacuum gauge.

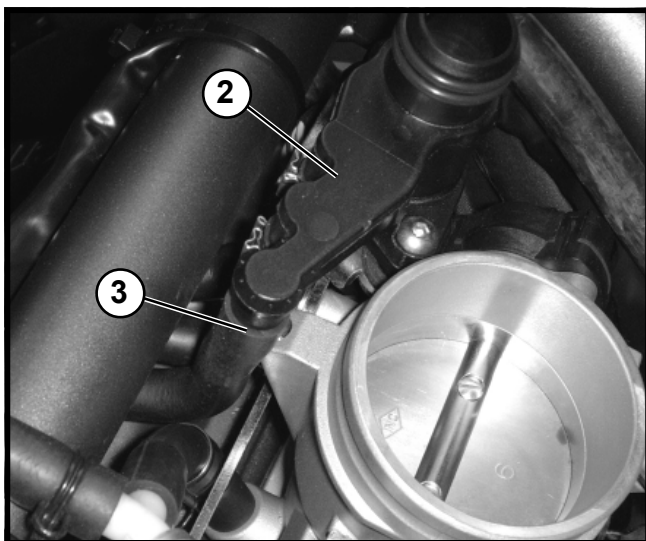


Start the engine and warm it up to 85-90 degrees.  
Verify that the mercury columns (2) with the engine running at minimum are aligned, otherwise balance them.



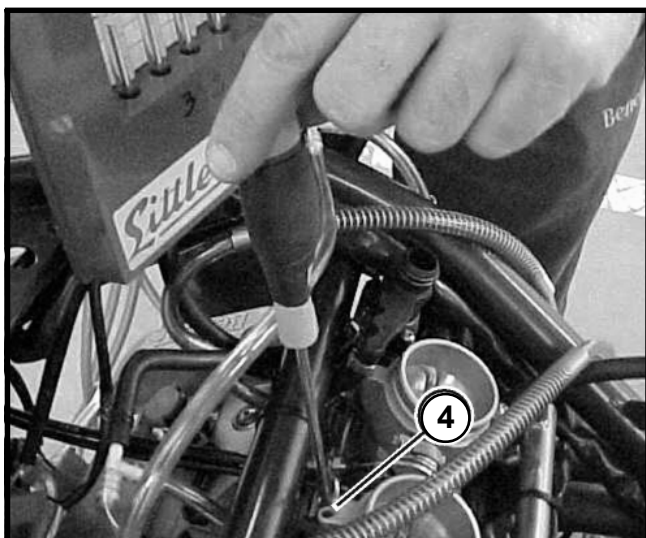
Adjust the values through the balancing screws (3) (alignment) of the body n° 3 with the body n° 2, the body n° 1 with the body n° 2 until you reach the alignment of the vacuum gauge's mercury columns.





Turn the engine off.

Now connect the vacuum meter including also the stepper (2), leaving connected the bodies n° 2 and n° 3 to the vacuum gauge. Connect the connector (3) of the body n° 1 to the stepper. Proceed to reset the throttle by aid of the diagnostics tool.



Start the engine and warm it up to 85-90 degrees.

Verify visually the alignment of the mercury columns of the vacuum gauge.

If necessary adjust the values through the by-pass screws (4). Once balanced the body tighten the by-pass screws closing the passages completely.



### 3.8 CHECK STEPPER

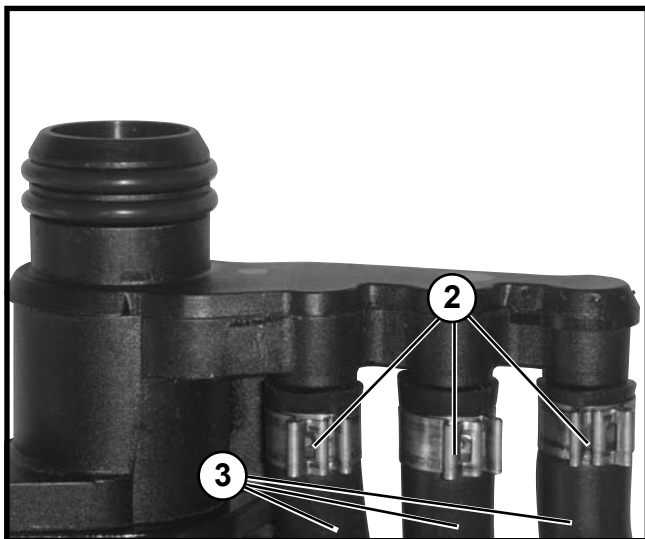
Remove the petrol tank (see "petrol tank disassembly").

Remove the air box (see "AIR box disassembly").

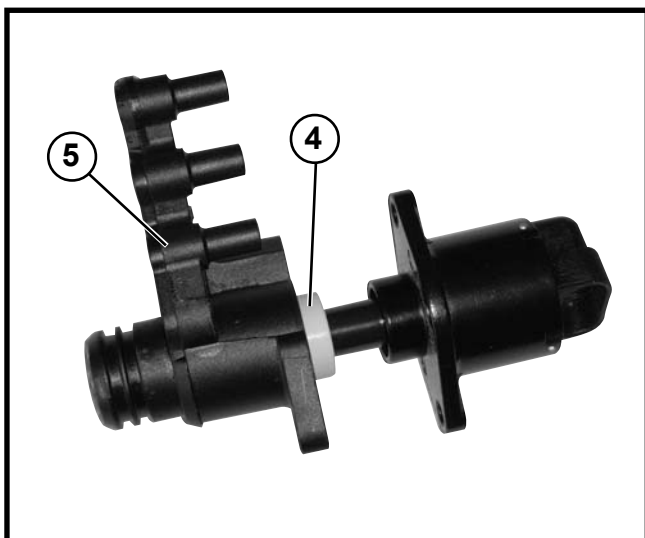
Remove the air box duct (see "AIR box duct disassembly").

Unscrew and remove the fixing screws (1) of the stepper motor.

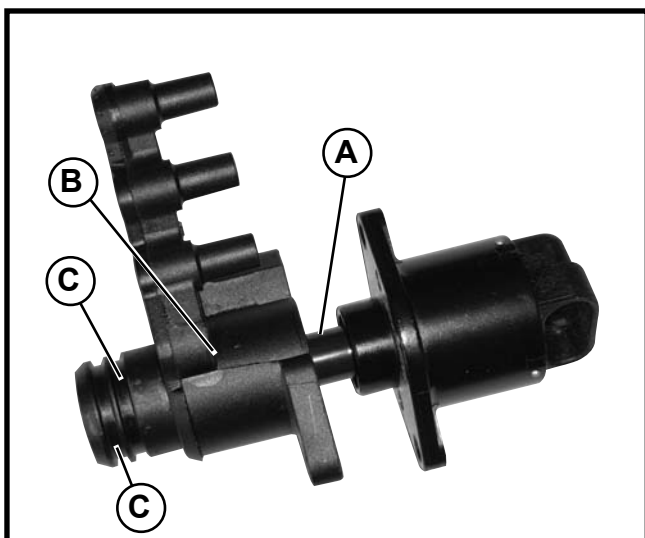




Take off the clamps (2) disconnect the connection (3) pipes between stepper and throttle body.  
Take off the electric connector, remove the component.



Check visually that the Stepper (4) does not present failures or deformation, otherwise replace it. Check visually that there are no obstructions inside the valve body (5) otherwise replace it. If required clean valve body and stepper.

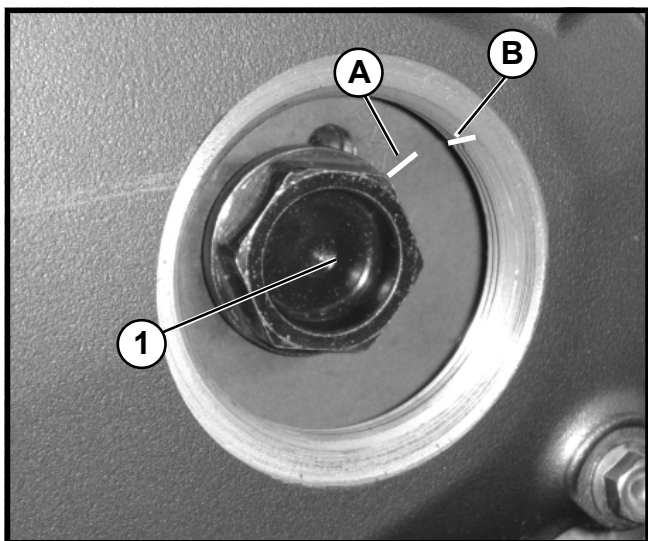


Make sure that the piston (A) is moving free inside the valve body (B).  
If there is a hindered or forced movement replace the valve body (B).  
Check the conditions of the two O-ring sealings (C), if required replace in couple.

**Note:**

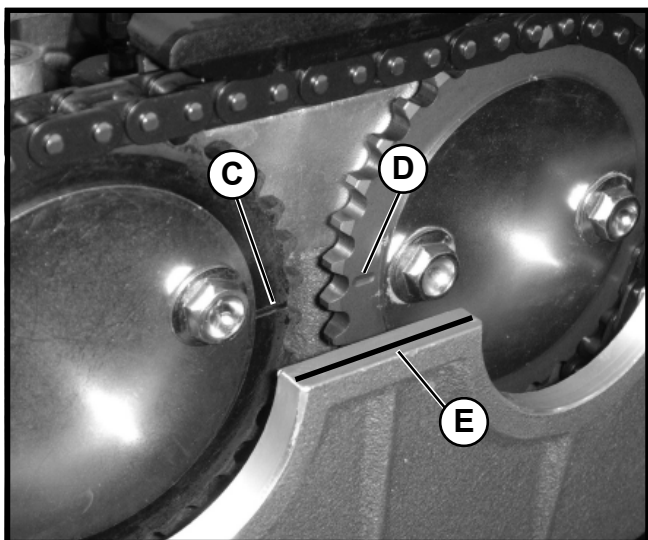
**In case of replacement of the Stepper verify the setup with the diagnosis tool, start with throttle valve balancing.**



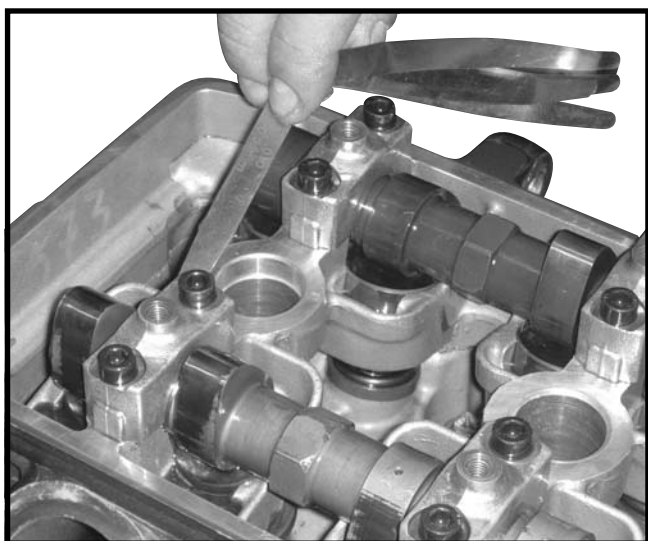


### 3.9 ADJUSTMENT VALVE PLAY

Remove the petrol tank (see "DISMANTLE TANK").  
 Rimuovere l'air box (vedi "SMONTAGGIO AIR BOX").  
 Remove the air box duct (see "AIR BOX DUCT DISASSEMBLY").  
 Remove the coils. (see "COIL DISASSEMBLY").  
 Remove the sparking-plugs. (see "SPARKING-PLUGS DISASSEMBLY").  
 Remove the head cover (see "DISMANTLE HEAD COVER").  
 Unscrew the phonic wheel inspection chap.  
 Turn the screw (1) using a compass key to align the two reference notches (A) and (B= taking the engine to the Upper dead point.



Taking the engine to the UDP verify that also the notches (C) and (D) of the Camshaft sprockets are aligned between them and with the head plain (E).



Measure the clearance between camshaft and valve chap. by a thickness gauge making sure that the clearance is in the specific range. Proceed in the same way for the remaining cylinders.

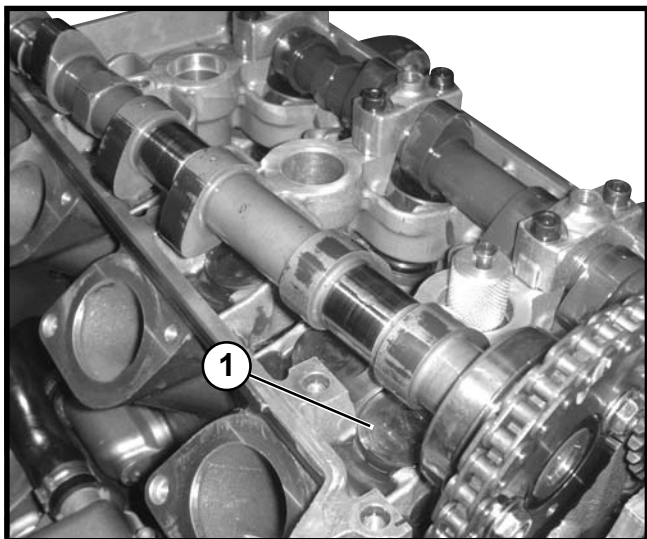


#### SPECIFIC VALUE

Suction =  $0.30 \pm 0.35$  mm

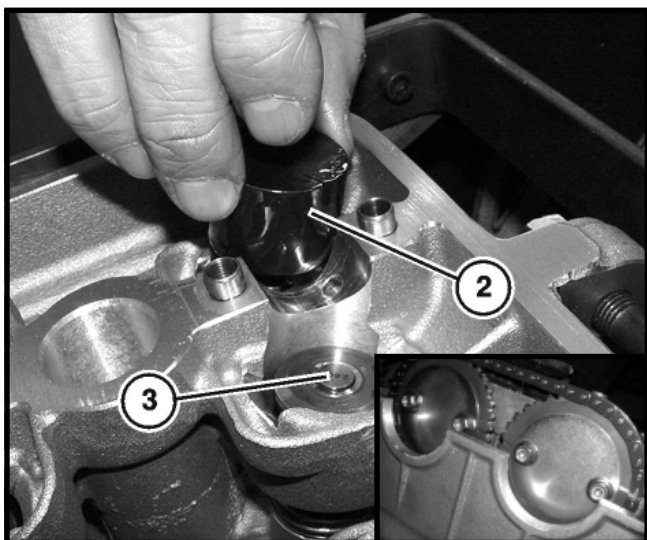
Exhaust =  $0.35 \pm 0.40$  mm





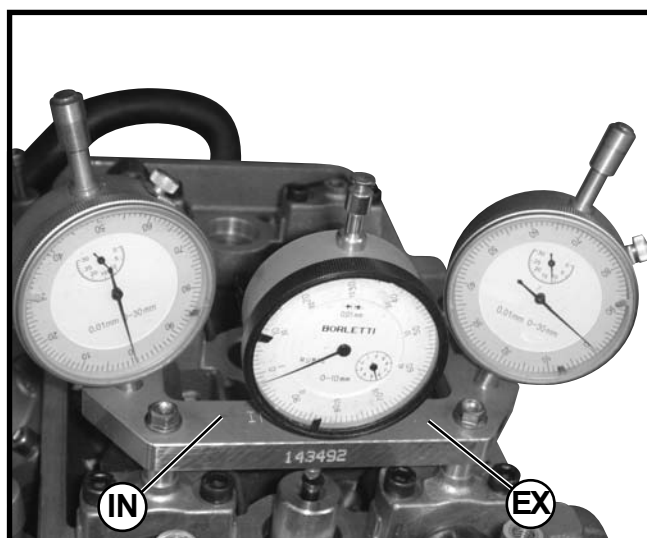
### 3.9.1 VALVE TABLET REPLACEMENT

Remove the chain stretcher.  
Remove the camshaft fixing bridges.  
Raise the cam shaft paying attention to keep all teeth of the distribution chain in place, allowing so the removal of the valve chap.s (1).



Raise the valve chap.s (2) one at a time by aid of a magnet.  
Remove the valve tablet (3) replace it with a new one.





### 3.10 ENGINE DISTRIBUTION



#### ATTENTION:

*Specific instruments are needed to set up the distribution:*

- *Indicator for goniometer: R1801977027000*
- *Goniometer grip: R180197015000:*
- *DP-meter: R180197020000*
- *Valve lift verification equipment: R180197026000*

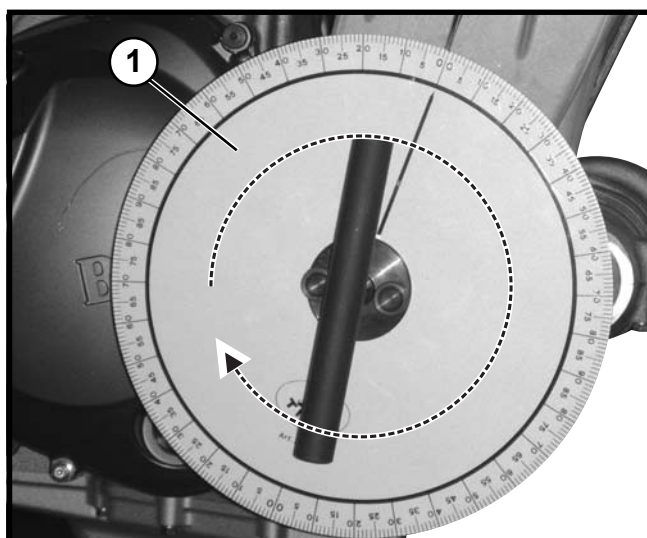
Remove the tank (see "tank disassembly").  
Remove the air box (see "AIR box disassembly").  
Remove the air box duct (see "AIR box disassembly").  
Remove the coils (see "coil disassembly").  
Remove the candles (see "candle disassembly").  
Remove the head carter (see "head carter disassembly").  
Remove the phonic wheel CHAP. (see "phonic wheel disassembly").

Mount the special tools.

Take the engine to the UDP (see procedure).

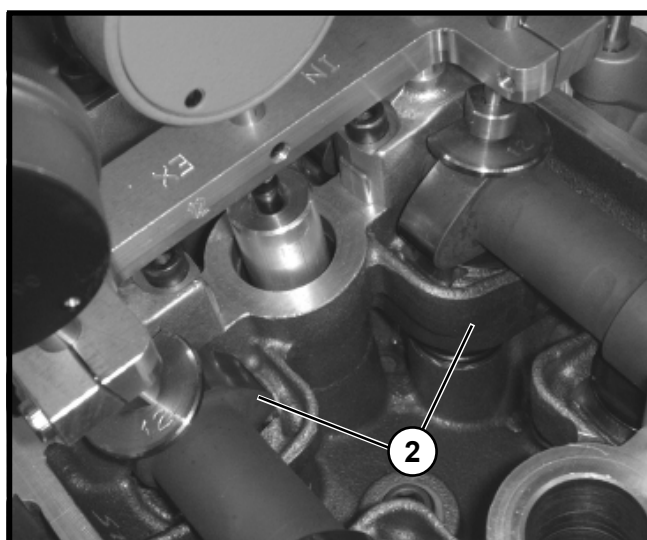
#### NOTE:

The equipment for checking the valve lifter is to be mounted with the initials **IN** aspiration side and **EX** on the exhaust side.



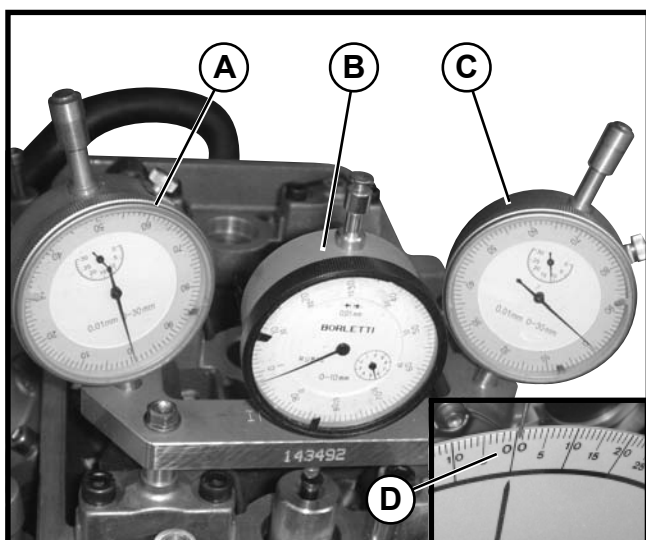
Rotate the goniometer hold clockwise (1) until the first piston reaches the UDP.

Verify that the notches on the sprockets of the camshaft are aligned among them and with the head plane.

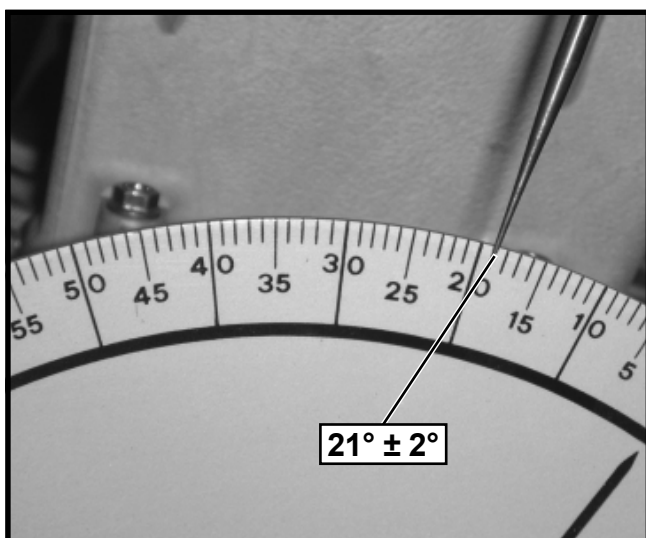


Verify that the Olive (2) of the camshaft aspiration and exhaust of the first piston are turned one towards the other.





At UDP set the comparators to (A) (B) (C) and the goniometer to zero.

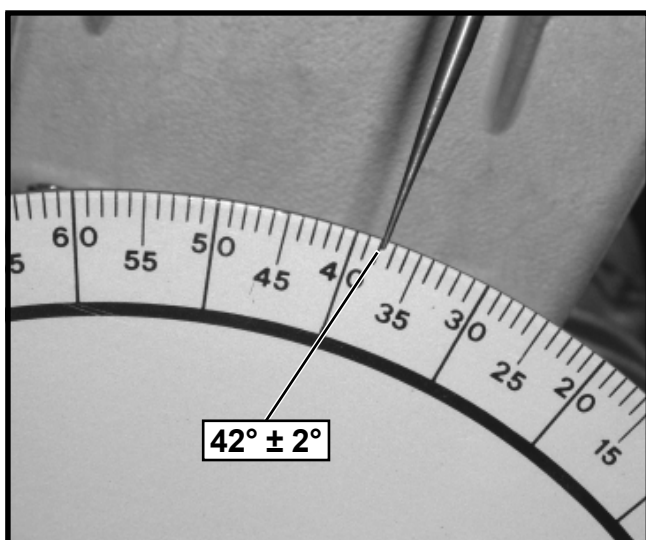


Rotate the goniometer hold clockwise the comparator (A) (aspiration) to 1 mm and check the goniometer value.



**SPECIFIC VALUE:**

**Aspiration 21° opening  $\pm 2^\circ$  before the UDP**



Return piston one to the UDP.  
Verify and reset the comparators and the goniometer.  
Rotate the goniometer clockwise charging 1 mm on the comparator (C) (exhaust).  
Verify the specific value on the goniometer.



**SPECIFIC VALUE:**

**Opening exhaust 42°  $\pm 2^\circ$  before the LDP**





### 3.11 CHECK ENGINE OIL LEVEL



**WARNING:**

*Do not mix chemical additives in the oil nor use types of oil different to that in the oils and liquids table. Make sure that foreign bodies do not penetrate into the casing during filling.*



**ATTENTION:**

*New or used engine oil can be dangerous. Swallowing new or used engine oil can be harmful to people and domestic animals. In the case of swallowing engine oil, call a doctor immediately and, in order to avoid sucking the product into the lungs, do not provoke vomiting. It has been noted that continuous contact with engine oil provokes skin cancer in cavies.*

*Brief contacts with engine oil can irritate the skin.*

- *Keep new or used engine oil away from children and domestic animals.*
- *Wear long-sleeved clothing and gloves impermeable to water every time filling engine oil is carried out.*
- *Wash with soap and water if engine oil has been in contact with the skin.*
- *Recycle or dispose of used engine oil correctly.*





**WARNING:**

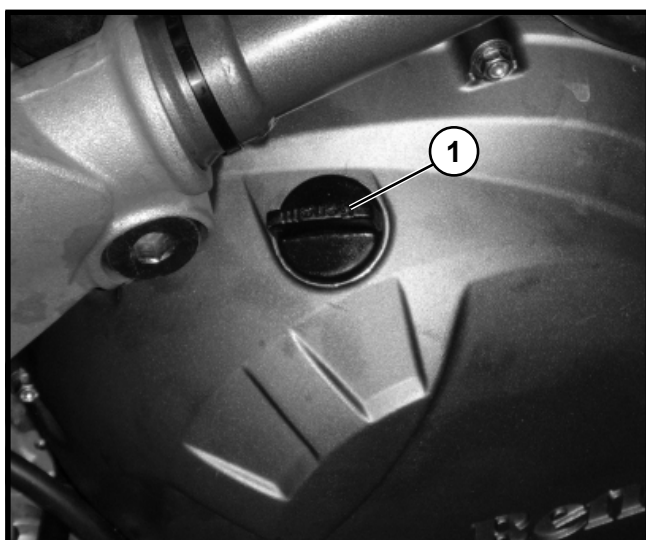
***Danger: Do not start the engine if the oil is below the MIN. reference.***

Carry out the check cold with the engine off.  
If carried out while warm, the engine must be off for at least ten minutes.

This check is carried out placing the motorbike on a horizontal surface and in an upright position (vertical position).

The level must be between the MAX and MIN references on the casing.

In the case where the level of the oil is below the MIN reference, refill.

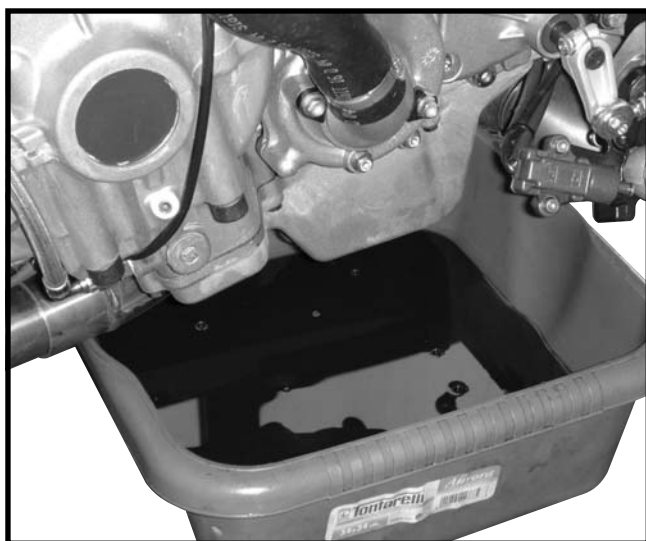


To restore the level, undo the oil cap (1) with the engine off and pour a quantity of oil of the type advised until reaching half way up the spyhole, between the MAX and MIN references. Screw on the cap (1) again.

**NOTE:**

The engine contains around 3.8 litres of oil.

Use oil classified API-SG or SH and viscosity SAE 15 W / 50.



### 3.12 CHANGE ENGINE OIL AND FILTER

Let the engine run at minimum for 5 minutes, then turn it off.  
Place an adequate container under the engine to catch the oil used.

Exchange the motor oil with hot engine and with the motorcycle on a horizontal plane to guarantee that it will empty completely.

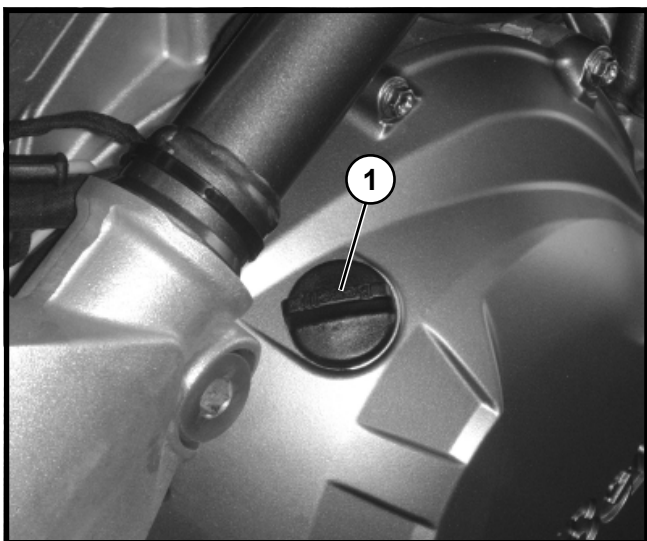
**ENGINE OIL:**

Replace initially at 1000 km (see maintenance table).

**OIL FILTER:**

Replace initially at 1000 km (see maintenance table).



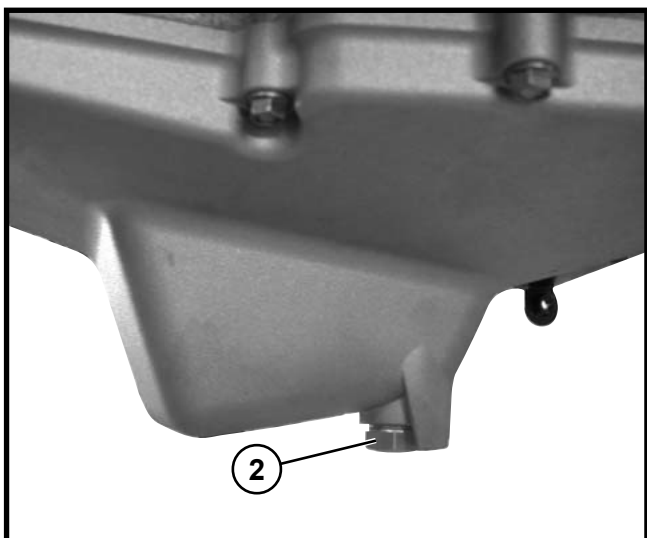


**ATTENTION:**

*Used oils are harmful to the environment.*

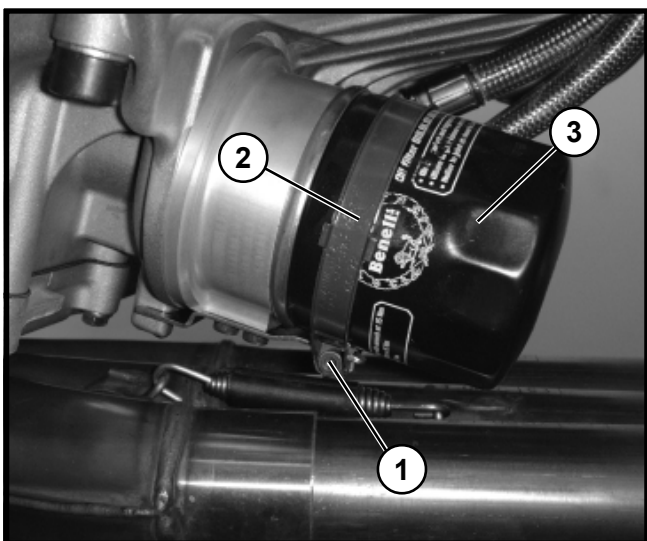
*Dispose of the used oils according to the regulations in vigour.*

Remove the oil loading cap (1).



Remove the magnetic oil discharge chap. (2).

Let all the used oil empty away.



Loosen the screw (1) and remove the security clamp (2).

Unscrew and remove the oilfilter (3).

Replace the filter with a new one, tighten to the correct torque.



**WORM DRIVE**

**15 N·m 1,5 Kg-m**

**20 N·m 2,0 Kg-m**





**ATTENTION:**

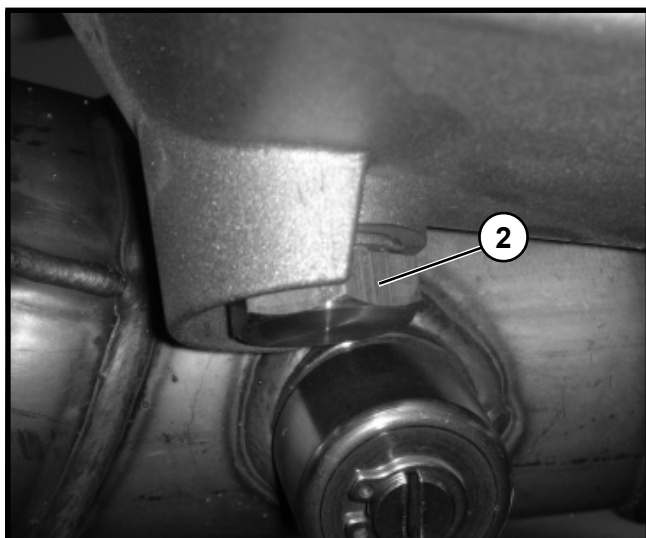
*To re-mount the oil filters (3), oil the surfaces of their contacts.*

**NOTE:**

It is essential to use original Benelli filter oil Code: R180107101000.

Oil filters of other brands can differ as far as the threading (diameter and step) is concerned.

Filtering performance and duration can consequently be a source of possible damage to the engine or loss of oil.



Verify that the sealing washer of the magnetic CHAP. is not damaged.

Replace it if necessary.

Re-position the oil exhaust cap (2) and tighten it.



**22 N·m 2,2 Kg-m**

Fill the engine block with the recommended motor oil until the maximum reference level is reached on the inspection window.

Turn the engine on and let it run at minimum for about 5 minutes.

Switch off the engine and wait for 5 minutes.



Always check that the level in the spyhole is midway between the Max and Min references.

Restore the engine oil level if necessary.



**ENGINE OIL QUANTITY:**

- without substitution of oil filter: about 3.8 litres
- with substitution of oil filter: about 4.0 litres





### 3.13 CHECK COOLING LIQUID LEVEL



**WARNING:**

*Filling the cooling liquid must always be carried out with the engine cold. Never try to remove the radiator cap when the engine is hot to avoid the risk of burns.*



**ATTENTION:**

*In determined conditions the ethylene glycol contained in the cooling liquid is inflammable and its flame is invisible. Avoid contact between the cooling liquid and hot elements, the consequent combustion of the ethylene glycol may expose to the risk of burns.*



**WARNING:**

*The cooling liquid of the engine is harmful if swallowed and enters into contact with the eyes or the skin.*

*Keep the cooling liquid far from children and domestic animals.*

*In the case of swallowing cooling liquid, call a doctor immediately and, in order to avoid sucking the product into the lungs, do not provoke vomiting.*

*In the case of contact of the engine cooling liquid with the eyes or the skin, immediately rinse with water.*



**WARNING:**

*Sprays of refrigerant can damage painted surfaces. Be careful not to spill the fluid when filling the cooling plant.*

*Wipe any eventually spilt refrigerant with a clean cloth immediately.*



**WARNING:**

*Do not use the motorcycle if the level of the cooling liquid is below the MIN reference.*



Execute the control with cold, stopped engine.

This check is carried out placing the motorcycle on a horizontal surface and in an upright position (vertical position).

The level must be between the reference MIN and MAX on the recovery tank.





To access the radiator CHAP., loosen and remove the screw (1) the upper closing lid (2) of the cooler right side. Remove the CHAP. and fill up to the upper limit of the radiators neck using recommended cooling liquid. Verify the reference MIN and MAX on the recovery tank.



### 3.14 CHANGE REFRIGERANT LIQUID

**NOTA:**

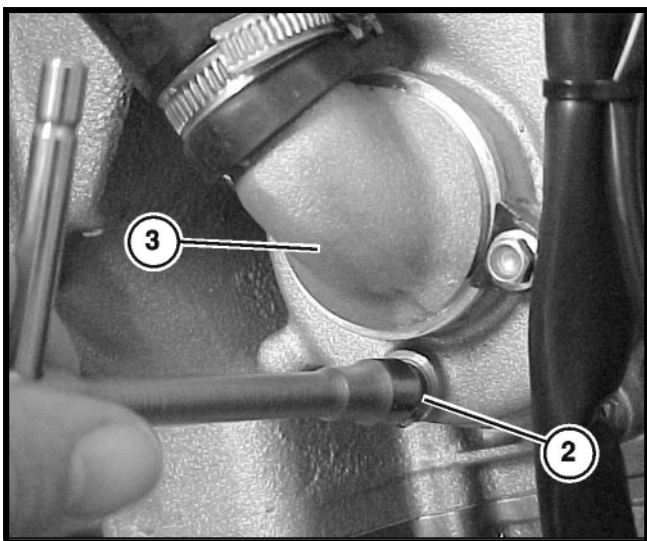
Eeguire le seguenti operazioni a motore freddo e moto sul cavalletto laterale.

Remove the radiator cap (1).



Prearrange near the motorcycle a container with a capacity higher than 4 litres for the exhausted liquid recovery.

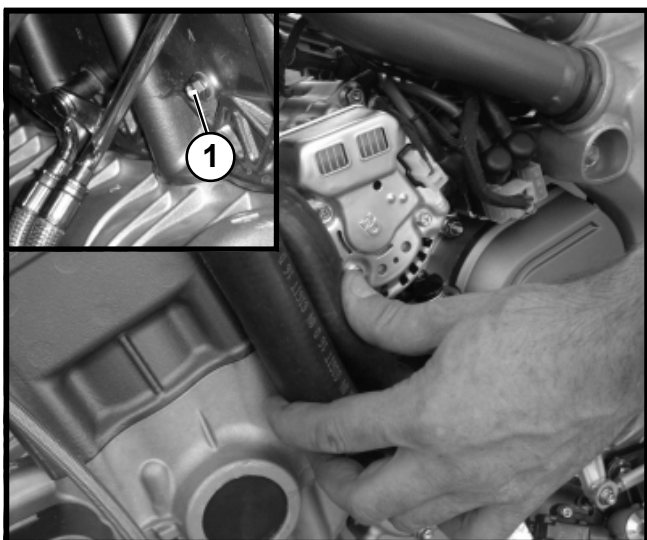




Remove the liquid discharge screw (2) on the pump (3) and recover the washer.

**NOTE:**

Let the cooling liquid empty away completely.



**NOTE:**

To facilitate the complete emptying of the cooling liquid contained in the cylinder blocks, lean the bike on both sides and press contemporaneously on the entry and exit rubber tubes of the radiator.

Remove the discharging bolt (1) on the cylinder (2) to discharge the residual liquid in the cylinder head body and cylinders. Wait for the cooling liquid to empty itself completely.



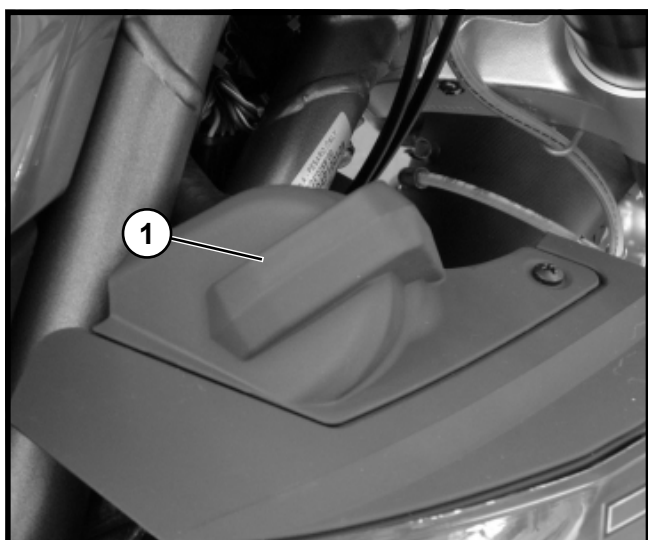
**TIGHTEN LIQUID DISCHARGE SCREWS ON PUMP AND CYLINDERS**  
8 N·m 0,8 Kg-m



**ATTENTION:**

*In re-mounting always substitute the copper washers of the discharge screws with new washers and tighten*





### 3.15 FILL COOLING PLANT

**NOTE:**

Carry out the following operations with the engine cold and the bike on the lateral assembly stand.

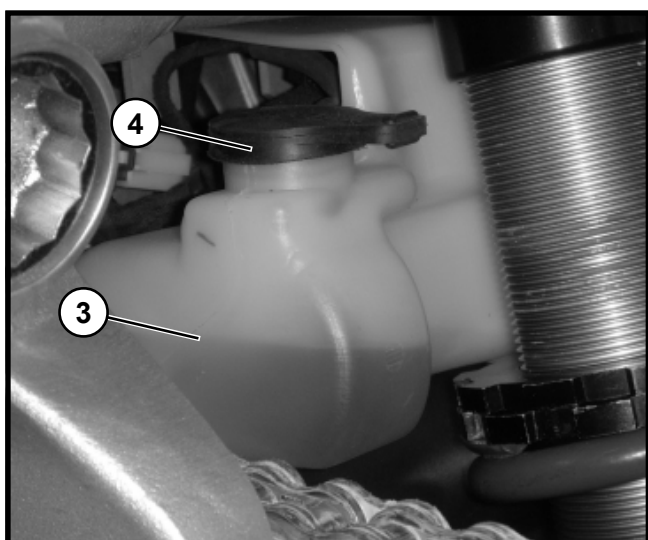
Remove the radiator chap. lid (1).  
Remove the radiator **chap.** right side.



Fill the circuit with about 3 litres of cooling liquid, through the supply pipe (2) up to the brim.

**NOTE:**

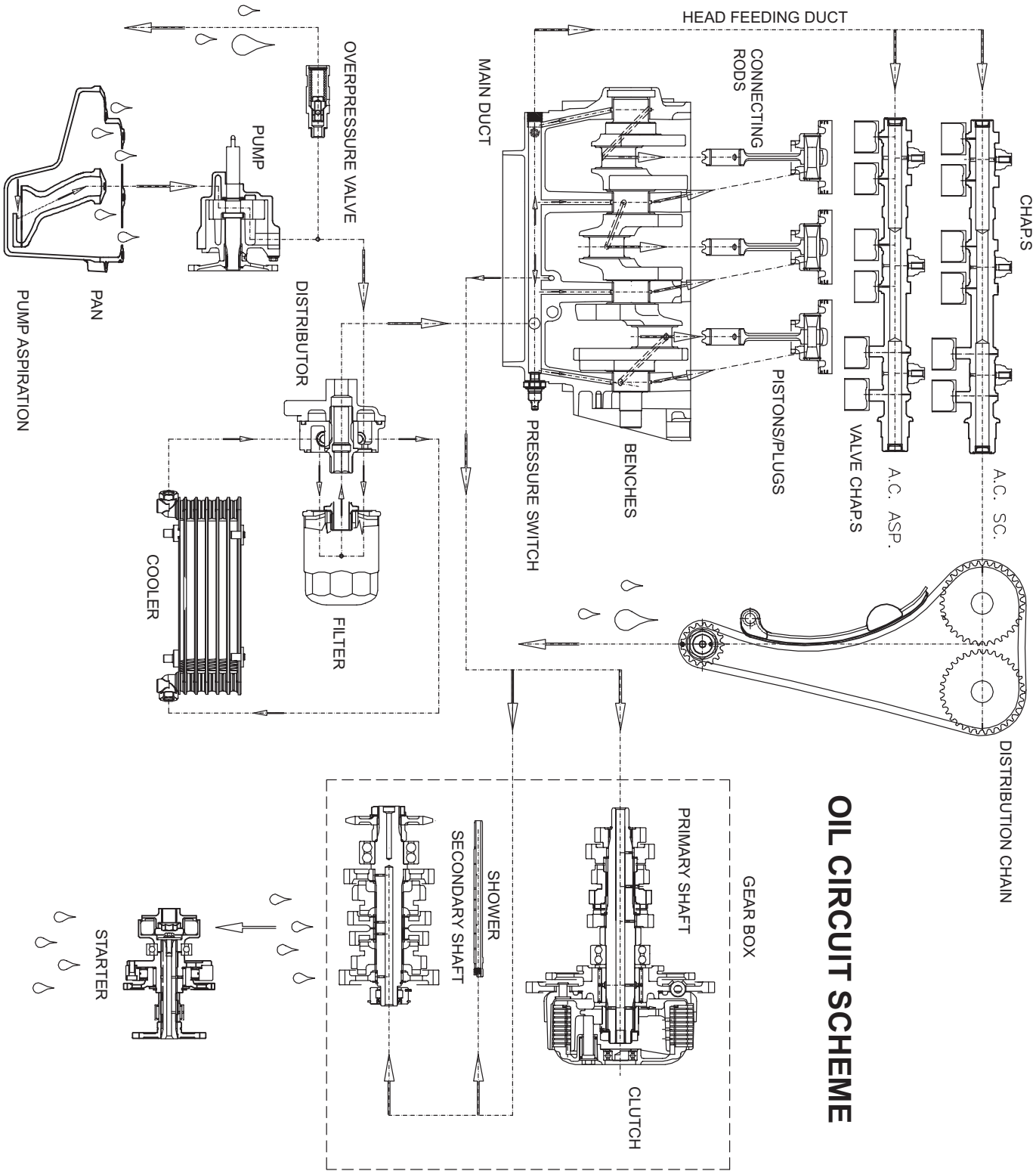
To remove possible air sacks press the **COOLER** rubber pipes or incline the motorbike alternating to both sides.



Verify the liquid cooling level through the recovery cistern (3).  
Take the reference level between MIN and MAX.  
Close the **CHAP.** of the recovery (4) tank.  
Start the engine and bring it to working temperature, until the fans start (about 103°).  
Through the radiator pipe union switch off the engine.  
Fill up through the radiator pipe if necessary and turn the engine off.  
Let it cool and check the level of the refrigerant liquid.

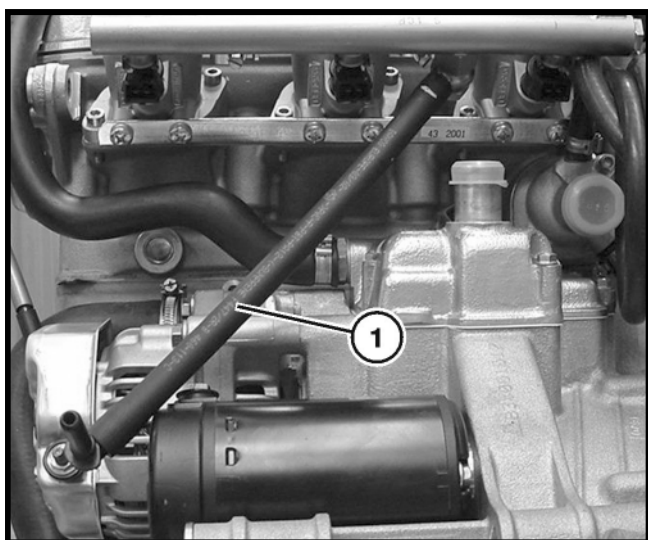


COOLING SYSTEM SCHEME



OIL CIRCUIT SCHEME





### 3.16 CHECK FUEL TUBES

Remove the tank (see "DISMANTLE TANK").  
Take off the petrol pipe with the specific tool.



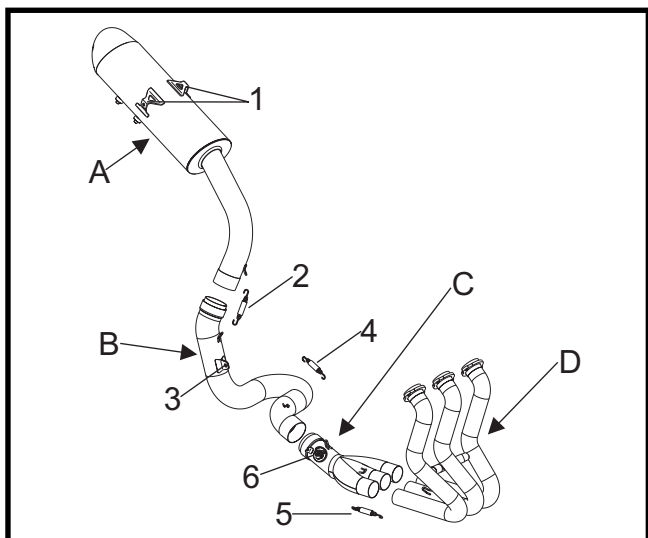
#### SPECIFIC EQUIPMENT

**Petrol tube rapid release kit:**  
**R180100143000**

Sight check the state of the fuel tube (1).  
If the tube is damaged or excessively worn, change it.  
Unscrew and remove the petrol pipe fixing screw from the injectors flute.

#### NOTE:

The petrol tube must be changed every 16000 Km.

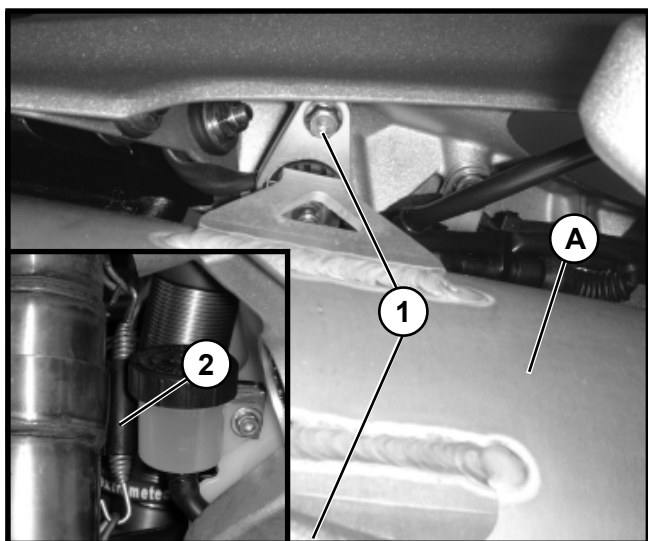


### 3.17 CONTROL AND REPLACEMENT EXHAUST PLANT

Remove the driver and passenger saddle (see "saddle disassembly").  
Verify the state of the components of the exhausting plant, if any piece is excessively worn or damaged replace it.

Remove the number plate holder (see "disassembly number plate holder").

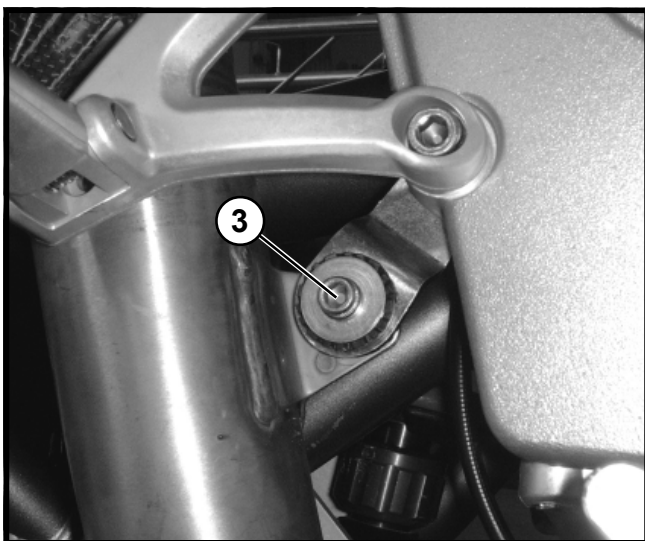
- Unscrew and remove the two screws (1), take off the spring (2) and slip off the muffler (A).
- Unscrew and remove the screw (3), take off the holding spring (4), slip off the second pipe union (b).
- Take off the spring (5), take off the valve cable (6), slip off the three in one pipe union (c).
- Unscrew and remove the nuts from the screws, remove the manifolds (d).
- Check the pieces visually and if damaged or particularly obstructed replace them.
- Remove the butterfly choke valve from the third three in one union, clean with solvent from the carbon deposits if damaged replace the piece.



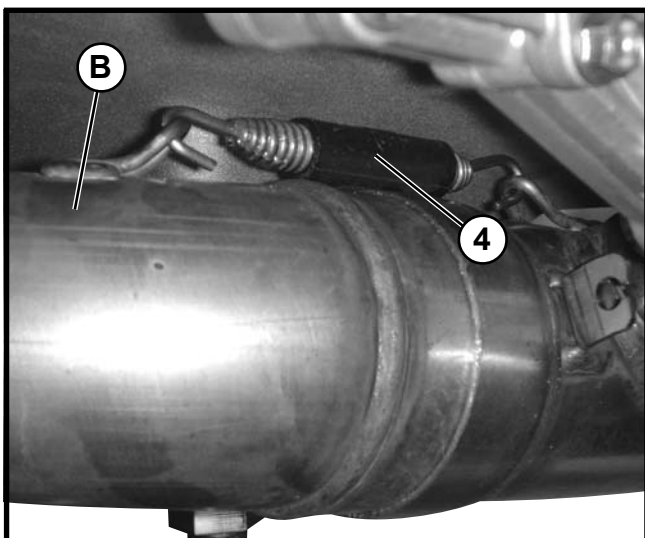
Remove the number plate holder.

Loosen and remove the screws (1), take off the spring (2) and slip off the muffler (A).

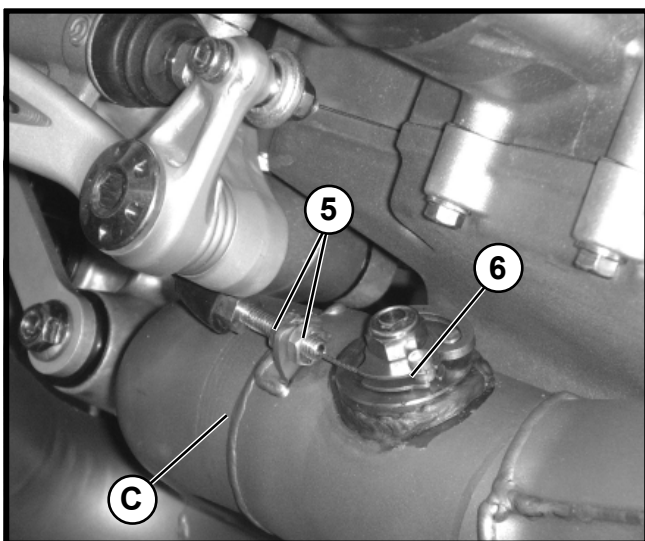




Loosen and remove the screw (3).

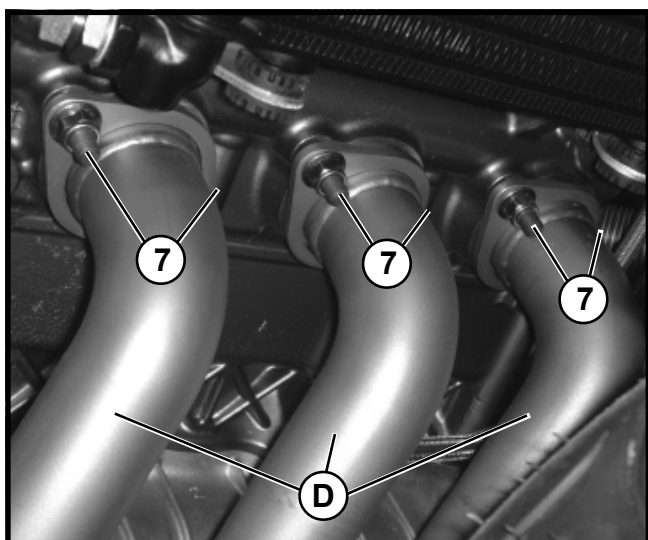


Take off the holding spring (4), slip off the pipe union (B).



Loosen the nut and the lock nut (5).  
Take off the valve recall cable (6).  
Slip off the three in one pipe union (c).

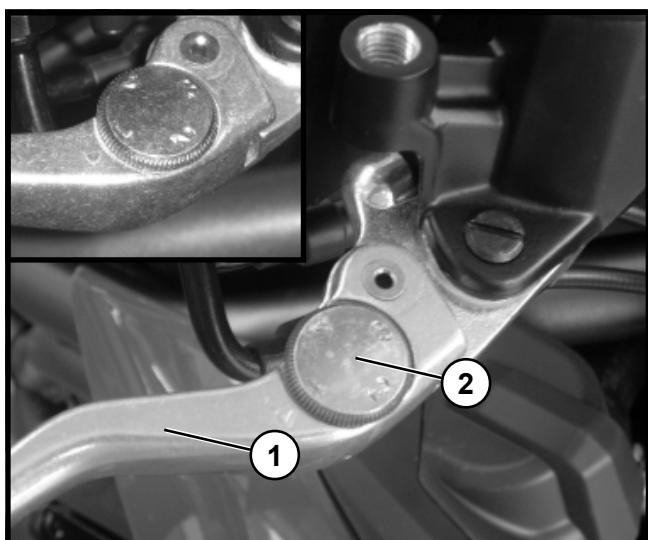




Unscrew and remove the screw's nuts (7).

Remove the manifolds (d).

Check parts visually if particularly damaged or obstructed replace them removing the three in one pipe union (c). Verify if the choke valve is not obstructed, if required clean with solvent to remove the carbon deposits. If damaged replace it.



### 3.18 ADJUSTMENT FRONT BRAKE LEVER



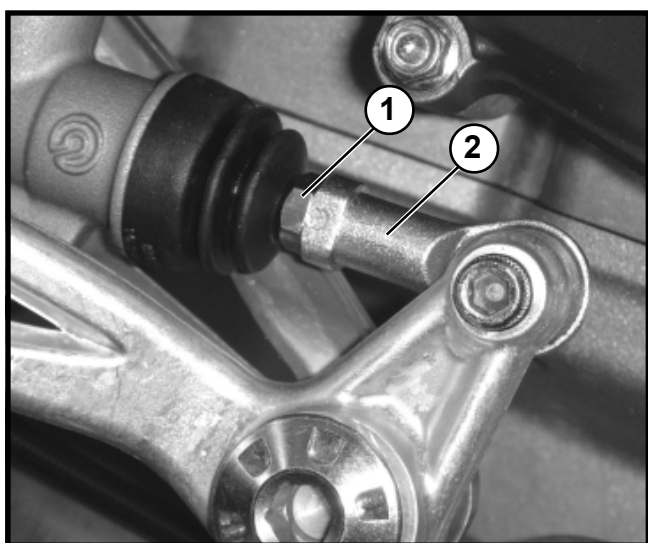
#### **ATTENTION:**

***Danger: never carry out adjustment with the engine running.***

Push on the lever (1) to neutralize the spring's push and simultaneously adjust the position rotating the ring nut (2) clockwise or counter clockwise, setting the lever in one of the four possible positions.

Position 1 farer from the handlebar.

Position 2 nearer the handlebar.



### 3.19 ADJUSTMENT REAR BRAKE PEDAL

Loosen the nut and the lock nut (1).

Adjust the rear brake command clearance acting on the threaded pivot (2).

Tightening the game increases.

Loosening the game decreases.



### 3.20 CHECK BRAKE LIQUID



#### **WARNING:**

*An insufficient quantity of brake liquid may allow the penetration of air into the brake plant, reducing the efficiency of braking with a consequent increase in the risk of accidents.*

*The presence of air in the hydraulic plant can be felt in the case in which, pressing the brake pedal, there is a sensation of excessive pliability. In the case of the presence of air in the hydraulic plant, carry out a purge.*

#### **NOTE:**

**Check initially at 1000 Km and then every 5000 Km**



#### **ATTENTION:**

*Brake liquid is harmful or mortal if swallowed and harmful if it comes into contact with the skin or the eyes.*

*Keep the brake liquid away from children and domestic animals. In the case of swallowing the brake liquid call a doctor immediately and, in order to avoid sucking the liquid into the lungs, do not provoke vomiting. In the case of contact of the brake liquid with the eyes or the skin, rinse immediately with water.*



Wear on the brake pads causes a normal fall in the level of the fluid.

In any case, the level must be between the MAX and MIN references.

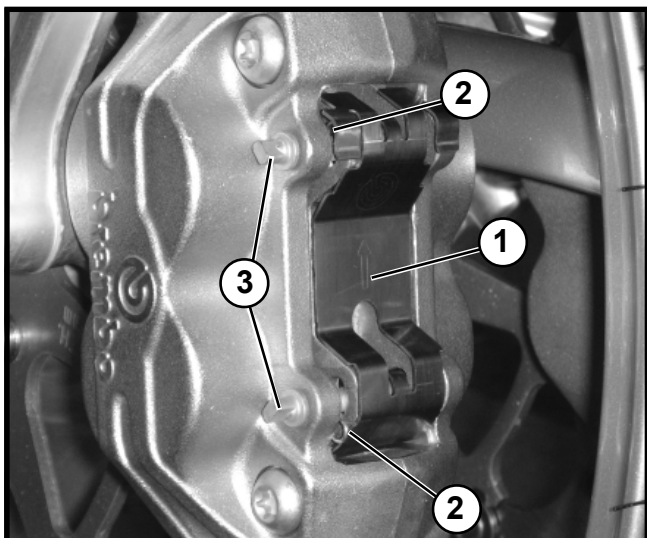
If this level falls below the MIN reference, a check must be made of the braking plant.



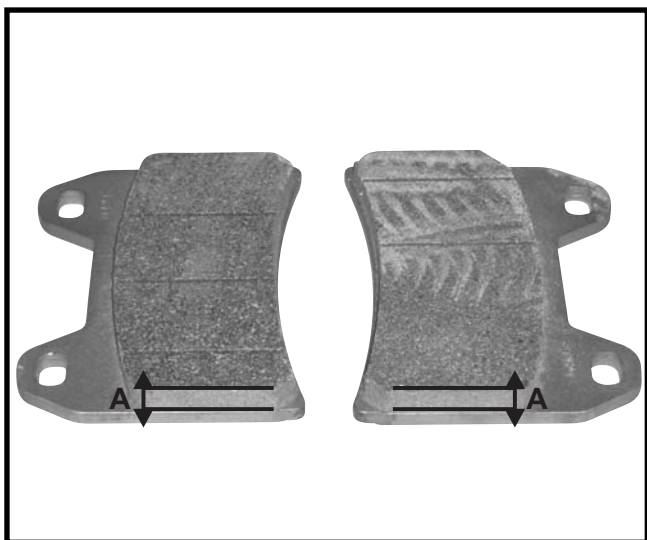


### 3.21 CHECK FRONT AND REAR BRAKE PADS

Unscrew and remove the fixing screws (1) of pliers.



Take off and remove the elastic bulkhead (1).  
Extract the two elastic pivots (2), slip off the two fixing plugs (3) of brake blocks.



Remove the brake blocks verifying that the thickness (A) is not under 3,5 mm.

It is necessary to replace the brake blocks when the contact surfaces between the block and the disc, is down to brake lining (A).

Besides the visual checking, you can hear a particular noise while braking due to the dragging of the brake lining on the disc.

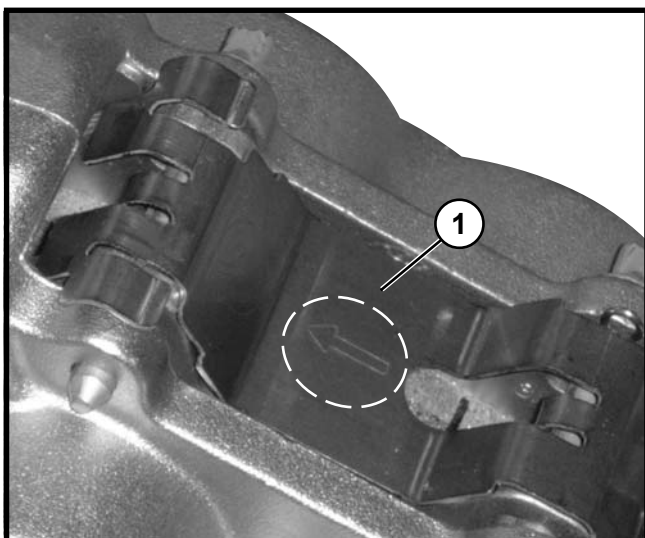
**NOTE:**

**It is necessary to replace brake blocks always in couple to guarantee a uniform pressure.**

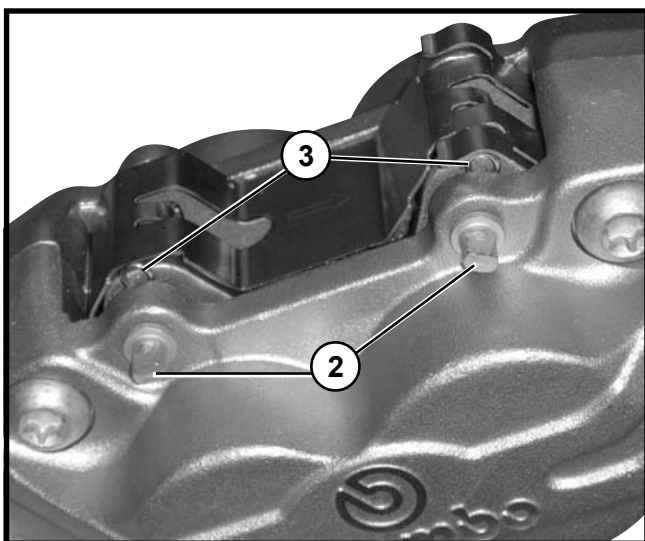




Clean the inside of the pliers especially around the pistons. Push the pistons of the pliers simultaneously inside to allow the installation of the new brake blocks.



Install the elastic bulkhead (1) with the arrow up (in march sense).



Position the two blocks, insert the two plugs (2), insert the two elastic stoppers (3). Position the brake pliers on the fork stem so that the disc is between the two blocks. Insert and tighten the two screws on the fork stem to the indicated torque.

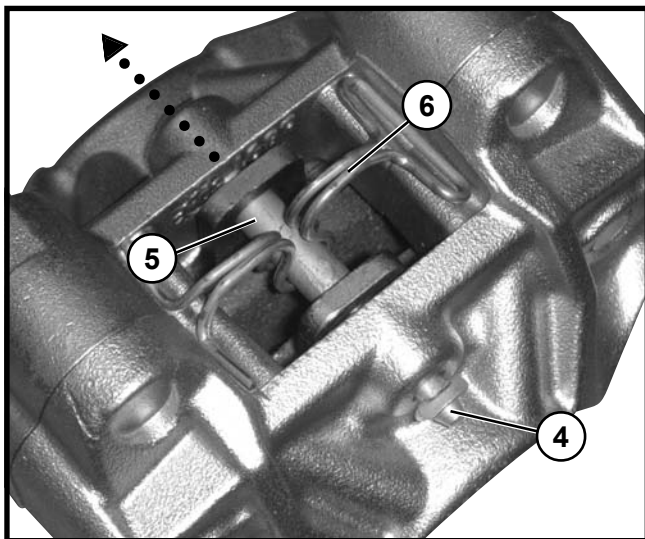


**30 N·m 3,0 Kg-m**



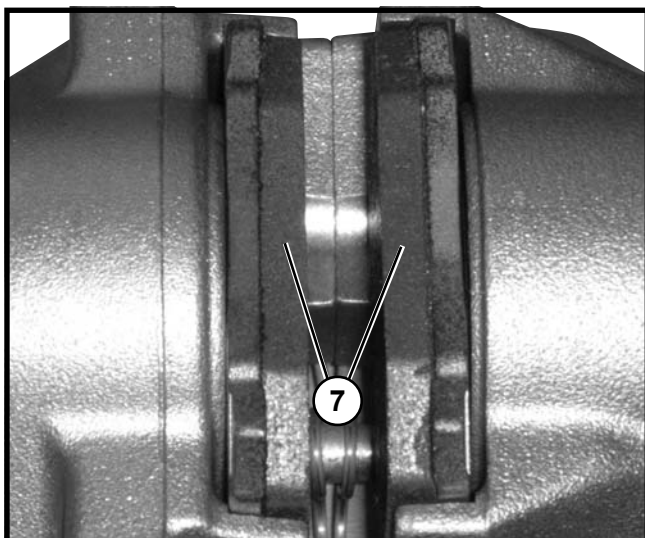
**WARNING:**  
After changing the brake pads, work on the brake command with long but not intense braking for about a hundred Km.





### 3.21.1 CHANGE REAR BRAKE PADS

Remove the safety ring (4), undo the pin (5) on the opposite side and remove the spring (6).



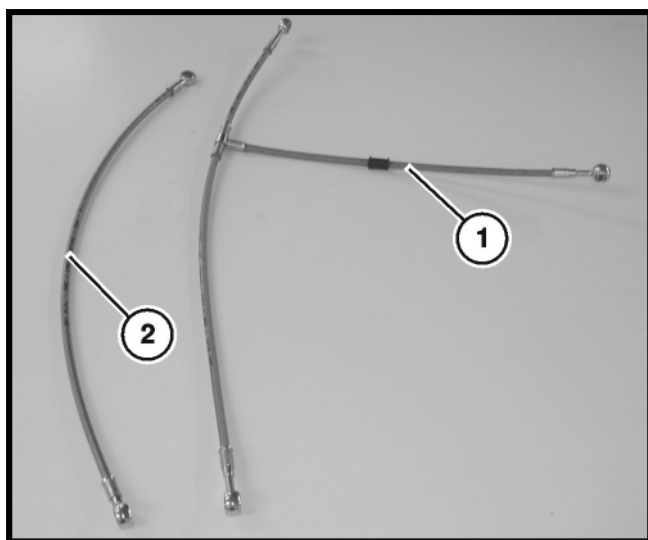
Replace the couple of blocks (7).  
Re-position spring (6), pin (5) and secure with ring (4).



**WARNING:**

*After changing the brake pads, work on the brake command with long but not intense braking for about a hundred Km.*





### 3.22 CHECK BRAKING PLANT TUBES

Pull the break lever or the break pedal fully and check that no air did come into the system.

If the lever or the pedal seem soft or elastic during use, discharge the air from the plant.

Inspect the flexible pipes and the connectors of the brake to identify wear signs, cuts or losses.

If necessary replace the flexible tubes and the connectors.

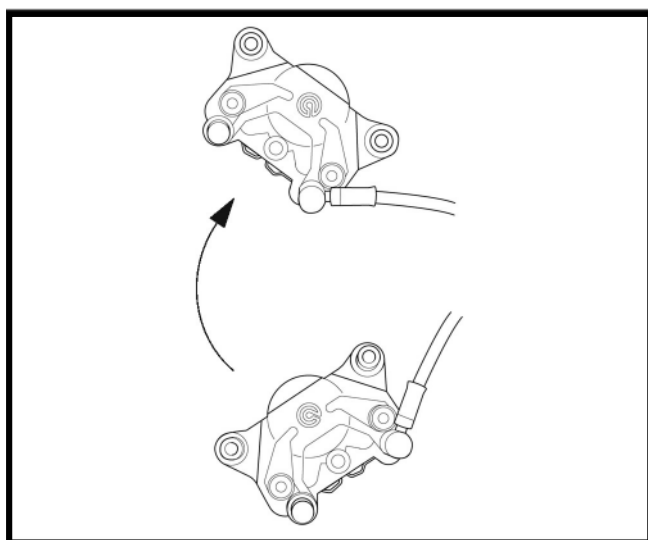
Refer to the air discharge procedures.

Sight check the state of the front (1) and rear (2) braking plant tubes.

#### NOTE:

Check every 5000 Km .

Change the tubes every 4 years.



### 3.23 AIR DISCHARGE FRONT BRAKING SYSTEM



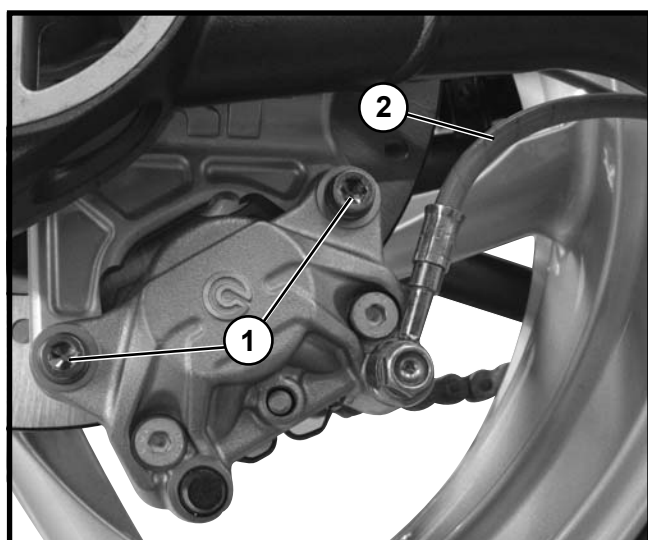
#### WARNING:

*Fill with the brake liquid using only the type of liquid advised in the oils and liquids table of this manual. Eventual mixing of fluids of a different type might cause a dangerous chemical reaction and a diminishing of braking efficiency, with a consequent increase in the risk of accidents.*



#### WARNING:

*During the purge of the braking plant maintain the level of the tanks between the MIN and MAX levels.*



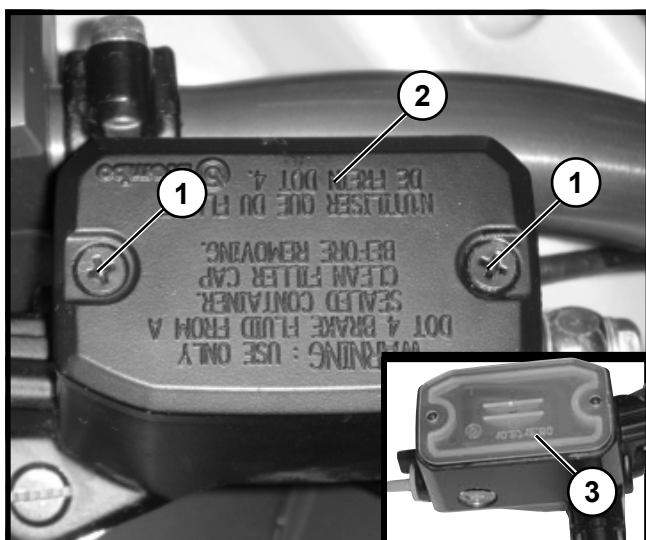
#### NOTE:

The liquid poured on painted parts made of plastic or rubber can damage them.

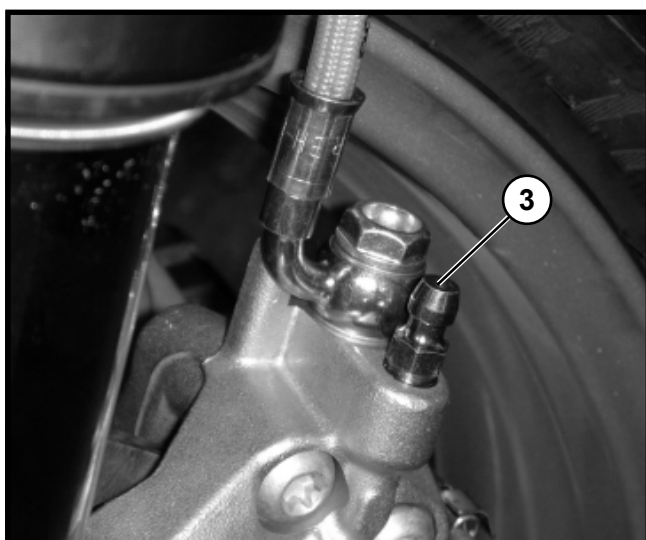
During the maintenance of the system cover the parts at risk with a cloth or paper.

Avoid alien parts coming into the system during the filling of the tank.





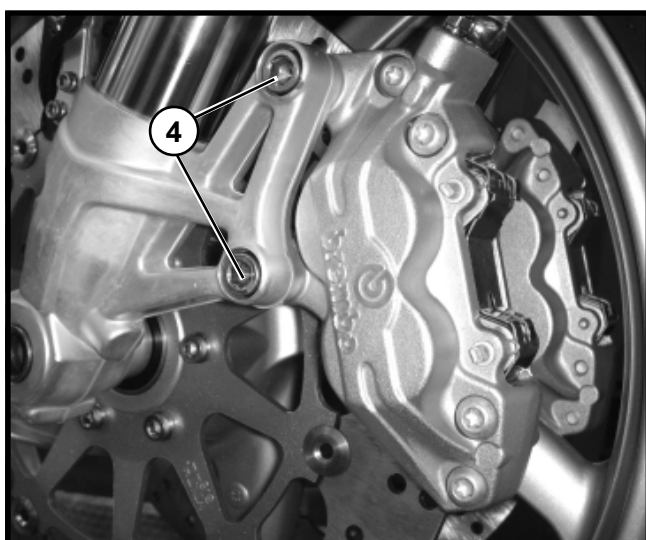
In the case of the front brake before taking away the lid of the tank turn the handlebar until the tank is parallel to the ground. Unscrew and remove the screws (1), remove the lid. Remove the lid (2) membrane plate (3), the membrane and the float.



Connect a discharge pipe to the pliers air discharge screw (3). Loosen the discharge valve. Push and release the lever or the pedal repeatedly and in quick sequence. Press fully and open the purge screw (2). Repeat the procedure until all the air bubbles have been completely removed. Check the oil level in the tank during the operation. Restore if necessary. Close the discharge screw. (3)



**25 N·m 2,5 Kg-m**

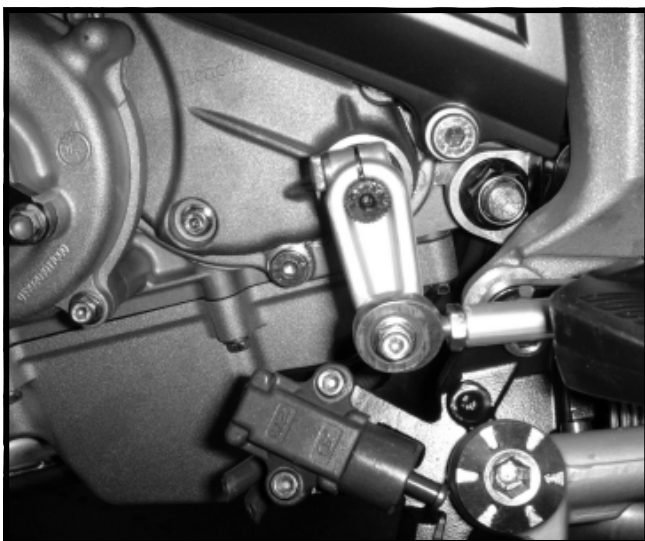


Reassemble the brake pliers. Tighten the fixing screws (4) to torque.



**25 N·m 2,5 Kg-m**





### 3.23.1 AIR DISCHARGE BACK BRAKE SYSTEM



#### **WARNING:**

*To carry out the purge of the rear plant, the brake clamps of the relative support have to be dismantled and the plant tubing kept as vertical as possible.*

To discharge the back brake system proceed in the same way as at the front removing also the pliers from the support. Raise the pliers taking it to a higher level than the brake oil tank making the discharge of air bubbles easier.

#### **NOTE:**

**Replace the oil every 2 years.  
Use oil classified DOT4.**



### 3.23.3 FILLING UP BRAKE LIQUID

Fill the tank with DOT 4 brake liquid. Connect a commercial automatic tool for brake discharge to the discharge valve.

Drive the discharge tool and loosen the discharge valve (1). If you do not use an automatic filling system, add the brake liquid when the liquid level in the tank goes down. Check the liquid level often during brake air discharge to avoid pumping air in the system. When a brake discharge tool is used, follow the user instructions of the manufacturer.

If a brake discharge tool is not available, adopt the following procedure.

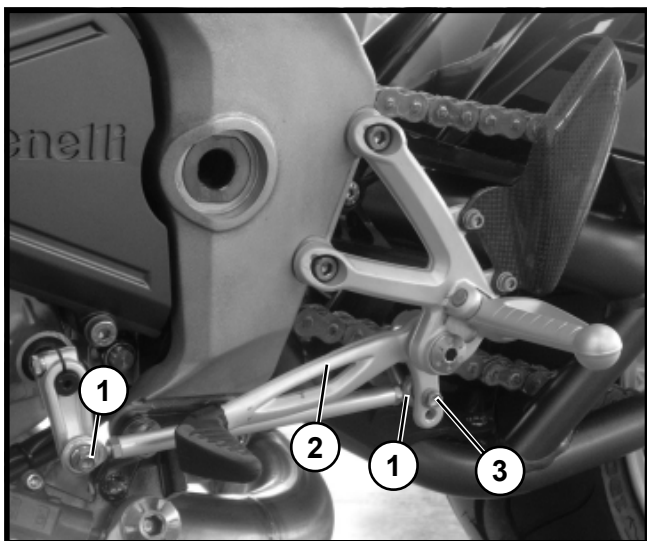
Connect a transparent discharge pipe to the discharge valve. Rise the plant pressure by pumping the lever or the pedal, until no more air bubbles are seen in the liquid coming out of the little hole and you can feel stronger pedal or lever resistance.

1. Press the brake lever or brake pedal, open the discharge valve by  $\frac{1}{2}$  turn and then close it again.
2. Release brake lever or pedal slowly and wait some seconds after reaching the end point.
3. Repeat the points 1 and 2 until in the liquid which comes out of the discharge valve is free of air bubbles.
4. Close the discharge valve.



**59 N·m 5,9 Kg-m**





### 3.24 ADJUSTMENT GEAR COMMAND PEDAL

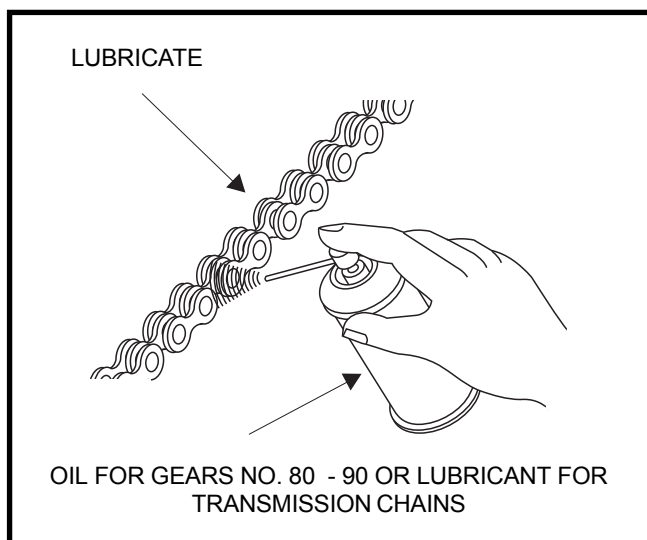
Remove the fixing screws (3) of the gear pedal rod.

Loosen the two nuts (1).

Adjust the angle of the gear command pedal by working on the rod (2).

Rotating it clockwise, the pedal will bend lower and vice versa if rotated anti-clockwise.





### 3.25 LUBRICATION AND CHAIN CLEANING



#### **WARNING:**

*The chain is of the type with seal rings (O-Ring); to prevent any damages, do not clean the chain by jet of high-pressure steam or water, neither using petrol or commercial cleaning solvents. The chain cleaning must be done exclusively using kerosene.*

Lubricate with oil for chains with O-ring.

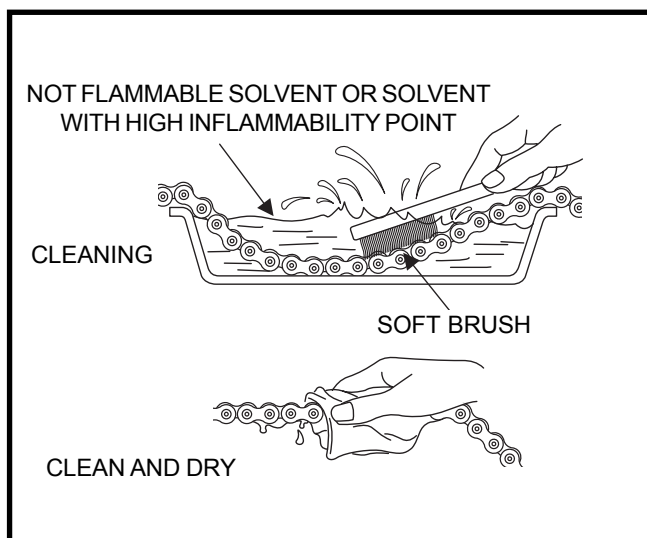
Apply a light and uniform lubricant layer on the whole length of the chain avoiding to spray on the surrounding parts, in particular the tyres.



**WARNING:** Do not dirty wheels and tyres with petrol or solvents during the chain cleaning.



**ATTENTION:** Kerosene is flammable. Contact with kerosene can be harmful to children and pets. Keep free flames and hot objects at high temperature far from kerosene. Keep children and pets away from kerosene. Dispose used kerosene correctly.



Preliminary cleaning: before lubrication it is mandatory to dissolve dirt deposits from the chain using kerosene: such deposits must be subsequently removed with a clean cloth and/or an air jet.

### 3.26 CHAIN REPLACEMENT



#### **WARNING:**

*Using the motorcycle with the chain in a bad condition or badly adjusted may cause accidents.*



#### **WARNING:**

*If the chain shows flattened or scuffed links, a correct oiling of the chain according to the instructions in this chapter needs to be carried out.*

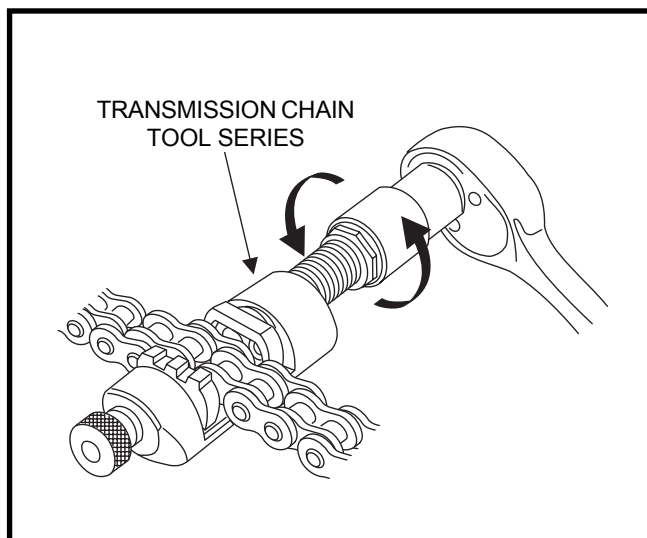
#### **NOTE:**

This motorcycle uses a transmission chain with riveted main link.

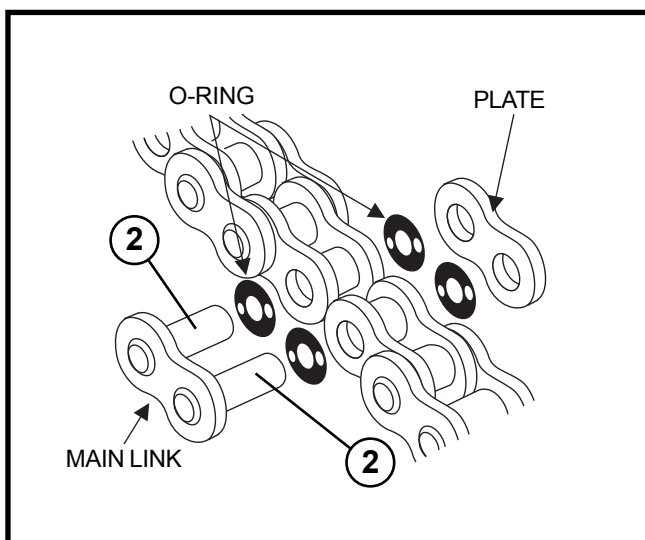
To execute the following operations place the motorcycle perpendicular to the soil on a back trestle. Fix the special chain closing/opening tool.

#### **NOTE:**

When the special tool is used, follow the instructions of the builder.







Identify the knurled terminals (2) of the pivots of the main link from the outside of the chain, remove the main link, the plate and the O-ring.

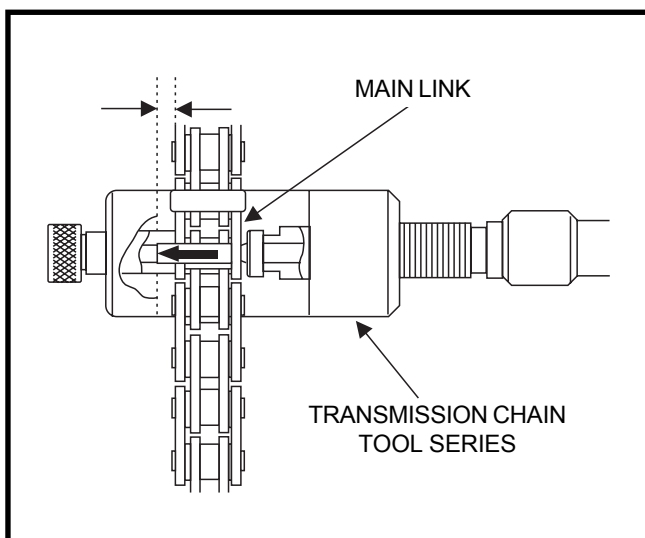
**NOTE:**

**When the links of the transmission chain are counted it is necessary to include the main link.**

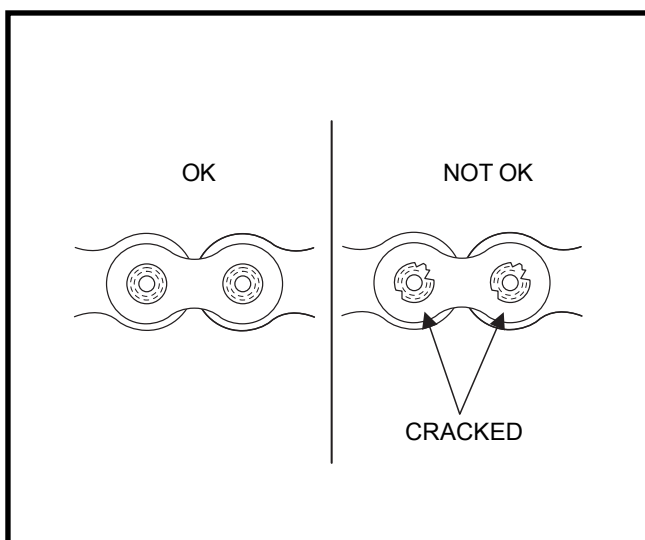
To make the following operations position the motorcycle perpendicular to the ground on a back trestle. Fix the special chain closing/opening tool.

**NOTE:**

**When the special tool is used, follow the instructions of the builder.**



Never use the old transmission chain, the main link, the plate of the main link and the O-ring rubber tops. Insert the main link from the inside of the transmission chain and install the plate with the identification sign turned towards the outside.



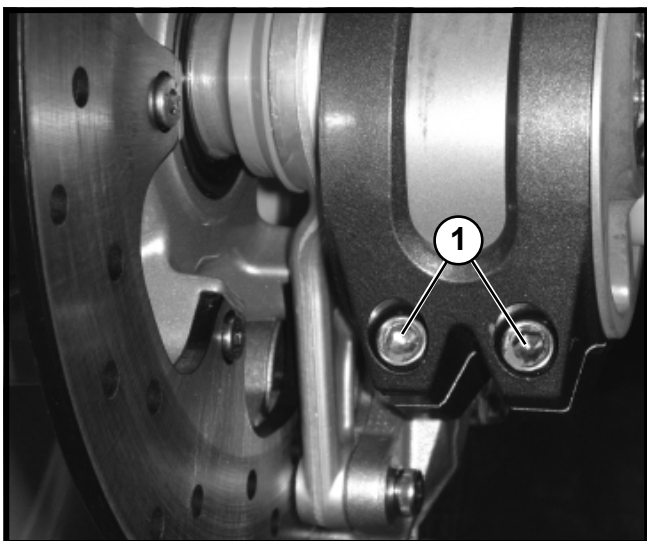
Be sure that the pivots of the main link are installed correctly. Rivet the pivots of the principal stitch. After riveting, check that the hit areas of the main link are not cracked. If there are cracks, replace the main link, the O-rings and the plate.



**WARNING:**

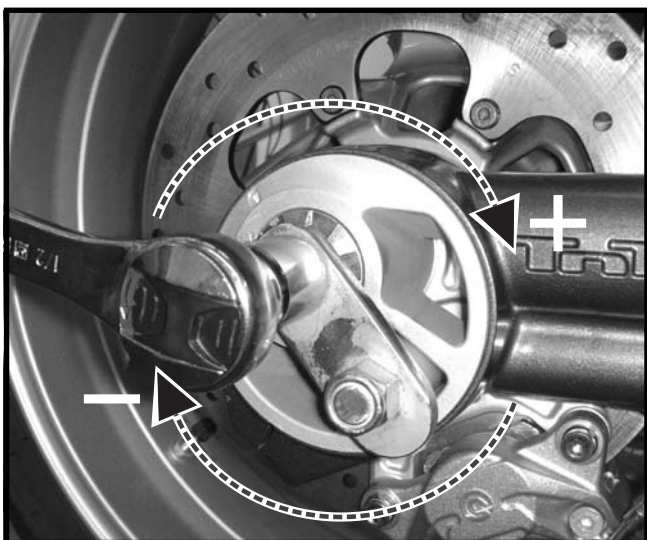
**Every time the chain is replaced also the relative cog-wheels must be replaced.**





### 3.27 CHAIN REGULATION

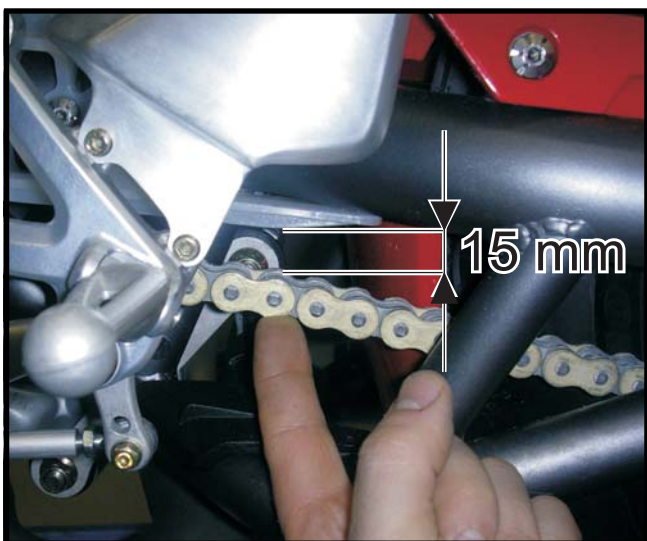
To make the following regulations position the motorcycle on a back trestle, on a horizontal plane with the gear in neutral. Loosen the eccentric blocking screws (1) on both sides of the fork.



Insert the specific tool in the eccentric rotate clockwise to pull the chain and counter clockwise to loosen the chain.



**SPECIFIC EQUIPMENT:**  
Chain regulation tool  
R300097147000



Verify that there are about 15 mm between the fork and the lower chain shoe.





**WARNING:**

*Use of the motorcycle with the chain in bad condition or never regulated can cause accidents.*



**WARNING:**

*If you note damages or excessive wear of the chain and the relative cog-wheels, replace them. Every time the chain is replaced also the relative cog-wheels must be replaced.*



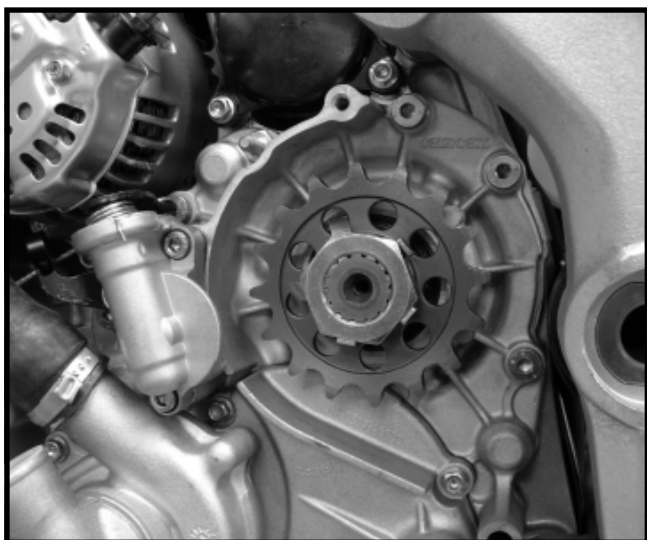
**WARNING:**

*If the chain presents squashed or seized links, lubricate correctly according to the instructions reported in the present chapter.*



**ATTENTION:**

*Do not inspect or adjust the transmission chain while the engine is on.*



### **3.28 CONTROL AND REPLACEMENT TRANSMISSION COG-WHEELS**

Remove the cog-wheel lid.

Remove the chain.

Check that the leading and conducted gear teeth are not damaged or worn, replace them if necessary.

Both, chain and cog-wheels must be in good conditions otherwise the new chain will wear rapidly.





### 3.29 CHECK AND ADJUSTMENT STEERING BALL-BEARINGS

Keeping the front brake drawn verify the clearance on the steering bearings.

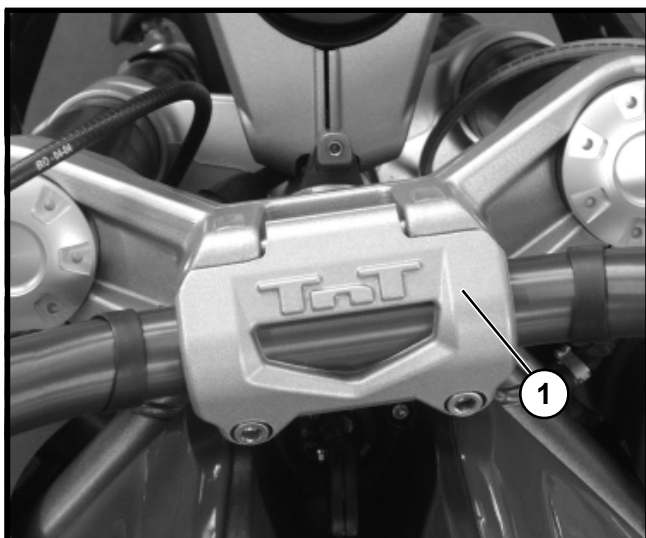
Check that the steering ball-bearings have no play.

If necessary procede as follows.

Unscrew and remove the handlebar plate fixing screws (1).

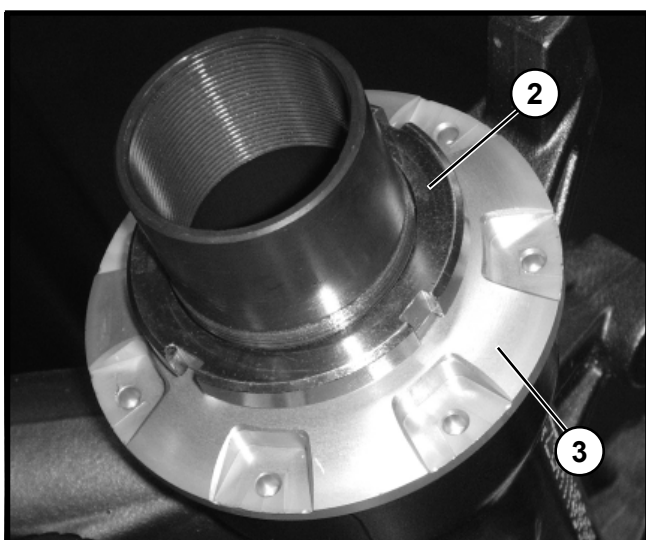
Lower the handlebar on the tank.

Protect the tank with a cloth.



Remove the upper steering plate (1) (see "DISMANTLE FRONT FORK").

Remove the handlebar.



#### **ATTENTION:**

*During the assembly phase never exceed the tightening torque to avoid steering malfunction.*

Loosen the counter ring-nut (2) and tighten the ring-nut (3) using the specific instrument.



#### **SPECIFIC EQUIPMENT**

**Steering ring-nut clamp:**  
R180297031000



**16 N·m 1.6 Kg·m**

Tighten the counter ring-nut (2).



**MANUAL + 90°**





Check the absence of play.  
If necessary, repeat the previous operations.  
Mount the handlebar.  
Mount the upper steering plate (1) (see "MOUNT FRONT FORK")  
Check the free rotation of the steering.



### 3.30 CHECK FORK

Keeping the front brake drawn verify the state of the fork moving it.  
Sight check the state of the splashguards.



If the fork needs maintenance, refer directly to the supplier listed in the "SPECIFICATIONS" chapter.





### 3.31 CHECK DAMPER

Check the state of the rear damper as shown in the figure.  
If the rear damper needs maintenance, refer directly to the supplier listed in the "SPECIFICATIONS" chapter.



### 3.32 ADJUSTMENT DAMPER

Two adjustments are possible on the rear damper: :

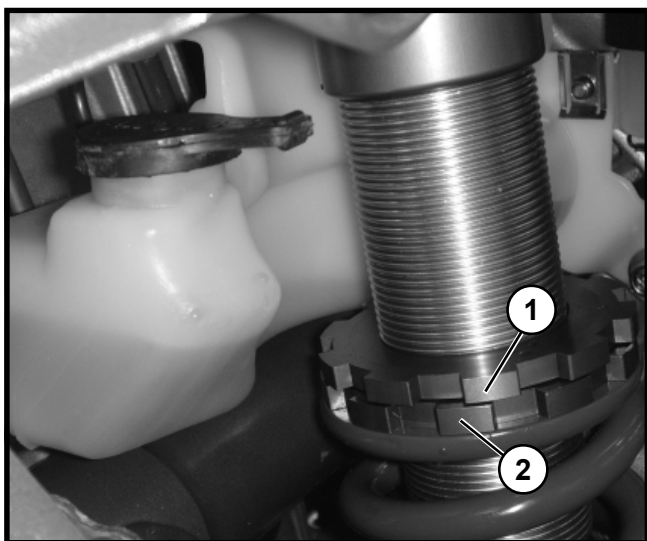
- Preload spring adjustment (1)
- Braking in extension adjustment (2)

#### REAR SUSPENSION

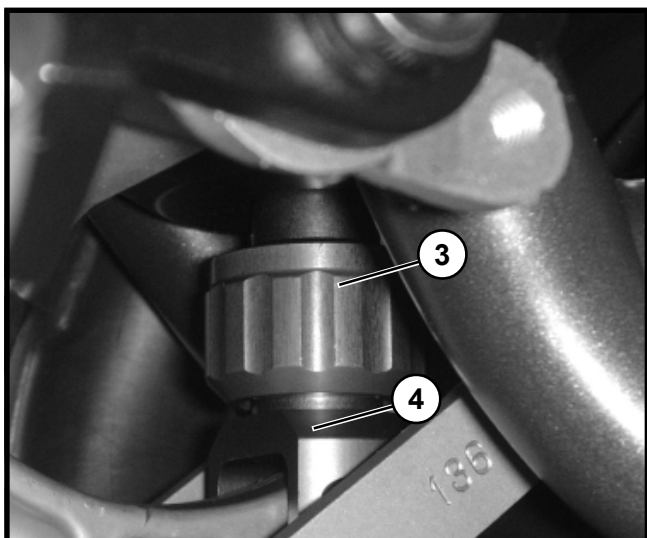
	Standard set-up
Spring length	140 mm
Spring Preloaded	14 mm
Brake in extension	12 clic

**NOTE:**  
The adjustment of the preload is carried out starting from the length of the damper equal to 140 mm.  
Adjustment in compression and extension starts from "all closed" (in direction +).



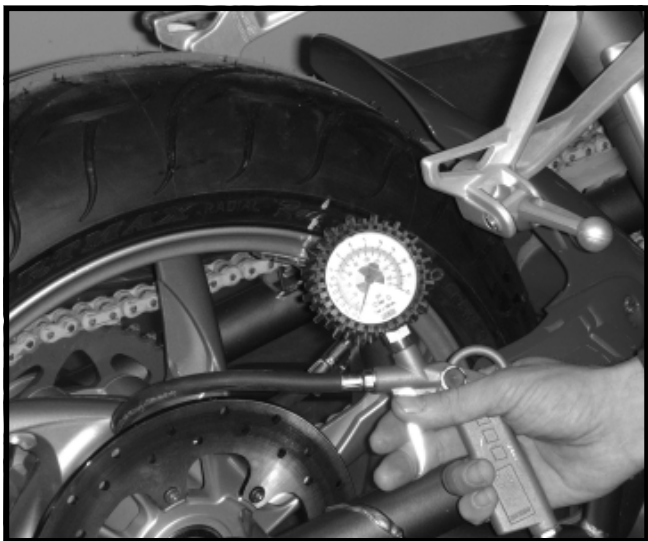


Adjustment of the preload spring is carried out using the two ring-nuts (1) and (2) in the figure.  
Loosen ring-nut (1) and adjust the preload with ring-nut (2).  
Clockwise, the preload will be more rigid.  
Anti-clockwise, the preload will be slacker.  
Once the preload is adjusted, tighten the ring-nut (1).



Adjusting the hydraulic braking device in compensation is carried out in sudden steps.  
Rotate the adjuster (3) clockwise to increase the braking action, or anti-clockwise to diminish it.





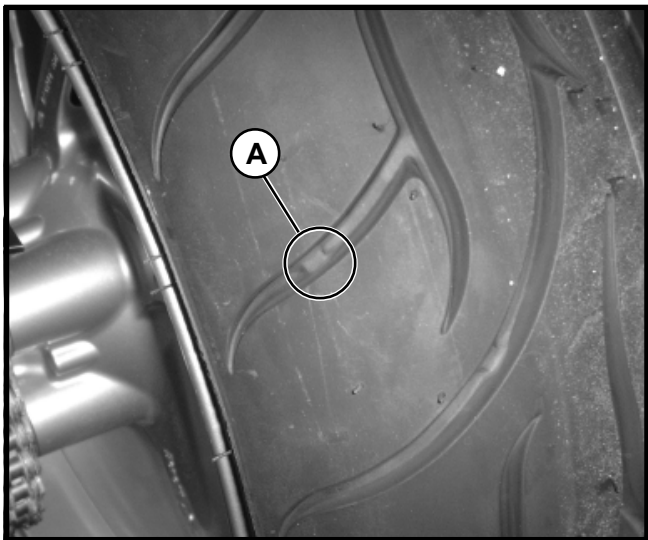
### 3.33 CHECK TIRE PRESSURE

**WARNING:**  
*Incorrect inflation of the tires causes serious danger in using the bike. Insufficient pressure can cause the tire to slip on the rim or its detachment, with consequent deflation of the tire and loss of control of the vehicle.*

Check the pressure of the tires with a manometer.

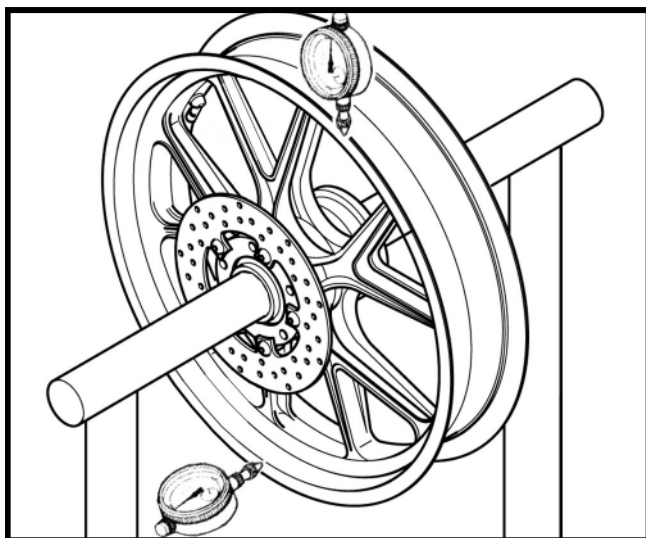
	Pressure	
Front tire	250 kPa	2.5 bar
Rear tire	250 kPa	2.5 bar

**NOTE:**  
 In the case of long continuous driving, increase the value of nominal pressure by 0.2 bar.



Check the wear on the tires.  
 When the tread is at the same level as in (A), change the tire.





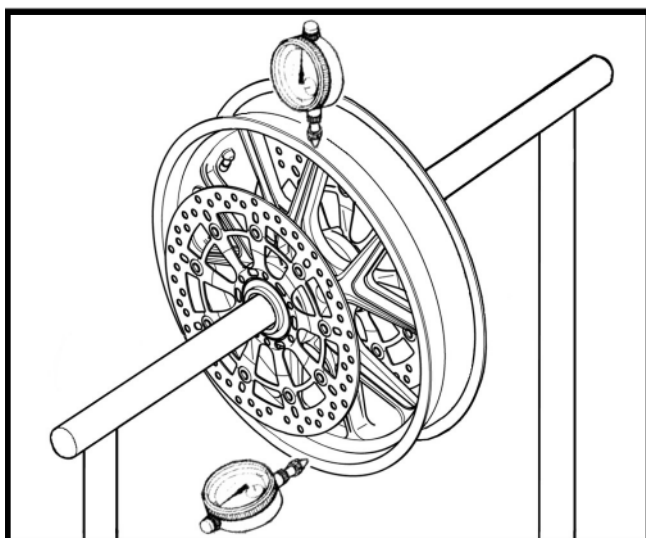
### 3.34 CHECK WHEELS

Check the radial and axial on the rear rim as in the figure.  
The value must enter within the specific value.



#### SPECIFIC VALUE

Axial veer = 0.3 mm



Work on the front wheel as on the back wheel.



#### SPECIFIC VALUE

Axial veer = 0.05 mm



Excessive veering and eccentricity are generally caused by wear of the ball-bearings  
Change the ball-bearings. If the problem persists, change the rim of the wheel.





### 3.35 CHECK AND OIL CLUTCH CABLE



Check the free run of the cable in its sheath. If necessary, oil it with the advised oil.

If the cable sheath is damaged, change both the cable and sheath together.



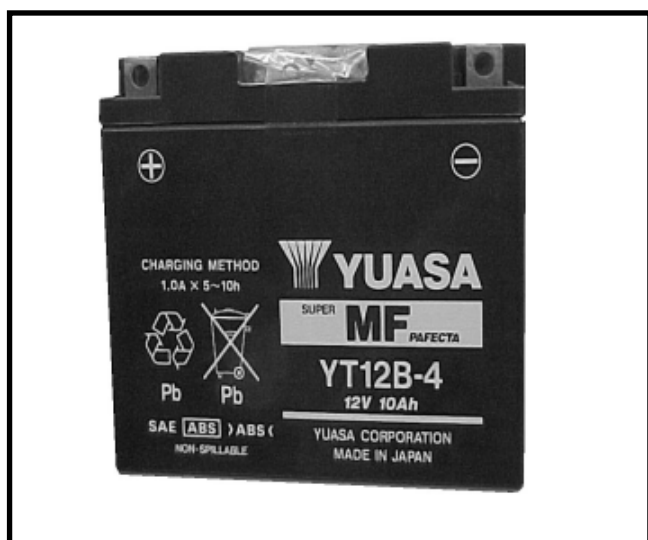
#### **WARNING:**

*If the external body of the battery is damaged, sulphuric acid, a poisonous and extremely corrosive substance, may leak out.*

*Avoid any contact with the skin, the eyes and clothing and always protect the eyes when working near the battery.*

*In case of contact, carry out FIRST AID as follows:*

- **EXTERNAL CONTACT:** Rinse with a lot of water.
- **INTERNAL CONTACT:** Drink great quantities of water or milk and immediately call a doctor.
- **EYES:** Rinse with water for 15 minutes and immediately see a doctor. Moreover, leakage of sulphuric acid leads to the formation of hydrogen that can provoke an explosion in the presence of a spark or a flame.



### 3.35 ELECTRICAL PLANT

#### 3.35.1 CHECK BATTERY

This motorcycle is equipped with a sealed battery installed under the tailpiece.

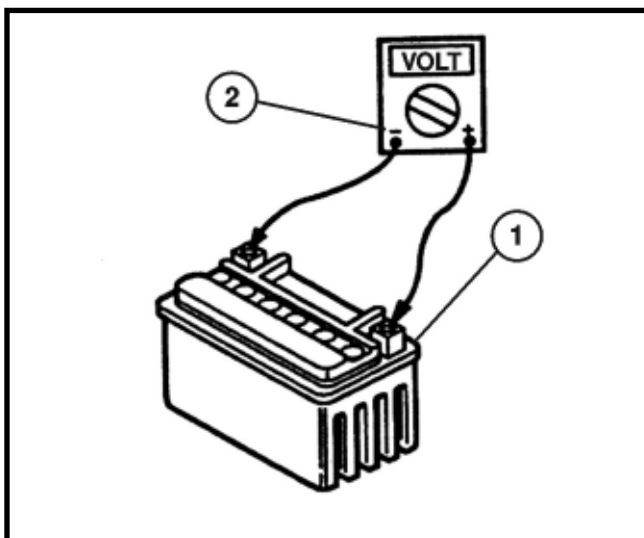
This element does not require maintenance and therefore the liquid does not need checking nor does distilled water need to be added.

If the battery seems to be exhausted (causing electrical problems or difficulty in starting), recharge it.

#### **NOTE:**

Charge the battery with a slow charge





Check the state of charge of the battery (1) with a tester (2) functioning as a voltmeter.  
If necessary recharge the battery.



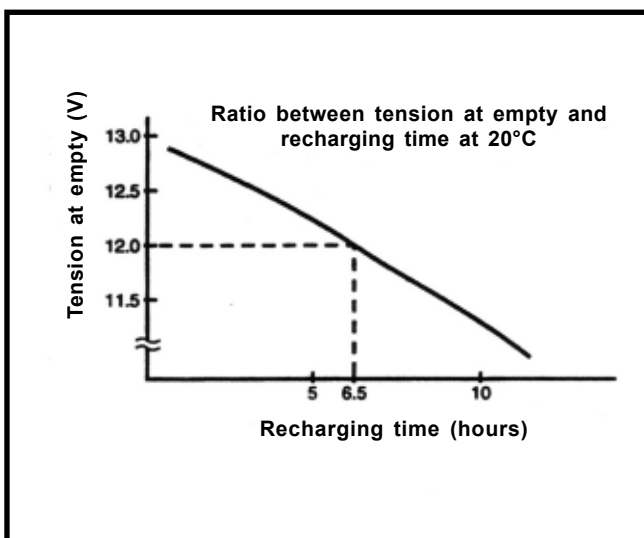
#### SPECIFIC VALUE

Battery charge = 12.5V



#### ATTENTION:

*These values vary according to the temperature, the condition of the battery plates and the level of the electrolyte.*



Connect a digital voltmeter to the battery terminals.

Positive tester probe > positive battery terminal.  
Negative tester probe > negative battery terminal.

#### NOTE:

It is possible to check the state of the MF battery recharging by measuring the tension at empty (i.e. the tension present with the positive terminal disconnected).

It is not necessary to recharge when the tension at empty is equal to or superior to 12.8V.

Check the recharging of the battery as illustrated in the diagram and the following example.

#### Example:

Tension at empty = 12.0 V

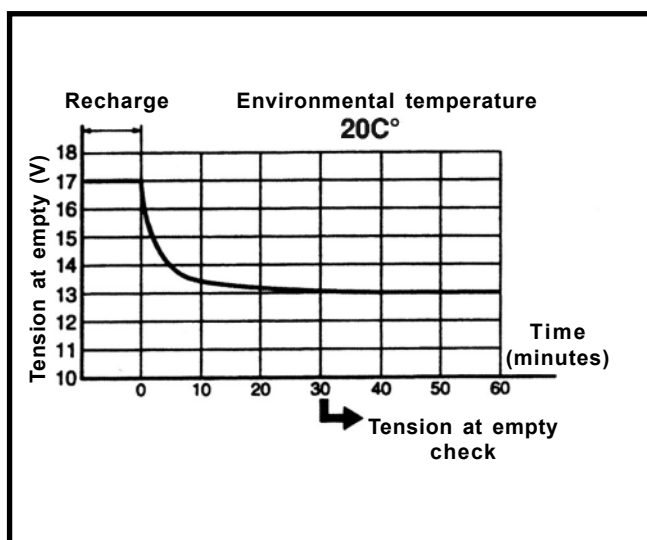
Recharging time = 6.5 ore

Recharging the battery = 20 ~ 30%

#### NOTE:

Do not recharge the battery rapidly.





#### ATTENTION:

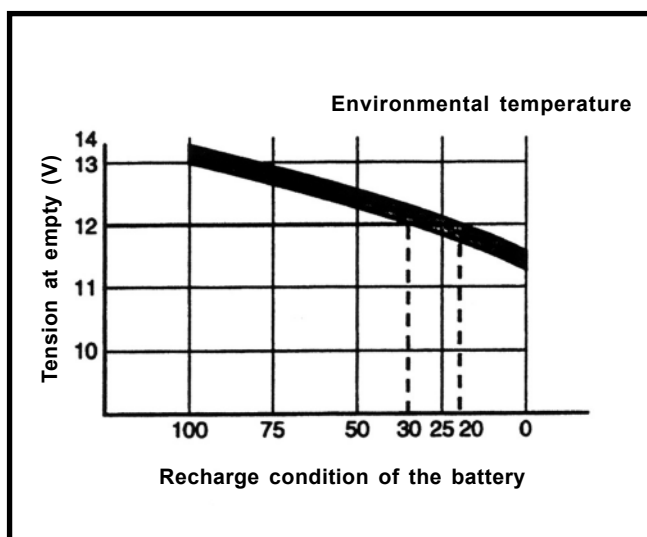
**Pay attention never to remove the sealing fastenings of the MF battery.**

**Avoid the use of a nominal high potential battery charge because this forces the high amperage tension too quickly inside the battery, causing the battery to overheat with consequent damage to the plates.**

If it is not possible to adjust the charging tension, make sure not to charge the battery excessively.

Remove the battery from the vehicle before charging.

To reduce the risk of sparks, do not insert the battery charger plug with the cables still connected to the battery.



Before removing the clips of the battery charger cables from the battery terminals make sure that the battery charger is off.

Make sure that the clips are well connected to the battery terminals and are not short circuited. A corroded clip can provoke overheating at the contact point and a clip left behind can cause sparking.

If the battery heats up during recharging, disconnect the battery charger and let the battery cool down before continuing.

This is necessary to avoid the battery exploding. As illustrated in the figure, the tension at empty of the MF battery stabilises after about 30 minutes from completing the recharge. We therefore advise waiting 30 minutes before measuring the tension at empty.



### 3.36.2 BATTERY RECHARGING SYSTEM

Remove the driver saddle.

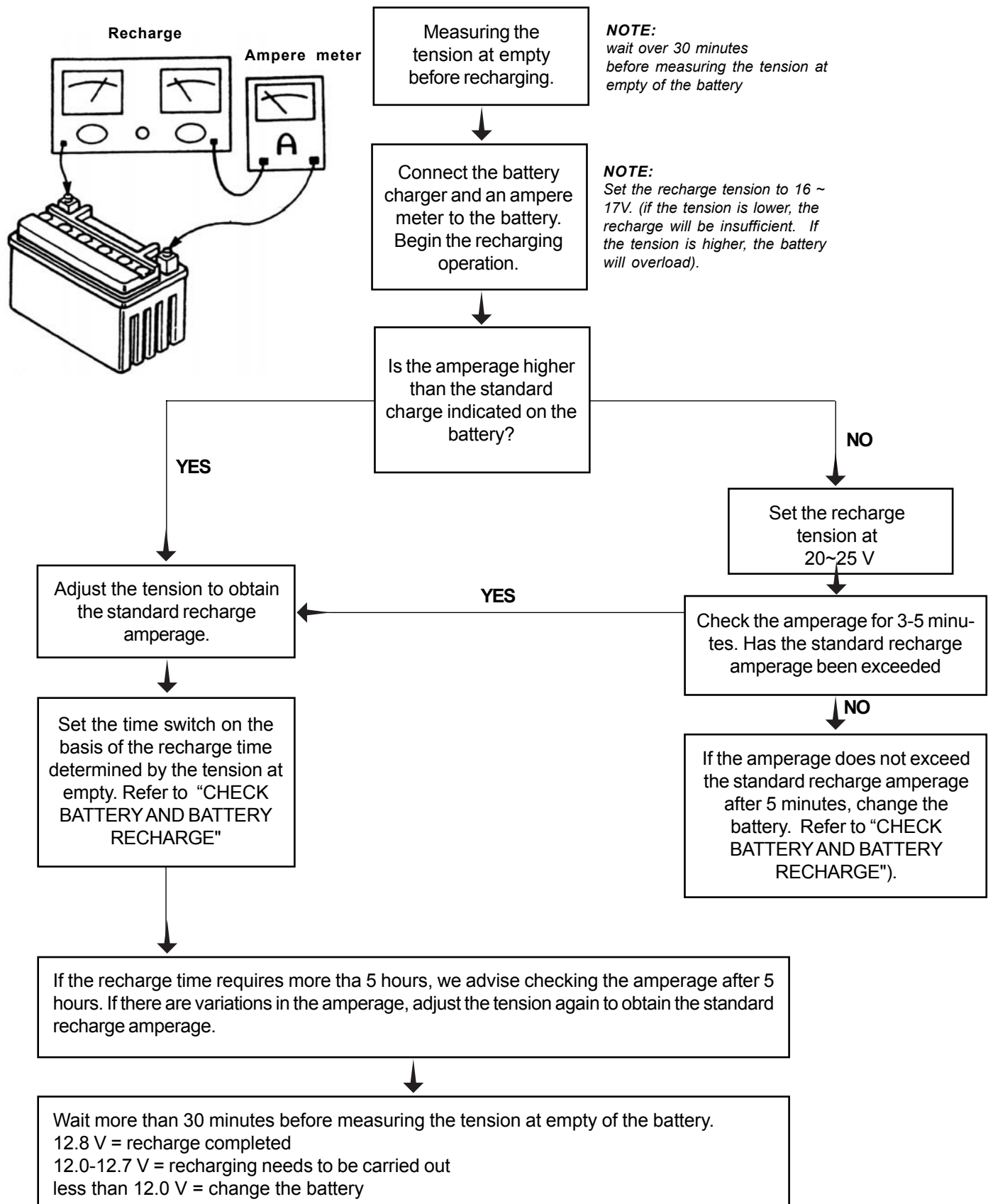
Disconnect the battery.

Remove the battery from the support, unhooking the elastic sealing belt (1).





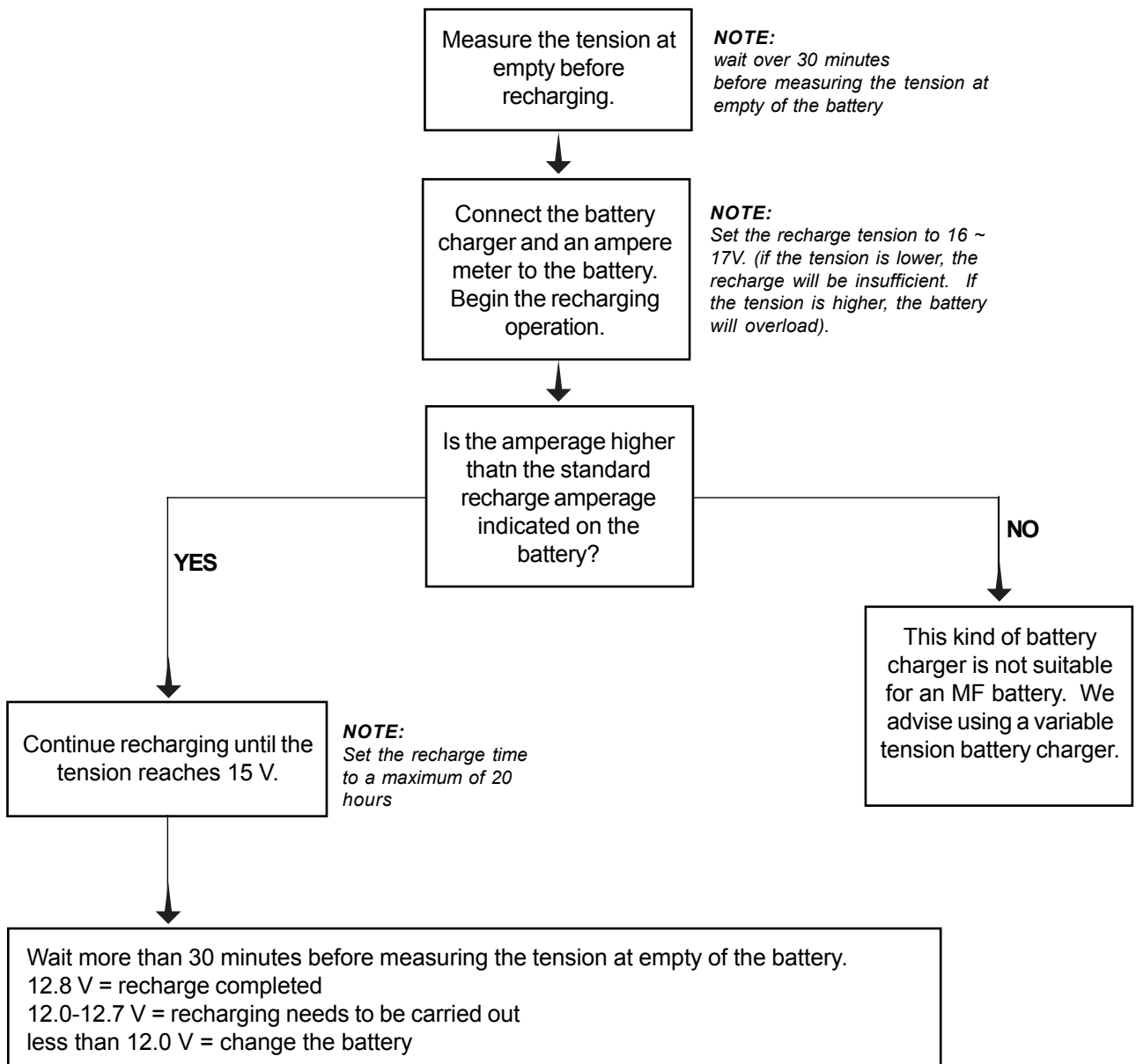
## RECHARGING WITH A VARIABLE TENSION BATTERY CHARGER





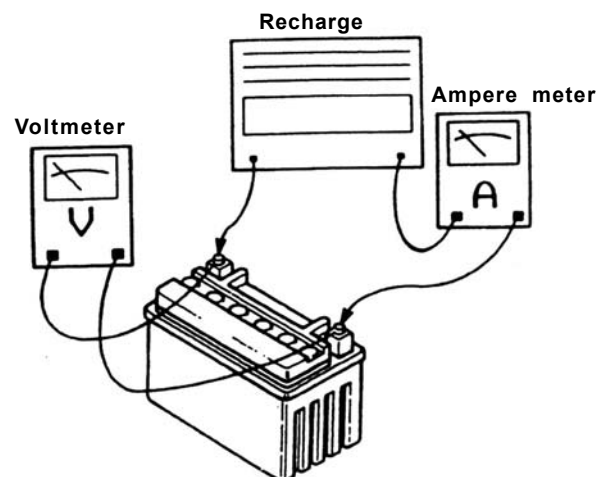


## RECHARGING WITH A CONTINUOUS TENSION BATTERY CHARGER



### WARNING:

continuous amperage battery chargers are not suitable for MF batteries







### 3.37 CHANGING FUSES

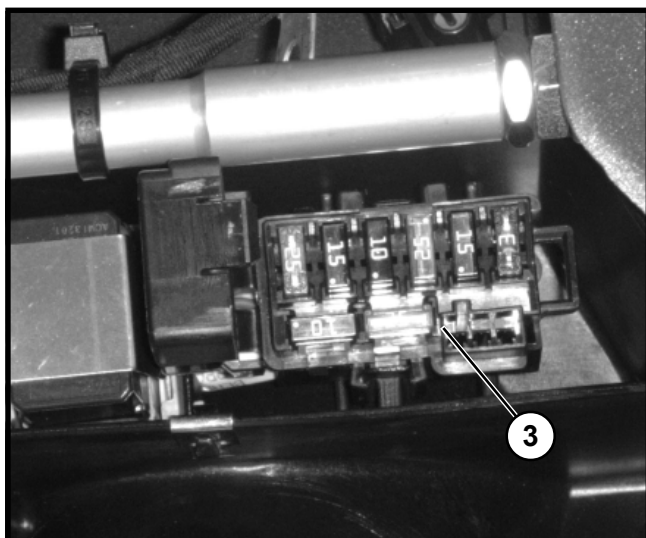
The reload fuse (1) is on the left side of the engine in the position indicated.

The spare fuse (2) is beside it.



#### **WARNING:**

*Never use a fuse with a setting different to that specified to avoid damaging the electrical plant of the motorcycle with a consequent danger of fire.*

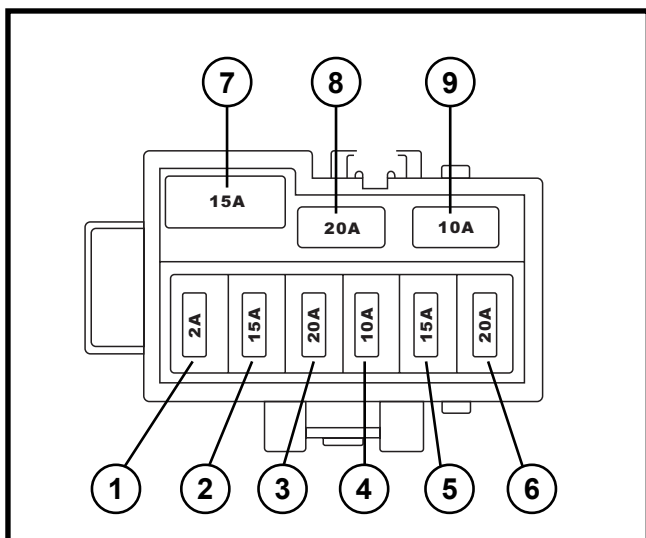


The fuses of the services (3) are in the glove box under the passengers saddle; that must be removed to reach them.

Replace the burned fuse and close the lid.

#### **NOTE:**

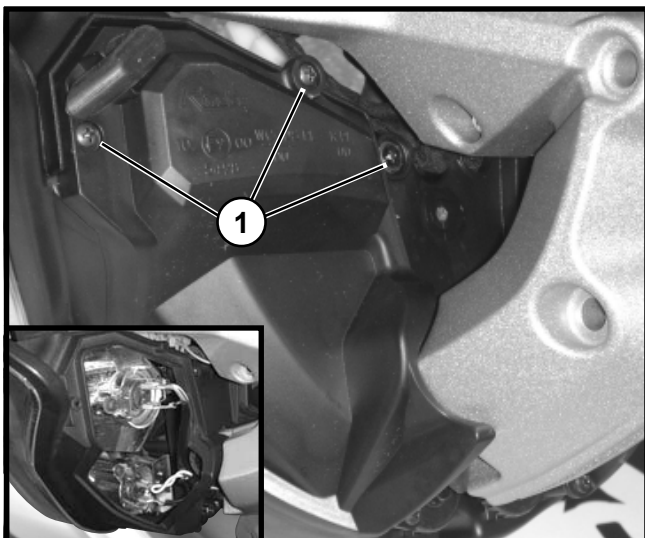
Consult the information in the key to identify the function of the fuses.



Nine fuses are in the fuse box:

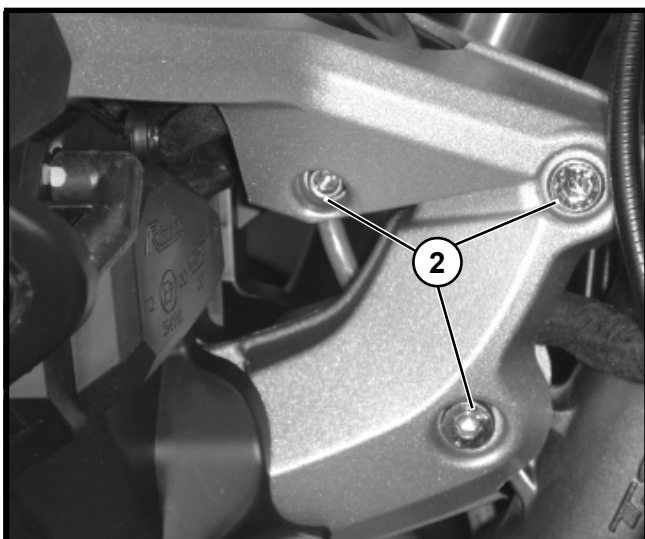
- Alarm equipment fuse 2A (1)
- Petrol pump fuse 15A (2)
- Electric fan fuse 20A (3)
- Service fuse 10A (4)
- *Light fuse* 15A (5)
- Injection fuse 20A (6)
- Fuse 15A (7)
- Fuse 20A (8)
- Fuse 10A (9)





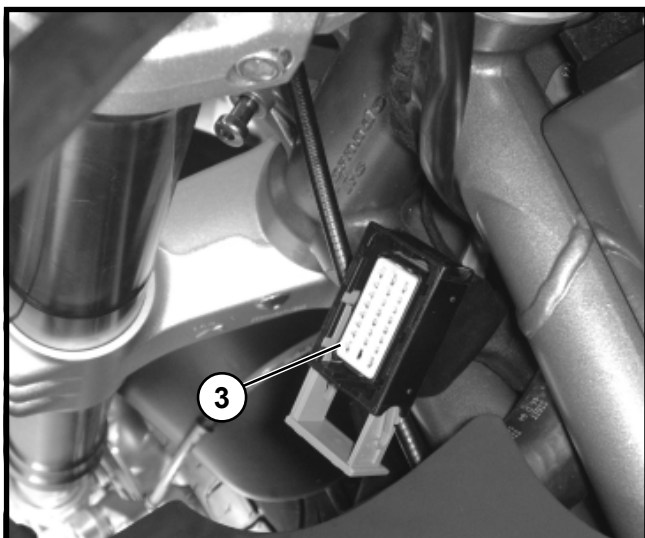
### 3.38 CHANGING FRONT LIGHTS

To replace the front lights remove the right and left inspection chap.s of the parabolas unscrewing and removing the fixing screws (1).



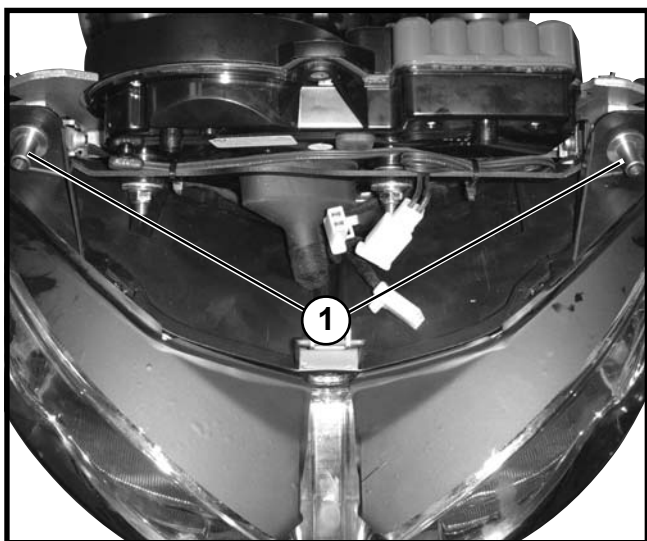
#### 3.38.1 FRONT LIGHT DISASSEMBLY

Remove the front shield carrier (see "Front shield disassembly"). Unscrew and remove the screws (2) from the framelet.

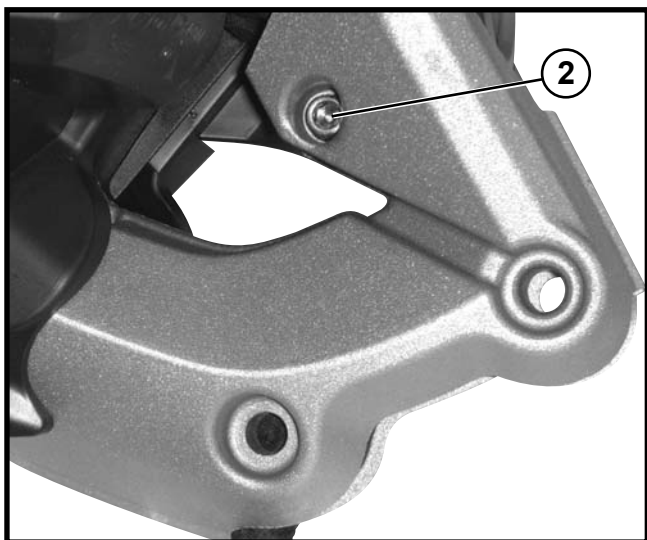


Take off the wiring connector front light (3).

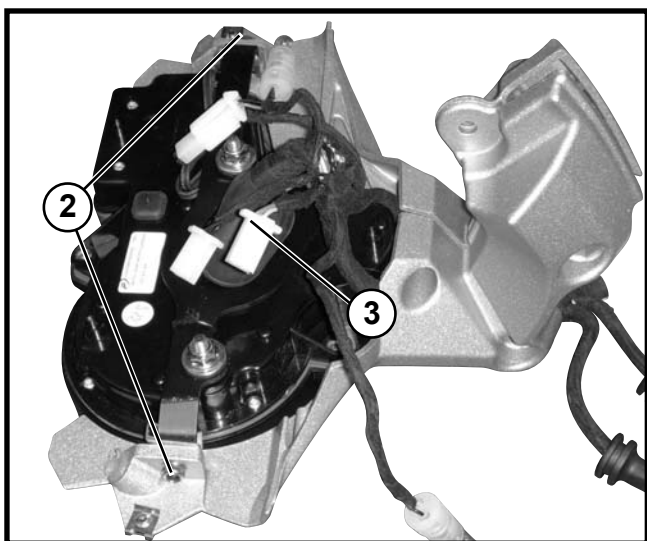




Remove the lamp inspection lids.  
Unscrew the light fixing pivots (1).

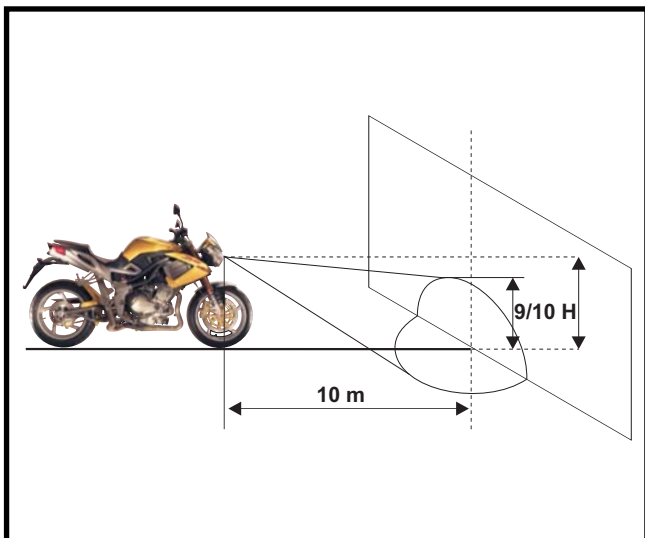


Unscrew and remove the central closing screw (2) from the framelet right and left.



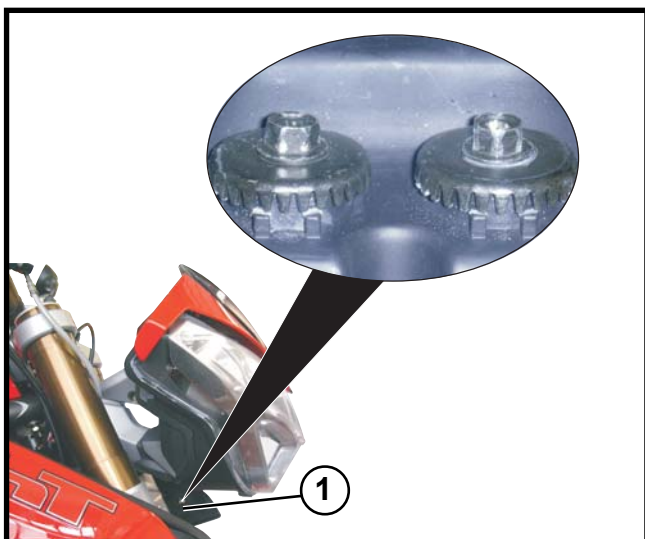
Loosen and remove the screws (2) remove the speed indicator,  
take off the connector (3) remove the light wiring.





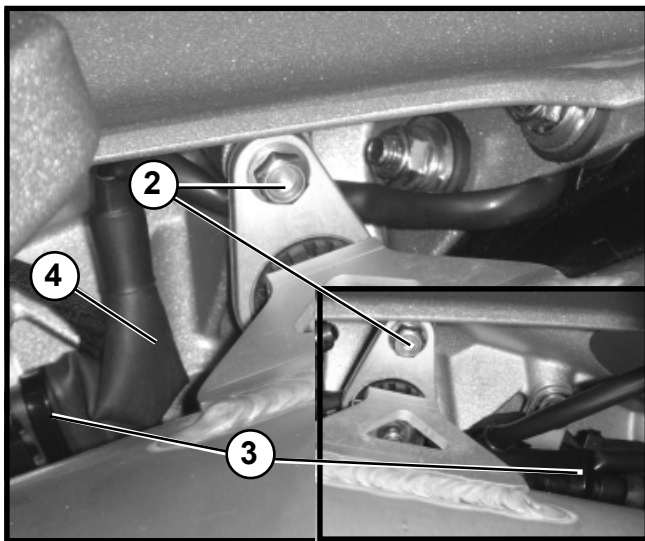
### 3.39 ADJUSTMENT FRONT HEADLIGHT

To carry out the correct adjustment of the luminous beam projected by the front headlight, position the vehicle at about 10 metres from a vertical wall on a perfectly flat terrain. Switch the front headlight on, sit on the vehicle in the driving position and check that the upper limit of the beam projected onto the vertical wall in less than about 1/10 with respect to the the horizontal axis of the lights.



For the setup of the front light adjust the two parabola adjustment screws (1) right and left positioned under the light. There is the possibility to set the light parabola right and left separately, loosening we will raise the light beam, tightening we will lower the light beam.

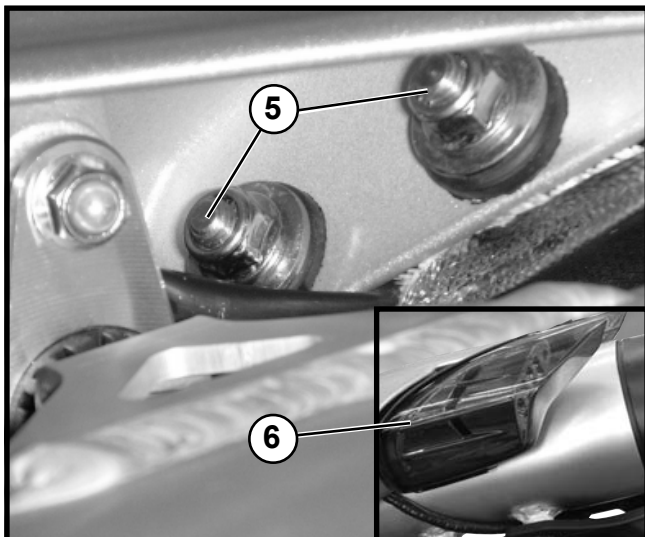




### 3.40 BACK LIGHT DISASSEMBLY

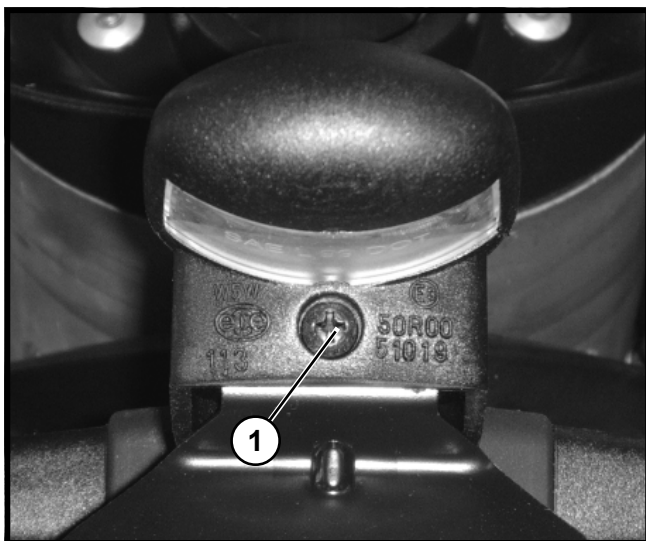
#### 3.40.1 CHANGING REAR HEADLIGHT

This motorcycle is equipped with led lights.  
Loosen the screws (2) of the muffler and lower it to allow to remove the lamp.  
Cut the wiring blocking clamp (3), take off the connector (4).



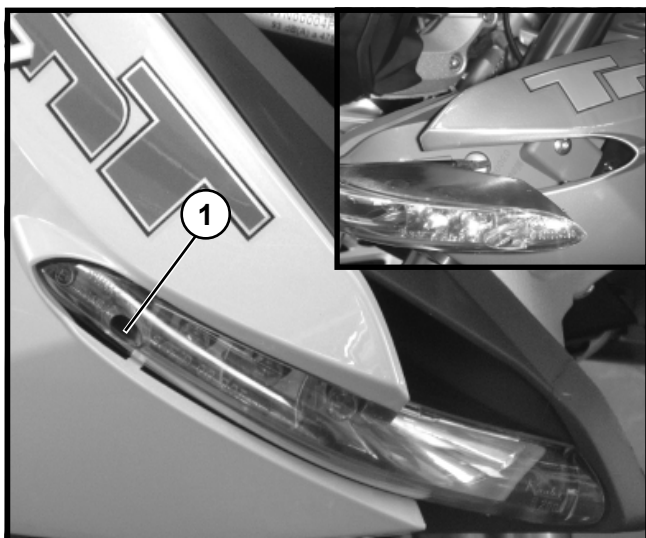
Loosen and remove the nuts (5), remove the light (6).





### 3.40.2 CHANGING LICENCE-PLATE LIGHT

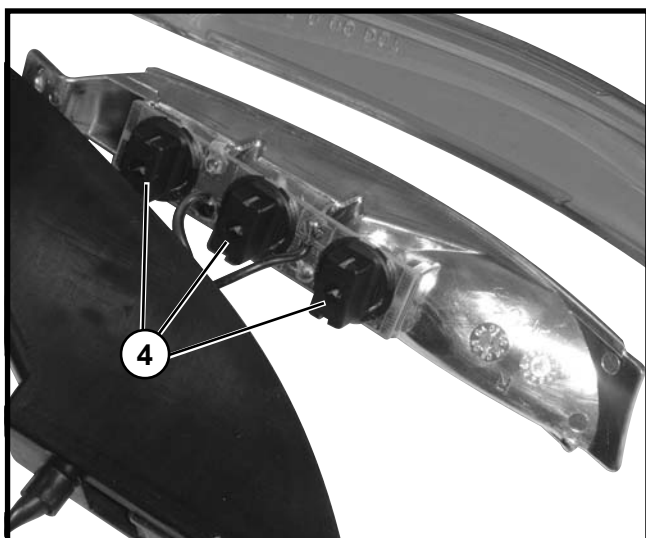
Loosen and remove the screw (1).  
 Remove the rubber lamp-holder.  
 Change the position lamp.  
 Position the rubber lamp-holder and tighten the screw (1).



### 3.40.3 CHANGE FRONT AND REAR ARROWS

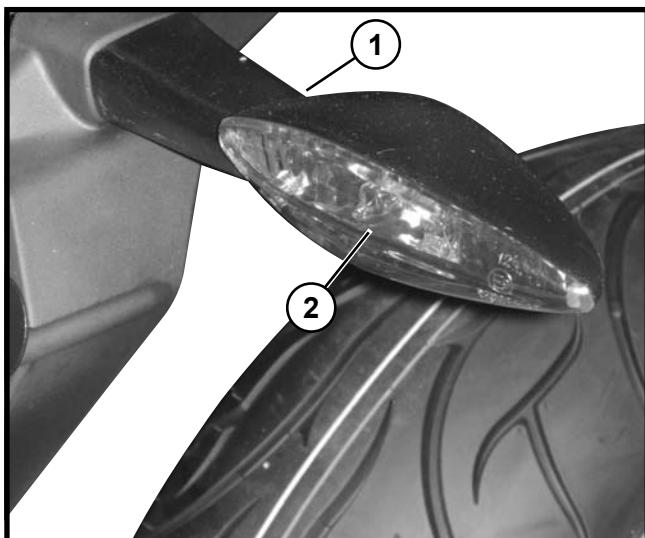
#### 3.40.3.1 CHANGE FRONT ARROWS

Cut the wiring fixing clamps.  
 Loosen and remove screw (1).  
 Remove the arrow body.  
 Disconnect the connector.  
 Unscrew and remove the glass fixing screw.



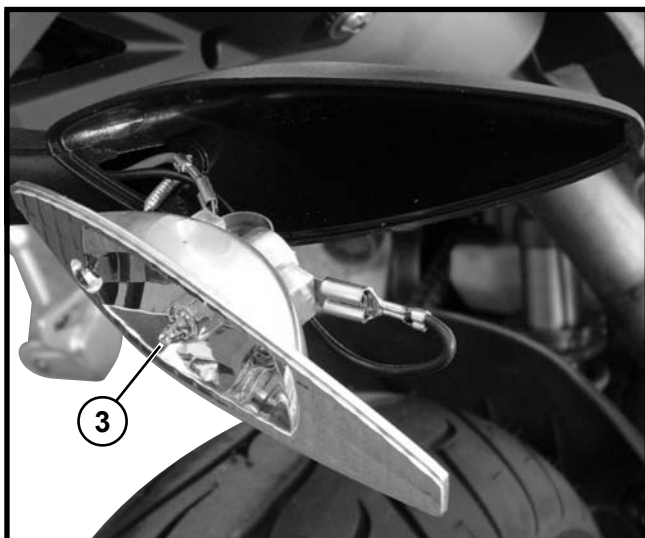
Replace the damaged lamp (4) rotating it counter clockwise.  
 Position the arrow body, the glass, and fix it with the relative screw.  
 Work in an analogous way with the opposite arrow.





### 3.40.3. BACK ARROW LAMP REPLACEMENT

Loosen and remove the screw (1).  
Remove the arrow glass (2).



Remove and replace the lamp (3).  
Reposition the glass (2) tighten the screw (1).

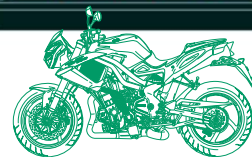






## Cowling

### 4 COWLING



#### 4.1 TANK COVER DISASSEMBLY



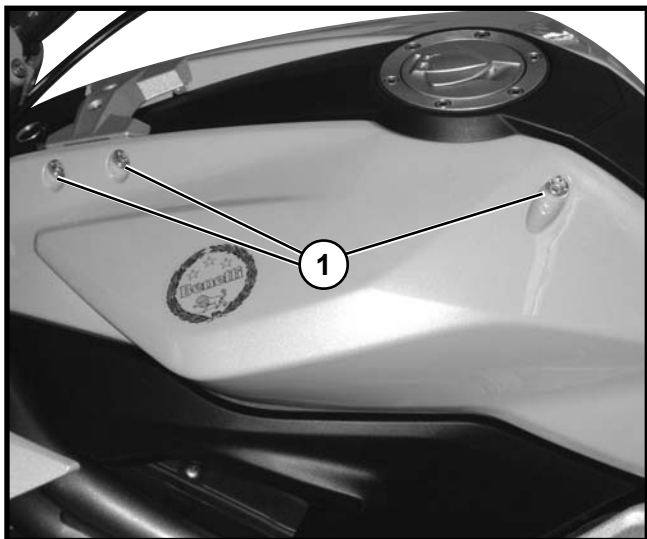
##### **WARNING:**

*Do not damage the cowling while removing.*

##### **NOTE:**

*Take note of the position of the screws for correct remounting.*

Unscrew and remove the screws (1) on the left cover, take off the cover pulling it towards away from the motorcycle. Proceed the same way for the right cover.

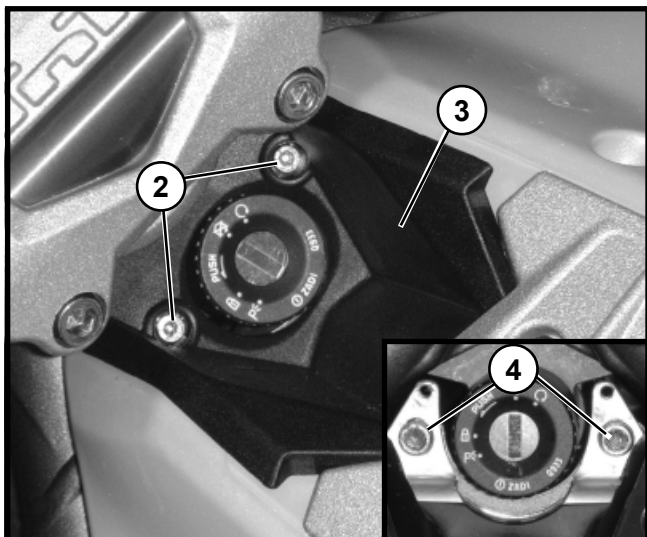


#### 4.2 PETROL TANK DISASSEMBLY

Remove the driver's saddle.

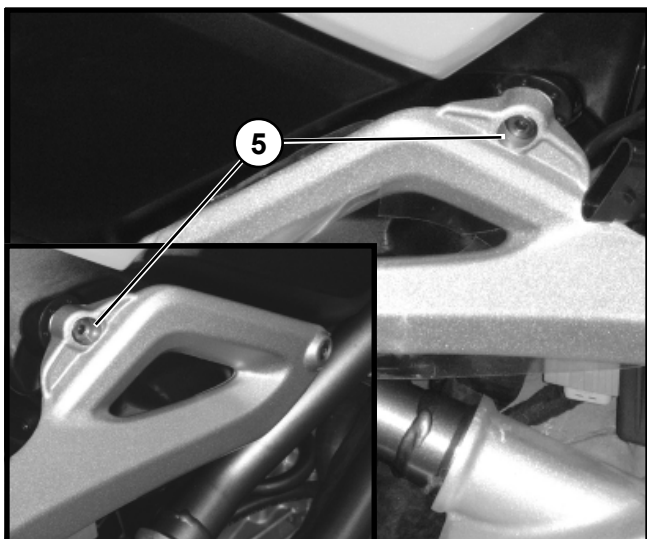
Loosen and remove the fixing screws (2) of the lock closing lid (3).

Loosen and remove the front tank fixing screws (4).

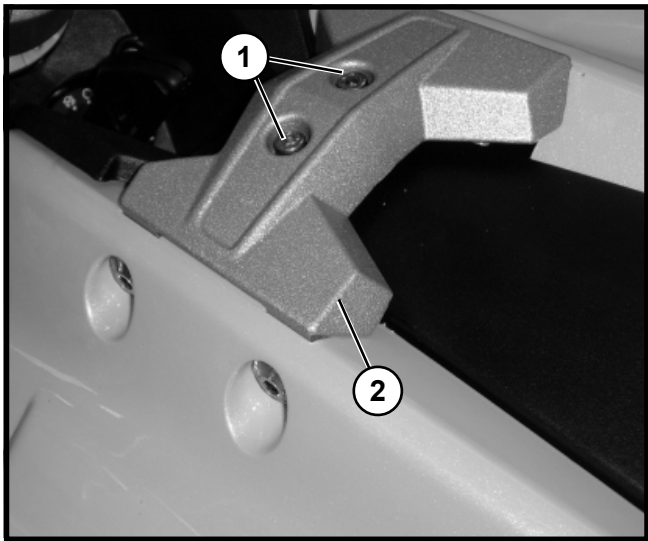


Loosen and remove the lateral right and left screws (5).

Raise the tank take off the petrol pipe remove the tank from the motorcycle.

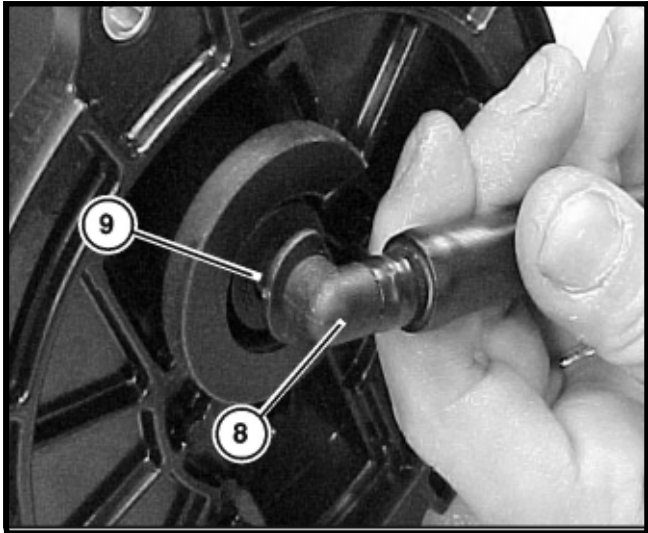






#### 4.2.1 COVER PLATE DISASSEMBLY

Raise the adhesive.  
 Unscrew and remove the screws (1).  
 Extract the cover fixing plate (2).

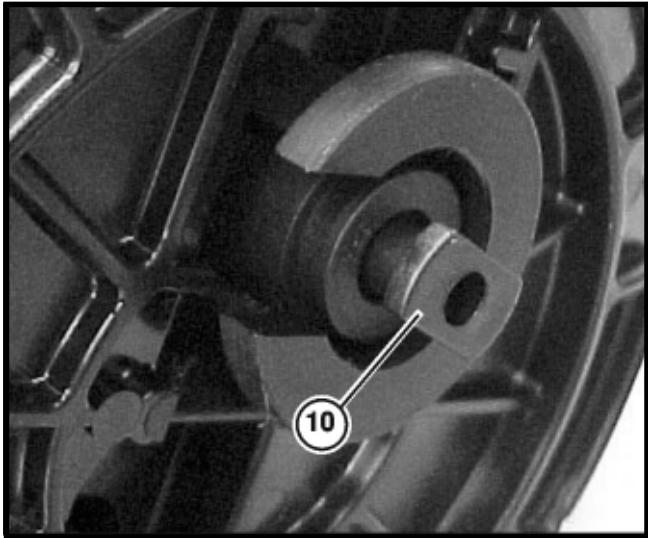


#### 4.2.2 PETROL PUMP REMOVAL

Remove the petrol pipe (see “petrol pipe disassembly”).  
 Disconnect the rapid unhooking petrol tube (8) from the pump using the specific equipment.

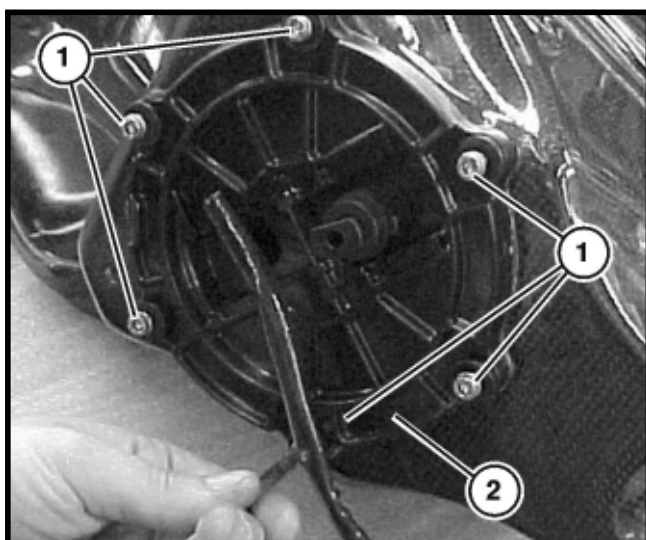


**SPECIFIC EQUIPMENT**  
**QUICK PIPE REMOVAL KIT:**  
**R180100143000**



Insert the specific pump valve closure cap (10) to avoid oil spilling out.





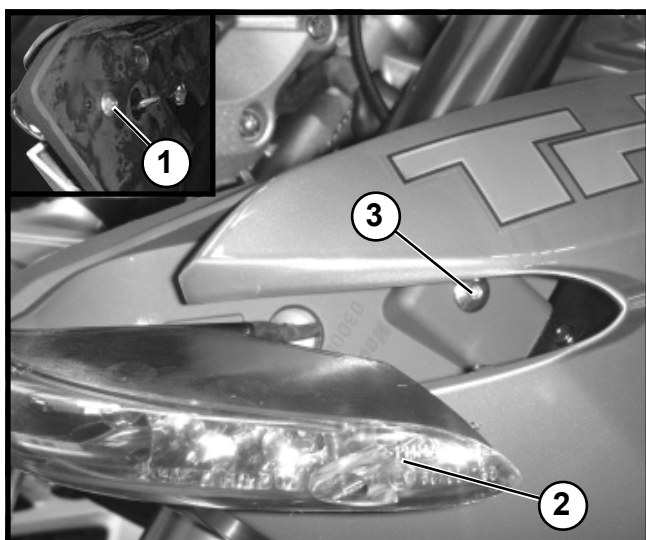
### 4.3 DISMANTLE TANK FUEL PUMP

Remove the tank from the vehicle (see "DISMANTLE TANK"). Empty the tank, conserving the fuel in a dry place and far from the rays of the sun and open flames.

Loosen and remove the six screws (1) and remove the pump (2). For remounting, proceed in the reverse way to dismantling.

**NOTE:**

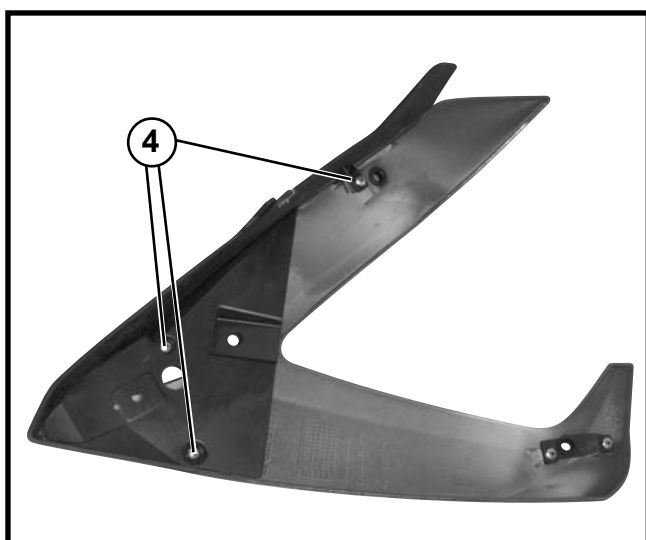
Position the sealing O-ring correctly in the apposite seat during remounting.



### 4.4 COOLER FAIRING DISASSEMBLY

Loosen and remove the screw (1) placed inside the flank cover. Remove the arrow (2).

Loosen and remove the fixing screw (3) fairing.

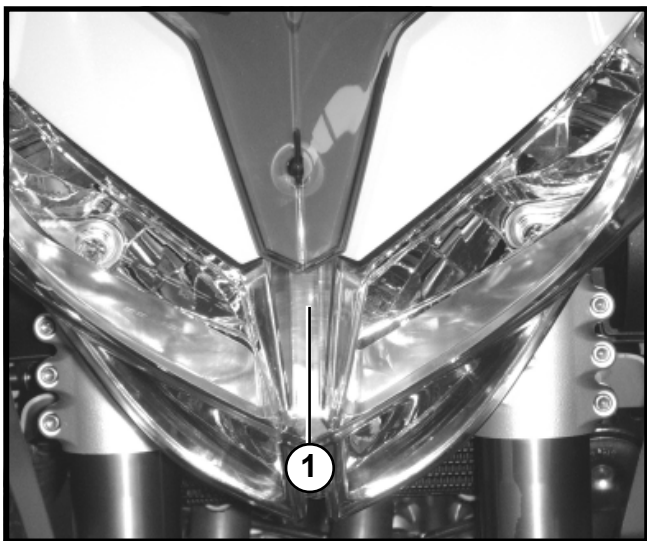


Take off the bottom from the cooler support.

Loosen and remove the screws (4) separating the internal fairing from the external one.

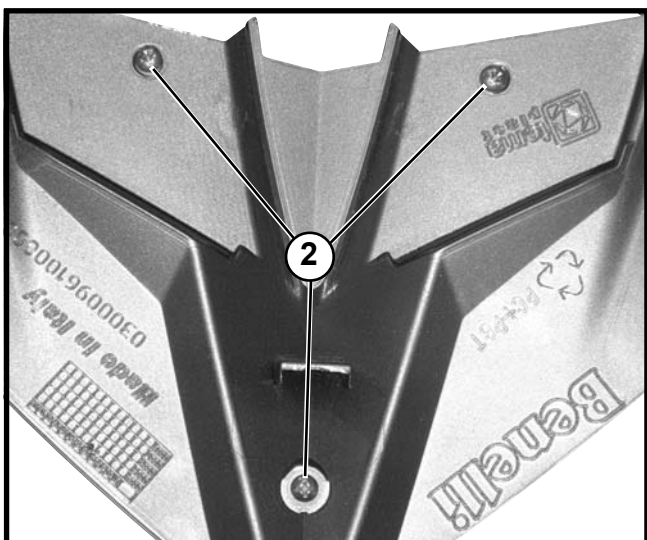
Proceed in the same way for the opposite fairing.



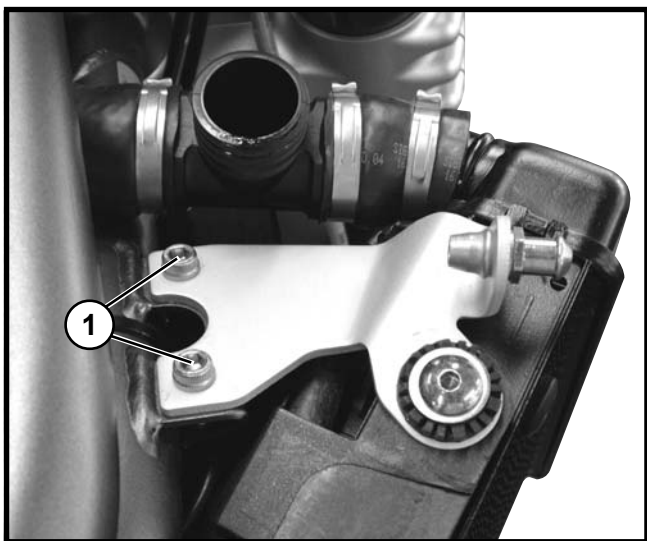


#### 4.4.1 FRONT SHIELD AND FRONT SHIELD SUPPORT DISASSEMBLY

Unscrew and remove the screw (1).  
Take off the front shield support pulling it away from the motorcycle.



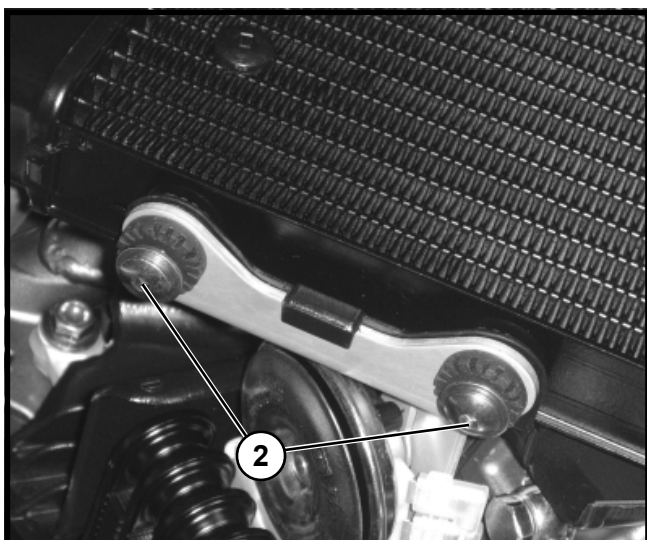
Loosen and remove the screws (2) remove the front shield from the front shield support.



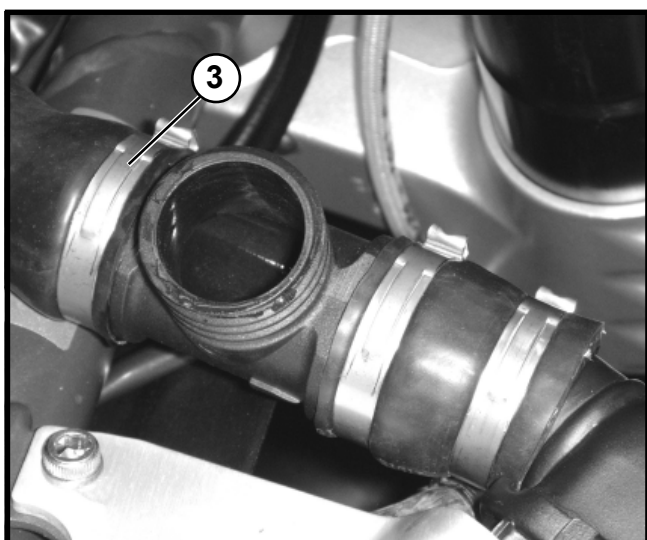
#### 4.5 COOLERS CONVEYORS DISASSEMBLY

Position the motorcycle on the side stand.  
Remove the cooler covers ( see " cover disassembly ).  
Unscrew and remove the screws (1) of the upper cooler fixing plate.



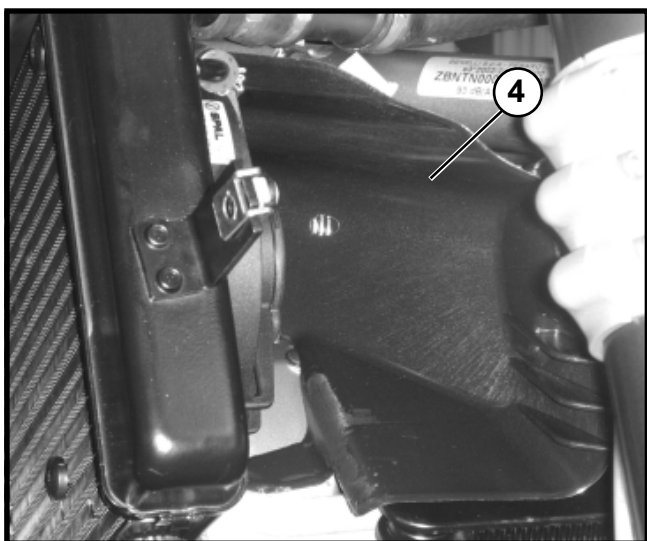


Unscrew and remove the lower fixing screws (2) of the cooler.



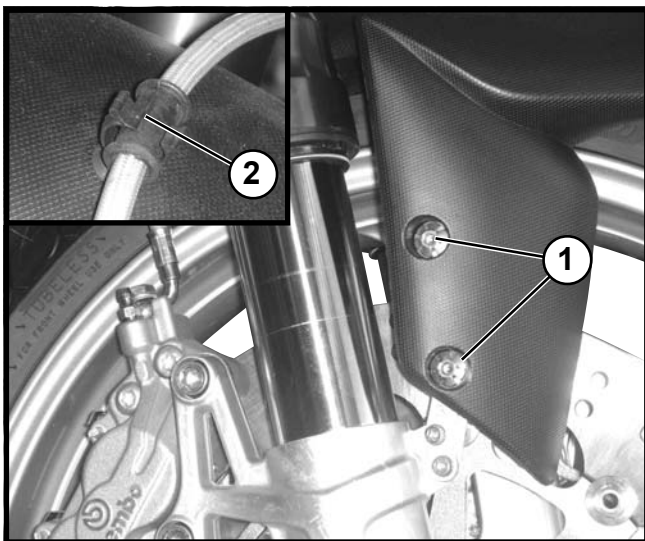
Take off the clamp (3) on the right cooler support from the inlet fixing.

**NOTE:**  
Replace the clamp when reassembling.



Take off the right cooler towards the outside from the supports allowing to slip from the ducts.  
Slip off the right cooler (4) duct.  
Proceed the same way for the left conveyor.  
Proceed in inverse way to reassemble.





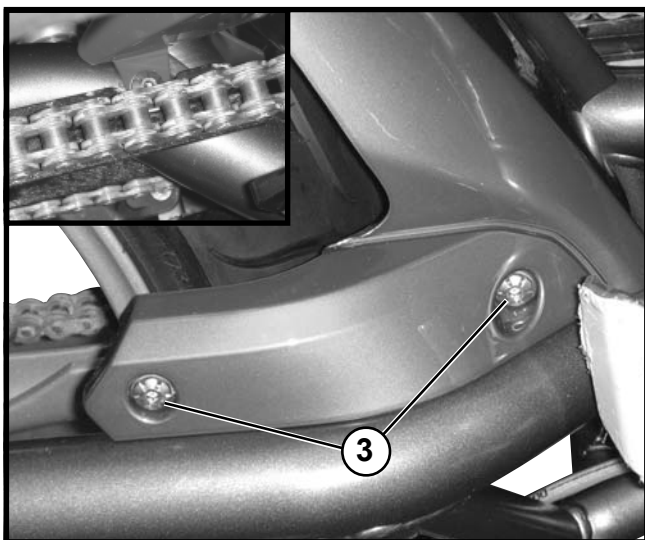
## 4.6 MUDGUARDS DISASSEMBLY

### 4.6.1 FRONT MUDGUARD DISASSEMBLY

Take off the oil brake pipe blocking support from the mudguard (2).

Unscrew and remove the screws (1).

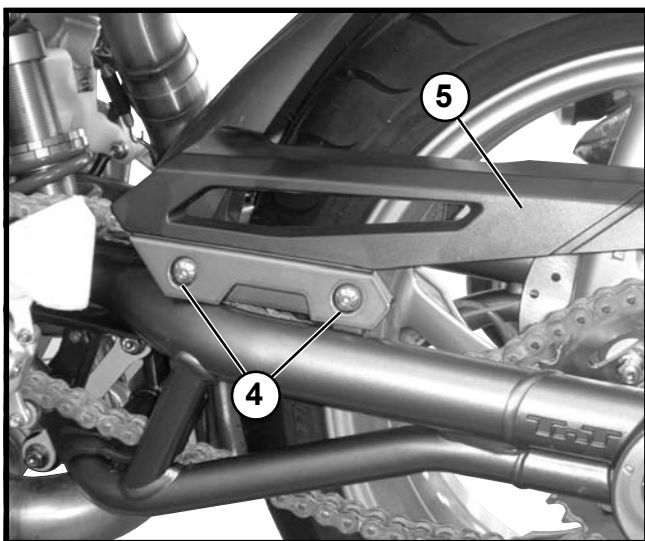
Slip off the mudguard.



### 4.6.2 BACK MUDGUARD DISASSEMBLY

Unscrew and remove the screws (1).

Slip off the mudguard (3).

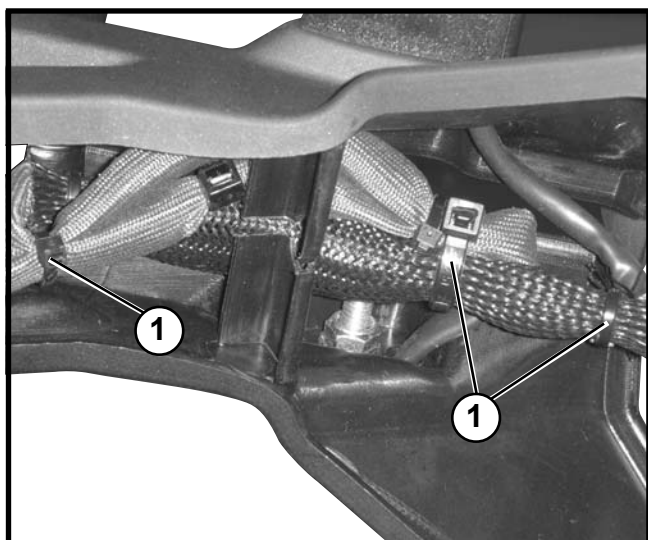


## 4.7 CHAIN CARTER DISASSEMBLY

Unscrew and remove the screws (4).

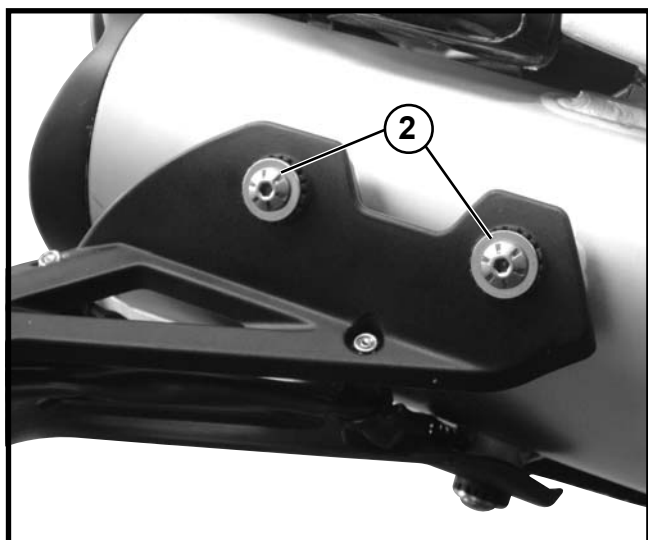
Slip off the chain carter (5).





#### 4.8 NUMBER PLATE HOLDER DISASSEMBLY

Cut the wiring blocking clips (1).  
Take off the connectors of the back lights.



Unscrew and remove the screws (2) on both sides of the exhaust.  
Remove the number plate holder









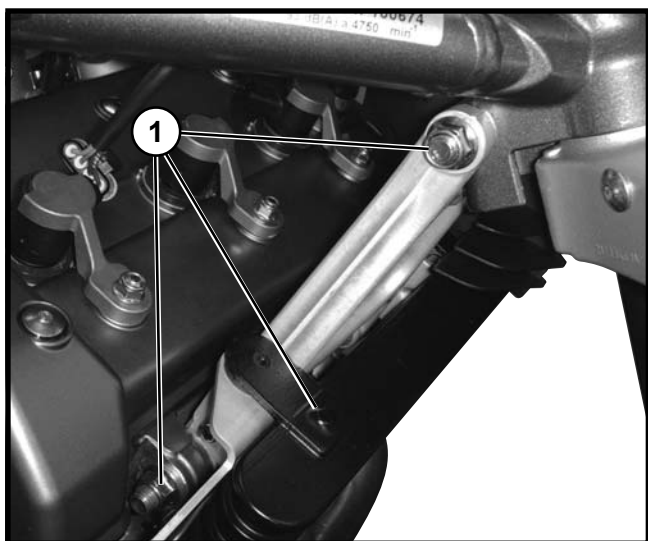
## *E*ngine

### 5. ENGINE

#### 5.0 MOTOR REMOVAL

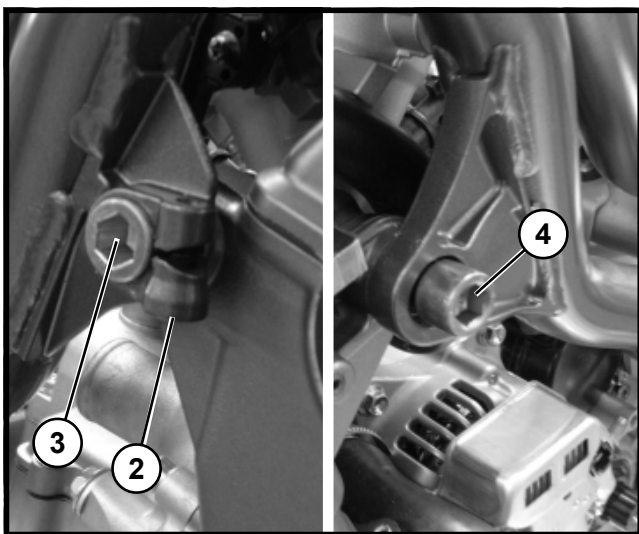
##### 5.0.1 MOTOR DISASSEMBLY FROM THE FRAME

Take off the cooler covers.  
Remove the coolers.  
Dismantle Air box.  
Dismantle the fuel tank.  
Remove Air box duct.  
Remove cooler ducts.  
Disconnect the battery.  
Disconnect the remote control switch.  
Disconnect the starting motor.  
Disconnect the radiator tube from the pump and blow off the liquid.  
Disconnect the gas cables.  
Disconnect the bobbins.  
Disconnect three injectors connectors.  
Disconnect the potentiometer connector.  
Disconnect the phase sensor connector.  
Disconnect the water sensor connector.  
Disconnect the stepper sensor connector.  
Disconnect the oil press sensor connector.  
Disconnect the neutral sensor connector.  
Disconnect the solenoid cables.



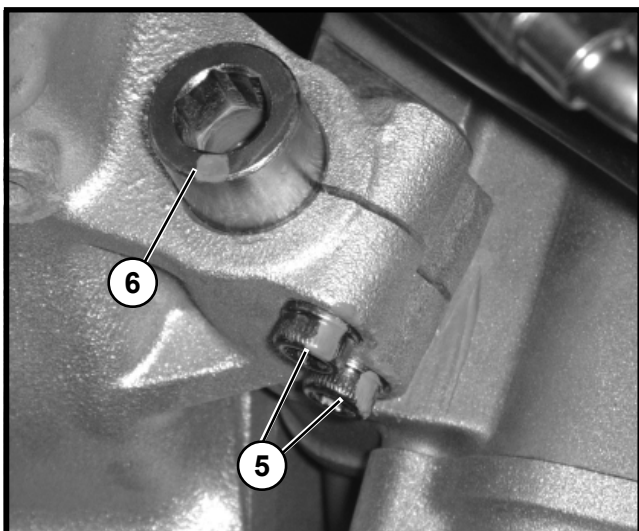
Remove the three screws of the small frame which fixes the motor to the principal frame (1).  
Remove the small frame.





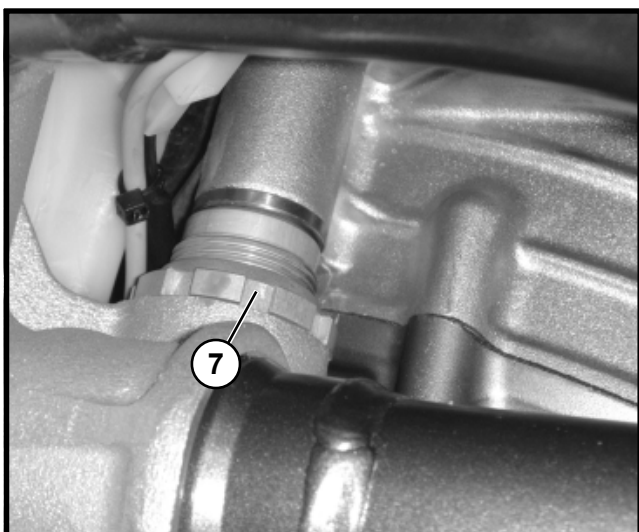
Loosen the screw (2) of the security arm band on the frame right side.

Loosen the two screws (3) and (4) fixing the motor upper right and left without removing them.



Loosen the two security arm band screws (5) of the lower motor fixing on the right side.

Loosen and remove the spindle (6) lower motor fixing.



Loosen the metal ring with the right tool (7) inside the frame of the upper motor spindle fixing.

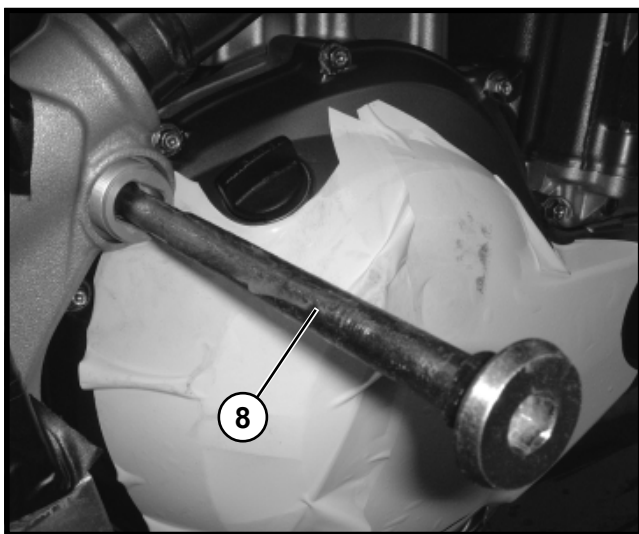


#### **SPECIFIC EQUIPMENT**

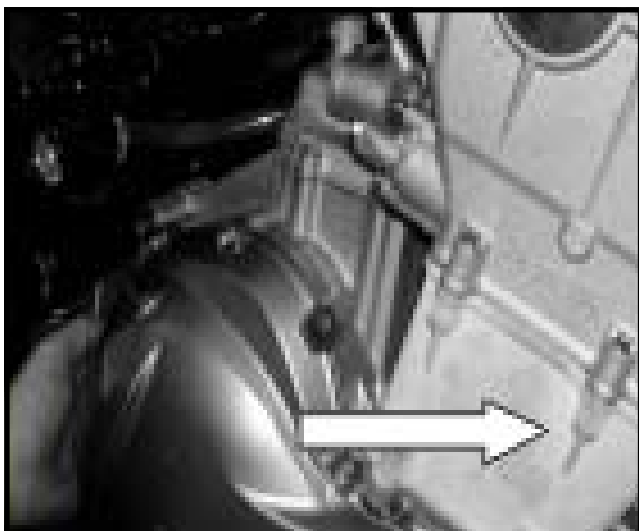
**Registration key**

**Motor shoulder: code R180197032000**





Loosen and remove the spindle (8) upper motor fixing.



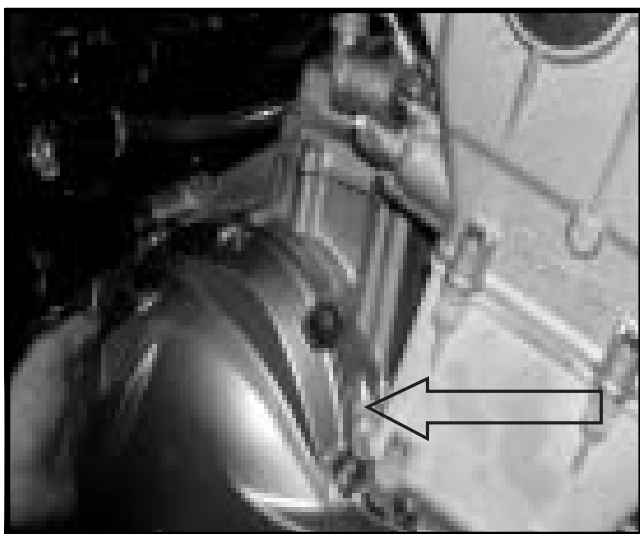
Place the motor ahead, and put a suitable support to the motor, remove definitively the two upper motor fixing screws, lower the motor and pull it out of the frame.



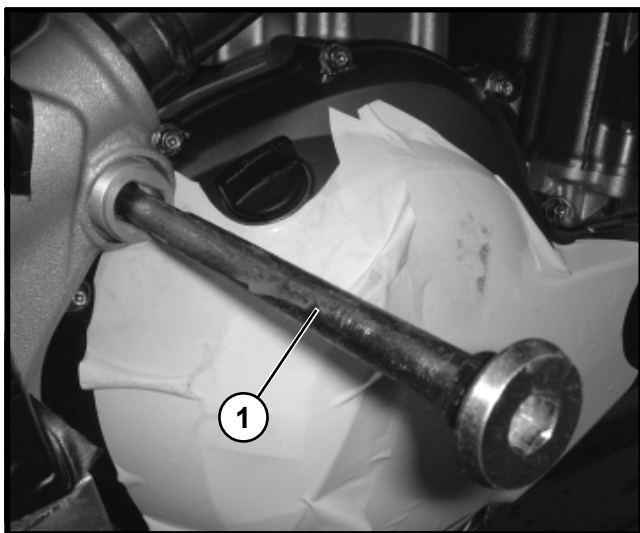
### 5.0.2 MOTOR ASSEMBLY ON THE FRAME

Place the motor, lift and fix it with the two upper fixing screws.

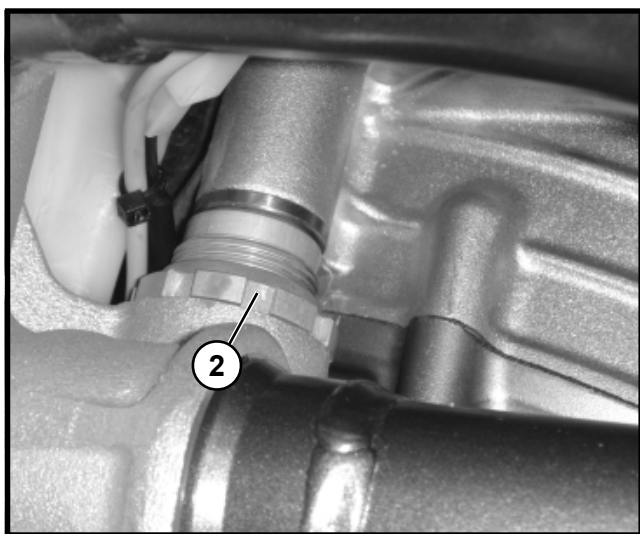




Move the motor toward the frame back wall , connect the lower and upper motor fixing spindles without closing.

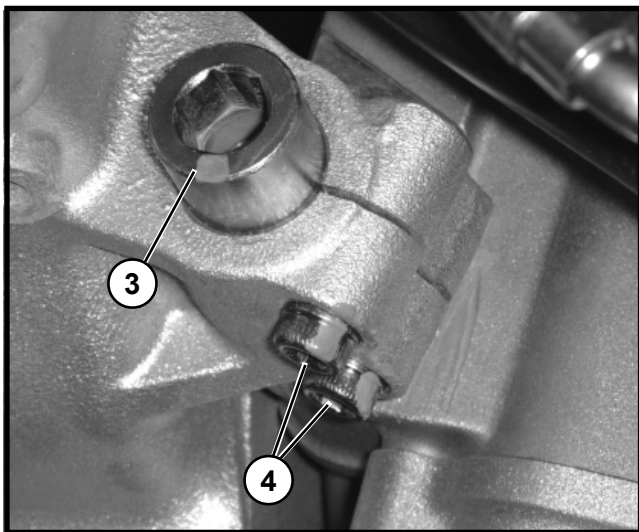


Close the upper spindle (1) to the ledge, loosen again the  $\frac{1}{4}$  revolution spindle, retighten it to ledge.

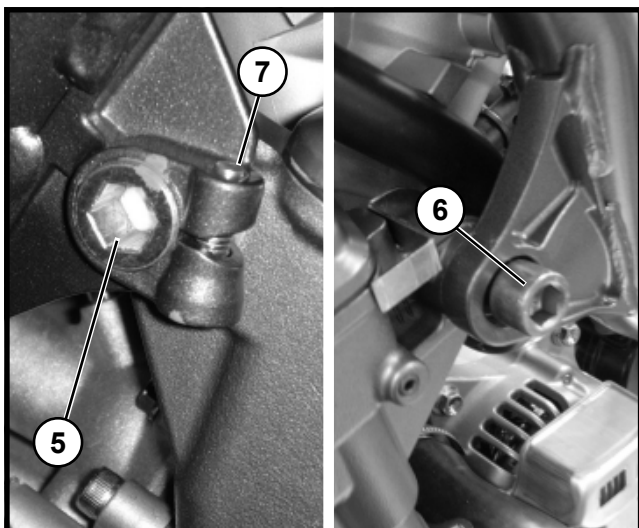


Close the ledge inside metal ring (2).

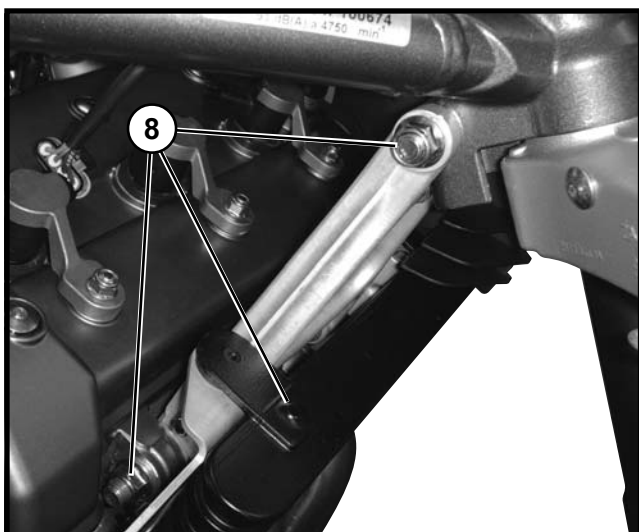




Close the ledge lower spindle (3).  
Close the two arm band security screws (4).

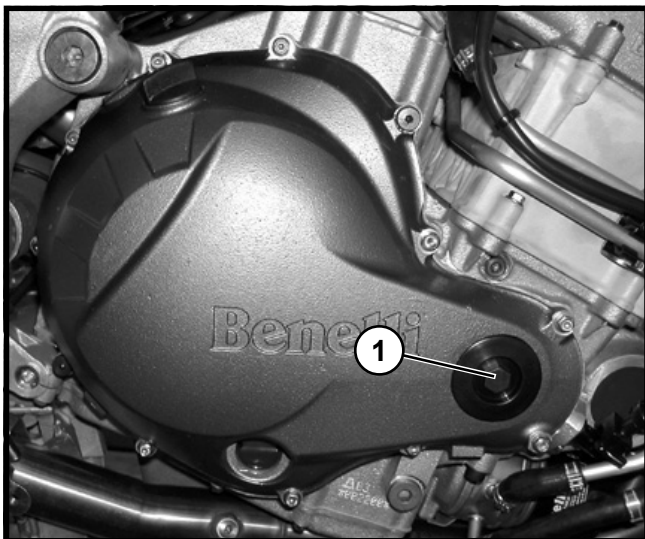


Close the two upper fixing motor screws (5) and (6), close the arm band security screw (7).



Install the small frame, close the couple of the upper fixing screws. (8), close the security screws.





## 5.1 CAMSHAFT

### 5.1.1 REMOVE CAMSHAFT

To remove the engine from the frame use the specific equipment.



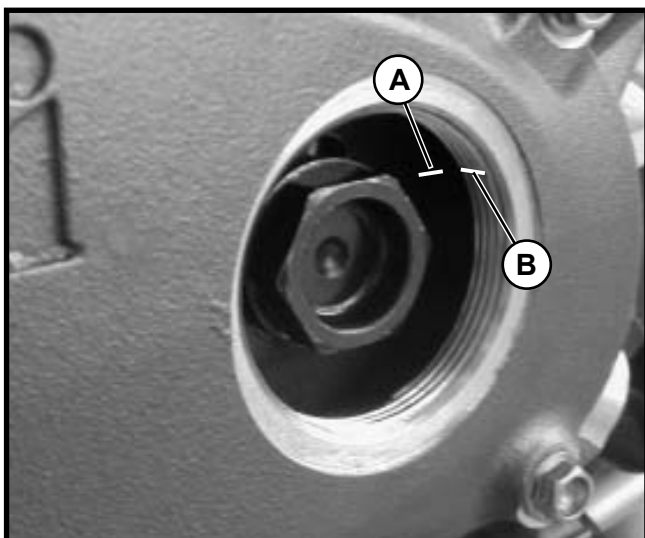
**SPECIFIC EQUIPMENT**  
Engine dismantling instrument:  
R180197034000

To support the engine use the specific equipment.

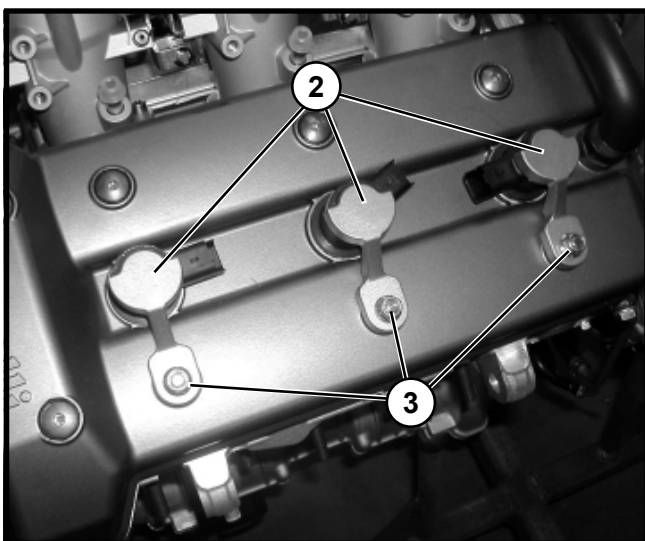


**SPECIFIC EQUIPMENT**  
Engine support:  
R180197029000

Remove the access cover (1) to the phonic wheel.

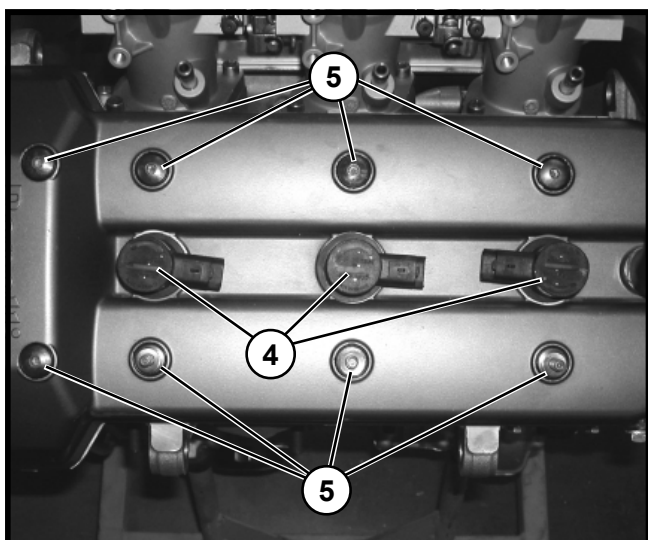


Position the phonic wheel as shown in the figure.  
The two signs (A and B), A on the cover, B on the phonic wheel, must coincide (PMS).



Remove the three aluminium rods (2) that fix the relative coils, using the fixing nuts (3).





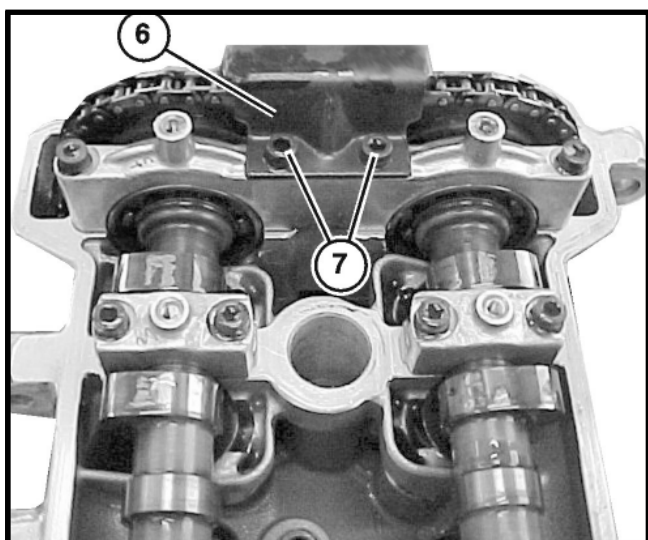
Remove the coils (4) and the sparking-plugs beneath.



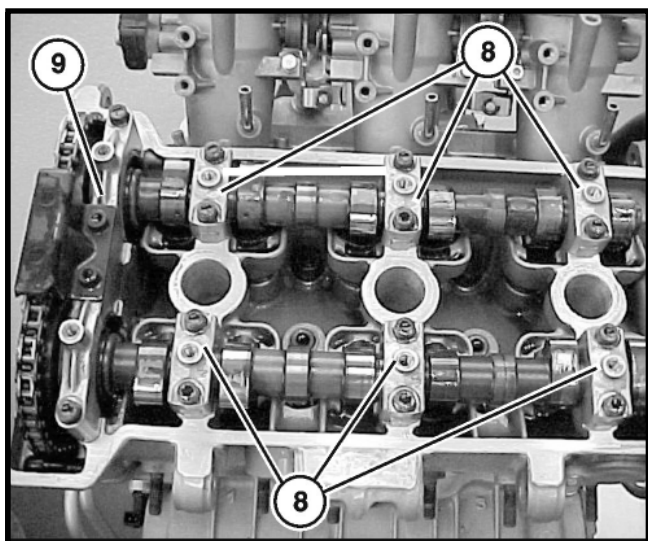
**ATTENTION:**  
Take note of the position of the screws for correct remounting.

Unscrew the eight head cover fixing screws (5).

**NOTE:**  
Replace the screws rubber tops (5) during reassembly.



Remove the head cover.  
Remove the chain pad (6), unscrewing the two fixing screws (7).



**ATTENTION:**  
Make sure that the distribution chain does not fall into the casing.

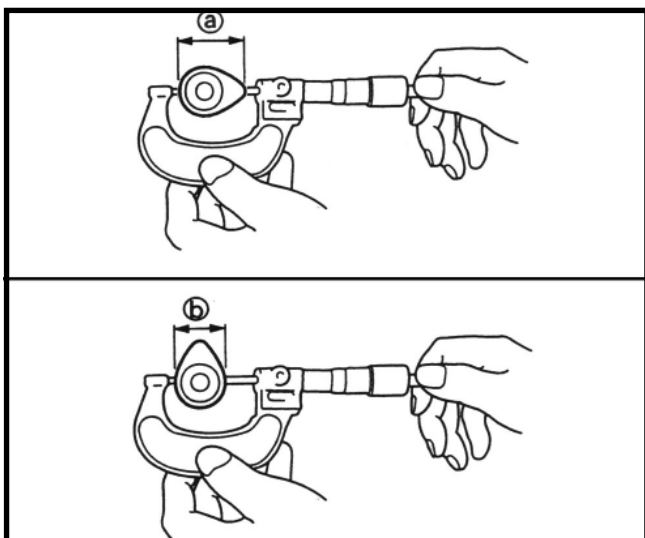
Remove the chain stretcher.



**ATTENTION:**  
Note the position of the elements for correct remounting.

Unscrew the fixing screws of the large caps (8) and remove them.  
Remove the bridge (9), unscrewing the fixing screws.  
Remove the camshafts and the chain.





### 5.1.2 CHECK CAMSHAFT

Check the olives of the camshaft with a micrometer, as indicated in the figure.

If the value does not enter within the specific measure, change the element.

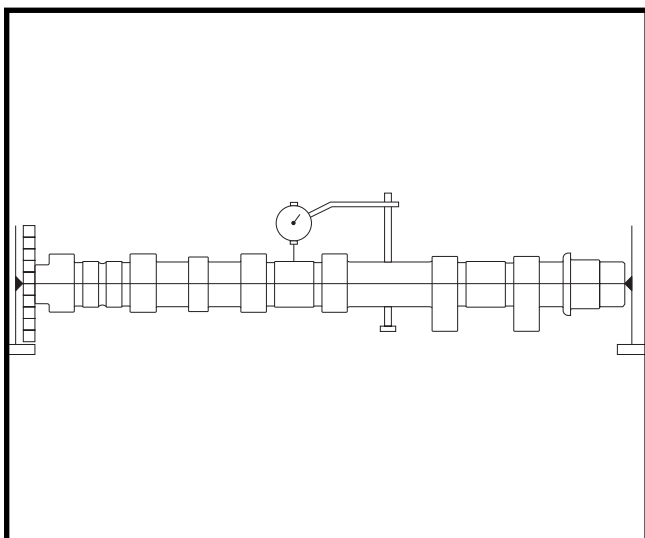


#### SUCTION SHAFT VALUE LIMIT:

A= 36.6 mm B= 27.85 mm

#### EXHAUST SHAFT:

A= 36.6 mm B= 27.85 mm



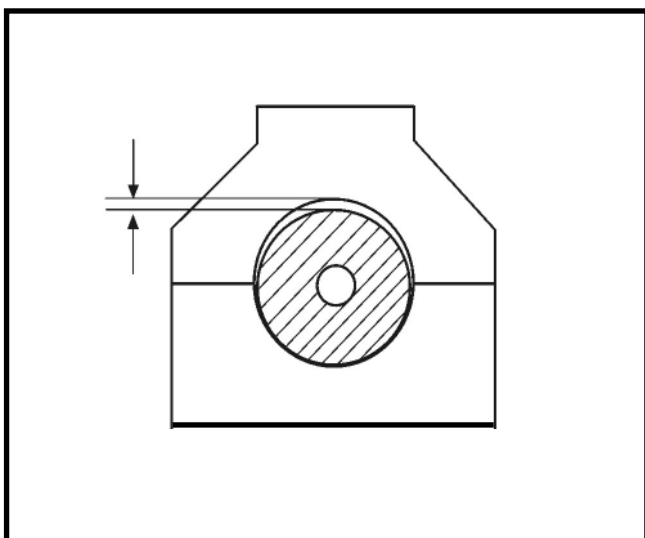
Check the deformation of the camshaft with a comparator, as shown in the figure.

If the value does not enter within the specific measure, change the element.



#### SUCTION AND EXHAUST SHAFT DIMENSIONS LIMIT:

MAX. VALUE = 0.03 mm



The maximum play between the distribution camshaft and seat is 0.1 mm.

If the value does enter within the specific value, change the element.



#### VALUE LIMIT

#### CAMSHAFT AND SEAT

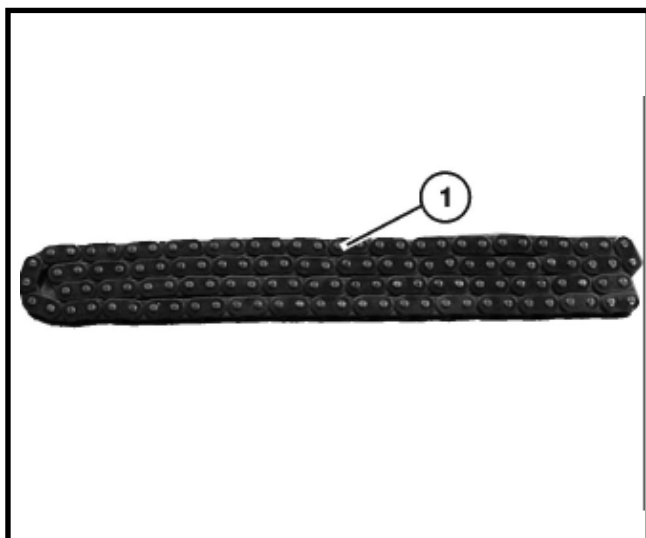
Max. play= 0.01 mm



#### SPECIFIC EQUIPMENT

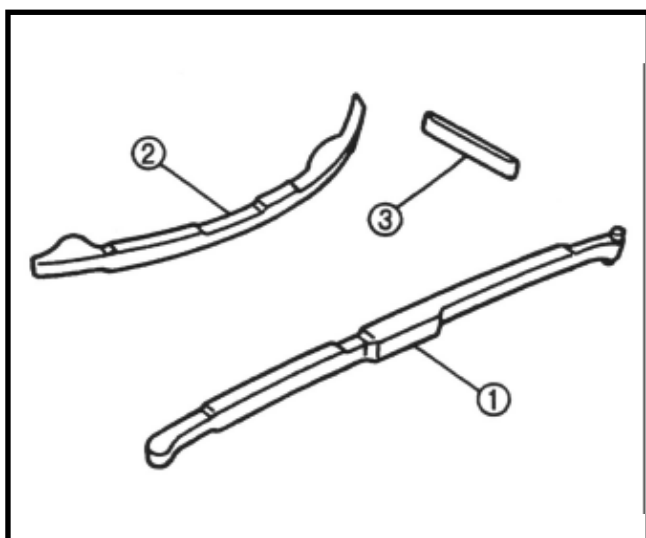
Instrument for checking engine shaft axle:  
R180197030000





### 5.1.3 CHECK CHAIN, SPROCKET WHEELS AND CAMSHAFT CHAIN GUIDE

Check the state of wear of the camshaft distribution chain (1). If the element has blocked links, is excessively worn or has exceeded 40000 Km, change it.



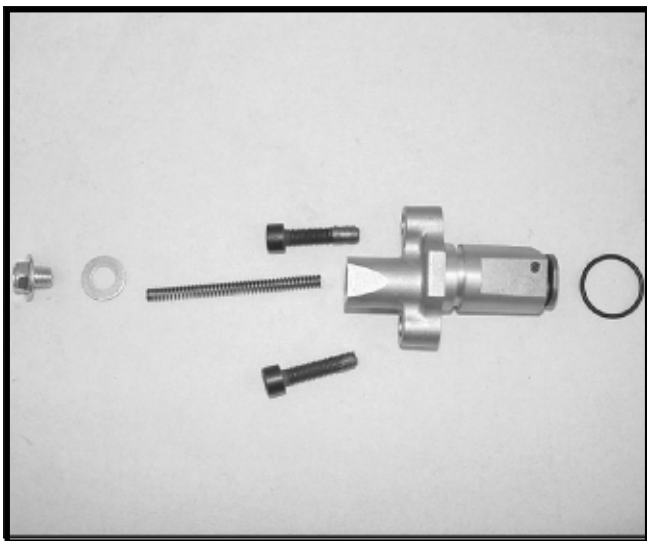
Sight check the distribution chain guides:

- 1 Fixed guide (FRONT PART)
- 2 Mobile guide (REAR PART)
- 3 Upper guide (FIXED ON HEAD)

If one or more elements are worn, change it/them.

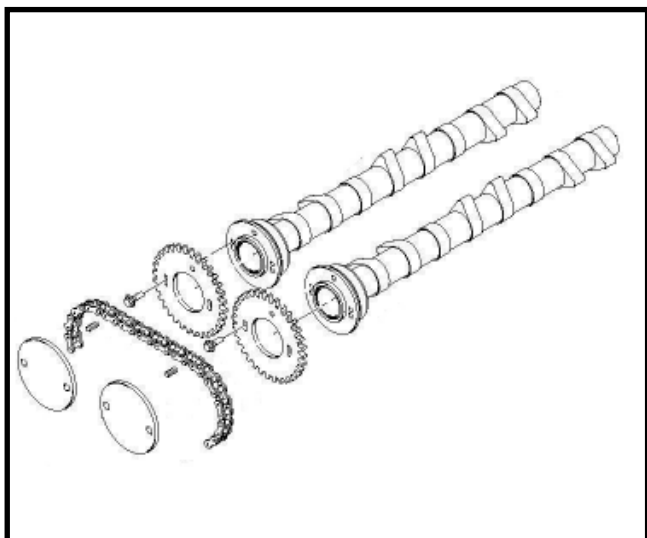
**NOTE**  
**REPLACE ALWAYS THE CHAIN SHOES WHEN REPLACING THE DISTRIBUTION CHAIN**





#### 5.1.4 CHECK CHAIN STRETCHER

Check the free sliding of the chain stretcher rod.  
 Check the state of the chain stretcher spring.  
 Check the integrity of the chain stretcher.  
 If an element or its components are damaged or ruined, change it/them.

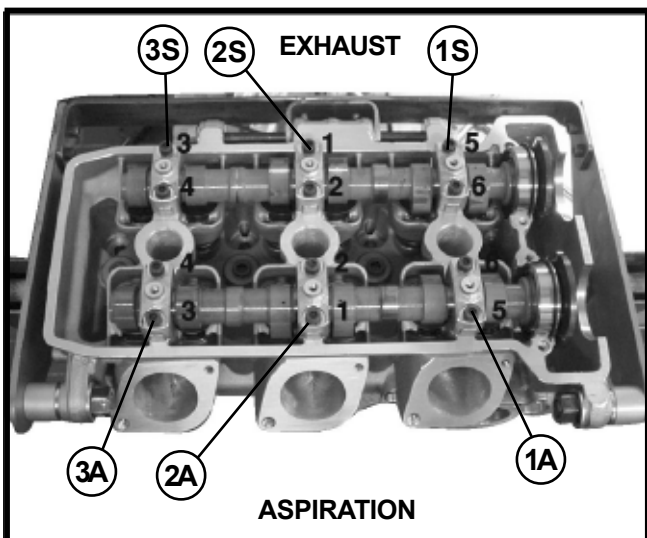


#### 5.1.5 MOUNT CAMSHAFT



##### **WARNING:**

*To mount the camshafts correctly position the olives on the first cylinder towards the outside on the side of the distribution chain, position the fixed pad and then the mobile pad.*



Position the exhaust shaft and the distribution chain, position the caps in their original direction (written on the outside) and tighten the fixing screws according to the diagram in the figure.



**1st phase: 6 N·m; 2nd phase: 13 N·m**

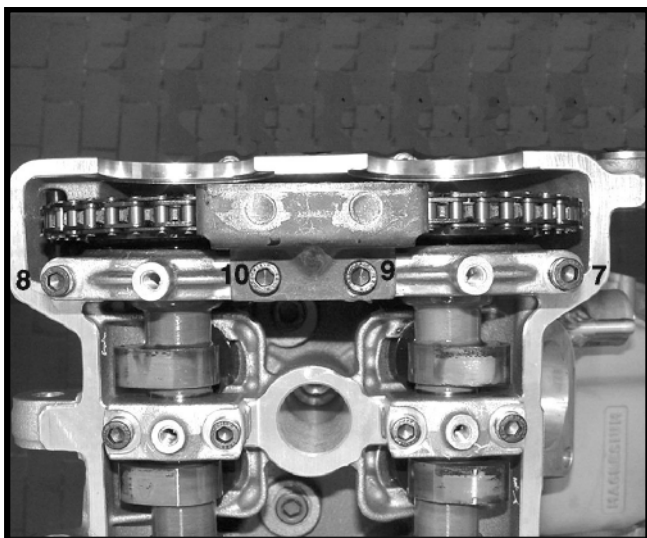
Position the aspiration shaft and the distribution chain, position the caps in their original direction (with the writing on the outside and the number engraved inside the head) and tighten the fixing screws according to the diagram in the figure.



**1st phase: 6 N·m; 2nd phase: 13 N·m**

**A = Aspiration**  
**S = Exhaust**





Position the transmission chain on the toothed wheels of the distribution shafts.

Position the bridge and the upper chain pad and tighten the fixing screws in two phases as in the diagram in the figure.

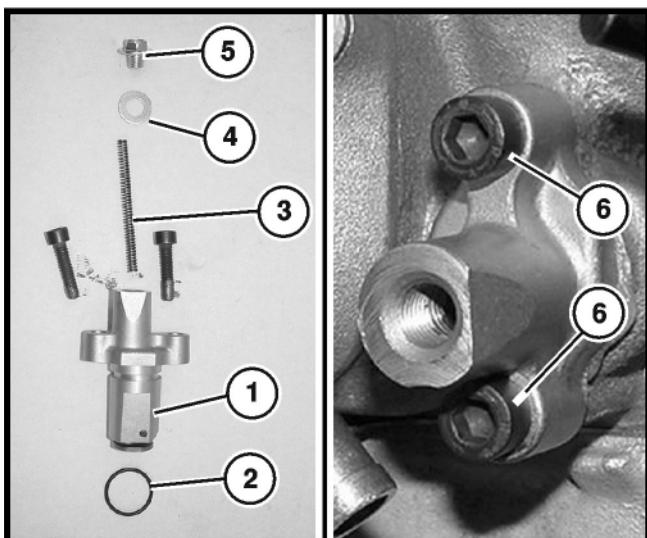


1st phase: 6 N·m; 2nd phase: 13 N·m

**NOTE:**

Always oil the sliding parts with Teflon SINTOFLOX paste. See chapter 2, specifications

Re-position the fixed pad.



Position the body of the chain stretcher (1) complete with O-ring (2) and tighten the two screws (6) as specified in the diagram.



10 N·m

Position the rod pushing spring (3) and the washer (4) and tighten everything with a drive screw (5) as in the diagram.

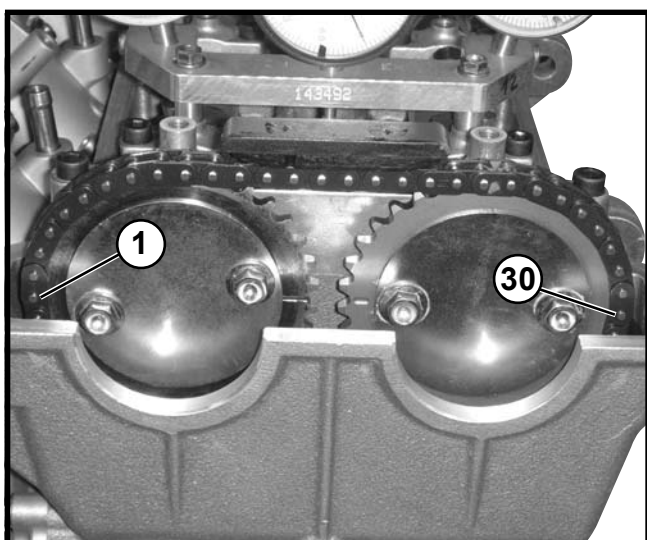


7 ÷ 8 N·m



**ATTENTION:**

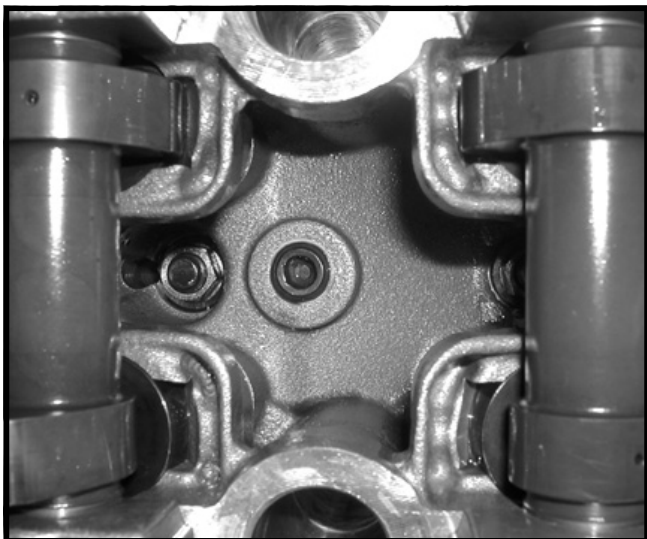
Always check that the chain stretcher is always in position 0 (in exhaust) before mounting it.



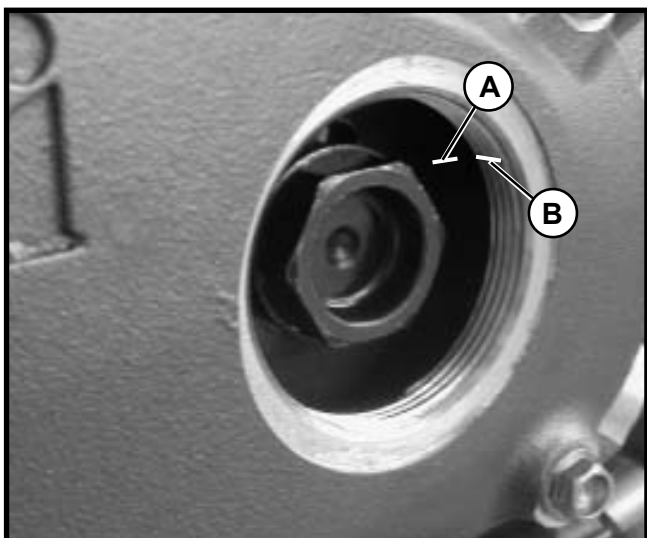
Align the signs on the toothed wheels at the head level as in the figure.

Count n° 30 chain pins from position 1 to position 30 as indicated in the figure.

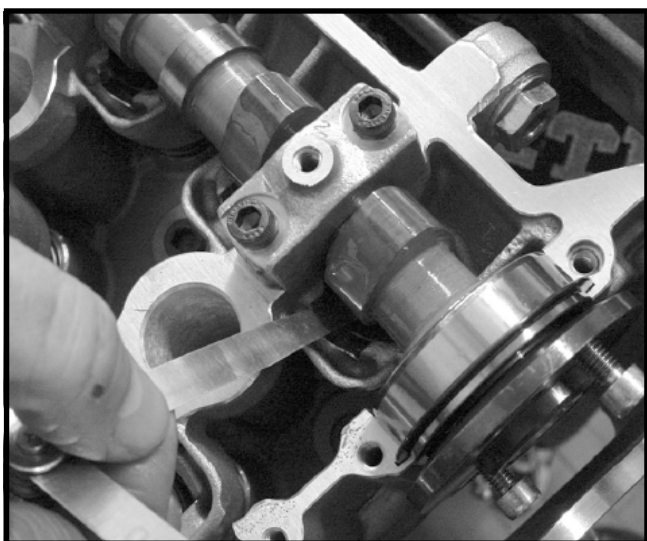




Check that the position of the cylinder 1 valves are turned towards each other as in the figure.



Check that the position of the phonic wheel is as indicated in the figure ("A" and "B" aligned).



**Check the valve play with a feeler.**

If the valve play is not within the specific value, adjust the valve play (see "ADJUST VALVE PLAY").  
Screw the phonic wheel cover onto the right side of the engine.

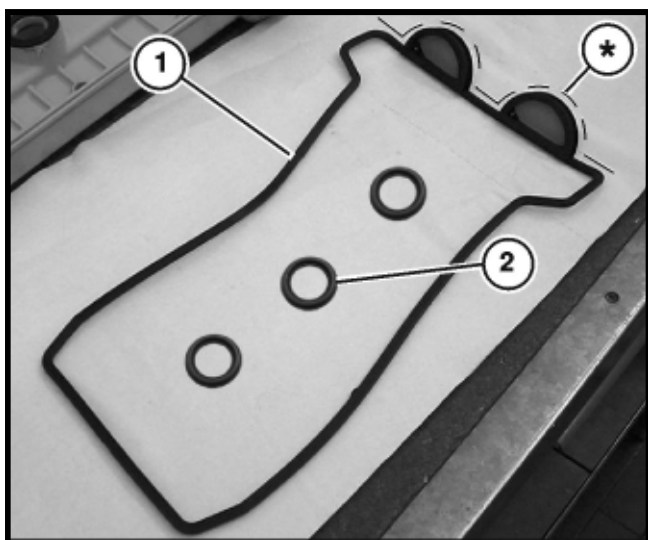
**ASPIRATION SHAFT VALVE PLAY:**

**0,30 - 0,35**

**EXHAUST SHAFT VALVE PLAY:**

**0,35 - 0,40**





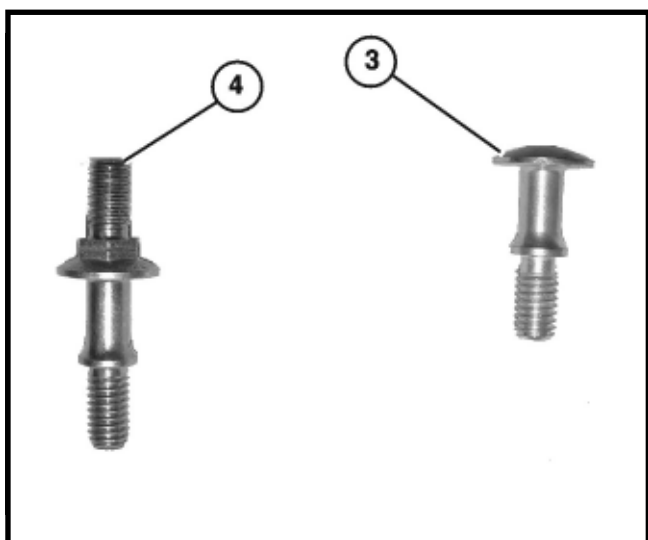
**ATTENTION:**  
Always use new gaskets.

Position the gaskets of the head cover (1 and 2 ).

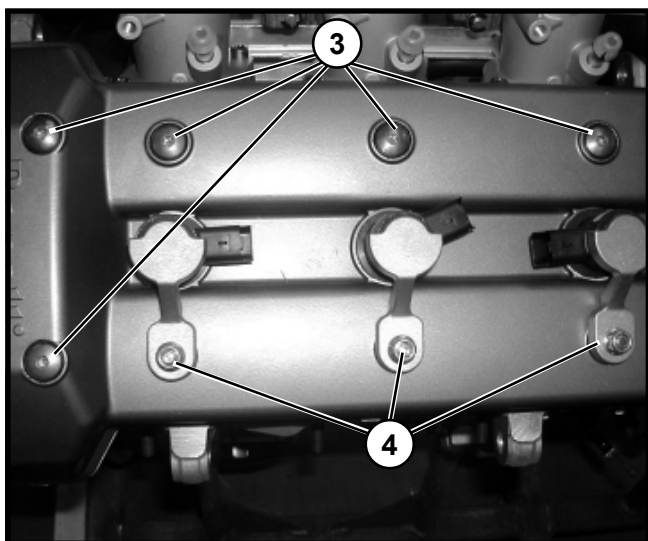


**ATTENTION:**  
Make sure during mounting that the gaskets (2) do not fall into the head.

\*Apply THREEBOND® paste as in the drawing.



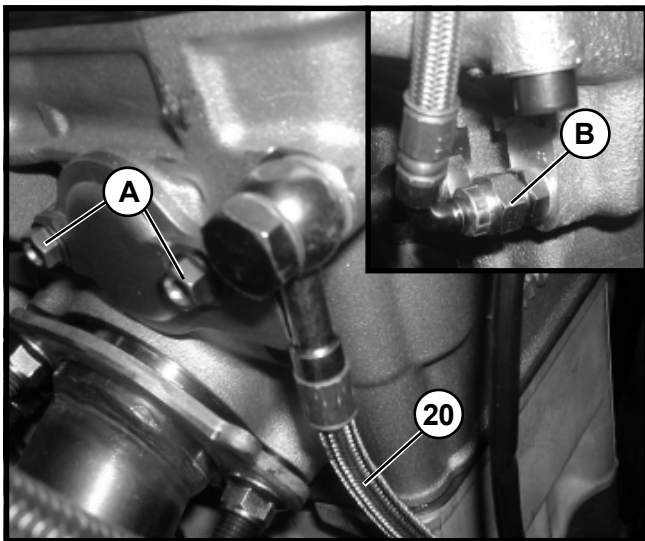
Position the cover of the head and insert the screws (3) and (4) where indicated in the figure.



Tighten the 8 fixing screws of the head with the appropriate rubber washers.

**NOTE:**  
Replace the rubber tops of the screws (3) during reassembly.





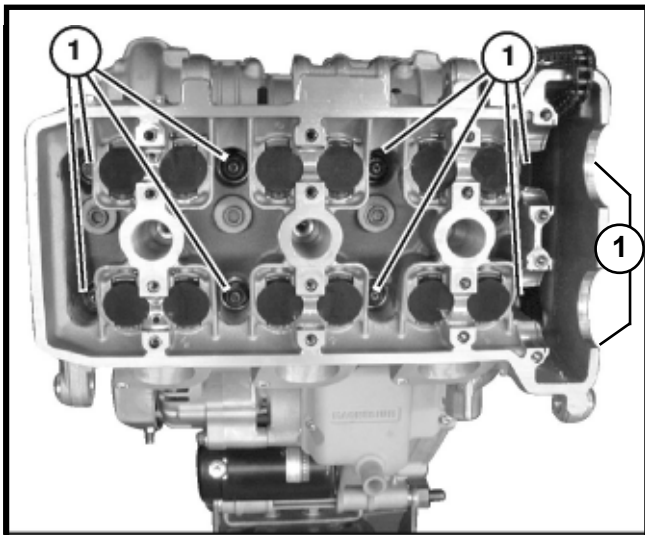
Remove the two fixing joining elements (A) and (B) of the head and the lower crankcase and disconnect the oil tube (20).

**NOTE:**

Tighten the head cover fixing screws to the specific worm drive according to the order indicated in the figure, paying attention not to cut or damage the gaskets.



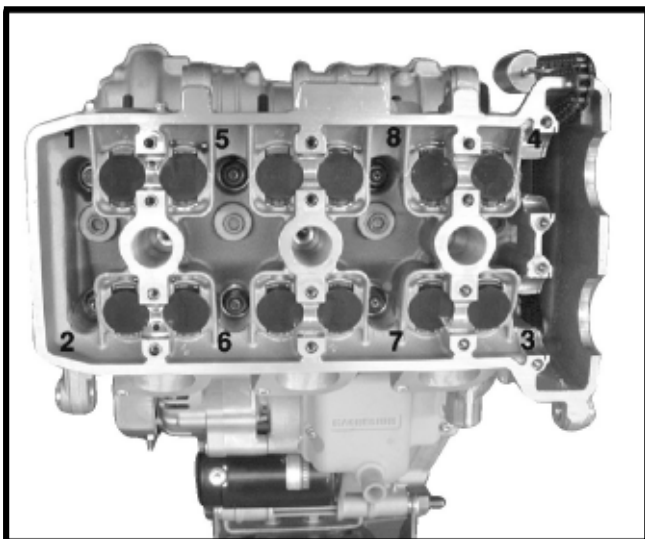
10 N·m 1 Kg-m



## 5.2 CYLINDER HEAD

### 5.2.1 REMOVE CYLINDER

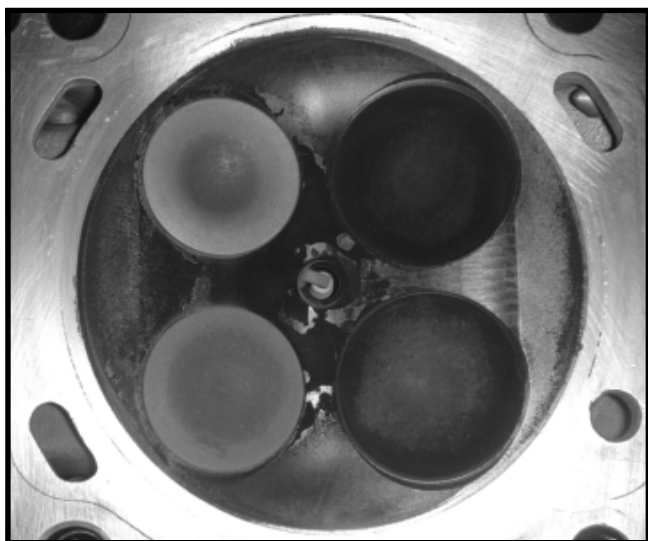
Remove the camshaft (see "REMOVE CAMSHAFT").  
Loosen and remove the eight nuts (1) indicated in the figure and the two screws on the right side of the engine (distribution side).



**NOTE:**

Loosen, for a moment, the fixing screws and nuts according to the sequence indicated in the figure. Then remove the head.





## 5.2.2 CHECK CYLINDER HEAD



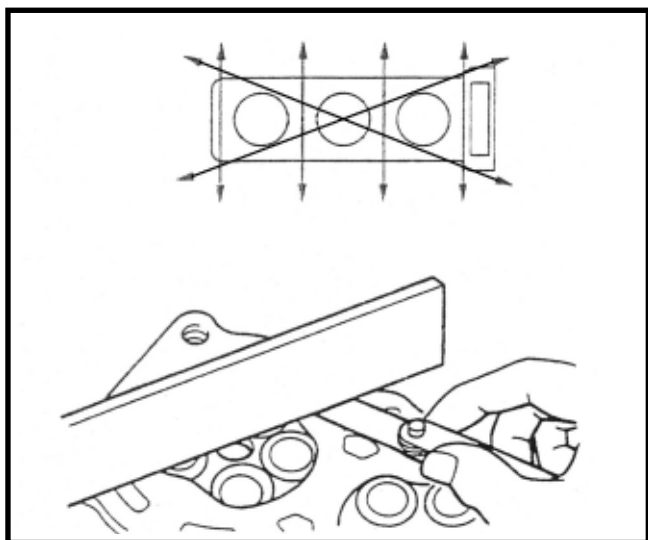
### **WARNING:**

*Do not use a pointed instrument to avoid damaging or scatching:*

*Sparking-plug hole threading*

*Valve seat*

Check and eventually eliminate carbon deposits in the combustion chamber with a rounded-off scraper.



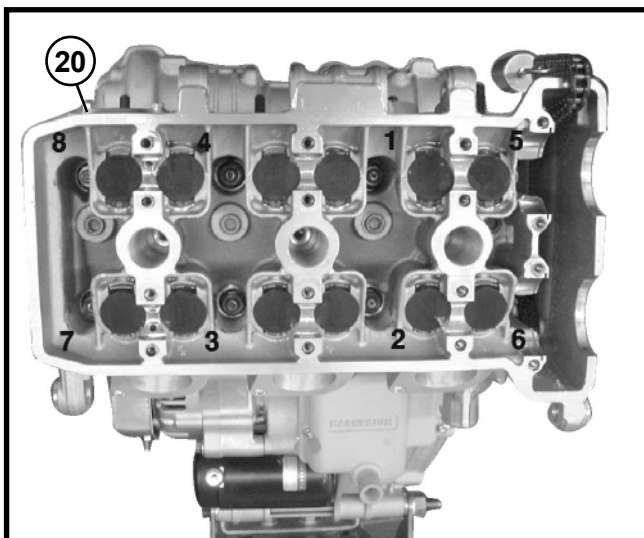
If the surface is damaged or scratched, change the element. Check the distortion of the cylinder head as indicated in the figure. If it is outside the specific value, rectify the head.



### **VALUE LIMIT HEAD DISTORTION**

**max. distortion = 0.2 mm**





### 5.2.3 MOUNT CYLINDER HEAD

#### NOTE:

Always use new gaskets. Clean and degrease the head surface and the cylinders.

Position the head/cylinder gasket.

Position the cylinder head. Position the fixing washers and nuts. Tighten to the specified worm drive following the order in the figure in the following phases:



1st phase: 2.5 Kg-m; 2nd phase: 3.5 Kg-m

3rd phase: 4.5 Kg-m; 4th phase: final tightening with an angle of 50°+50°

#### NOTE:

Apply grease to the fixing nuts to oil the threading (MOLIKOTE® CU7439 PLUS copper grease).

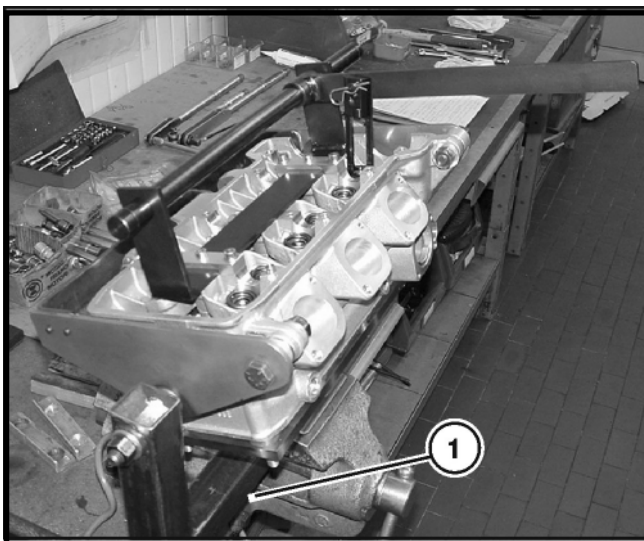
Mount the oil tube head (20) connection to the crankcase. Tighten to the prescribed worm drive.

**N.B.** This tightening requires a worm drive angle wrench.



Drilled screw: 20 N.m 2 Kg-m + LOCTITE 270®

Joining element on crankcase: 20 N.m 2 Kg-m

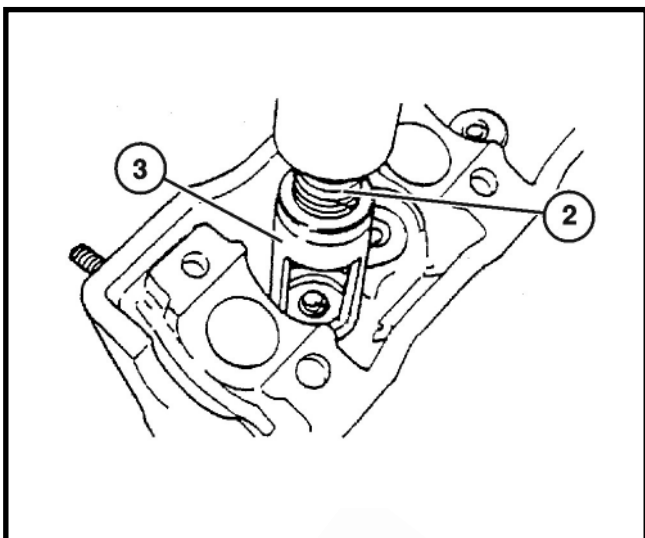


## 5.3 VALVES AND VALVE SPRINGS

### 5.3.1 REMOVE VALVES

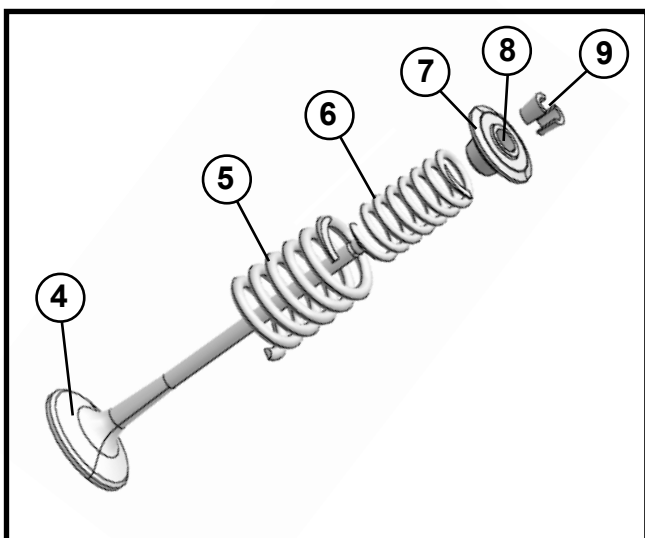
Remove the cylinder head (see ("REMOVE CYLINDER HEAD"). Position the head on a slightly inclined surface to show the valves to remove, perpendicular to the surface.





To remove the valves use a valve dismantling instrument (2) with the correct attachment (3), press the valve down and take off the two semi-cones.

Loosen the clamp and remove the valve and its components as in the photo.

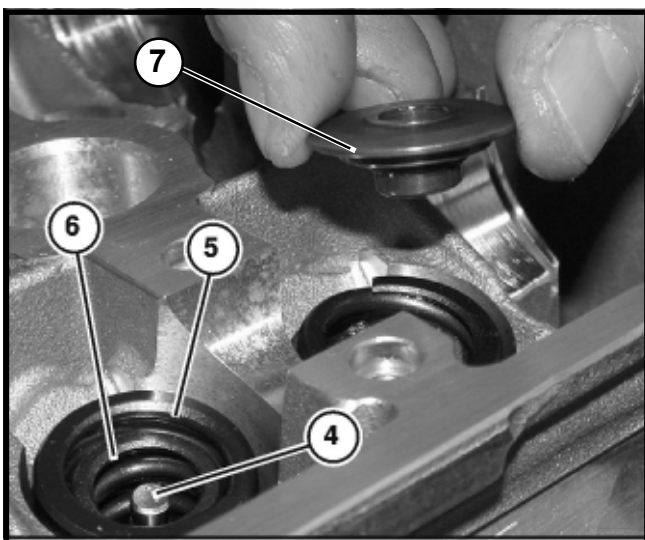


The following procedure is applied to the valves (4), the springs (5 and 6) and relative components (7, 8 and 9).

**NOTE:**

**Make sure that valve (4) has a perfect seal by pouring petrol into the conduits and making sure that there are no losses through the valves. Make sure that the valves are perfectly sealed.**

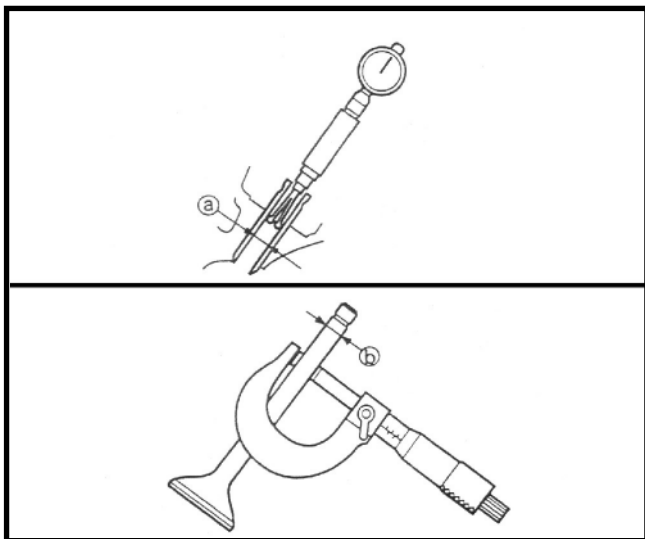
Remove the small bowls taking note of the position on each valve and coupling them to their pads.



Free the pusher spring plate (7) using the specified instrument to remove the two lock cones.

Remove the external spring (5), the internal spring (6), valve (4), the valve seal ring and the lower cup.





### 5.3.2 CHECK VALVES AND VALVE GUIDES

The following procedure must be carried out on all valves and relative valve guides.

Check that values (A) and (B) are within the tolerance of the specific values.

If values (A) and (B) are not within the value limits, change the elements.



#### ASPIRATION VALVE DIAMETER LIMIT

A max. = 5.05 mm

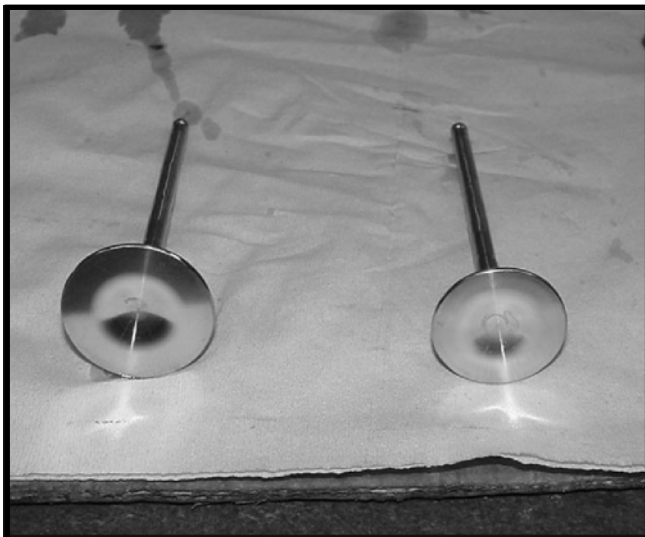
B min. = 4.965 mm



#### EXHAUST DIMENSION LIMITS

A max. = 5.05 mm

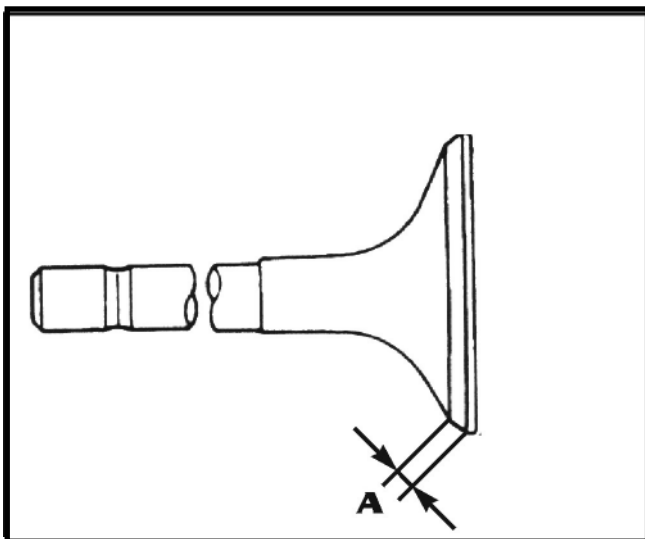
B min. = 4.955 mm



Check the state of the surfaces of the valves.

Eliminate eventual carbon deposits.

If the surface is excessively ruined, change the element.



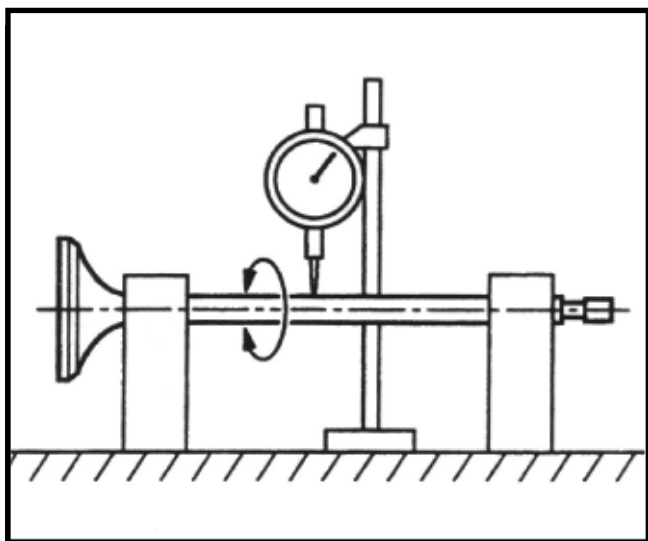
Check thickness (A) indicated in the figure.



#### VALVE THICKNESS VALUE LIMIT

A = 1,0 ÷ 1,3 mm



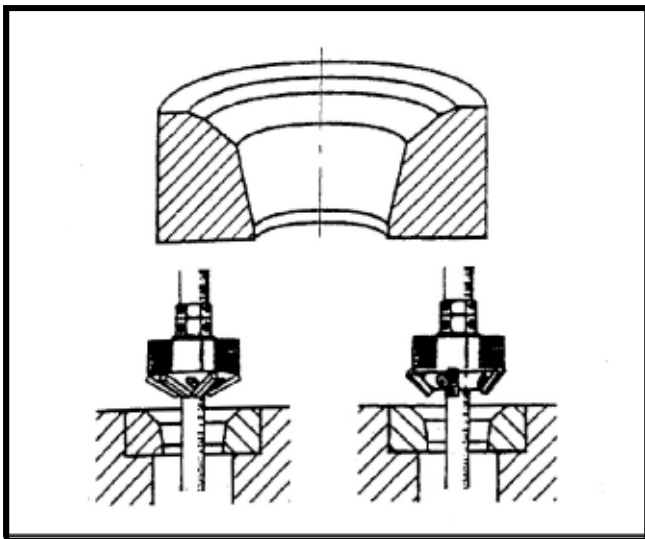


Check the deformation of the legs of the valve.  
If the concentricity value does not enter within the margin, change the element.



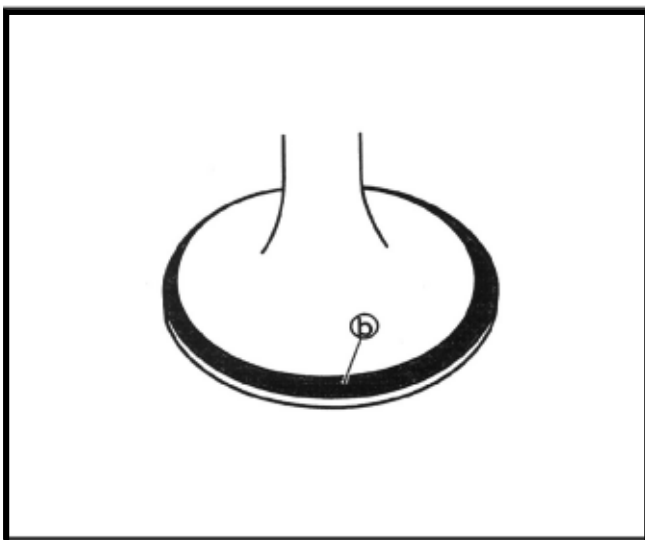
**VALVE REFORMATION**  
**VALUE LIMIT**  
**0.01 mm**





### 5.3.3 CHECK VALVE SEATS

The following procedure must be applied to all the valve seats. Eliminate eventual carbon deposits.



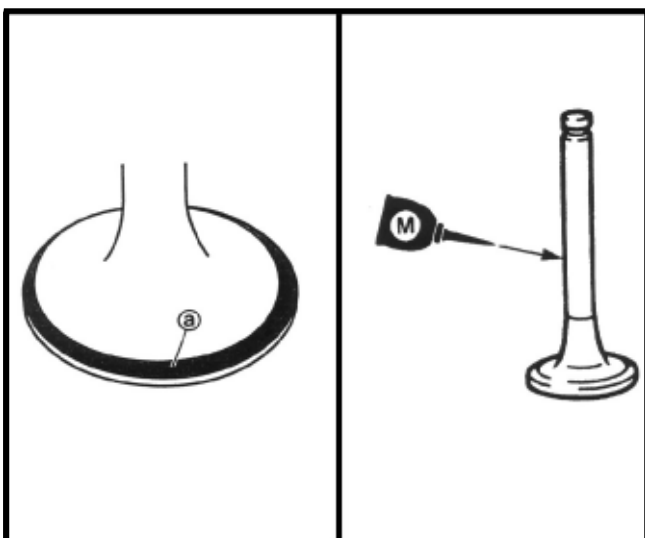
Apply the tincture of bluing (b) on the face of the valve. Install the valve into the appropriate seat. Press it using the guide on the seat to leave an evident impression. Measure the width of the seat of the valve.

**NOTE:**

It will be necessary to remove the bluing at the point at which the seat and the face of the valve touch.

**NOTE:**

If the trace is not partial or not uniform, carry out a smoothing operation on the face and the seat of the valve.



Smooth:

- the face of the valve
- the seat of the valve

**NOTE:**

After having changed the cylinder head or the valve and the relative guide, it will be necessary to smooth the seat and face of the valve.

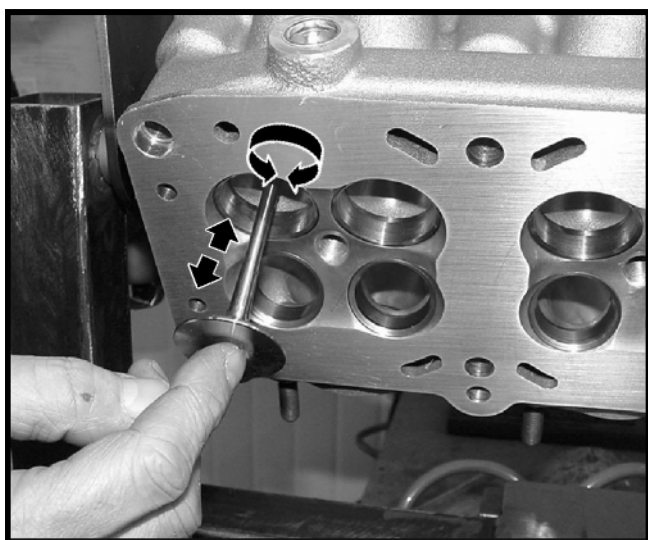
Apply a coarse grained paste (a) for smoothing on the face of the valve.



**ATTENTION:**

*Do not allow the smoothing paste to enter into the space between the stem of the valve and the guide.*

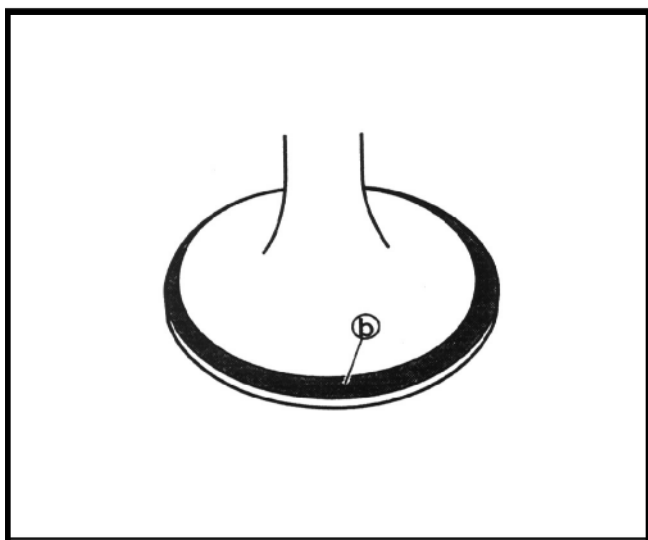




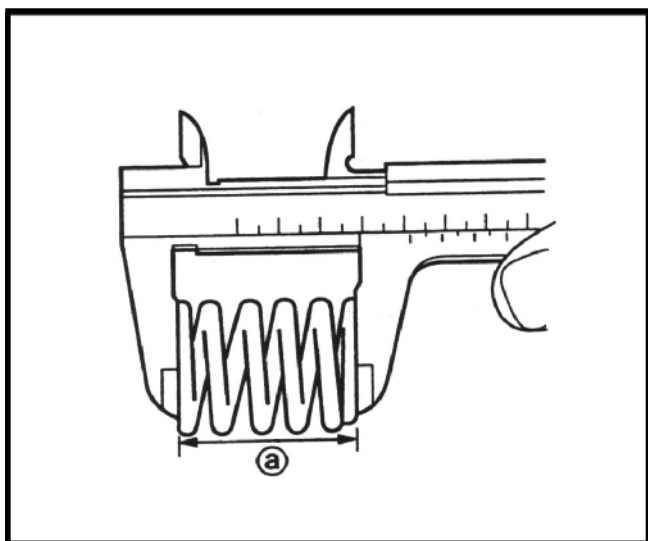
Apply disulfide of molybdenum to the stem of the valve.  
Insert the valve into the cylinder head.  
Rotate the valve until its face and seat shine uniformly, then remove the smoothing paste.

**NOTE:**

To obtain optimum smoothing results, strike the seat of the valve lightly while turning it forwards and backwards in your hands.



Apply a fine grained paste to the face of the valve and repeat the above operations.  
Completely eliminate the smoothing paste from the face and the seat of the valve at the end of each operation.  
Apply the tincture of bluing (b) on the face of the valve.  
Install the valve in the cylinder head.  
Press the valve through the valve guide and on the valve seat to leave a clear trace.



### 5.3.4 CHECK THE VALVE SPRING

The following procedure is valid for all the valve springs.

Measure the length (a) of the free valve.  
If the value does not enter within the envisaged limits, change the spring.



**Free valve spring length**

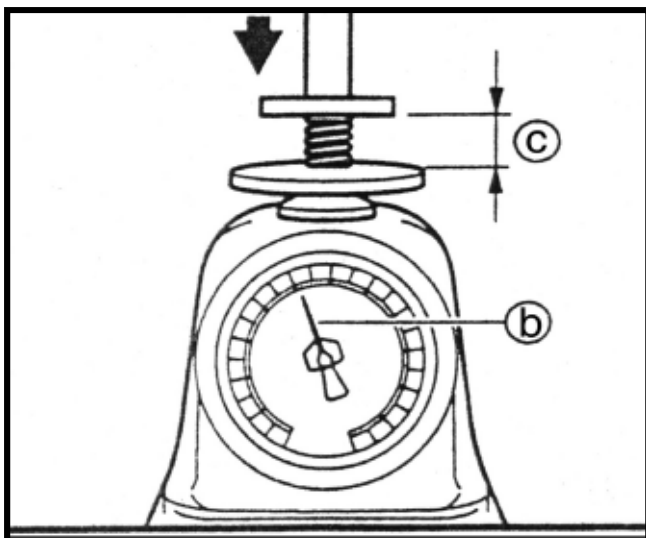
**External valve spring**

**Tolerance limit: 37 mm**

**Internal valve spring:**

**Tolerance limit: 34.0 mm**





Bring the spring to a value length (c) and check the value of the load:



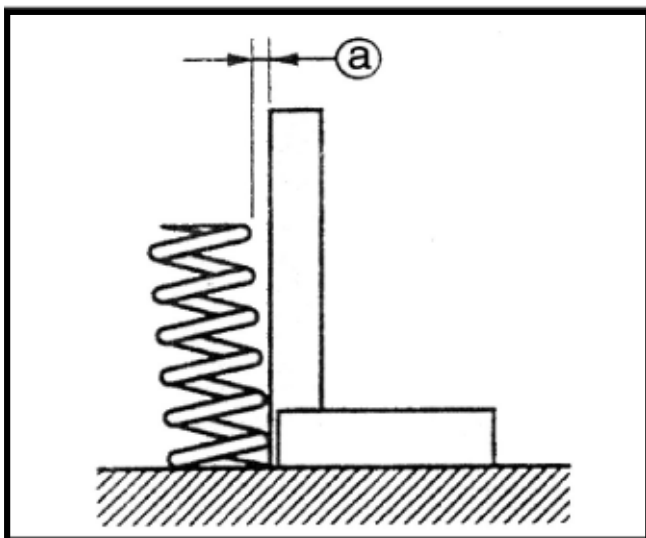
**VALUE LIMIT**

**External spring length: 23.2 mm**

**Load value limit: 565 N**

**Internal spring length: 21.2 mm**

**Load value limit: 314 N**



Check the inclination (a) of the valve spring as illustrated in the figure.

If (a) does not enter within the specific value, change it.



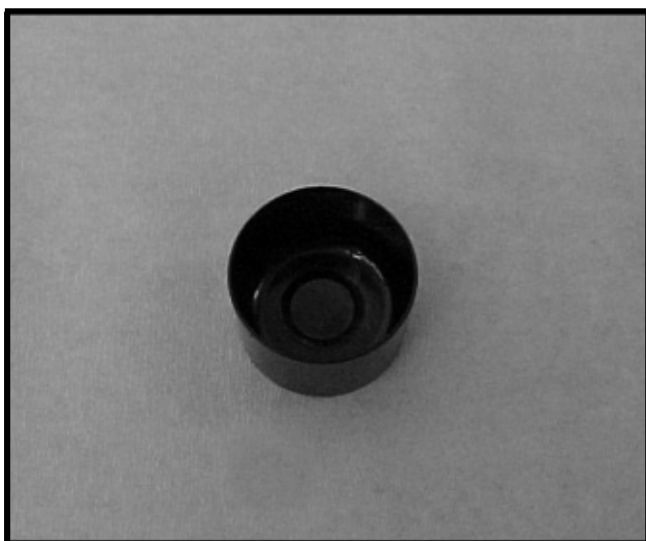
**VALUE LIMIT**

**INCLINATION SUCTION SPRING A = 2 mm**



**VALUE LIMIT**

**INCLINATION EXHAUST SPRING A = 2 mm**

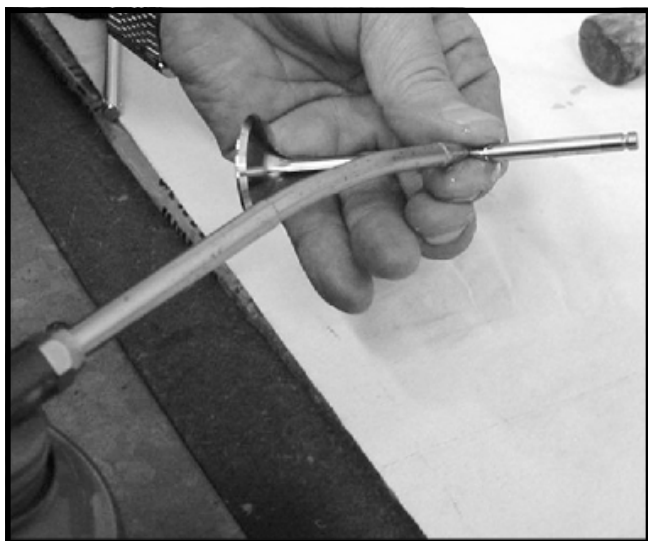


### 5.3.5 CHECK BUCKET-TYPE TAPPET

The following procedure must be applied to all the bucket-type tappets.

Check that the buckets are not broken or scratched, if so change them.





### 5.3.6 MOUNT VALVES

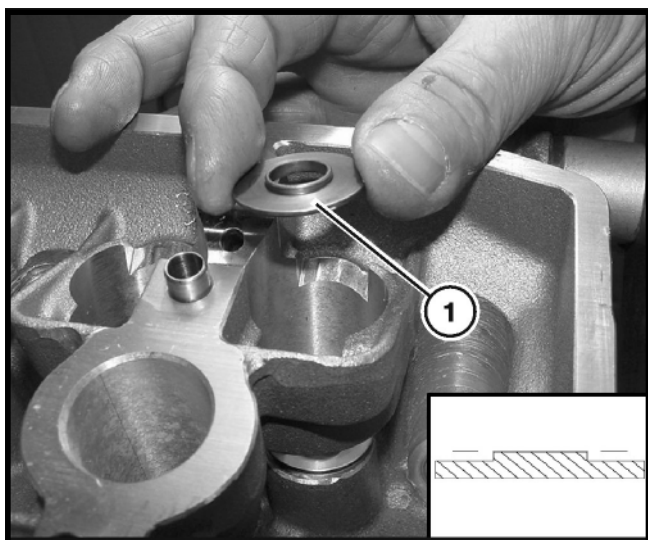
The following procedure must be applied to all the valves and relative components.

Oil the valve stem with the recommended oil.



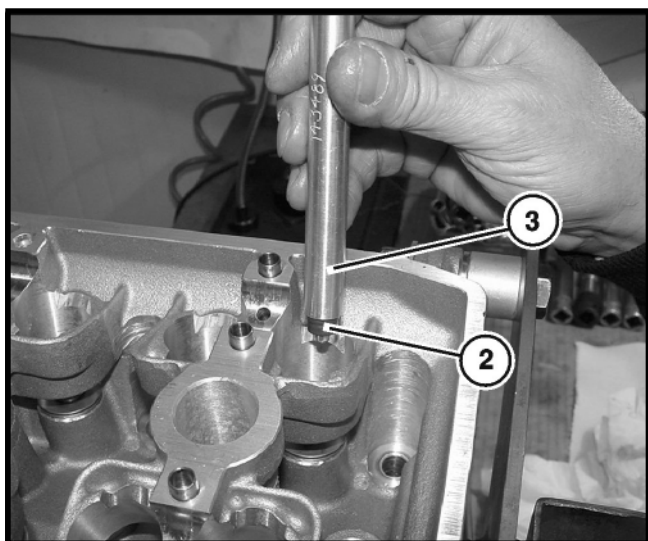
#### RECOMMENDED OIL

Disulfide of molybdenum oil



Mount the lower small cup (1).

Check that the thickness of the small cap is 1.5 mm.



#### WARNING:

*Always use new gaskets and oil seals.*

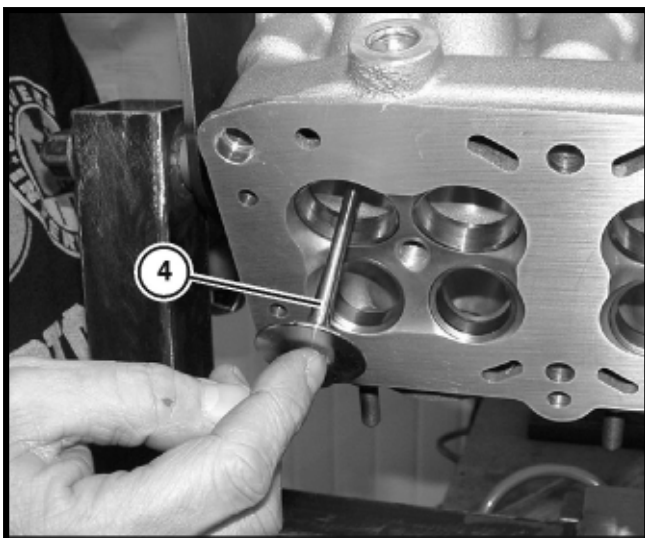
Mount the rubber valve seal (2) with the appropriate pad (3).



#### SPECIFIC EQUIPMENT

INSTRUMENT (3): R180197025000

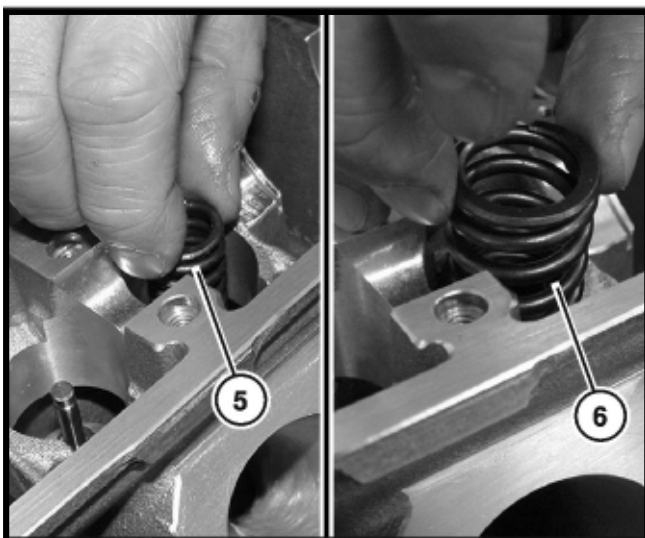




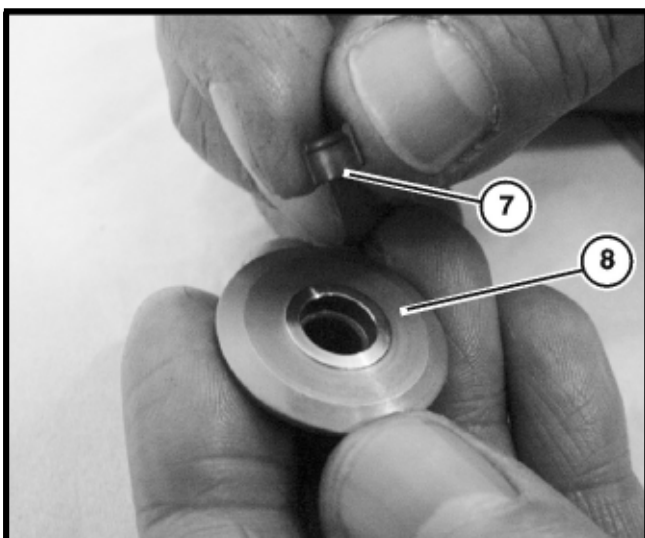
**ATTENTION:**

*The suction valves are larger than the exhaust valves.*

Insert the valves (4).

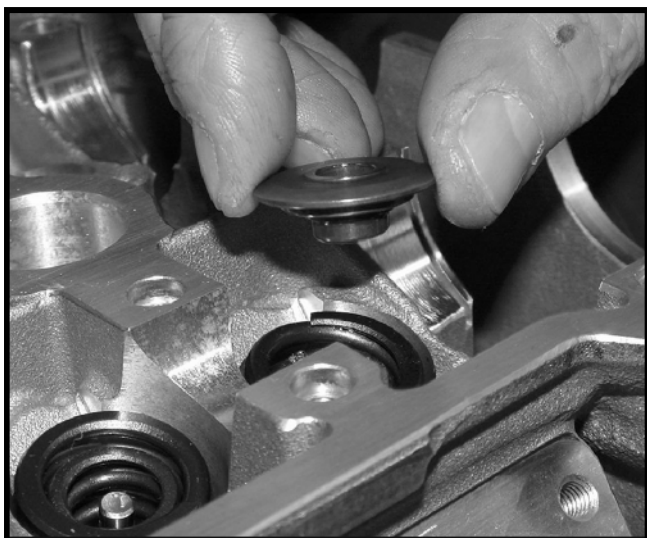


Position the internal (5) and external (6) springs as shown in the figure.

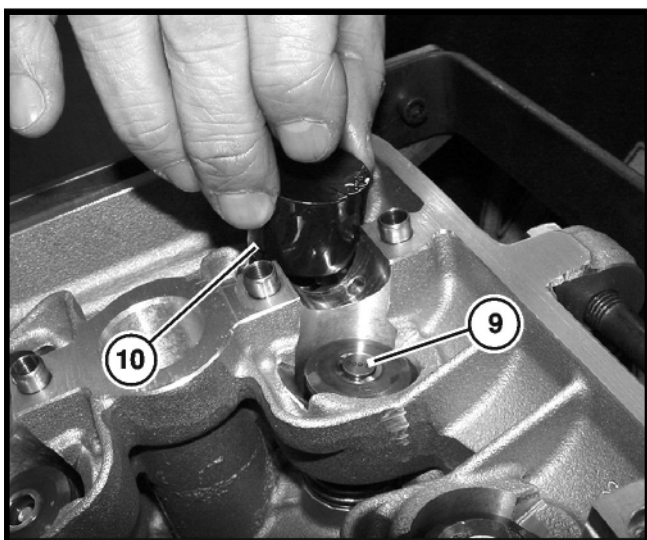


Insert the two lock cones (7) into the upper small cup (8).





Position the small cap as shown in the figure.  
Use the dismantling valve instrument making sure that the valve is correct.



Position the calibrated pads (9) and the bucket-type tappets (10).

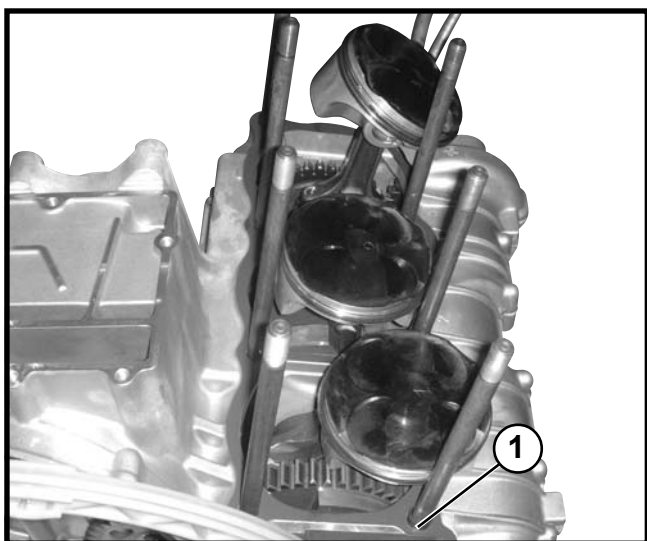


#### **ATTENTION**

*Make sure that the individual valve lifters and the valve guide are re-mounted in the original position.*

#### **NOTE:**

Check that the buckets turn easily by rotating them with a finger.

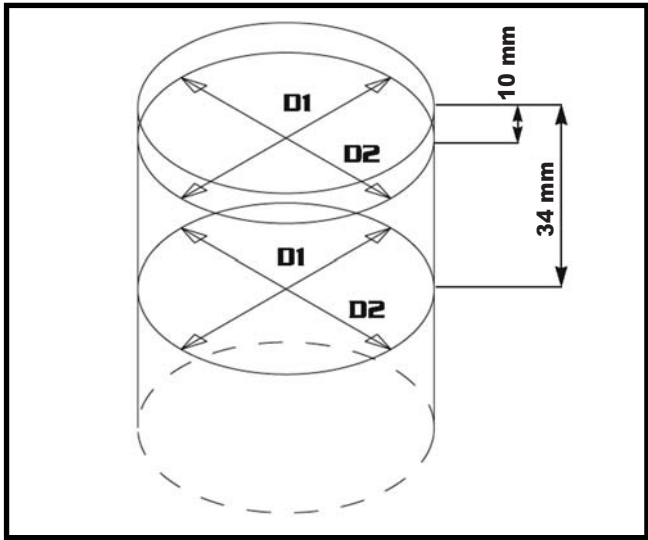


## **5.4 CYLINDER**

### **5.4.1 DISMANTLE CYLINDER BODY**

Remove the cylinder head (see "REMOVE CYLINDER HEAD").  
Remove the gasket of the head, the cylinder body (1) and the base of the cylinders gasket beneath.





### 5.4.2 CHECK CYLINDER

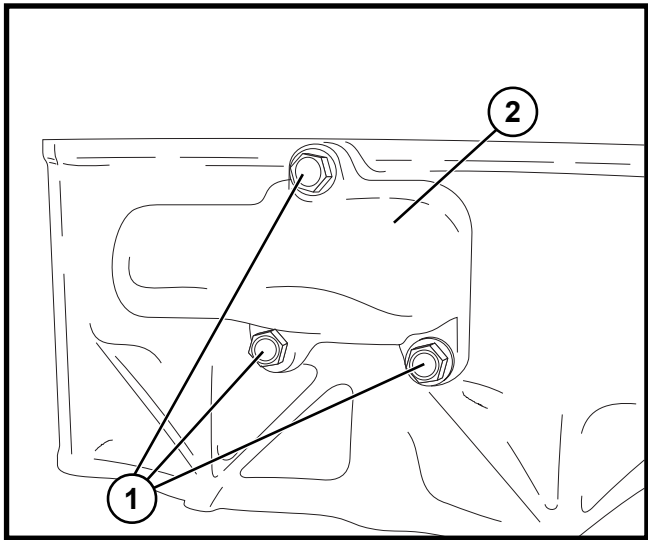
Check that the walls do not present signs of seizure with the pistons.  
Check the ovalisation of the cylinders as indicated in the figure.

CLASS	D1/D2
A	ø 88,00-88,01
B	ø 88,011-88,021
C	ø 88,022-88,032



**ATTENTION:**  
*In the case of changing the cylinder block also change the pistons and the elastic straps, if necessary. The cylinder is distinguished by a letter that indicates the class it belongs to. The cylinder-piston coupling must be carried out among the same classes that they belong to.*

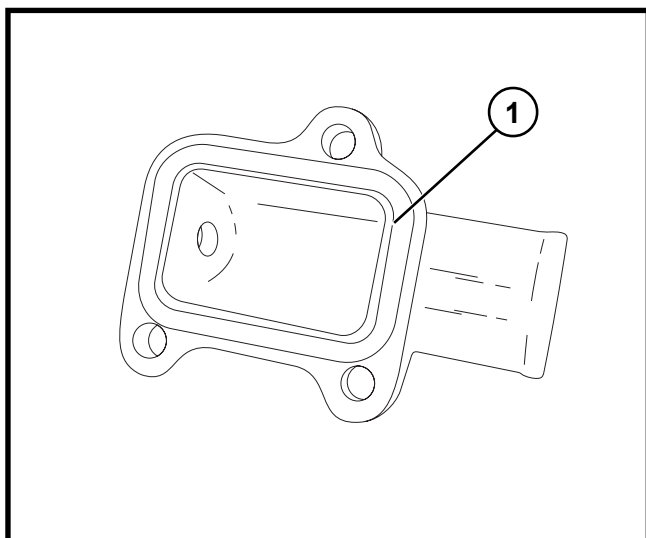
The letters are on the external front part (exhaust side) of the cylinder.



### 5.4.3 DISMANTLE WATER COLLECTOR

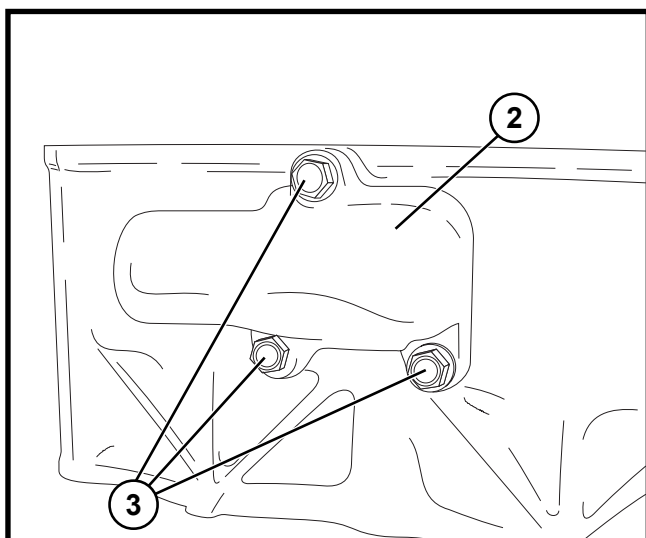
Unscrew and remove the three screws (1) and remove the collector (2).





#### 5.4.4 CHECK WATER COLLECTOR

Check eventual breaks on the collector and if necessary change the piece.



#### 5.4.5 MOUNT WATER COLLECTOR

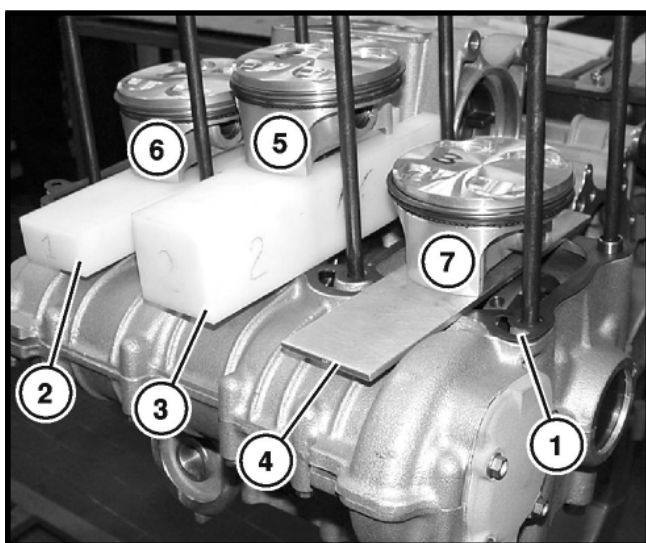


**ATTENTION:**  
Always use new gaskets.

Position the gasket (1) and the collector (2) and tighten the screws (3).



10 N·m 1 Kg-m



#### 5.4.6 MOUNT CYLINDERS



**WARNING:**  
Always use new gaskets.

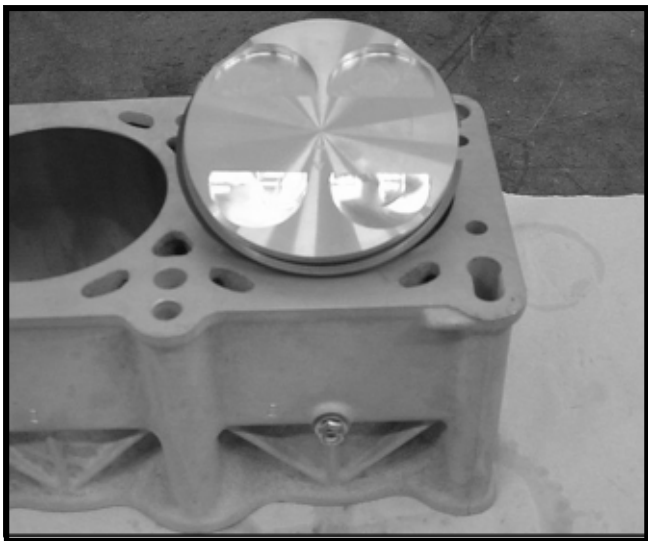
Position the gasket (1) and the liners (2), (3) and (4), as shown in the figure and check the correct position of the centering dowels.

Position the cylinder pistons (5), (6) and (7) enter them in order.



**SPECIFIC EQUIPMENT**  
**CYLINDER MOUNTING LINERS:**  
R180197018000





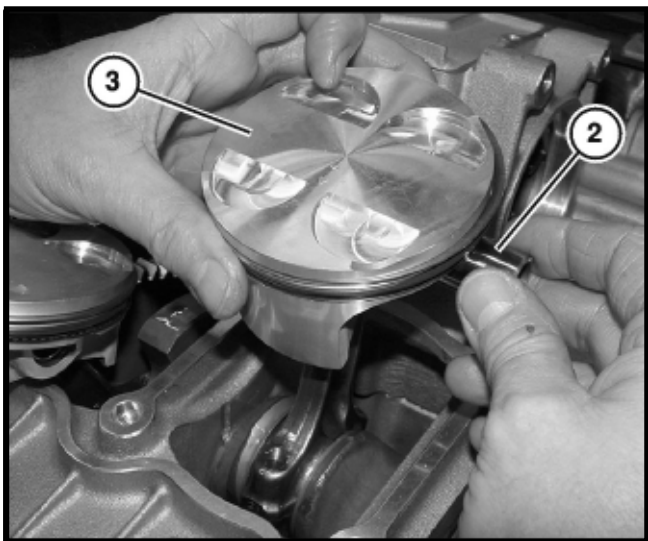
## 5.5 PISTON

### 5.5.1 DISMANTLE PISTON

Remove the cylinder (see "DISMANTLE CYLINDER BODY").



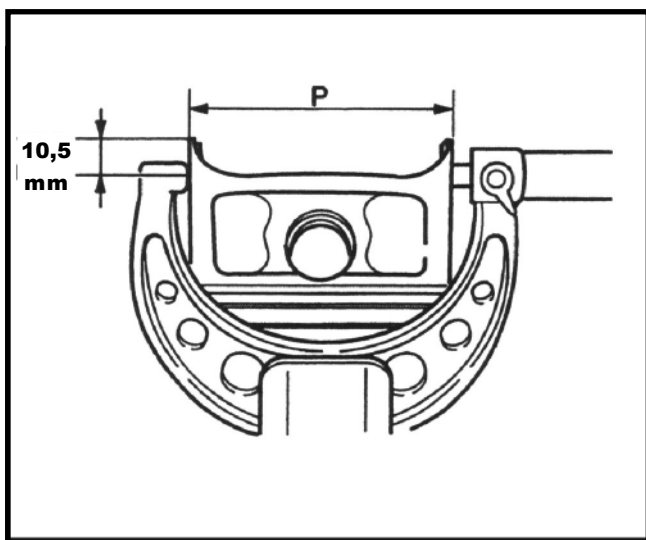
The following procedure must be applied to all 3 pistons.  
Remove the elastic ring (1).



 **ATTENTION:**  
*Do not use hammers for the spindle removal (2).*

Remove pin (2) and remove piston (3).





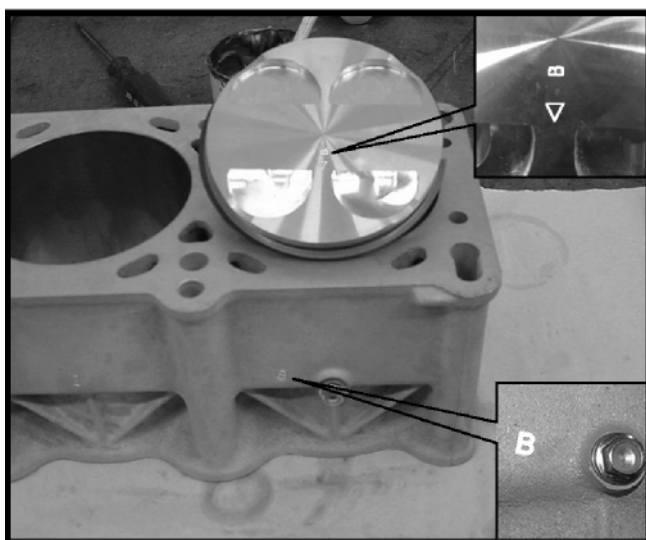
### 5.5.2 CHECK PISTON

The following procedure must also be applied to all the other pistons.

Check eventual breaks on the piston.

Use a micrometer, as shown in the figure, to check that the value (P) enters within the specific value.

CLASS	P
A	$\varnothing 87,950 \div 87,960$
B	$\varnothing 87,961 \div 87,971$
C	$\varnothing 87,972 \div 87,982$



#### ATTENTION:

*In the case of changing one or more pistons:*

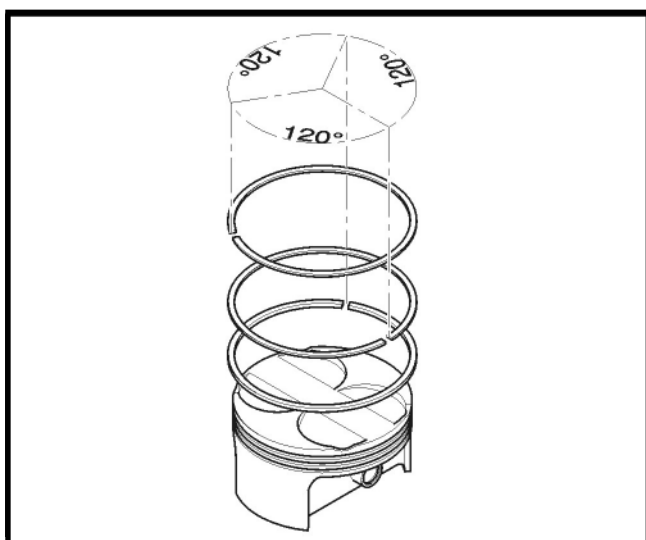
*The piston is distinguished by a letter that indicates the class it belongs to.*

*The cylinder-piston coupling must be carried out among the same classes that they belong to.*

#### NOTE:

The maximum play of the piston is of 0.1 mm.

Change the piston if necessary.



### 5.5.3 CHECK SEGMENTS

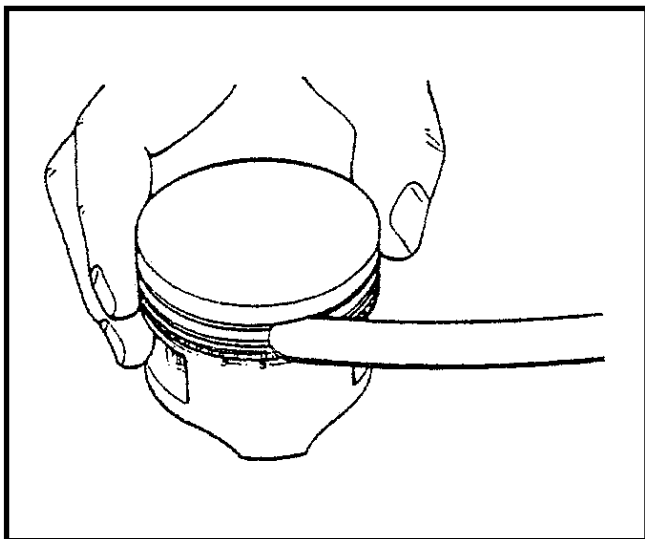
The following procedure must be applied to all the segments.

Check the absence of scuffing and traces of shrinkage on every segment.

Check that the edge of the section is well defined and free in the housings.

Whenever wear in the segments is found, change the pistons as well.

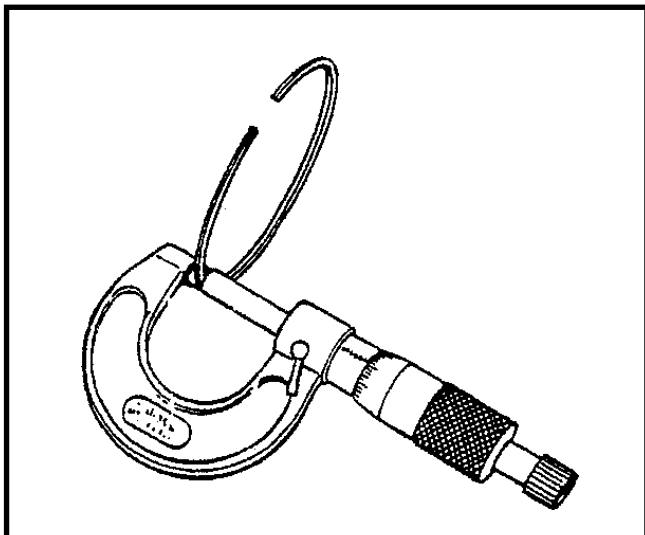




#### 5.5.4 SEGMENT-CABLE PLAY

Measure the lateral play of the 1<sup>st</sup> and 2<sup>nd</sup> segment using a feeler.

If one of the two plays exceeds the limit specified, change both the piston and the segments.



#### SEGMENT-CABLE PLAY

SERVICE LIMIT: (1<sup>st</sup>): 0.20 mm

(2<sup>nd</sup>): 0.18 mm

#### SEGMENT CABLE WIDTH

STANDARD: (1<sup>st</sup>): 1.02 – 1.04 mm

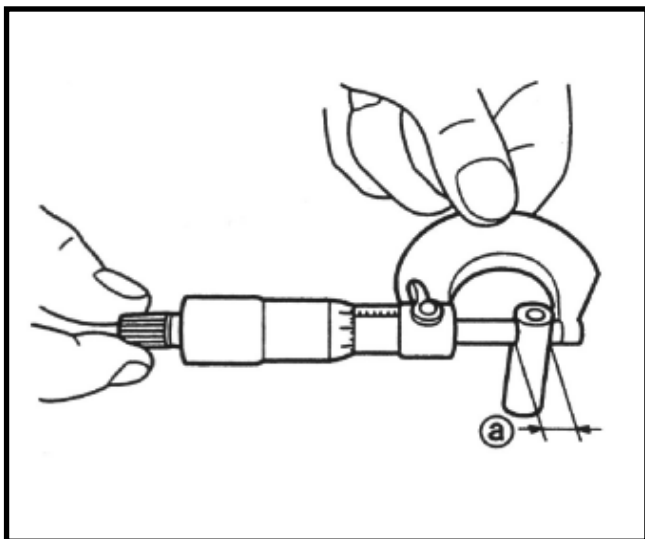
(2<sup>nd</sup>): 1.01 – 1.03 mm

(SCRAPER RING): 2.01-2.03

#### SEGMENT THICKNESS

STANDARD: (1<sup>st</sup>): 0.97 – 0.99 mm

(2<sup>nd</sup>): 0.97-0.99 mm



#### 5.5.5 CHECK PISTON PIN

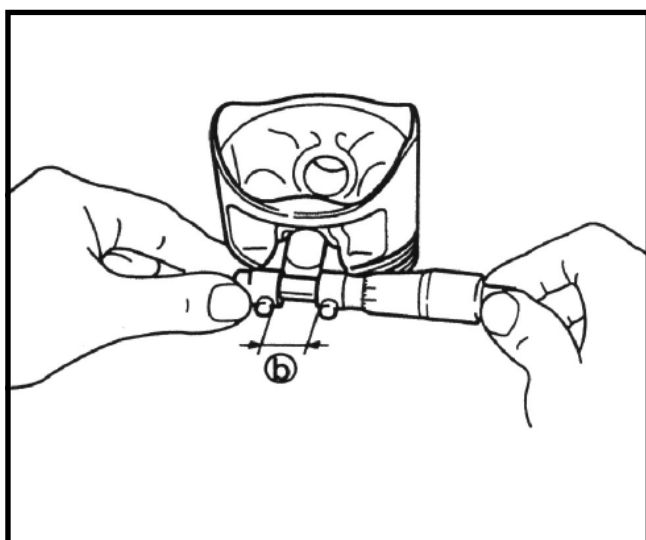
The following procedure must be applied to all the piston pins. Check that value (a) enters within the specific value.



#### NOMINAL VALUE

a = 18,995 ÷ 19,000 mm





Check the value of (b).

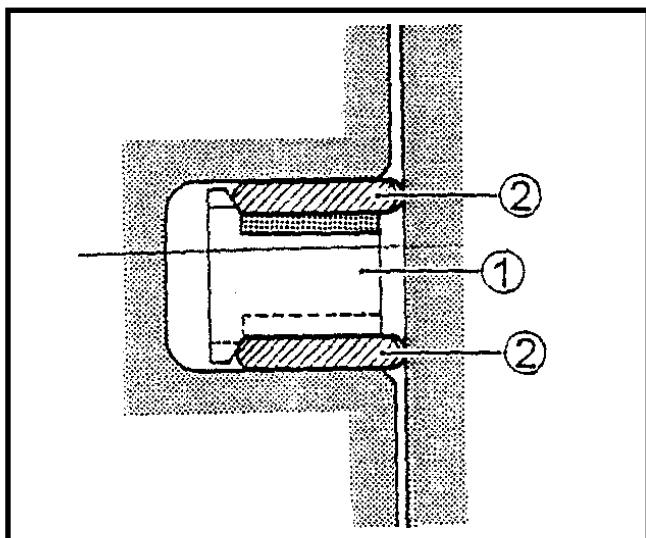


#### NOMINAL VALUE

$b = 19,002 \div 19,008 \text{ mm}$

#### NOTE:

If the play between the piston pin and the pin is more than 0.03 mm, change the piston.



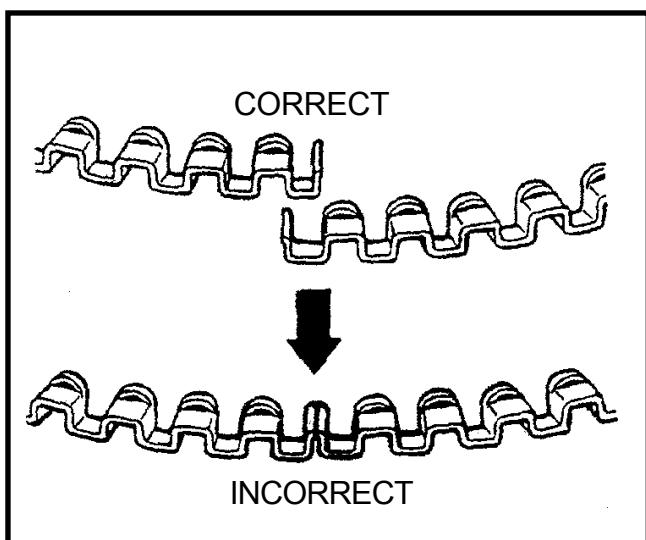
### 5.5.6 MOUNTING SEGMENTS

Install the segments in the order: scraper ring segment, 2nd segment, 1st segment.

The first element to insert into the slot of the scraper ring segment is the spacer (1). After having positioned the spacer, insert its lateral rings (2).

#### NOTE:

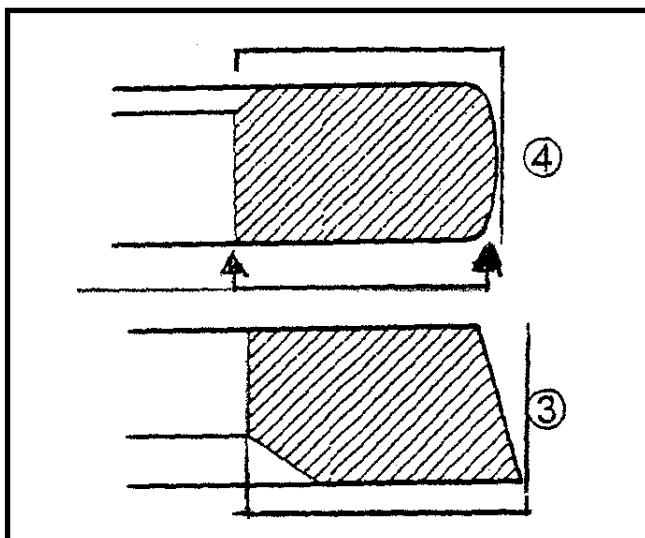
The spacer and the lateral rings do not possess a particular upper or lower side so they can be inserted in any way.



#### WARNING:

*When installing the spacer, pay attention so that its ends are not superimposed in the cable.*





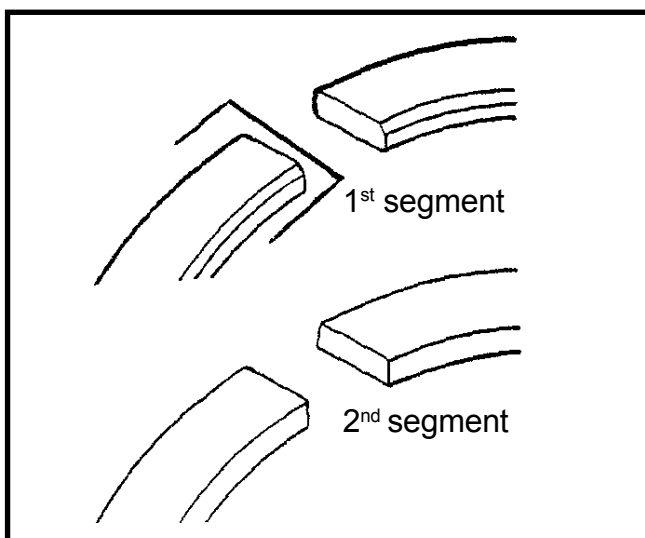
Install the 2<sup>nd</sup> segment (3) and the 1<sup>st</sup> segment (4).

**NOTE:**

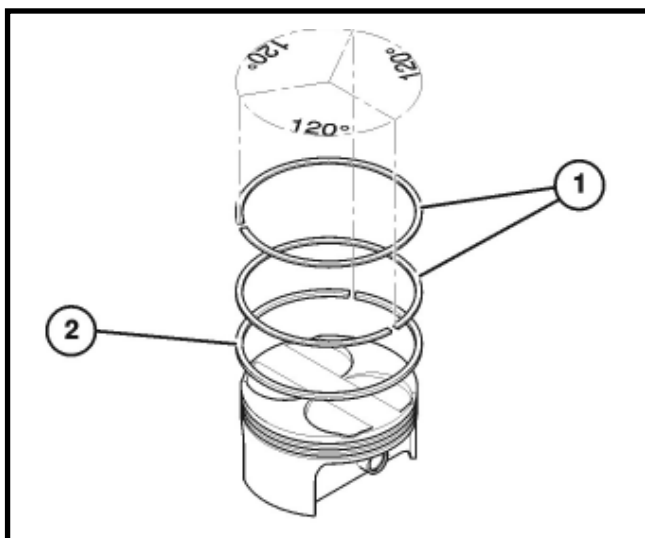
The form and width of the 1<sup>st</sup> and 2<sup>nd</sup> segment are different.

$$W4 = 3.1 \pm 0.1 \text{ mm}$$

$$W3 = 3.7 \pm 0.1 \text{ mm}$$



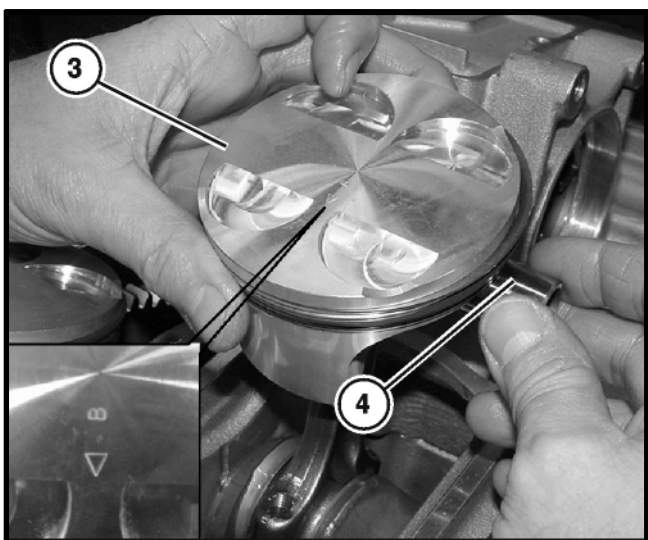
The 1<sup>st</sup> and 2<sup>nd</sup> segment have the letter "N" on the upper side. Make sure that the marked side is turned upwards when being installed on the piston.



### 5.5.7 MOUNT PISTON

Position the two segments (1) and the scrapper ring (2) on the piston, positioning the opening at 120° from each other.





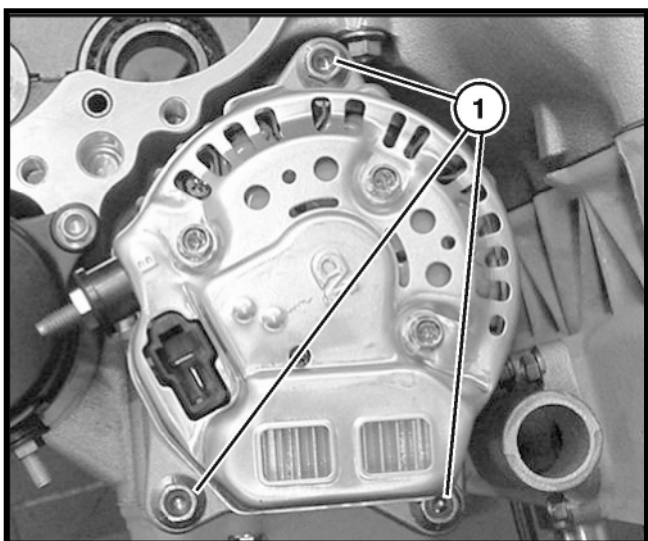
Position the piston (3), as shown in the figure, with the arrow on the piston pointing towards the exhaust.  
Insert the pin (4).



**ATTENTION:**

*Always use new elastic rings for mounting the pistons.  
To avoid breaks that can take place with the rings bent.*

Position the two elastic rings (5), one for each side pay attention not to deform them.



## 5.6 GENERATOR

### 5.6.1 REMOVAL GENERATOR

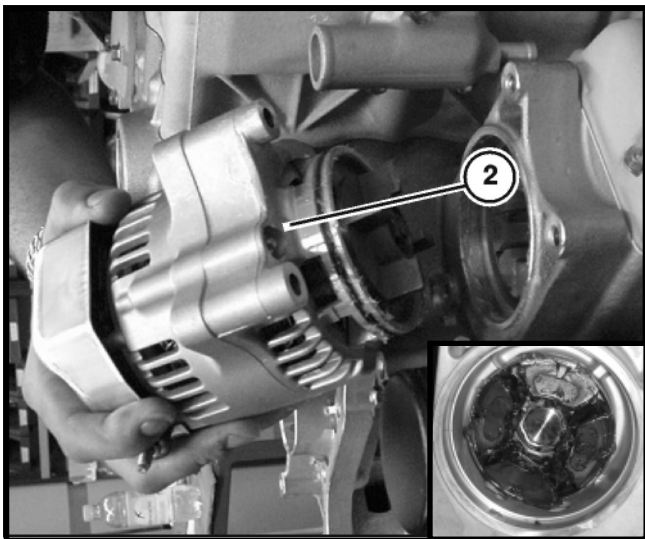


**ATTENTION:**

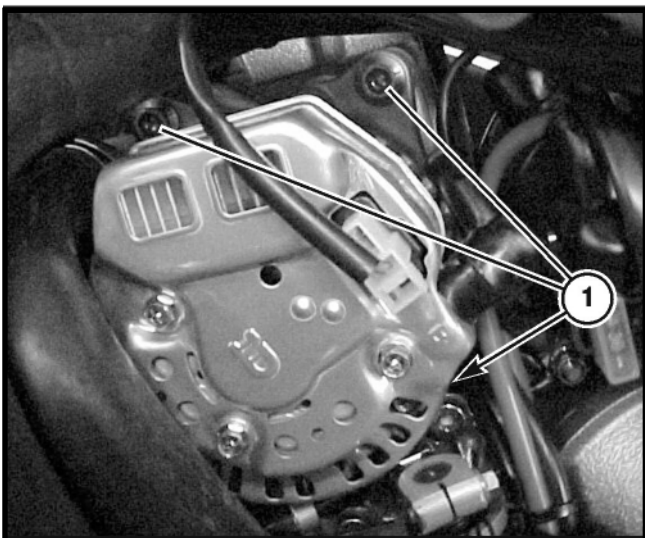
*Support the generator during the mounting phase.*

Remove the electrical connections.  
Loosen and remove the three screws (1).





Remove the generator (2).  
Check the state of the flexible couplings of the tires.  
If they are worn or damaged, change them.



### 5.6.2 MOUNT GENERATOR

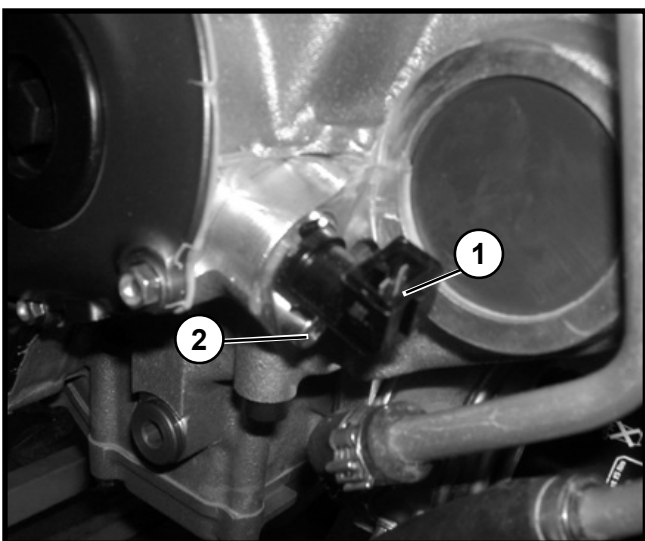
To mount the generator, grease the O-ring and work in the reverse way to dismantling, tightening screws (1) to the specific worm drive after having applied LOCTITE®.

**NOTE:**

To ease mounting the generator, position the engine, if possible, horizontally.



27 N·m 2.7 Kg-m + LOCTITE 243®

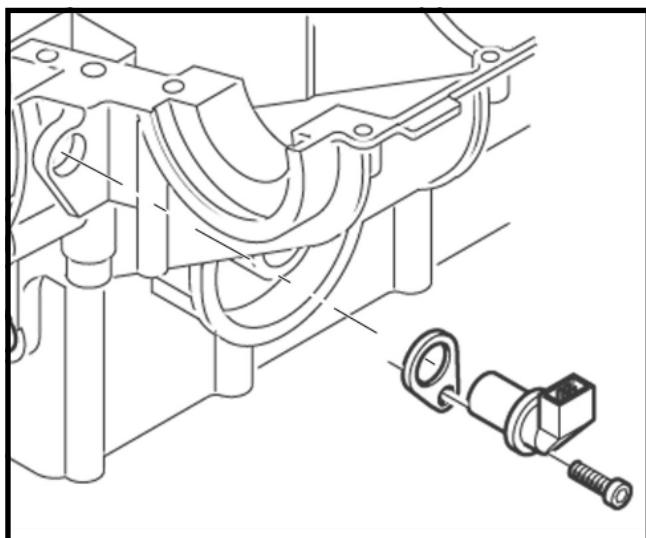


### 5.7 PHASE SENSOR AND PHONIC WHEEL

#### 5.7.1 REMOVE PHASE SENSOR

Remove the phase sensor (1) by unscrewing the fixing screw (2).



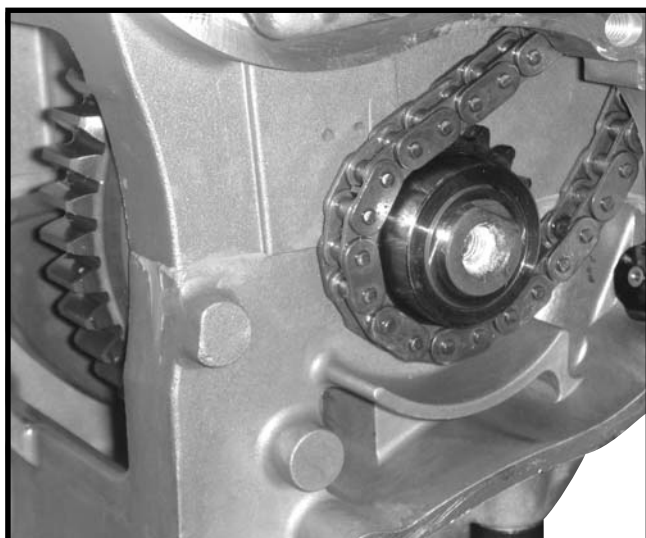


### 5.7.2 MOUNT PHASE SENSOR

Position the sensor in its housing and fix with screw (2), and tighten.

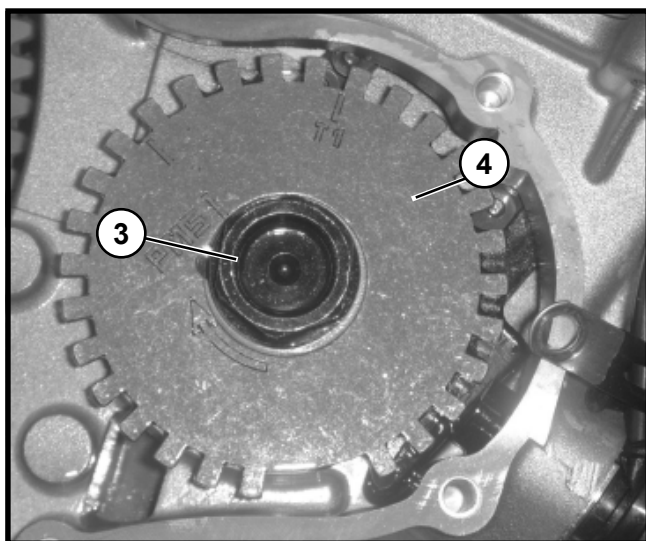


10 N·m 1 Kg-m + LOCTITE 243®



### 5.7.3 REMOVE PHONIC WHEEL

Remove the clutch cover (see "REMOVE CLUTCH COVER"). Unscrew and remove the screw and the washer (3) and remove the phonic wheel (4).



### 5.7.4 MOUNT PHONIC WHEEL



**ATTENTION:**  
*During the phonic wheel mounting phase, position it with the writing towards the outside of the engine.*

Position the phonic wheel (4) and tighten the fixing screw to the specified worm drive.

Check the liner (a) between the phonic wheel and the phase sensor.

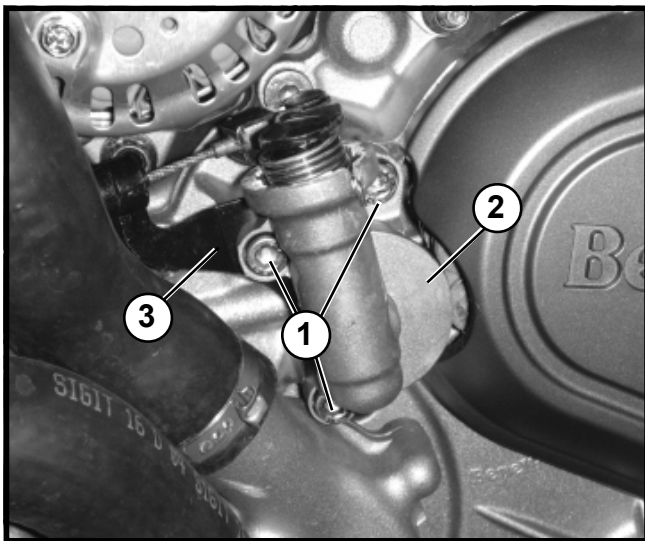


**VALUE LIMIT**  
a = from 0.8 to 1.0 mm



26 N·m 2.6 Kg-m + LOCTITE 648®

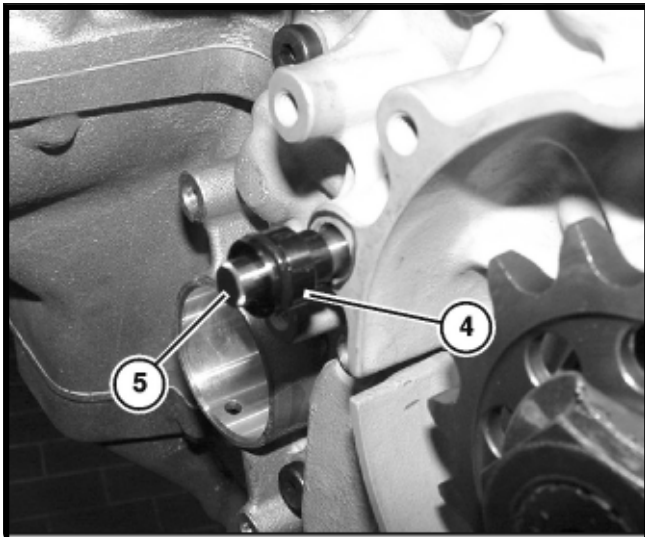




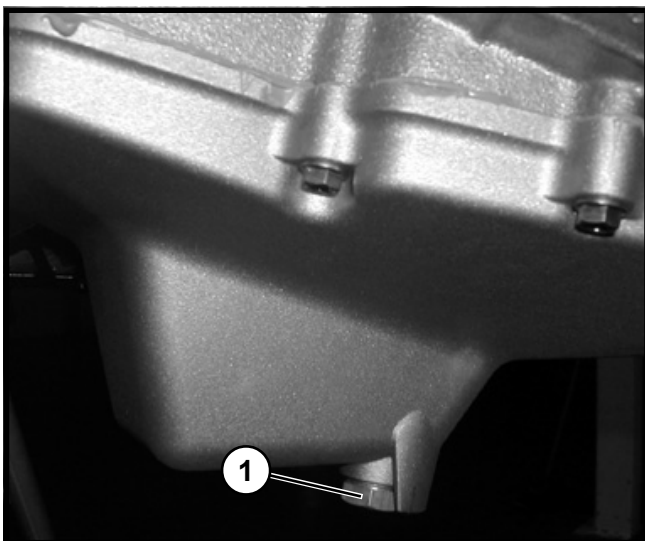
## 5.8 CLUTCH

### 5.8.1 DISMANTLE CLUTCH COMMAND

Remove the clutch command cable and unscrew the three screws (1).  
Remove the clutch body command (2) and the cable support plate (3).



Remove the ferrule (4) and the clutch command rod (5).



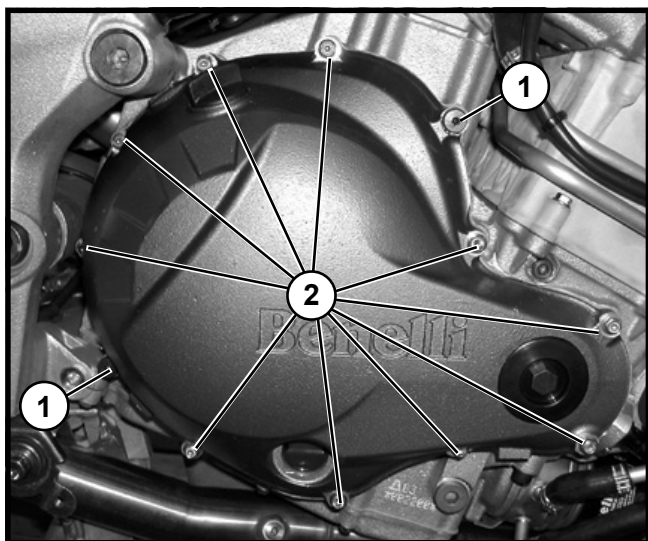
### 5.8.2 REMOVE CLUTCH COVER

Place a container under the oil sump to allow the oil to empty.  
Remove the discharge screw cap (1).

#### NOTE:

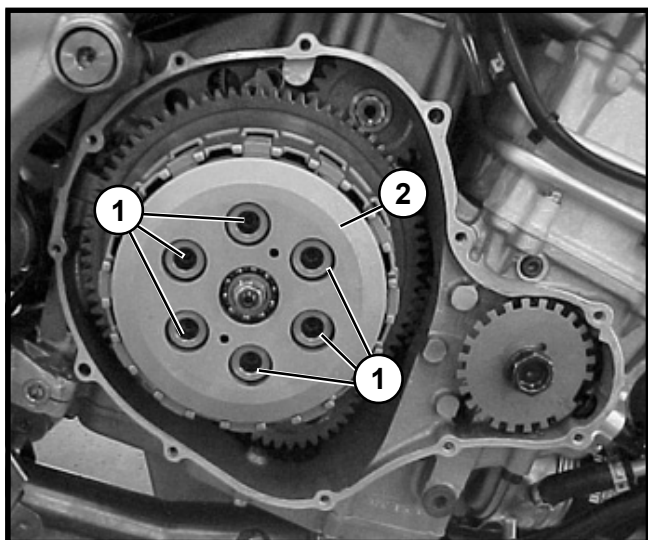
Be careful not to lose the sealing washer beneath.  
If damaged, replace it.



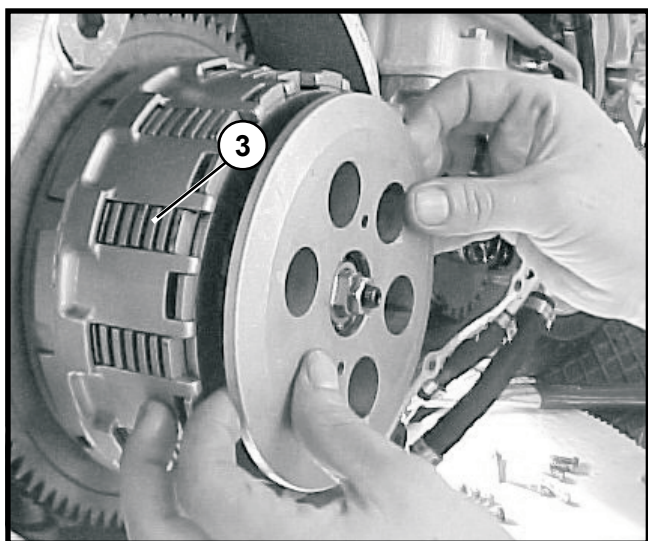


### 5.8.3 REMOVE THE CLUTCH

Remove the clutch cover, loosening the two centring screws (1) first, then the rest of the screws (2).

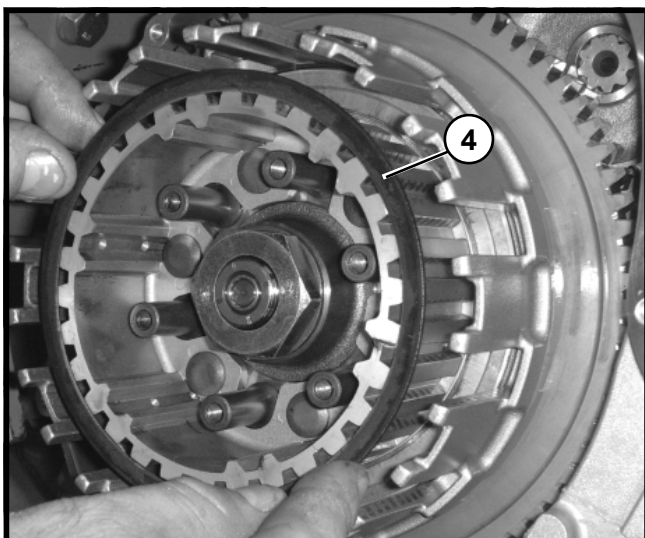


Remove the six clutch disk pushing plate fixing screws (1). Extract the clutch plate (2).

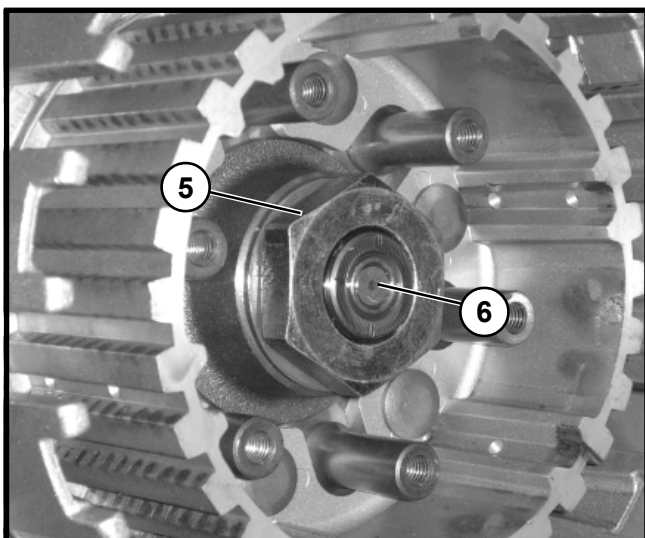


Extract the external teeth and internal teeth disk unit conductor (3).

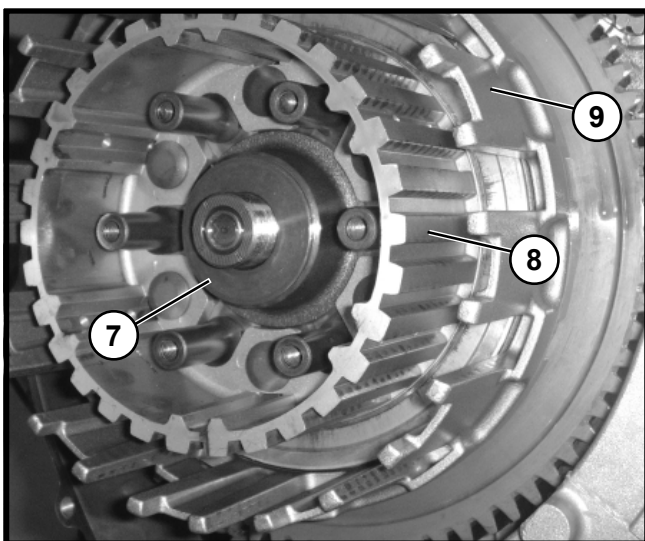




Remove the Belleville spring (4).

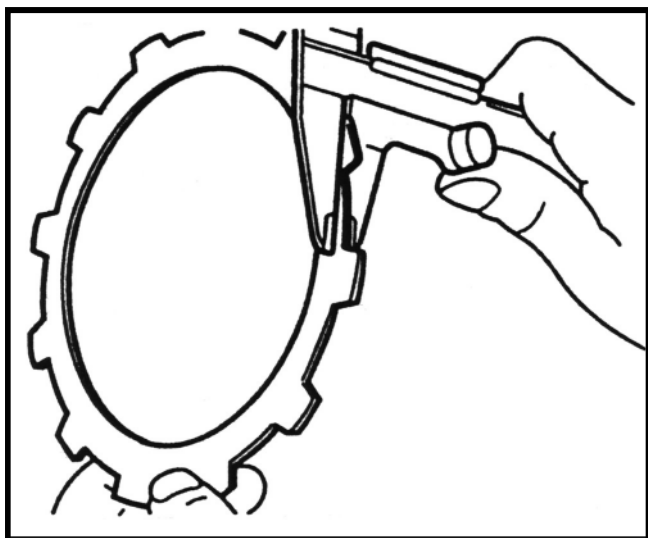


Unscrew and remove the clutch fixing nut (5).  
Extract the sphere from inside the gear shaft with a magnetic tool (6).



Remove the clearance adjustor (7) with the 4 mm thick projecting stop.  
Undo the drum (8).  
Undo the bell (9).





#### 5.8.4 CHECKING THE EXTERNAL TEETH DISK CONDUCTOR

The following operations must be carried out on all the external equipped disks.

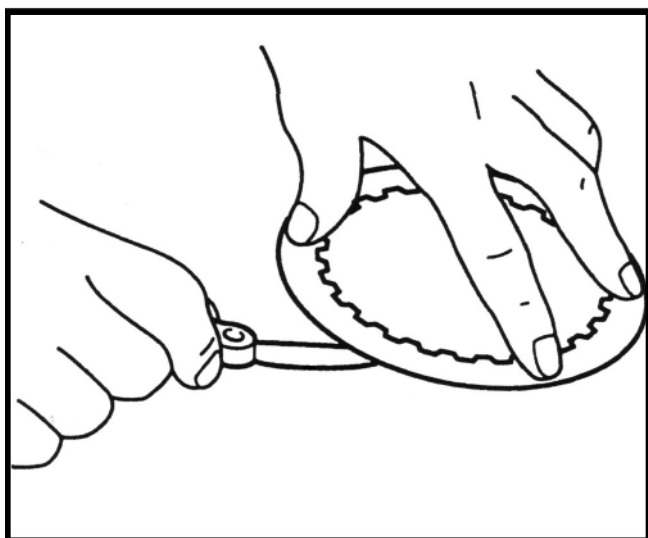
Check the external equipped disk liner.

If it does not enter within the specific value, change the entire set of disks.



**VALUE LIMIT**

**DISK LINER = 2.8 mm**



#### 5.8.5 CHECKING THE INTERNAL TEETH DISK

The following operations must be carried out on all the internal disks.

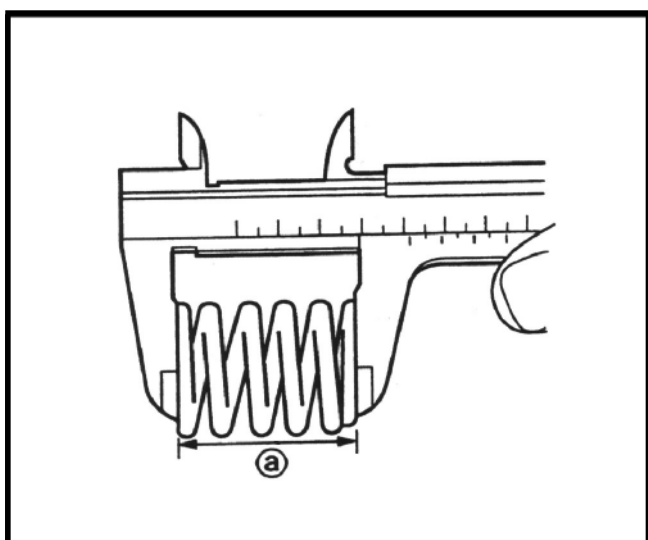
Check the distortion of the disk, as shown in the figure.

If the disk is broken or does not enter within the specific value, change the entire set of disks.



**VALUE LIMIT**

**MAX. DISTORTION = 0.1 mm**



#### 5.8.6 CHECK CLUTCH SPRINGS

The following operations must be carried out on all the clutch springs.

Measure the lengths (a) of the free spring.

If the value does not enter within the envisaged value, change the entire set of springs.

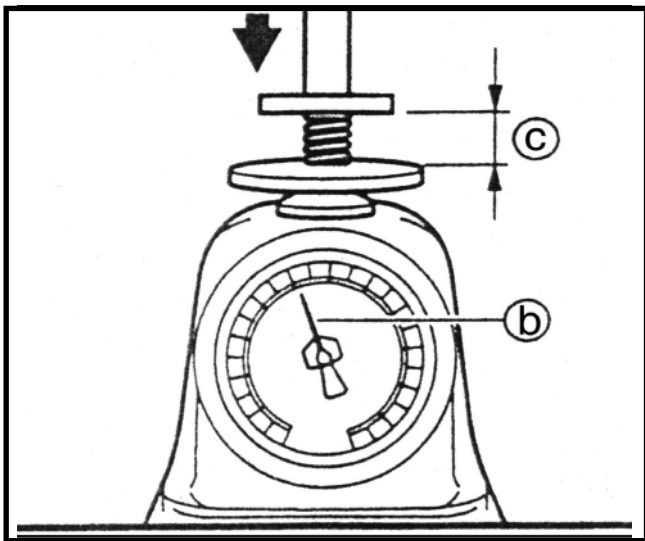


**VALUE LIMIT**

**CLUTCH SPRING**

**A = Yellow spring: 33,5 mm**





Bring the spring to a value length (c) and check the value of the load.

The value C is the same for all springs.

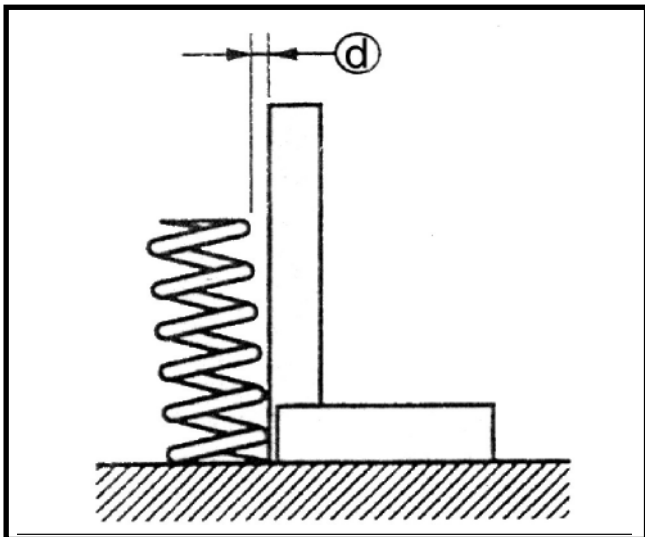


#### CLUTCH SPRING LENGTH

c = 22 mm



**YELLOW SPRING LOAD VALUE LIMIT =170 N**



Check the incline (d) of the clutch spring as illustrated in the figure.

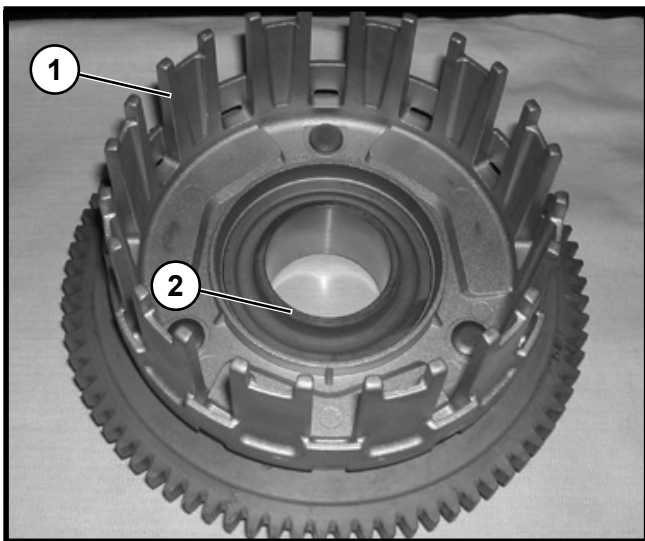
If (d) does not enter within the specific value, change the entire set of springs.



#### VALUE LIMIT

**YELLOW AND BLACK CLUTCH SPRING INCLINATION**

d = 2 mm

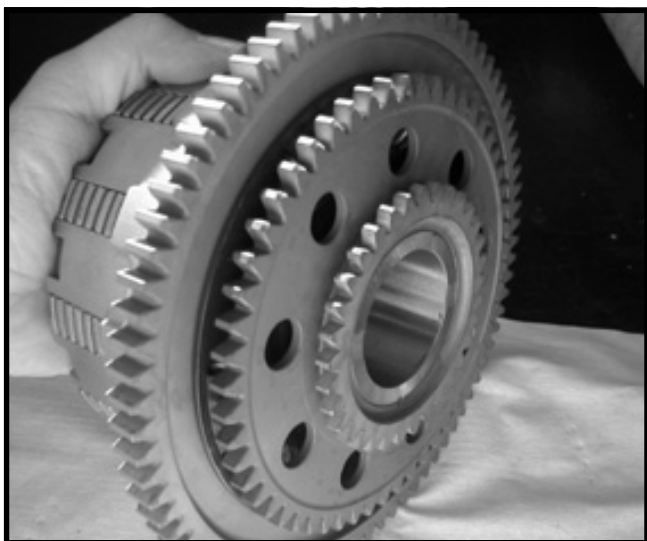


### 5.8.7 CHECK CLUTCH COVER

Check that the cover (1) is not broken, otherwise change it.

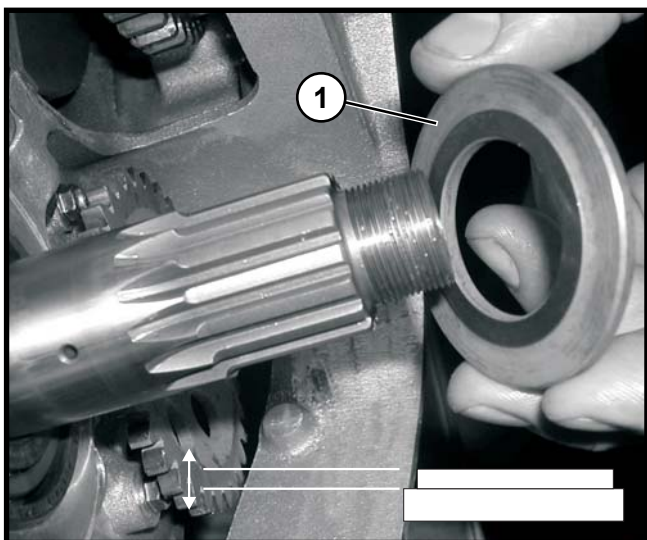
Check the state of the roller ball-bearings (2) and change them if necessary.





### 5.8.8 CHECKING PRIMARY CLUTCH BELL UNIT

Verify that the primary assembly gear does not present an excessive wear, roughness or breaking.  
If necessary change the clutch bell unit and primary.



### 5.8.9 MOUNTING CLUTCH UNIT

**NOTE:**

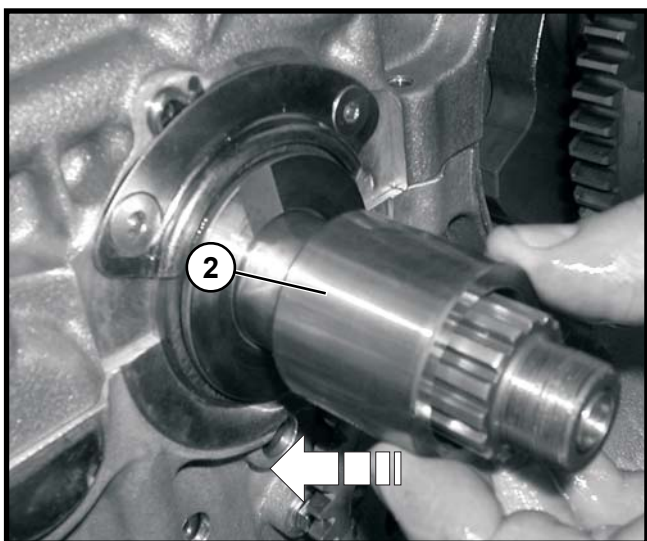
There are two clearance elements for assembling the clutch unit.

Always check the thickness of the projection.

Internal engine thickness 3.5 mm

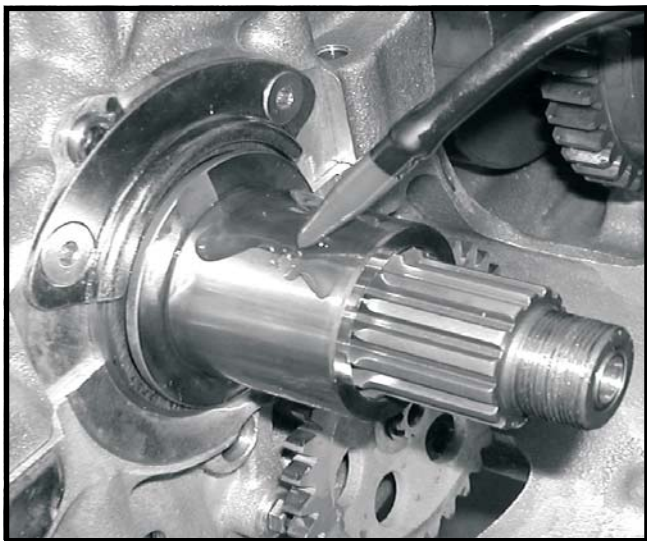
External engine thickness 4.0 mm

Position the clearance element (1) with the lowest projection (1) (3.5 mm) turned towards the inside of the engine.

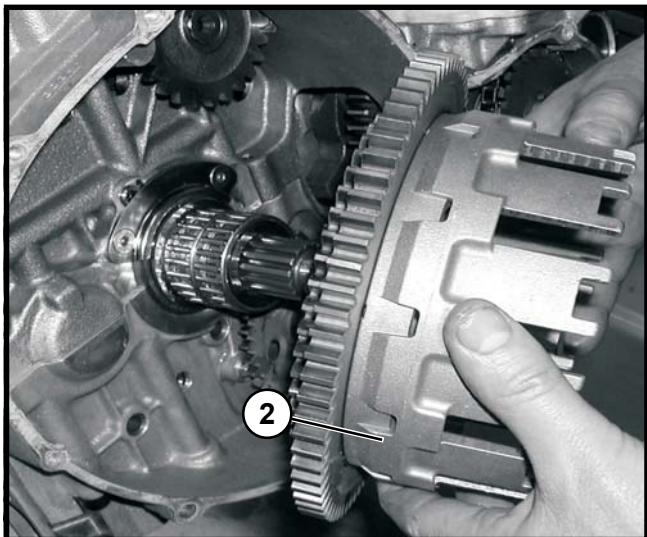


Insert the spacer (2).

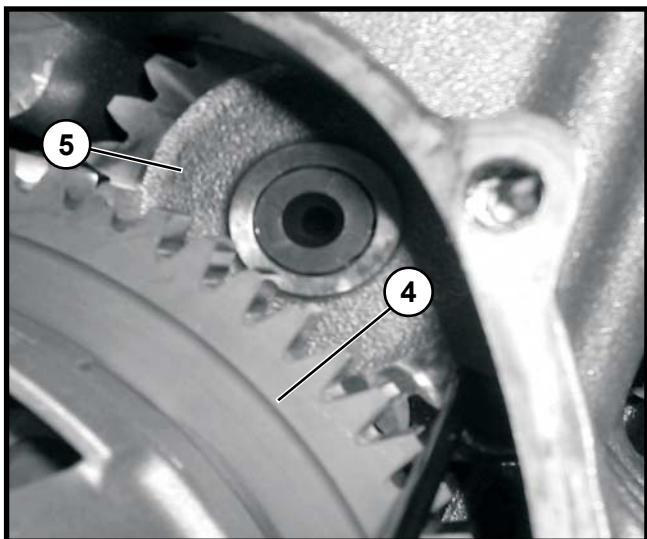




Oil the ball-bearing slide area well.



Insert the clutch bell unit (2) complete with roller bearings.

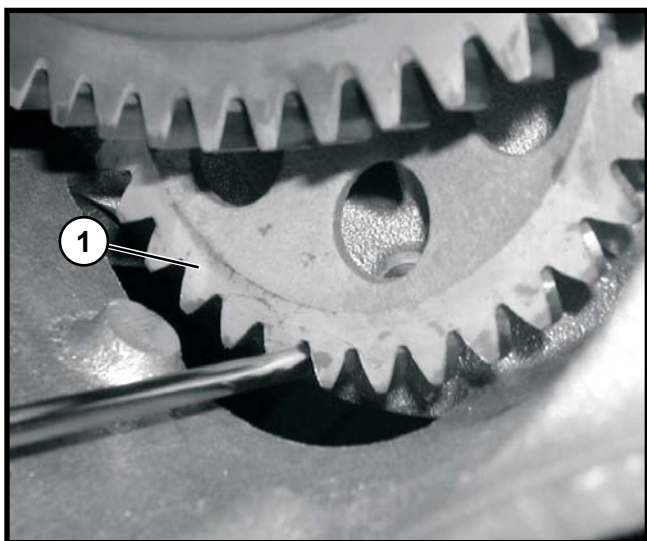


Engage in sequence:

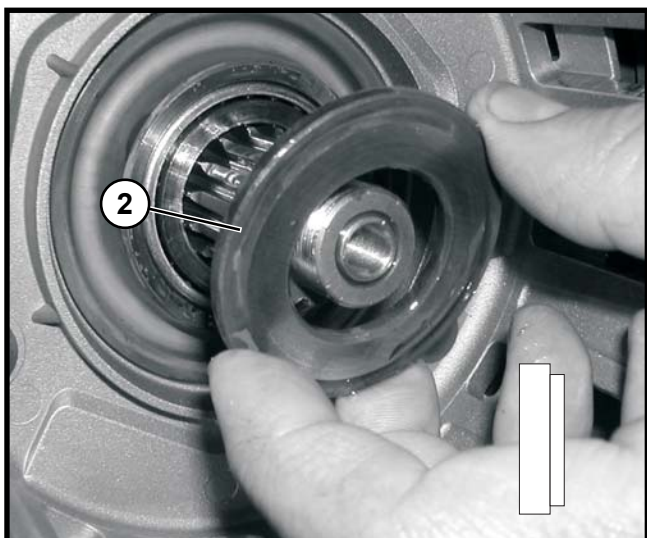
Primary gear (4)

Gear control alternator (5).

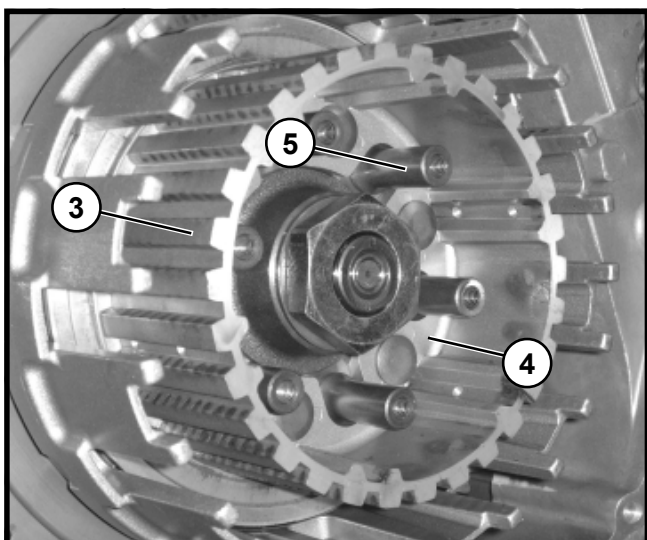




Oil pump gear (1)

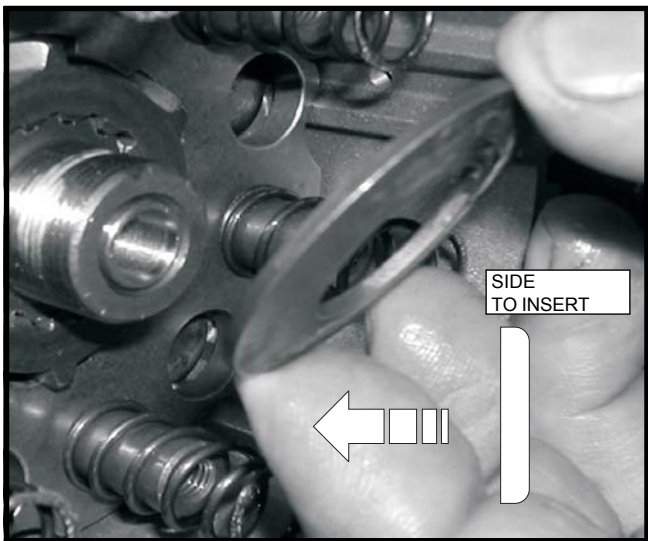


Insert the second (2) clearance element with the projection thickness (4.0 mm) towards the outside of the engine.

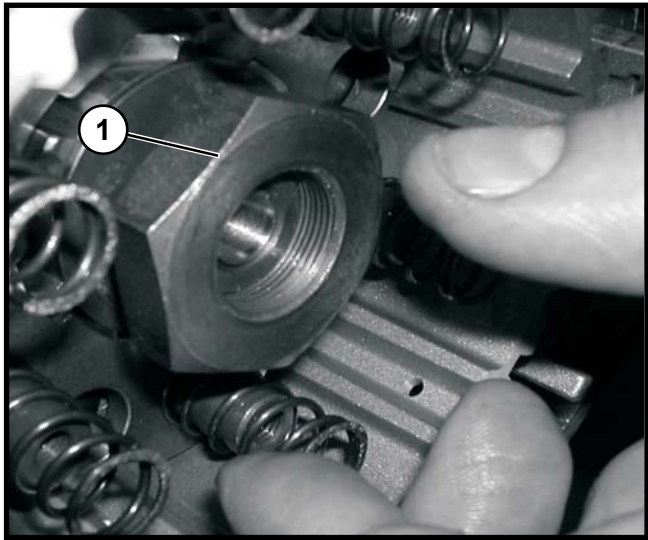


Insert the clutch drum (3).  
Insert the slide plate (4) and relative 6 return springs (5) into the appropriate columns.





Insert the convex washer towards the outside of the engine.



Insert the clutch bell unit fixing nut (1).



Block the clutch bell unit with the specific instrument.  
Screw and tighten the nut with loctite.

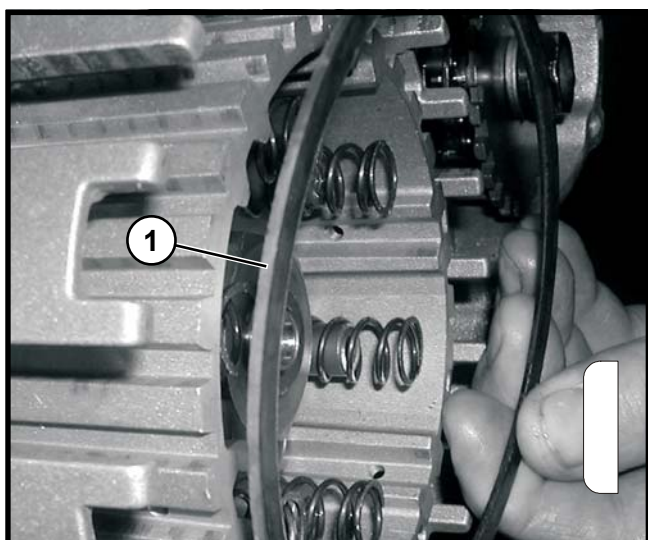


**Worm drive: 80 N.M 8 Kgm**  
**Loctite: 648®**

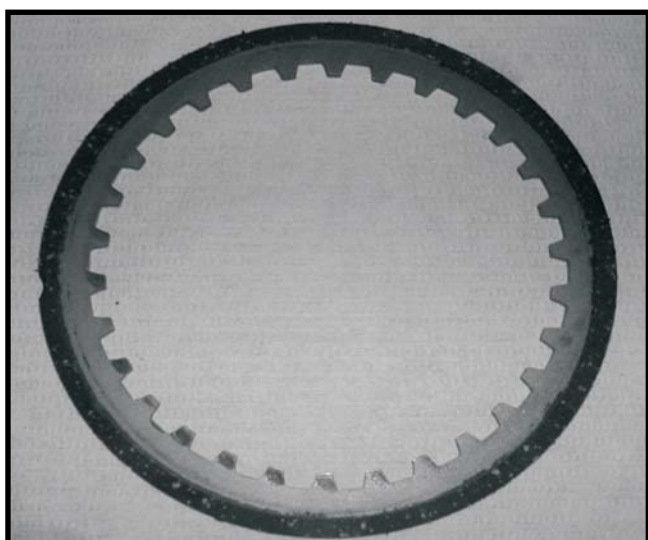


**SPECIFIC INSTRUMENT**  
**Dismantling clutch instrument**  
**R180297047000**



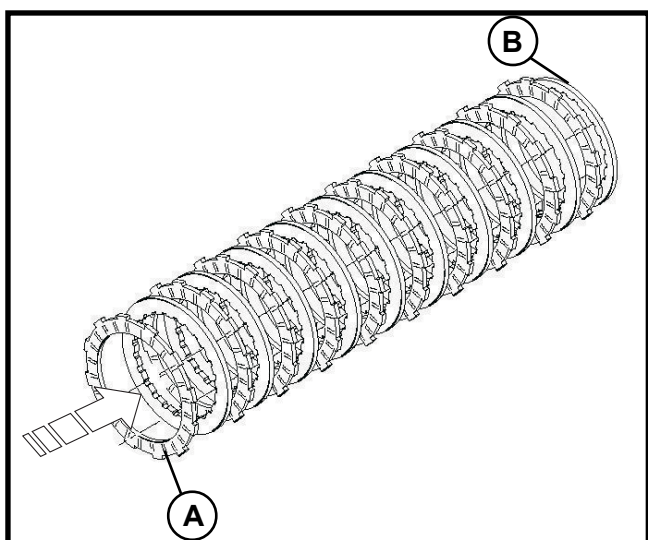


Insert the Belleville spring with the convex side towards the inside of the engine (1).



**NOTE:**

The first steel internal teeth conduit disk is to be inserted with the friction band turned towards the inside of the engine.



Insert in sequence alternating the conductor disks with external teeth (A) and conducted disks with internal teeth (B).

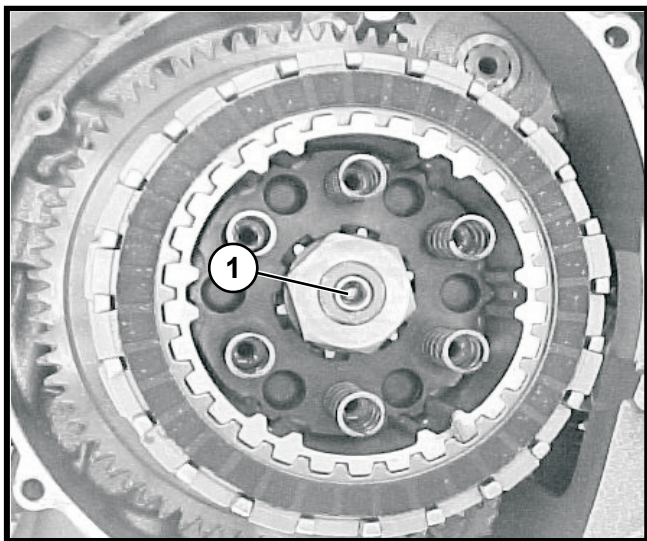
**NOTE:**

Oil the disks with engine oil one by one before inserting them into the clutch drum.

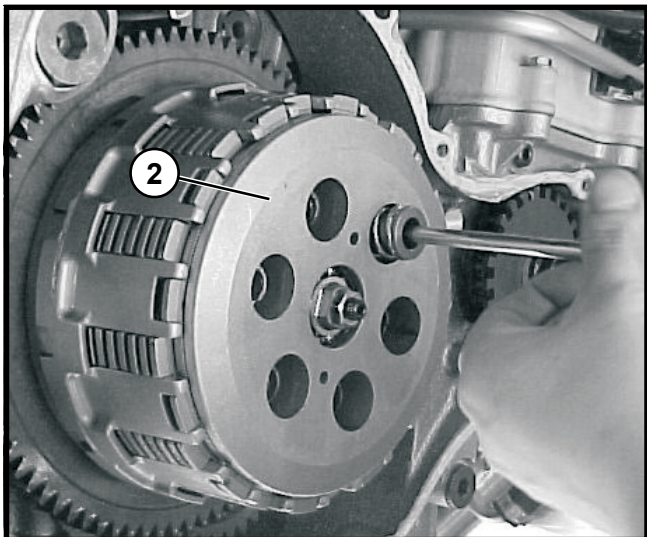
**CLUTCH PACK:**

- N° 5 conducted disks thickness 2 mm
- N° 5 conducted disks thickness 1,5 mm
- N° 1 conducted disk thickness 2,5 mm
- N° 10 conducting disks thickness 3 mm
- Total thickness clutch pack 53 mm





Reinsert the sphere (1).



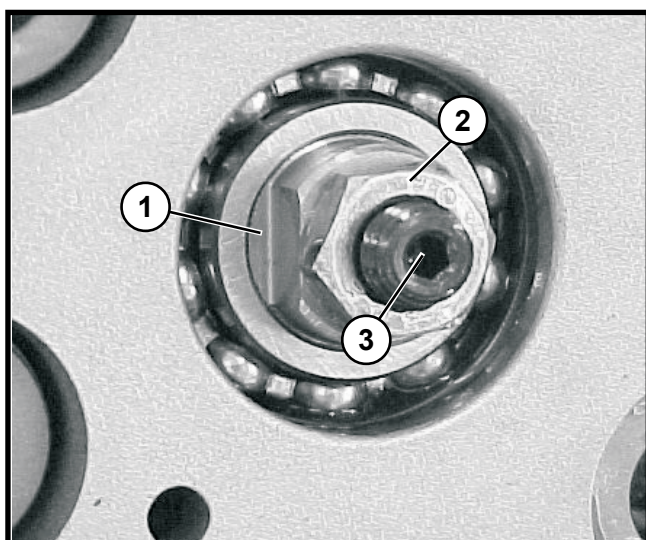
Insert the disk pushing plate (2), insert the springs and the screws alternated between them tighten to indicated torque.



**Worm drive 10N.M 1 Kg-m**

**NOTE:**  
Oil the screw threads.

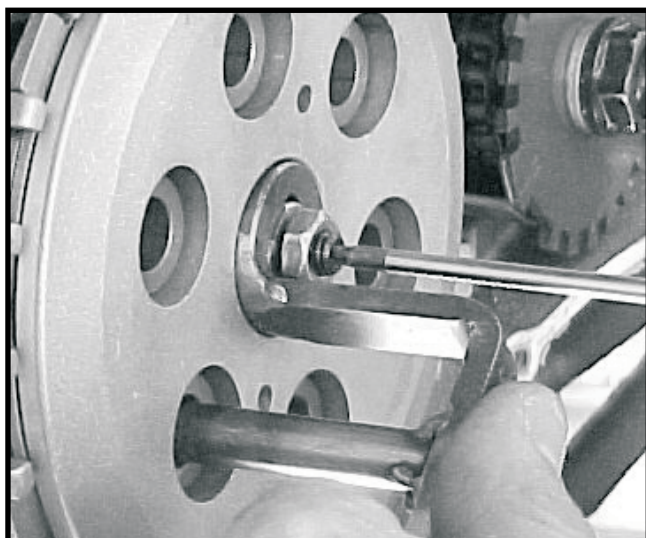




### 5.8.10 ADJUSTING CLUTCH DISKS

Block the flange (1), loosen the locknut (2) and screw up the adjuster (3) until it makes contact with the internal reaction rod, unscrew a ¼ turn.

Check the play on the clutch control positioned on the opposite side of the engine.

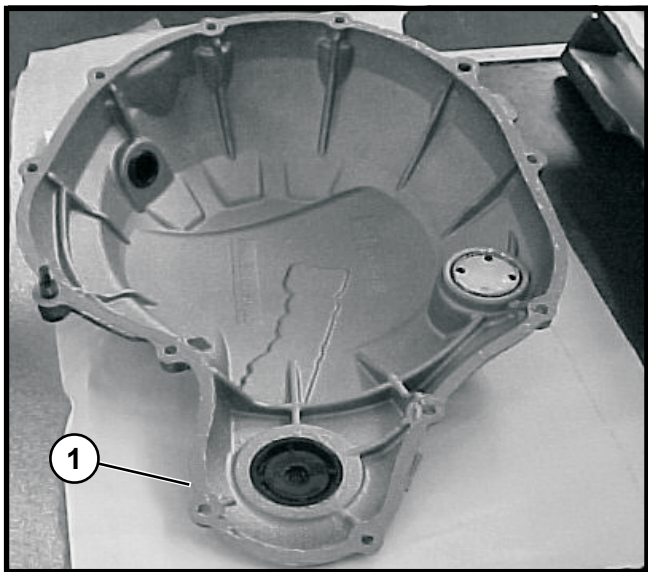


#### SPECIFIC INSTRUMENT

Regulation clutch equipment

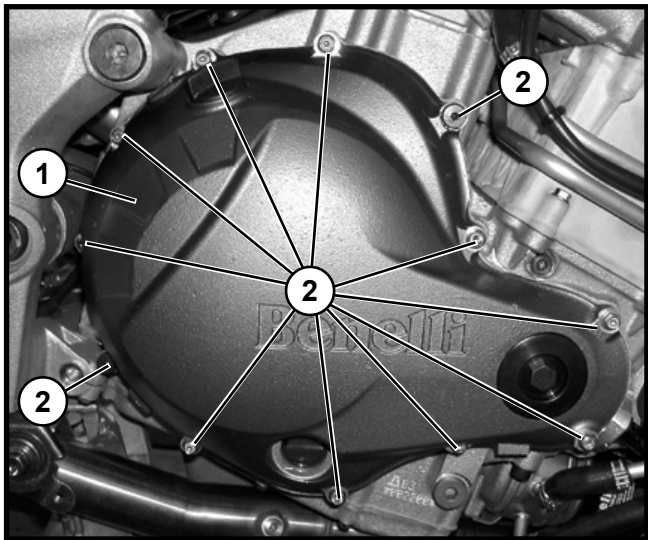
*R180297130000*






### 5.8.11 MOUNT CLUTCH COVER

**NOTE:**  
Before mounting the clutch cover, clean the contact surface with the engine (1) accurately without damaging it, change the clutch casing cover gasket.

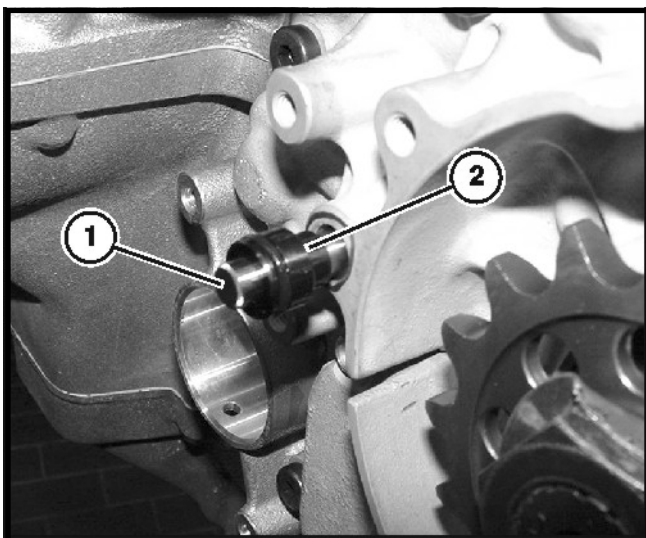


 **ATTENTION:**  
*Always use new gaskets.*

Position the gasket and the clutch cover (1) and tighten with the centering screws (2) and then with screws (2).

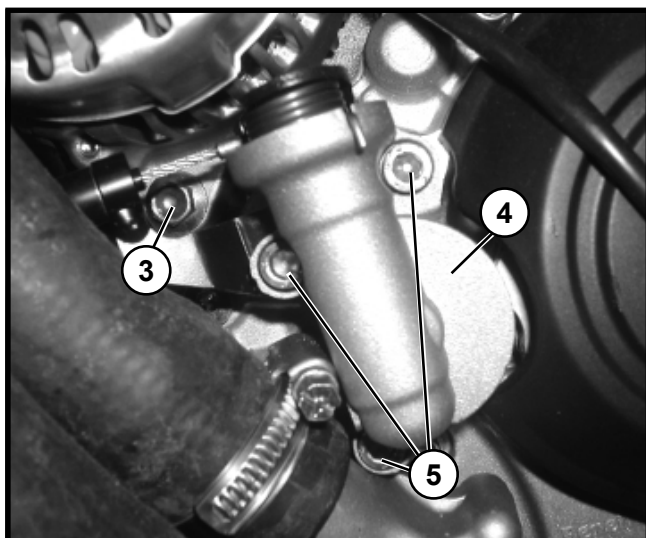
 **10 N·m 1 Kg-m**





### 5.8.12 MOUNT CLUTCH COMMAND

Insert the clutch command rod (1).  
Insert the ferrule (2).



Position the cable support rod (3) and the clutch command body (4).

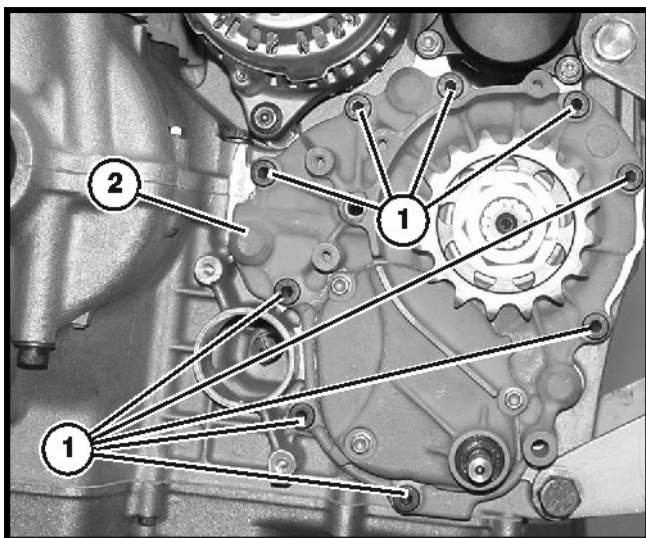
Fix the clutch command with the three screws (5) and tighten.

Insert the clutch command cable.



**10 N·m 1 Kg-m + LOCTITE 243®**





## 5.9 GEARS

### 5.9.1 REMOVE GEARS

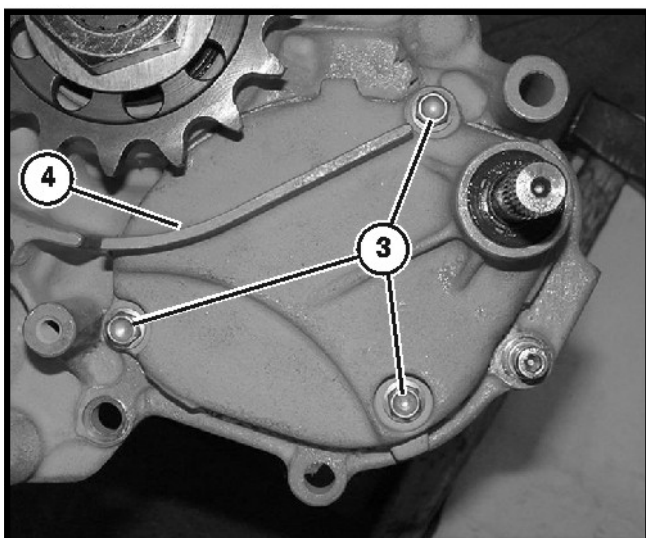
Remove the clutch unit. (see "REMOVING CLUTCH UNIT").



#### **ATTENTION:**

*Before removing the gears, remove the neutral sensor at the back of the engine.*

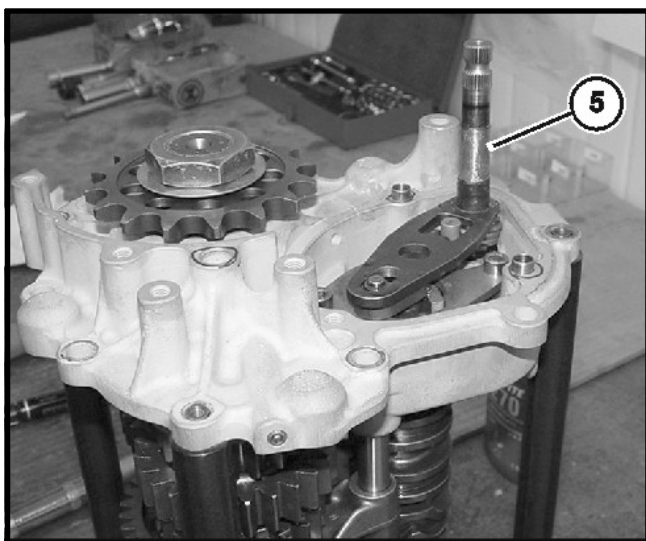
Loosen and remove the nine fixing screws (1) and remove the gears (2).



### 5.9.2 DISMANTLE GEARS

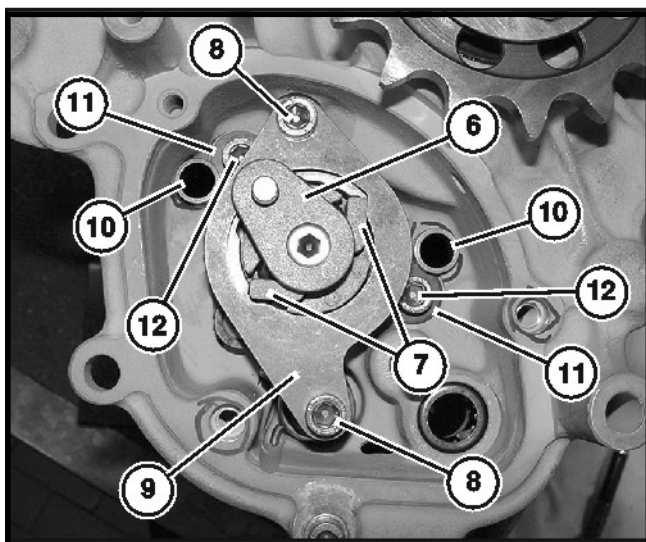
Position the gears on a support.

Loosen and remove the three screws (3) and remove the gear command cover (4).



Remove the shaft command selector (5).



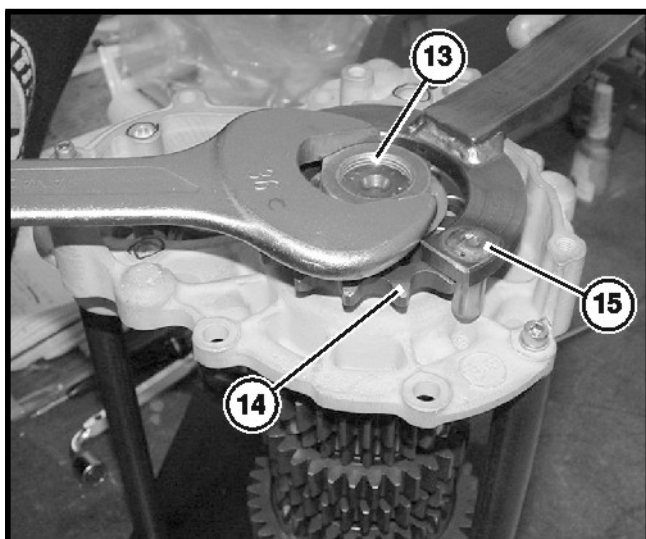


**WARNING:**  
While removing pin (6), resist the reaction of the spring placed under the pawls (7).

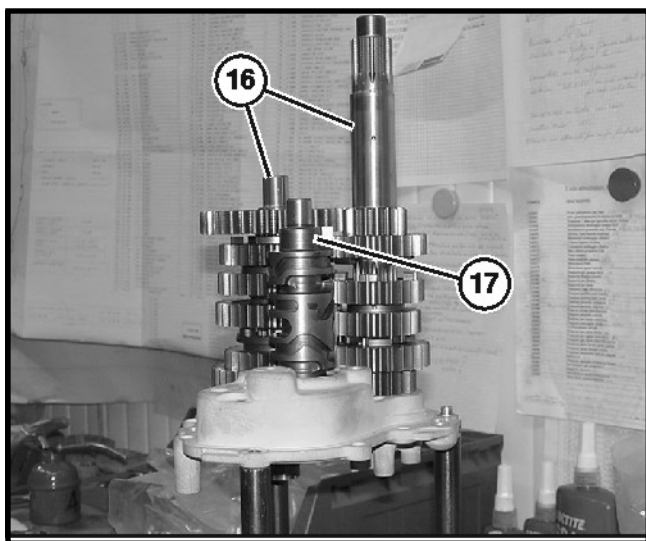


**WARNING:**  
Take note of the position of the forks before removing them for correct re-mounting.

Remove the sprocket wheel (6).  
Loosen and remove the two screws (8).  
Remove the stop plate (9).  
Free and remove the two fork pins (10) from the washers (11), working on the screws (12).  
Remove the forks.



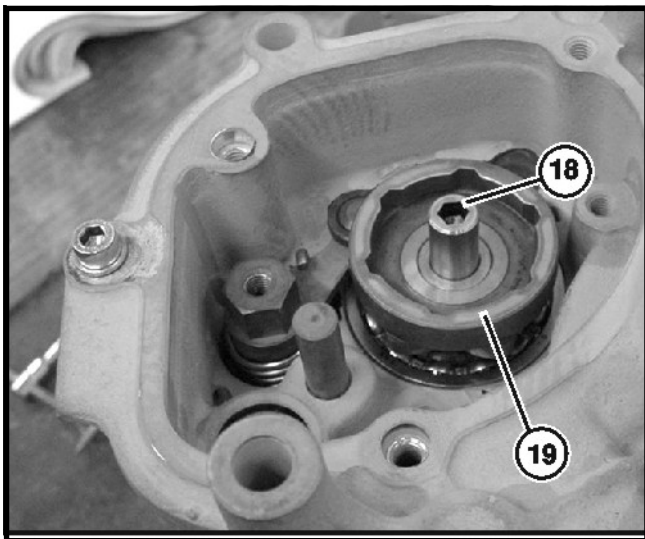
Remove the nut (13) holding the pinion firm (14) with the instrument (15).  
Remove the safety washer, the pinion and the spacer.



**WARNING:**  
The toothed wheels of the gear are free.

Rotate the gears on the support (the external side below).  
Remove the two shafts contemporaneously.

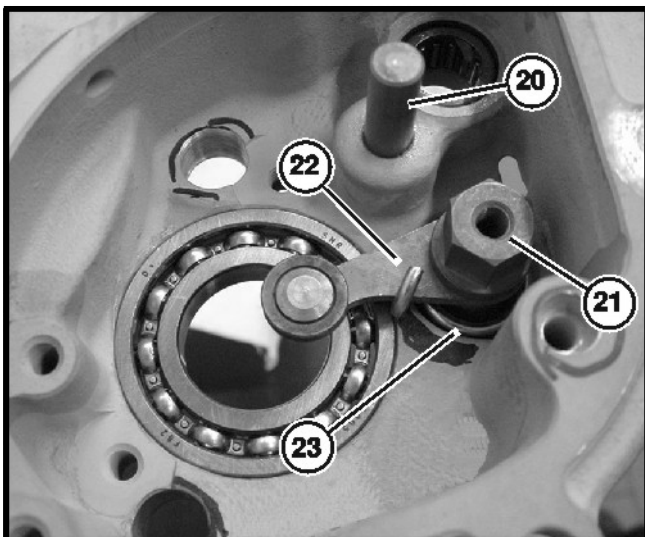




**ATTENTION:**

*During the dismantling of the drum fixing pin, support the positive valve gear (17) (see previous figure) to avoid it falling.*

Rotate the gear flange (external side above).  
Unscrew and remove the drum fixing pin (18),  
Remove the positive valve gear (17) (see previous figure) and the gear selector drum (19).

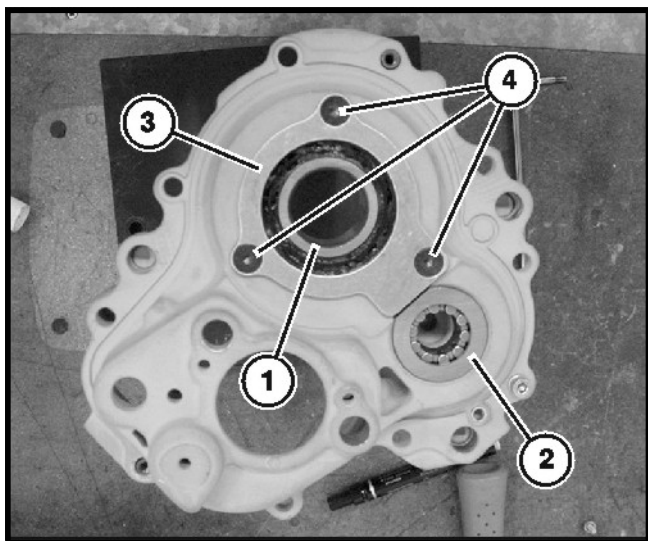


**ATTENTION:**

*Make sure that the peg (20) is well inserted into its seat.*

Unscrew and remove the threaded pin (21) and the gear fixing assembly (22), the washer beneath and the gear fixing spring (23).



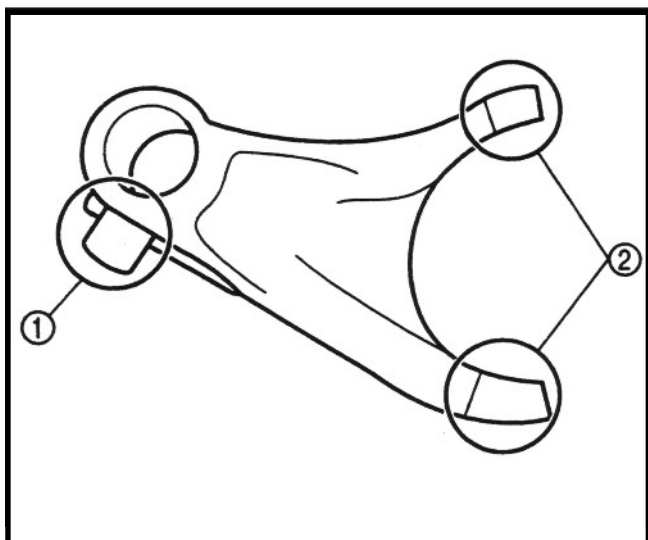


### 5.9.3 CHECK GEAR FLANGE BALL-BEARINGS

Check the free rotation of the ball-bearings (1) and (2).  
If necessary, change them.

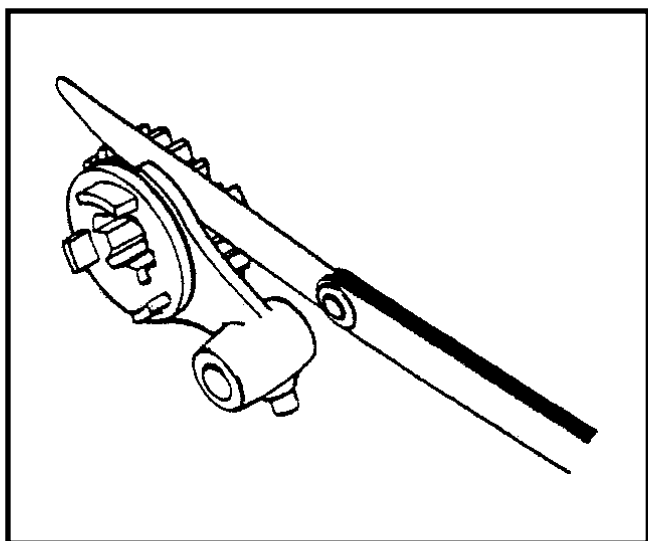
**NOTE:**

It is necessary to remove plate (3), working on screws (4), to change the ball-bearings (1) and (2).



### 5.9.4 CHECK FORK GEAR AND SLIDE RODS

The following procedure must be carried out on all the fork gears.  
Check the state of elements (1) and (2) shown in the figure and if necessary, change them.



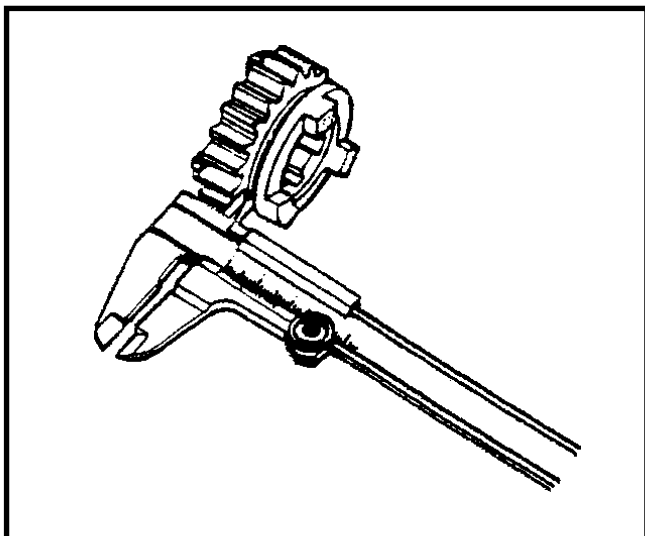
#### FORK-SLOT PLAY

Check the play of the gears in the fork slot. Using a feeler, check the play of the gear fork in its gear slot.  
The play of each fork is important for the sliding and precision of the speed gears.

Fork-slot play:  
Value Limit: 0.50 mm

If the play exceeds the specified limit, change both the fork and relative gear.



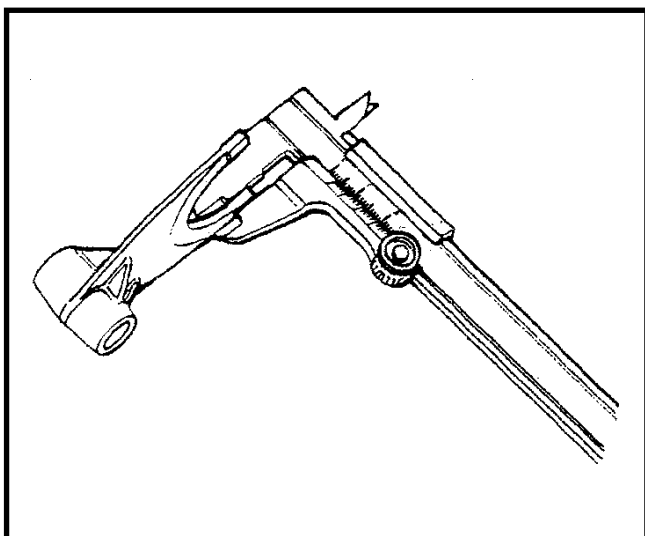


### **FORK GEAR SLOT WIDTH**

Measure the width of the fork gear slot using a cursor gauge.

Fork slot length:

Standard value: 5.0 – 5.1 mm

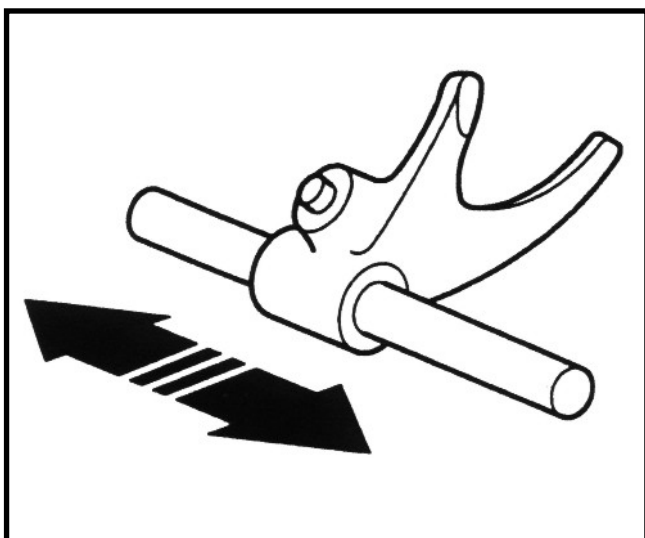


### **FORK GEAR THICKNESS**

Measure the **THICKNESS** of the fork gear slot using a cursor gauge.

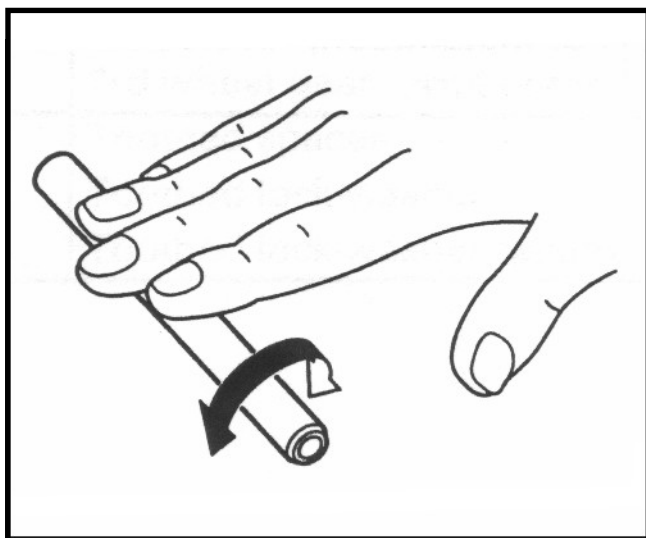
Fork gear thickness:

Standard: 4.8 – 4.9 mm



Check the free movement of the fork on the slide rod.





**ATTENTION:**

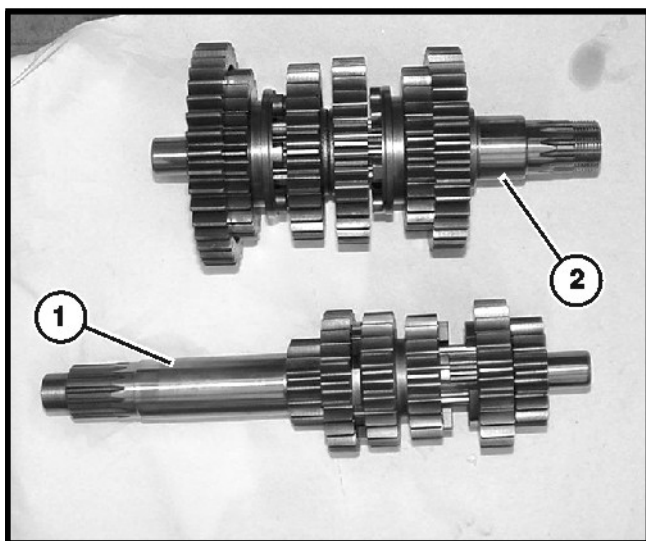
*Do not attempt to straighten the rod.*

Check the presence of curvature on a surface plate on the sliding rod.  
If necessary, change the element.



**5.9.5 CHECK POSITIVE GEAR SHAFT VALVE**

Sight check the state of the guide on the positive shaft.  
If necessary, change it.



**5.9.6 CHECK PRIMARY AND SECONDARY SHAFT**

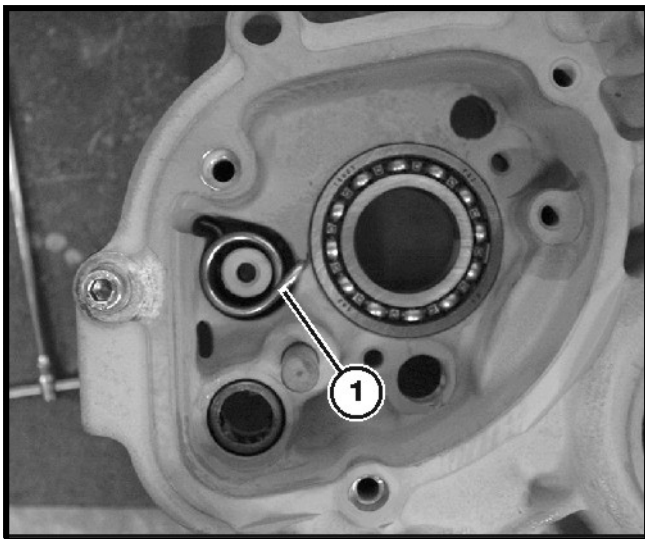
Check wear and eventual breaks on the primary shaft (1) and the secondary shaft (2) and their components.  
If necessary, change the entire 1 or 2 unit.



**ATTENTION:**

- Never use a used elastic ring. After having removed the elastic ring of the shaft, throw it away and install a new elastic ring.*
- When installing a new elastic ring, make sure not to enlarge its ends more than is necessary to insert it onto the shaft.*
- After having installed an elastic ring, always make sure that it is completely and firmly inserted into its slot.*





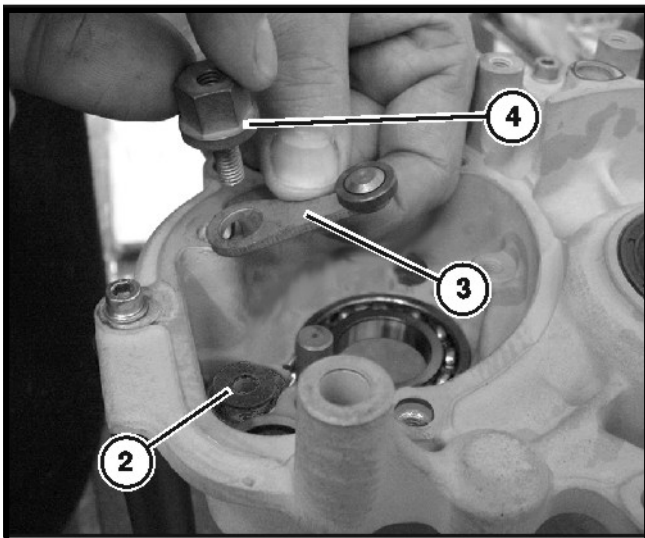
### 5.9.7 ASSEMBLE GEAR



#### **ATTENTION:**

*Always use new gaskets and oil seals.*

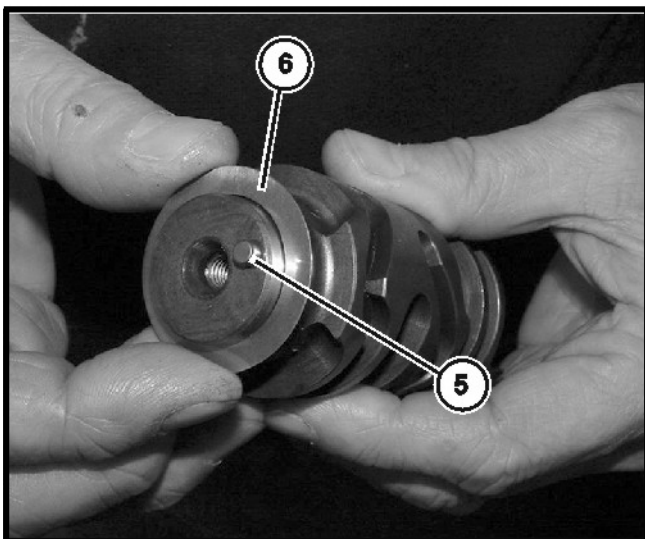
Position the gear flange on a support (external side uppermost).  
Position the gear fixing spring (i) in the appropriate hole.



Position the washer (2) and the gear fixing spring (3) and fix with the threaded pin (4).  
Tighten.



**10 N·m 1 Kg-m**

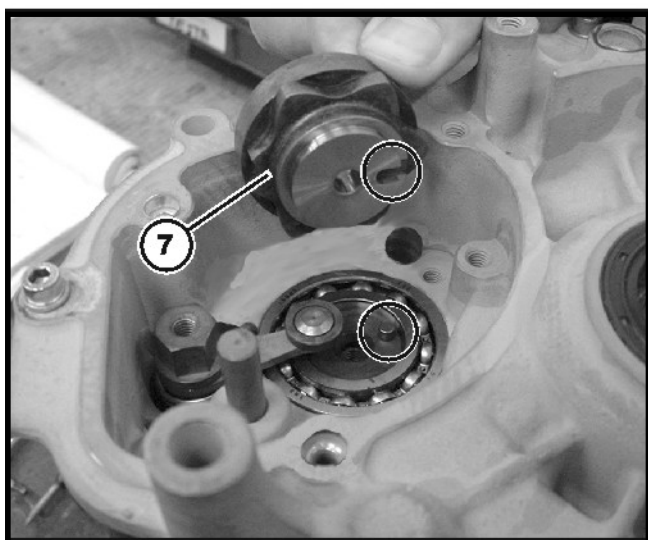


Position pin (5) onto the positive valve gear shaft with the appropriate instrument and the two liners (6) (of 0.2 mm each).



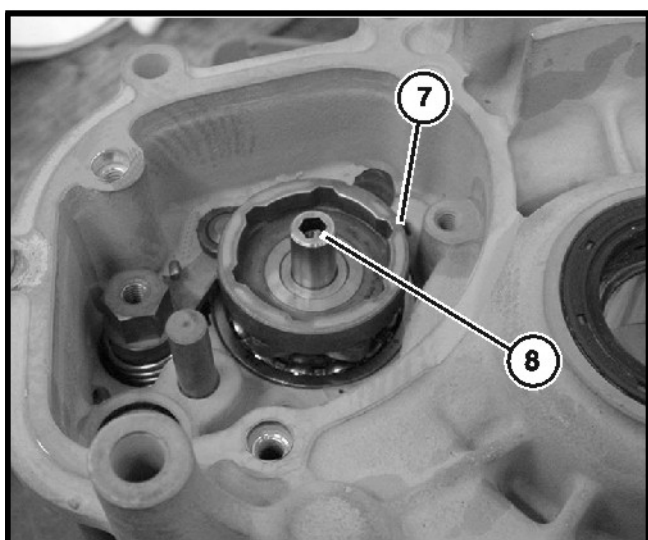


Position the positive valve gear shaft as in the figure, supporting it with a suitable support.



**NOTE:**

Check, while mounting the gear selector drum, that the two elements shown coincide.



Fix the drum (7) with the threaded pin (8) and tighten.

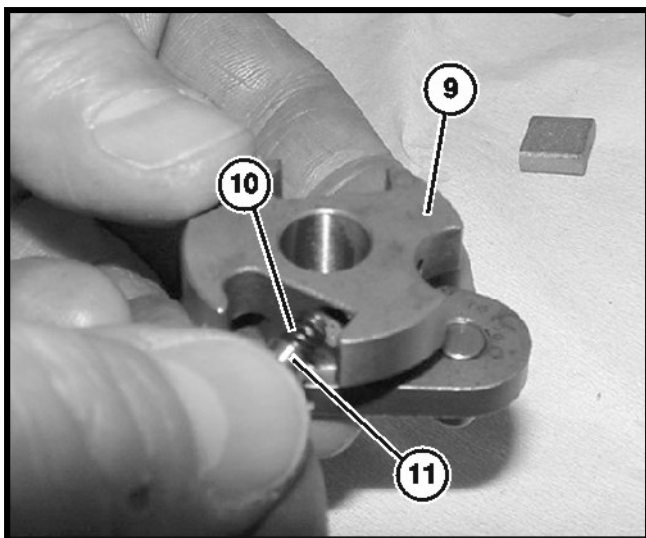
**NOTE:**

Once pin (8) is tightened it is possible to remove the support previously positioned under the positive valve gear shaft.

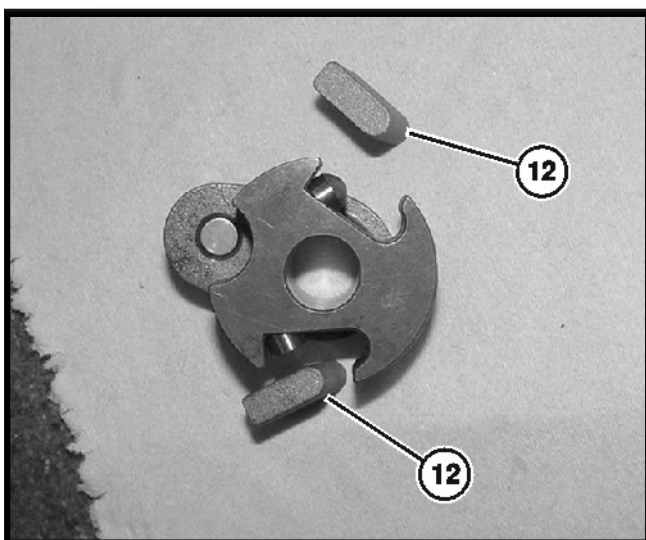


10 N·m 1 Kg-m + LOCTITE 270®

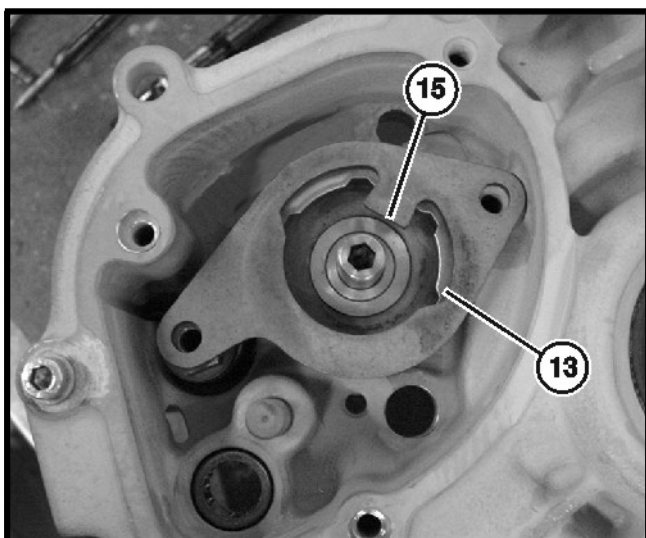




Mount springs (10) and push rods (11) onto the flange (9).

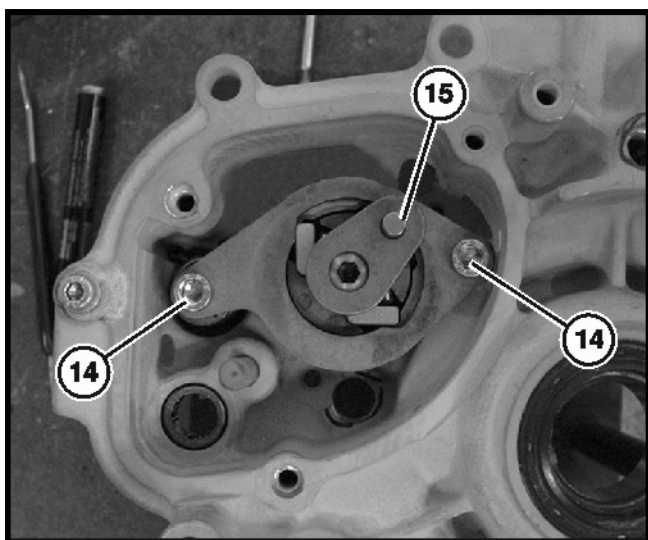


Position the pawls (12).



Position the stop plate (13).  
Position the pre-mounted pin complete with sprocket wheel and pawl (15).





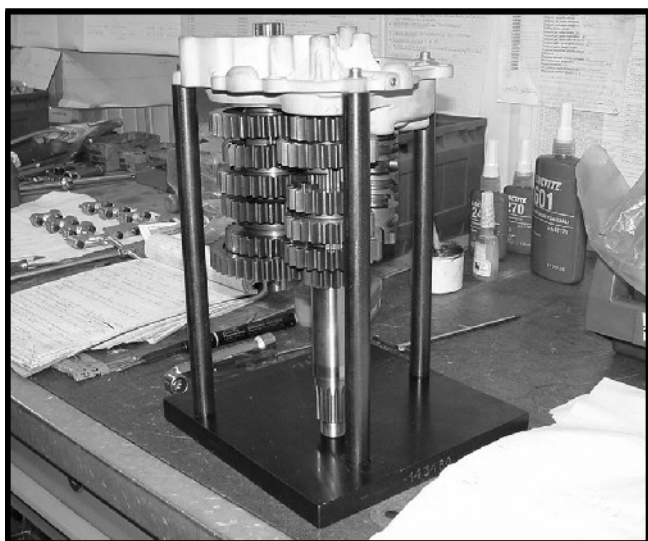
Fix the plate with the two screws (14) and tighten.  
Position the pre-mounted pin (15).



10 N·m 1 Kg-m + LOCTITE 243®



Rotate the flange on the support (internal side above).  
Couple the primary and secondary shafts  
Position them as shown in the figure.

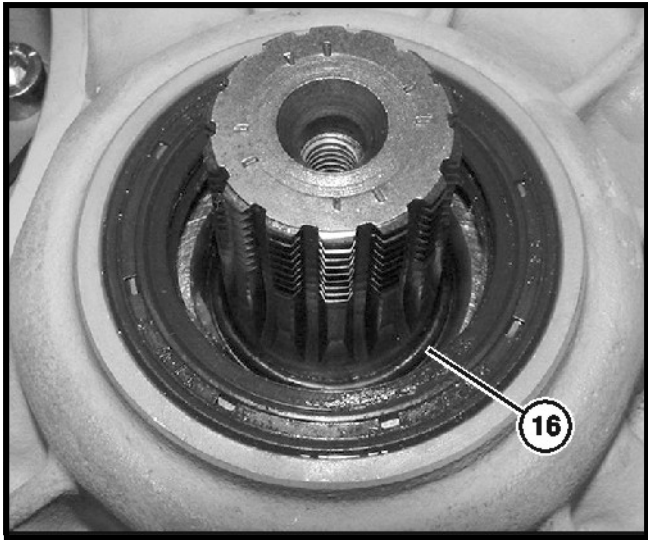


Rotate the flange (external side above).

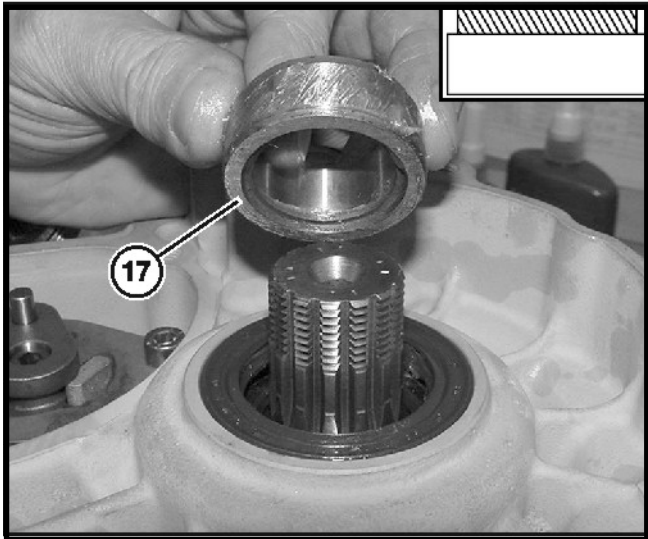


**ATTENTION:**  
*Support the primary and secondary shafts because they are loose.*

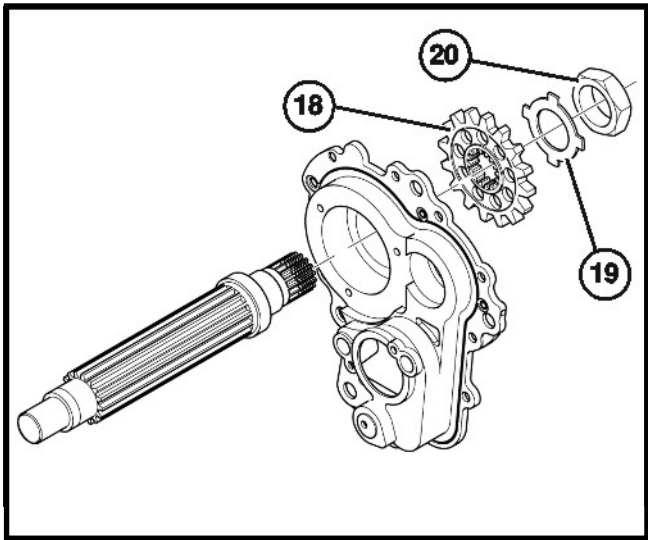




Position the O-Ring (16) on the secondary shaft.



Position the spacer (17) with its minor dimension outwards.

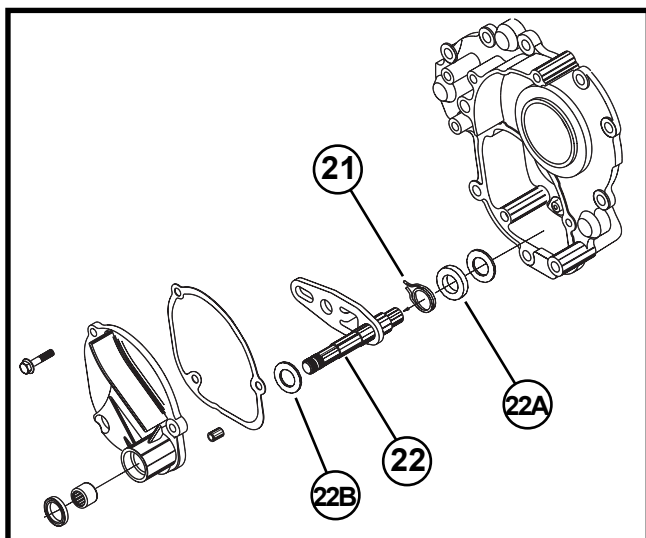


Position the pinion (18), the safety washer (19) and the nut (20).  
Tighten the nut.  
Bend the washer tongue.



**140 N·m 14 Kg-m + LOCTITE 648®**





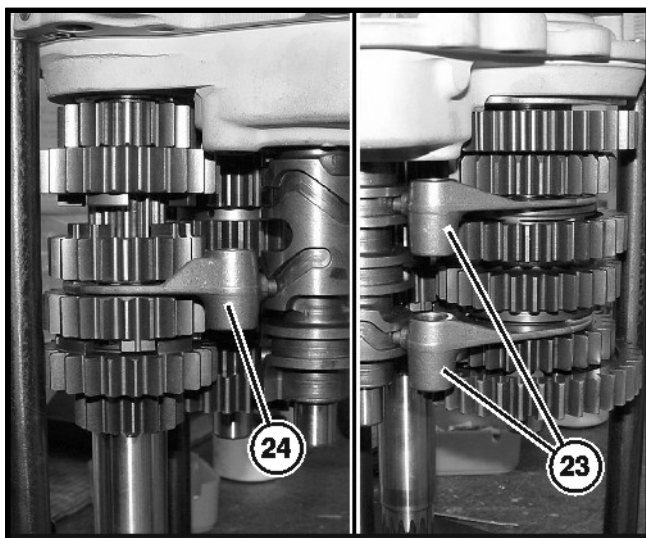
**ATTENTION:**

*Do not force the spring (21) too much while mounting the command shaft (22).*

Mount the spring (21) on the command shaft selector (22), as indicated in the figure.

Insert the 3 mm thick spacer (22A) next to the spring.

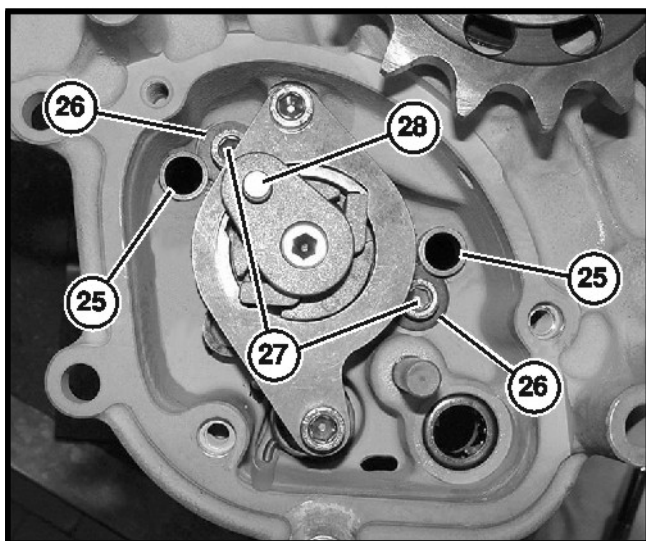
Insert the 1 mm thick clearance element (22B) on the selector shaft.



Position the two forks (23) on the secondary shaft and fork (24) on the primary shaft.

**NOTE:**

Forks (23) are greater in diameter than fork (24).



Insert the two slide rods (25).

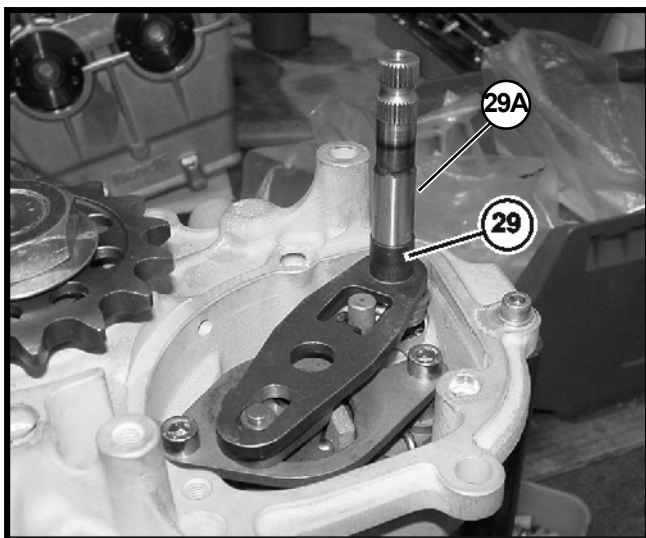
Insert the two washers (26) into the hole of the rod and fix them with screws (27) and tighten.

Position the ferrule onto the sprocket wheel pin (28).

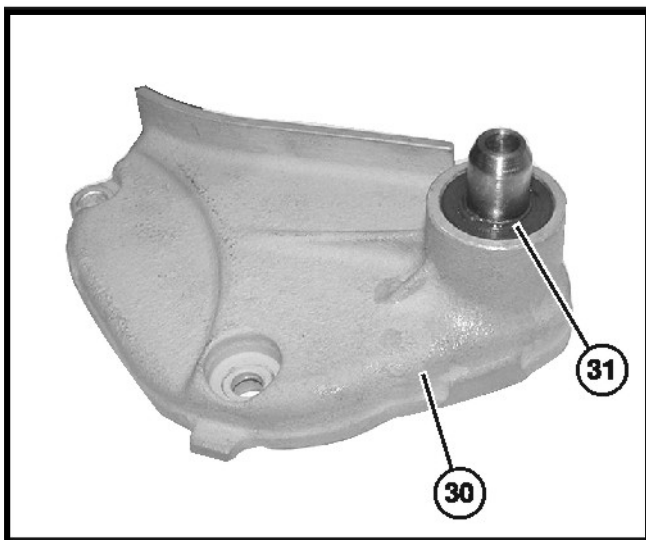


**10 N·m 1 Kg-m + LOCTITE 243®**

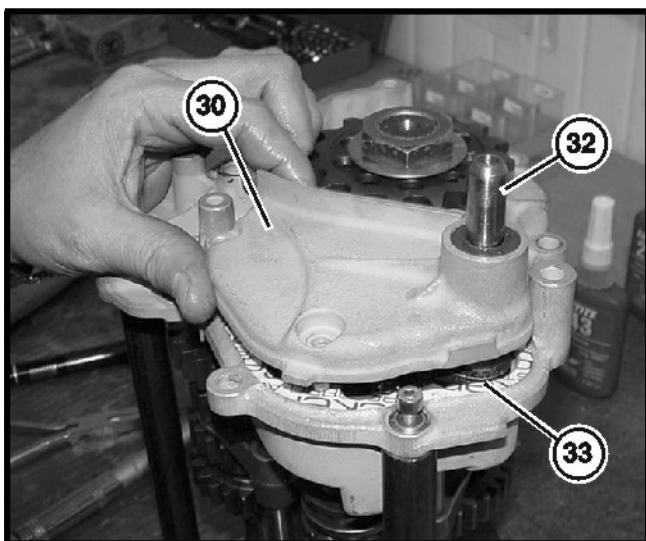




Position the command shaft selector (29), already pre-mounted, as shown in the figure.  
Insert on the shaft the smoother ( 29A ) of 0,8 mm thickness.

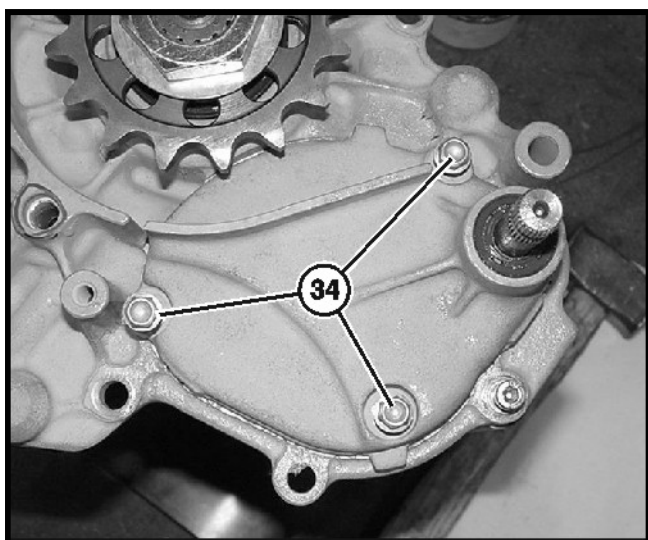


Insert the oil seal (31) onto the gear command cover (30) with the appropriate instrument.  
Grease the internal lip, see chapter 2: specifications.



Insert the two centring dowels.  
Mount the gasket (33).  
Protect the teeth of the shaft with a hood (32).  
Mount the cover (30) and push it down until it emerges completely from the protective hood (32).

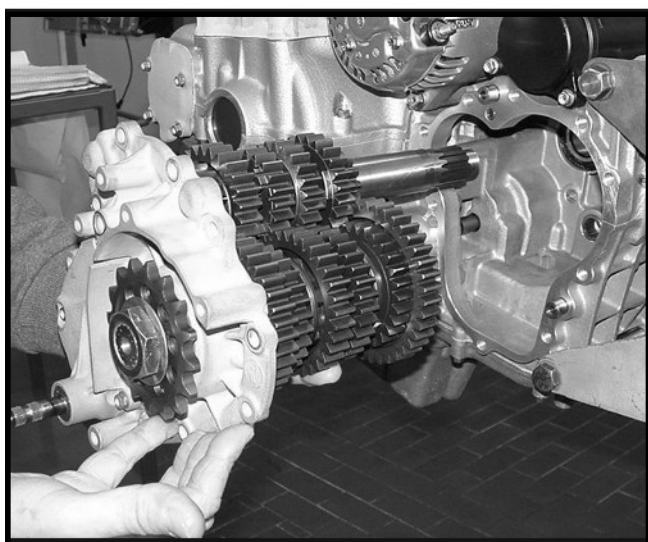




Insert the fixing screws (34) and tighten.



10 N·m 1 Kg-m



### 5.9.8 MOUNT GEARS



**ATTENTION:**

*While mounting the gears make sure that they are in fourth gear to avoid breaking the neutral sensor. Otherwise, remove the neutral sensor before re-mounting the gears.*

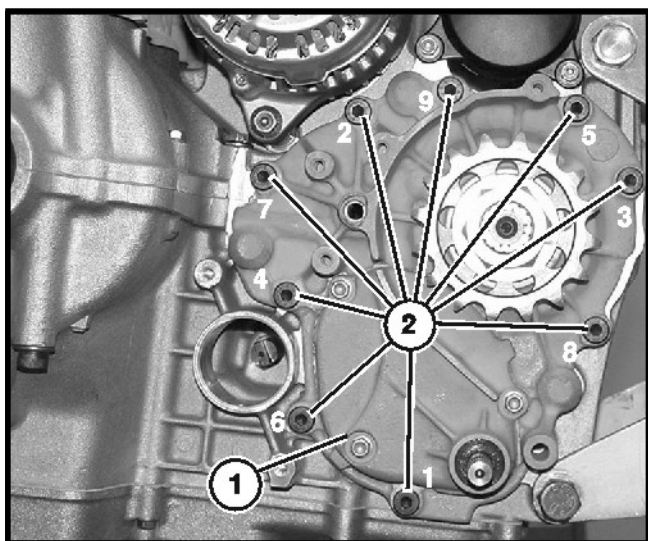


**ATTENTION:**

*Verify the presence of the oil pipe inside the carter.*

**NOTE:**

Apply Treebond paste onto the gear flange coupling surface, paying attention not to obstruct the oil passage hole.

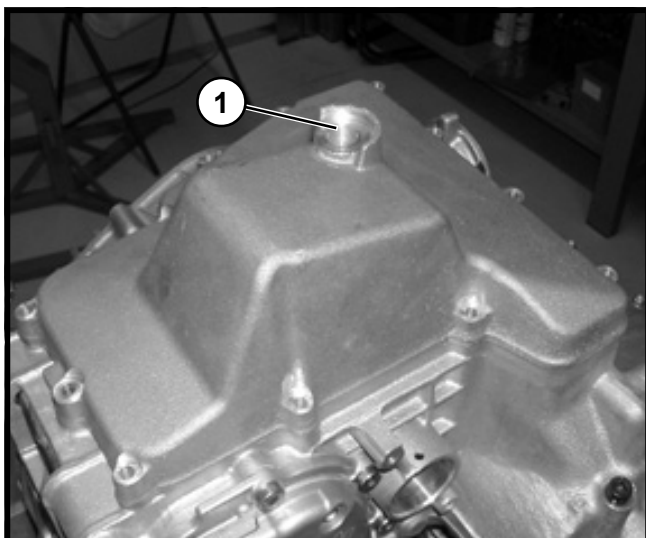


Insert the gear unit (1) and lock the screws (2) tightly, according to the order indicated.



20 N·m 2,0 Kg-m + Copper fat

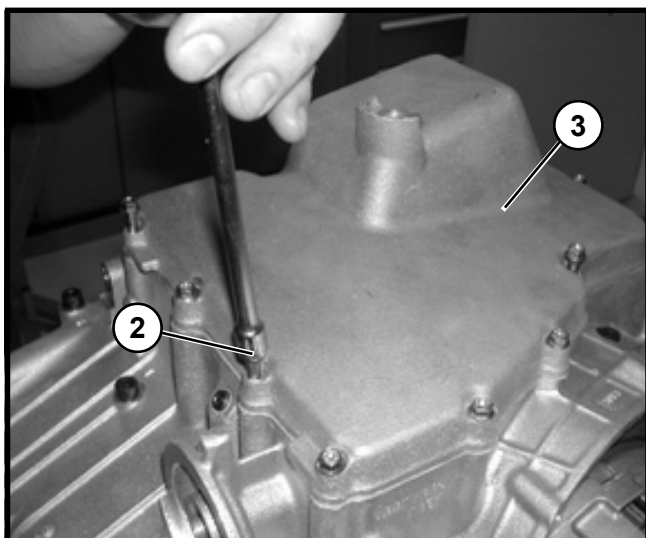




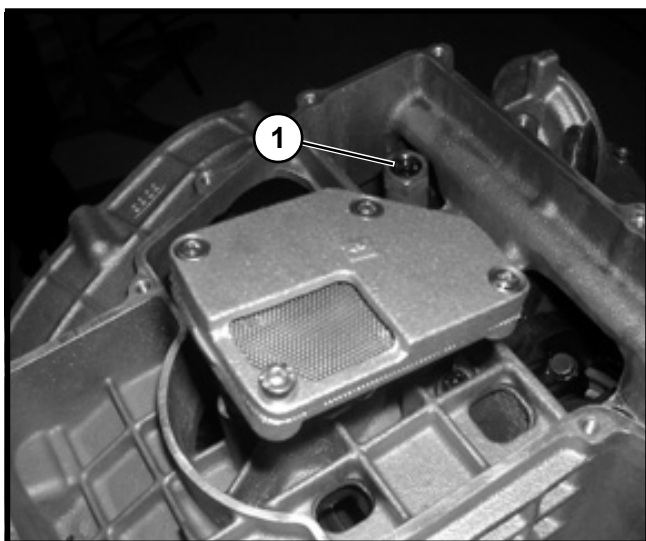
## 5.10 OIL SUMP AND OIL PUMP

### 5.10.1 DISMANTLE OIL SUMP

Unscrew and remove the oil discharge cap (1) and the gasket beneath.



Unscrew and remove the twelve screws (2) and remove the oil sump (3).



### 5.10.2 DISMANTLE OVERPRESSURE OIL VALVE

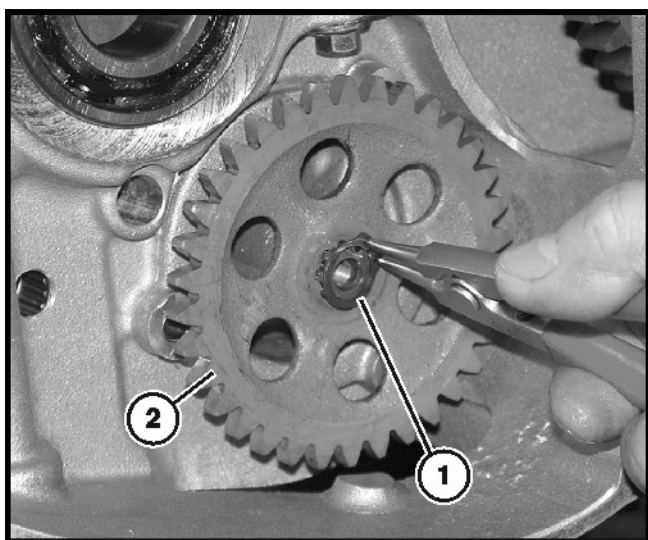
Remove the oil sump (see "DISMANTLE OIL SUMP").  
Remove the overpressure oil valve (1).

Check the functioning of the overpressure oil valve, pushing the piston with a plug of adequate dimensions from the threaded side.

If the piston does not move freely, change it.

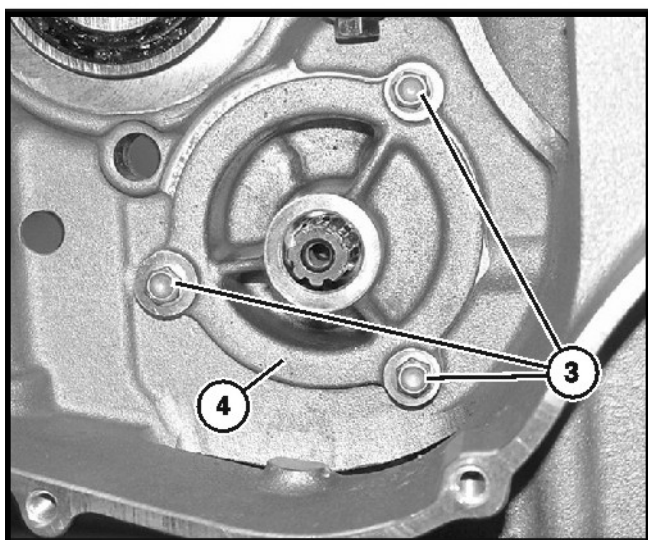
Remove the oil drip filter and, if necessary, clean the net or change the riser if damaged.



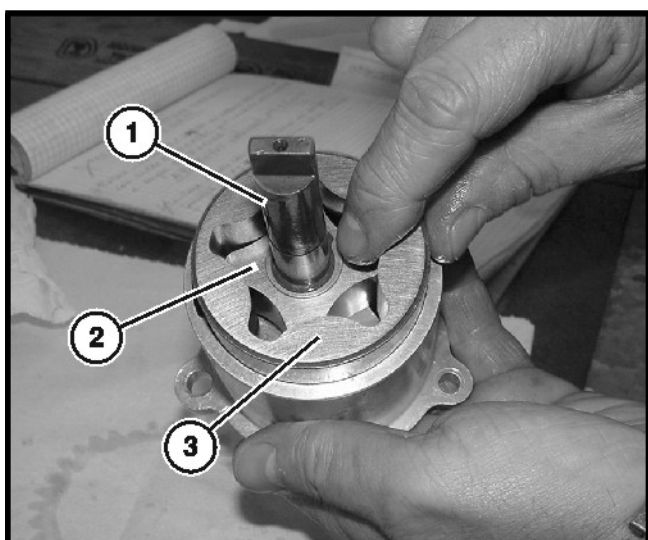


### 5.10.3 REMOVE OIL PUMP

Remove the clutch unit.  
Remove the safety ring (1) and the toothed wheel (2)



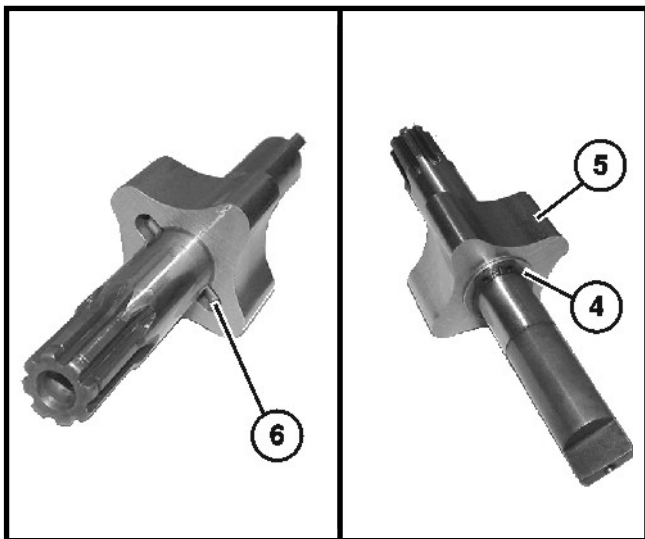
Unscrew and remove the three screws (3) and extract the oil pump (4).



### 5.10.4 DISMANTLE OIL PUMP

Remove the oil pump shaft (1) complete with internal rotor (2).  
Remove the external rotor.



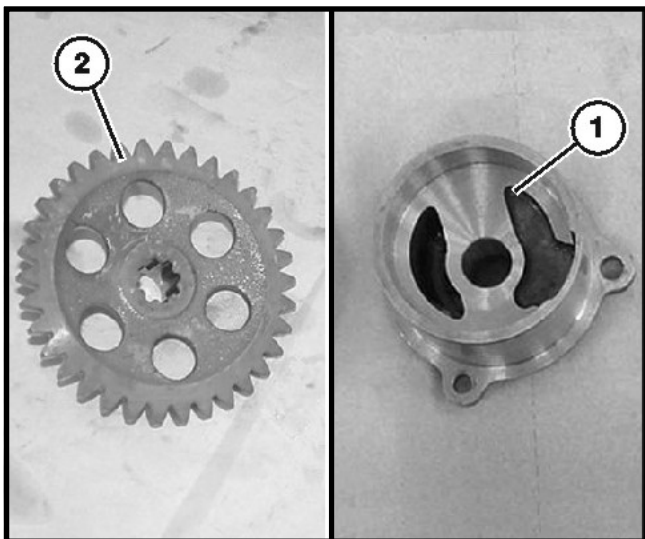


If necessary, remove the safety ring (4) and the internal rotor (5).  
Take off the pin (6).



#### 5.10.5 CHECK OIL SUMP

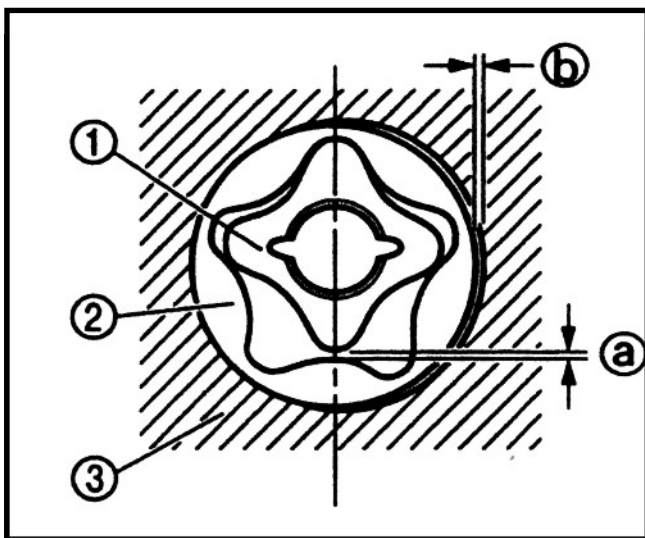
Check for breaks on the oil sump (1), eventually changing it.  
Check the presence of foreign bodies, eventually cleaning the drip filter.  
Eliminate the residues.



#### 5.10.6 CHECK OIL PUMP

Check that the pump body (1) and the toothed wheel (2) are not damaged or excessively worn.  
If necessary, change the element or elements.





The internal and external rotors should not be serrated.  
Check that the measurements (a) and (b) enter within the specific value, otherwise change the oil pump.

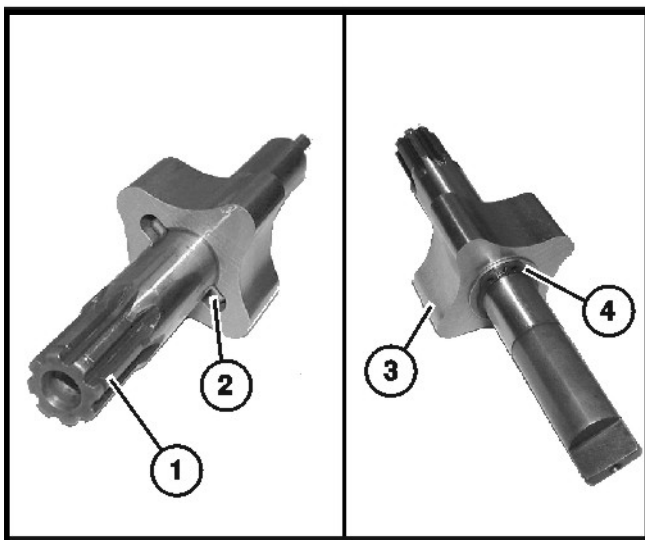
- 1: Internal rotor
- 2: External rotor
- 3: Pump body



#### VALUE LIMIT

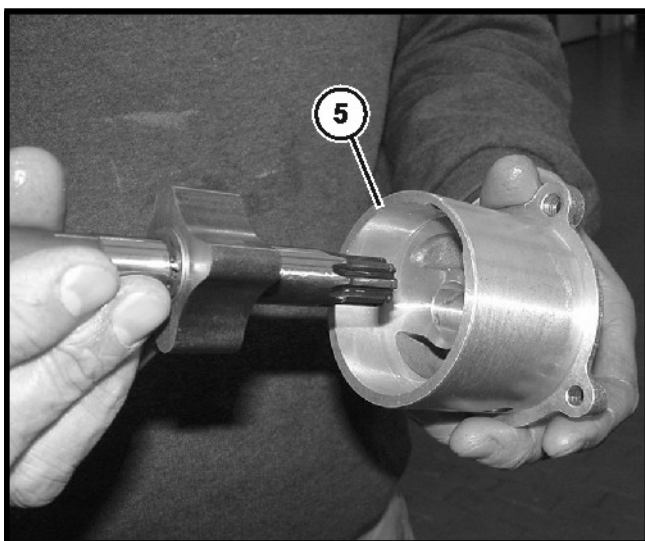
a = 0.25 mm max.

b = 0.2 mm max.



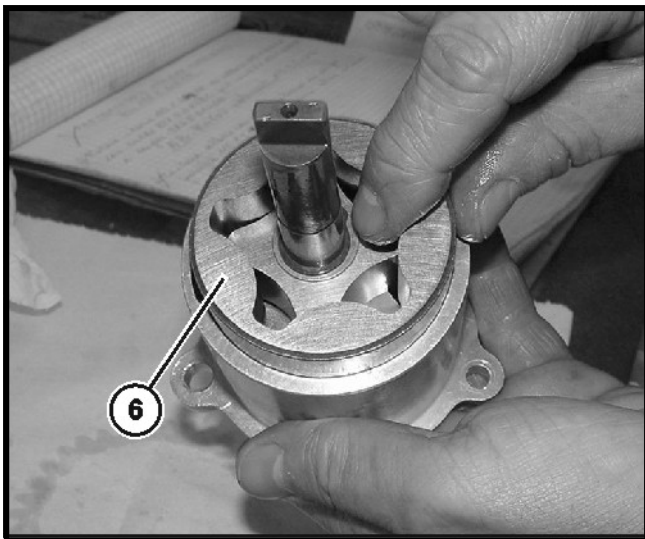
### 5.10.7 ASSEMBLE OIL PUMP

Position the pin (2) in the shaft (1).  
Insert the internal rotor (3) and the 1 mm liner clearance and block with the safety ring (4).

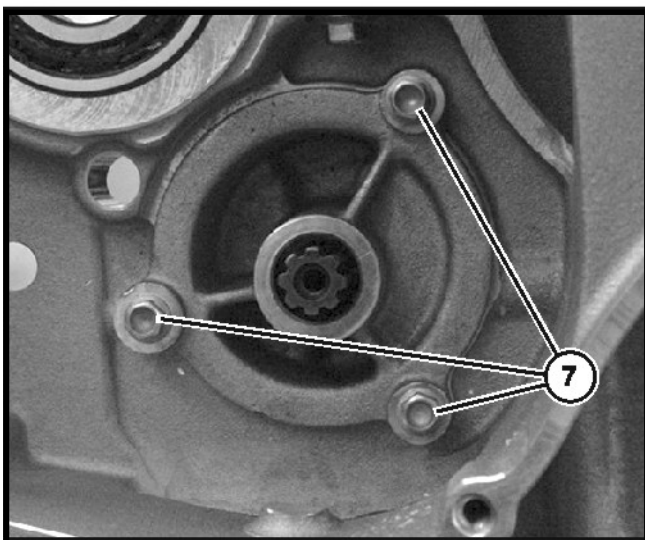


Position the shaft inside the body (5) as indicated in the figure.





Insert the external rotor (6) as in the figure.  
Oil the two rotors abundantly.

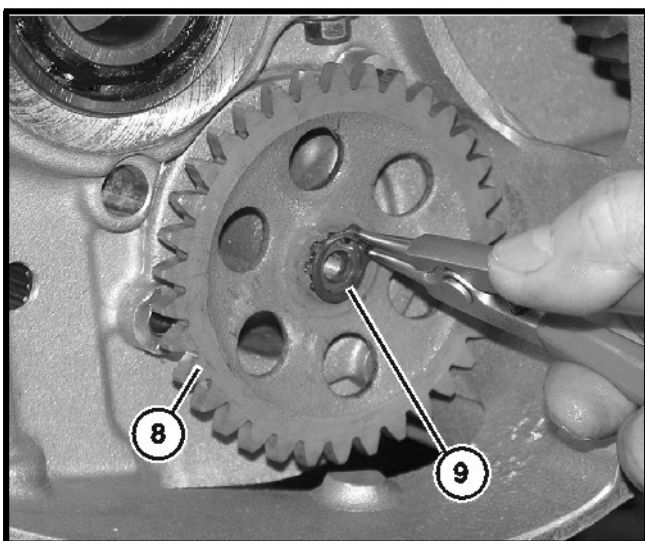


#### 5.10.8 MOUNT OIL PUMP

Insert the oil pump from the right with the specific instrument until it touches, as in the figure.  
Insert the centering dowel.  
Fix with the three screws (7) and tighten.



8,5 N·m 0.85 Kg-m + LOCTITE 243®

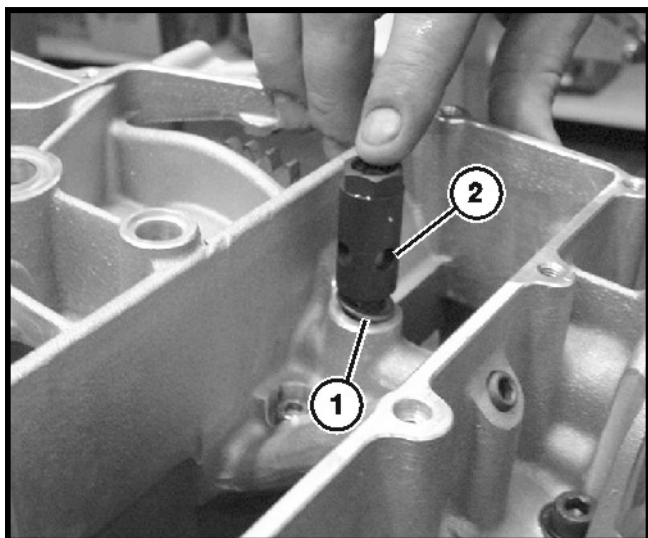


Insert the toothed wheel, check the free movement of the oil pump (8) and fix with the elastic ring (9).



**ATTENTION:**  
*Cover the sump drainage hole with paper or rags in order to avoid the elastic ring accidentally falling inside the engine.*



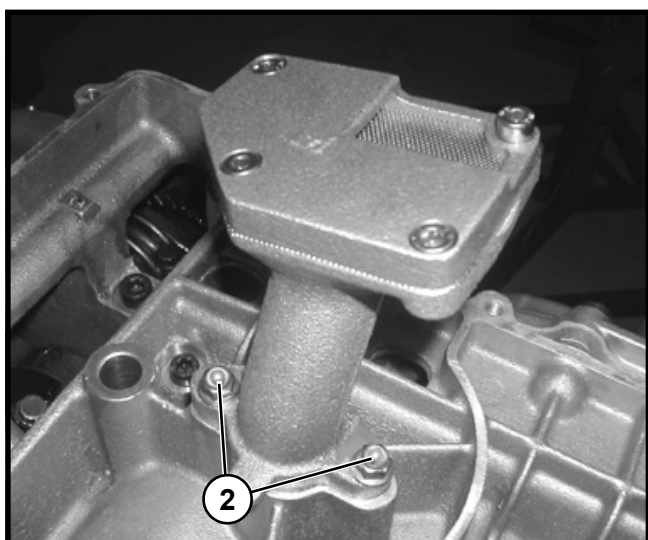


#### 5.10.9 MOUNT OVERPRESSURE VALVE

Position the overpressure valve (1) and valve (2).  
Tighten.



25 N·m 2.5 Kg-m + LOCTITE 243®



#### 5.10.10 MOUNT OIL SUMP



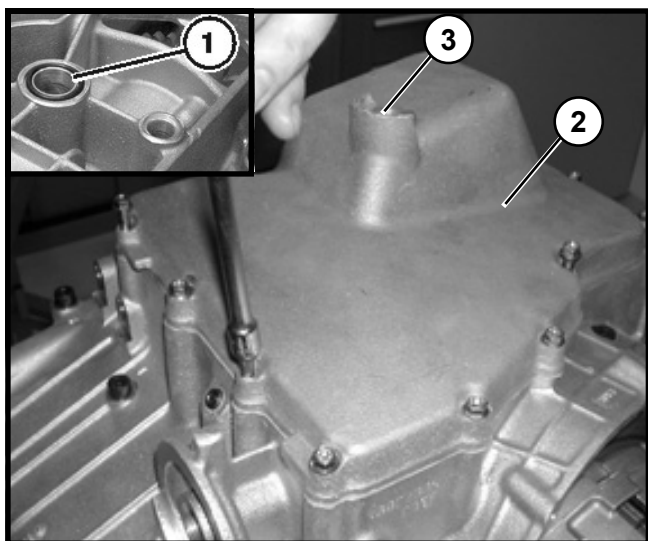
**ATTENTION:**  
*Always use new gaskets or O-rings.*

Position the two centering dowels on the base.  
Position the O-Ring (1) on the casing.

**Apply the gasket onto the casing surface.**  
**Remount the oil drip filter fixing the two screws (2) and tightening them.**



10 N·M 1Kg-m + LOCTITE 243®



Position the sump (2) and tighten the magnetic screw cap (3).



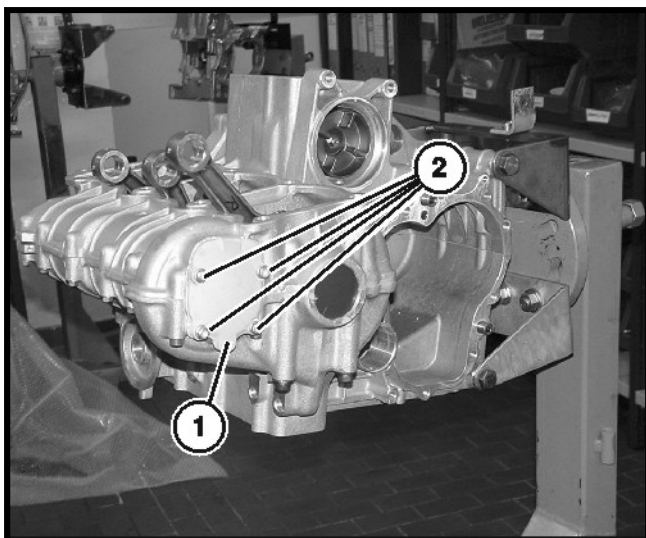
22 N·m 2.2 Kg-m

Tighten according to the order indicated in the figure.



10 N·m 1 Kg-m

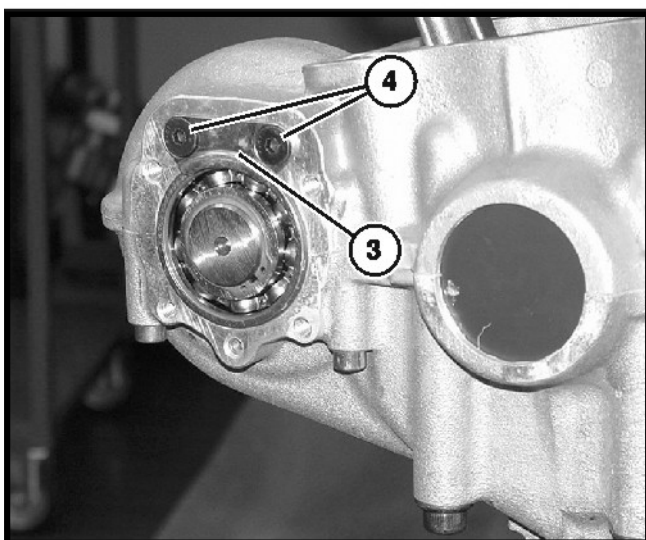




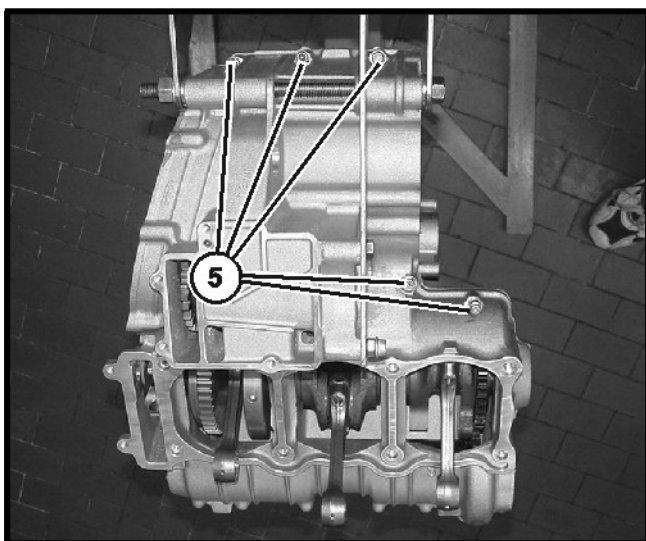
## 5.11 CASING

### 5.11.1 DISMANTLE CASING

Remove the head.  
 Remove the pistons (see "DISMANTLE PISTONS").  
 Remove the oil sump (see "DISMANTLE OIL SUMP").  
 Remove the oil pump (see "DISMANTLE OIL PUMP").  
 Remove the water pump (see "DISMANTLE WATER PUMP").  
 Remove the gears (see "ADJUSTMENT PHASE").  
 Remove the oil distributor (see "OIL DISTRIBUTOR").  
 Remove the counter-shaft cover (1), unscrewing the four screws(2).



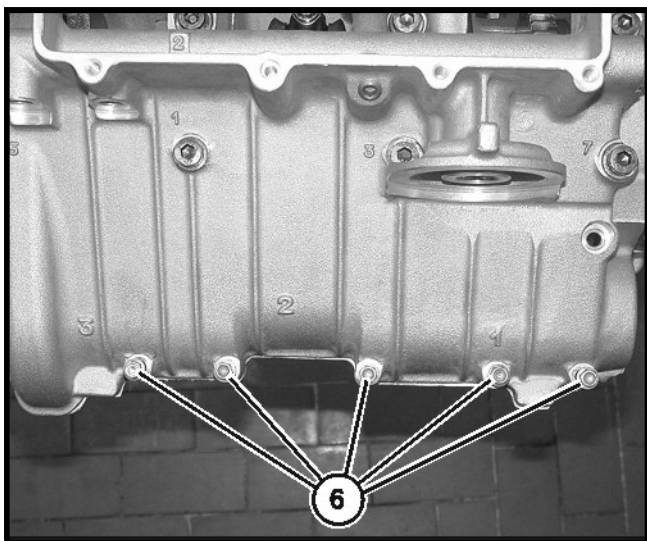
Remove the stop plate (3), unscrewing the two screws ((4).



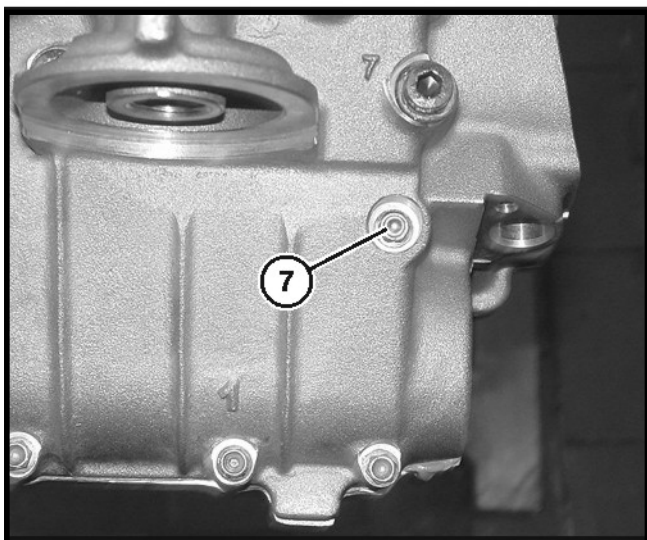
**ATTENTION:**  
*Note the position of the screws for correct re-mounting.*

Remove the five screws (5) indicated in the figure (upper part of the engine).

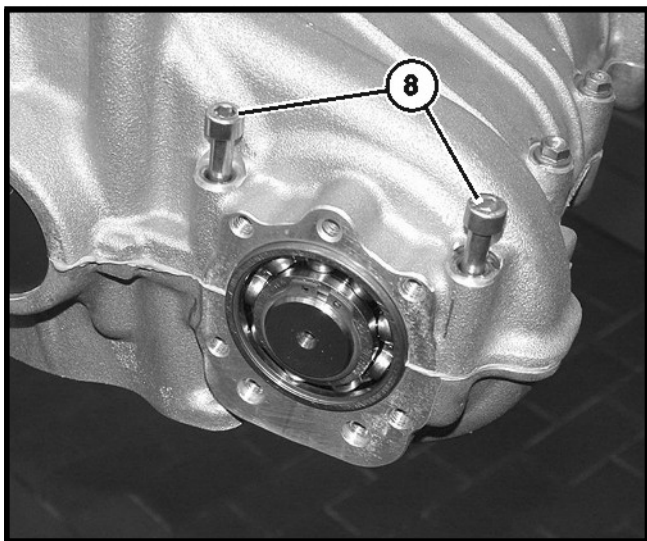




Remove the five screws (6).

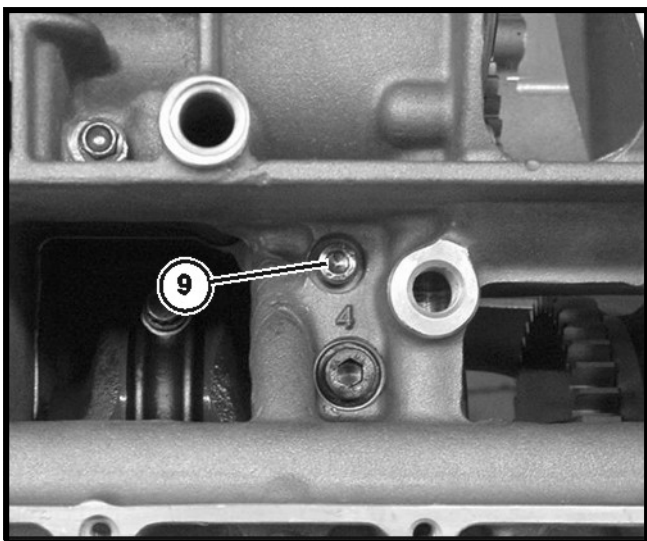


Remove screw (7).

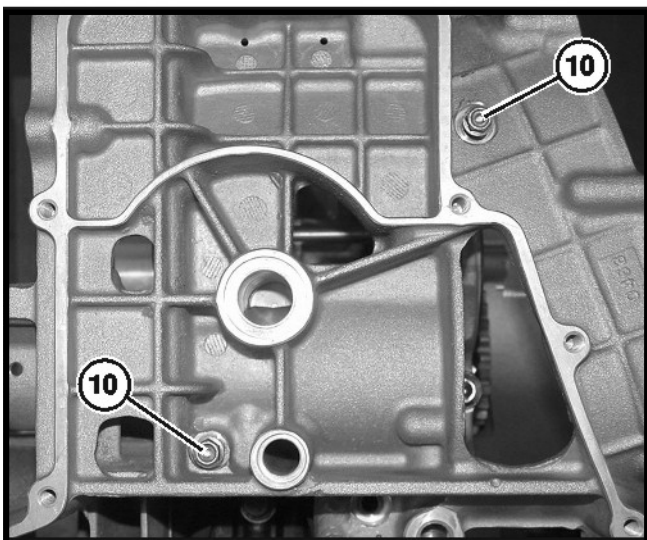


Remove the two screws (8).

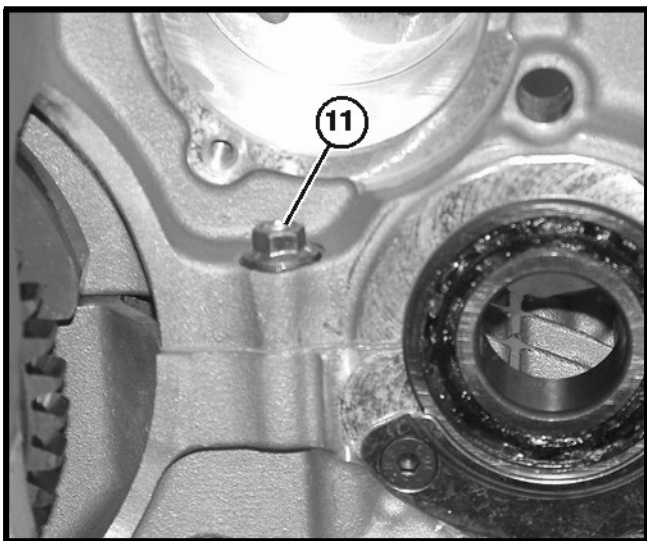




Remove screw (9).

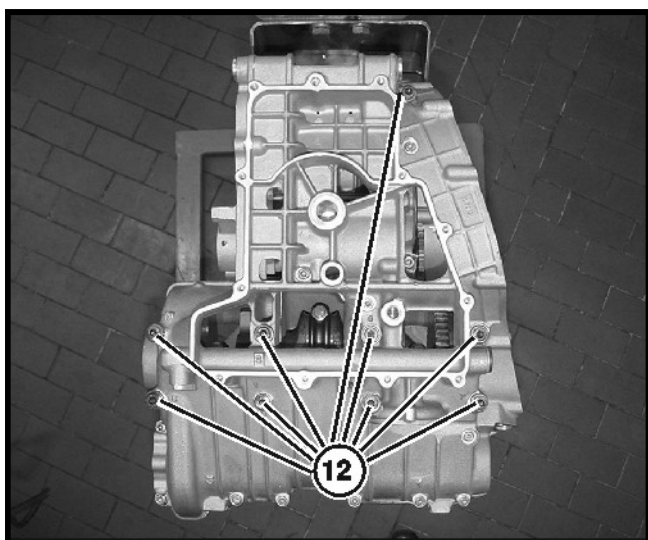


Remove the two screws (10).



Loosen and remove screw (11).

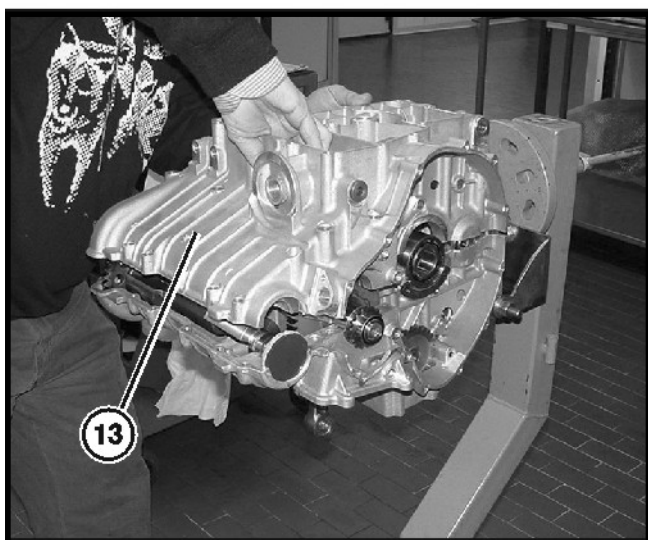




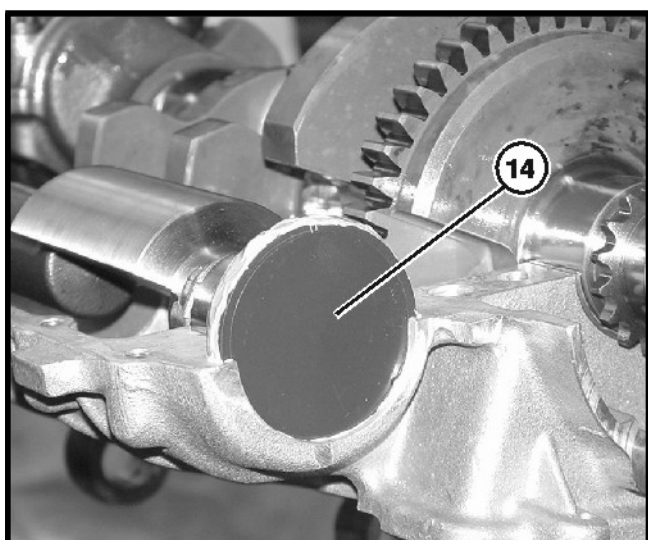
**ATTENTION:**

*Take note of the position of the screws for correct re-mounting.*

Remove the nine screws (12) indicated in the figure (lower part of the engine).

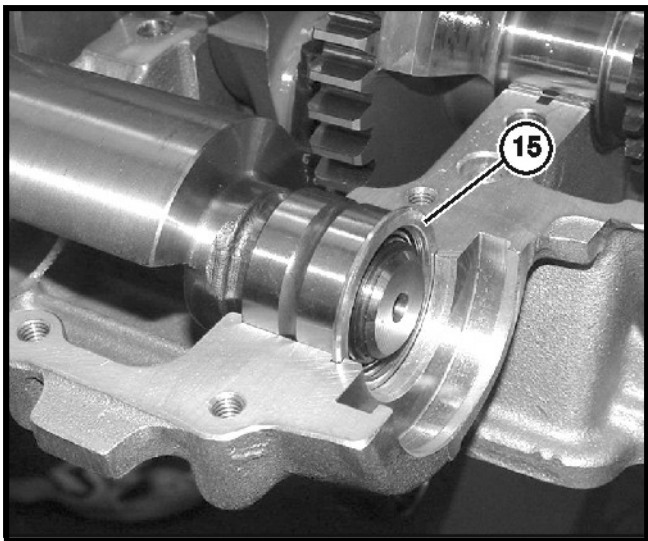


Remove the lower base (13).

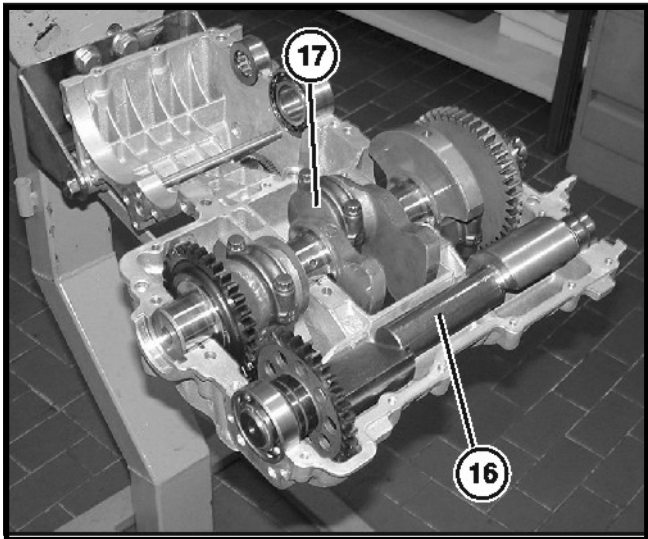


Remove the large plastic lock nut (14).

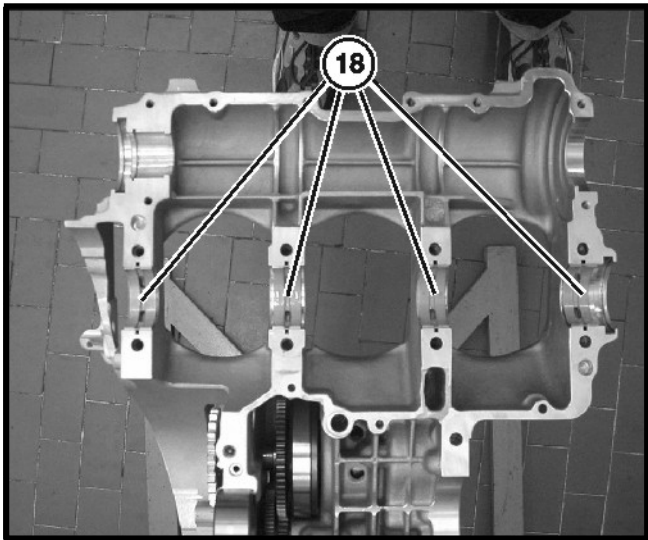





Remove the ring (15).



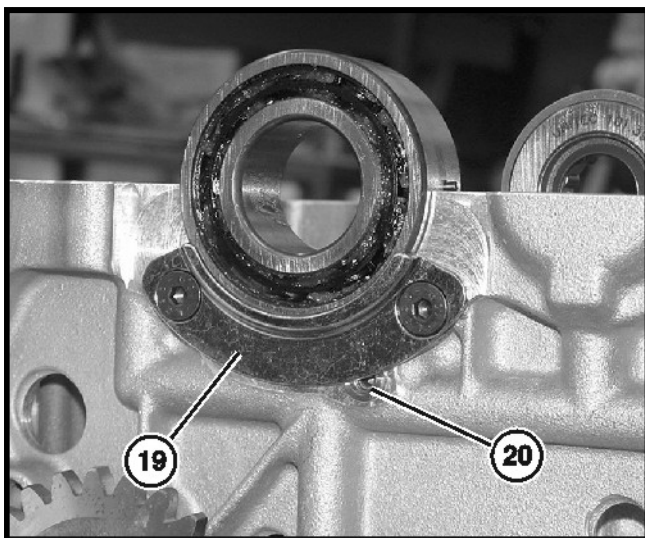
Remove the balancing counter-shaft (16).  
Remove the engine shaft (17).



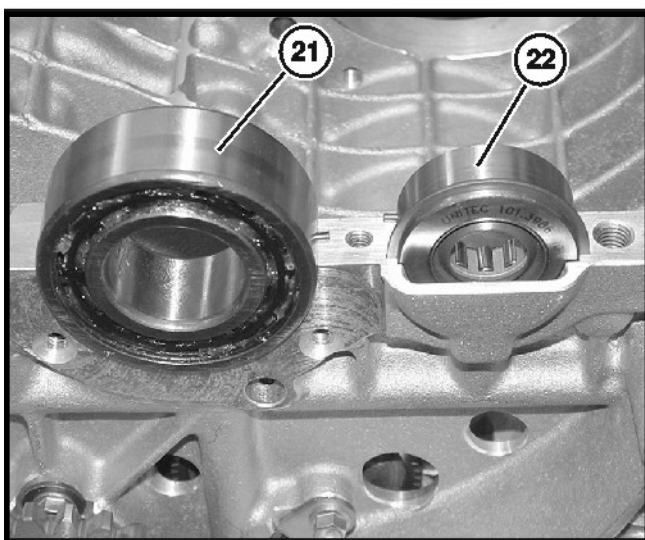
 **ATTENTION:**  
*Take note of the position of the bronze bearings for correct re-mounting.*

Remove the four semi-bronze bearings (18).

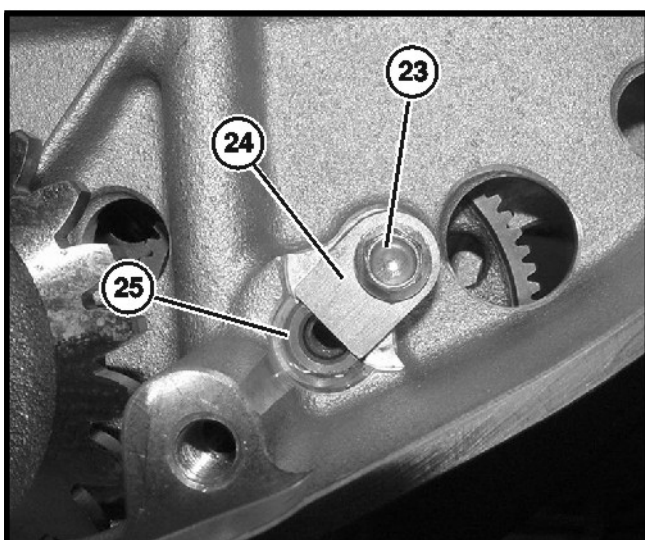




Remove the drainage tube stop plate (19.)  
Remove the drainage tube (20).

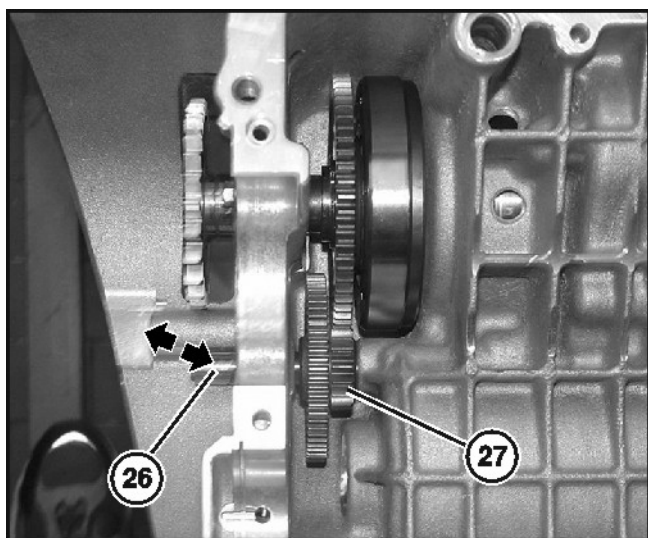


Remove the ball-bearings (21) and (22).

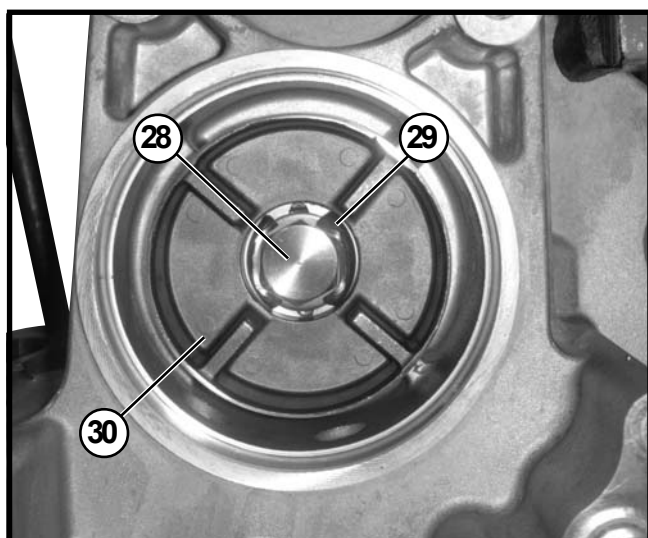


Remove screw (23) and plate (24), freeing the pin (25).

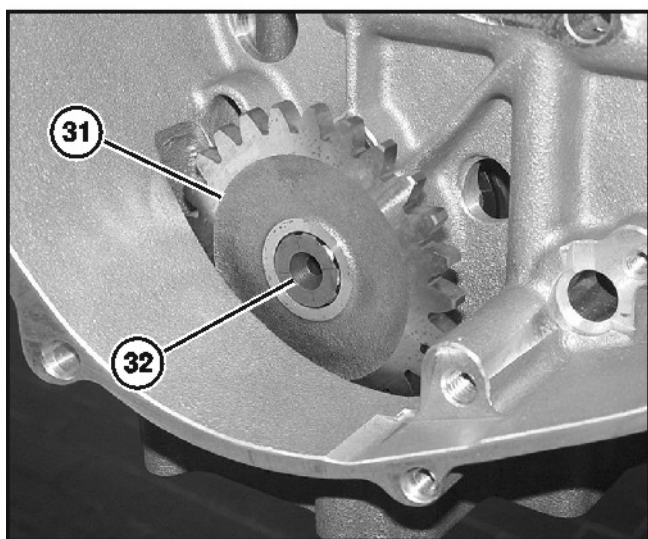




Support the satellite gear (27) and take off the pin (26) as shown in the figure.

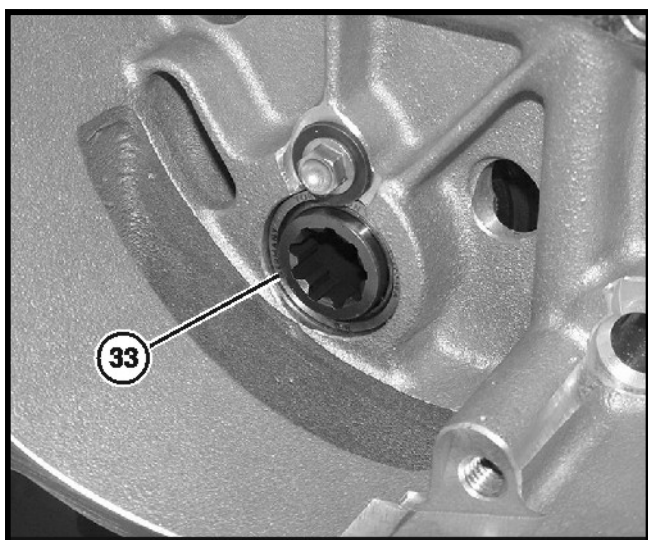


Unscrew and remove the screw (28), the washer (29), the retaining plate and the female flexible coupling (30).

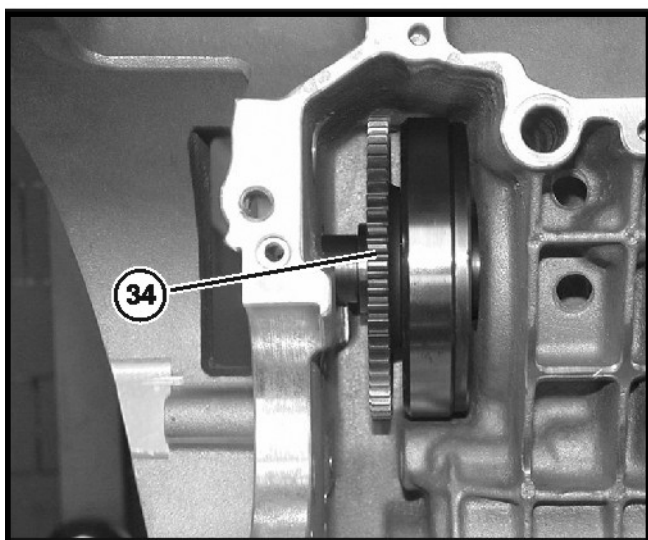


Support the toothed wheel (31) and remove pin (32).  
Remove the toothed wheel (31).

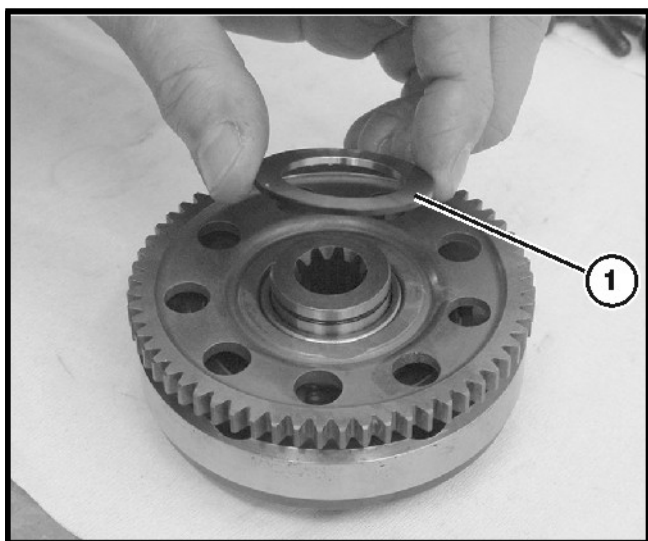




Remove the spacer (33).



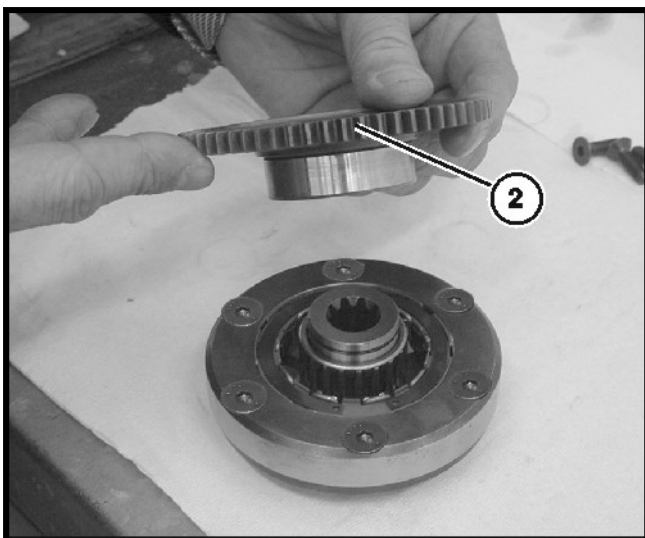
Remove the free wheel (34).



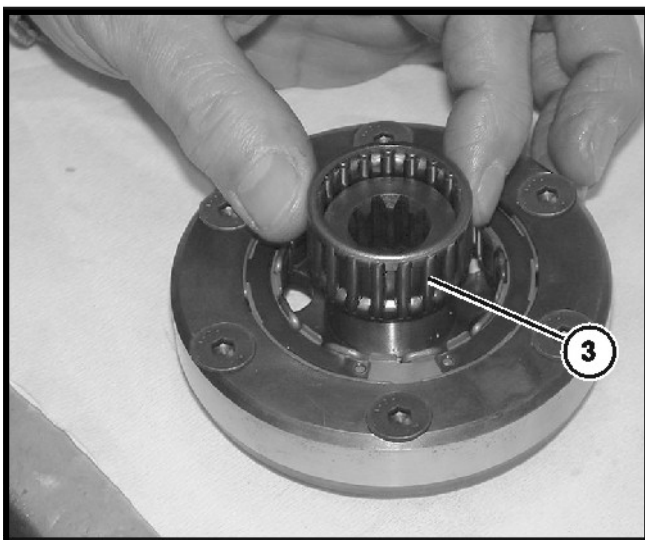
### 5.11.2 DISMANTLE FREE WHEEL

Remove the elastic safety ring.  
Remove the washer (1).

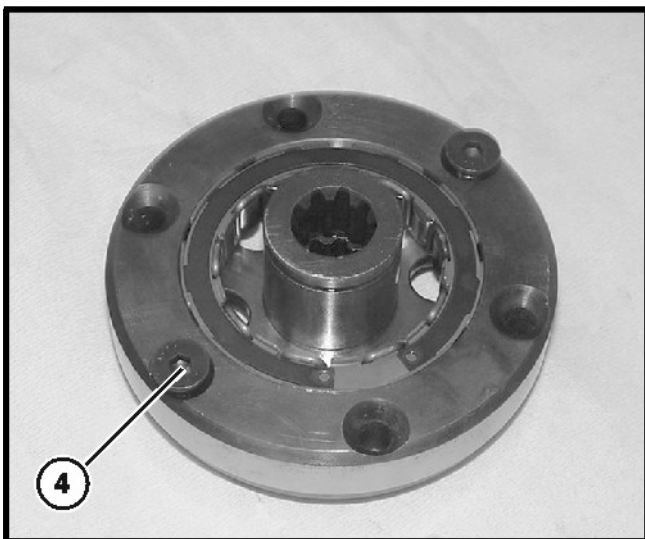




Remove the toothed wheel (2).

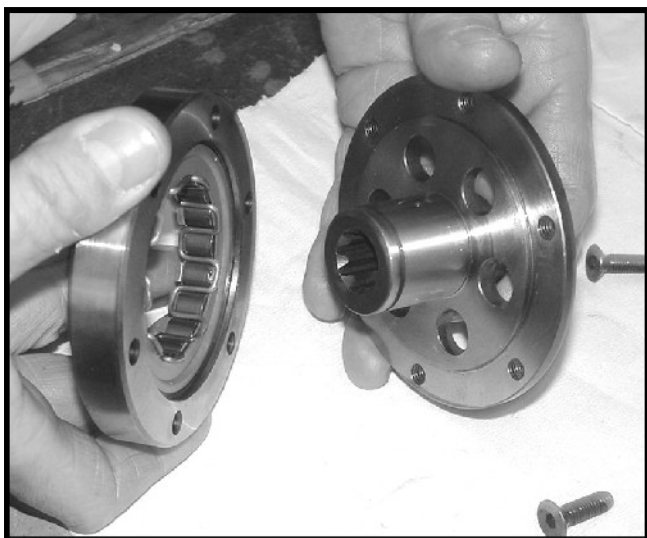


Remove the roller cage (3).

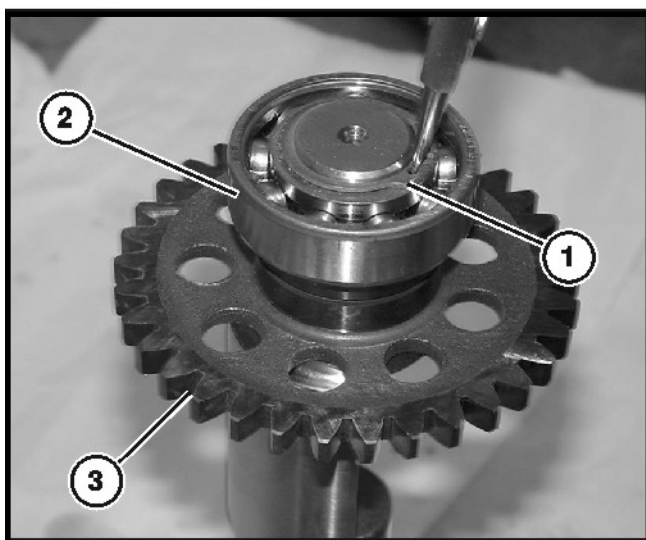


Remove the screws (4).





Dismantle the free wheel.



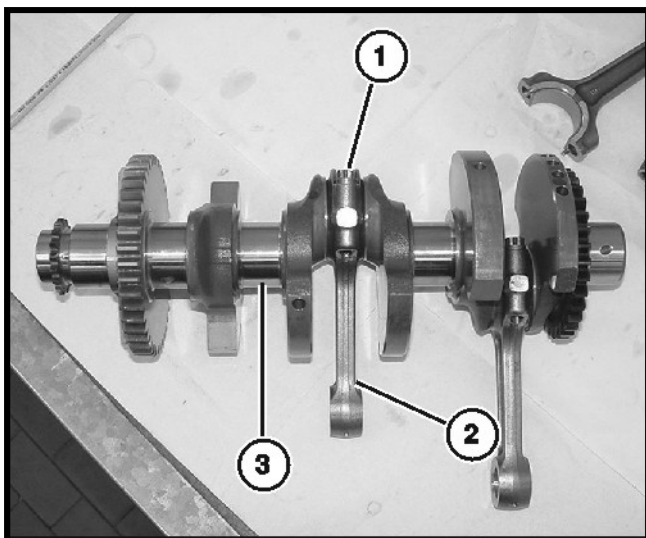
### 5.11.3 DISMANTLE BALANCING COUNTER SHAFT

Remove the circlip (1).  
Remove the ball-bearing (2) and the toothed wheel (3).



Remove the ball-bearing (4).





#### 5.11.4 DISMANTLE ENGINE SHAFT



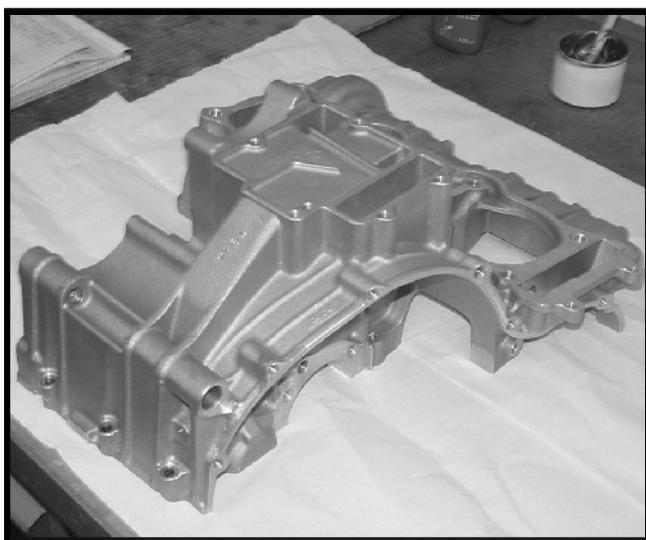
##### **ATTENTION:**

*Take note of the position of the elements for correct re-mounting.*

The following procedure must be applied to all the connecting rods mounted on the engine shaft.

Unscrew and remove screws (1).

Remove the connecting rod (2) from the engine shaft (3).



#### 5.11.5 CHECK CASING

Check the presence of any breaks on the upper and lower casing, eventually changing the casings, always coupled.

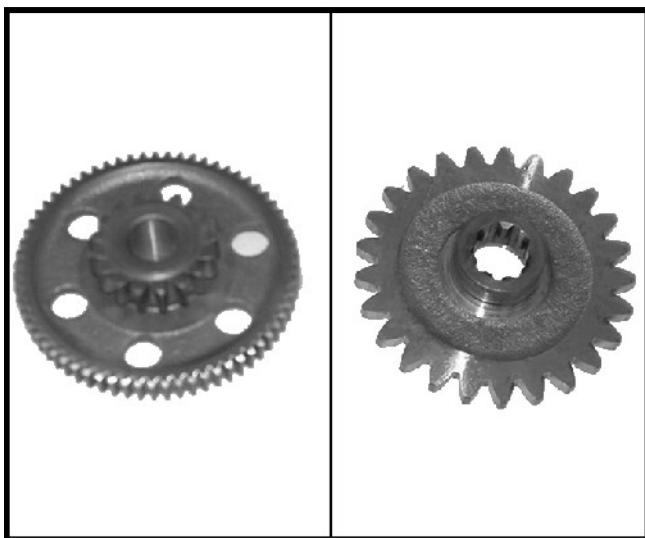
##### **NOTE:**

Check that the oil passage channels are not obstructed, otherwise clean them with an appropriate piece of wire and compressed air.

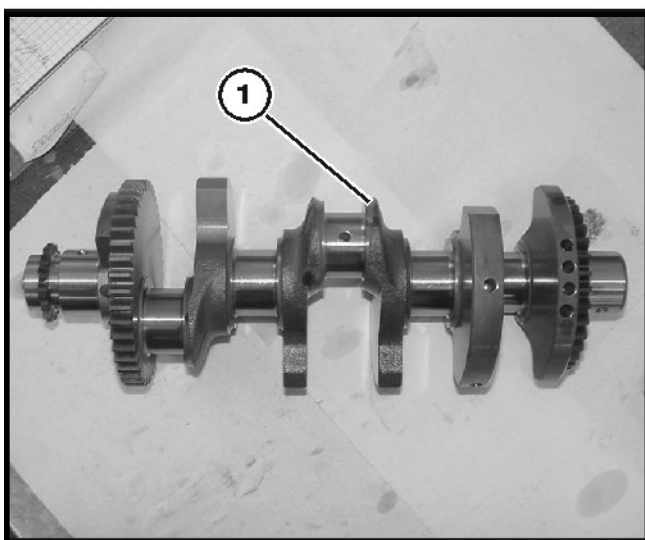


Check the free rotation of the ball-bearings, changing them if necessary.





Check that the toothed wheels are not broken or excessively worn.  
Change them if necessary.

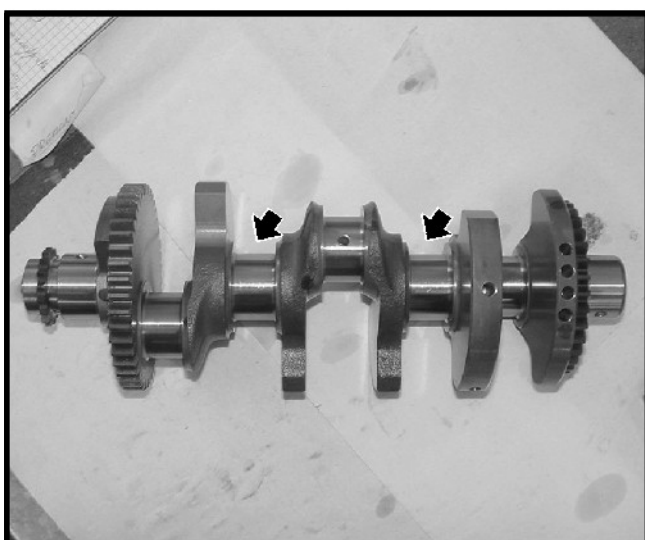


#### 5.11.6 CHECK ENGINE SHAFT AND CONNECTING ROD

Check eventual breaks or excessive wear on the whole engine shaft (1).

Change the piece if necessary.

Support the engine shaft with two "V" blocks and with the two ends resting upon the blocks, install a comparator and turn the engine shaft slowly.



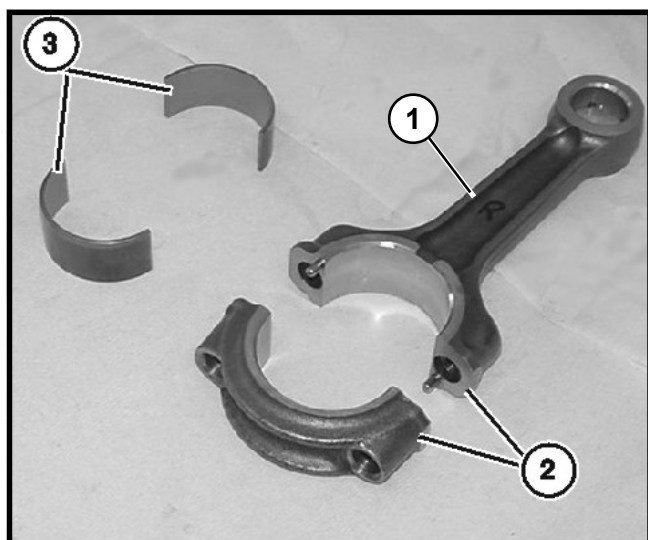
Check the deformation of the engine shaft at the points indicated in the figure.

If the deformation does not enter within the specific value, change the piece.



**DEFORMATION  
VALUE LIMIT = 0,040 mm**

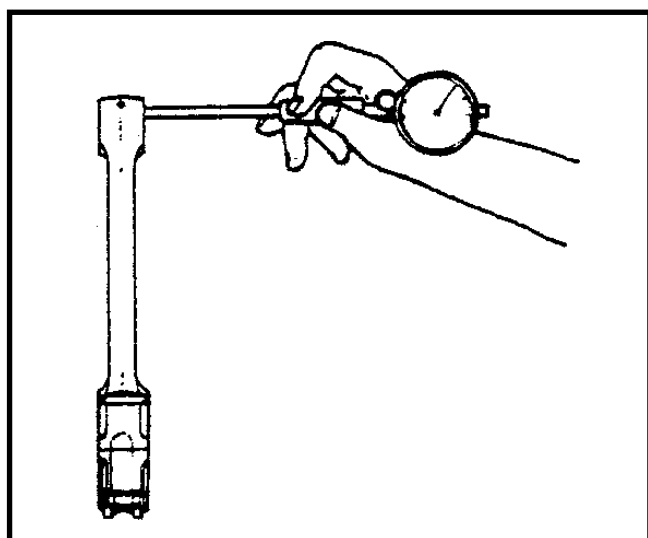




Check eventual breaks or excessive play on the connecting rod (2) and on the two semi-bronze bearings.

In case of replacement of the connecting rod, verify the belonging class marked on the shank (1).

SELECTION SHEET		
TYPE	COLOUR	Ø CONNECTING ROD HEAD
A	Red	40.395/40.401
B	Blue	40.401/40.407
C	Yellow	40.407/40.413
TYPE	COLOUR	WEIGHT (g)
K1	Black	412/416
K2	Green	396/400
K3	White	400/404
K4	Brown	404/408
K5	Orange	408/412



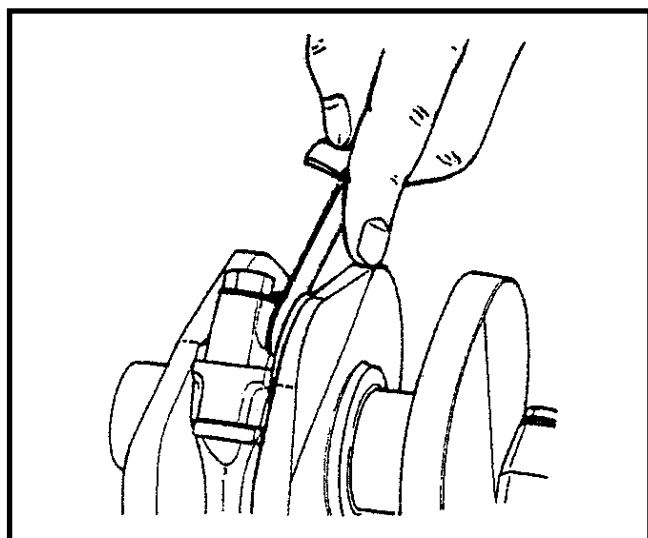
### 5.11.7 INTERNAL DIAMETER CONNECTING ROD FOOT

Using a calibre for small holes, measure the internal diameter of the connecting rod foot.



**INTERNAL DIAMETER CONNECTING ROD FOOT**  
**SERVICE LIMIT: 19.040 mm**

If the internal diameter of the connecting rod foot exceeds the specified limit, change the connecting rod.



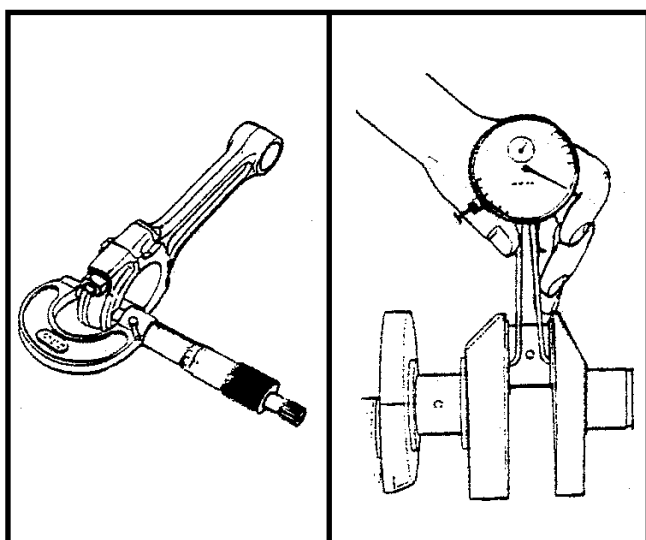
### 5.11.8 CONNECTING ROD HEAD LATERAL PLAY

Check the lateral play of the connecting rod with a feeler.  
If the play exceeds the specified limit, remove the connecting rod and check the width of the connecting rod head and pin.  
If the width exceeds the specified limit, change the connecting rod or the engine shaft.



**CONNECTING ROD HEAD LATERAL PLAY**  
**SERVICE LIMIT: 0.40 mm**





**CONNECTING ROD HEAD WIDTH**  
STANDARD: 2,18 - 2,19 mm



**CONNECTING ROD PIN WIDTH**  
STANDARD: 22,0 - 22,05 mm



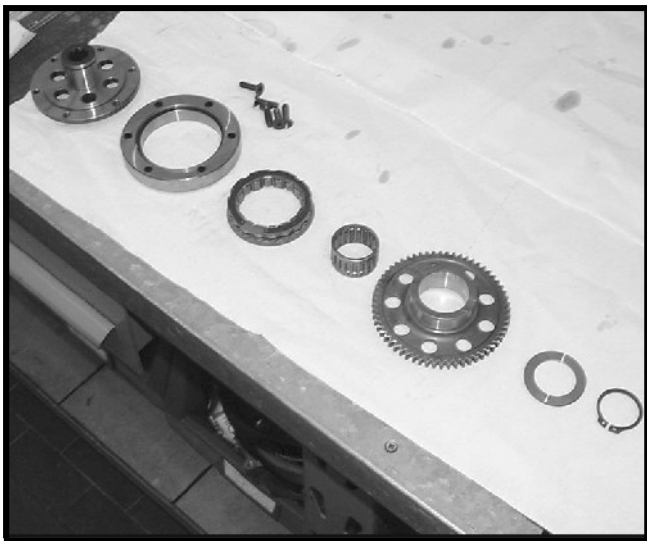
#### 5.11.9 CHECK BALANCING COUNTER SHAFT

Check the eventual presence of breaks on the balancing counter shaft.



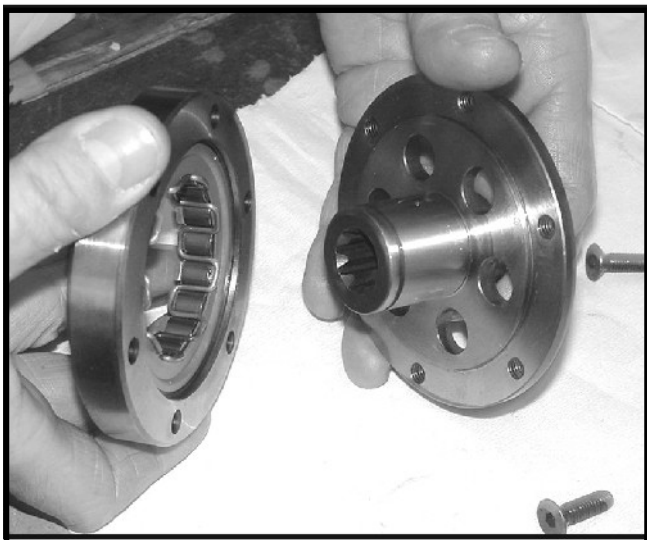
Check the free rotation of the ball-bearings.  
Check eventual breaks or excessive wear on the toothed wheel.  
If necessary, change the elements or the entire balancing counter shaft.





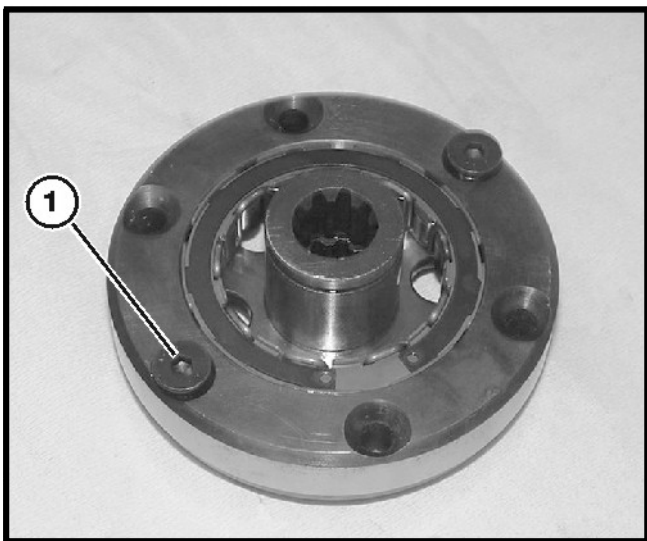
#### 5.11.10 CHECK FREE WHEEL

Check eventual breaks, wear and slippage on the free wheel.  
Change the element if necessary.



#### 5.11.11 ASSEMBLE FREE WHEEL

Assemble the two elements as shown in the figure.

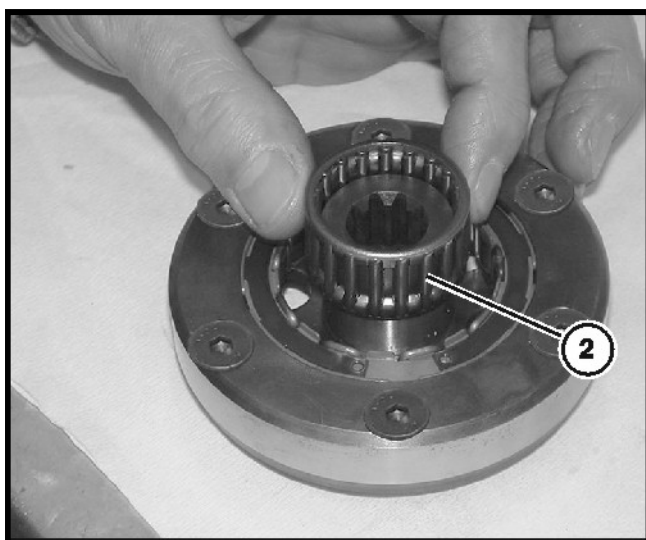


Tighten screws (1).

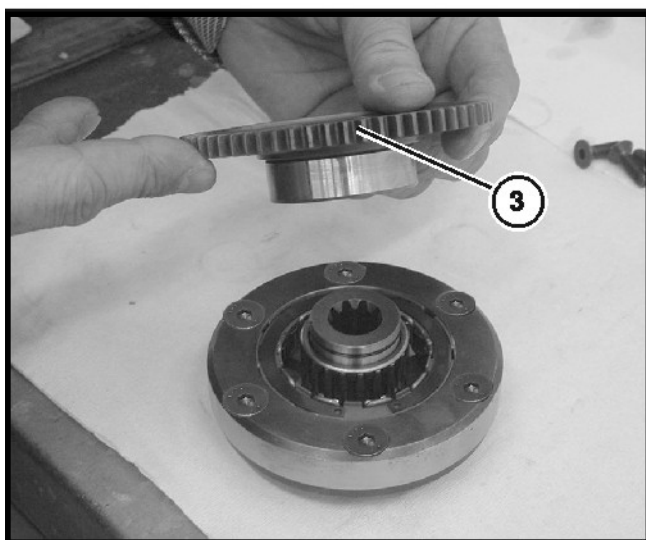


17 N·m 1.7 Kg-m + LOCTITE 270®

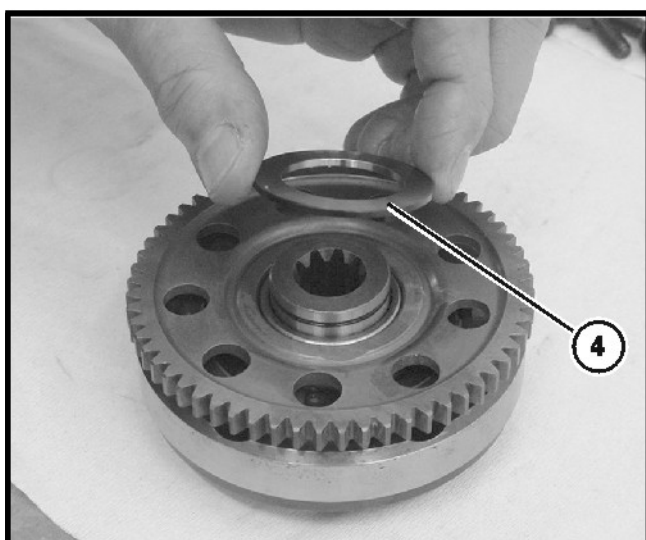




Position the roller-cage (2), oiling it. (See Chapter. 2: SPECIFICATIONS)



Position the toothed wheel (3).



Position the washer (4) and fix with the circlip.





CONNECTING ROD SEMI-BALL-BEARING		
STD	COLOUR	SELECTION
A	Red	1.680 - 1.684
B	Blue	1.684 - 1.688
C	Yellow	1.688 - 1.692
Ø seat std A red		40.395 - 40.401
Ø seat std B blue		40.401 - 40.407
Ø seat std C yellow		40.407 - 40.413
Ø single std shaft		36.976 - 36.986

## 5.11.12 MOUNT ENGINE SHAFT

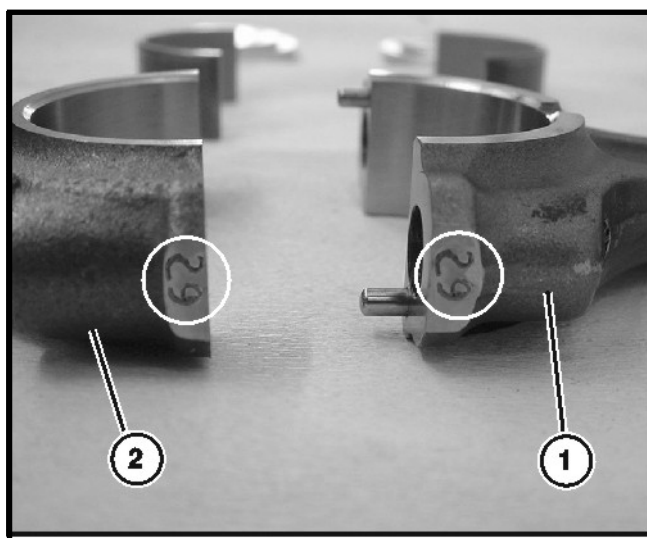


### WARNING:

*Various semi-bronze bearings liners exist distinguished by different colours (see table).*

### NOTE:

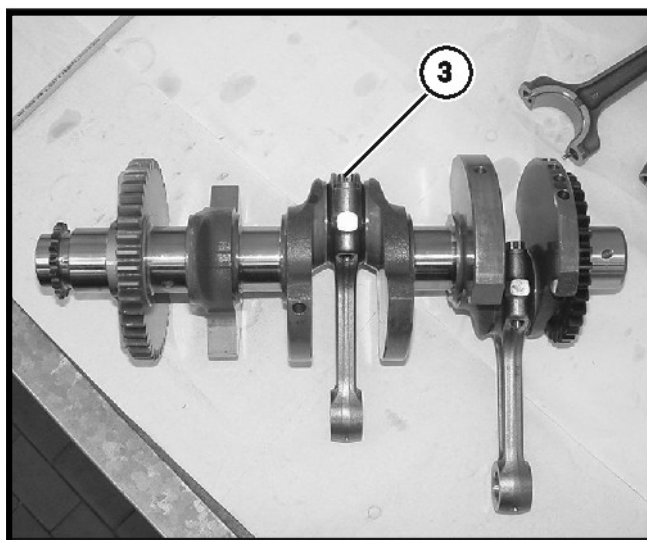
Position every bronze bearing of the right colour connected to its letter indicated on the connecting rod, checking it with the teeth in the relative slot.



### WARNING:

*The two writings shown in the figure must coincide to couple the connection rod container (1) to the large cap (2).*

Couple the connecting rod on the engine shaft so that the referent writing for the coupling is turned towards the front of the engine.



### ATTENTION:

*Always change the connecting rod screws after each dismantling.*

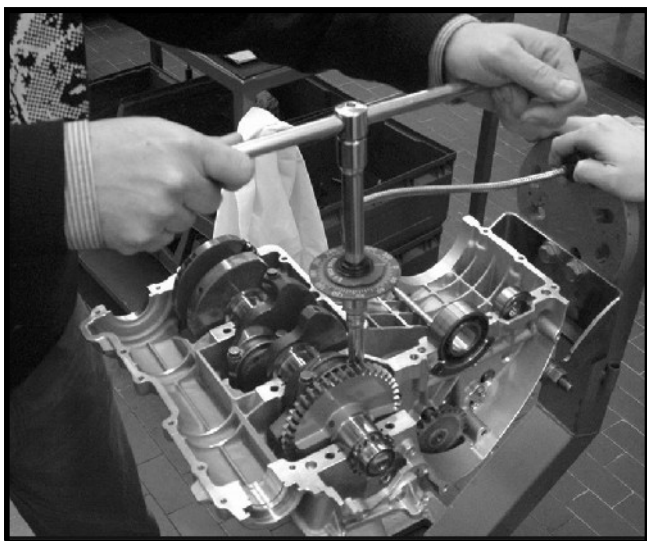
Oil the thread and the diameter under the flanging of the fixing screws (3) with the recommended oil. Tighten the fixing screws (3) slightly.



### RECOMMENDED OIL

**MOLIKOTE® CU7439 PLUS copper grease.**





Position the engine shaft on the upper semi-casing. Tighten the connecting rod screws in three phases.



1<sup>st</sup> = 15 N·m 1,5 Kg-m



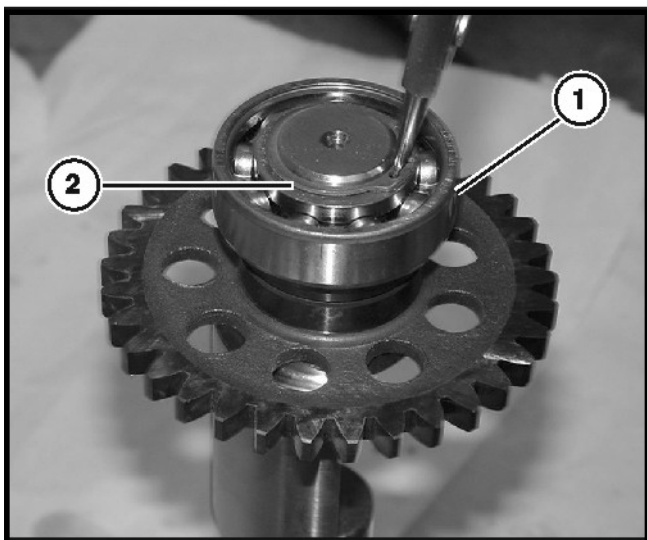
2<sup>nd</sup> = 25 N·m 2,5 Kg-m



3<sup>rd</sup> = + 50°

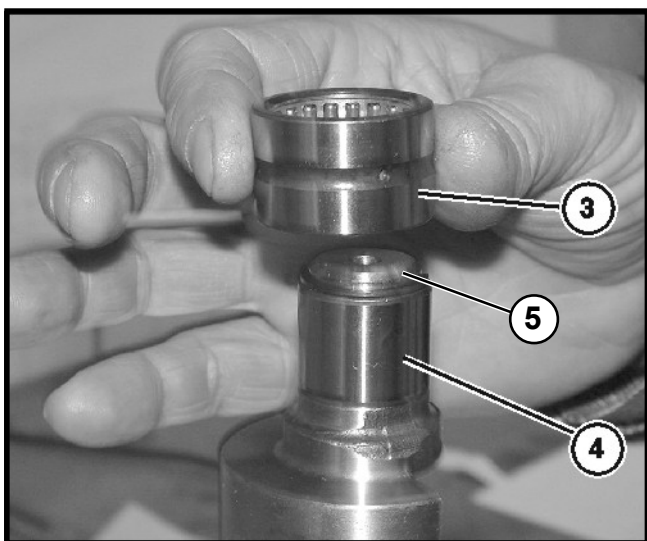
**NOTE:**

An angle torque control wrench is needed to carry out the third tightening phase.



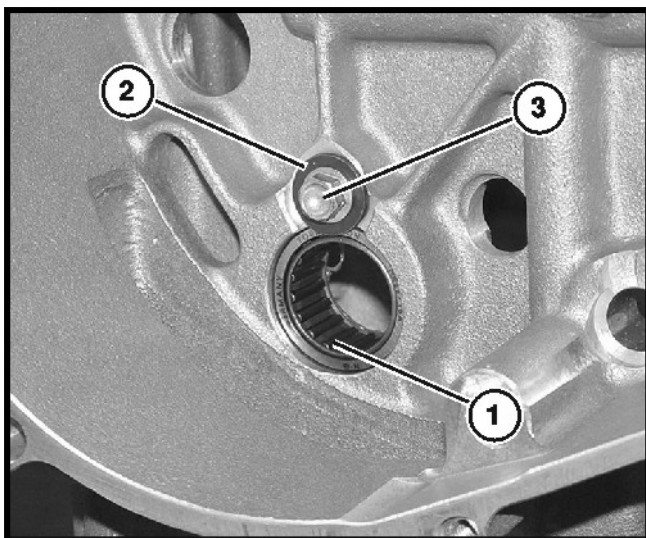
### 5.11.13 MONTAGGIO BALANCING COUNTER SHAFT

Position the ball-bearing (1) and fix with the circlip (2).



Position the bush (4).  
Position the seeger ring (5).  
Position the roller ball-bearing (3) on the counter shaft.



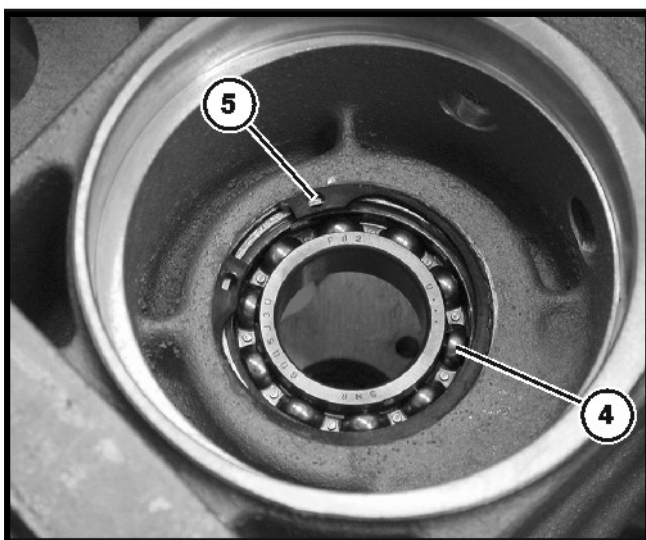


#### 5.11.14 MOUNT CASING

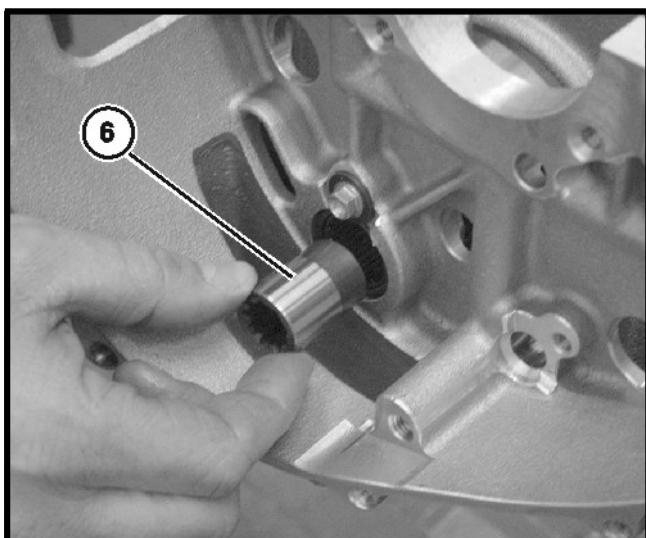
Position the roller cage (1), block it with washer (2) and fix with screw (3) tightly.



10 N·m 1 Kg-m + LOCTITE 243®

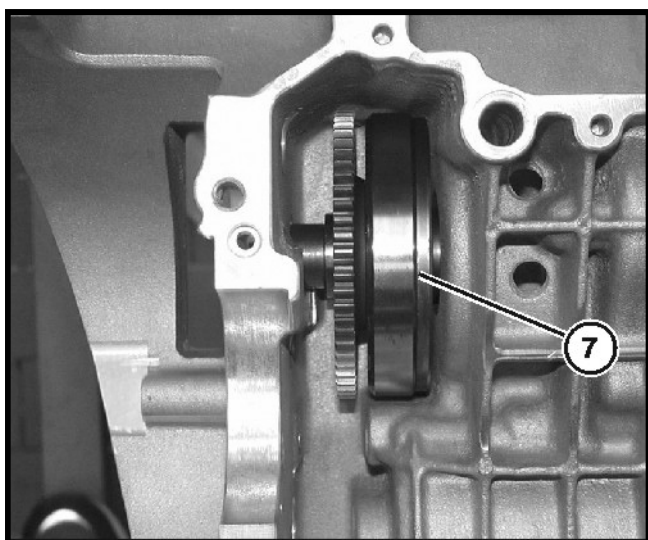


Position the ball-bearing (4) with the apposite pad and fix with the circlip (5).

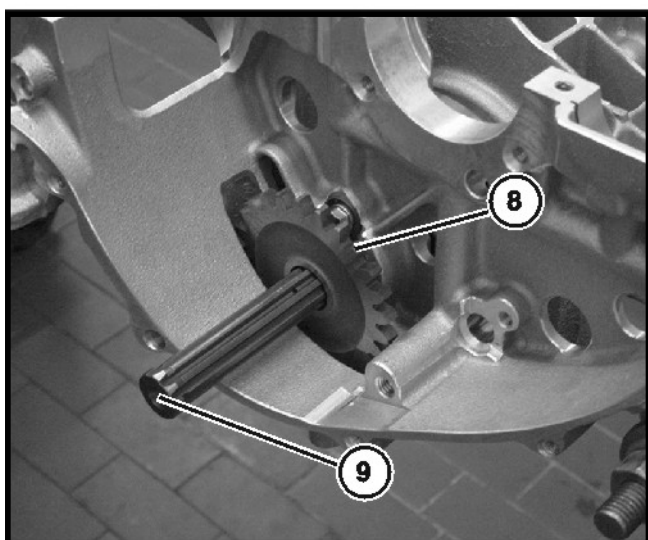


Position the spacer (6) as indicated in the figure.

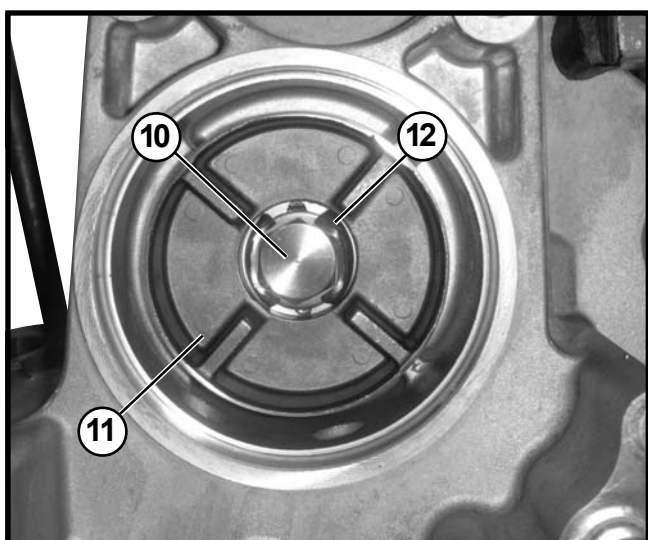




Position the free wheel (7) as shown in the figure.



Position the toothed wheel (8) and insert pin (9) until touching, in the direction in the figure..

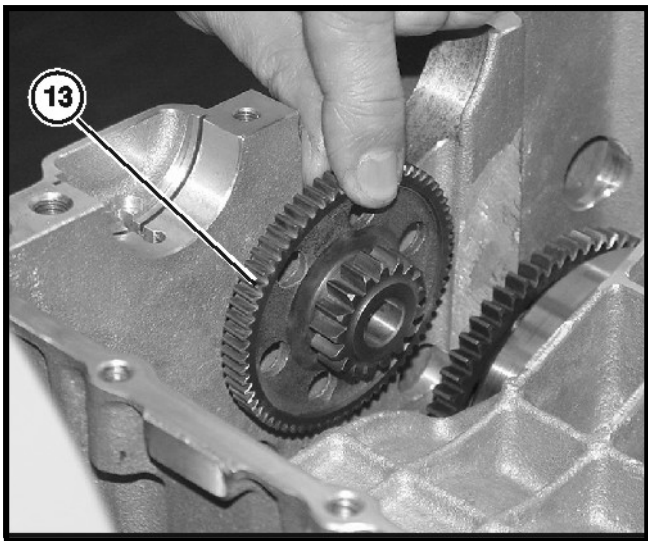


Position the flexible coupling, the washer retaining plate and tightened screw in the housing.  
Bend the retaining plate to avoid it protruding from the head of the screw.

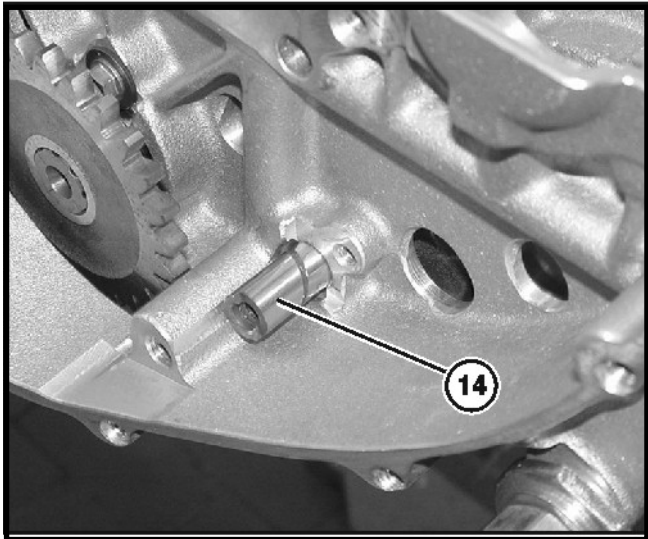


**50 N·m 5,0 Kg-m + LOCTITE 648®**

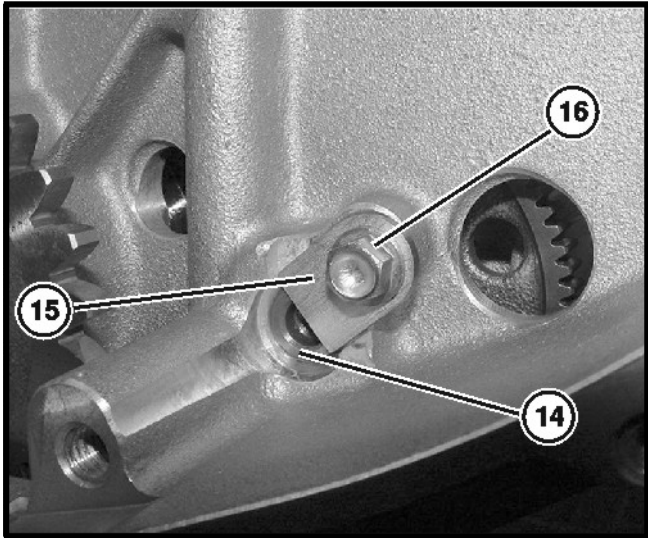





Position the toothed wheel (13) as shown in the figure.



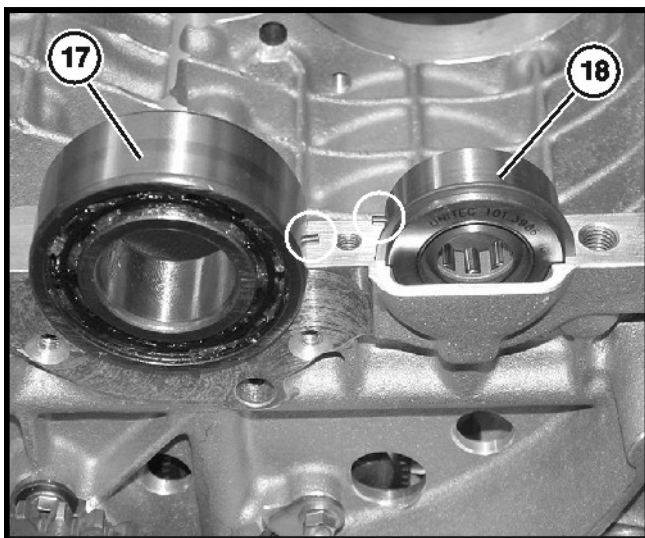
Position pin (14) until touching, as indicated in the figure.



Position plate (15) and fix with screw (16) tightly.


10 N·m 1 Kg-m + LOCTITE 243®

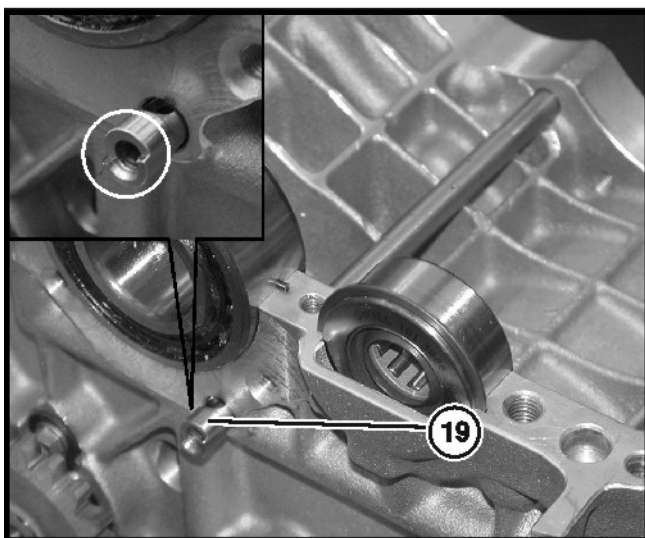




**ATTENTION:**

*Position the element highlighted in the figure.*

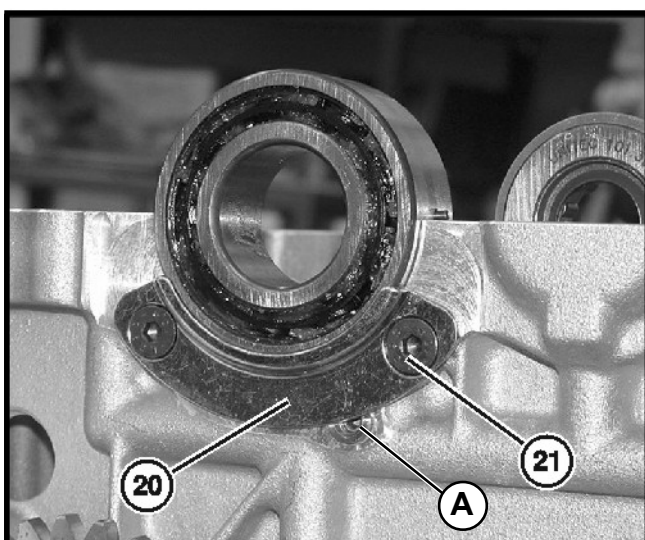
Position ball-bearings (17) and (18).



**ATTENTION:**

*Position element (19) as shown in the figure.*

Insert the shower pipe (19) completely verifying the phase on the bearing sealing plate (A).

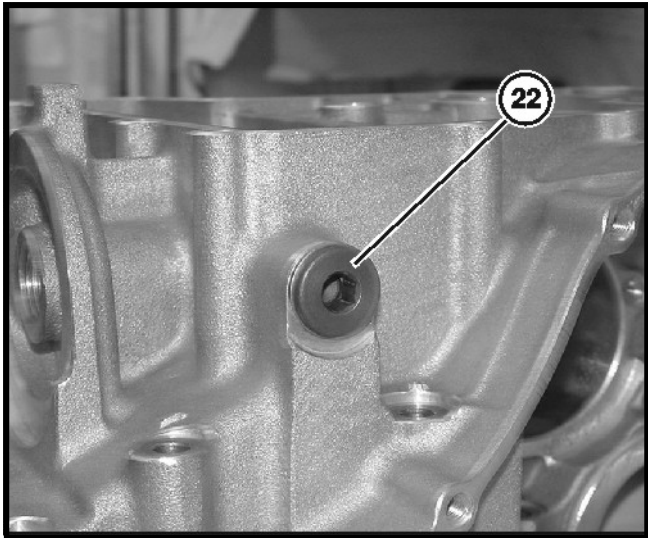


Position the tube retaining plate and ball-bearing (20) and fix with screws (21) tightly.



10 N·m 1 Kg-m + LOCTITE 648®

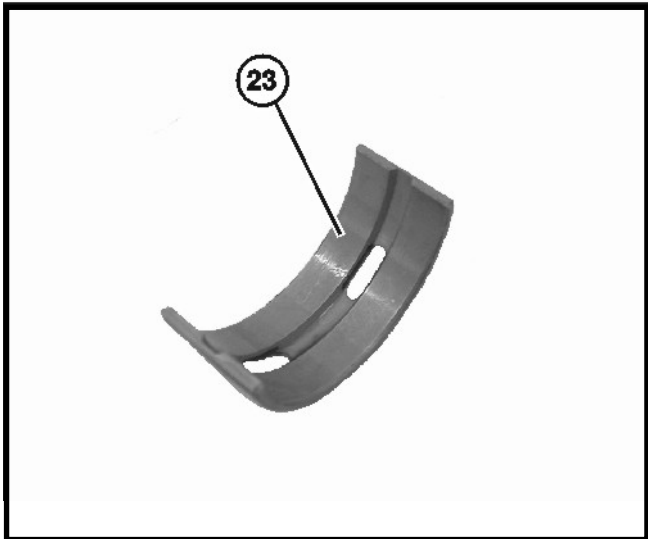




Position and tighten the copper washer and the cap (22).



25 N·m 2,5 Kg-m

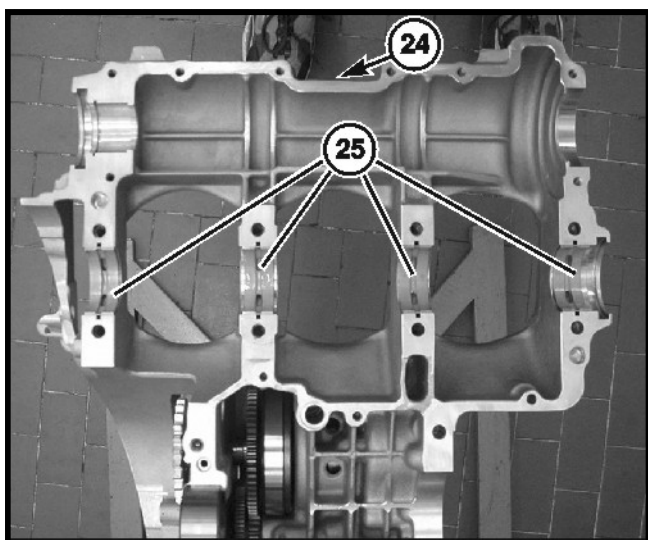


**ATTENTION:**  
*A type of semi-bronze bearing exists:*

Various liners of this semi-bronze bearing exist distinguished by different colours (see table).

BENCH SEMI-BALL-BEARING		
STD	COLOUR	SELECTION
A	Red	1.918 - 1.922
B	Blue	1.922 - 1.926
C	Yellow	1.926 - 1.930
Ø seat std A red		41.830 - 41.836
Ø seat std B blue		41.836 - 41.843
Ø seat std C yellow		41.843 - 41.849
Ø single std shaft		37.960 - 37.970

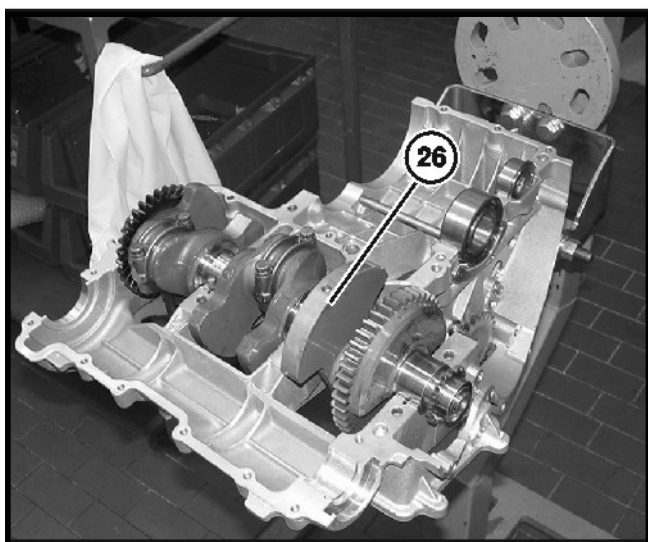




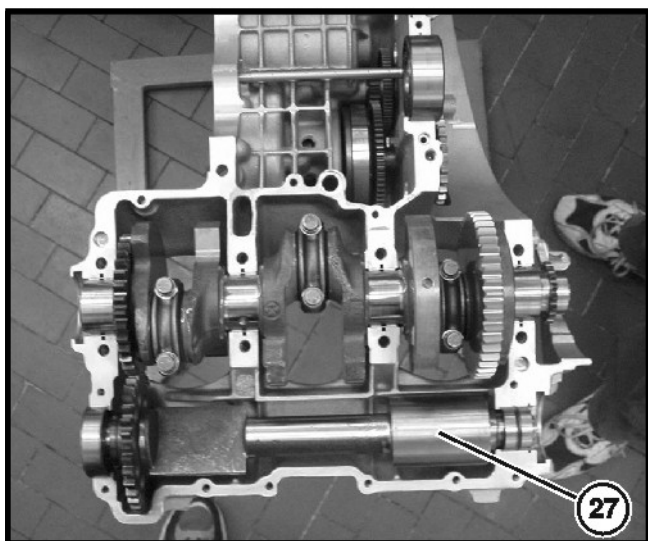
**WARNING:**  
Reading the letters must always be carried out starting from the side of the distribution chain.

Position the four semi-bronze bearings (25) each slotted with the correct colour associated with its letter stamped on the outside of the casing (24), centering them with the tooth in the cable.

LETTER	COLOUR
A	Red
B	Blue
C	Yellow

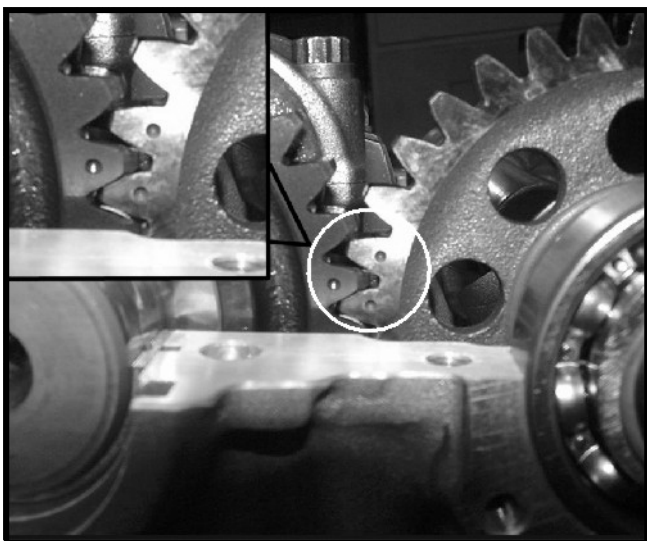


Position the engine shaft (26) as in the figure.

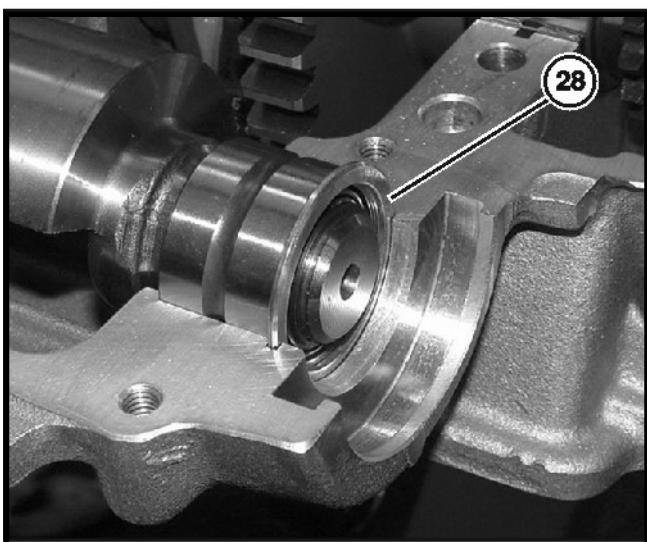


Position the balancing counter shaft (27).

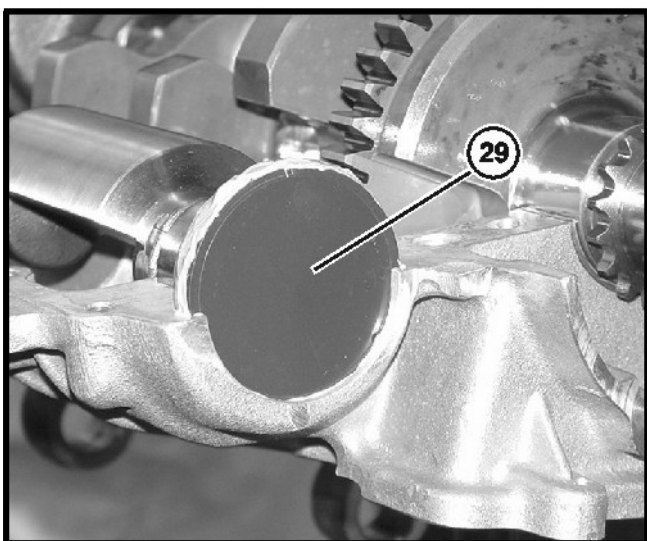




Make sure that the toothed wheels of the balancing counter shaft and the engine shaft are as shown in the figure.

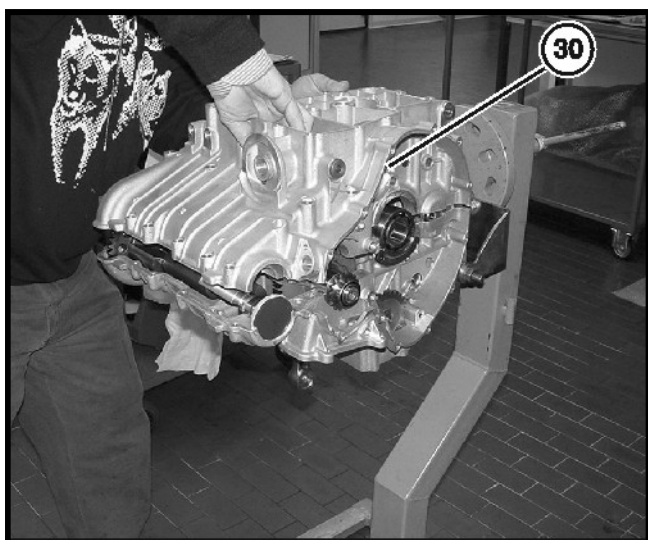


Position ring (28).

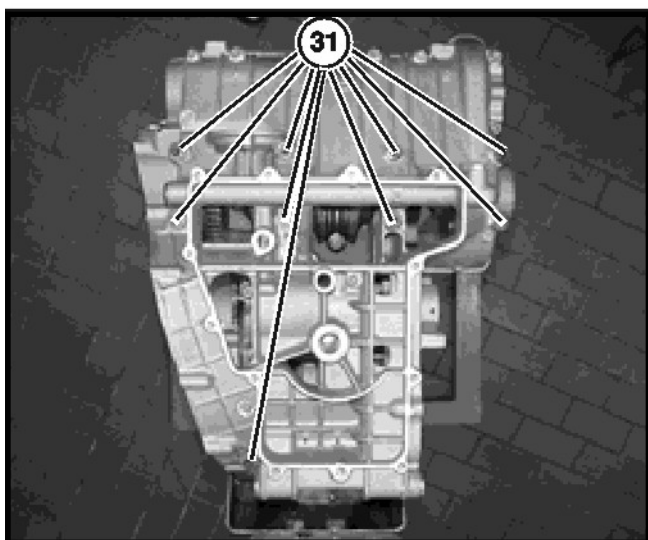


Position the large cap (29), one per side, in the apposite seats. Put THREEBOND 1215 on the contact surfaces of the two casings.





Position the lower casing (30) on the upper.



**ATTENTION:**  
Follow the mounting phases correctly.

Position the eight screws (31) with washers and copper fat and tighten to torque in three phases according to the order printed on the carter.



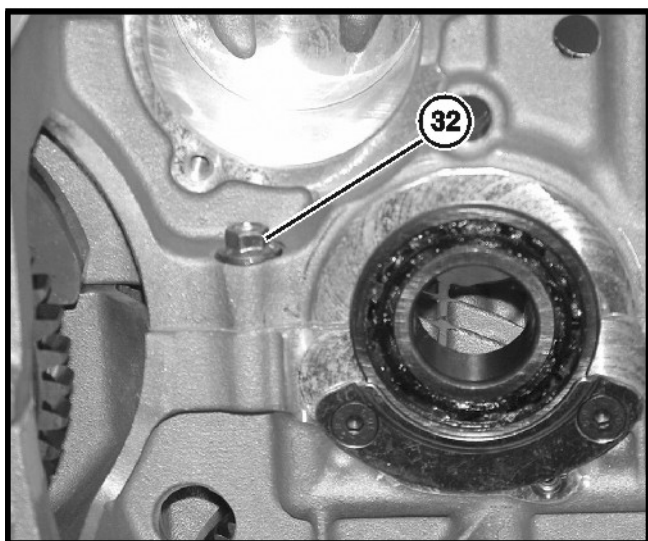
**1<sup>st</sup> 13 N·m 1.3 Kg-m**



**2<sup>nd</sup> 25 N·m 2.5 Kg-m**



**3<sup>rd</sup> 45 N·m 4.5 Kg-m**



Tighten screws (32) in two phases.

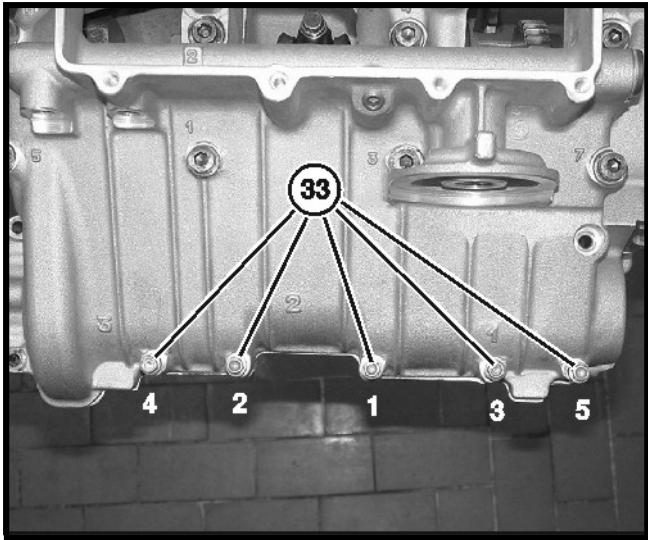


**1<sup>st</sup> 10 N·m 1 Kg-m**




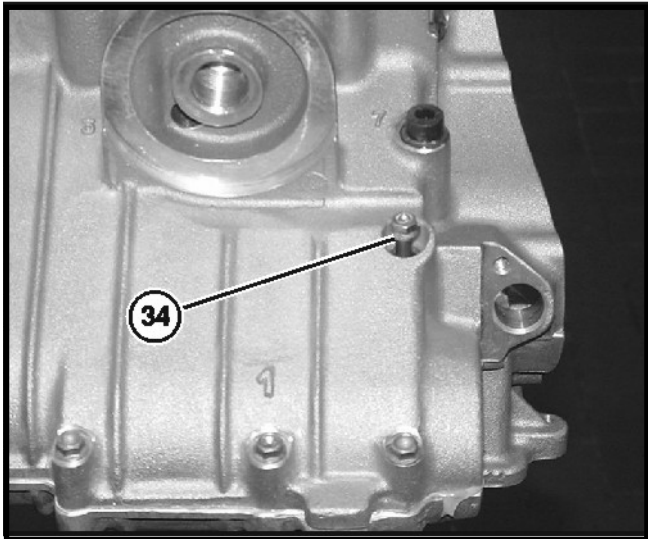
**2<sup>nd</sup> 25 N·m 2.5 Kg-m**






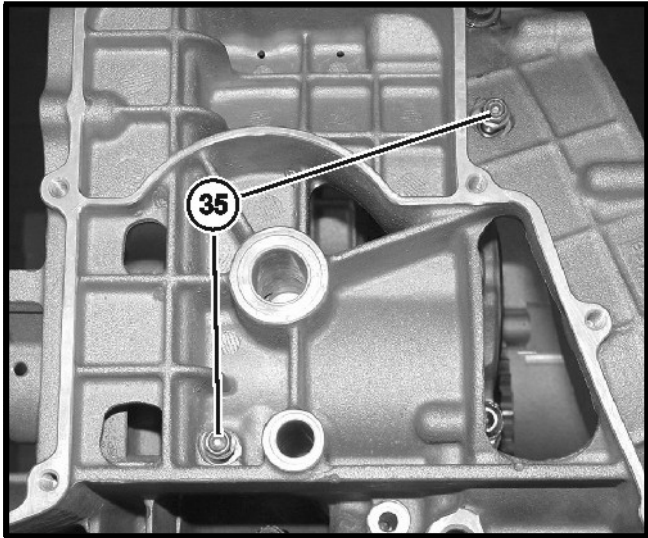
Tighten screws (33) according to the order in the figure.


10 N·m 1 Kg-m



Tighten screw (34).


10 N·m 1 Kg-m



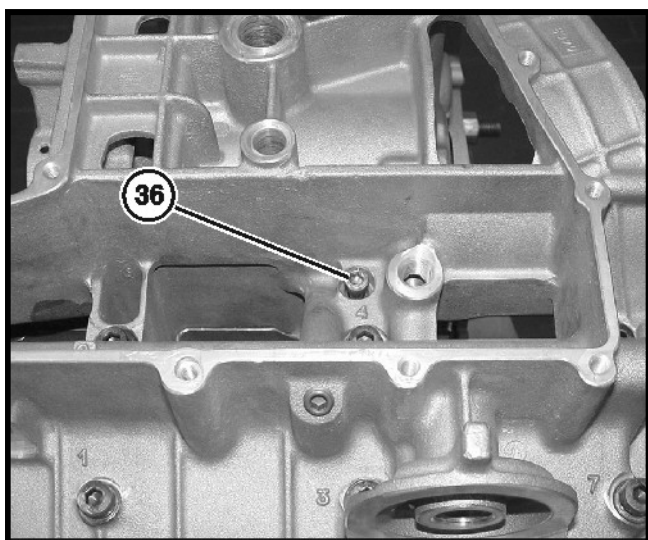
Tighten the two screws (35).

With M8 screws, the worm drive is:


1° 13 N·m 1.3 Kg-m


2° 30 N·m 3 Kg-m





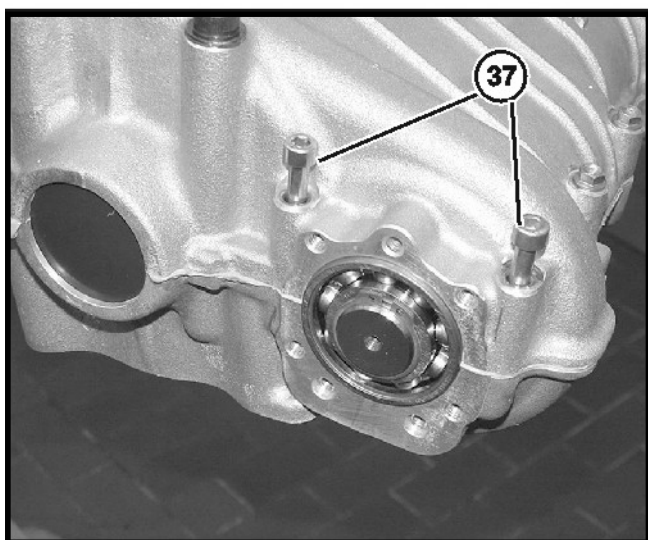
Tighten screw (36).

With M8 screws, the worm drive is:

1° 13 N·m 1.3 Kg-m



2° 30 N·m 3 Kg-m



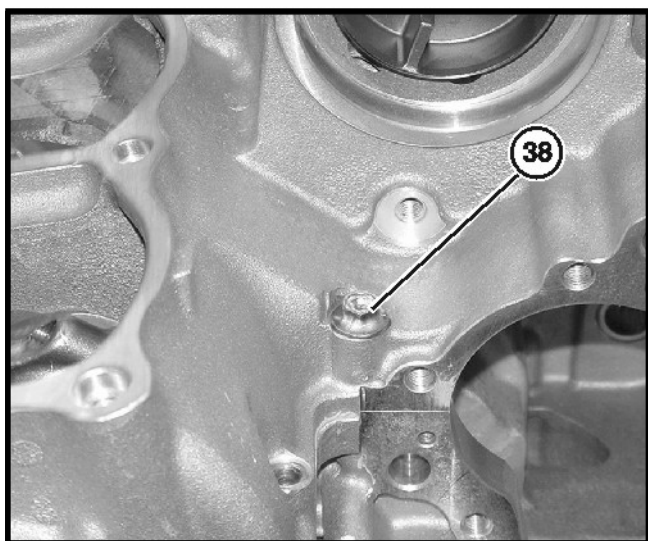
Tighten the two screws (37) in two phases.

With M8 screws, the worm drive is:

1° 10 N·m 1 Kg-m



2° 25 N·m 2,5 Kg-m



Tighten screw (38) in two phases.

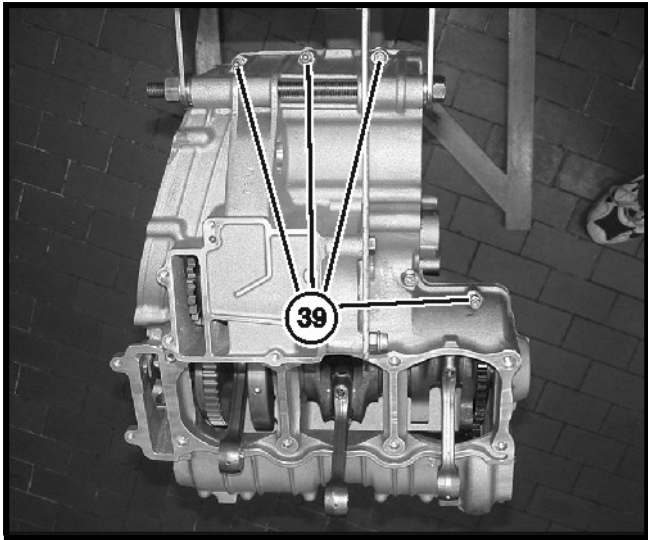
1° 10 N·m 1 Kg-m




2° 25 N·m 2.5 Kg-m

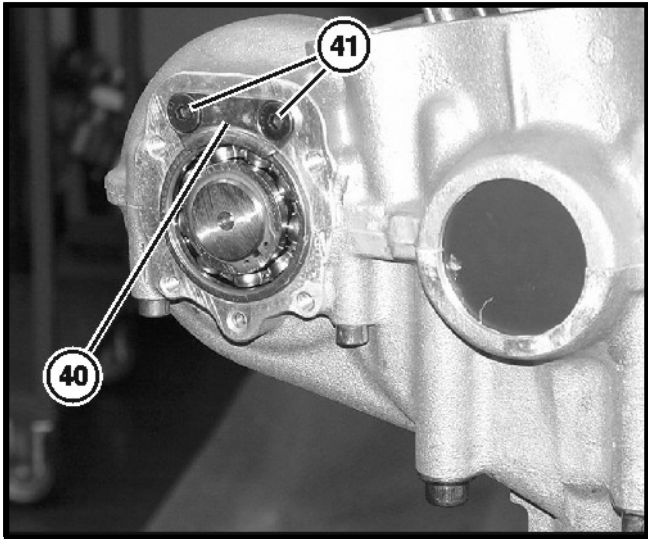







Tighten the four screws (39).

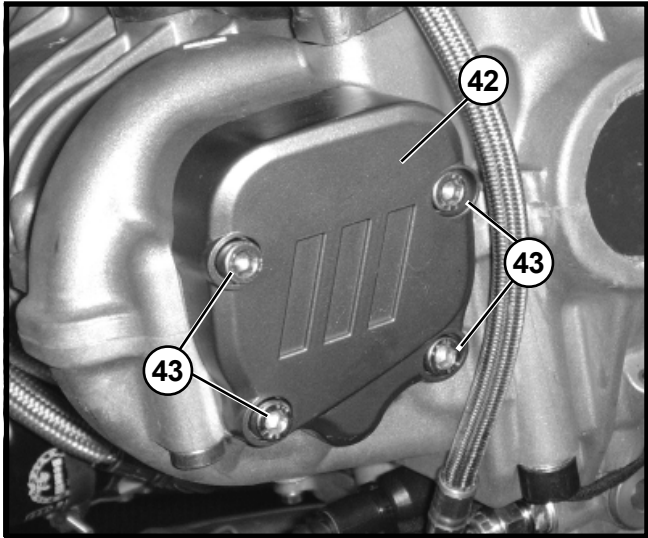

1° 10 N·m 1 Kg-m




Position balancing counter shaft ball-bearing stop plate (40) and fix with the two screws (41) tightly.


10 N·m 1 Kg-m


**ATTENTION:**  
Always use new gaskets.



Position the gasket and the counter shaft cover (42). Tighten the screws (43).


10 N·m 1 Kg-m

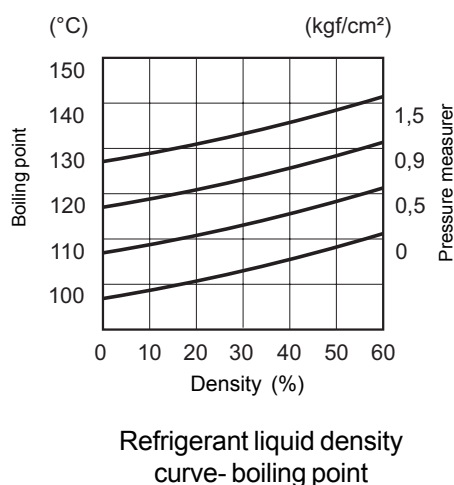
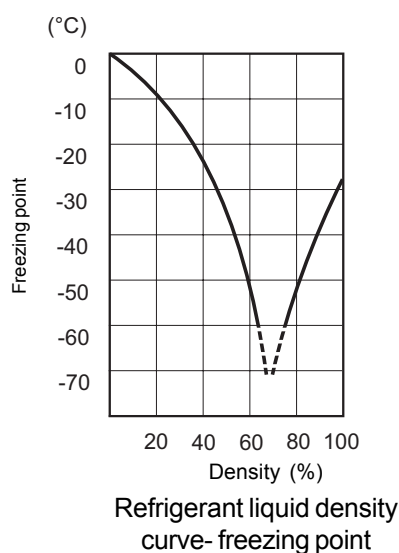




## Cooling Plant

## 6 COOLING PLANT

Antifreeze density	Freezing point
50%	-30°C
50%	-40°C
60%	-55°C



### REFRIGERANT LIQUID ENGINE

The cooling circuit is filled in the factory with a 50:50 mixture of distilled water and ethylene glycol antifreeze.

This 50:50 mixture provides optimum protection against both corrosion and temperature and shelters the cooling system against freezing at temperatures higher than -31°C.

If the motorcycle is exposed to temperatures lower than -31°C, the ratio of the mixture must be increased up to 55% or 60% as indicated in the figure.



#### WARNING:

**Use good quality ethylene glycol based antifreeze mixed with distilled water. Do not mix alcohol based antifreeze or other brands of antifreeze.**

**Do not use more than 60% or less than 50% of antifreeze. (See the figure to the left).**

**Do not use additives against radiator loss.**

Refrigerant liquid engine at 50% including tank capacity.

Antifreeze	1500 ml
Water	1500 ml



#### ATTENTION:

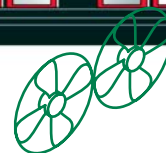
**Boiling water or steam can cause grave burns if the radiator tap is removed while the engine is still hot. After having let the engine cool down, wrap a thick cloth around the tap and remove it cautiously, rotating it a quarter of a turn to release the pressure and then unscrew it completely.**

**The engine must be cold when carrying out maintenance of the cooling system.**

**Refrigerant liquid is damaging:**

- If it comes into contact with the skin or the eyes, rinse with abundant water.
- If it is swallowed, make yourself be sick and call a doctor immediately.
- Keep the liquid in a safe place.





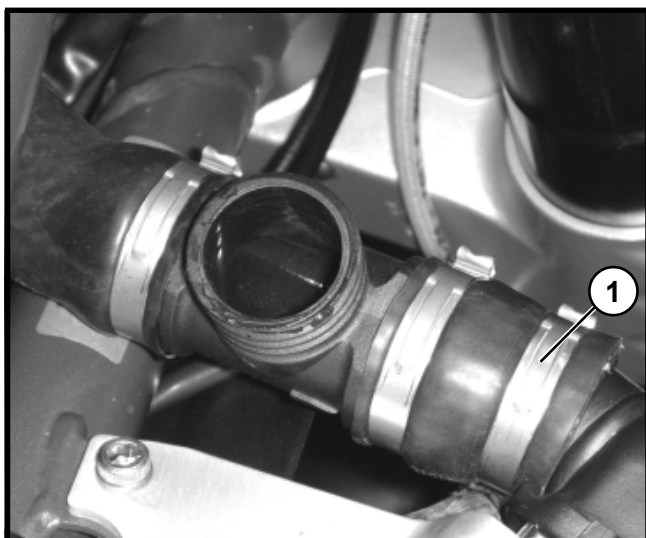
## 6.1 RADIATOR

### 6.1.1 DISMANTLE RADIATOR

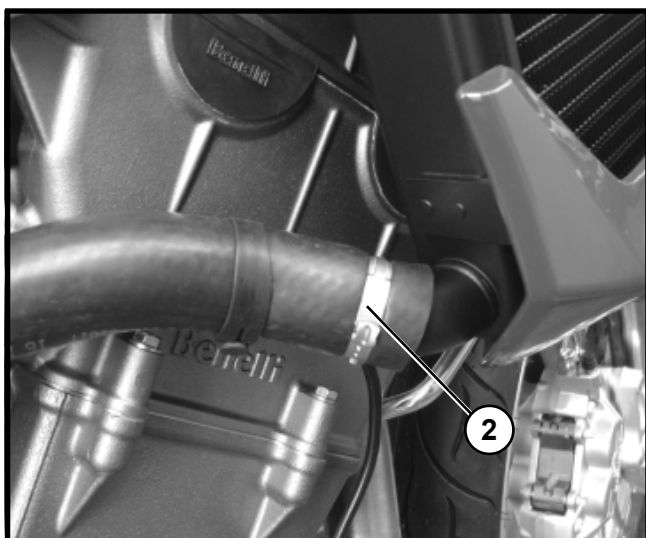
Remove cooler fairings (see "COOLER FAIRING DISASSEMBLY")



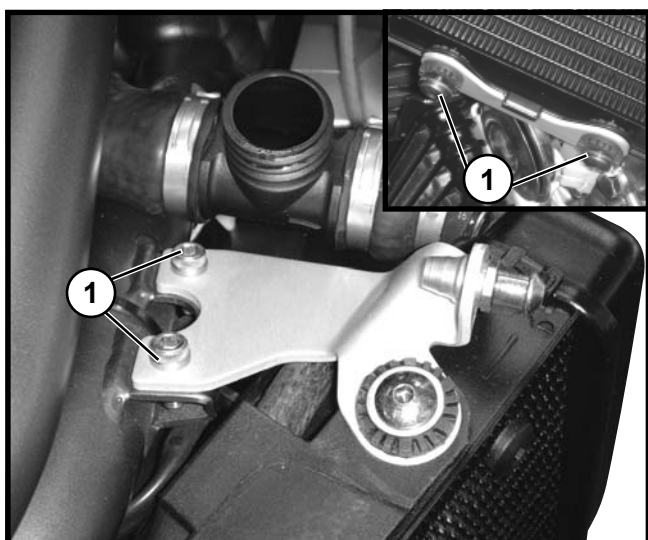
Take off the elastic clamp (1) on the right side cooler pipe union.



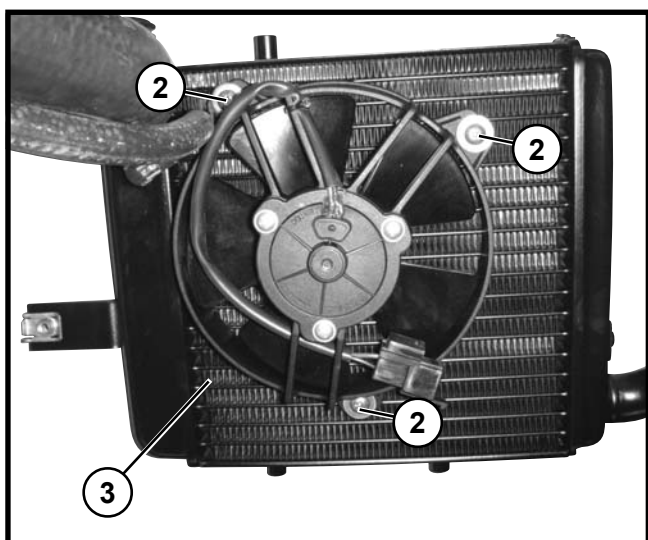
Take off the lower elastic clamp (2) on the cooler.



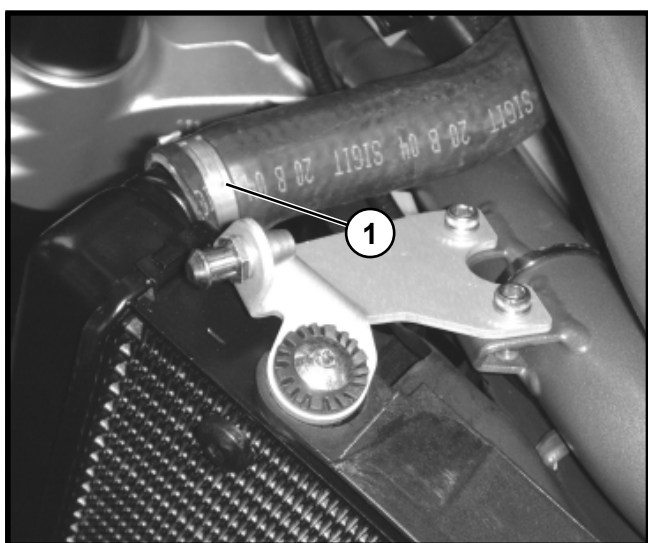




Remove the upper and lower fixing screws (1).  
Take off the cooler, disconnect the fan connector.



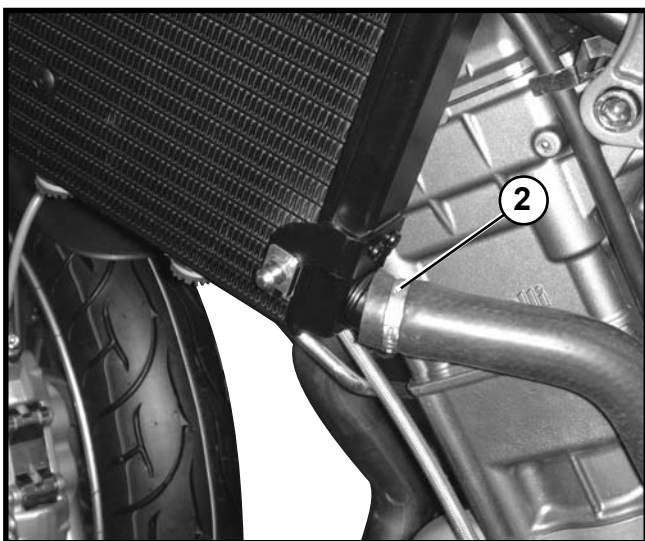
Unscrew the screws (2).  
Remove the fan from the cooler (3).



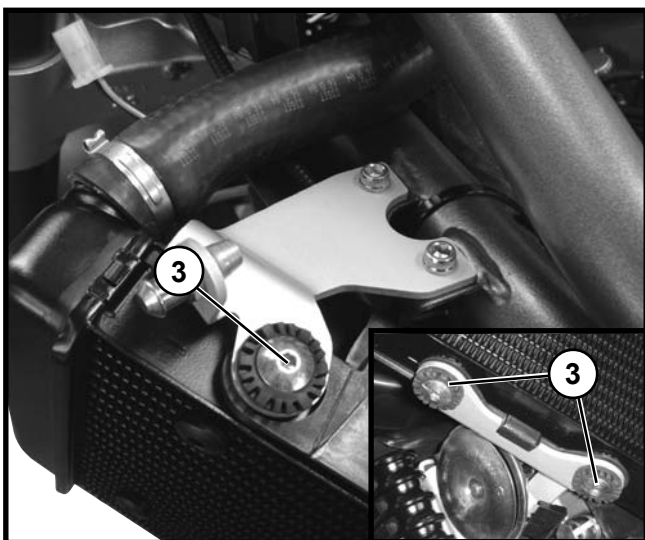
#### 6.1.1.1 LEFT COOLER DISASSEMBLY

Remove the cooler fairings (see "fairing disassembly").  
Take off the upper elastic clamp (1).



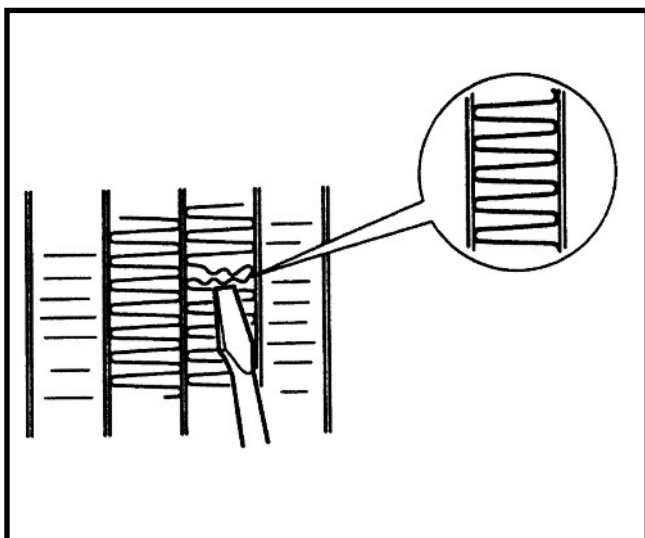


Take off the lower elastic clamp (2) on the cooler.



Remove the upper and lower fixing screws (3).  
Take off the cooler.  
Disconnect the fan connector.





### 6.1.2 COOLER CHECK AND CLEANING

Bent or indented tabs can be straightened with a small screwdriver.

Dirt and foreign bodies must be removed.

We recommend using compressed air for cleaning.

Repair or change the radiator if necessary.

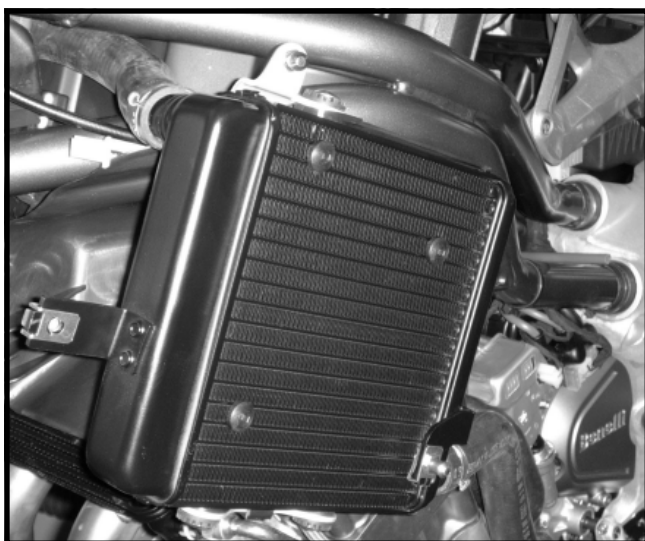
If any water-carrying tube is cracked or flattened, it must be removed.

Check the state of the radiator entry and exit tubes. If any water-carrying tube is cracked or flattened, it must be removed.

Change the elements if necessary.



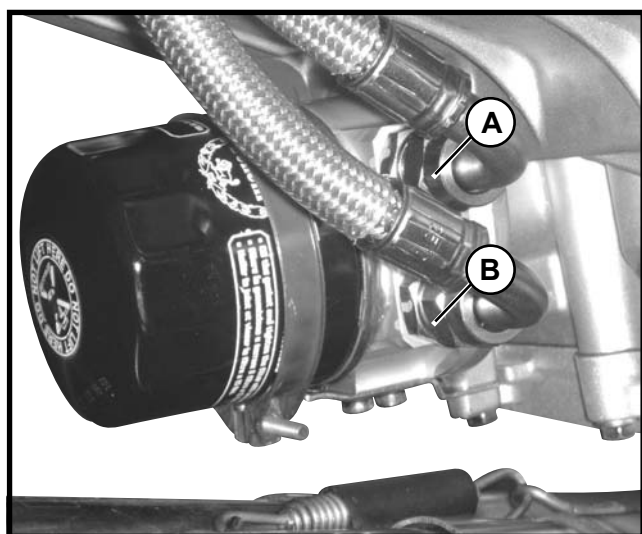
Verify the tightness of the radiator cap. (1) checking that it is not damaged or deformed.



### 6.1.3 RIGHT RADIATOR ASSEMBLY

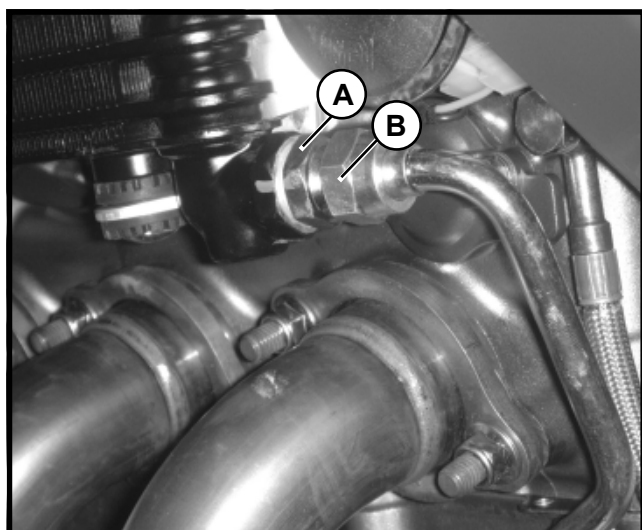
Reverse the operations described in the dismantling procedure. Pour the refrigerant liquid into the the cooling plant (see "CHANGE REFRIGERANT LIQUID").



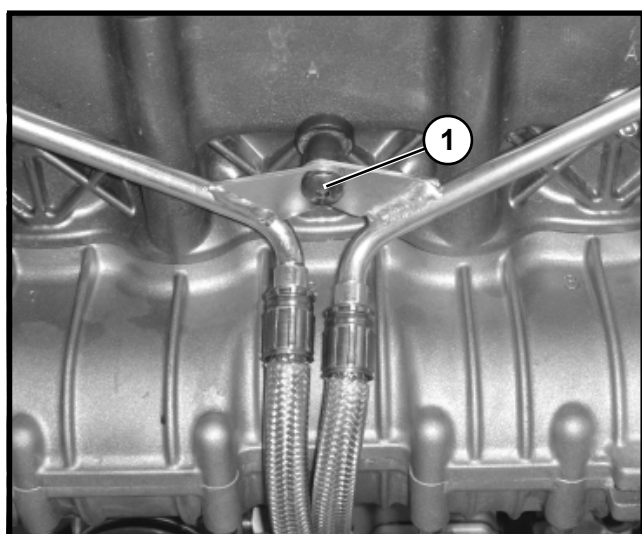


#### 6.1.4 OIL RADIATOR DISASSEMBLY

Put the container under the oil filter to impound the oil to blow off. Remove the two pipes fittings (A) and (B) on the oil distributor. Blow off the oil in the container.

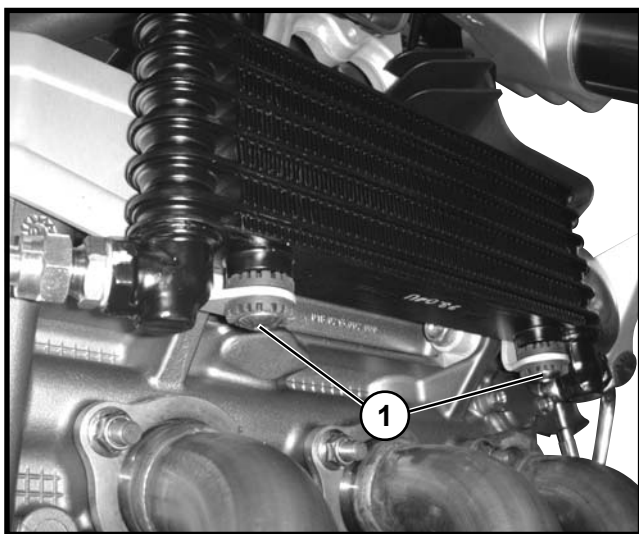


Loosen and remove the two pipe unions (A) and (B) on the oil cooler.

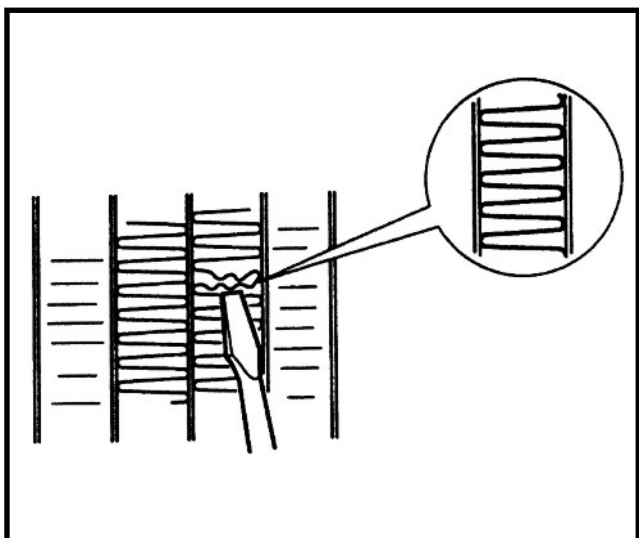


Loosen and remove the oil cooler pipe fixing screw (1) on the engine.



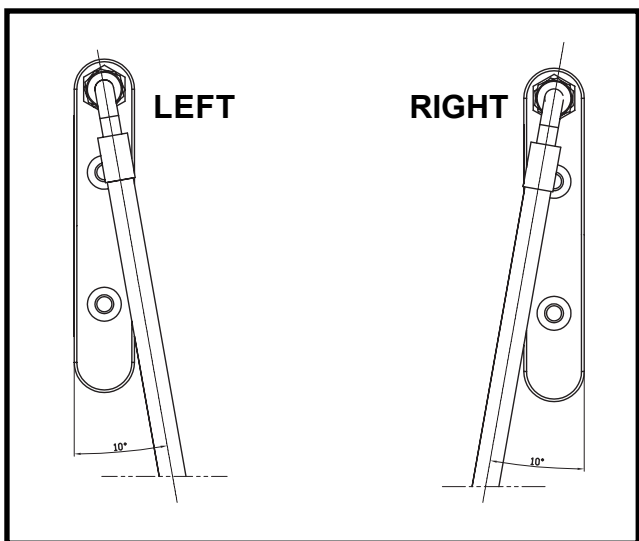


Loosen and remove the cooler fixing screws (1).  
Take off the cooler from the support removing it.



### 6.1.5 OIL COOLER CHECK AND CLEANING

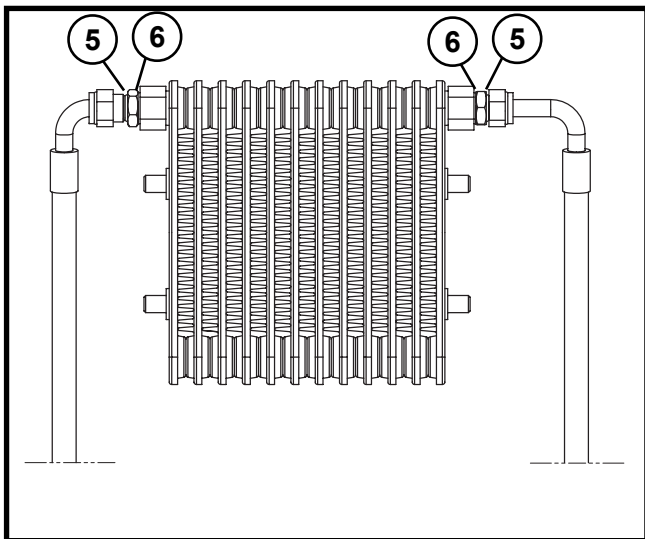
Verify the radiator wings conditions.  
Bent or nicked wings can be rectified with a small screwdriver.  
For the cleaning the foreign materials must be removed.  
For the cleaning we suggest you to use compressed air.  
If necessary repair or replace the radiator.  
If one of the two delivery and recovery oil tubes are damaged, squashed or cracked replace them.



### 6.1.6 OIL COOLER ASSEMBLY

To install the radiator again on the frame, use the inverse procedure instead of the disassembly.  
Put the two oil delivery and recovery tubes on the radiator maintaining the right inclination.

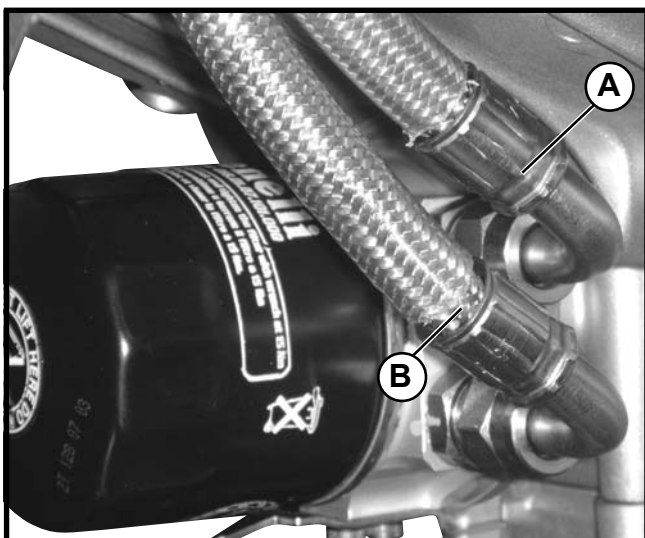




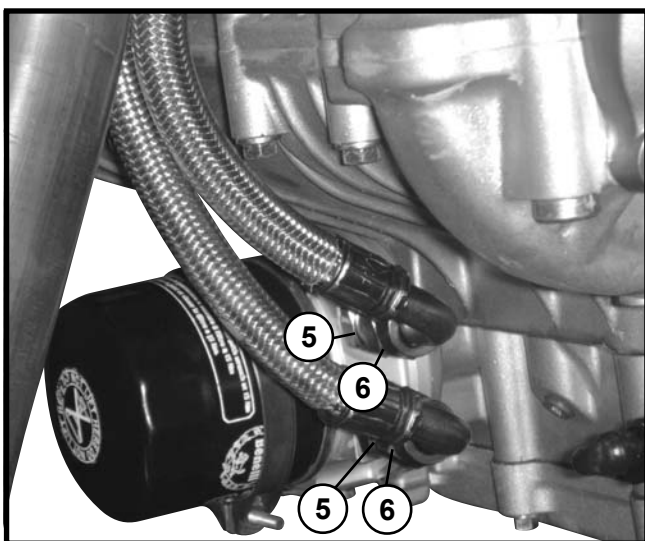
Close in couple the two connectors (5/6) on the radiator.



**30 Nm 3 Kg-m**



Put the two oil delivery and recovery tubes (A) and (B) on the distributor.



Close in couple the two connectors (5/6) on the distributor.

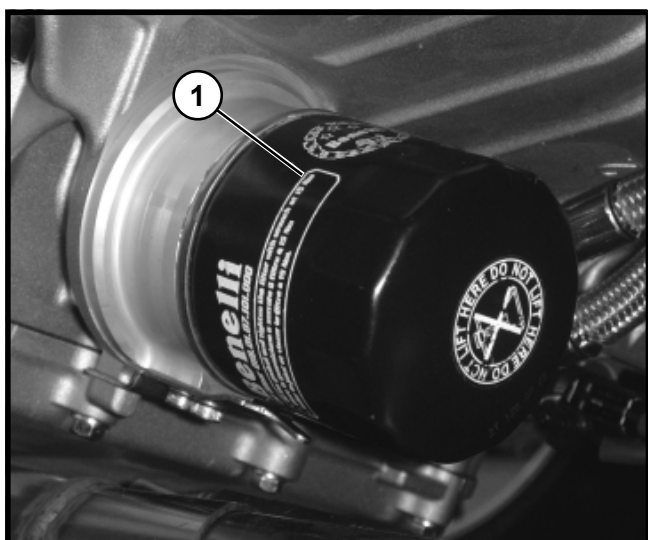


**30 Nm 3 Kg-m**



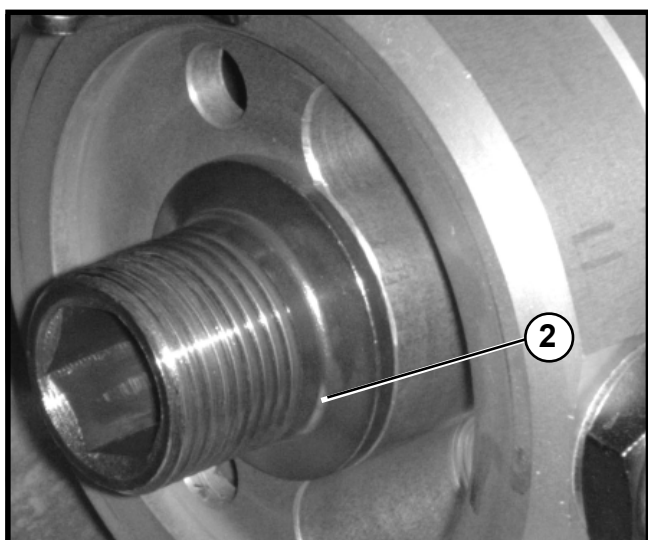
**WARNING:**  
Fit the oil with about 400cc, make the starting motor rotate without switching on the motor, favouring in this way the lubrication system reintegration.





## 6.2 OIL DISTRIBUTOR

Remove the exhaust system.  
Remove the engine oil filter (1) ( see " OIL FILTER REMOVAL ").  
Disconnect the inlet and outlet pipes of the oil distributor.



**NOTE:**  
**Take care not to lose the clearance.**

Loosen and remove the screw (2) and remove the distributor.  
Loosen and remove the two underlying screws.

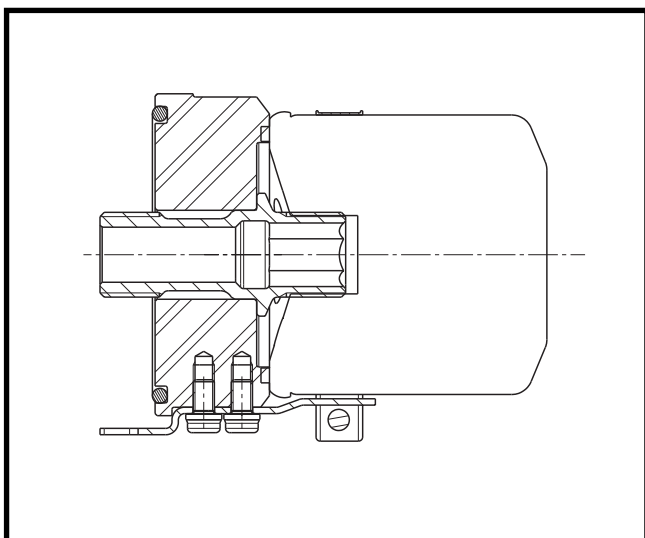


Be sure that the distributor is not damaged or clogged, otherwise replace the particular.  
Verify that the delivery and recovery oil tubes are not broken.  
Change the damaged element if necessary.

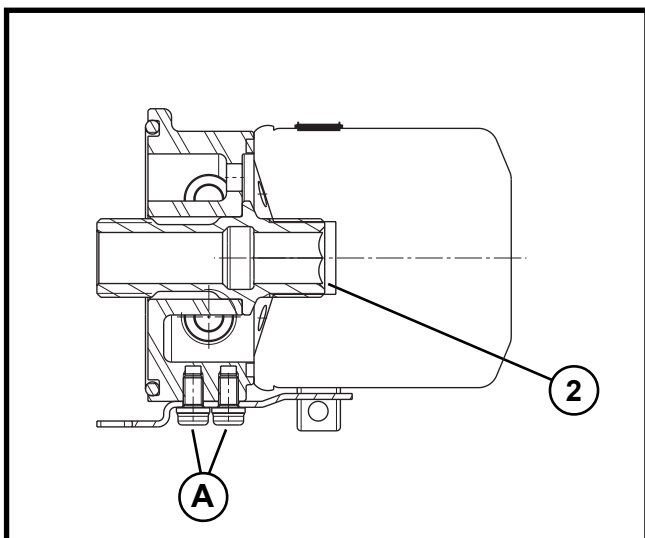


## 6.2.1 OIL DISTRIBUTOR ASSEMBLY

Oil the O-Ring (1) on the distributor.



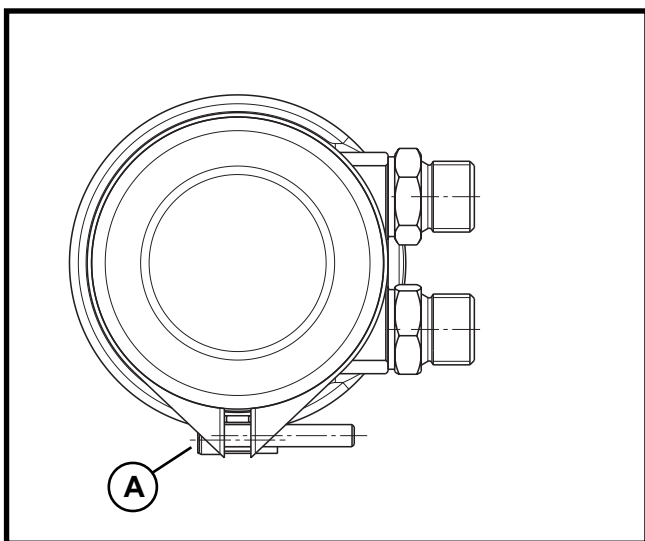
Place the oil distributor with the phase plaque without closing the two screws (A).  
Close in couple, in two phases the connector screw (2).



1° phase: 30 N·m 3 Kg-m

2° phase: 60 N·m 6 Kg-m

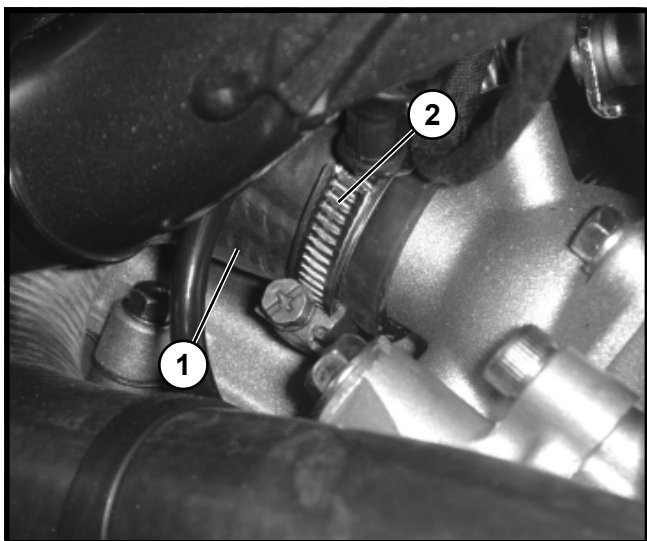
Close in couple the two screws (A) of the phase plaque.  
Remount the oil filter.



6 N·m 0,6 Kg-m

Reintroduce the lacking oil into the engine.  
Remount the exhaust plant.





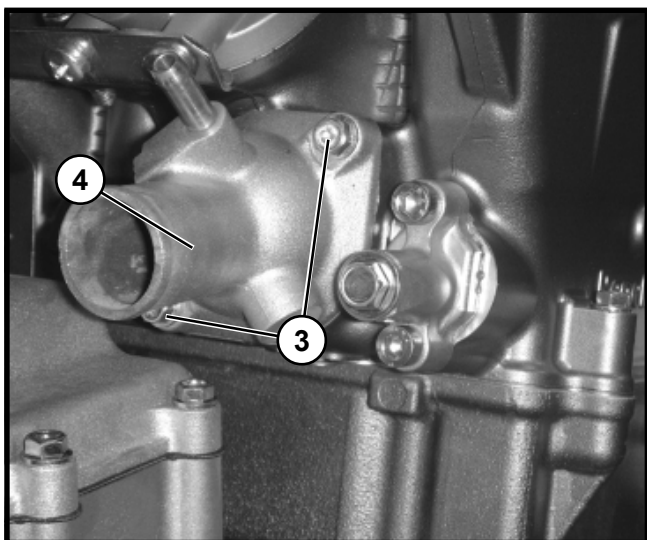
## 6.3 THERMOSTAT

### 6.3.1 DISMANTLE THERMOSTAT

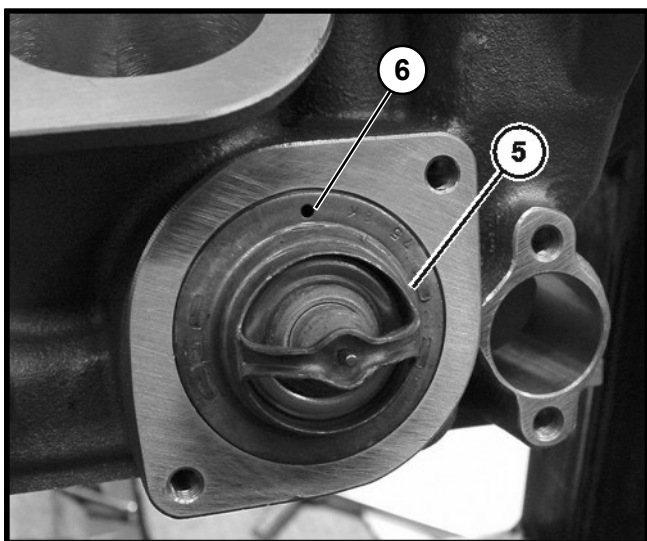


**WARNING:**  
*Always use new gaskets and oil seals.*

Remove the refrigerant liquid from the cooling circuit (see "CHANGE REFRIGENRANT LIQUID").  
Remove the tube (1) loosening the clamp (2).

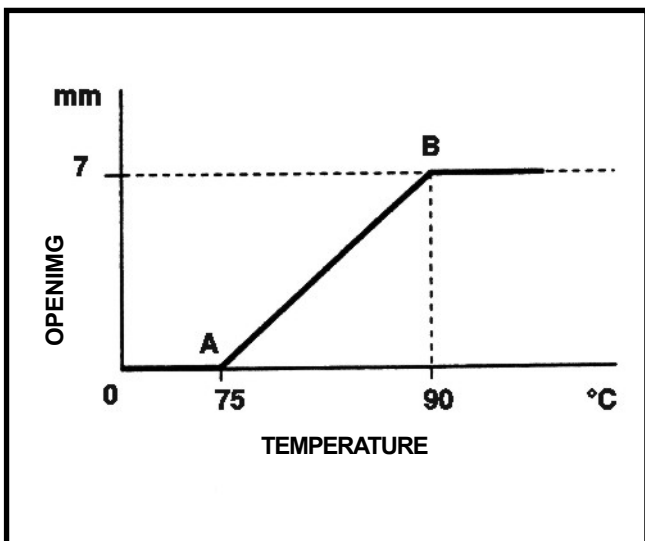


Loosen and remove the two screws (3) and remove the thermostat cover (4).



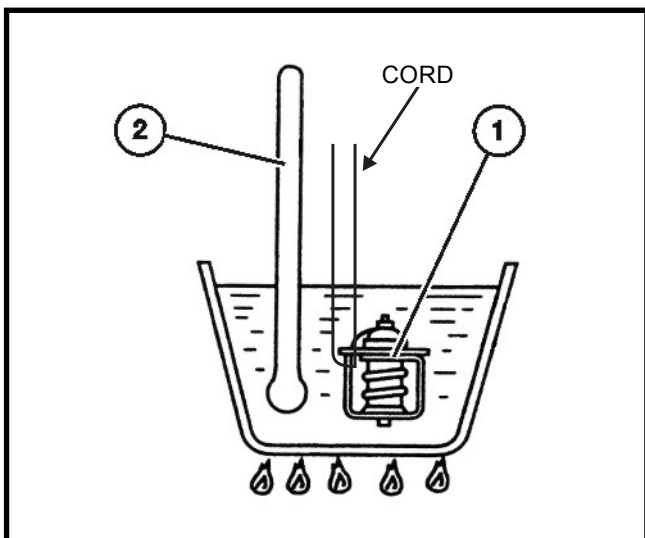
Remove the thermostat (5).  
Verify that the by-pass hole (6) is not obstructed.





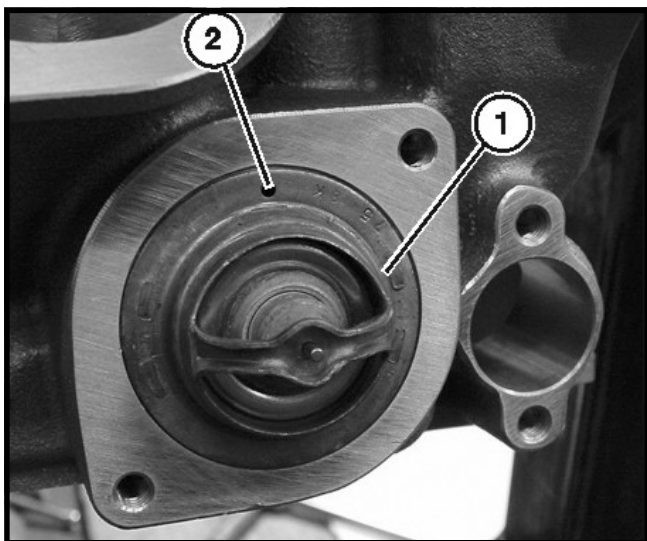
### 6.3.2 CHECK THERMOSTAT

The thermostat begins and opens at around 75°C and reaches 7 mm minimum opening at 90°C, as shown in the diagram in the figure.



Check whether the thermostat pad is cracked.  
 Pass a cord through the flange as indicated in the figure.  
 Check the above-mentioned conditions by immersing the thermostat (1) in a container with water, maintaining it in suspension.  
 Slowly heat the water and check the temperature with a thermometer (2).  
 When a temperature of 75°C is reached, the thermostat valve begins to open and arrives at a temperature of 90°C.  
 The thermostat valve reaches an opening of at least 7 mm.  
 Change the thermostat if necessary.  
 Check that the thermostat cover and the tubes connected to it are not broken, otherwise change the damaged element.





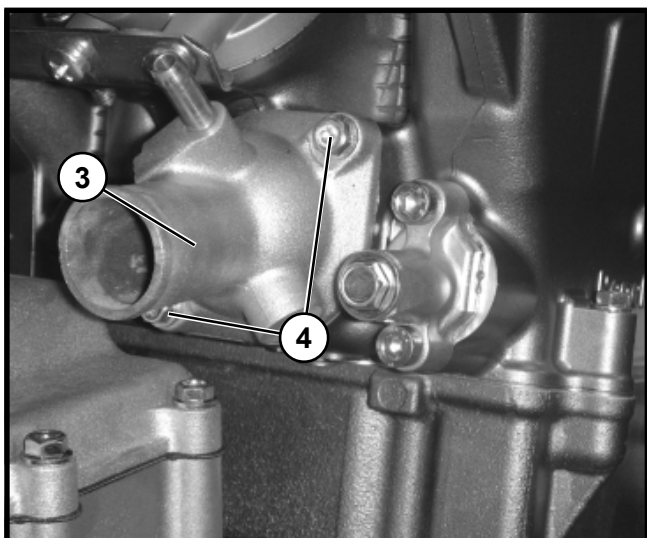
### 6.3.3 MOUNT THERMOSTAT



**WARNING:**

*The thermostat must be mounted with the by-pass hole (2) turned upwards, as in the figure.*

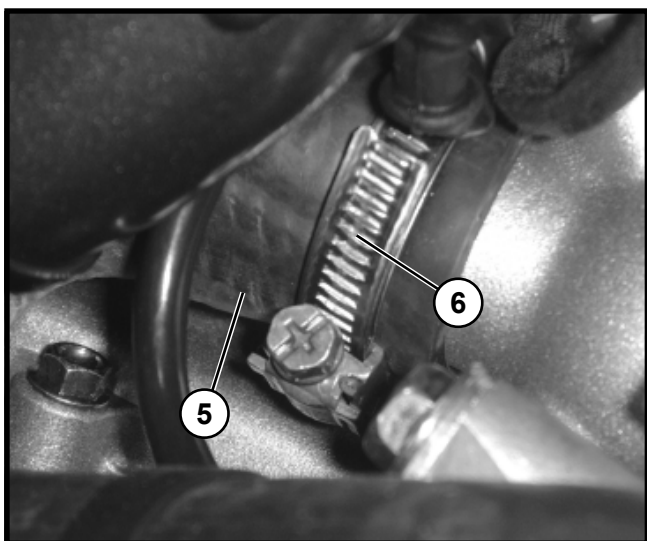
Position the thermostat (1) as indicated in the figure.



Position the thermostat cover (3) and tighten with the two screws (4) il coperchio termostato (3) e fissare con le due viti (4).



10 N·m 1 Kg-m



Place the tube (5) and tighten the clamp (6).  
Reinsert the refrigerant liquid into the cooling circuit (see "CHANGE REFRIGERANT LIQUID"),

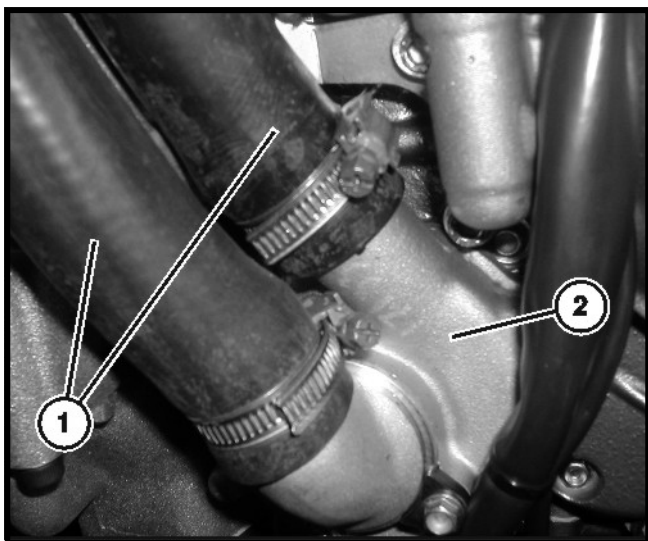


## 6.4 WATER PUMP

### 6.4.1 REMOVE WATER PUMP

Remove the refrigerant liquid from the cooling circuit ("CHANGE REFRIGERANT LIQUID").

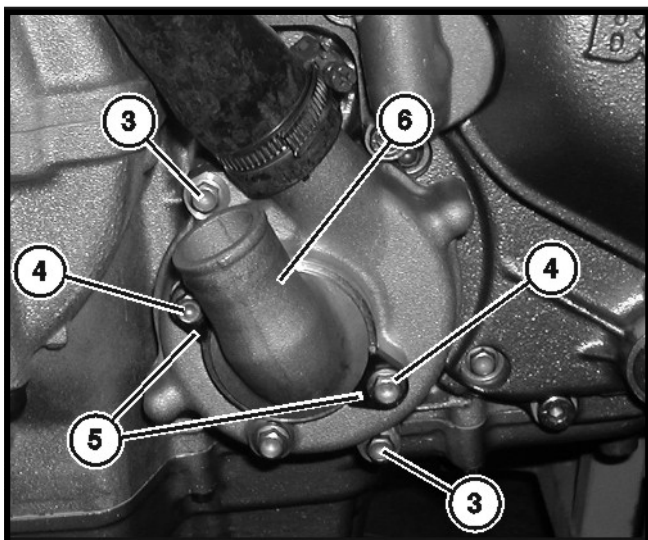
Remove the inlet and outlet pipes(1) from the pump (2) .



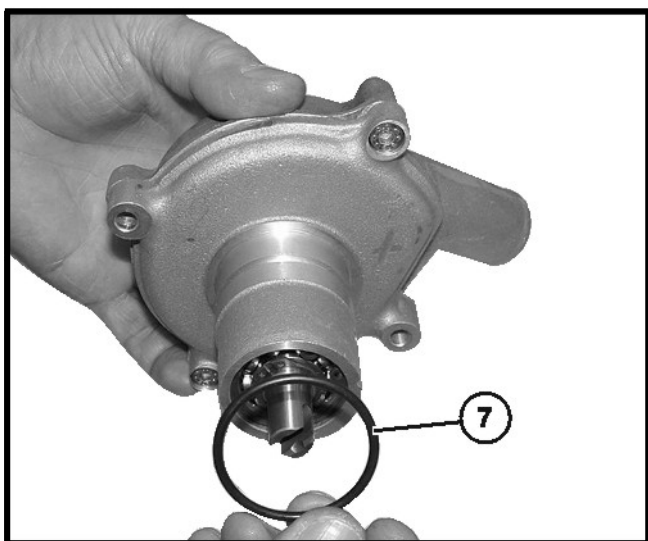
### 6.4.2 DISMANTLE WATER PUMP

Loosen and remove the two screws (4) and the small plates (5). Remove the entry elbow (6).

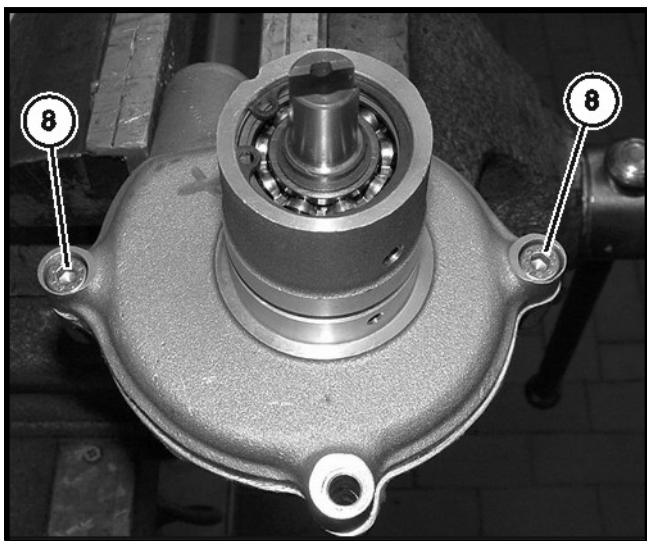
Loosen and remove the two screws (3) and remove the water pump from the engine.



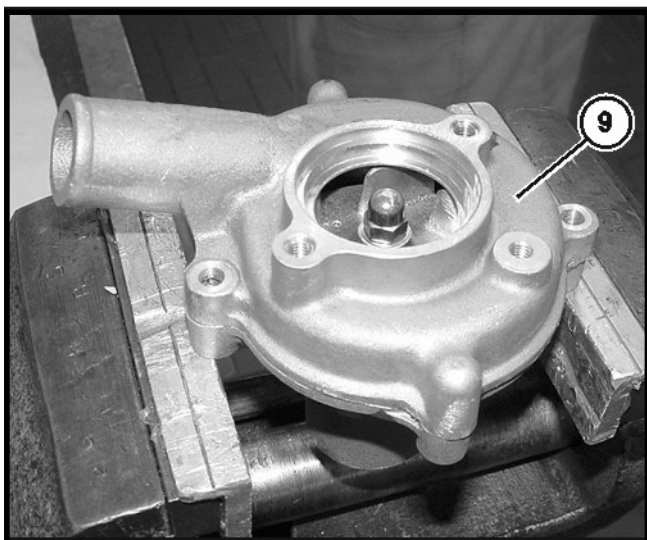
Remove the l'O-Ring (7).



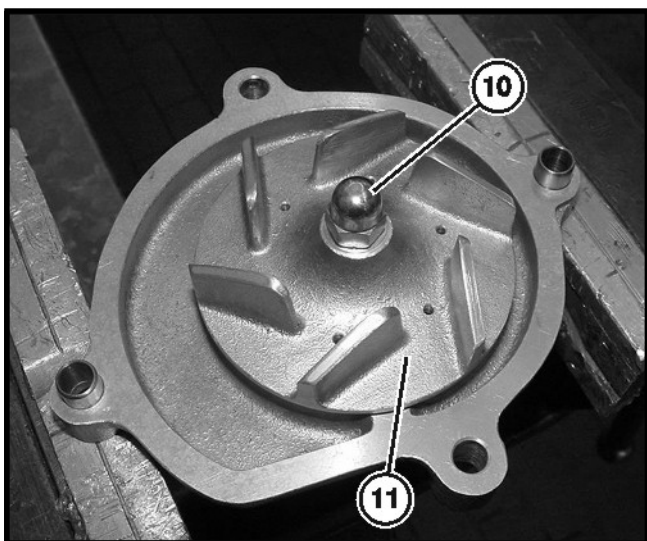




Loosen and remove the two screws (8).

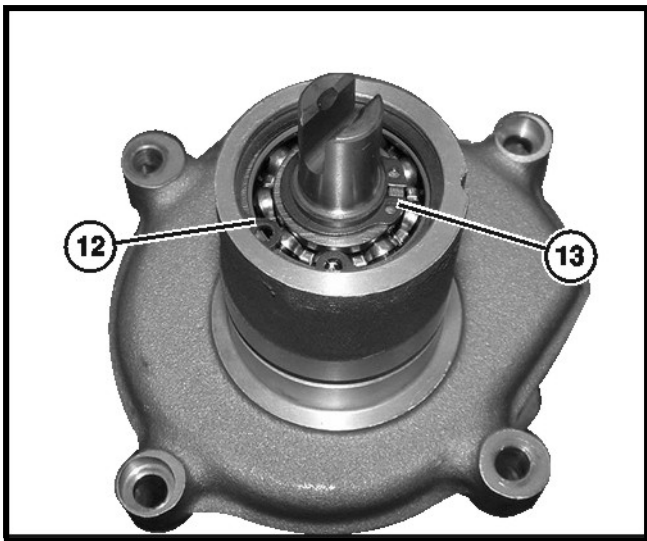


Remove the cover (9).

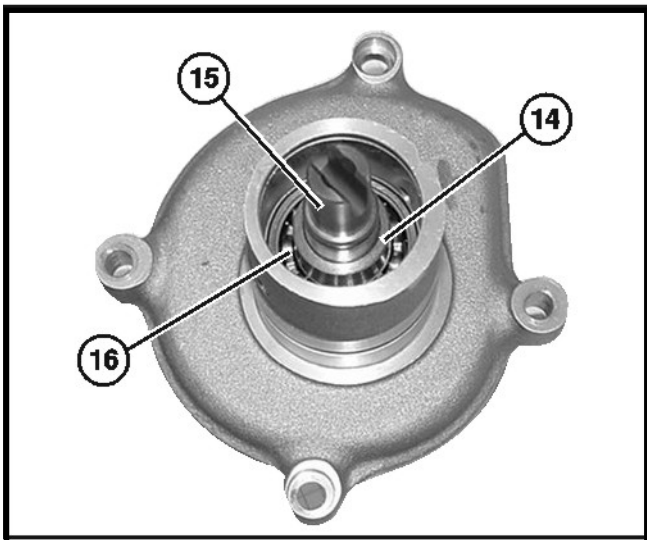


Loosen and remove the nut (10) and remove the rotor (11).

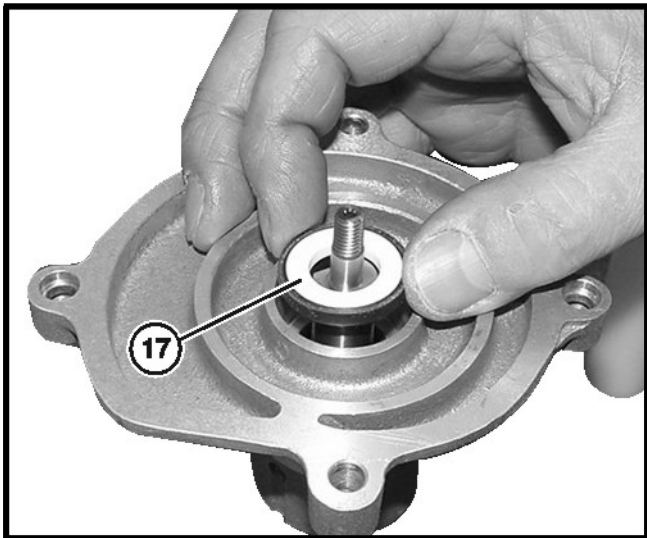




Remove the external circlip (12), the internal circlip (13) and the ball-bearing beneath.

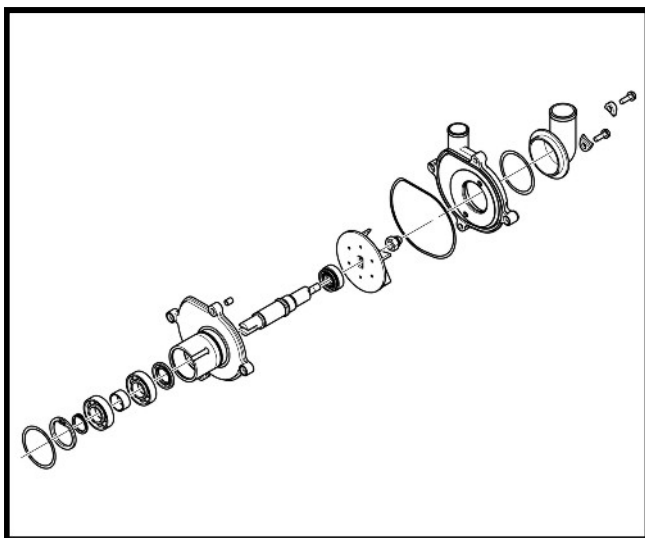


Remove the liner (14), the shaft (15), the ball-bearing (16) and the oil seal beneath.



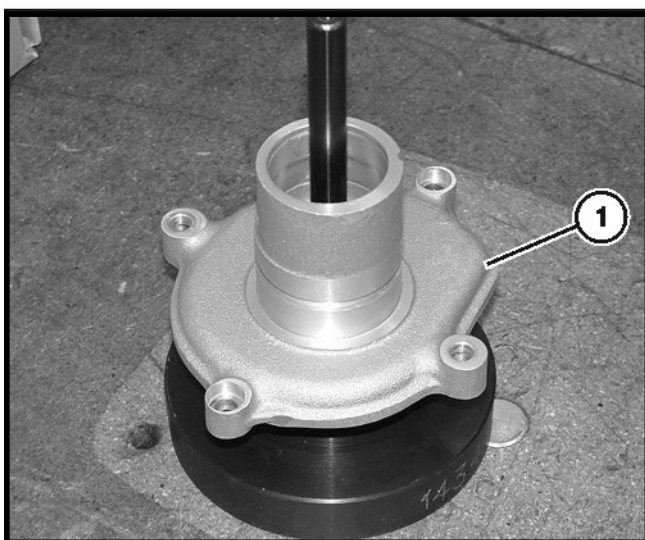
Remove the mechanical seal (17).





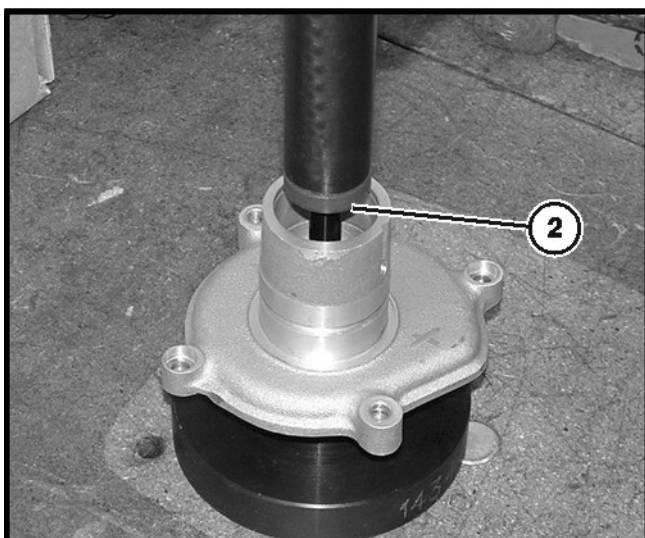
### 6.4.3 CHECK WATER PUMP

Check the state of wear of the various components of the pump.  
Check that the various elements are not broken.  
Change worn or damaged elements if necessary.



### 6.4.4 WATER PUMP ASSEMBLY

Position the pump body (1) on a support.

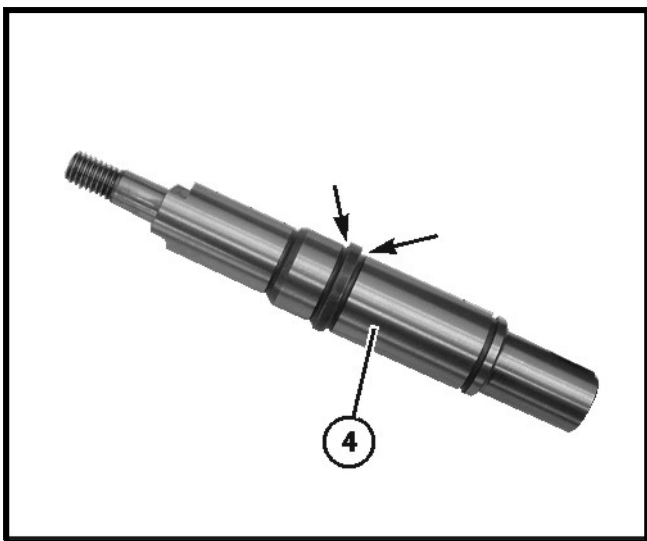


**ATTENTION:**

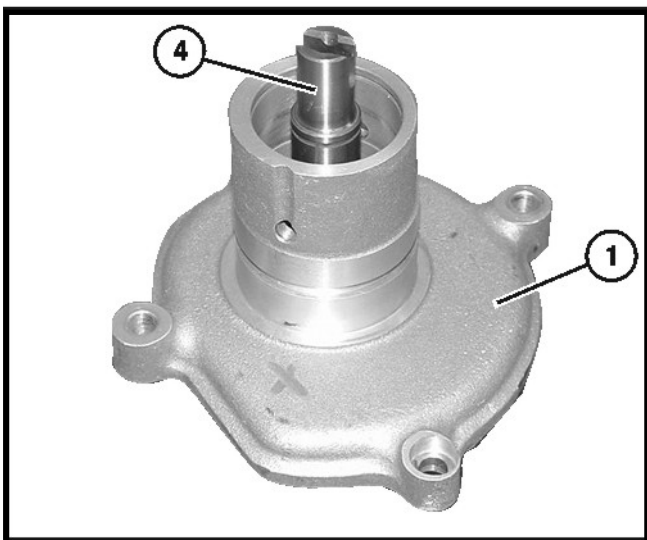
*The oil seal must be inserted downwards with the lip closed.*

Position the oil seal until it touches (2).

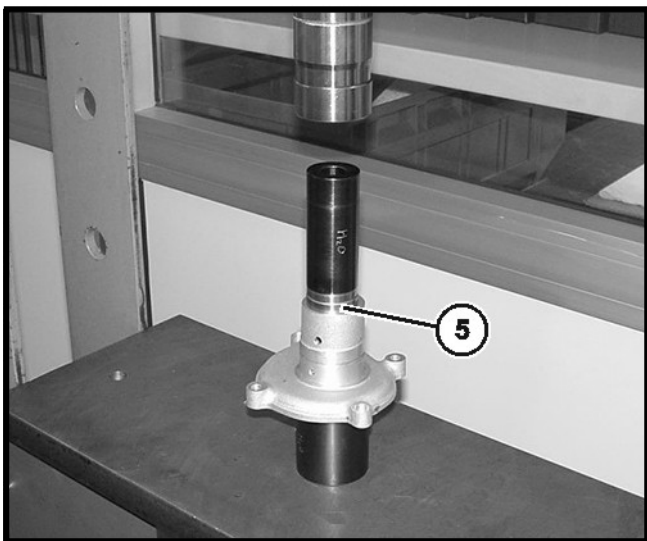




Grease the shaft (4) at the points indicated in the figure.

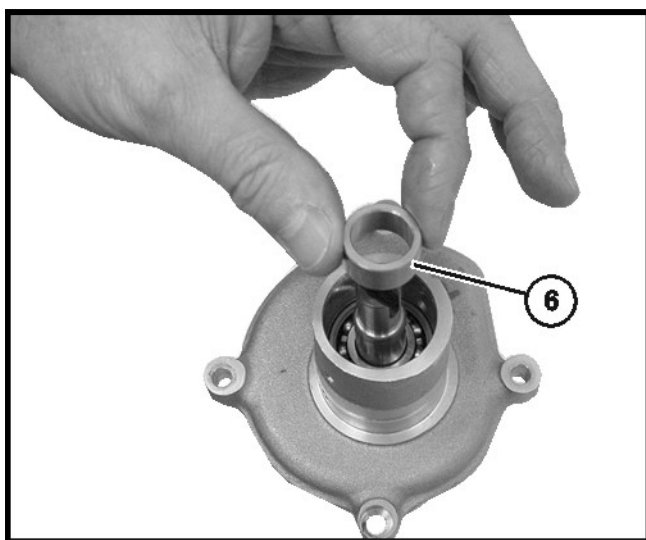


Position the shaft (4) inside the pump body (1).

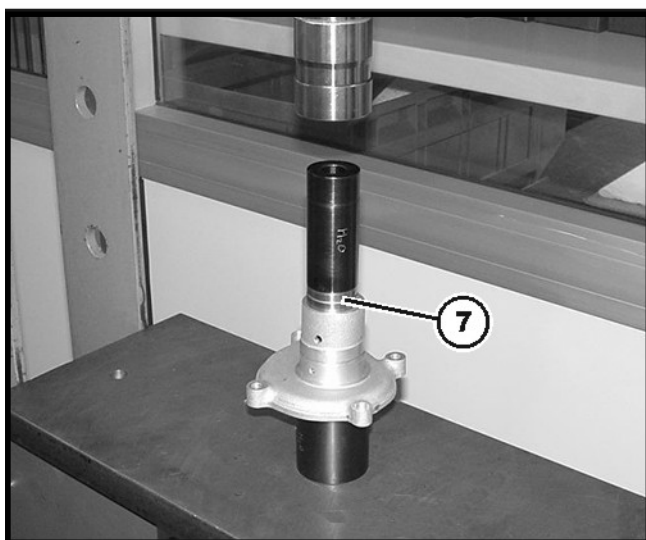


Position the first ball-bearing (5), using a press to make it touch.

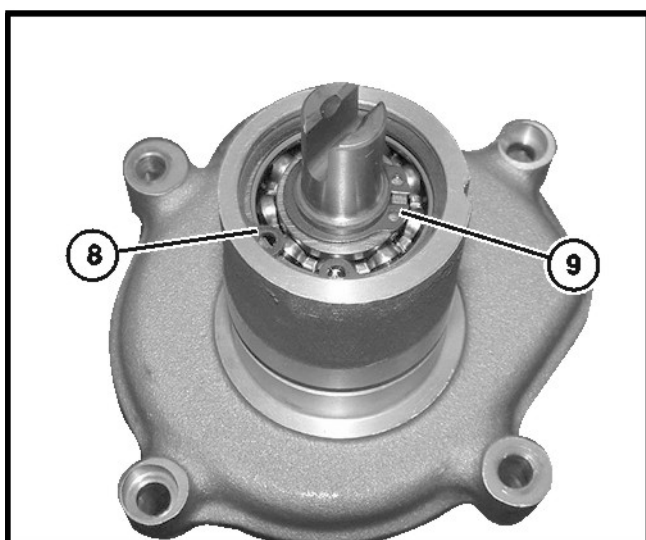




Position the liner (6).

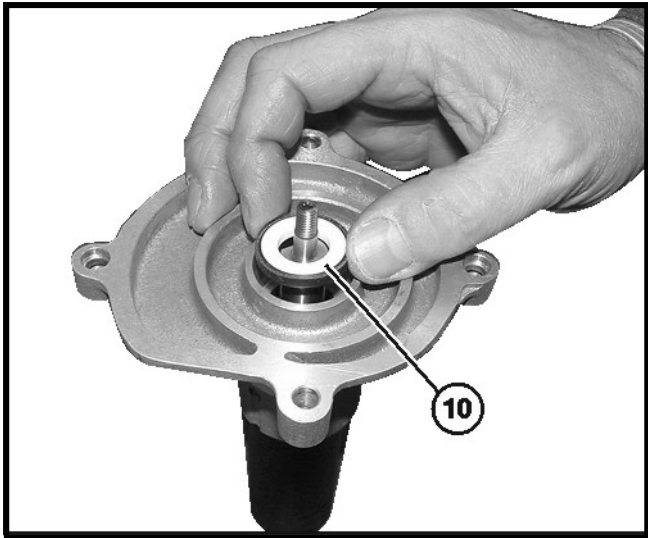


Position the second ball-bearing (7), using a press to make it touch.



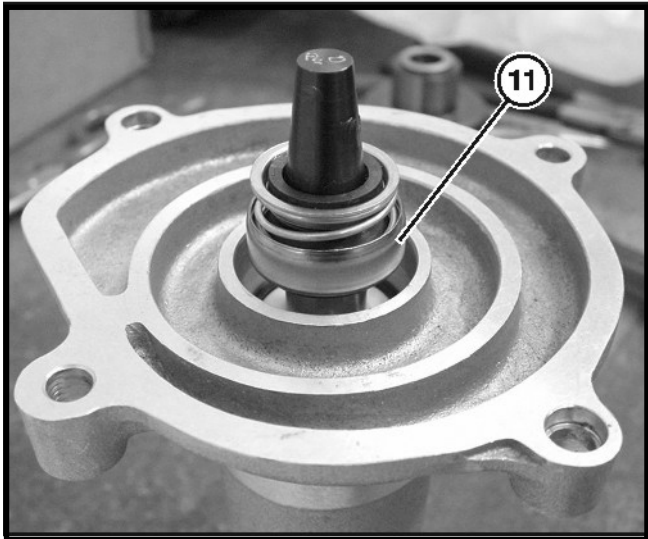
Fix the ball-bearings with the external (8) and internal (9) circlips.



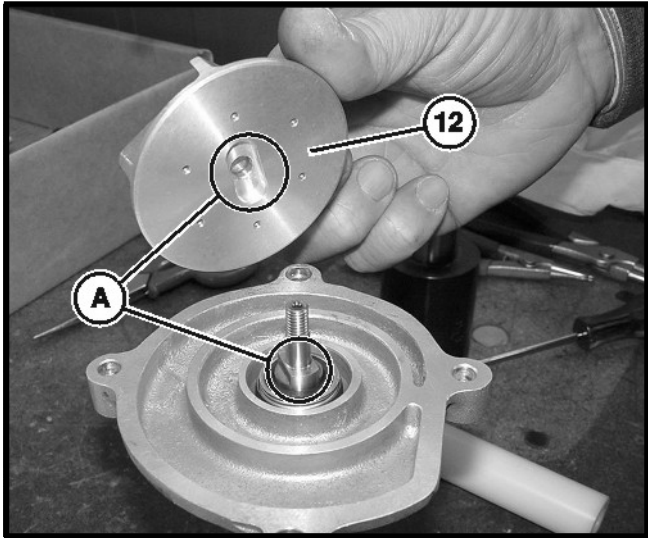


**ATTENTION:**  
While mounting the counterface and the mechanical seal make sure that they are clean and bear no traces of grease.

Position the counterface as in the figure (10).

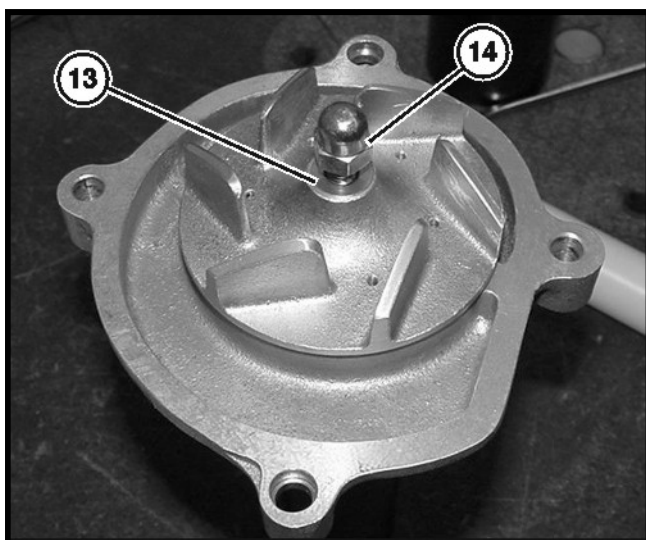


Position the mechanical seal (11) until it touches as shown in the figure.



Position the rotor (12) making it meets clutch (A).

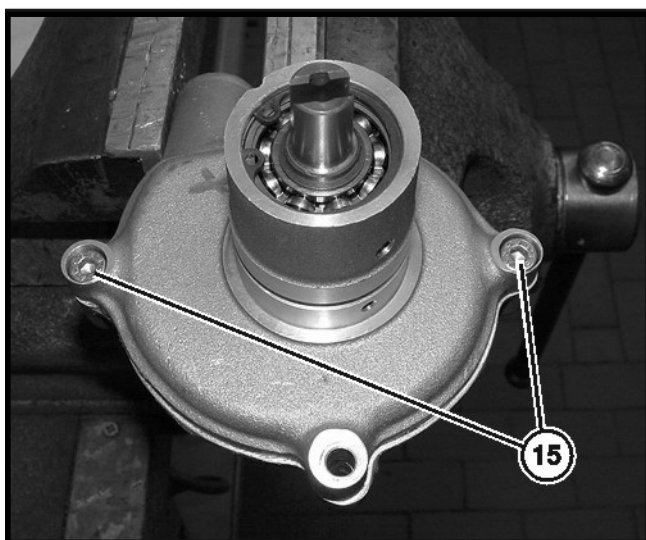




Position the sealing washer (13) and fix it tight with the nut (14).



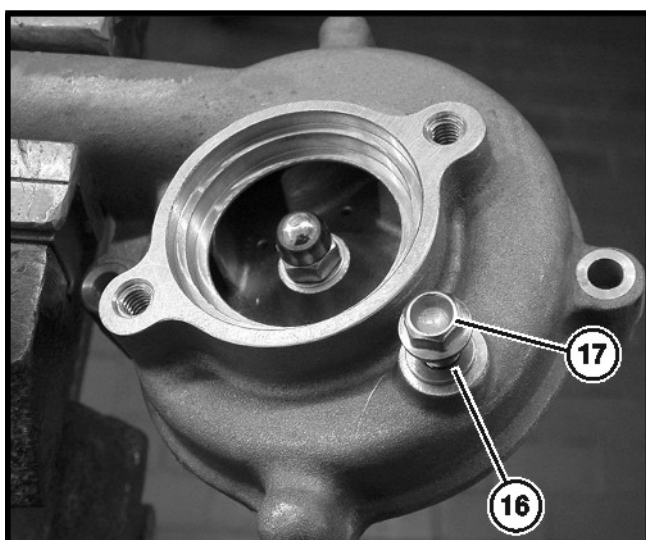
**8 N·m 0.8 Kg-m**  
Always use LOCTITE 243®



Position the cover and lock it tight with the two screws (15).



**10 N·m 1 Kg-m**

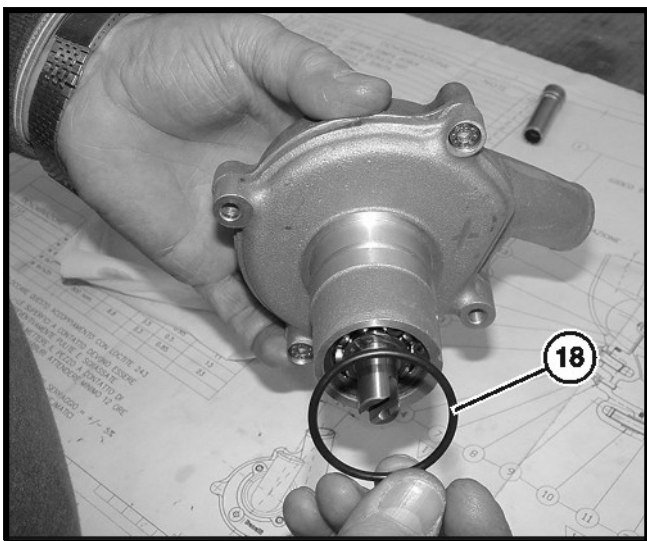


Position the sealing washer (16) and tightly screw the purge screw (17) up.

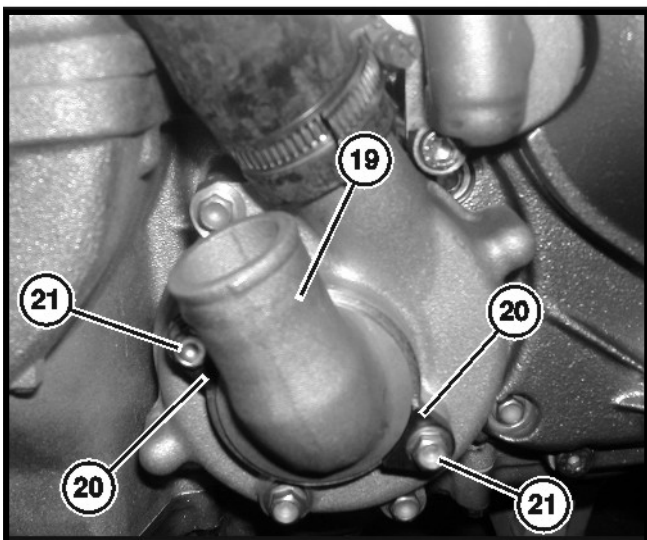


**10 N·m 1 Kg-m**  
Always use LOCTITE 243®





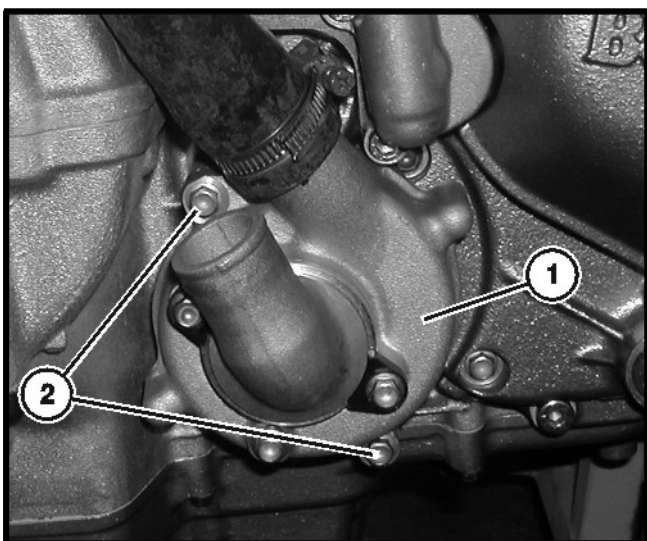
Position the O-Ring (18) on the pump body.



Position the entry elbow (19) and fix with the two small plates (20) and the two screws (21) tightly.



**10 N·m 1 Kg-m**



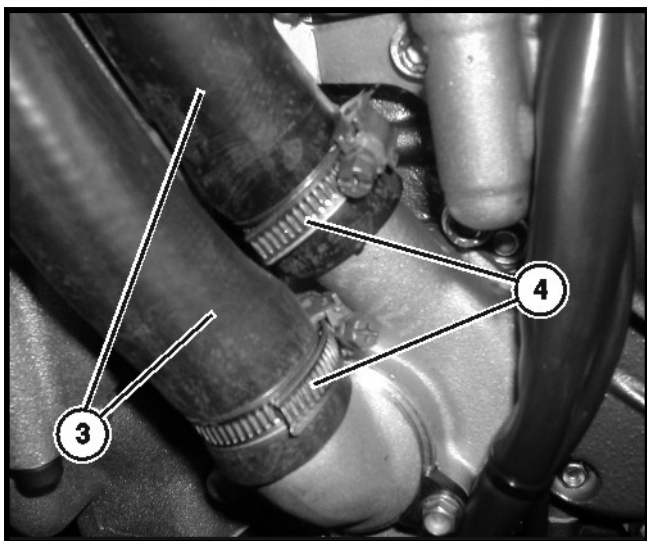
#### 6.4.5 MOUNT WATER PUMP

Position the pump (1) as in the figure and screw the two screws (2) up tightly.



**10 N·m 1 Kg-m**  
**Always use LOCTITE 243®**





Reposition the entry and exit tubes (3) of the pump, tightening the two bands (4).

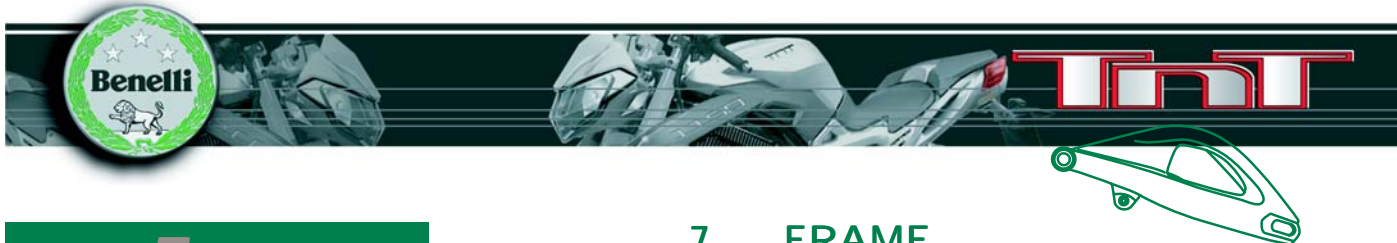


Restore the level of the liquid in the circuit (see "CHANGE COOLING LIQUID").









## Frame

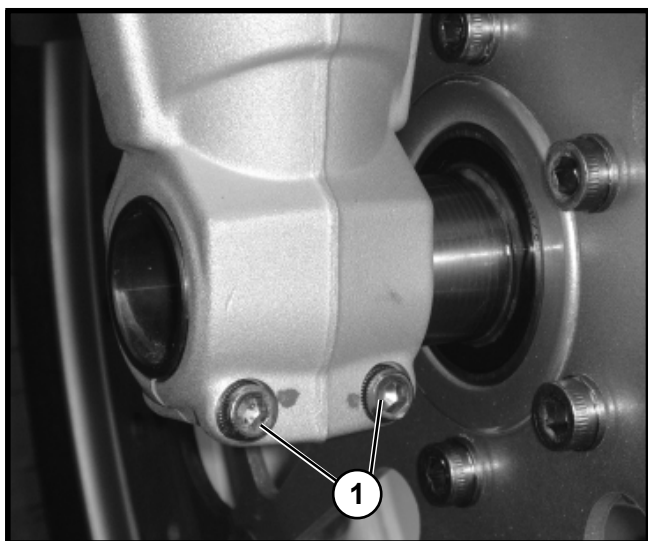
## 7 FRAME

### 7.1 FRONT WHEEL AND BRAKE DISKS

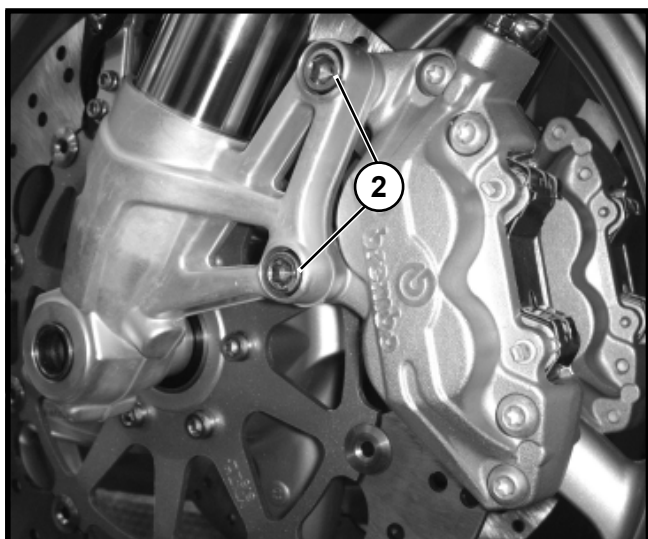
#### 7.1.1 REMOVE FRONT WHEEL

Prepare a support suitable to sustain the bike without the front wheel.

Loosen the two fork clamp locking screws (1) on the right stem.



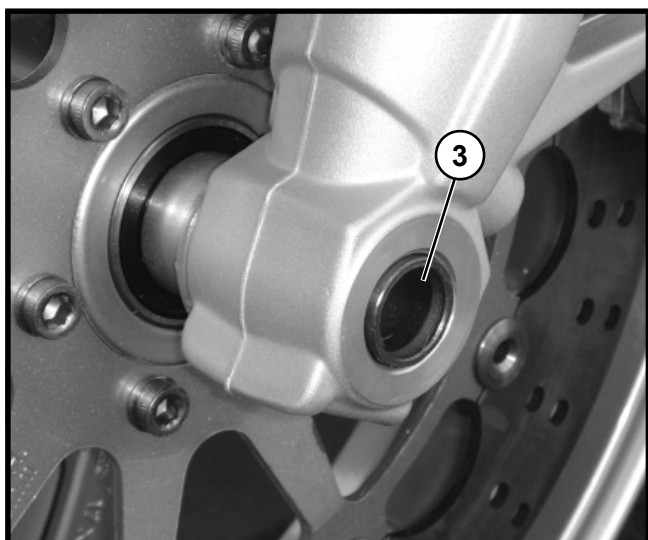
Loosen and remove the two brake clamp fixing screws (2) on both sides.



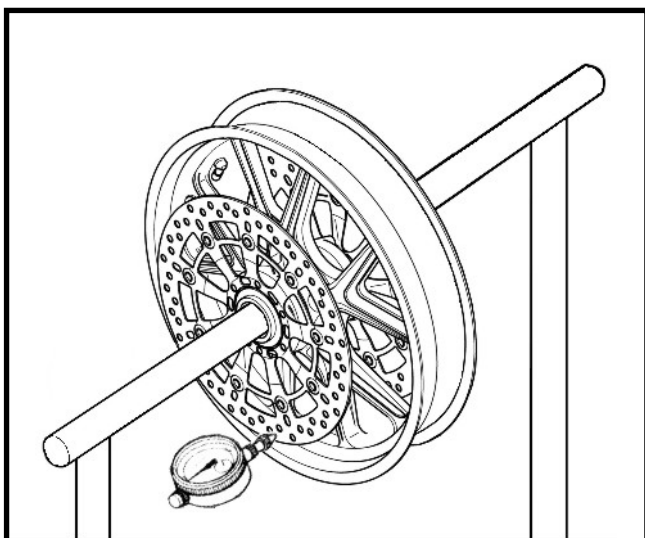
**WARNING:**  
Note the position of the elements for correct re-mounting.

**WARNING:**  
During the following operation, prevent the left spacer falling.

Loosen and remove the pin (3).  
Remove the front wheel. .







### 7.1.2 CHECK FRONT BRAKE DISKS



**WARNING:**

*The following procedures must also be applied to the opposite disk.*



**WARNING:**

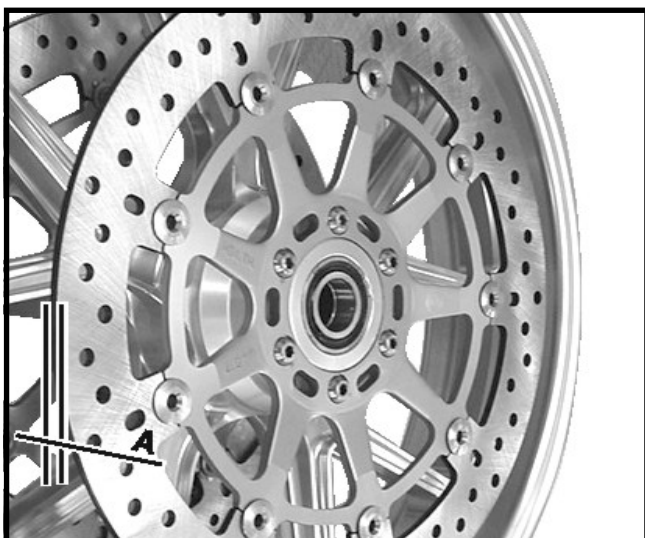
*The following procedures must be applied with the disk mounted on the wheel.*

Check the lateral displacement of the brake disk with a comparator. The lateral displacement must enter within the specific value. If the value of the displacement does not enter within the specific value, change the piece.



**SPECIFIC VALUE**

Lateral displacement = 0.3 mm

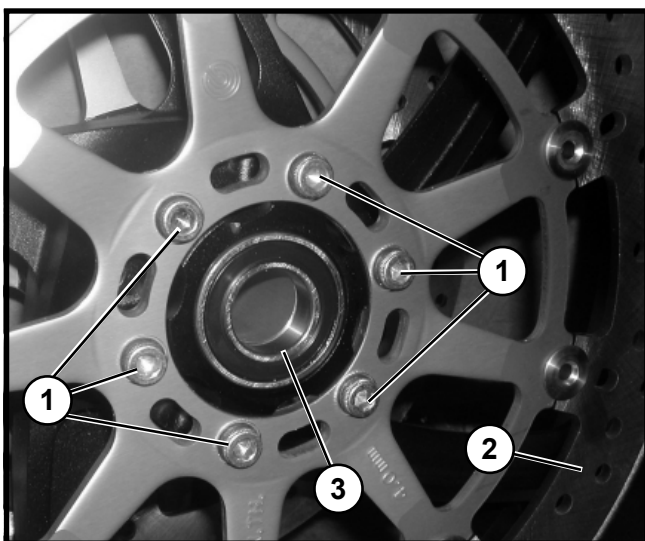


Check the state of wear of the disk with a gauge. If the value of the liner (A) does not enter within the specific value, change the piece.



**SPECIFIC VALUE**

A = 4.5 mm



### 7.1.3 DISMANTLE FRONT WHEEL

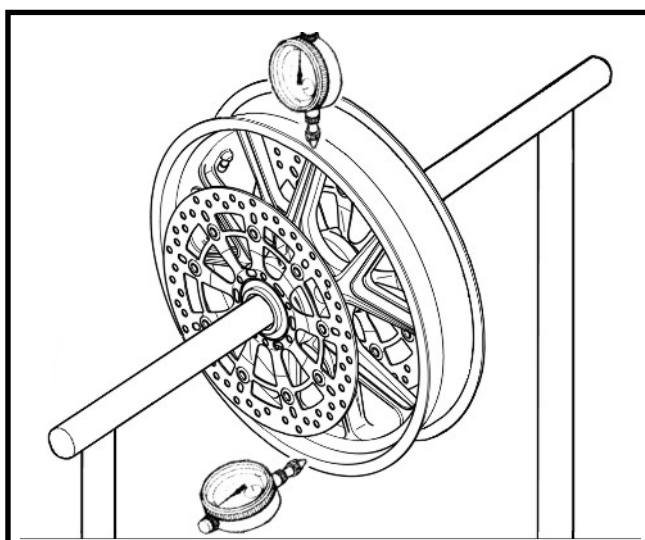


**ATTENTION:**

*During the following procedure, prevent the internal spacer falling if dismantling the ball-bearings is envisaged.*

Remove the six disk (2) fixing screws (1).  
Remove the disk (2) and the ball-bearing (3).  
The operation of removing the ball-bearings is to be carried out exclusively if requested by the maintenance plan or if the ball-bearing could be the source of malfunctioning. Once removed the ball-bearings must be changed.  
Repeat the operations on the opposite side of the wheel as well.





#### 7.1.4 CHECK FRONT WHEEL



##### **ATTENTION:**

*Change the brake disk fixing screws. The ball-bearings must be changed if removed.*

Carry out the radial and axial check on the front rim (see "CHECK WHEEL"), using a comparator.

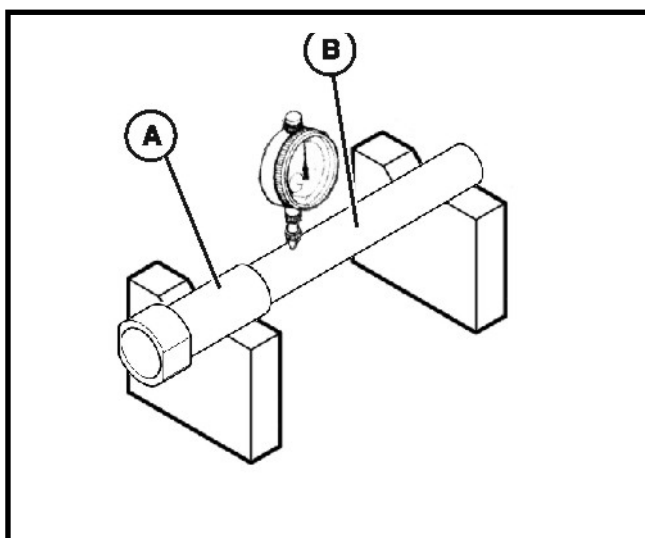
If the value of displacement does not enter within the specific value, change the piece.

Check the cylindricity of the front wheel pin.



##### **SPECIFIC VALUE**

**A = 0.05 mm**



##### **ATTENTION:**

*Do not try to straighten a bent pin.*

Check the lateral displacement of the two cylindrical zones (A) and (B) with respect to one another with a comparator.

The lateral displacement (cylindricity error) must enter within the specific value.

If the lateral displacement value does not enter within the specific value, change the piece.



##### **SPECIFIC VALUE**

**0.05 mm**

#### 7.1.5 MOUNT FRONT WHEEL



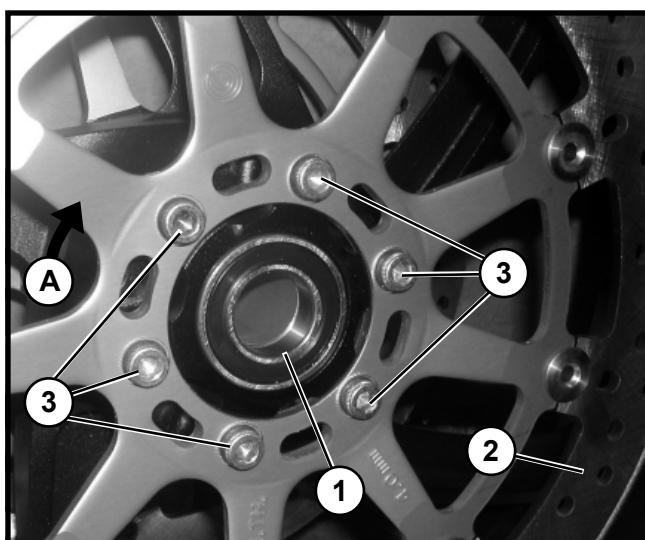
##### **ATTENTION:**

*Before mounting the ball-bearings, identify correctly the right and left sides of the wheel, based upon the direction of rotation.*

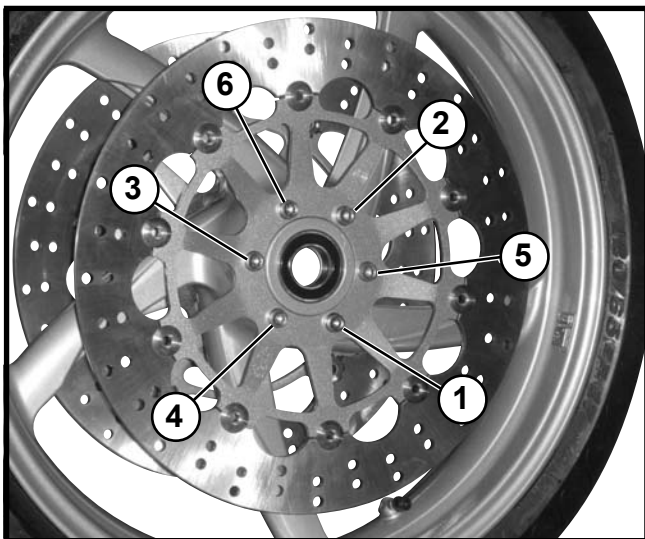
Place the left side ball-bearing (1) first until it touches.

Insert the internal spacer from the right side and place the right ball-bearing until it touches this spacer.

Position the two brake disks (2) and the fixing screws (3).







Tighten the disk fixing screws in the order indicated in the figure.

Do the same for the opposite disk.



22 N·m 2.2 Kg-m Grease thread

### 7.1.6 INSTALL FRONT WHEEL



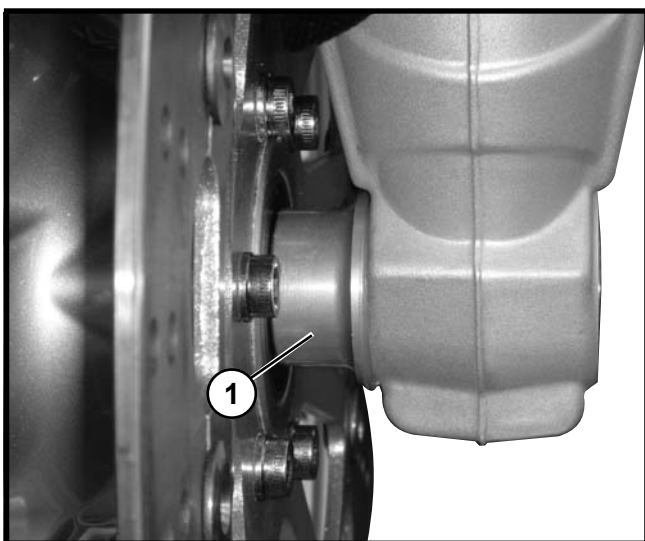
**WARNING:**

*After each operation on the bike it is advisable to balance it.*



**ATTENTION:**

*While installing the wheel pay attention to the direction of mounting.*

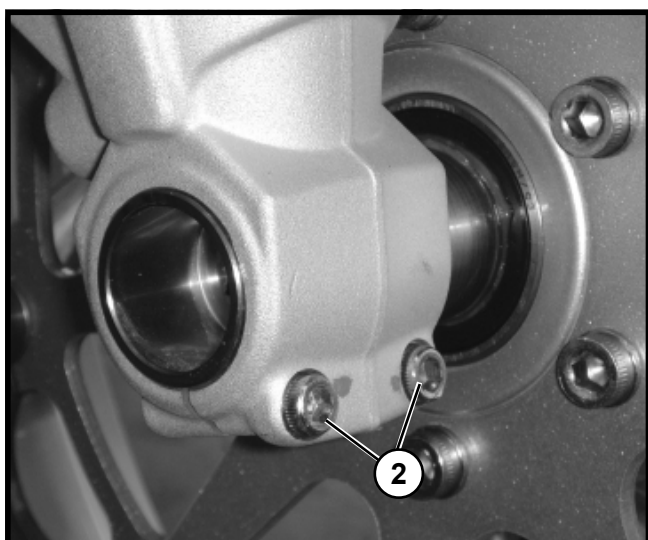


Position the front wheel and the left spacer (1) coaxial with respect to the respective housing holes on the fork and insert the wheel pin from the right side, tightening it.



60 Nm 6 Kgm grease the thread.





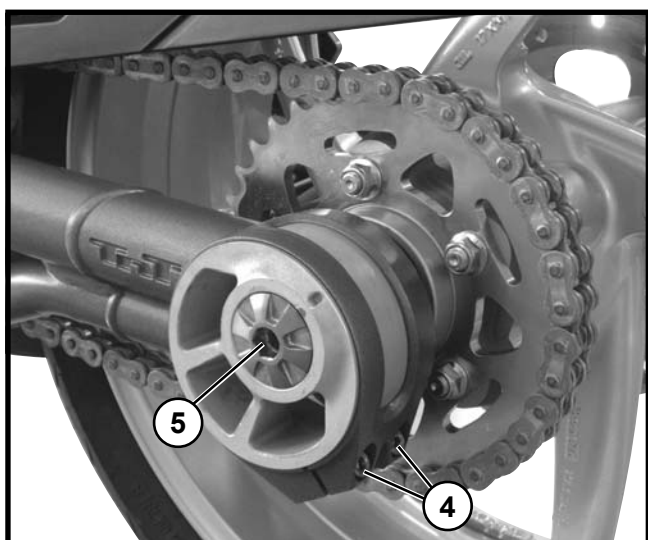
Tighten the two fork clamp locking screws (3) on the right stem. Mount the brake clamp. Tighten.



**30 N·m 3 Kg-m Grease the thread  
Clamp screws**



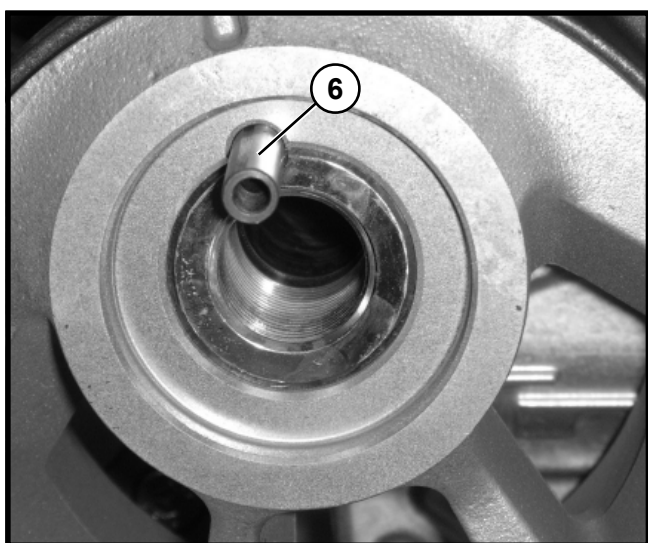
**50 N·m 5 Kg-m Grease the thread  
Brake clamp screws.**



## **7.2 REAR WHEEL, BRAKE DISK AND CROWN**

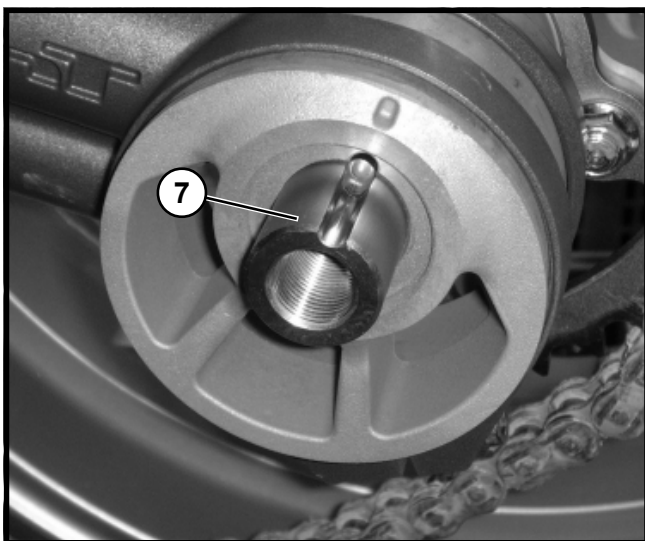
### **7.2.1 REMOVE REAR WHEEL**

Loosen the fork screws (4).  
Loosen and remove the nuts (5) of the wheel pivot.

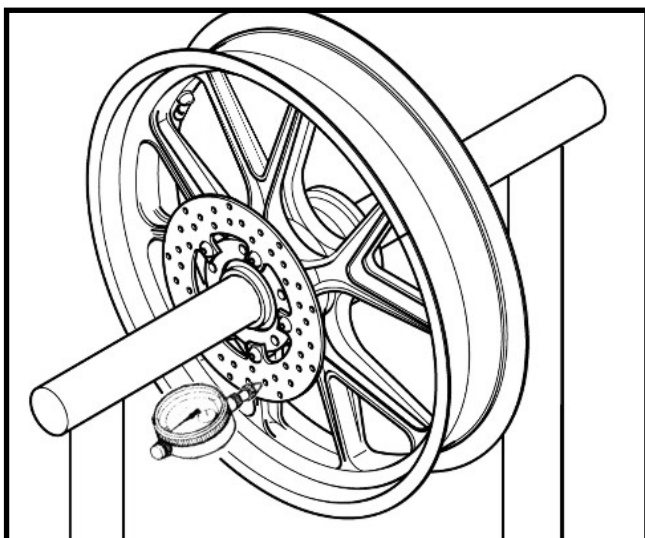


Remove the two grains (6) through a M4 metrical screw.  
Rotate the eccentrics loosening the chain.  
Remove the chain from the cog-wheel.





Slip off the pivot (7).  
Remove the wheel.



## 7.2.2 CHECK REAR BRAKE DISK



### ATTENTION:

*The following procedure must be carried out with the disk mounted on the wheel.*

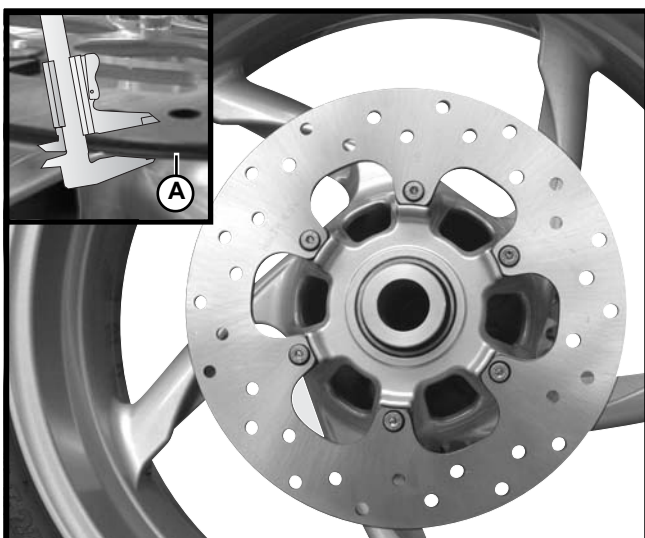
Check the lateral displacement of the brake disk with a comparator.

The lateral displacement must enter within the specific value. If the value of the displacement does not enter within the specific value, change the piece.



### SPECIFIC VALUE

Lateral displacement = 0.3 mm



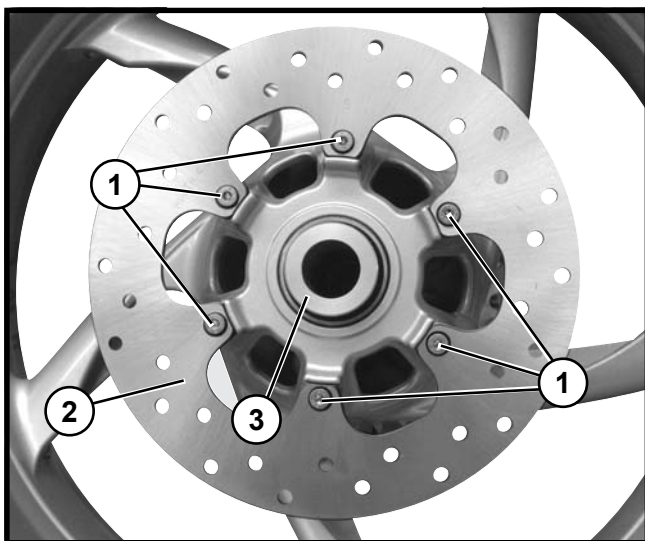
Check the state of wear of the disk with a gauge. If the value of the liner (A) does not enter within the specific value, change the piece.



### SPECIFIC VALUE

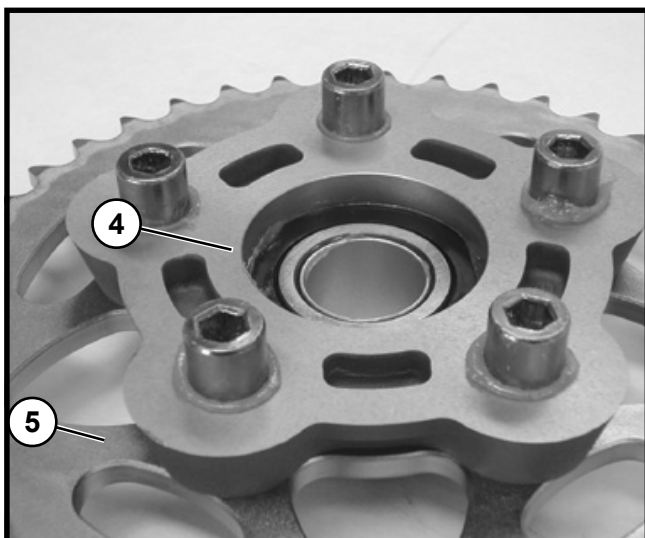
A = 4.5 mm



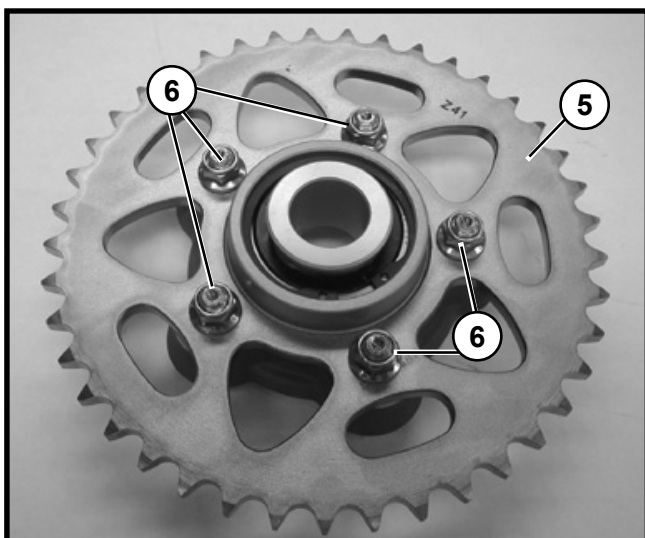


### 7.2.3 DISMANTLE REAR WHEEL

Loosen and remove the six disk fixing screws (1).  
 Remove the brake disk (2).  
 Change the brake disk fixing screws.  
 Remove the right spacer (3), extracting it from the wheel.

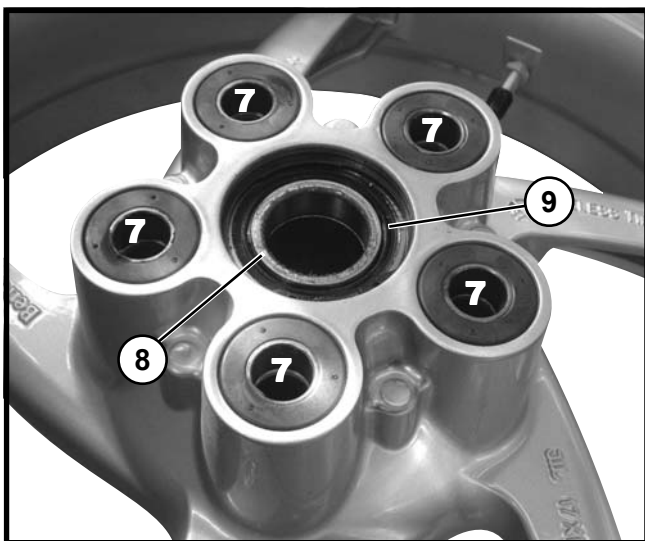


Remove the flange (4) complete with crown (5), extracting it from the wheel.



Loosen and remove the five nuts (6) and remove the crown (5) from the flange.





**ATTENTION:**

*During the following operation prevent the internal spacer falling if dismantling the ball-bearings is envisaged.*

Remove the five flexible couplings (7).

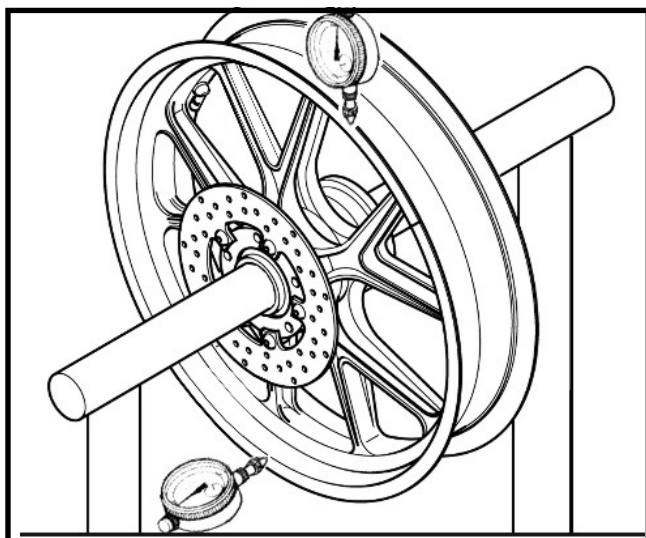
Remove the circlip (9).

Extract the ball-bearings (8) on both sides.

This operation is to be carried out exclusively if required by the maintenance plan or if the ball-bearing could be the source of malfunctioning.

Once dismantled, the ball-bearings must be changed.





## 7.2.4 CHECK REAR WHEEL



### ATTENTION:

*Change the fixing screws on the brake disk. If the ball-bearings are dismantled, they must be changed.*

Carry out the radial and axial check on the rear rim (see CHECK WHEEL"), using a comparator.

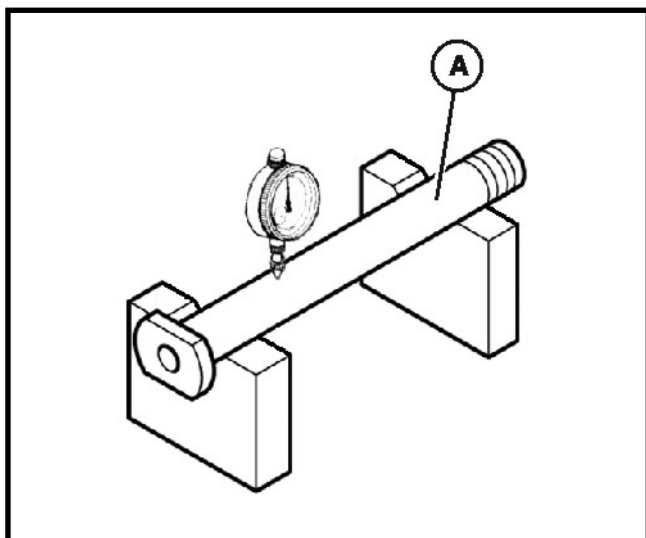
If the value of displacement does not enter within the specific value, change the piece.

Check the cylindricity of the rear wheel pin.



### SPECIFIC VALUE

**A = 0.05 mm**



### ATTENTION:

*Do not try to straighten a bent pin.*

Check the lateral displacement of the cylinder zone (A) with a comparator.

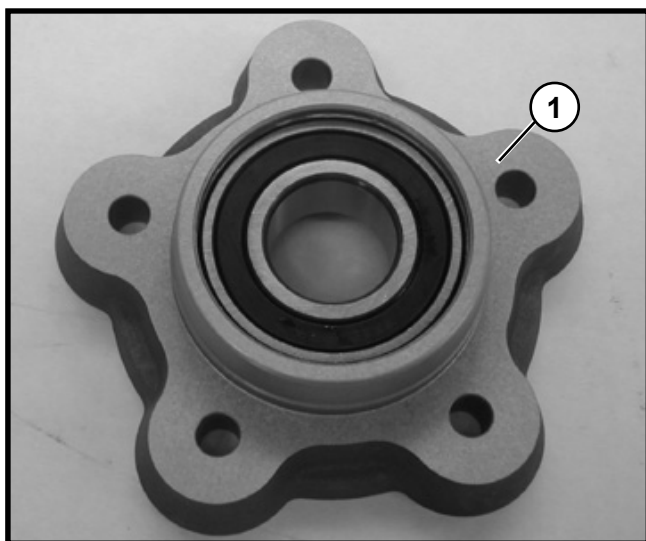
This lateral displacement (cylindricity error) must enter within the specific value.

If the value of the displacement does not enter within the specific value, change the piece.



### SPECIFIC VALUE

**A = 0.05 mm**

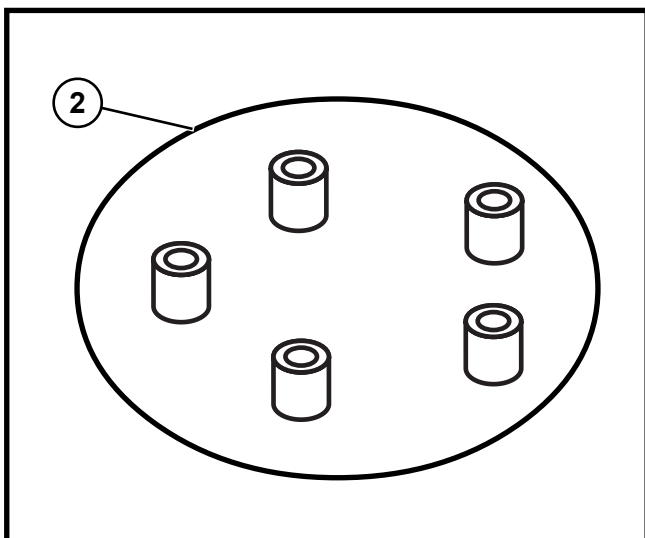


## 7.2.5 CHECK HUB

Check that the crown fixing flange (1) is not broken or excessively worn.

If necessary, change it.



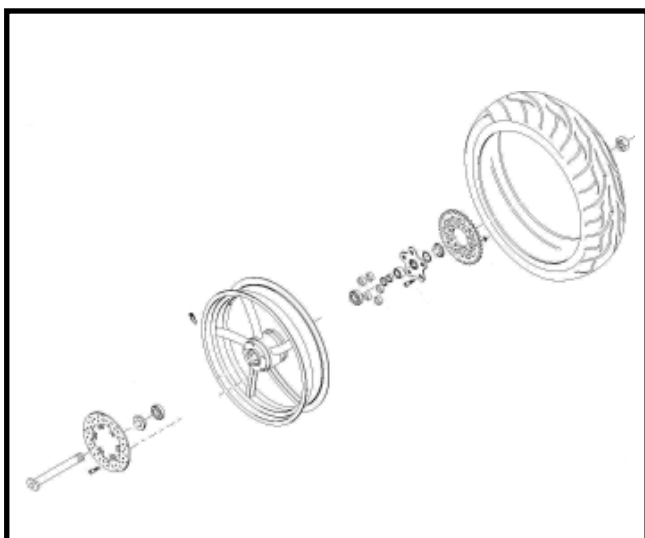


Check that the flexible couplings (2) are not broken.  
If necessary, change them.

### 7.2.6 CHECK CROWN



Sight check that the crown (1) is not broken and that the teeth are not excessively worn.  
Change the crown, the pinion and the chain if necessary.



### 7.2.7 MOUNT REAR WHEEL



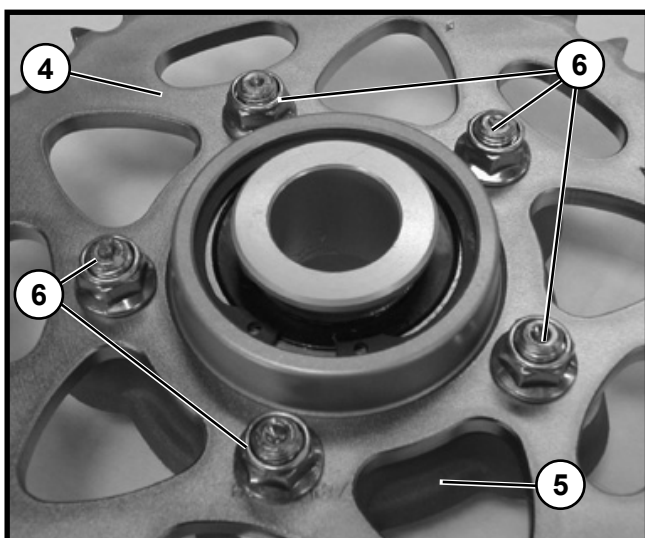
#### **ATTENTION:**

*Before mounting the ball-bearings, identify the right and left sides of the wheel correctly, basing yourself upon the direction of rotation shown on the circle with the drawing of an arrow.*





Push the left side ball-bearing in first until it touches and fix it with the circlip (2).  
 Insert the internal spacer from the right side and push the right side ball-bearing in until it touches.  
 Position the five flexible couplings in the correct seats (3).



Position the crown (4) on the flange (5) and fix it with the nuts (6) tightening then according to the order indicated.

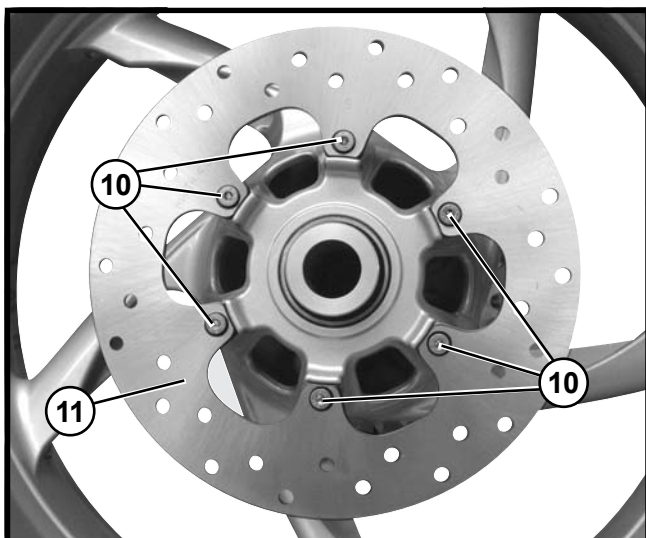


**45 N·m 4.5 Kg-m Grease thread**



Position the flange complete with crown on the wheel.

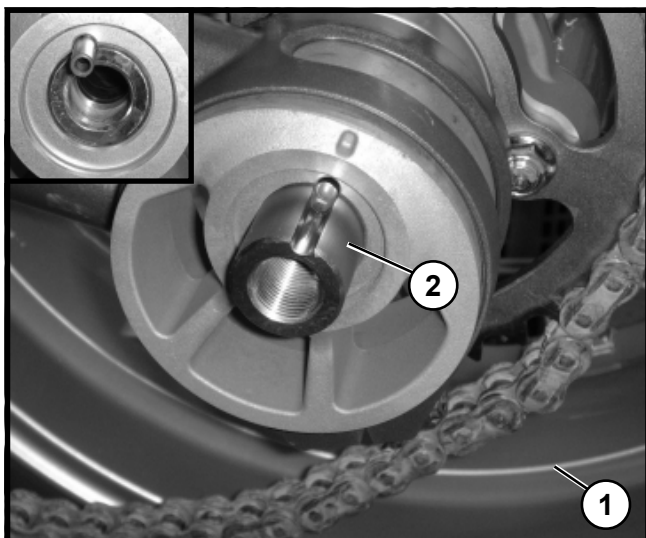




Position the disk (11) and tighten the six screws (10) according to the order in the figure.



**22 N·m 2.2 Kg-m Grease thread**



### 7.2.8 INSTALL REAR WHEEL



#### **ATTENTION:**

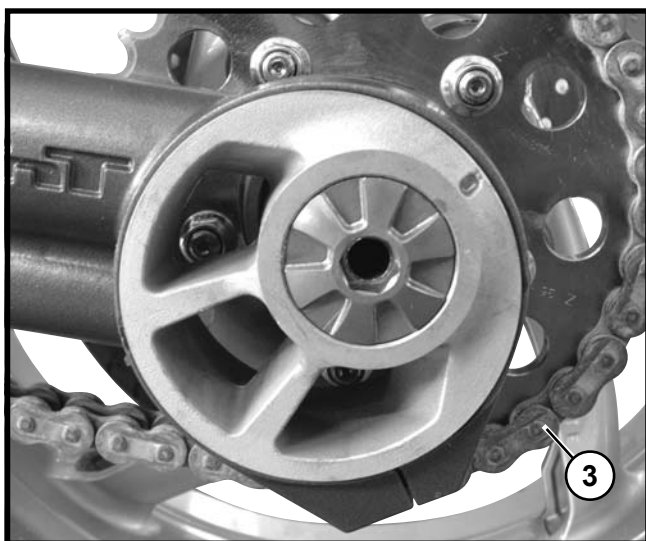
*It is advisable to balance the wheel after every operation on the wheel.*

Position the wheel (1).

Insert the pivot (2) paying attention to the sense of assembly, the part with the left side punching attention must be positioned on the chain side. Insert the two grains, tighten the nuts of the pivot to the indicated torque.



**65 N·m 6,5 Kg-m Grease thread**



Position the chain (3).

Regulate the chain through the eccentrics. Tighten the fork screws.



**80 N·m 8 Kg-m Grease thread**



## 7.3 FRONT AND REAR BRAKES

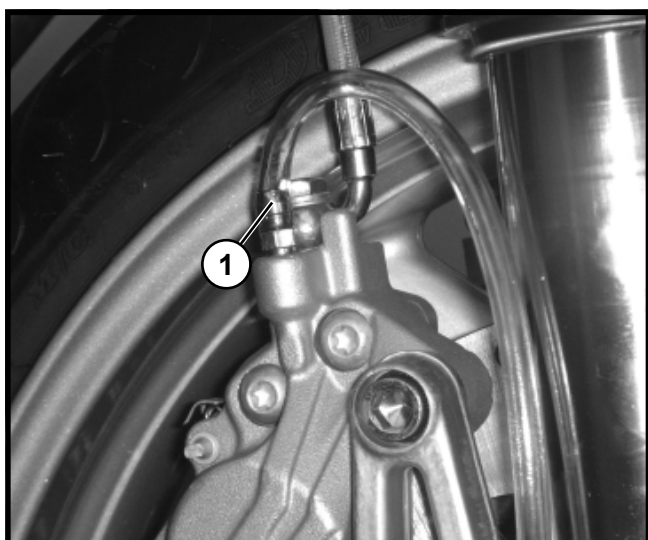
### 7.3.1 REMOVE FRONT BRAKE PUMP

The oil in the braking plant needs to be emptied before proceeding to remove the pump. Position the end of a tube of suitable diameter at the purge screw (1) of a front brake clamp and the other end in a suitable recipient.

Open the purge screw (1) and empty the braking liquid. Do the same thing with the opposite clamp.

#### NOTE:

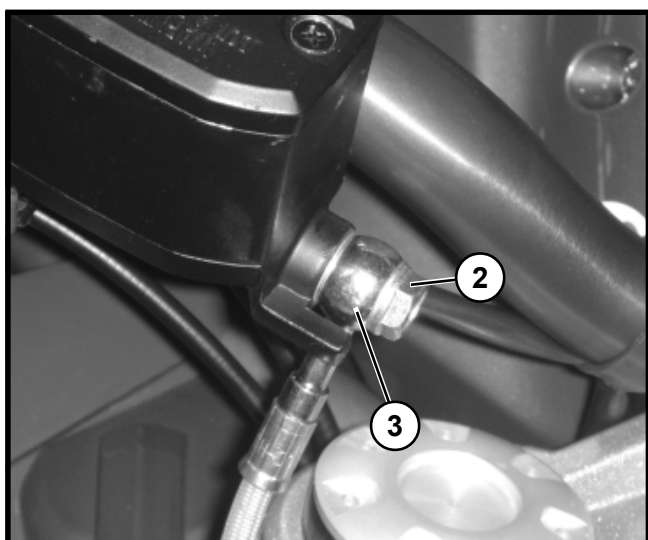
To help the liquid discharge open the liquid tank lid and drive the front brake lever repeatedly.



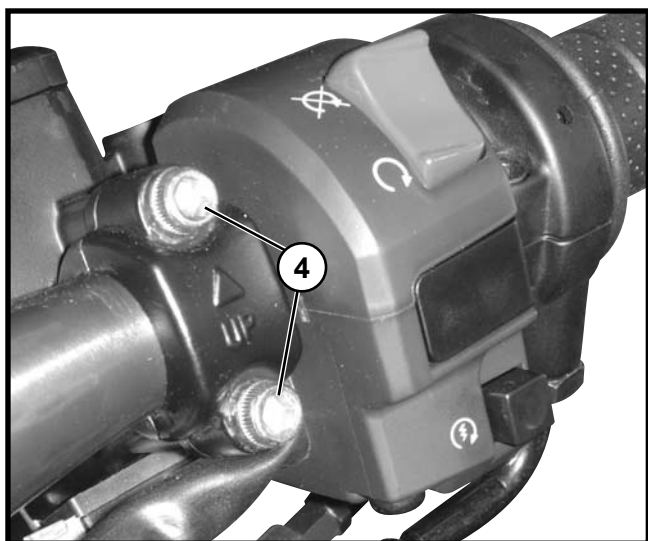
#### ATTENTION:

*Place a rag under the connector because of the probable leakage of braking liquid.*

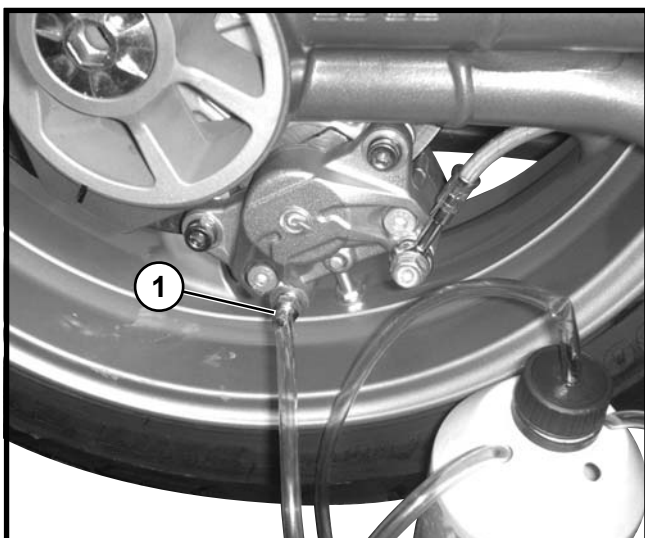
Remove the screw (2) and the connector (3).



Loosen and remove the two screws (4). Remove the complete brake pump.







### 7.3.2 REMOVE REAR BRAKE PUMP

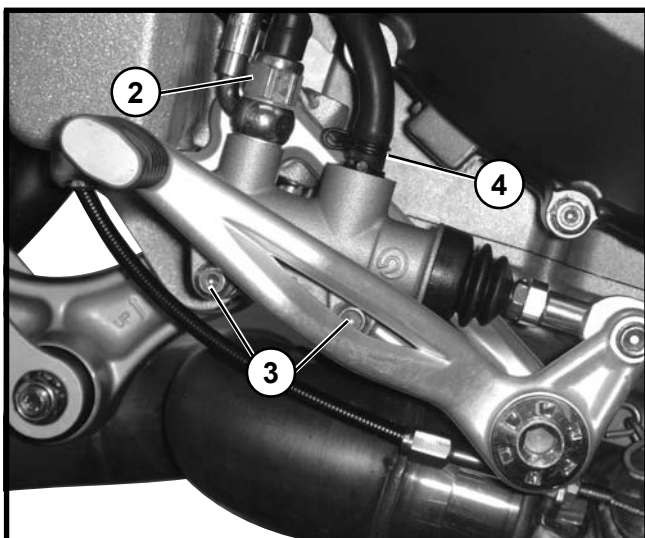
Remove the rear brake pump from the clamp support and position it under the brake pump.

Position the end of a tube of suitable diameter at the purge screw (1) and the other end in a suitable recipient.

Open the purge screw (1) and empty the braking liquid. Do the same thing with the opposite clamp.

#### NOTE:

To help empty the liquid, open the liquid tank cap and work on the rear brake lever repeatedly.

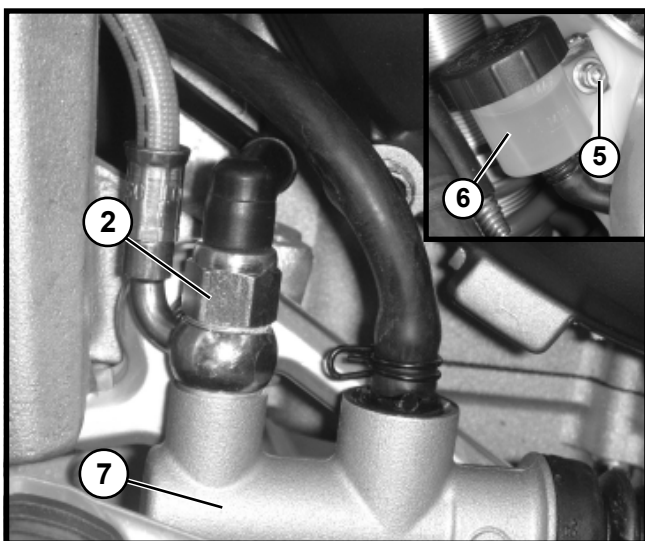


First loosen the idrostop (2), making sure not to twist the wires of the relative cabling excessively.

Loosen and remove the two screws (3).

Remove the elastic clip (4).

Remove the oil pipe from the pump.



Rotate the pump (7) keeping the idrostop (2) steady until the latter is completely unscrewed. Remove the idrostop.

Remove the pump.

Unscrew and remove the screw (5).

Remove the brake oil tank (6).





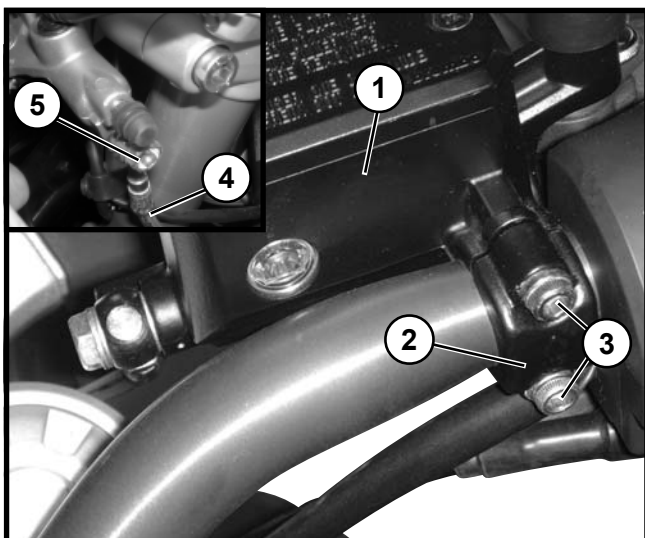
### 7.3.3 CHECK FRONT AND REAR BRAKE PUMP

Check that the front and rear brake pumps are not damaged. If necessary, change the damaged pump.



Check that the front and rear brake pumps are not obstructed. If necessary, eliminate the obstruction with a jet of compressed air.





### 7.3.4 INSTALL FRONT BRAKE PUMP



**WARNING:**  
First tighten the arrow side screw.



**ATTENTION:**  
Always change the braking plant sealing gaskets.

Position the front brake pump (1), and the assembly stand (2) and fix tightly with the two screws (3).

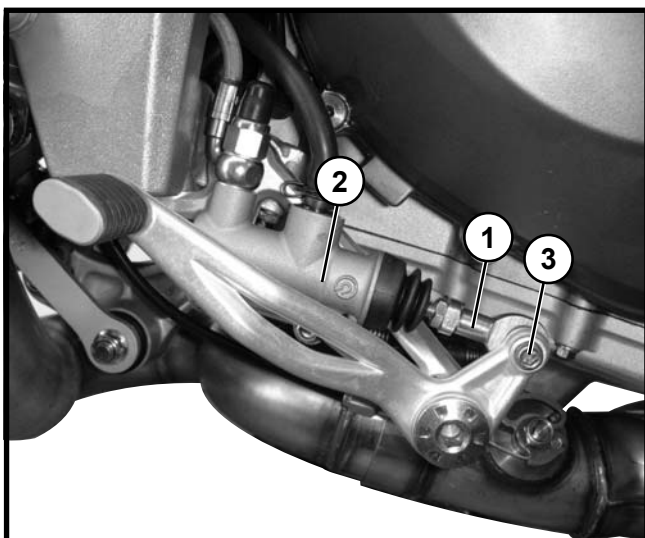


10 N·m 1 Kg-m

Position the brake (4) and fix it tightly with screw (5) on the connector.



15 N·m 1.5 Kg-m

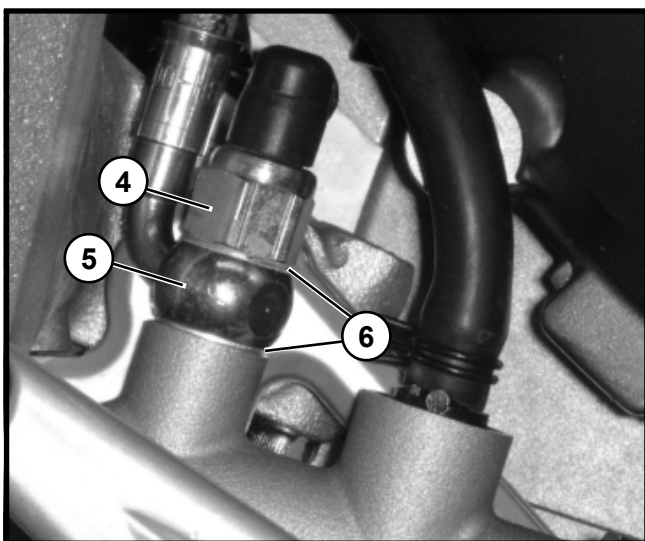


### 7.3.5 INSTALL REAR BRAKE PUMP

Connect the cap (1) of the brake pedal pump (2) and tighten the screw (3).



10 N·m 1 Kg-m



**ATTENTION:**  
Always change the braking plant sealing gaskets.

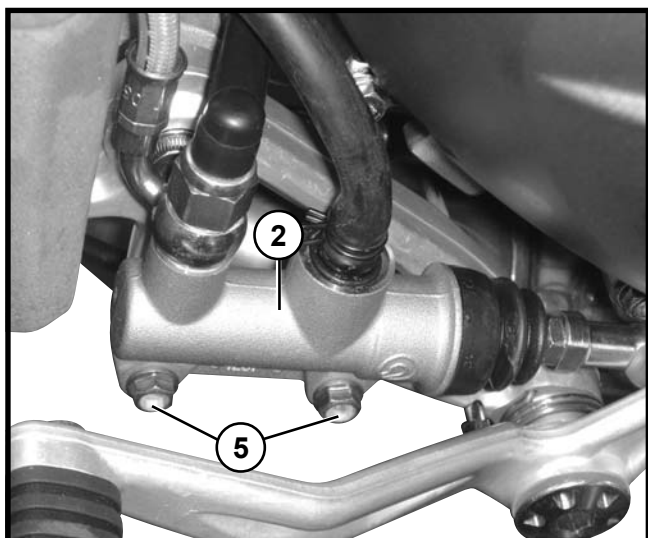
Fix the connector (5) of the brake pipe to the pump through idrostop (4) and the two gaskets (6). Rotate the pump to tighten the idrostop (4). Tighten the idrostop keeping the brake tube in the correct angular position.



15 N·m 1.5 Kg-m

Fill the circuit with braking liquid and purge the braking plant (see "PURGE BRAKING PLANT").

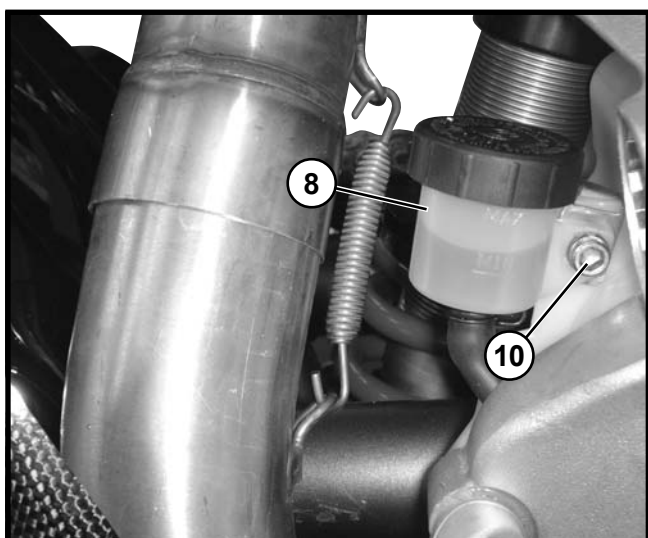




Position the rear brake pump (2) and fix with the two screws (5) and the relative nuts tightly.



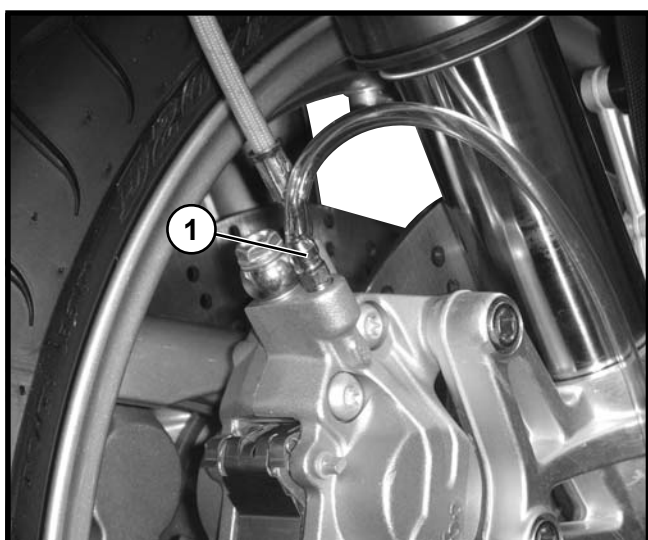
10 N·m 1 Kg-m



Fixing the pump tank (8) with the screw (10).  
Mount the footrest (see "MOUNT FOOTREST").



4 N·m 0.4 Kg-m



### 7.3.6 DISMANTLE FRONT BRAKE PLANT TUBES

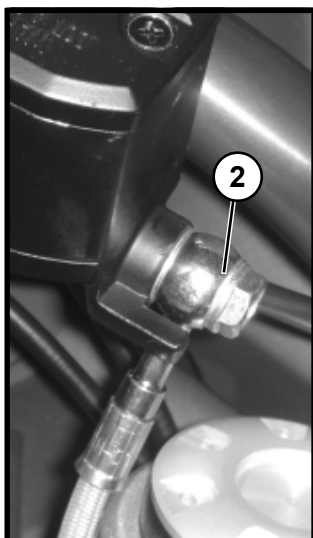
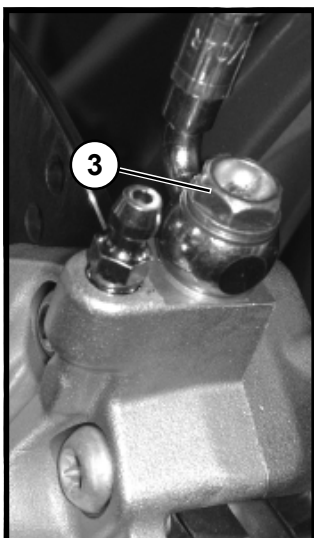
Position the end of a tube of suitable diameter at the purge screw (1) of a brake clamp and the other end in a suitable recipient.

Open the purge screw (1) and empty the braking liquid.

#### NOTE:

To help empty the liquid, open the liquid tank cap and work on the rear brake lever repeatedly.

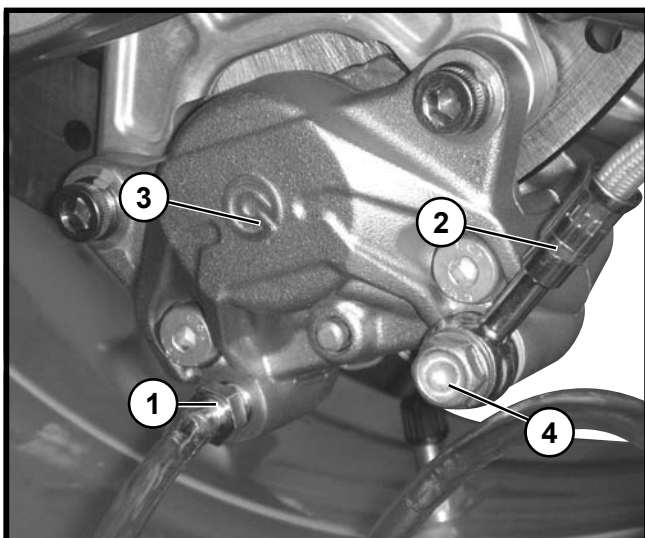




**WARNING:**

**Always change the sealing gaskets at every dismantling.**

Loosen and remove the pump connector screw (2).  
Loosen and remove the pliers connector screws (3).  
Unhook the brake tube from the eye positioned on the front mudguard.  
Remove the front brake plant tubing.  
Be careful with the sealing gasket.

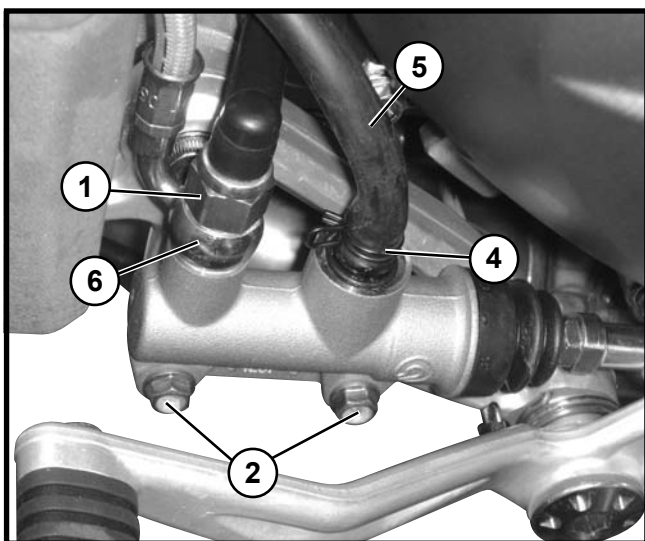


### 7.3.7 DISMANTLE REAR BRAKE PLANT TUBES

Remove the rear brake clamp from the clamp support and position it under the brake pump.  
Position the end of a tube of suitable diameter at the purge screw (1) of a brake clamp and the other end in a suitable recipient.  
Open the purge screw (1) and empty the braking liquid. Remove the brake tube (2) from the clamp (3), unscrewing screw (4).

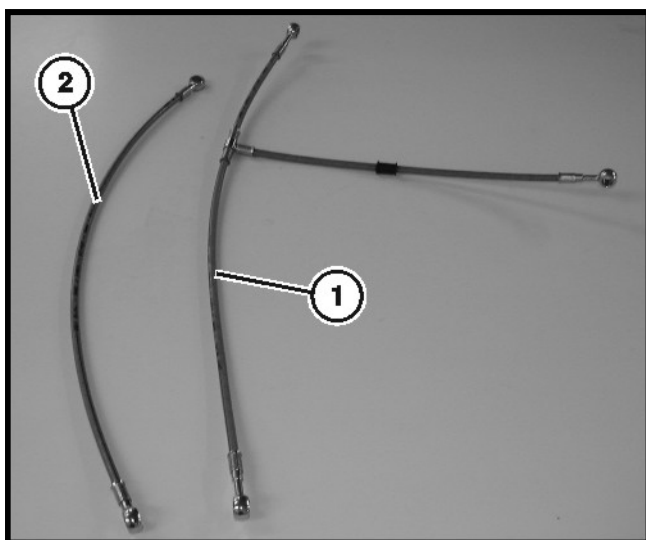
**NOTE:**

**To help empty the liquid, open the liquid tank cap and work on the rear brake lever repeatedly.**



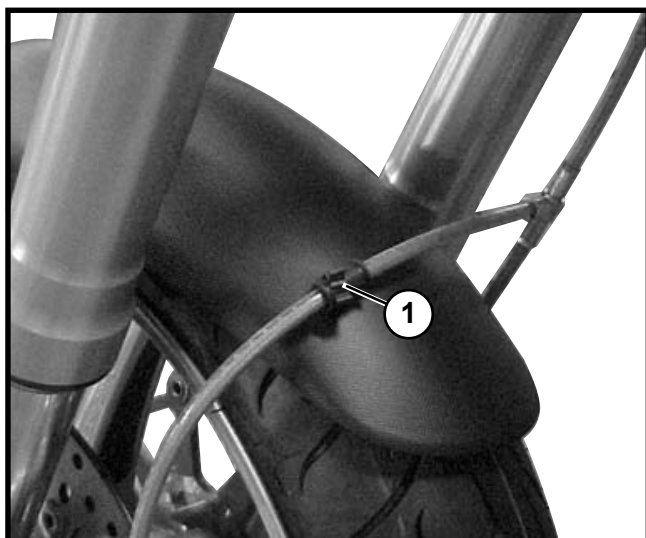
Loosen the idrostop (1) taking care not to twist the cables of the cabling excessively.  
Loosen and remove the two screws (2).  
Remove the elastic bands (4) and take the tube (5) of the pump off.  
Rotate the pump freeing the idrostop and removing the rear brake tube (6).





### 7.3.8 CHECK FRONT AND REAR BRAKE TUBING

Check that the front (1) and rear (2) tubing is not broken. Change the damaged element if necessary.



### 7.3.9 MOUNT FRONT BRAKE TUBES PLANT



#### ATTENTION:

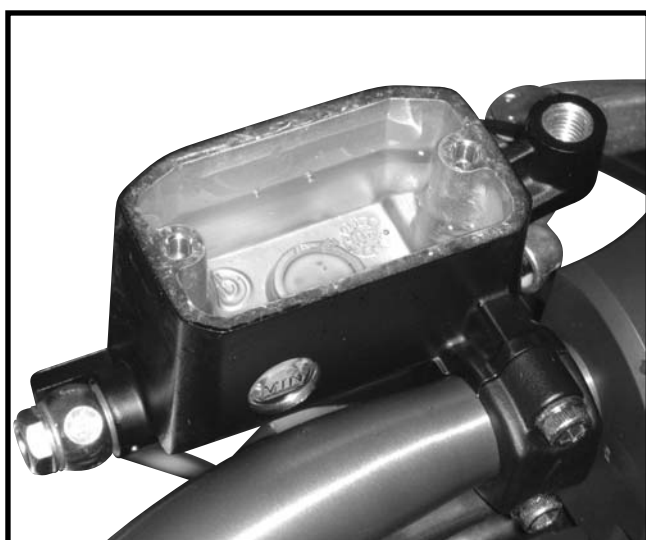
*Always change the sealing gaskets at every dismantling.*

Position the brake plant tubes with the "T" (1) connector on the right side of the vehicle.

Fix the tubes with the connector screws and the sealing gaskets tightly, two on the clamp and one on the pump.

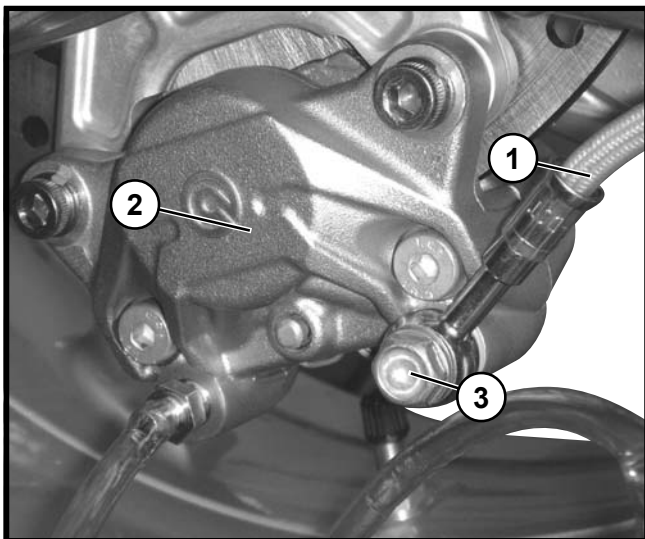


**15 N·m 1.5 Kg-m**



Restore the level of the braking liquid and purge the plant (see "PURGE BRAKING PLANT").





### 7.3.10 MOUNT REAR BRAKE TUBES PLANT



**ATTENTION:**

*Always change the sealing gaskets at every dismantling.*

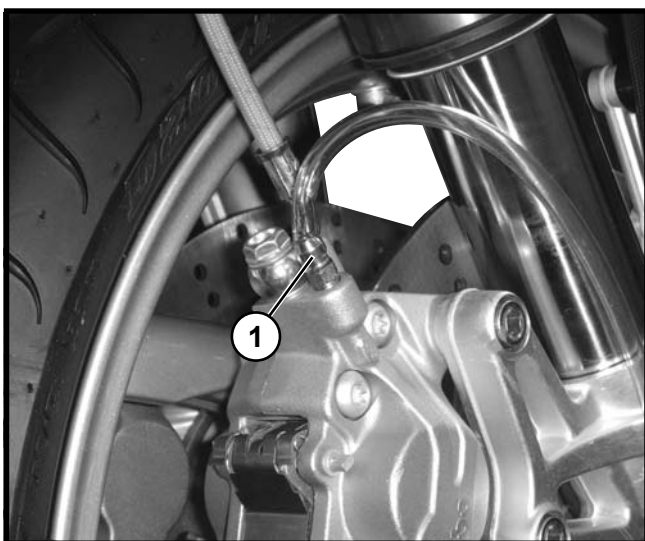
Position tube (1) on the clamp (2) and on the pump.  
Position the connector screw (3) and tighten it with the associated sealing gasket.



**15 N·m 1.5 Kg-m**



Restore the level of the braking liquid and purge the plant (see "PURGE BRAKING PLANT").



### 7.3.11 DISMANTLE FRONT BRAKE CLAMPS



**ATTENTION:**

*Always change the sealing gaskets at every dismantling.*

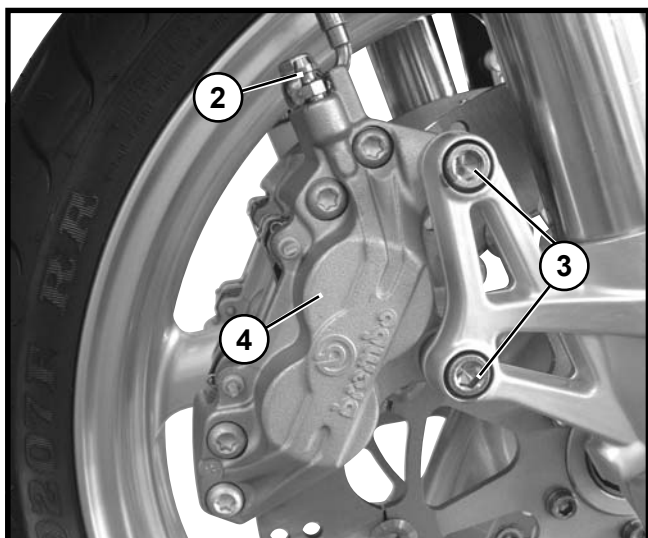
Position the end of a tube of suitable diameter at the purge screw (1) of a brake clamp and the other end in a suitable recipient.

Open the purge screw (1) and empty the braking liquid.

**NOTE:**

To help empty the liquid, open the liquid tank cap and work on the rear brake lever repeatedly.



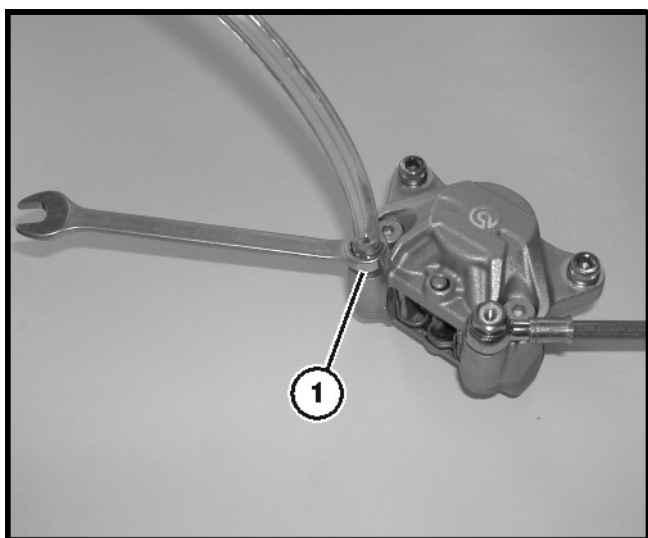


Remove the connector screws (2).  
Loosen and remove the two brake clamp fixing screws (3).  
Remove the brake clamps (4).

### 7.3.12 DISMANTLE REAR BRAKE CLAMP



**WARNING:**  
*Always change the sealing gaskets at every dismantling.*

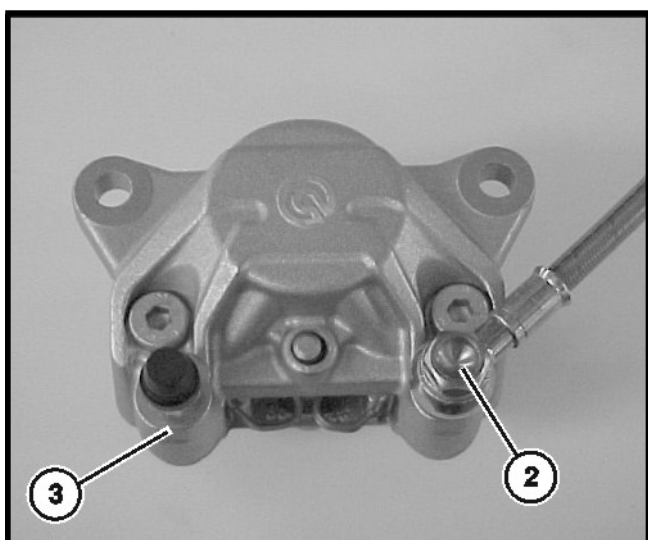


Remove the rear brake clamp from the clamp support unscrewing the two screws and position it under the brake pump.  
Position the end of a tube of suitable diameter at the purge screw (1) of a brake clamp and the other end in a suitable recipient.

Open the purge screw (1) and empty the braking liquid.

**NOTE:**

To help empty the liquid, open the liquid tank cap and work on the rear brake lever repeatedly.



Loosen and remove the connector screw (2) and free the clamp (3) completely.

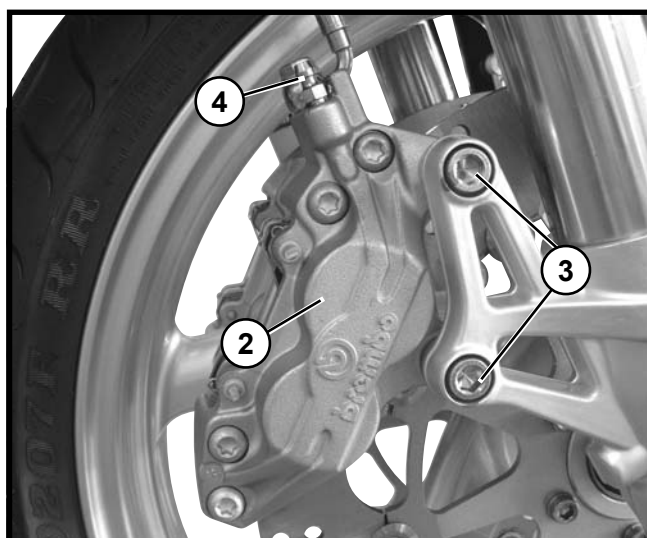




### 7.3.13 CHECK BRAKE CLAMP

Check that the front and rear brake clamps are not broken or show losses.

If necessary, change the damaged element.



### 7.3.14 MOUNT FRONT BRAKE CLAMP

Position the right and left (2) brake clamps.

Tighten screws (3).

Position the brake tubing on the two clamps and on the pump.



50 N·m 5 Kg-m

Tighten screws (4).

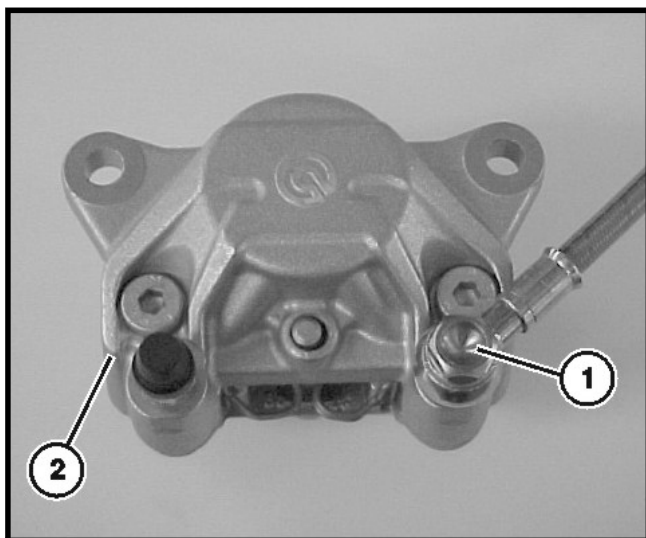


15 N·m 1.5 Kg-m



Restore the level of the braking liquid and purge the front plant (see "PURGE BRAKING PLANT").





### 7.3.15 MOUNT REAR BRAKE CLAMP

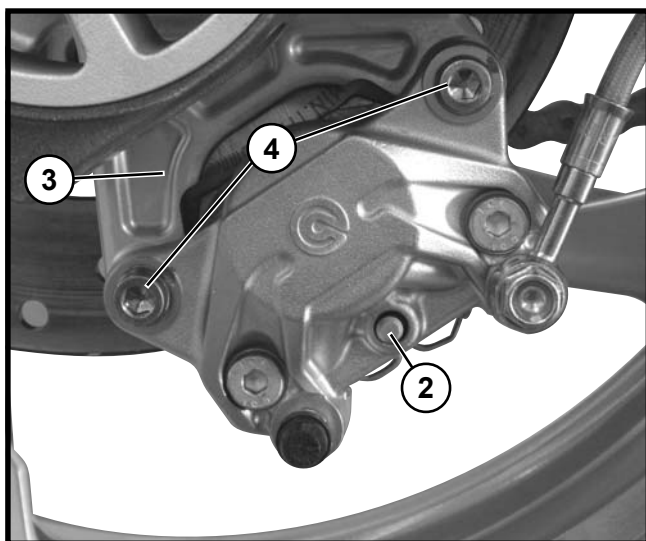
Tighten the connector screw (1) on the clamp (2).



15 N·m 1.5 Kg-m



Restore the level of the braking liquid and purge the rear plant (see "PURGE BRAKING PLANT").



Position the clamp (2) on the clamp support (3). Tighten the two screws (4).



22 N·m 2.2 Kg-m





## 7.4 FORK

### 7.4.1 REMOVE RIGHT AND LEFT STEM



#### **ATTENTION:**

*After removing the stem clamps do not leave them hanging up but provide an adequate support.*

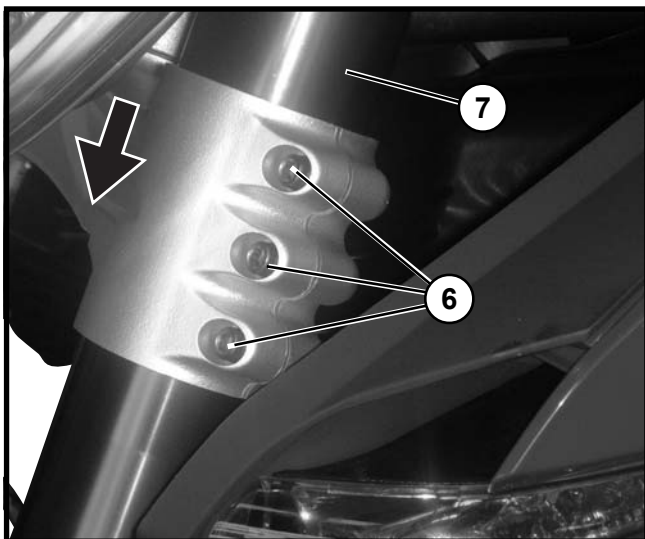
Remove the front mudguard (see "DISMANTLE FRONT MUDGUARD").

Remove the front wheel (see "REMOVE FRONT WHEEL").

Remove the handlebar.



Remove the front pliers.



Remove the upper steering plate (see "DISMANTLE STEERING PLATE").



#### **SPECIFIC INSTRUMENTS**

**Wrench with male hexagonal insert:  
R180197033000**

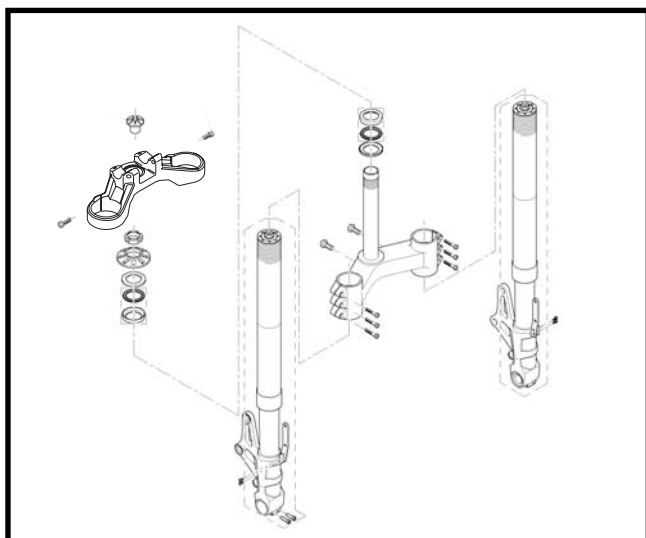
Remove the handlebar.

Loosen the three screws (6).

Take the lining (7) off downwards.

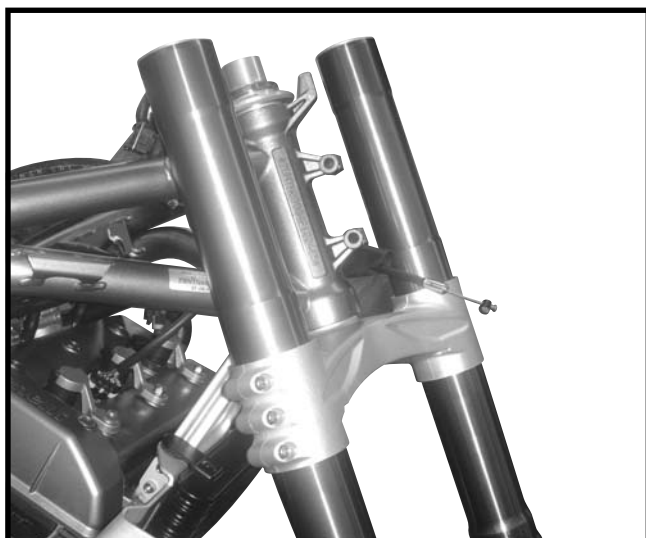
Repeat the operation for the opposite lining.





## 7.4.2 CHECK FORK LEGS

Turn directly to the supplier listed in the "SPECIFICATIONS" chapter with regard to checking the stems and linings.



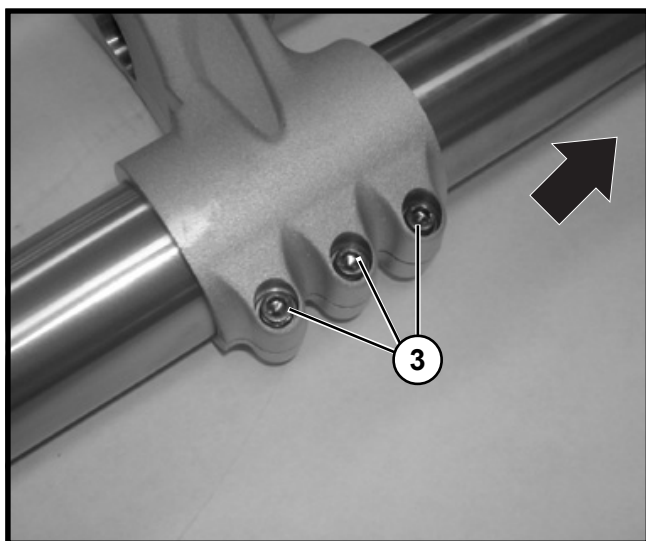
## 7.4.3 INSTALL FORK LININGS



**WARNING:**  
*Do not damage the surfaces of the linings.*

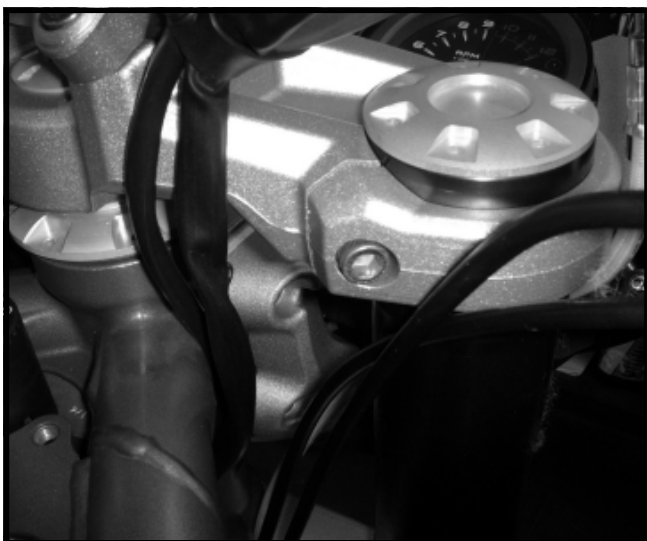


**WARNING:**  
*The stem must be mounted with the brake clamp holder support towards the inside of the vehicle.*



Insert from under the lining, right and left, without tightening the screws (3).





Position the upper steering plate (4) and adjust the stems according to specific value A.



**SPECIFIC VALUE**  
**A = 10 mm**

Tighten the screws (5), one for each stem.

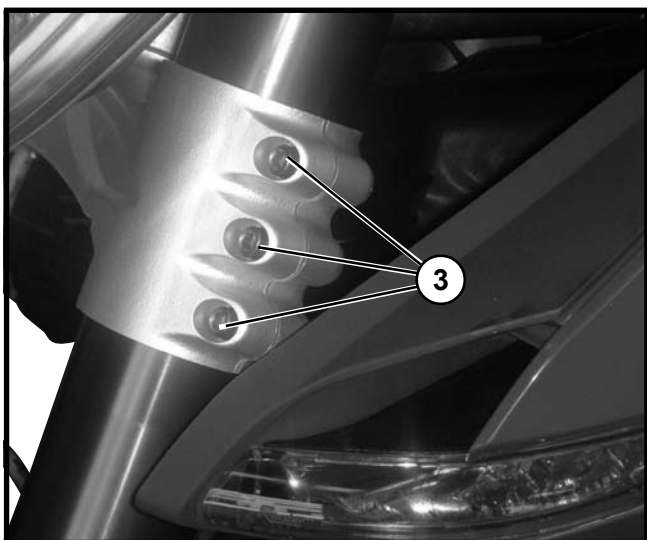


**25 N·m 2.5 Kg-m**

Tighten the steering plate central screw (6).



**60 N·m 6 Kg-m**

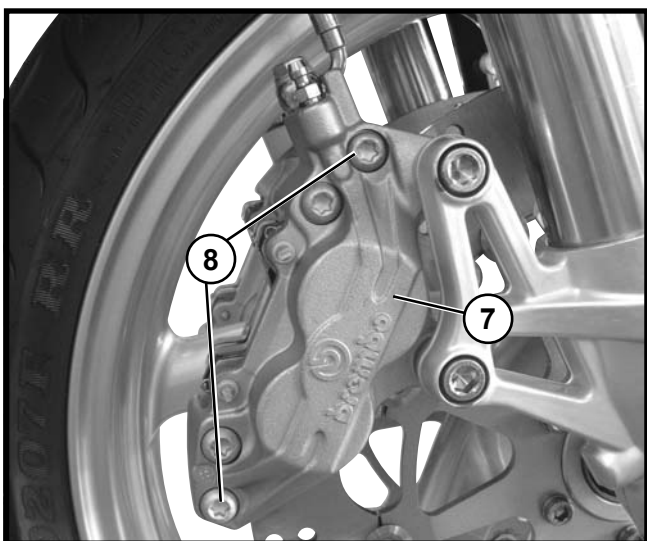


Tighten the six screws (3), three for each stem.

Position the front wheel (see "MOUNT FRONT WHEEL").



**12 N·m 1.2 Kg-m**



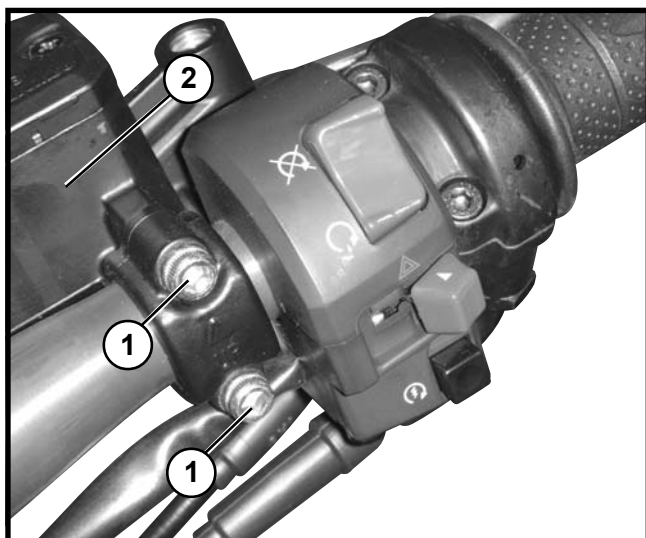
Position the front brake clamp (7) and tighten the two screws (8).

Do the same with the opposite brake clamp.



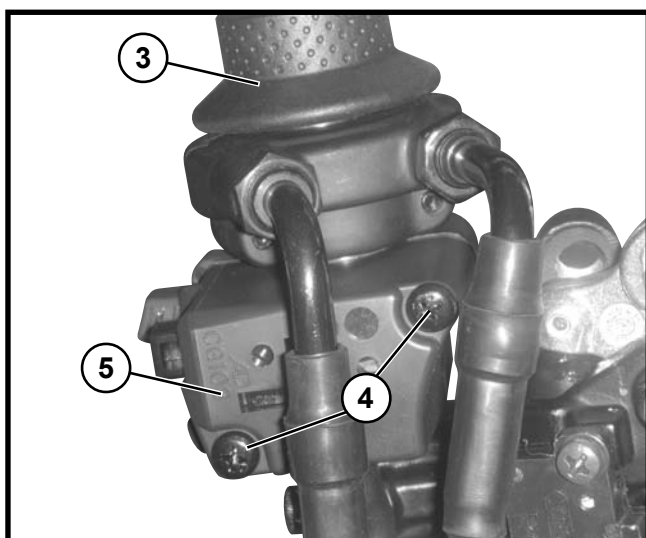
**50 N·m 5 Kg-m**



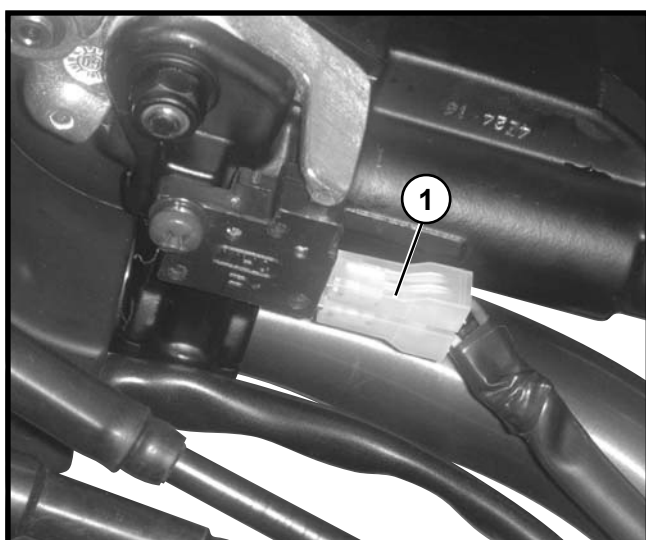


## 7.5 HANDLEBAR

Loosen and remove the two screws (1) and free the front brake pump (2).

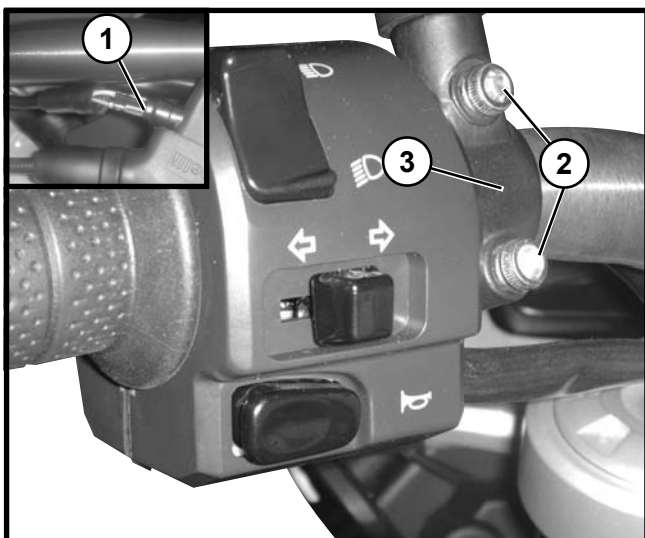


Remove the gas command, using the two screws beneath. Loosen and remove the two screws (4). Disconnect the connector. Remove right light command (5).

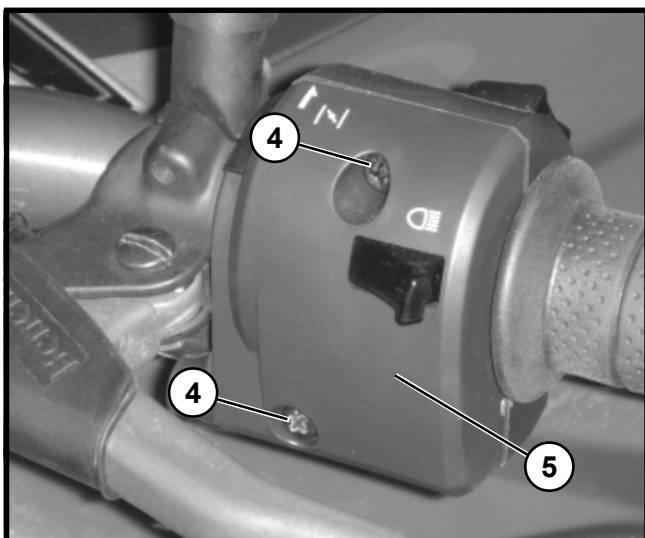


Disconnect the micro switch connector (1) brake lights.

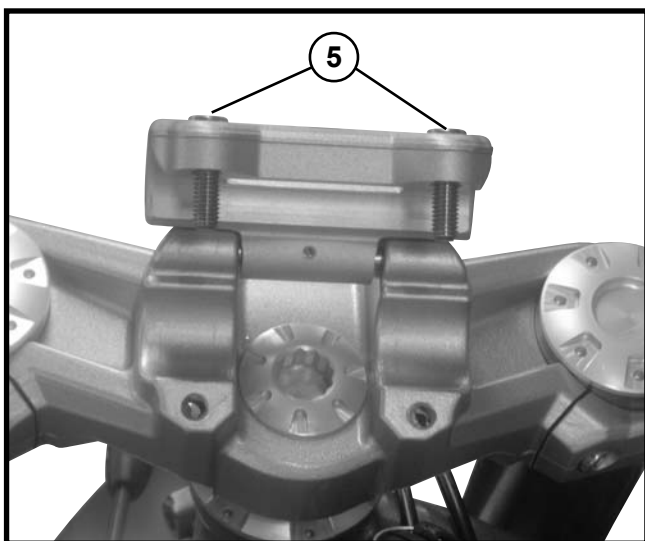




Disconnect the micro clutch connector (1), taking the rubber cap off first.  
Loosen and remove the two screws (2) and free the clutch command (3).  
Disconnect the left light command connector.

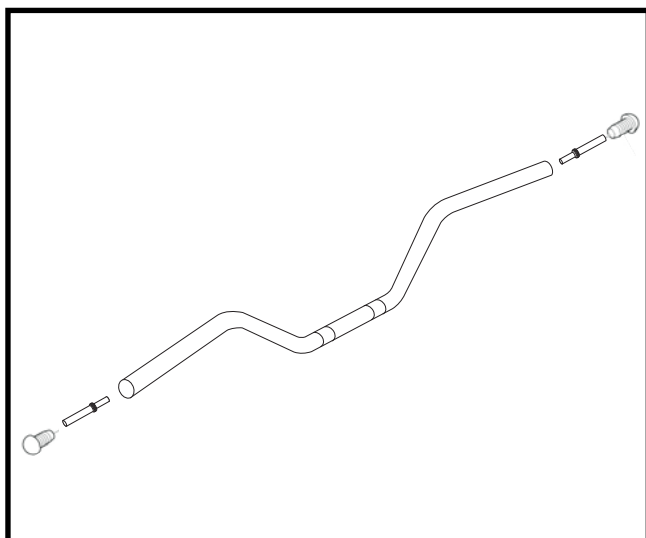


Loosen and remove the screws (4).  
Remove the left light command (5).  
Slip off the handlebar grip.



Loosen and remove the screws of the steering plate bridge (5).  
Remove the handlebar.





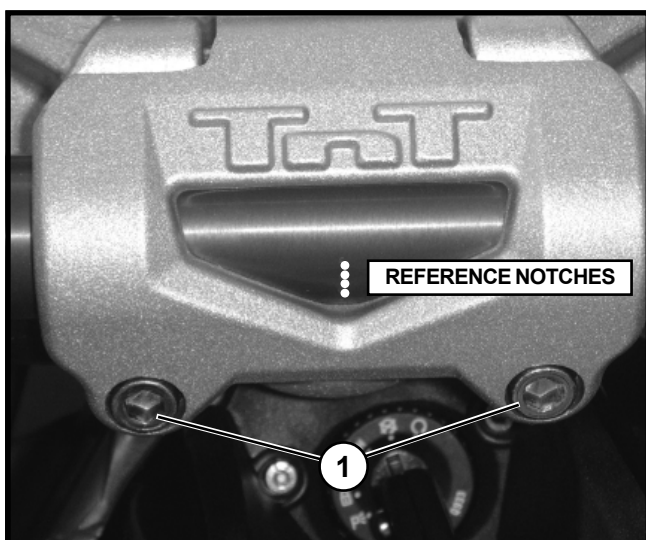
## 7.5.1 HANDLEBAR CONTROL



### ATTENTION:

*Do not try to straighten the semi-handlebar rod.*

Verify that the handlebar does not present any damages or bending.  
If necessary replace it.

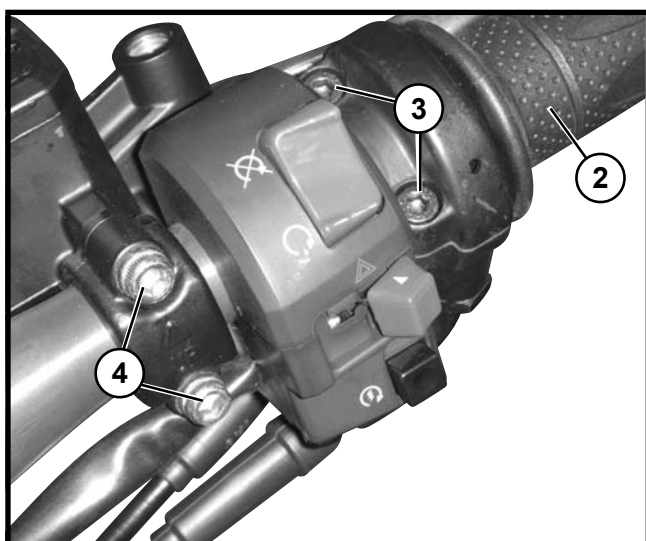


## 7.5.2 HANDLEBAR INSTALLATION

Position the handlebar on the steering plate seat.  
Verify the correct inclination with the reference notches, tighten the two screws (1) of the U-bolt to the indicated torque.

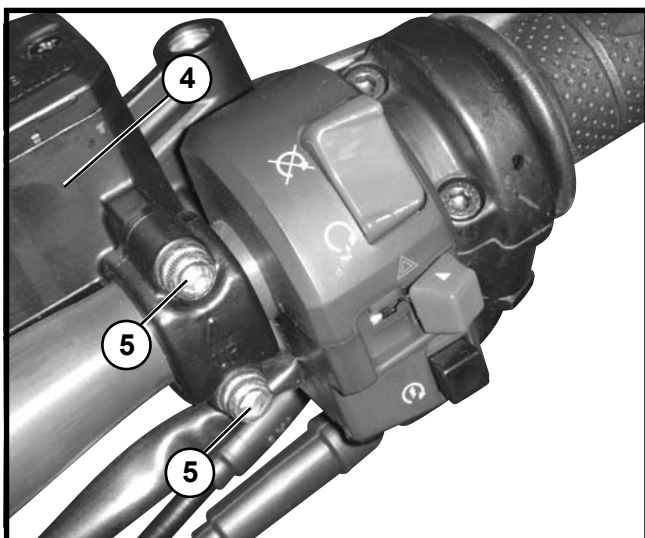


**22 N·m 2,2 Kg-m**



Position the gas command (2) fix it with the two screws (3).  
Position the front brake pump and fix it with the two screws (4).

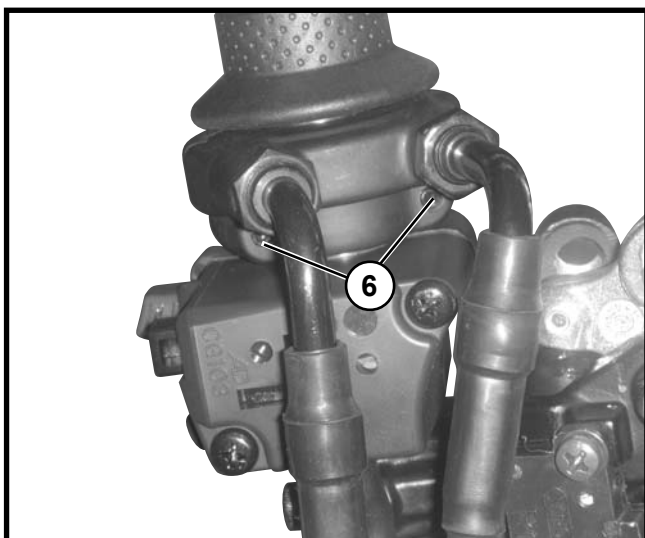




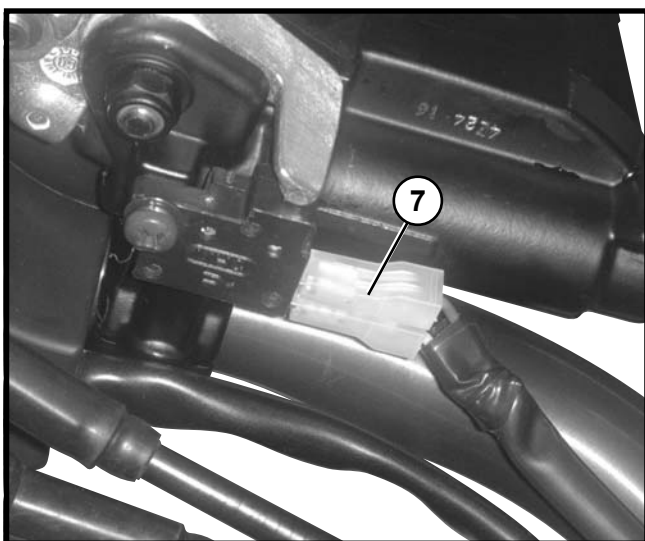
Position the front brake pump (4) and fix it with the two screws (5) to the indicated torque.



**22 N·m 2,2 Kg-m**

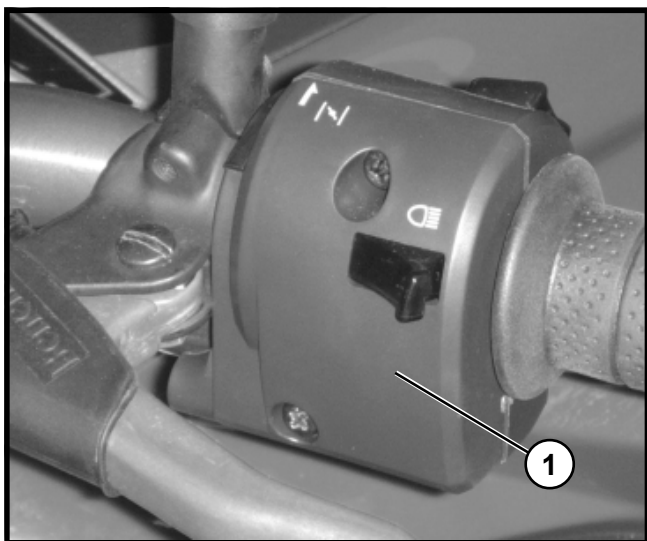


Position right light command block and fix it with the two screws (6).

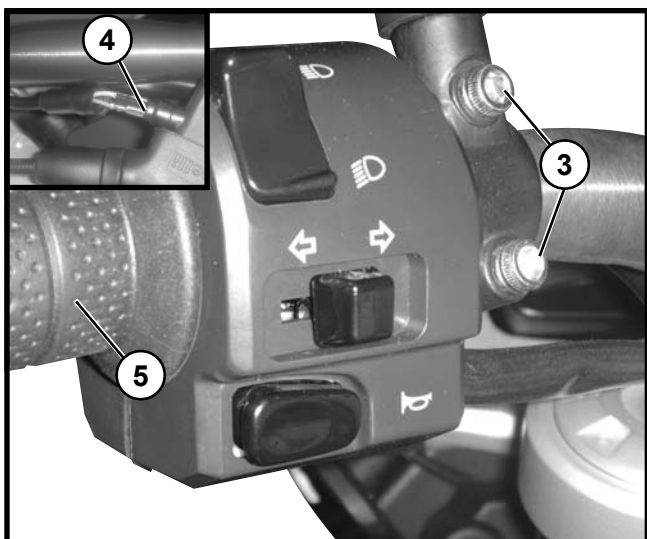


Connect the brake light micro switch connector (7).





Position the left light command block (1).  
Connect the connector.



**6 N·m 0.6 Kg-m**

Position the clutch command and tighten the two fixing screws (3).



**10 N·m 1 Kg-m**

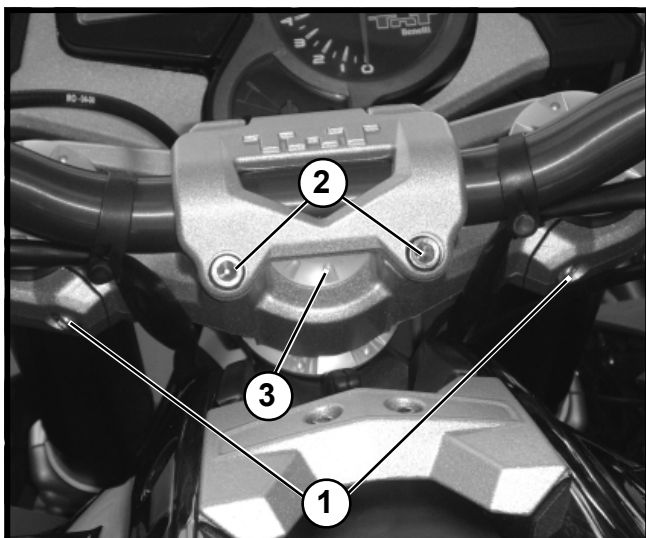
Connect the micro clutch connector (4) on the lever.  
Insert the handle (5).



## 7.6 STEERING HEAD

### 7.6.1 DISMANTLE LOWER STEERING PLATE

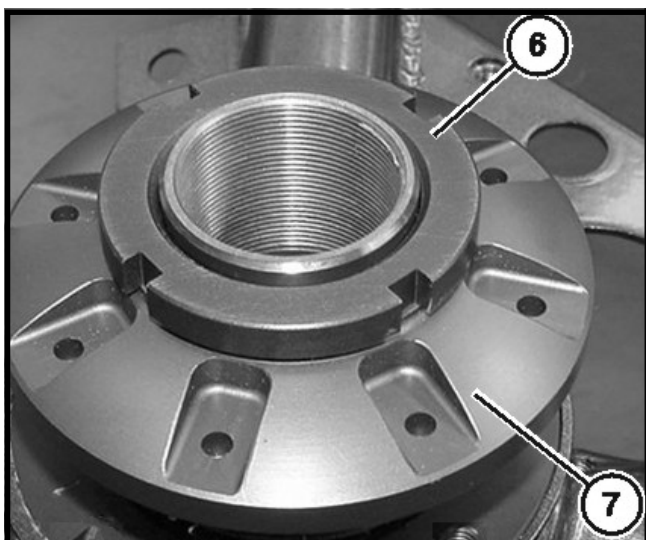
Loosen the two lateral steering plate screws (1).  
Remove the two bridge fixing screws (2).  
Remove the fixing screw, steering plate (3).  
Remove the upper plate.



#### **ATTENTION:**

*Support the lower steering plate during the following operation.*

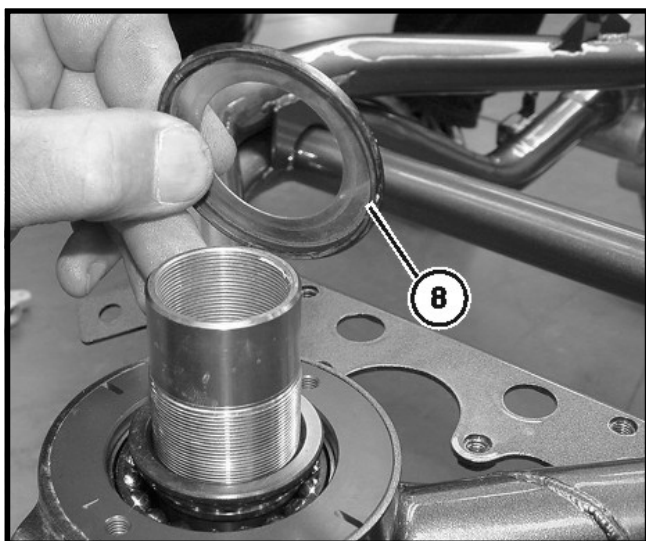
Loosen and remove the counter ring-nut (6).  
Loosen and remove the ring-nut (7).



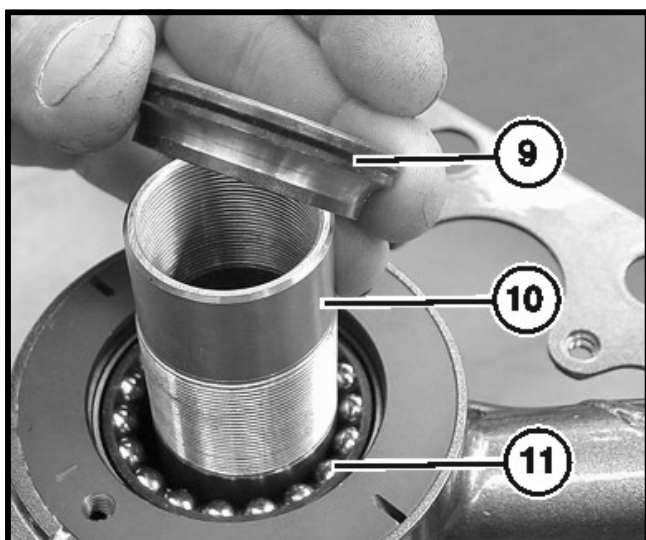
#### **SPECIFIC EQUIPMENT**

**Steering ring-nut wrench:**  
R180197031000

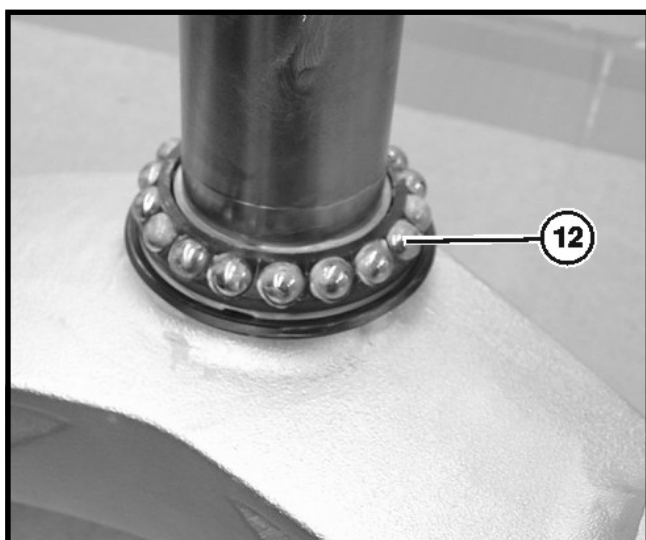
Remove the dust cover (8).



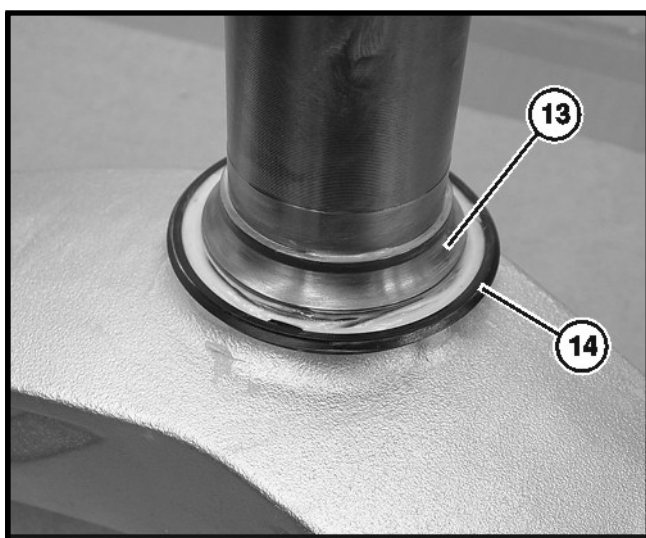




Remove the upper cowling pin (9) and the lower steering plate complete with pin (10).  
Remove the ball cage (11) and the upper and lower coupling pins inside the chassis.

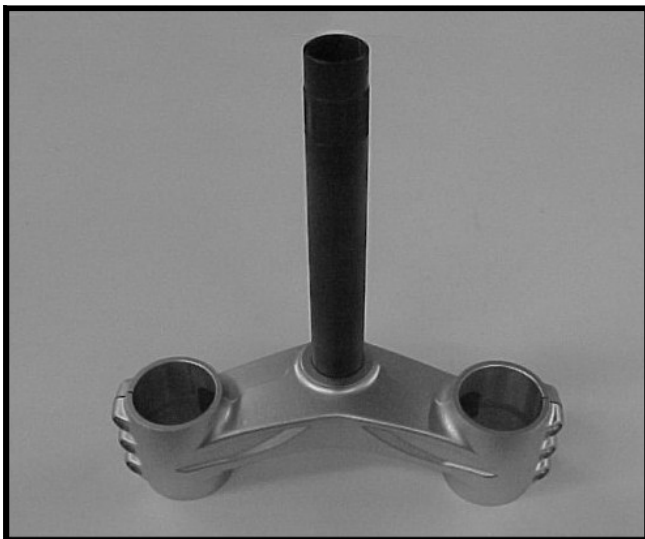


Remove the ball cage (12).



Remove the upper coupling pin (13) and the dust cover (14) from the steering plate.



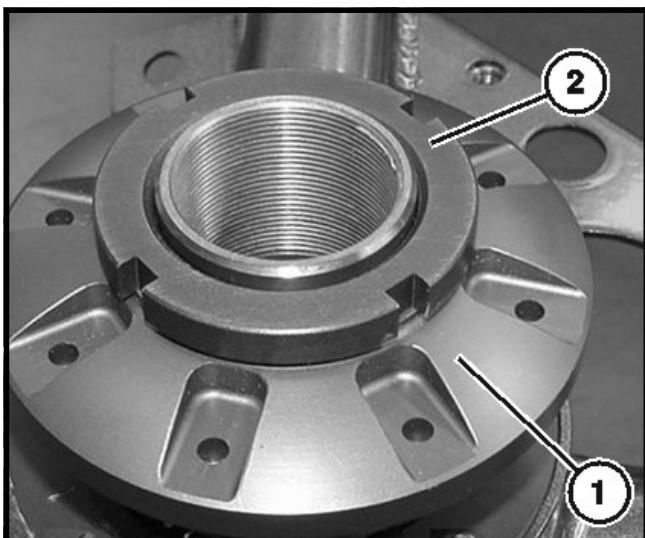


### 7.6.2 CHECK LOWER STEERING PLATE

Check that none of the components of the steering plate are broken.

Check that the steering roller cages are not excessively worn or broken.

Change the elements damaged or worn if necessary.



### 7.6.3 MOUNT LOWER STEERING PLATE

Carry out in reverse order to dismantling.  
Tighten the ring-nut (1).

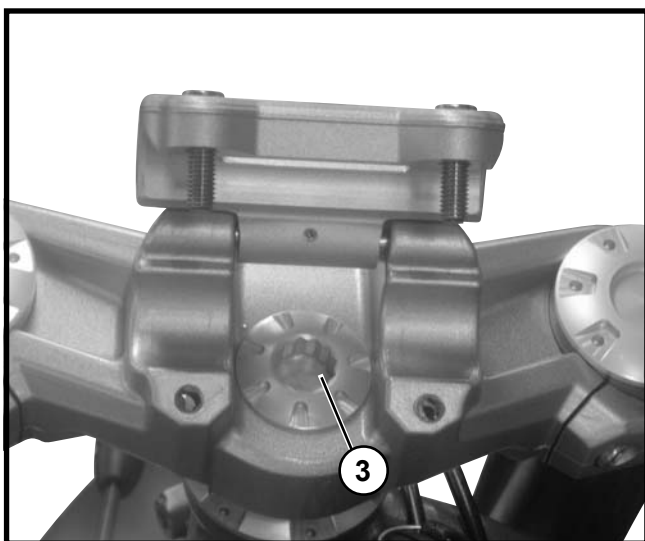


40 N·m 4 Kg-m

Tighten the counter ring-nut (2).



Manual + 90°

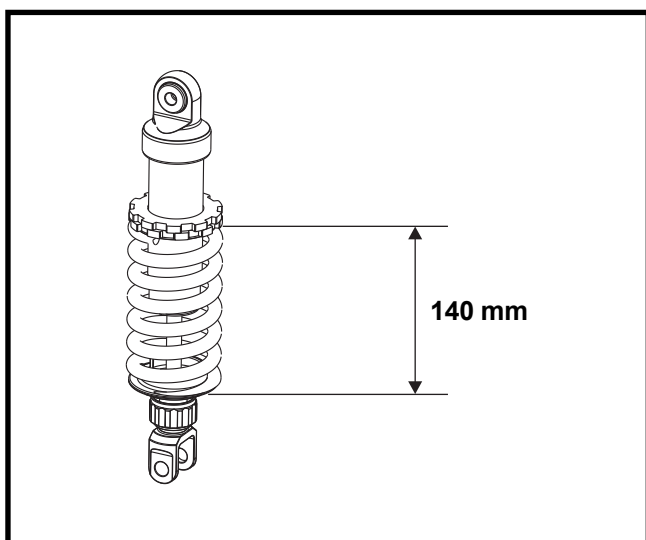


Tighten the steering fixing screw (3).



60 N·m 6 Kg-m

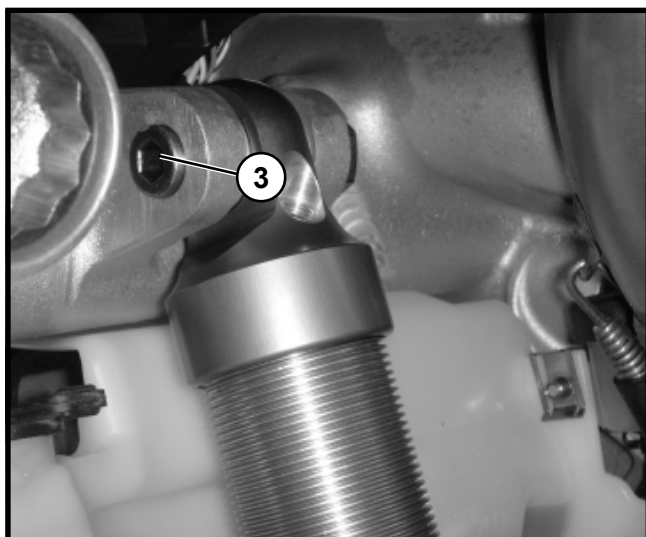




## 7.7 REAR DAMPER

### 7.7.1 CHECK REAR DAMPER

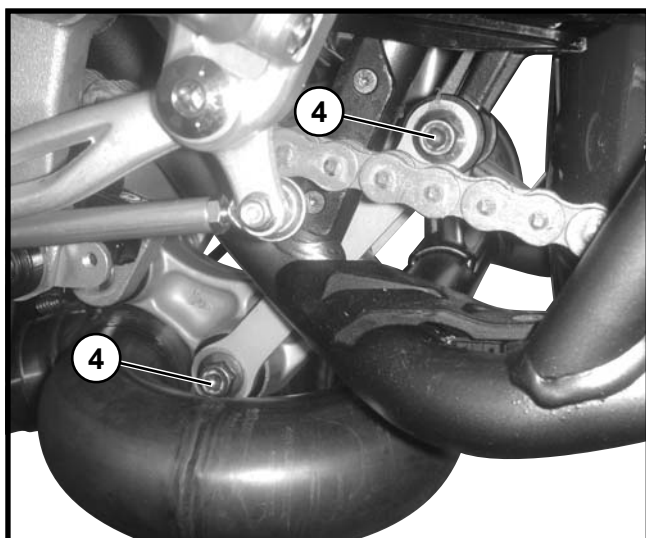
Apply to the direct supplier listed in the "SPECIFICATIONS" chapter with regard to checking the rear damper.



### 7.7.2 REMOVE REAR DAMPER

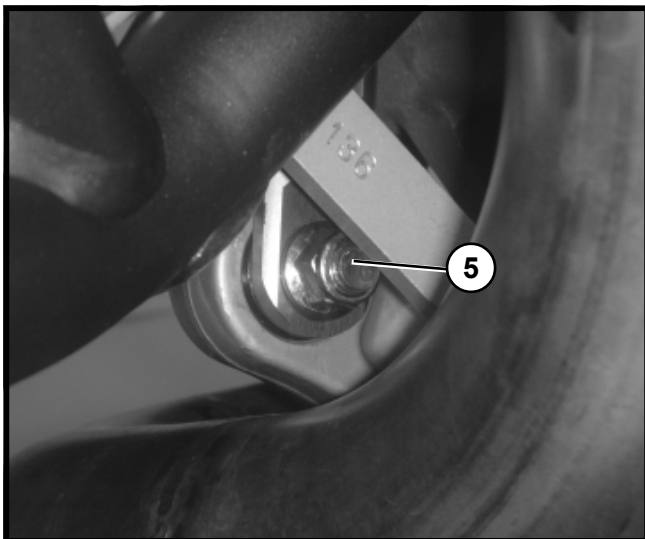
Lift the vehicle adequately with some supports under the driver's footboards keeping the back wheel raised from earth.

Loosen and remove the upper fixing screw (3) from the engine setting the shock-absorber free, laying the wheel to ground.

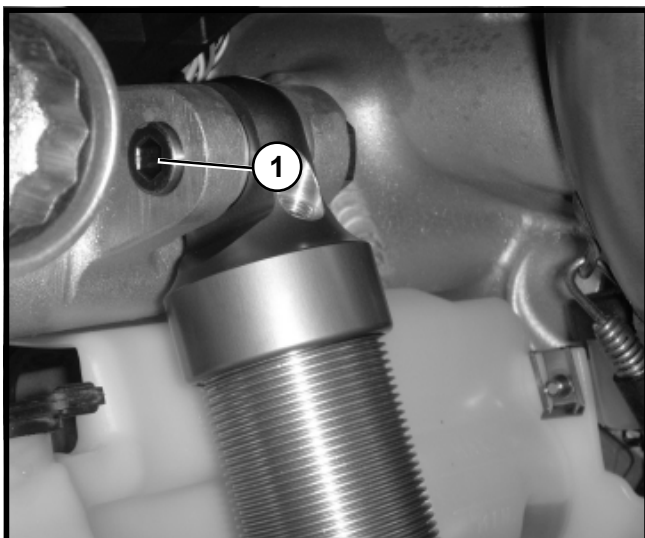


Loosen and remove the nuts and the related screws (4). Remove the two connecting rods.





Loosen and remove the lower shock-absorber fixing screw (5). Setting the shock-absorber totally free slip the shock-absorber off from the left side.

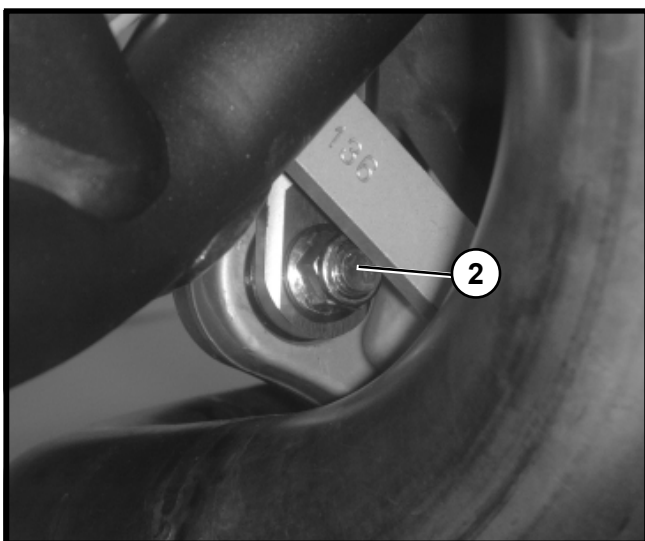


### 7.3.3 MOUNT REAR DAMPER

Operate in the reverse sense to dismantling. Tighten the upper shock-absorber fixing nut (1) to the indicated torque.



50 N·m 5 Kg-m

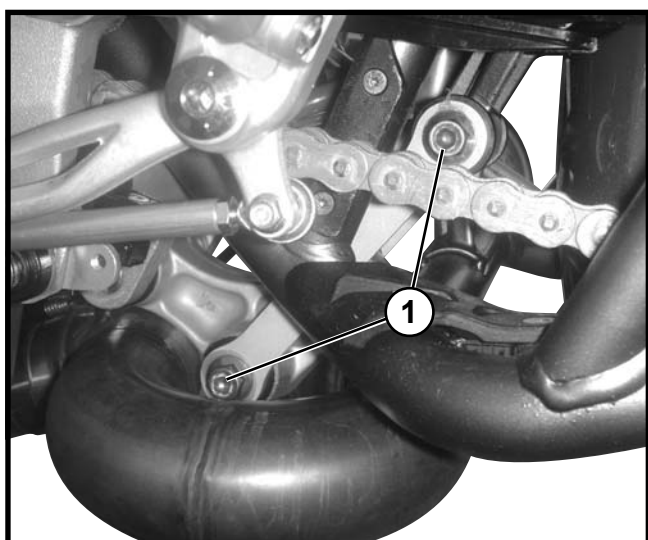


Tighten the lower shock-absorber fixing nut (2) to the indicated torque.



50 N·m 5 Kg-m





Tighten the connecting rod fixing nuts (1) to the indicated torque.

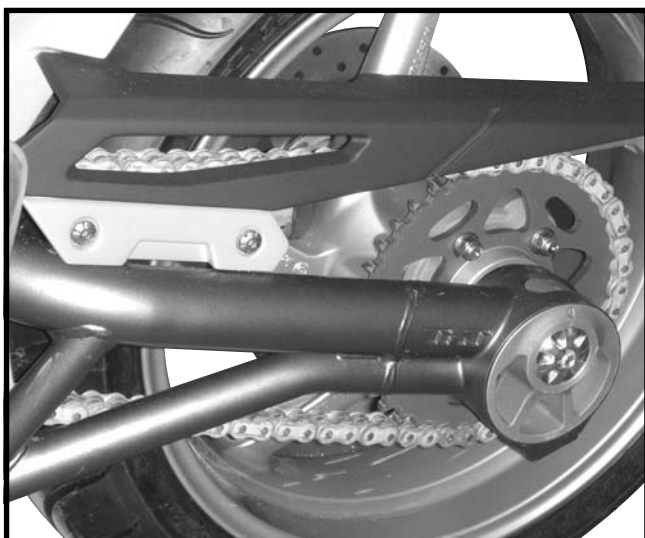


**50 N·m 5 Kg-m**



**65 N·m 6,5 Kg-m**





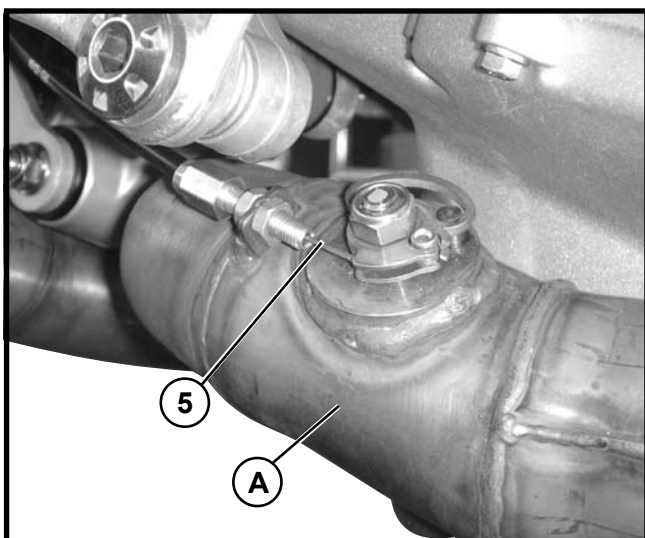
## 7.8 REAR FORK

### 7.8.1 REMOVE REAR FORK

Support the vehicle adequately.  
 Remove the rear wheel(see "REMOVE REAR WHEEL").  
 Remove the chain (see "DISMANTLE CHAIN").  
 Remove the mudguard.  
 Remove the chain carter.  
 Remove the brake pliers.

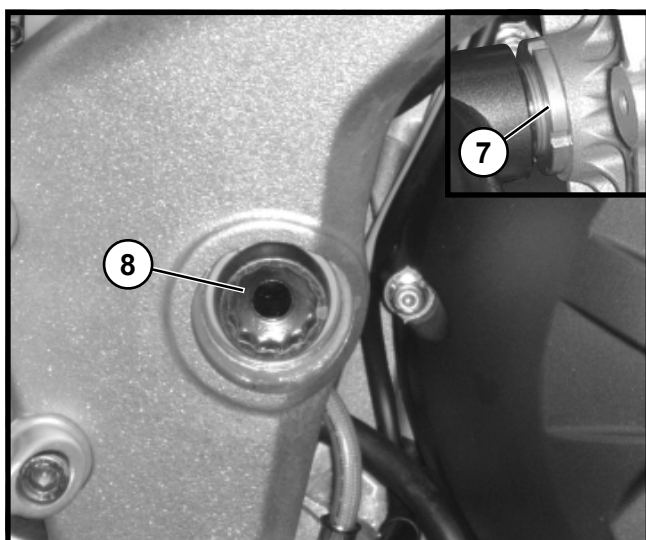


Disconnect the connector of the speed sensor wiring (4).

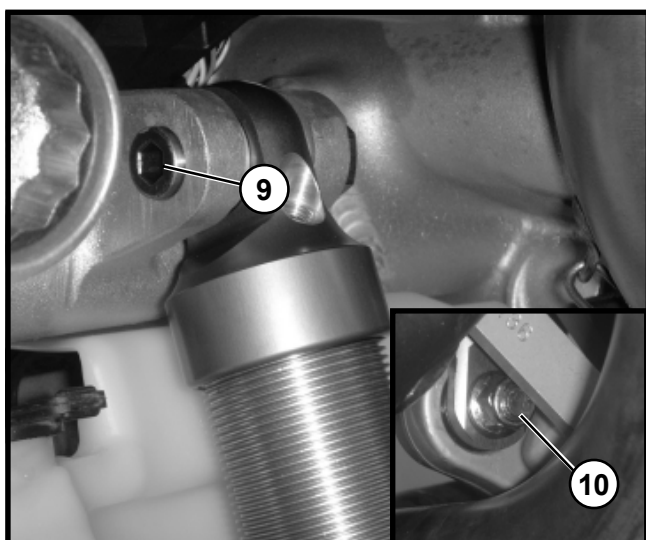


Disconnect the cable (5) on the exhaust valve.  
 Remove the muffler (A), the pipe union (b) and the pipe union (c).

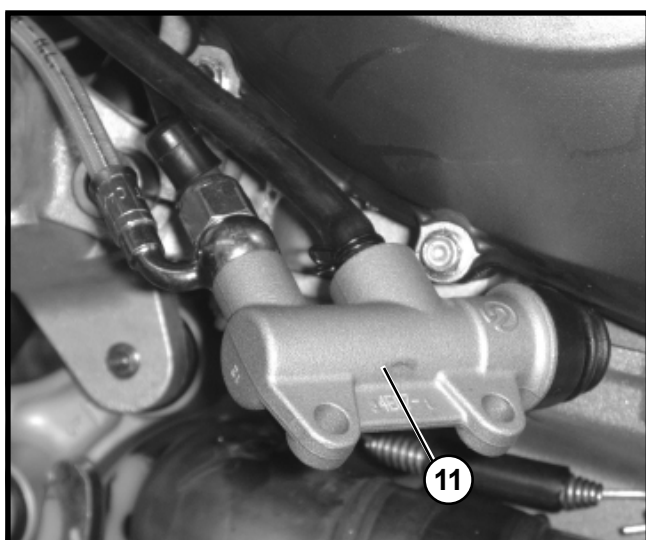




Loosen the reaction ring nut (7) inside the frame, loosen the register (8).

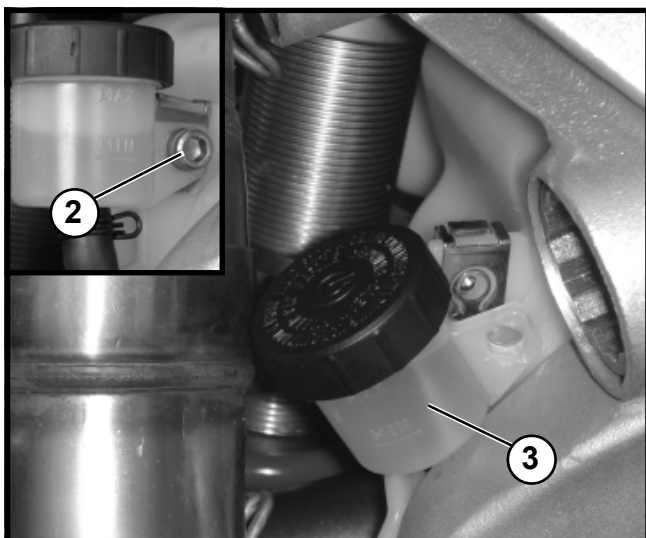


Loosen the nut (9) and the relative upper fixing screw of the shock-absorber.  
Loosen and remove the lower fixing screw shock-absorber.

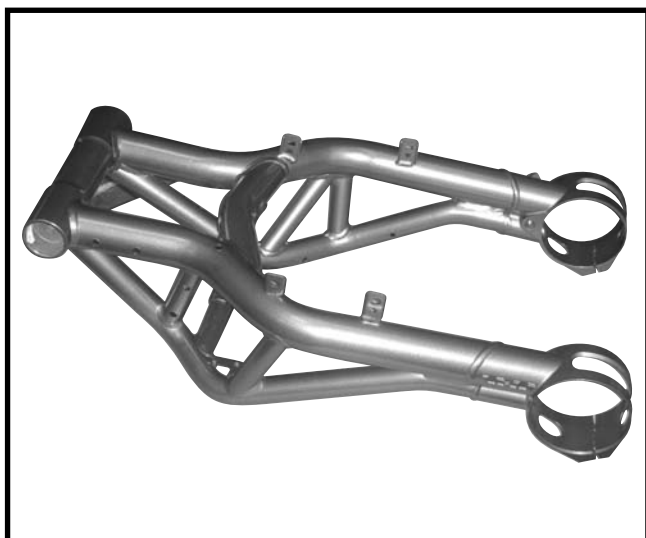


Set the back brake pump body free (11).

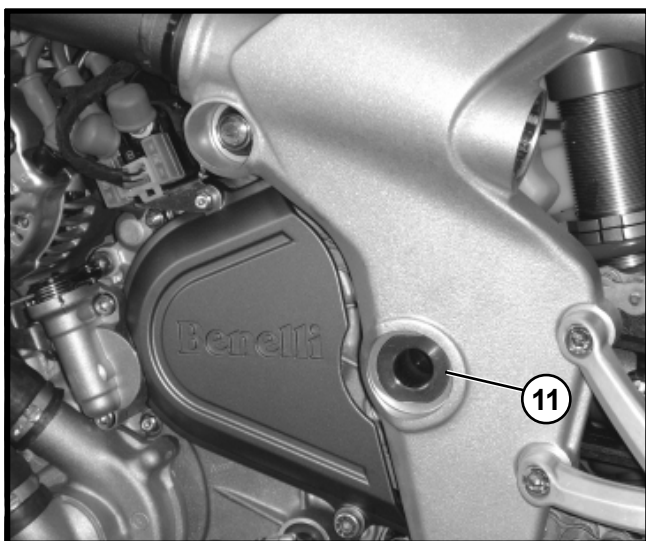




Loosen and remove the upper fixing screw (2) of the right footboard setting the brake oil tank free.

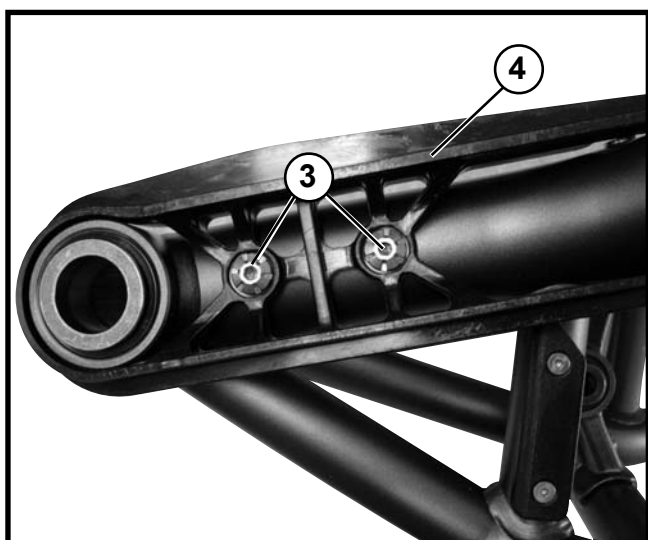


Slip off the fork from the frame.

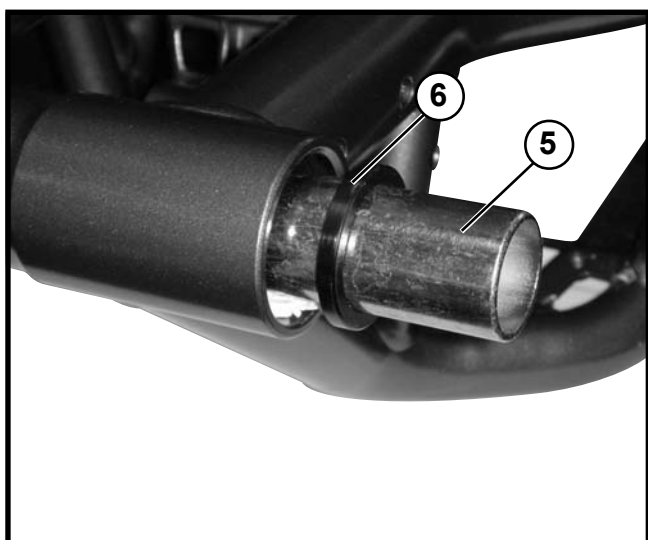


Slip off the pivot (11).  
Extract the fork.

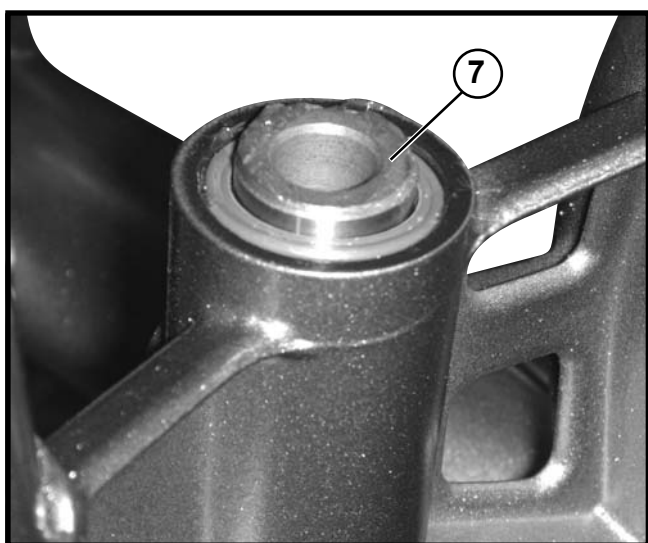




Loosen and remove the two screws (3) and remove the chain pad (4).

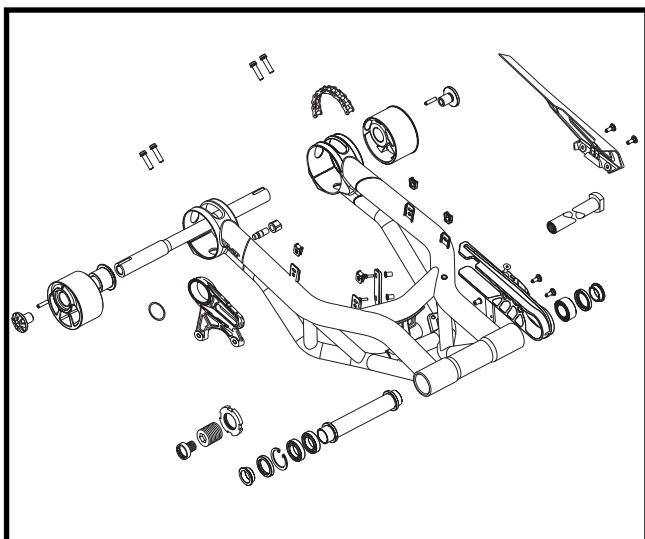


Remove the ferrule (5) and the oil seal (6).  
Repeat the operation on the opposite part of the rear fork as well.



Remove the oil seal (7).  
Repeat the operation on the opposite part of the rear fork as well.





### 7.8.2 CHECK REAR FORK

Sight check the state of the rear fork, change it if there are breaks.

Check the free rotation of the ball-bearings (1). If necessary, change them.

Check the state of wear of the chain pad. If necessary change it. Verify the eccentrics state if necessary replace them.

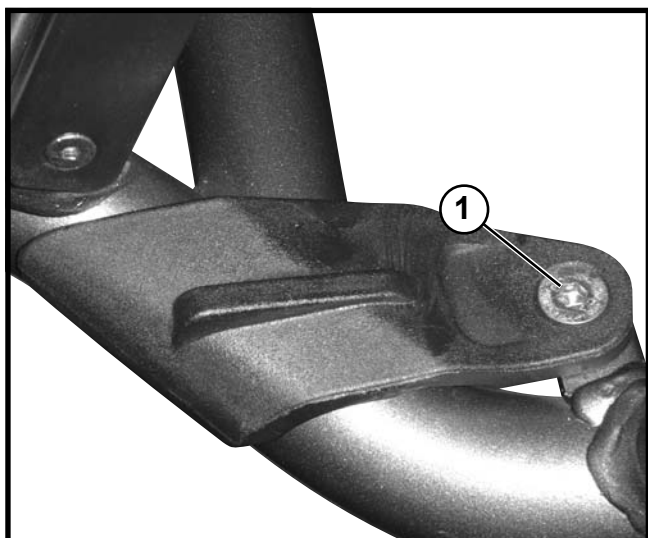


### 7.8.3 MOUNT REAR FORK



**ATTENTION:**  
*Always use new oil seals.*

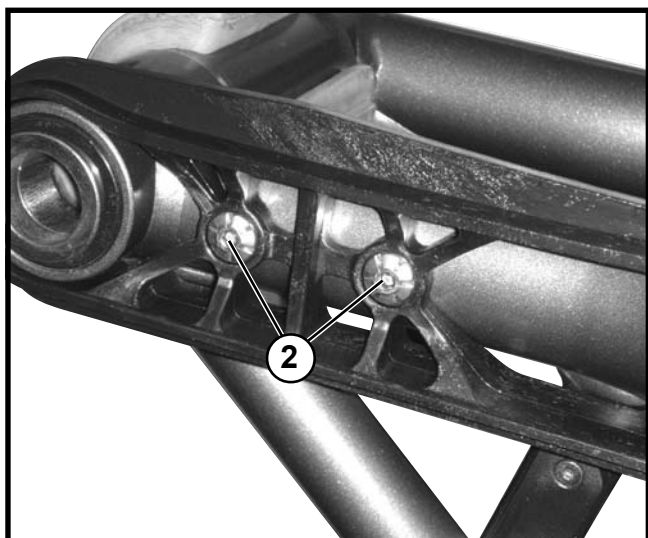
Proceed in the reverse manner to dismantling.  
Tighten the screws (1) of the lower chain shoe



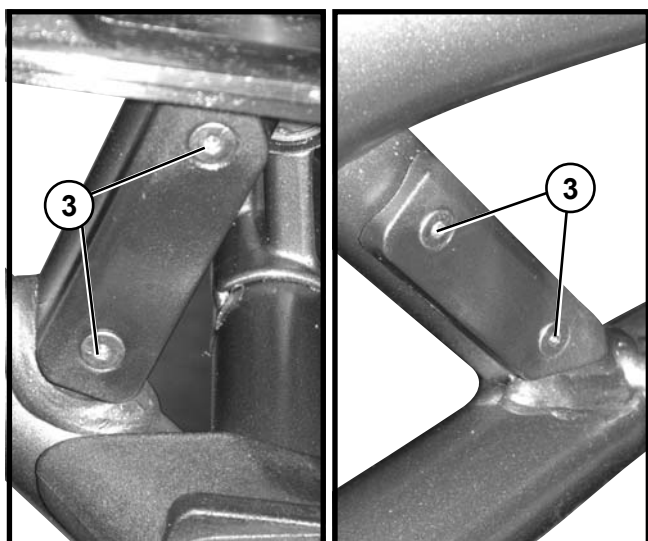
Tighten the screws (2) of the upper chain shoe to the indicated torque.



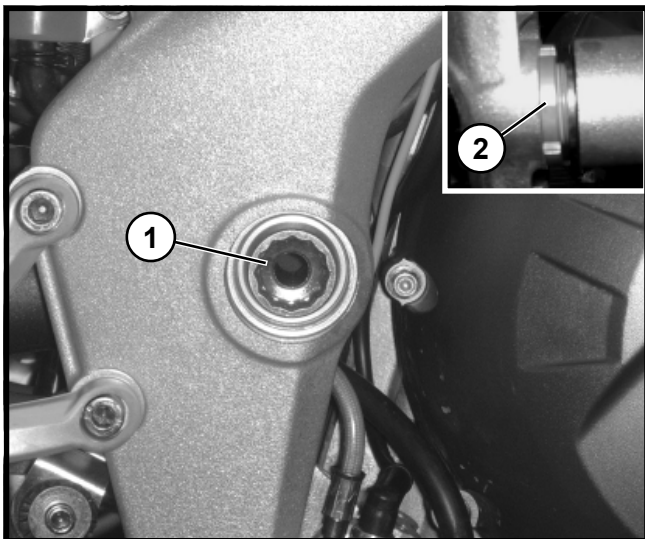
**10 N·m 1 Kg-m**



Tighten the screws (3) of the internal chain shoes.







#### 7.8.4 BACK FORK INSTALLATION ON FRAME

Operate in the reverse manner to removal.

Bring the adjuster (1) to touch and tighten.

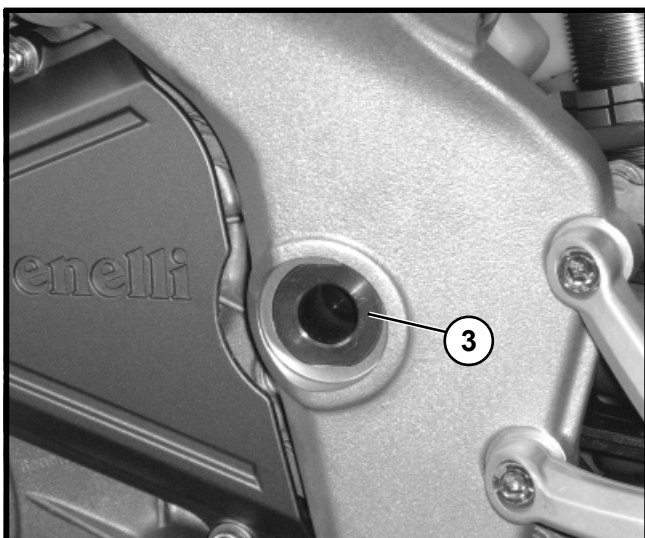


+ 90°



40 N·m 4 Kg-m

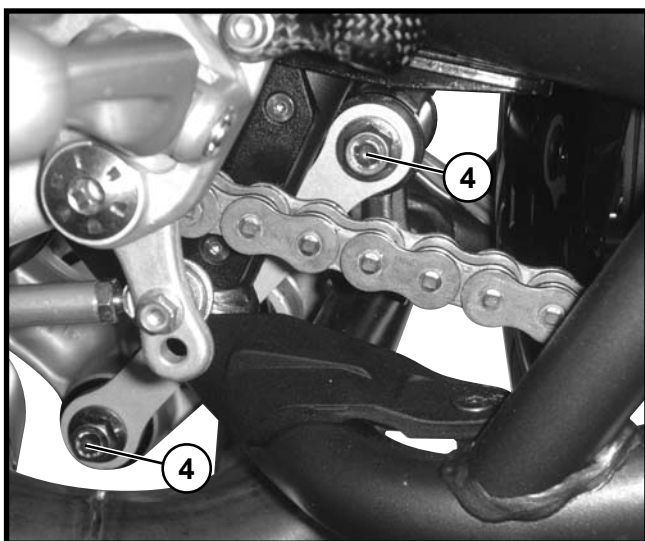
Tighten the ring nut (2) placed inside the frame.



Insert the pin from the left side.  
Tighten the rear fork pin fixing screw (3).



65 N·m 6,5 Kg-m



Tighten the two connecting rod nuts (4) to the indicated torque.



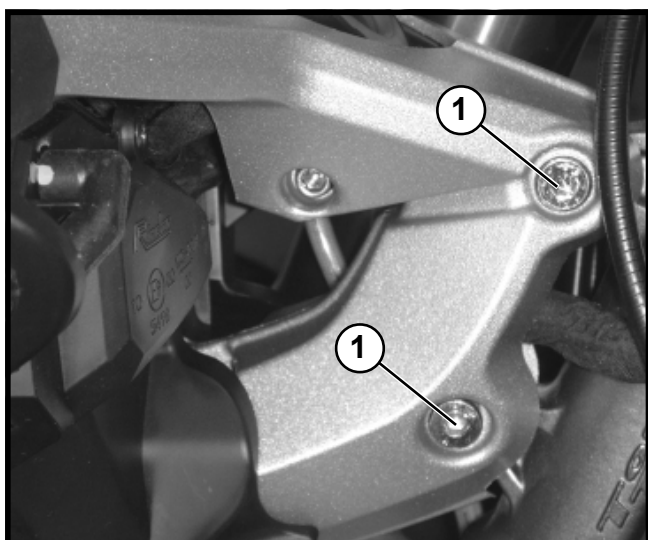
50 N·m 5 Kg-m



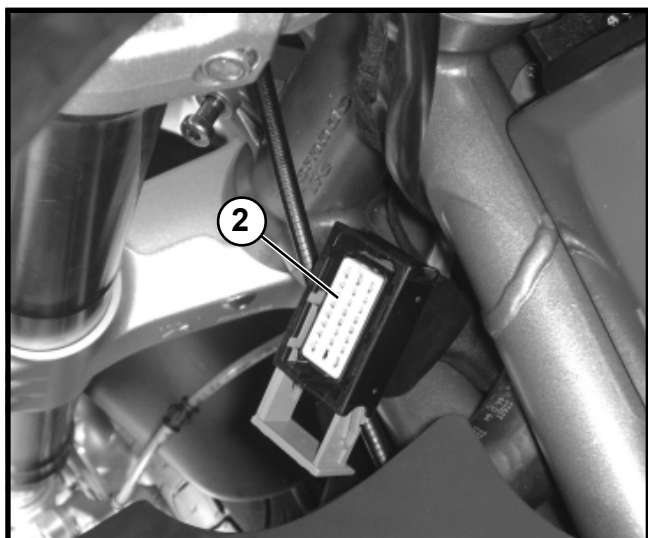
## 7.9 SUPPORT FRAME

### 7.9.1 LIGHT SUPPORT FRAME REMOVAL

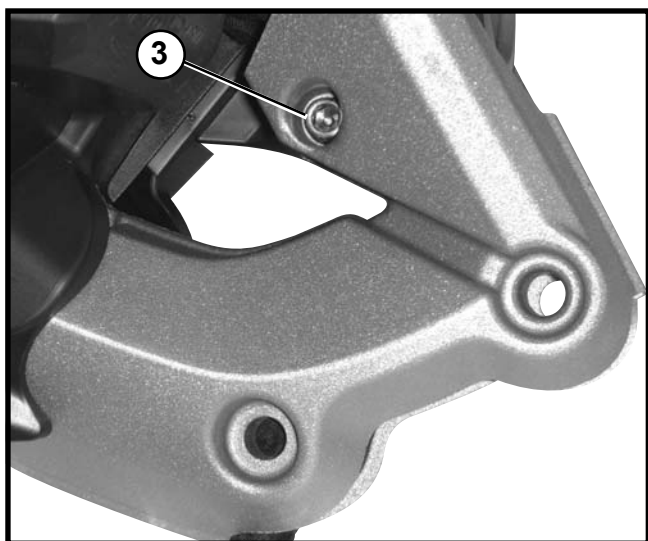
Loosen and remove the two screws (1).



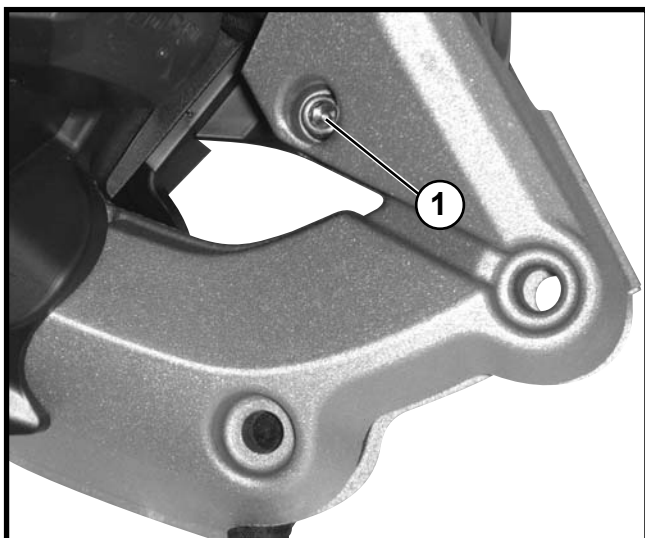
Disconnect the front light wiring connector (2).  
Remove the light support frame.  
Remove the front shield (see "front shield disassembly").  
Remove the light from the light support frame (see "LIGHT DISASSEMBLY").



Loosen and remove the central closing screw (3) on right and left framelet.

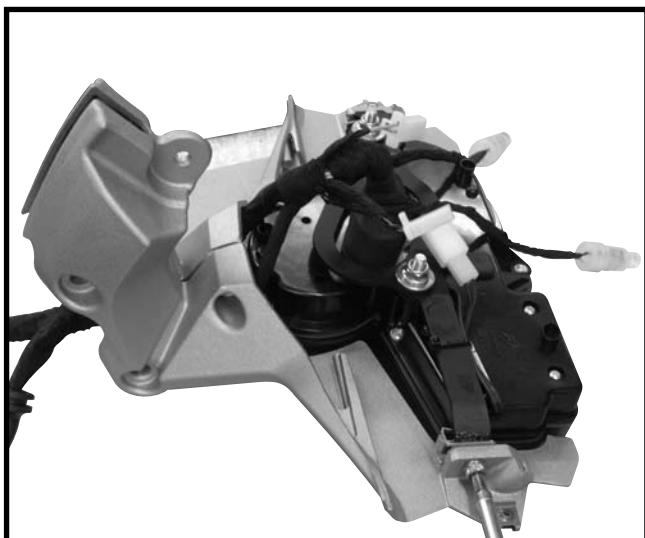






Loosen and remove the lateral fixing screws (1) of the speed meter dashboard.

Take off the dashboard, separate the light support frame.

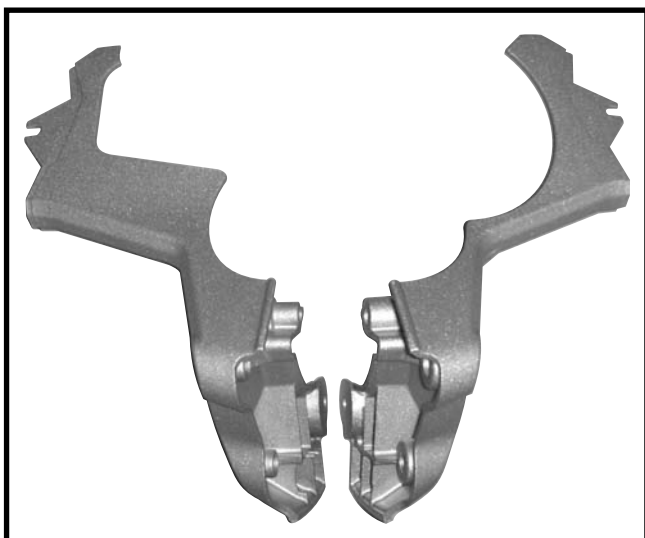


### **7.9.2 TEST FRONT LIGHT SUPPORT FRAME**

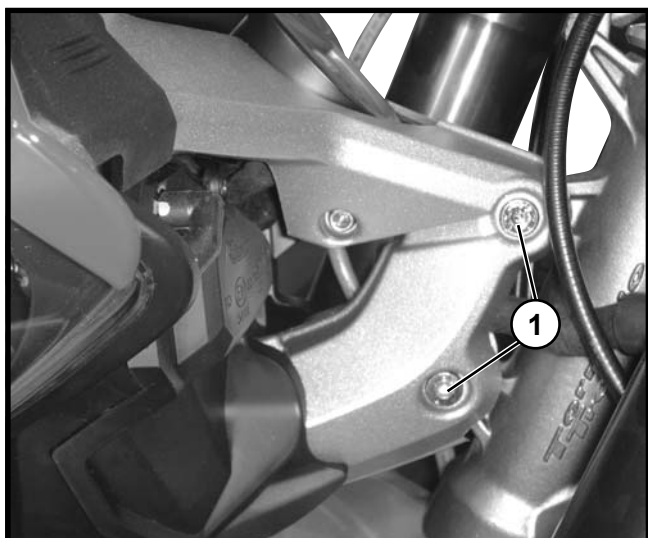
Check the state of the two parts of the light support frame visually.

If necessary replace the damaged piece.

Do not try to straighten.





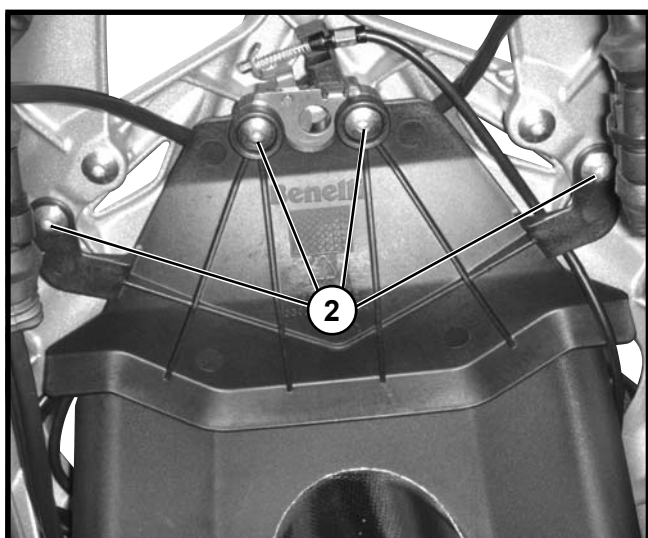


### 7.9.3 FRONT LIGHT SUPPORT FRAME INSTALLATION

Operate in the reverse manner to removal.  
Tighten the two fixing nuts (1) on the frame to the indicated torque.  
Connect the front wiring connector.



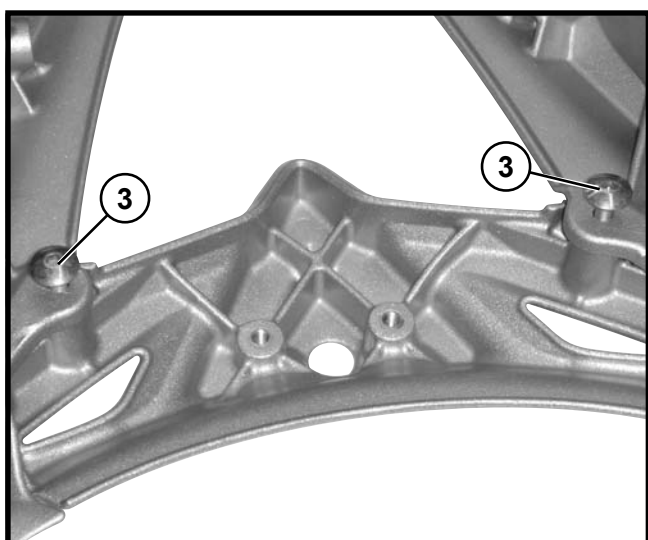
12 N·m 1,2 Kg-m



### 7.10 REAR FRAME

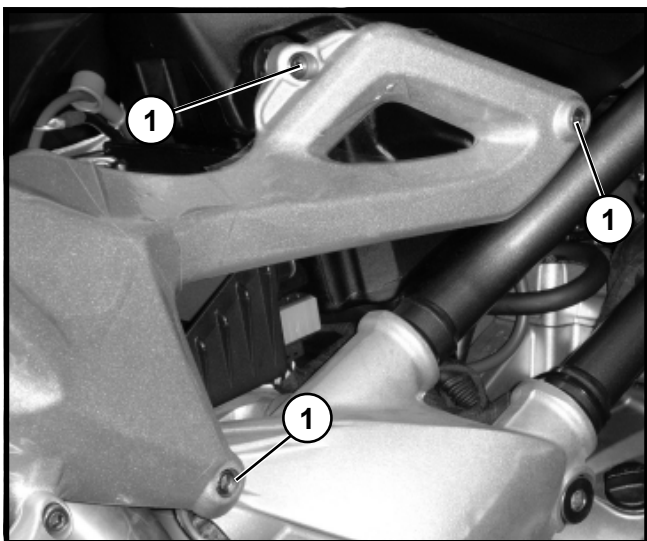
#### 7.10.1 BACK RIGHT FRAME DISASSEMBLY

Loosen and remove the heat shield screws (2) under the saddle.  
Remove the number plate holder.  
Remove the muffler.  
Remove the saddles.

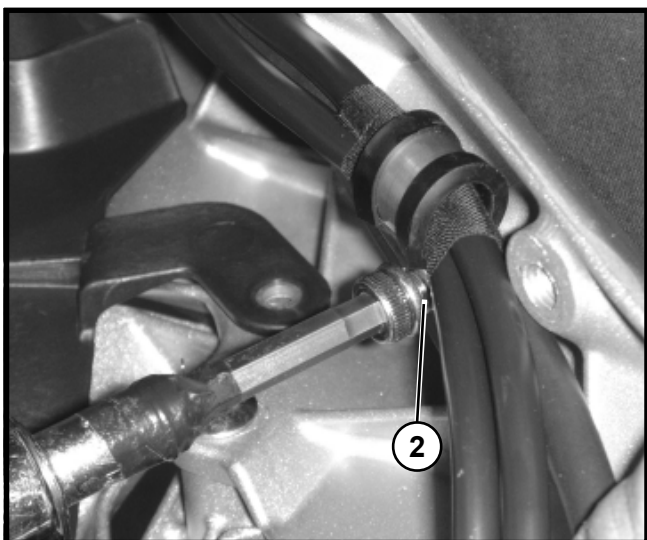


Loosen and remove the screws (3).  
Remove the rear frame cross bar.



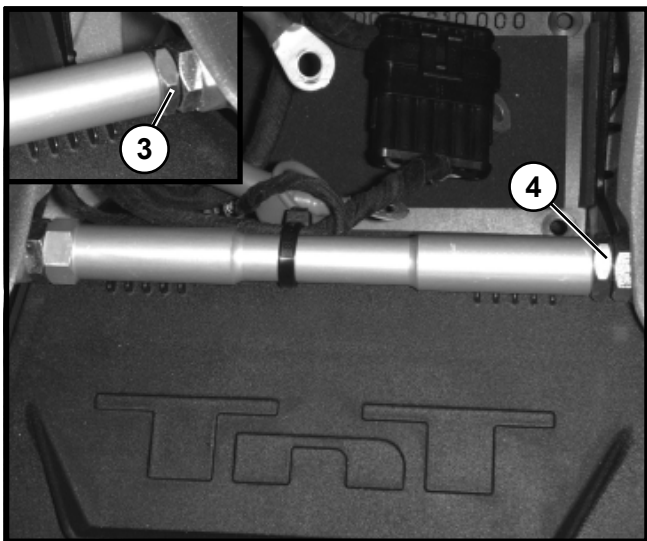


Loosen and remove the lateral fixing screws (1).



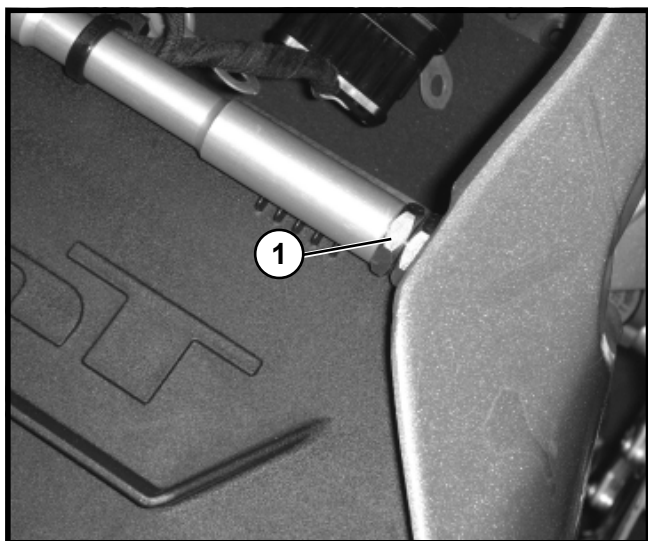
Loosen and remove the screw (2).  
Remove the internal wiring fixing clip.

**NOTE:**  
Verify always before dismantling the passage of the wiring.



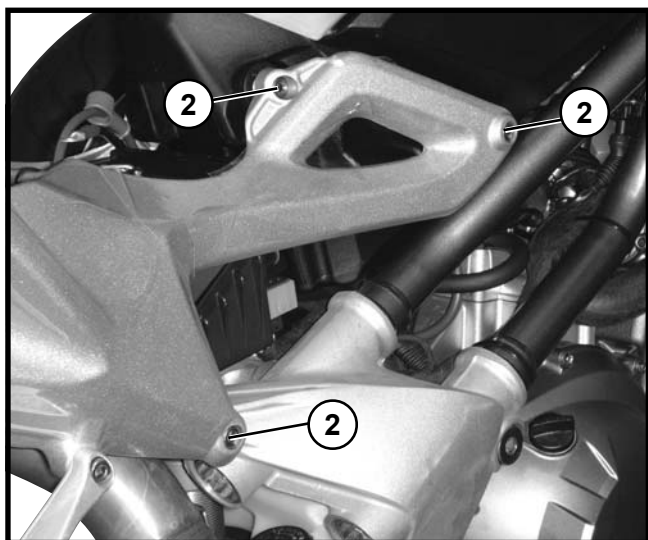
Loosen the lock nut (3) of the joint pivot.  
Loosen the pivot (4) making the side of the frame come out from its seat.  
Remove the right side of the frame.





### 7.10.2 BACK RIGHT FRAME ASSEMBLY

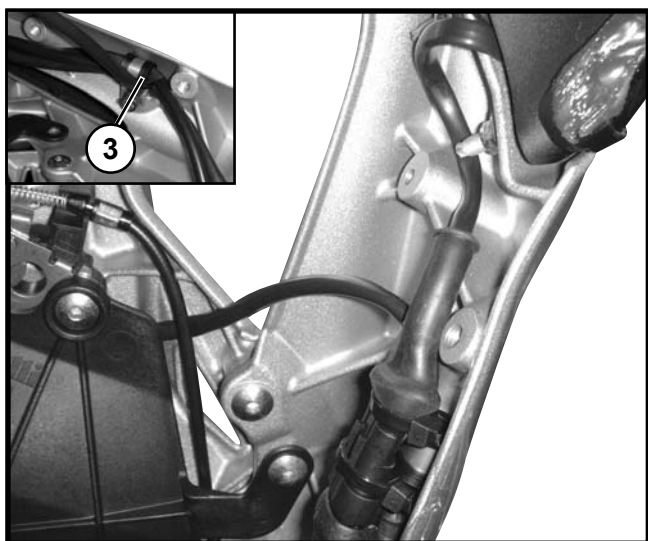
Position the right side of the rear frame on motion.  
Screw the joint pivot up to reach the contact of the two parts.  
Block the pivot with the lock nut (1).



Position and tighten the frame right side fixing screws (2) to the frame with the indicated torque.

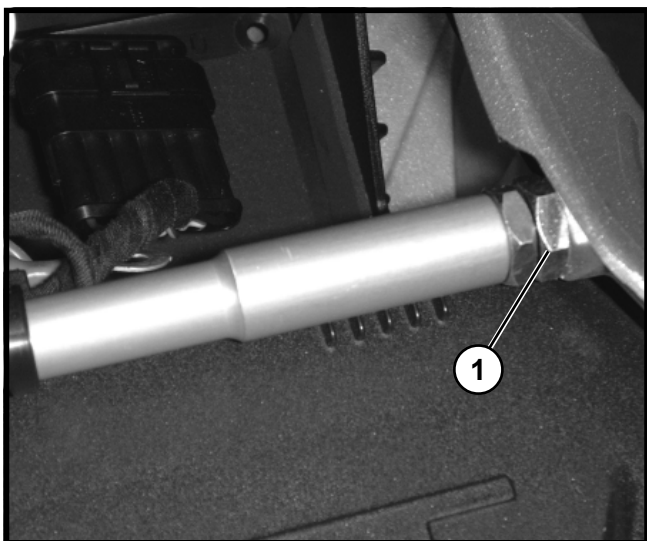


**22 N·m 2,2 Kg-m**

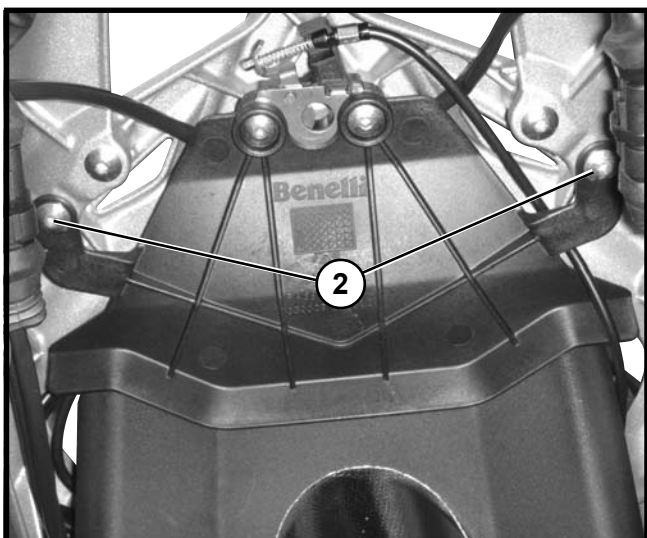


Position and fix the wiring on the inner side of the frame with tie-wraps(3).

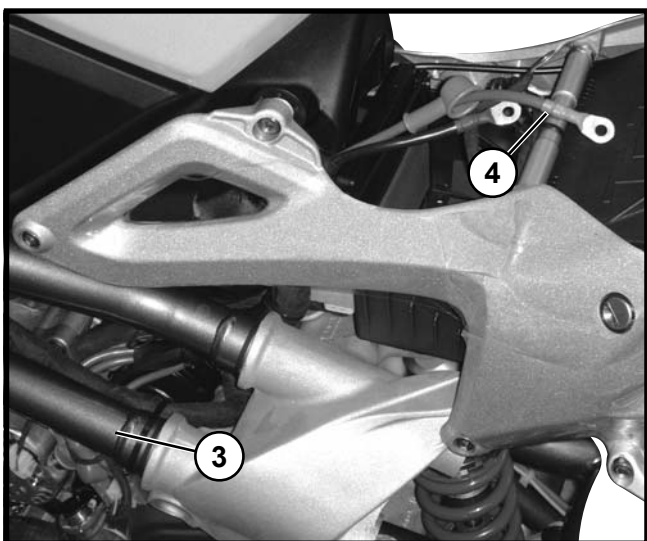




Position the cross bar.  
Tighten the screws (1) to the indicated torque.



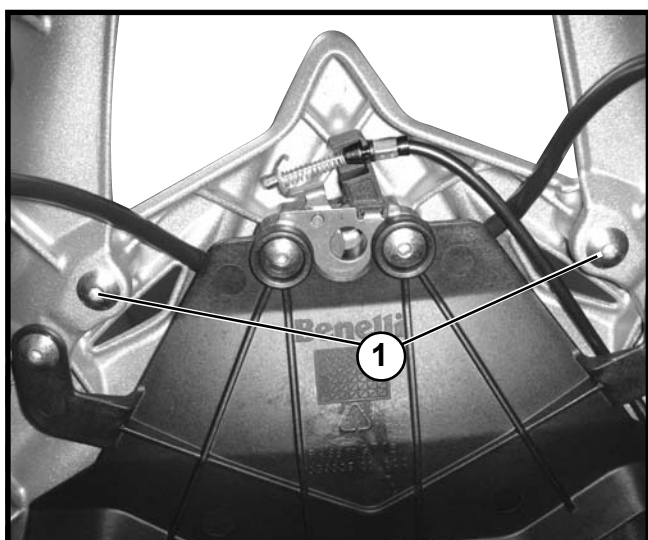
Position the heat shield under the saddle and tighten the screws (2).  
Assemble the number plate holder (see "NUMBER PLATE HOLDER assembly").  
Assemble the muffler.



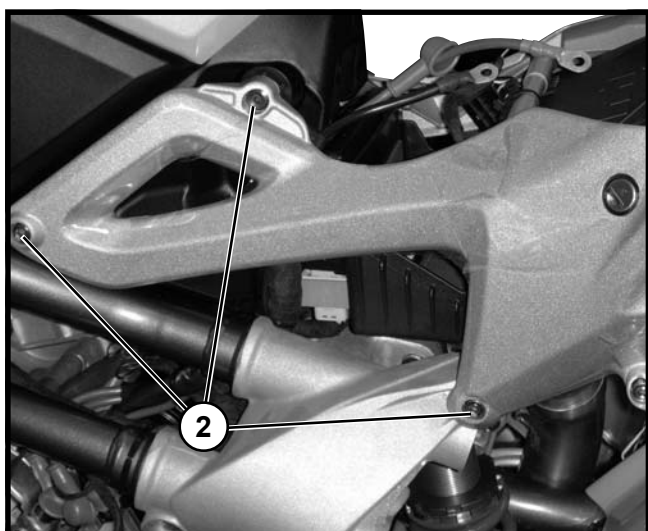
### 7.10.3 LEFT BACK FRAME DISASSEMBLY

Remove the saddles.  
Remove the number plate holder.  
Remove the muffler.  
Loosen and remove the screws of the heat shield under the saddle.

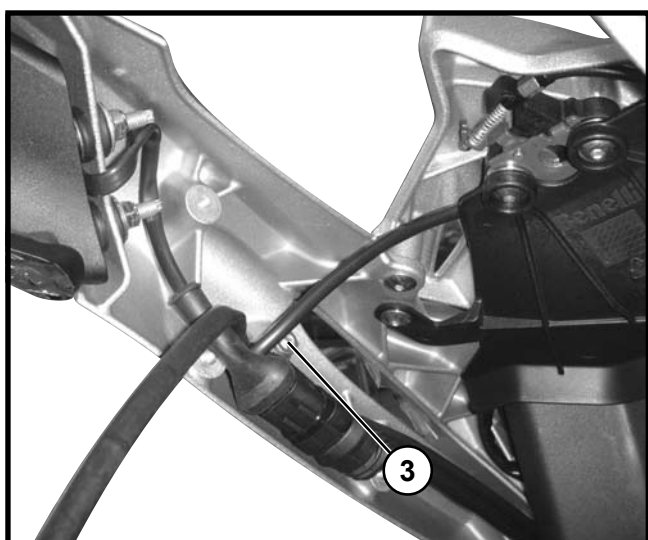




Loosen and remove the screws (1).  
Remove the back frame cross bar.



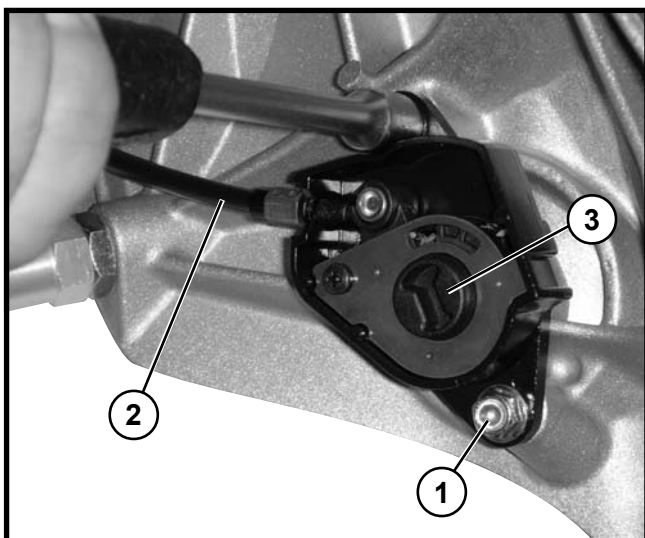
Loosen and remove the lateral fixing screws (2).



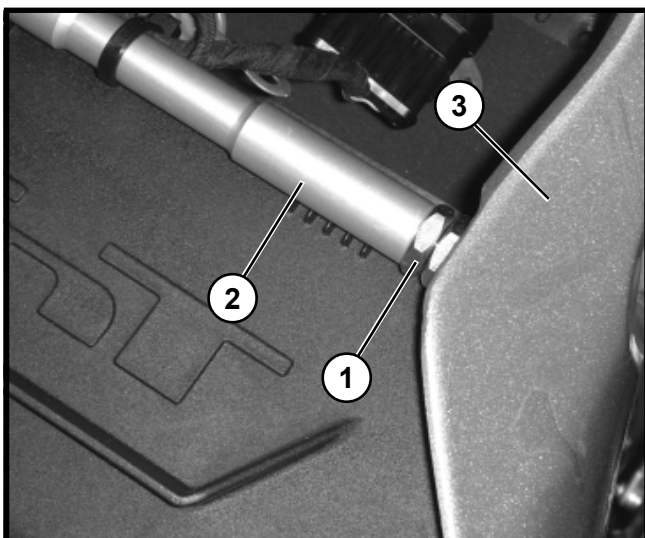
Loosen and remove the screw (3).  
Remove the internal wiring fixing tie-wrap.

**NOTE:**  
Verify always before dismantling the passage of the wiring.

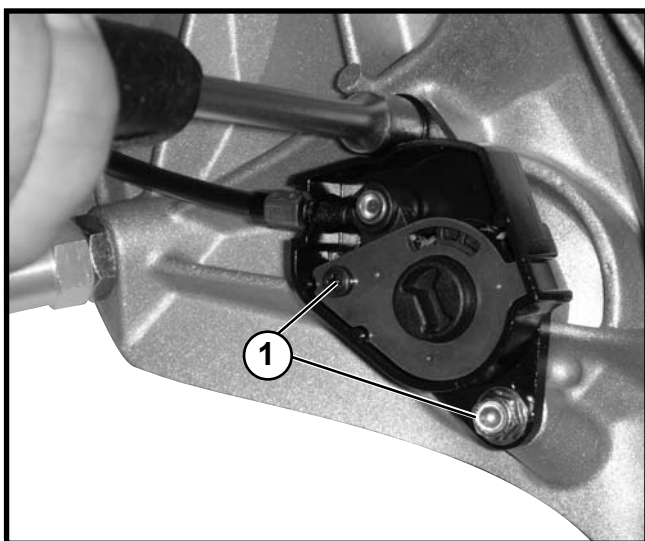




Loosen and remove the screws (1) and take off the cable (2).  
Remove the lock (3)



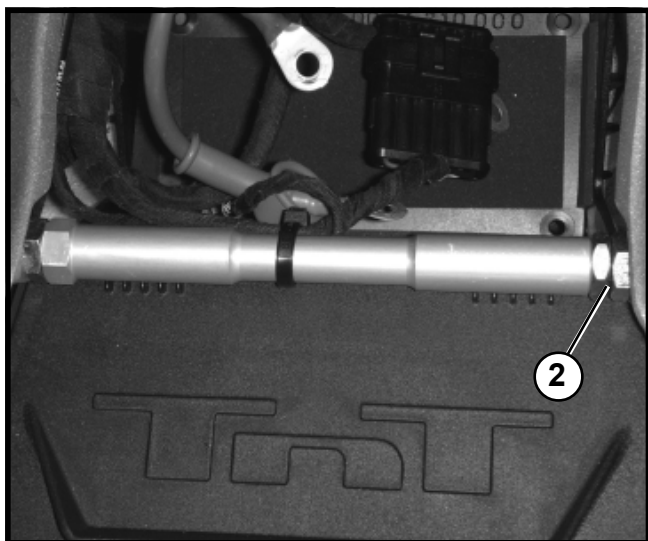
Loosen the lock nut (1) of the joint pivot.  
Loosen the pivot (2) making the side of the frame coming out of its seat.  
Remove the left side from the frame.



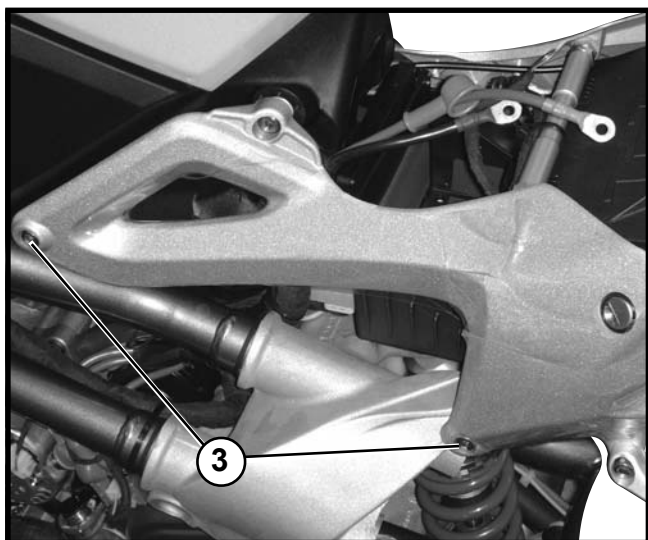
#### 7.10.4 LEFT BACK FRAME ASSEMBLY

Position the left side of the back frame on the motorcycle.  
Position the saddle opening lock, hook on the opening cable and fix it by the screws (1).





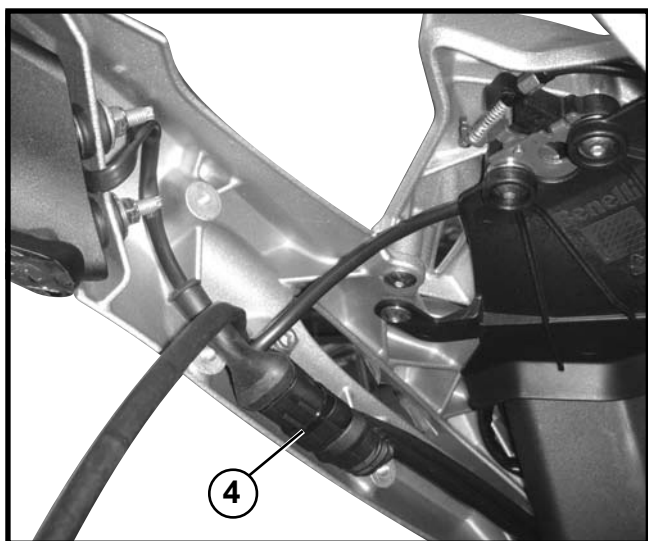
Insert and screw the joint pivot of the two sides of the frame up to reach the contact of the two parts.  
Block with the lock nut (2).



Position and tighten the left frame side fixing screws (3) to the indicated torque.

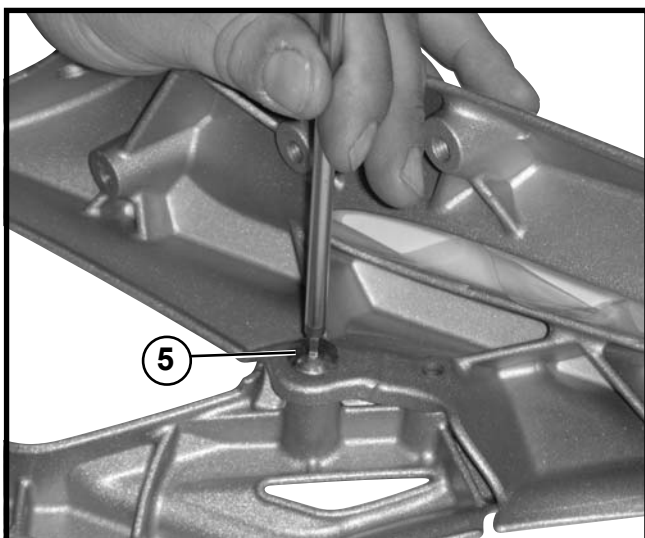


**22 N·m 2,2 Kg-m**

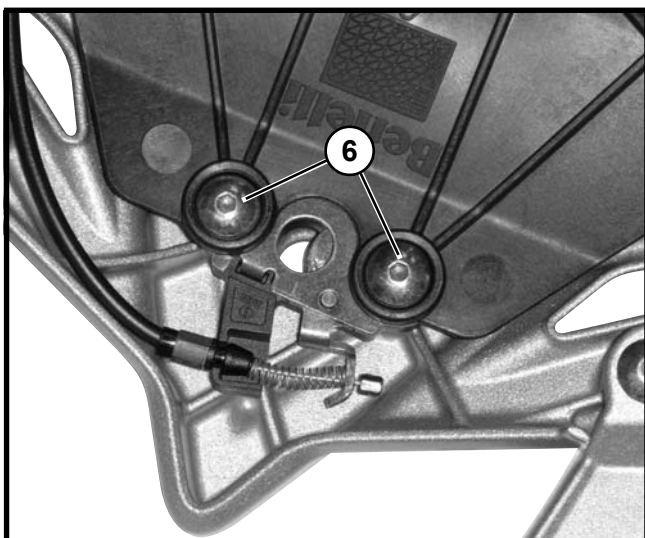


Position and fix the wiring on the inner side of the frame by a tie-wrap (4).

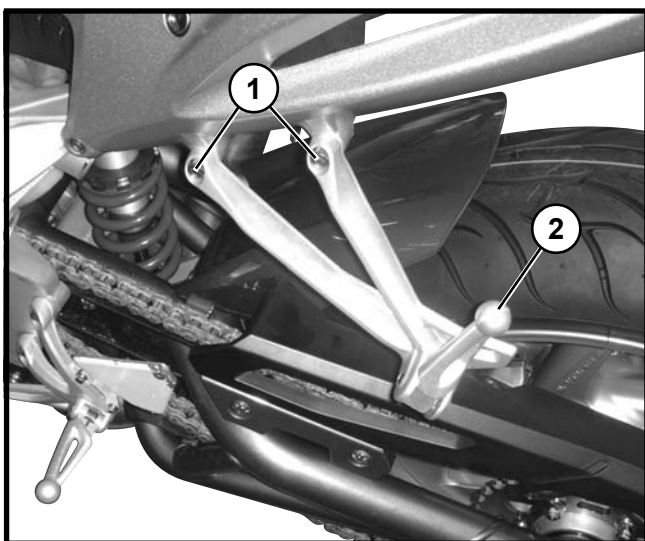




Position the central cross bar and tighten the screws (5) to the indicated torque.



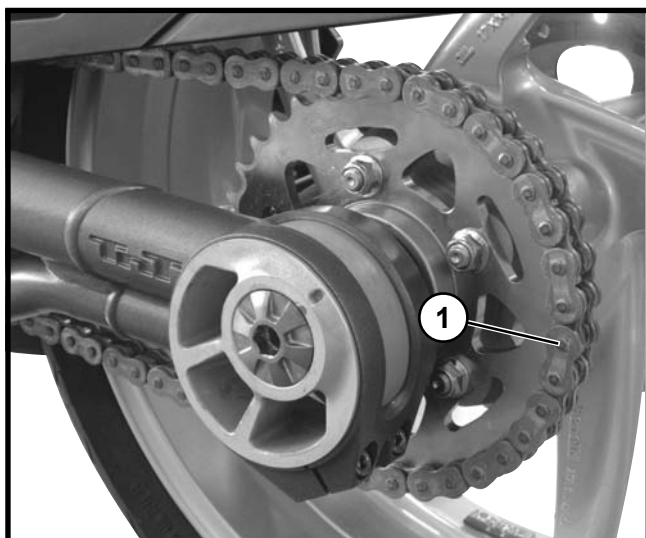
Position the heat shield under the saddle and tighten the screws (6).  
Assemble the exhaust muffler ( see "muffler assembly" ).  
Assemble the saddles.



#### **7.10.5 STIRRUP REMOVAL PASSENGER FOOTBOARDS**

Loosen and remove the screws (1) right footboard stirrup (2).  
Check visually the state of the stirrup, if necessary replace the piece.  
Proceed in the same for the opposite footboard stirrup.





## 7.11 TRANSMISSION CHAIN

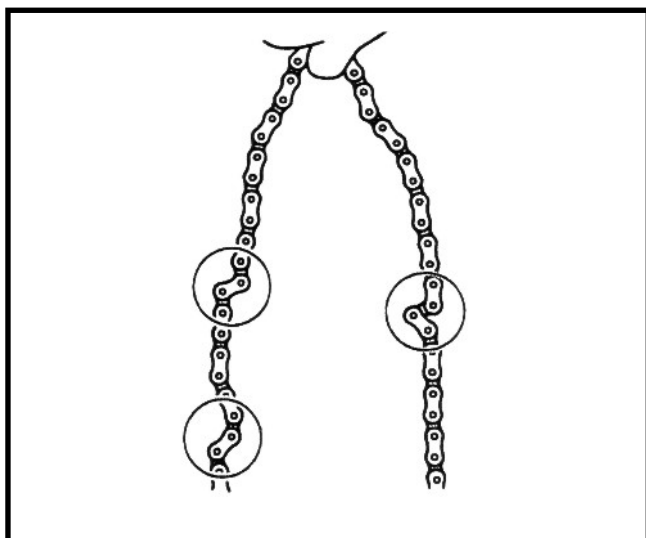
### 7.11.1 REMOVE TRANSMISSION CHAIN

Remove the transmission chain (1) with a link cutter.

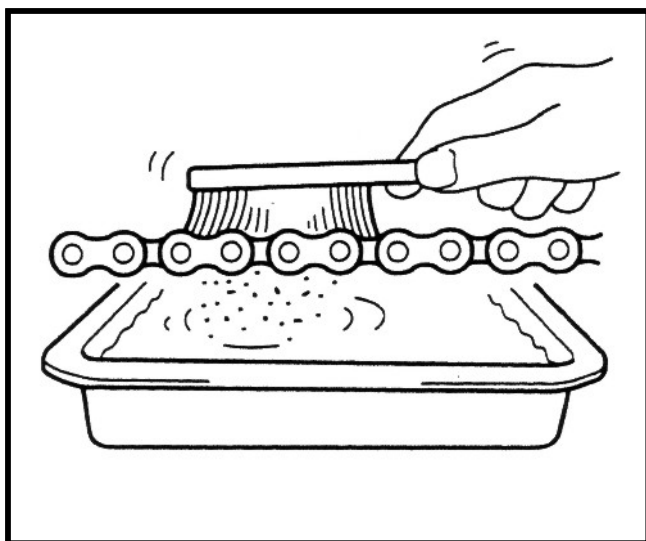
### 7.11.2 CHECK TRANSMISSION CHAIN

Check that the chain is not excessively worn or excessively loose.

Change the chain if necessary.



Check that the chain does not have crushed or seized up links.



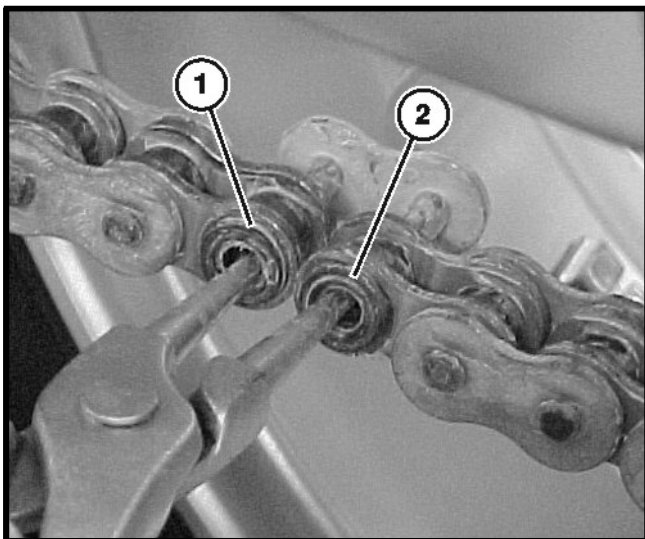
#### **ATTENTION:**

***This is a chain with an O-ring. Respect the cleaning phases.***

If necessary, dissolve the dirt deposits on the chain using kerosene. These deposits must be later removed with a clean rag or a jet of air.

Then oil the chain.





### 7.11.3 INSTALL TRANSMISSION CHAIN

Position the chain on the crown and on the pinion.  
Unite the two ends of the chain (1) and (2) with the specific equipment.  
Adjust the chain (see "ADJUST CHAIN").





## Injection Plant

## 8 INJECTION PLANT

### 8.1 ENGINE MANAGEMENT SYSTEM

#### 8.1.1 DESCRIPTION OF THE SYSTEM

Each model is equipped with an electronic engine management system with a control that includes both the ignition and the distribution of the fuel.

The electronic control module (ECM) receives information from sensors placed around the engine and the cooling and suction systems, and calculates with precision the anticipation of ignition and the fuel needs for all engine states and loads.

Moreover, the system has hardware diagnostic functions that conform to the demands of the USA State of California for on board diagnostics.

These functions ensure that, in the case of faults in the system, the type of fault and the engine data at the moment of fault are stored in the ECM memory.

The stored data can be retrieved by a Benelli dealer using the apposite service equipment supplied to all Benelli dealers (see Axone instruction manual).

In this way, a precise diagnosis of the fault can be carried out and the defect rapidly repaired.

#### 8.1.2 SYSTEM SENSORS

**Suction air temperature sensor** - placed in the air filter box. Considering that the density of the air (and therefore the quantity of oxygen available for burning the fuel) varies with the temperature, a suction air temperature sensor has been provided.

Variations in the air temperature (and therefore the density of the air) are compensated by adjusting the quantity of fuel injected at a level conforming to clean combustion and low emissions.

**Barometric pressure sensor** - the barometric pressure sensor is incorporated within the ECM and is connected to the air filter box by a flexible tube. The barometric pressure sensor measures the pressure of the air in the air filter box. The density of the air is calculated for this measurement and, when added to other information to the ECM, the engine load is calculated.

With this information the quantity of fuel for the injector is calibrated, adapting itself to the prevalent conditions.

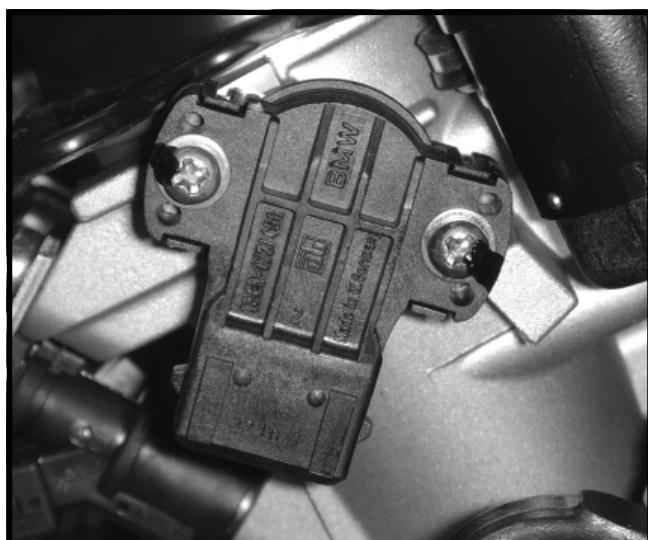
**Engine shaft position sensor (phase sensor)** - placed on the right of the engine near the engine shaft. The elbow position of the shaft sensor notes the movement of a toothed wheel fixed to the right end of the engine shaft. The wheel has 28 equidistant teeth and a tripple sized tooth next to a space of triple dimension.

The triple dimension of the tooth and the space acts as a point of reference from which the immediate position of the engine shaft is calculated.

The engine shaft position sensor is used by the ECM to determine the position of the engine shaft in relation to the point at which the fuel is injected and the need to ignite the fuel.

**Engine refrigerant liquid temperature sensor** - placed on the right of the cylinder head. The information about the temperature of the refrigerant liquid received by the ECM is used to optimise the supply of the temperature of the engine to all and to calculate the supply needs in hot and cold starts.





**Throttle body group position sensor** - placed at the right end of the small throttle body group shaft. The throttle body group position sensor gives a completely closed position reading and all the other opening angles are calculated taking the completely closed position as basis.

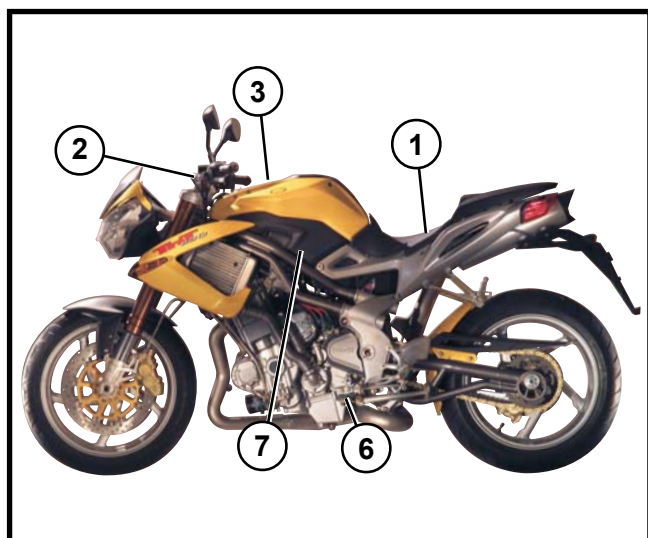
The throttle body group angle is used by the ECM to determine the supply needs of all the throttle body group positions.

**Neutral switch** - situated in the gear box. The neutral switch indicates when the gears are in neutral. Moreover, the neutral switch sends a signal to a safety device that prevents starting with the assembly stand lowered.

If a gear is engaged with the assembly stand lowered, supply to the ECM is immediately interrupted, causing the engine to stop.

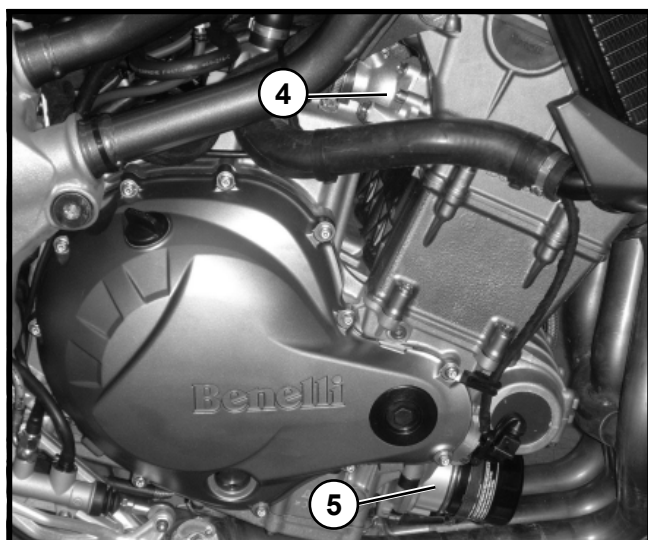
**Lateral assembly stand switch** - placed at the top of the lateral assembly stand leg. If the lateral stand is lowered, the motor does not ignite until the speed gear is in the neutral position or the stand is closed.

**Clutch switch** - placed on the clutch lever. The engine will not start until the lever is pulled up to the handle.



### 8.1.3 POSITION OF THE SENSORS

- 1 Barometric pressure sensor. Engine control module (under the saddle)
- 2 Clutch lever (on the clutch lever)
- 3 Suction air temperature sensor (low in the air filter box)
- 4 Cooling liquid temperature sensor (on the cylinder head)
- 5 Position of the engine shaft sensor (on the right side of the engine near the engine shaft)
- 6 Neutral switch (on the left of the gearbox)  
Lateral assembly stand switch (on the arm of the lateral assembly stand)
- 7 Position sensor (right end of the throttle body group).



### 8.2 SYSTEM ACTIVATING DEVICES

In response to signals received from the sensors, the ECM adjusts a series of activating electronic and electromechanical devices. The function and arrangement of the activating devices is illustrated below.

**Minimum air control system** - Situated inside the air filter box: the system includes a control valve of the passage of air under the throttle of the throttle body and is equipped with a stepper engine.





The system controls the following parameters:

- Minimum functioning.
- Supply of air in the case of the engine missing.
- Correction of the air/fuel relation operating at minimum speeds at heights above sea-level.
- Correction of the air/fuel relation in cold and hot starts. When the stepper is activated it opens the valve more or less to allow a determined flow of air to flow along a series of tubes in the throttle body group.

**Injectors** - positioned on the throttle body group. The engine is equipped with three quadruple jet injectors. The quantity of the jets is constant, but the amount of time that each injector remains open is variable. The duration of each injection is calculated by the ECM on the basis of the data received from various sensors of the system.

**Ignition coils** - Placed directly above the head of every sparking-plug. The ECM controls the moment at which the coils are turned on or off. In calculating the turning on time, the ECM allows the sparking-plug sufficient time to produce a spark. The coils are turned off at ignition in the time needed to have correct combustion.

**Injection relay** - placed near the ECM, under the vehicle's saddle and the glove box. The main power relay is encouraged to supply a stable voltage to the ECM. When turned off, the ECM maintains the main power relay in such a way as to be able to accomplish the turning off procedure that includes:

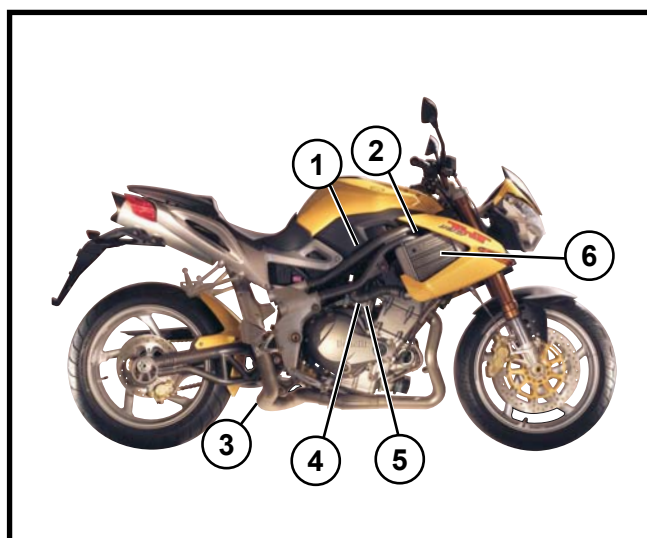
- Inserting the data in the ECM memory.
- Supplying data about the position of the stepper engine of the air control valve.
- Activating the cooling fans until the engine is sufficiently cool.

At the moment in which all the turning off procedures are completed, the injection relay turns itself off.

**Fuel pump** - placed in the fuel tank. The electric pump distributes the fuel in the supply plant using a pressure adjustor at a constant pressure of 3.5 bar. The pump rotates continuously while the engine is functioning and rotates for a brief period when the engine is turned off so that the pressure of 3.5 bar is ensured as soon as the engine is turned on.

**Cooling fans** - positioned behind to the radiators. The ECM activates and deactivates the cooling fans in function of a signal received from the refrigerant liquid temperature sensor. When the temperature of the refrigerant liquid reaches a level at which the cooling effect of the natural flow of air is insufficient the cooling fans are activated by the ECM. When the temperature of the refrigerant liquid lowers itself sufficiently, the ECM deactivates the cooling fans.





## 8.2.1 ENGINE SUPPLY PLANT

### Location of actuators

- 1 Oil pump (on the base of the oil tank)
- 2 Ignition coils (upper part of the cover of the cams)
- 3 Canister breather valve (only USA version)
- 4 Minimum air control system (on the lower part of the air box filter)
- 5 Injectors (behind the throttle bodies)
- 6 Cooling fan (behind the radiator).



## 8.2.2 IGNITION AND INJECTION DIAGNOSTIC SYSTEM

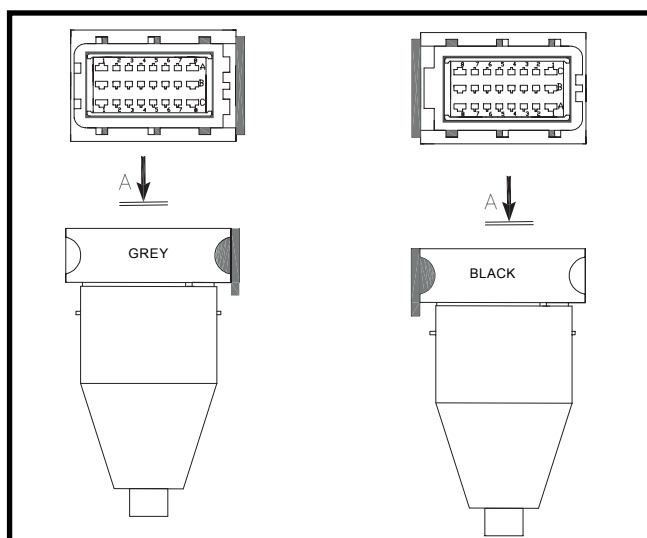
In the special equipment (Cod.R180197036000) there is a diagnostic Software for diagnosing the system able to identify damage present or presenting itself on the bike.

This Software is supplied with a manual guide to the use of the programme in order to be able to carry out a check on every single component of the system.

The system can also be checked observing the operations described as follows.

### NOTE:

See Axone user instructions in chapter 10 diagnostics.

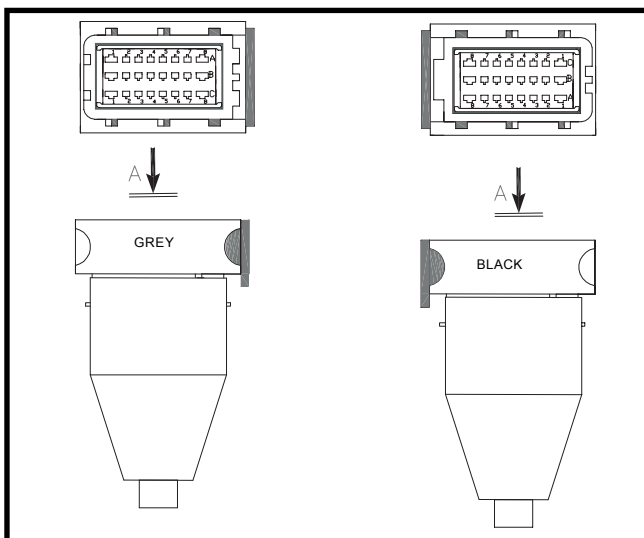


## 8.3 NUMBERING THE ECM CONNECTORS

The diagram on the side shows the sequence of the two ECM connectors. These pin numbers correspond directly to the pin numbers supplied in the diagnostic procedure and the schematic drawings of the cabling used in this manual.

Each connector has 32 pins arranged in four rows numbered 1, 2, 3 and 4 and in eight columns as illustrated below. The first column is denominated A and the eighth column H.





**NOTE:**

**Note that the first column is not marked A because of the restricted space on the face of the connector.**

The diagram to the side shows the numbering of the pins as they appear on the connector.

The position of the ECM connectors is described in this manual through the identification of the connector, 1 (black) or 2 (grey), followed by the row number and the column number in which it is situated.

In the example to the side, pin 1/F2 is shown from the intersection of the lines.





## 8.4 SUPPLEMENTARY DIAGNOSIS

The following tables, if used correctly, help to identify a fault in the system once the diagnostic code of the problem has been stored.

### NOTE:

**1 BLACK CONNECTOR ECU**

**2 GREY CONNETOR ECU**

### INJECTORS – WALBRO ECUA - 1

Fault code	Possible cause	Instruction
P1201/02/03	Flooding indicates short circuit. Open or short circuit – injectors 2/1/3	Make sure that the relative injector connectors are correctly inserted. Disconnect the ECM and proceed to location test 1.

### NOTE:

**1 BLACK CONNECTOR ECU**

**2 GREY CONNETOR ECU**

### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM 1/B1 pin - ECM 1/C1 pin - ECM 1/B2 pin	Ok	Proceed to test 2
	Fault	Repair the fault, proceed to test 6
2 - Check the value of the resistance red/white safety relay: - ECM pin 1/RO/BI at ECM pin 1/C1 (injector 2) - ECM pin 1/RO/BI at ECm pin 1/B1 (injector 1) - ECM pin 1/RO/BI at ECM pin 2/B8 (injector 3)	from 15.5 a 16.3	Disconnect the relative injector and proceed to test 3
	Open circuit	Proceed to test 4
	Short circuit	Disconnect the relative injector and proceed to test 5
3 - Check whether the cable is short circuited: - ECM Pin 1/B1 at the chassis - ECM Pin 1/C1 at the chassis - ECM Pin 2/B8 at the chassis	Ok	Proceed to test 7
	Short circuit	Locate and repair the cable fault, proceed to test 7





4 - Check the continuity of the cable: - ECM Pin 1/AB at the injection relay - ECM Pin 1/B1 at connector pin 2 (injector 2) - ECM Pin 1/C1 at connector pin 2 (injector 1) - ECM Pin 2/B8 at connector pin 2 (injector 3)	Ok	Proceed to test 6
	Open circuit	Locate and repair the cable fault and proceed to test 7
5 - Check the continuity of the cable for short circuiting: - ECM Pin 1/RO/BI at ECM pin 1/B1 (injector 1) - ECM Pin 1/RO/BI at ECM pin 1/C1 (injector 2) - ECM Pin 1/RO/BI at ECM pin 2/B8 (injector 3)	Ok	Proceed to test 6
	Short circuit	Locate and rectify cable fault, proceed to test 7
6 - Check the resistance of the relative injector: - between Pin 1 and Pin 2	from 15.5 to 16.3	Proceed to test 7
	Fault	Change the relative injector, proceed to test 7
7 - Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault	Ok	Activity carried out - terminate test
	The fault persists	Contact the Benelli assistance





### POSITION SENSOR OF THE THROTTLE BODY GROUP – WALBRO ECUA -1

Fault Code	Possible cause	Instruction
P0122	Entrance voltage of the sensor low	Check and note the data on the display of the diagnostic instrument (see Axone instruction manual).
P0123	Entrance voltage of the sensor high	Make sure that the sensor is inserted correctly and the connector fixed well. Disconnect the ECM and proceed to location test 1.

### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM pin 1/B5 - ECM pin 1/B7 - ECM pin 1/B3	OK	Disconnect the sensor and proceed to test 2
	Fault	Rectify the fault, proceed to test 5
2 - Check whether the cable is short circuited: - ECM pin 1/B7 to the chassis	OK	Proceed to test 3
	Short circuit	Locate and repair the cable fault, proceed to test 5
3 - Check the continuity of the cable: - ECM pin 1/B3 at sensor pin 3 - ECM pin 1/B7 at sensor pin 2 - ECM pin 1/B5 at sensor pin 1	OK	Proceed to test 4
	Open circuit	Locate and repair the cable fault, proceed to test 5
4 - Check whether the cable is short circuited: - ECM pin 1/B7 at ECM pin 1/B5 - ECM pin 1/B7 at pin ECM 1/B3	OK	Change the position sensor of the throttle body group, proceed to test 5.
	Short circuit	Locate and repair the cable fault, proceed to test 5
5 - Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault.	OK	Activity carried out – terminate the test
	The fault persists	Contact the Benelli assistance





### IGNITION COIL – WALBRO ECUA -1

Fault Code	Possible cause	Instruction
P1351/52/53	Open or short circuit – ignition coil 2/1/3	Make sure that the connector of the relative ignition coil is inserted correctly. Disconnect the ECM and proceed to location test 1.

### LOCATION TEST

Test	Result	Instruction
1- Check the integrity of the terminal and the cable: - ECM pin 1/A8 (BOB1) - ECM pin 1/B8 (BOB2) - ECM pin 1/A1 (BOB3)	OK	Proceed to test 2
	Fault	Repair the fault, proceed to test 7
2- Check the resistance value red/white safety relay: - ECM pin 1/RO/B at: - ECM pin 1/B8 (ignition coil 2) - ECM pin 1/A8 (ignition coil 1) - ECM pin 2/A1 (ignition coil 3)	0.8 $\Omega$	Disconnect the relative coil and proceed to test 3
	Open circuit	Proceed to test 4
	Short circuit	Disconnect the relative coil and proceed to test 5
3- Check the cable for short circuiting: - ECM pin 1/B8 at the chassis - ECM pin 1/A8 at the chassis - ECM pin 2/A1 at the chassis	OK	Proceed to test 7
	Short circuit	Locate and rectify the cable fault, proceed to test 7
4- Check the continuity of the P1/RO/BI cable with each ignition coil pin 2: Supply pin 8 of the relay block with each ignition coil pin. - ECM pin 1/B8 at pin 1 of ignition coil 2 - ECM pin 1/A8 at pin 1 of ignition coil 1 - ECM pin 2/A1 at pin 1 of ignition coil 3	OK	Proceed to test 6
	Open circuit	Locate and rectify the cable fault, proceed to test 7





5- Check the cable for short circuit RO/BI from safety relays with: Supply blocking relay pin 8 to: - ECM pin 1/B8 (ignition coil 2) - ECM pin 1/A8 (ignition coil 1) - ECM pin 2/A1 (ignition coil 3)	OK	Proceed to test 6.
	Short circuit	Locate and repair the cable fault, proceed to test 7
6- Check the resistance of the relative ignition coil: - Pin 1 of the ignition coil at pin 2 of the ignition coil	0.8 $\Omega$	Proceed to test 7
	Fault	Change the relative ignition coil, proceed to test 7
7- Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault	OK	Activity carried out - terminate test
	The fault persists	Contact the Benelli assistance

#### COOLING LIQUID TEMPERATURE SENSOR – WALBRO ECUA-1

Fault Code	Possible cause	Instruction
P0118	C.C engine temperature sensor.	Make sure that the connector is inserted correctly. Disconnect the ECM and proceed to location test 1.  Disconnect the sensor and proceed to location test 1.
P0119	C.A engine temperature sensor.	Proceed to location test 1.





### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM pin 1/B2 - ECM pin1/C6	OK	Proceed to test 2
	Fault	Repair the fault, proceed to test 7
2 - Check the resistance value:  - ECM pin 1/B2 to ECM pin 1/E4  (depending on the temperature, - see below)	OK	Disconnect the temperature sensor and proceed to test 6
	Open circuit	Proceed to test 3
	Short circuit	Disconnect the temperature sensor and proceed to test 4
3 - Check the continuity of the cable:  - ECM pin 1/C6 to sensor pin 2 - ECM pin 1/B2 to sensor pin 1	OK	Proceed to test 5
	Open circuit	Locate and rectify the cable fault, proceed to test 7
4 - Check the cabling for short circuiting: - pin 1/C6 to ECM B2 1/E4	OK	Proceed to test 5
	Short circuit	Locate and rectify the cable fault, proceed to test 7
5 - Check the cable for short circuiting: - ECM pin 1/C6 to the chassis	OK	Proceed to test 7
	Short circuit	Locate and restore the cable fault, proceed test 7
6 - Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault	OK	Activity carried out - terminate test
	Fault	Contact the Benelli assistance

**Resistance data in typical conditions:**  
**Engine warm:**

Environmental temperature	Resistance value
20°C	2.35 a 2.65 KΩ
10°C	3.60 a 4.00 KΩ
0°C	5.60 a 6.25 KΩ





### AIR ENTRANCE TEMPERATURE SENSOR – WALBRO ECUA-1

Fault code	Possible cause	Instruction
P1502	Open or short circuit at positive battery pole (+)	Check and note the data on the display of the diagnostic instrument (see Axone instruction manual) if available. Check and note the data on the diagnostic instrument sensor (see Axone instruction manual). Make sure that the sensor connector is inserted correctly. Disconnect the ECM and proceed to location test 1
P1501	Short circuit at the chassis	Disconnect the sensor and proceed to location test 6.

### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM pin 1/B2 - ECM pin 1/E5	OK	Proceed to test 2
	Fault	Rectify the fault, proceed to test 7
2 - Check the resistance value:  - ECM pin 1/B2 to ECM pin 1/C5 (depending on the temperature, - see below)	OK	Disconnect the temperature sensor and proceed to test 6
	Open circuit	Proceed to test 3
	Short circuit	Disconnect the temperature sensor, proceed to test 4
3 - Check the continuity of the cable:  - ECM pin 1/C5 to sensor pin 2 - ECM pin 1/B2 to sensor pin 1	OK	Proceed to test 5
	Open circuit	Locate and rectify cable fault, proceed to test 7
4 - Check the cabling for short circuiting: - ECM pin 1/E5 to ECM pin 1/B2	OK	Proceed to test 5
	Short circuit	Locate and rectify cable fault, proceed to test 7





5- Check the sensor resistance:  - Sensor pin 1 to sensor pin 2 (depending on the temperature, - see below)	OK	Proceed to test 7
	Fault	Change the temperature sensor, proceed to test 7
6- Check the cabling for short circuiting: - EXM pin 1/C5 to the chassis	OK	Procedere al test 7
	Short circuit	Locate and restore the cable fault, proceed to test 7
7- Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault	OK	Activity carried out - temoinate test
	Fault	Contact Benelli assistance

If the engine is hot, remove the sensor and let it cool down beofre carrying out the test

**Resistance data:**

Environmental temperature	Resistance value
30°C	1.6 a 1.8 KΩ
25°C	1.9 a 2.2 KΩ
20°C	2.3 a 2.7 KΩ
15°C	2.9 a 3.3 KΩ
10°C	3.5 a 4.0 KΩ
5°C	4-4 a 4.9 KΩ
0°C	5.5 a 6.1 KΩ





### FUEL PUMP – WALBRO ECUA-1

Fault code	Possible cause	Instruction
P1231	Open or short circuit to the chassis	Check whether the pump starts working when activating ignition. make sure the the pump connector is inserted correctly. Disconnect the ECM and proceed to test 1.
P1232	Short circuit to the positive battery pole (+)	Disconnect the fuel pump and proceed to test 4.

### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM pin 2/A2	OK	Disconnect the fuel pump and proceed to test 2
	Fault	Rectify the fault, proceed to test 5
2 - Check the cable for short circuiting: - pin dell'ECM 2/A2 to the chassis	OK	Proceed to test 3
	Short circuit	Locate and rectify the cable fault, proceed to test 5
3 - Check the continuity of the BLUE/ GREEN cable from relay petrol pump: - pin 2/A2 to fuel pump pin 2 - fuel pump pin 1 +12 vDC with ignition key on	OK	Proceed to test 4
	Open circuit	Locate and rectify the cable fault, proceed to test 5
	OK	Proceed to test 5
4 - Check the cable for short circuiting: RO/BI safety relay: - ECM pin 2/A2 to ECM pin 2/E1	Short circuit	Locate and rectify the cable fault, proceed to test 5
	OK	Activity carried out – terminate the test
5 - Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault	Fault	Contact the Benelli assistance





**NOTE:**

Another possible cause for non correct working of the sensors TPS /TEMP. Air/TEMP. H<sub>2</sub>O could be due to the missing of the 5 Vdc supply.

Check as follows:

Disconnect TEMP. Air/TEMP. H<sub>2</sub>O/TPS according to the discovered anomaly and verify turning on the switchboard and using a voltmeter that:

- On Pin 2 of the connector TEMP. Air (or on Pin 1/ C5 of the ECU) there is a voltage between 4,5 ~ 5,5 Vdc
- On Pin 2 of the ENGINE T (or on Pin 1/ C6 of the ECU))
- On Pin 1 of the TPS command (or on Pin 1/ B5 of the ECU)

**VOLTAGE SUPPLY SENSOR – WALBRO ECUA-1**

Fault code	Possible cause	Instruction
P0562	Alternator/battery damaged - low voltage	Check and note the data on the display of the diagnostic instrument (see Axone instruction manual) if available. Make sure that the voltage through the battery is acceptable, note the voltage. Disconnect the ECM and proceed to location test 1
P0563	Alternator damaged - high voltage	Make sure that the alternator exit voltage is acceptable, note the voltage.

**NOTE:**

- 1) Verifying by voltmeter that the battery is charged
- 2) Check that on the brown cable (alternator) there are 12 Vdc once the switchboard is turned on.
- 3) Switch on the engine reach 3500 RPM and verify by voltmeter, connecting it to the battery poles, that there is a voltage in the range 13,5/14,5 dc





**BAD FUNCTIONING OF THE ENGINE DIAGNOSIS WARNING LAMP (MIL) –  
WALBRO ECUA-1**

Fault code	Possible cause	Instruction
P1601	Open or short circuit to the chassis	Check and make sure that the connector of the warning lamp is inserted well and that the bulb works. Disconnect the ECM and proceed to location test 1.
P1602	Short circuit at the positive battery pole (+)	Disconnect the warning lamp, proceed to test 4.





### COOLING FAN - WALBRO ECUA-1

Fault code	Possible cause	Instruction
P1552	Open or short circuit to the chassis	Check and note the data on the display of the diagnostic instrument (see Axone instruction manual). Make sure that the fan connector is inserted well. Disconnect the ECM and proceed to location test 1.
P1553	Short circuit at the positive battery pole (+)	Disconnect the ECM and proceed to test 4.

### LOCATION TEST

Test	Result	Instruction
1 - Check the integrity of the terminal and the cable: - ECM pin 2/A4	Ok	Disconnect the fan and proceed to test 2
	Fault	Repair the fault, proceed to test 5
2 - Check the cable for short circuiting: - ECM pin 2/A4 to the frame	Ok	Proceed to test 3
	Short circuit	Locate and repair the cable fault, proceed to test 5
3 - Check the continuity of the cable: - Fan cable with electric fan relay of the ECM	Ok	Proceed to test 4
	Open circuit	Locate and rectify the cable fault, proceed to test 5
4 - Check the cable for short circuiting: - ECM pin 2/A4 to ECM pin 1/ RO/BI relays injection of the ECM	Ok	Proceed to test 5
	Short circuit	Locate and repair the cable fault, proceed to test 5
5 - Reconnect the cabling, cancel the fault code and activate the engine to check the elimination of the fault.	Ok	Activity carried out – terminate the test
	Fault	Contact the Benelli l'assistance









## *Electrical Plant*

### 9 ELECTRICAL PLANT

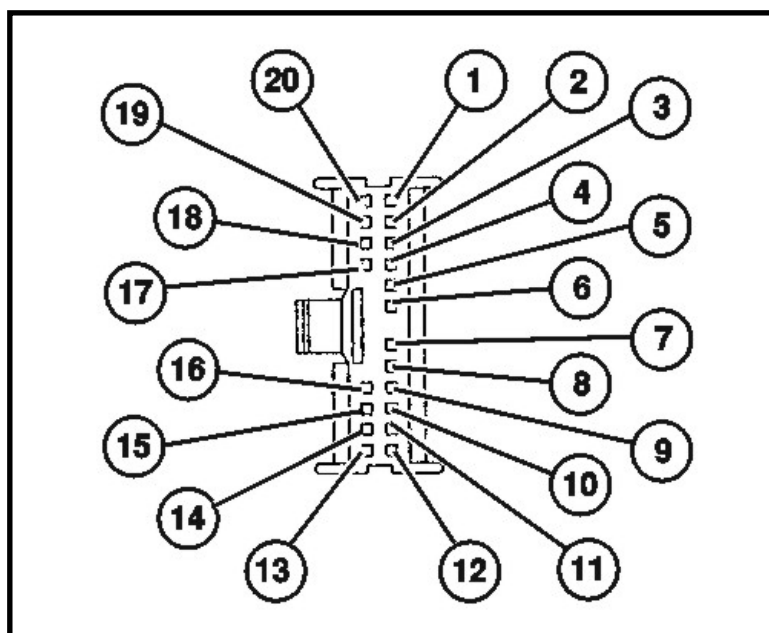








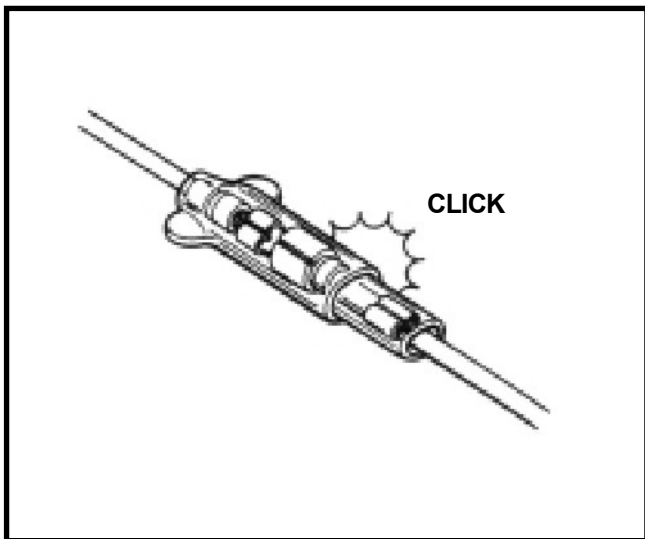
Consult the table below to identify the contacts of the various components:



A	COLOURS
1) Oil pressure	Violet
2) H <sub>2</sub> O Temperature	Brown / Violet
3) Injection alarm	Red / Black
4) Right arrow	Pink
5) Left arrow	Blue
6) Neutral	White / Violet
7) Driving beams	Yellow/ White
8) Position light	Yellow / Black
9) Fuel level GND	Yellow / Violet
10) Fuel level	Brown / Yellow

A	COLOURS
11) Set / Reset Switch	Yellow / Grey
12) Gears	Grey / Red
13) Speed sensor exit	Blue
14)	
15) Speed sensor mass	Blue / Black
16) Mass	Black
17) Mass sensor environment temp.	Black
18) Mass sensor environment temp	Red
19) Feeding control position	Red
20) Lower key	Brown / Red

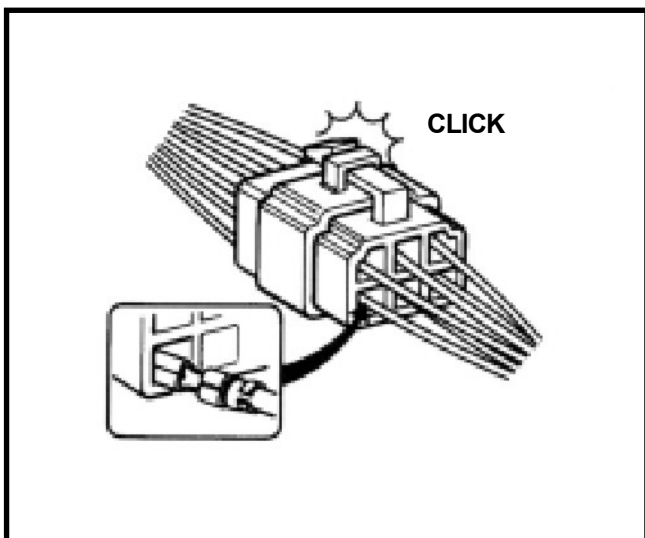




## 9.1 CONNECTORS

When connecting a connector make sure to press until hearing a click.

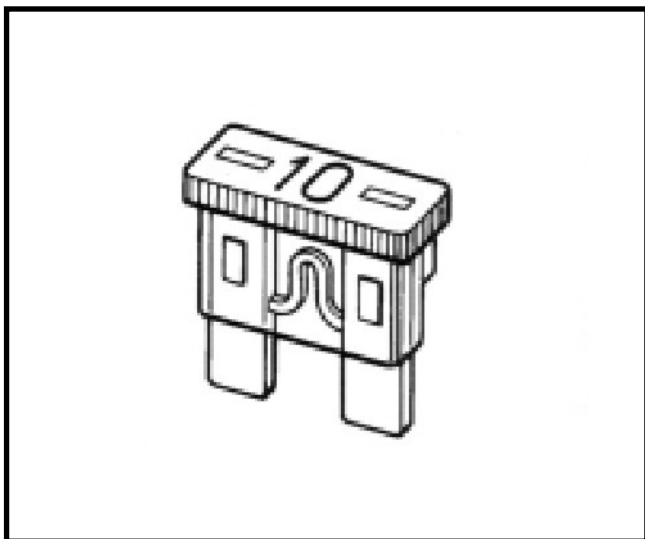
Check whether the connector is corroded or dirty and whether its cover is broken.



With a block type connector make sure to release the block before disconnecting it and to press down completely when connecting.

On disconnecting the connector make sure to hold the body of the connector and not pull the wires.

Check whether the connector terminals are loose or bent. Check whether the terminals are corroded or dirty.



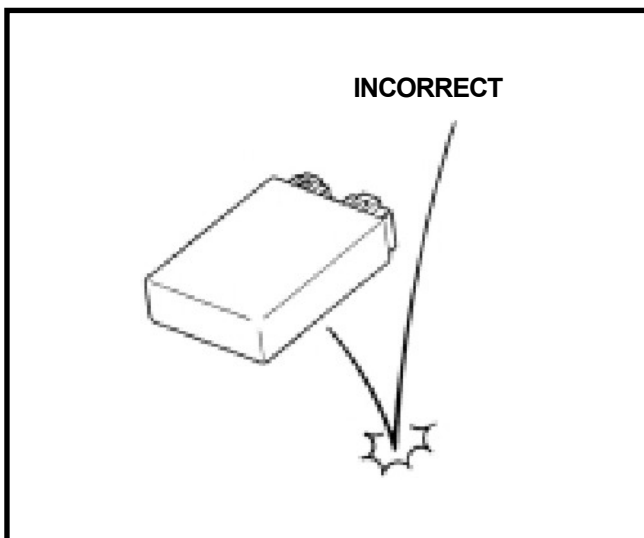
## 9.2 FUSES

Always investigate the cause of a fuse burning out, repair and then change the fuse.

Do not use a fuse with a capacity different to the original.

Do not use a wire or other substitute for the fuse.





### 9.3 SEMI-CONDUCTOR PARTS



#### **ATTENTION:**

*Be careful not to let the parts fall with an incorporated semi-conductor like the ECU.*

When controlling such parts follow the checking instructions to the letter.

Failure to respect the correct procedure can cause grave damage.



### 9.4 BATTERY



#### **ATTENTION:**

*Do not use batteries other than those specified.*

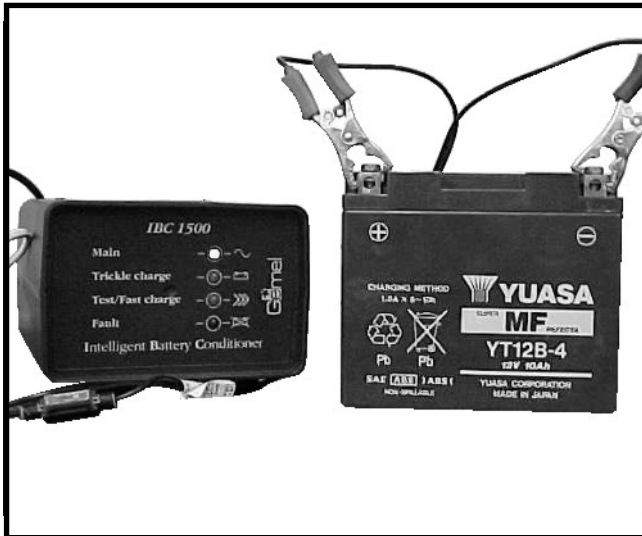
The battery (1) mounted on this vehicle is the hermetic type. There is no need, therefore, for maintenance.

The batteries advised are the following:

- YUASA YTZ 14S

Proceed to reload, following the indications in the battery packaging or as indicated.





## Loading method

It is preferable to use the constant tension method of loading so as not to overload the batteries. Follow this rule:

**NORMAL:** 1.0A x 5 ~ 10h

**SLOW:** 0.5A x 8 ~ 16h

Check the voltage after ~ 30 minutes from loading the voltage at the battery heads.

Voltage  $\geq$  12.5 Volt.

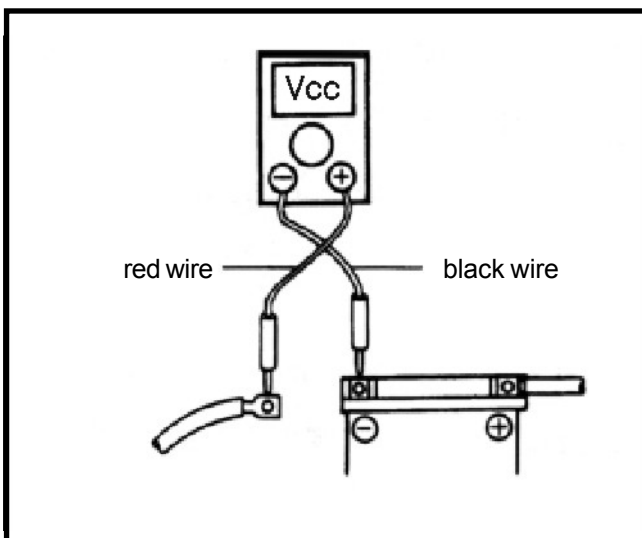


## 9.4.1 CHECK BATTERY EFFICIENCY

### Check battery current losses

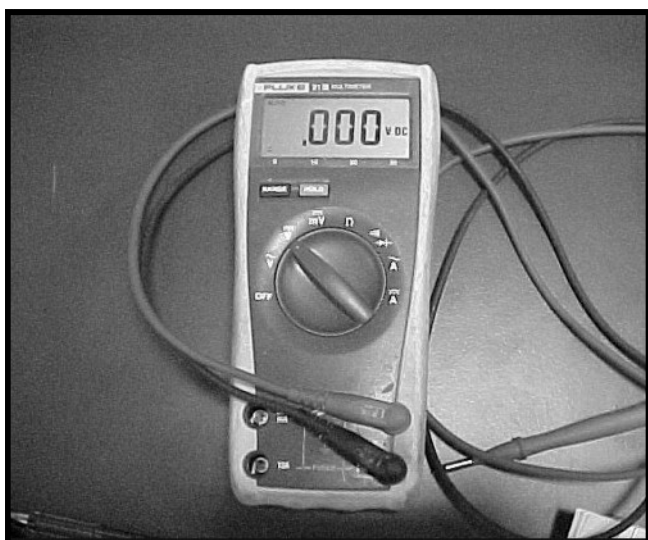
Bring the ignition switch to the OFF position.

Disconnect the cables of the negative pole (-) of the battery.



Connect the multimeter between the negative pole (-) and the negative cable (-) of the battery, in function of a continuous current ammeter.





## Battery current losses

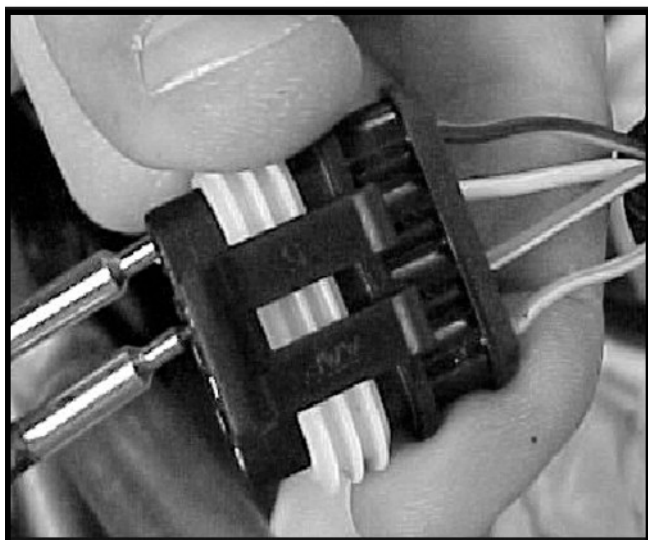


### ATTENTION:

*Since current losses in the case of malfunctioning can be high, use a high range of the multimeter first when using the ammeter.*

*Do not put the ignition switch on "ON" when measuring the current.*

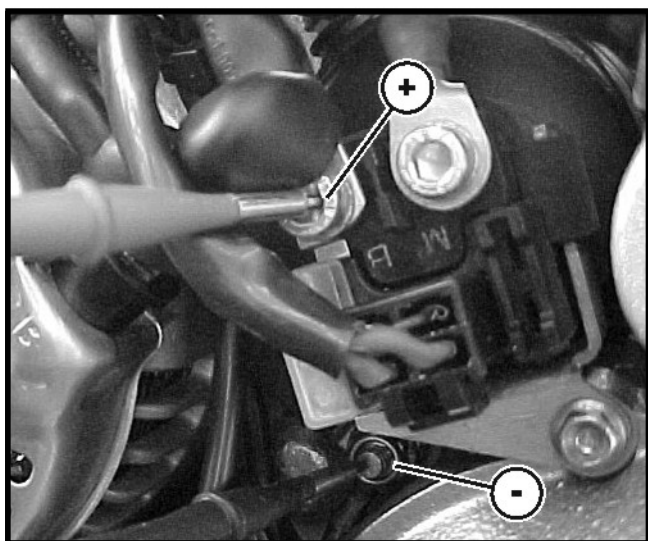
*With the switchboard off, the losses of current should be  $\approx 2 \sim 2,5$  mA.*



In the contrary case, identify the source of this absorption by disconnecting the connectors of every single use supplied directly from the battery (see electricity diagram).

### NOTE:

**In the case of eventually installing anti-theft devices, disconnect the latter before carrying out the checks.**



## Check load exit

Dismantle the semi-cowlings to get to the alternator zone.

Start the engine and make it spin at 2000 rev/min with the lights switch ON and the selector on the dazzle position.

HI.

Measure the DC voltage between the positive + and negative - terminals of the battery with a multimeter. If the tester indicates less than 13.0 V or more than 15.0 V, the cause is to be identified in the generator.

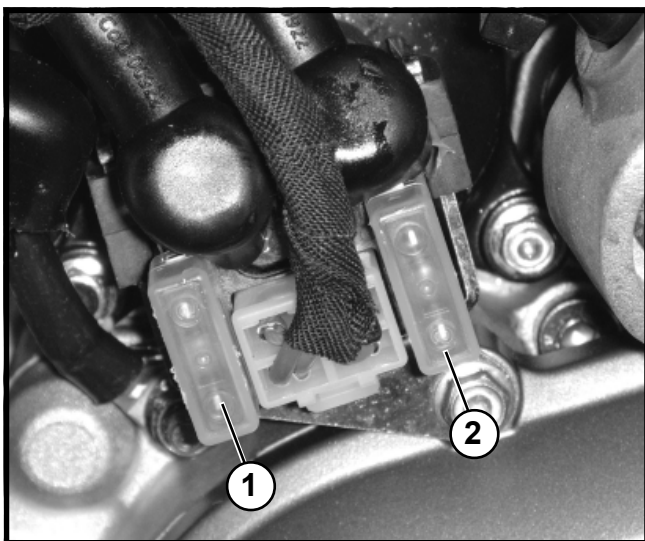
### NOTE:

**When carrying out this test, make sure that the battery is completely charged.**

Load exit

Standard: 13.0 V - 14.5 V at 2000 rev/min



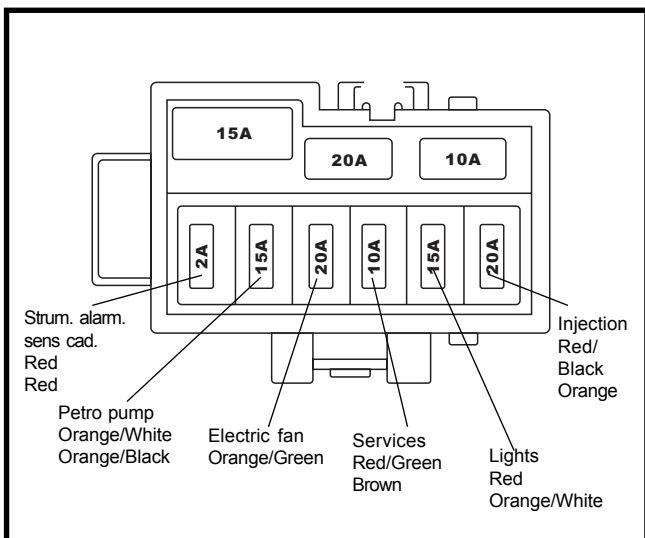


## 9.5 FUSES

### General fuse:

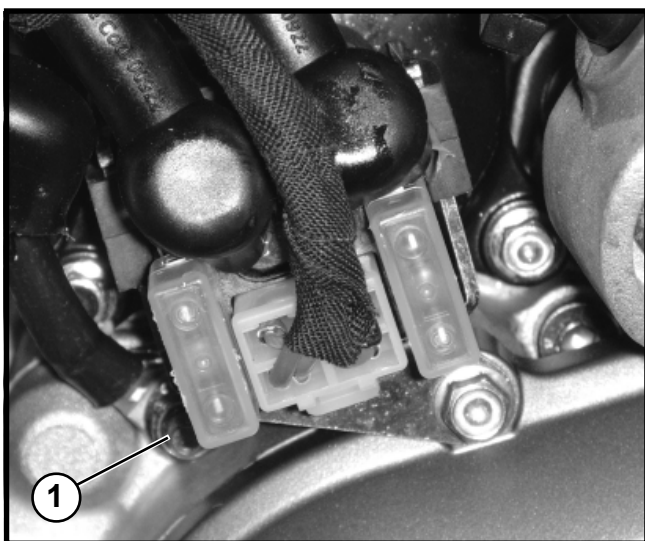
The general fuse (1) is on the left side of the engine. To remove it undo the plastic protective cover. Fuse (2) is the spare.

**GENERAL FUSE 40 Ah**



### Service fuses:

The service fuses box is under the saddle. Open the fusebox cover to identify the position of the burned-out fuse, read the key placed under the cover and consult the electricity diagram.

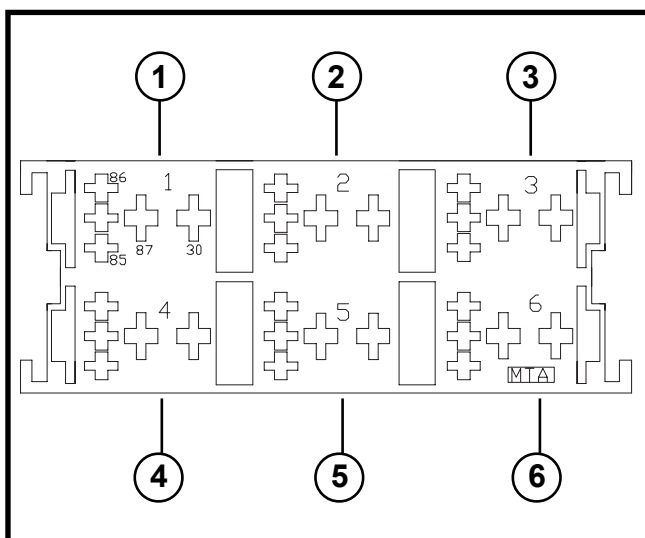


## 9.6 RELAYS

### 9.6.1 RELAY STARTER

The relay starter (1) is on the left side of the engine, inside the left semi-cowling.





## 9.6.2 RELAY SERVICES GROUP

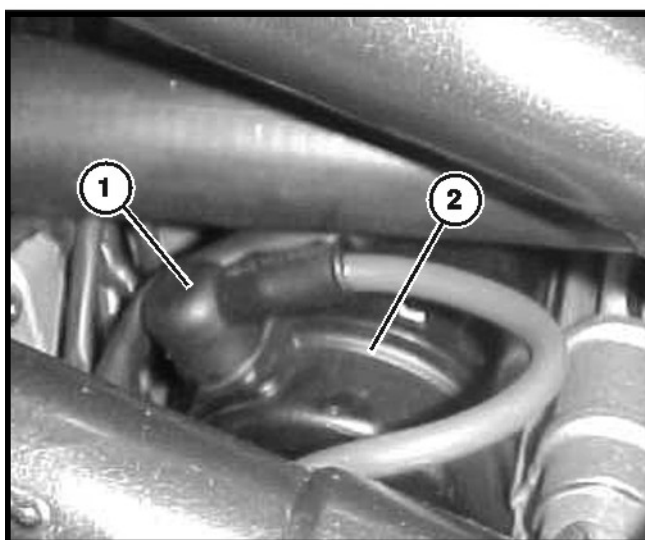
Positioned under the passenger saddle there are:

- 1) Electro-fan relay (NE+AR/NE+MA+BI/NE).
- 2) Safety (MA/BI+MA+BI/RO+RO/GI)
- 3) Dazzle relay (GI/VE+AR/BI+GI/BI).
- 4) Injection (VI/MA+AR+RO/GI)
- 5) Oil pump relay (BI/RO+NE+AZ/VE).
- 6) Anti-dazzle relay (GI/VE+AR/BI+RO/GI).

### LEGENDA COLORI:

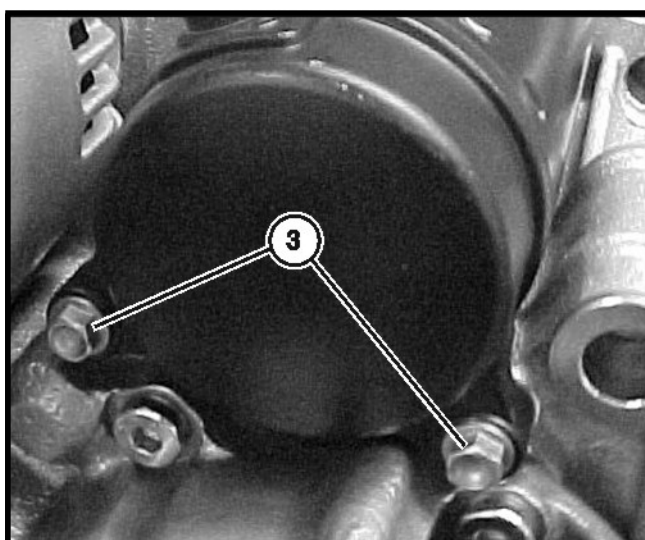
MA = BROWN  
MA/BI = BROWN/WHITE  
NE = BLACK  
BI/NE= WHITE/BLACK  
AR = ORANGE  
GI/RO = YELLOW/RED  
GI/BI = YELLOW/WHITE

AZ/VE = BLUE/GREEN  
AR/BI = ORANGE/WHITE  
BI/RO = WHITE/RED  
RO/GI = RED/YELLOW  
VI/MA = VIOLET/BROWN  
BL/VE = BLUE/GREEN  
AR/NE = ORANGE/BLACK



## 9.7 ENGINE STARTER

Disconnect the supply cables on the battery.  
Remove the starter relay (see "DISMANTLE RELAY").



Disconnect the supply cables (1) on the engine starter (2), unscrew the engine starter fixing screws (3) and extract the component.

Check that the engine rotates freely without effort. Otherwise change the piece. Check the state of the O-ring and if damaged change the piece.

### NOTE:

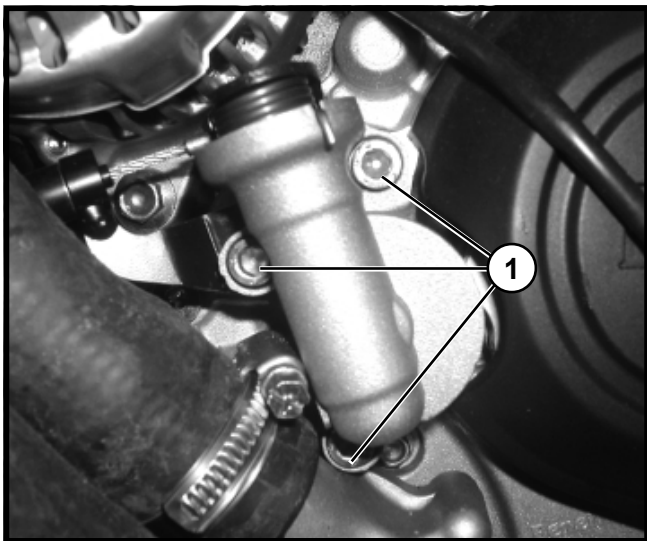
Oil the O-ring during mounting, paying attention not to damage it.

Tighten the screws (2).



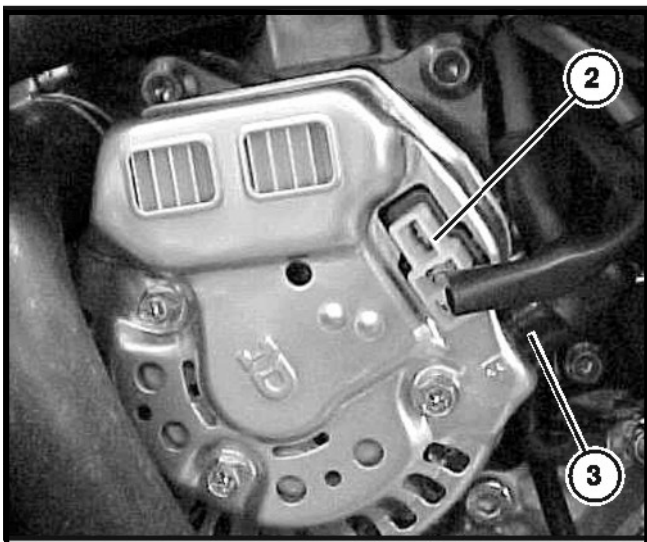
10 N·m 1 Kg-m



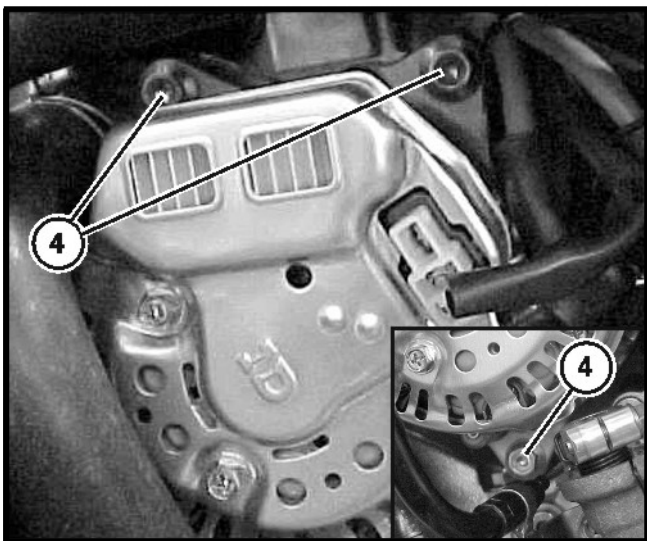


## 9.8 ALTERNATOR

Unscrew the three clutch command fixing screws (1), unhook the clutch cable and remove the clutch command to allow the removal of the alternator.



Disconnect the battery supply cables. Disconnect the connector (2), lift the protective cap and unscrew the starter supply fixing nut(3).



Unscrew the three fixing screws (4) and extract the alternator moving the water pump tube slightly and paying attention not to let the flexible rubber couplings fall. To re-mount it, use the reverse procedure, oiling the flexible couplings and the O-rings. Tighten the three screws.

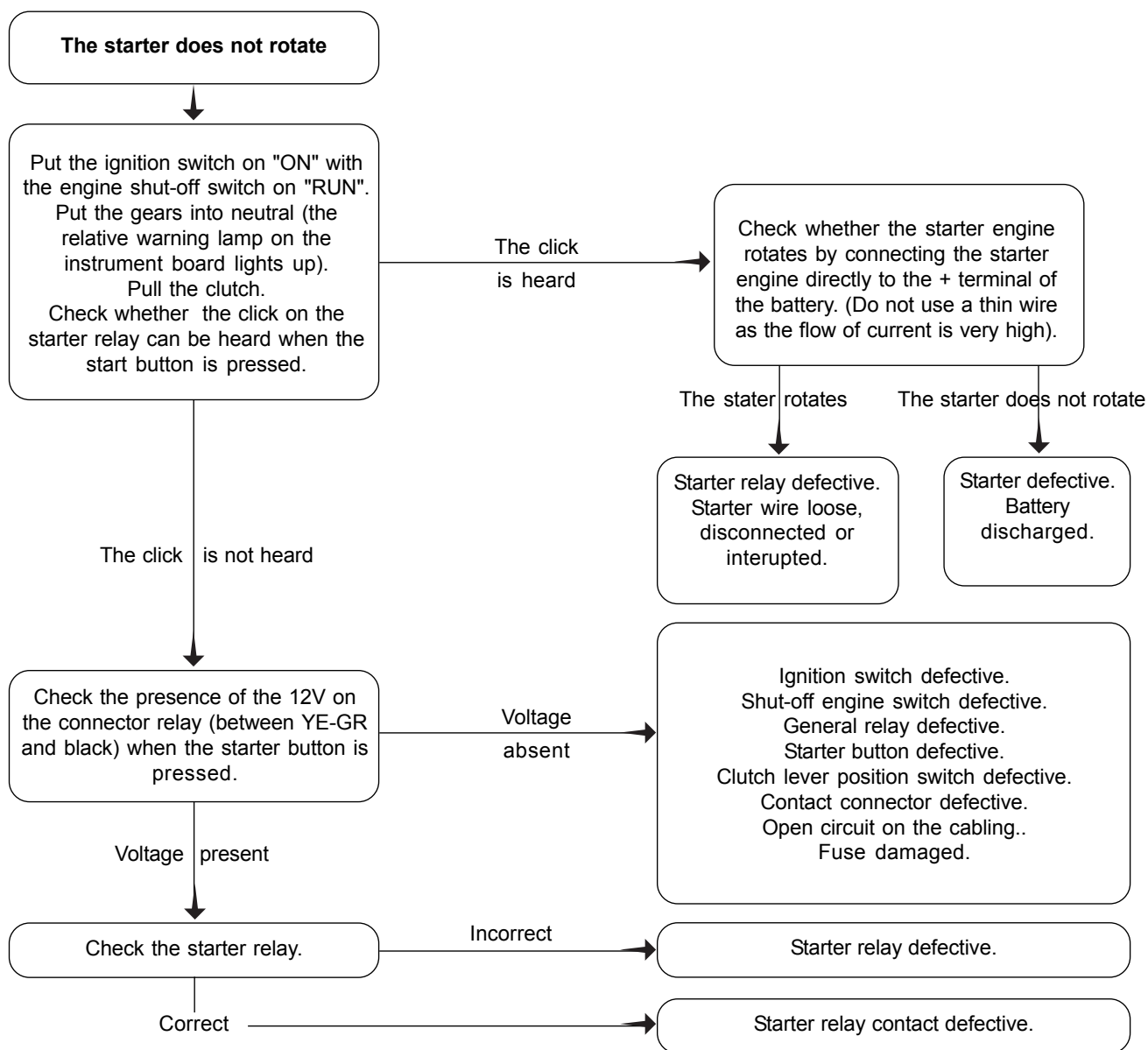


**25 N·m 2.5 Kg-m**





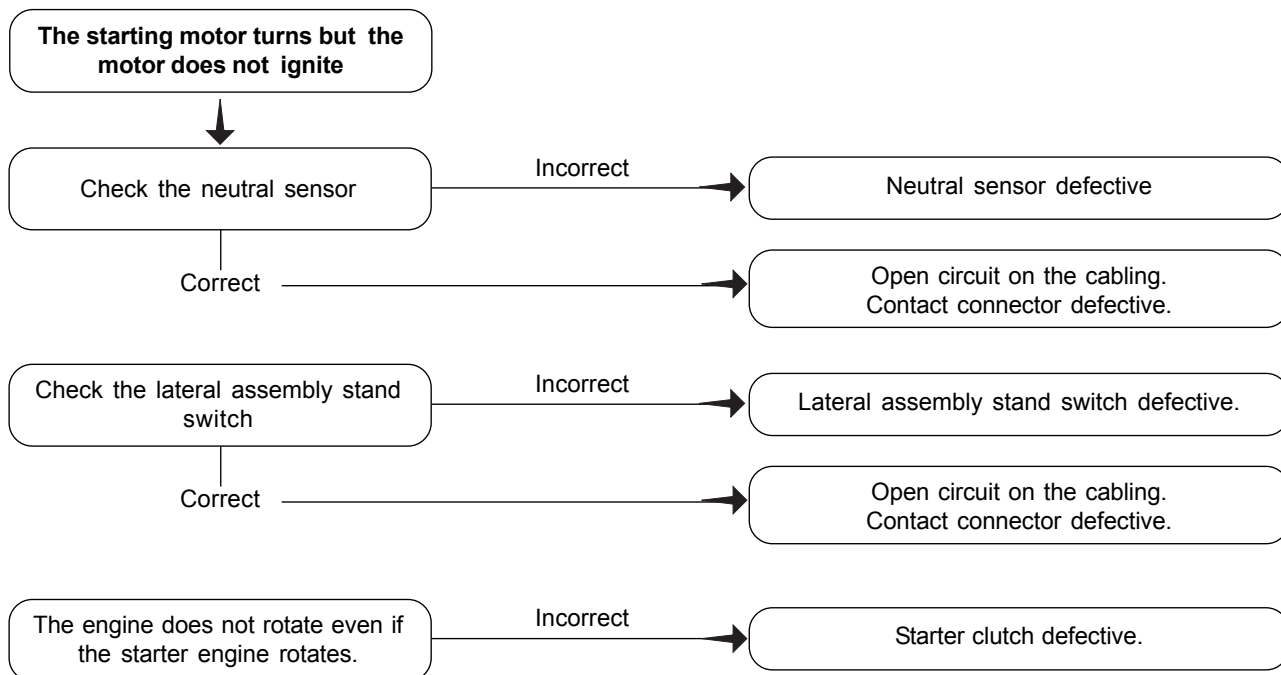
## 9.9 STARTER DIAGNOSTIC SYSTEM



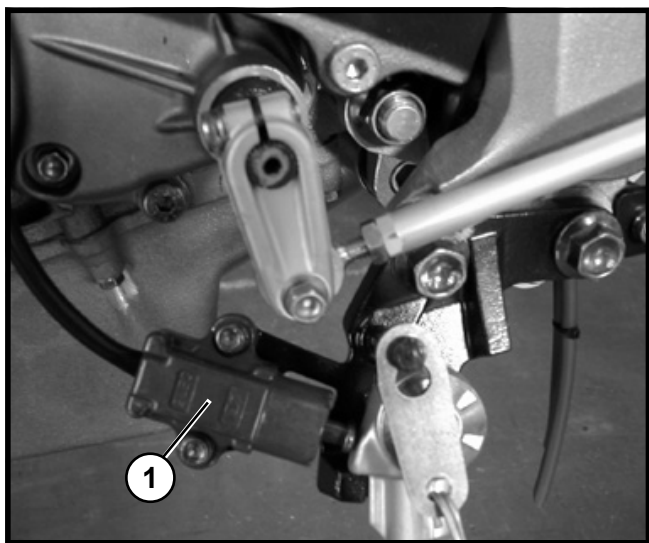
**NOTE:** the security conditions during the motorcycle starting are managed by the ECU (gearcase) as showed below:

- During the motion and with the lowered stand, the starting motor turns but does not switch on the motor.
- In the neutral position and with the lowered stand, the starting motor turns and switch on the motor.



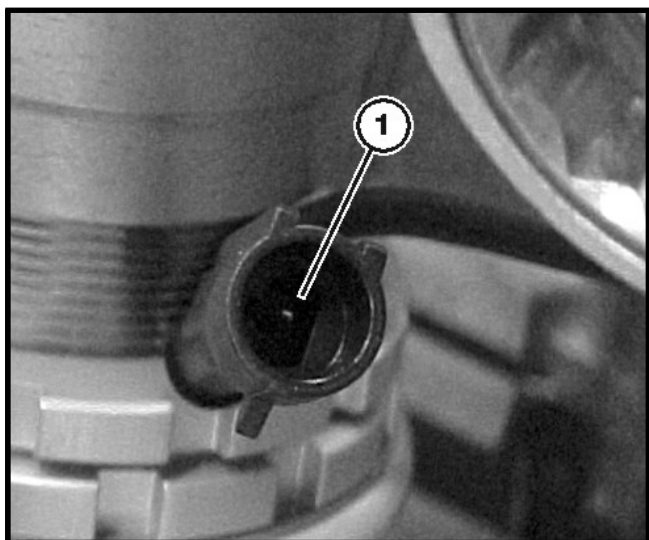






### 9.10 CHECK SAFETY SYSTEM PARTS

If the safety system does not function properly, check each component.  
If anomalies are found, substitute the component (1) with a new one.



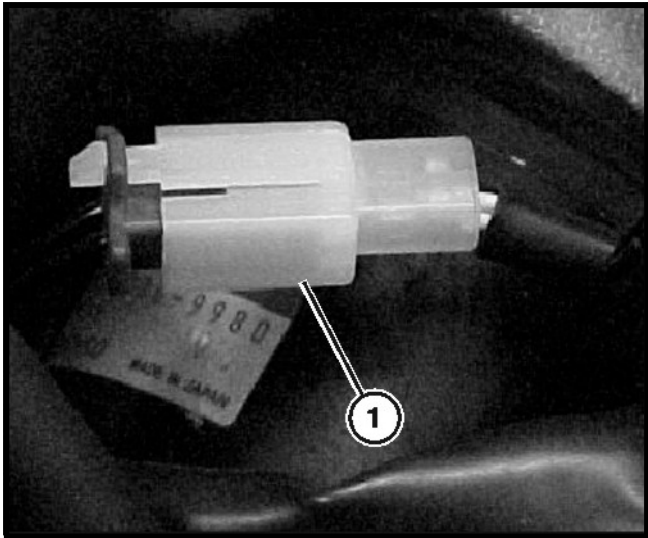
### 9.11 GEAR POSITION SWITCH

The connector of the neutral switch wire is in the rear zone of the engine. Disconnect the neutral switch wire and check the continuity between the "NEUTRAL" sensor wire and the chassis.

	Engine frame	
ON (neutral)	●	●
OFF (neutral excluded)	●	●





In the case in which there is no continuity between the neutral sensor wire and the chassis, change the component.

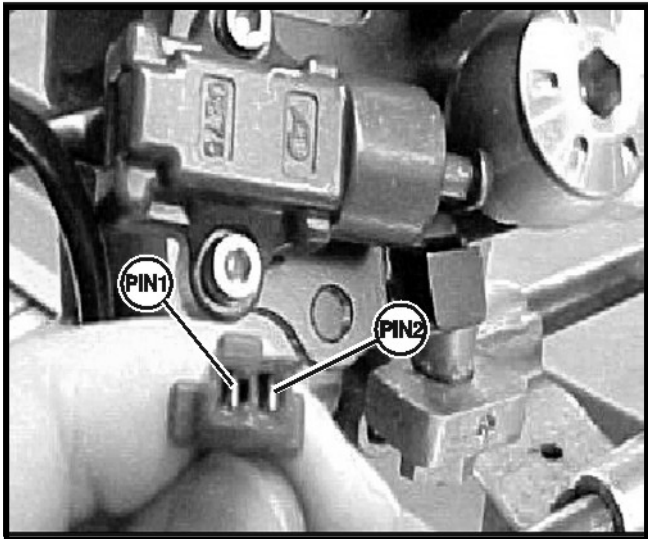




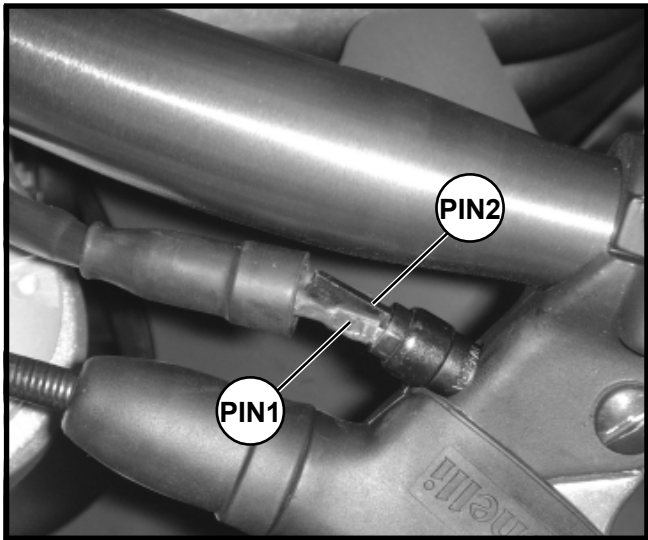
### 9.12 LATERAL STAND SWITCH

The connector of the lateral stand switch is under the petrol tank.  
 Remove the petrol tank.  
 Disconnect the lateral stand switch and measure the continuity as described below.  
 Check the continuity with a multitester as indicated in the table.

Stand	PIN 1	PIN 2
Raised		
Lowered		







If the above conditions are satisfied, the stand switch is functioning.

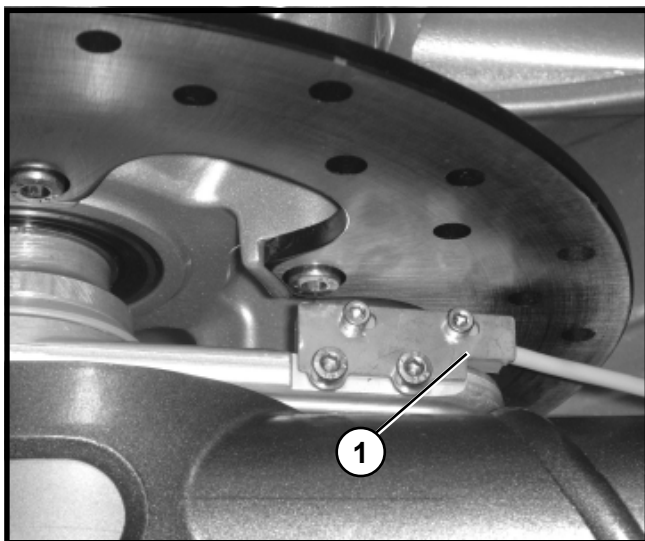


### 9.13 CLUTCH SWITCH

Disconnect the clutch switch cables.  
 Use a tester to check the following on the clutch switch pins:

Clutch	PIN 1	PIN 2
Pulled		
Released		





#### 9.14 SPEED SENSOR

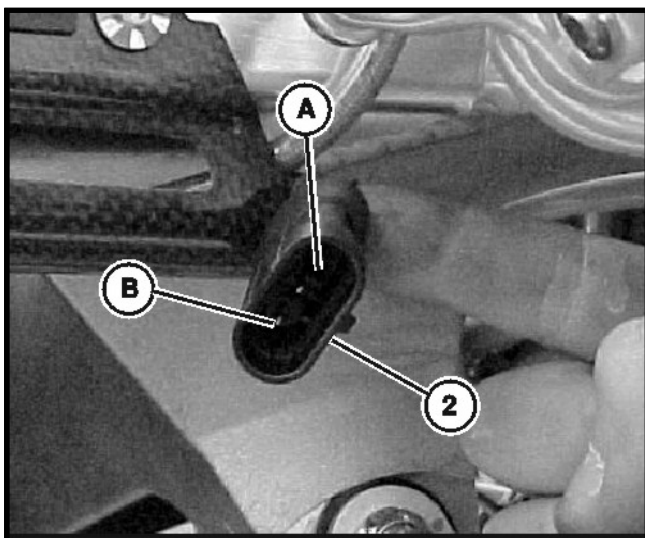
When the speed is not indicated on the instrument board, proceed as follows:

Check the integrity of the fuse.

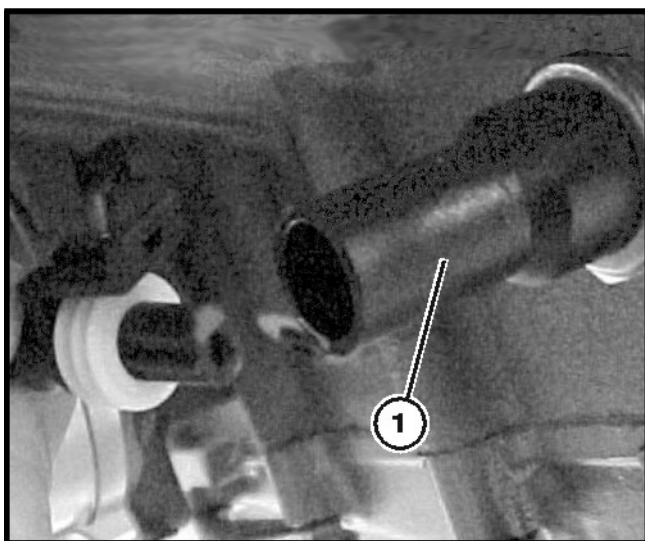
If the fuse in question is intact, check the speed sensor (1):

**NOTE:**

Verify that the distance between sensor and disc fixing screws is 1 mm.



- 1) Remove the vehicle sensor as described in the "ENGINE" chapter.
- 2) Disconnect the connector (2), and check that the connector measures 10K between terminal (A) (brown wire) and (B) (blue wire).

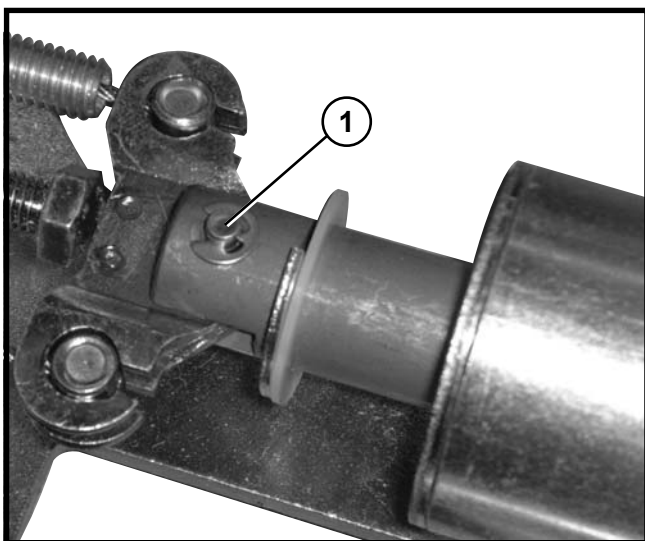


#### 9.15 OIL PRESSURE SENSOR

To check the good functioning of this component, the continuity between the contact on the sensor (1) and the chassis of the vehicle must be ascertained with the vehicle not running, as shown in the figure.

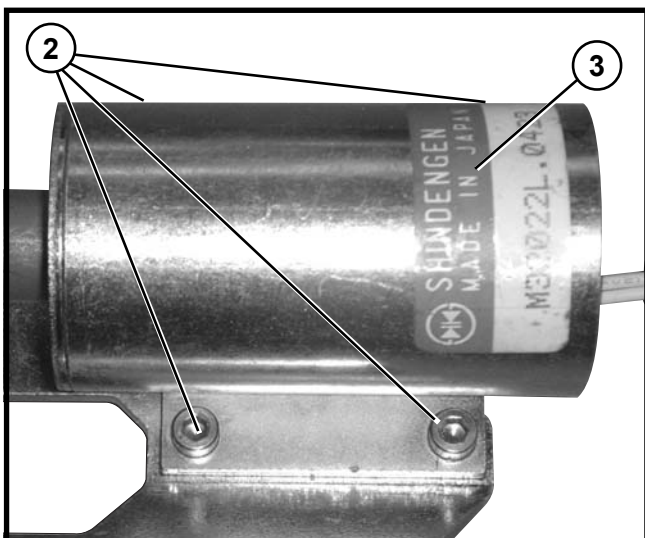
On the contrary, with the vehicle running the contact must be interrupted.



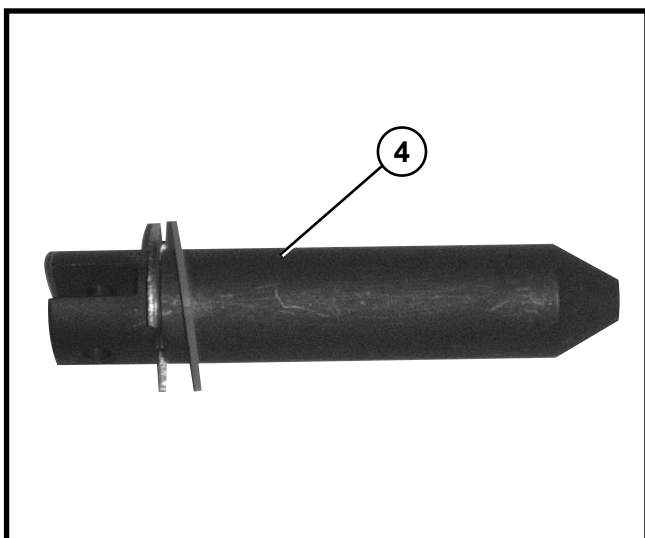


## 9.16 SOLENOID

Remove the solenoid (see solenoid disassembly).  
Remove the Seeger ring (1) remove the cable fixing plate, set the piston free.

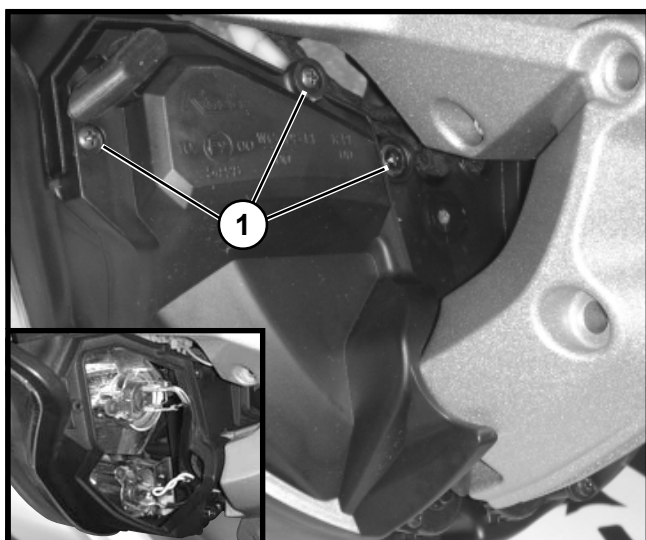


Loosen and remove the screws (2) remove the solenoid (3).



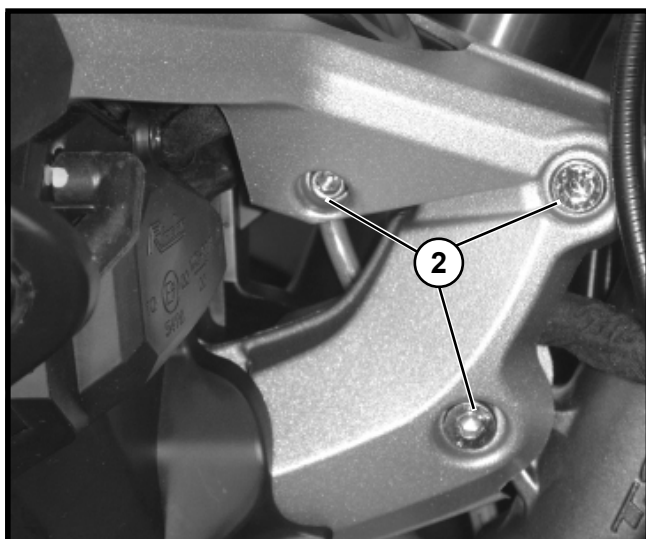
Verify the free movement of the piston (4), if it moves hard remove it and lubricate the sliding zone.





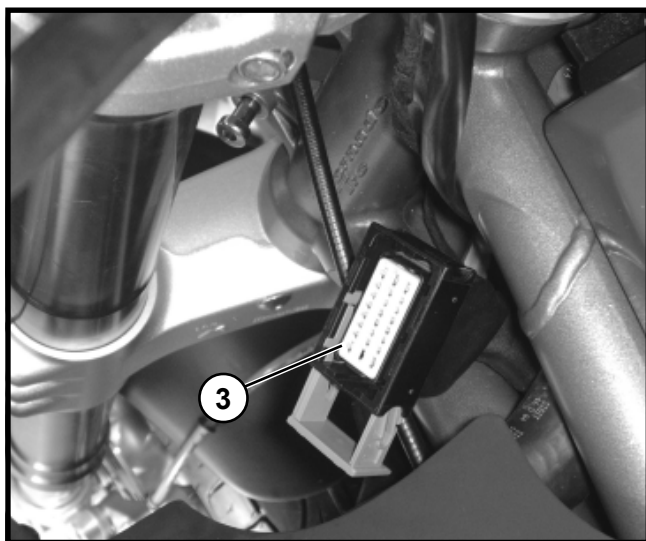
## 9.17 CHANGING FRONT LIGHTS

For front lamps replacement remove the parabolas right and left inspection lids unscrewing and removing the fixing screws (1).



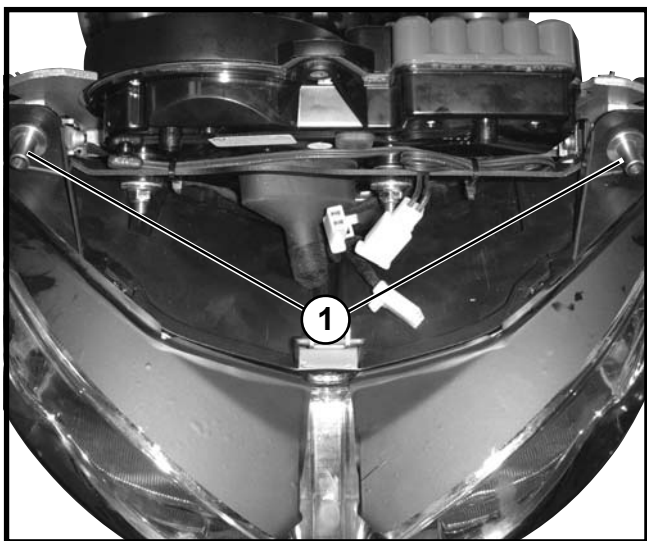
### 9.17.1 FRONT LIGHT DISASSEMBLY

Remove the wind shield (see "wind shield disassembly"). Unscrew and remove the frame screws (2) .

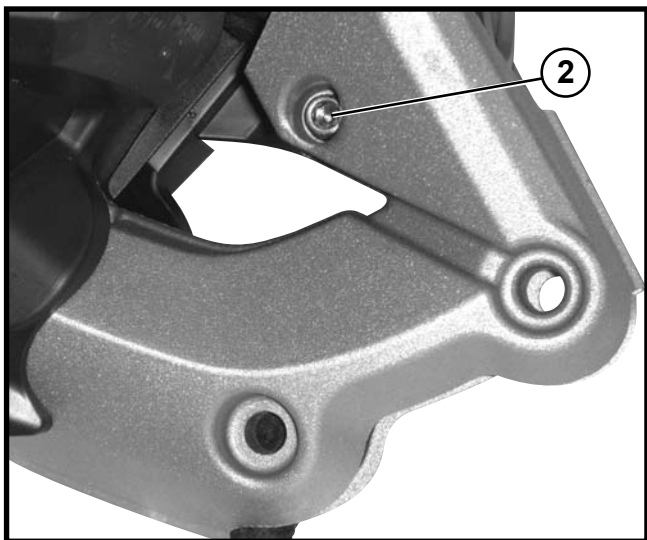


Take off the front LIGHT wiring connector (3).

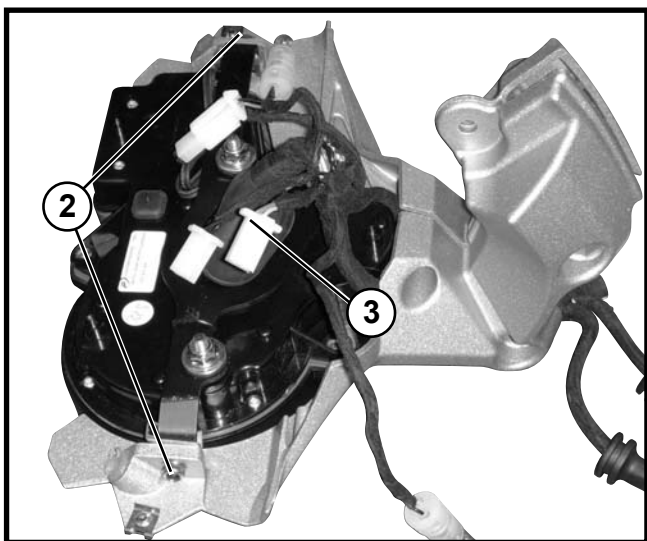




Remove the lamp inspection lids.  
 Unscrew the LIGHT fixing pivots (1).

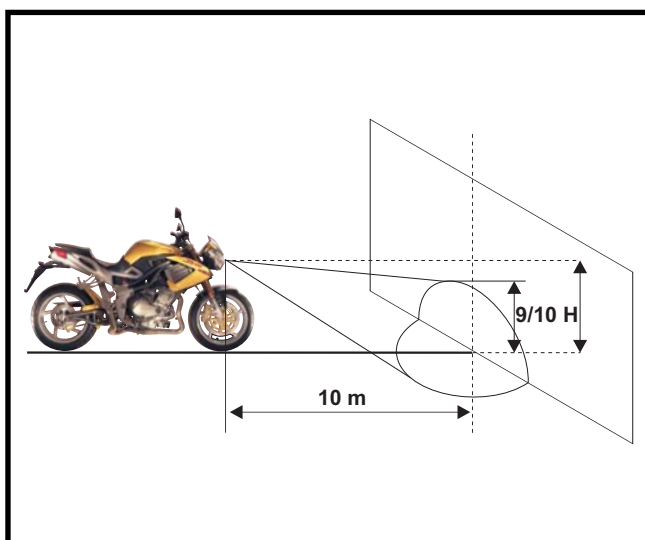


Unscrew and remove the central closing screw (2)of the right and left frame.



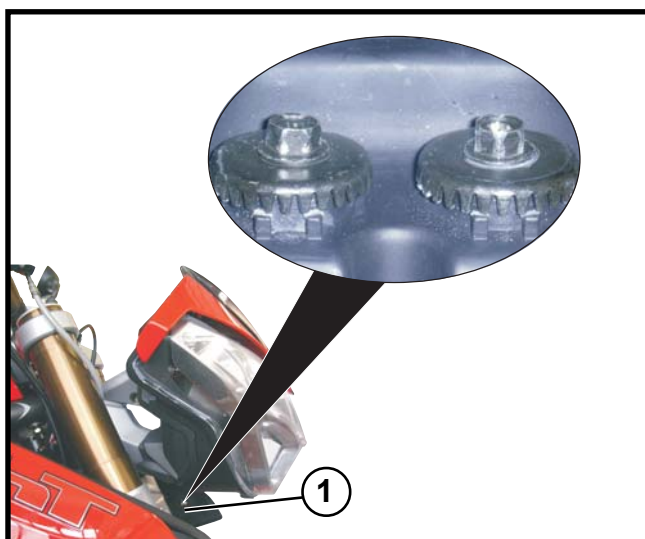
Loosen and remove the screws (2) remove the speed indicator  
 remove the connector (3) remove the LIGHT wiring.



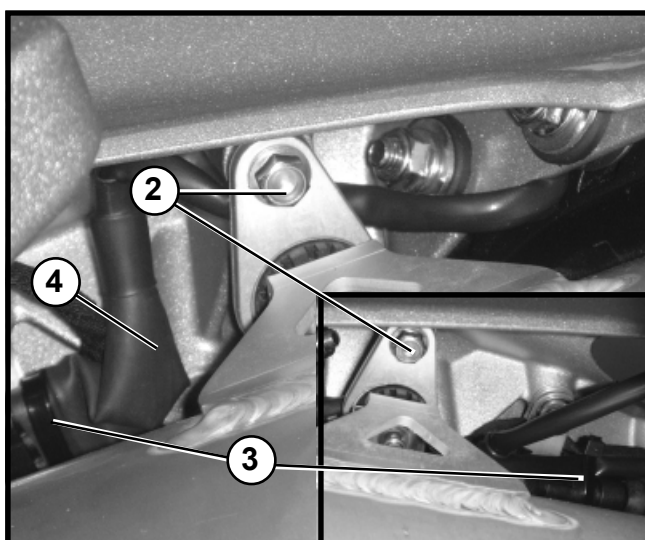


## 9.17.2 ADJUSTMENT FRONT HEADLIGHT

To carry out the correct adjustment of the luminous beam projected by the front headlight, position the vehicle at about 10 metres from a vertical wall on a perfectly flat terrain. Switch the front headlight on, sit on the vehicle in the driving position and check that the upper limit of the beam projected onto the vertical wall is less than about 1/10 with respect to the horizontal axis of the lights.



For the regulation of the front light act on the two adjustment screws (1) of parabola right and left positioned under the light. The right and left parabola can be set separately, loosening will raise the light beam, Tightening will lower the light beam.

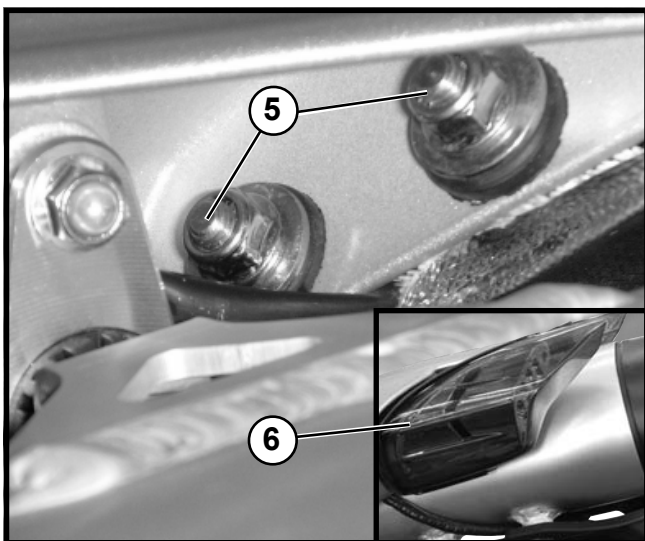


## 9.18 BACK LIGHT DISASSEMBLY

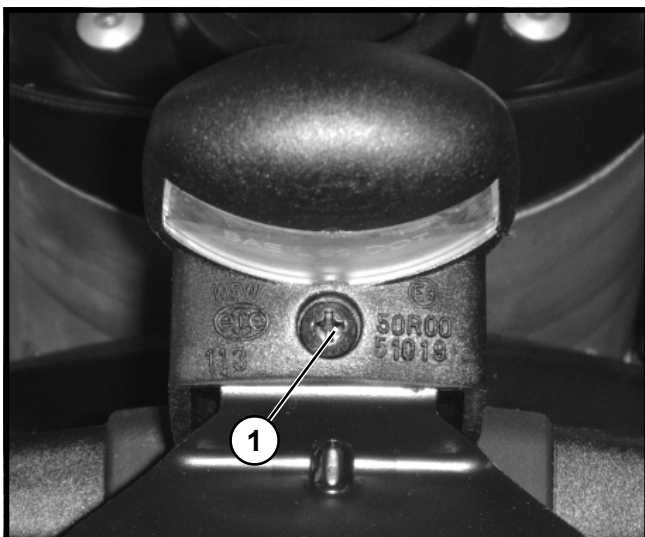
### 9.18.1 CHANGING REAR HEADLIGHT

This motorbike is equipped with led lights. Loosen the screws (2) of the muffler and lower it to allow the removal of the light. Cut the wiring locking tie-wrap (3), take off the connector (4).



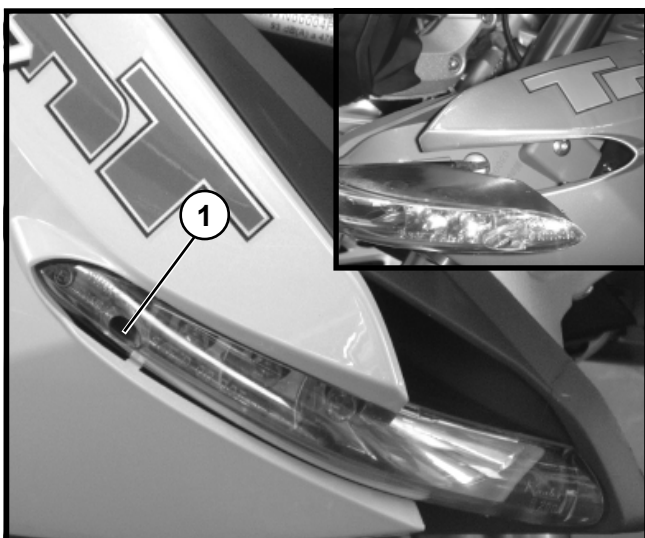


Loosen and remove the nuts (5), remove the light (6).



### 9.18.2 CHANGING LICENCE-PLATE LIGHT

Loosen and remove the screw (1).  
Remove the rubber lamp-holder.  
Change the position lamp.  
Position the rubber lamp-holder and tighten the screw (1).

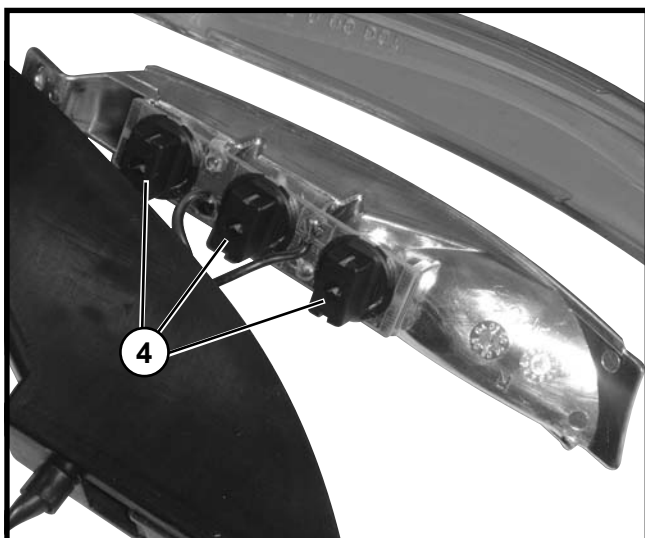


### 9.18.3 CHANGE FRONT AND REAR ARROWS

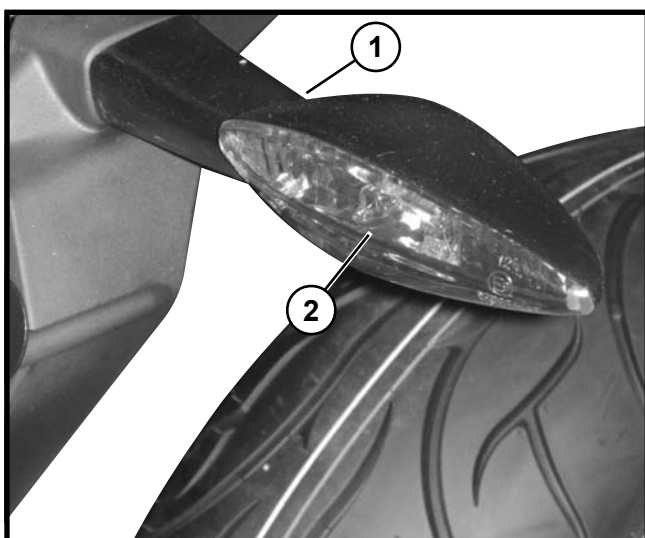
#### 9.18.3.1 CHANGE FRONT ARROWS

Cut the wiring fixing tie-wraps  
Loosen and remove screw (1).  
Remove the arrow body.  
Disconnect the connector.  
Unscrew and remove the glass fixing screw.



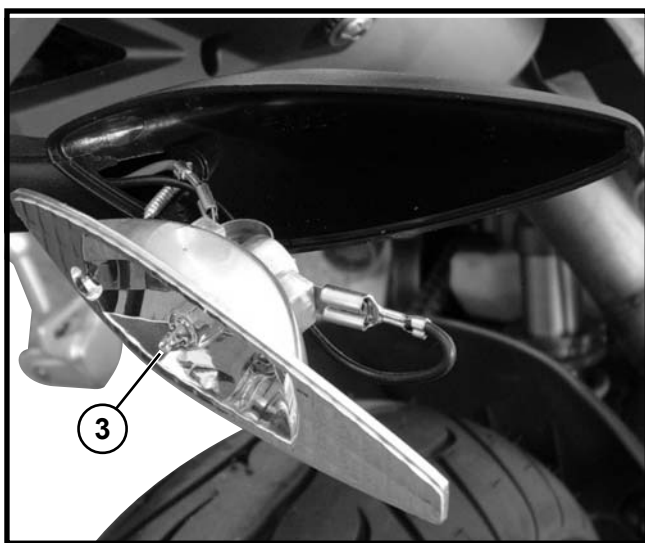


Replace the damaged lamp (4) rotating it counter clockwise. Position the arrow body, the glass, and fix with the dedicated screw. Work the same way with the opposite arrow.



### 9.18.3.2 BACK ARROW LAMP REPLACEMENT

Loosen and remove the screw (1). Remove the glass arrow (2).



Remove and replace the lamp (3). Reposition the glass (2) tighten the screw (1).









## Diagnostic

### 10 DIAGNOSTICS

#### 10.1 ELECTRICAL PART

##### LOADING SYSTEM

*Battery warning light lit*

Alternator damaged	Change
Alternator connection defective	Check
Battery damaged	Change

##### GENERAL

*No function*

30A Fuse	Change
Relay switch burnt	Change
Battery connections oxidised	Deoxidise/Restore

##### 12V SUPPLY SERVICES PLANT

*No function enabled*

Key switch damaged	Change
Key switch connection defective	Deoxidise/Restore
General relay damaged	Change
General relay connection defective	Deoxidise/Restore

##### ELECTRICAL STARTER

*Starter not functioning*

10A engine fuse burnt	Change
10A engine fuse connection defective	Deoxidise/restore
Clutch switch damaged	Change
Starter damaged	Change
Starter button damaged	Change
Right electrical connection block	Deoxidise/Restore
Relay starter damaged	Change
Power cable connections defective	Deoxidise/Restore

##### COOLING PLANT

*Electric fan not functioning*

Electric fan fuse burnt	Change
Electric fan fuse connection defective	Deoxidise/Restore
ECU defective	Change
H <sub>2</sub> O bulb	Change
H <sub>2</sub> O bulb connection defective	Deoxidise/Restore
Electric fan damaged	Deoxidise/Restore

##### LIGHTS/INDICATORS PLANT

*Front/rear position lights not functioning*

Lights fuse burnt	Change
Lights fuse connection defective	Deoxidise/Restore
Key switch damaged	Change
Key switch connection defective	Deoxidise/Restore
Lamp burnt	Change
Lamp connections defective	Deoxidise/Restore
Lights switch damaged	Change
Lights switch connection defective	Deoxidise/Restore





<i>Dazzle/dimmer lights not functioning</i>	Light fuses burnt	Change
	Light fuses connection defective	Deoxidise/Restore
	Lamps burnt	Change
	Lamp connections defective	Deoxidise/Restore
	Lights switch damaged	Change
	Lights switch connection defective	Deoxidise/Restore
	Dazzle + dimmer lights relay damaged	Change
	Dazzle light and dimmers relay connection defective	Deoxidise/Restore
<i>Rear light stop not functioning</i>	10A fuse burnt	Change
	10A fuse connection defective	Deoxidise/Restore
	Lamp burnt	Change
	Lamp connectiond defective	Deoxidise/Restore
	Front brake lever switch damaged	Change
	Front brake lever switch connection defective	Deoxidise/Restore
	Rear brake lever damaged	Change
	Rear brake lever switch connection defective	Deoxidise/Restore
<i>Rear stop light remains lit</i>	Front brake lever blocked	Change/Repair
	Rear brake lever switch blocked	Change/Repair
<i>Horn not functioning</i>	10A engine fuse burnt	Change
	10A engine fuse connection defective	Deoxidise/Restore
	Horn damaged	Change
	Switch damaged	Change
	Horn connection defective	Deoxidise/Restore
	Switch connection defective	Deoxidise/Restore
<i>Direction indicators not functioning</i>	10A engine fuse burnt	Change
	10A engine fuse connection defective	Deoxidise/Restore
	Intermittent light damaged	Change
	Intermittent light connection defective	Deoxidise/Restore
	Lamp burnt	Change
	Lamp connection defective	Deoxidise/Restore
	Direction indicators switch damaged	Change
	Indicators switch connection defective	Deoxidise/Restore
<i>Direction indicator remains lit</i>	The lamp of the other indicator, same side is burnt	Change
	The other indicator connection is defective	Deoxidise/Restore
<b>INSTRUMENT BOARD PLANT</b>		
<i>Instrument board not functioning</i>	2A fuse burnt	Change
	2A fuse connection defective	Deoxidise/Restore
<i>The instrument board does not light up</i>	2A fuse burnt	Change
	2A fuse connection defective	Deoxidise/Restore
	Instrument board damaged	Change
	Instrument boatd connection defective	Deoxidise/Restore





<i>Tachymeter not functioning</i>	Speed sensor damaged Speed sensor connection defective 10A fuse burnt 10A fuse connection defective Instrument board damaged Instrument board connection defective	Change Deoxidise/Restore Change Deoxidise/Restore Change Deoxidise/Restore
<i>Oil warning light does not light up</i>	Oil pressure sensor damaged Oil pressure sensor connection defective Instrument board damaged Instrument board connection defective Warning light burnt	Change Deoxidise/Restore Change Deoxidise/Restore Change instrument board
<i>Neutral warning light does not light up</i>	Neutral sensor burnt Neutral sensor connection defective Warning light burnt	Change Deoxidise/Restore Change instrument board
<i>Pilot lamp battery switched on</i>	Alternator connection defective Instrument board damaged Defective battery Defective generator	Deoxidise/Restore Change Change Change
<i>Fuel reserve warning light does not light up</i>	Fuel level sensor damaged Fuel level sensor connection defective Instrument board damaged Instrument board connection defective Warning light burnt	Change Deoxidise/Restore Change Deoxidise/Restore Change instrument board
<i>Direction indicator warning lights do not light up</i>	Intermittent light damaged Intermittent light connection defective Instrument board damaged Instrument board connection defective Warning light burnt	Change Deoxidise/Restore Change Deoxidise/Restore Change instrument board
<i>Position warning lights do not light up</i>	Instrument board damaged Instrument board connection defective	Change Deoxidise/Restore





## INJECTION

*Air temperature sensor indicates a fault*

Sensor damaged	Change
Sensor connection defective	Deoxidise/Restore

*Potentiometer floating body*

Potentiometer damaged	Change
Potentiometer connection defective	Deoxidise/Restore

*H<sub>2</sub>O temperature indicator not functioning*

Bulb H <sub>2</sub> O	Change
10A fuse burnt	Change
10A fuse connection defective	Deoxidise/Restore
Instrument board damaged	Change
Instrument board connection defective	Deoxidise/Restore
Sensor connection defective	Deoxidise/Restore
Detective ECU connection	Deoxidise/Restore

## FUEL INJECTION PLANT

*Injector does not inject fuel*

25A fuse burnt	Change
25A fuse connection defective	Deoxidise/Restore
Injection relay damaged	Change
Injection relay connection defective	Deoxidise/Restore
Injector damaged	Change
Injector connection defective	Deoxidise/Restore
ECU injection damaged	Change
Lateral injection hanger damaged	Change
Pick up engine damaged	Change
Pick up light/phonic wheel not exact	Change
Petrol pump damaged	Change
Neutral sensor fault	Change

## IGNITION PLANT

*Sparkling-plug spark absent*

25A fuse burnt	Change
25A fuse connection defective	Deoxidise/Restore
Relè detective injection connection	Deoxidise/Restore
Coils damaged	Change
Coil connections	Deoxidise/Restore
ECU injection damaged	Change
Sparkling-plug damaged	Change
Engine chassis connection defective	Restore
Lateral hangere switch damaged	Change
Pick up engine damaged	Change
Pick up/phonic wheel not exact	Restore
Neutral sensor damaged	Change





## 10.2 FRAME

### STEERING

*Steering hard*

Steering ball-bearings damaged	Change
Steering ball-bearings tightened excessively	Adjust
Steering pin bent	Change
Steering damper braked excessively	Adjust
Steering damper joints damaged	Change
Low tire pressure	Adjust

*The engine tends to swerve or not proceed in a direct line*

Fork bent	Change
Frame bent	Change
Rear fork bent	Change
Steering damper joints damaged	Change
Steering ball-bearings damaged	Change
Wheel pin bent	Change
Rear wheel ball-bearings damaged	Change

### FRONT WHEEL

*Front wheel oscillates/vibrates*

Wheel rim bent	Change
Wheel not balanced	Balance
Tire defective	Change
Wheel ball-bearings damaged	Tighten
Pin fixing screws not tight	Tighten
Pin fixing ring-nut not tight	Tighten

*Front wheel rotates with difficulty*

Ball-bearings damaged	Change
Wheel pin damaged	Change
Brake pads drag excessively on the disks (see brakes)	Check
Brake disks bent	Change
Wheel ring-nut pin tightened excessively	Loosen

### FRONT SUSPENSION

*Front suspension too pliable*

Fork oil deteriorated	Change
Fork oil level low	Refill
Tire pressure low	Adjust
Fork damaged	Adjust

*Front suspension too rigid*

Fork oil level high	Adjust
Tire pressure high	Adjust





## REAR WHEEL

*Rear wheel oscillates/vibrates*

Wheel rim bent	Change
Wheel not balanced	Balance
Tire defective	Change
Tire unsuitable	Change
Wheel ball-bearings damaged	Tighten
Fixing nut not tight	Tighten
Suspension screws not tight	Tighten
Suspension ball-bearings damaged	Change

*Rear wheel rotates with difficulty*

Ball-bearings damaged	Change
Wheel hub sealing ring out of place	Check
Brake pads drag excessively on disk	Check
Brake disk bent	Change
Transmission chain damaged	Change

## REAR SUSPENSION

*Rear suspension too pliable*

Preload spring insufficient	Adjust
Hydraulic brake in extension insufficient	Adjust
Tire pressure low	Adjust
Damper damaged	Change

*Rear suspension too rigid*

Preload spring excessive	Adjust
Hydraulic brake in extension insufficient	Adjust
Tire pressure high	Adjust
Rear wheel ball-bearings damaged	Change
Suspension balancer ball-bearings damaged	Change
Damper joints damaged	Change
Suspension joints connecting rod damaged	Repair
Rear wheel pin bent	Change

## BRAKES

*Brake lever and pedal too pliable or "spongy"*

Air bubble in hydraulic circuit	Purge
Losses in the hydraulic circuit	Repair
Clamp seals damaged	Change
Pump seals damaged	Change
Clamp pistons do not run freely	Check
Hydraulic liquid low	Refill
Brake disks distorted	Change

*Brake lever and pedal too hard*

Brake lever and pedal bent	Change
----------------------------	--------





#### *Braking power insufficient*

Disks dirty	Clean
Air bubble in hydraulic circuit	Purge
Losses in the hydraulic circuit	Repair
Clamp seals damaged	Change
Pump seals damaged	Change
Clamp pistons do not run freely	Check
Hydraulic liquid low	Refill
Brake disks distorted	Change

#### *Pads dragging on brake disks*

Pad springs damaged	Change
Brake disks distorted	Change
Clamp pistons do not run freely	Check
Hydraulic liquid level too high	Adjust
Brake pads worn out	Change

### **EXHAUST PLANT**

#### *Exhaust noise excessive*

Exhaust pipe damaged	Change
Fixing pipe loosened	Tighten

#### *Poor engine performance*

Exhaust pipe damaged	Change
Fixing pipe loosened	Tighten

### **COOLING PLANT**

#### *Engine temperature too high*

Cooling liquid level too low	Refill
Defective cooling fanwheels	Change
Expansion tank cooling liquid cap defective	Change
Electric fan thermoswitch defective	Change
Sensor temperature instrument defective	Change
Thermostat blocked closed	Change
Cooler fins folded or choked	Repair/clean
Coolers encrusted	Clean
Water pump damaged	Change
Injection/ignition plant defective	Check
Fuel not suitable	Change
Engine cooling circuit defective	Check
Sparking-plug thermal grade not suitable	Change
Accumulation of carbon residues in the head/piston	Clean

#### *Engine temperature too low*

Thermostat blocked open	Change
-------------------------	--------





## **10.3 AXONE2000 BENELLI INSTRUCTION MANUAL**

### **10.3.1 GENERAL SAFETY PRECAUTIONS FOR OPERATORS**

Carefully read the instructions on set up, use and maintenance in this operative manual.

Do not allow unskilled personnel to use this machine as this could cause injury to personnel and damage to the equipment.

The working area must be dry, ventilated and with enough light. In particular, all testing with running engine must take place in areas equipped with extraction fans. Please remember that breathing carbon dioxide (which is odourless) is a health hazard.

#### **When operating on engines or other parts of motorcycle:**

- Use proper clothing and act appropriately in order to avoid accidents.
- Before starting make sure that the motorcycle gearbox is neutral and check that the wheels are blocked.
- Protect your face, hands and feet and avoid contact with hot parts such as spark plugs, exhaust pipes, radiators, and connectors of the cooling system.
- Do not smoke and do not use flames while working on the motorcycle.
- Check that all electric connections are isolated and firm.
- Do not look directly into the carburettor inlet while the engine is running.
- Keep hands and hair away from moving parts.
- Do not wear ties, slack clothing, wrist jewellery and watches while working on a motorcycle, especially with running engine.
- Keep away from the fan. Then cooling fan is controlled by a temperature switch operates according to the temperature of the coolant: disconnect the fan cable whenever operating on a warm engine, so that the fan does not suddenly start up after the engine has been turned off.
- Do not pour fuel directly into the carburettor to start the engine quickly.
- Do not open the radiator cap before both the temperature of the engine and the pressure of the cooling system have decreased.
- Do not touch high voltage cables while the engine is on.
- Handle portable lamps with care and use safety models only.
- Wear safety goggles to protect your eyes from fuel, dust and metal.
- Remember that the catalytic converter can become extremely hot and cause severe injury or fires.
- Be very careful that there is no spilt oil, rag, paper or other easily flammable material near the catalytic converter.

#### **When operating on car batteries, remember that:**

Motorcycle batteries contain sulphuric acid and produce explosive gases. Therefore, keep the following in mind:

- Always wear safety goggles.
- Do not leave tools on batteries because they could cause short circuits.
- Before testing or charging, cover the battery inlets with a wet rag to choke any explosive gases.
- Avoid sparks when connecting cables to the battery.
- Avoid splashes of electrolyte on your skin, eyes or clothing, because it is corrosive and highly toxic.

#### **When operating with the device connected to mains remember to:**

- Check that the instrument has been connected to earth.





- Turn off power before connecting or disconnecting cables.
- Do not touch with wet hands.

#### **How to use AXONE2000 BENELLI correctly**

Observe the following safety rules in order to use your AXONE2000 BENELLI correctly:

- The equipment must be used in a dry area. Do not expose it or use it near to heat sources.
- Do not subject the AXONE2000 BENELLI CPU to heavy shocks.
- Do not expose the AXONE2000 BENELLI CPU to water or other liquids.
- Do not lay objects on the power cable and do not kink the cable.

### **10.3.2 HOW TO USE AXONE2000 BENELLI CORRECTLY**

Observe the following safety rules in order to use your AXONE2000 BENELLI correctly:

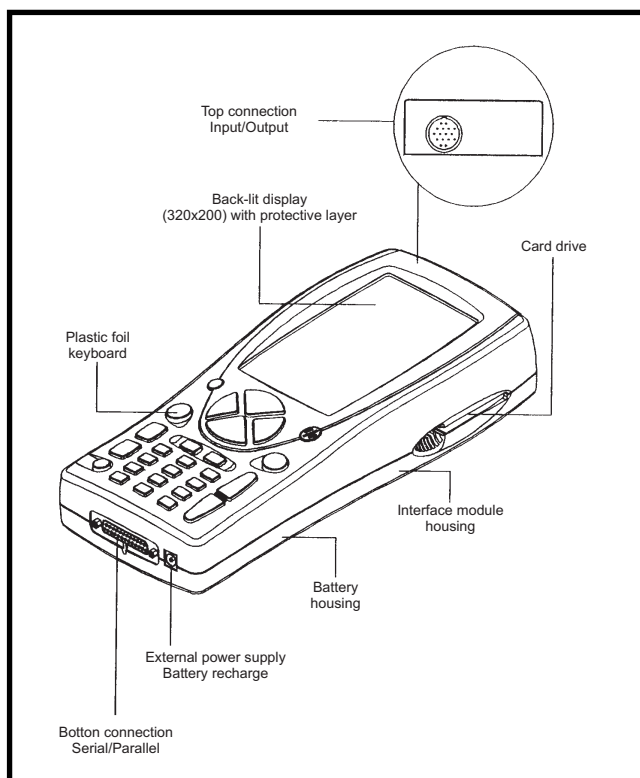
- The equipment must be used in a dry area. Do not expose it or use it near heat sources.
- Turn the device on and off using only the ON/OFF switch.
- Do not subject the AXONE2000 BENELLI CPU to heavy shocks.
- Do not expose the AXONE2000 BENELLI CPU to water or the liquids.
- Do not lay objects on the power cable and do not kink the cable.
- For frequent use, store the equipment with the power/charge cable connected.
- Disconnect the power/charge cable if you do not plan to use the equipment for a long period. (longer than one month).
- Do not use the AXONE2000 BENELLI with the battery charger connected except during Internet on-line upgrading and only if the label on the power supply module carries one of the following captions:

Sec: 12V=1000mA 12.0 VA
----------------------------

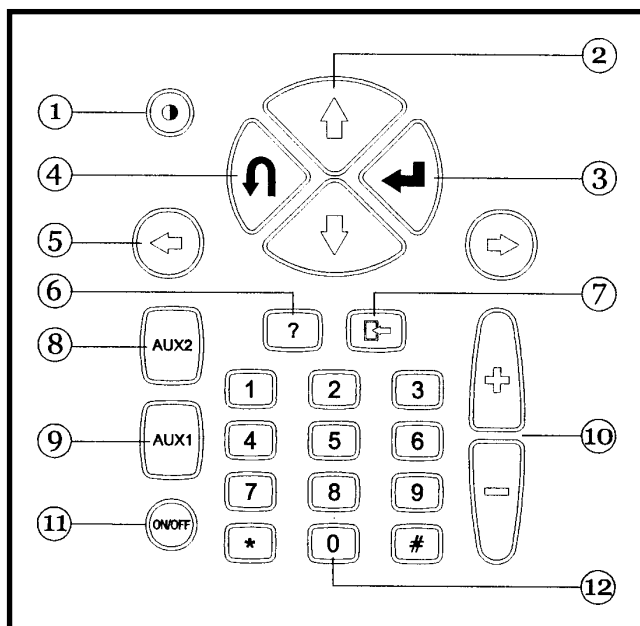
OUTPUT:12Vdc 1A
-----------------

- Do not replace electronic modules (e.g.:OBD, ACQ, etc.) when the instrument is powered.





### 10.3.3 DESCRIPTION OF AXONE2000 BENELLI

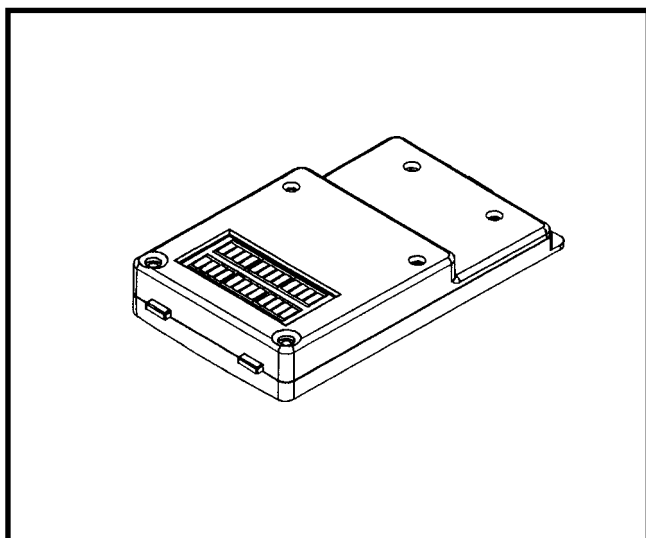


#### 10.3.3.1 KEYPAD

- 1 - Contrast key: to adjust and the screen contrast, push whilst adjusting with the vertical scroll keys (2).
- 2 - Vertical scroll keys: to move the cursor up and down and select the various functions.
- 3 - ENTER key: to confirm selections.
- 4 - CANCEL key: to cancel the most recently selected function and restore the previous function.
- 5 - Horizontal scroll keys: to move the cursor left and right and select the various functions.
- 6 - HELP keys: it is used to display an on-line help guide (when provided by the program).
- 7 - Store/delete key: to store test data or to delete the data from the memory (according to the selected program).
- 8 - AUX 2 key: to access auxiliary functions.
- 9 - AUX 1 key: to access auxiliary functions.
- 10 - Up/down keys.
- 11 - ON/OFF key: to turn the instrument on and off.
- 12 - Number keys: to enter codes, numeric data and select tests (according to the selected program).

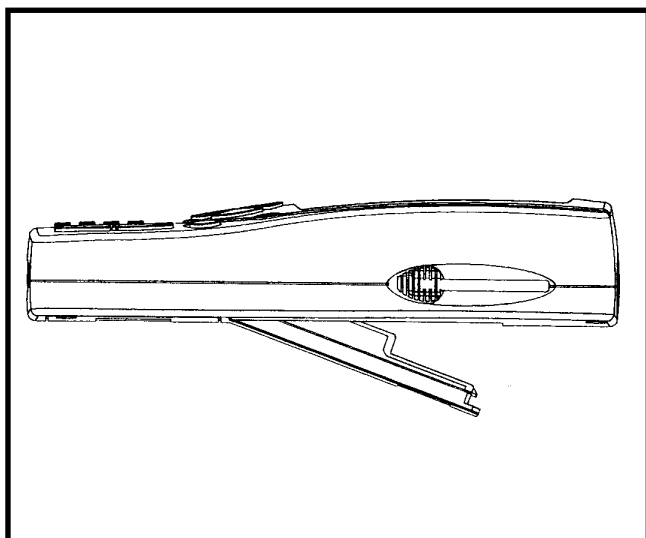
The instrument confirms the selection with a beep every time a key is pressed.





### 10.3.3.2 INTERFACE MODULE

This module is used to physically interface the AXONE2000 BENELLI with the cables, the sensor and the probes of the various available kits.

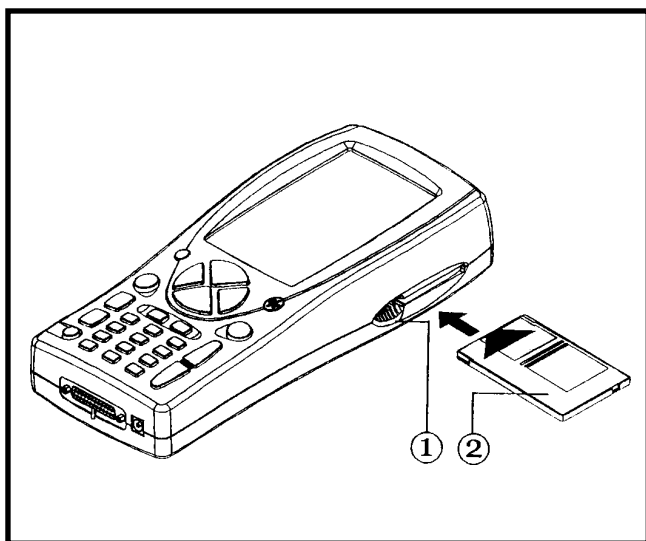


Three different types of interface modules are available.

- Self-test OBD-II (OBD module)
- Measurements (ACQ module)
- Modem (for on-line upgrading via the Internet)

Each module is to be used with a specific group of programs.

The module is clipped into the dedicated housing in the base of the AXONE2000 BENELLI. The OBD module can be replaced when AXONE2000 BENELLI is working, but is recommended to replace the module when the AXONE2000 BENELLI is off.



### 10.3.3.3 READ/WRITE UNIT

The read/write unit (1) includes a memory card (2), containing various diagnostic programs.

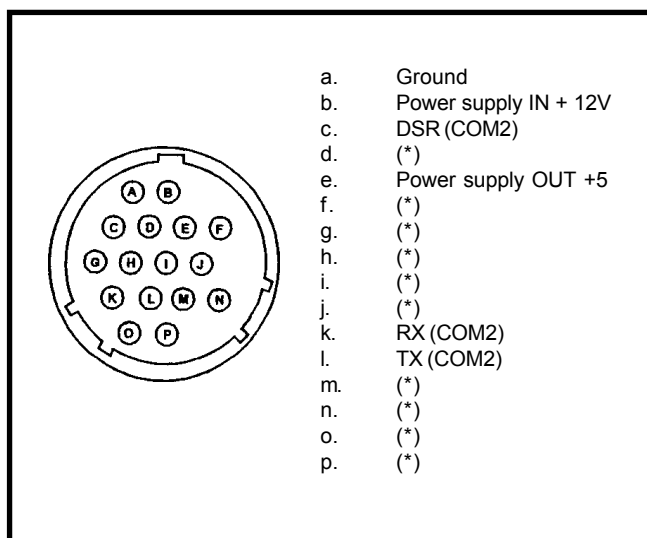
**NOTE:**

Always insert the memory card before switching the AXONE2000 BENELLI on. The screen displays an image prompting you to insert the memory card if it is missing.

*Insert the memory card when the instruments is off!*

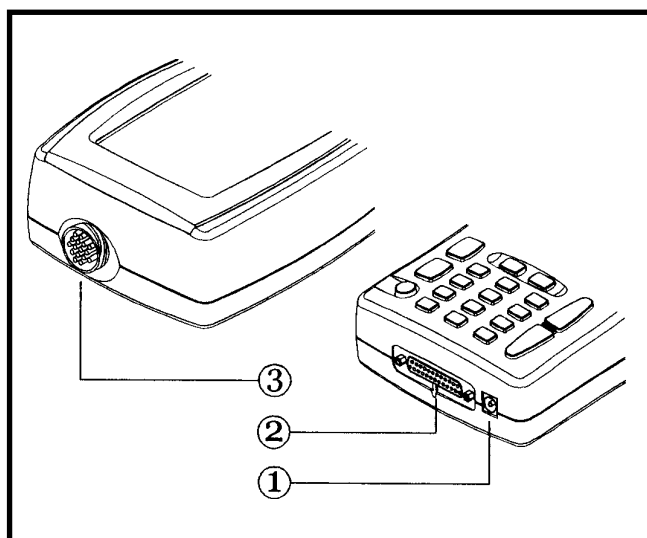


### 10.3.3.4 INPUT/OUTPUT CONNECTORS



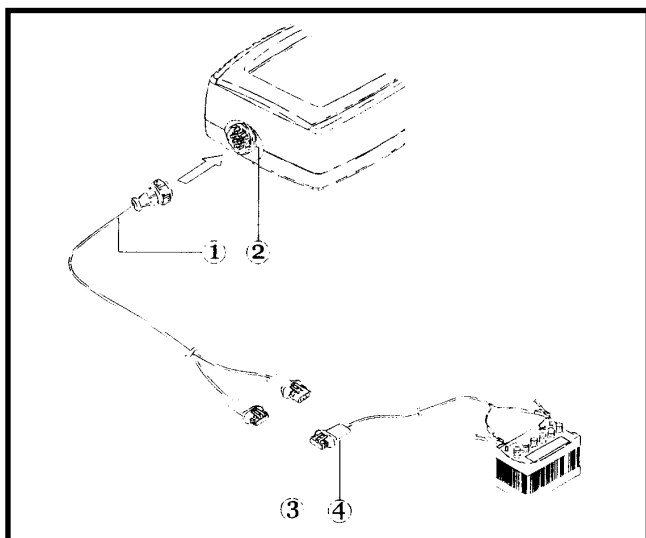
**NOTE:**

The pins marked with \* have different uses according to the interface fitted in the base of the AXONE2000 BENELLI instrument.



- 1 - POWER connector:  
To charge the internal battery, using only the charger supplied.
- 2 - Lower parallel-serial connection:  
This connector acts as an interface between the AXONE2000 BENELLI and external units such as: printers, remote terminals, serial devices, etc... This connector is also used to power the AXONE2000 BENELLI.
- 3 - Upper connector:  
Depending on the interface module inserted in the AXONE2000 BENELLI, the connector is used to carry out special tests or characteristics for perform AXONE2000 BENELLI diagnostic functions, using the standard cables provided in each kit.





### 10.3.3.5 HOW TO POWER THE AXONE2000 BENELLI

The AXONE2000 BENELLI can be powered automatically by means of an internal battery (self-powered) or externally using the cable provided.

Connect as follows:

Connect the cable of the kit in use (1) to the upper connector (2) and connect the battery clamp cable (4) to the connector.

#### NOTE:

The terminal battery will be automatically recharged when the AXONE2000 BENELLI is powered externally.

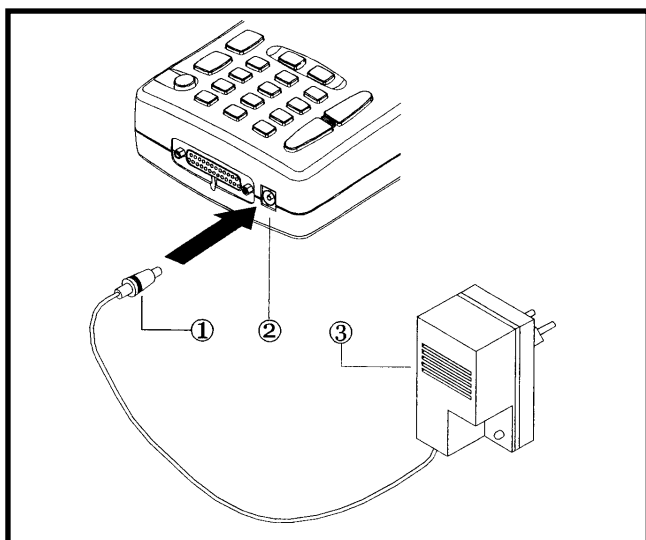


#### ATTENTION:

The battery charger may be used as an external power source, but only if the label carries one of the following captions:

Sec: 12V=1000mA  
12.0 VA

OUTPUT: 12Vdc 1A



### 10.3.3.6 RECHARGING THE BATTERY

To recharge the AXONE2000 BENELLI internal battery:

- Insert the plug (1) in the POWER connector (2).
- Connect the power unit (3) to the 220 V mains.

The fully charged instrument battery (efficient battery charged for approximately 12 hours at 20°C) will provide over two hours of operation.

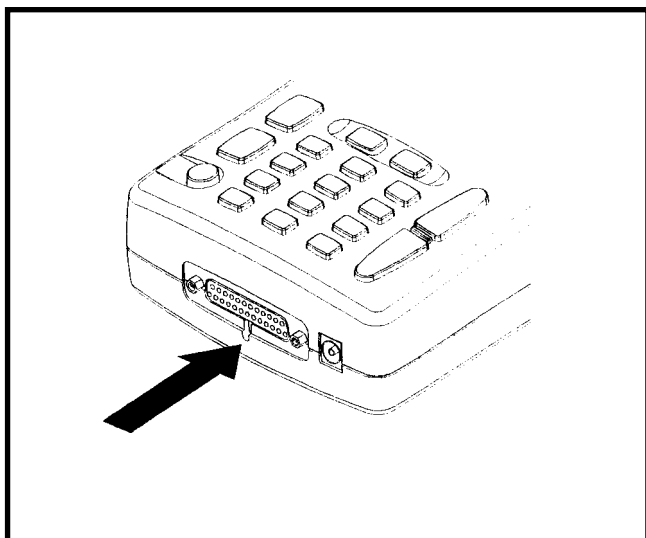
#### IMPORTANT:

The battery charger must only be used for recharging the batteries and never to power the instrument externally.

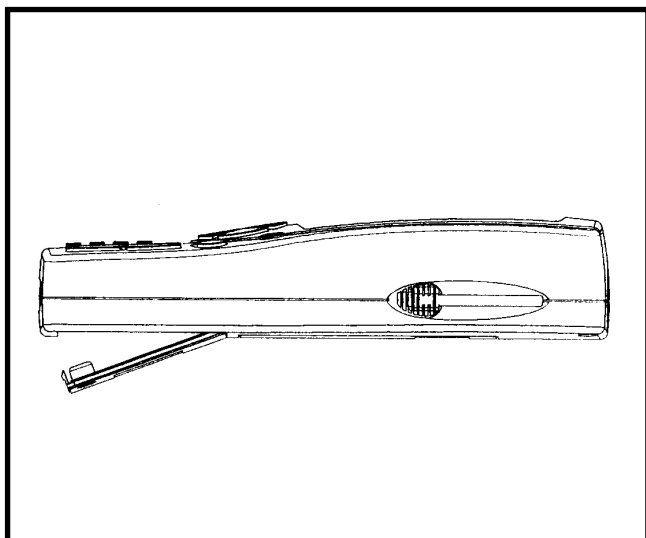


### 10.3.3.7 REPLACING THE BATTERY

The battery is contained a compartment in the base of the AXONE2000 BENELLI. Delicately open the retainer by inserting by the arrow to open the flap and access the battery compartment.



The flap will open.  
Access the battery compartment to replace the battery.  
Make sure the battery is correct connected as shown on the label inside the compartment.



#### **ATTENTION:**

*The battery is charged when supplied. The charge level may present normal decay. For this reason, you are advised to recharge the battery completely for 12-18 hours before normal use.*

### 10.3.3.8 NOTES FOR CORRECT USE

#### RECHARGING PRECAUTIONS

Always use AXONE2000 BENELLI with charged battery.  
In order to maximise the performance, a slow charge should always be preferred. For the efficient battery operation, just follow the simple rules below:

- The first two charge cycles must be performed with the instrument under charge for minimum 12 hours (the night charge is recommended). Afterwards, the charging time may be shorter.  
However, the battery charge automatically disconnects the supply when the battery has reached the charge complete status.
- It is advisable to charge the battery when the charge indicator on the display shows just one mark.





- Charge at room temperature; if the tool has been exposed to the sun in summer or in a cold place in winter, wait that the room temperature is reached (approx. 20°C) before beginning to charge.

Programs check battery charge while running and warn you by flashing the battery icon when power is low. After this the control software allows you to use the instrument for about 10 minutes more and then proceeds with auto-shut down.

This function is disabled only when the maximum computing power of the processor is required for instance during fast data acquisition, in such cases the operator is not warned that the battery is almost depleted.

#### **AUTOMATIC RESET INTERNAL FUSES**

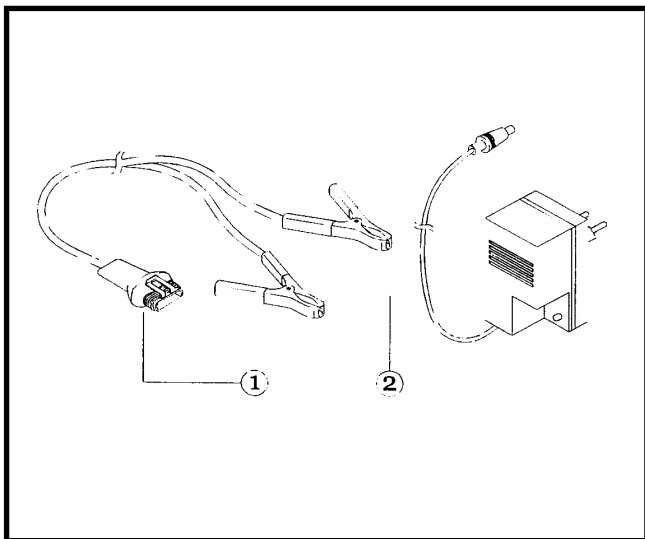
AXONE2000 BENELLI is equipped with automatic reset protection fuses. Sometimes, the reset is not immediate and it may be necessary to wait for a few minutes.

#### **10.3.3.9 TECHNICAL SPECIFICATIONS**

The following technical characteristics refer to the use of the AXONE2000 BENELLI CPU, those relating to the various programs and the associated interface modules are available in the specific section of each kit.

- Self-powered portable computer.
- Graphic display with adjustable brightness and contrast (backlit), resolution 320 x 200, brightness can be adjusted by keypad.
- Plastic-foil keypad with touch keys.
- Internal and external power supply and automatic charge at 12-15 V DC.  
Internal power supply with fully charged battery > 2h
- Three standard RS232 serial communication ports.
- Standard parallel communication port.
- External software on memory card.
- Possible connection to hard disk.
- Standard ATA/FLASH PC-CARD drive.
- Possible connection to modem or remote terminal.
- Size: 310 x 140 x 60 mm
- Weight: 1,5 kg
- Consumption: 10W.
- Working temperature range: -5°C + 40°C





### 10.3.3.10 SPARE PARTS

- |                         |         |
|-------------------------|---------|
| 1 - Battery power cable | 7200052 |
| 2 - Battery charger     | 51VI150 |

### 10.3.3.11 GLOSSARY

- ON-LINE HELP: Press HELP to get help information. Press CANCEL to quit.
- DATABASE: set of data.
- DISPLAY: screen where images are shown.
- DRIVE: device which accommodates and reads the memory card.
- HARDWARE: all material parts of the computer and peripheral devices connected to it.
- MEMORY: an electronic component where all information needed to process data, instructions, intermediate and final results are recorded and stored.
- MEMORY CARD: data card which can be inserted into AXONE2000 BENELLI drive; data can be read and written on the card.
- PARALLEL: execution of several tasks at the same time (e.g. transmission of several data at the same time).
- PERIPHERAL: external device connected to the instrument.
- SERIAL: execution of operations one after the other (e.g. transmission of data in sequence).
- OPERATING SYSTEM: group of programs which manage resources of AXONE2000 BENELLI and other programs.
- SOFTWARE: all programs contained in the computer or everything which is not HARDWARE.
- CENTRAL UNIT: in a processing system this is the data control centre (interpretation and execution of instructions).

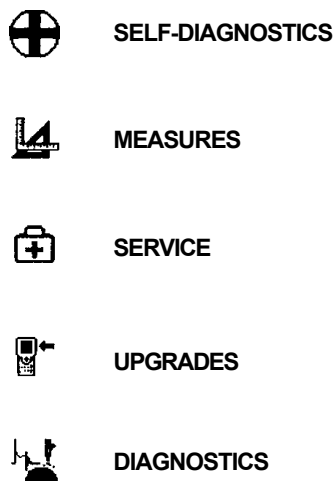
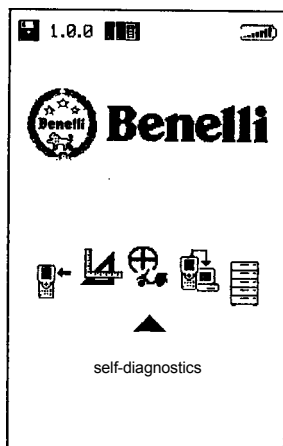




### 10.3.3.12 GETTING STARTED

AXONE2000 BENELLI is a programmable electronic platform for accessing various fields of motorcycle diagnostics by means of special kits.

The main menu where to select the programs relevant to the required instrument appears when the AXONE2000 BENELLI is switched on.



Use the left/right scroll arrows to scroll the icons of the tool/function to be selected and the press ENTER to confirm.

AXONE2000 BENELLI offers a special kit for each diagnostic requirement. Each kit includes the instrument control program, an interface module (to be arranged in the base AXONE2000 BENELLI), the sensors, the cables for the connection to the engine, the adapters, the manual and all what is required by the tools and the specific tests.

Contact your area BENELLI dealer for information on available kits.

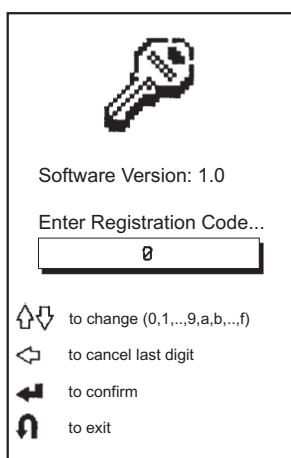
### 10.3.3.13 STARTING PROGRAMS

An introductory screen where to select the required language will appear when AXONE2000 BENELLI is switched on for the first time. After this, the following screen where enter numbers and letters will appear:

A REGISTRATION CODE is required to start a program. Enter the alphanumeric registration code provided by the retailer, the dealer or others during the first installation or the runoff.

Enter the code and press ENTER to confirm.

AXONE2000 BENELLI is now ready for use. All the production functions can be accessed.







### 10.3.4 HOW TO USE AXONE2000 BENELLI

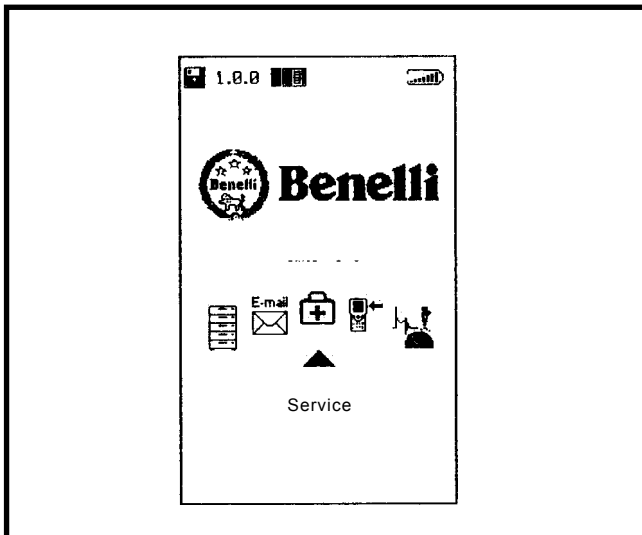
The instructions refer to the AXONE2000 BENELLI CPU; those relating to the various programs are available in the section specific for each kit.

#### 10.3.4.1 SERVICE MENU

From the introductory page, you can access the diagnosis and service programs using the scroll arrows as described in the previous paragraph.

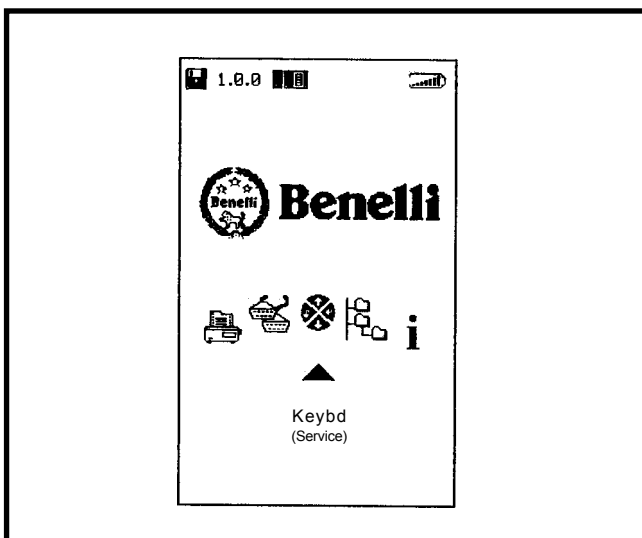
To select SERVICE, move to the corresponding icon and press ENTER to select. The following functions can be accessed:

- KEYPAD
- DISALE INSTRUMENT
- RESET SERIAL INSTRUMENT
- BIOS UPGRADE
- WORKSHOP
- BATTERY
- PARALLEL
- SERIAL

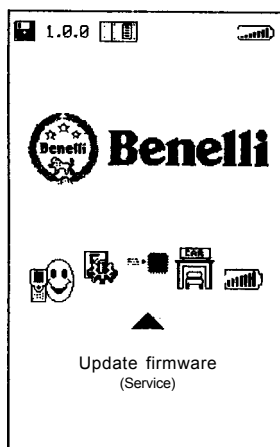


#### KEYPAD:

This function is used to test the correct operation of each key.

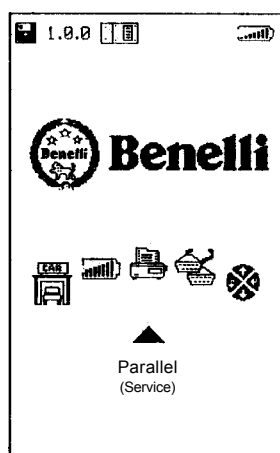






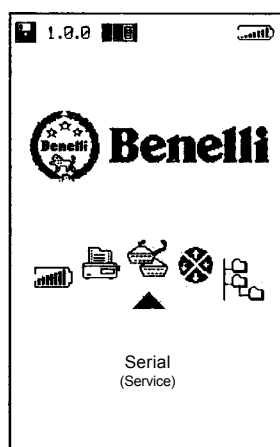
### **FIRMWARE UPGRADE:**

This function is used to upgrade the firmware contained in the various interface modules.



### **PARALLEL:**

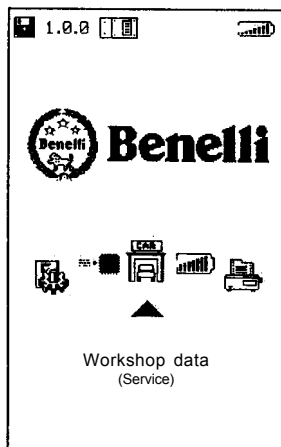
This function is used to test transmission/reception and check correct operation of the parallel port.



### **SERIAL:**

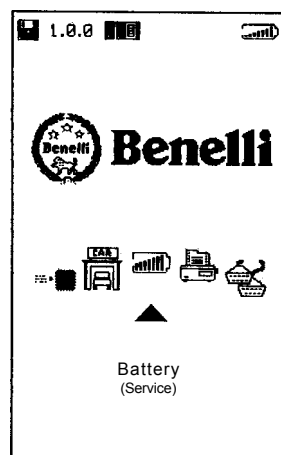
This function is used to test transmission/reception and check correct operation of the serial ports.





#### **WORKSHOP:**

This function is used to enter the name of the workshop which will appear in the main menu when the AXONE2000 BENELLI is switched on.



#### **BATTERY:**

The function is used to discharge the battery. The discharge curve is stored on the memory card to be displayed at a later time.

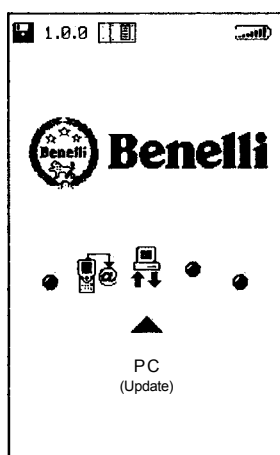
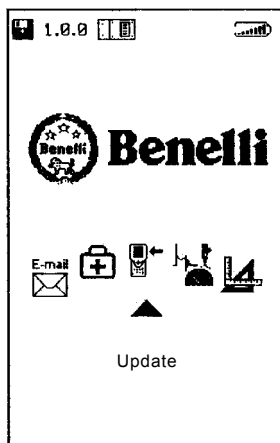
The remaining functions (BIOS UPGRADE, RESET INSTRUMENT and DISABLE INSTRUMENT) are reserved to technical assistance and must not be used by the end user.





### 10.3.5 UPGRADES

This menu can be used to upgrade the programs stored in the memory card in two different ways:

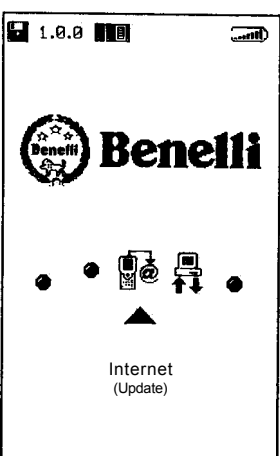


#### PC CONNECTION:

Use a serial connection cable to connect AXONE2000 BENELLI to a PC where the upgrade program is installed. The memory card will be upgraded based on the upgrade file installed in the PC.

The upgrade file can be loaded to the PC in various ways:

- By means of a CD-ROM or a diskette provided by the technical assistance service.
  - Downloading from the internet or by modem link to by the technical assistance service server.
  - Receiving it directly on the PC as an e-mail attachment.
- BENELLI will inform you on the relevant upgrade method.



#### INTERNET CONNECTION:

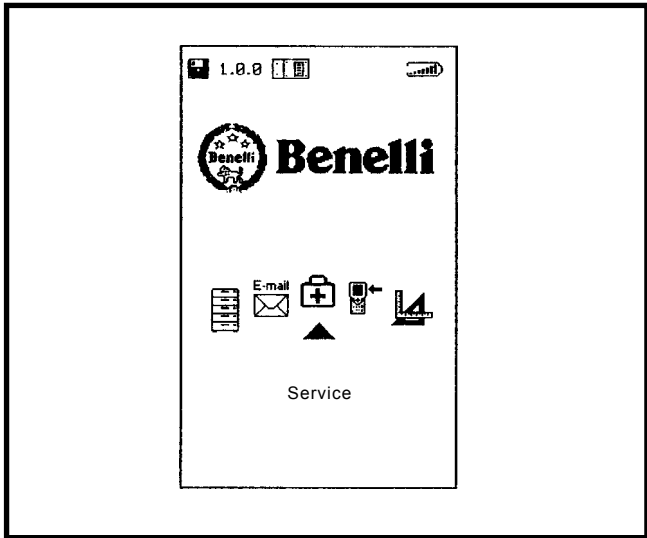
Information regarding the availability of upgrades is supplied by the manufacturer. This function is only available to subscribers.



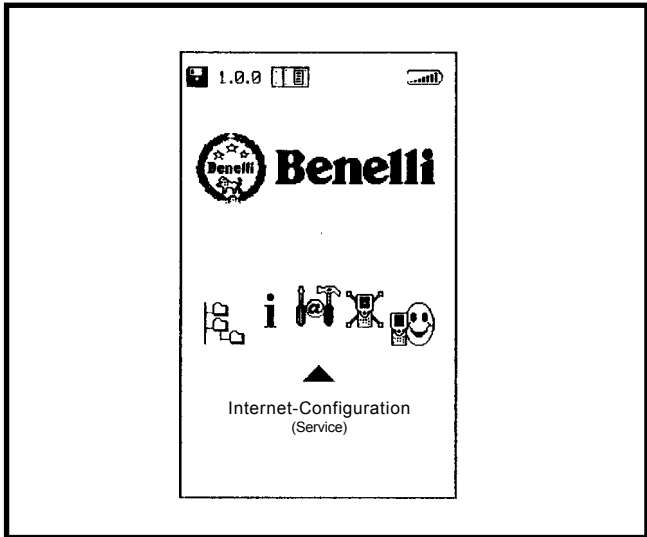


**CONFIGURATION OF THE INTERNET CONNECTION**

Accede to the menu Service

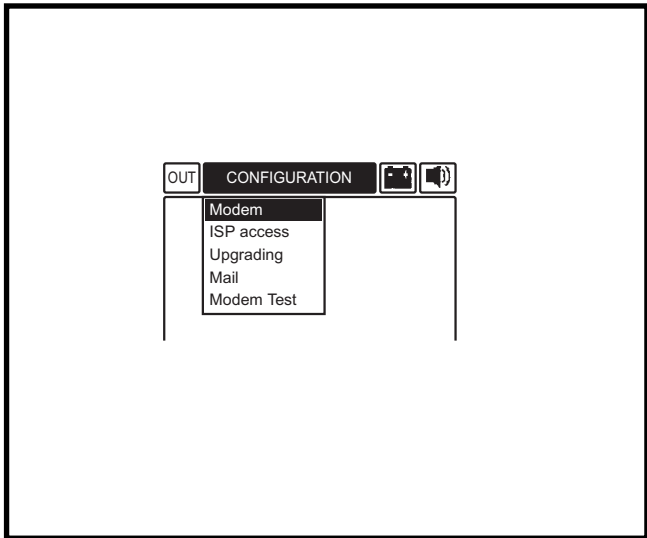


Accede to the program internet Configuration



**CALLING COUNTRY CONFIGURATION**

Select page MODEM







Make sure that in the Calling Country row appears: "Your Country" otherwise set your Country.

To move the various session use the + and - keys and make the necessary changes up to get the request of "save the performed changes".

## CONFIGURATION OF THE PARAMETERS OF INTERNET ACCESS:

Select the page ISP ACCESS





OUT ISP ACCESS

Telephone number  
123456

External line access number  
0

Username  
\*\*\*\*\*

Password  
\*\*\*\*\*

DNS 212 . 11 . 95 . 200

ISP timeout 90

LCP MAX 10

LCP restart 3

FVD / BACK  
INSERT / DELETE  
NEXT / CANCEL

Insert:

- Provider POP (Point Of Presence) phone number (obligatory).
- External line code if necessary otherwise leave it free.
- Username (obligatory).
- Password (obligatory).
- DNS Address (Domain Name Server) used by the provider (if available).

OUT ISP ACCESS

Telephone number  
123456

External line access number  
0

Username  
\*\*\*\*\*

Password  
\*\*\*\*\*

DNS 212 . 11 . 95 . 200

ISP timeout 90

LCP MAX 10

LCP restart 3

Save changes?  
Yes No

To move to the various sessions use the + and - keys and make the necessary changes.

To insert the Username and password use the character map (see the following example). To modify the phone numbers and the DNS address, use the numeric key.

Use again the + and - characters up to the request of “save the performed changes”.

OUT ISP ACCESS

Telephone number  
123456

External line access number  
0

Username  
XXX

Character map:  
A B C D E F G H I J K L M N O P  
Q R S T U V W X Y Z a b c d e f  
g h i j k l m n o p q r s t u v  
w x y z 0 1 2 3 4 5 6 7 8 9  
DEL END

ISP timeout 2

LCP MAX 10

LCP restart 3

CONFIRM  
INSERT  
CANCEL

#### EXAMPLE:

Username Insertion:

- 1 - By using the MINUS key, got to Username field.
- 2 - Open the “character map” through any ARROW key (UP, DOWN, RIGHT, LEFT).
- 3 - In the map to move for selecting the required character use ARROW keys (UP, DOWN, RIGHT, LEFT) press ENTER to write the selected one.
- 4 - To cancel the last character, point on to “DEL” key in the map and press ENTER.
- 5 - To terminate the Username insertion go to “END” in the map and press ENTER.

Proceed by the same mode for inserting the Password.





OUT ISP ACCESS

Telephone number  
123456

External line access number  
0

Username  
XXX

Password  
YYY

DNS 212 . 11 . 95 . 200

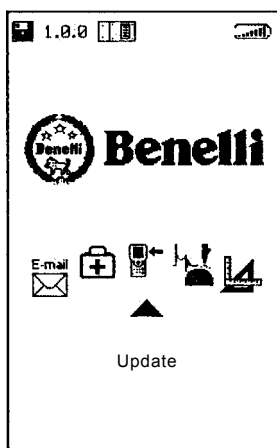
ISP timeout 2

LCP MAX 10

LCP restart 3

FWD / BACK  
INSERT / DELETE  
NEXT / CANCEL

To change the DNS, use the numeric keys.



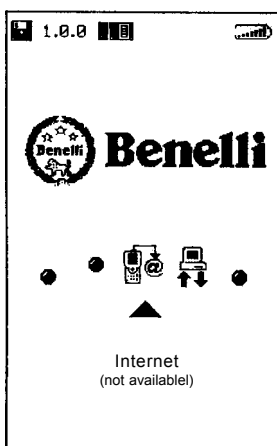
### INTERNET ON-LINE UPGRADE

Insert the MDM56 communications module and connect the AXONE2000 BENELLI to a telephone socket using the cable provided for this upgrade procedure. Select "Upgrade" in the main menu to proceed.

**NB:** If the battery is down, the programme indicates the potential criticality of the connection. In this case, the battery charger supplied with the system can be used to power the AXONE2000 BENELLI.

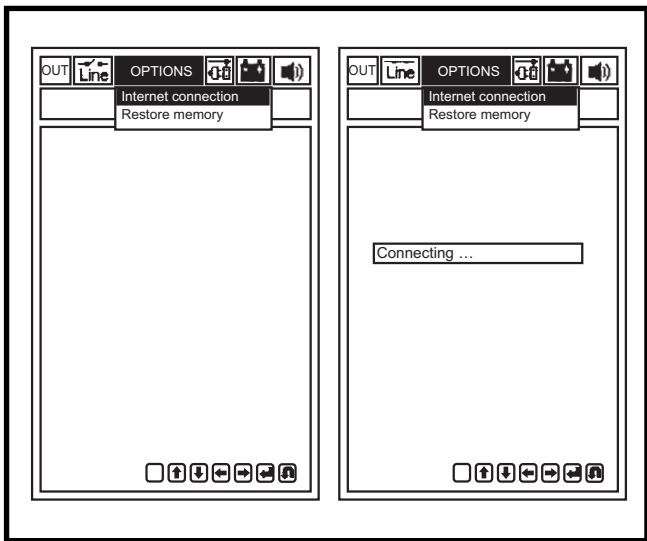
Sec: 12V=1000mA  
12.0 VA

OUTPUT: 12Vdc 1A

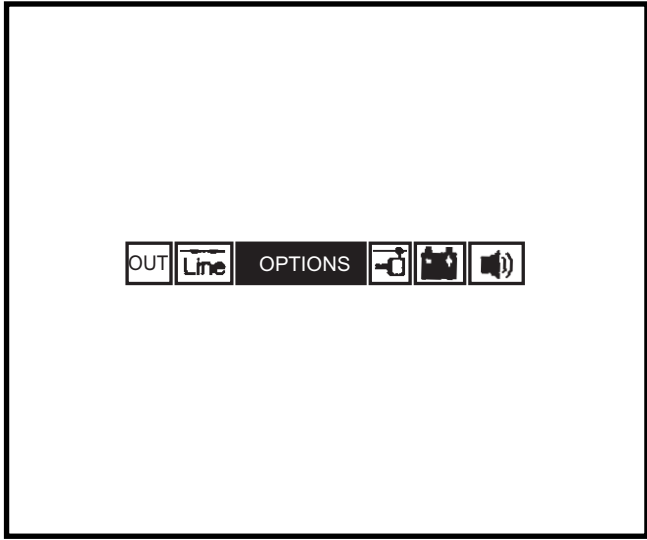
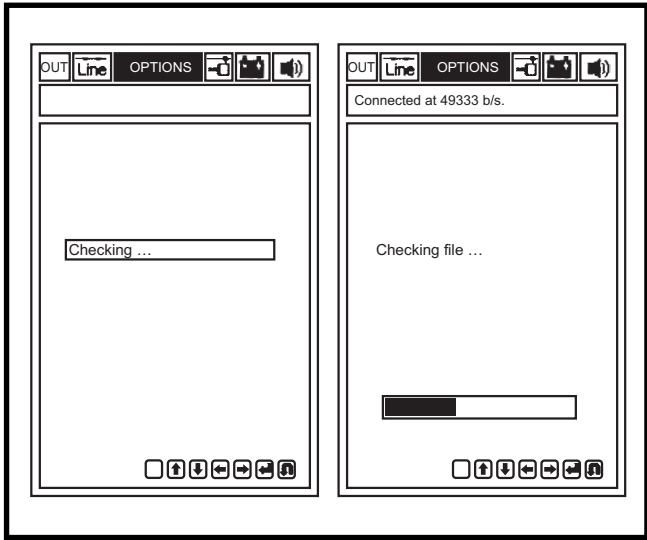


Select "Via internet" in the following submenu to go to the connection wizard page.





The upgrade wizard will guide you step by step.

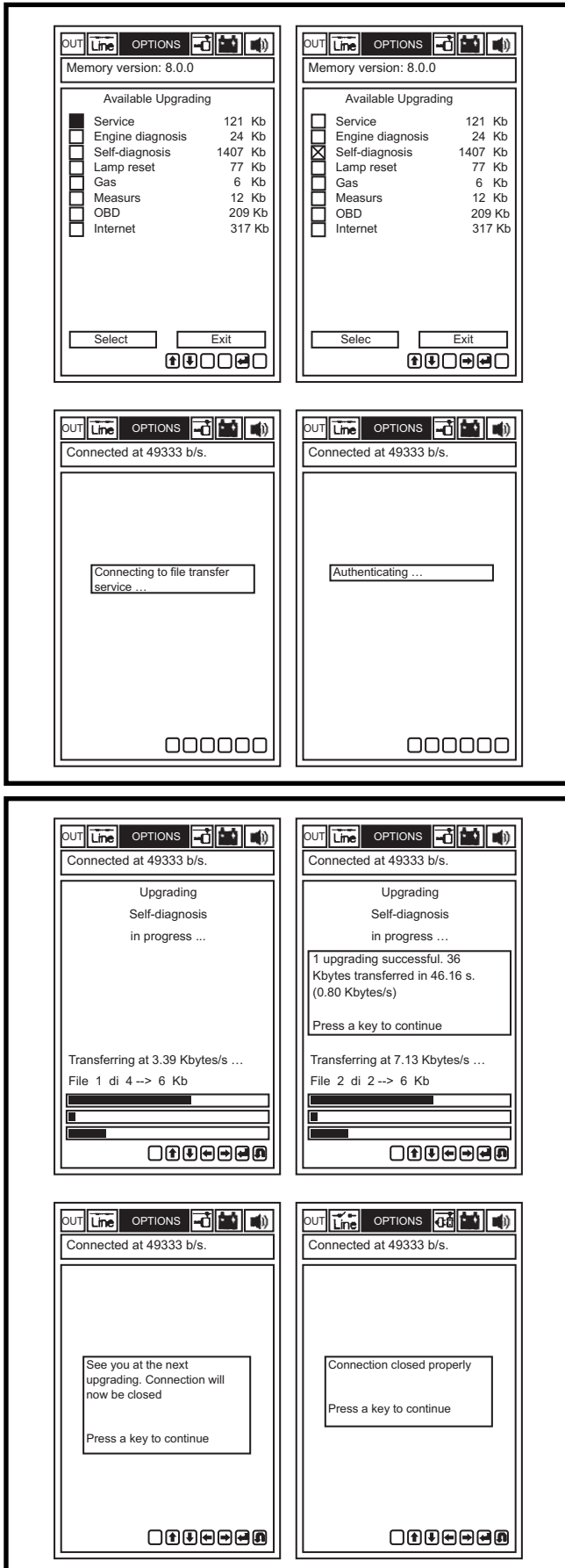


Select “internet connection” in the Options menu to proceed. Icons will appear in the upper line when the connection is up:

Additionally, the message “Connected” will appear in upper window with the connection speed (which depends on the communication line).

The first steps ends once the available programs on the BENELLI server have been detected and after comparing the versions on the BENELLI server with those installed on the AXONE2000.



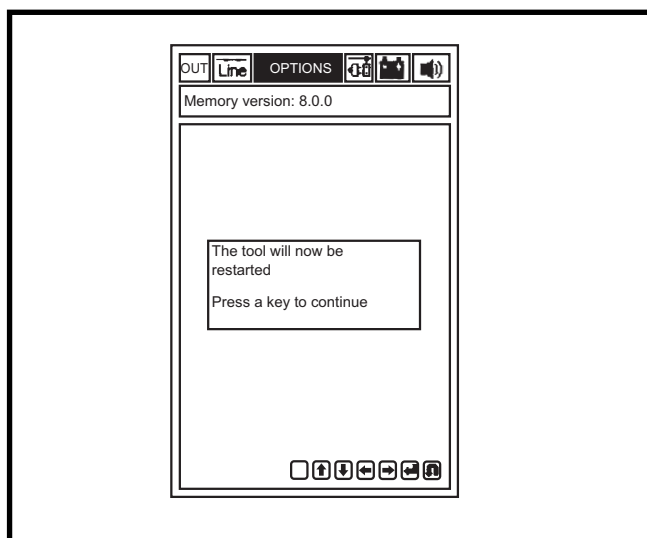


The next page will show the new available programs which can be selected and downloaded to the AXONE2000 BENELLI memory card.

In this example, the self-diagnostics program is selected. The program automatically connected to the Ftp Server and authenticates the request (verifying that the subscription is valid).

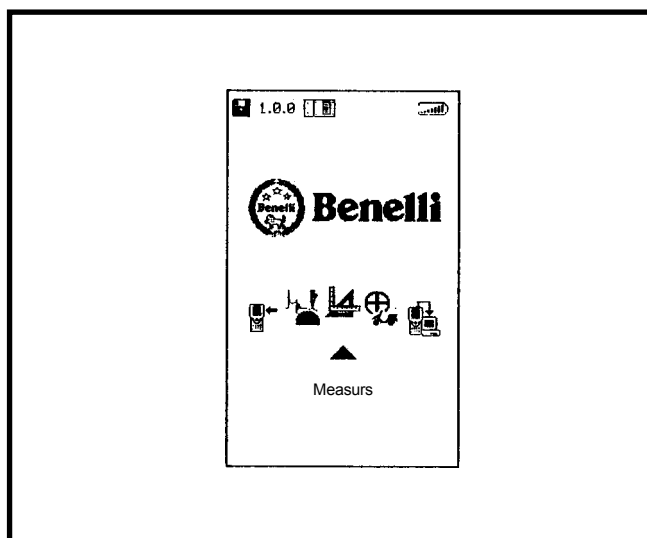
After identifying the product and the user, the program rapidly start downloading the new self-diagnostics program version to the AXONE2000 BENELLI memory card. The lower bars indicate current, partial and total file upgrade advancement.



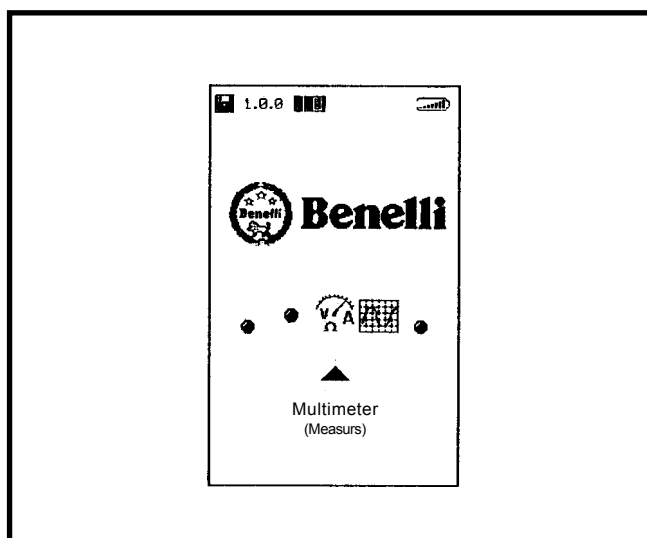


The program will shut down and AXONE2000 BENELLI will be restarted after upgrading.

The AXONE2000 BENELLI has now been upgraded.



### 10.3.6 MEASURES



#### 10.3.6.1 MULTIMETER (VOLTMETER, AMMETER, OHMMETER, CONTINUITY TEST)

Positive probe: connected to channel 1 (red cable).  
Negative probe: connect to the negative battery terminal. The function can be accessed from the main menu. Go to the corresponding icon and press ENTER to access the function.

**NOTE:**

The multimeter function can be used to measure voltage, current and resistance. Particularly, current can be measured on different scales. The original kit cables can be used to measure capacity up to 2A (full-scale). Capacity from 20A to 600A require the use of an ammeter clamp.





### 10.3.6.2 VOLTMETER

An instrument calibration procedure is started automatically when one of the instruments (voltmeter, ammeter, ohmmeter) is used for the first time. The message CAL will blink and temporarily replace the clock icon). The calibration procedure is used to specifically optimise the AXONE2000 BENELLI. The calibration will be stored only after closing the selected function. The instrument can be used at this point. During this phase, you are advised to short-circuit the red probe and the black probe (i.e. the two input terminals) of the instrument.

The main characteristics of the voltmeter are:

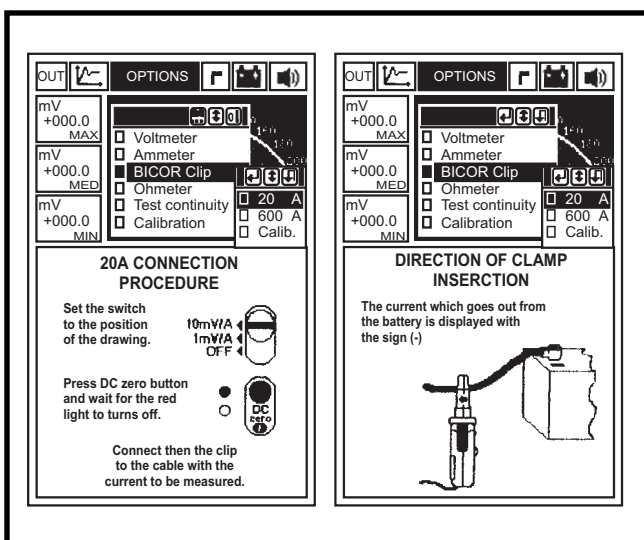
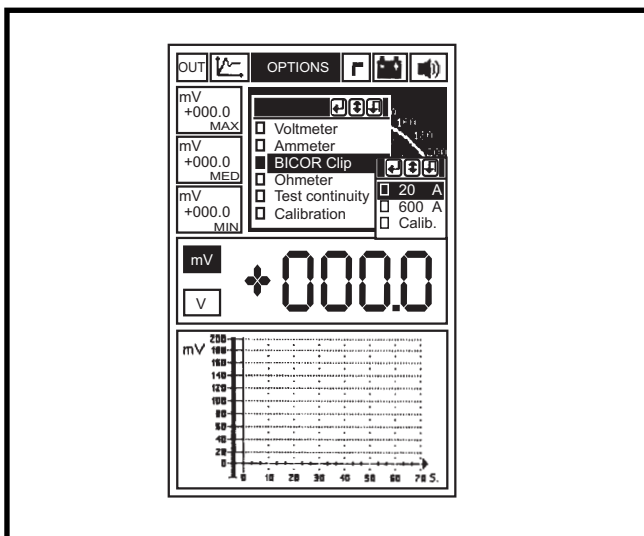
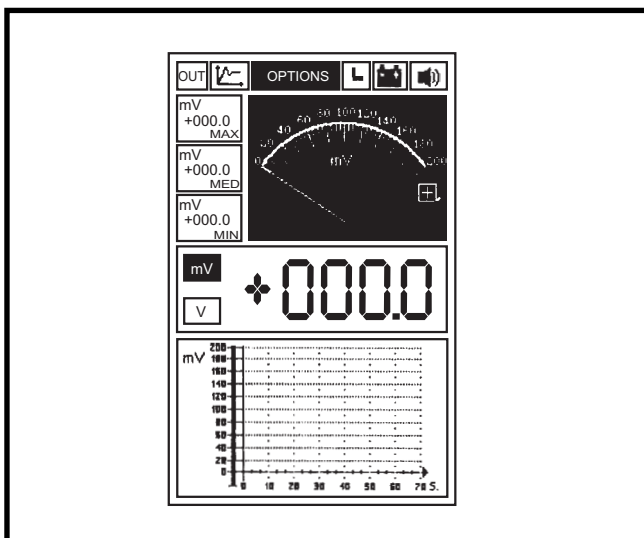
- Automatic scale change.
- Stored values: minimum, medium, maximum.
- Graphic view of voltage flow in time.
- Concurrent analogue and digital display.

#### NOTE:

Measurements are possible only with DC (direct current) up to 200 Volts.

### 10.3.6.3 AMMETER

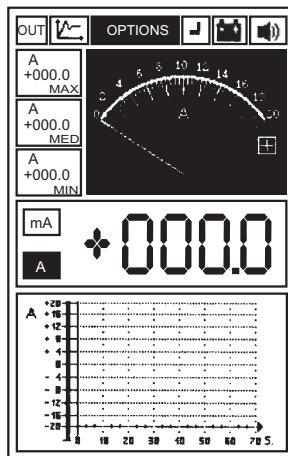
Simply select AMMETER on the OPTIONS menu for tests up to 2A full-scale. A BICOR ammeter clamp (optional) is required for tests from 20A to 600A. Set the required full-scale value manually following the indications in the selection menu:



This menu will provide all the indications required for connecting the BICOR clamp.

This will ensure that the instrument is set correctly (in this example, the full-scale value is set to 20A).



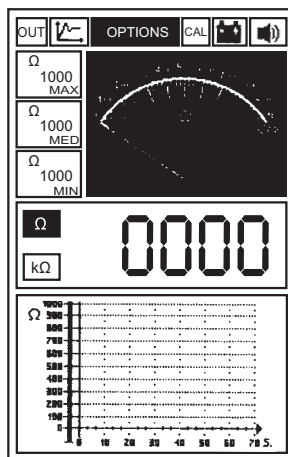


The main characteristics of the ammeter clamp are:

- Stored values: minimum, medium, maximum.
- Graphic view of voltage flow in time.
- Concurrent analogue and digital display.

**NOTE:**

**Measurements are possible only with DC (direct current).**

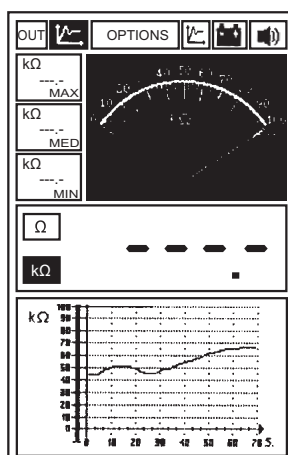


### 10.3.6.4 OHMMETER

Resistance tests are performed during the red probe and the black earth clamp. Connect the component to be measured between the two terminals.

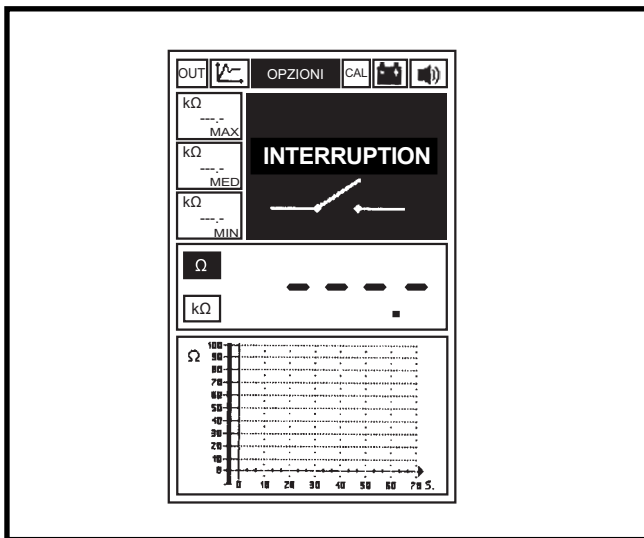
The main characteristics of the ohmmeter are:

- Automatic scale change.
- Stored values: minimum, medium, maximum.
- Graphic view of resistance in time.



- Concurrent analogue and digital display.



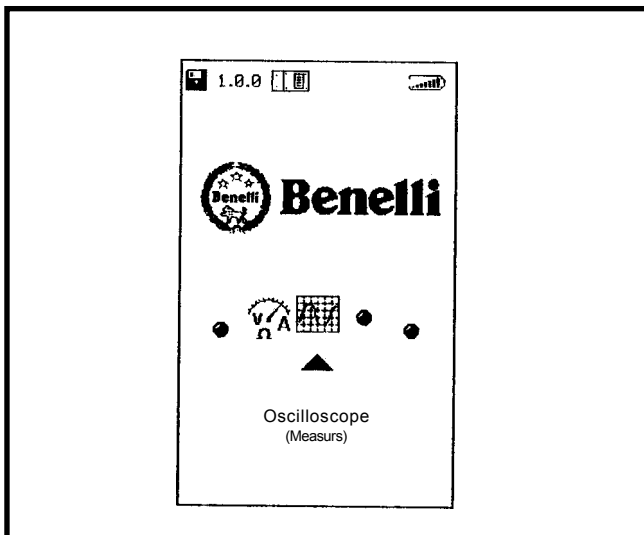


### CONTINUITY TEST:

This function is used to test continuity in an electrical circuit. The symbol of an open switch will appear if an interruption in the circuit is found. The symbol of a closed switch and a sound alarm are used to confirm continuity of the circuit.

### QUITTING THE PROGRAM

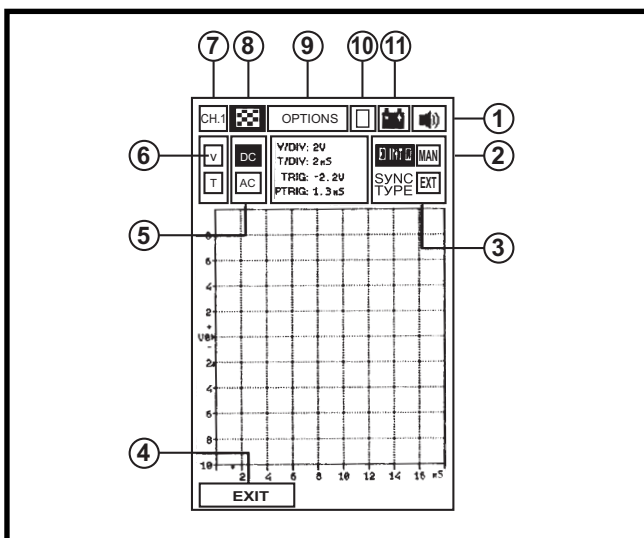
Select the OUT icon on all pages and press ENTER to confirm.



### 10.3.6.5 OSCILLOSCOPE

This function can be accessed from the main menu. Select the corresponding icon and press ENTER. The manual oscilloscope page will be opened. Functional details are described below.

- 1 - Bell icon: to enable or disable confirmation and alarm tones. Use the scroll buttons to go to the corresponding icon (which will start blinking) and press ENTER.
- 2 - Synchronisation window: to select the type of synchronism (i.e. the way used to stabilise the waveform on the display). Three options: manual, external, internal. TRIGGER EXT can only be enabled by the program.
- 3 - Values window: to show the values corresponding to the cursors on the measurement graph. Select Cursor in the Options submenu to activate the reading.
- 4 - Navigation window: to quit the program and go back to main menu.
- 5 - Readings window: to set two different reading modes: alternate (AC) or direct (DC).
- 6 - Scale window: to set the voltage (V) and time (T) scales according to the signal to be displayed.
- 7 - Channel window: to indicate the selected channel (1, 2, 3 or 4) and the red, yellow, green and blue wires, all referred to the AXONE2000 BENELLI black power clamp (i.e. the common earth terminal).
- 8 - Flag icon: to start and end measurements. The flag icon will blink when the manual function page is accessed. Press ENTER to start measuring. Press again to stop measuring and block the waveform on the display.
- 9 - Options window: to select various modes to simplify reading the signal being measured.
- 10 - Save windoe: indicating that a signal has been saved.
- 11 - Battery icon: the icon will flash when the internal battery is nearly flat. In this case, an external power source is required to continue testing. Use the specific battery charger for a sufficiently long period of time to recharge the internal battery.



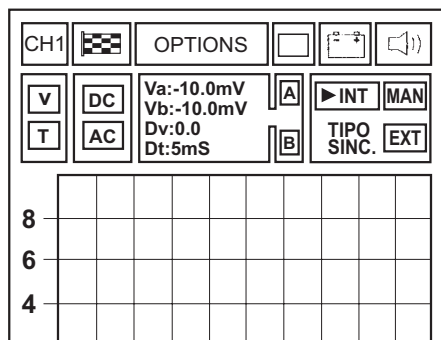




### 10.3.6.6 OPTIONS

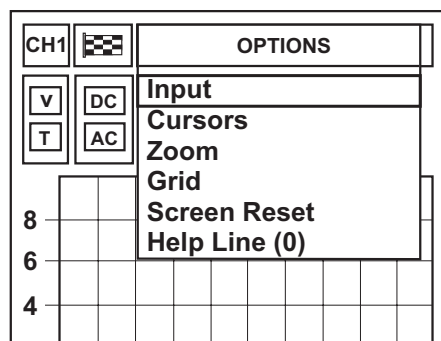
Use the scroll arrows to access the Options window and press ENTER.

The options menu containing several functions will be opened:  
 INPUT  
 CURSORS  
 ZOOM  
 GRID  
 SCREEN RESET  
 ON-LINE HELP (0)



#### INPUT:

Press ENTER in the Options menu to access the input function. This offers the possibility of displaying the input channel on the display.

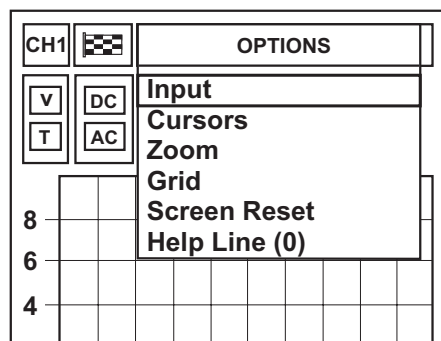


Select the required channel (highlighted in bold print) by means of the scroll arrows and press ENTER.

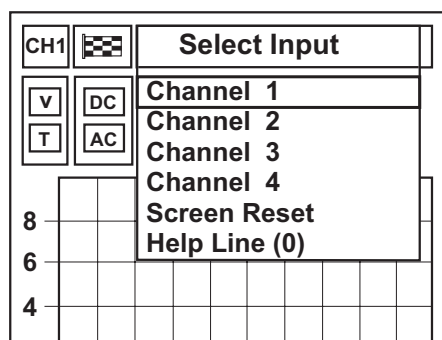


#### IMPORTANT:

*The function can be selected directly by means of the number keypad by recalling the corresponding channel number.*







### CURSOR:

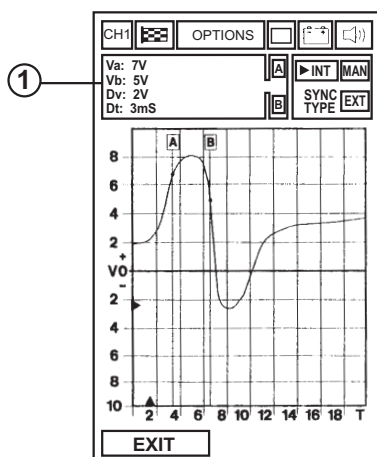
To select the Cursors function, go to the required option by means of the scroll buttons and press ENTER.

The Cursors function window (1) shows the readings on the curve. Letter A will blink. In this condition, move cursor A to the required point on the displayed curve by means of the left/right scroll arrows.

Select letter B to move cursor B to a point of the curve with the up/down scroll arrows. Move the cursor B to the required point with the left/right scroll arrows.

The voltage and time readings will appear instant by instant during these operations.

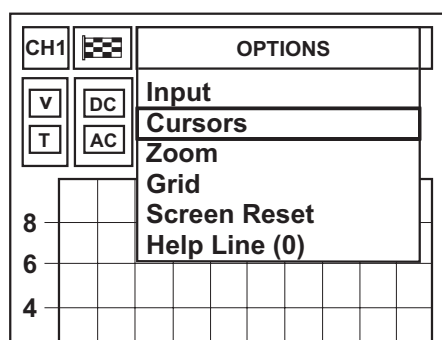
Window (1) will show the two voltage values  $V_a$  and  $V_b$ , measured in the two points where the cursors crosses the curve. The difference in voltage ( $Dv$ ) and the time that separates them ( $Dt$ ) will be shown in absolute values.



Note that the colour of the intersection point will be inverted by moving the two cursors on the curve at the point corresponding to where the signal was read.

This allows an easier, more accurate reading.

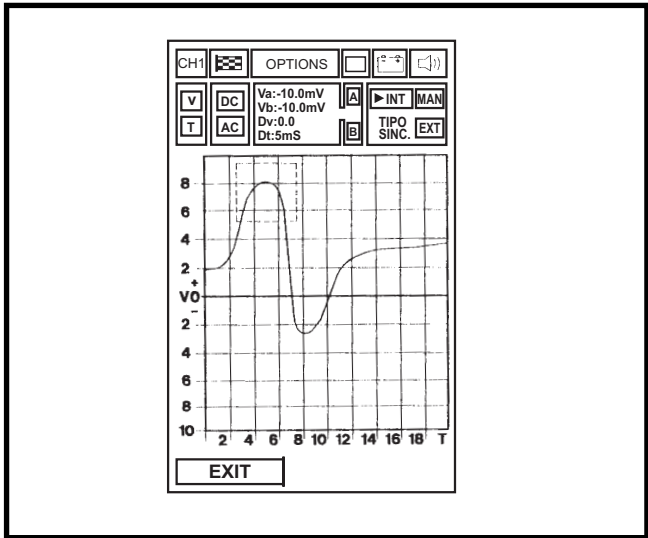
The original line will be cancelled, whereby confirming the right position, when the cursor has been placed exactly on the desired point.



### ZOOM:

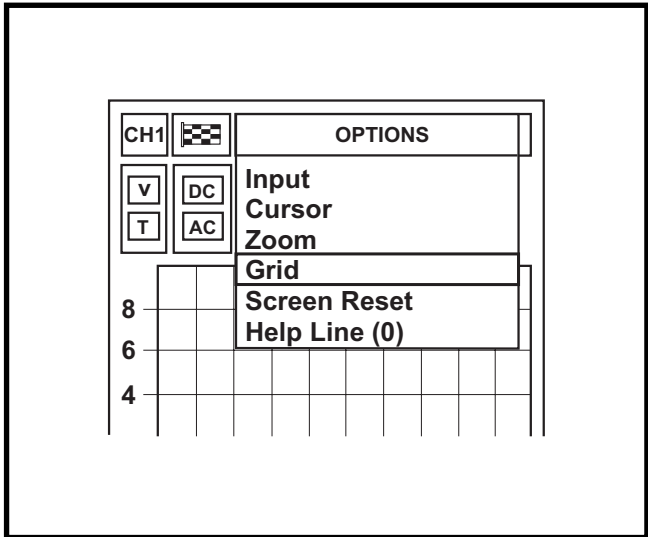
To select the Zoom function, go to the required option by means of the scroll buttons and press ENTER.





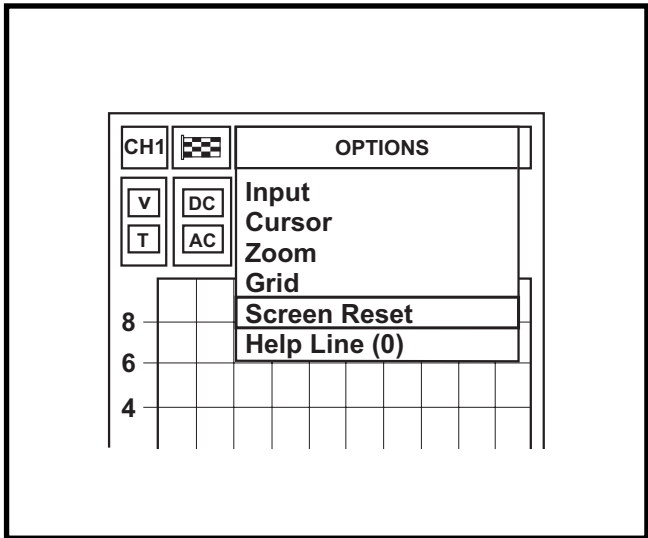
A dotted-border square will appear on the display when the Zoom function is on.

Use the scroll buttons to position the square where you want to zoom in (magnify). The zoom magnifies all the area within the square. Use + and - on the keypad to increase or decrease the zoom area and press ENTER the selected signal will be displayed with the required zoom.



**GRID**

The grid function is used to hide and show grid lines on the display. Go to the corresponding function and press ENTER to select.

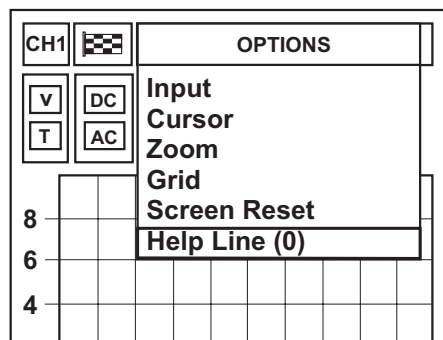


**SCREEN RESET**

To select the Screen reset function, go to the required option by means of the scroll buttons and press ENTER.

The signal or signals stored on the display will be cancelled and the initial page will appear.

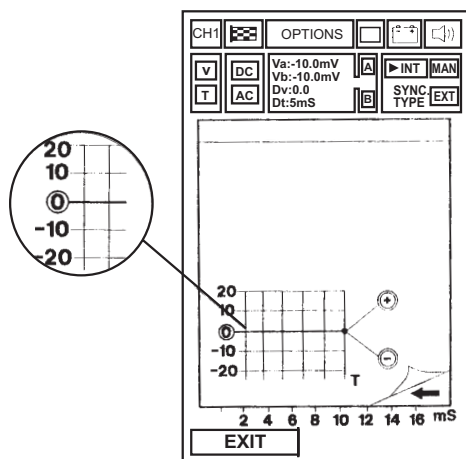




### HELP LINE (0)

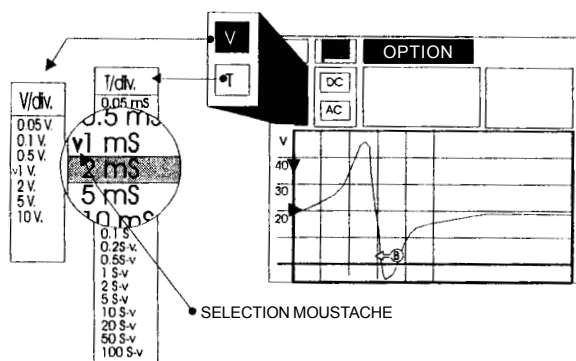
To select the Help line (0) function, go to the corresponding option and press ENTER.

A page describing the operations required to change the zero potential line will appear. This function can be used to view parts of the signal which would otherwise be left out.



Press the left arrow to go back to the signal view page.

The zero line can be adjusted while the signal is being read by means of + and - on the keypad.



### 10.3.6.7 SCALE SELECTIONS

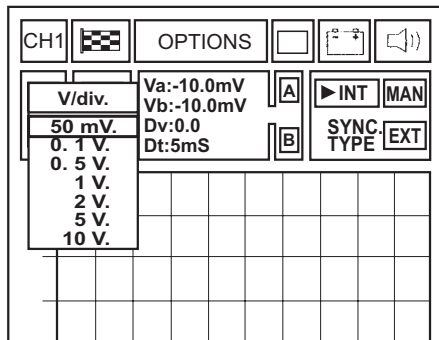
The windows identified by letters V and T are used to select the voltage and time scale.

A grid will appear in the signal display window dividing the display into square. Squares of the same side may indicate different units and values.

These functions must be set according to the signal to be measured in Manual mode so that the best resolution is used for displaying the curve or part of it.

In this way, the instrument must be used for more rapid and exact measurements.





### SCALE SELECTION (V):

To select V/div scale, select the window with the letter V (bold and blinking) and press ENTER.

A drop-down menu will appear containing the values which can be set on the volt scale. Use the scroll arrows to select the required volt/division value and press ENTER. The new scale with the selected scale will be displayed: the voltage value axis will change automatically.

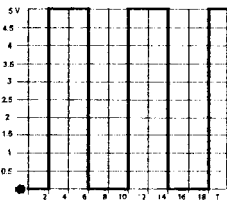


fig.1

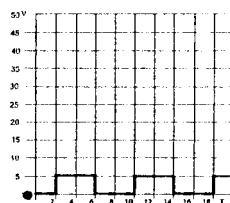
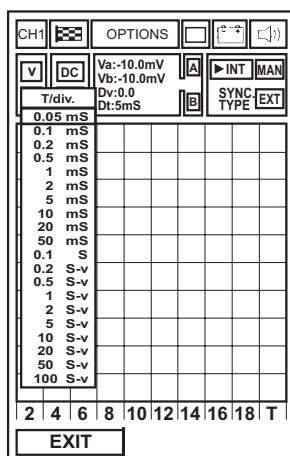


fig.2

A certain voltage value corresponds to each division on the volts axis. For example, the square wave of an optical sensor can be displayed and will fill the entire display with a division of 0.5 V (Fig.1).

In this case, a part of the signal might stretch beyond the screen and may not be seen. Simply select a greater value per division (e.g.5 V) to see the same signal squeezed down to the height of a single square (Fig.2).



### SCALE SELECTION (T):

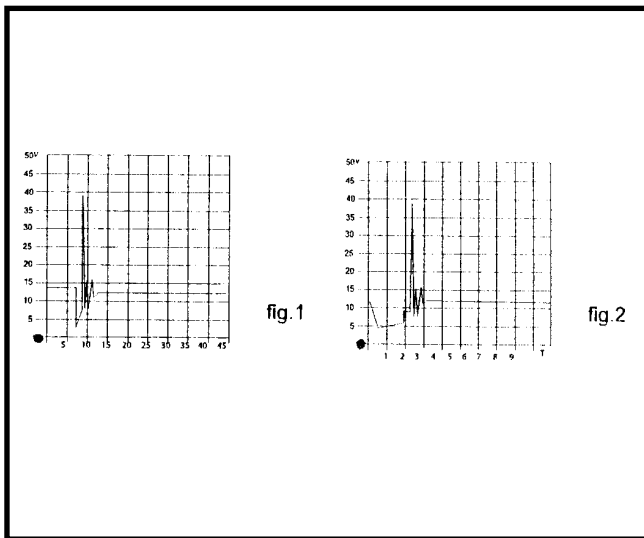
To select T/div scale, select the window with the letter T (bold and blinking) and press ENTER. A drop-down menu will appear containing the values which can be set on the time scale.

Use the scroll arrows to select the required time/division value and press ENTER. The new scale with the selected scale will be displayed: the time value axis will change automatically.

A certain voltage value corresponds to each division on the time axis. For example, the signal measured on the terminals of the injector can be displayed.

This is because the signal is shorter than expected.

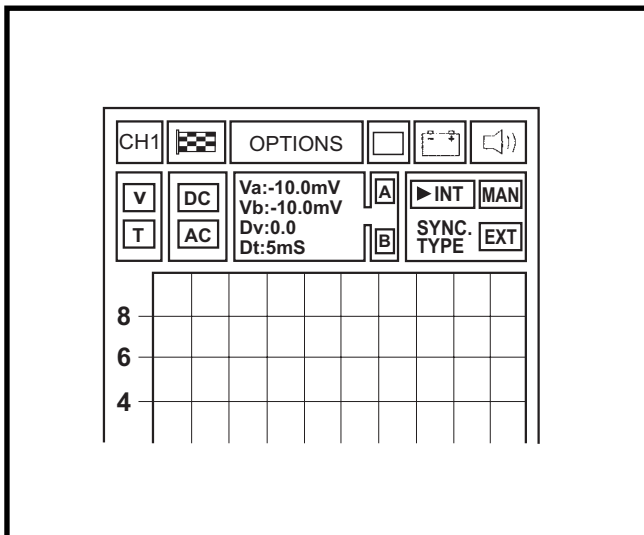




Specially, accurate measurements will not be possible if you want to measure the injection time (Fig. 1). Simply change the time division value, lowering to 1 ms for each division (Fig.2).

In this case the signal will now show the entire form and appear clearly and easily quantifiable.

Therefore, when selecting the voltage and the time measurement scales, it is advisable to adopt the resolution that provides the best view of the signal to be measured. This will also allow the best positioning of the measurement cursors.



### 10.3.6.8 AC/DC READING SELECTION

The two windows with the letters AC and DC may be used for enabling two different measurement modes.

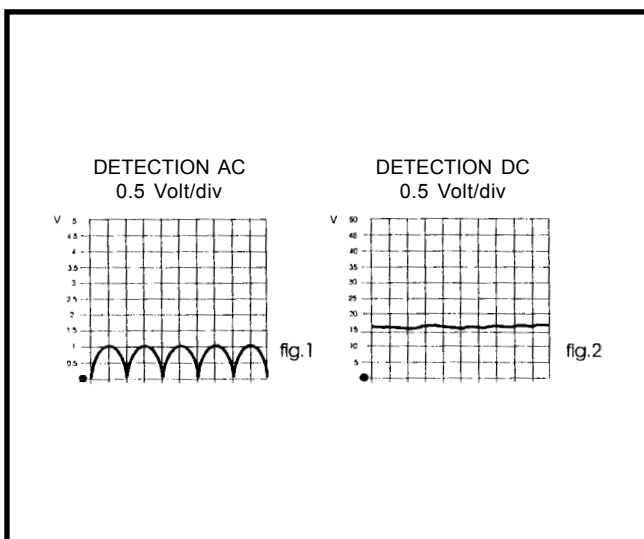
Select DC to view the direct component of the signal. The direct component will be cancelled and replaced with the alternative component if AC is selected.

This option is extremely useful to highlight the disturbance overlaying a direct signal.

A typical example is testing the voltage of a battery. If the test is executed in AC, the reading shows the residual signal generated by the rectifier diodes of the alternator.

The measurement with the oscilloscope in AC mode (alternate) allows the selection of small voltage resolution (e.g. 1 V/div), while detecting and displaying a high voltage direct signal.

In the above example (battery check), the positive voltage of 12 - 14.7 V is tested and controlled with a test sensitivity of 1 V/div. The resulting oscillogram will show a signal on the zero line with a set of arcades in the positive quadrant (Fig.1). Such arcades confirms that the alternator and the charging system are in working order.







CH1		OPTIONS			
V	DC	Va:-10.0mV	A	INT	MAN
T	AC	Vb:-10.0mV	B	SYNC.	EXT
		Dv:0.0		TYPE	
		Dt:5mS			

8									
6									
4									

#### AC READING SELECTION:

To select alternate current measurement, select the window with the letters AC (bold and blinking) and press ENTER. This function is useful for identifying interference signals.

CH1		OPTIONS			
V	DC	Va:-10.0mV	A	INT	MAN
T	AC	Vb:-10.0mV	B	SYNC.	EXT
		Dv:0.0		TYPE	
		Dt:5mS			

8									
6									
4									

#### DC READING SELECTION:

To select direct current measurement, select the window with the letters DC (bold and blinking) and press ENTER. This function is useful for identifying interference signals.

#### EXAMPLE OF CONTINUOUS SIGNALS:

- Hall-effect magnetic (temperature sensor)
- Piezoelectric sensor (pressure sensor)
- Potentiometer signal (throttle position sensor)

#### EXAMPLE OF ALTERNATE SIGNALS:

- Magnetic sensor (pickup sensor)
- Generator signal before the voltage regulator.

CH1		OPTIONS			
V	DC	Va:-10.0mV	A	INT	MAN
T	AC	Vb:-10.0mV	B	SYNC.	EXT
		Dv:0.0		TYPE	
		Dt:5mS			

8									
6									
4									

#### 10.3.6.9 TYPES OF SYNCHRONISM

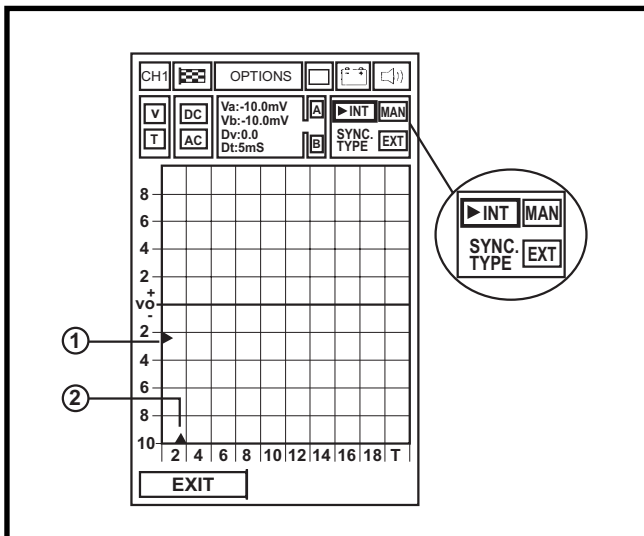
Synchronism means the way of stabilising the display of the wave form (signal) on the screen; an auxiliary signal is used. It may be generated from yxz itself (INT), it may be input from the outside (EXT), or it may be generated by the operator (MAN).

The type of synchronism is shown in the window in the right of the screen. There are three types of synchronism:

INTERNAL  
MANUAL  
EXTERNAL

Simply use the scroll arrows to go to the required synchronism window and press ENTER to confirm.





### INTERNAL SYNCHRONISM:

The waveform on the display is stabilised with a signal generated by the yxz microprocessor.

The synchronism may be adjustment in size and position (TRIGGER). To start such adjustment, move to the window with the letters INT and press ENTER.

The triangles on the V and T axis will blink.

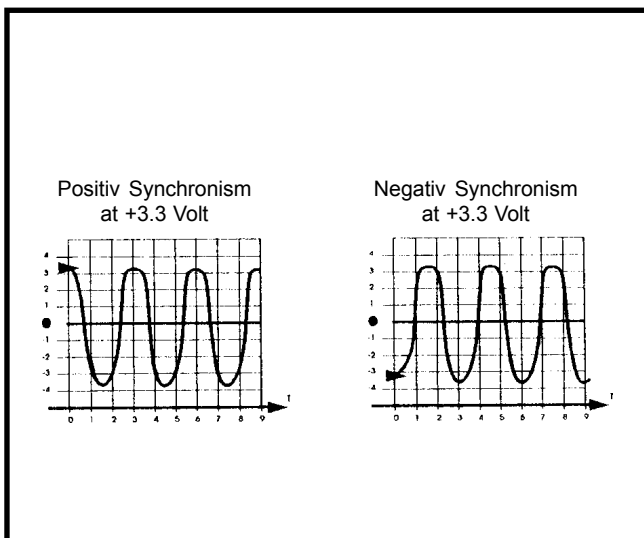
While blinking, triangles (1) and (2) may be positioned on the required points by using the scroll arrows.

In particular, triangle (1) on the V axis represents the level and polarity point in which the connection with the internal synchronism signal will take place.

If the triangle is above the zero line, the signal will be displayed starting from its positive phase.

If the triangle is below the zero line, the signal will be displayed starting from its negative phase (see diagram on next page).

The triangle, on the T axis, represents the starting point of the synchronism in the display. Use the arrow keys to move it left or right in order to improve the display of the signal by centring it in the screen.



### MANUAL SYNCHRONISM:

To select the Manual synchronism, select the window with the MAN letters.

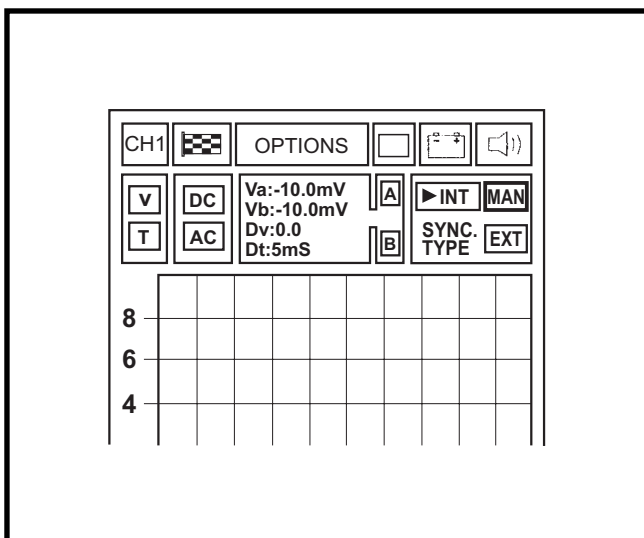
Press ENTER to start measuring of the signal.

Manual trigger offers new diagnostic possibilities. While internal or external trigger is as set before, actual signal measurement starts only when the operator presses ENTER.

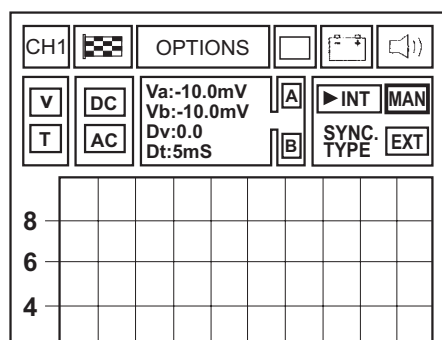
The acquired image is saved and then show on the display.

To carry out another measurement, press ENTER again.

The second measurement will be placed on top of the previous, this way the operator may compare the two tests.



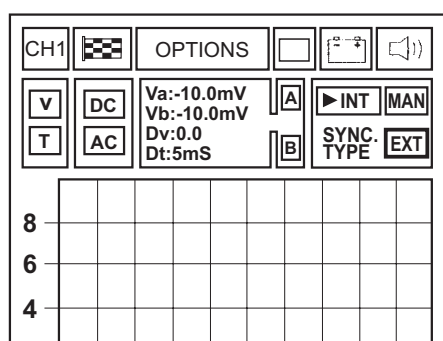




This function supplies multiple options. For example, it is possible to compare two signals that have been measured at different revs (injection timing test), or to compare the output signal of a spark knock sensor, with and without knocking.

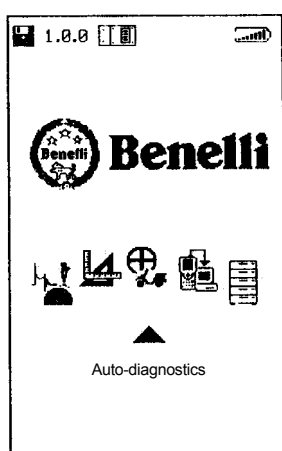
It is possible to carry out this procedure as many times as needed. To avoid confusion and to improve the clearness of the signals, it is advisable to use the hide grid option as shown before.

To exit this function, just press twice any of the scroll arrows.



### EXTERNAL SYNCHRONISM:

Not available



### 10.3.7 AUTO-DIAGNOSTICS

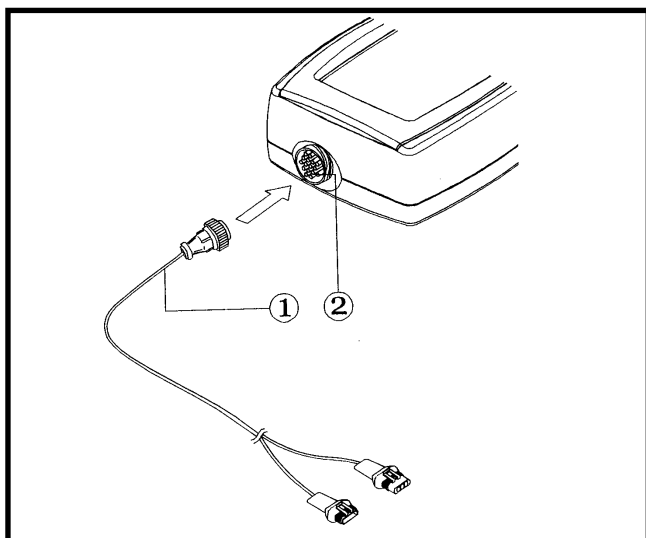
The AUTO-DIAGNOSTICS program is used to connect the AXONE2000 BENELLI to various injection ECUs with different characteristics according to the make and the specific injection system.

The auto-diagnostics with the motorcycle ECU.

Possible procedures:

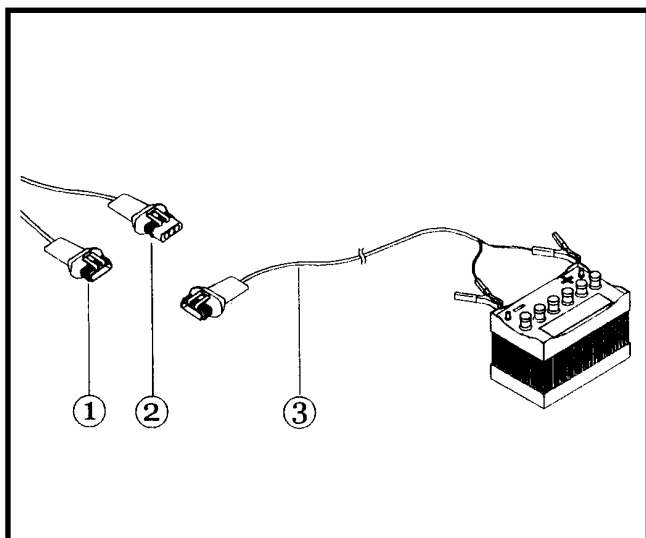
- Read functional parameters of all systems connected to the ECU.
- Automatically acquire failure codes.
- Edit some engine management parameters.





### HOW TO CONNECT AXONE2000 BENELLI TO THE ECU:

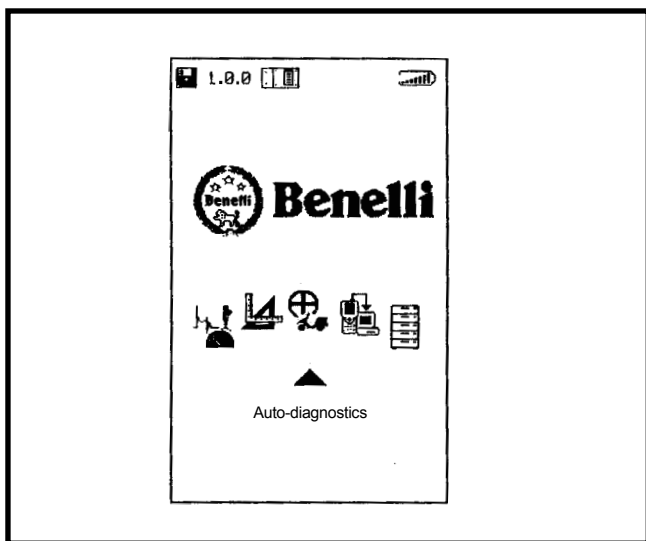
Insert the interface cable connector (1) in the upper connector (2) on the yxz respecting the indications shown on the labels attached to the cable.



### HOW TO POWER THE AUTO-DIAGNOSTICS INTERFACE CABLE:

The auto-diagnostics interface cable cannot be powered by the yxz internal battery. An external power source must be used as shown below:

- connector (1) to the motorcycle;
- connector (2) to the motorcycle battery power cable (3) (never to an external battery).

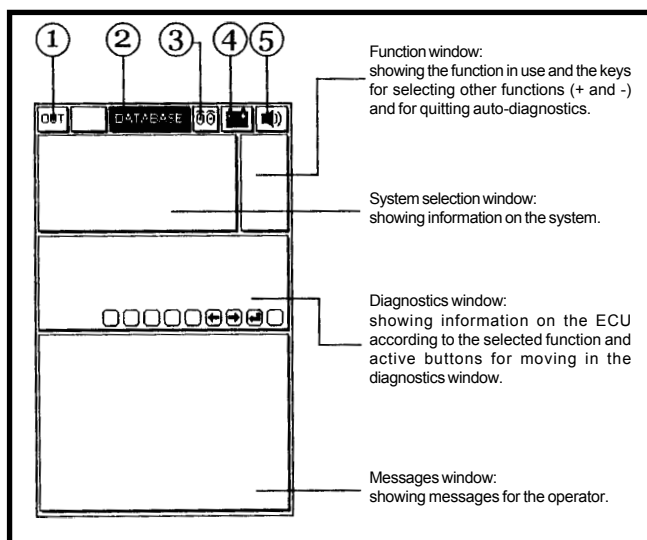


### 10.3.7.1 TESTING

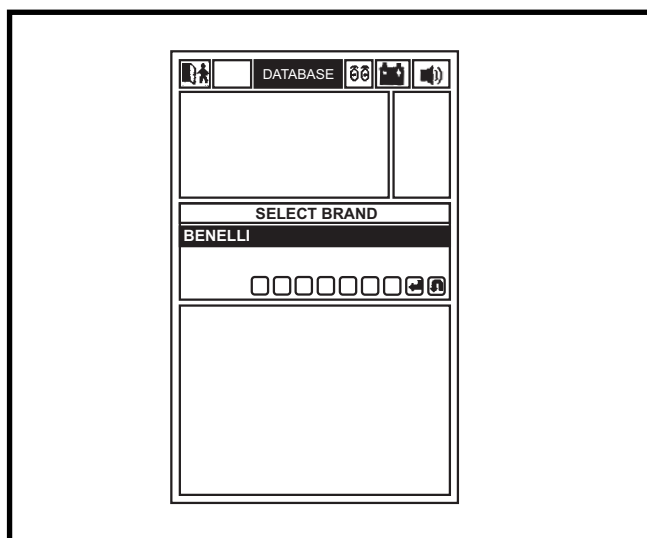
To start a program, insert the OBD module with the instrument off, select AUTO-DIAGNOSTICS and press ENTER to confirm.

Details on the page which will appear are provided below.



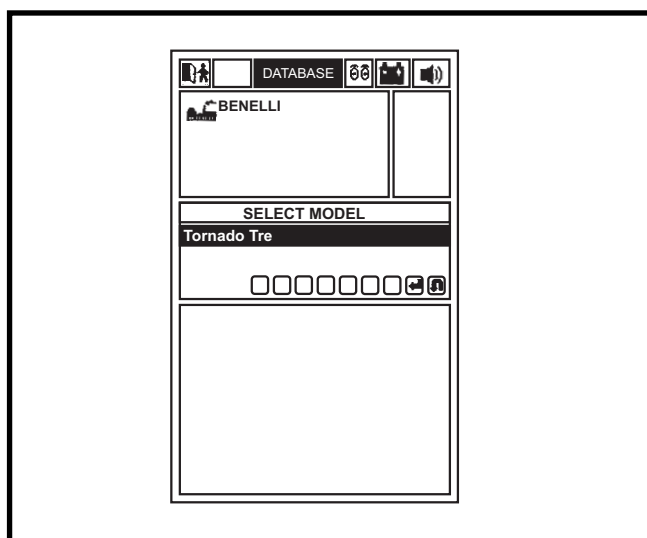


- 1 - OUT box: select to go back to MAIN MENU.
- 2 - DATABASE box: to select the motorcycle type and system to be tested.
- 3 - Activity box: to indicate when the yxz is communicating with the ECU. The icon will become a lamp and blink when the communication is up.
- 4 - Battery box: the symbol will blink slowly when the battery is running low and faster when the battery is flat. The instrument will switched off after 20 seconds.
- 5 - Bell box: to enable or disable tones.



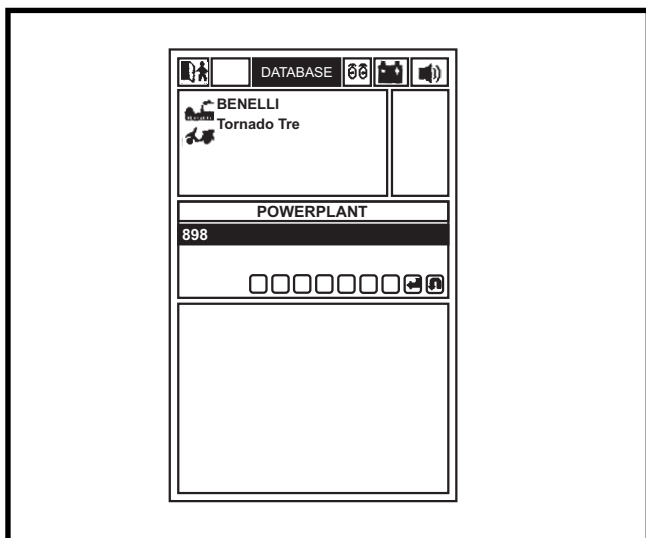
### HOW TO SELECT MAKE AND MODEL:

Use the scroll arrows to select the available manufacturers and press ENTER to confirm.

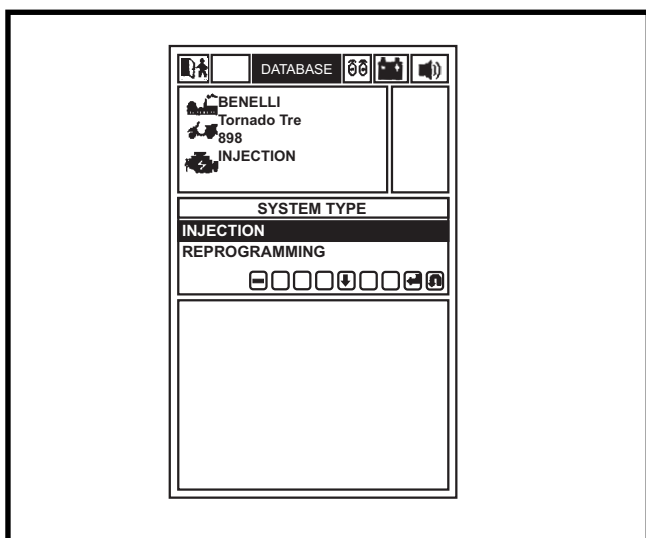


Select the motorcycle model and press ENTER to confirm.



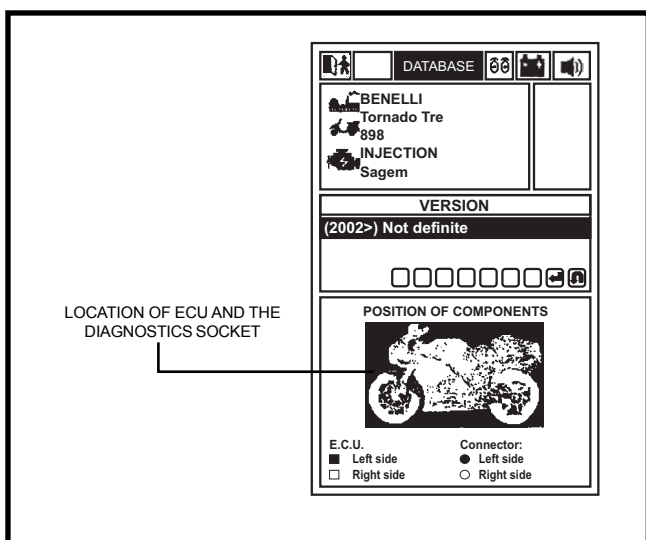


Select the engine type and press ENTER to confirm..



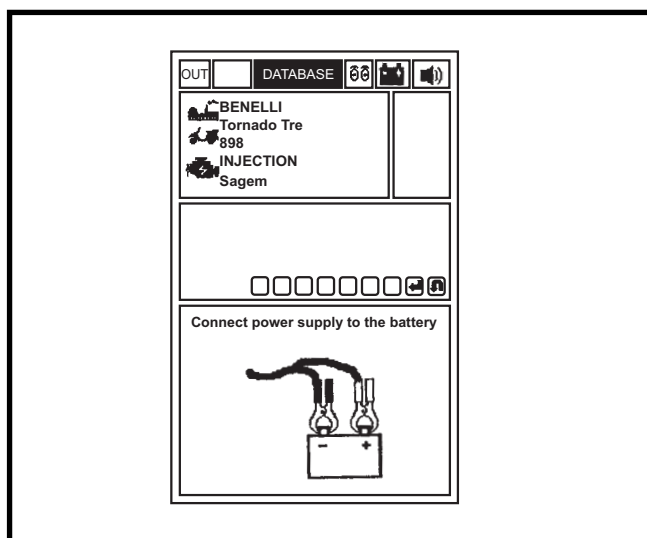
Select the system to be tested from the list of available systems.  
Select chassis code and system type.  
The following can be selected:

- INJECTION (injection system auto-diagnostics)
- RE-PROGRAM (ECU re-mapping)



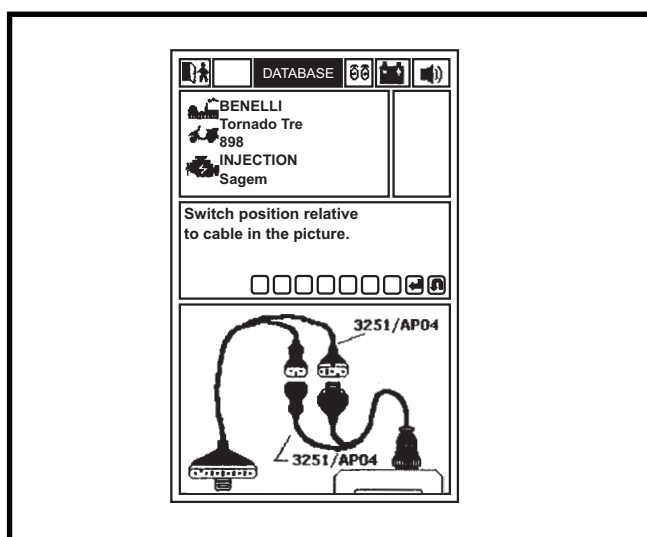
In this example, select the injection system and then the ECU type/code. Press ENTER to confirm. The version and location of the diagnostic socket will be provided.





Confirm selections. A picture of the adapter cable to be used and the interface between auto-diagnostics cable interface and 3151/AP01 main cable with respective code will appear after confirming all selections.

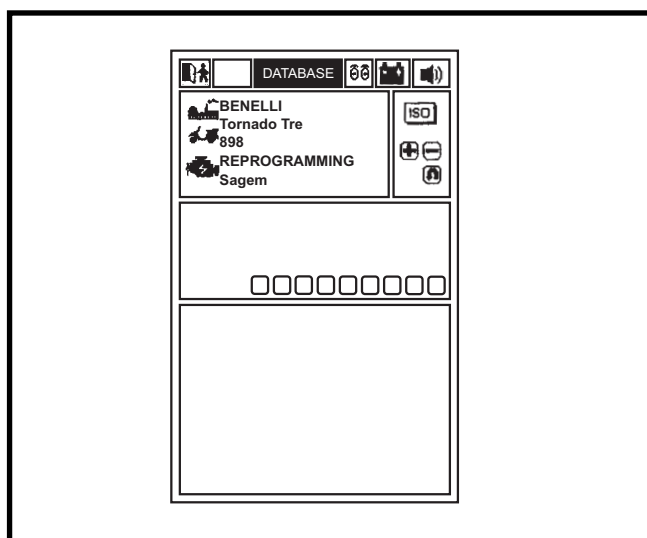
The battery icon will appear to indicate that the power cable must be connected.



### HOW TO CONNECT AUTO-DIAGNOSTIC SOCKET

A specific page is provided to indicate the adapter cable to be used for the interface between the motorcycle cable interface and the main cable.

Connect the adapter cable to the ECU auto-diagnostic socket as shown in the figure using the suggested sonnection cable.



### STARTING DIAGNOSTICS

Select the motorcycle system to be tested and start the test.



#### ATTENTION:

**Make sure the ignition key is off before starting the test.**

- Set up the connection.





DATABASE			
BENELLI Tornado Tre 898 INJECTION Sagem		°C mV mA	
wait...			
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			
Correct throttle pos.			
Air temperature		°C	
Stepper position			
Engine temperature		°C	
Engine speed		rpm	
Ignition advance		°	
Barometric pressure		mBar	
Battery voltage		V	

The auto-diagnostics program will start if the cable is correctly connected and powered.

A message such as the one shown in the figure will appear. On the other hand, if the connections has not been set up correctly, the message "Communication interrupted, reactivate?" will appear.

- Check motorcycle auto-diagnostic socket connection.
- Turn the ignition key on to start communication the ECU as instructed by the program.
- Wait for a few for the communication between the main cable and ECU to be established.

The lamp icon in the top right will start blinking when the communication is up. A tone (where relevant) will be heard to indicate the presence of errors in memory.

Select the specific page with the keys (+ and -) to view errors.

OUT	DATABASE			
BENELLI Tornado Tre 898 Injection Sagem		°C mV mA		
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
Correct throttle pos.				
Air temperature		°C		
Stepper position				
Engine temperature		°C		
Engine speed		rpm		
Ignition advance		°		
Barometric pressure		mBar		
Battery voltage		V		

ENGINEERING  
PARAMETER  
ICON

### ENGINEERING PARAMETERS

A list containing a number of parameters referred to the selected motorcycle will appear. The list may not be comprehensive. Use the left/right scroll arrows to select missing items and display them instead of those shown. Press ENTER to confirm.

To view a parameter value:

- Select the required parameter.
- Press ENTER.
- Press ENTER again to display parameter view.

### NOTE:

The selected data refresher speed and the number of available items depends on the ECU.

OUT	DATABASE			
BENELLI Tornado Tre 898 INJECTION Sagem		°C mV mA		
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>				
Engine temperature		ATT		

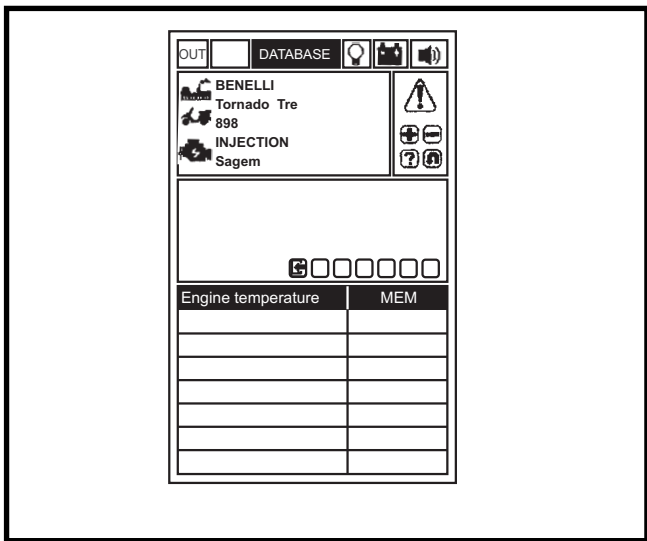
ERROR  
ICON

### CURRENT AND SAVED ERRORS

Use the keys (+ and -) on the keypad to view the errors icon intop right to access to ERRORS function. The yxz picture will appear indicating that an engine temperature error has been found.

The message ATT will appear next to the message to indicate that the error is current (i.e. currently present) Repair the problem on the motorcycle.





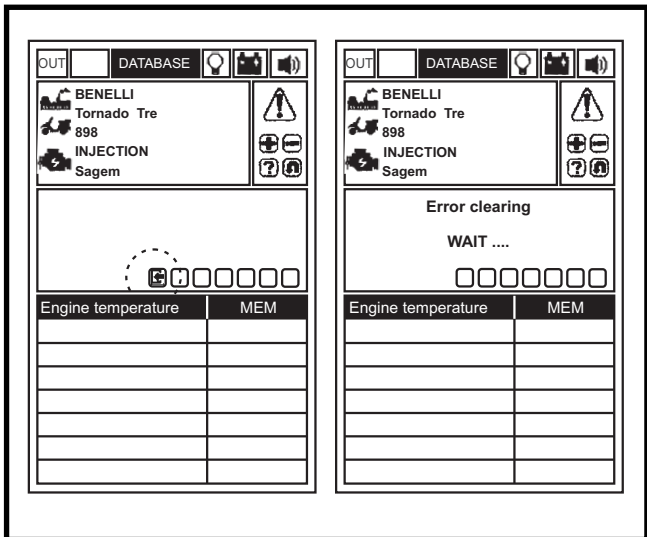
Example of stored error:

The message MEM will appear next to the error message if the ECU detected a fault in the past which may no longer be present.

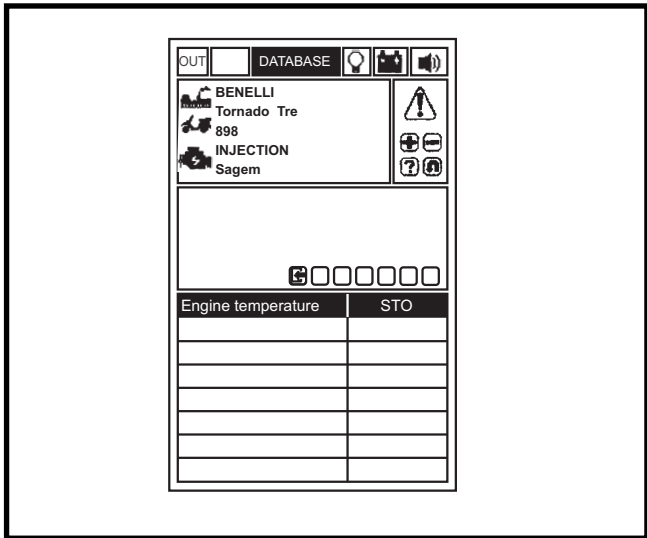
**NOTE:**

In some ECUs, the communication protocol may not be capable of discriminating between a current error and a stored error.

The message MEM will appear in any case in this event.



- Press STORE/DELETE to detected errors.
  - Press either ENTER to confirm deletion or ESC to cancel the operation.
- An error deletion message will appear.

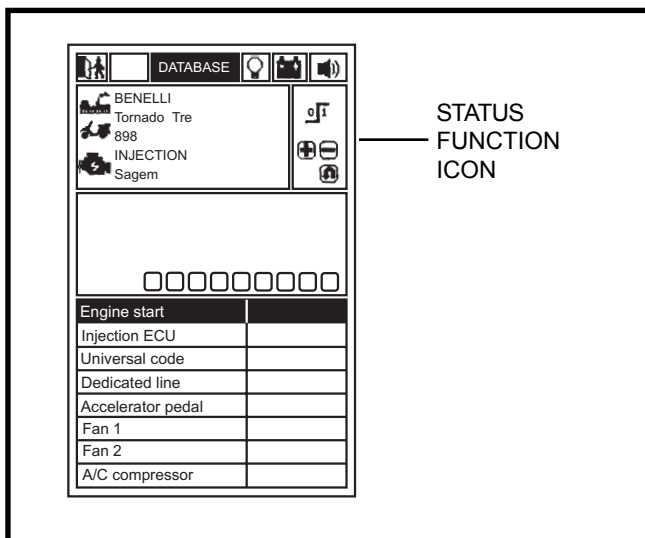


**STO FUNCTION  
(AUTOMATIC STORAGE)**

Error deletion will be confirmed by the message STO which will appear next to the error message. The automatic storage function is used to temporary store the errors deleted from the ECU memory in the yxz memory and display them. STOP will appear next to the items on the display. All stored errors will be cleared by deletion.

ATT, MEM and STO error status management depends on the selected system and may vary.



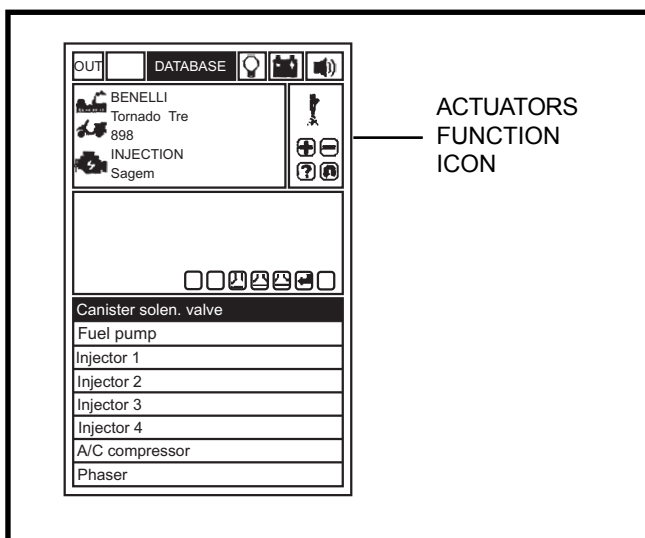


### INPUT STATUS:

Status parameters indicate the conditions of some ECU inputs, specifically ON/OFF (engine running/not running, lambda sensor on/off, etc.). Status view is constantly enabled in some systems. -Repeatedly press keys (+ or -) to view the STATUS function to access INPUT STATUS.

### NOTE:

The data refresher speed and the number of available items depends on the ECU.



### ACTUATORS/REGULATIONS:

#### ACTUATORS TEST



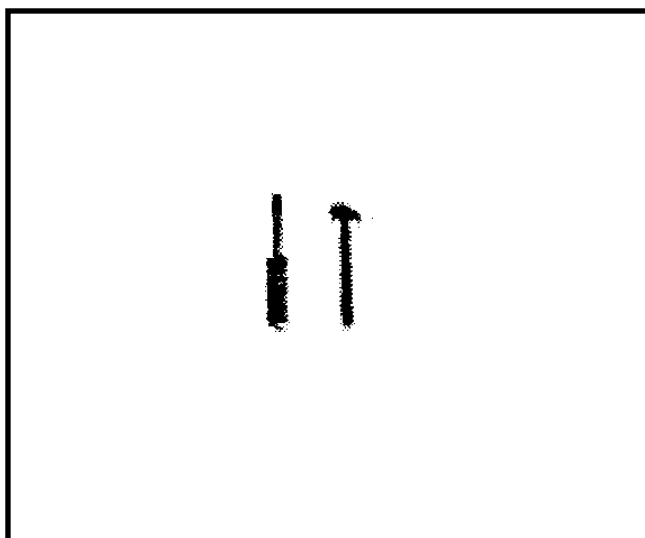
### ATTENTION:

*This function will operate some motorcycle components. This may be dangerous and cause damage in certain conditions. Adopt the necessary precautions.*

- Repeatedly press keys to view the ACTUATORS function.
  - Go to the required actuator with the scroll arrows.
  - Press ENTER to activate the selected component.
- The list may not be comprehensive. Use the left/right scroll arrows to select missing items and display them instead of those shown. Press ENTER to confirm.

### NOTE:

In most cases, the engine must be off before accessing the ACTUATORS functions. Follow the instructions provided by the program for systems requiring different procedures.



The following icon will appear for some models:





DATABASE			
BENELLI	Tomado Tre	898	INJECTION
Sagem			
<div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> </div>			
Error clearing			

#### DELETE CODE PAGE

#### ACTUATOR ERROR/ACTIVE DIAGNOSTICS

Press "ENTER" to confirm deletion of all failures stored in the memory.

AVAILABLE press ENTER to activate the selected actuator.

DATABASE			
BENELLI	Tomado Tre	898	INJECTION
Sagem			
<div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> </div>			
Press ENTER to confirm EXIT			
<div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> <div>0</div> </div>			
RPM			
Température eau			°C
Air temperature			°C
Battery voltage			V
Ignition advance			"
Injection time			ms
Trottle potentiometer			V
Idle motor			Step

#### HOW TO QUIT THE PROGRAM:

- Press ESC until the message CONFIRM EXIT appears.
- Press ENTER to confirm.
- Press any key when the message showed the second figure appears.
- Press ESC repeatedly until MAIN MENU appears.
- Select another model to resume auto-diagnostics.
- Press the ON/OFF button to switch the device off.



#### ATTENTION:

*Always use the ESC key to quit procedures in a sale correct way.*





## 10.4 MAINTENANCE OPERATIONS WITH DIAGNOSTIC TOOL

- Connect the supplied cables to the instrument.
- Switch the instrument on.
- Move with the horizontal or vertical buttons inside the menu.
- Select the item wanted with the "enter" key.
- Follow the indications supplied.

## 10.5 SELF-DIAGNOSIS

- The self-diagnosis system reads the information dialoging directly with the console (ECU) of the vehicle.
- It reads the functional parameters of all the devices connected to the console.
- It acquires automatically eventual faulty codes.
- It modifies a number of engine management parameters.

Procedure:

1. Carry out the procedure described in "Preliminary operations", selecting "self-diagnosis" and pressing "ENTER".
2. Select "DATABASE" with the horizontal arrows
3. Press "ENTER"
4. From the "SELECT TRADEMARK" menu select "Benelli"
5. Press "ENTER"
6. From the "SELECT MODEL" menu select "TnT"
7. Press "ENTER"
8. From the "MOTORISATION" menu select "1130"
9. Press "ENTER"
10. From the "SYSTEM TYPE" menu select "INJECTION"
11. Press "ENTER"
12. The "FRAME CODE" menu is not defined, press "ENTER"
13. From the "PLANT TYPE" menu select "Walbro"
14. Press "ENTER"
15. The "VERSION" menu is not defined, press "ENTER"
16. Follow the instructions seen on the instrument and press "ENTER"
17. At this point the instrument is in communication with the console.

- With the "+" and "-" keys it is possible to scroll the following menus, identified by icons

  1. ENGINEERING PARAMETERS (icon °C mV mS)
  2. PRESENT AND MEMORISED ERRORS (icon generic danger)
  3. FUNCTION OF STATES (icon 0 1)
  4. ACTIVATION FUNCTION (injector icon)
  5. ADJUSTMENTS (screwdriver and hammer icon)

## 10.6 SET THROTTLE

1. Carry out the procedure described for self-diagnosis
2. Go to ENGINEERING PARAMETERS page (icon C°....)
3. Look for the "correct throttle position" item with the horizontal arrows (if not already present on the display).
4. Press "ENTER" to see the parameter value (this value with the engine off and the panel lit must be equal to 0%)
5. if the value is other than 0%, proceed as follows
6. Go to the ADJUSTMENTS page (icon screwdriver and hammer)
7. Using the vertical arrows position yourself on the "Set throttle" line
8. Press "ENTER" and follow the instructions supplied by the instrument





## 10.7 ADJUST STEPPER / CO

This operation must be carried out also using an exhaust gases analyser. The process is repetitive, arriving at the CO wanted by repeating the procedure described below.

1. Carry out the procedure described for self-diagnosis.
2. Go to the "ENGINEERING PARAMETERS" page(icon C°....)
3. Look for the "STEPPER POSITION" item with the horizontal arrows (if not already present on the display).
4. Press "ENTER" to see the parameter value (this parameter, with the engine running at minimum and at 85-90°C working temperature, must be around 10-15 steps)
5. Go to the ADJUSTMENTS page (icon screwdriver and hammer)
6. Using the vertical arrows position yourself on the "FUELADJUSTMENT AT MINIMUM" line
7. Press "ENTER"
8. Start the engine, keep it at minimum and connect the exhaust gases analyser
9. A percentage value will be seen that is possible to modify with the vertical arrows
10. Increase or diminish this procedure according to whether you want to thin or thicken the fuel
11. Go to the "ENGINEERING PARAMETERS" page(icon C°....)

NOTE: it is important, in order to have a correct reading of the CO, that the position of the stepper is at a value of about 10-15 steps as, acting on the "FUELADJUSTMENT AT MINIMUM" value, this parameter is modified automatically (this parameter with the engine running is in continuous correction, and it is very difficult to read a fixed value equal to 10-15 steps. It is therefore sufficient that the fluctuations are around this value).

A way of finding the exact position of the stepper is to step slightly on the accelerator and read the value at the instant in which the engine goes back to the minimum.

12. Select the "STEPPER POSITION" item
13. In the case of the value being very far off (attention, fluctuations of 4 or 5 steps are normal) it needs to be corrected
14. Read the CO value of the exhaust gases analyser (it should be equal to (1-1.5)
15. In the case where the CO value is not that desired, repeat the operation from point 5.





## 10.8 INSTRUCTIONS TO ADJOURN THE GEARCASE SOFTWARE WITH THE AXONE

### NOTE:

During update of the control unit software connect also the second diagnostics connector (to two poles).

SCREENS	SYMBOL
Self-diagnosis screen	Press Enter
Benelli screen	Press Enter
TnT screen	Press Enter
Displacement 1130	Press Enter
Injection screen	Select
<b>With the UP and Down arrows select the reprogramming line</b>	
Reprogramming Screen	Press Enter
Frame code screen	Press Enter
Sagem Screen	Press Enter
Components position screen	Press Enter
Cables connection screen	Press Enter
Turn the key in the ON position screen	Press Enter
Gearcase data screen	Press Plus or Minus
<b>With the symbol + o – go in the selection Gearcase</b>	
Selection gearcase screen	Select
<b>Select with the Up and Down arrows the gearcase type</b>	
Selected gearcase screen	Press Enter
<p><b>Starting the gearcase reprogramming (waiting time about 6 min.) the temperature needle moves until reaching the lower scale on the Axone display you will read a value which goes from 0% to 100% showing the programming residual time. When the 100% index is reached, on the display appears the writing programming well-done.</b></p>	
Well-done programming screen	Press Enter
<p><b>When you press Enter with programming screen well- done, you hear the fuel pump loading. Turn the key in OFF and you will hear a Relay clicking in the battery area. Now you can switch off the Axone.</b></p>	









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