PIAGGIO

SERVICE STATION MANUAL

• Engine 500 cc

Piaggio & C. S.p.A.

Pontedera
After Sales Service
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SERVICE STATION MANUAL
X9 500 cc

This manual has been prepared by Piaggio & C. S.p.A. for use in the workshops of authorised Piaggio dealers and sub-agents.
It is assumed that the person utilising this manual for servicing or repairing Piaggio vehicles has a knowledge of the principles of mechanics and standard procedures for vehicle repair. Any important changes in vehicle characteristics or specific repair operations will be divulged by means of updates to this manual.
Satisfactory repair or service cannot be achieved without the necessary equipment and tools. Refer to the pages of this manual concerning specific tools and equipment and the special tools catalogue.

Critical information in the manual is indicated as follows.

N.B.: Important information for facilitating and explaining a procedure.

Warning - Procedures that must be followed to avoid damage to the vehicle.

Caution - Procedures that must be followed to eliminate the risk of injury to repair / service personnel.

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GENERAL INFORMATION AND MAINTENANCE	1

Safety prescriptions

- If the work to be carried out requires the vehicle engine to be running, make sure the workshop is well ventilated and use proper exhausters. Do not run the engine in closed places. Exhaust fumes are toxic.

- Battery electrolyte contains sulphuric acid. Protect the eyes, clothes and skin. Sulphuric acid is highly corrosive, if it comes into contact with eyes or skin, wash the affected area abundantly with water and seek immediate medical assistance.

- The battery produces hydrogen gas which is potentially explosive. Do not smoke near the battery and keep naked flames and sparks well clear, especially when the battery is on charge.

- Petrol is highly flammable and can be explosive in certain conditions. Do not smoke in the work area and do not introduce naked flames or sparks.

- Clean brake shoes, drums and pads in a well ventilated place. When using compressed air direct the jet away from you to avoid inhaling the dust. Although the brake linings are asbetos-free, inhalation of the resulting dust is harmful.

Maintenance regulations

- Use only genuine PIAGGIO spare parts and recommended lubricants. The use of non-original or non-conforming spare parts can cause damage to the vehicle.

- The only specific tools that can be used are those expressly designed for this vehicle.

- Always fit new gaskets, seal rings and split pins when reassembling parts.

- After disassembly, clean parts with non-flammable solvent or a solvent with a high flash point. Lubricate all surfaces before reassembly with the exception of conical couplings.

- After reassembling, check that all the components are correctly installed and that they work perfectly.

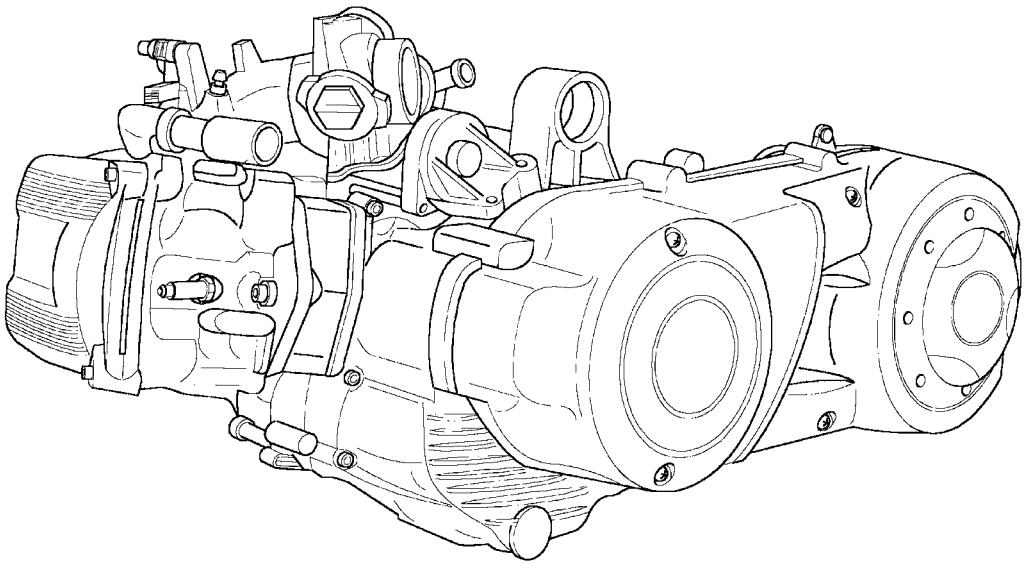
- Use only metric tools for disassembly, assembly and maintenance work. Metric screws, nuts and bolts cannot be interchanged with BS components. The vehicle may be damaged if unsuitable tools or nuts, bolts or screws are used.

- When working on the electrical system, ensure electrical components are correctly installed, paying particular attention to ground and battery connections.

Specifications (500 cc 4-stroke, 4-valves H_20 engine)

ENGINE

Type ..... single-cylinder, 4-stroke
Bore ..... 92 mm
Stroke ..... 69 mm
Displacement ..... 460 cm^3
Compression ratio ..... 10.5 : 1
Timing ..... chain-operated overhead single-shaft flywheel side, integrated phonic wheel, 4-valves and automatic starting valve lifter
Valves play: intake 0.15mm
exhaust 0.15mm
Valves play adjustment ..... threaded register on equalizers
Idle speed ..... 1450±50 rpm
CO% value ..... 1±1.5%
Starting system ..... electric starter
Lubrication ..... trochoid pump (inside the crankcase), oil filter and pressure adjustment by-pass
Lubrication pressure ..... 4 bar
Minimum allowed pressure (at 100°C) ..... 0.8 bar
Fuel system ..... electronic injection with electric fuel pump, throttle body Ø 38mm and single injector
Max power (at crankshaft) ..... 29 kW (39 CV) 7250 rpm
Max torque (at crankshaft) ..... 40 N·m (4 Kgm) 5500 rpm
Cooling system ..... liquid, by means of motorized pump, 3-way thermostat and electric fan.
Transmission ..... automatic speed variator by means of expanding pulleys, V-belt, automatic clutch, reduction gear, and transmission compartment cooling by air forced-circulation.
Ignition type ..... high efficiency inductive type integrated with injection, variable spark advance and separated high voltage coil
Spark advance (before T.D.C.) ..... variable controlled by injection power unit
Spark plug ..... CHAMPION RG 6 YC
NGK CR7 EKB
Engine-wheel ratio ..... short: 1/11.988
long: 1/ 4.86
Engine oil ..... SAE 5W/40 exceeding API SJ specifications
Quantity ..... ~ 1.7 l
Hub oil ..... TUTELA ZC 90
Quantity 250cc
Cooling system capacity ..... ~ 1.8 l



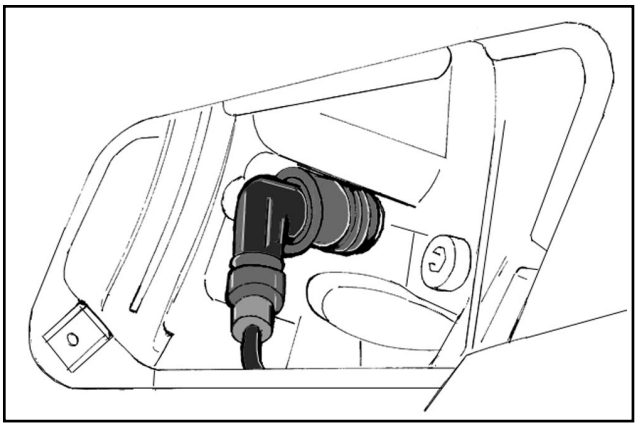
Spark plug

Check and replacement

Warning - Remove the spark plug when the engine cold. Replace the spark plug every 12,000 Km. The use of unsuitable control units or spark plugs other than those specified can seriously damage the engine.

Recommended spark plug: CHAMPION RG 6 YC
NGK CR 7 EKB

- Put the vehicle on its central stand.
- Open the door on the left side of the vehicle by levering in the recess in the lower part of the door after removing the screw.
- Disconnect the spark plug high voltage cable cap;
- Unscrew the spark plug with the spanner provided; check the spark plug to see if the insulator is cracked, the electrodes are worn out or excessively sooty. Also check the condition of the sealing washer and measure the electrodes gap with a suitable thickness gauge.
  Electrode gap: 0.7 - 0.8 mm
- If necessary adjust the gap by carefully bending the side electrode. If the spark plug has any of the defects mentioned above replace it with a plug of the recommended type;
- Insert the plug into the hole with the proper inclination, screw it in fully by hand and then tighten it with the specially designed spanner.
  Tightening torque: 10 N·m (1 Kg·m)
- Push the spark plug cap all the way down onto the spark plug and then proceed to the reassembly.



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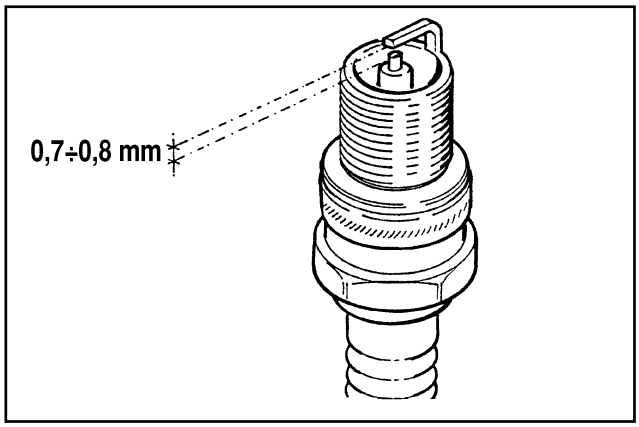

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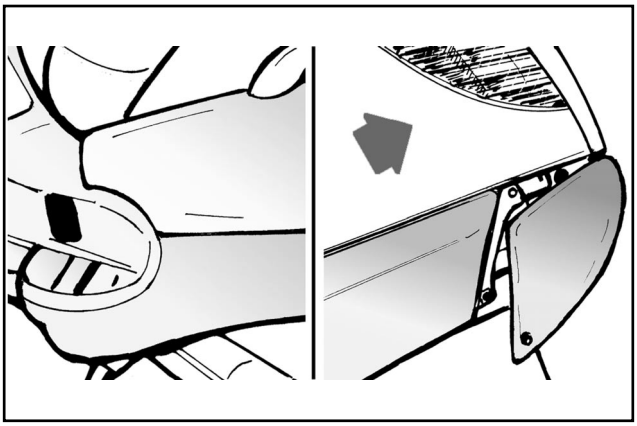
Air filter

- Remove the left-hand lower side panel
- Remove the cleaner cap after unscrewing the eight fixing screws, including one screw of the knob type.
- Pull out the filter element.
- Replace the air filter with a new one.

N.B.: Check and if necessary blow the air filter every 6,000 km. Direct the air jet from the inside to the outside of the filter (i.e. in the opposite direction to the air flow during normal engine operation).



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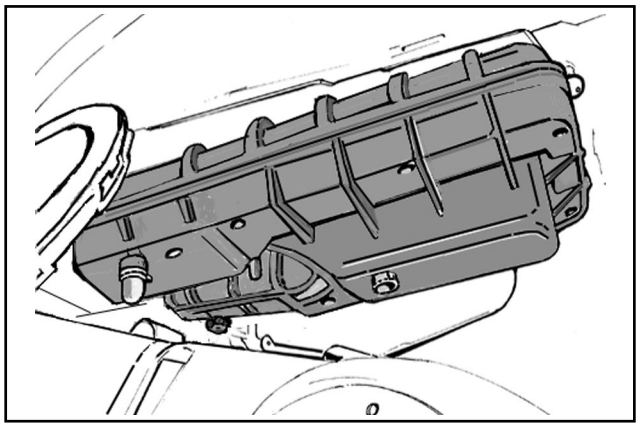
Warning - If the vehicle is mostly used on dusty roads, the air filter needs to be cleaned and replaced at shorter intervals than indicated in the Maintenance Schedule.

Warning - Do not run the engine if the air filter is not in place as this would result in excessive wear of the cylinder and piston as well as in damage to the throttle body.



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Engine oil level

In four-stroke engines oil is used to lubricate the valve gear components, the crankshaft bearings and the thermal unit. **A lack of engine oil can cause serious damage to the engine.**
In all four-stroke engines, oil deterioration and consumption are, to some extent, normal, especially during running-in. Consumption partly depends on the riding style (for example, constantly riding at full throttle increases oil consumption).

Checking the oil level

Perform this operation when the engine cold, as described below:
1) Put the vehicle on its central stand on a flat surface.
2) Unscrew dipstick «**A**», dry it with a clean cloth and refit by **screwing it completely.**
3) Remove the dipstick again and check that the oil level is between the MAX and MIN marks on the dipstick; top up if necessary.
   When the oil level is at MAX the engine contains 1700 cc of oil.

The level will be lower if checked after using the vehicle (i.e. when the engine is hot). To obtain a correct indication of the oil level, wait for at least 10 minutes after switching off the engine.

Topping up

If the oil level is too low, top up by adding fresh oil **without exceeding the MAX level.**

Approximately **400 cc** of oil are needed to restore the level between the **MIN** and **MAX** marks.

Oil pressure warning light

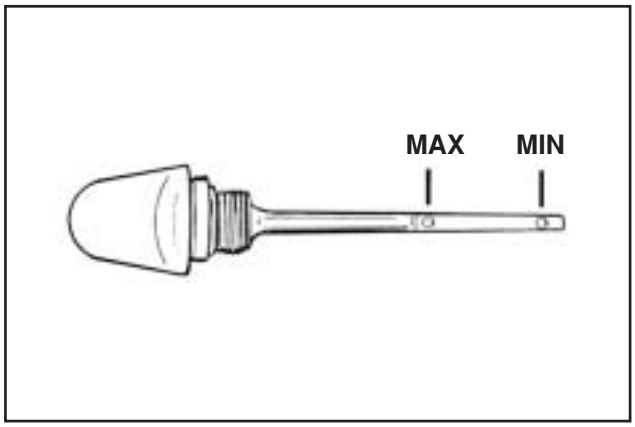
A warning light on the instrument panel comes on when the ignition key is turned to the **"ON"** position. The light must go out after the engine has started.
Should the warning light come on while braking, idling or cornering, check the oil level and the lubrication system as soon as possible.

Renewing the oil and the filter

The oil and the filter must be renewed every 6,000 km. Drain all the oil from the engine by removing gauze strainer drain plug «**B**» on the transmission side. To facilitate the outflow, also remove cap/dipstick «**A**».
Once the oil has drained completely through the drain hole, unscrew oil filter cartridge «**C**» and remove it as described below.

Since a certain amount of oil remains in the circuit, the replenishment must be made by adding approximately 1,500 cc of fresh oil through cap «**A**». Subsequently start the engine, let it idle for a few minutes and then switch it off. After about 5 minutes, check the level and if necessary top up **without ex-ceeding the MAX level.**
The filter cartridge must be replaced every time the oil is changed. For top-ups and
renewals use fresh oil of the **Selenia HI Scooter 4 Tech type.**

N.B.: Renew the oil when the engine is hot.



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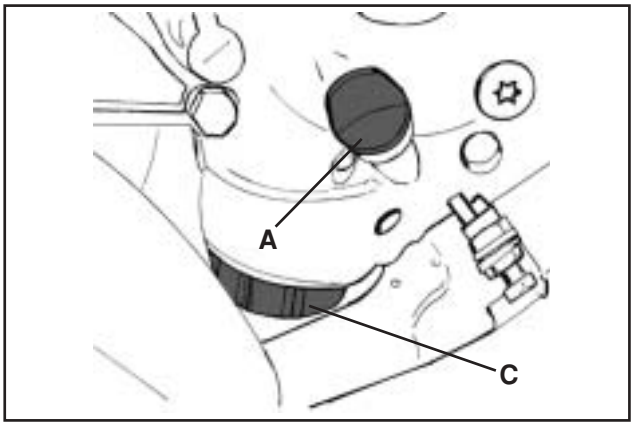

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Replacing the filter

Warning - Do not dispose of the oil in the environment. Carry out the disposal of the oil, the gasket and the filter in accordance with the law.

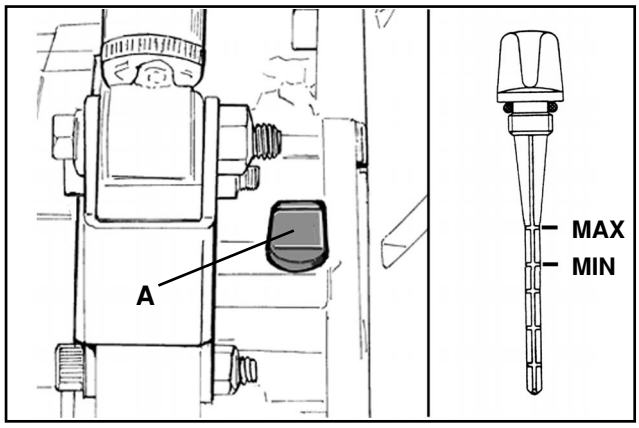
Warning - To avoid burns, take care not to touch hot engine parts.

- Remove the silencer.
- Remove filler plug «**A**».
- Remove and clean the drain plug gauze strainer with compressed air.
- Using a strap wrench for filters, remove cartridge filter «**C**».
- Ensure that the O-rings on the prefilter and the drain plug are in good condition.
- Lubricate the O-rings and then refit the gauze strainer and the oil drain plug. Tighten the drain plug with the prescribed torque.
- Fit a new cartridge filter after lubricating the O-ring. Turn in until the gasket makes contact and then screw it with the prescribed torque.
- Reinstall the silencer.
- Add engine oil as previously described.

Tightening torque:
Oil filter: 12 - 16 N·m
Recommended oil: **Selenia HI Scooter 4 Tech**

Checking the hub oil level

- Put the vehicle on the central stand on level ground.
- Unscrew oil dipstick «**A**», wipe it with a clean cloth, reinsert it and **then screw it in fully**.
- Pull out the dipstick again and check that the oil level is between the MIN and MAX marks (see figure); if the level is below the MIN mark, top up with oil.
- Reinsert the dipstick and screw it tight.



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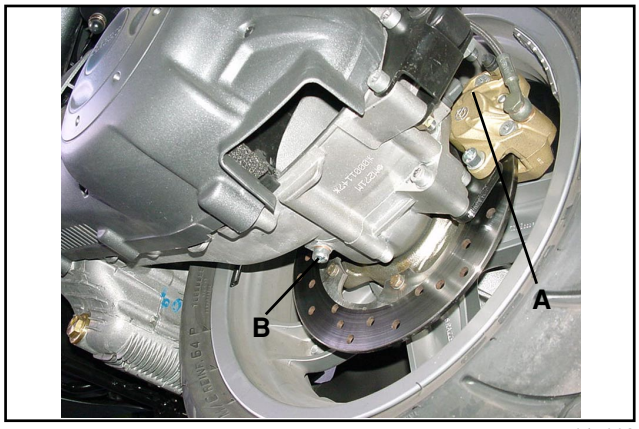
Renewing the hub oil

- Remove oil filler plug «**A**».
- Unscrew oil drain plug «**B**» and drain all the oil.
- Retighten the oil drain plug and then fill the hub with fresh oil.

Hub oil capacity: ~ 250 cc

Recommended oil: **TUTELA ZC 90**



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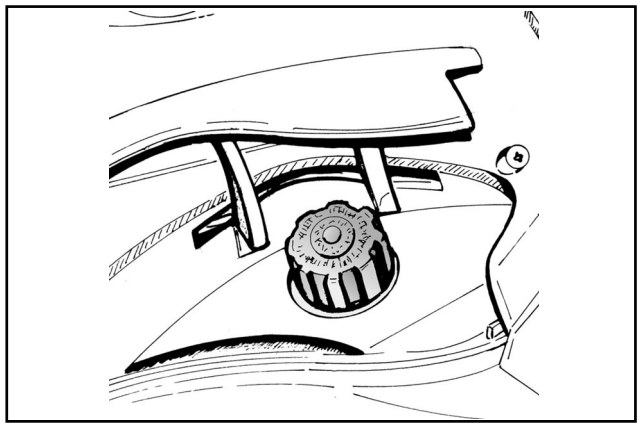
Engine cooling
Adding coolant and bleeding air from the system.
The level of the fluid must be checked every 6,000 km when the engine is cold.
Follow these steps:
- Put the vehicle on the central stand on level ground.
- Remove the expansion tank cap and top up if the coolant is below or near the MIN level in the expansion tank. The level of the fluid should always be between the MIN and MAX marks.
- To have an indication of the coolant level, refer to the groove in the plastic strip that can be seen through the coolant filler hole. The upper and lower parts of the groove correspond to the MAX and MIN levels respectively.
- The coolant consists of a 50 percent mixture of demineralized water and antifreeze solution with a base of ethylene glycol and corrosion inhibitors.
  Total coolant capacity: ~ 1.8 lt
- To check the presence of air in the circuit follow the procedure described in Chapter 11 - Cooling.
- Switch off the engine and allow it to cool down. After a few minutes, remove the expansion tank cap and check the level of the fluid.
- If necessary, top up by pouring fresh coolant into the expansion tank up to the correct level.

Warning - To prevent the coolant from leaking out of the expansion tank during use, be sure to never exceed the MAX level when refilling.



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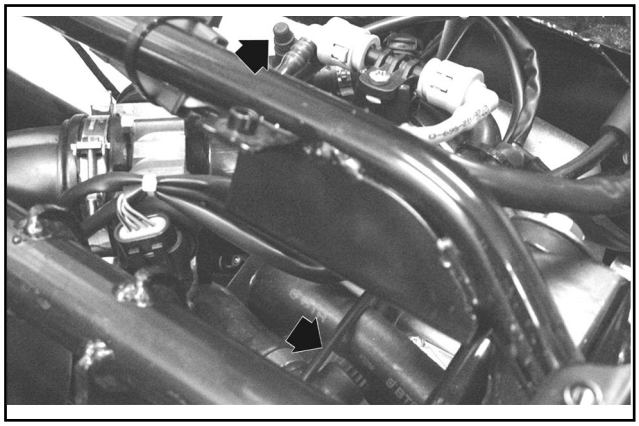


01_011

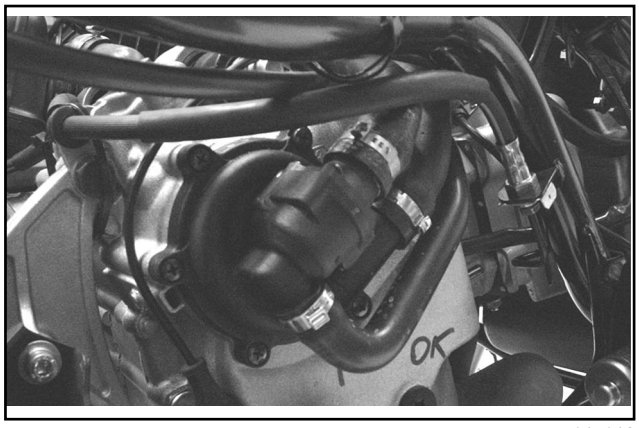
Water pump

If the water pump becomes noisy or liquid leaks through the pump drain hole, check the water pump as described in Chapter 5-Flywheel cover. Follow these steps:
- Put the vehicle on the central stand on level ground.
- Remove the lower right-hand side panel and the right-hand footboard as described in Chapter 8-Bodywork of the X9- 500 cc manual;
- Remove the sleeves from the water pump cover and the filler cap from the expansion tank and empty the cooling circuit.
- Drain the cooling system by removing the sleeves located on the water pump cover and the plug located on the expansion tank.

Warning - Perform the operation when the engine is cold.

- Remove the water pump cover shown in the figure after loosening the six fixing screws.
- Cooling circuit capacity: ~ 1.8 lt.
- As described in Chapter 5-Engine of the X9 500cc manual, partially drain the system and overhaul the pump.
- After solving the problem and refitting all components, fill and bleed the cooling circuit again.

N.B.: Change the coolant as described in Chapter 11-Cooling.



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Checking the valve gear timing

- With a wrench of the TORX type, remove the timing check plug located on the flywheel cover.
- Remove the transmission cover and relevant insulation as described in Chapter 3-Automatic Transmission.
- Remove the head cover as described in Chapter 7-Thermal Unit and Timing System.
- Turn the driving shaft by means of the driving pulley until the reference mark on the magneto support coincides with the mark on the flywheel cover (TDC).
- Make sure that the reference mark on the phonic wheel is aligned with the mark on the head. If necessary, turn the driving shaft accordingly.

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Valves play check/adjustment

- Check the valves play after aligning the valve timing reference marks as described in the previous section.
- Check that the valve-register play corresponds with the indicated values by means of a feeler gauge. If the valve play values, intake and exhaust respectively, do not correspond with those indicated below, adjust them by loosening the check nut and acting on the register with a screwdriver, as shown in the figure.

Intake: 0.15mm cold engine
Exhaust: 0.15mm cold engine

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Checking pressure at the end of the compression

- Remove the spark plug cap with the engine cold.
- Remove the spark plug.
- Fit a compression control gauge in the spark plug seat by means of a 10mm plug connection. Tighten to the prescribed torque.
- Start the engine by means of the starting motor and with throttle body fully open until the gauge pointer stops. If the pressure is between 8 - 11 bar, remove the tool and reassemble the spark plug.
- If the measured pressure is lower than the recommended values, check the engine revs number; if it is lower than 450 rpm, check the starting system; if the revs number is correct or slightly higher, check the timing. If no troubles are found, proceed as follows:
- Check that the cylinder gasket is the right one.
- Check the thermal zone sealings (compression rings-valves).

Tightening torque:
Compression test connection: 10 N·m

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SPECIFIC TOOLING 2

Specific tools for Piaggio X9 500 cc 4-stroke 4-valve

RECOMMENDED TOOLS	
TOOL NAME	**PART NO.**
Circlip pliers	002465Y
Steering thrust ring removing drift	020004Y
Crankshaft aligning tool	020074Y
Support for “METABO HG 1500/2” air heater	020150Y
“METABO HG 1500/2” air heater	020151Y
Mityvac-type vacuum pump	020329Y
Stroboscopic gun for two- and four-stroke engines	020330Y
Digital multimeter	020331Y
Single battery charger	020333Y
Multiple battery charger	020334Y
Magnetic stand and dial gauge	020335Y
Engine support connection	020482Y
Engine mount base	020527Y
Engine mount revolving base	020604Y11

= New tools

NECESSARY TOOLS	
TOOL NAME	**PART NO.**
STEERING SEAT FITTING TOOL, to be fitted with parts 9 - Lower bearing adaptor, 10 - Upper bearing adaptor	001330Y
Bell Ø 80 mm	001467Y002
20 mm pliers	001467Y006
Bell Ø 63 mm	001467Y007
18 mm pliers	001467Y008
Bell Ø 45 mm	001467Y017
Bell Ø 60 mm	001467Y031
15 mm pliers	001467Y034
Hub bearing extraction bell	001467Y035
Steering tube ring spanner	020055Y
Oil pressure gauge	020193Y
Valve seal rings assembly tool	020306Y
37x40 mm adaptor	020358Y
42x47 mm adaptor	020359Y
52x55 mm adaptor	020360Y
20 mm guide (Driven pulley bearings)	020363Y
25 mm guide (Driven pulley bearings)	020364Y
Ø 28x30 mm adaptor	020375Y
Adapter sleeve	020376Y
Bushing (valve removing tool)	020382Y012
15 mm guide	020412Y
Valve oil seal extractor	020431Y
Oil pressure gauge unio	020434Y
17 mm guide (countershaft bearings)	020439Y
Driven half pulley spring compressor	020444Y
46-55 mm spanner	020444Y009
Ø 24 mm adaptor	020456Y
Steering tube lower bearing extractor	020458Y
Drift for fitting bearing on steering tube	020459Y
Injection tester kit	020460Y
Flywheel extractor	020467Y
Piston fitting band	020468Y
Injection tester reprogramming kit	020469Y
Piston pin retainer fitting tool	020470Y
Countershaft timing peg	020471Y
Flywheel retaining tool	020472Y
Clutch bell housing retaining tool	020473Y
Drive pulley stop spanner	020474Y
Piston position comparator support	020475Y
Pillar kit	020476Y
Ø 37 mm adaptor	020477Y
Driven pulley needle roller drift	020478Y
Countershaft stop spanner	020479Y
Fuel pressure measuring kit	020480Y
Control unit interface wiring harness	020481Y
30 mm guide	020483Y
Piston stop fork	020512Y
Compass wrench (valve lifter bell stop)	020565Y
Exhaust gas analyser	494929

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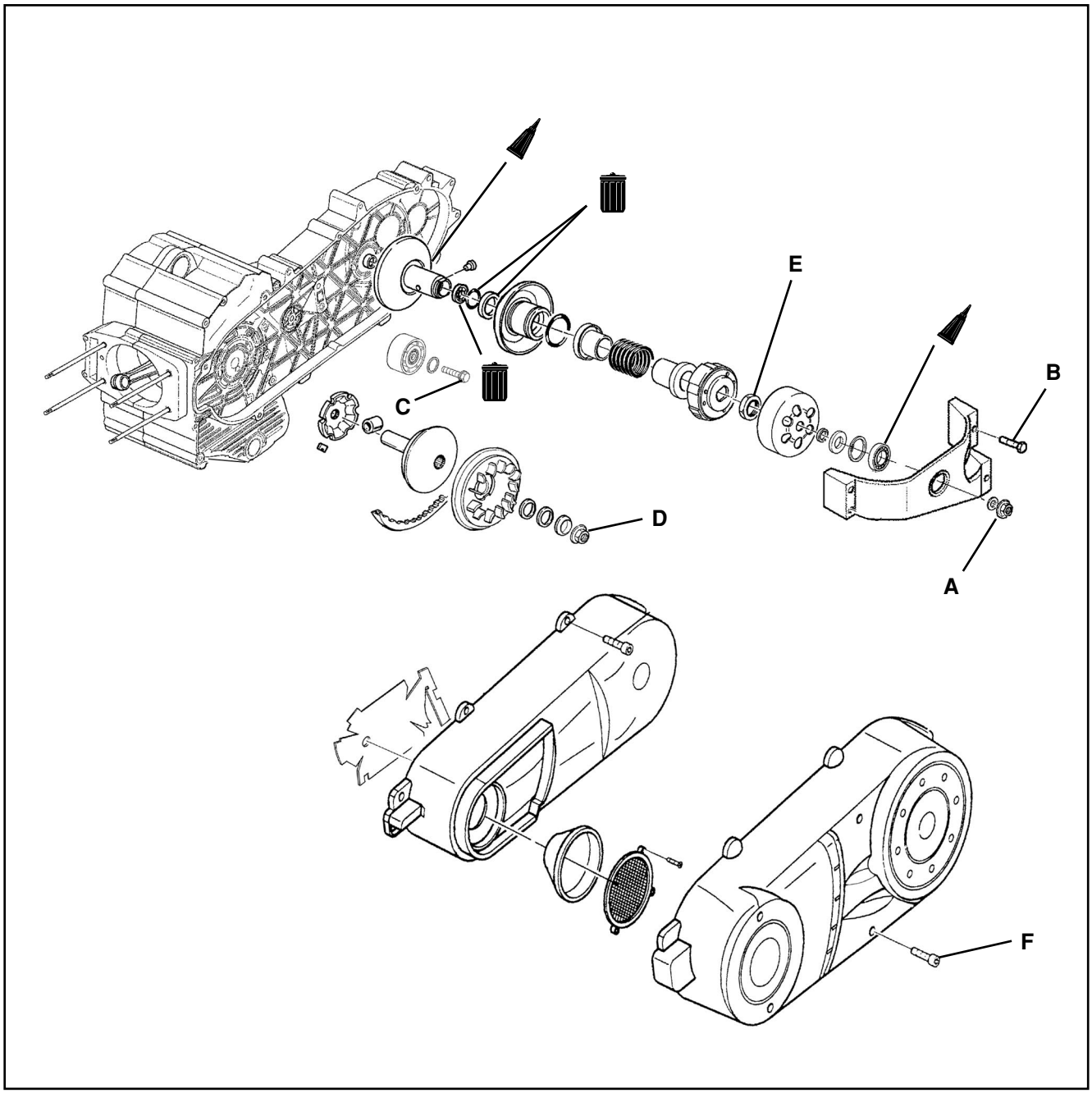
AUTOMATIC TRANSMISSION 3



LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

LUBRICATE WITH GREASE

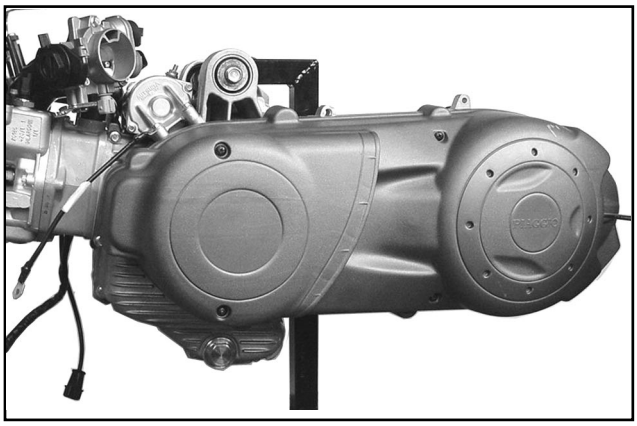
CLEAN WITH CARE

ALWAYS REPLACE

REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	1	4	1	1	1	7									
TORQUE N·m	90-92	23-26	17-20	160-175	65-75	11-13									

External transmission cover

- Unloose the 5 fixing screws
- Remove the external plastic cover



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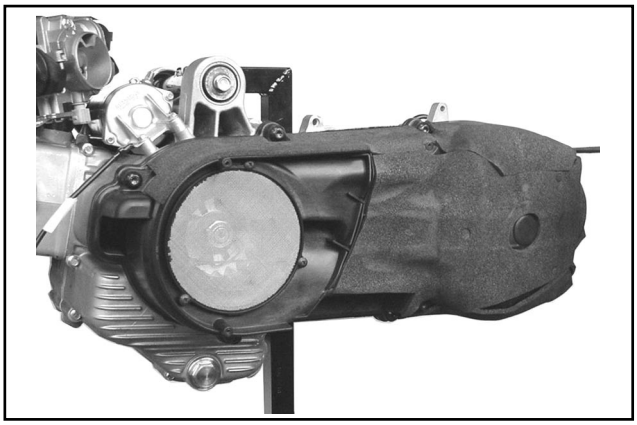
Transmission cover

- Unloose the 7 fixing screws
- Remove the cover and net filter

N.B.: Disassemble the net filter only if it is to be replaced.



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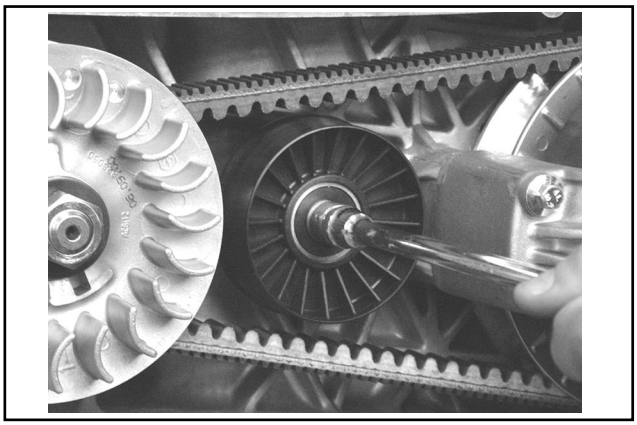
Belt antiflapping roller

- Check that the roller is in good condition and that it turns freely.
- Unloose the fixing screw with a 13 mm wrench
- Remove the roller and relevant bearing.

N.B.: If the roller does not turn freely, replace it.



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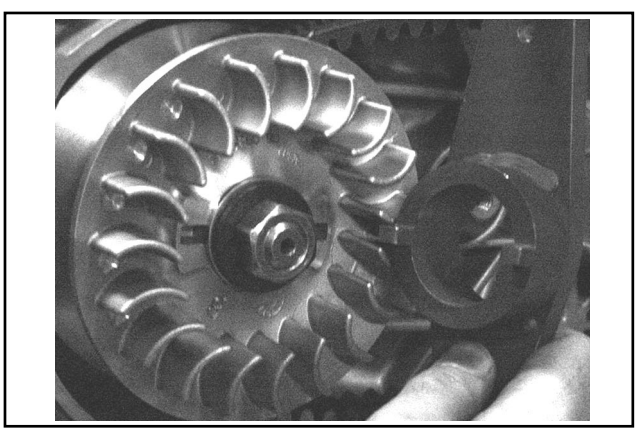
Driving pulley

- Turn the pulley central nut with a 27 mm wrench to align the internal holes horizontally, therefore allowing for the specific tool fitting.

Specific tool:
Driving pulley lock wrench 020474Y



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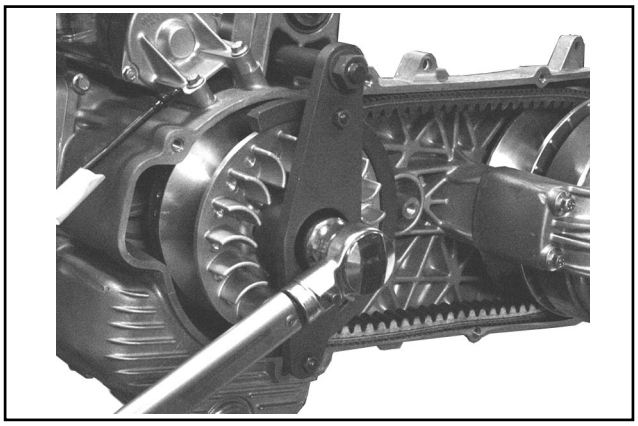
- First fit the specific tool stop ring on the pulley until the groove is fully in contact.
- Afterwards, insert the tool so that the studs on the ring fit the holes in the tool.
- Tighten, also manually, the two fixing nuts of the tool
- Unloose the central nut.
- Remove the cup washer and the plain washer.
- Remove the fixed driving half pulley.
- Remove the washer to bush connection.



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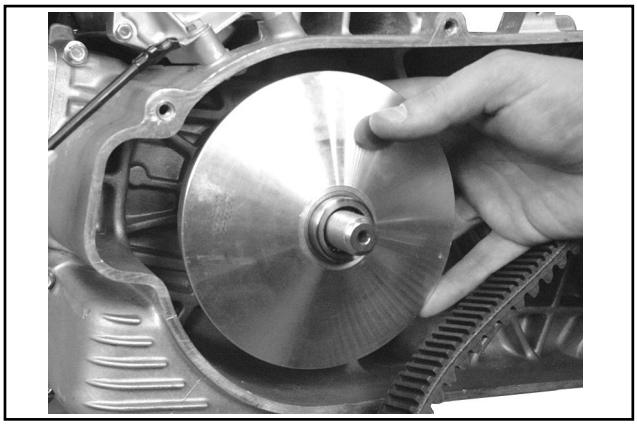
- Move the belt downwards.
- Hold the roller stop plate, remove the mobile driving half pulley with its bush and rear washer, taking care not to let the rollers come out.



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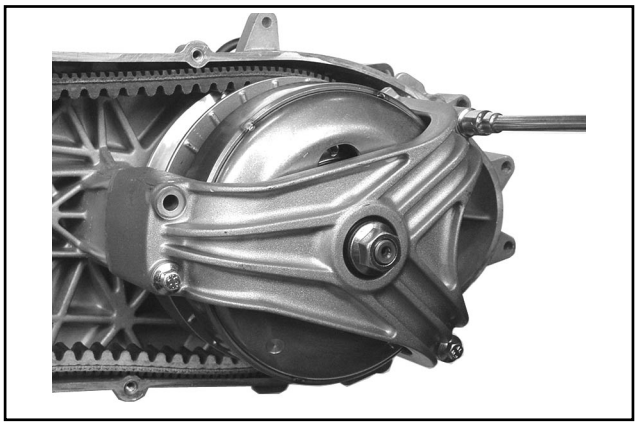
Driven pulley axle support

- To be able to fit the specific tool for removal of the driven pulley shaft nut, unloose the 2 upper screws of the driven pulley axle support.
- Manually turn the clutch housing as to partially uncover one of the holes in the driven pulley axle support.



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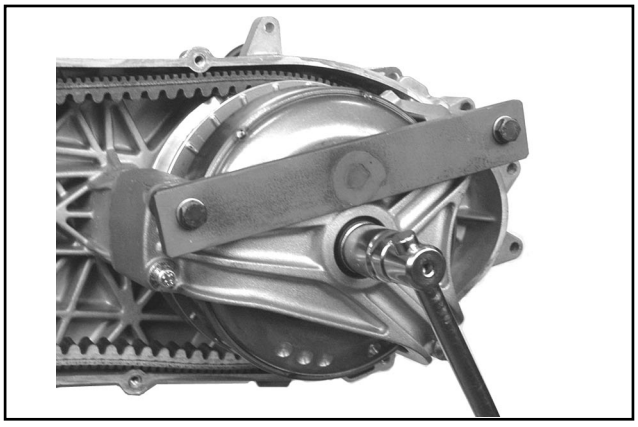
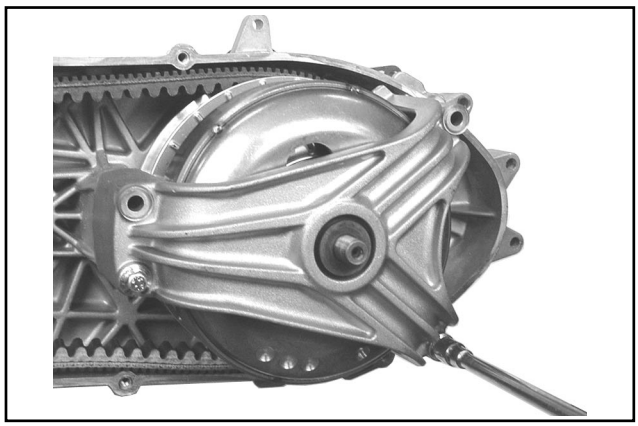
- Insert the specific tool on the driven pulley axle support, checking that the tooth fits the hole in the housing previously uncovered, and that it is resting on the support.
- Tighten the 2 fixing screws.
- Unloose the driven pulley shaft nut.

Specific tool:
Clutch housing stop tool 020473Y



05_013

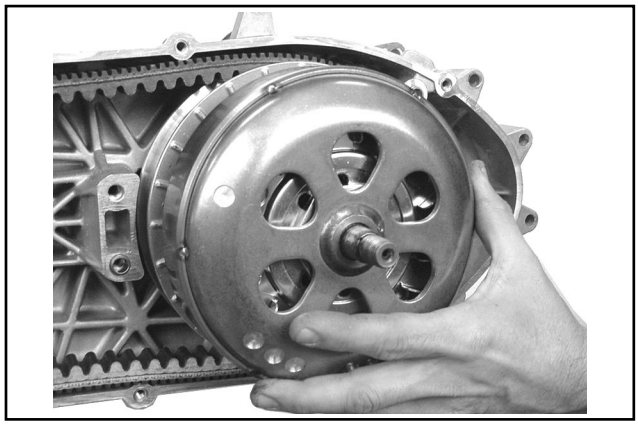
- Remove the specific tool
- Unloose the 2 remaining fixing screws of the driven pulley axle support.
- Remove the driven pulley axle support and the washer.
- Remove the spacer below.



05_014

Clutch housing

- Remove the clutch housing.



05_015

- Check that the clutch housing shows no signs of wear or damage.
- Measure the clutch housing I.D.

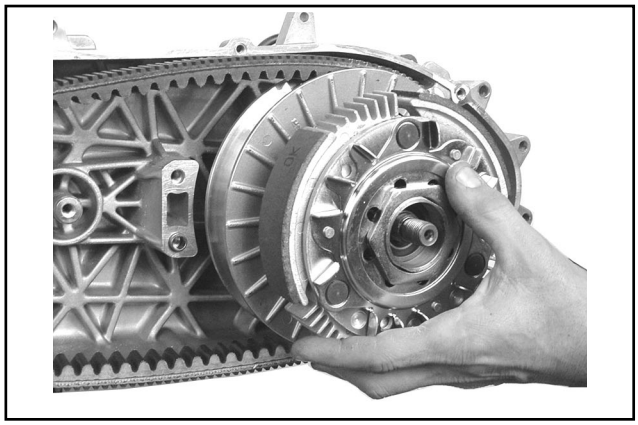
Standard value: 160.2 mm
Max value: 160.5 mm

N.B.: Check that the measured eccentricity is max 0.2 mm

05_016

Driven pulley assembly

- Remove the driven pulley assembly and relevant belt.



05_017

Clutch disassembly

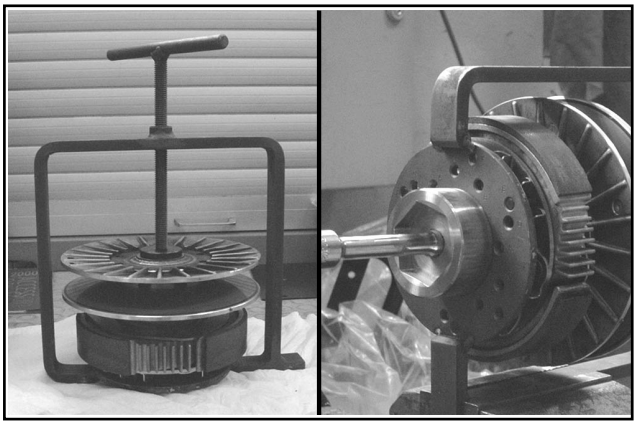
- Remove the clutch and driven pulley by means of the specific tool;
- Prepare the tool with the pins screwed in the «**E**» position on the internal side;
- Assemble the driven pulley assembly on the tool and insert the pins in the ventilation holes;
- Bring the rear stop screw in contact with the fixed driven pulley, as shown in the figure.

Warning - Put the tool in a vice firmly. Do not overtighten the rear screw to avoid buckling the tool.

- Remove the fixing ring nut with the specific spanner of 55 mm.
- Unloose the tool screw and dismount the driven pulley, clutch, spring with sheath assembly

Specific tools:

Driven pulley spring compressor	**020444Y**
55 mm spanner	**020444Y009**
Ring	**020444Y010**



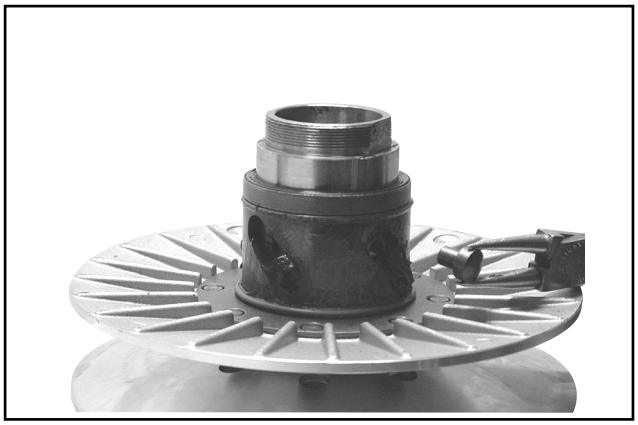
05_019

Pins stop collar

- Remove the collar by means of 2 screwdrivers.

05_020

- Remove the 4 guide pins.
- Remove the mobile driven half pulley.



05_021

Fixed driven half pulley bearings

- Check that the bush shows no signs of wear or damage; if necessary, replace the fixed driven half pulley.
- Remove the stop ring with the pliers.

05_022

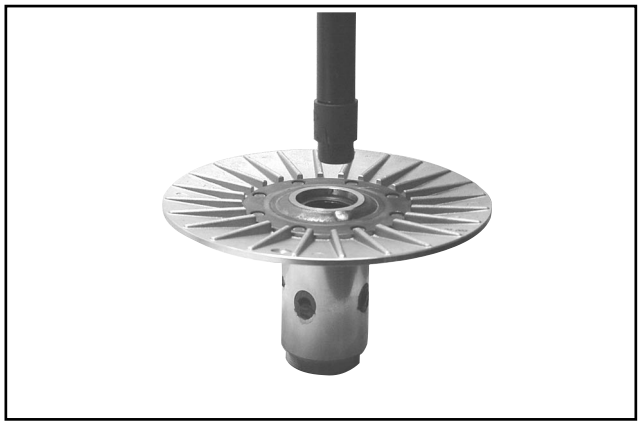
- Remove the ball bearing by inserting the specific tool in the roller bearing.

N.B.: Hold the pulley to avoid damaging the thread.

Specific tools:

Handle	**020376Y**
24 mm adapter	**020456Y**
20 mm guide	**020363Y**

N.B.: If the bearings are overhauled with the driven pulley unit assembled, make sure to support the unit with bell 001467Y002.



05_023

- Remove the roller bearing by means of the specific tool, supporting the fixed half pulley with the bell.

Specific tools:

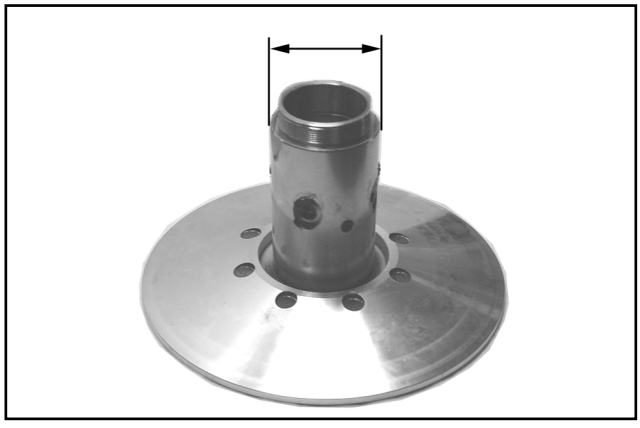
Handle	**020376Y**
28x30 mm adapter	**020375Y**
25 mm guide	**020364Y**
Bell	**001467Y002**

05_024

Fixed driven half pulley

- Check the belt contact surface out for signs of wear.
- Measure the pulley bush O.D.

Minimum allowed diameter: 49.96 mm
Standard diameter: 49.965 mm

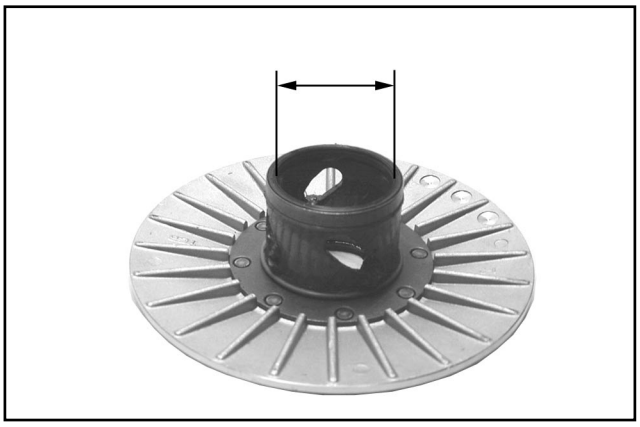


05_025

Mobile driven half pulley

- Check the belt contact surface out for signs of wear.
- Remove the 2 internal and external O rings.
- Measure the mobile half pulley bush I.D.

Maximum allowed diameter: 50.08 mm
Standard diameter: 50.085 mm



05_026

Fixed driven half pulley bearings assembly

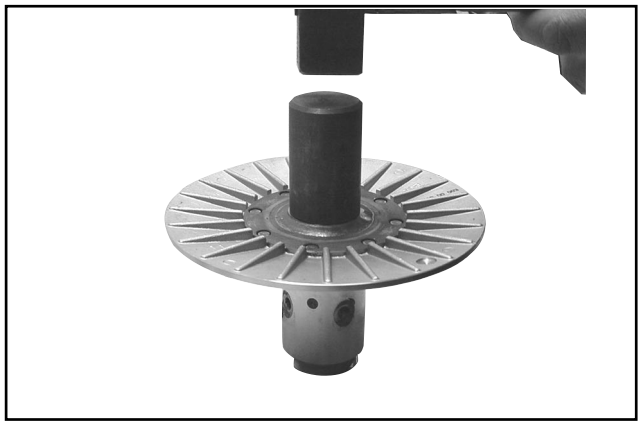
- Fit a new roller bearing using the specific tool

N.B.: Put the bearing and the incorporated oil seal on the outside.

- Hold the half pulley to avoid damaging the thread. Operate with tool 001467Y002, with the driven pulley unit completely assembled.

Specific tool:

Driven pulley roller case tool	**020478Y**
Bell	**001467Y002**



05_027

- Fit a new ball bearing by means of the specific tool.

Specific tools:

Handle	**020376Y**
37 mm adapter	**020477Y**
20 mm guide	**020363Y**

- Fit the stop snap ring.

05_028

Driven pulley assembly

- Fit the new oil seals
- Fit the new O rings

N.B.: The O rings come supplied in 2 sizes. The larger one is installed on the work end radius, half pulley base.

- Fit the half pulley on the bush taking care not to damage the upper O ring.

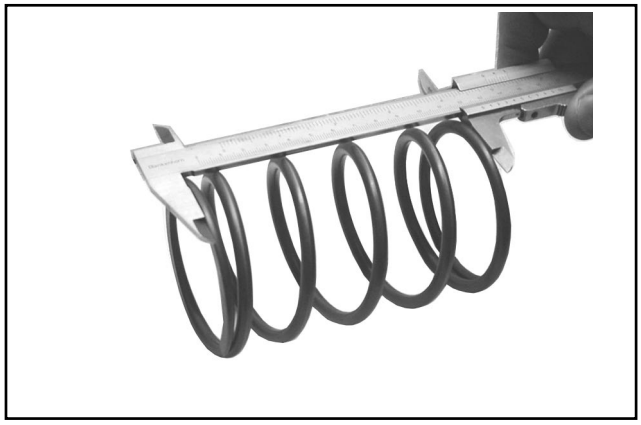
05_029

- Check the pins and collar condition, and then reassemble them.
- Lubricate the driven pulley assembly with a hook-bill greaser. Apply 10 gr. of TUTELA MRM2 grease through one of the holes inside the bush until grease comes out of the opposite hole.

Spring

- Measure the free length of the mobile driven half pulley spring.

Standard length: 125.5 mm
Limit allowed after use: 120 mm

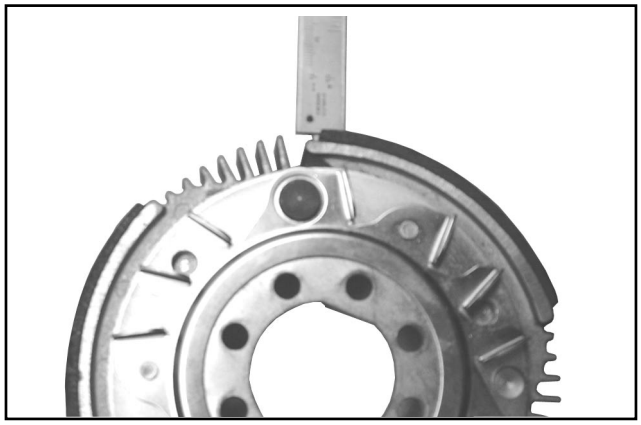


05_030

- Check the thickness of the clutch weights friction material.
  Minimum allowed thickness: 1 mm
- The weights must show no traces of grease. If necessary, check the seals of the driven pulley assembly.

N.B.: During the running in phase the weights must have a central contact surface and must not be different one from the other to avoid the clutch jerking

- Do not open the weights with the tools to avoid the return springs load variation.

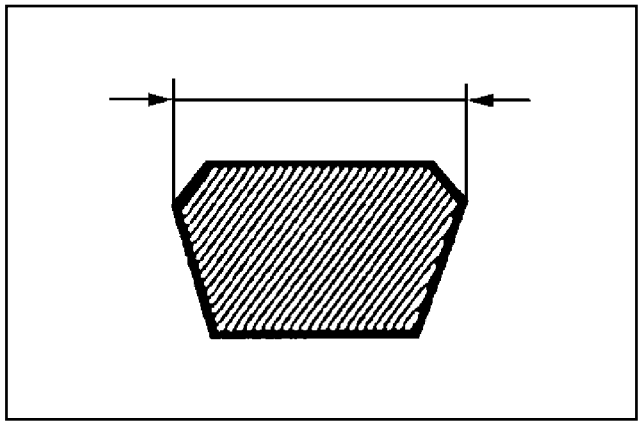


05_031

Driving belt

- Check that the driving belt is not damaged.
- Check the belt width.

Minimum width: 25 mm
Standard width: 26.2 mm

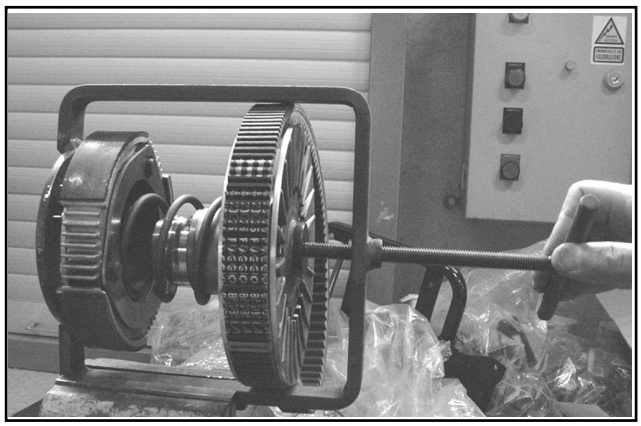


05_034

Clutch reassembly

- Prepare the specific tool as already done during the disassembly phase;
- Preassemble the driven pulley unit with the driving belt according to its direction of rotation.
- Insert the driven pulley unit, spring with sheath and clutch in the tool.

Specific tools:
Driven pulley spring compressor 020444Y
Adapter ring 020444Y010



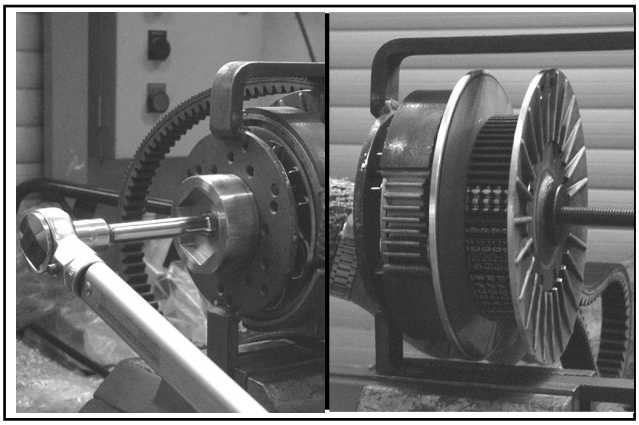
05_032

- Compress the spring and insert the clutch on the driven pulley bush.

N.B.: Take care not to damage the sheath or the bush threaded end.
- Screw the ring nut manually and then tighten it with the specific wrench to the prescribed torque.

Tightening torque:
Clutch ring nut: 65 - 75 N·m
Specific tool:
55 mm wrench: 020444Y009

- To facilitate the reassembly operation, turn the mobile driven pulley and fit the belt on the smaller diameter.



05_033

Mobile driving half pulley

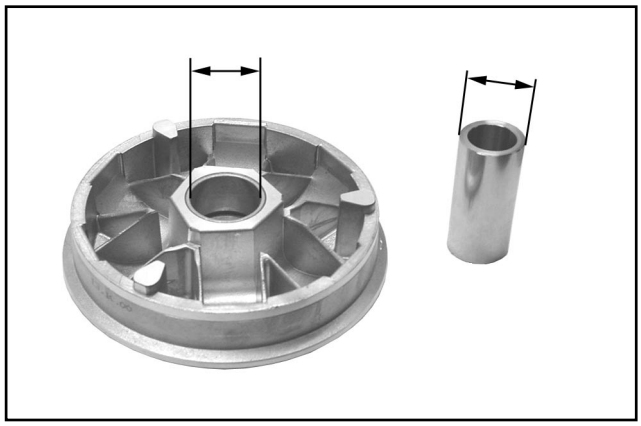
- Check that the internal bushes shown in the figure show no signs of anomalous wear. Measure the I.D.

Maximum allowed diameter: 30.12 mm
Standard diameter: 30.021 mm

Warning - Do not lubricate or clean the bushes.

- Measure the O.D. of the pulley sliding bush shown in the figure.

Minimum allowed diameter: Ø 29.95 mm
Standard diameter: Ø 29.959 mm

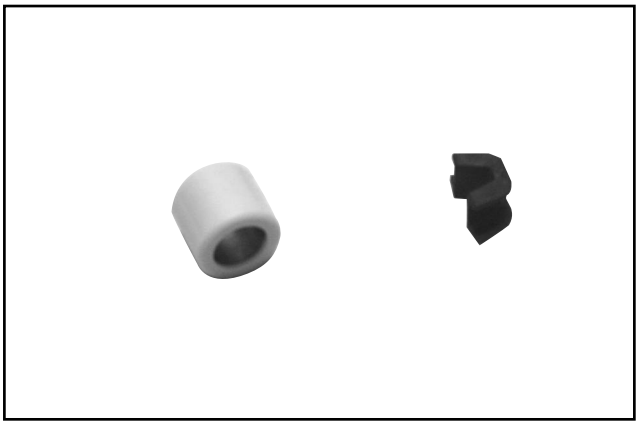


05_035

- Check that the rollers are not damaged or worn.

Minimum allowed diameter: Ø 24.5 mm
Standard diameter: Ø 24.9 mm

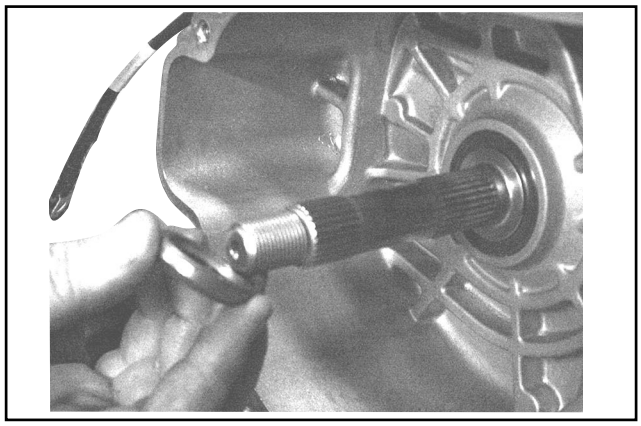
- Check that the shoes of the roller stop plate are not worn.
- Check the rollers housing and belt contact surfaces condition on both half pulleys.



05_036

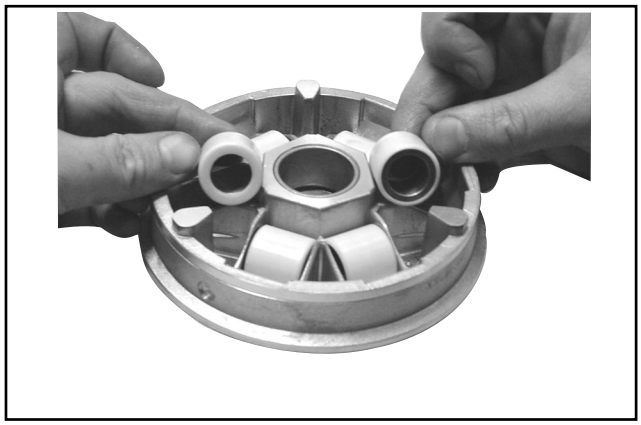
Rollers housing assembly

- Fit the spacer with the internal beveling facing the insertion side.



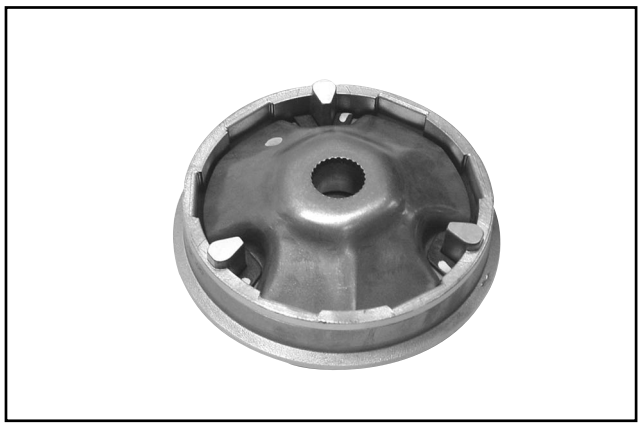
05_041

- Put the rollers in the half pulley as shown in the figure.
- The covered side must rest on the internal thrust side of the roller housing.



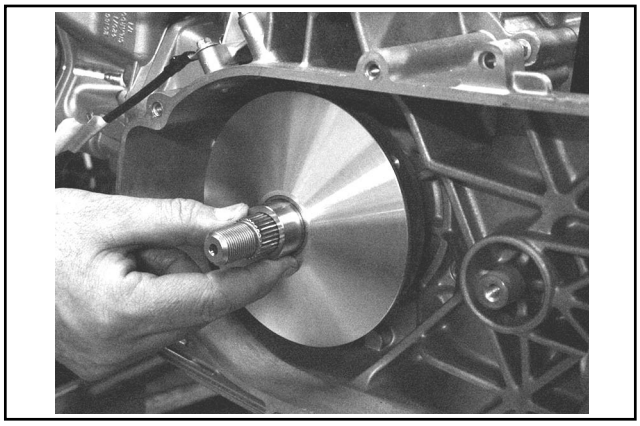
05_042

- Assemble the half pulley with the rollers stop plate and the sliding shoes.



05_043

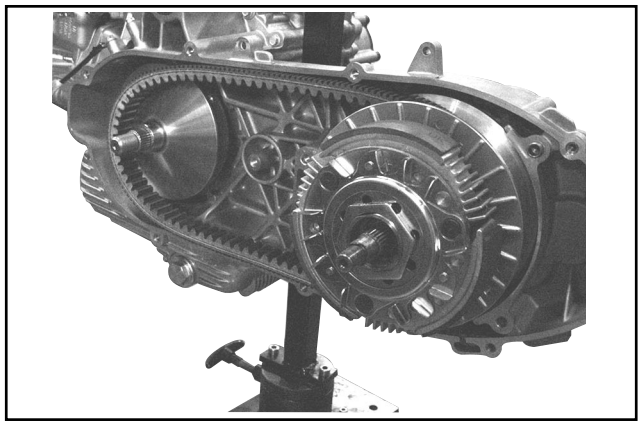
- Fit the half pulley on the driving shaft.
- Fit the spacer bush.



05_044

Driven pulley unit assembly

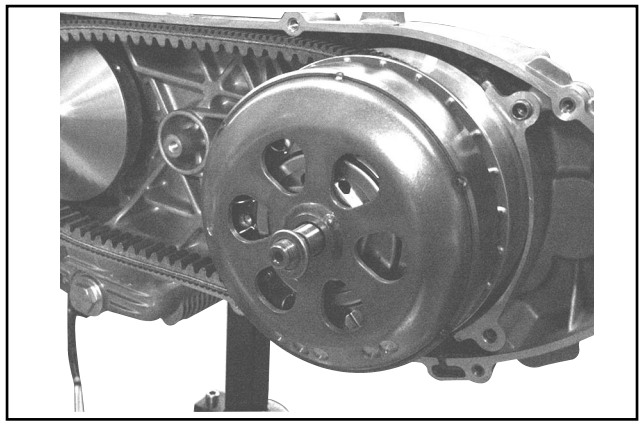
- Fit the driven pulley unit and relevant belt.



05_045

Housing assembly

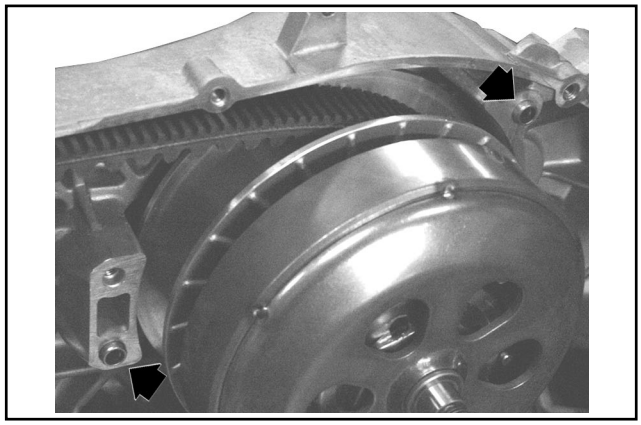
- Fit the housing and the spacer



05_046

Driven pulley axle support assembly

- Make sure the 2 centering dowels are properly fitted in the crankcase.



05_047

Driven pulley axle support bearings disassembly

- Check that the bearing turns freely. Replace the bearing if necessary.
- Remove the snap ring.

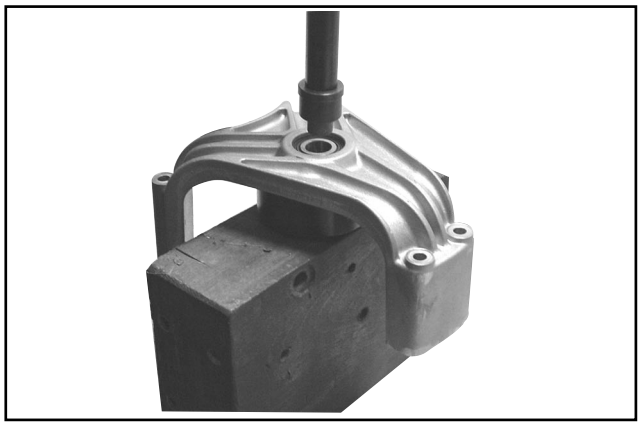
05_037

- Hold the driven pulley axle support by means of the specific tool 001467Y002.
- Remove the bearing by means of the specific tool.

N.B.: If the bearing decay has caused the external race to lose strength, replace the driven pulley axle support.

Specific tools:

Bell	**001467Y002**
Handle	**020376Y**
28x30 mm adapter	**020375Y**
17 mm guide	**020439Y**



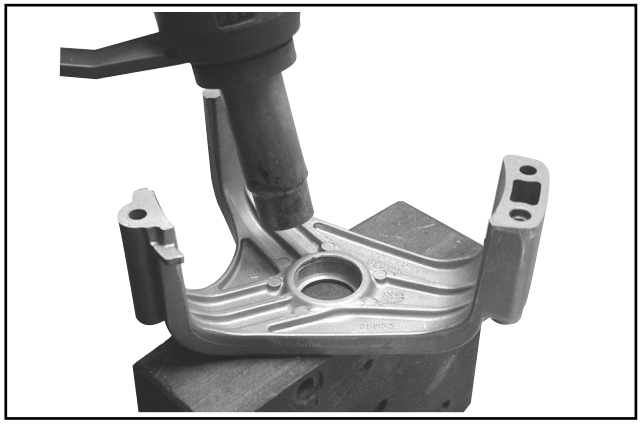
05_038

Driven pulley axle support bearing assembly

- Heat the driven pulley axle support with the thermal gun.

Specific tool:

Air heater	**020151Y**

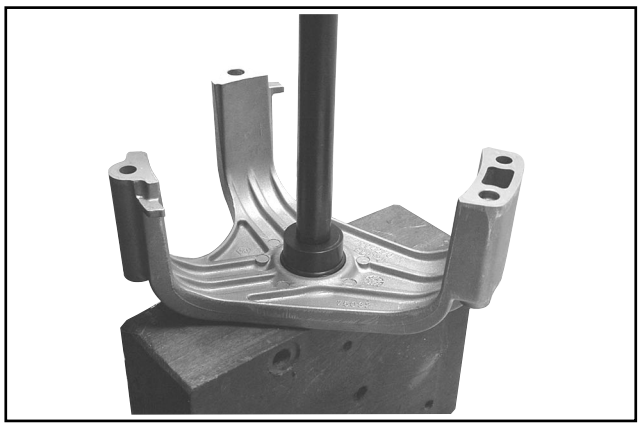


05_039

- Fit the bearing on the specific tool. Grease it to prevent it from coming out.
- Refit the new bearing by means of the specific tool.
- Refit the snap ring.

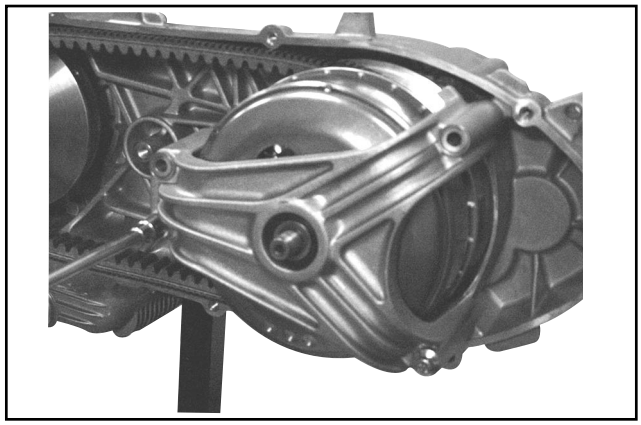
Specific tools:

Handle for drifts	**020376Y**
37x40 mm adapter	**020358Y**
17 mm guide	**020439Y**



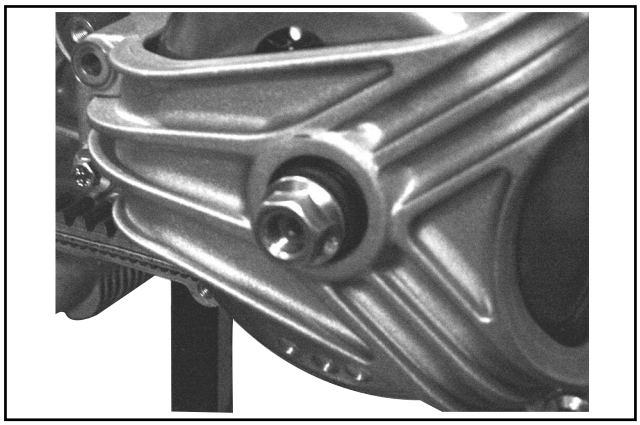
05_040

- Fit the driven pulley axle support and tighten the two lower screws.



05_048

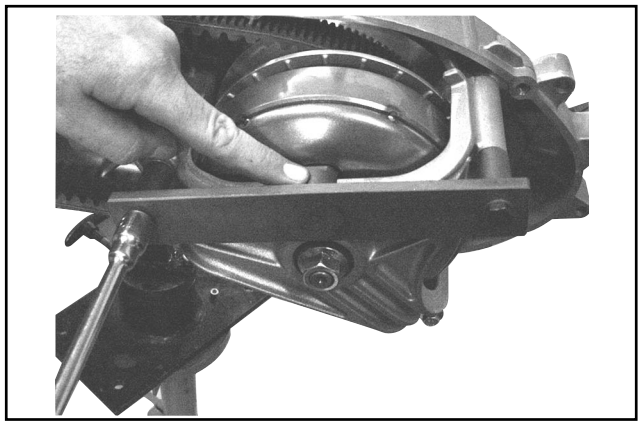
- Fit the washer and the nut.



05_049

- Insert the specific tool tooth in the hole on the housing.
- Tighten the 2 screws making sure that the catch is in contact with the driven pulley axle support.

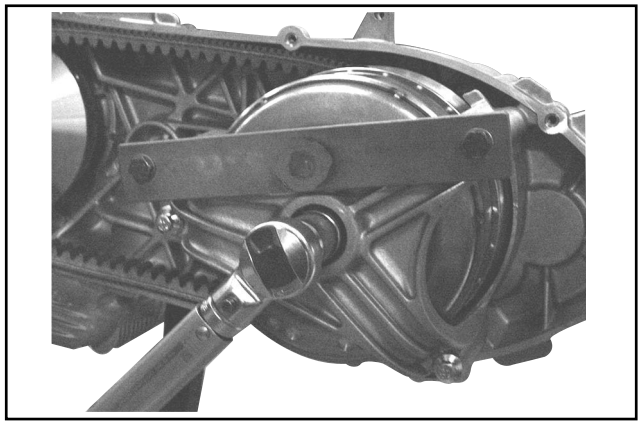
Specific tool:
Clutch housing lock tool 020473Y



05_050

- Tighten the housing fixing nut to the prescribed torque.

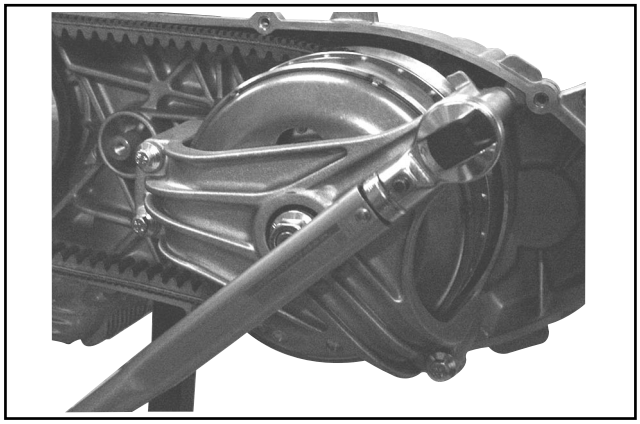
Tightening torque:
Driven pulley shaft nut: 90 - 92 N·m



05_051

- Remove the specific tool
- Insert the 2 remaining fixing screws of the driven pulley axle support and cross-tighten the 4 screws to the prescribed torque.

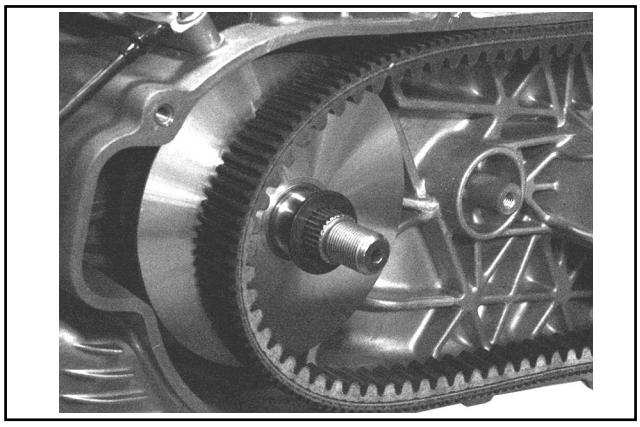
Tightening torque:
Driven pulley axle support fixing screws: 23 - 26 N·m



05_052

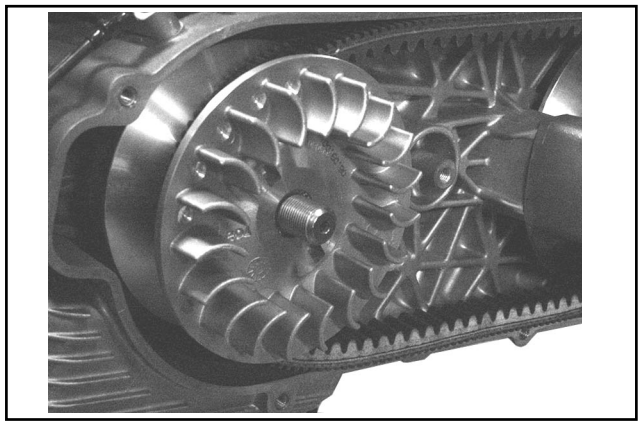
Fixed driving half pulley assembly

- Fit the spacer



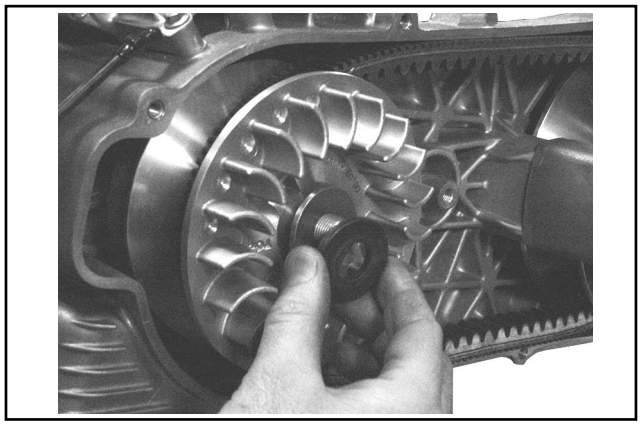
05_053

- Fit the fixed driving half pulley making sure it is in contact with the spacer and with the sliding bush of the mobile driving pulley



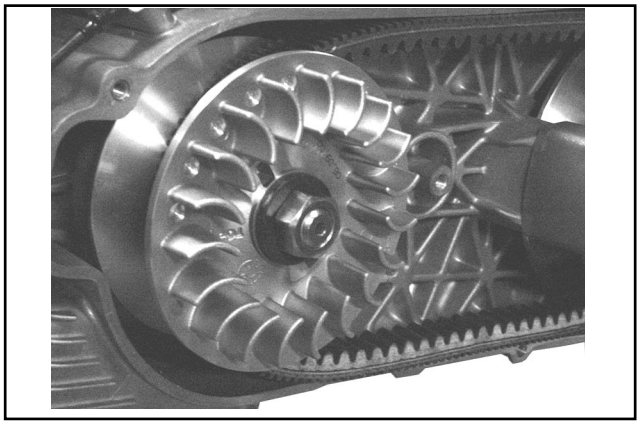
05_054

- Fit the plain washer and the cup washer as shown in the figure.



05_055

- Insert the nut in its previous position (nut side in contact with the cup washer).

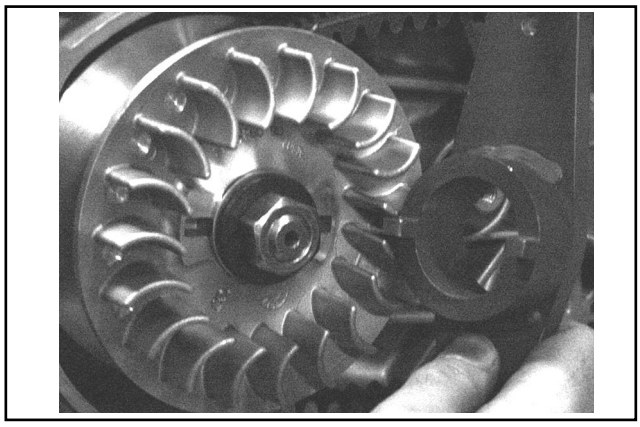


05_056

- Turn the pulley central nut aligning its holes horizontally to be able to install the specific tool.

N.B.: Make sure that the lock wrench fits easily in the pulley and engine crankcase.

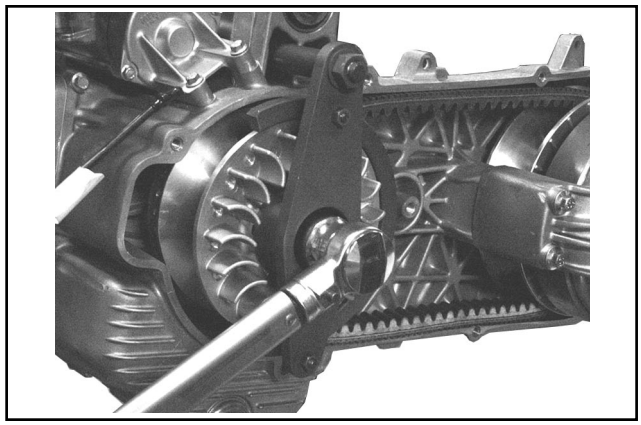
Specific tool:
Driving pulley lock wrench 020474Y



05_009

- Fully insert the stop ring from the rear side.
- Fit the tool by drawing the nuts near manually and making sure it is on a flat surface.
- Tighten the driving pulley fixing nut to the prescribed torque.
- Remove the specific tool.

Tightening torque:
Driving pulley nut: 157 - 172 N·m



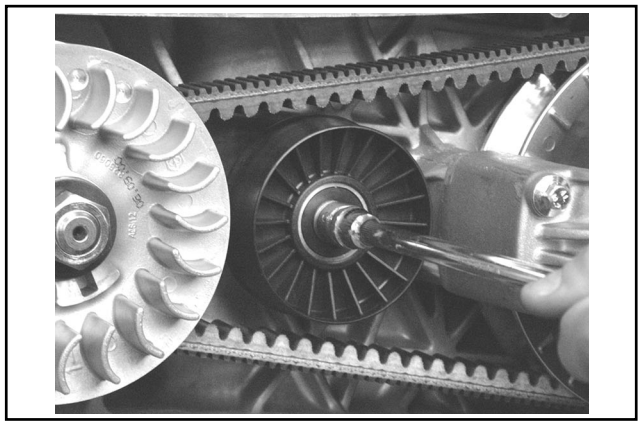
05_010

Belt antiflapping roller assembly

- Fit the belt antiflapping roller with the belt containment edge to the engine crankcase side.
- Tighten the central screw to the prescribed torque.

N.B.: Turn the driven pulley and/or the driving pulley until the belt is properly tensioned.

Tightening torque:
Antiflapping roller screw: 16.7 - 19.6 N·m



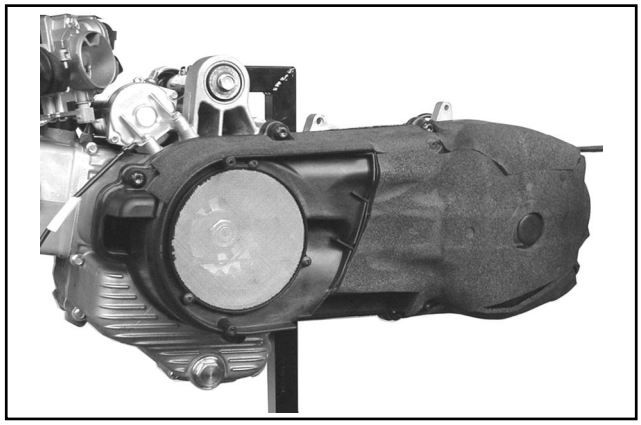
05_008

Transmission cover

N.B.: Check the transmission air filter metal net condition. If damaged, replace it. If necessary, clean it by blowing compressed air.

- Fit the transmission cover.
- Fully tighten the 7 fixing screws to the prescribed torque.

Tightening torque:
Transmission cover screws: 10.8 - 12.8 N·m

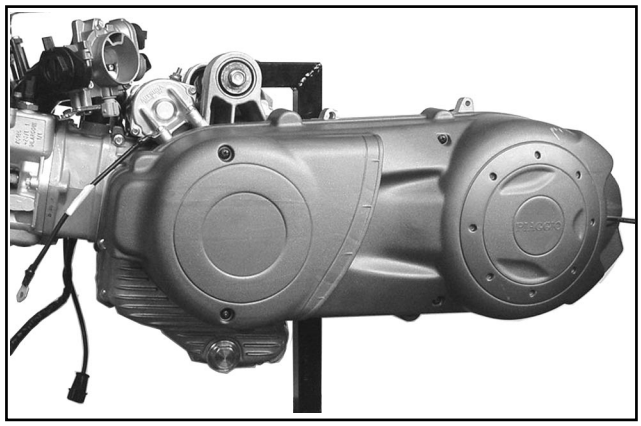


05_007

External transmission cover

N.B.: Make sure that the air intake and the three air outlets are completely free.

- Fit the plastic external transmission cover;
- Tighten the 5 fixing screws to the prescribed torque.



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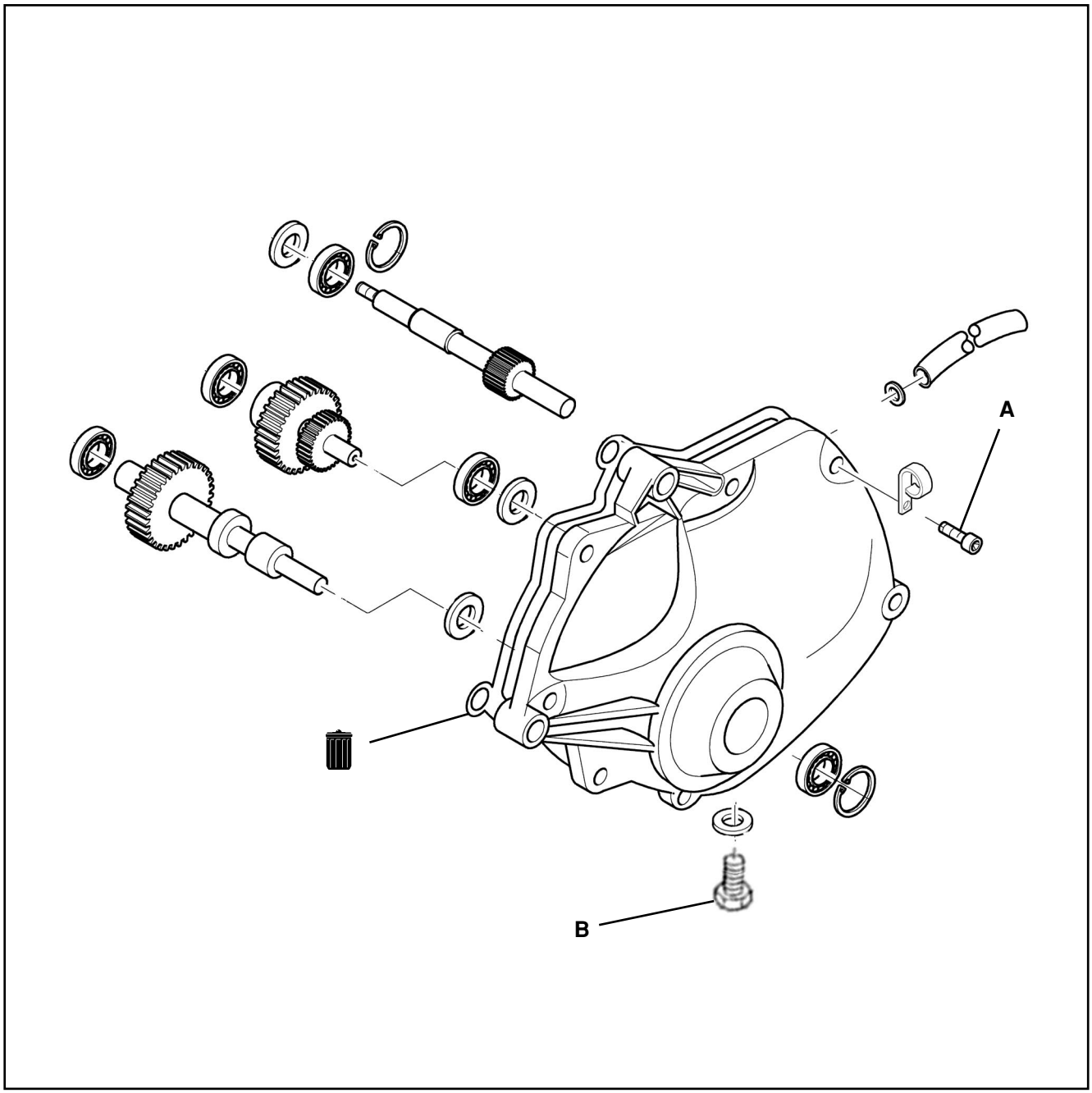
FINAL REDUCTION



LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

LUBRICATE WITH GREASE

CLEAN WITH CARE

ALWAYS REPLACE

REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	6	1													
TORQUE N·m	24-27	15-17													

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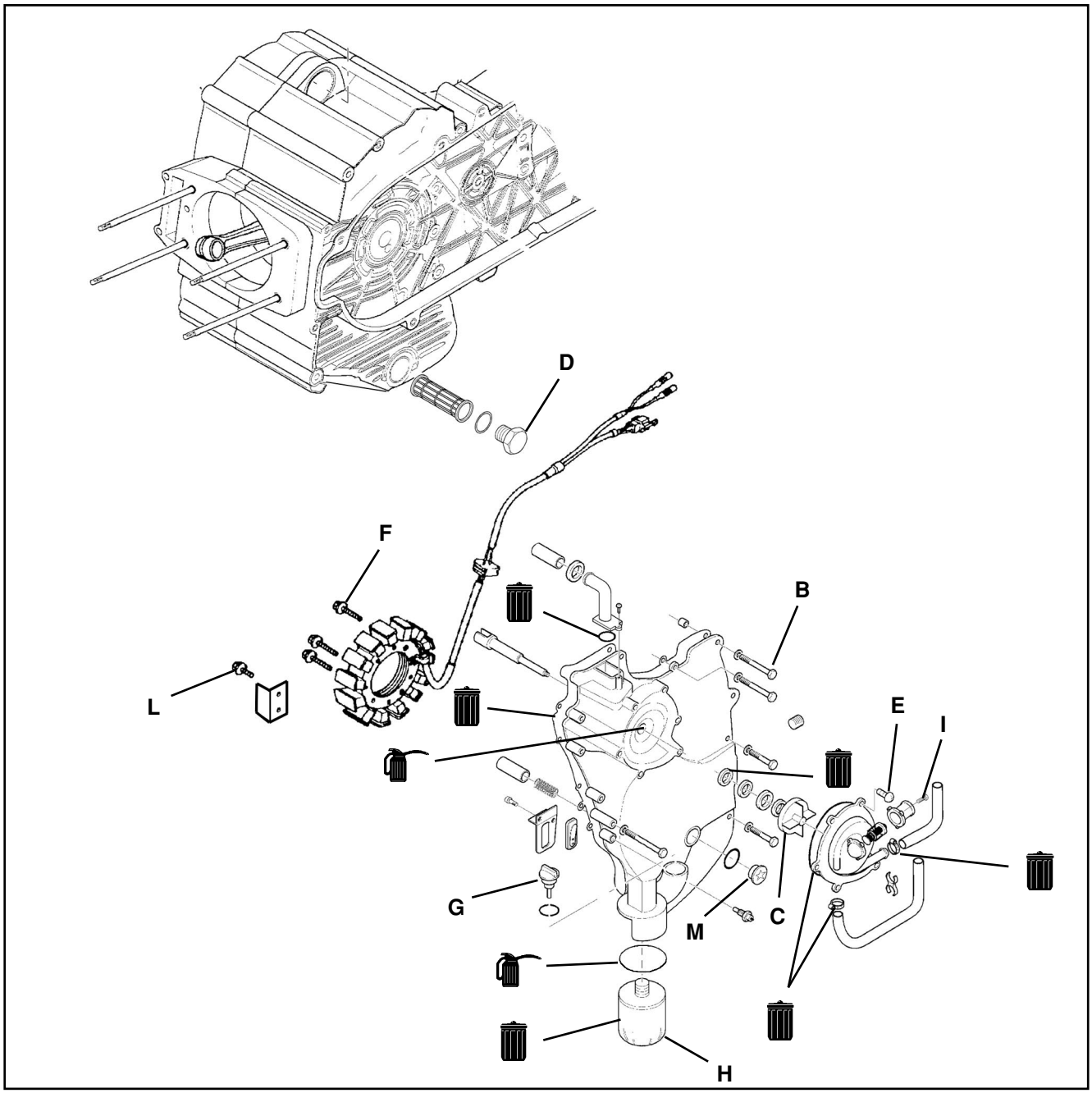
FLYWHEEL COVER 5

FLYWHEEL COVER



LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

LUBRICATE WITH GREASE

CLEAN WITH CARE

ALWAYS REPLACE

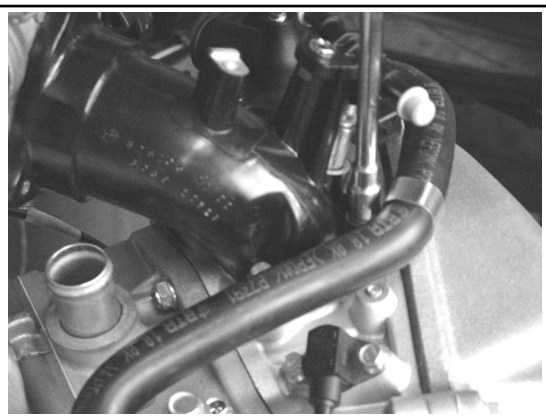
REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	6	14	1	1	6	3	1	1	2	2	1				
TORQUE N·m	3-4	11-13	4-5	24-30	3-4	8-10	1.5-2.5	12-16	1.5-2	3-4	3.5-4.5				

- Disassemble the flywheel cover by removing the 2 cooling system sleeves
- Remove the 4 clamps shown in the figure

N.B.: The clamps must be replaced. Remove the clamps by opening them with a screwdriver or by cutting them. Take care not to damage the plastic unions

05_081

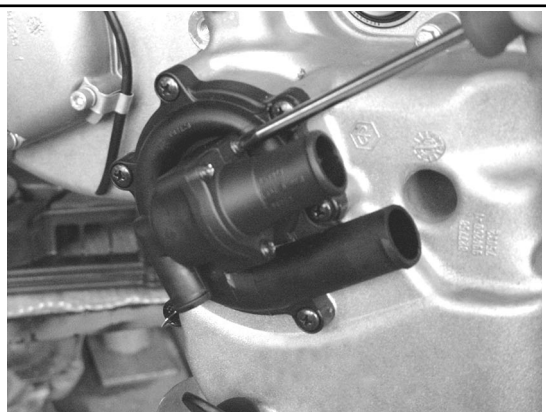
- Remove the cooling tube bracket from the manifold fixing.



05_082

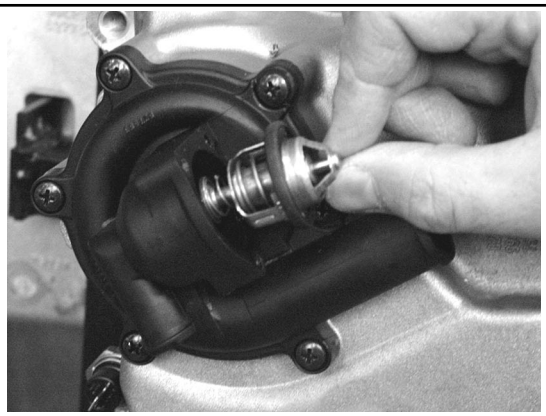
Thermostat cover disassembly

- Unloose the 3 fixing screws and remove the thermostat cover.



05_083

- Remove the thermostat.

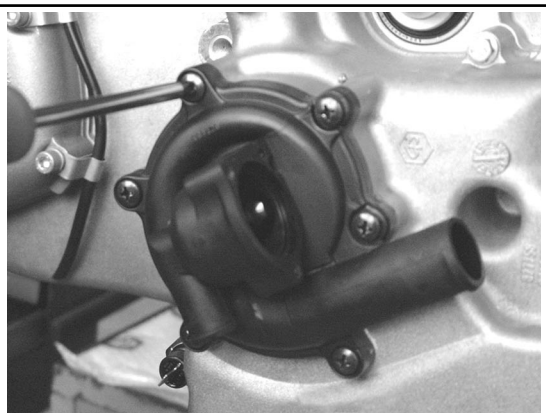


05_084

Water pump cover disassembly

- Unloose the 6 fixing screws and remove the water pump cover and relevant O ring.

N.B.: If necessary, disassemble the pump cover complete with thermostat and sleeves.



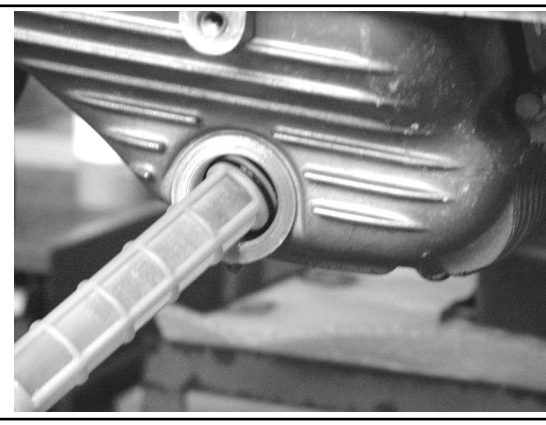
05_085

Flywheel cover disassembly

- Drain the engine oil by removing the drain plug.
- Collect the oil in a suitable container.

05_086

- Remove the prefilter.



05_087

- Remove the oil filter by means of a suitable wrench.

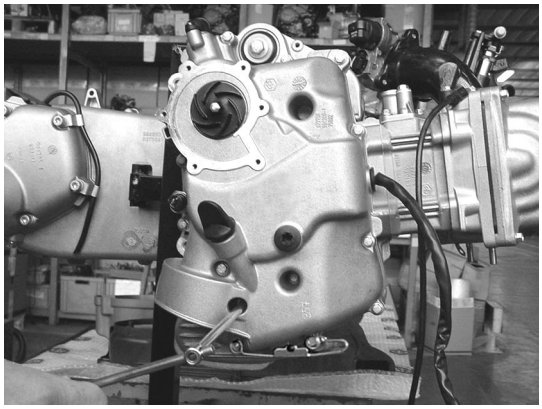
05_088

- Unloose the 14 fixing screws.
- Remove the flywheel cover and relevant gasket, and the stand stop bracket..

N.B.: Screws come supplied in 3 different lengths plus 2 for the stand stop. Take note of their positions.

Warning - Avoid any interferences between the stator and rotor while removing the cover.

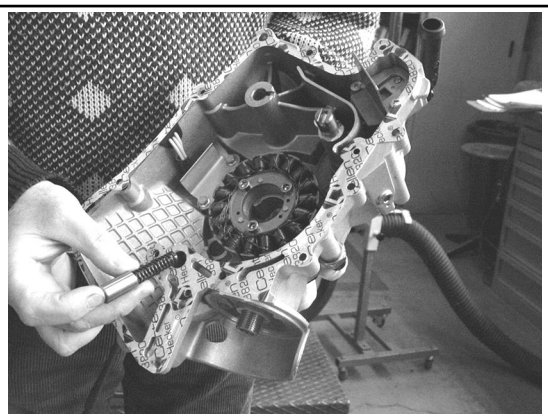
Warning - Do not drop the bypass valve and relevant spring.



05_089

Flywheel cover components disassembly

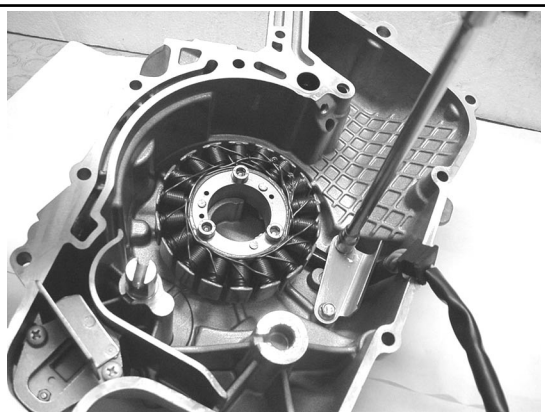
- Remove the bypass and relevant spring.
- Remove the seal gasket



05_090

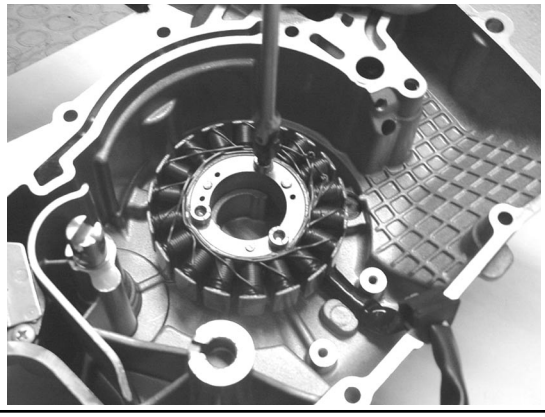
Stator

- Remove the 2 fixing screws and the harness guide bracket.



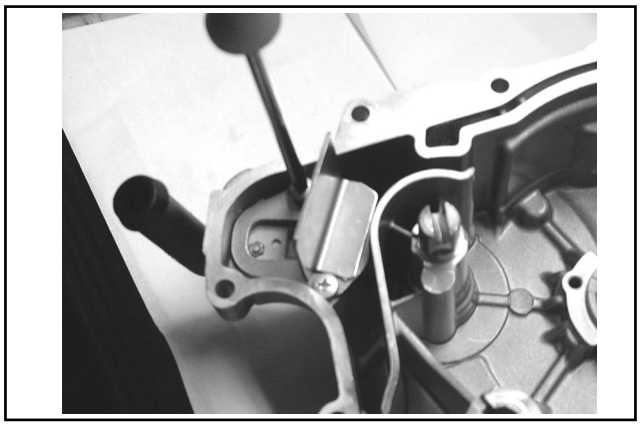
05_091

- Unloose the 3 fixing screws and remove the stator complete with the harness.



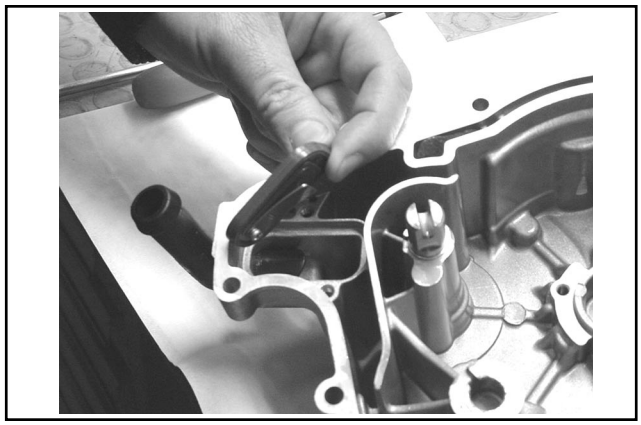
05_092

- Unloose the 2 fixing screws and remove the support of the reed valve with gate.



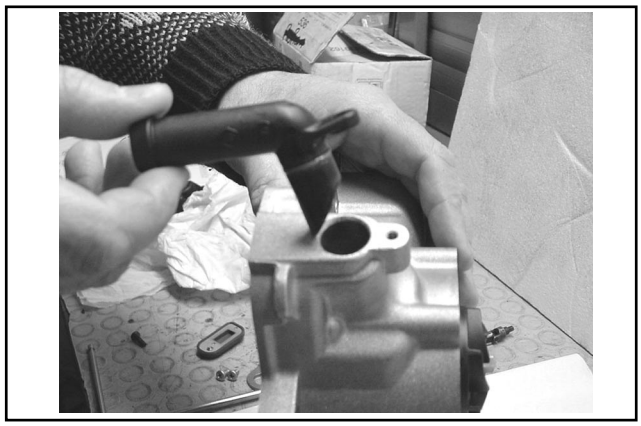
05_093

- Remove the blow-by reed valve and relevant seal gasket



05_094

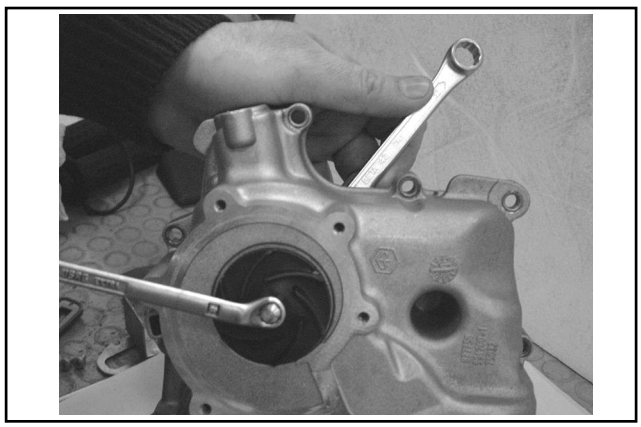
- Unloose the fixing screw and remove the gas outlet pipe and relevant O-ring



05_095

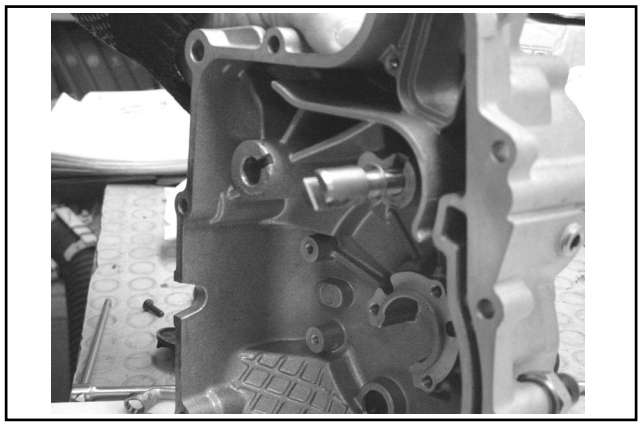
- Remove the water pump rotor by unscrewing it from its shaft.

N.B.: The threading goes in the r.h. direction. Prevent the shaft from turning by inserting a 12 mm wrench in the drive.



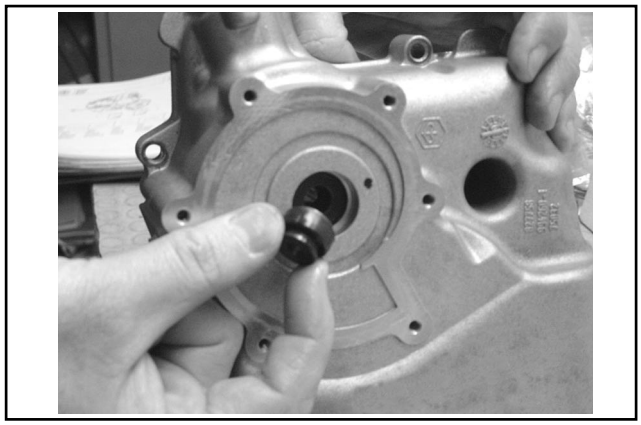
05_096

- Remove the shaft and relevant stop washer.



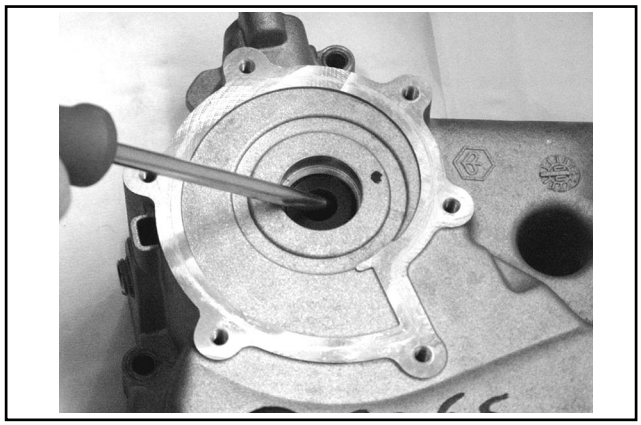
05_097

- Remove the O-ring



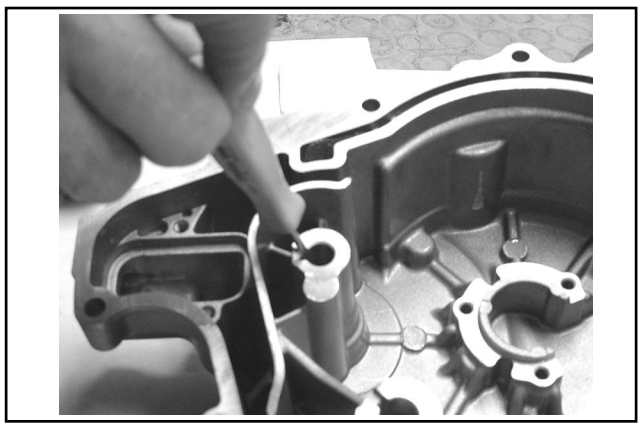
05_098

- Remove the ceramic ring and relevant gasket.



05_099

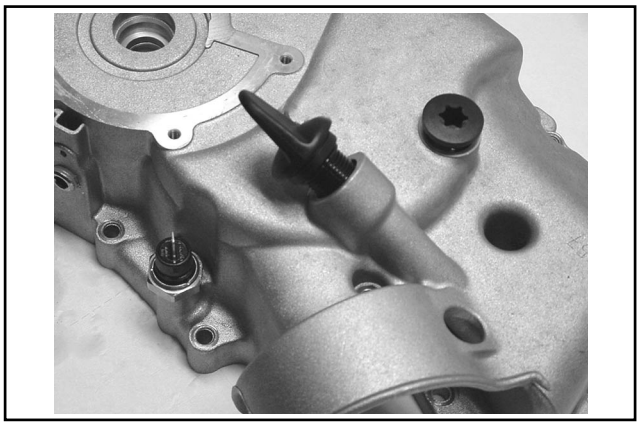
- Remove the O ring for the pump shaft lubrication by means of a properly shaped tool.



05_100

Flywheel cover

- Remove the engine oil dipstick and the plug of the valve gear timing reference hole
- Remove the oil minimum pressure sensor.

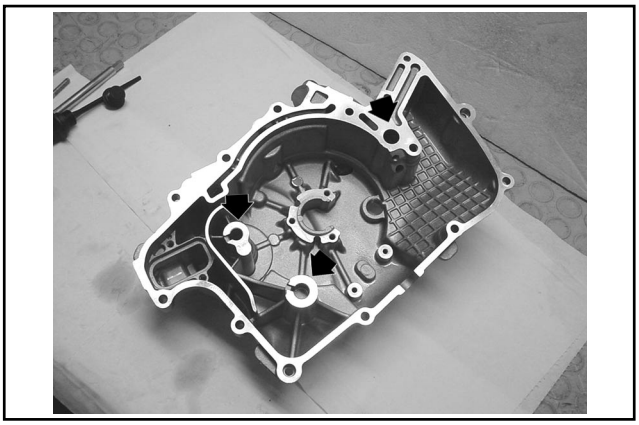


05_101

Checking the cover case components
Cover case

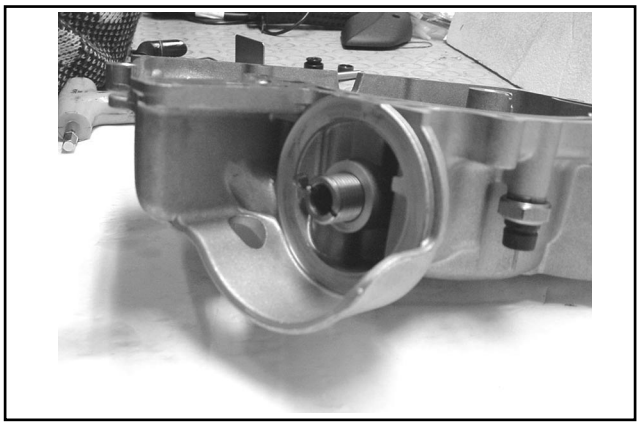
- Check that the case coupling surface shows no signs of wear or deformation.
- Check that the bypass valve seat, torque limiter support and water pump shaft support show no signs of wear

Bypass housing hole diameter: 13.9 mm
Diameter of starting gear shaft support: 12 mm
Diameter of pump shaft support: 8 mm



05_102

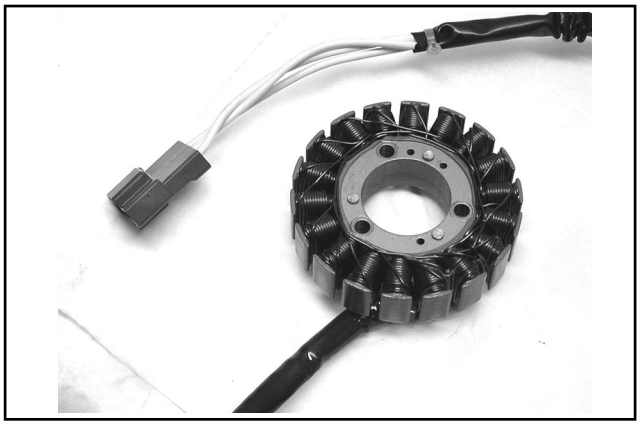
- Check that the coupling surface and the oil filter pipe show no signs of wear or deformation.



05_103

Stator

- Check the stator and relevant harness condition.

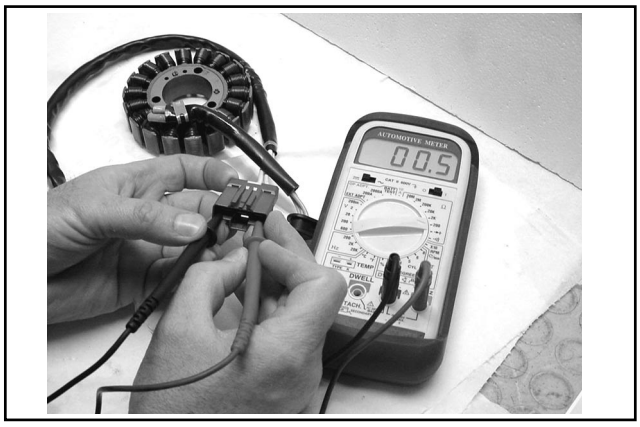


05_104

- Check the 3 phases continuity.

N.B.: The indicated values have been measured at ambient temperature. Higher values will be measured with stator at operative temperative.

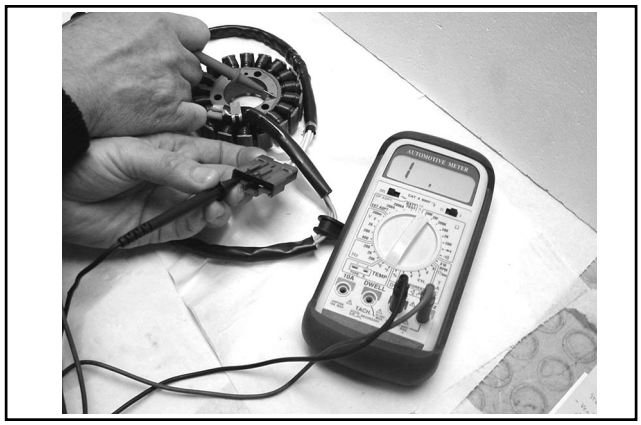
Approximate resistance of each phase: 0.2 - 1 Ω



05_105

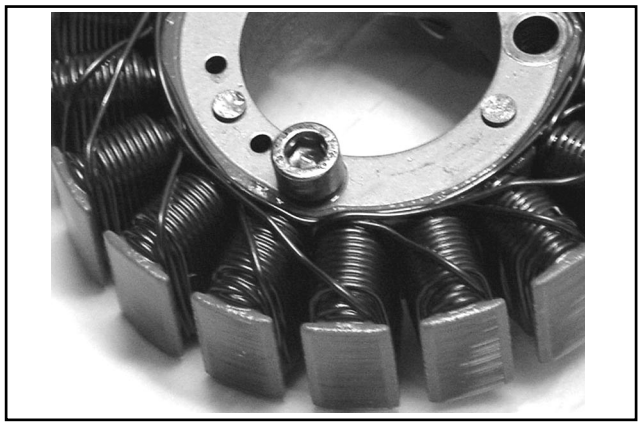
- Check the earth insulation of each phase.

- If troubles are noticed, remember to carefully check the harness as this is realized with 2 types of cables: stiff cables near the stator, and soft cables near the connector.



05_106

- Check that the winding does not interfere with the fixing screw heads.



05_107

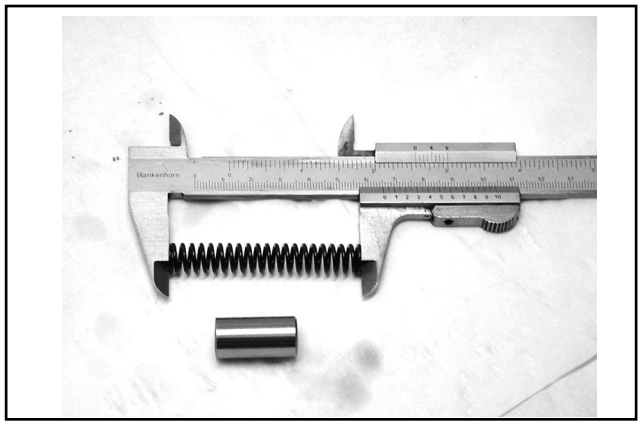
Bypass piston and spring

- Check that the bypass outside diameter shows no signs of damage or scoring.

Outside diameter: 10.5 mm

- Check the spring free length.

Standard length: 65.2 mm
Limit length after use: 64.0 mm

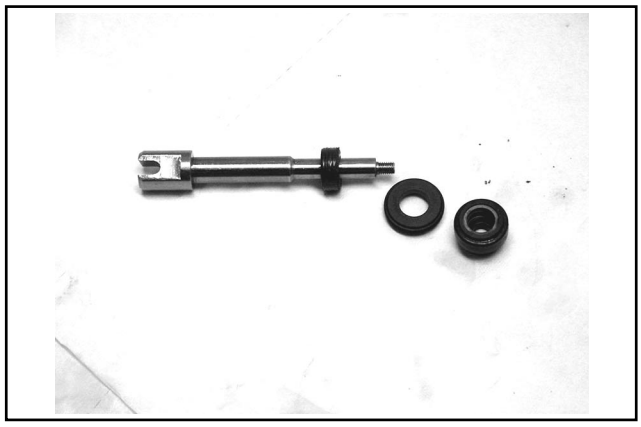


05_108

Water pump shaft

- Check that the water pump shaft shows no signs of wear on the part in contact with the case, in the oil seal working area, and on the drive.

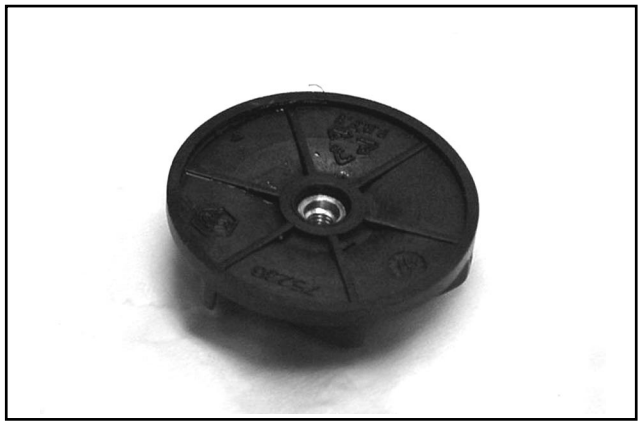
- Check that the ceramic seal working areas are not scored or worn.



05_109

Water pump rotor

- Check that the rotor is not deformed or cracked.
- Check that the plastic rotor is perfectly integral with the metal part.



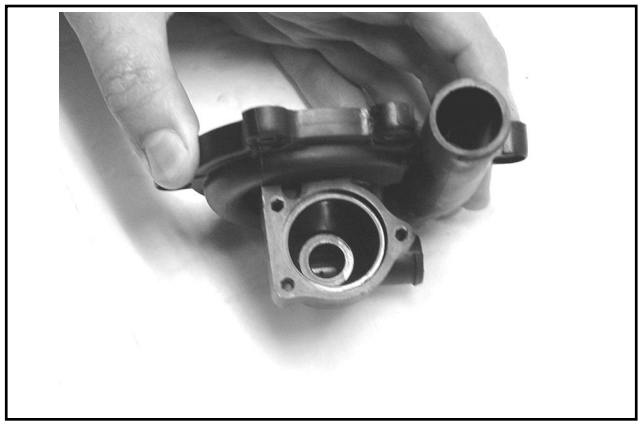
05_110

Checking the water pump cover

- Check that the water pump cover is not deformed or cracked.
- Check the O ring condition.

05_111

- Check that the coupling surfaces of the thermostat cover and the cooling bypass lock slot are not worn or cracked.



05_112

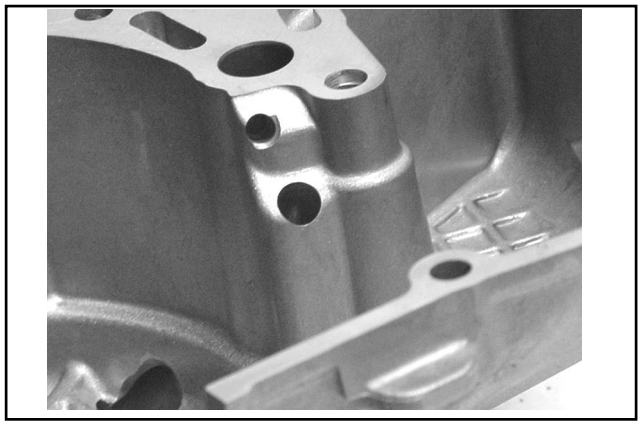
Reed valve

- Check that the blow-by circuit reed closes correctly.

05_113

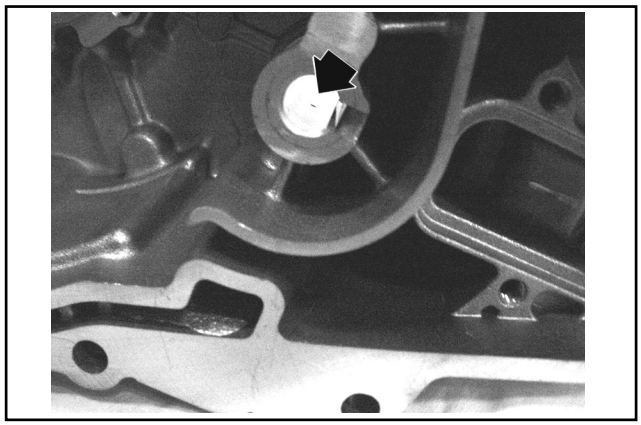
Assembling the flywheel cover components

- Make sure that all the components are well clean before reassembling them.
- Carefully check all the cover case lubrication ducts, in particular:
- The 3 bypass channels.



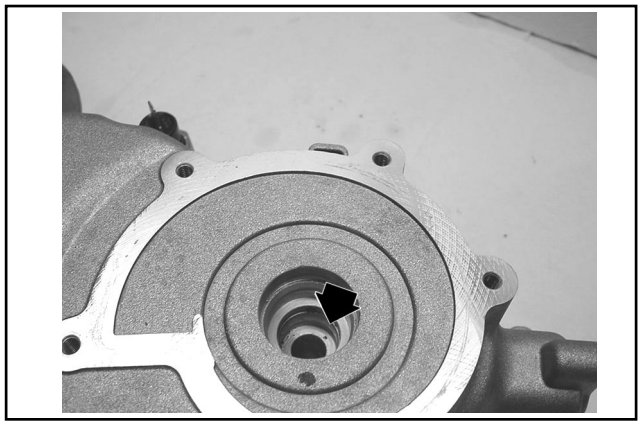
05_114

- Oil supply duct to water pump shaft support.



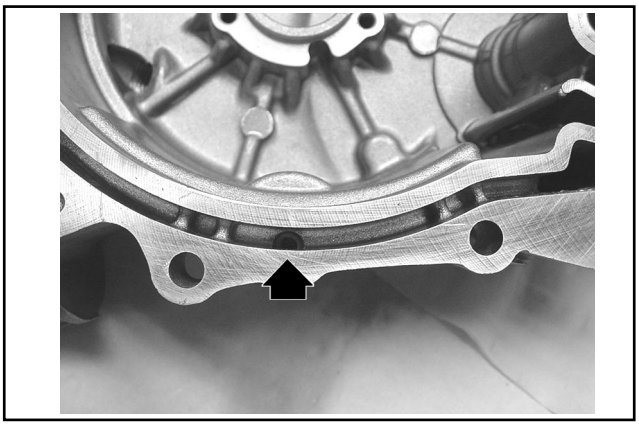
05_115

- Pump draining duct.



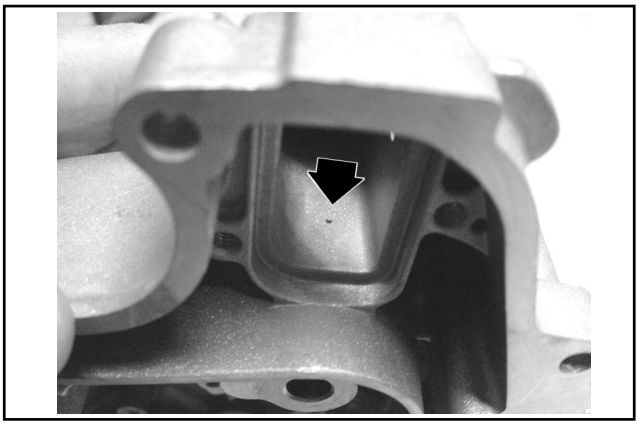
05_116

- Oil pressure sensor supply duct



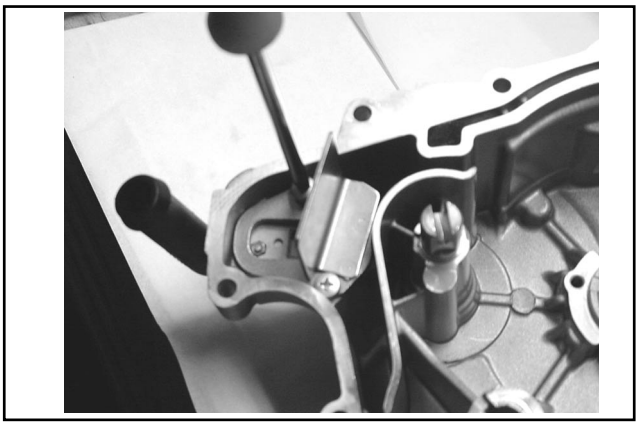
05_117

- Oil vapors decantation chamber exhaust.



05_118

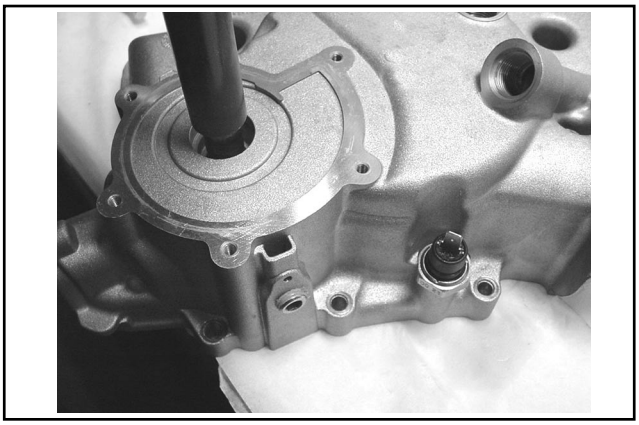
- Refit the blowby reed valve with a new seal gasket.
- Refit the support with gate and tighten the screws to the prescribed torque.



05_093

Tightening torque:
Support screws: 0.3 - 0.4 N·m

- Fit a new pump shaft O ring by means of the specific tool.
- Fit the oil minimum pressure sensor and tighten it to the presrcibed torque.



05_119

Tightening torque:
Oil minimum pressure sensor: 4 - 5 N·m

Specific tools:

Handle	**020376Y**
15 mm guide	**020412Y**

- Preassemble the ceramic seal and relevant gasket.

N.B.: The bevel must face the gasket. Take care not to dirty the ceramic ring with oil or grease in order not to compromise the seal.

05_120

- Fit the ceramic seal on the flywheel cover.

N.B.: Assemble the seal by hand to avoid damaging it.

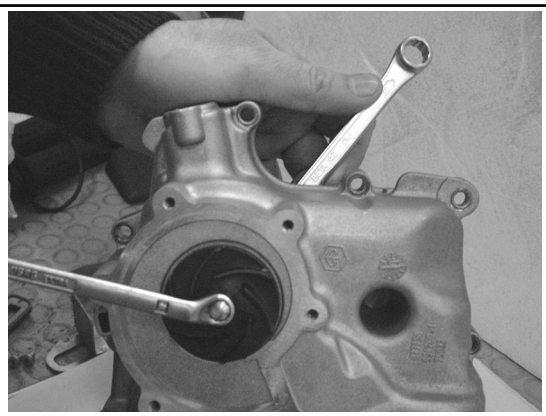
- Fit the water pump shaft after lubricating the seat on the flywheel cover.
- Fit the mechanical seal on the shaft aligning it with the rotor stop surface.

N.B.: The depth of the final fitting depends on the rotor.

05_121

- Screw the rotor and lock it to the prescribed torque.

Tightening torque:
Water pump rotor: 4 - 5 N·m



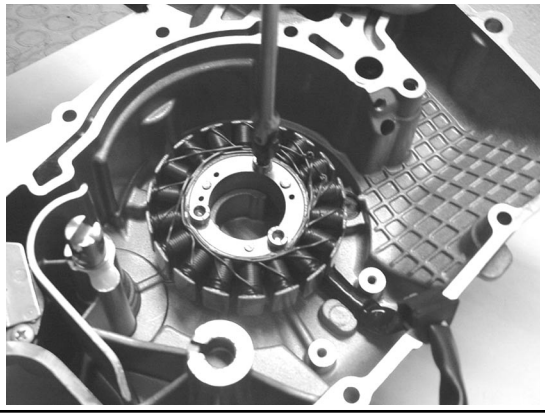
05_096

Stator assembly

- Fit the stator and relevant harness. Tighten the 3 screws to the prescribed torque.

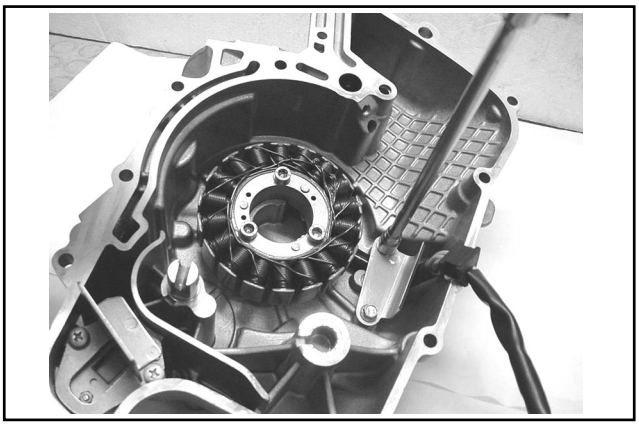
N.B.: Fit the harness rubber seal in the relevant seat on the crankcase.

Tightening torque:
Stator fixing screws: 8 - 10 N·m



05_092

- Fit the harness guide and tighten the 2 screws to the prescribed torque.



05_091

Tightening torque:
Harness guide fixing screws: 3 - 4 N·m

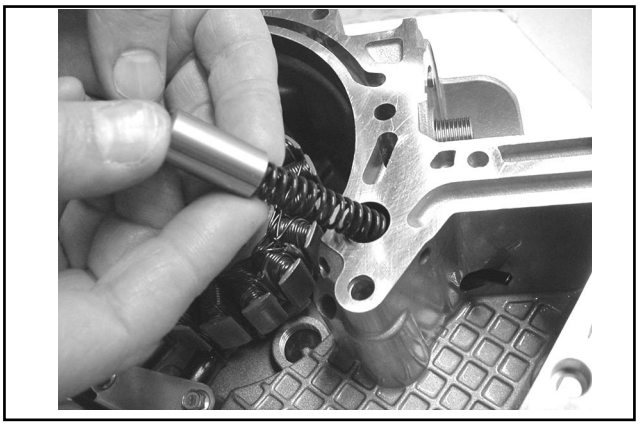
- Temporarily fit the valve timing control hole plug and the engine oil dipstick
- Fit the blow-by recovery duct with a new O ring.
- Tighten the screw to the prescribed torque.

05_122

Tightening torque:
Blow-by recovery duct fixing screws: 3 - 4 N·m

- Fit the spring and the bypass piston on the flywheel cover.

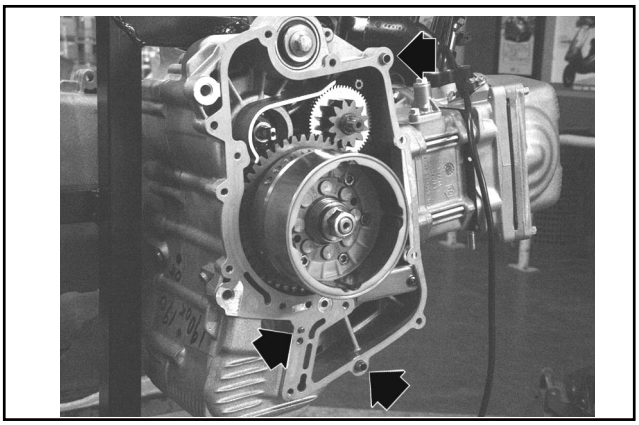
N.B.: Lubricate the bypass valve.



05_123

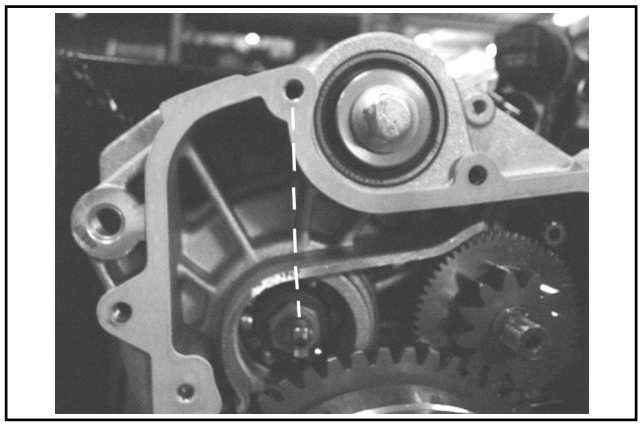
Flywheel cover assembly on the engine

- Fit a new gasket on the engine crankcase
- Make sure the 3 centering dowels are there.



05_124

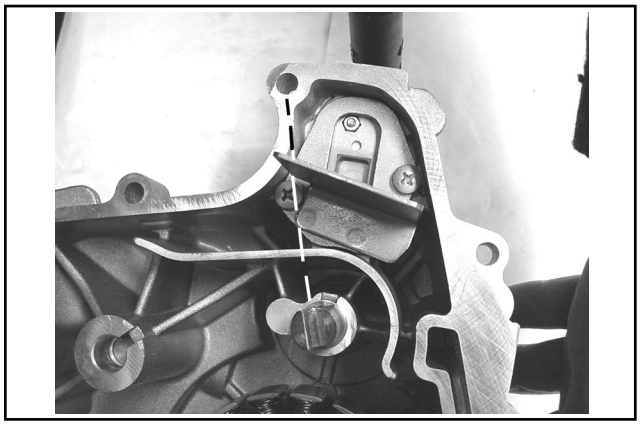
- Turn the driving shaft as to align the countershaft drive with a reference mark on the crankcase (see figure)



05_125

- Align the water pump shaft with the same reference on the cover.

N.B.: This is useful especially in case of interventions with the water pump cover assembled.



05_126

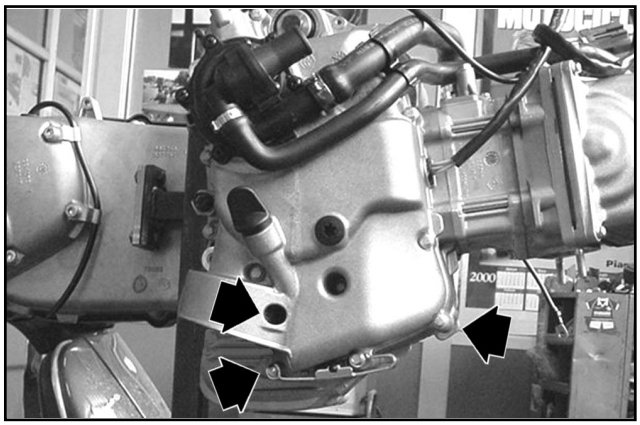
- Fit the flywheel cover on the engine. Avoid any interferences between the stator and the rotor.

Warning - Failure to observe the above procedure may cause the ceramic magnetos breaking.

- Refit the stand stop.
- Tighten the 14 fixing screws of the cover to the prescribed torque.

N.B.: The screws come supplied in three different lengths: the 5 shorter screws are located in the position shown in the figure, and the longer screw is situated under the engine oil filler plug.

Tightening torque:
Flywheel cover fixing screws: 11 - 13 N·m



05_127

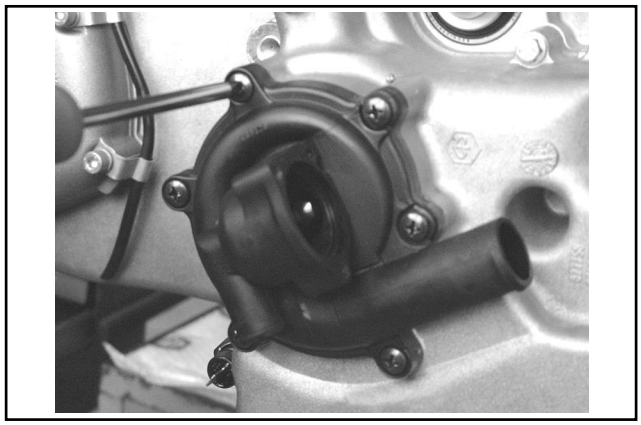
Water pump cover assembly

- Carefully fit a new O ring preventing it from coming into contact with grease or oil.

Warning - Failure to observe this procedure may cause the O ring buckling.

- Refit the water pump cover. Tighten the 6 fixing screws to the prescribed torque.

Tightening torque:
Flywheel cover fixing screws: 3 - 4 N·m

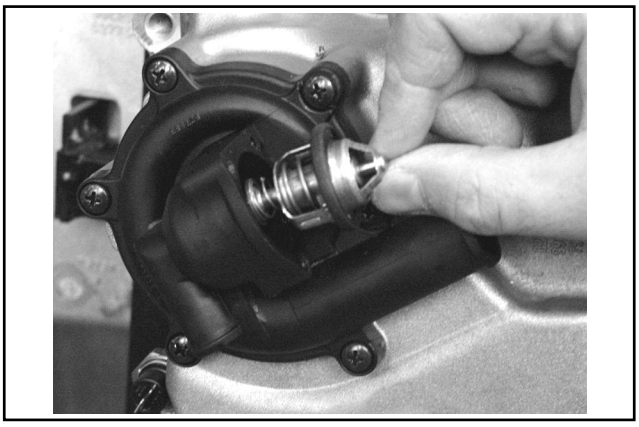


05_085

Thermostat cover assembly

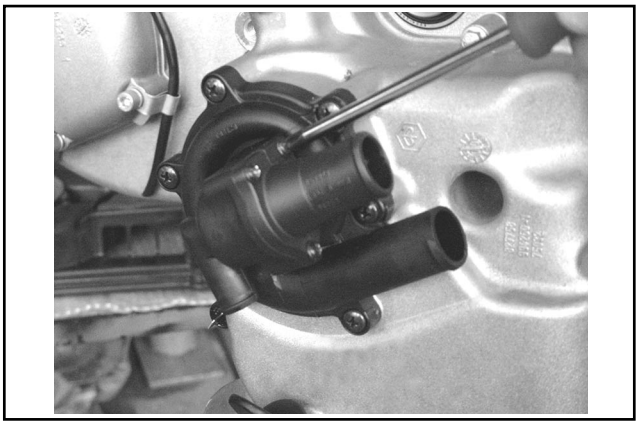
- Refit the thermostat

N.B.: Check the thermostat as described in Chapter 9-Cooling. The thermostat seal provides for the sealing to the outside and for the internal sealing with the thermostat closed.



05_084

- Assemble the thermostat cover. Tighten the 3 fixing screws to the prescribed torque.



05_083

Tightening torque:
Thermostat cover fixing screws: 1.5 - 2 N·m

- Fit a new oil filter, lubricate the seal, tighten to the prescribed torque.

05_088

Tightening torque:
Oil filter: 12 - 16 N·m

- Assemble the two cooling system sleeves using 4 new clamps.
- Fit the supporting bracket. Tighten the intake manifold fixing screw to the prescribed torque.

N.B.: Lock the clamps by means of suitable pliers. Take care not to dent the tubes. Arrange for proper tightening making sure it is not insufficient.

05_081

Tightening torque:
Intake manifold screws: 11 - 13 N·m

- Reassemble the prefilter and the engine oil drain plug. Tighten it to the prescribed torque.
- Refill the engine with oil of the recommended type.

05_086

Tightening torque:
Oil drain plug: 24 - 30 N·m

Recommended oil: Selenia HI Scooter 4 Tech 5W/40

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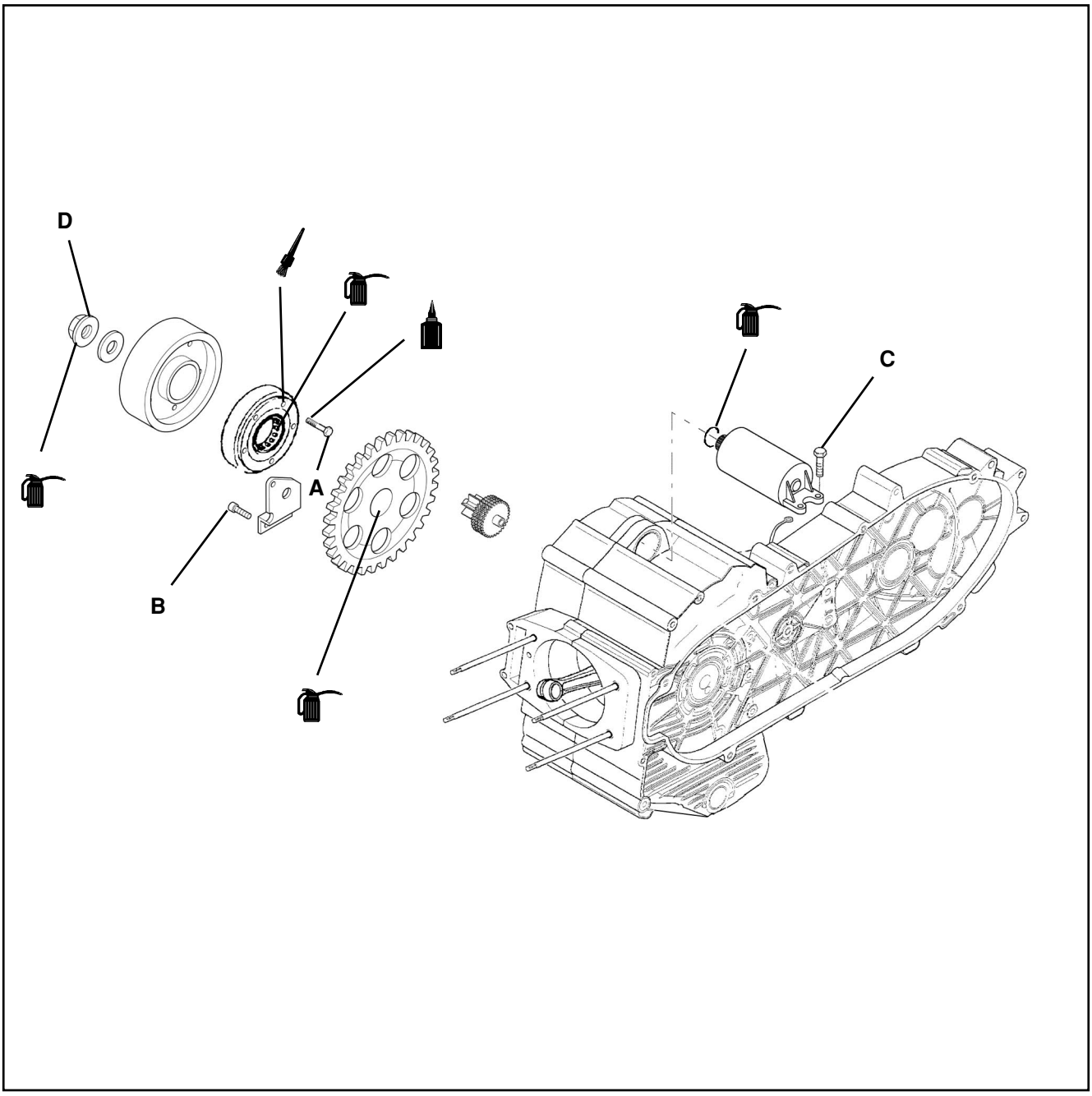


LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

LUBRICATE WITH GREASE

CLEAN WITH CARE

ALWAYS REPLACE

REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	6	3	2	1											
TORQUE N·m	13-15	3-4	11-13	115-125											

Flywheel cover disassembly

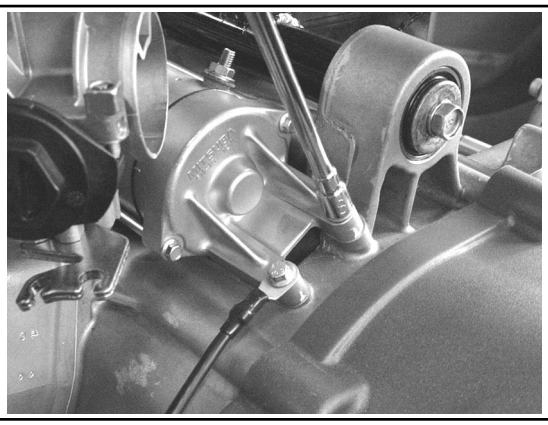
- Remove the cooling system sleeves and the flywheel cover as described in Chapter 5-Flywheel Cover.

05_081

Starting motor disassembly

N.B.: This operation can also be performed with the flywheel cover assembled.

- Unloose the two fixing screws and remove the engine earth cable.
- Remove the starting motor assembly.

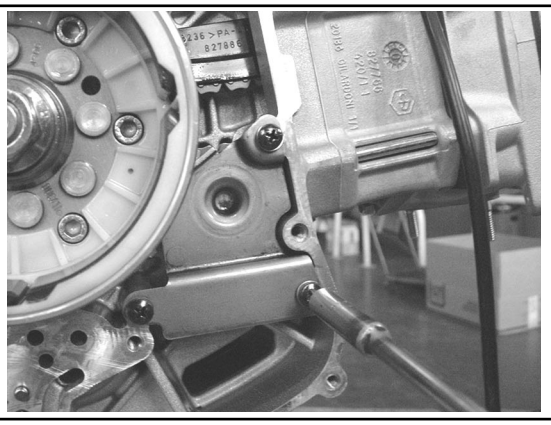


05_128

Magneto flywheel disassembly

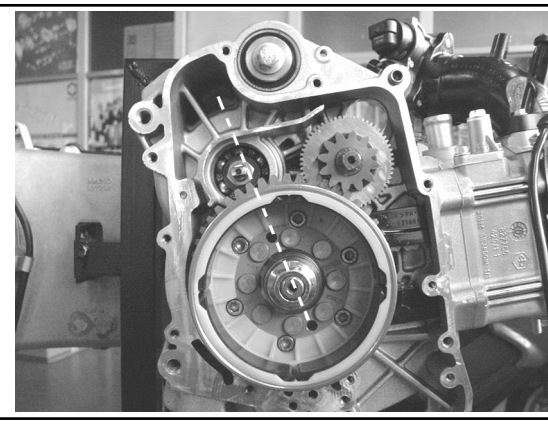
N.B.: To disassemble the magneto flywheel, first remove the chain guide shoe stop plate

- Unloose the 3 fixing screws, remove the chain guide shoe stop plate and the starting ring gear.



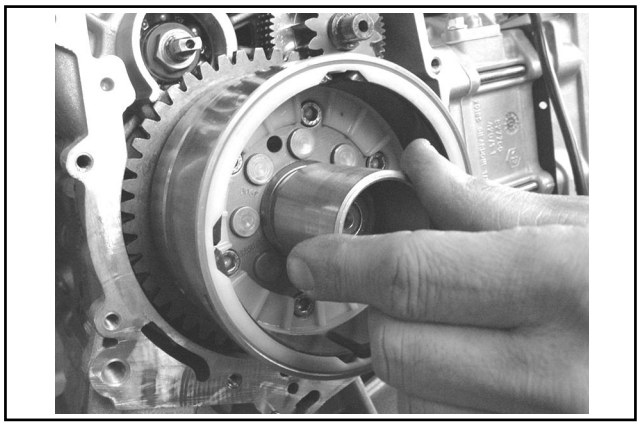
05_129

- Align the two holes on the flywheel with the housing on the crankcase to be able to fit the specific tool.



05_130

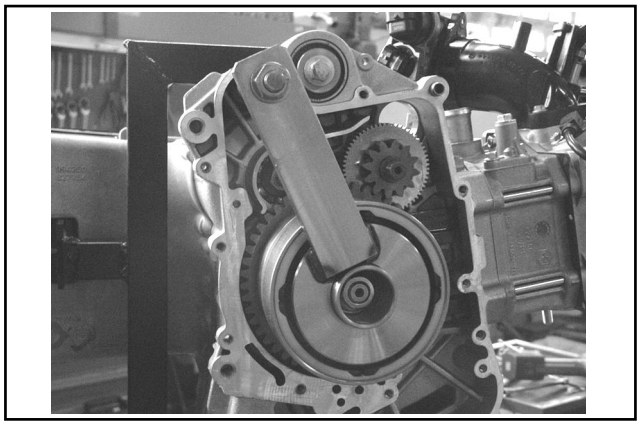
- Screw the flywheel lock tool bush on the threading intended for the extractor.



05_131

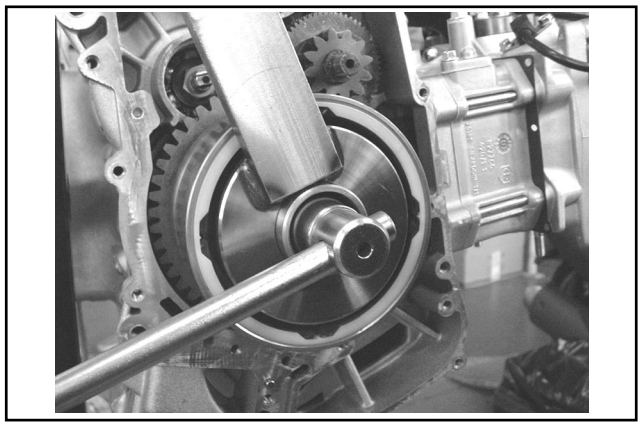
- Fully insert the specific tool as shown in the figure making sure that the pins perfectly fit in the holes previously aligned, and that it is almost in contact with the flywheel

Specific tool:
Flywheel lock tool **020472Y**



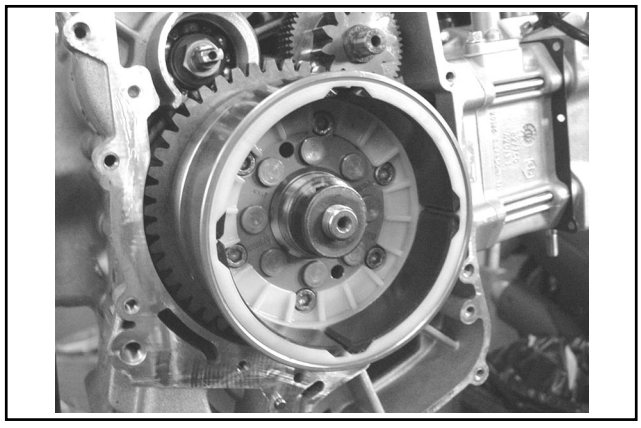
05_132

- Unloose the magneto flywheel fixing nut.
- Remove the specific tool and the fixing nut.



05_133

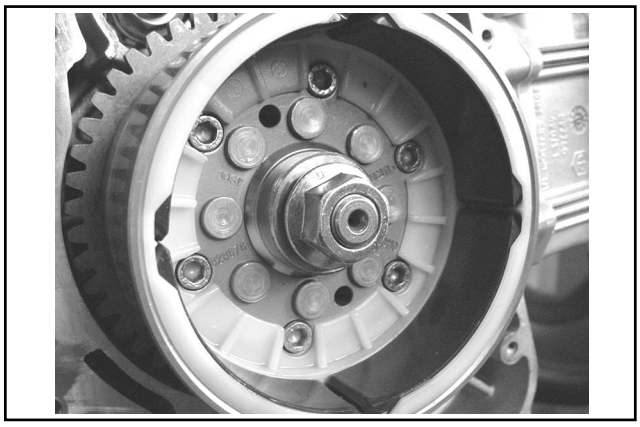
- Remove the washer.



05_134

- Refit the nut as to slightly uncover the shaft and to free the space where the washer was.

Warning - This operation is necessary as the flywheel is firmly locked, hence the cone detachment could cause the rotor to fall with consequent breaking of the magnetos.

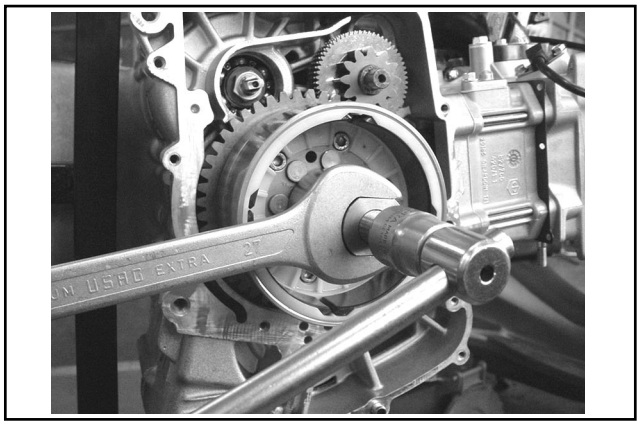


05_135

- Fit the extractor.

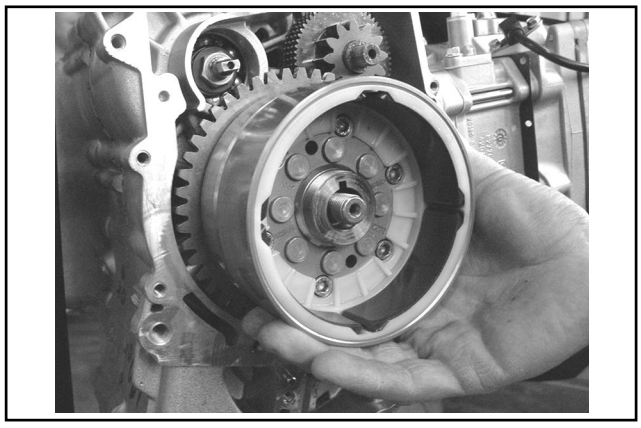
- Use a 27mm wrench and a 19mm bush to unlock the magneto flywheel.

Specific tool:
Flywheel extractor **020467Y**



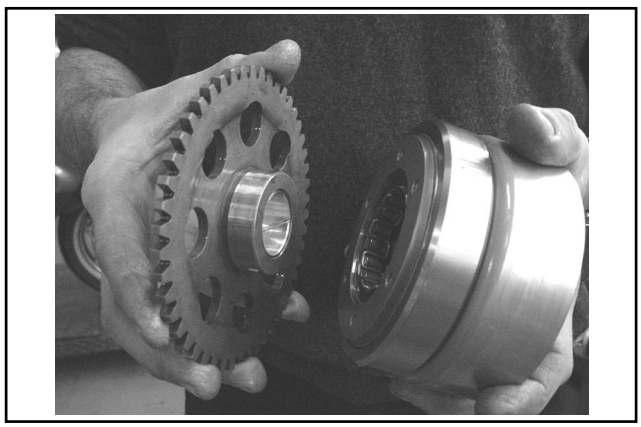
05_136

- Remove the extractor.
- Remove the nut and the magneto flywheel complete with the starting ring gear.
- Remove the key from the driving shaft.



05_137

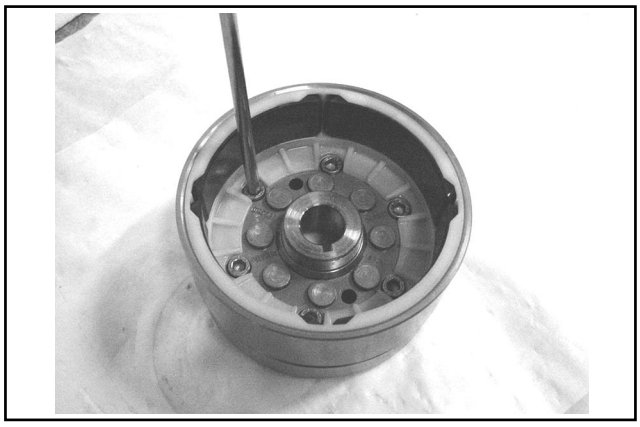
- Withdraw the starting ring gear from the free wheel by turning it clockwise.



05_138

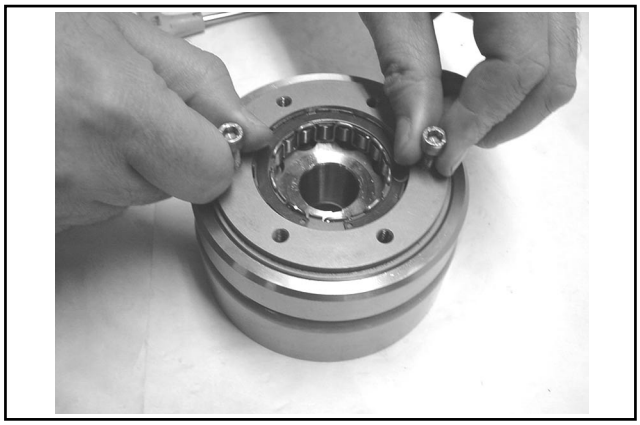
- Remove the freewheel from the magneto flywheel by unloosing the 6 fixing screws.

N.B.: To be able to disassemble the freewheel, it is recommendable to first unloose the 6 fixing screws with the flywheel still assembled on the driving shaft.



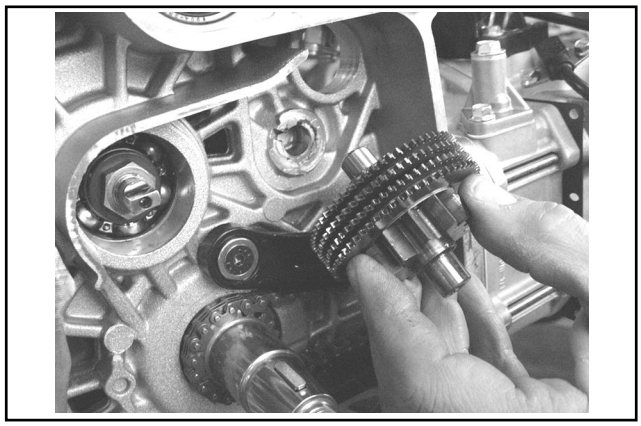
05_139

- The freewheel is precisely coupled with the flywheel; if disassembly becomes difficult, use 2 screws as holding points and as extractors.



05_140

- Remove the idler gear provided with a torque limiter.



05_141

Checking the magneto flywheel components

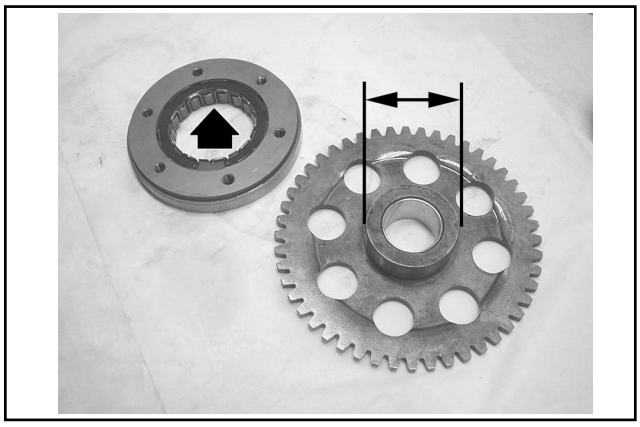
- Check the magnetos condition.
- Check that the magneto supporting cage shows no signs of deformation or breaking.
- Check that the flywheel riveting is not loose.

05_142

Starting ring gear and freewheel

- Check that the freewheel “rollers” and the starting ring gear hub surface show no signs of anomalous wear or dents.
- Check the hub outside diameter.

Hub outside diameter: Ø 45,665 $^{+0.008}_{+0.005}$ mm

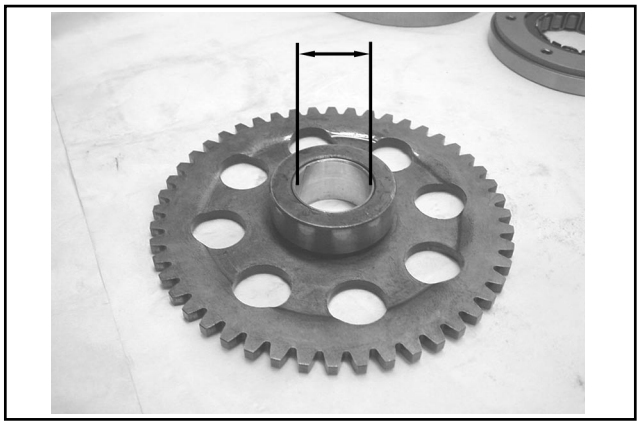


05_143

- Check the starting ring gear brass I.D.
- Check that the toothing shows no signs of wear.

N.B.: If the hub is damaged, replace the starting ring gear and the free wheel. If only the brass is damaged, it is sufficient to replace the starting ring gear assembly. In this case also check the diameter and surface of the driving shaft support. Replace the driving shaft if necessary.

Brass I.D.: Ø 27 $^{+0.020}_{+0.041}$ mm

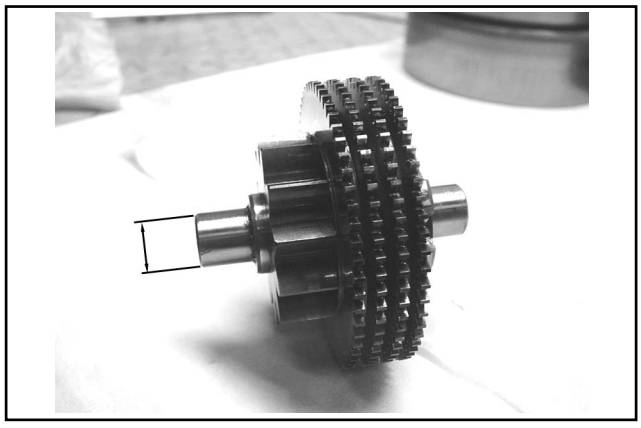


05_144

Idler gear with torque limiter

- Check the toothing out for signs of wear.
- Check the diameter of the two bearings.

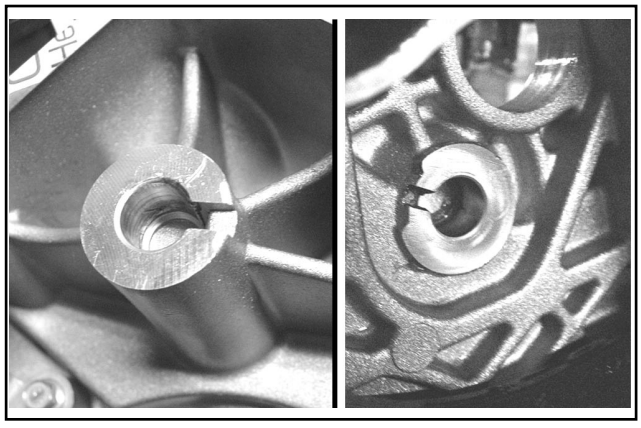
Gear bearing diameter: Ø 12 $^{-0}_{-0.011}$ mm



05_145

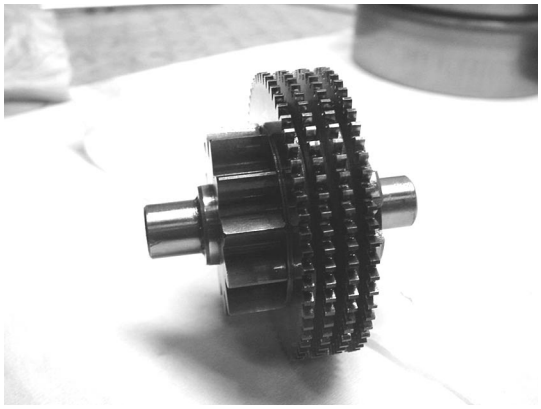
- Also check the bearings diameter on the flywheel cover and engine crankcase.

Flywheel cover bearing diameter: Ø 12 $^{+0.034}_{-0.016}$ mm
Engine crankcase bearing diameter: Ø 12 $^{+0.034}_{-0.016}$ mm



05_146

N.B.: the torque limiter is provided with 4 gears that function as clutch driving plates. The driven plates are made with 4 Belleville washers with a splined shape; this assembly allows to transmit torques below 10 kgm. In case of wrong starting operations, any counterstrokes likely to damage the engine structure are avoided by the limiter, with consequent reversal of rotation of the driving shaft.The limiter assembly cannot be over-hauled. If defects are found on the toothed disks, it is recommendable to replace the assembly.



05_145_1

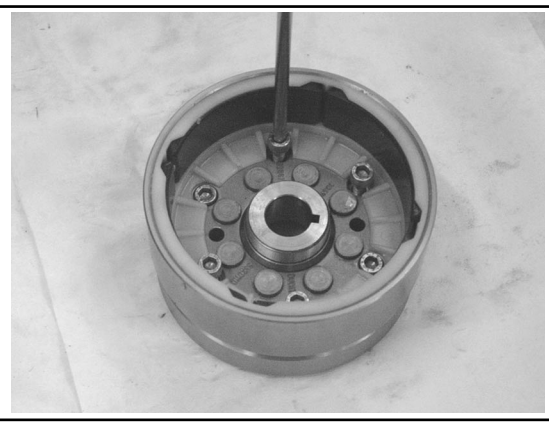
Freewheel assembly on magneto flywheel

- Check the freewheel contact surfaces condition.
- Carefully clean the freewheel to remove any trace of LOCTITE.
- Degrease the freewheel holes threading and the fixing screws.
- Apply LOCTITE 242 to the screw ends.

- Assemble the freewheel on the magneto flywheel making sure that the ground part is in contact with the flywheel, that is the wheel snap ring must be visible.

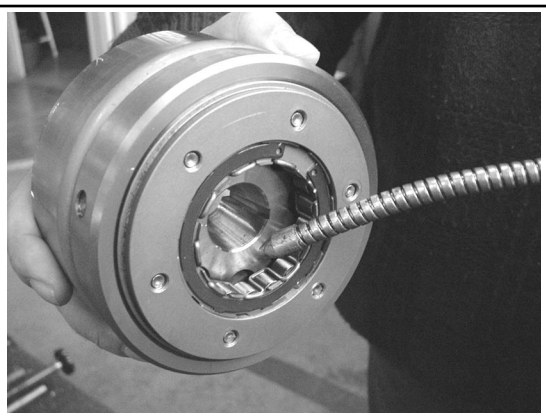
- Cross-tighten the 6 fixing screws to the prescribed torque.

Tightening torque:
Free wheel fixing screws: 13 - 15 N·m



05_147

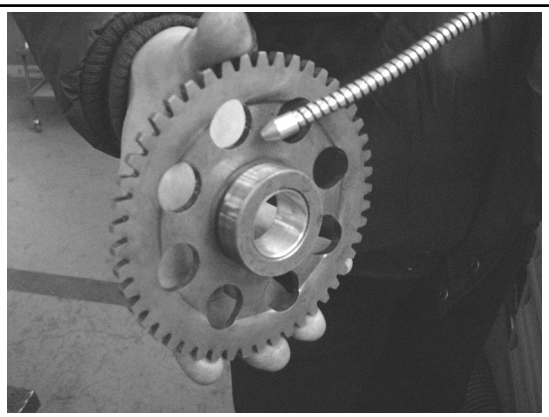
- Oil the freewheel “rollers”.



05_148

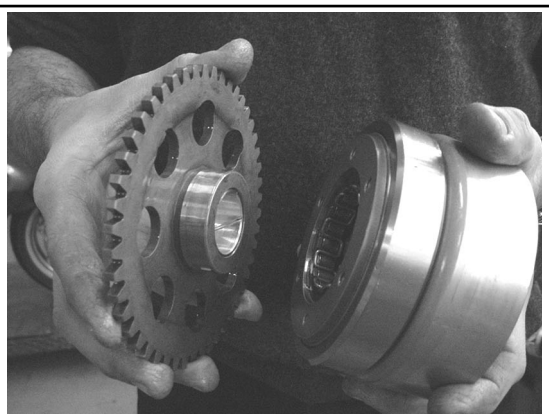
Starting ring gear assembly on magneto flywheel

- Oil the inner brass and the starting ring gear hub surface



05_149

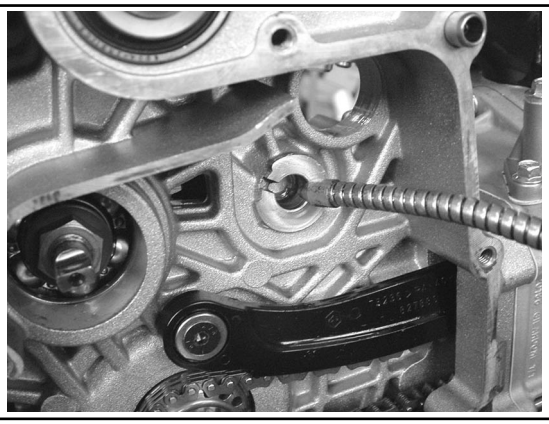
- Fit the starting ring gear on the flywheel and turn it clockwise at the same time.



05_138

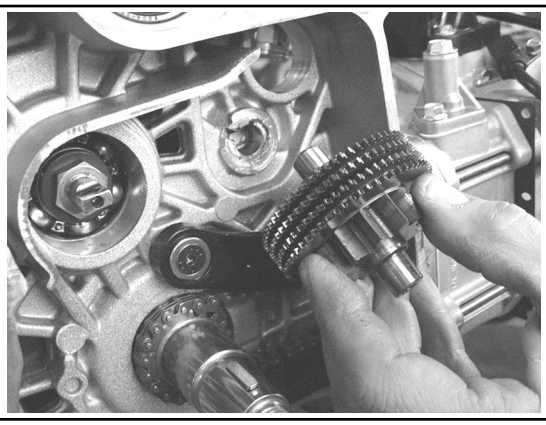
Idler gear with torque limiter assembly

- Grease the gear housing on the engine crankcase.



05_150

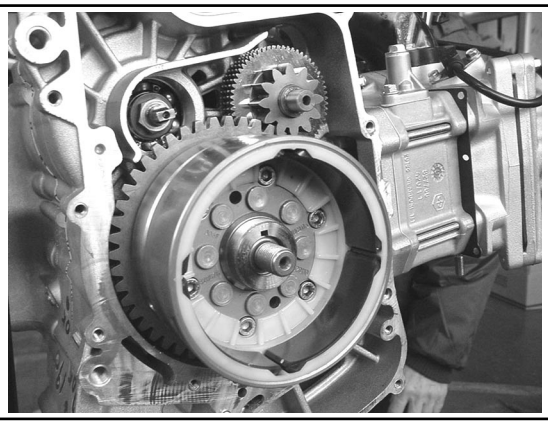
- Fit the idler gear with the torque limiter.



05_141

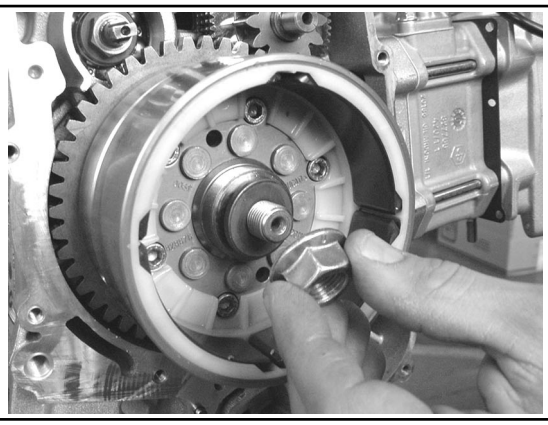
Magneto flywheel assembly on engine

- Insert the key on the driving shaft
- Assemble the magneto flywheel making sure to correctly insert the key. At the same time, mesh the torque limiter gear with the starting ring gear.



05_151

- Insert the washer and the nut on the driving shaft.

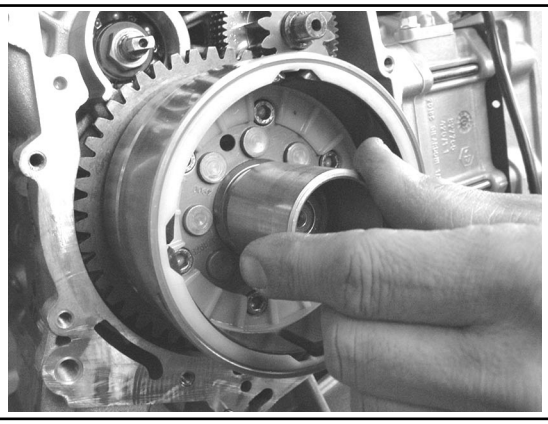


05_152

- Fully screw the flywheel lock tool guide bush, and unscrew it by 1/4 of a turn.

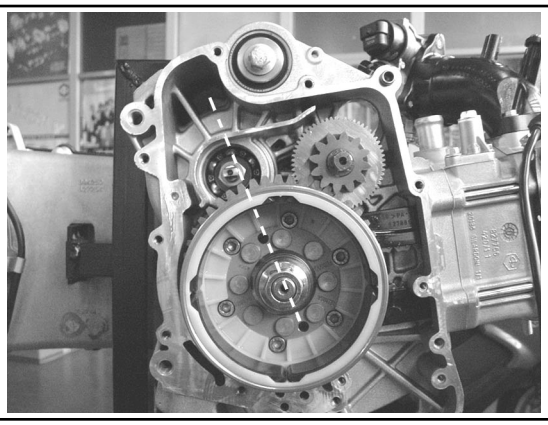
N.B.: Failure to observe the above procedure will cause the guide locking on the flywheel.

Specific tool:
Flywheel lock tool 020472Y



05_131

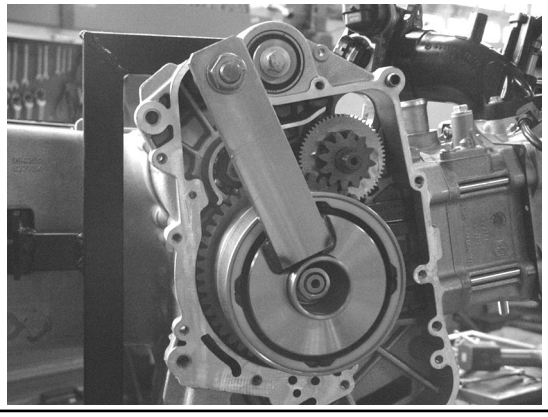
- Align the 2 magneto flywheel holes with the housing on the crankcase intended for the specific tool.



05_130

- Insert the specific tool making sure to perfectly fit the pins.

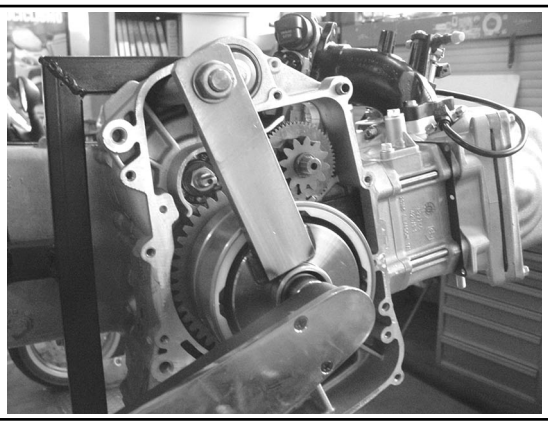
Specific tool:
Flywheel lock tool 020472Y



05_132

- Tighten the flywheel lock nut to the prescribed torque.

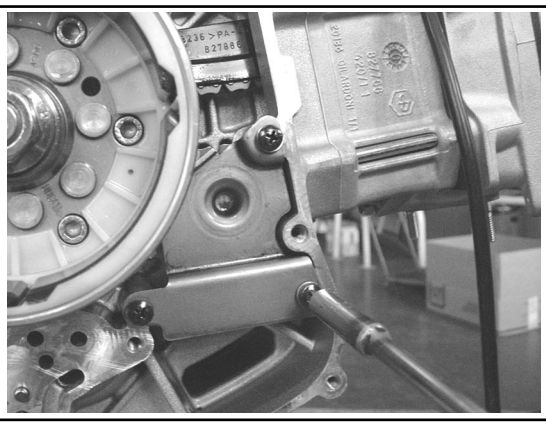
Tightening torque:
Flywheel lock nut: 115 - 120 N·m



05_153

- Assemble the chain guide shoe stop plate and tighten the 3 screws to the prescribed torque.

Tightening torque:
Chain guide shoe plate fixing screws: 3 - 4 N·m

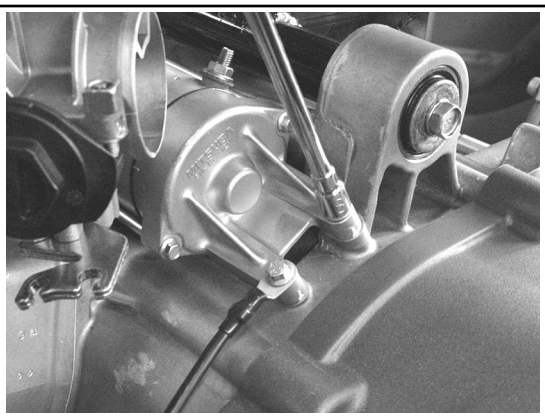


05_129

Starting motor assembly

- Check the O ring condition and oil it.
- Fit the starting motor.
- Fix the earth cable.
- Tighten the 2 fixing screws to the prescribed torque.

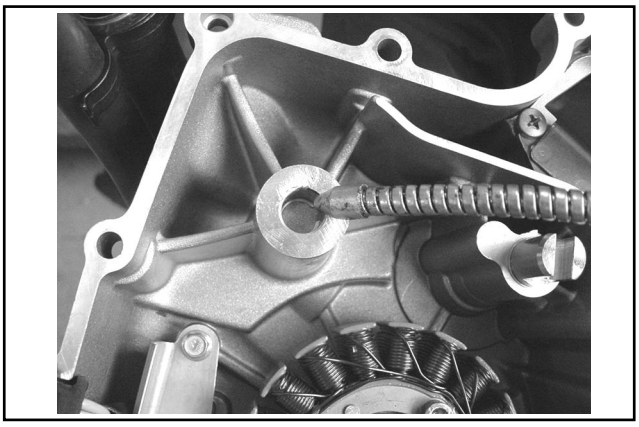
Tightening torque:
Starting motor fixing screws: 11 - 13 N·m



05_128

Flywheel cover assembly

- Grease the housing of the idler gear with torque limiter, located on the flywheel cover.
- Align the water pump drive with a reference mark and fit the flywheel cover as described in Chapter 5- Flywheel cover.



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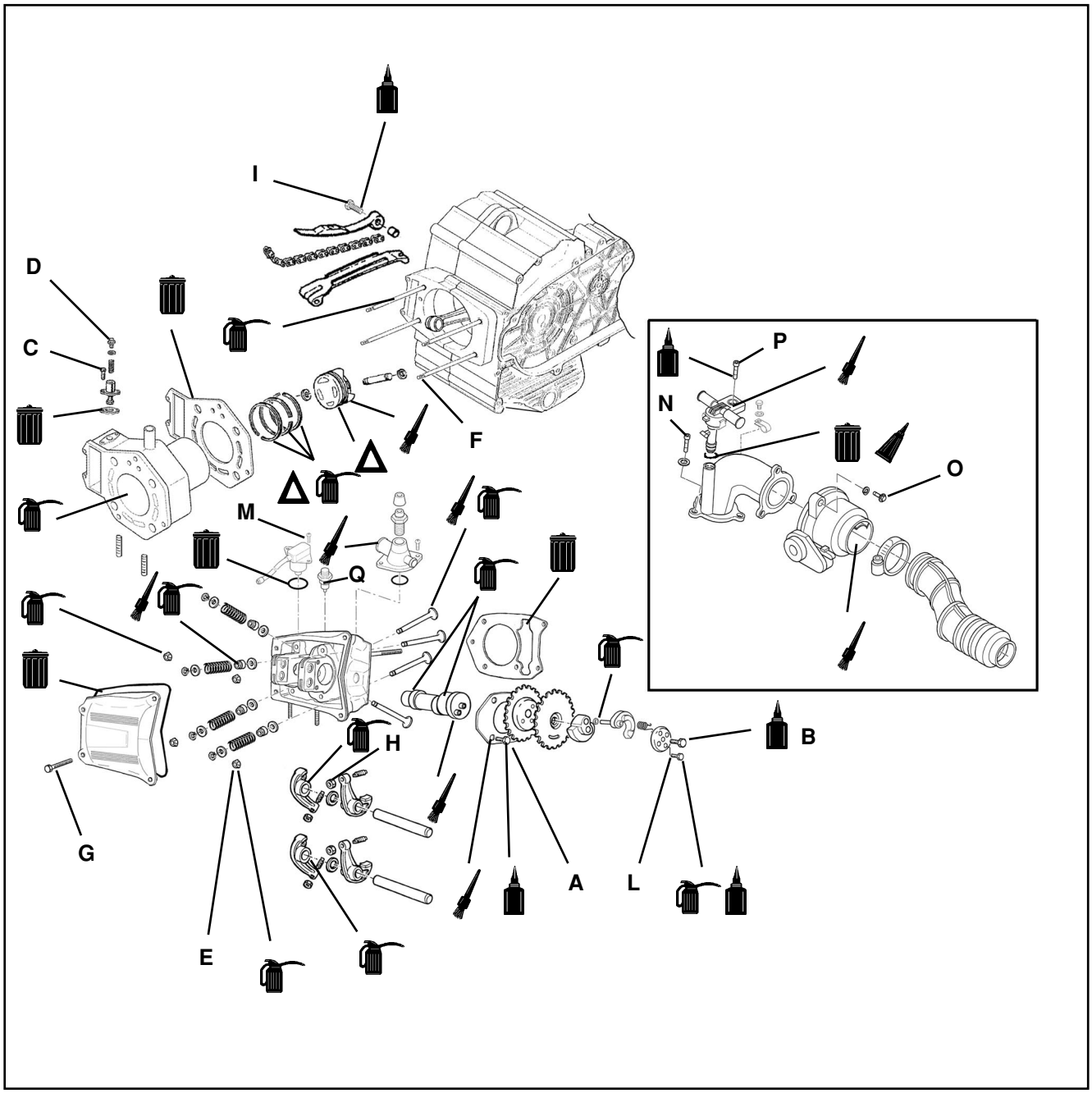
THERMAL UNIT AND TIMING SYSTEM 7



LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

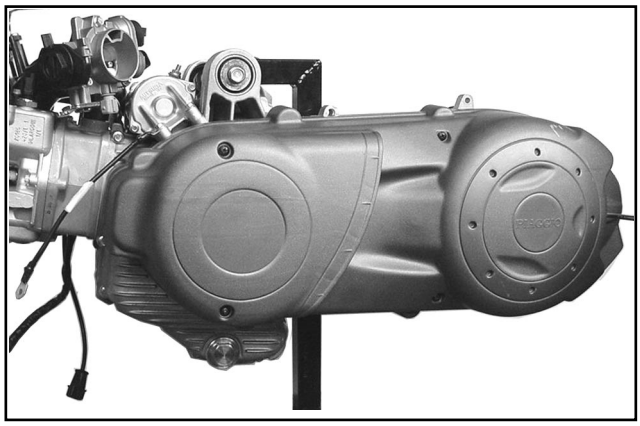
LUBRICATE WITH GREASE

CLEAN WITH CARE

ALWAYS REPLACE

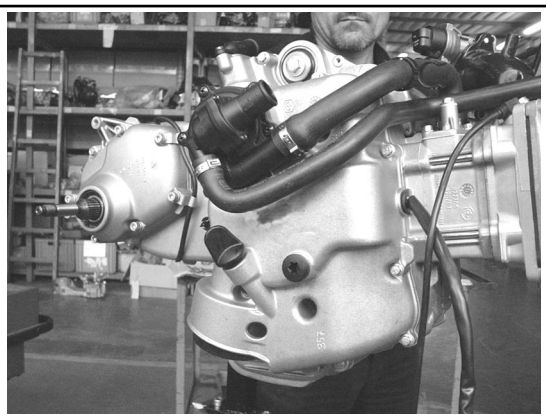
REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	3	1	2	1	4	4	4	4	1	1	2	3	3	1	1
TORQUE N·m	4-6	30-35	11-13	5-6	38-42	44-46	11-13	6-8	10-14	7-8,5	3-4	11-13	11-13	3-4	10-12

- Remove the external transmission cover and the transmission cover complete with net filter, as described in Chapter 3-Automatic Transmission.



05_006

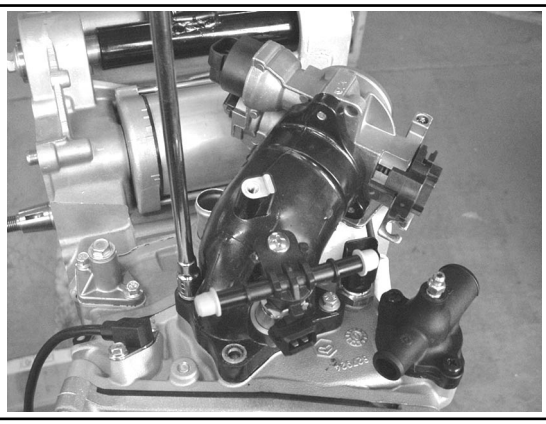
- Remove the flywheel cover, the flywheel and the idler gear with torque limiter as described in Chapter 5-Flywheel Cover, and in Chapter 6-Flywheel and Starting system.



05_155_1

Intake manifold disassembly

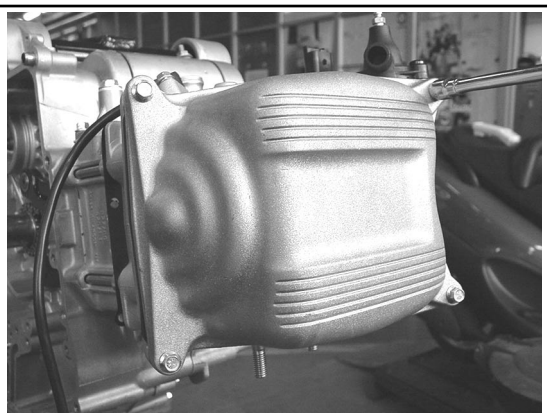
- Unloose the 3 fixing screws, one of which locks the supporting bracket of the cooling bypass tube previously removed.
- Remove the intake manifold assembly.



05_155

Tappet cover disassembly

- Unloose the 4 fixing screws and remove the tappet cover with relevant gasket.

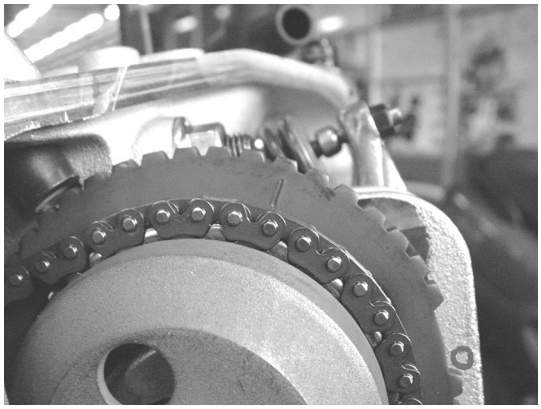


05_156

7

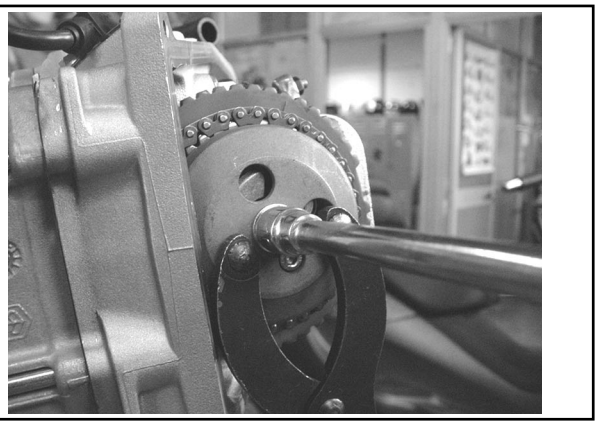
Valve gear disassembly

- Turn the engine until the intake valves close, that is the reference mark on the phonic wheel must be moved upwards as shown in the figure.



05_157

- Remove the central screw and the valve lifter weight stop bell by means of the specific tool.

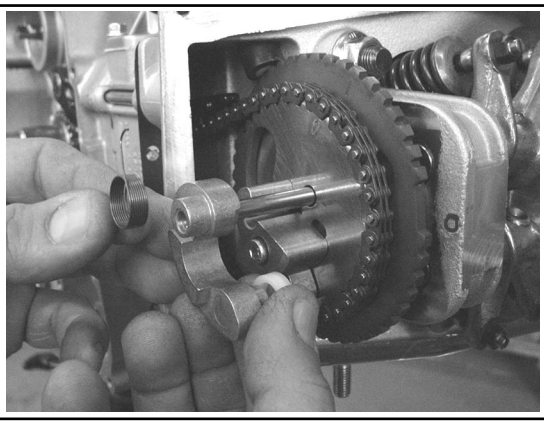


05_158

Specific tool:
Compass wrench 020565Y

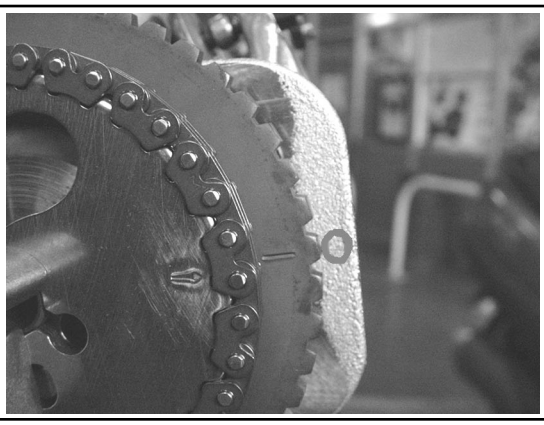
- Remove the return spring and the valve lifter weight with the relevant stop washer.

N.B.: Make sure the spring and the washer do not drop in the engine through the chain compartment.



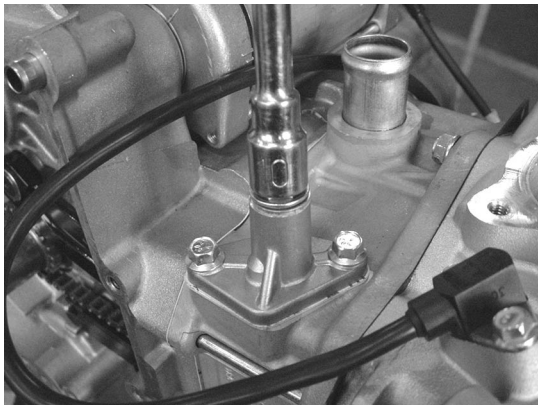
05_159

- Align the reference marks on the phonic wheel and on the head.



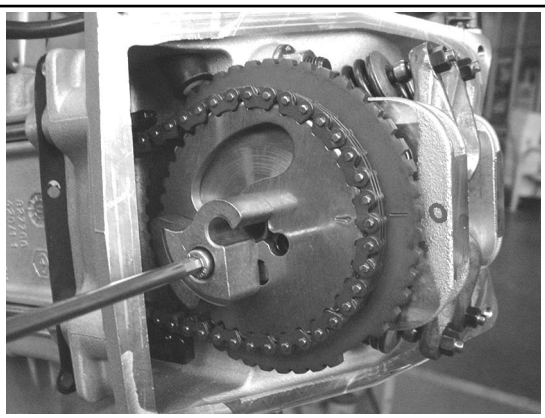
05_160

- Unloose the tightener central screw.
- Unloose the 2 fixing screws and remove the tightener and relevant gasket.



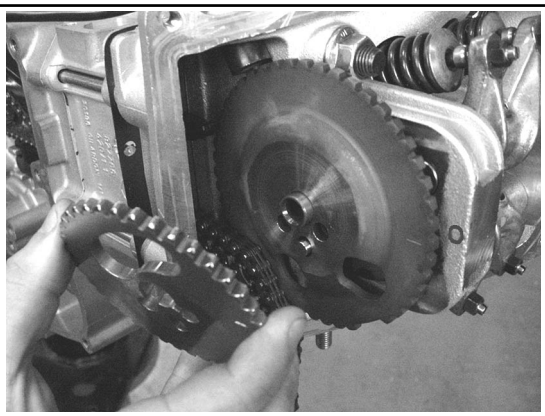
05_161

- Remove the internal hexagonal-head screw and the counterweight, as shown in the figure.



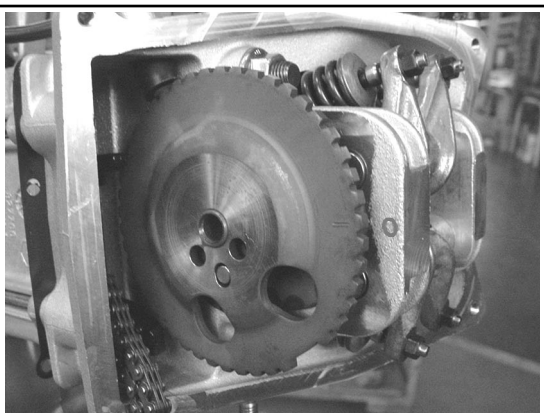
05_162

- Remove the timing chain gear from the camshaft
- Remove the timing chain gear.



05_163

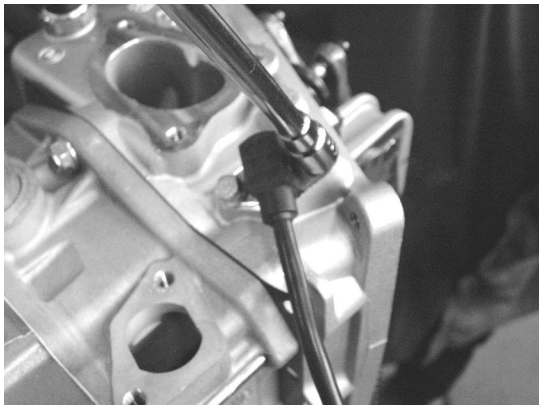
- Remove the phonic wheel.



05_164

- Remove the engine revs-stroke sensor and relevant O ring by unloosing the two fixing screws.

N.B.: Check this component as described in Chapter 9- Injection.

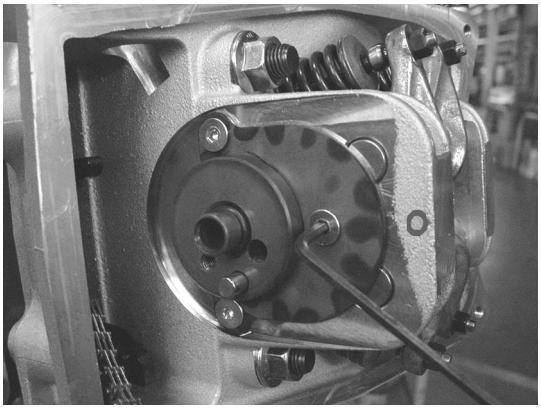


05_165

Camshaft and equalizers disassembly

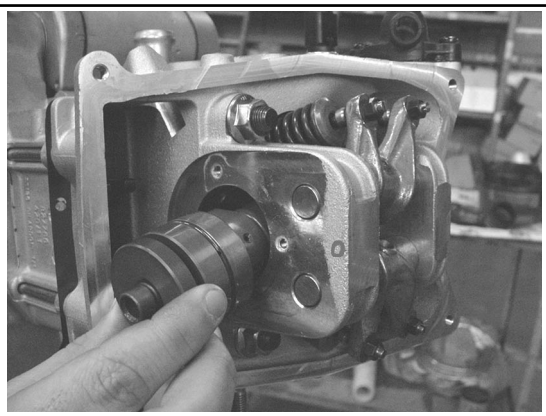
- Unloose the 3 fixing screws and remove the camshaft stop bracket.

N.B.: Removing the fixing screws may turn out to be difficult. Make sure not to damage the internal hexagon. If necessary, first unglue the threading.



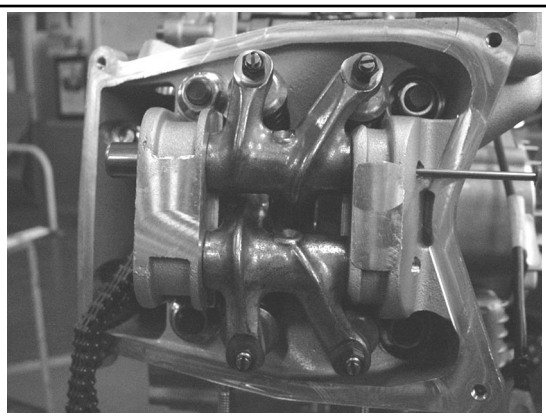
05_166

- Remove the camshaft.



05_167

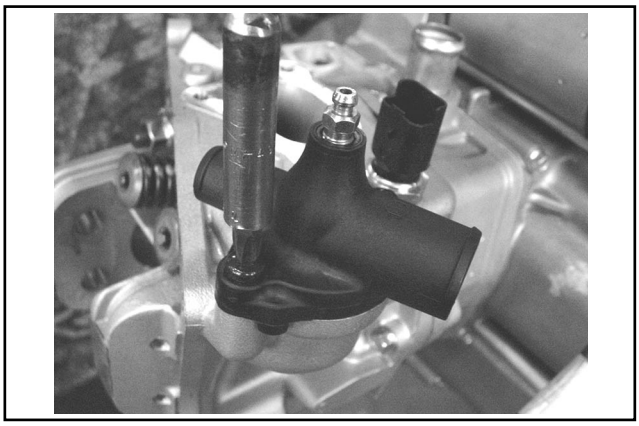
- Remove the pins and equalizers by acting through the holes, transmission side.



05_168

Head disassembly

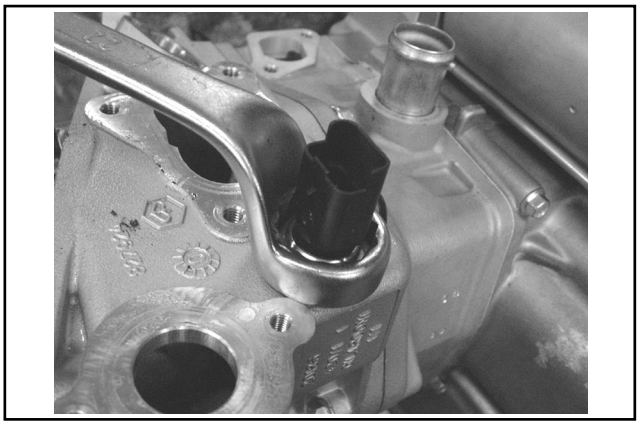
- Remove the spark plug.
- Remove the cooling system outlet union and relevant O ring by unloosing the 2 screws.



05_170

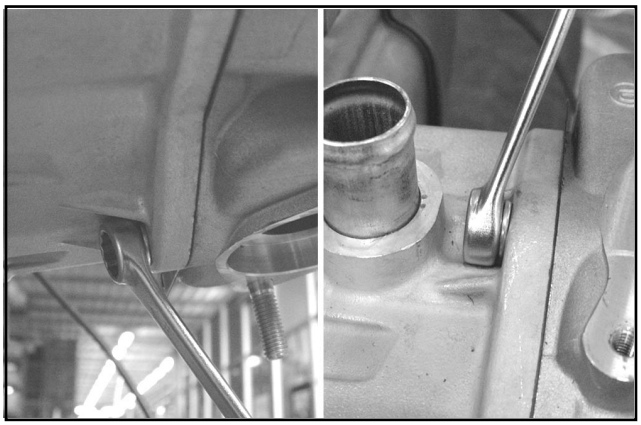
- Remove the coolant temperature sensor.

N.B.: The sensor controls both the injection and the analogue instrument on the dashboard. Check this component according to the procedure described in Chapter 9-Injection.



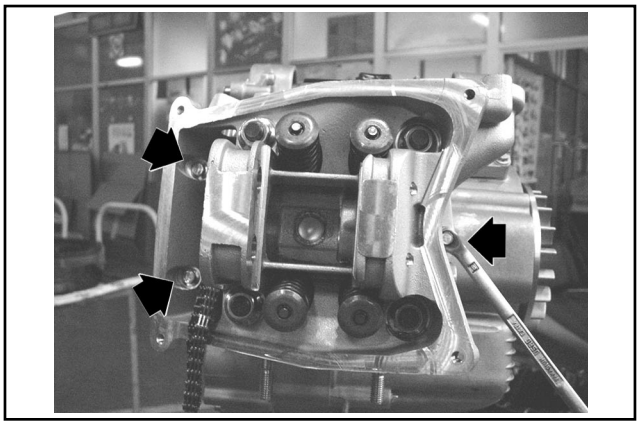
05_171

- Remove the 2 fixing nuts on the head, exhaust and intake side.



05_172

- Remove the 3 side fixings shown in the figure.



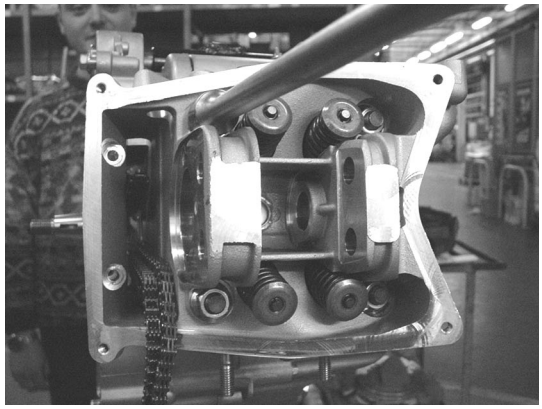
05_173

N.B.: If necessary, the head can be removed together with the camshaft, equalizer pins and fixing bracket.

- Unloose the 4 head to cylinder fixing nuts in 2-3 times in a crossed sequence.
- Remove the head, the 2 centering dowels, the gasket and the lower chain guide shoe.

N.B.: Avoid removing the dowels if they are forced in a housing.

Warning - Collect the thermal unit coolant in a suitable container when the head is disassembled

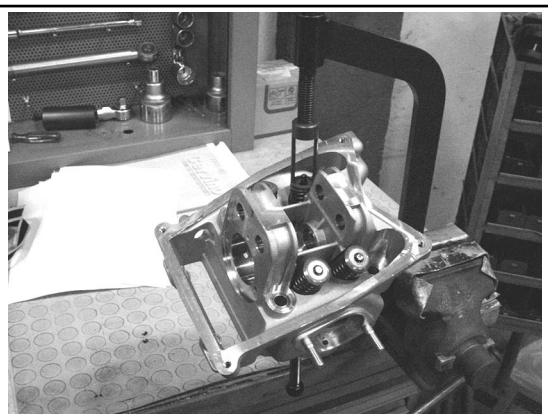


05_174

Valves disassembly

- Disassemble the cotters, caps, springs and valves by means of the specific tool provided with an adapter.

Specific tool:
Valves disassembly tool 020382Y
Adapter 020382Y012

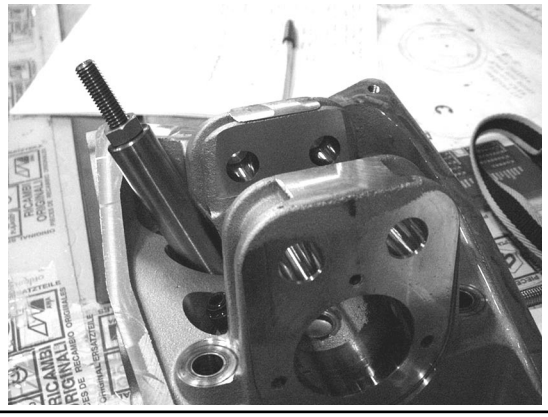


05_175

Warning - Put the valves away in such a way as to easily recognize their original position on the head (flywheel side and transmission side)

- Remove the oil seals by means of the specific tool

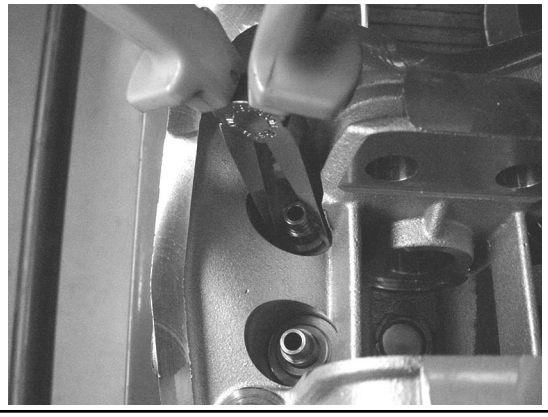
Specific tool:
Oil seal extractor 020431Y



05_176

- Remove the spring supports

N.B.: Blow compressed air in the housings to facilitate the spring supports removal.

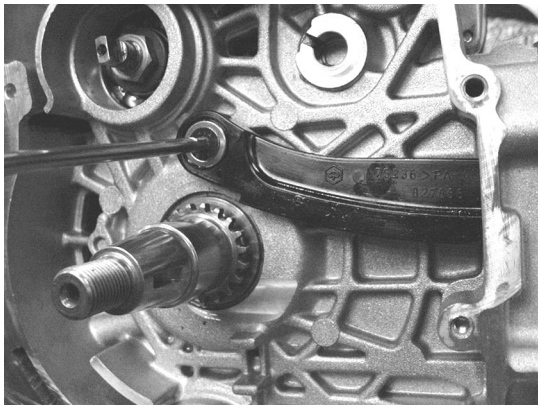


05_177

Cylinder and piston disassembly

- Remove the timing chain.
- Unloose the fixing screw and remove the spacer and the tightener pad.

N.B.: It is recommendable to mark the chain in order to refit it in the original direction of rotation.

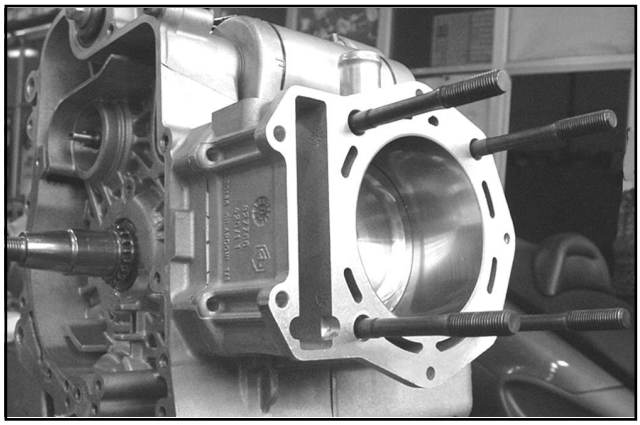


05_178

- Remove the cylinder and relevant gasket, and the centering dowel.

N.B.: The second centering is made possible thanks to a pin fitted in the cylinder.

Warning - To avoid damaging the piston, hold it while disassembling the cylinder.



05_179

- Remove the 2 stop rings of the piston gudgeon pin through the specific openings.
- Remove the gudgeon pin and the piston.

N.B.: Close the cylinder housing opening on the crank-case with paper or a cloth, to prevent one of the two stop rings from falling inside.

05_180

- Remove the compression rings and the scraper ring.

Warning - Mark the compression rings assembly position to avoid inverting them if they are re-used.

N.B.: Take care not to damage the rings during the disassembly procedure.

05_181

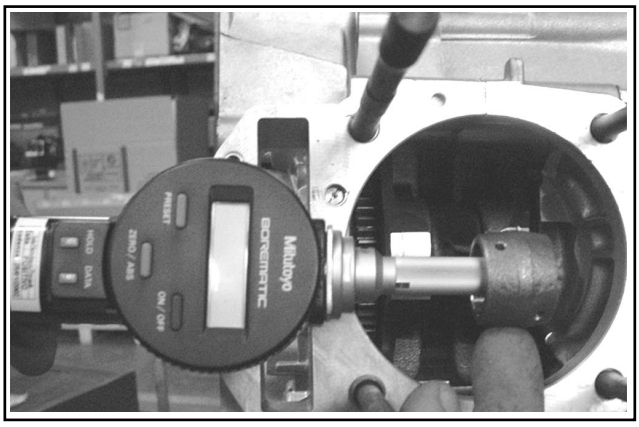
7

Checking connecting rod small end

- Measure the connecting rod small end diameter by means of a reamer.

Standard diameter: $22^{+0.025}_{+0.015}$ mm

N.B.: If the connecting rod small end diameter exceeds the standard value, if it shows signs of wear or overheating, replace the driving shaft as described in Chapter 8-Crankcase and Driving Shaft.



05_182

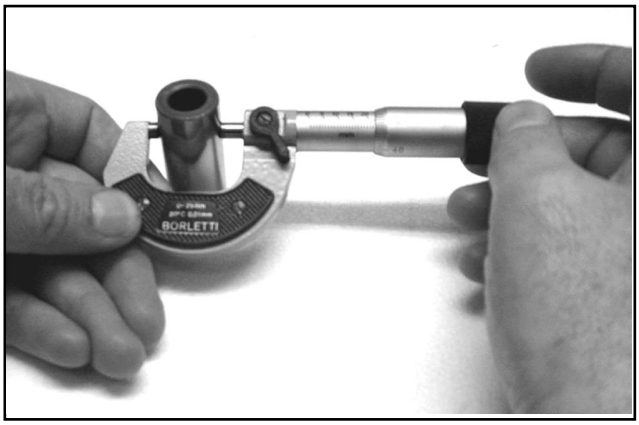
Gudgeon pin diameter

- Check the gudgeon pin outside diameter by means of a micrometer.

Standard diameter: $22^{0}_{-0.004}$ mm

- Calculate the connecting rod small end - gudgeon pin allowance

Standard clearance: 0.015 - 0.029 mm



05_183

- Measure the piston support diameter

Standard diameter: $22^{+0.006}_{+0.001}$ mm

- Calculate the gudgeon pin - piston allowance.

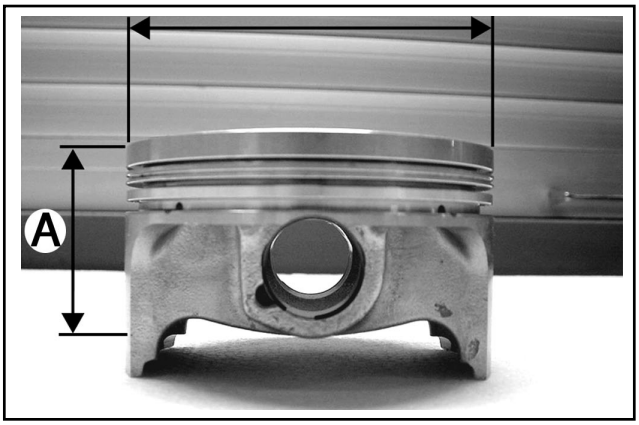
Standard clearance: 0.001 - 0.010 mm

N.B.: The gudgeon pin housings are provided with 2 lubrication ducts. Therefore the diameter must be measured according to the piston axis

05_184

- Measure the piston outside diameter orthogonally to the gudgeon pin axis.
- Perform the measurement as shown in the figure: A = 43.2 mm

Piston diameter: 92 mm



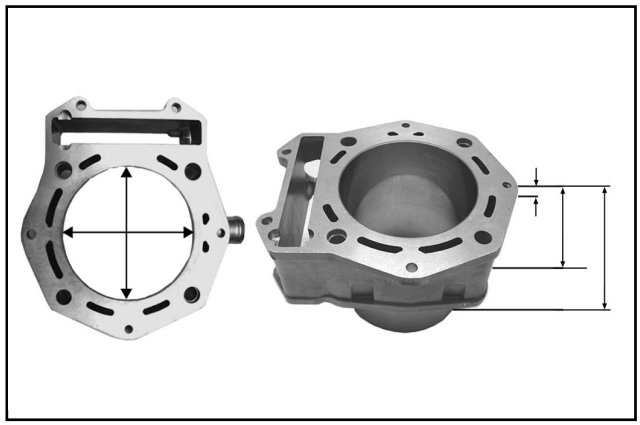
05_185

- Measure the cylinder inside diameter by means of a reamer in the directions shown in the figure and at three different heights.
  Standard diameter: $92^{+0.018}_{+0.010}$ mm

- Make sure that the lining is not exfoliated.
- Check that the head coupling surface shows no signs of wear or deformation.

  Maximum allowed runout: 0,05 mm

- The pistons and cylinders are classified according to their diameter. The coupling is made under the same conditions (A-A, B-B, C-C, D-D).

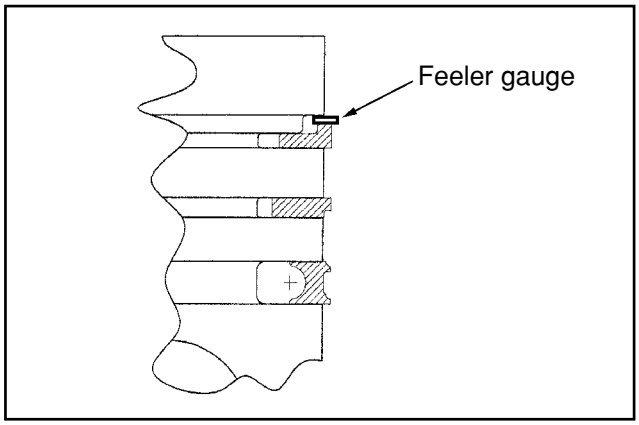


05_186

Piston

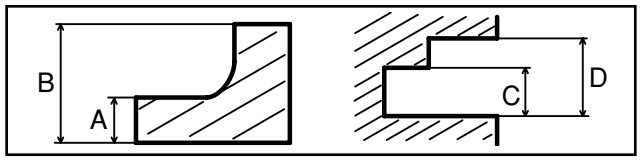
- Carefully clean the gas ring slots.
- With suitable feelers, measure the allowance between the gas rings and piston slots as shown in the figure.
- If values higher than those indicated in the table are measured, replace the piston.

N.B.: Measure the play by inserting the feeler gauge blade on the 2nd gas ring side.



05_187

	Standard allowance	Maximum allowance allowed after use
1st compression ring	$A=0.9^{-0.005}_{-0.030}$ mm $B=1.5^{-0.005}_{-0.03}$ mm	$C=0.9^{+0.03}_{+0.01}$ mm $D=2^{+0.05}_{-0.02}$ mm
2nd compression ring	$12^{-0.005}$ mm	$1.25^{+0.03}$ mm
Scraper ring	$2.5^{-0.005}$ mm	$2.5^{+0.03}$ mm



05_187_1

Gas rings

- Insert alternately the 3 gas rings in the cylinder, in the area of its original diameter. Insert the rings orthogonally to the cylinder axis using the piston to such purpose.
- Measure the gas rings opening (see figure) by means of a feeler gauge.
- If values higher than those prescribed are measured, replace the rings.

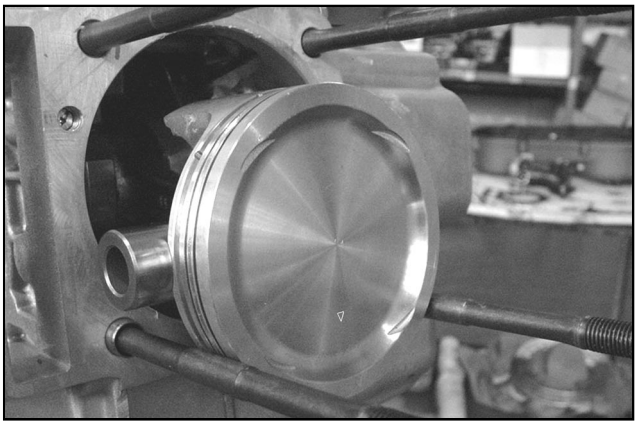
05_188

	Standard opening	Max value
Compression ring	0.15 - 0.35 mm	0.5 mm
Scraper ring	0.25 - 0.50 mm	0.65 mm
Scraper ring	0.25 - 0.50 mm	0.65 mm

N.B.: Before replacing the rings, make sure that the instructions regarding the ring-slot and piston-cylinder allowances have been followed. However, the bedding of new rings on secondhand cylinders may differ from the standard bedding conditions.

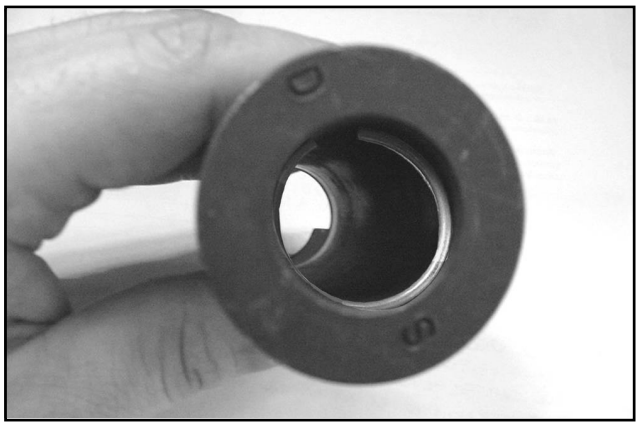
Piston assembly

- Assemble the piston and the gudgeon pin on the connecting rod. Position the piston with the arrow facing the exhaust.



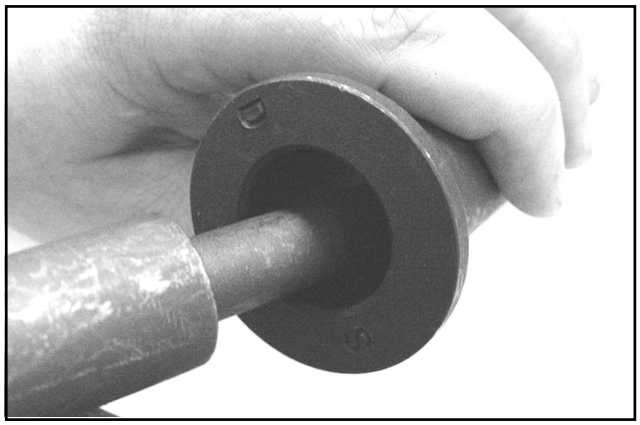
05_189

- Insert the gudgeon pin stop ring in the specific tool, with the opening in the position marked on the tool.
  S = left
  D = right



05_190

- Fit the stop ring by means of the punch



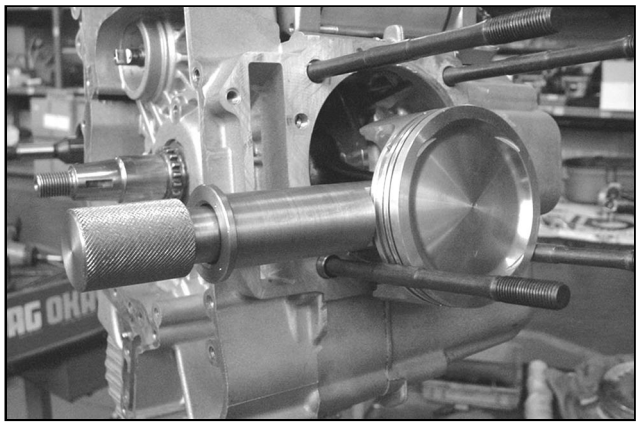
05_191

- Assemble the gudgeon pin lock using the pin, as shown in the figure.

Specific tool:
Tool for gudgeon pin lock assembly 020470Y

N.B.: The stop rings assembly tool must be used by hand.

Warning - Using a hammer may damage the locks housing.



05_192

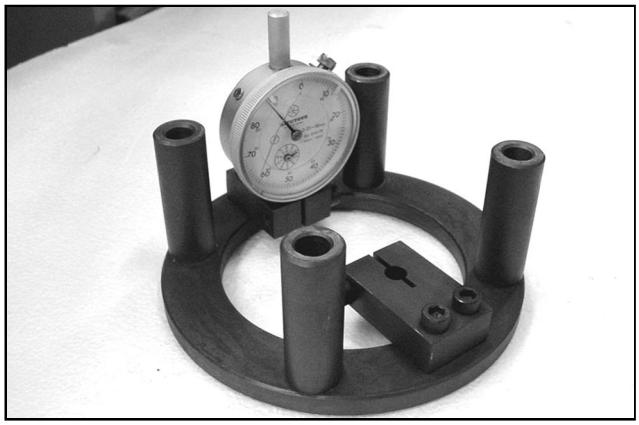
Cylinder gasket selection

- Temporarily assemble the cylinder on the piston without its gasket.
- Fit a dial gauge on the specific tool using the short connection, as shown in the figure.

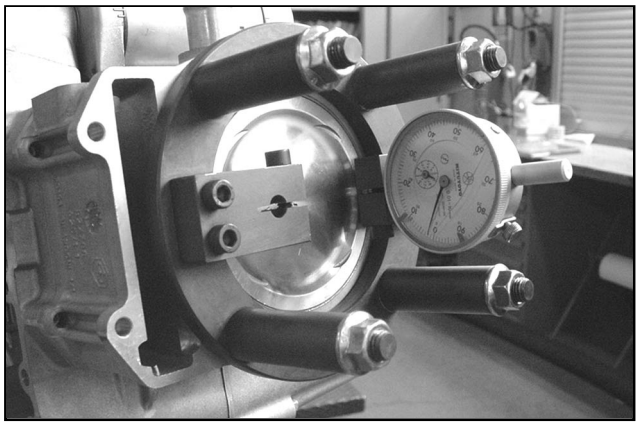
Specific tool:
Stand for piston position check 020475Y

- Set the dial gauge to zero with a preload of a few millimeters by means of a surface plate,
- Fix the dial gauge.
- Check that the feeler pin is sliding perfectly.
- Assemble the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the head fixing original nuts.

- Move the driving shaft up to the TDC (dial gauge reversal of rotation point).
- Measure the deviation from the zero setting value.
- Consult the table below to find the thickness of the cylinder gasket to be used for reassembly. Identifying the right cylinder gasket thickness will allow to maintain the right compression ratio.
- Remove the specific tool and the cylinder.



05_193



05_194

N.B.: If the deviation (projection or recess) is near to the change of class, repeat the measurement on the opposite side. Reassemble the tool by inverting its position.

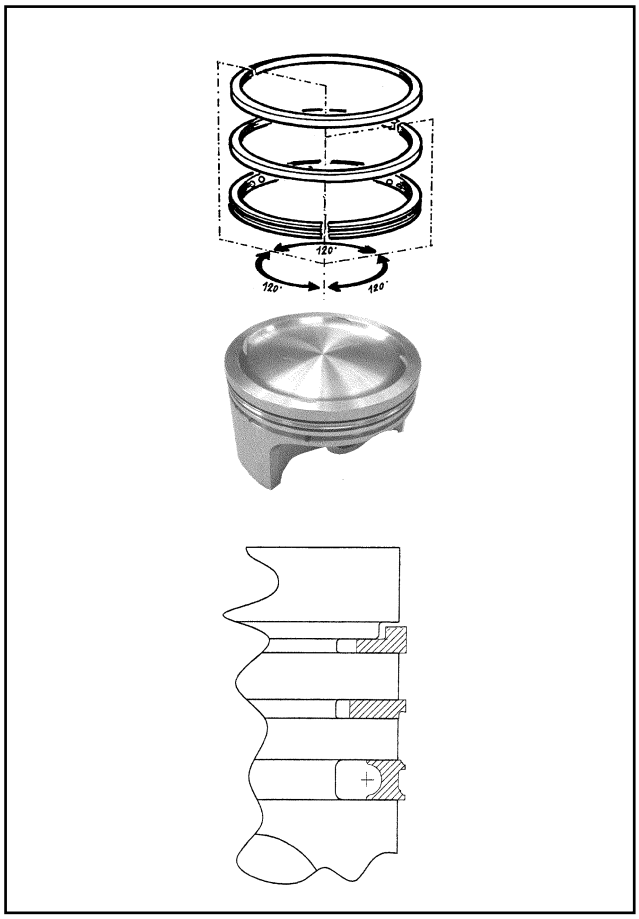
Measured recess / projection	Gasket thickness
- 0.185 - - 0.10	0.4 ± 0.05
- 0.10 - + 0.10	0.6 ± 0.05
+ 0.10 - + 0.185	0.8 ± 0.05

Compression rings assembly

- Put the scraper ring spring on the piston.
- Assemble the scraper ring by keeping the opening opposite to the spring joint and with the top writing facing the piston crown. The chamfer must always be positioned towards the piston crown.
- Assemble the second ring with the identification letter or the top writing facing the piston crown. The step must always face the opposite side of the piston crown.
- Assemble the first compression ring respecting the direction of its housing.
- We suggest a suitable tool be used to fit the rings.

N.B.: The point of contact of the 2 sealing rings with the cylinder has a conical shape allowing for a better bedding.

- Offset the ring openings by 120° as shown in the figure.
- Lubricate the parts with engine oil.
- The engine requires the 1st compression ring with L section.



05_195

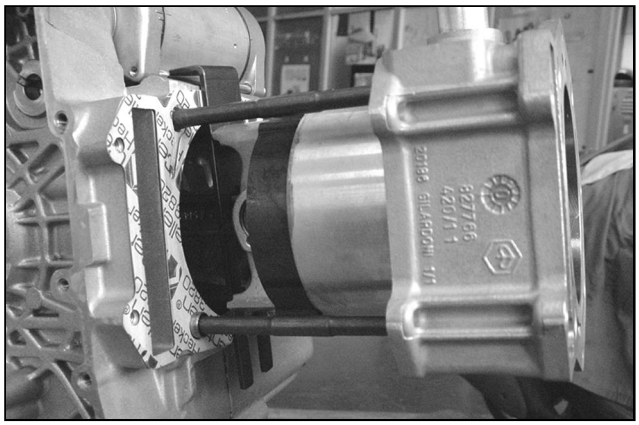
Cylinder assembly

- Fit the cylinder gasket having the selected thickness.
- Assemble the cylinder by means of the fork and the ring clamp, as shown in the figure.

Specific tool:

Piston assembly ring	**020468Y**
Fork	**020512Y**

N.B.: Before assembling the cylinder, carefully clean the lubrication duct by blowing in air, and oil the cylinder liner. Make sure that the two dowels are there.



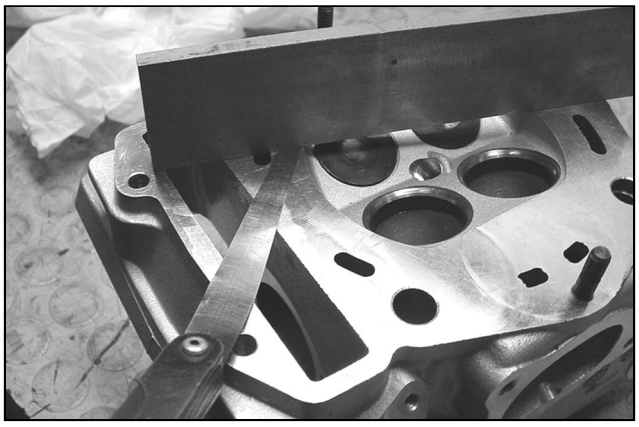
05_196

Head check

- Check that the head surface shows no signs of wear or deformations by means of a ground bar and a feeler gauge.

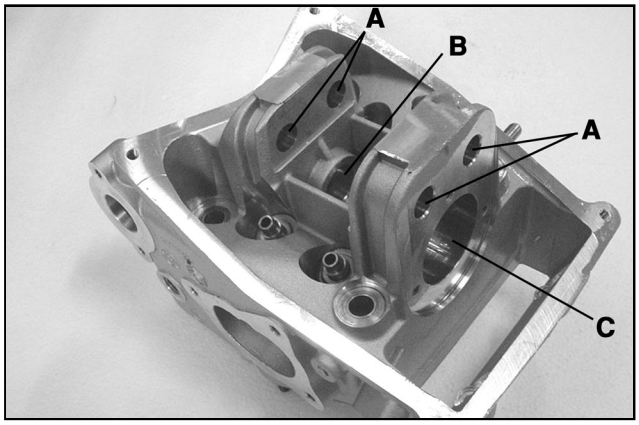
Maximum allowed runout: 0.1 mm

- In case of troubles, replace the head.
- Check the sealing surface of the intake and exhaust manifold.
- Check that the camshaft and equalizer pin supports show no signs of wear.
- Check that the head cover surface shows no signs of wear.
- Check that the coolant sealing pad shows no signs of oxidation.



05_197

	Standard diameter
A	$13^{+0.018}_{0}$
B	$20^{+0.021}_{0}$
C	$42^{+0.025}_{0}$



05_198

- If worn, also check the corresponding component when the head is replaced

Checking the valve sealing surfaces

- Visually check the valves sealing surfaces.

Warning - Do not change the valves assembly position (RH-LH).

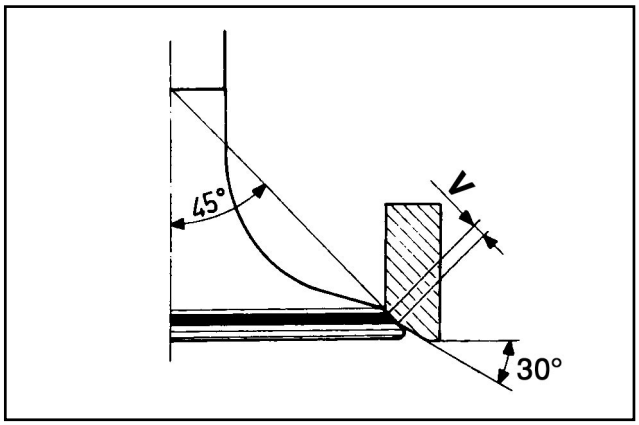
- If the valve sealing surface is discontinued in one or more points, or if it is bent, replace the valve.

05_199

7

Checking valve seat wear

- Remove any carbon deposits from the valve seat.
- Check the width of the imprint on the valve seat "**V**" by means of Prussian blue.
- Measure the inside diameter of each valve guide.
- Perform the measurement according to the thrust direction of the equalizer at three different heights.



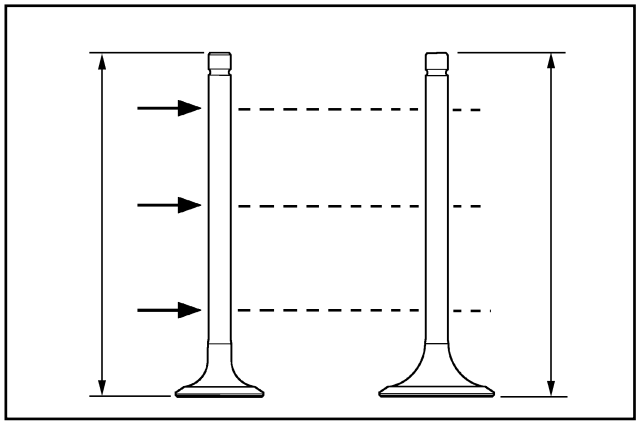
05_200

Standard value: 1 - 1.3 mm
Limit allowed: 1.6 mm

- If the imprint width on the valve seat exceeds the recommended limits, regrind the seats with the 45° cutter and then recondition them.
- In case of excessive wear or damages, replace the head.

Valves check

- Check the valve stem diameter in the three points shown in the figure.



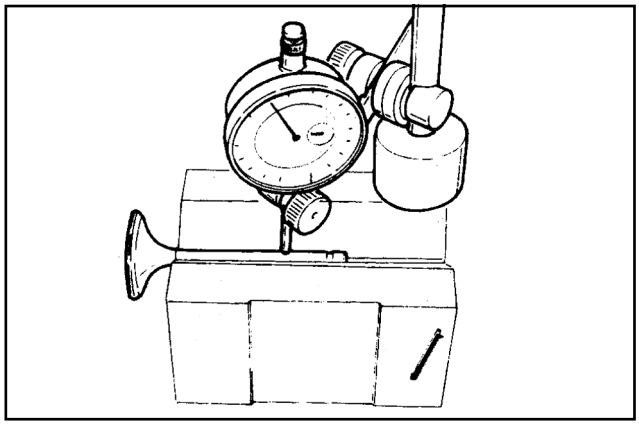
05_201

Standard diameter
Intake: 4.987 - 4.972 mm
Exhaust: 4.975 - 4.960 mm

Minimum allowed diameter
Intake: 4.96 mm
Exhaust: 4.945 mm

- Calculate the valve - valve guide clearance.

- Check the valve stem deviation by putting it on a **"V"** surface. Measure the deformation by means of a dial gauge.

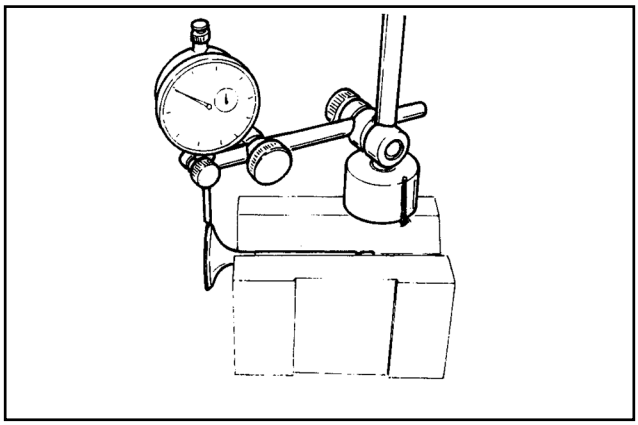


05_201_1

Limit allowed: 0.01 mm

- Check the valve head concentricity by placing a dial gauge at right angle to the valve head and turning the valve head on a **"V"** surface.

Limit allowed: 0.03 mm



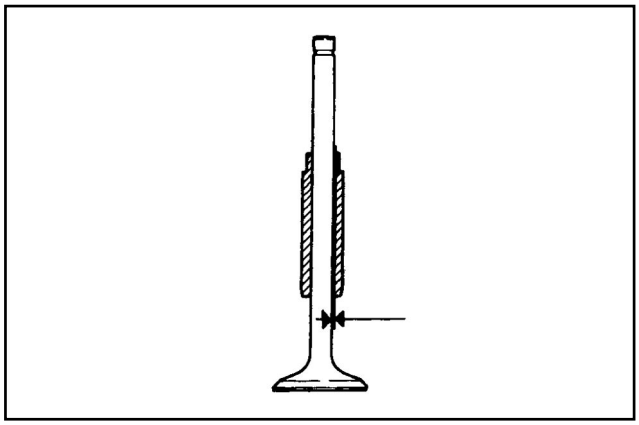
05_201_2

Valve-guide play check

- After measuring the valve guide and valve stem diameters, check the guide-and-stem play.

Intake:
Standard play: 0.013 - 0.04 mm
Limit allowed: 0.08 mm

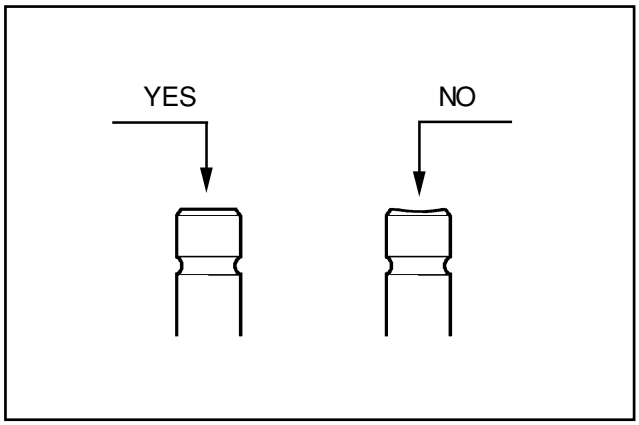
Exhaust:
Standard play: 0.025 - 0.052 mm
Limit allowed: 0.09 mm



05_201_3

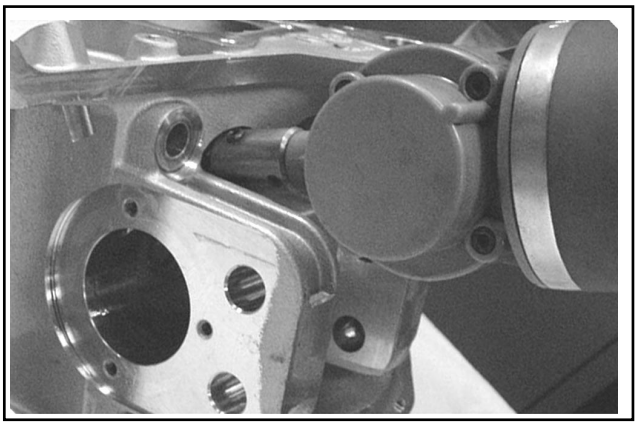
- Check that the surface in contact with the register articulated terminal shows no signs of wear.

Valve standard length
Intake: 95.0 ± 0.3 mm
Exhaust: 94.2 ± 0.3 mm



05_202

- If no troubles have been found after performing the above check, it is possible to use the same valves. To obtain a perfect sealing, it is recommendable to grind the valve seats by using a fine grain lapping compound. While grinding the valve seats, keep the head with the valve axis horizontally to prevent the lapping compound residuals from entering the valve guide stem coupling. (see figure)



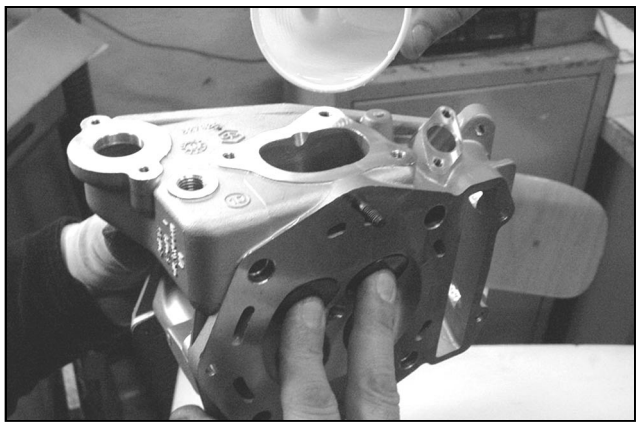
05_203

Warning - To avoid scoring the contact surface do not insist on turning the valve when the lapping compound is finished. Carefully wash the head and the valves with a product suitable for the type of lapping compound used.

N.B.: Do not change the valves assembly position.

Valves tightness test

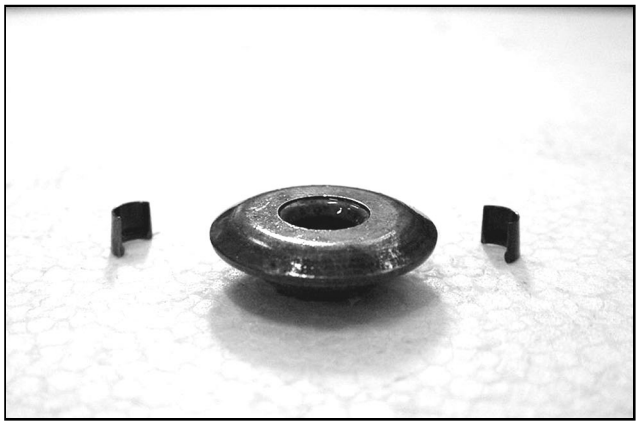
- Fit the valves in the head.
- Test alternately the intake and the exhaust valves
- The test must be performed after filling the manifold with petrol. Check that the head is well in contact with the screw caps by keeping them pressed with the fingers.



05_204

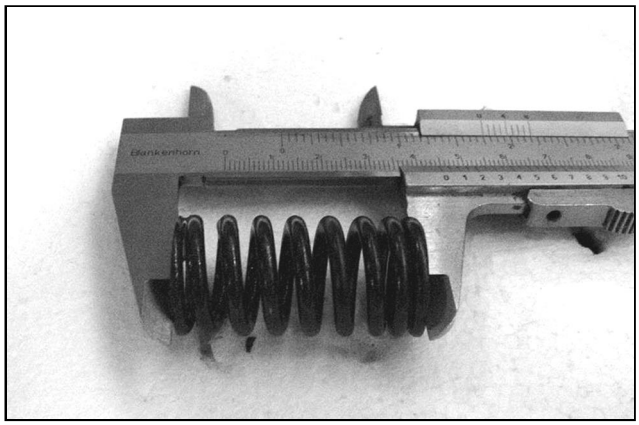
Springs, caps, cotters check

- Check that the upper spring caps and the cotters show no signs of anomalous wear.



05_205

- Measure the spring free length

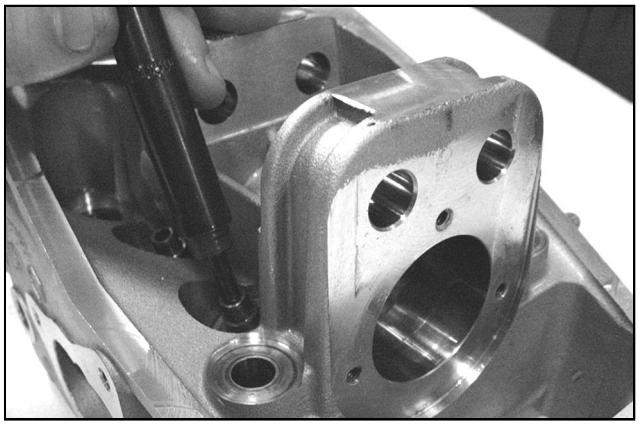


05_206

Standard length: 44.4 mm
Limit allowed after use: 43.7 mm

Valves assembly

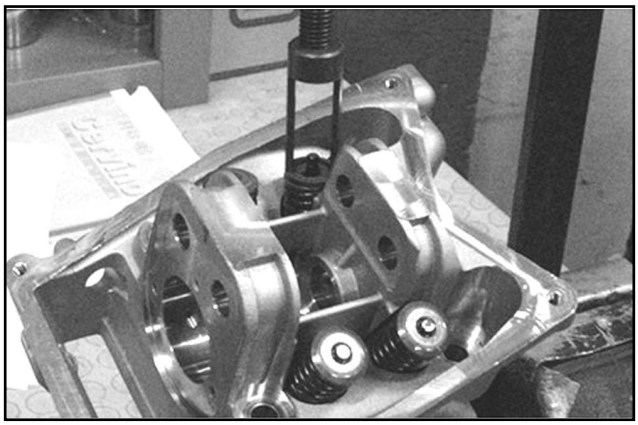
- Put the valve spring caps on the head.
- Assemble, alternately, the 4 oil seals by means of the specific tool
- Lubricate the oil seals and the valve guides.



05_208

Specific tool:
Oil seal assembly tool **020306Y**

- Assemble the valves, springs, and caps. Compress the springs and insert the cotters in their seats by means of the specific tool provided with adapter.



05_208_1

Specific tools:
Valve assembly tool **020382Y**
Adapter **020382Y012**

N.B.: Do not change the valves assembly position. Assemble the valve springs according to the reference colour, cotters side (large coil spring).

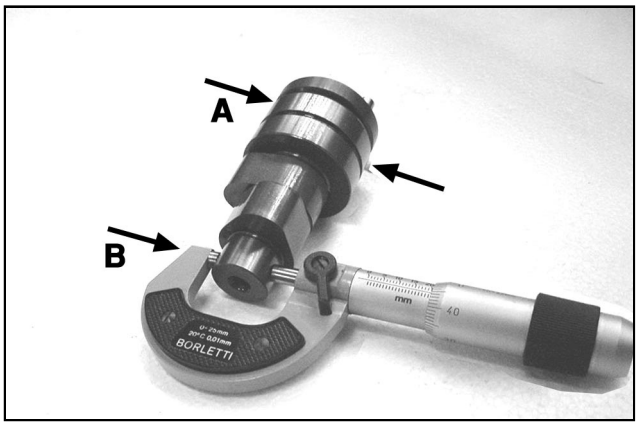
7

Camshaft check

- Check that the camshaft supports show no signs of anomalous wear or scoring.
- Measure the camshaft supports by means of a micrometer.

Standard diameter
Support A Ø: 42 $^{-0.060}_{-0.085}$ mm
Support B Ø: 20 $^{-0.020}_{-0.041}$ mm

Minimum allowed diameter
Support A Ø: 41.910 mm
Support B Ø: 19.940 mm



05_209

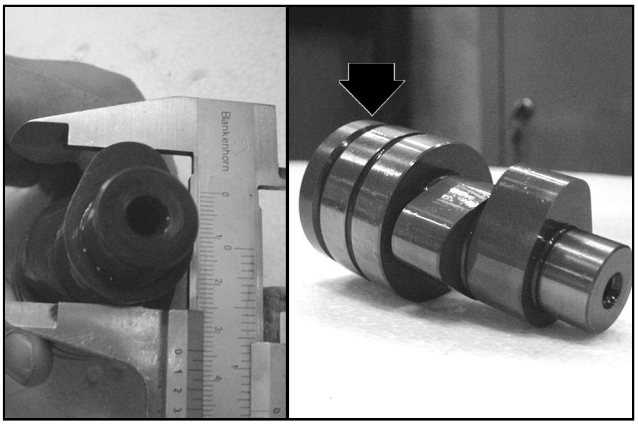
- Check the cams heights by means of a gauge

Standard height
Intake: 33.988 mm
Exhaust: 33.417 mm

Limits allowed
Intake: 33.740 mm
Exhaust: 33.170 mm

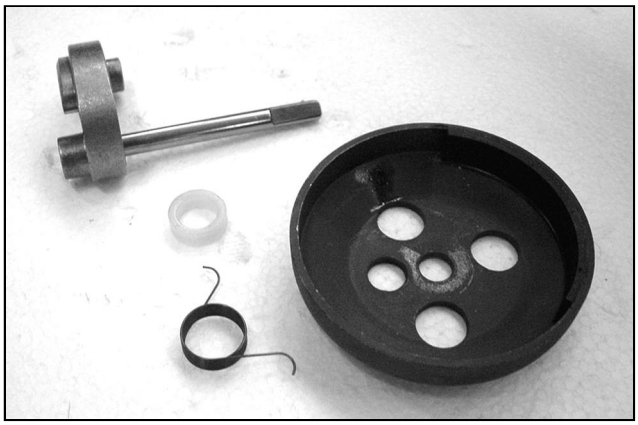
Standard end play: 0 - 0.22 mm
Maximum allowed end play: 0.3 mm

- Replace the defective parts in case of anomalous wear or values different from those prescribed.
- Check that the groove shown in the figure, seat of the stop plate, shows no signs of wear.



05_210

- Check that the automatic valve lifter cam, the stop roller and the rubber stop on the containment bell show no signs of wear.
- Check that the valve lifter spring is not overstressed.
- Replace any worn parts.


05_211

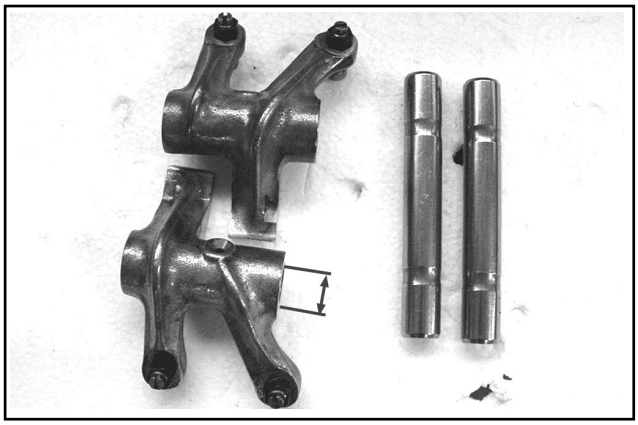
- Check that the equalizer pins show no signs of scoring or wear

Standard diameter: Ø 13 $^{-0.010}_{-0.018}$ mm

- Check the inside diameter of each equalizer.

Standard diameter: Ø 13 $^{+0.026}_{+0.015}$ mm

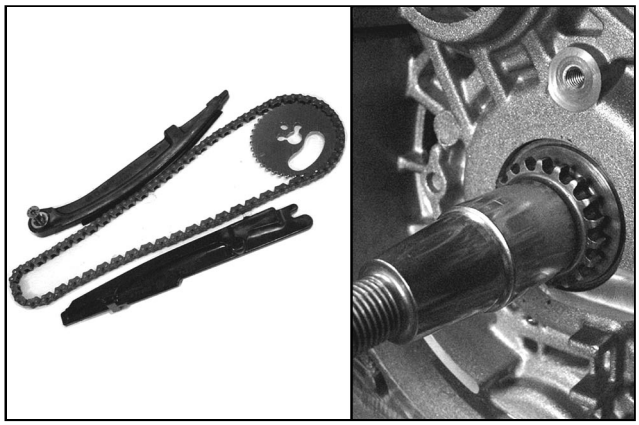
- Check that the cam sliding shoe and the registers articulated plate show no signs of wear.
- Replace the component if necessary.


05_212

Checking timing system parts

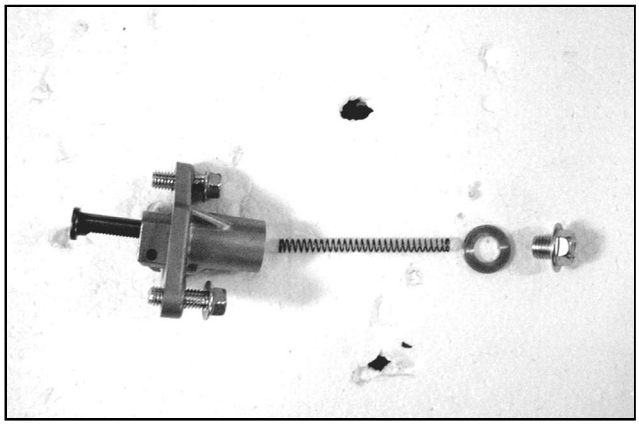
- Check that the guide shoe and the tension pad are not excessively worn.
- Check that the camshaft control timing gear and driving shaft pinion assembly show no signs of wear.
- Replace the pads, or the whole assembly if the chain, or ring gear, are worn.

N.B.: If the chain has damaged the pinion, replace the driving shaft as described in Chapter 8-Crankcase and Driving Shaft.



05_213

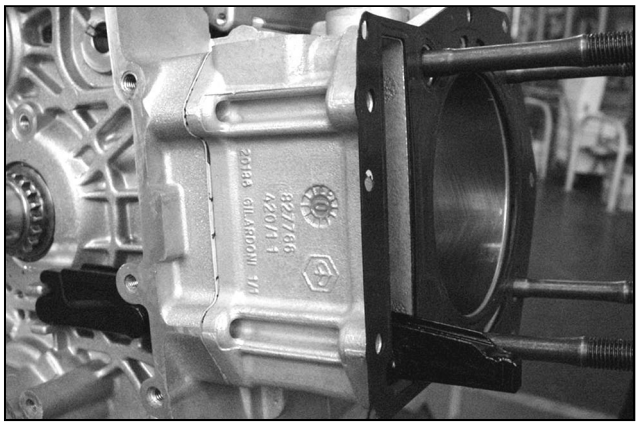
- Remove the central screw with the washer and the tightener spring. Make sure the unidirectional mechanism shows no signs of wear.
- Check the tightener spring condition.
- If necessary, replace the whole assembly.



05_214

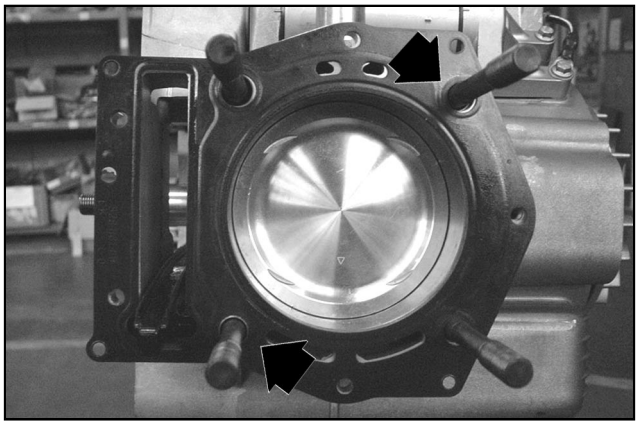
Head and timing system parts assembly

- Fit the chain guide shoe
- Fit the two centering dowels between the head and the cylinder.
- Assemble the head gasket.



05_215

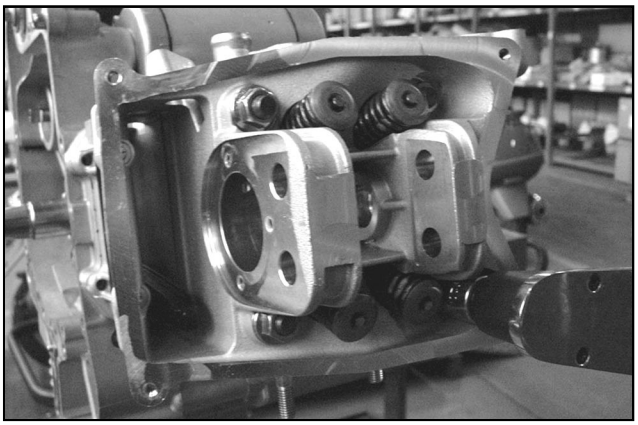
N.B.: The figure shows the assembly position of the two centering dowels between the head and the cylinder. The gasket assembly position is forced by the dowels. The head gasket is made of steel and has a standard thickness.



05_216

- Make sure the head lubrication duct is well clean. If necessary, clean with a jet of compressed air.
- Assemble the head.
- Oil the studs and the 4 fixing nuts.
- Screw the 4 fixing nuts in a crossed manner to the pre-torque value of 20 N·m
- Afterwards, cross-tighten them to the prescribed torque.

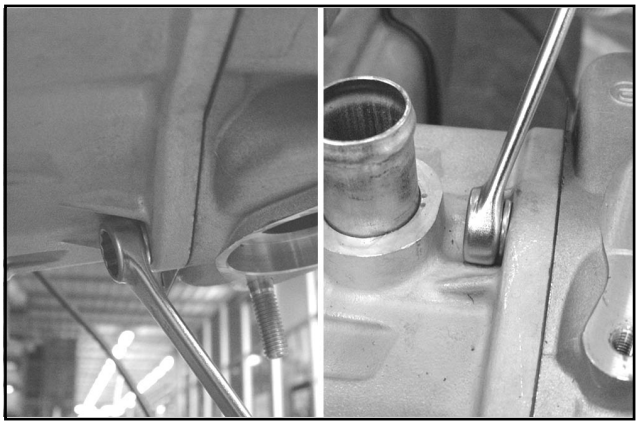
Tightening torque:
Head fixing nuts: 42 - 45 N·m



05_217

- Lock the fixing nuts, exhaust and intake side, to the prescribed torque.

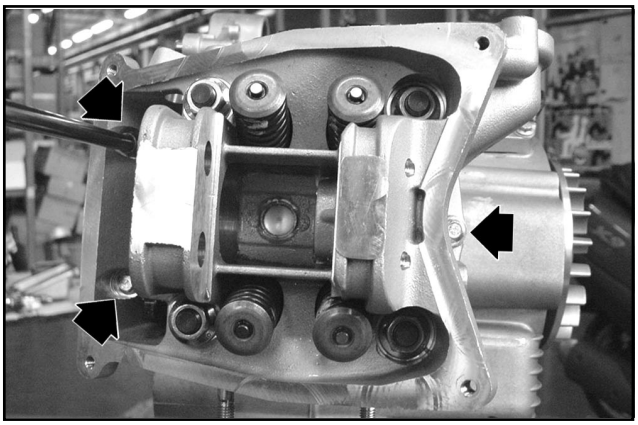
Tightening torque:
Head fixing nuts, exhaust/intake: 10 - 12 N·m



05_172

- Lock the 3 side fixings shown in the figure to the prescribed torque.

Tightening torque:
Head fixing screws: 10 - 12 N·m

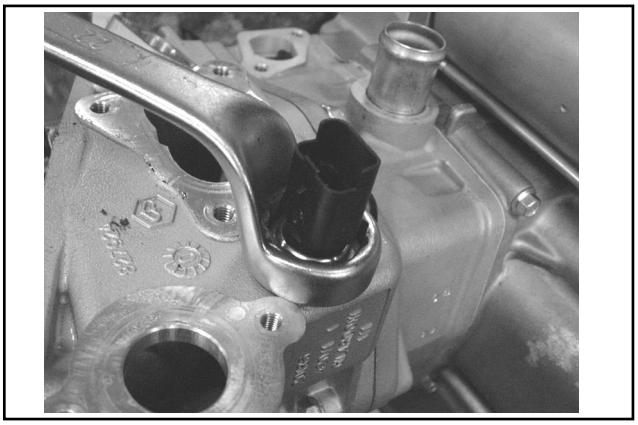


05_218

- Assemble the coolant temperature sensor with the washer and tighten to the prescribed torque.

Warning - Failure to observe the recommended tightening torques may cause damage to the sensor.

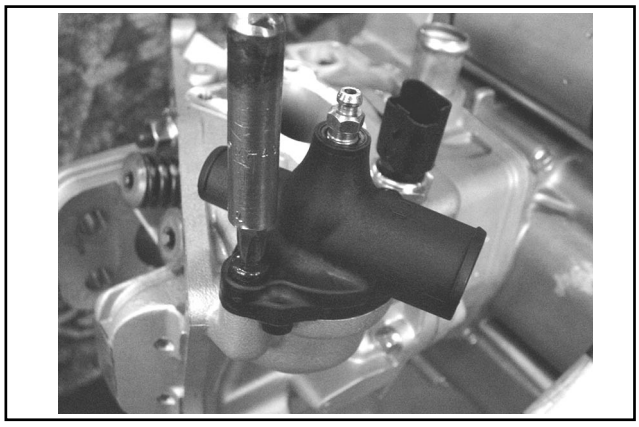
Tightening torque:
Coolant temperature sensor: 10 - 12 N·m



05_171

- Clean the cooling system outlet union with jets of compressed air.
- Check the O ring sealing.
- Assemble the union with the larger diameter facing the transmission side. Tighten the 2 fixing screws to the prescribed torque.
- Assemble the spark plug and tighten it to the prescribed torque.

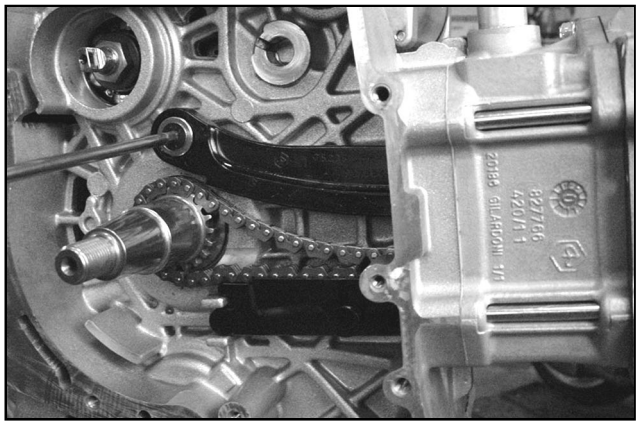
Tightening torque:
Cooling system outlet union fixing screws: 3 - 4 N·m
Spark plug: 12 - 14 N·m



05_170

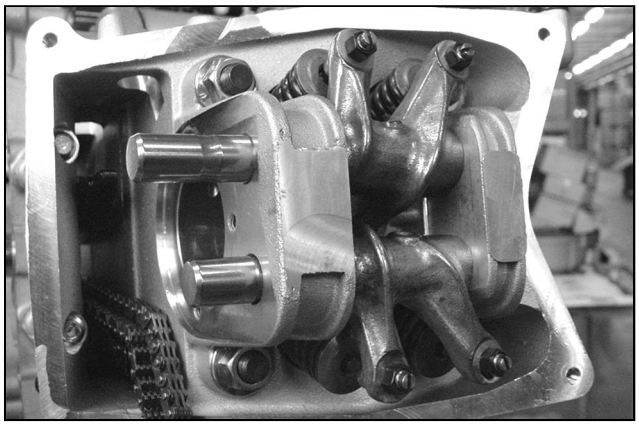
- Fit the timing control chain on the driving shaft respecting the original direction of rotation.
- Assemble the tension pad and relevant spacer, tighten the fixing screw to the prescribed torque. Smear thread locking compound LOCTITE medium type 242.

Tightening torque:
Tension pad fixing screw: 10 - 14 N·m



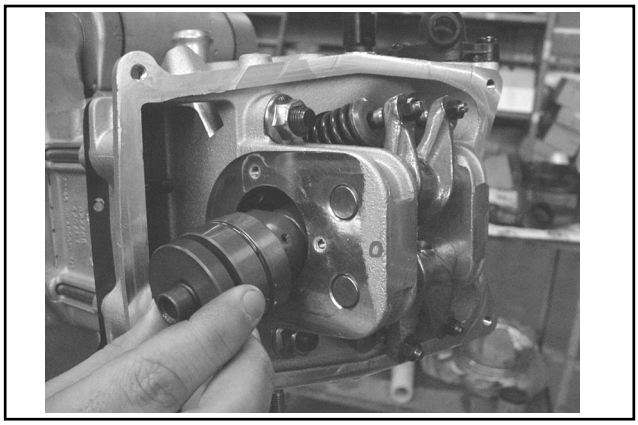
05_219

- Assemble the pins and equalizers from the flywheel side.
- Lubricate the 2 equalizers through the upper holes.



05_220

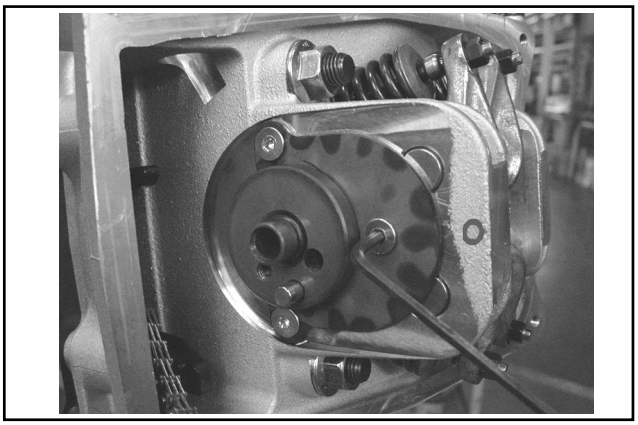
- Clean the camshaft by means of compressed air, in particular the groove, seat of the stop plate.
- Lubricate the 2 supports.
- Assemble the camshaft in the head, with cams opposite to the equalizers.



05_167

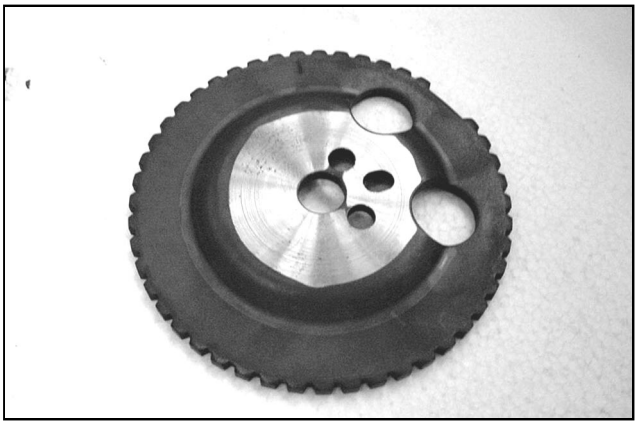
- Remove any LOCTITE residuals from the camshaft stop bracket fixing screws by means of a brush.
- Apply LOCTITE 242 to the fixing screws after cleaning them from any residual of thread locking compound.
- Assemble the camshaft stop bracket with countersinks well visible. Tighten the 3 fixing screws to the prescribed torque taking care not to damage the internal hexagon.

Tightening torque:
Camshaft stop bracket fixing screws: 4 - 6 N·m



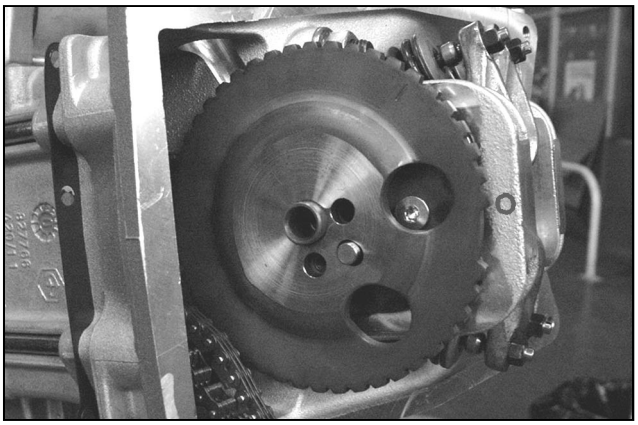
05_166

- Check that the phonic wheel timing pin opening and toothing show no signs of deformation or dents.



05_221

- Assemble the phonic wheel on the camshaft, keeping the timing reference mark visible.

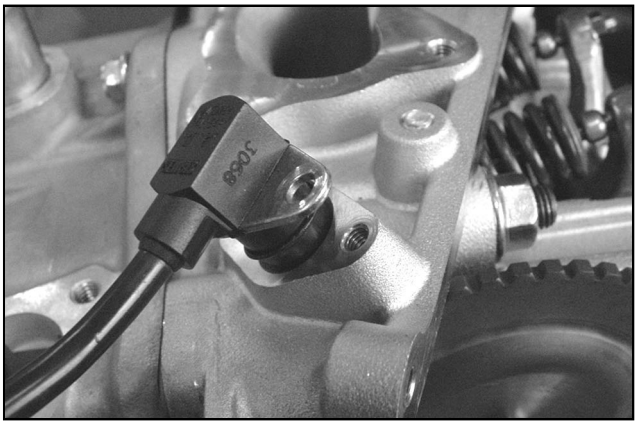


05_222

- Assemble the engine revs-timing sensor with a new O ring as shown in the figure. Tighten the 2 fixing screws to the prescribed torque.

N.B.: Check this component as described in Chapter 9-Injection.

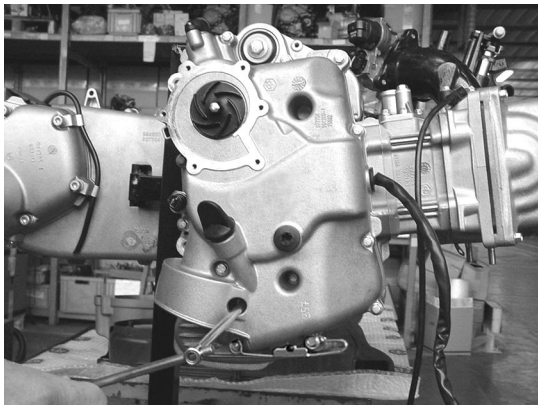
Tightening torque:
Timing revs sensor fixing screws: 3 - 4 N·m



05_223

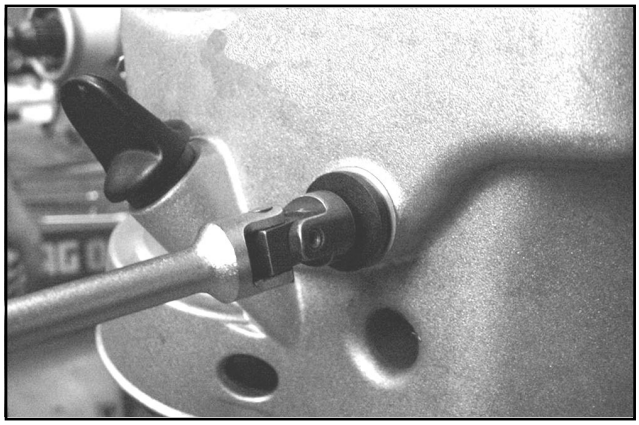
- Assemble the idler gear with torque limiter, flywheel and flywheel cover as described in Chapter 6-Flywheel and Starting System and in Chapter 5-Flywheel Cover

N.B.: To facilitate the assembly operation, assemble the flywheel cover without the cooling system sleeves.



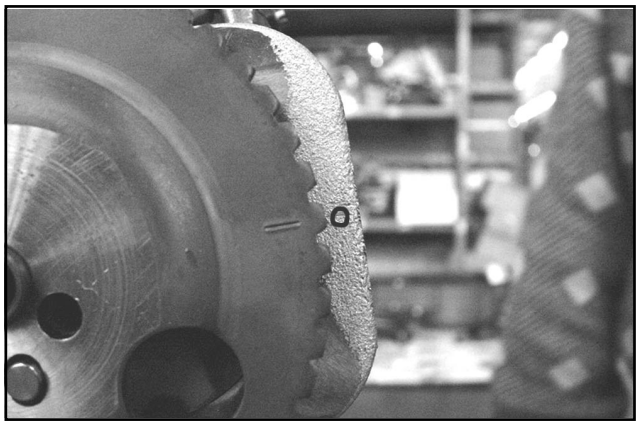
05_089

- Remove the timing control plug by means of a TORX wrench.



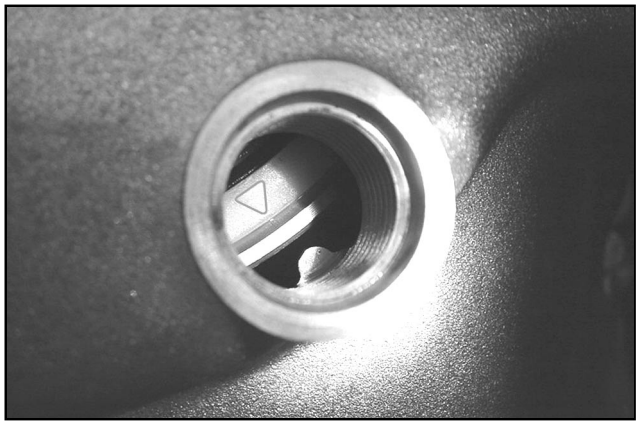
05_224

- Align the phonic wheel and head reference marks as shown in the figure.



05_225

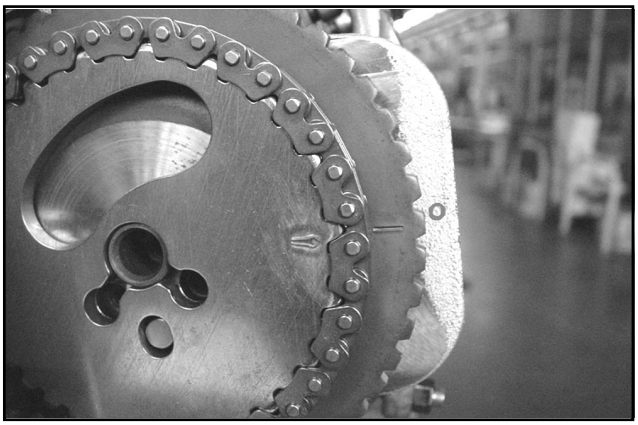
- Keep the chain slightly tensioned, turn the driving shaft by means of the driving pulley until the reference mark on the magneto support and the one on the flywheel cover are aligned.



05_226

- Fit the chain on the camshaft timing gear
- Fit the timing gear on the camshaft, aligning the reference marks.

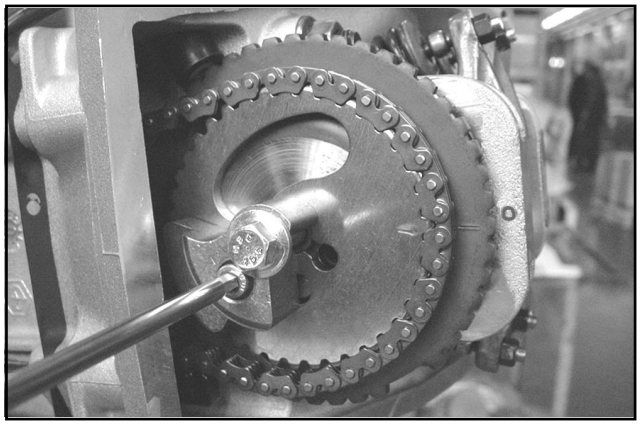
N.B.: During the timing check, keep the chain tensioned by pressing from the tightener compartment side.



05_227

- Assemble the counterweight
- Center it by means of the bell fixing screws.
- Tighten the counterweight fixing screw to the prescribed torque. Apply LOCTITE 242.

Tightening torque:
Counterweight fixing screw: 7 - 8.5 N·m

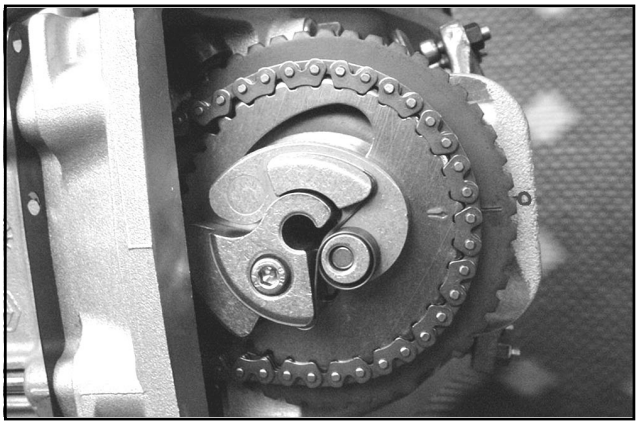


05_228

- Remove the central screw
- Install the valve lifter counterweight paying attention to correctly position the stop ring.
- Oil the decompressor counterweight control pin

05_229

- Assemble the return spring. Load it by about 3/4 of a turn.



05_230

- Turn the engine. Move the reference marks to the upper position as shown in the figure (intake end)

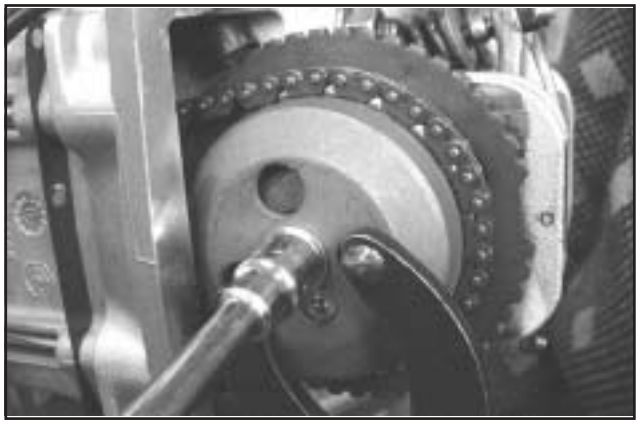
05_231

- Fit the valve lifter counterweight stop bell.
- Tighten the fixing screw to the prescribed torque, using LOCTITE 242.

N.B.: The bell timing is given by the head of the counterweight fixing screw

- Check that the decompression counterweight is free and the returning action of the spring.

Tightening torque:
Valve lifter counterweight stop bell fixing screws: 30 - 35 N·m

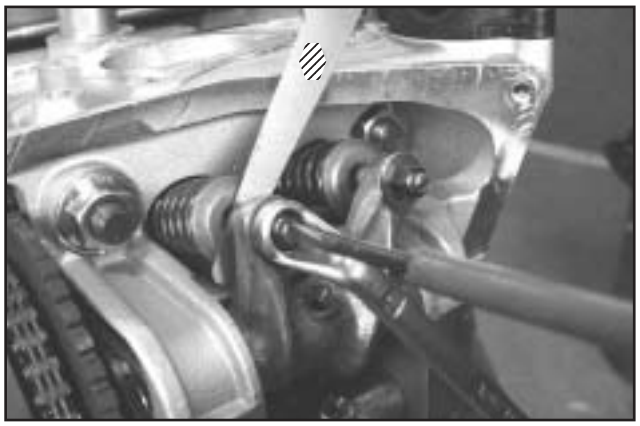


05_232

- Position the engine with the valve play adjustment timing reference marks aligned with the head
- Check the valve-equalizer play by means of a thickness gauge

Prescribed play: intake 0.15mm
(cold engine)
exhaust 0.15mm
(cold engine)

- If different values are measured, adjust by unloosing the check nut and by acting on the register with a tool as shown in the figure.



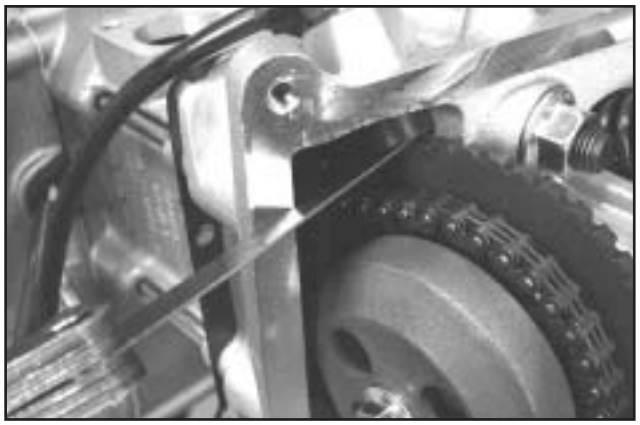
05_233

Checking the revs-timing sensor air gap

- Align one tooth of the phonic wheel with the revs-timing sensor.
- Check the air gap by means of a feeler.

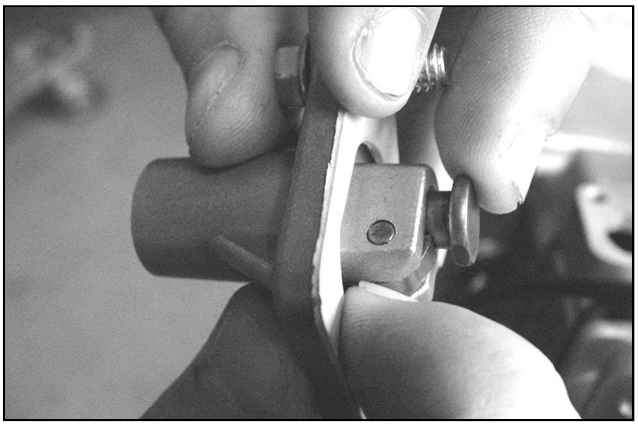
Standard air gap: from 0.20 to 0.70 mm

- Perform the check in 3-4 points.



05_234

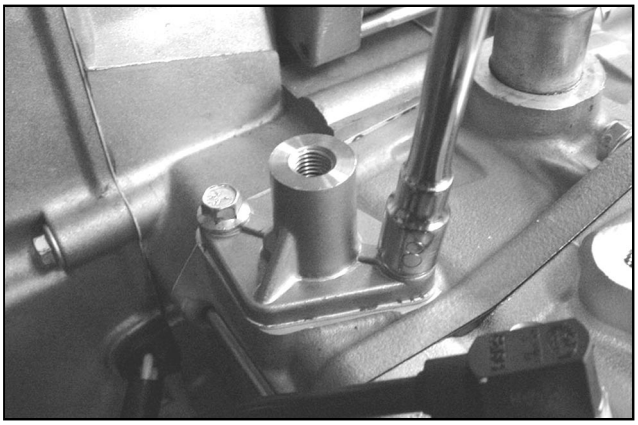
- Set the tightener cursor in the rest position by keeping pressed the stop dog



05_235

- Assemble the tightener on the cylinder with a new gasket.
- Tighten the two fixing screw to the prescribed torque.

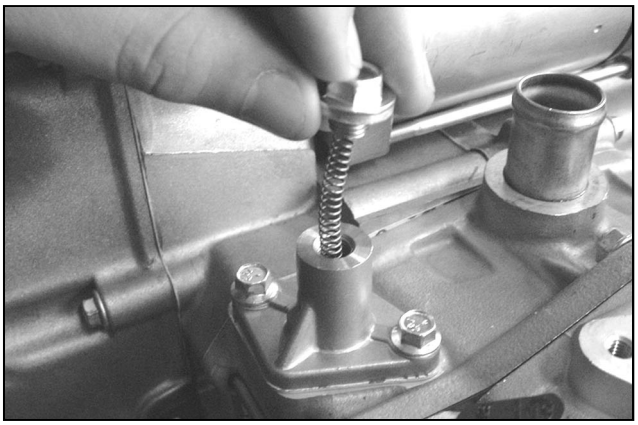
Tightening torque:
Tightener fixing screws: 11 - 13 N·m



05_236

- Fit the spring with the central screw and washer
- Tighten the central screw to the prescribed torque

Tightening torque:
Tightener screw: 5 - 6 N·m



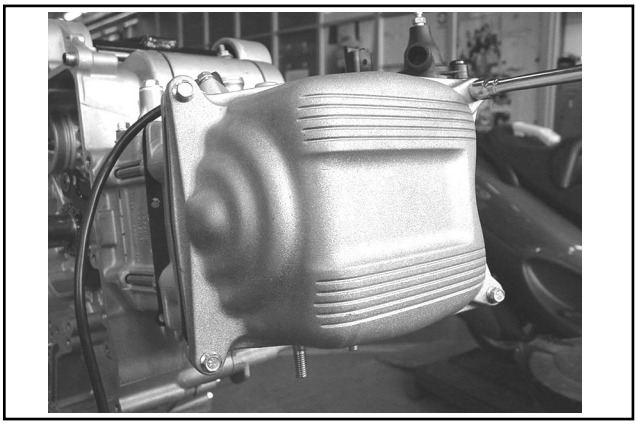
05_237

Tappets cover assembly

- Check the gasket condition
- Assemble the tappets cover and tighten the 4 screws to the prescribed torque

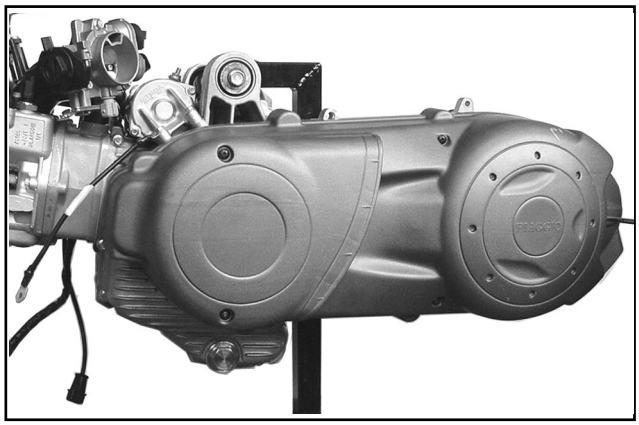
N.B.: Make sure the gasket is in the right position.

Tightening torque:
Tappets cover fixing screws: 11 - 13 N·m



05_156

- Assemble the transmission cover complete with net filter, and the external transmission cover according to the procedure described in Chapter 3-Automatic Transmission



05_006

- Assemble the cooling system sleeves using new clamps. Follow the procedure described in Chapter 5-Flywheel cover.

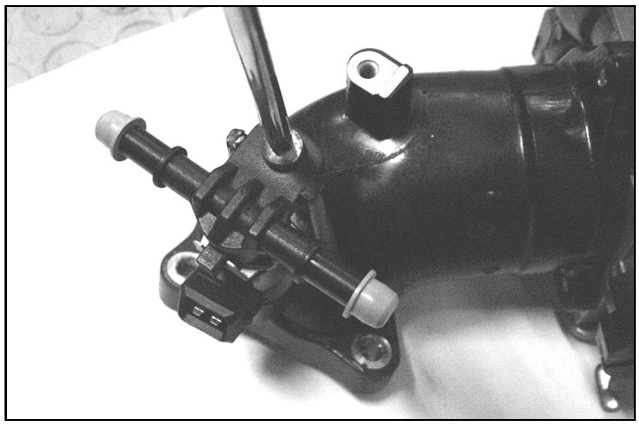
05_081

Intake manifold parts disassembly

Injector disassembly

N.B.: Remove the injector from the manifold only if it is faulty. Check the injector operation with the injector assembled on the manifold (see Chapter 9-Injection)

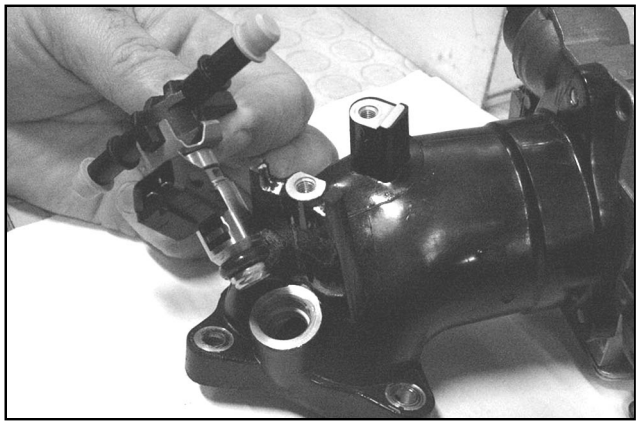
- To remove the injector, first remove the T joint central fixing screw supporting the injector.



05_238

- Remove the manifold injector.

N.B.: The abovementioned procedure is necessary to be able to wash or replace the manifold.

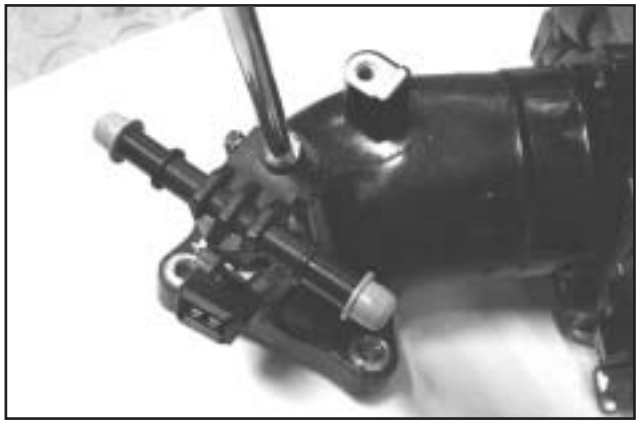


05_239

Injector assembly

- Check that the components are well clean
- Assemble new O rings and lubricate them with grease.
- Apply thread locking compound LOCTITE 242 to the fixing screw and tighten it to the prescribed torque.
  Note.
  After restoring the engine, check again that the CO% value at idle is within the prescribed range.
  Should the CO% exceed the allowable range carry out the adjustment as described on page 9-95

Tightening torque:
Injector support fixing screw: 3 - 4 N·m



05_238

Disassembly of throttle body from manifold

N.B.: The throttle body assembly includes various components that come supplied all together.
Check the components as described in Chapter 9-Injection.

Warning - The throttle body is supplied already calibrated. Absolutely avoid tampering with the valve beat register as the register has been suitably sealed. For any troubles related with the slow running, see Chapter 9-Injection.

N.B.: The throttle body can be removed with the manifold disassembled or assembled.

- Remove the 3 fixing screws shown in the figure.

05_241

- Check the condition of the sealing lips on the coupling surfaces between manifold-throttle body and manifold-head.

Warning - The penetration of air may compromise the injection system correct operation, in particular with engine running at idle speed.

05_242

- Check that the throttle valve and relevant duct are well clean.
- Also check that the additional air duct operated by the Stepper-motor is well clean.

05_243

Throttle body assembly to manifold

- Perform the disassembly operations in the reverse order. Tighten the 3 fixing screws to the prescribed torque

05_241

Tightening torque:
Throttle body fixing screws: 11 - 13 N·m

Intake manifold assembly to engine

- Assemble the intake manifold on the engine
- Insert the 3 fixing screws and tighten them to the prescribed torque. One of the screws is provided with a clamp supporting the cooling system sleeve.

05_244

Tightening torque:
Intake manifold fixing screws: 11 - 13 N·m

Note.
Fitting the throttle body on the manifold.
If the throttle body is replaced, reset the T.P.S. as described on page 9-87
and adjust the CO%at idle as derected on page 9-95.
After restoring the engine, check again that the CO% value at idle is within the prescribed range.
Should the CO% exceed the allowable range, carry out the adjustment as described on page 9-95.

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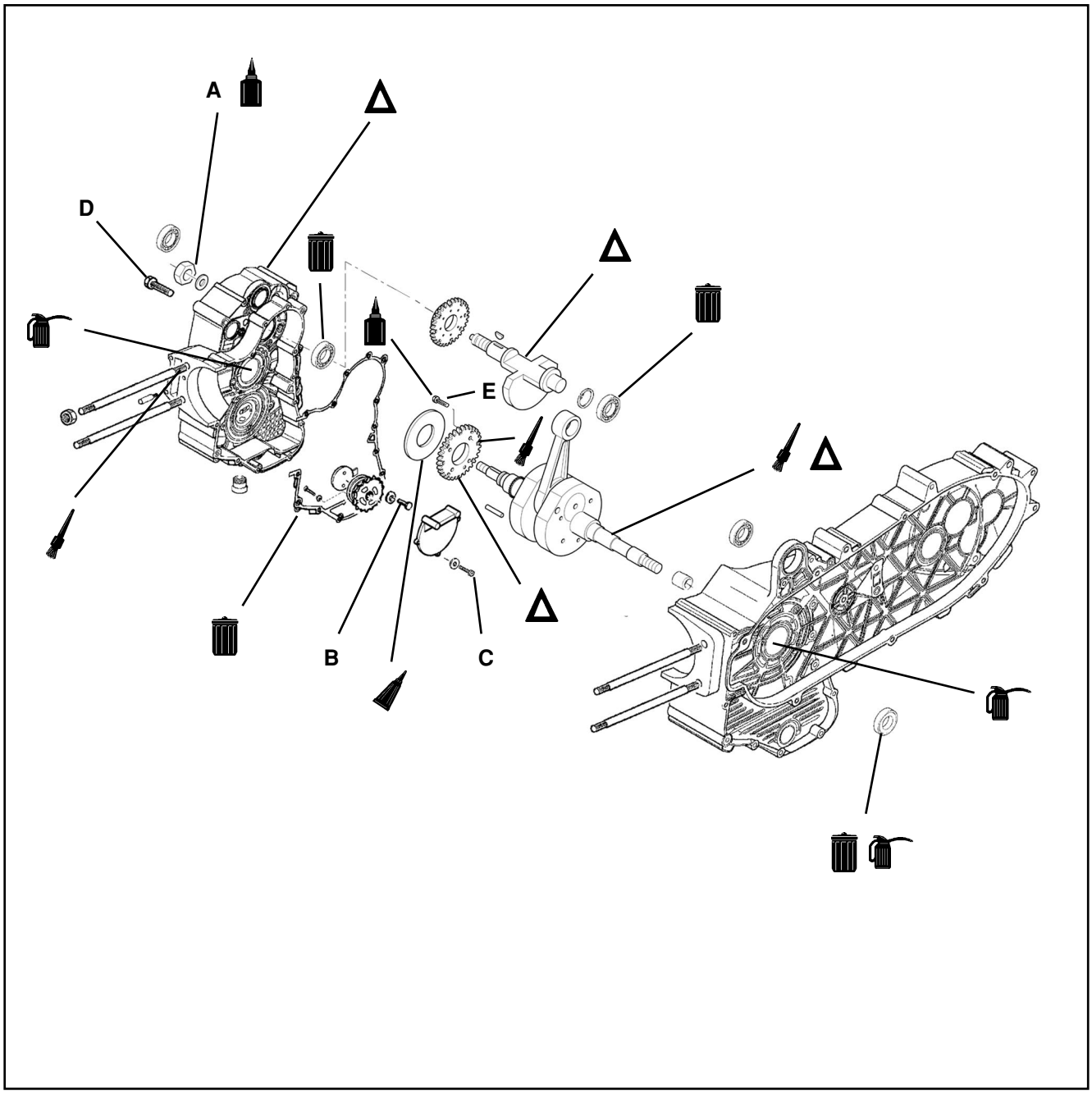
CRANKCASE AND DRIVING SHAFT 8

CRANKCASE AND DRIVING SHAFT



LUBRICATE WITH OIL

APPLY PRODUCT

WARNING: HANDLE WITH CARE

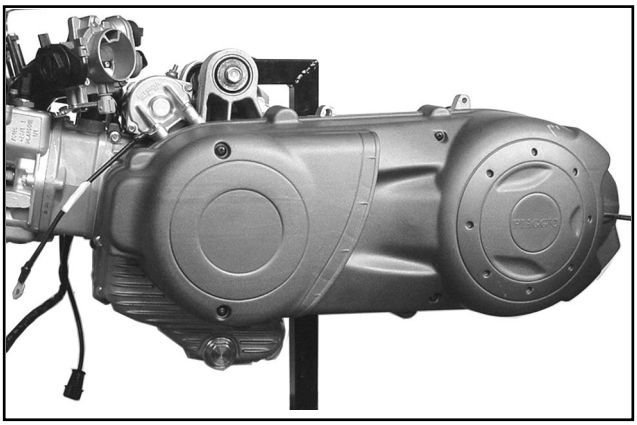
LUBRICATE WITH GREASE

CLEAN WITH CARE

ALWAYS REPLACE

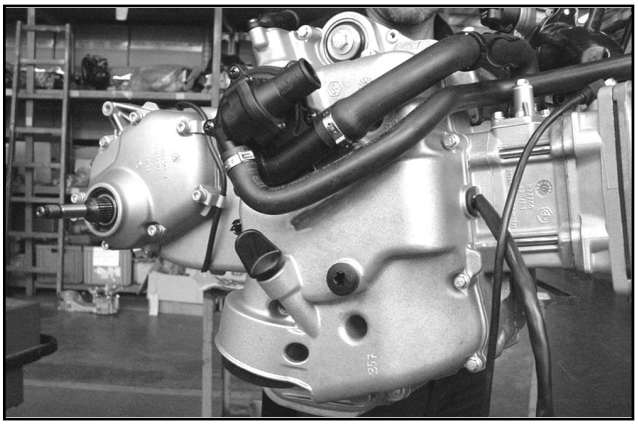
REFERENCE	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q
QUANTITY	1	2	2	14	4										
TORQUE N·m	25-29	5-6	8-10	11-13	10-12										

- Remove the external transmission cover, the transmission cover complete with net filter and the driving pulley assembly as described in Chapter 3-Automatic transmission.



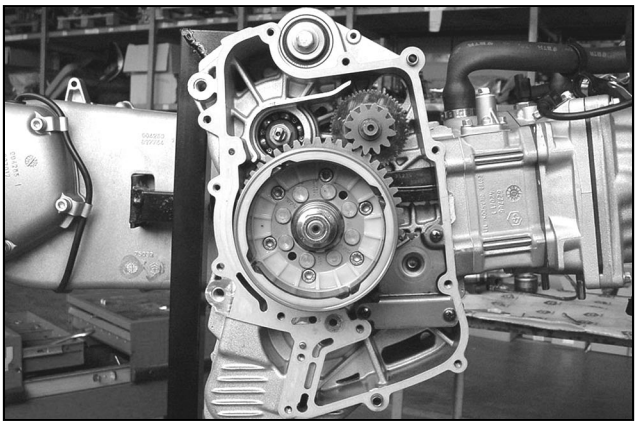
05_006

- Remove the flywheel cover with the cooling system sleeves as described in chapter 5-Flywheel cover



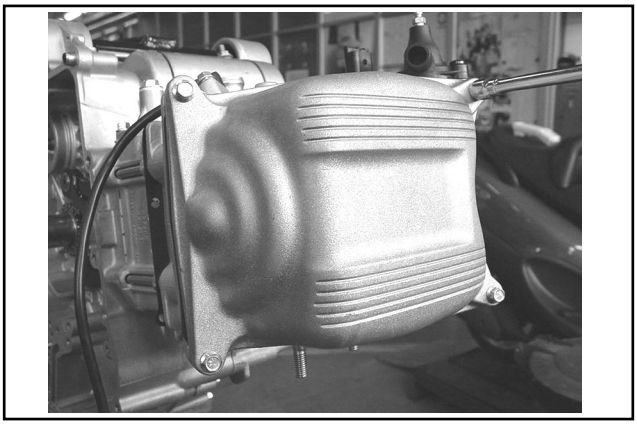
05_245

- Remove the magneto flywheel with the starting control as described in Chapter 6-Flywheel and Starting System.



05_246

- Remove the thermal assembly (cylinder, head, piston) as described in Chapter 7-Thermal Assembly.



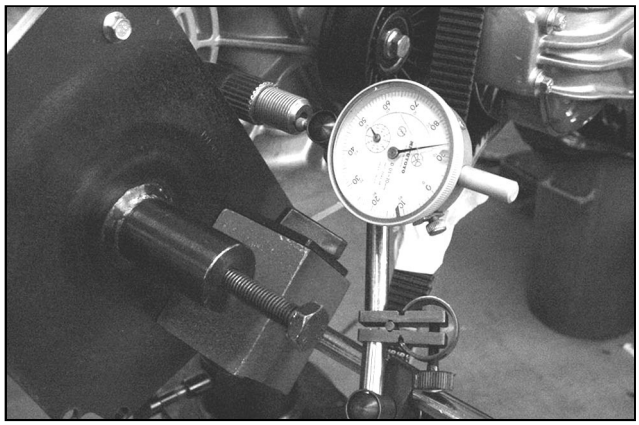
05_156

- Check the driving shaft end play before you open the engine crankcase.
  Use for this procedure a plate (e.g. specific tool) and a stand with dial gauge, specific tool

Specific tool:

Crankcase separating plate	**020262Y**
Dial gauge and stand	**020335Y**

Standard play: 0.10 - 0.50 mm
Limit allowed after use: 0.60 mm

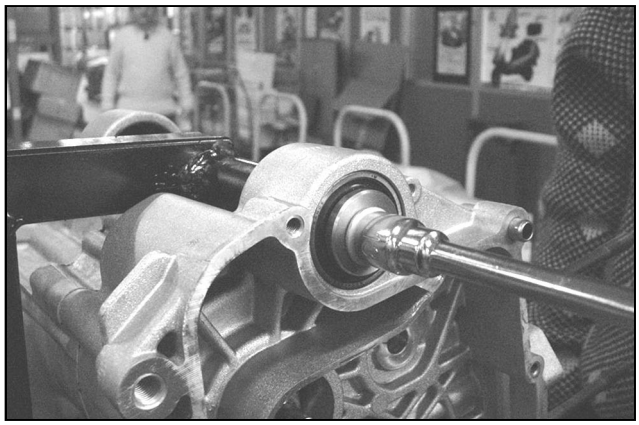


05_247

- If the play exceeds the indicated values, it means that the supporting surfaces of the crankcase driving shaft are worn.
- To correctly measure the play, completely restore the play in both directions by acting between the crankcase and the driving shaft.

Engine crankcase opening

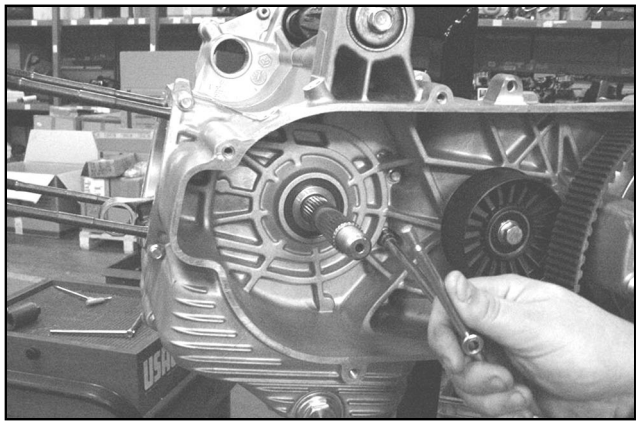
- Remove the engine mount setscrew on the half crankcase, flywheel side.



05_248

- Remove the crankcase 14 coupling screws.

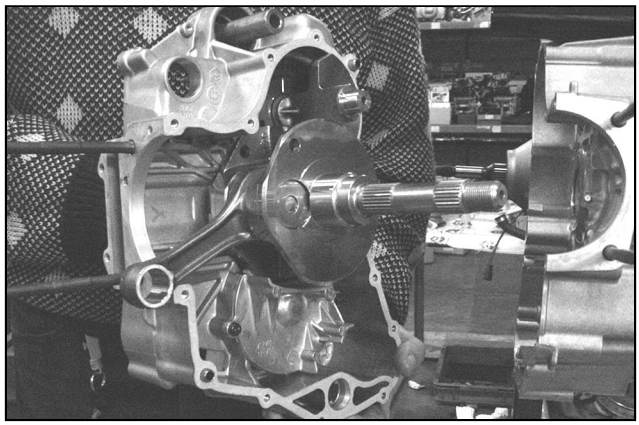
N.B.: The fixing screws come in 3 different lengths. Take note of their right position.



05_249

- Separate the crankcase by keeping assembled the driving shaft on the half crankcase, flywheel side.
- Remove the coupling gasket

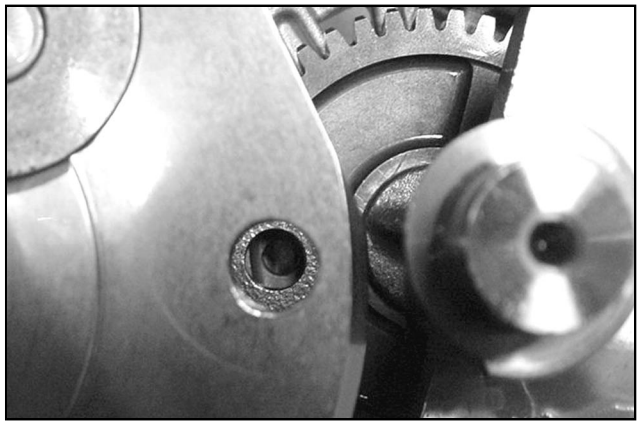
N.B.: The support bush can be maintained in the half crankcase, flywheel side.



05_250

Driving shaft disassembly

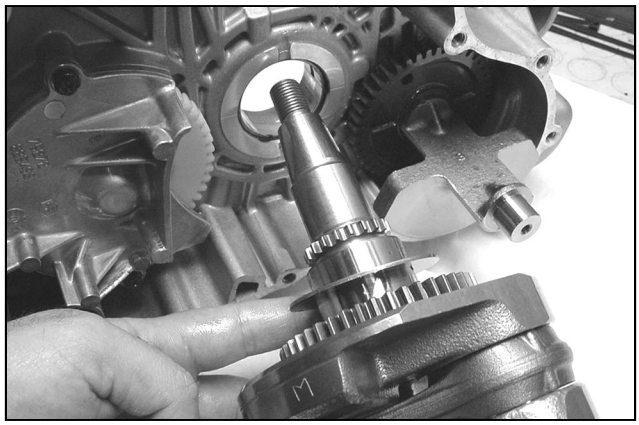
- Before disassembling the driving shaft, check the timing with the countershaft. Perform this check by turning the driving shaft until the two holes on the driving shaft are aligned with the hole on the countershaft control gear.
  This position also allows for the driving shaft removal.



05_251

- Remove the driving shaft with the shim washer, flywheel side.

Warning - While separating the crankcase and removing the driving shaft, take care that the shaft threaded ends do not interfere with the main bearing brass. Failure to observe this recommendation may cause damage to the main bearing brass.

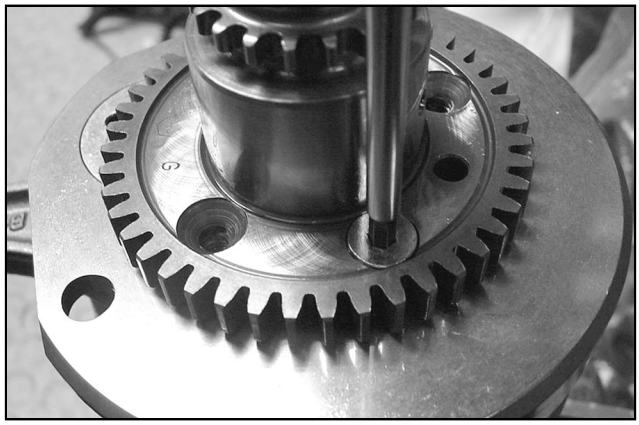


05_252

Removing the countershaft control gear and the oil pump.

- Remove the control gear by acting on the 4 fixing screws.

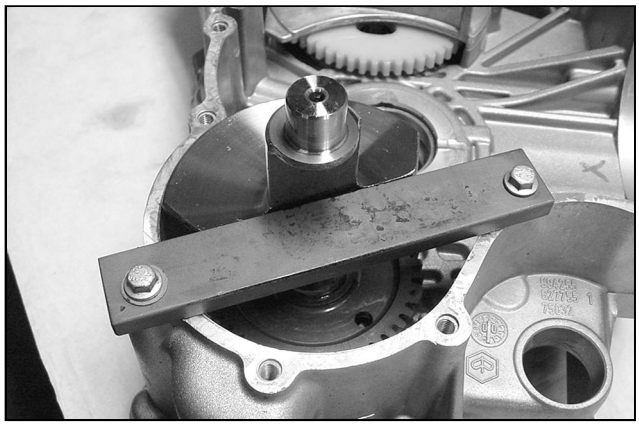
N.B.: The head screws are blocked with LOCTITE thread locking compound. Take care not to damage the control hexagon. To achieve the best results, it is recommendable to use a hexagonal socket wrench.
Remove the gear only when necessary.



05_253

Countershaft disassembly

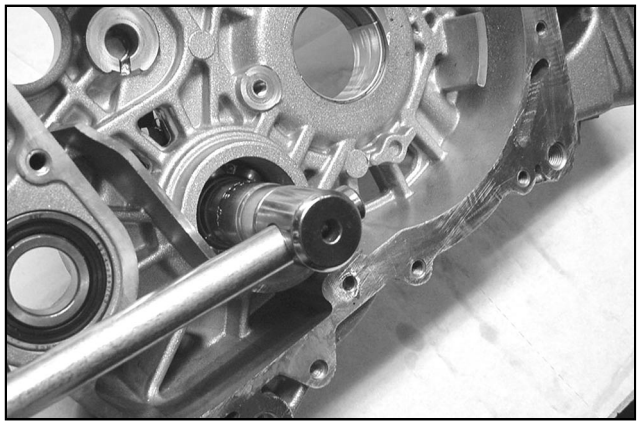
- Position the specific tool as shown in the figure.



05_254

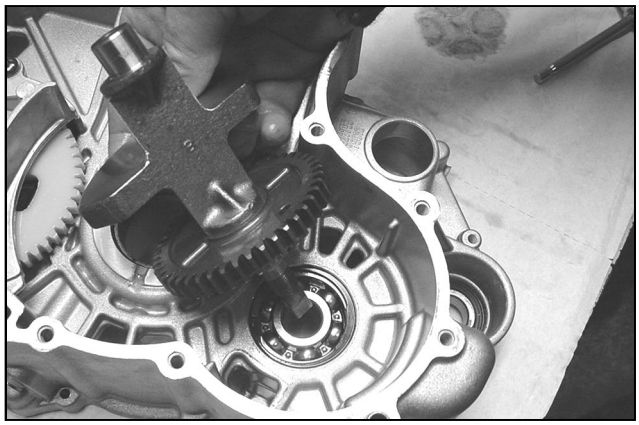
Specific tool
Countershaft lock wrench: 020479Y

- Remove the fixing nut and relevant washer.



05_255

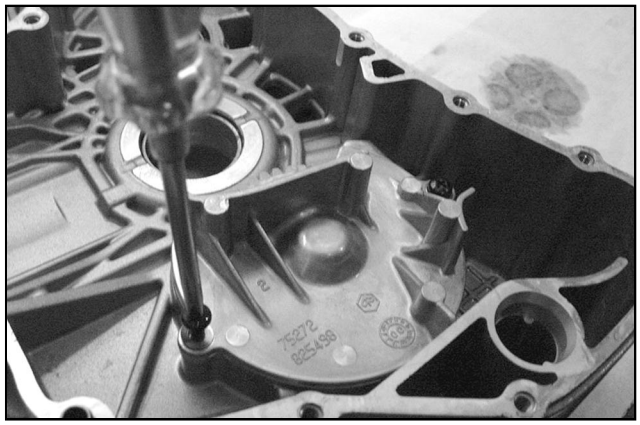
- Remove the specific tool and withdraw the countershaft complete with control gear.



05_256

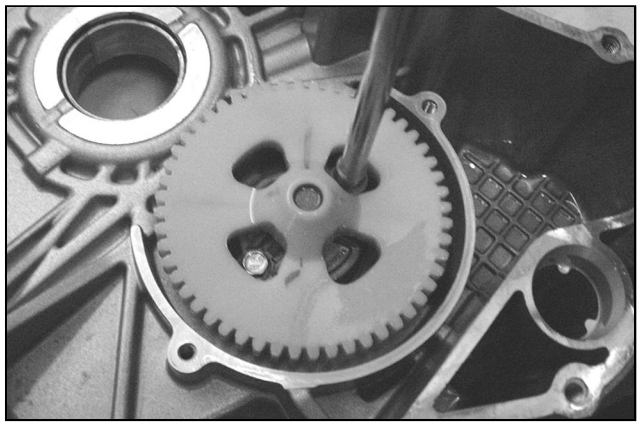
Oil pump disassembly

- Remove the oil pump compartment gate by unscrewing the 2 fixing screws and relevant washers.



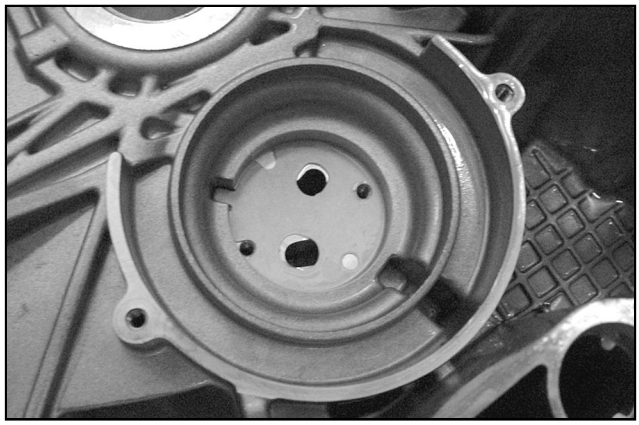
05_258

- Remove the oil pump complete with gear by unloosing the 2 fixing screws through the slots situated on the gear itself.



05_259

- Remove the gasket.



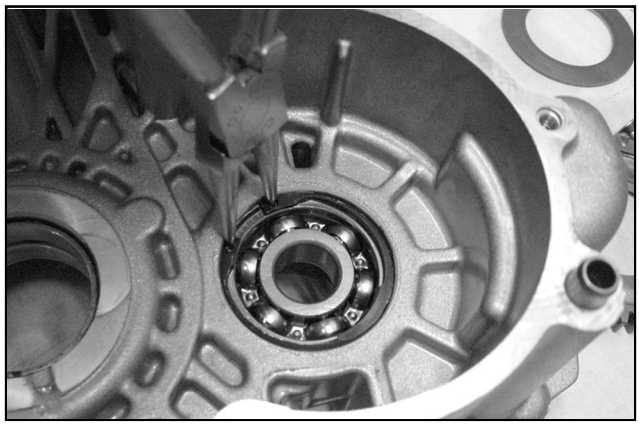
05_260

Replacing the countershaft bearings

- Check the bearings out for anomalous noise or play. Replace if necessary.

Half crankcase flywheel side

- Remove the snap ring situated on the inner side.

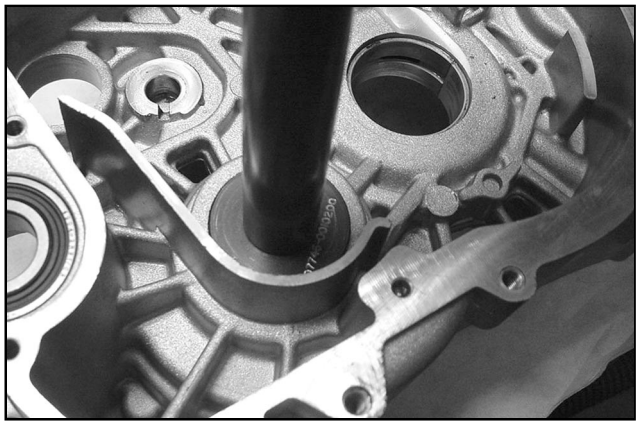


05_261

- Overturn the half crankcase.
- Remove the bearing from the half crankcase flywheel side by means of the specific tool and a hammer.

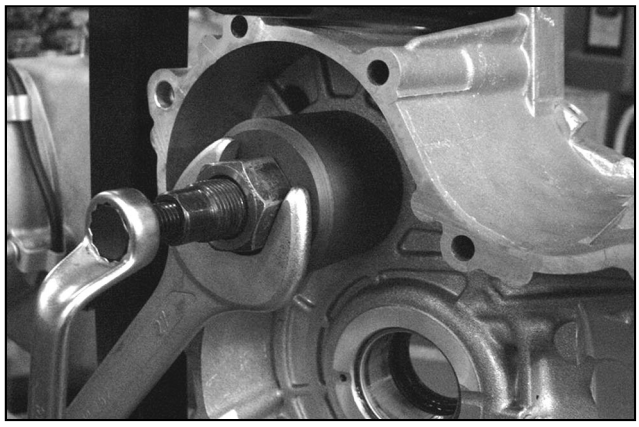
Specific tool:

Punch handle	**020376Y**
Adapter 37x40 mm	**020358Y**
17 mm guide	**020439Y**



05_262

- Remove the bearing from the half crankcase transmission side by means of the specific tool.

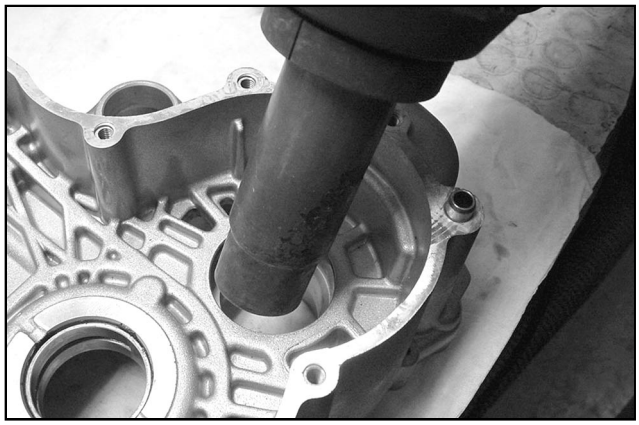


05_263

Specific tool:

Pliers	**001467Y008**
Bell	**001467Y007**

- Before assembling a new bearing, heat the half crankcase flywheel side by means of the specific tool
- Put the half crankcase on a wooden base



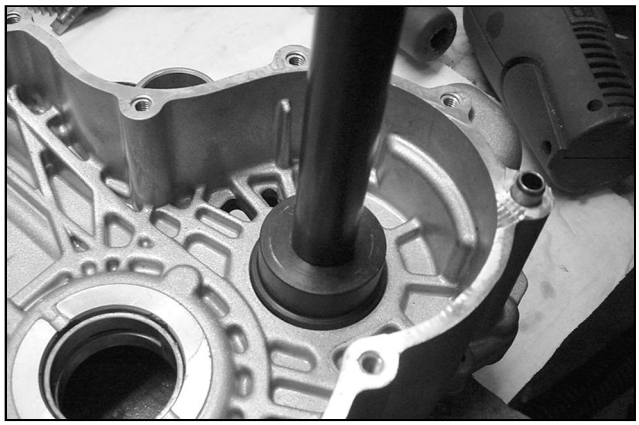
05_264

Specific tool:

Heater	**020151Y**

- Fit a new bearing on the specific tool after having greased the fitting slot
- Assemble the new bearing on the half crankcase by means of the specific tool.

N.B.: If a bearing with a plastic cage is used, position the balls so that they face the crankcase inner side.

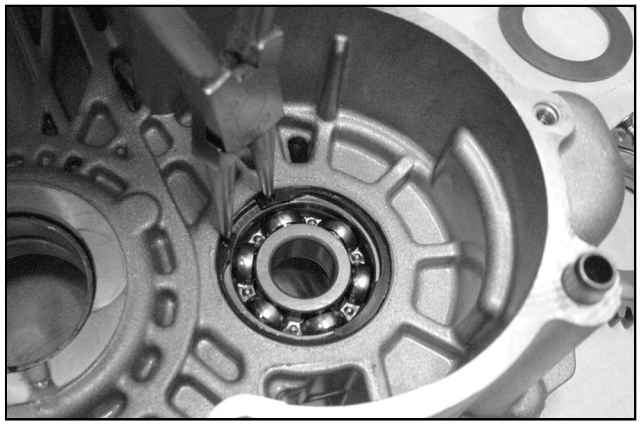


05_265

Specific tool:

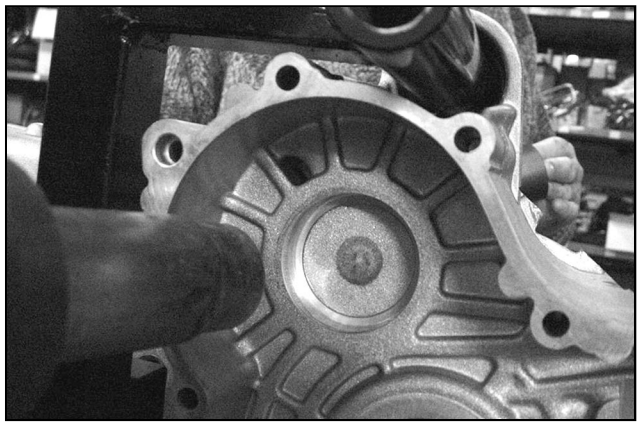
Punch handle	**020376Y**
Adapter 42x47 mm	**020359Y**
17 mm guide	**020439Y**

- Assemble the snap ring.



05_261

- Before assembling the new bearing on the crankcase transmission side, heat the housing by means of the specific tool.

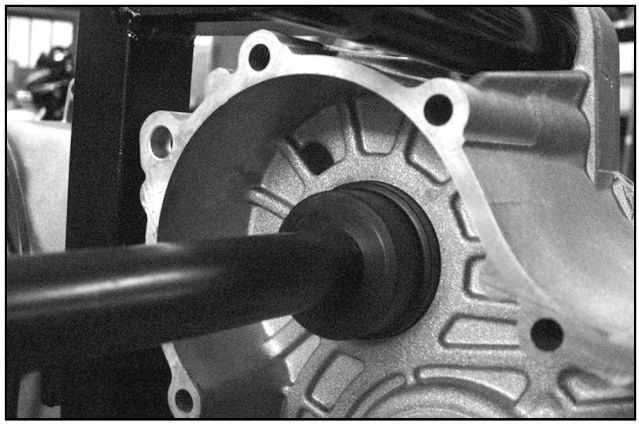


05_266

Specific tool:

Heater	**020151Y**

- Fit a new bearing on the specific tool after having greased the fitting slot
- Assemble a new bearing on the engine crankcase by means of the specific tool.



05_267

N.B.: If a bearing with a plastic cage is used, position the balls so that they face the crankcase inner side.

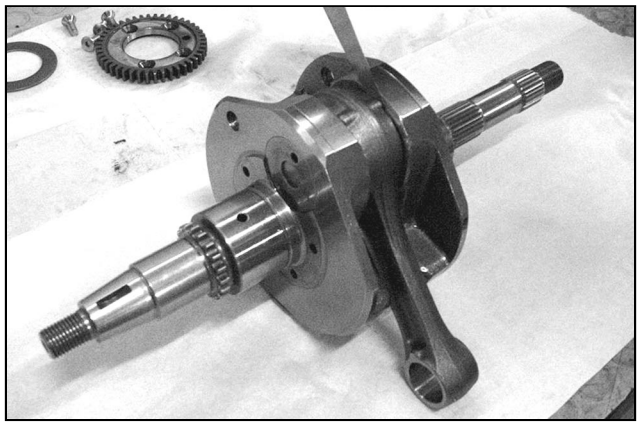
Specific tool:

Punch handle	**020376Y**
Adapter 42x47 mm	**020359Y**
17 mm guide	**020439Y**

Checking driving shaft components.

- Check the connecting rod end play.

Standard play: 0.20 - 0.40 mm



05_268

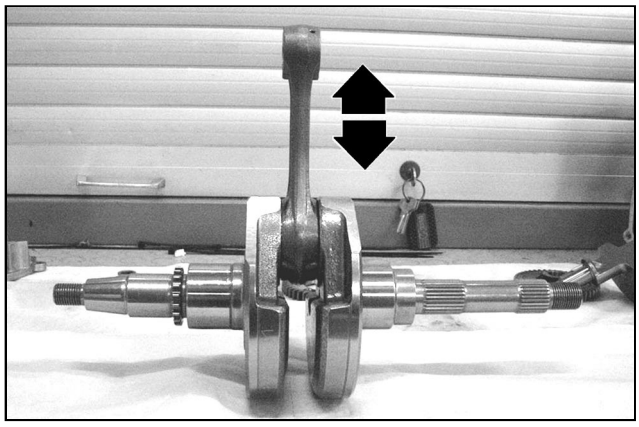
- Check the connecting rod diametral play.

Standard play: 0.046 - 0.076 mm

- Check that the end play containment surfaces show no signs of scoring. Measure the driving shaft width by means of a gauge, as shown in the figure.

N.B.: Check that the measuring is not distorted by the driving shaft support radius.

Standard dimensions: 63.6 - 63.45 mm



05_269

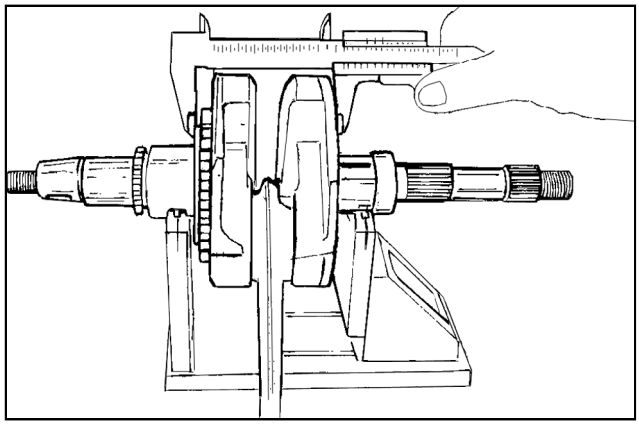
Warning - The driving shaft can be reused when the width conforms to the standard values and the surfaces show no signs of scoring.

Shim
- Check the total dimension of the driving shaft-shoulder-gear assembly.

Standard thickness: 71.804 - 72.000 mm

- Make sure that the shim is not scored.

N.B.: If reused, maintain the original assembly position.



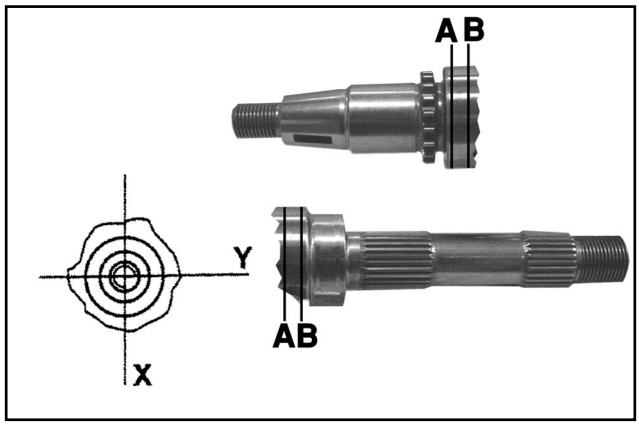
05_270

Specific tool:
Support for driving shaft control 020074Y

- If the driving shaft-crankcase end play exceeds the standard values but the driving shaft is not damaged, the trouble is certainly due to the wear or wrong machining of the engine crankcase.

- Check the diameter of both the driving shaft supports according to the axis and planes shown in the figure. The half shafts are subdivided in Class 1 and Class 2, as shown in the table below.

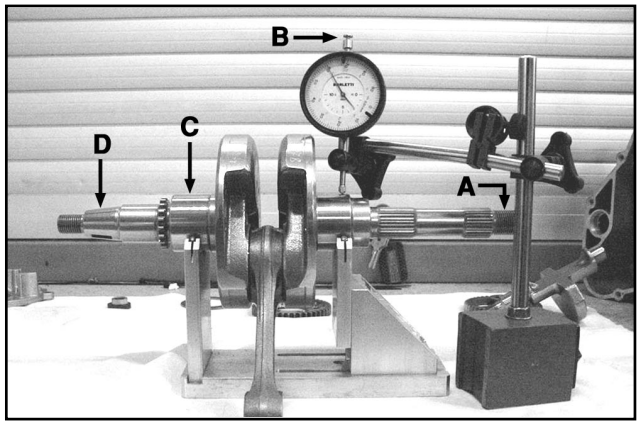
	Standard diameter
Class 1	40.010 - 40.016
Class 2	40.016 - 40.022



05_270_1

Driving shaft alignment check

- Assemble the driving shaft on the support. Measure the disalignment in the 4 points shown in the figure.



05_270_2

Specific tool:
Support for driving shaft control 020074Y

Max. out-of-line allowed: **A** = 0.15 mm
B = 0.01 mm
C = 0.01 mm
D = 0.10 mm

- Check the condition of the driving shaft cone, tange seat, oil seal housing, and the threading.
- If necessary, replace the driving shaft.

N.B.: The main bearings cannot be ground.

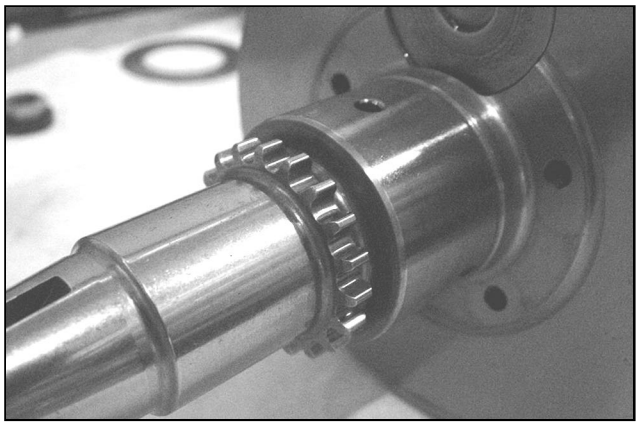
The connecting rod cannot be replaced. To check the connecting rod small end, see Chapter 7-Thermal Unit and Timing System.

- While cleannig the driving shaft, make sure that no dirt enters the shaft lubrication hole.

8

Warning - If the driving shaft made up of two half shafts of different classes is to be replaced, it is also necessary to replace the two half crankcases and to match the two components (shaft and crankcase) with the same class.

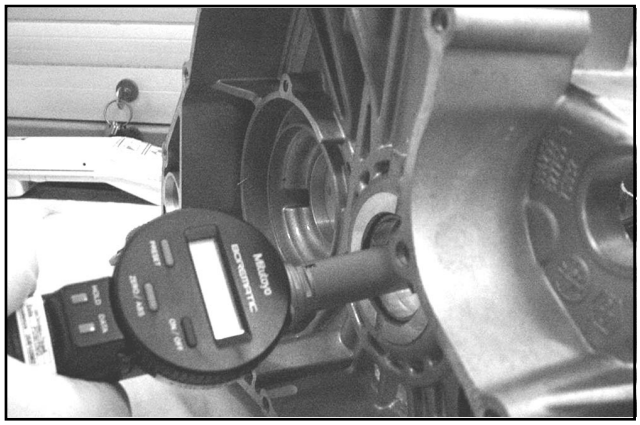
- Check the driving shaft gear according to the procedure described in Chapter 7-Thermal Unit and Timing System.



05_273

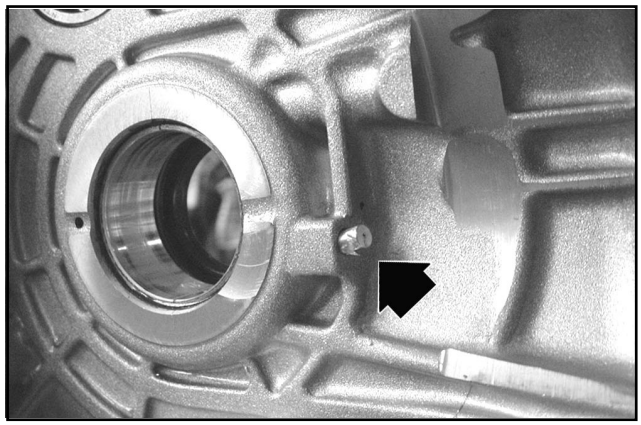
Engine half crankcase check

- Before checking the crankcases, carefully clean all the surfaces and lubrication ducts.
- For the half crankcase transmission side, act on the main bearing brass, cooling jet transmission side (see figure) and lubrication duct.



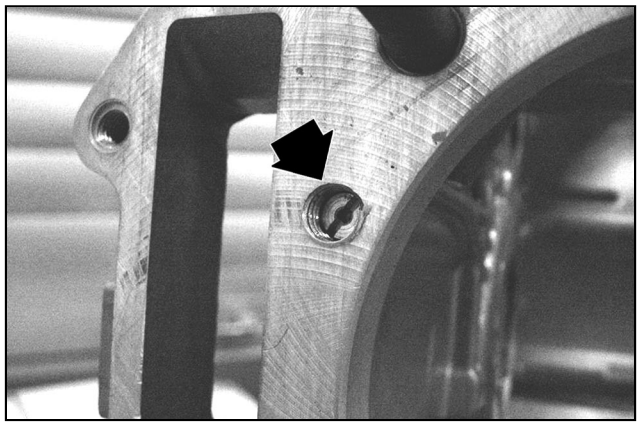
05_272

N.B.: The jet is fed through the main bearing brass. Correct operation of this component improves the piston crown cooling. Its clogging will cause troubles that are difficult to notice (piston temperature increase). Failure of this component may drastically reduce the lubrication pressure to the main bearing brass and connecting rod.



05_274

- For the half crankcase flywheel side, pay special attention to the lubrication ducts to the main bearing brasses, oil pump compartment and channels, and by-pass duct situated on the flywheel cover.



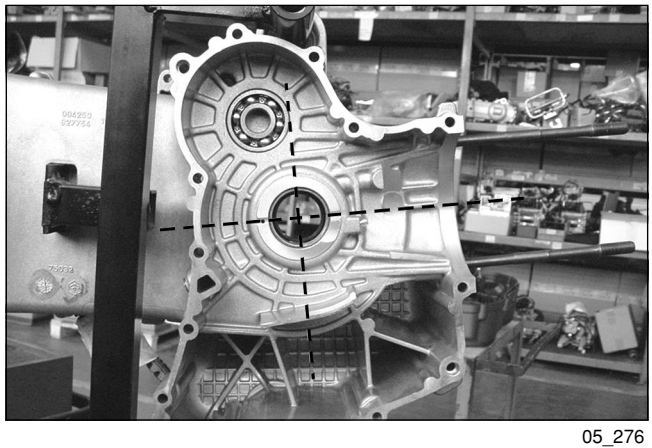
05_275

N.B.: As already described in Chapter 10-Lubrication, it is very important that the by-pass housing on the flywheel cover shows no signs of wear that would compromise the sealing of the lubrication pressure adjusting piston. The head lubrication duct is provided with a choking jet, that provides for a head lubrication of the “low pressure” type. This is to reduce the oil temperature in the pan.
The jet clogging will prejudice the lubrication to the head and timing system mechanism.
The jet failure will reduce the lubrication pressure to the main bearing brasses and connecting rod.

- Check that the surfaces show no signs of dents or deformation, especially on the cylinder-crankcase surface and crankcase coupling area.
- A defective gasket and crankcase coupling surface (see flywheel cover coupling) may cause leaks of the oil under pressure, thus compromising the lubrication pressure to the main bearing brasses and connecting rod.
- Check that the driving shaft end play containment surfaces show no signs of wear. Check the dimensions according to the procedures described for the end play check and driving shaft dimensions.

Main bearing brass check

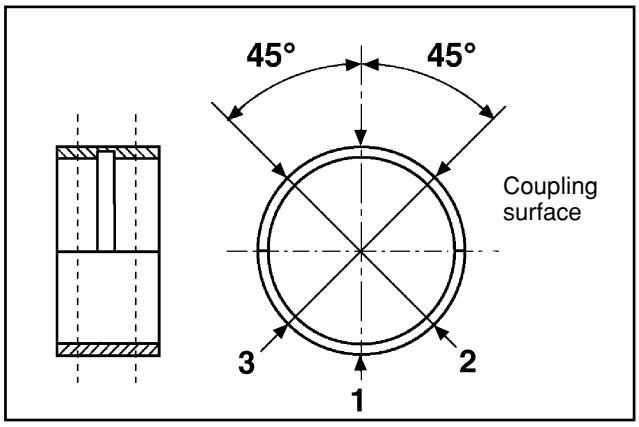
- A good lubrication of the bearing brasses is achieved with a good lubrication pressure (4 bar) and good oil flow rate. To this purpose, the bearing brasses must be positioned correctly to avoid the oil supply ducts choking.
- The main bearing brasses are obtained with 2 half bearings, 1 full and 1 with holes and openings for the lubrication.
- The full half bearing supports the thrusts produced by the combustion, therefore it is positioned opposite to the cylinder.
- To avoid the oil supply ducts choking, the coupling surface of the two half bearings must be perfectly orthogonal with the cylinder axis, as shown in the figure.
- The oil supply channels square measure is also affected by the brass driving depth respect to the driving shaft end play containment surface.



05_276

N.B.: To maintain the brass position on the crankcase, the driving is forced on cast iron rings that are fitted in the casting of both half crankcases.

- Check the brasses diameter in the 3 directions shown in the figure.
- Repeat the measuring on the other half of the brass. See figure.



05_277

N.B.: Do not measure the mating of the 2 half bearings as the ends are splined to allow deformation while being fitted

- The brasses standard diameter after the driving changes according to the coupling selected.
- The brasses housing in the crankcases are subdivided in 2 classes, as for the driving shaft Class 1 and Class 2.
- The brasses are subdvided in 3 classes depending on the thickness, see table below:

TYPE	IDENTIFICATION	THICKNESS
A	Red	1.982 - 1.987
B	Blue	1.987 - 1.992
C	Yellow	1.992 - 1.997

Half shafts coupling with half crankcase and brass

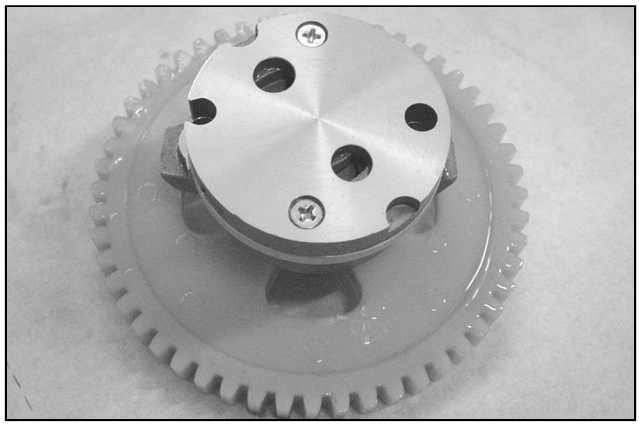
Half shaft Class	Half shaft Class	Brass class	Spare crankcase preparation
1	1	B	FC1 Drg. CM1033015001
	2	C	
2	1	A	FC2 Drg. CM1033015002
	2	B	

N.B.: When assembling the spare parts, use the shaft with two shoulders class 1 with crankcase FC1 (or class 2 with crankcase FC2).
A spare crankcase cannot be used with a mixed class driving shaft. The shaft for the spare parts is provided with half shafts of the same class.

N.B.: To replace the half crankcases, remove the countershaft bearings as described above. Remove from the half crankcase, transmission side, the antiflapping roller and the driven pulley assembly, as described in Chapter 3-Automatic transmission, and the hub cover with relevant gears and bearings, as described in Chapter 4-Final Reduction.

Oil pump

- Overhaul the oil pump as described in Chapter 10-Lubrication.



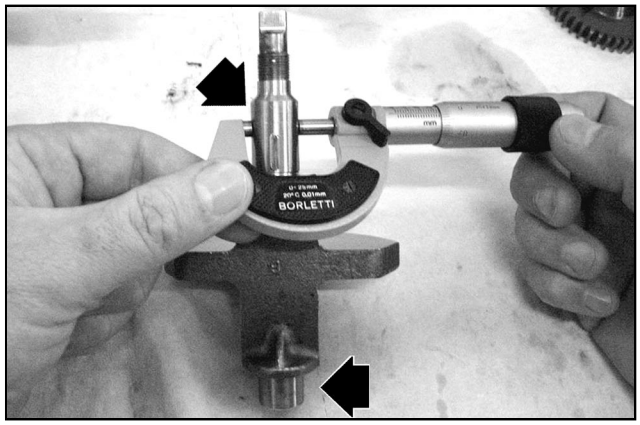
05_278

Countershaft

- Measure the 2 countershaft supports by means of a micrometer, as shown in the figure.

Standard diameter: $17\ ^{-0.01}_{-0.02}$ mm

- Check that the water pump drive shows no signs of wear.



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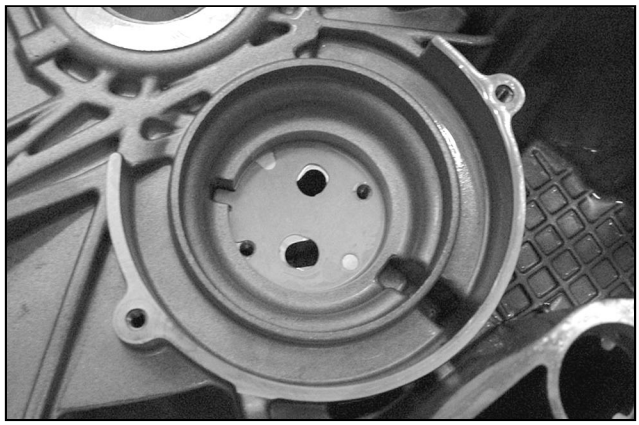
Oil pump assembly

- Check the gasket correct position.

N.B.: The gasket tooth must be positioned in the relevant seat.

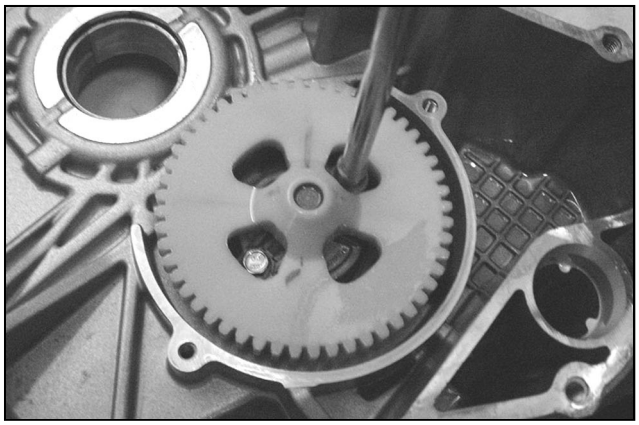


05_260

- Assemble the oil pump complete with the gear.
- Fit the 2 fixing screws through the slots on the gear and then tighten them to the prescribed torque.

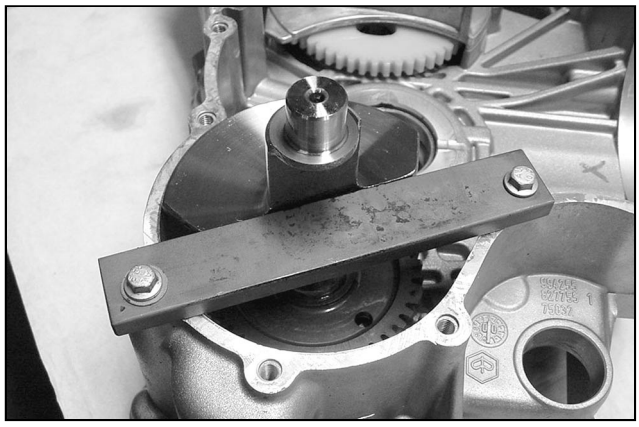
N.B.: The pump assembly position is determined by the screws. Failure to observe the tightening torque may change the rotors to pump casing allowance.

Tightening torque:
Oil pump fixing screws: 5 - 6 N·m



05_259

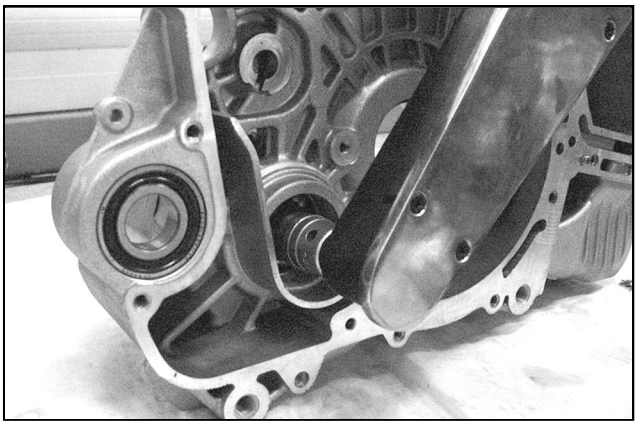
- Assemble the countershaft with the gear on the half crankcase flywheel side
- Fit the specific tool in the position shown in the figure



05_254

Specific tool:
Countershaft lock wrench 020479Y

- Hold the countershaft and fit the washer with nut
- Tighten the nut to the prescribed torque, apply LOCTITE 242
- Remove the specific tool.



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Tightening torque:
Countershaft fixing nut: 25 - 29 N·m

Driving shaft assembly

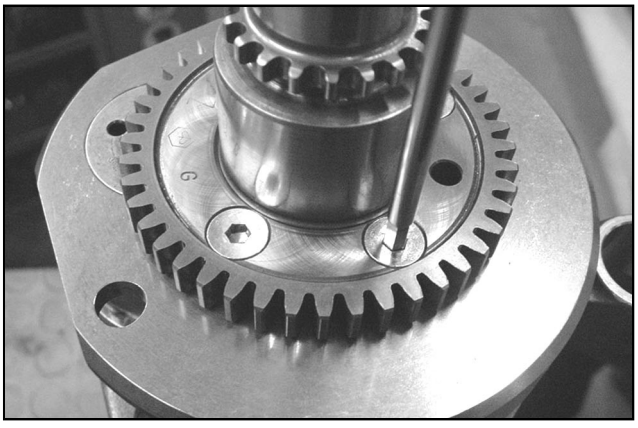
- Check that the countershaft control gear and the oil pump show no signs of dents or deformation. Replace if necessary.

N.B.: If the countershaft control gear and the oil pump are to be replaced, also replace the countershaft gear.

- Before assembling the gear on the driving shaft, carefully clean the two coupling surfaces by removing any residuals of LOCTITE from the holes by means of a brush.
  Blow compressed air and degrease the fixing holes on both surfaces to improve the new LOCTITE setting.
  Apply LOCTITE 242 again.

- Repeat the same procedure for the 4 fixing screws.
- Fit the control gear on the driving shaft with the holes countersink well visible.
- Tighten the 4 fixing screws to the prescribed torque.

N.B.: In order not to damage the screws control hexagon, use a socket wrench with inner hexagon.



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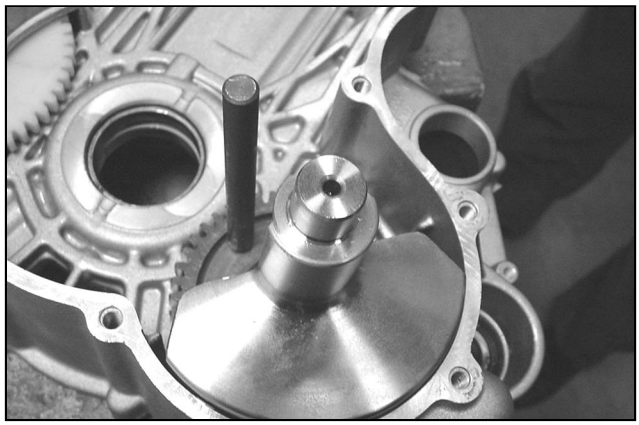
Tightening torque:
Driving shaft gear fixing screws: 10 - 12 N·m

- Lubricate the main bearing brass on the half crankcase flywheel side.
- Grease the shim washer
- Fit the shim washer on the driving shaft, in its original position
- Insert the specific tool for the timing in the hole on the countershaft

Specific tool:
Countershaft timing pin 020471Y



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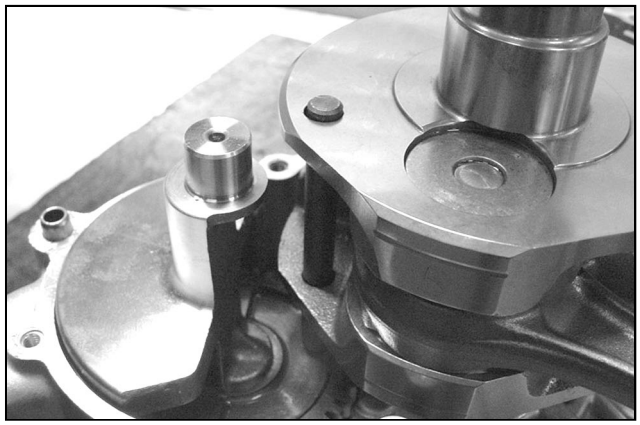
- Assemble the driving shaft on the pin. Further insert it in the brass very carefully.
- Before completing the assembly, fit the oil pump gear with the control gear.
- Complete the assembly and remove the specific tool.

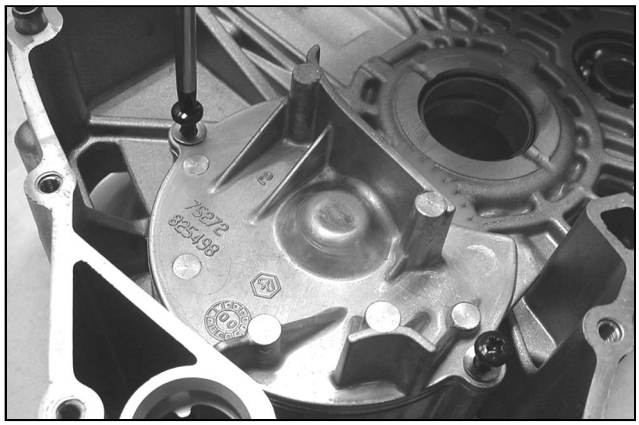
N.B.: While assembling the shaft on the half crankcase, take care not to damage the main bearing brass with the threaded tang of the driving shaft and with the timing control toothed pinion.



05_285

- Assemble the oil pump compartment gate.
- Tighten the 2 flanged fixing screws to the prescribed torque.

Tightening torque
Gate fixing screws: 8 - 10 N·m



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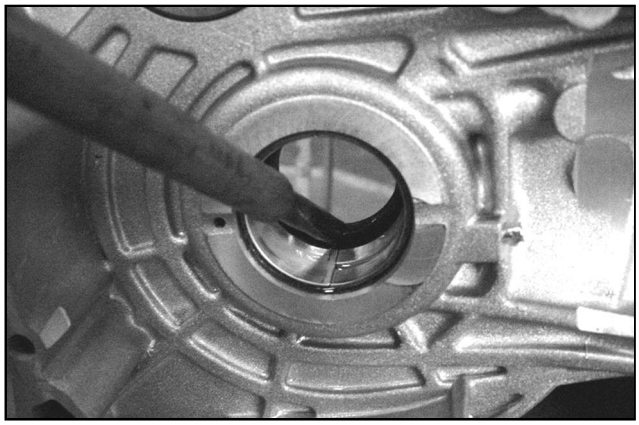
Crankcase coupling

- Remove the oil seal on the half crankcase transmission side by means of a screwdriver



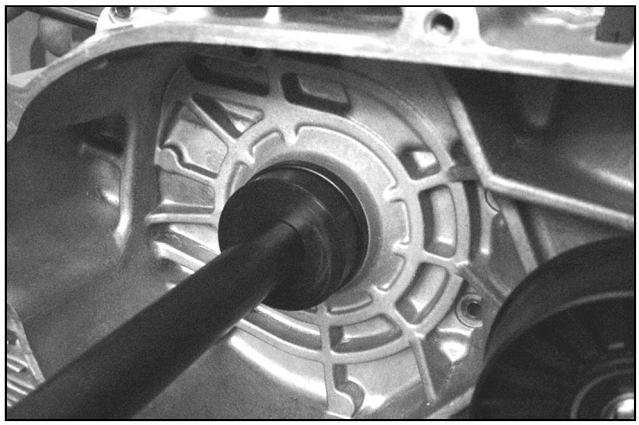
05_286

- Grease and assemble a new oil seal by means of the specific tool. Put it at 0.5 mm from the crankcase surface.

Warning - The oil seal wrong position will compromise the lubrication oil circulation.

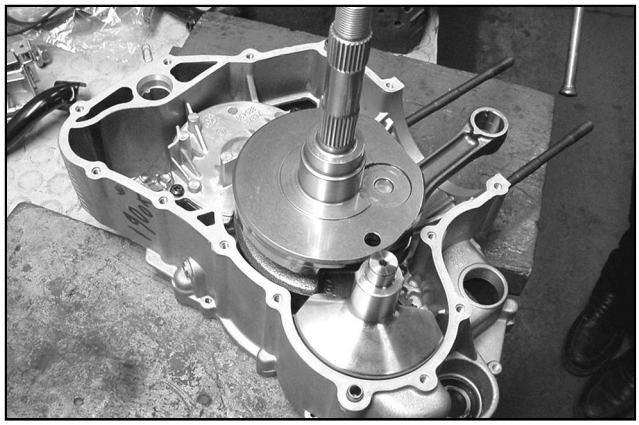
Specific tool:

Adapter 52x55	**020360Y**
Punch handle	**020376Y**



05_287

- Assemble the gasket on the half crankcase flywheel side



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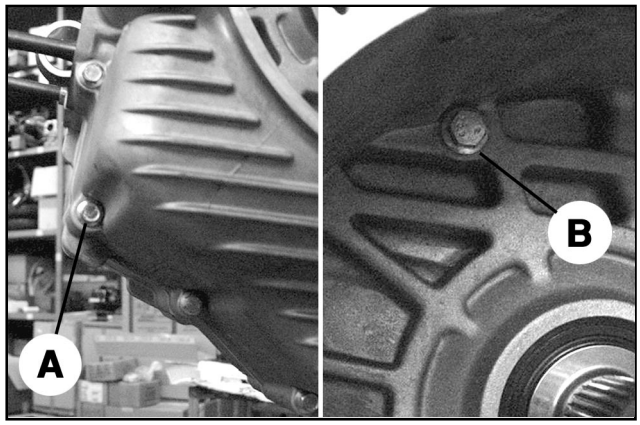
- Lubricate the main bearing brass on the half crankcase transmission side.
- **Mate the 2 half crankcases taking care not to damage the half crankcase brass transmission side, with the driving shaft threaded tang.**
- Insert, without locking it, the engine mount setscrew on the half crankcase flywheel side.
- Fit the 14 fixing screws, using the shorter screw **«A»** and the longer screws **«B»**, as shown in the figure.
- Fully screw the screws and then tighten them to the prescribed torque.
- Check that the driving shaft turns freely.

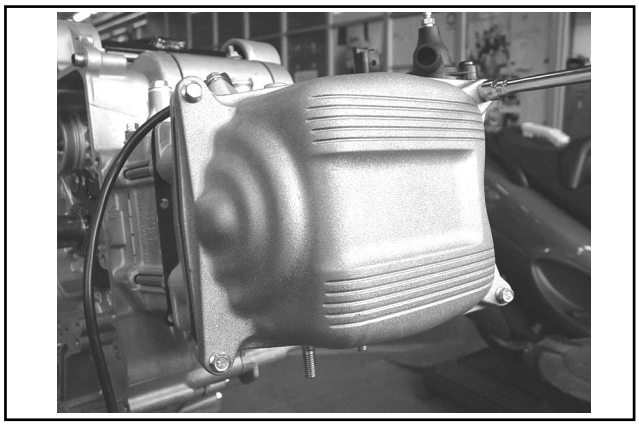
N.B.: Remove any part in excess from the crankcase coupling gasket on the cylinder surface in order to improve the sealing.

Tightening torque:
Crankcase coupling screws: 11 - 13 N·m



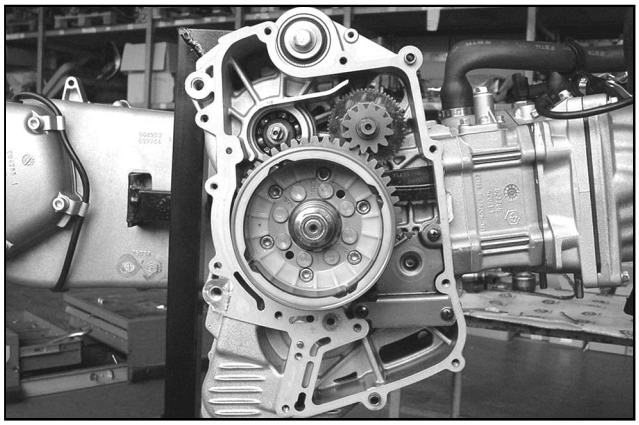
05_289

- Assemble the thermal unit (cylinder, head, piston) as described in Chapter 7-Thermal unit and Timing system.



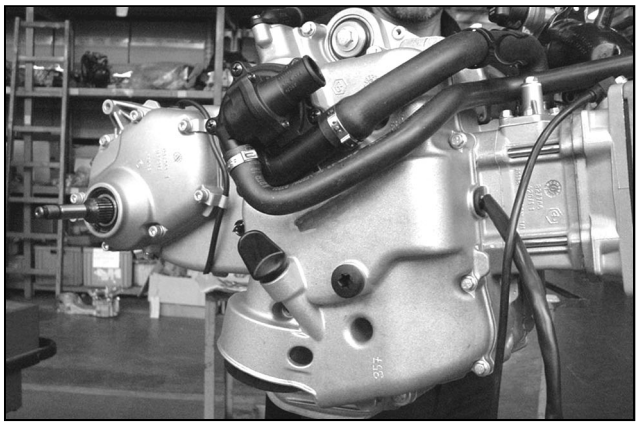
05_156

- Assemble the magneto flywheel with starting control as described in Chapter 6-Flywheel and Starting system.



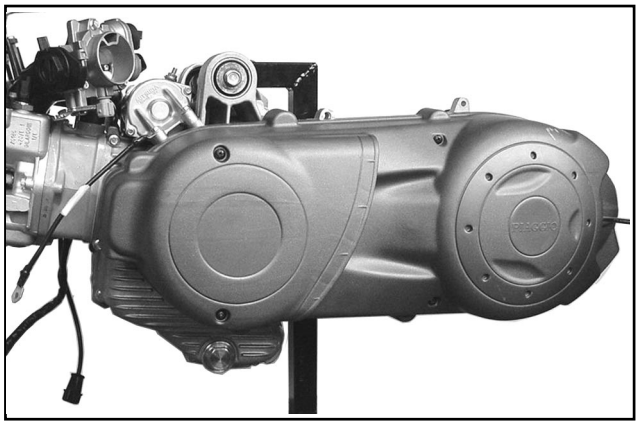
05_246

- Assemble the flywheel cover with the cooling system sleeves as described in Chapter 5-Flywheel cover.



05_245

- Assemble the driving pulley assembly, transmission cover complete with net filter and the external transmission cover as described in Chapter 3-Automatic transmission.



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INTRODUCTION

EMS fuel injection system

The fuel injection system used is of the integrated fuel injection and ignition type.
Fuel is injected indirectly into the manifold by means of the electroinjector.
Fuel injection and ignition are timed on a 4-stroke cycle via a phonic wheel splined to the cam shaft control and a reluctance variance sensor.

Carburation and ignition are managed in relation to the engine revolutions and the opening of the throttle valve. Further corrections are carried out on the basis of the following parameters:
- Coolant temperature
- Air intake temperature
- Ambient pressure

The system carries out the idling supply correction on a cold engine via a stepper motor inserted on to a by-pass circuit of the throttle valve. The control unit manages the stepper motor and the timing of the injector opening, thus guaranteeing idling stability and correct carburation.
Under all working conditions, carburation is managed by modifying the injector opening time.
Fuel supply pressure is kept constant on the basis of ambient pressure.

The **feed circuit** is composed of:
- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

The pump, filter and regulator are inserted into the fuel tank via a single support.
The injector is connected by means of two quick-connection tubes. This allows continuous circulation and avoids the risk of petrol overheating. The pressure regulator is situated at the end of the circuit. The fuel pump is commanded by the EMS control unit; thus guaranteeing vehicle safety.

The ignition circuit is composed of:
- H.V. coil
- H.V. cable
- Shielded cap
- EMS control unit
- Spark plug

The EMS control unit manages ignition with optimum advance, at the same time guaranteeing 4-stroke cycle timing (ignition only during compression stage).

The EMS igntion-injection system manages the working of the engine by means of a preset programme.
Should certain entry signals fail, an acceptable working of the engine is still guaranteed in order that the user may reach a repairs centre.

Obviously, this will not happen if the revolutions signal fails, nor if there is an anomaly in the control circuit:
- Fuel pump
- A.T.Coil
- Injector

The control unit has its own auto-diagnosis system connected to an indicator on the instrument panel.

Anomalies may be discovered and cancelled with a 020460Y diagnosis tester.

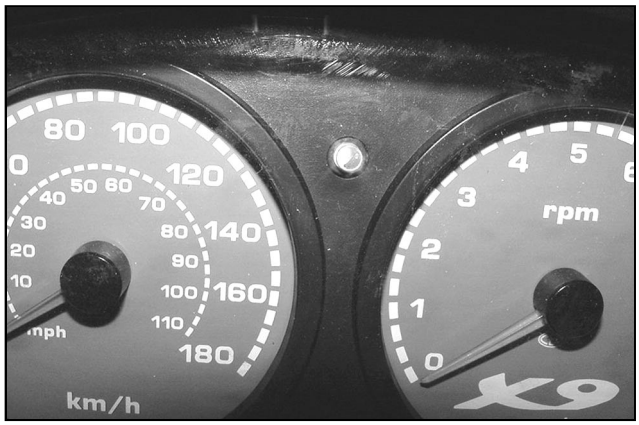
In any event, when the anomaly is no longer present, its memorization is automatically cancelled after 16 usage cycles (cold start, warm running, stopping).

The diagnosis tester is also indispensible for idling carburation regulation.

The EMS igntion-injection system carries out the function of revolution counter control and electrical fan control for cooling of the radiator.

The EMS control unit is connected to the decoder of the anti-theft immobilizer system.

The decoder is in turn connected to a diagnosis LED that also functions as a blinking deterrent light.



Feed of the EMS control unit is further controlled by the emergency switch and the side stand deviator; thus guaranteeing more vehicle safety.

PRECAUTIONS

1 - Before proceeding with any repairs concerning the fuel injection system, check for the presence of registered anomalies.
Do not disconnect the battery prior to checking the anomaly.

2 - The supply system is pressurized at 300 Kpa (3 BAR). Before disconnecting the quick-connection of a supply system tube, check that no open flames are present and do not smoke. Act with caution to avoid spraying into the eyes.

3 - During repairs on electrical components, the battery should remain connected only in cases of necessity.

4 - When carrying out functional controls, ensure that the battery tension is more than 12V.

5 - Before attempting to restart the engine, ensure that the tank holds at least two litres of petrol. Failure to respect this regulation could damage the fuel pump.

6 - If a long period of inactivity is foreseen for the vehicle, fill the fuel tank to more than half-full. This guarantees that the pump will remain immersed in the petrol.

7 - When washing the vehicle do not place pressure on the electrical components and cables.

8 - When ignition irregularities are revealed, begin controls by checking the battery and fuel injection system.

9 - Before disconnecting the EMS control unit connector, carry out the following operations in the order given:
- Set the ignition switch to “OFF”
- Disconnect the battery
Failure to respect this regulation may damage the control unit.

10 - When mounting the battery take care to not invert the polarity.

11 - So as not to cause damage, disconnect and reconnect the EMS system connectors only if it proves necessary. Before reconnecting, verify that the connections are not wet.

12 - During electrical controls do not forcefully insert the tester prods into the connectors. Do not take measurements which are not foreseen by the manual.

13 - At the end of each control carried out with the diagnosis tester, remember to protect the system connector with the appropriate cap.
Failure to respect this regulation could damage the EMS control unit.

14 - Before reconnecting the supply system quick-connections, verify that the terminals are perfectly clean.

TROUBLESHOOTING

Suggestions for troubleshooting

1 Damage to the EMS system could derive most probably from the connections and not from the components. Before carrying out a search on the EMS system, carry out the following controls:

1 Electrical feed
- Battery tension
- Burnt out fuse
- Electromagnetic switches
- Connectors

2 Frame earthed

3 Fuel supply
- Fuel pump broken
- Fuel filter dirty

4 Ignition system
- Spark plug faulty
- Coil broken
- Shielded cap broken

5 Air intake circuit
- Air filter dirty
- By-pass circuit dirty
- Stepper motor broken

6 Others
- Incorrect valve gear timing
- Idling carburation incorrect
- T.P.S reset sensor incorrect

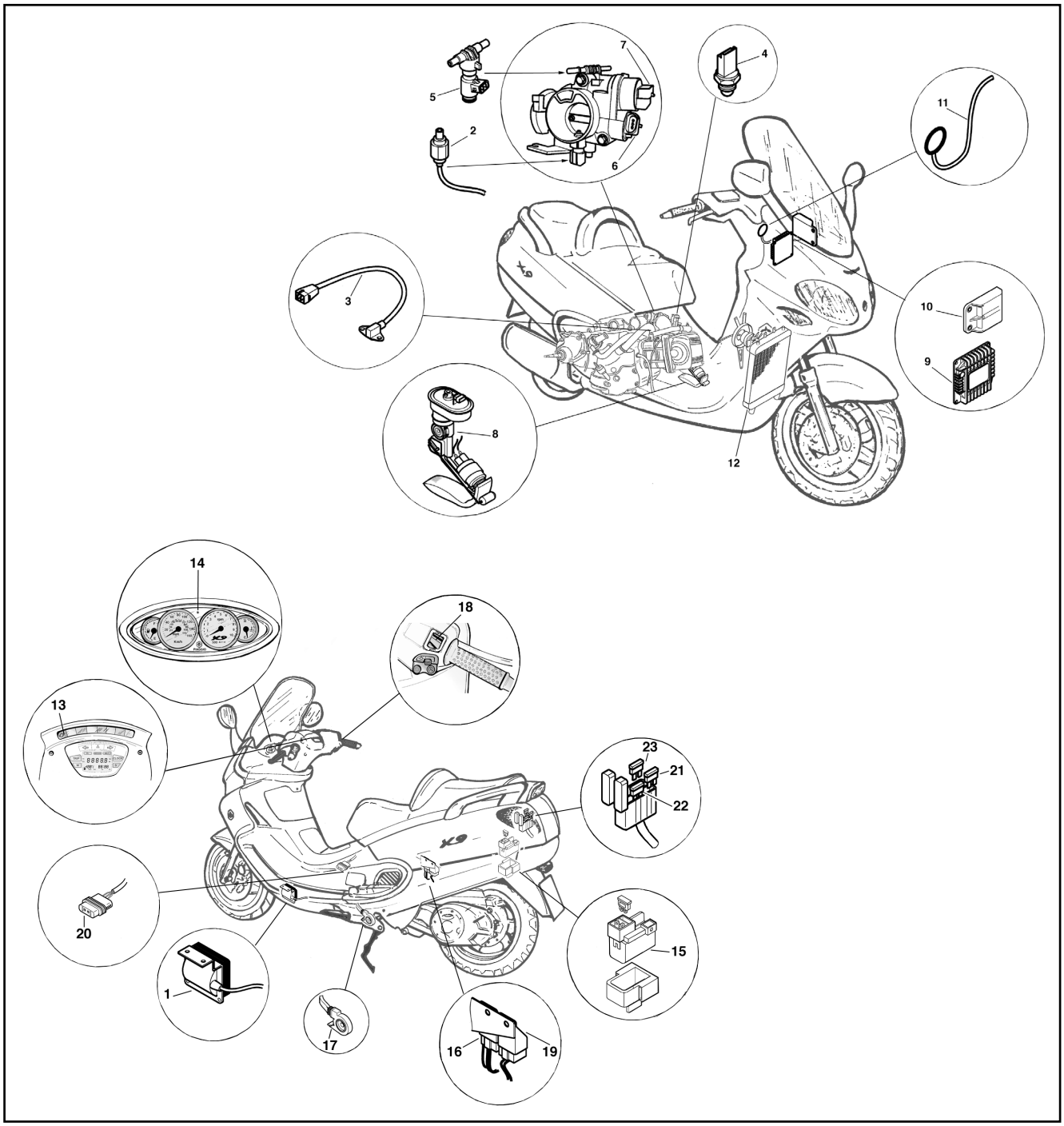
2 Anomalies in the EMS system may derive from loose connectors. Ensure therefore that all connections are carried out correctly.

Check the connectors, paying attention to the following points:
1 check that the terminals are not bent.
2 check that the connectors are properly engaged.
3 check that poor functioning is modified by provoking a slight vibration of the connector.

3 Before replacing the EMS control unit check the entire system accurately.
If the anomaly disappears by replacing the EMS control unit, install the original control unit again to see if the anomaly returns.

4 For the fault search use a multimeter with an internal resistance of more than 10K/V.
Unsuitable instruments could damage the EMS control unit.
The recommended instruments are those with a definition superior to 0.1V and 0.5; precision must be superior to ±2%.

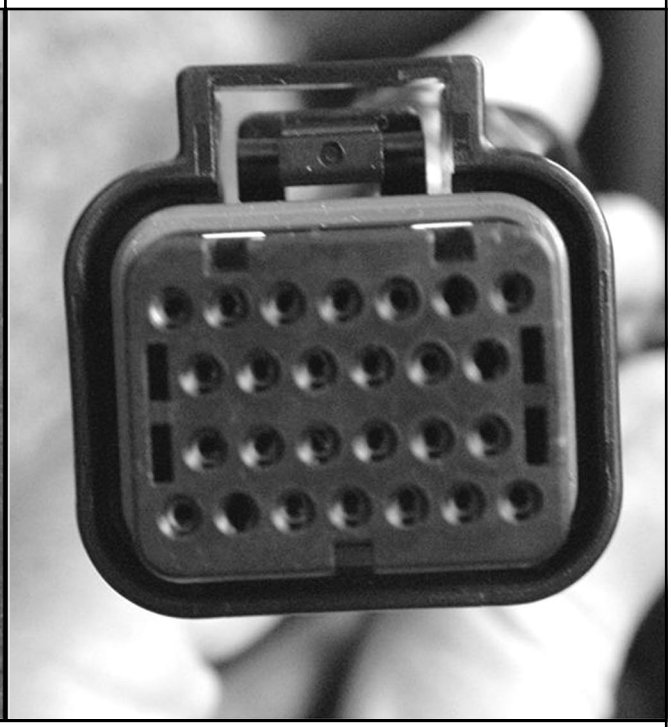
COMPONENTS LAYOUT



1 H.V. COIL	10 CONTROL UNIT DECODER	19 CONTROL UNIT CONTR. ELECTROMAGNETIC SWITCH
2 INJECTOR	11 AERIAL DECODER	20 EMS DIAGNOSIS SOCKET
3 ENGINE REVOLUTIONS SENSOR	12 ELECTRICAL FAN	21 5A N°4 FUSE
4 LIQUID TEMP. SENSOR	13 FUEL INJECTION INDICATOR	(FEED PANEL-LED-DECODER-EMS CONTROL UNIT)
5 AIR TEMP. SENSOR	14 IMMOBILIZER LED	22 3A N°3 FUSE
6 VALVE POS. SENSOR	15 ELECTROMAGNETIC SWITCH WITH FUSE (30A)	(FEED BASE DECODER-EMS CONTROL UNIT)
7 STEPPER MOTOR	16 ELECTROMAGNETIC SWITCH ENGINE STOP	23 10A N°2 FUSE
8 FUEL PUMP	17 DEVIATION STAND	(PUMP-INJECTOR- H.V. COIL)
9 EMS CONTROL UNIT	18 OFF-RUN SWITCH	

LAYOUT OF THE EMS CONTROL UNIT TERMINALS AND IMMOBILIZER

Representation of the control unit connector and the connector system side.

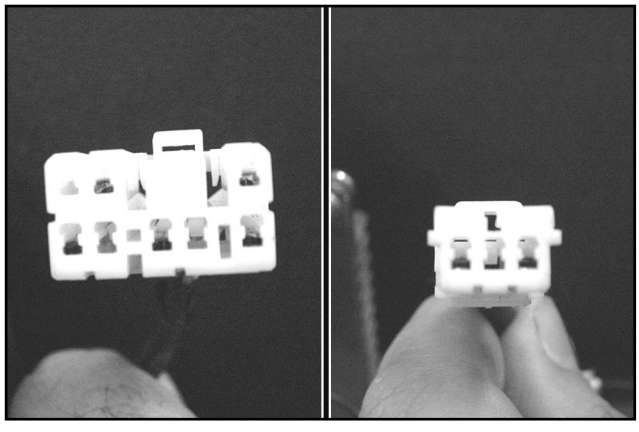
CONTROL UNIT SIDE	SYSTEM SIDE
	

EMS CONTROL UNIT

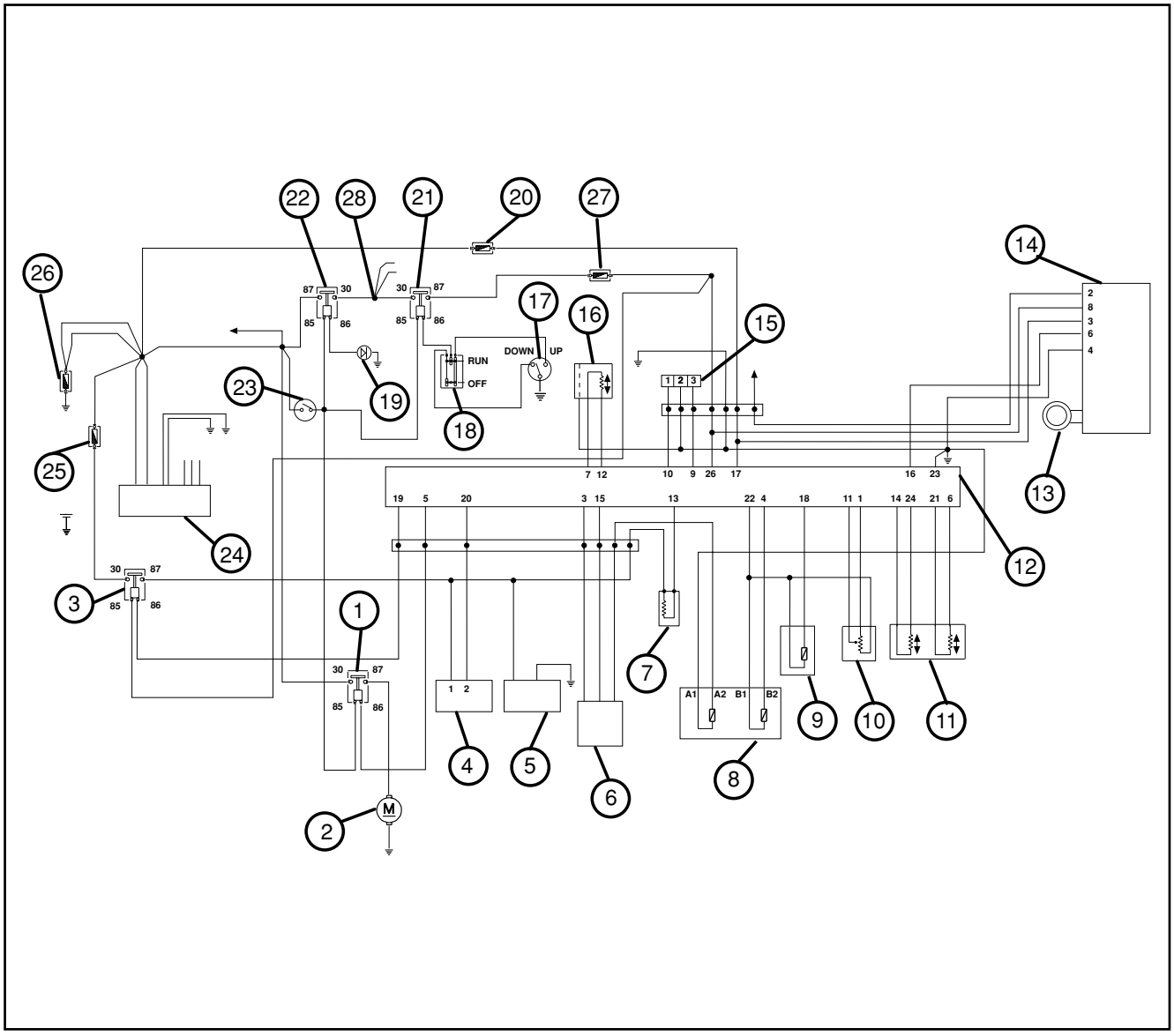
N°	FUNCTION	N°	FUNCTION
1	THROTTLE POTENTIOMETER FEED (+5V)	14	STEPPER MOTOR
2	-	15	DIGITAL INSTRUMENT (FUEL INJECTION INDICATOR - NEGATIVE)
3	DIGITAL INSTRUMENT (REVOLUTIONS COUNTER CONTROL)	16	DECODER (SERIAL)
4	ENGINE TEMPERATURE (+)	17	BASE FEED (POSITIVE)
5	86 ELECTRICAL FAN ELECTROMAGNETIC SWITCH	18	AIR TEMPERATURE SENSOR (+)
6	ENGINE REVOLUTIONS SENSOR	19	85 ELECTROMAGNETIC SWITCH (PUMP-INJECTOR-H.V. COIL) (-)
7	EMS DIAGNOSIS CONNECTOR	20	H.V. COIL (NEGATIVE CONTROL)
8	-	21	STEPPER MOTOR
9	EMS DIAGNOSIS CONNECTOR	22	SENSORS FEED (-)
10	EMS DIAGNOSIS CONNECTOR	23	CONTROL UNIT NEGATIVE
11	THROTTLE POTENTIOMETER SIGNAL	24	STEPPER MOTOR
12	ENGINE REVOLUTIONS SENSOR	25	-
13	INJECTOR CONTROL (NEGATIVE)	26	UNDER PANEL FEED (POSITIVE)

DECODER

N°	FUNCTION
1	-
2	IMMOBILIZER LED CONTROL (NEGATIVE)
3	BASE FEED (POSITIVE)
4	NEGATIVE
5	-
6	EMS CONTROL UNIT (SERIAL)
7	-
8	UNDER PANEL FEED (POSITIVE)
	IMMOBILIZER AERIAL
	IMMOBILIZER AERIAL



EMS SYSTEM DIAGRAM

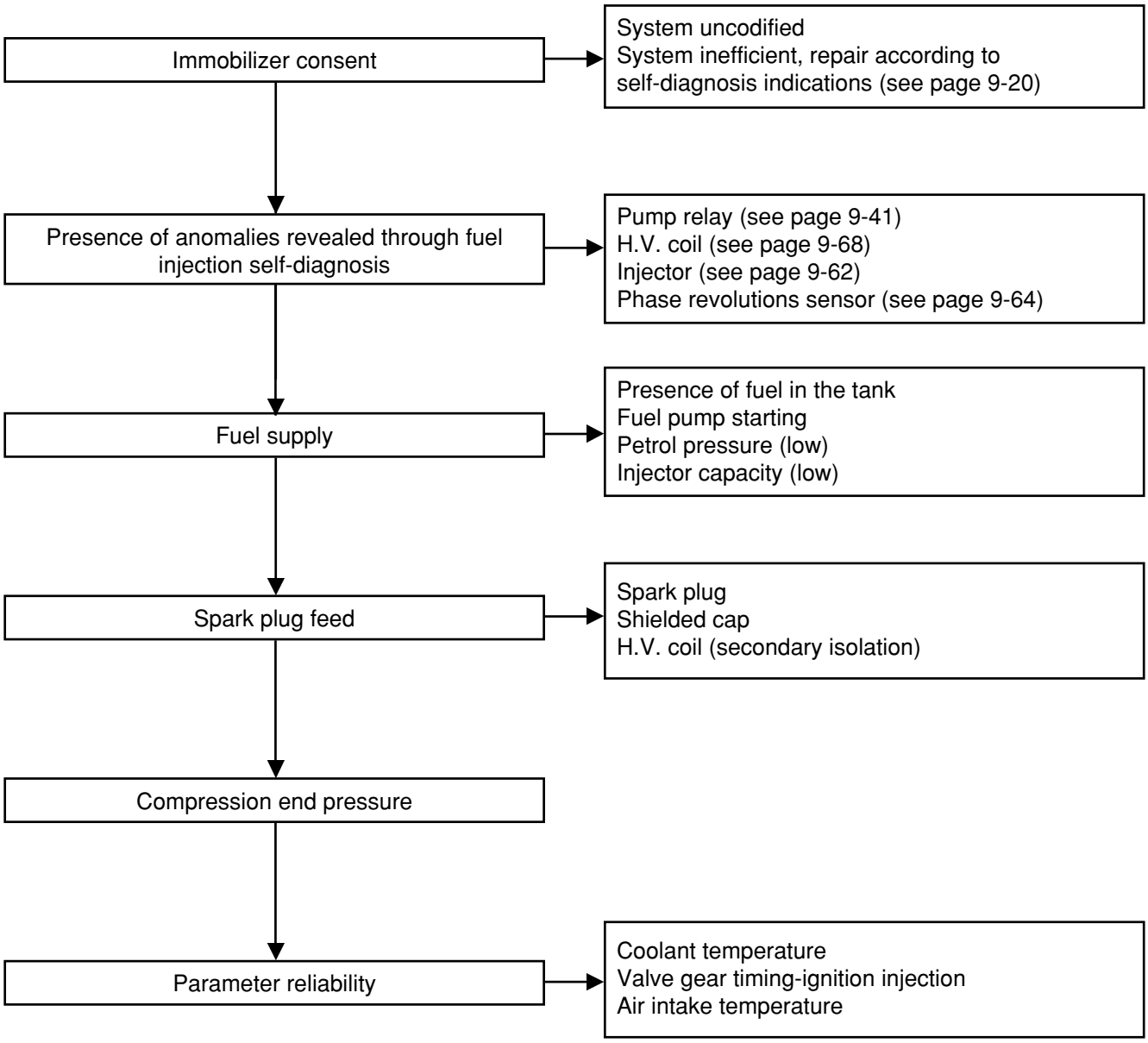


1) Electrical fan electromagnetic switch
2) Electrical fan
3) Electromagnetic switch
4) H.V. coil
5) Fuel pump
6) Digital instrument
7) Injector
8) Liquid temp. sensor
9) Air temp. sensor
10) Throttle potentiometer
11) Stepper motor
12) EMS control unit
13) Aerial
14) Decoder
15) EMS diagnosis socket
16) Phase revolutions sensor
17) Deviation stand
18) Emergency switch
19) 2A diode
20) 3A Fuse
21) Engine stop electromagnetic switch
22) Services electromagnetic switch
23) Key switch
24) Rectifier regulator
25) 10A Fuse
26) 30A Fuse
27) 5A Fuse
28) Services

TROUBLESHOOTING

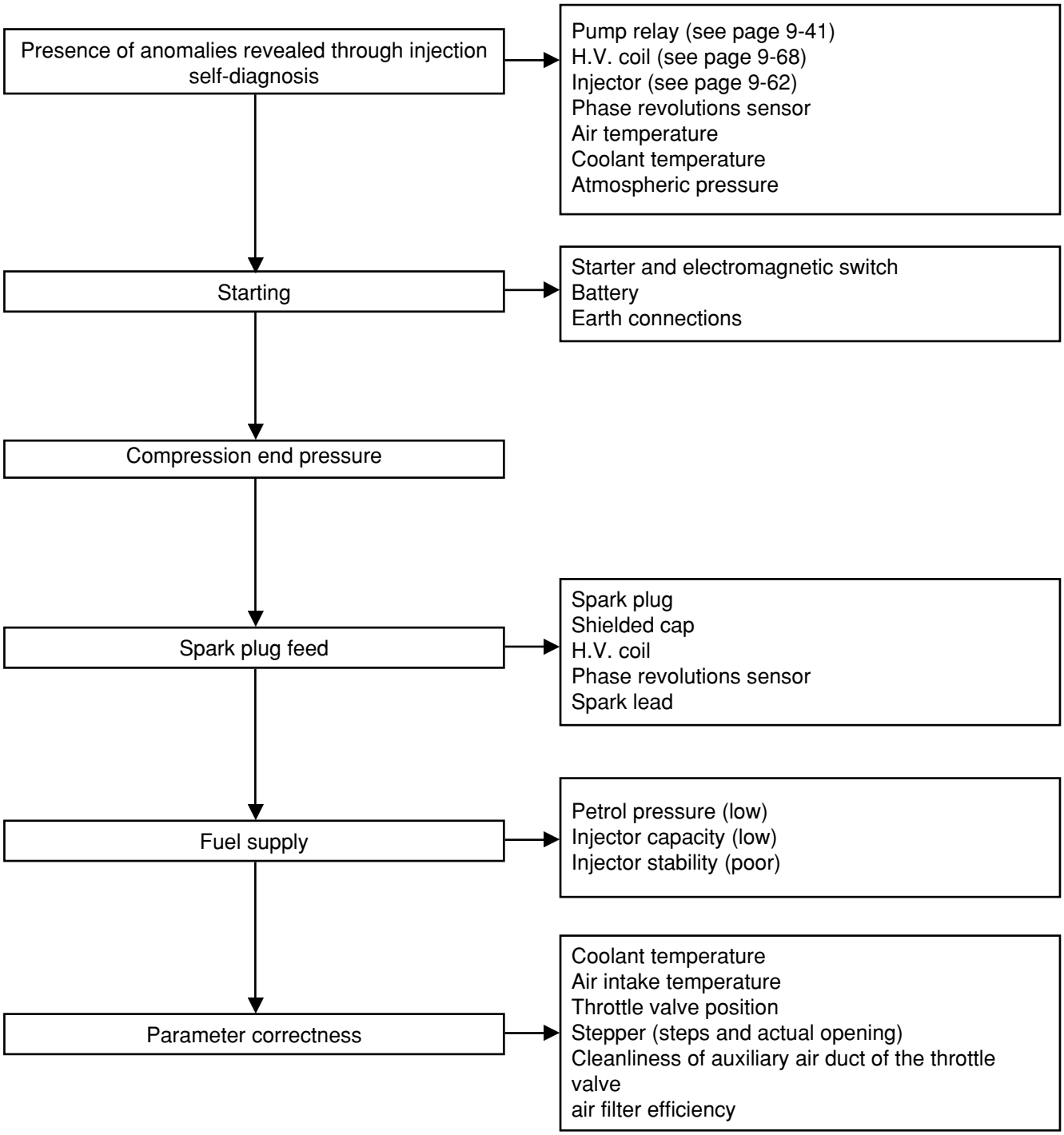
1) THE ENGINE DOES NOT START EVEN WITH NORMAL MOTORING OVER

Proceed with the following controls:



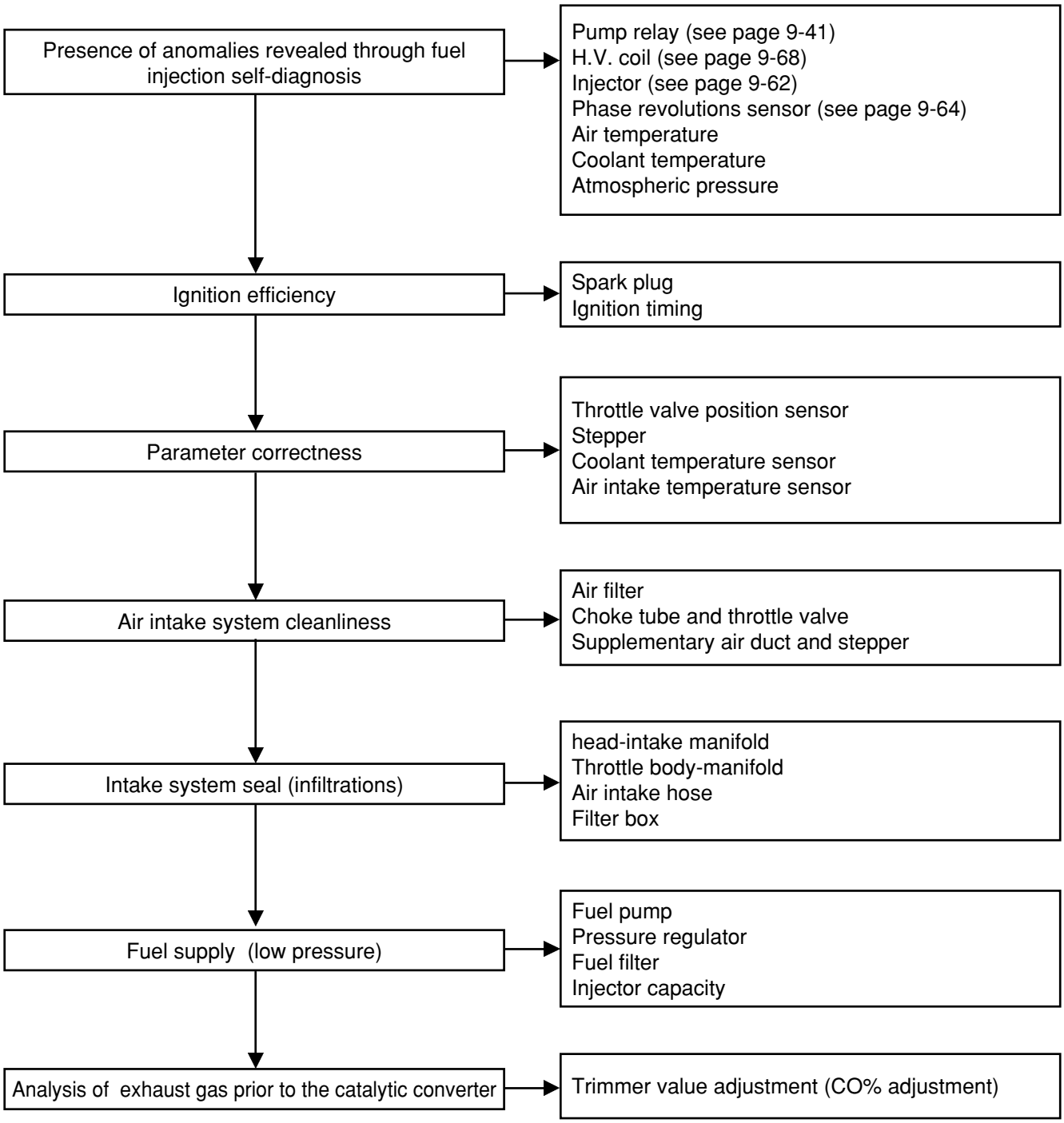
2) DIFFICULT COLD START OR WARM START OF THE ENGINE

Proceed with the following controls:



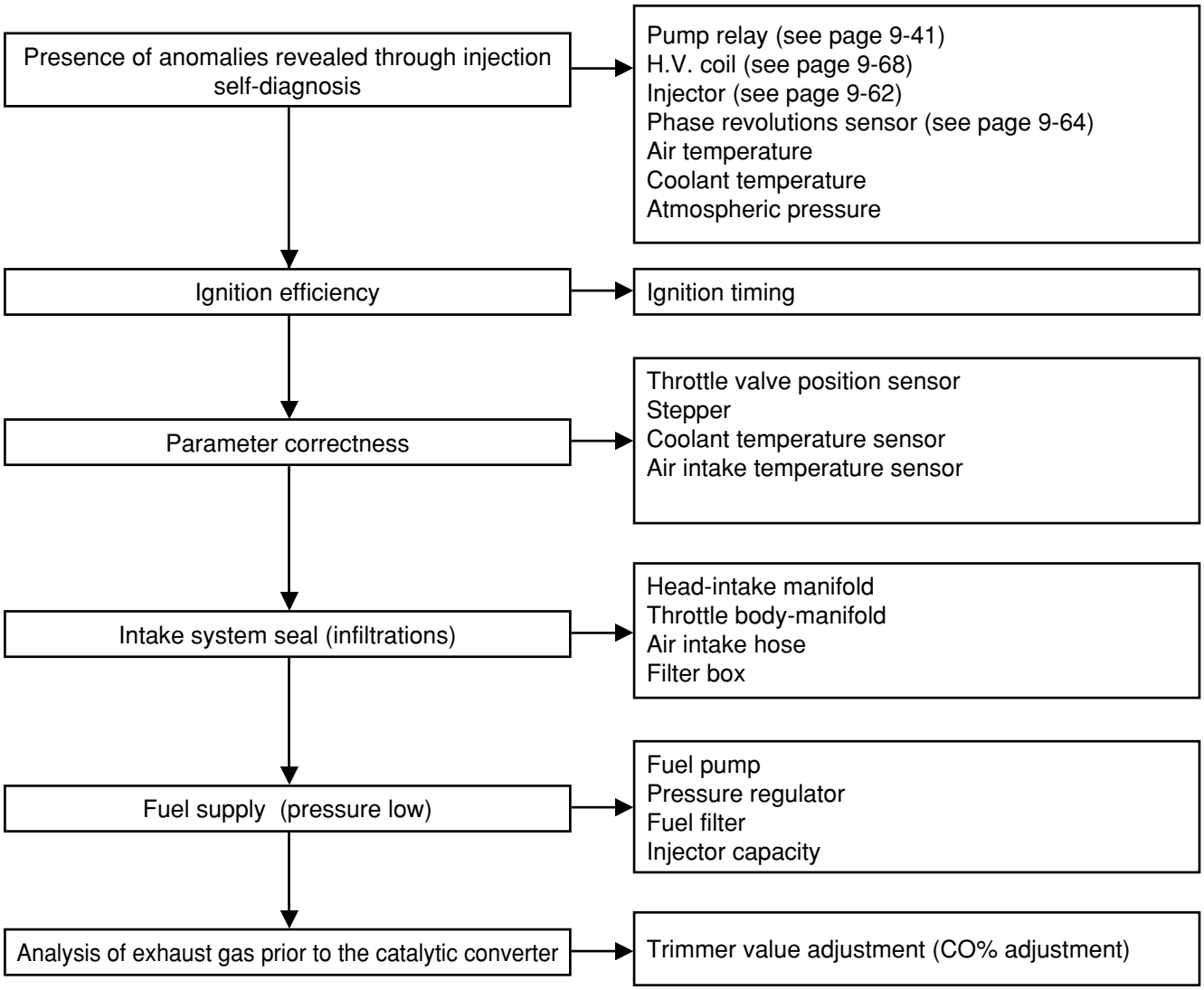
3) THE ENGINE DOES NOT MAINTAIN IDLING SPEED
IDLING SPEED IS UNSTABLE
IDLING SPEED IS TOO LOW

Proceed with the following controls:



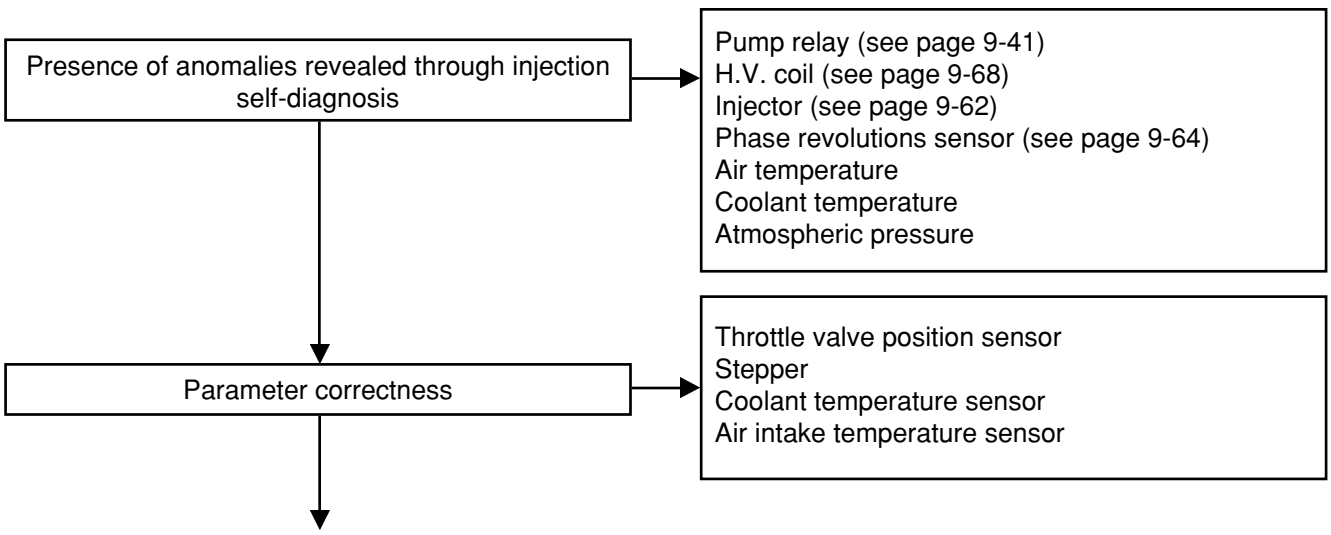
4) THE ENGINE DOES NOT TURN OVER ON IDLING SPEED
IDLING SPEED TOO HIGH

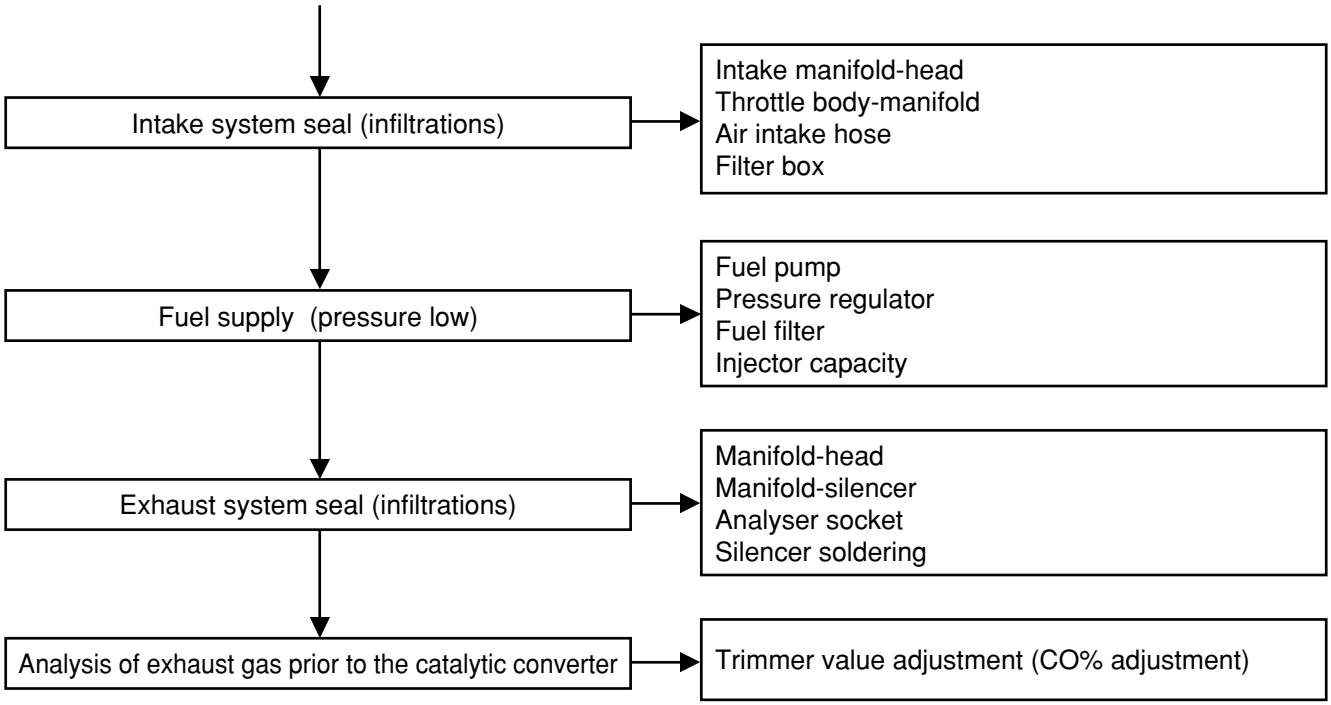
Proceed with the following controls:



5) BACKFIRING IN DECELERATION

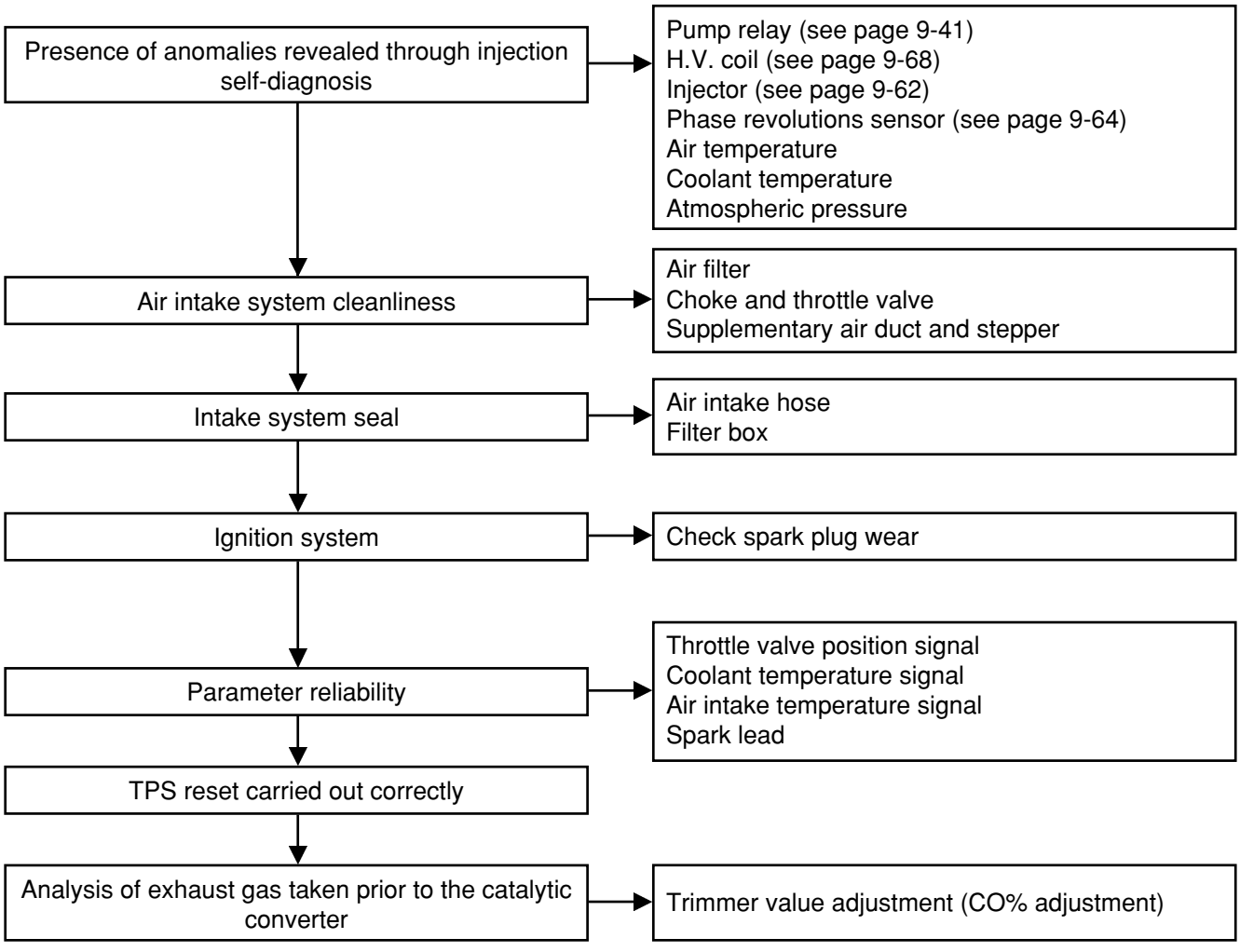
Proceed with the following controls:





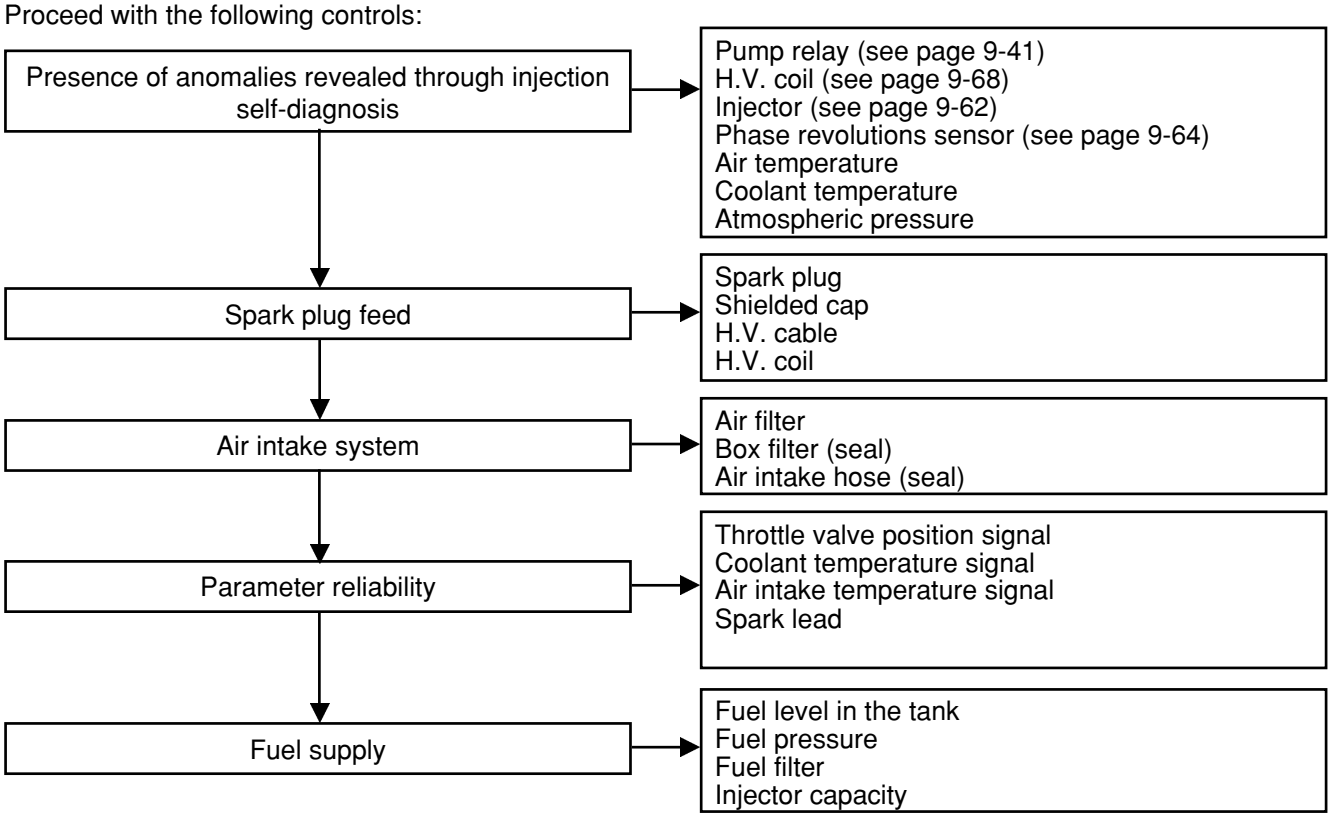
6) IRREGULAR RUNNING OF THE ENGINE WITH THROTTLE VALVE SLIGHTLY OPEN

Proceed with the following controls:



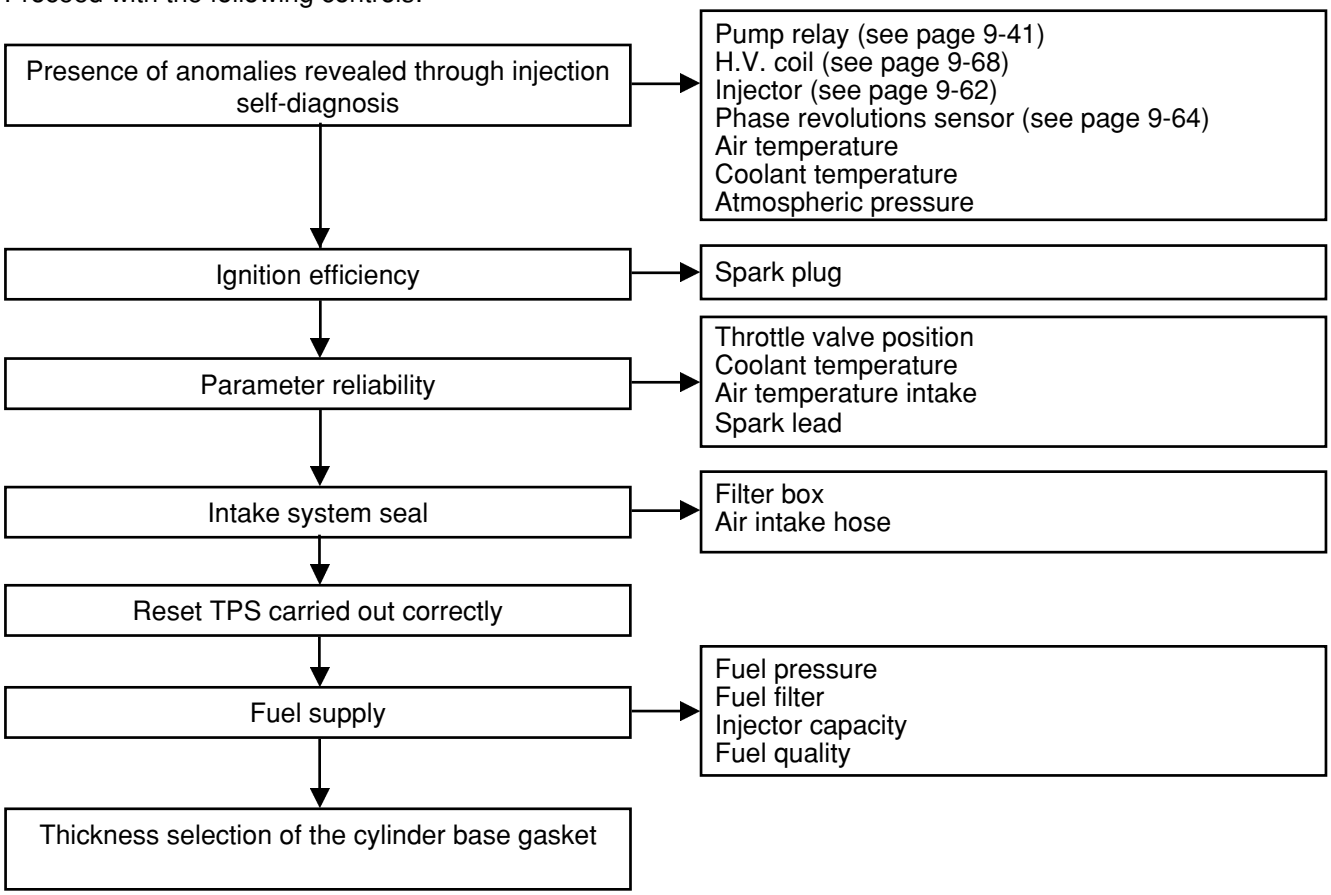
7) POOR ENGINE RUNNING ON FULL POWER IRREGULAR RUNNING OF THE ENGINE DURING ACCELERATION STAGE

Proceed with the following controls:



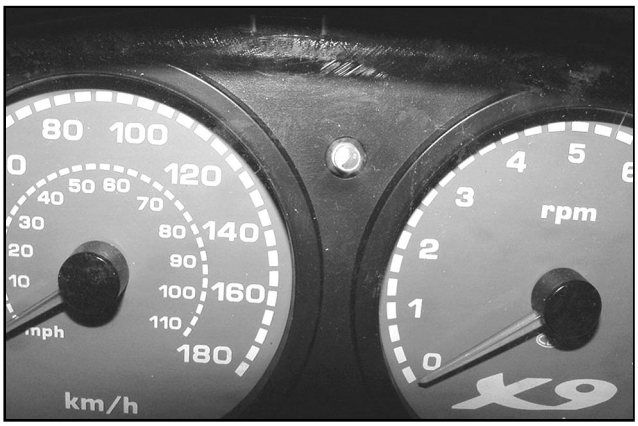
8) PRESENCE OF DETONATION (COMBUSTION SHOCK)

Proceed with the following controls:



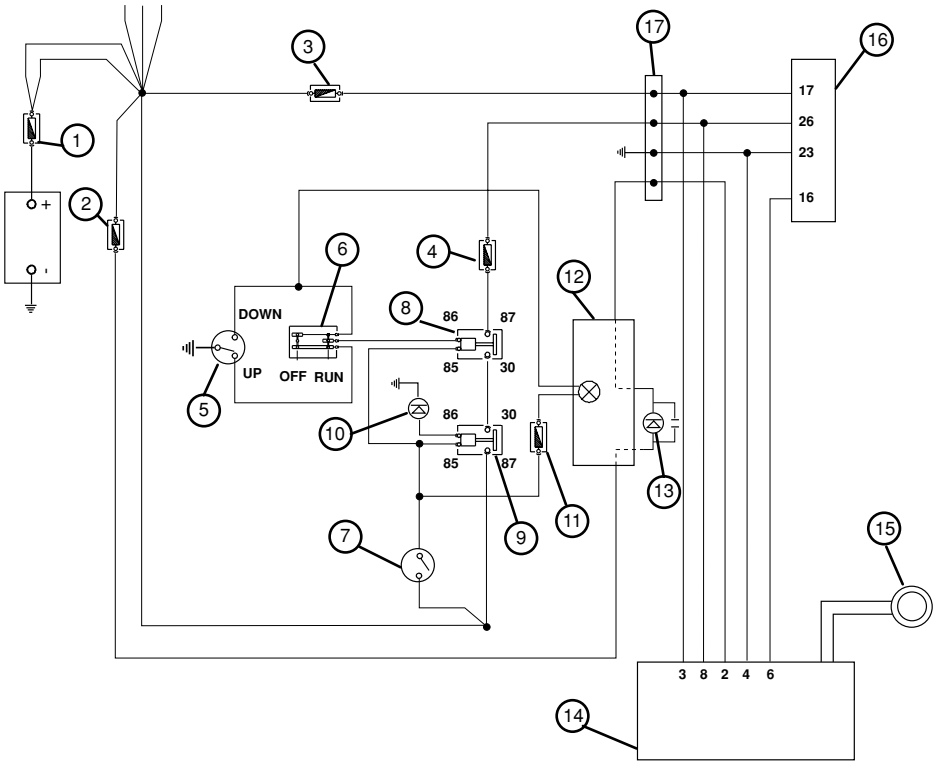
IMMOBILIZER SYSTEM

The EMS system is integrated with an immobilizer-type anti-theft device.
The functions achieved are:
- Starter initialization via key recognition
- Blinking deterrent light



System components

The system is composed of:
- EMS system control unit
- decoder
- aerial
- master key (red)
- service key (black)
- diagnostic and deterrent LED



1	30A MAIN FUSE	10	DIODE
2	7.5A FUSE	11	7.5A FUSE
3	3A FUSE	12	DIGITAL INSTRUMENT
4	5A FUSE	13	IMMOBILIZ . LED
5	STAND SWITCH	14	DECODER
6	EMERGENCY SWITCH	15	AERIAL
7	KEY SWITCH	16	ECU CONTROL UNIT
8	STOP ELECTROMAGNETIC SWITCH	17	VEHICLE SYSTEM - INJECTION SYSTEM CONNECTOR
9	MAIN ELECTROMAGNETIC SWITCH		

Unprogrammed system

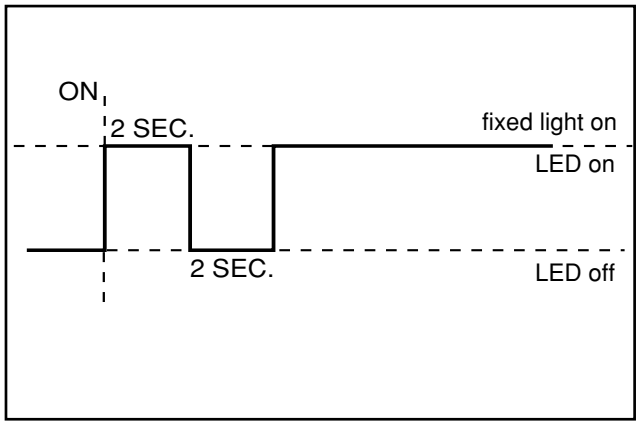
When the control unit (ECU) and the decoder are not programmed, the conditions described below occur:

- Key switch in “OFF” position. Blinking deterrent light inactive.

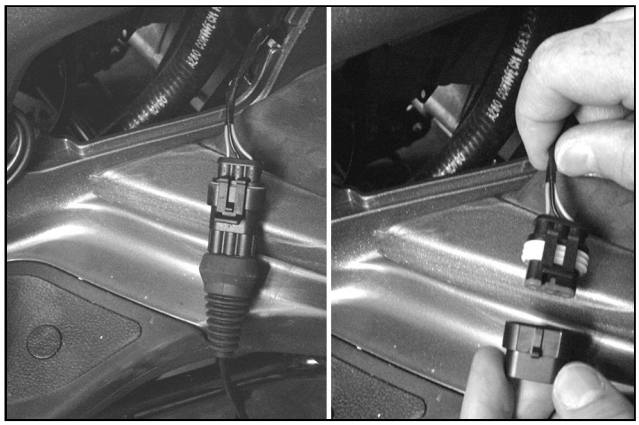
- Key switch in "ON" position. Ignition and fuel injection not activated and LED fixed light on.

When the key switch is set to "ON", the LED is lit as indicated in the diagram.

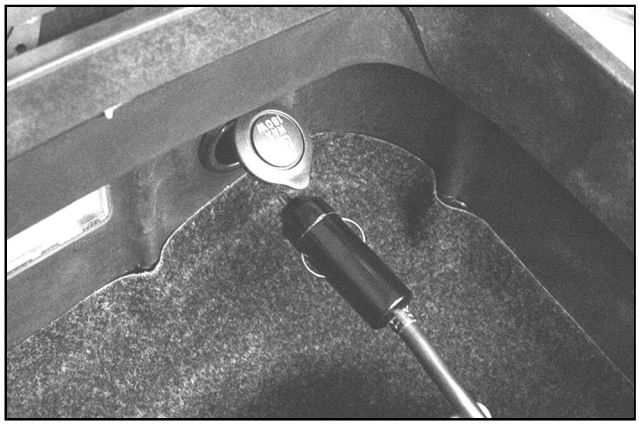
The LED lighting is commanded by the decoder.
It is possible to check the information present in the control unit using a diagnosis tester 020460Y.



To connect the diagnosis tester, open the spark plug inspection door and pull out the EMS diagnosis socket. Remove the protection cap and connect the tester terminals.



Feed the diagnosis tester by connecting the clamps to the battery poles or the specific connector to the internal socket of the glove compartment.



Set the commutator to "ON" and select the diagnosis tester menu on the immobilizer function.
Scroll down the available pages to reveal the data present in the control unit.

NOTE: The blank system can be revealed after initial assembly, or if the decoder and control unit are replaced at the same time.

The indications will be as follows:

Blank control unit	ON
Starting inhibited	ON
Number of keys	Zero › 250

System programming

Two keys are supplied with the vehicle:
- Master key (red) with removable transponder
- Service key (black) with fixed transponder

To codify the system the master key and service key must be used as follows:

- Insert the master key, set to “ON” and keep in this position for 2 seconds (limited values 1-3 seconds).
- Insert the black key and set to “ON” for 2 seconds.
- If duplicate keys are available, repeat the operation with each key.
- Insert the master key again and set to “ON” for 2 seconds.

The maximum amount of time available for changing from one key to the next is 10 seconds.
Up to 7 service keys (black) are accepted in the same memorization process.
The correct timing of the procedure is indispensable; if incorrect, repeat all from the beginning.

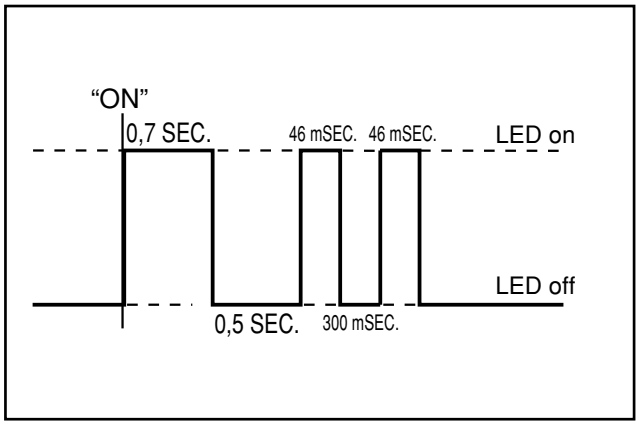
Once the system programming has been carried out, an inseparable link is created between the master key transponder and the decoder and control unit.
Maintaining this link, it is possible to proceed with programming of new service keys resulting from loss, replacement, etc.
Every new programming procedure cancels the previous one, so to add or eliminate a key it is indispensable that the procedure be repeated with all the service keys to be used.

NOTE: Accidental loss of the service key programming may derive from general disturbances of the ignition system. In this case proceed with the H.V. line screening controls.

In any event it is recommended that resistive spark plugs be used.

1 - LED indications

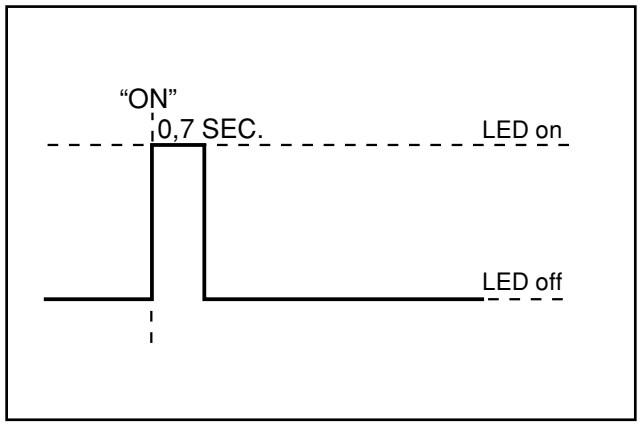
When the key switch is set to “ON” and programming is carried out normally, the LED should light up as indicated in the diagram.



WITH MASTER KEY

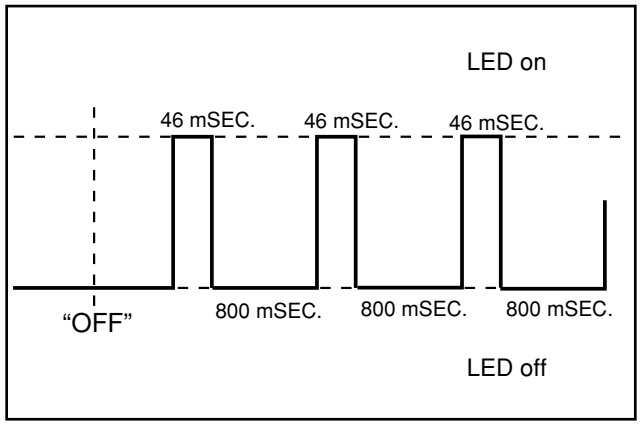
After the confirmation flash when set to “ON”, the number of flashes that follows is equal to the number of keys programmed.

WITH SERVICE KEYS



2 - Blinking deterrent light

By setting from "ON" to "OFF" when the system is programmed, the LED gives an intermittent light, as a deterrent against theft. This occurs with any key that has been programmed.



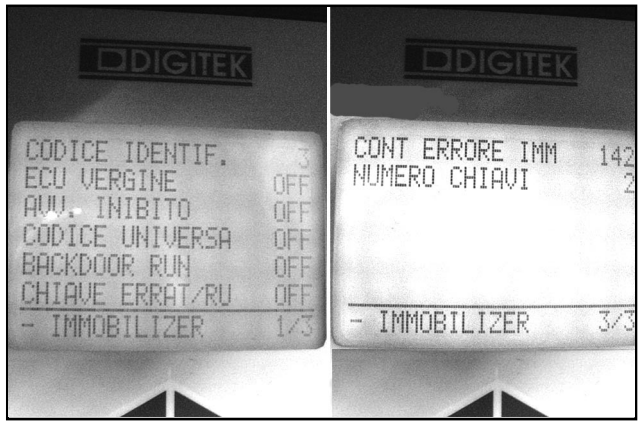
When the vehicle is not in use, so as not to eccessively discharge the battery, the blinking deterrent light stops automatically after 48 hours. By setting to the positions "OFF" "ON" "OFF" a new 48 hour cycle begins.

3 - Control of information revealed by the control unit with the system programmed

Connect the diagnosis tester 020460Y - see page 9-17
Set to "ON" and select the immobilizer function.
Visualize the data by scrolling the available pages.

The information given will be as follows:
Blank control unit OFF
Starting inhibited OFF
Number of keys 2*

* The number indicates how many keys have been entered in the programming including the master key.



4 - System reprogramming in case of component replacement

1 Cylinder replacement
- Remove the transponder of the original master key and install it on the master key of the new cylinder.
- Reprogramme the system as described previously.

2 Decoder replacement
Following replacement of the decoder the full programming procedure must be followed.
The programming is indispensable to achieve engine ignition.
(See page 9-18 system programming)

3 Control unit replacement
Following replacement of the control unit it is necessary to carry out the programming in order to activate engine ignition.
In this case it is sufficient to set to “ON” using the master key.

NOTE:
- Programming cannot be carried out with a service key (black).
- An unprogrammed control unit allows no functional diagnosis of the engine.

4 Service key replacement or duplication
Keys can be duplicated by using the drafts and the original master key.
It is also possible to request a duplicate by using the code of the vehicle CODE CARD.
Carry out the new programming using the master key and all the service keys (See page 9-18 - system programming)

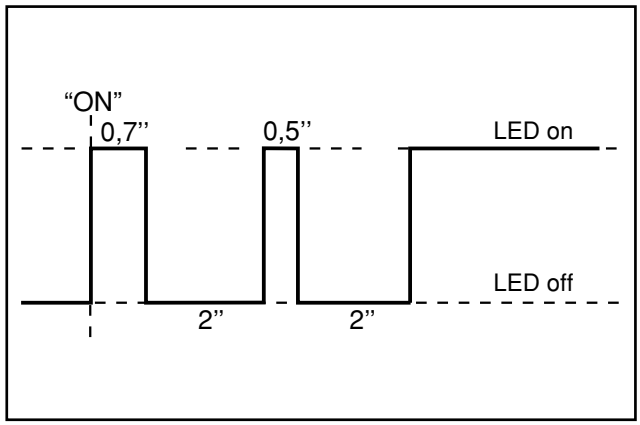
NOTE:
The CODE CARD can only be used when the original MASTER KEY is available.

Diagnostic codes

LED signalling is divided into 3 phases:

1st phase - One flash: recognition of the “ON” setting
2nd phase - Series of flashes: diagnostic code signal
3rd phase - Fixed light on or off: on = ignition inhibited,
off = ignition possible

1 Diagnostic code n°1



Code 1 indicates an unprogrammed system - see page 9-17.

If the code persists after carrying out the programming procedure, repeat the procedure more carefully, paying attention to the “ON” timing of each key.

If the code still persists proceed as follows:

- Disconnect the negative battery.
- Remove the connector from the control unit.
- Link the special tool 020481Y between the fuel injection system and the control unit.
- Remove the main connector from the decoder.

NOTE: To access the components see page 9-7.

Using a multimeter check the continuity between control unit pin 16 and decoder connector pin 6

NO → Reset or replace the harness

YES

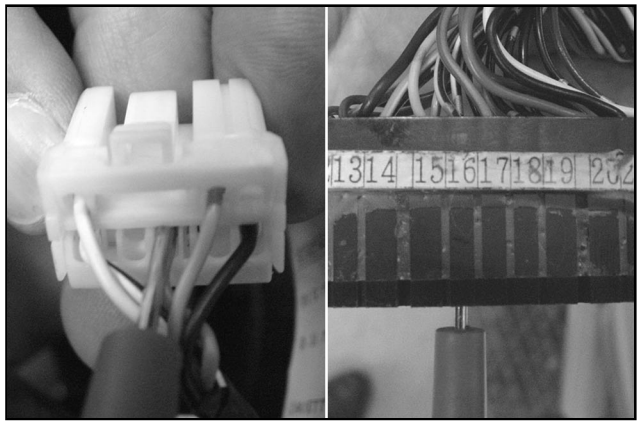
Check the connections accurately

NO → Reset

YES

Replace the decoder. Connect the battery Repeat the programming

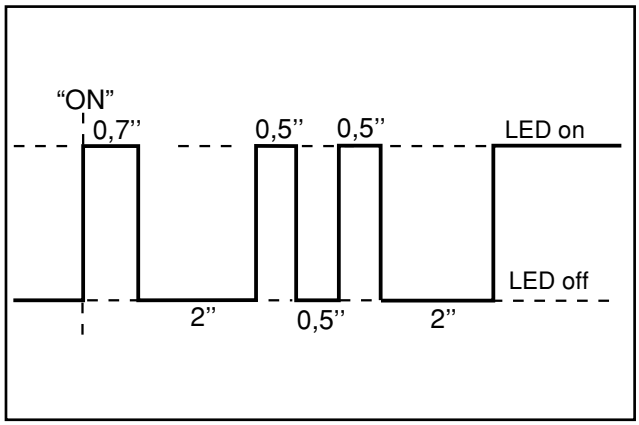
NO → Disconnect the battery, replace the control unit, connect the battery. Repeat the programming



2 Diagnostic code n°2

Code n°2 indicates a system in which the decoder does not perceive the transponder signal

- Starting inhibited
- Fuel injection indicator fixed light



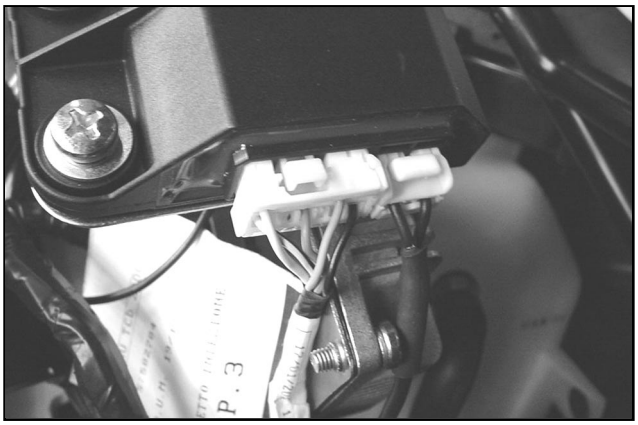
In this case proceed as follows:

Control whether the code is repeated when using a second key

NO → <u>Anomaly revealed with a service key:</u>
Replace and reprogramme.
<u>Anomaly revealed with master key:</u>
Replace the transponder with one from a new cylinder kit.
Replace the decoder and control unit.
Reprogramme.

YES

Check that the aerial connector is correctly inserted

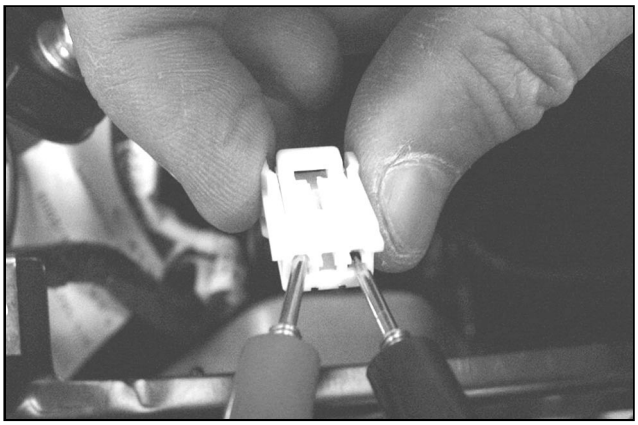


NO → Reset the connection and check that the code is present.

YES

YES

Disconnect the aerial connector and check continuity (8 ± 2 Ω).



NO → Replace aerial

YES

Check the correct positioning of the aerial

NO → Position correctly

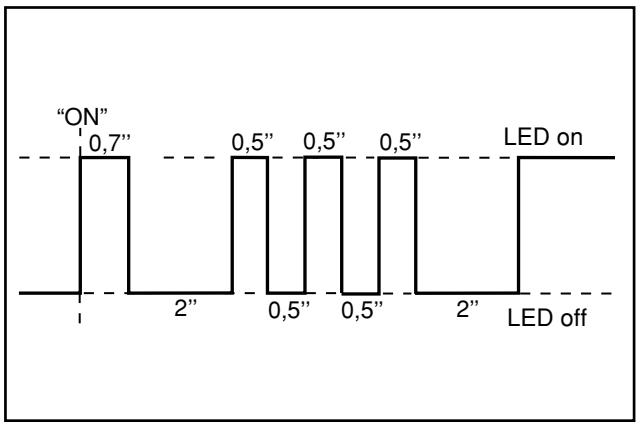
YES

Replace the decoder and check that the code is present

3 Diagnostic code n°3

Code n°3 indicates a system in which the decoder perceives a transponder not foreseen in the programming.

- Starting inhibited
- Fuel injection indicator fixed light on



Check whether the code persists if the master key is used.

NO → Repeat the programming of all the service keys.

YES

Check that component connections are correct (keys-decoder-control unit)

NO → Reset

YES

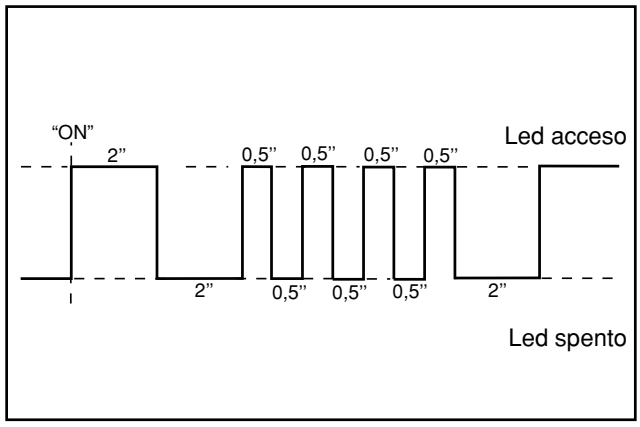
Replace the decoder and control unit. Reprogramme the components.

4 Diagnostic code n°4

Code n°4 indicates a system in which the decoder is blank and the control unit is programmed.
The key is recognized by the control unit.

- Starting inhibited
- Indicator

Repeat the key programming procedure using the original MASTER key.



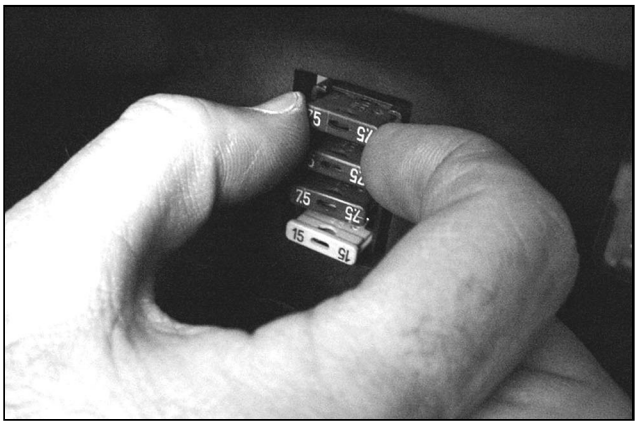
Diagnostics guide of anomalies not revealed through decoder self-diagnosis

① Immobilizer LED fails to light up

Control whether the fuel injection indicator lights up for 5 seconds after setting to "ON"

YES

Check 7.5A fuse n°8 (undersaddle compartment)



NO

Check for any short circuits on the digital instrument feed line.
Check that there are no short circuits on the digital instrument itself.

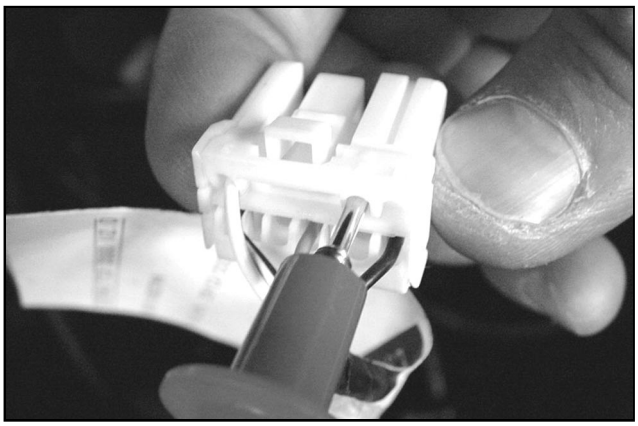
Reset

NO

YES

9

YES



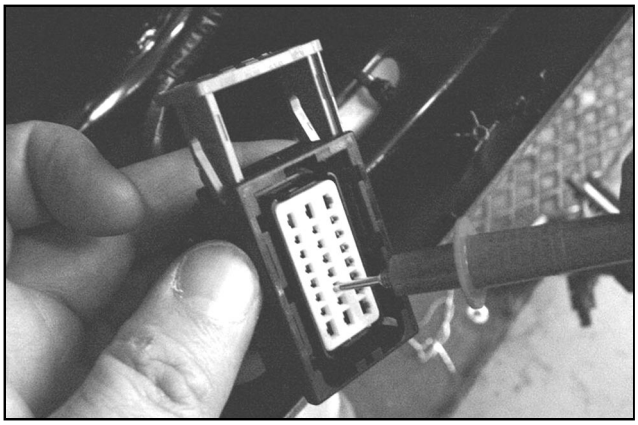
Check that the LED lights up by earthing PIN N°2 of the decoder (grey wire)

YES

Replace the decoder and reprogramme

NO

Disconnect the connector between the vehicle system and the fuel injection system.

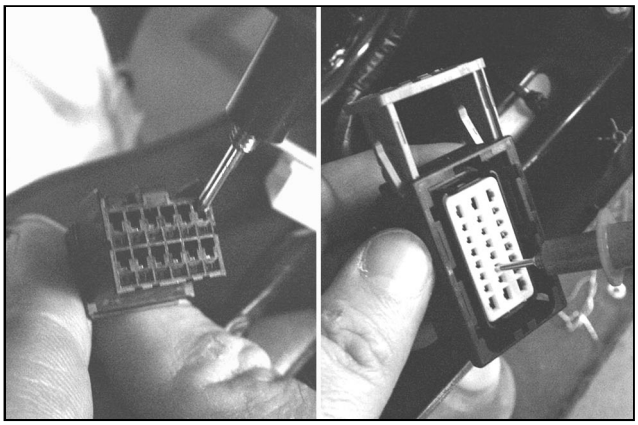


Earth the connector yellow-grey wire, vehicle system side.
(connector with control button)
Check if the LED lights up.

YES

Carefully check the connector between the vehicle system and the fuel injection system.
Reset or replace the fuel injection harness.

NO



Check that there is continuity of the yellow-grey wire misurando between the connecting link from the fuel injection system
and the yellow-grey 12-way connector to the digital instrument, vedi figura.

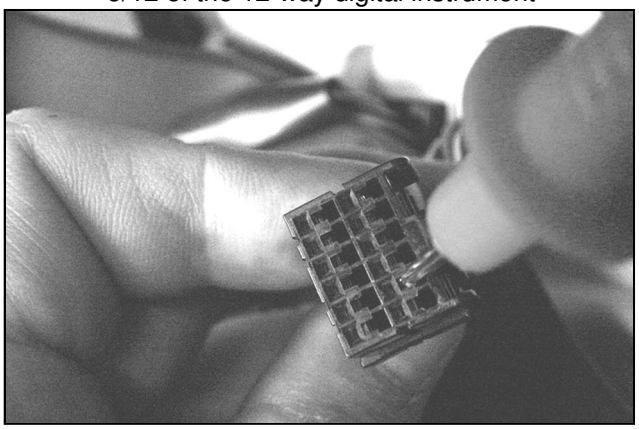
(connector with button)-yellow-grey (PIN 6/12 digital instrument) = continuity

YES

NO

YES

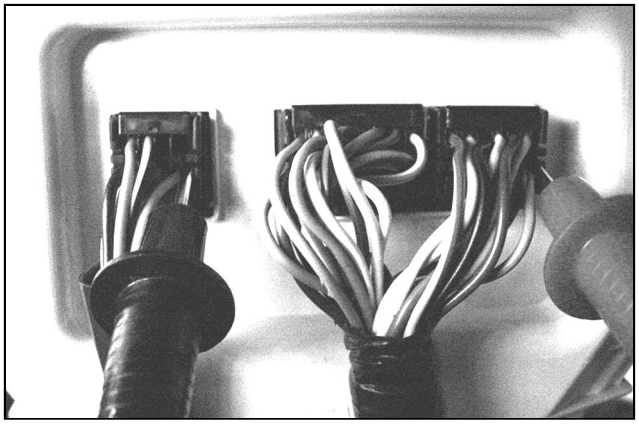
Check the presence of battery positive tension on PIN 5/12 of the 12-way digital instrument



NO

Reset or replace the harness

YES



Check continuity of the digital instrument between PIN:

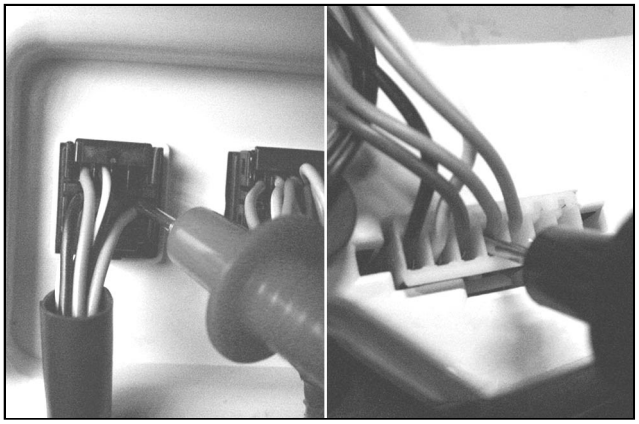
6/12 (yellow-grey) - 4/8 (light blue) = 0Ω (continuity)

YES

NO

Replace the digital instrument

Check continuity of the connection wire on the analogic instrument
4/8 (light blue) - 4 (analogic instrument) = 0Ω (continuity)



NO

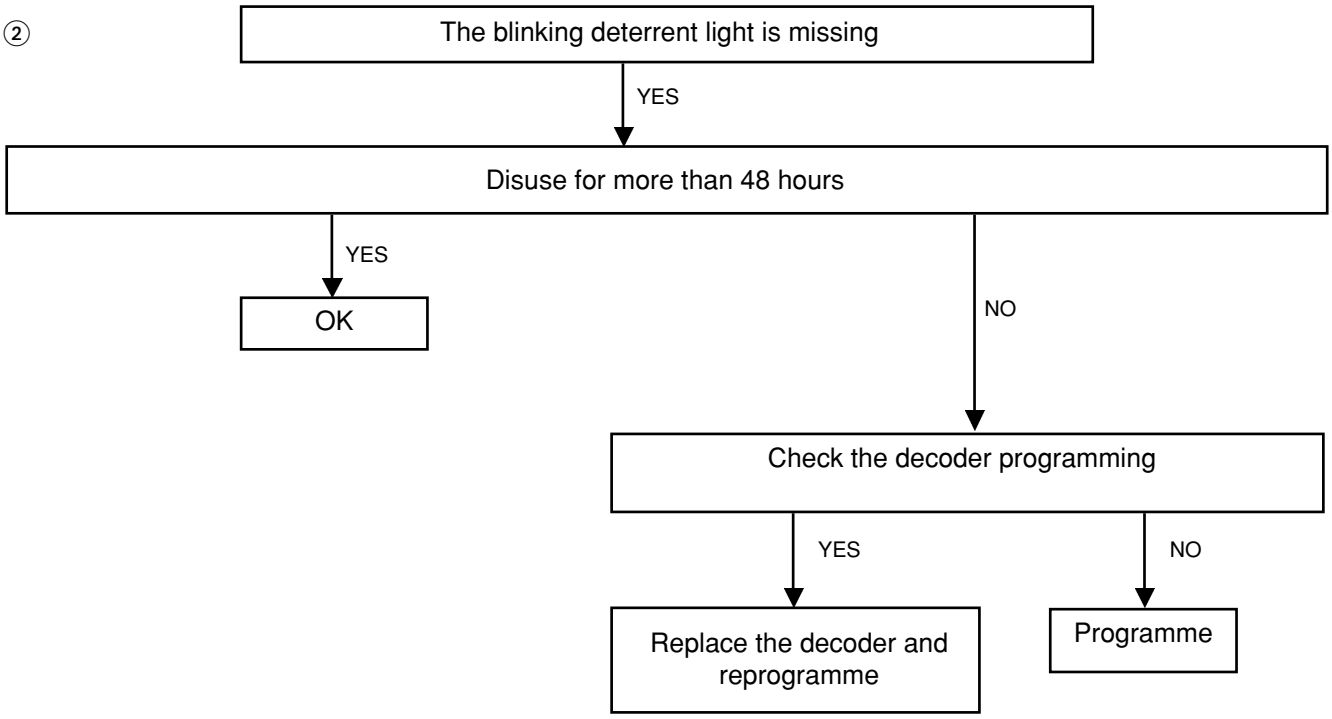
Reset the harness

NO

YES

<u>The LED is faulty.</u> Replace the analogic instrument.

If the fuel injection indicator does not light or if it lights up for 3 seconds, proceed with controls of decoder and control unit feed circuits.
See page 9-27.


②
The blinking deterrent light is missing
YES
Disuse for more than 48 hours
YES
OK
NO
Check the decoder programming
YES
NO
Replace the decoder and reprogramme
Programme

FEED CIRCUIT OF THE DECODER AND THE FUEL INJECTION CONTROL UNIT

1 Check that circuit feed is constant

The basic feed on the decoder is necessary for the management of the blinking deterrent light. The feed on the injection control unit is necessary for the management of the stepper motor.
The lack of basic feed inhibits both ignition and fuel injection.
In the case of a feed problem, diagnosis tester n° 020460Y gives the information “THE CONTROL UNIT DOES NOT RESPOND”.

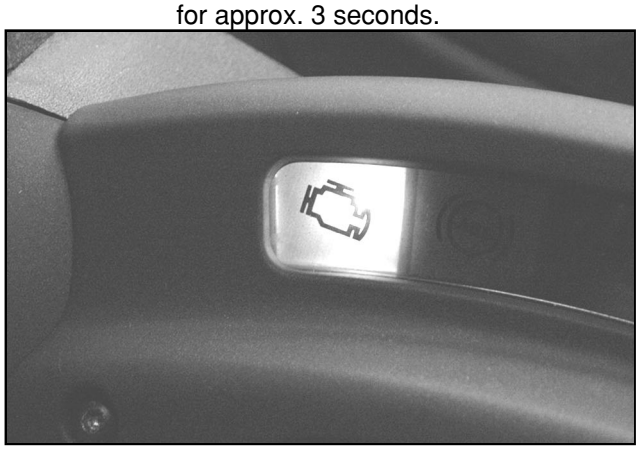
To carry out controls proceed as follows:

Check if the immobilizer system LED signals that it is set to “ON” and if the blinking deterrent light is present.

YES

The decoder is being fed correctly

Set to "ON" with the side stand raised and The emergency switch in the “OFF” position. Illumination of the fuel injection indicator is provided for approx. 3 seconds.

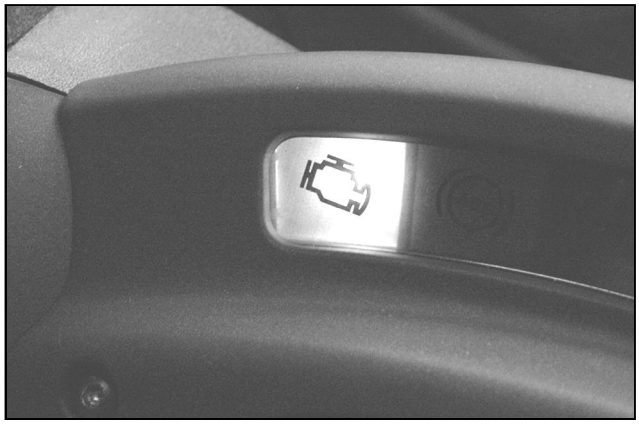


NO

Check the digital instrument and its feed

YES

Set the emergency switch to "RUN". The fuel injection indicator lights up for approx. 5



YES

NO

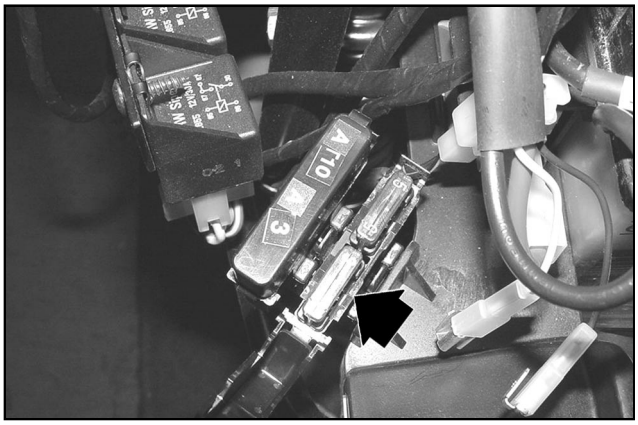
NO

YES

The fuel injection control unit is being fed safely.

NO

Check efficiency of 3A fuse n°3.



YES

Interpose the special tool n° 020481Y between the control unit and the fuel injection system. See page 9-8

NO

Eliminate any possible short circuit of the harness and replace the fuse.

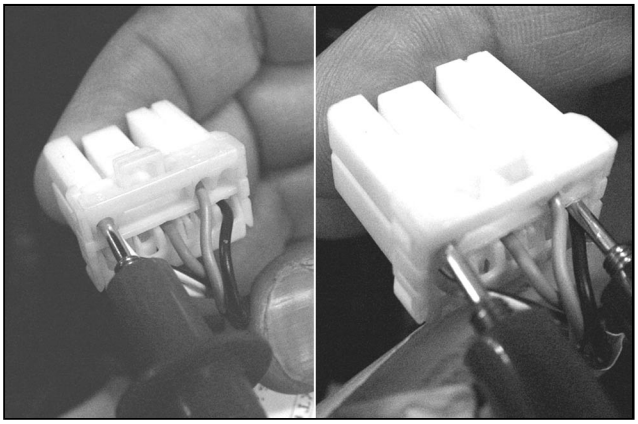
YES

NO

Check for a possible short circuit of the decoder or control unit. Replace if necessary

YES

Disconnect the main decoder connector and check the following conditions:
terminal n° 3=positive battery
terminal n° 4= negative battery



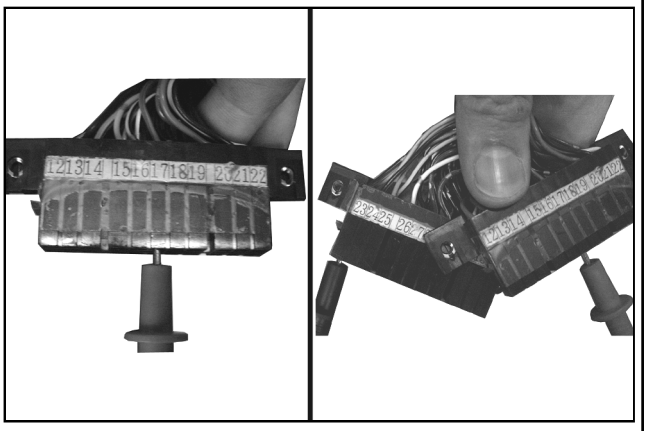
NO

YES

Decoder basic feed correct

YES

Using the special tool check the
basic feed of the control unit
PIN 17= positive battery
PIN 23= negative battery



YES

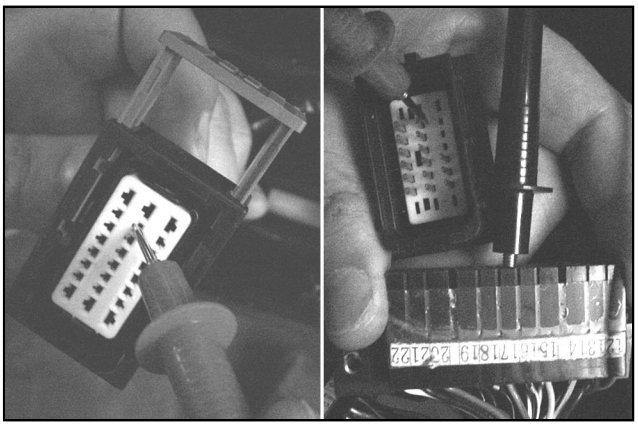
Control unit basic feed
is correct

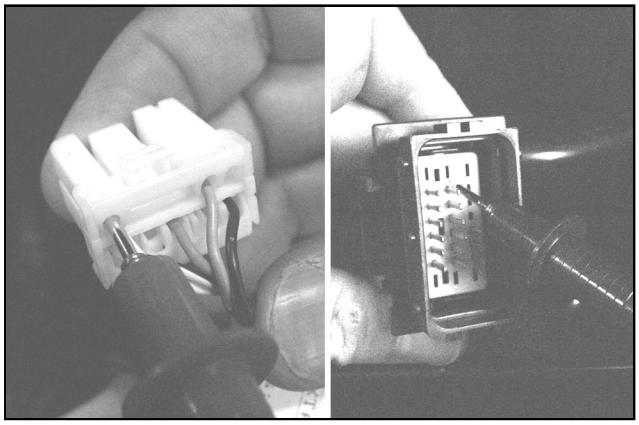
NO

NO

If lack of the battery negative is revealed, check the harness and earthing to the control unit clamp.

If lack of the battery positive is revealed, disconnect the connection between the fuel injection system and the vehicle system. The vehicle system is recognizable by the connector with a coupling control button. Red-white wire on the connector, vehicle system side = battery positive Red-white wire, fuel injection system side = continuity with PIN 17 of the tool and n° 3 of the decoder.





YES

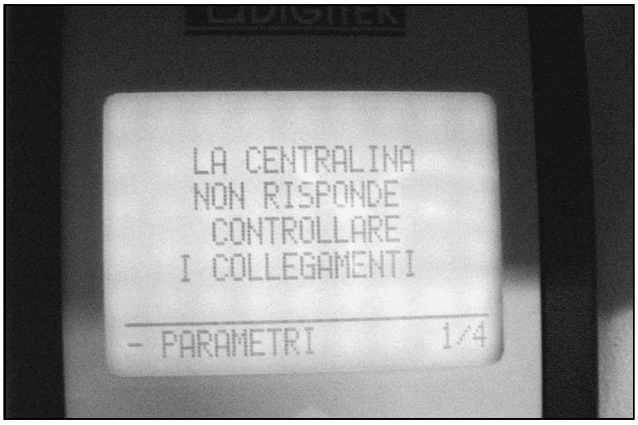
NO

Reset the harness

9

2 Control of the feed circuit deriving from the key switch.

- Lack of under-panel feeds inhibits functioning of the ignition and fuel injection.
- If a feed problem is revealed, the diagnosis tester n° 020460Y gives the information "THE CONTROL UNIT DOES NOT RESPOND".

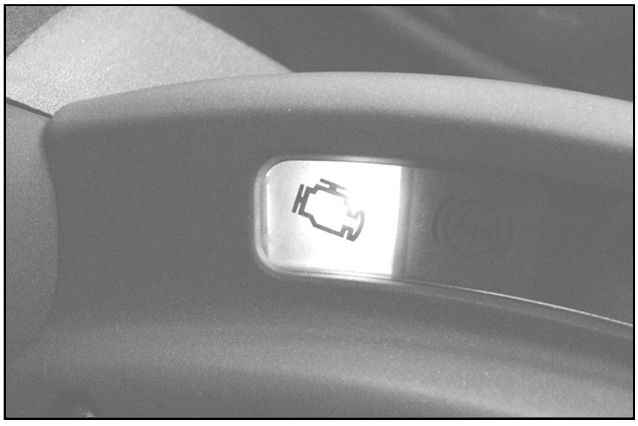


To control the circuit proceed as follows:

Check if the immobilizer system LED signals the setting to "ON".

YES

Raise the side stand.
Set the emergency switch to "OFF".
Set the key switch to "ON".
Set the emergency switch to "RUN".
Check if the fuel injection indicator lights up for 5 seconds.



YES

The under-panel feeds are regular.

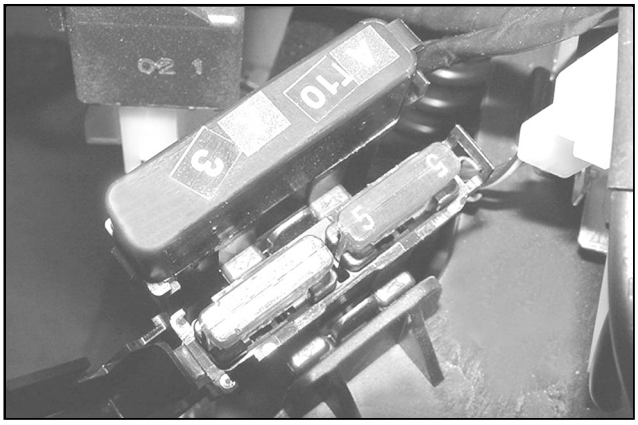
NO

NO

NO

NO

Check efficiency of n°4 5V fuse



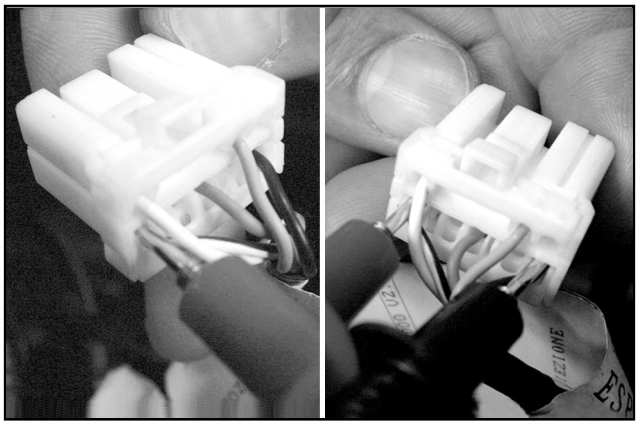
YES

NO

Interpose the special tool n° 020481Y between the control unit and fuel injection system. See page 9-8

Eliminate any short circuit, replace the fuse If necessary check the decoder and control unit.

Disconnect the main decoder connector and check the following conditions:
Commutator set to "ON", switch set to RUN, side stand raised
Terminal n°8= battery positive
Terminal n°4= battery negative



YES

NO

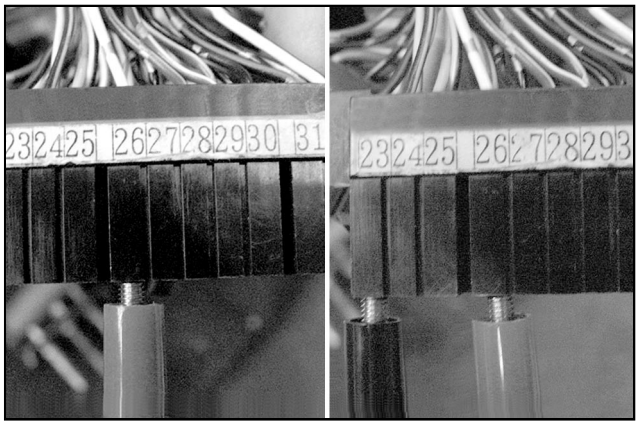
Decoder with under-panel feed is correct

YES

9

YES

Using special tool 020481Y check the under-panel feed of the control unit.
Commutator set to "ON", switch set to "RUN", side stand raised.
PIN 26= battery positive; PIN 23= battery negative



YES

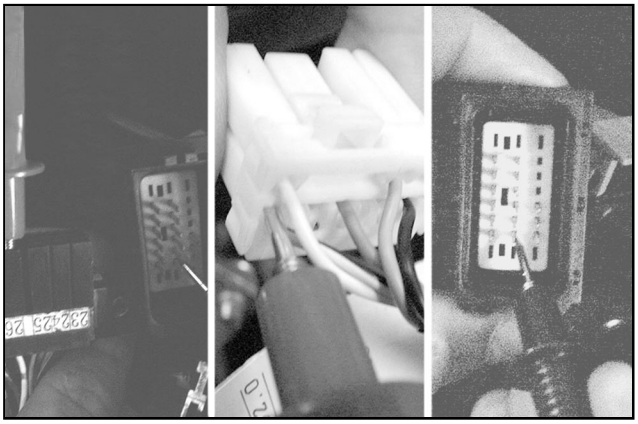
Control unit with under panel feed is correct

NO

NO

If lack of feed is revealed in only one component, check the connector concerned.
If the anomaly concerns both the decoder and the control unit, disconnect the connector linking the vehicle system and the fuel injection system.

White-black wire on terminal, fuel injection side = continuity with pin 26 of the control unit and n° 8 of the decoder.

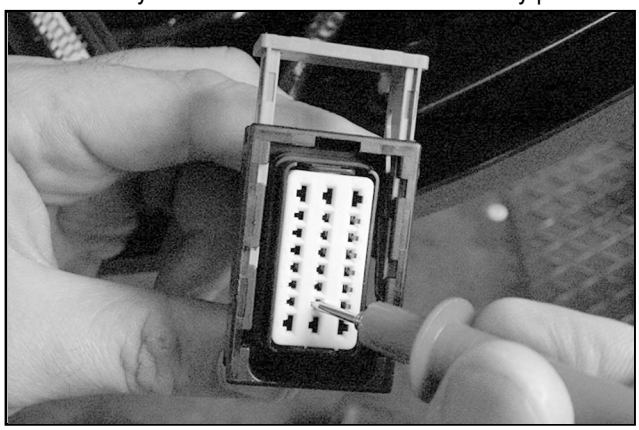


YES

NO

Repair the connection or harness

Side stand raised, commutator set to "ON", switch set to "RUN".
Terminal vehicle system side white-black wire = battery positive tension



YES

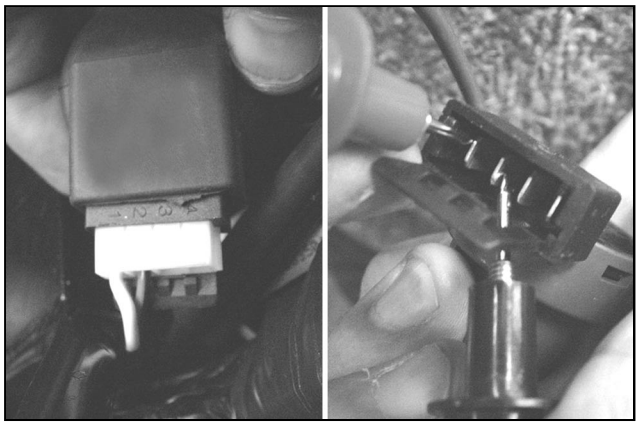
NO

YES

Under-panel feed is correct
(vehicle system section)

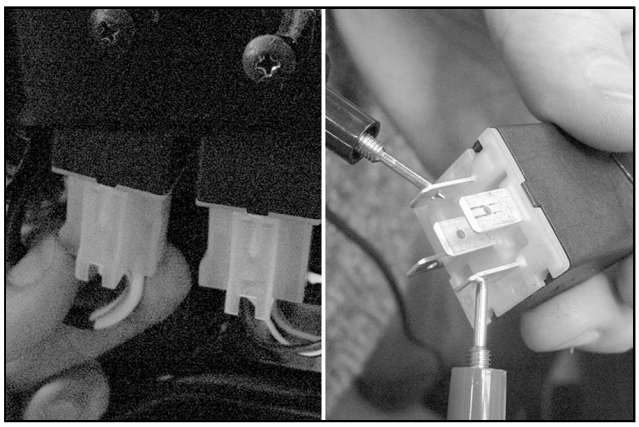
NO

Check the connector and continuity of the Key switch set to "ON"



Check the stop engine electromagnetic switch connector and its efficiency.
The connector is recognized by its thicker white wire.

NOTE: check the coil resistance
85 - 86 = ~ 70Ω



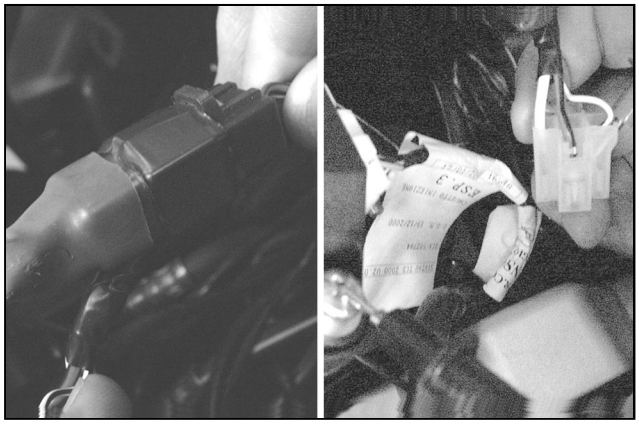
Check consents circuit:
- connector and emergency switch
- connector and deviation of the side stand

NOTE: the functioning of this circuit can be revealed also via:
- signalling of impossibility to start the engine
- functioning of the ignition control

Check the harness continuity.

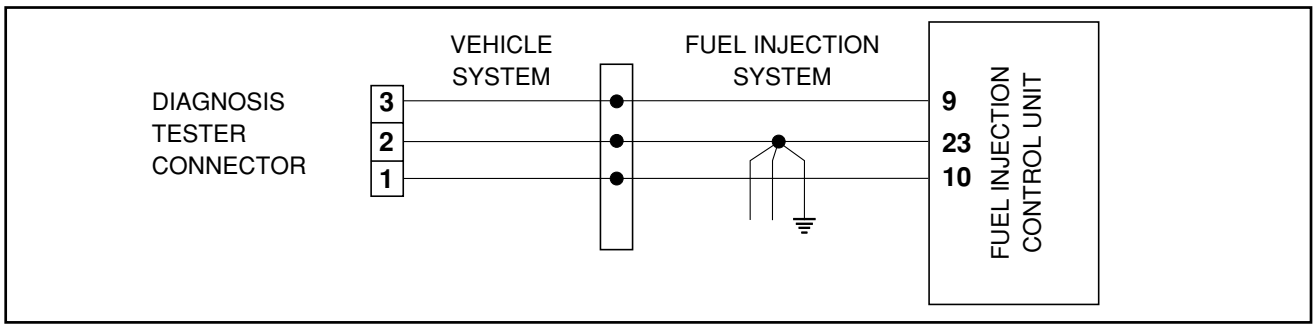
Check the services control main electromagnetic switch.

Disconnect the main electromagnetic switch.
Check the diode inserted on the excitation earthing of the main electromagnetic switch.
86 - earth = high resistance continuity (connect the positive tester with 86 negative to the earth).
On inverting the polarity there should not be continuity.



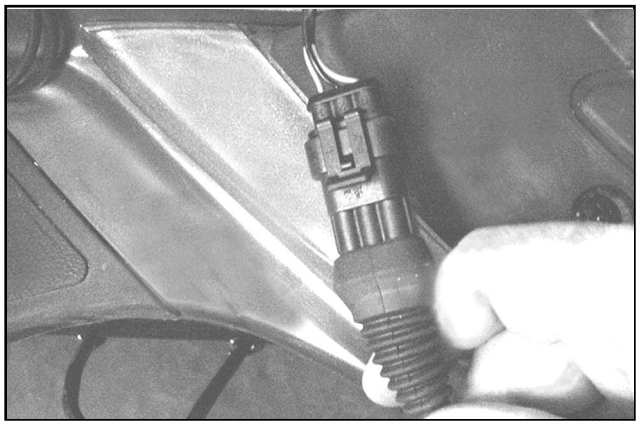
DIAGNOSIS TESTER LINK CIRCUIT

CIRCUIT DIAGRAM



Connect the diagnosis tester n° 020460Y see page 9-17.
If the diagnosis tester gives the information "THE CONTROL UNIT DOES NOT RESPOND", remove the under-panel feed for 10 seconds and reset to "ON"; if the same information is repeated proceed as follows:

Check the diagnosis tester connections



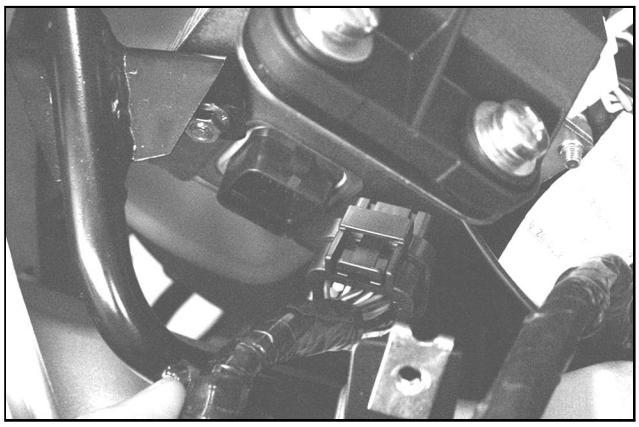
YES

Check the basic and under-panel feeds of the control unit (see page 9-8).

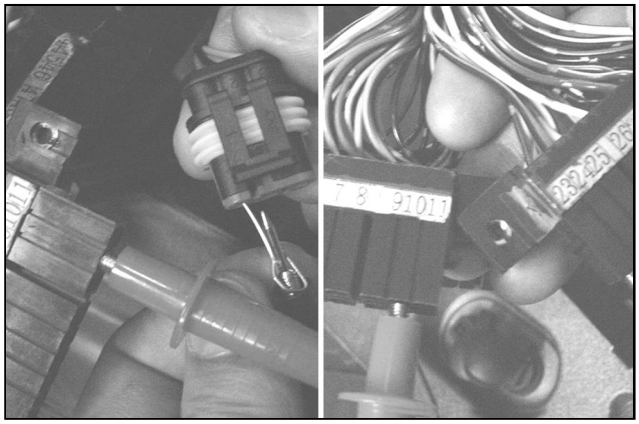
NO

Reset

Interpose the special tool 020481Y between the control unit and the fuel injection system (see page 9-8). Keep the control unit disconnected.



Check the following conditions:
① diagnosis socket - 10 control unit = continuity
② diagnosis socket - 23 control unit = earthed continuity
③ diagnosis socket - 9 control unit = continuity
10 - 23 = isolation (> 1MΩ)
9 - 23 = isolation (> 1MΩ)



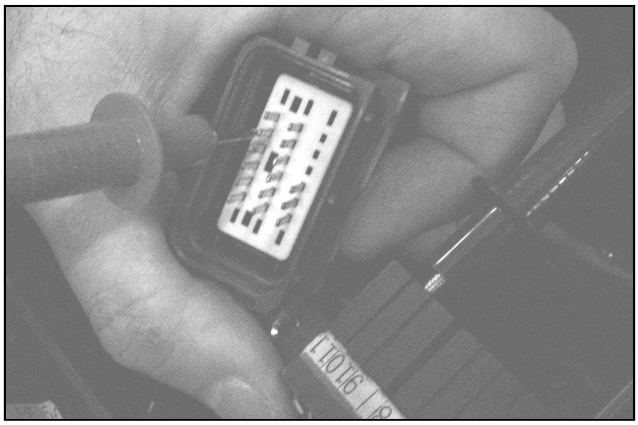
YES

The circuit functions correctly

Check the control unit

NO

Disconnect the connection between the fuel injection system and the vehicle system.
Repeat controls in the two system sections.

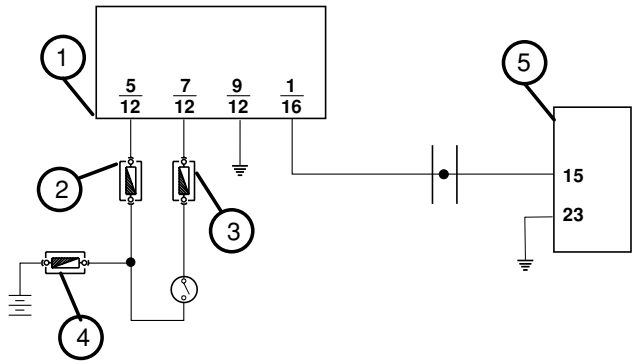


Repair any interruptions or short circuits

9

FUEL INJECTION INDICATOR CIRCUIT

CIRCUIT DIAGRAM



1	DIGITAL INSTRUMENT	4	30A FUSE
2	7.5A FUSE	5	CONTROL UNIT
3	7.5A FUSE		

TERMINAL	CONDITIONS		STANDARD VALUES
15 - 23	- commutator set to "ON" - side stand raised - switch set to "RUN"	during checks	O V
		after checks	battery tension

The fuel injection indicator is commanded whenever the setting is "ON" with a timing of 3 seconds generated by the digital instrument. This phase is normally superimposed by fuel injection control unit control. This timing lasts 5 seconds.

The diagnosis tester 020460Y is not programmed for the control of this circuit.
Proceed as follows:

Commutator "ON" under conditions of:
- Side stand raised
- Emergency switch set to "OFF"

The fuel injection indicator lights up for 3 seconds.

YES

Keep the commutator set to "ON"
Set the emergency switch to "RUN"
Check that the indicator lights up for 5 seconds

YES

The system is functioning

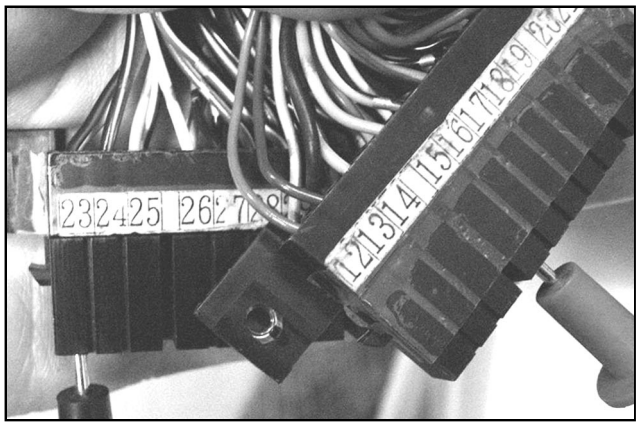
NO

NO

If the other indicators light up check the digital instrument. Otherwise, control the feed and fuses, and if necessary replace the digital instrument.

Interpose special tool 020481Y between the control unit and the fuel injection system (see page 9-8).

Key switch set to "ON".
Side stand raised.
Emergency switch set to "RUN".
Wait for more than 5 seconds.
15 - 23 = battery tension



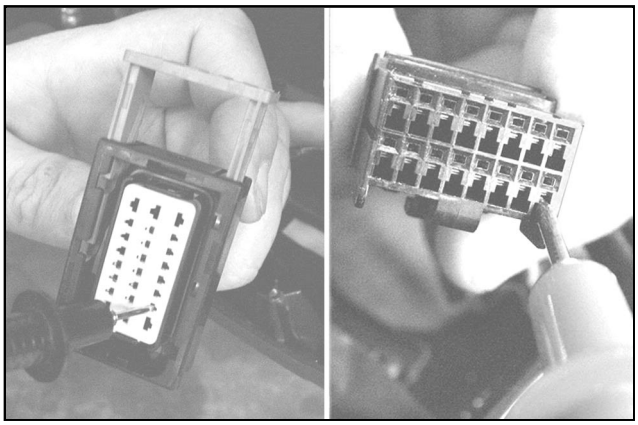
YES

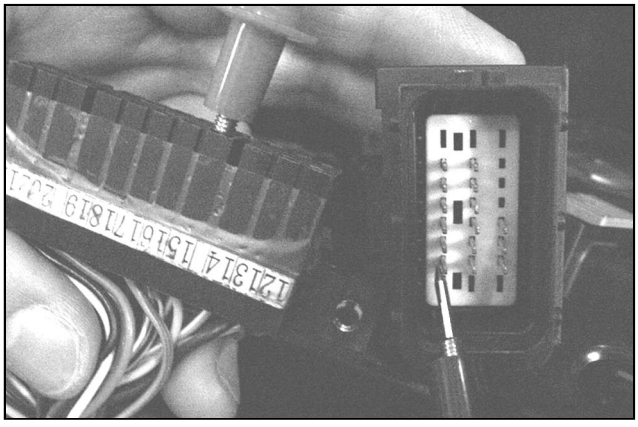
Check the control unit connector
Check the control unit

NO

Check the connector between the fuel injection system and the vehicle system.

Check continuity of the brown-black (1/12) wire:
digital instrument (1-2) - connector
connector - PIN15 control unit





The fuel injection control unit therefore manages the indicator negative. The indicator should turn itself off after the initial check.
The indicator lights up again as soon as the control unit self-diagnosis reveals an anomaly.
When the anomaly disappears, the indicator turns itself off again; however, it is necessary to proceed with related function controls.
The indicator may light up independently of engine functioning.

SELF-DIAGNOSIS SYSTEM

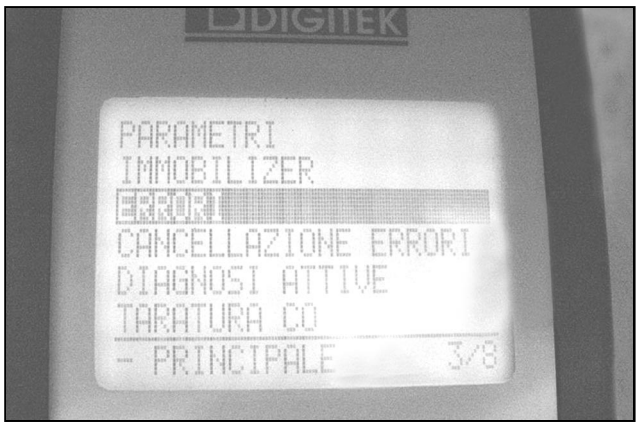
The fuel injection control unit has a self-diagnosis function.

When an anomaly is revealed, the control unit proceeds to:
- lighting of the fuel injection indicator (only when current).
- activation of engine management controls on basic data entered in the control unit (where possible).
- memorization of the anomaly (always).

If an anomaly revealed is not always present, the indicator follows the state of the anomaly and memorization remains active. Memorization of the event is cancelled automatically if the anomaly does not occur again for more than 16 usage cycles (warm up - usage - cooling). Disconnection of the battery does not cancel the memorization.

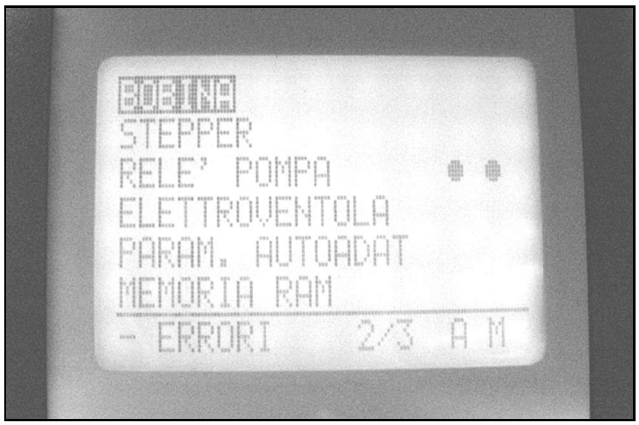
- **Control of memorized anomalies**

Connect diagnosis tester 020460Y to the vehicle system - see page 9-17.
Selection the “ERRORS” function menu.



The pages of the tester show a list of the errors that may be revealed during self-diagnosis.
Errors revealed through self-diagnosis are marked by one or two reference bullets.

These are located in two rows
Row A = current anomalies (present)
Row M = memorized anomalies



Errors revealed through self-diagnosis may refer to the following control unit system circuits or fields:
- throttle valve position signal
- ambient pressure signal
- coolant temperature signal
- air intake temperature signal
- incorrect battery tension
- Injector and related circuit
- H.V. coil and related circuit
- Stepper and related circuit
- Pump relay circuit
- Electrical fan relay circuit
- RAM Memory
- ROM Memory
- EEPROM
- Microprocessor
- Signals panel (revolutions - phase - unstable cycle signal)

The anomalies underlined cause the engine stopping.
In the other cases the engine works on basic data management.

- **Cancellation of memorized anomalies**
After any repairs, connect the diagnosis tester 020460Y (see page 9-17).
Select the function menu “ERROR CANCELLATION”
Press OK and follow the instructions given.

Carry out a trial run to check if the anomaly is repeated.

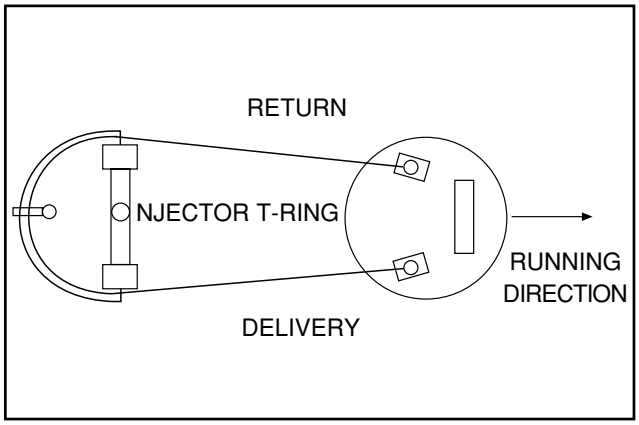
For a guide to resolving any anomalies consult the related parts of this chapter.

FUEL SUPPLY SYSTEM

General details

Fuel supply to the injector is guaranteed by a pump, a filter and a pressure regulator integrated with a fuel level indicator inside the tank.

The pump assembly is connected to the injector via:
2 semi-rigid tubes
4 quick-connections
1 T-ring joint with O ring and injector stop bracket



The tubes are crossed and fixed to the air intake manifold so as not to provoke wear and tear on the quick-connections connected to the injector T-ring joint.

9

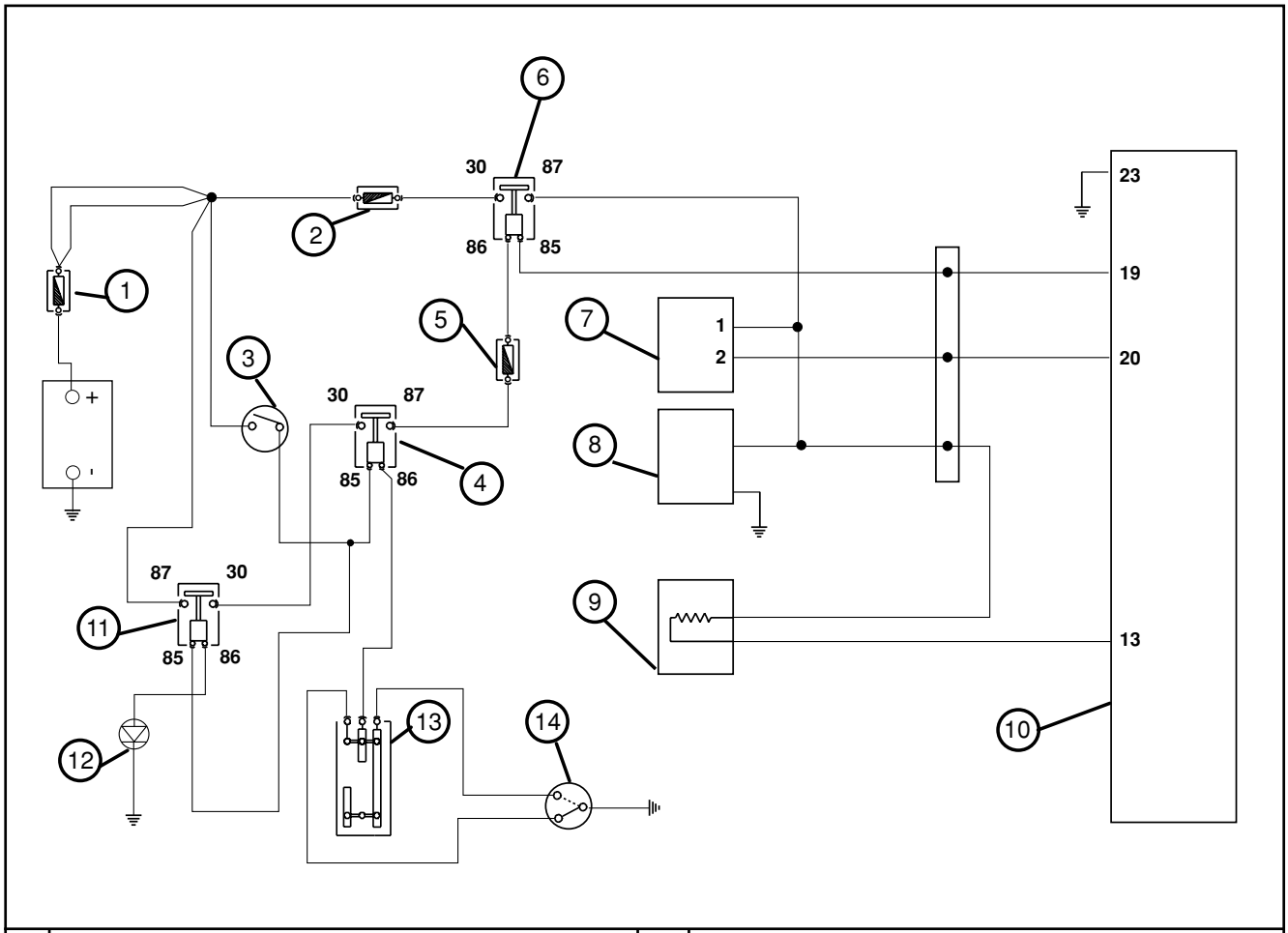
NOTE: before carrying out work on the supply system, all parts should be cleaned accurately to avoid damaging the stability of the quick-connections or allowing the infiltration of impurities into the ducts.

WARNING: The system is pressurized.
Do not smoke while working on parts.
Sprays of fuel can be expected.

PRECAUTIONS:
- Before starting the engine, ensure there is fuel in the tank.
- Do not run the vehicle on the reserve tank, so as to avoid the risk of running dry.
- If a long period of disuse is expected, fill the tank to at least half.

FAILURE TO RESPECT THESE REGULATIONS MAY DAMAGE THE PUMP

CIRCUIT DIAGRAM



1	30A FUSE	8	FUEL PUMP
2	10A FUSE	9	INJECTOR
3	COMMUTATOR	10	FUEL INJECTION CONTROL UNIT
4	ENGINE STOP ELECTROMAGNETIC SWITCH	11	MAIN ELECTROMAGNETIC SWITCH
5	5A FUSE	12	2A DIODE
6	ELECTROMAGNETIC SWITCH	13	ENGINE STOP SWITCH
7	H.V. COIL	14	STAND SWITCH

Pump feed circuit

The control unit intervenes by activating the pump under the following conditions:

- setting to "ON" with emergency switch set to "RUN" and side stand raised.
  Pump feed for 2 seconds.

- when the phase revolutions signal is present.
  Continuous feed

The initial timing is useful to drain the system, especially after leaving the vehicle parked with the engine warm. In these conditions, fuel altered by overheating will be mixed with that in the tank.

During use, the pump function will be subordinated by the engine revolutions.

Circuit control

Proceed as follows:

Set to "ON" with the emergency switch set to "RUN" and the side stand raised.
There is pump revolution for 2 seconds.

YES

Attempt ignition.
Check that the engine revolution matches that of the pump.

YES

The electrical feed of the pump is conformant.

NO

Connect diagnosis tester 020460Y
to the vehicle system. (See page 9-17).

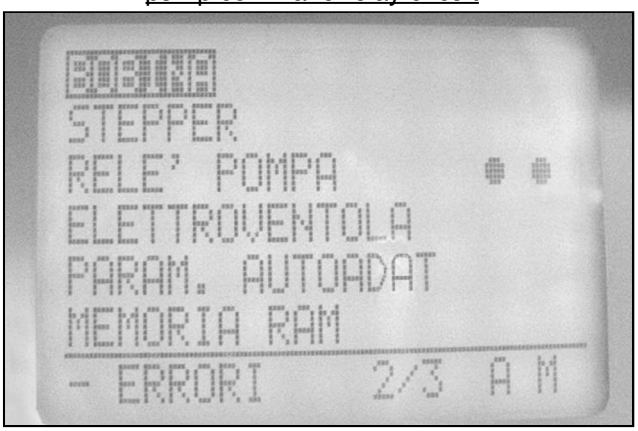
NO

The pump does not turn or turns continuously.

Attempt ignition.
Select the "ERRORS" function menu.
Check for the presence of anomalies.

YES

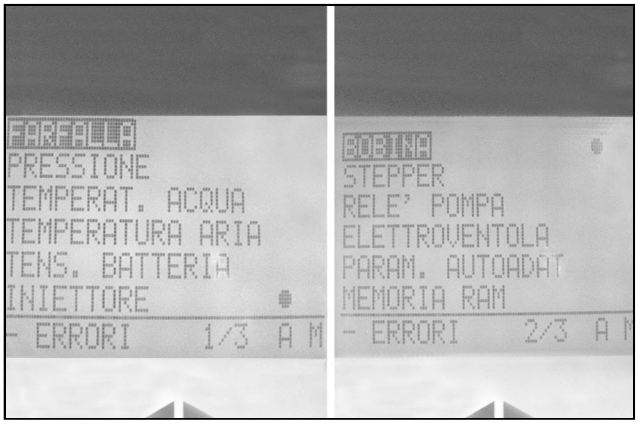
Malfunctioning of the
pump command relay circuit.



NO

YES

Malfunctioning of:
- injector
- HV coil
- signals panel



9

The control unit reveals an anomaly on the wire of pin 19

YES

Earth wire
In this case the pump turns constantly when under-panel tension is present.

Check and reset the earthing isolation of wires 19-85 (of the electromagnetic switch). Check the two sections separately: vehicle system fuel injection system

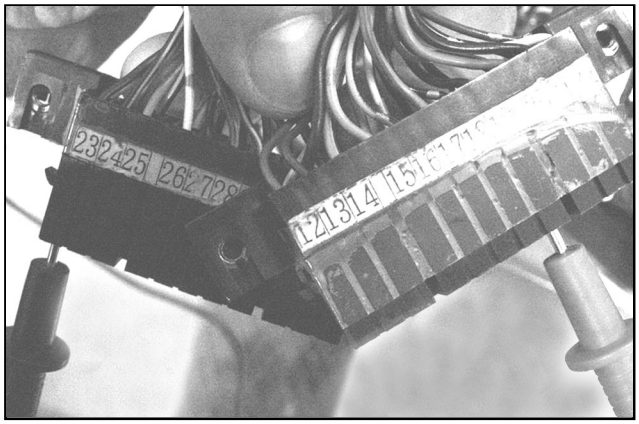
Cancel the code and check from the beginning

YES

Broken wire connection
The relay cannot control the pump feed.

Install special tool 020481Y between the control unit and fuel injection system - see page 9-8.

Set to "ON" with the switch set to "RUN" and side stand raised.
Wait more than 2 seconds and check the following conditions:
19-23 = battery tension

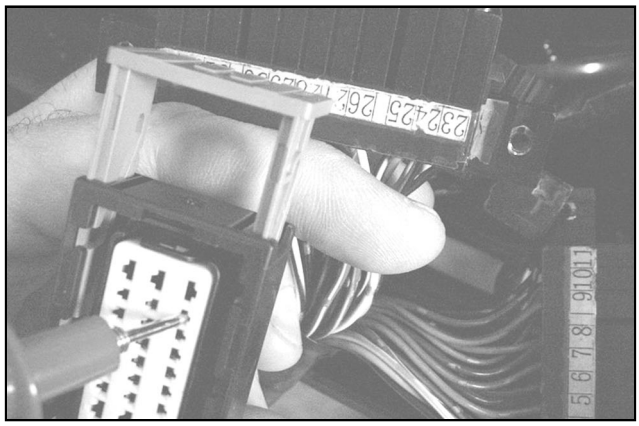


NO

YES

Replace the control unit

Disconnect the vehicle system- fuel injection system connection.
23 - black - violet (vehicle system) = battery tension

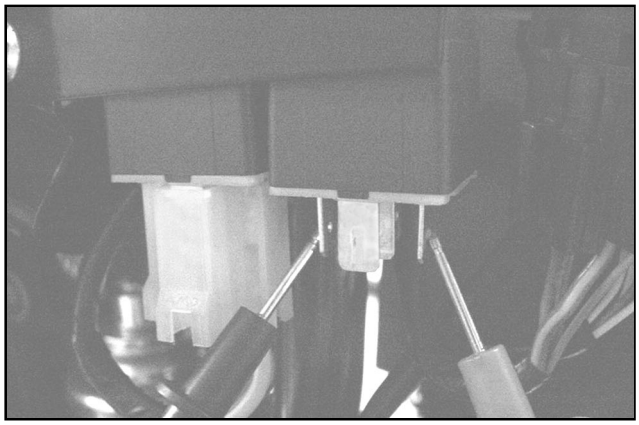


YES

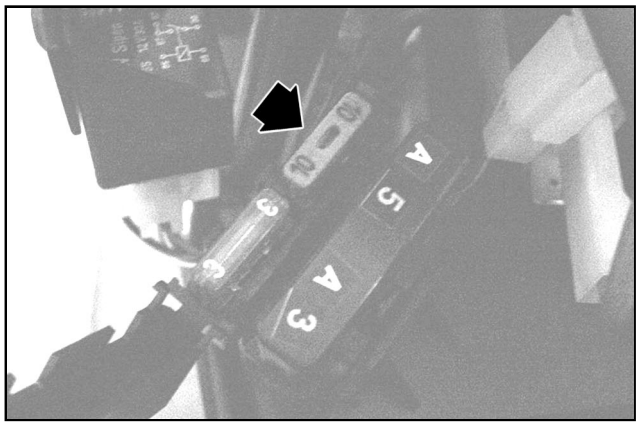
Check the connector and the harness injection side

NO

Check continuity of the vehicle harness and continuity of the relay coil. Relay control:
85 - 86 = 100 ± 50Ω



Check the efficiency of 10 A fuse n° 2



NO

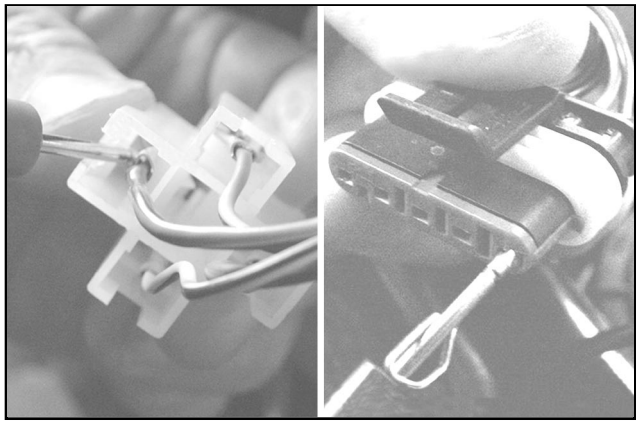
YES

9

YES

NO

Check efficiency of the pump command electromagnetic switch. Check continuity of the harness between electro-magnetic switch and pump.
87 (electromagnetic switch) - green - black (pump) = continuity



Reset and repeat controls from the beginning.

Disconnect the connectors to: fuel pump, HV coil, injector

Check the earthing isolation of the harness
87 (pump electromagnetic switch) - 23 = isolation (> 1MΩ)

NO

Reset harness isolation and replace the fuse.

YES

Check the earthing isolation of the HV coil primary and the injector coil. See related sections. (page 9-68).

YES

Check resistance of the windings in the pump.
Resistance ~1.5 Ω

NO

Replace the fuse and proceed with pump control.

Proceed with control of absorbed current (see page 9-53).

Select the function menu "ACTIVE DIAGNOSIS" of the diagnosis tester 020460Y.
Select the fuel pump simulation function.
Activate the function with under-panel feed inserted and engine stopped.

The tester asks the control unit to activate the pump for 30 seconds

Check acoustically the following conditions:
- relay closure
- pump revolution
- relay opening

YES

NO

<u>The pump receives feed.</u>
Proceed with the pump functioning control

Check the pump support connector.

YES

NO

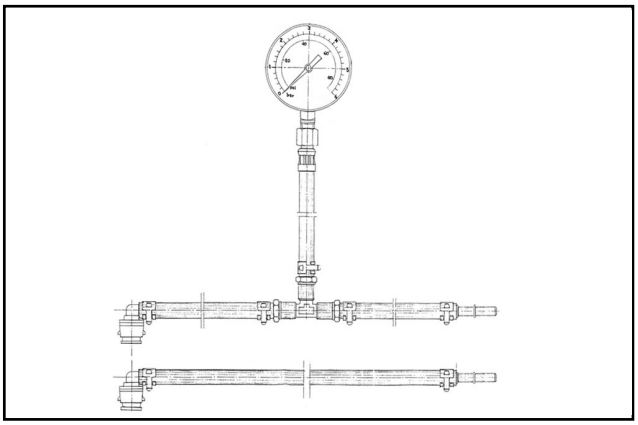
Replace the pump see page 9-54.

Reset

9

Hydraulics control and system maintenance

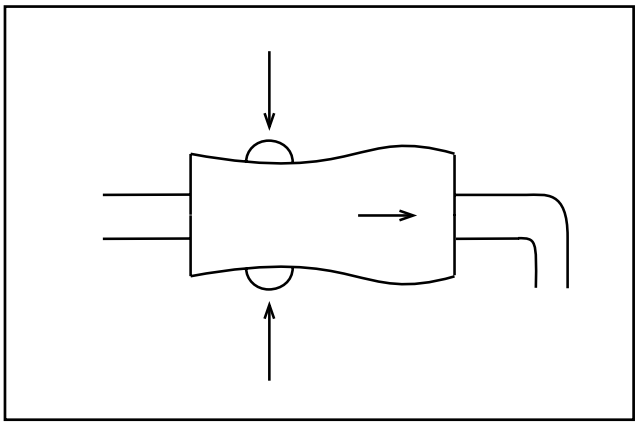
Before carrying out controls concerning system pressure, carefully clean all the components of the supply system.
To carry out the controls the special tool 020480Y from the fuel pressure control kit is required.



Before proceeding to detach any quick-connection reduce system pressure.
Disconnect the electrical connection from the pump support while the engine is turning over and wait for it to stop.
The engines stops at around 1.5 bar.

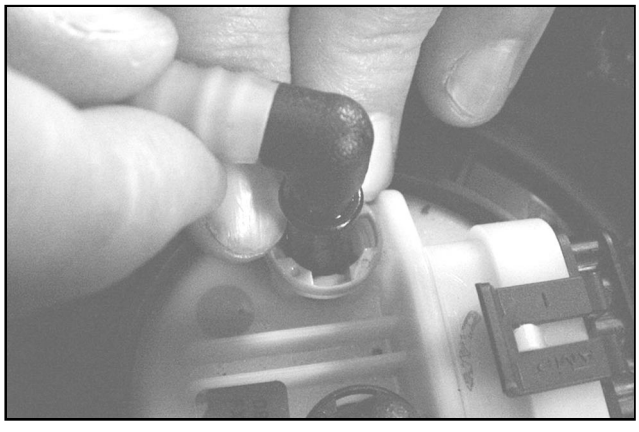
WARNING: disconnect the tube terminal with caution. Prevent spraying in the eyes.

The special tool has quick-connections of the same kind as those in the system.
To disconnect the female terminals (injector side) it is necessary to push the two appendices then pull outwards.



Warning - Do not use force if the terminal does not come out; try to turn it. The system is created in such a way that if traction is increased, the terminal blocks further.

To disconnect the male terminals (pump side) it is necessary to push the coaxial tube rings towards the pump support and extract the terminals.

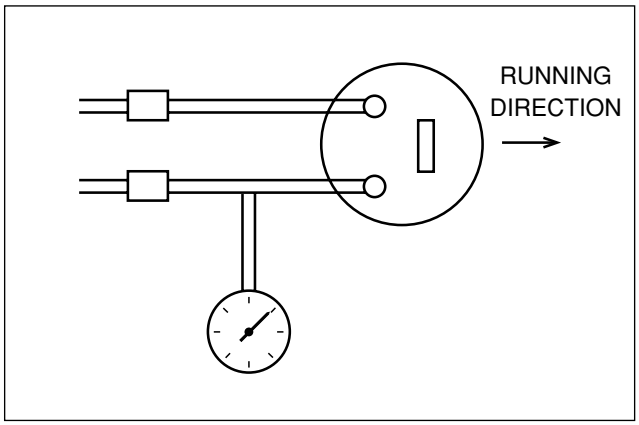


Warning - Do not use force if the terminal does not come out; try to turn it. The system is created in such a way that if traction is increased, the terminal blocks further.

System pressure control, for practical reasons, must be carried out by connecting to the pump side.

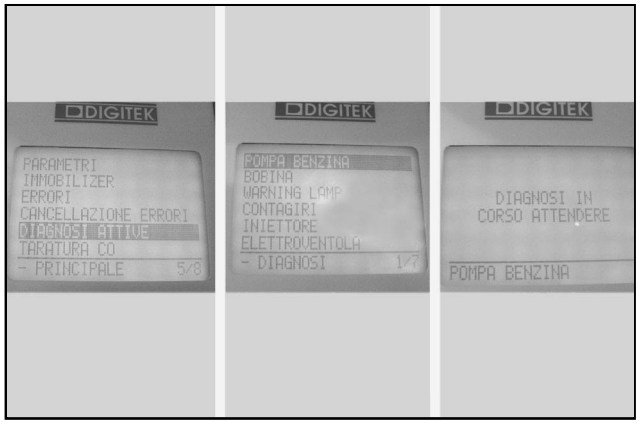
Connect the manometer to the delivery duct (right side) and the extention tube to the return duct (left side).

NOTE: before mounting check that the tool ducts are clean.



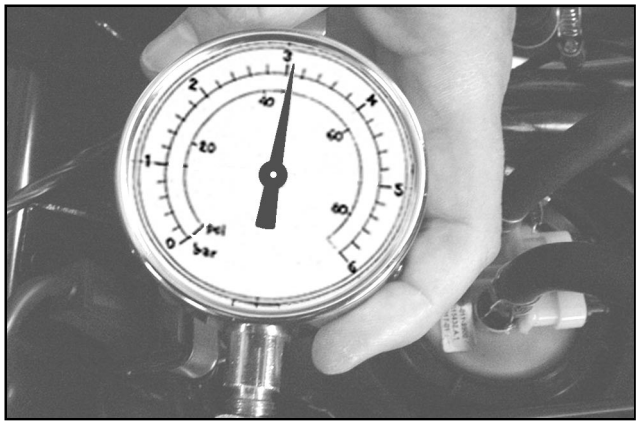
Pressure regulator control

Connect the diagnosis tester 020460Y
see page 9-17.
Select the function menu "ACTIVE DIAGNOSIS".
Select the function "PUMP DIAGNOSIS".



Activate the function with under-panel feed inserted and the engine stopped.
The control unit controls the pump for 30 seconds.

Allow the system to purge for a few seconds.
Check that the system has no external leaks.
Check the adjusting pressure with pump feed tension of more than 12 V.
Adjusting pressure = 300 - 320KPa (3 - 3.2 BAR)



YES

The pressure regulator is efficient

NO

<u>Pressure too high</u>

Check that the return duct is not clogged or compressed.

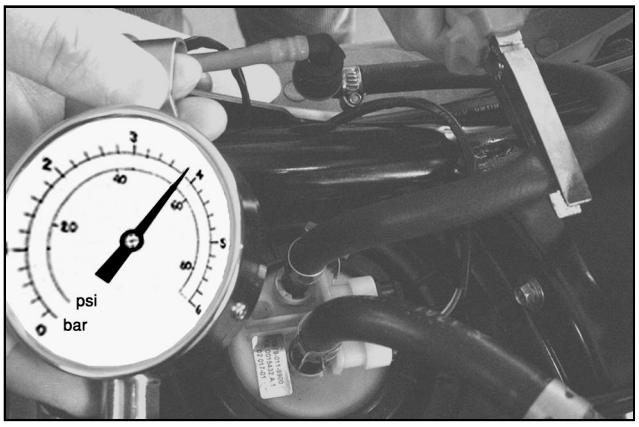
NO

<u>Replace the pressure regulator</u>

See page 9-54 - pump support overhaul.

<u>Adjusting pressure too low</u>

Activate pump revolution again. Using long, flat-tonged pliers, squeeze the return duct for a moment acting only on the extention part of the special tool.
(the current tube does not allow this operation).
fuel pressure = greater than 300 KPa (3 BAR)



YES

NO

YES

Replace the pressure regulator

See page 9-54 - pump support overhaul.

NO

Replace the fuel pump

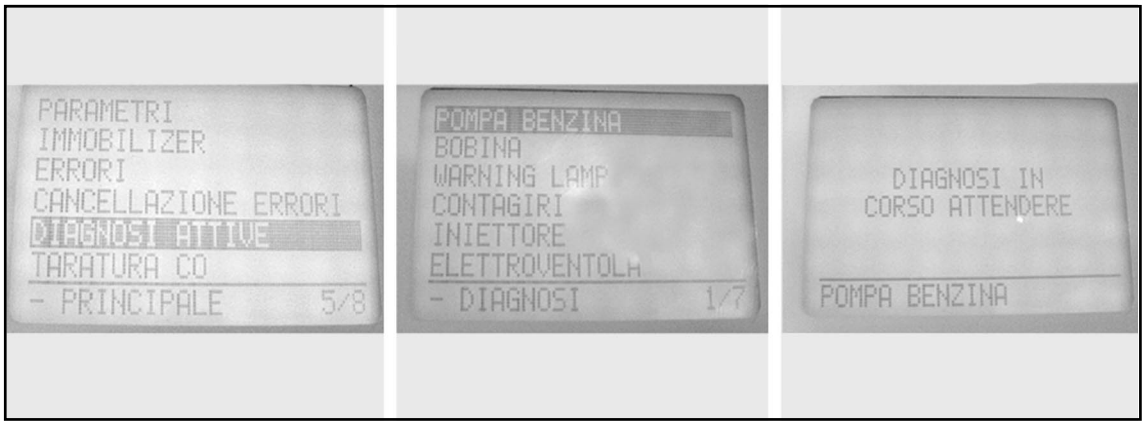
See page 9-54 - pump support overhaul.

Pump and fuel filter control

This procedure is useful during maintenance to check the efficiency of the outlet filter.

Connect the diagnosis tester 020460Y see page 9-17.
Connect the fuel pressure control kit 020480Y see page 9-46.

Select the “ACTIVE DIAGNOSIS” function menu on the diagnosis tester.
Select the function "PUMP DIAGNOSIS".
The pump activates for 30 seconds.



Allow to purge for a few seconds.
Check that the system has no leaks.
Using long, flat-tonged pliers, squeeze the return duct for a moment by acting only on the extention of special tool 020480Y with pump feed tension greater than 12 V, check the maximum system pressure.
maximum pressure = > 600 KPa (6 BAR)

YES

NO

Proceed with the system seal control

Activate the pump for 30 seconds using diagnosis tester 020460Y.
After the pump stops wait for 3 minutes.
Check the system pressure.
Fuel pressure = greater than 200 KPa (2 BAR)

NO

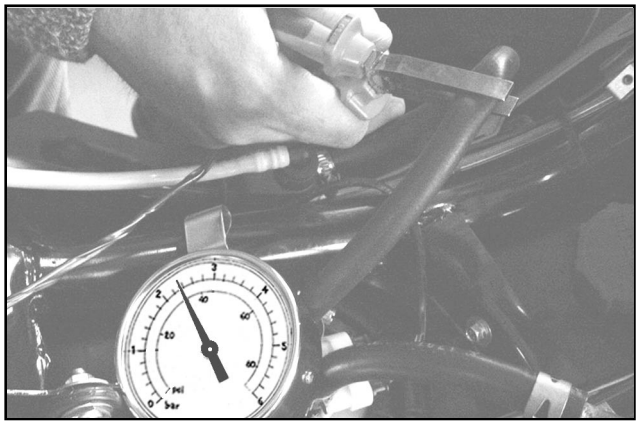
YES

System seal is good.

The pressure is lower

Carefully check the tension with the pump under pressure.
If tension is greater than 12 V replace the pump (see page 9-54 overhaul of the pump support).

Repeat the test. When the pump stops, using long, flat-tonged pliers, squeeze the return duct acting only on the extention of the special tool. This action leads to an increase in fuel pressure.



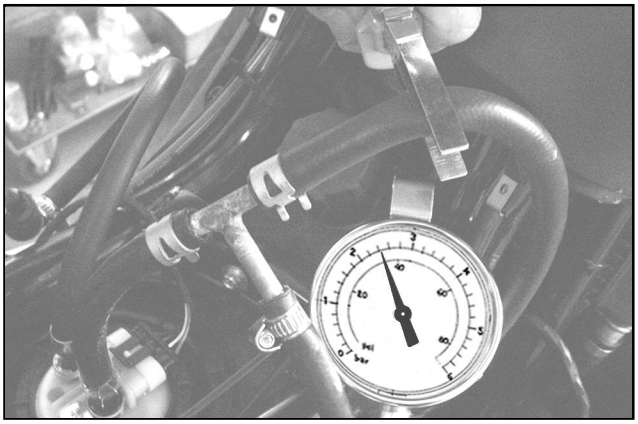
Check if the pressure reduces at the same rate as when the system is not squeezed.

The pressure reduces much more slowly

Replace the pressure regulator (see page 9-54 overhaul of the pump support).
Check system seal again

Rate variations are not evaluated

Repeat the test by squeezing the tube of the special tool 020480Y in the tract between the derivation and the injector. Check if pressure reduces at the same rate as when the system is free.

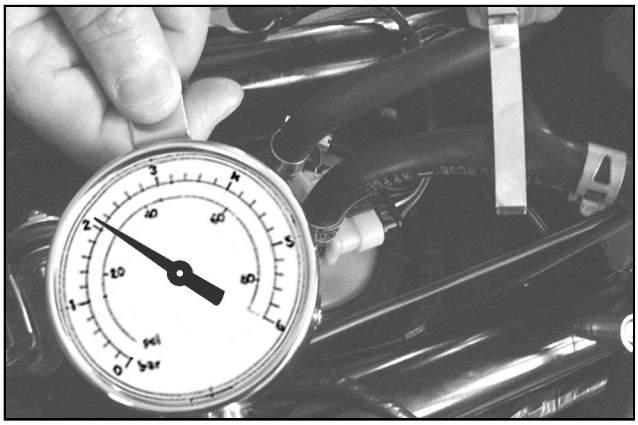


The pressure reduces much more slowly

Proceed with controls and possible replacement of the injector due to insufficient seal (see page 9-62 and Chapter. 7-THERMAL UNIT AND TIMING SYSTEM).

Rate variations are not evaluated

Repeat the test by squeezing the tube of the special tool 020480Y in the tract between the derivation and the injector. Check if pressure reduces much more slowly.



YES

The unidirectional pump valve is defective Replace the pump (see page 9-54 - overhaul of the pump support).

NO

Check seal of the tubes and the injector. joint more accurately. If necessary repeat seal controls of the components.

NOTE: poor system seal only prejudices readiness at ignition stage.

9

Check the free flow capacity

Disconnect the pump connector, start the engine, wait for it to stop, reconnect the connector. Disconnect the fuel return duct from the pump support (left hand tube).

Insert the return duct in a measuring container. Using the diagnosis tester 020460Y, activate the fuel pump for 10 seconds. Ensure that feed tension is greater than 12 V. Measure the quantity of fuel distributed.

Free flow capacity of the pump = 300 - 320 cc.

YES

The fuel filter is not clogged. It is possible to continue using it respecting the 48000 Km limit.

NO

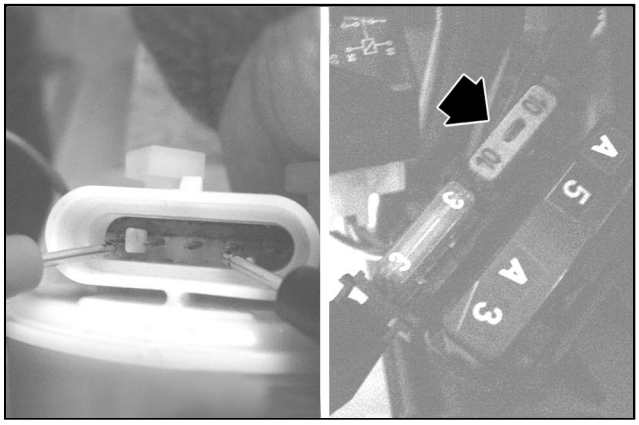
The flow capacity is lower than 250 cc.

The fuel filter is dirty. Proceed with replacement of the pump support (see page 9-54).

Pump electrical controls

Resistive check

Disconnect the pump support connector. Using a tester measure the resistance of the pump windings.
Connect the tester prods to the pump support pins as shown in the figure.

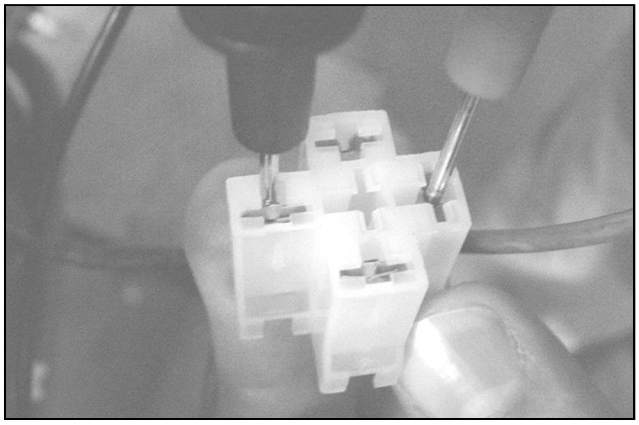


Resistance = ~1.5 Ω

On meeting with infinite resistance replace the pump.
With infinite resistance, the pump will not turn.
With resistance close to 0 W the pump absorbs excessively with the possibility that the 10 A fuse n° 2 will burn out. Proceed with controls as below.

Pump absorption control

Pump absorption may vary depending on:
- feed tension
- running-in of the pump
- adjusting pressure
- cleanliness of the delivery filter



To carry out a control of the current absorbed, proceed as follows:
- disconnect the pump command electromagnetic switch connector
- with the ignition key set to "OFF", jump 30-87 to the connector using the tester prods in amperometer function (see figure).
- check the pump revolution and its absorption

Current absorbed = ~ 3.5 - 4.2 A

NOTE: this absorption refers when:
- feed tension = ~ 12 V
- pump run-in
- system pressure = 300 KPa (3 BAR)
- clean fuel filter

A dirty filter causes absorption increase.
If the overpressure valve is opened the pump absorbs ~ 6-7 A

If excessive absorptions are revealed (> 5A) proceed with replacement of the filter. See page 9-54 overhaul of the support pump.
If the anomaly persists replace the pump.

Fuel filter control

For the fuel filter control, check:
- Free flow capacity. See page 9-52
- Current absorbed by the pump. See page 9-53

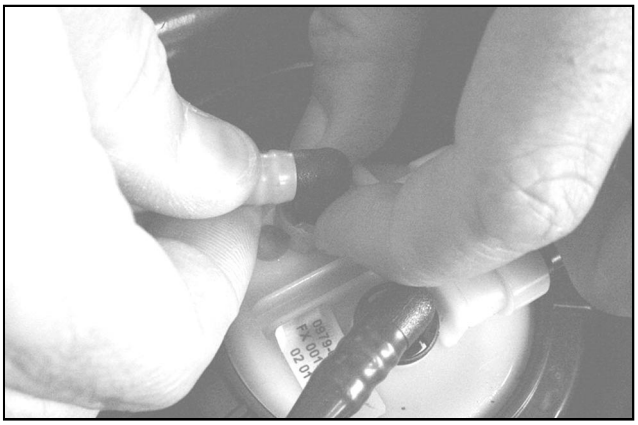
An obstructed filter causes:
- Performance decline, especially at full power
- Increased pump absorption

NOTE: Do not blow the filter with compressed air.
A damaged filter may cause blocking of the injector.

Pump support overhaul

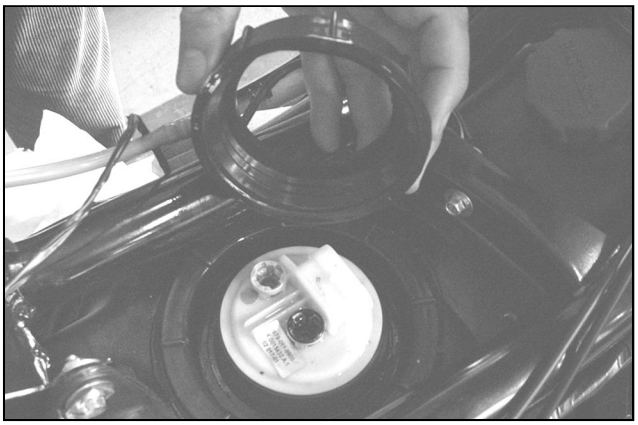
To remove the pump support from the tank, proceed as follows:

- Disconnect the electrical connection
- Start the engine and wait for it to stop spontaneously
- Clean the tank and the pump support (if necessary wash and blow dry with compressed air)
- Disconnect the delivery and return pipes by means of the quick-connections (see page 9-46)



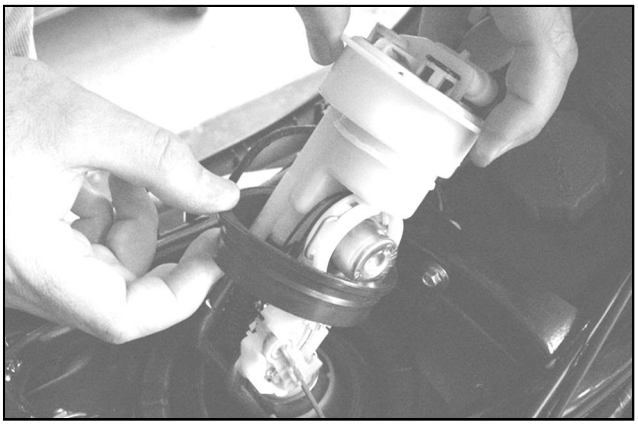
Warning - Expect possible sprays of fuel.

- Unscrew the pump support fixing ring nut (right-threaded twist)



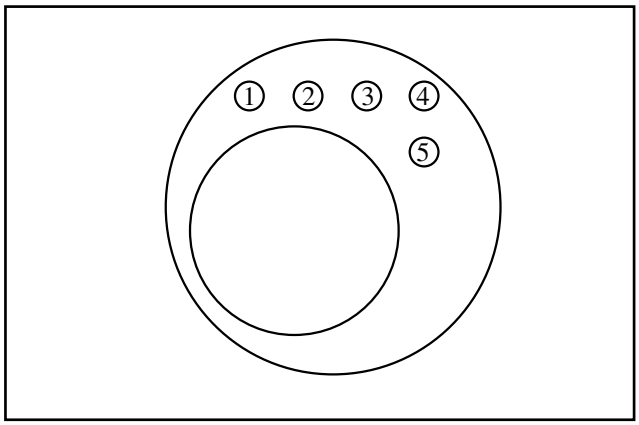
- Remove the pump support and the gasket

NOTE: carry out the extraction operation paying attention not to bend the float arm.



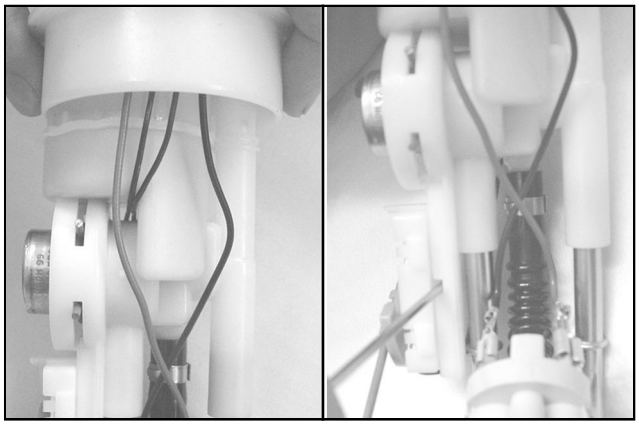
For the replacement of components proceed as follows.

(**1**) Level indicator:
- Take note of the mounting position and course of the two connecting wires.
  pos 2 = wire connected to the circuit
  pos 3 = wire connected to the moving arm

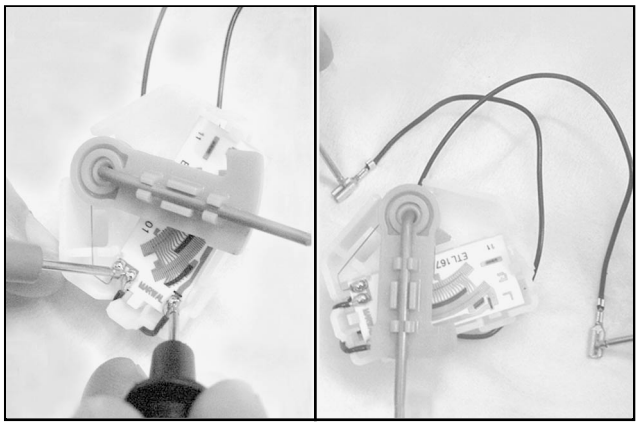


The wires must pass through the hole made between the filter and the pressure regulator.

- Disconnect and pull out the wires
- Using a screwdriver on the stop tang as shown in the figure, pull the level indicator out from the support.



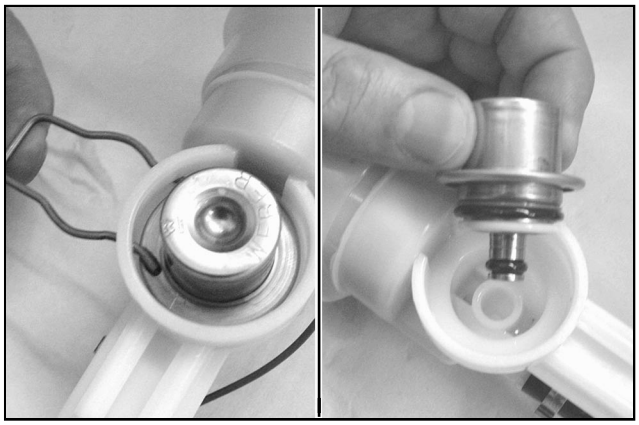
- Indicator level control
  The control can also be carried out before dismantling from the support.
  Measure resistance between the two wires of the indicator level.
  Moving the arm with float, check that the resistance is subjected to progressive variations with the arm movement.
  Value limits
  empty tank position = 95 - 105 Ω
  full tank position = 0 - 9 Ω
- For reassembly follow the dismantling procedure in the reverse order.



(**2**) Pressure regulator:
- Remove the spring clip
- Pull out the pressure regulator complete with its fixing rings.

NOTE: to overcome resistance of the O rings, lever with a screwdriver using the openings cut into the side where the clip is inserted.

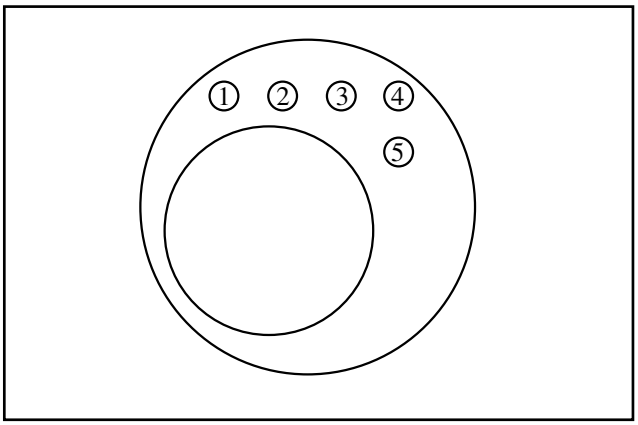
- For the reassembly, grease the O rings and assemble in the disassembly reverse order.



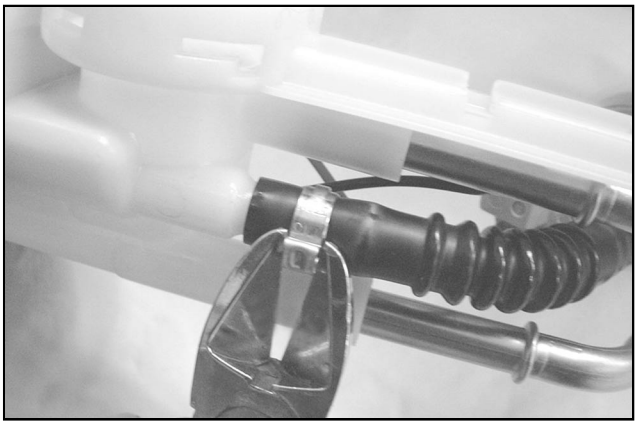
(**3**) Fuel pump
- Take note of the position of the feed wires on the support
  pos 1 = positive (red)
  pos 4 = negative (black)

NOTE: the pump connections are not interchangeable.

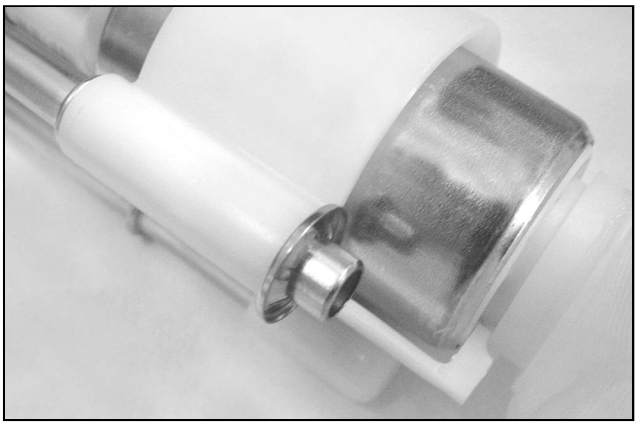
- Disconnect the feed wires



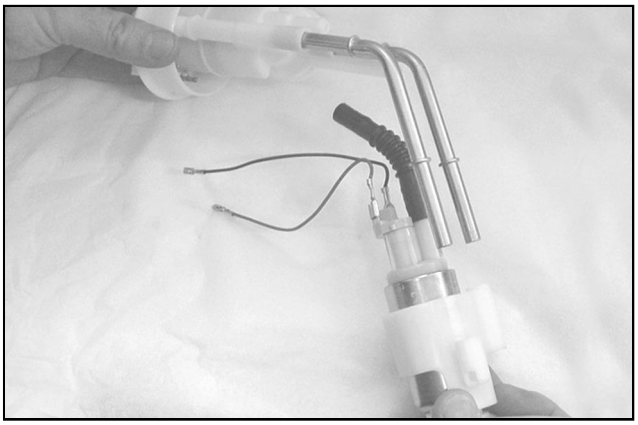
- Cut the hose clamp from the delivery pipe on the support



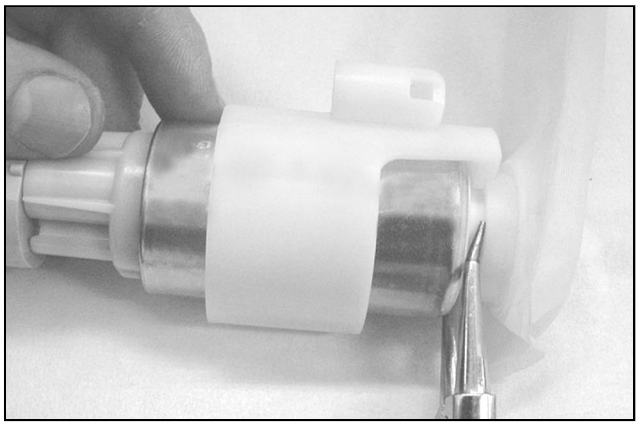
- Remove the fixing washer from the pump



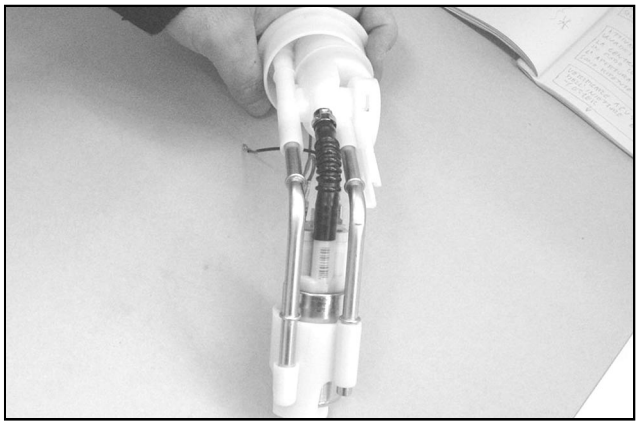
- Remove the tube from the filter attachment
- Remove the pump complete with ring support and prefilter



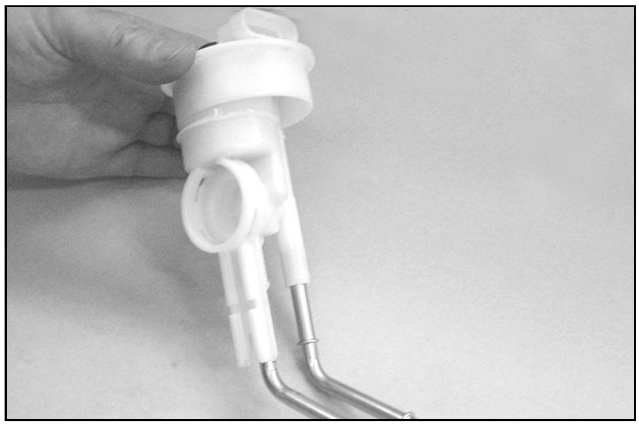
- If the pump is to be replaced, remove the prefilter and ring support.
- For the reassembly follow the dismantling procedure in the reverse order using a new clamp for the delivery pipe and a new fixing washer for the pump.



NOTE: To clean the prefilter use fuel and compressed air.
Place the pump correctly.



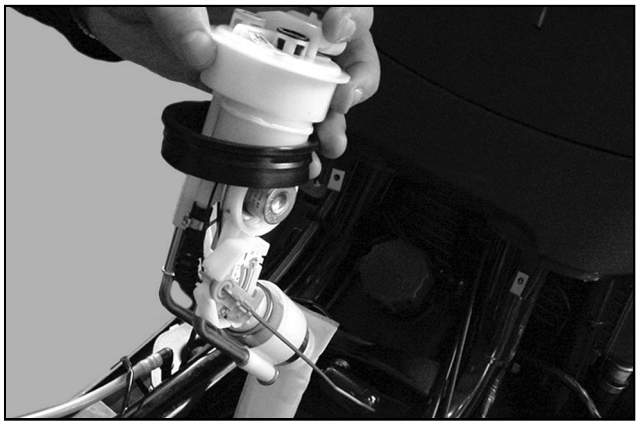
(**4**) Fuel filter
The fuel filter is supplied ready-assembled with the pump support.
For replacement of the support it is necessary to transfer the level indicator, the pressure regulator and the pump from the old to the new support.
For these operations the instructions described above must be respected.



Installation of the pump support on to the tank

- Before proceeding with the reassembly check the cleanliness of the tank accurately.
  If traces of dirt or water are found proceed with dismantling of the tank.

- Install the gasket on the pump support
- Insert the pump into the tank taking care to not bend the arm of the level indicator.



- Position the gasket on the tank.
- Install the pump support into its seat taking care to align the connector with the longitudinal axis of the vehicle.

NOTE: incorrect orientation may compromise the functioning of the level indicator.

- Screw the fixing ring nut fully on.

Tightening torque:
Electropump locking ring nut 20 N·m

- Reconnect feed circuit tubes, checking correct insertion via upwards traction and rotation.
- Reconnect the electrical connection.
- Reload the system with at least 4 - 5 timings (key switch OFF-ON)

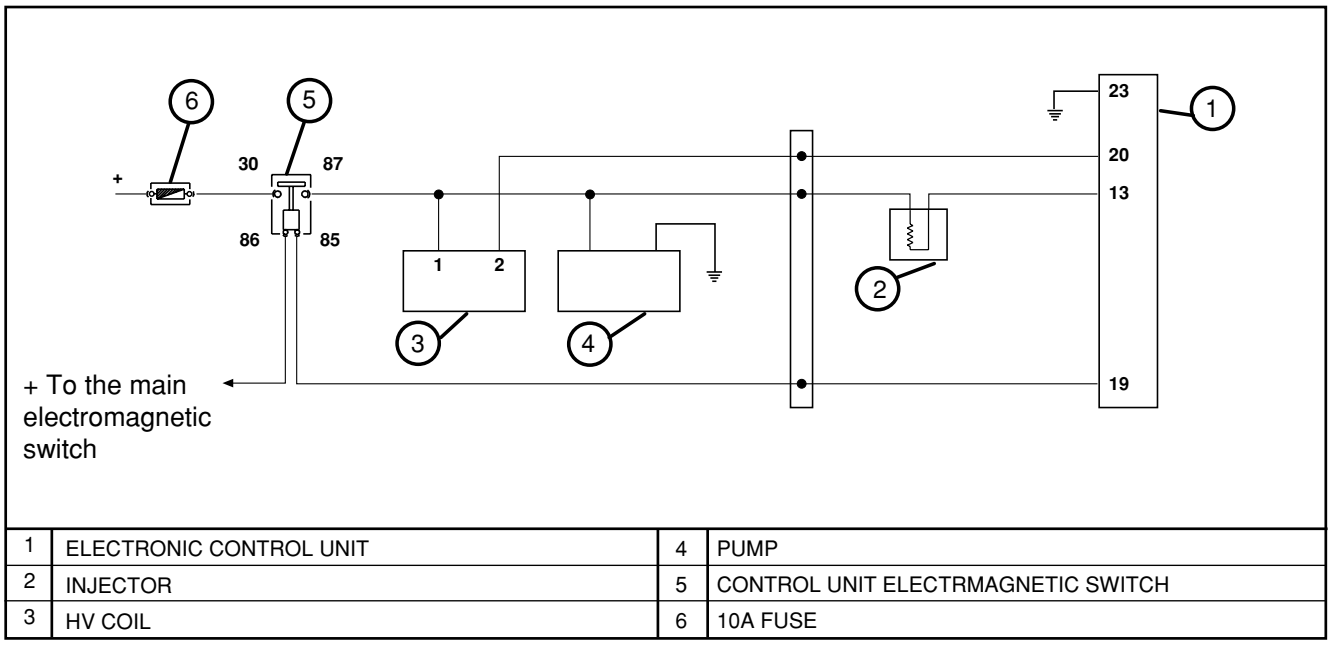
NOTE: do not activate the pump without fuel in the tank. Failure to respect this regulation causes damage to the pump.

- Check the seal of the quick-connections of the supply system.

Injector circuit control

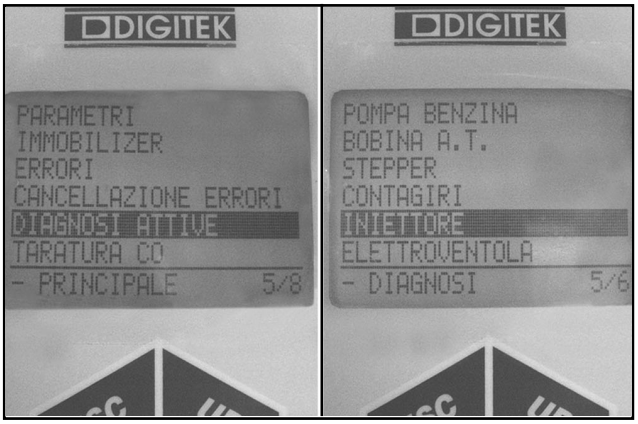
Terminals	Conditions	Standard
13-23	During timing of the pump with the engine stopped	Battery tension

CIRCUIT DIAGRAM



1	ELECTRONIC CONTROL UNIT	4	PUMP
2	INJECTOR	5	CONTROL UNIT ELECTRMAGNETIC SWITCH
3	HV COIL	6	10A FUSE

Connect the diagnosis tester 020460Y
(see page 9-17)
Select the "active diagnosis" function on the menu
Select the "injector diagnosis" function.



Activate the function with under-panel feed inserted and the engine stopped.
The control unit commands the fuel pump constantly and at the same time activates opening of the injector. The injector openings are repeated for a few seconds.

Acoustically check the injector openings and await the tester result.

4 injector openings are revealed.
The fuel injection tester responds "test completed successfully".

The injector control circuit is efficient. Proceed with injector hydraulics control.

No injector openings are revealed.
The fuel injection tester responds "test failed".

No injector openings are revealed.
The fuel injection tester responds "test completed successfully".

The injector control circuit is efficient. Repeat the acoustic check and to be even more certain, proceed with the Injector hydraulics control (see page 9-62)

Select the "ERRORS" function from the menu.
Check if only the injector damage is present.

NO

YES

NO

9

Damage is also indicated as being present:
- relay pump

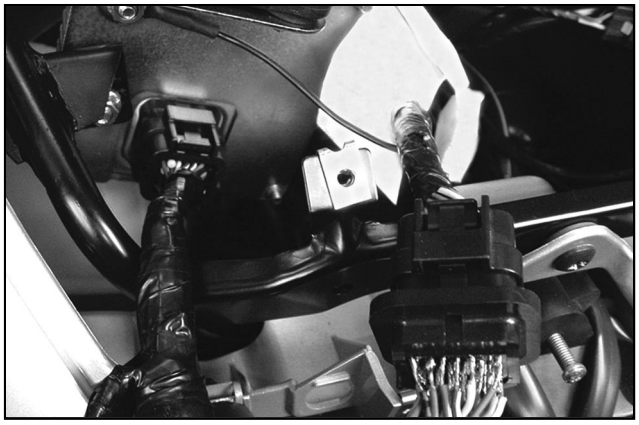
Control the relay pump control circuit
See: pump feed circuit.
(see page 9-40)

damage is also indicated as being present:
HV coil

Control the feed circuit with the 10A fuse and the electromagnetic switch.
Feed to the fuel pump is regular.
(see: pump feed circuit page 9-40)

YES

Install the special tool 020481Y between the control unit and fuel injection system (see page 9-8)



Arrange the multimeter with the positive prod on pin 13 and the negative prod on pin 23.
Set to "ON" with the switch on "RUN" and the side stand raised.
Check the presence of battery tension during timing of the fuel pump.

13-23 = battery tension for 2 seconds.

YES

NO

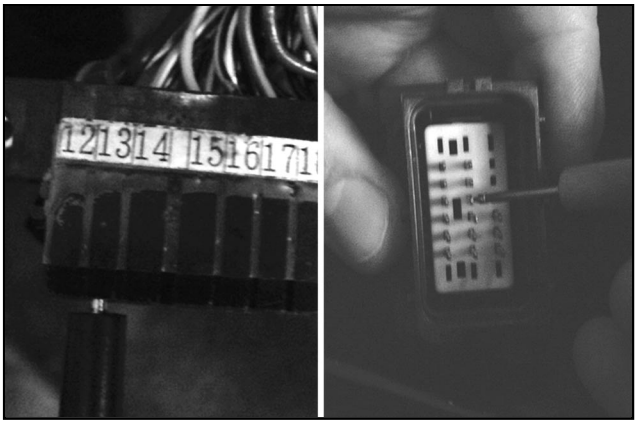
The electrical circuit of the injector is continuous.
Repeat checks.
If the anomaly persists check the control unit connector.
If necessary replace the control unit.

NO

Disconnect the connector between the vehicle system and the fuel injection system.
Disconnect the connector to the control unit.

Check resistance between pin 13 and the terminal of the black-green wire on the connector fuel injection system side.

13-black-green = 14.5Ω ± 5% (injector resistance)



YES

Check continuity of the black-green wire in the vehicle system section.
<u>Check the connector accurately between vehicle system and fuel injection system.</u>
Repair or replace the harness.

Check the earthing isolation of the negative wire of the injector.
Control unit and injector connectors disconnected

13-23 = Ω infinity

NO

Repair or replace the harness

NO

<u>There is no continuity</u>
Disconnect the connector and repeat resistance controls directly on the injector terminals.
Resistance =14.5Ω ± 2%

YES

NO

9

YES

Check continuity between:
- injector feed connector (red-yellow) and pin 13.
- injector feed connector and black-green wire terminal on the connector between the vehicle system and the fuel injection system.

Reset continuity or replace the harness.

NO

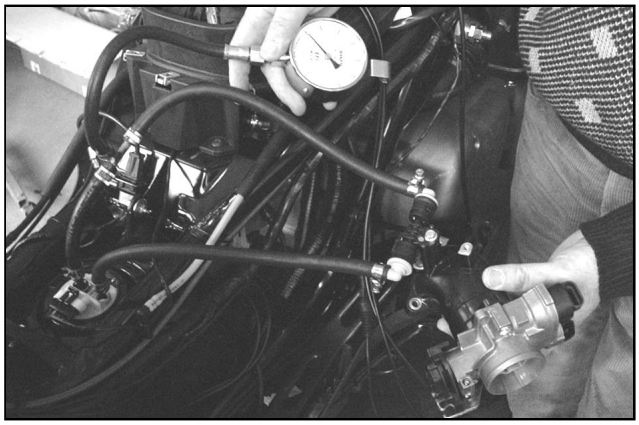
Replace the injector

Injector hydraulics control

To carry out injector control, it is advisable to proceed to dismantling of the air-intake manifold Complete with throttle body and injector.
Dismantle the injector from the collector only if it proves necessary.
For these operations see Chapter. 7-THERMAL UNIT AND TIMING SYSTEM

Connect the diagnosis tester 020460Y (see page 9-17). Use the socket in the saddle compartment.

Install the special tool 020480Y from the fuel pressure control kit. See page 9-46
In this case the injector may be connected directly to the quick-connections of the tool.



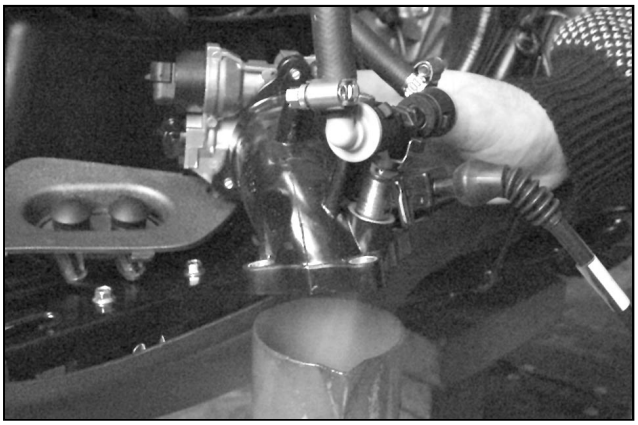
Prepare a measuring container of at least 100 cm^3 with a resolution of 10 - 20 cm^3

Connect the injector to the wire forming part of the fuel injection tester kit .
The wire is supplied with crocodile terminals for direct connection to the battery.
Prepare an auxiliary battery.

Set to "ON" with switch on "RUN" and side stand raised.
Select the "diagnosis active" function.
Activate pump diagnosis.

During the 30 seconds of pump diagnosis, feed the injector via the wire and the auxiliary battery for 15 seconds.
Using the measuring container, collect the fuel distributed from the injector.

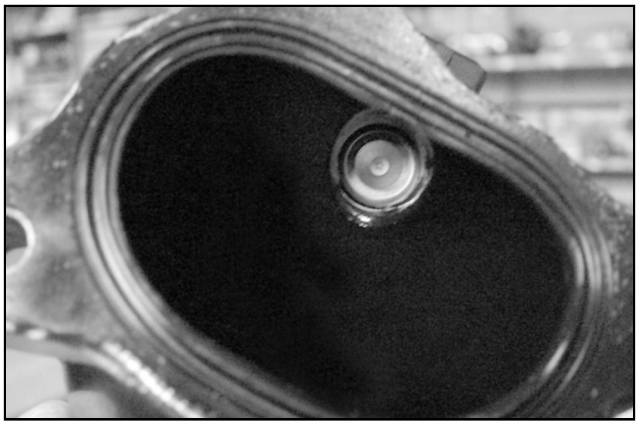
Supply pressure = 300 KPa (3 BAR)
Quantity supplied = around 40 cm^3



YES

Proceed with the injector seal test.
Dry the injector outlet with a jet of compressed air. Activate the fuel pump. Wait one minute, check that there is no loss from the injector outlet. A slight oozing is normal.

Limit value = 1 drop per minute



YES

The injector is conformant

NO

Higher quantities are not plausible.
For lesser quantities proceed with replacement of the injector. (see Chapter. 7-THERMAL UNIT AND TIMING SYSTEM)

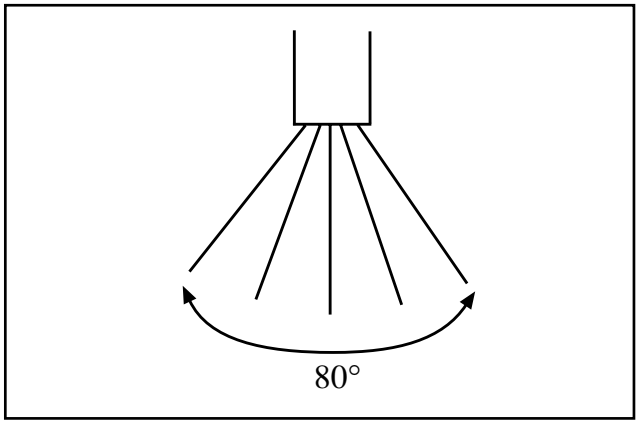
NO

Repeat the test. If the anomaly persists replace the injector. (see Chapter. 7-THERMAL UNIT AND TIMING SYSTEM)

Atomization of the injector cannot be checked with simple systems. The injector is supplied with 5 holes whose gradient form gives a jet with taper of around 80°. Formed in this manner, the jet covers both the air intake valves.

NOTE:

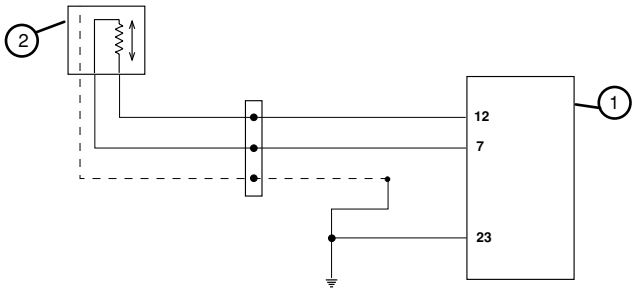
- An injector with low flow capacity influences the maximum performance.
- And injector with poor seal mainly influences idling and ignition characteristics after parking briefly with the engine warm.
- On discovering occlusion of the injector, proceed with replacement of the injector, filter and the fuel tank contents. Clean the system and the tank accurately.



REVOLUTIONS SENSOR

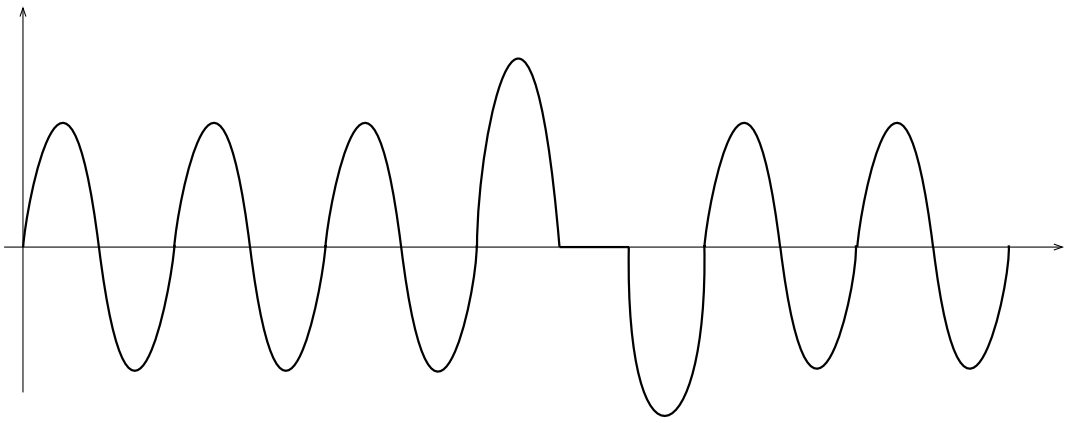
Terminals	Conditions	Standard
7-12	Starting speed	0,8 - 4.5 V~

CIRCUIT DIAGRAM



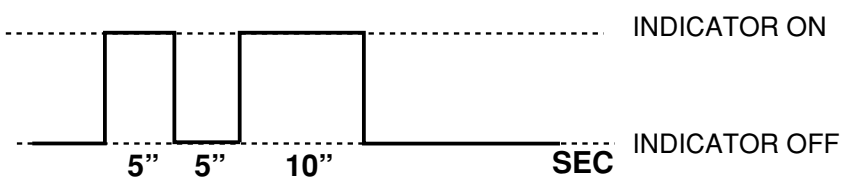
1	CONTROL UNIT SENSOR	2	ENGINE REVOLUTIONS

The sensor allows recognition of the revolutions and the angular position of the driving shaft with reference to the TDC. As the phonic wheel is keyed on the camshaft it is also possible to recognize the 4-stroke cycle. This solution allows command of the injector and spark plug every 2 revolutions of the driving shaft.
The sensor is of the reluctance variation kind, and can therefore be assimilated to a alternate tension generator which feeds the control unit.
The signal frequency is interrupted by the vacuum generated by two cogs lacking on the phonic wheel.



The sensor signal is fundamental in order to achieve engine ignition.
The engine may however function even with an unstable signal, due to corrective action on the control unit.

The total absence of revolutions signals does not cause the fuel injection indicator to light up.
When the signal anomaly (open circuit) occurs during use on the road, the indicator signals the start of the anomaly, blinking as follows:

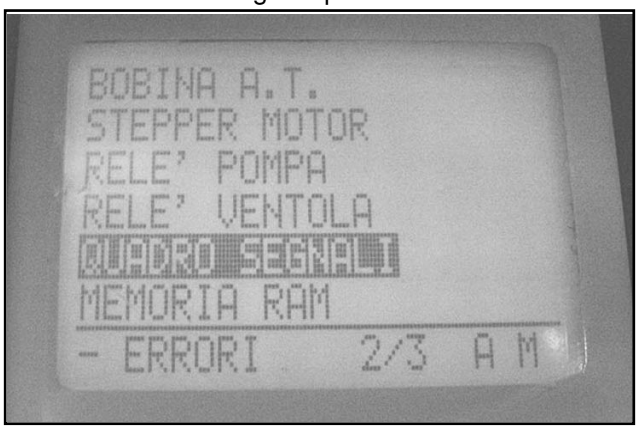


To control the sensor and related circuit proceed as follows:

Connect the diagnosis tester 020460Y. See page 9-17. Start the engine.

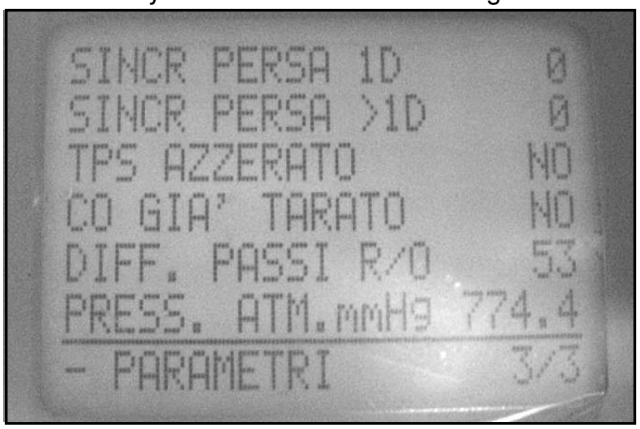
YES

The engine starts normally
Select the “errors” function from the menu. Check for the presence of anomalies concerning the "signals panel".



NO

Select the "parameters" function from the menu.
Check the number of
Synchronizations lost = 1 cog
Synchronizations lost = > 1 cog



NO

Indication = 1 - 3
The phase-revolutions signal conforms

YES

IThe value increases progressively with time, insisting with engine ignition.
Check the circuit and the sensor.

NO

The engine does not start
Select the “errors” function from the menu.

NO

No anomaly is revealed.

YES

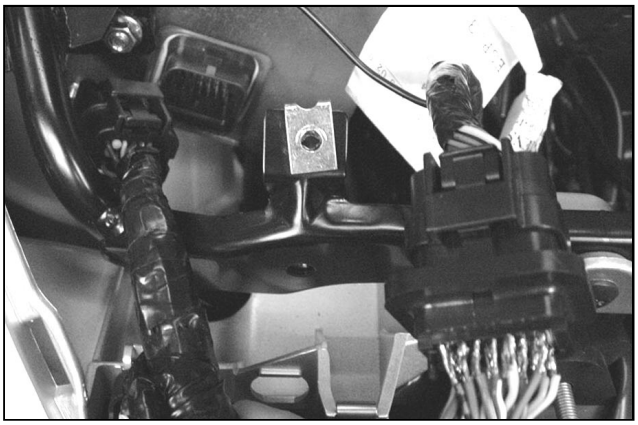
Proceed according to the indication revealed

YES

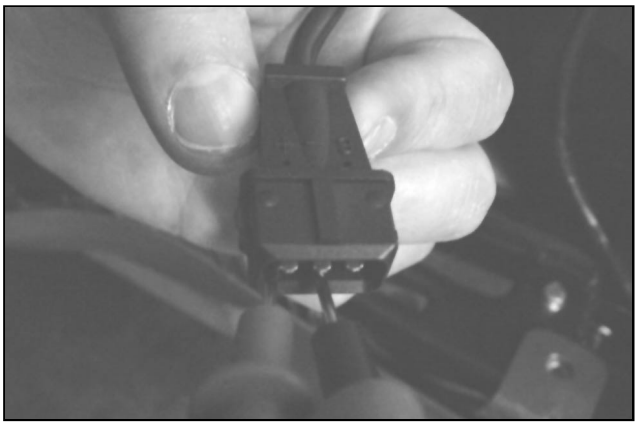
9

YES

Install the connection harness between the control unit and the fuel injection system. Tool 020481Y.
See page 9-8
Do not carry out connection with the control unit.



Disconnect the connection between the phase-revolutions sensor and the fuel injection system.
Measure the resistance of the sensor connecting the multimeter between the terminals marked ⊕ and ⊖.
Phase-revolution sensor resistance =680 Ω±15%



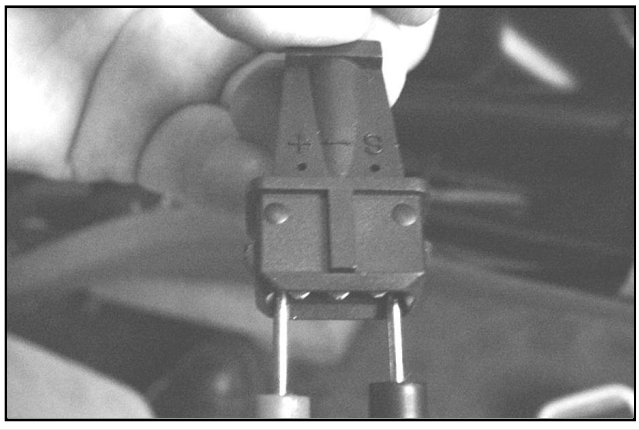
YES

NO

Replace the revolutions sensor.

Check the earthing isolation between one pole and the shielding.

Ⓢ-⊕ = infinity (>1MΩ)

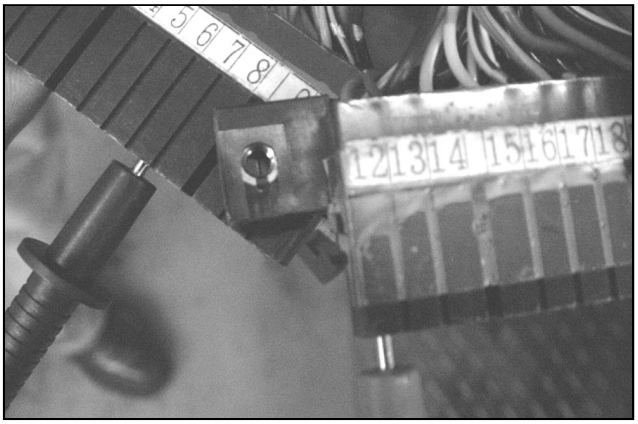


YES

NO

YES

Reconnect the phase-revolutions sensor.
Repeat resistance control through the fuel injection harness on pins 7 - 12.
7-12 = 680 ± 15 %
The value must be very near to that revealed directly to the sensor.



NO

Greater or infinite resistance.
Control the connectors accurately.
Disconnect and check continuity between the connector and pins 7 and12
Connector-7 = continuity
Connector-12 = continuity
Repair the connectors or replace the harness.

NO

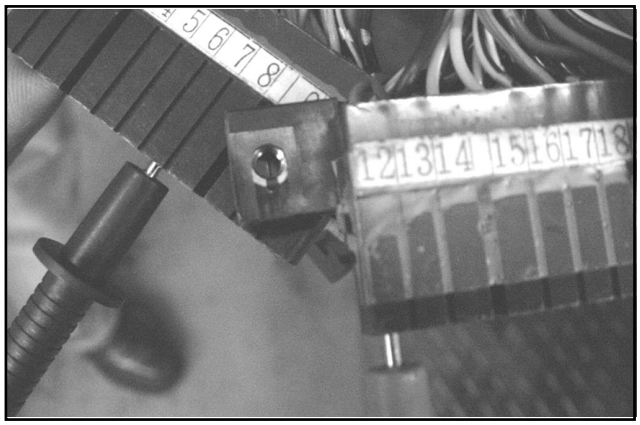
Resistance 0 Ω
Repair or replace the fuel injection harness (short circuit)

YES

Check the earthing isolation again.
7-23 = infinity (>1MΩ)

YES

Measure the alternate tension between pins 7 and 12 with the engine in starting speed.
7-12 = 0.8 - 4.5 V~eff
Revolutions speed = ~300-400 rpm



NO

Check the sensor and control unit connectors.
Repair or replace the fuel injection harness

YES

The sensor circuit conforms.
If the anomaly of failed ignition persists, replace the control unit.

NO

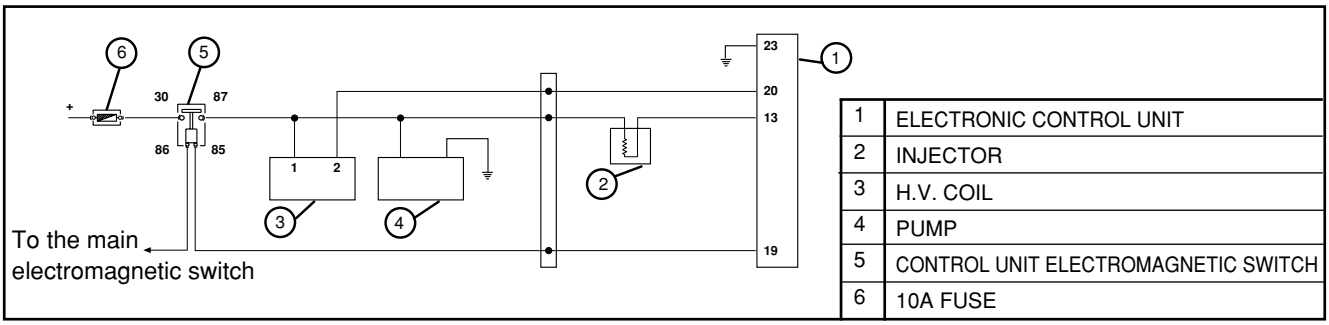
Check the air gap and magnetic activity of the sensor.
See: Chapter. 7-THERMAL UNIT AND TIMING SYSTEM
If magnetic activity is zero, replace the sensor.

NOTE
- During repairs install the sensor cable correctly .
- Do not force the cable.
- A poor shielding of the cable may prejudice the functioning of the engine at high speed.

HV COIL

Terminals	Conditions	Standard
20-23	During pump timing with engine stopped	Battery tension

CIRCUIT DIAGRAM



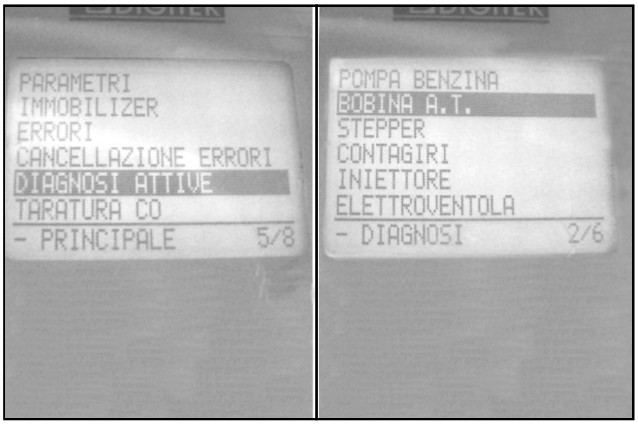
1	ELECTRONIC CONTROL UNIT
2	INJECTOR
3	H.V. COIL
4	PUMP
5	CONTROL UNIT ELECTROMAGNETIC SWITCH
6	10A FUSE

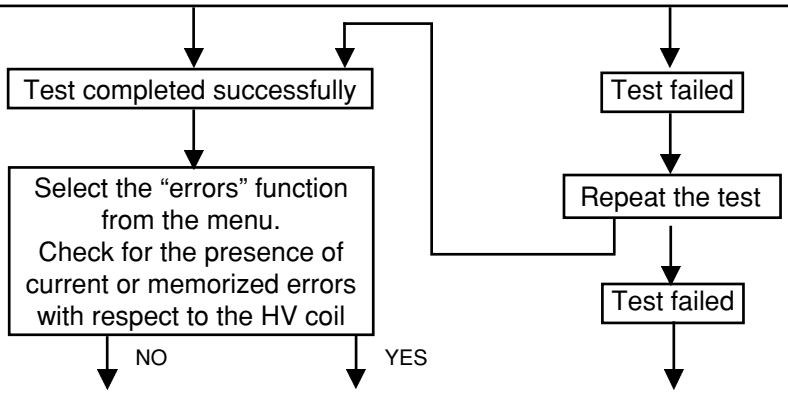
The ignition system integrated with the fuel injection is of the high-efficiency induction type.
The control unit controls two important parameters:
- Spark advance
  This is optimized on the spot on the basis of engine revolutions, engine load, temperature and environmental pressure.
  With the engine idling, it is optimized to achieve speed stability at 1450 ± 50 rpm.
- Magnetization time
  The magnetization time of the coil is controlled via the control unit.
  The ignition power is increased during the engine starting phase

The fuel injection system recognizes the 4-stroke cycle, and so ignition is commanded only during the compression phase.

To control the ignition circuit proceed as follows:

Connect the diagnosis tester 020460Y
(see page 9-17)
Activate the HV coil control with the commutator set to "ON", switch on "RUN" and side stand raised.
Await the response of the tester.





NO

The coil circuit control is efficient.

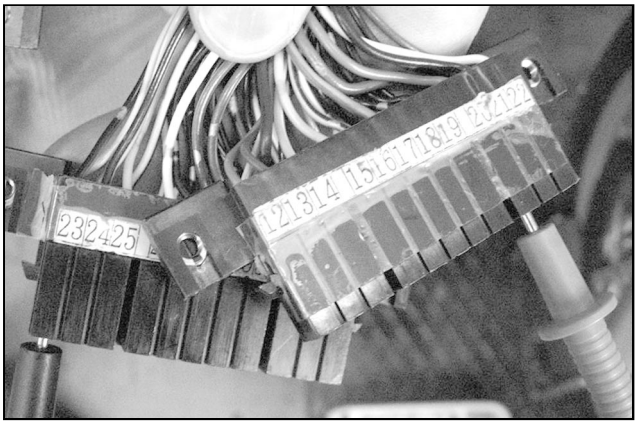
Proceed with secondary control of the della HV coil, cable and shield cover (see page 9-68 and 9-72)

YES

Install the connection harness between the control unit and fuel injection Special tool 020481Y (see page 9-8)

Measure the tension between pins 20 and 23 of the special tool during the fuel pump timing phase.
To activate timing set to "ON" with switch on "RUN" and side stand raised.
20-23 = Battery tension (matched with pump revolution - 2 sec.)

If an increased time available for the test is desired, activate the "relay pump diagnosis" function (30 seconds)



YES

The coil primary control circuit is efficient.
Check the connections with the control unit and coil accurately.
If necessary proceed with replacement of the control unit.

NO

Disconnect the connection with the HV coil primary
Repeat the tension control between the black-green wire and the earth.
Black-green-23 = battery tension
(matched with pump revolution -2 seconds)

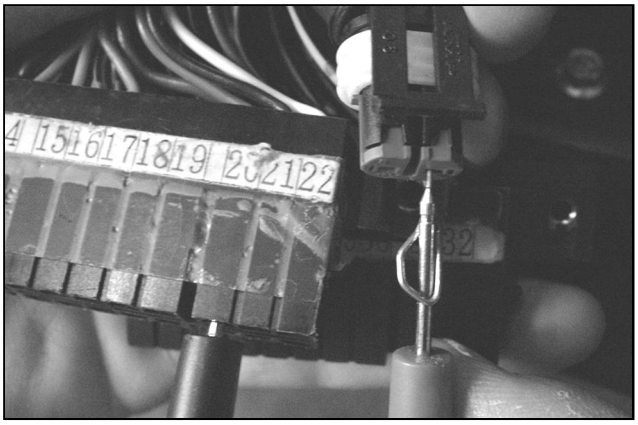
NO

Check continuity of the black-green wire.
Repair or replace the harness.
NOTE: any anomaly of the command electromagnetic switch would lead to failed pump turning. (see page 9-53)

YES

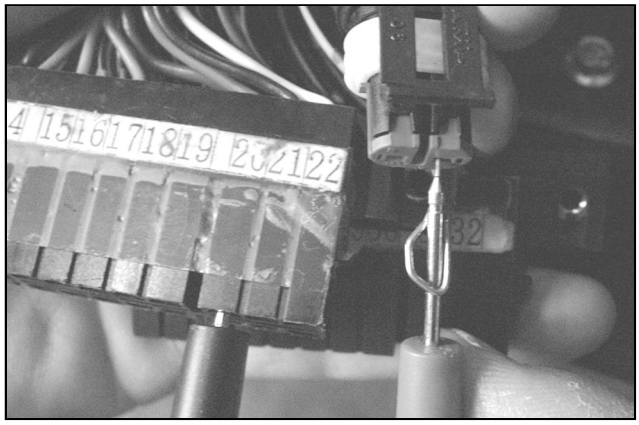
9

Positive feed conforms.
Check continuity between the pink-black wire of the connector and pin 20
pink-black-20 = Continuity



NO

Disconnect the connection between the vehicle System and fuel injection system.
Check continuity of the pink-black wire in the two systems.
Pink-black (coil connector)-(system connector) = Continuity
Pink-black (system connector)-20 = Continuity



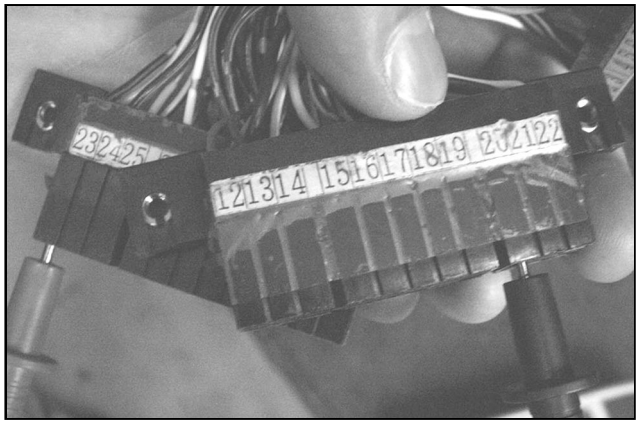
NO

Reset or replace the system concerned.

Repeat the control using "active diagnosis" from the menu

YES

Check the earthing isolation of the negative wire.
20-23 = Ω infinity (>1MΩ)



YES

NO

NO

Disconnect the connector between the vehicle system and the fuel injection system.
Repeat control of the earthing isolation in the two sections.

Repair or replace the harness concerned.

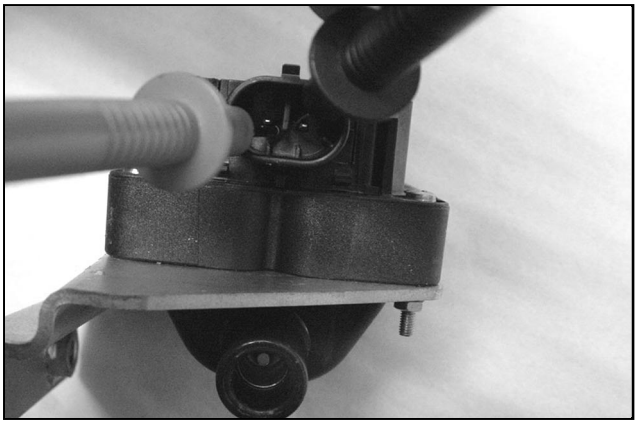
Repeat control using “active diagnosis” from the menu for HV coil command simulation.

Cancel the errors present in memory.

YES

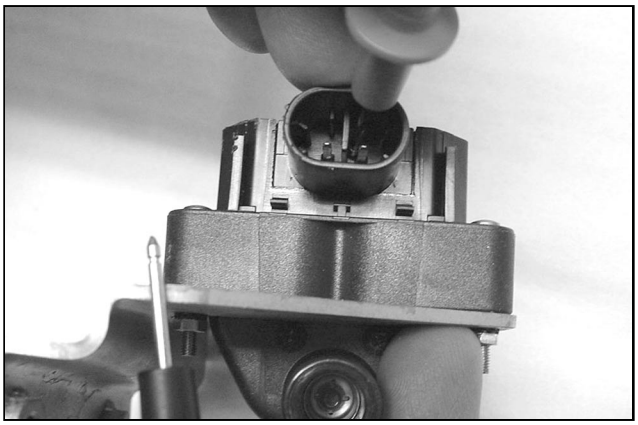
Check continuity of the HV coil primary
See diagram

Resistance of the primary = 0,5Ω ± 8%



YES

Check the earthing isolation of the primary circuit
Measure between one of the two terminals of the primary and the earth.
Primary-earth = Ω infinity (>1MΩ)



YES

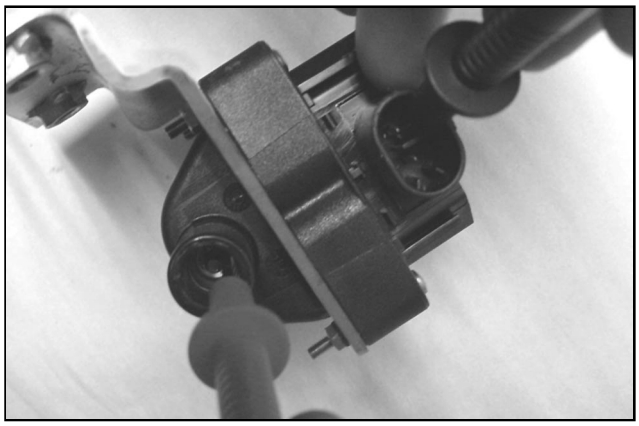
NO

NO

9

SI

Check the resistance of the secondary
Measure the resistance between one of the two terminals of the primary and the spark plug cable outlet.
Primary-HV cable outlet = 3.1KΩ ± 9%



YES

The coil conforms.

NO

NO

NO

Replace the coil.

Shielded cap control

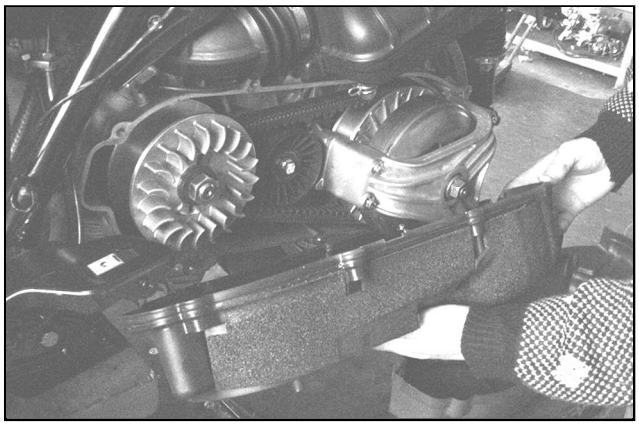
Measure the resistance of the shielded cap
Resistance = 5 KΩ
If substantially different values are obtained (<1;>20KΩ), proceed with replacement.
NOTE
The lack of shielding on the cap or spark plug may lead to problems in the fuel injection system.

For full information concerning the spark plug, see the chapter "Maintenance" Chapter. 1 - GENERAL INFORMATION AND MAINTENANCE.

IGNITION TIMING

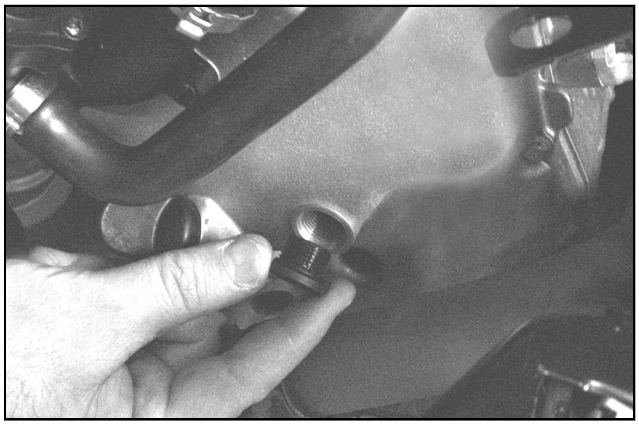
The spark advance is determined electronically on the basis of known parameters from the control unit.
For this reason it is not possible to state reference values based on the number of engine revolutions.

The spark advance value can be obtained at any time by means of the diagnosis tester 020460Y.
Using stroboscopic lamp 020330Y it is possible to check if the spark advance, determined by the fuel injection system, corresponds to that truly activated on the engine.

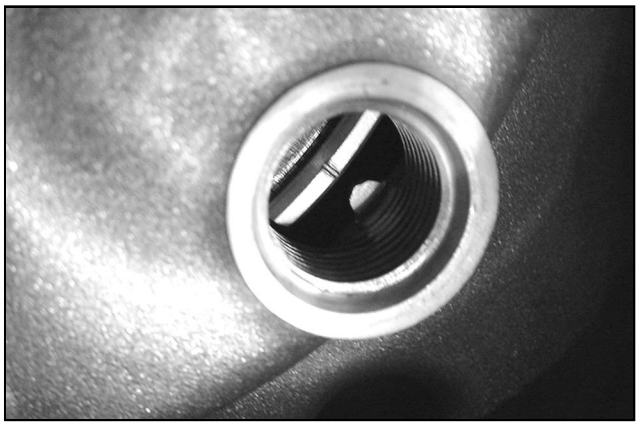


Proceed as follows:
- Remove the transmission box cover. See chapter 3 - AUTOMATIC TRANSMISSION

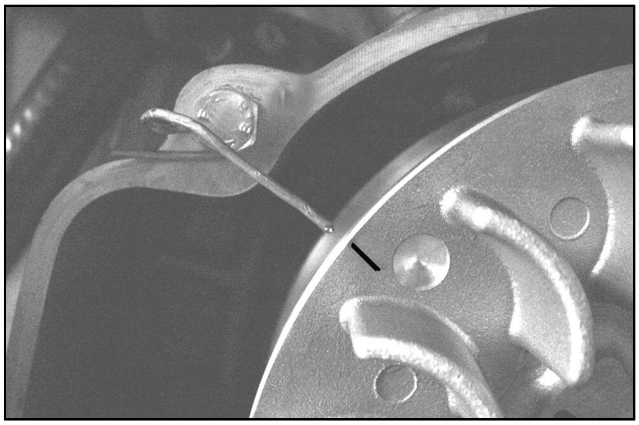
- Remove the plug for inspection of the TDC reference made between the flywheel and the cover crankcase. See chapter 5- FLYWHEEL HOUSING.



- Using the driving pulley, rotate the engine until the reference alignment to identify the TDC is found.



- Reproduce the reference between the driving pulley and the engine crankcase See figure.

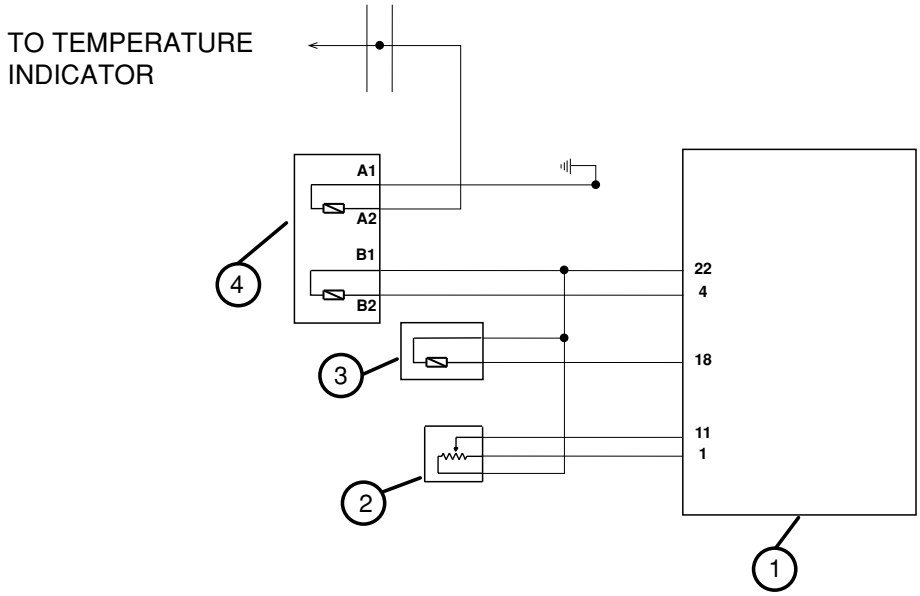


- Reassemble the flywheel side inspection plug.
- Connect the diagnosis tester 020460Y. See page 9-17.
- Start the engine.
- Select the function from the menu "parameters".
- Select the stroboscopic lamp command in the traditional 4-stroke engine position (1 spark 2 revolutions).
- Check correspondence between the revolutions values and actual spark advance and those stated by the diagnosis tester.
- If the values do not correspond check:
  - valve gear timing
  - phase-revolutions sensor
  - fuel injection control unit

COOLANT TEMPERATURE SENSOR

Terminals	Conditions	Standard
4-22	coolant temperature	With sensor connected: 20° = 2500 ± 100 Ω 80° = 308 ± 6 Ω

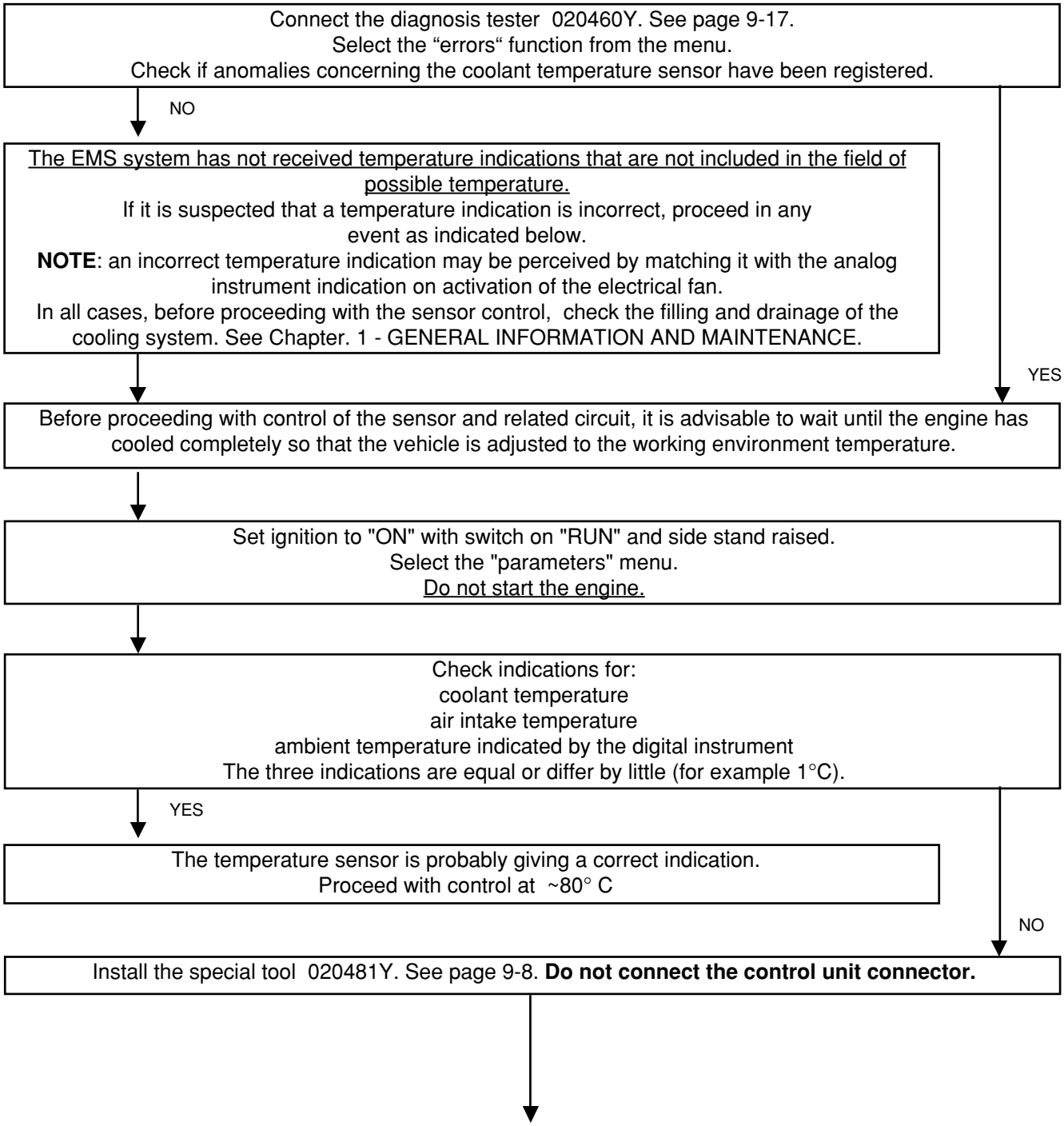
CIRCUIT DIAGRAM



1	CONTROL UNIT	3	AIR TEMPERATURE SENSOR
2	THROTTLE POSITION SENSOR	4	COOLANT TEMPERATURE SENSOR

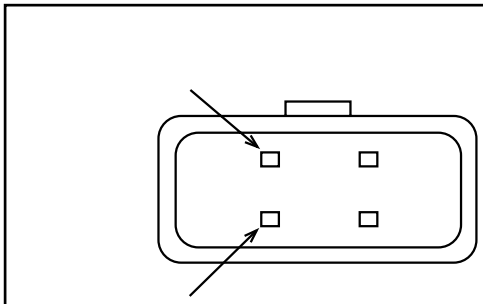
The coolant temperature sensor mounted on the engine head, supplies indications to the digital instrument and fuel injection.
It is constructed with two electrically distinct sections.
The fuel injection section has a NTC sensor connected with a 5V feed circuit. The resistance variation causes a circuit tension variation. This tension is linked to a temperature value.
With this information, the control unit can manage the engine functioning, optimizing it for all temperatures.
Damage to this circuit causes the fuel injection indicator to light up and protective action (amongst which continuous running of the electrical fan). Under these conditions, the engine can still function even if not at optimum standard, but always safeguarding the integrity of the catalyctic converter.
The most difficult anomaly to manage is an unreal temperature indication, but one which is comprised in the possible temperatures field. This may lead to a lack of protective action and incorrect carburation management. Such an anomaly can be highlighted more easily at ignition stage.

To check the sensor and related circuit proceed as follows.



Disconnect the coolant temperature sensor connection.
Measure the sensor resistance between the terminals indicated on the diagram.
Check that the resistance corresponds with the

RESISTANCE	TEMPERATURE
9.6KΩ	-10° C
5.975KΩ	0
3.81KΩ	+10° C
2.5KΩ	+20° C
1.68KΩ	+30° C
0.3KΩ	+80° C

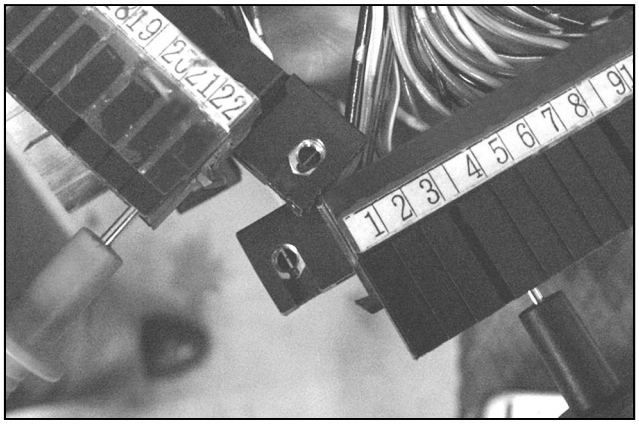


NO

Proceed with replacement of the sensor.

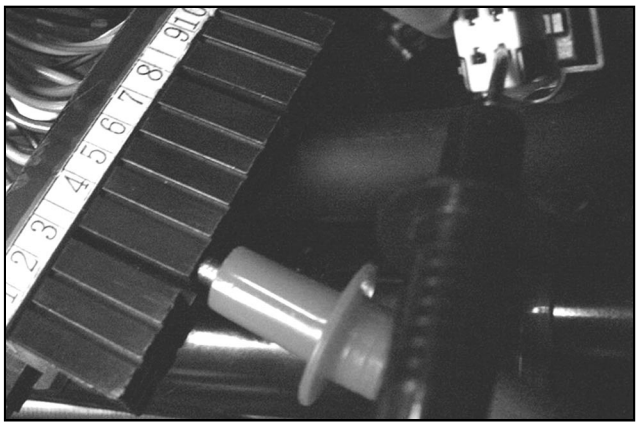
YES

Connect the sensor connection and repeat resistance control on terminals 4 and 22;
4-22 = Resistance equal to the value provided to the sensor.



NO

On revealing slightly higher values, check the connectors.
On revealing infinite resistance (>1MΩ) check continuity of the two wires with connectors disconnected.
Bluee-white-4 = 0 Ω (continuity)
Light bluee-green-22 = 0 Ω (continuity)

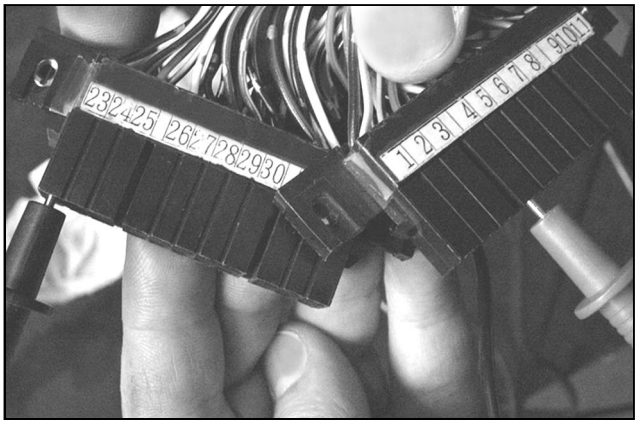


Repair or replace the harness.

YES

YES

Check that the sensor circuit is isolated from the earth.
4-23 = Ω infinity (>1MΩ)
22-23 = Ω infinity (>1MΩ)



NO

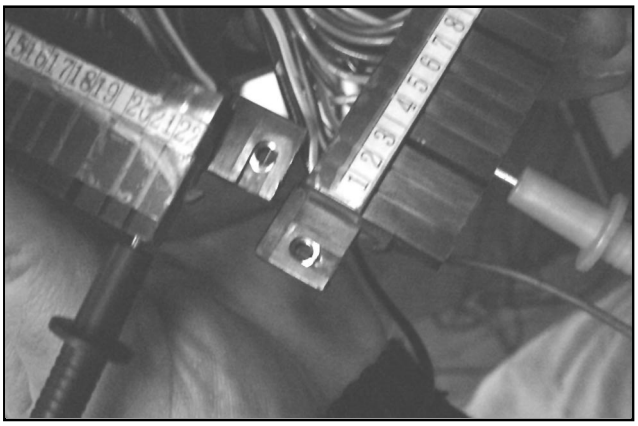
Reset or replace the harness
Check the air temperature lines and throttle valve position.

YES

Connect the special tool 020481Y to the control unit.
Set ignition to "ON" with switch on "RUN" and side stand raised.

Measure the tension at terminals 4 and 22;
4-22 = V (as per table)

TENSION	TEMPERATURE
X V	-10° C
X V	0
X V	+10° C
X V	+20° C
X V	+30° C
X V	+80° C



NO

Measured value = 5±0,2 V
Repeat continuity controls of the harness and sensor.

NO

Measured value = 0 V
Repeat controls of earthing isolation of the circuit and the sensor.

YES

YES

NO

9

YES

Check the connection to the control unit.
Check the control unit feeds
If necessary,
replace la control unit.

NO

Reset or replace the harness.

YES

Start the engine and check that tension reduces progressively according to temperature increase as per the table.

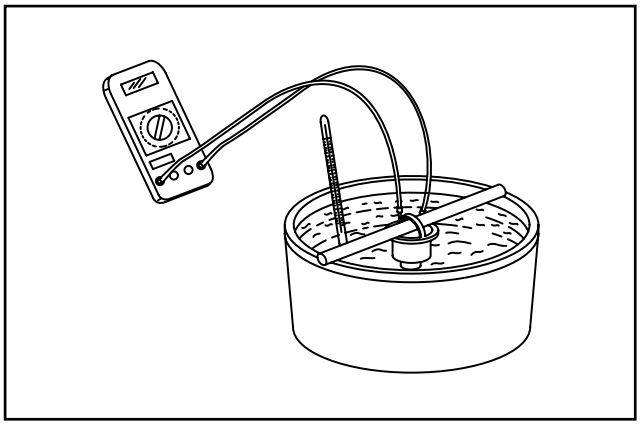
YES

The temperature signal conforms.

NO

Replace the temperature sensor.

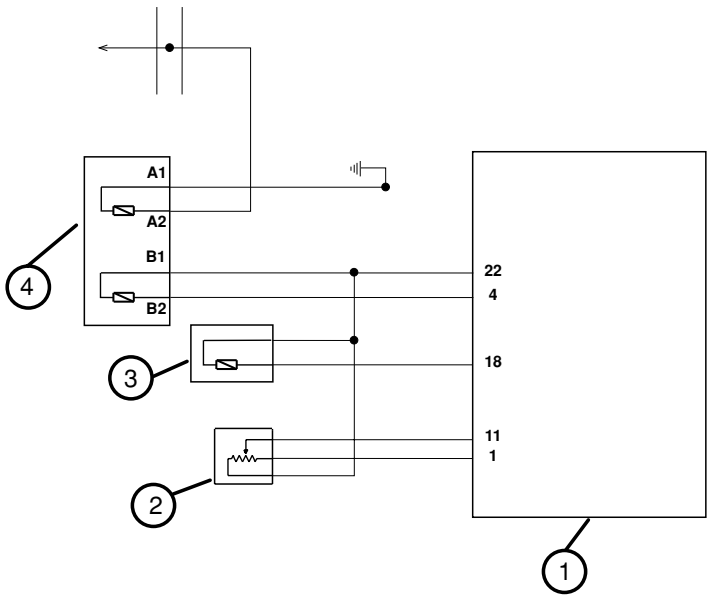
NOTE
For more in-depth control of the sensor, remove it from the engine and check the controlled temperature resistance.
Using a suitable container, immerse the metal part of the sensor in water, heat gradually and read the temperature and resistance values.
Check how they match with the table (see page 9-76).



AIR INTAKE TEMPERATURE SENSOR

Terminals	Conditions	Standard
18-22	air intake temperature 20°	With sensor connected: 3750 ± 200 Ω

CIRCUIT DIAGRAM

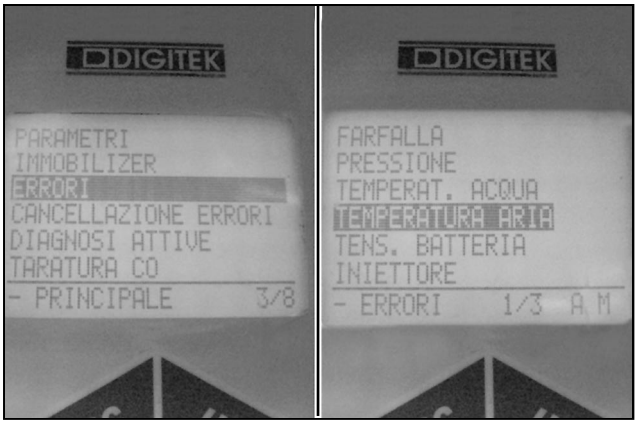


1	CONTROL UNIT	3	AIR TEMPERATURE SENSOR
2	THROTTLE POSITION SENSOR	4	COOLANT TEMPERATURE SENSOR

The air intake temperature sensor is inserted in the lower part of the throttle body from the filter box side.
The sensor is an NTC and has the same function layout as the coolant temperature sensor.
This signal is used to optimize the engine functioning. It is, however, a less influential signal than that of the coolant temperature.
In case of circuit damage, the control unit commands the lighting up of the fuel injection indicator and activates protection control, thus guaranteeing engine function.

To control the sensor and related circuit, proceed as follows.

Connect the diagnosis tester 020460Y.
See page 9-17.
Select the “ERRORS“ function from the menu.
Check if any anomalies concerning the air intake temperature sensor have been registered.



NO

The EMS system has not received temperature indications not included in the field of those possible.
If it is suspected that a temperature indication is incorrect, proceed with controls as indicated below.

YES

Before proceeding with control of the sensor and related circuit, it is advisable to wait until the engine has cooled completely so that the vehicle is adjusted to the working ambient temperature.

Set ignition to "ON" with switch on "RUN" and side stand raised.
On the diagnosis tester, select the “parameters” menu
Do not start the engine.

Check indications for:
coolant temperature
air intake temperature
ambient temperature indicated by the digital instrument.
The three indications are equal or differ by little (for example, 1°C)

YES

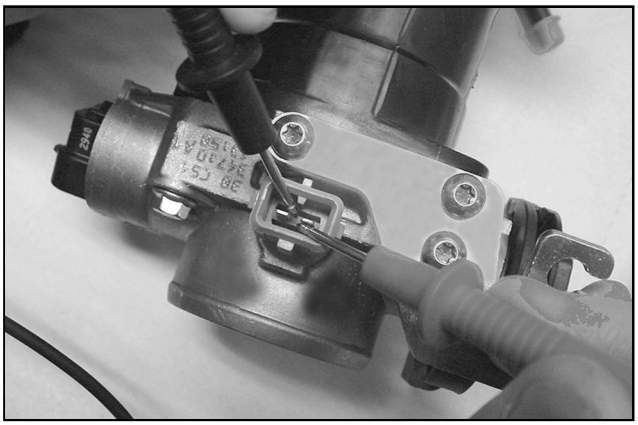
The air intake temperature sensor is probably giving a correct indication.

NO

Install the special tool 020481Y. See page 9-8.
Do not connect the control unit connector

Disconnect the air intake temperature sensor connector.
Measure the resistance between the sensor terminals.
Check that the resistance corresponds to the values stated on the basis of temperature.

RESISTANCE	TEMPERATURE
16.6 KΩ	-10° C
9.75 KΩ	0
5.97 KΩ	+10° C
3.74 KΩ	+20° C
2.41 KΩ	+30° C



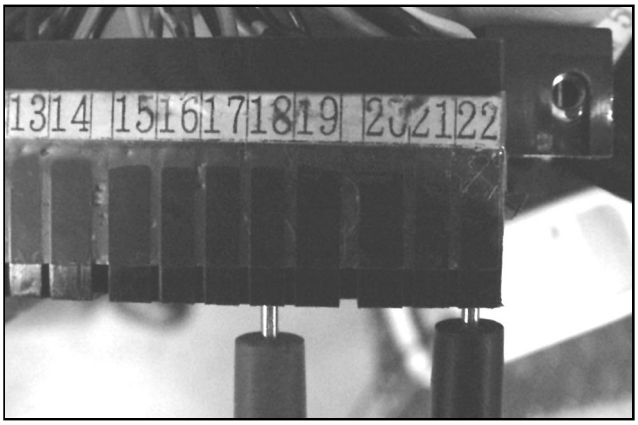
NO

Proceed with sensor replacement.

YES

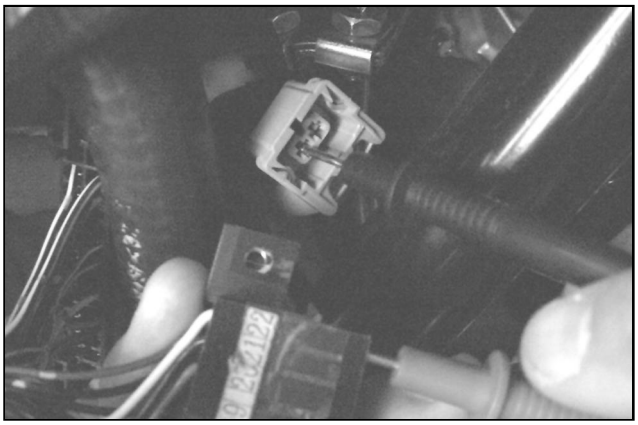
Connect the sensor connector and repeat resistance control on terminals 18 and 22.

18-22 = Resistance equal to the value given directly to the sensor.



NO

On revealing slightly higher resistance values, check the connectors.
On revealing infinite resistance (>1MΩ) check continuity of the two wires with connectors disconnected.
Grey-white-18 = 0 Ω (continuity)
Light blue-green-22 = 0 Ω (continuity)



Repair or replace the harness.

YES

YES

Check that the sensor circuit is isolated from the earth.
18-23 = Ω infinity (>1MΩ)
22-23 = Ω infinity (>1MΩ)

NO

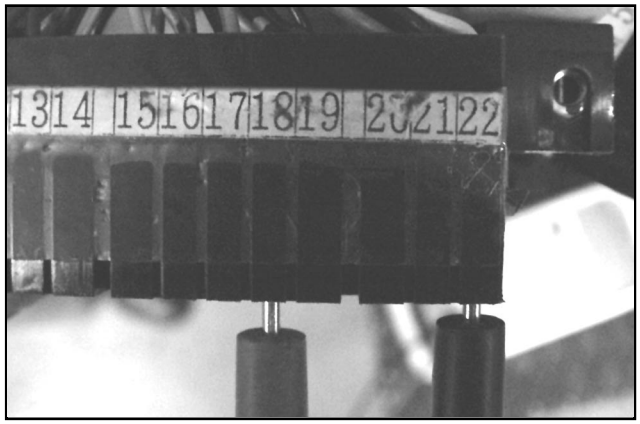
Reset or replace the harness.
Check the coolant temp. lines and throttle position.

YES

Connect the special tool 020481Y to the control unit.
Set ignition to "ON" with switch on "RUN" and side stand raised.

Measure the tension at terminals 18 and 22.
18-22 = V as per table.

TENSION	TEMPERATURE
XXX V	-10° C
XXX V	0
XXX V	+10° C
XXX V	+20° C
XXX V	+30° C



NO

Measured value = 5±0.2V
Repeat continuity controls of the sensor and harness.

NO

Measured value = 0 V
Repeat control of earthing isolation of the sensor circuit.

YES

Check the connection to the control unit.
Check the control unit feeds If necessary replace the control unit.

NO

Reset or replace the harness.

YES

Start the engine and check that the tension reduces progressively according to temperature increase in the air filter box.

NOTE

In a temperate climate it is quite easy to reach 30°C after a few minutes of parking with the engine idling.

9

PRESSURE SENSOR

This sensor does not have an installation, in that it is inserted directly into the control unit.
The sensor allows the control unit to optimize engine performance based on altimeter variations.

To control the sensor proceed as follows.

Connect the diagnosis tester 020460Y.
See page 9-17
Select the “errors“ function from the menu.
Check if anomalies concerning the pressure sensor have been registered.

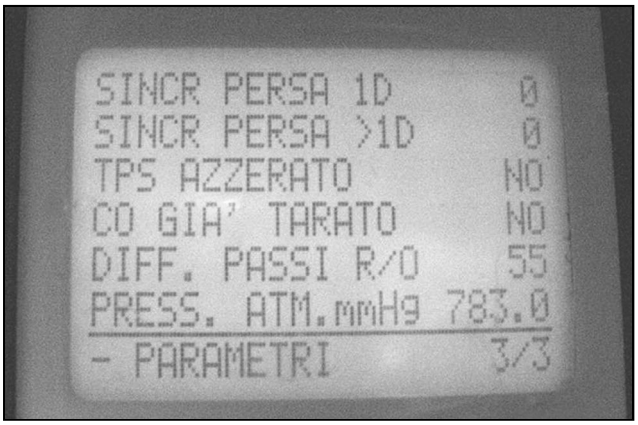
YES

Proceed with replacement of the fuel injection control unit.

NO

Select the “parameters“ function from the menu.
Check that the mm/Hg pressure indication corresponds to that of another vehicle or to an external barometer.

Max error: ±20 mmHg



YES

The ambient pressure signal is correct.

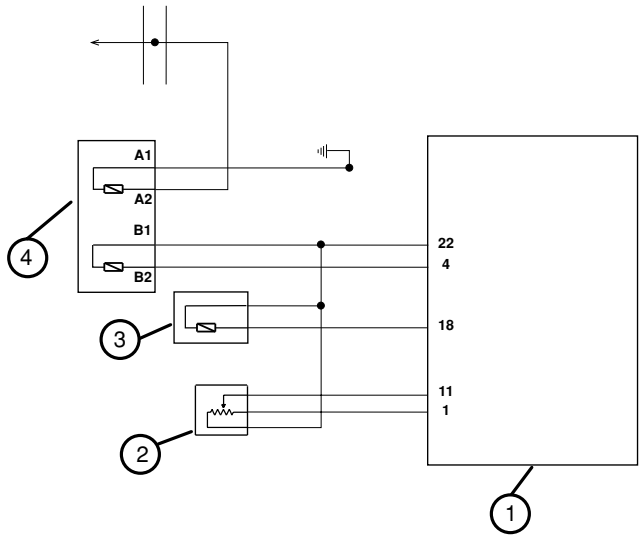
NO

Replace the fuel injection control unit.

T.P.S.=THROTTLE POSITION SENSOR

Terminals	Conditions	Standard
1-22	Ignition set to "ON"	5V
11-22	Opening the throttle gradually progressive	Volt= progressive increase

CIRCUIT DIAGRAM



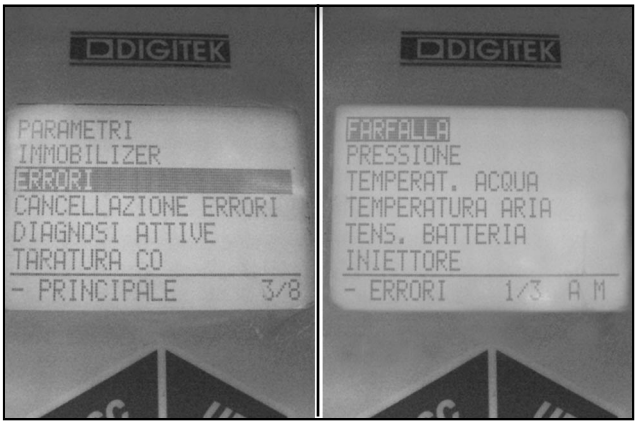
1	CONTROL UNIT	3	AIR TEMPERATURE SENSOR
2	THROTTLE POSITION SENSOR	4	COOLANT TEMPERATURE SENSOR

The TPS is set on the throttle body and is of the fixed type.
This sensor receives a 5V feed from the control unit and sends it a gradually increasing tension as the throttle opening increases. The control unit converts this tension into an angular position of the throttle.
The number of engine revolutions and the TPS are the two basic signals for management of the engine.
Damage to this circuit causes the fuel injection indicator to light up and activation of protection. Under these conditions the engine can function even if not on optimum, always safeguarding the integrity of catalyctic converter.
The TPS is particularly important in correspondence with the small openings in the throttle. These are also the areas where the sensor works most often and therefore to be controlled more often.

To control the sensor and related circuit proceed as follows.

9

Connect the diagnosis tester 020460Y.
See page 9-17
Ignition set to "ON" with switch on "RUN"
and side stand raised.
Select the "ERRORS" function from the tester menu
Check if the control unit has revealed anomalies
Concerning the TPS.

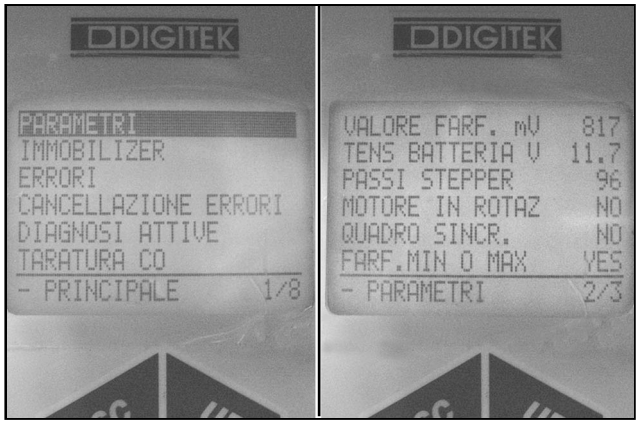


NO

YES

NO

Select the "parameters" function from the diagnosis tester menu.
Check if the control unit recognizes the extreme positions:
throttle valve to minimum
throttle valve to maximum



NO

Check regulation of the throttle command flexible transmissions.

NO

Reset or replace.

YES

Gradually open the throttle valve,
check that mV indication
Increases gradually in proportion to opening variations.

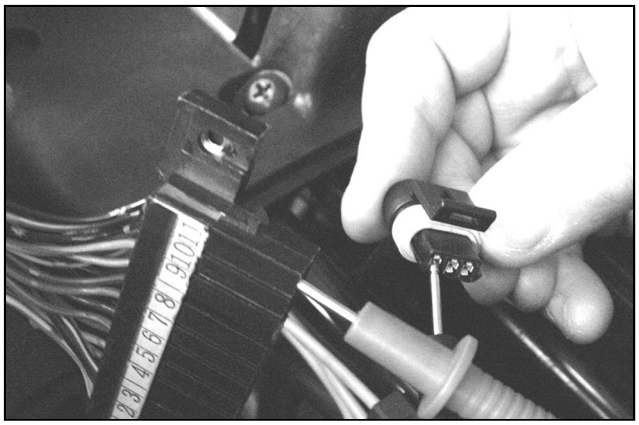
YES

The TPS conforms.

NO YES YES

Connect the special tool 020481Y to the fuel injection system. See page 9-8.
Do not connect the tool to the control unit.

Disconnect the TPS connector.
Check the continuity between the connector terminals and related pins on the control unit side.
Light blue-green-22 = 0 Ω (continuity)
Brown-yellow-1 = 0 Ω (continuity)
Orange-light blue-11 = 0 Ω (continuity)



NO

Reset or replace the fuel injection harness.

YES

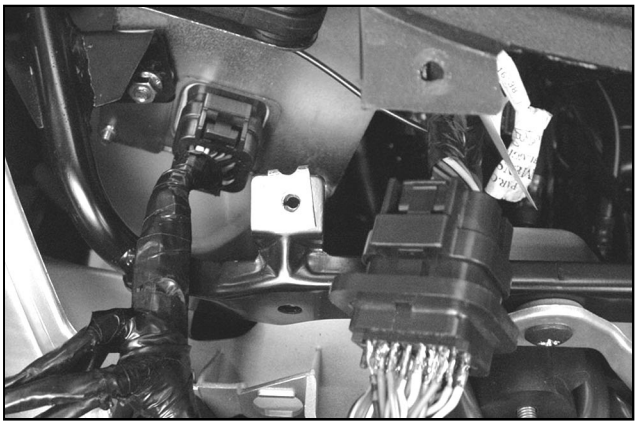
Check the earthing isolation of the three circuit wires.
22-23 = Ω infinity (>1MΩ)
1-23 = Ω infinity (>1MΩ)
11-23 = Ω infinity (>1MΩ)

NO

Reset or replace the fuel injection harness.

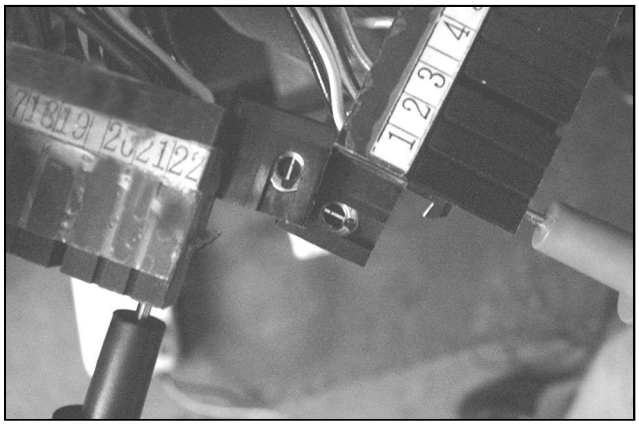
YES

Connect the special tool 020481Y to the control unit.
Set ignition to "ON" with switch in position "RUN" and side stand raised.



9

Measure the tension between terminals 1 and 22 of the special tool.
1-22 = 5±0.2 V

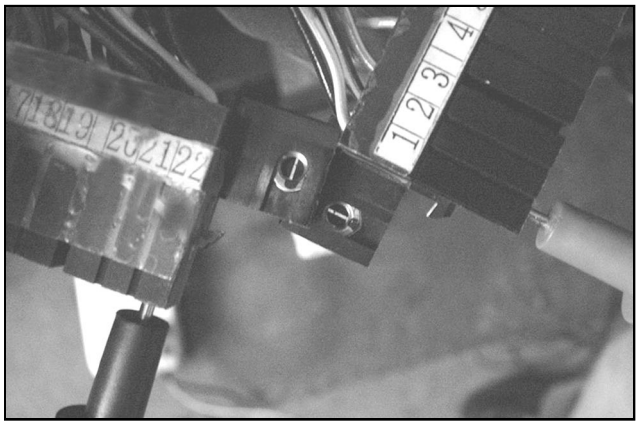


NO

Check the control unit connection.
If necessary proceed with replacement of the control unit.

YES

Connect the TPS connector.
Repeat tension measurement between terminals
1 and 22 of the special tool.
1-22 = 5±0.2 V



NO

YES

Measure the tension between terminals 11 and 22. Gradually open the throttle valve and check that tension value increases gradually.
11-22 = V (gradual variation)
NOTE
As an indication, the tension limits can vary from a minimum ~700mV to more than 4V maximum.
The possible variations in value limits are generated by the mounting tolerances of the sensor.

NO

Replace the throttle body complete with sensors and stepper.
(see Chapter. 7-THERMAL UNIT AND TIMING SYSTEM)

YES

YES

Check that the tension measured on pins 11 and 22 corresponds with the tension indicated by the diagnosis tester set to "parameters".

YES

The TPS and related circuit conform.

NO

Replace the control unit.

NOTE
The TPS control has been set with voltometer checks in that resistance controls are rather unreliable.
To check the potentiometer of a throttle body it is always advisable to connect it to a vehicle, even if only from an electrical point of view.

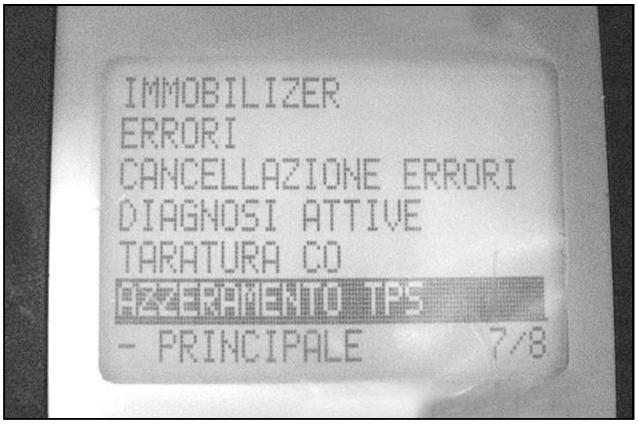
TPS RESET

The throttle body is supplied complete with TPS and is precalibrated.
The precalibration consists in an operation of regulating the minimum throttle opening, to achieve a set air flow under pre-established reference conditions.
Precalibration introduces an optimum air flow for idling management.
This setting must under no circumstances be tampered with.
The fuel injection system will complete the idling management via the stepper and the spark advance variation.
The throttle body, after precalibration, has the valve open at an angle that can vary according to the working tolerance of the duct and the valve itself.
The TPS, in turn, may assume different mounting positions. For these reasons the mV of the sensor with throttle to the minimum can vary from one throttle body to another.
To achieve optimum carburation, especially to the small openings of the throttle, the matching of the throttle body to the control unit is indispensable, via the procedure defined as TPS reset.
Through this operation we inform the control unit, as a starting point, the mV value corresponding to the precalibration position. The control unit will recognize this position as an angle of 5.24°.

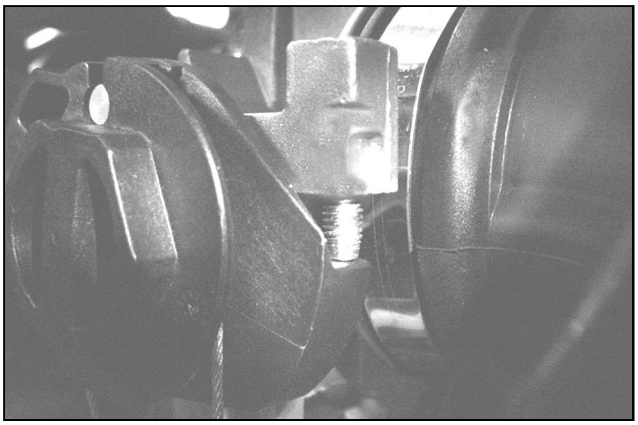
To reset, proceed as follows.

Connect the diagnosis tester 020460Y. (See page 9-17).
Set ignition to "ON" with switch on "RUN" and side stand raised.

Select the "TPS reset" function on the diagnosis tester

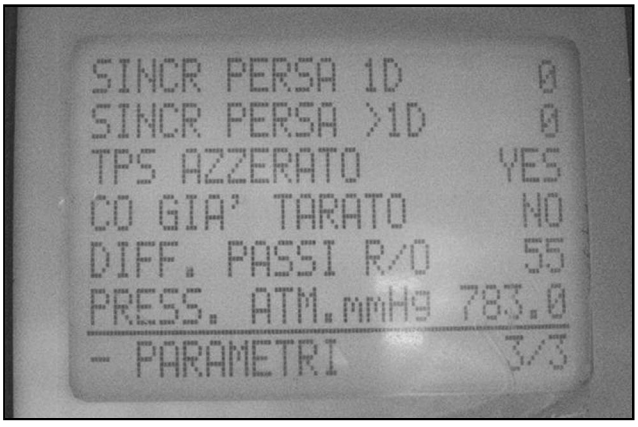


Check that the throttle command is supported by the setscrews.



Ensuring that this position is maintained, confirm the TPS reset procedure.

Select the "parameters" function and check that the TPS reset “YES” indication is given.

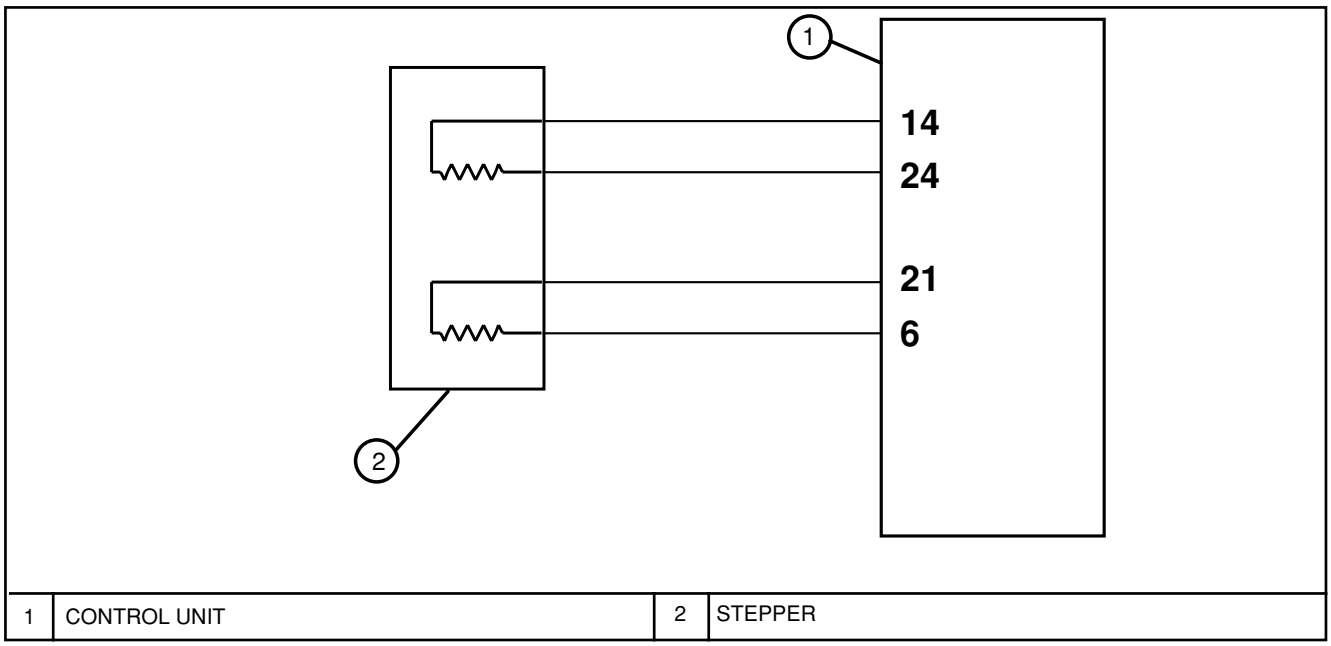


Reset must be carried out in the following cases:
- on initial assembly
- when the throttle body is replaced
- when the fuel injection control unit is replaced.

NOTE
The TPS reset procedure must not be carried out on a used throttle body, in that possible wear of the throttle and the minimum opening stop, render the air flow different from that of precalibration.

STEPPER MOTOR

CIRCUIT DIAGRAM



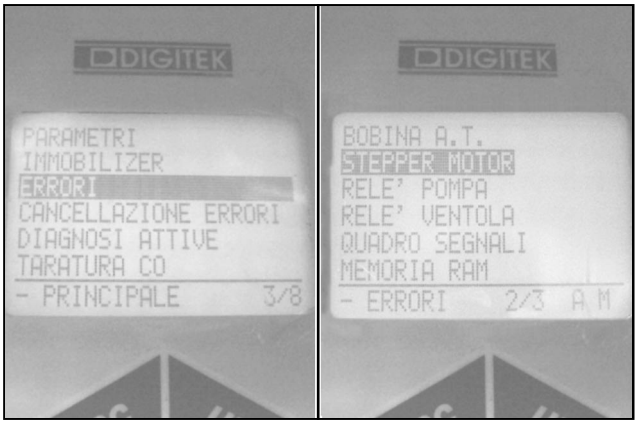
1	CONTROL UNIT	2	STEPPER

The throttle body is supplied with an auxiliary air circuit. This is activated more or less by a piston valve controlled by a stepper.
The stepper is fed by the control unit only when necessary to vary the opening.
Revolution is subdivided in rev fractions called “steps”.
By varying the opening “steps”, it is possible to adequately feed the engine to facilitate the ignition procedure and correct the cold engine air feed.
When the engine reaches normal running temperature, the stepper is partly closed.
To avoid anomalous wear on the adjusting piston, the speed functioning is achieved with a minimum opening of around 20 “steps”.
To recover any adjustments, when ignition is set to “OFF”, the piston closes completely and reopens by the number of steps pre-established (autoreset).
When the control unit modifies the opening “steps” of the stepper, it also modifies the fuel injection timing to guarantee that correct carburation is maintained.
Idling speed is practically stable 1450-50 rpm. After a warm starting phase the first revolutions increase is perceivable with the subsequent closure of the stepper to stabilize the speed.
On revealing speed irregularities, before proceeding with electrical controls, check accurately the cleanliness of the throttle and the auxiliary air circuit.

To control the stepper and related circuit, proceed as follows.

Connect the diagnosis tester 020460Y. See page 9-17.
Set ignition to "ON" with switch in position "RUN" and side stand raised.
Lift the vehicle with the central stand.

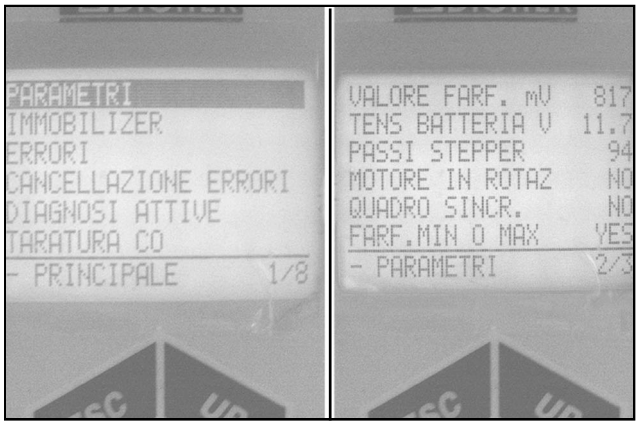
Select the “errors “ function from the menu
Check if the control unit has registered anomalies concerning the stepper circuit.



YES

NO

Select the “parameters“ function from the menu
Check the number of "steps" programmed by the control unit to achieve ignition.
This arrangement is a function of the engine temperature.
20° C = ~ 80-90 steps



YES

Start the engine and allow it to warm up.
With a coolant temperature greater than 70°C, the control unit should command the stepper with around 20 "steps".

YES

NO

NO

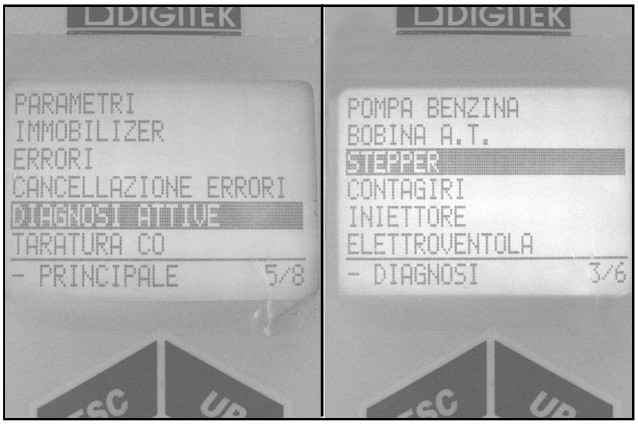
NO

NO

Check the coolant temperature sensor signal.
See page 9-74.
If necessary check the control unit.

YES

Select the “active diagnosis“ function from the menu
Select "stepper" diagnosis



Activate the diagnosis with the engine warm and idling.
Check if the stepper commands any revolutions variation and await the response of the diagnosis tester.

NO

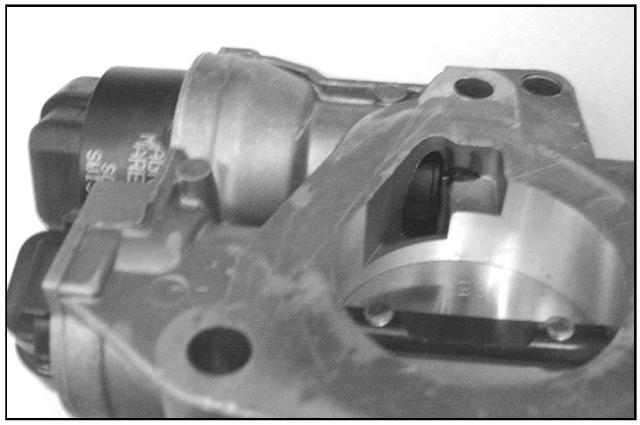
YES

Test completed successfully
Revolutions variations perceived.

Stepper and related circuit are efficient.

Test failed
No revolutions variation

Test completed successfully
No revolutions variation.
Remove the throttle body (see Chapter. 7-THERMAL UNIT AND TIMING SYSTEM).
Check cleanliness of the auxiliary air circuit.
Set ignition from "ON" to "OFF" and again to "ON" and check if the piston valve moves.



NO

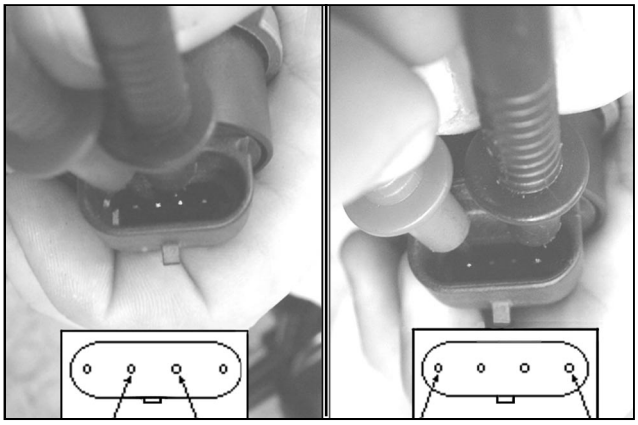
If the valve does not move, replace the throttle body.
See Chapter. 7-THERMAL UNIT AND TIMING SYSTEM.

9

YES

Proceed with control of the stepper circuit.

Disconnect the stepper connection.
Check the resistance of the stepper circuits connecting the tester as shown in the diagram.
The two measurements must have the same value.
Resistance = ~ 51 Ω



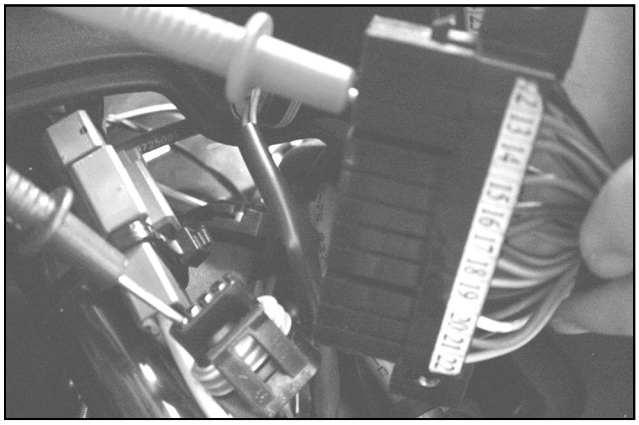
NO

Proceed with replacement of the throttle body.
See Chapter. 7-THERMAL UNIT AND TIMING SYSTEM.

YES

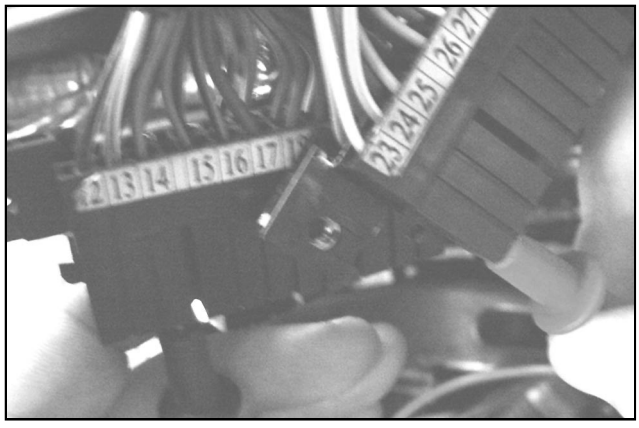
Connect the special tool 020481Y. See page 9-8
For these controls do not connect the special tool to the control unit.

Check continuity of the 4 feed wires of the stepper.
A Light blue-red-14 = 0 Ω (continuity)
B Orange-blue-6 = 0 Ω (continuity)
C Light blue-yellow-21 = 0 Ω (continuity)
D Light blue-black-24 = 0 Ω (continuity)



YES

Check the earthing isolation of the 4 wires of the stepper.
14-23 = >1MΩ (infinity)
6-23 = >1MΩ (infinity)
21-23 = >1MΩ (infinity)
24-23 = >1MΩ (infinity)



NO

YES

NO

NO

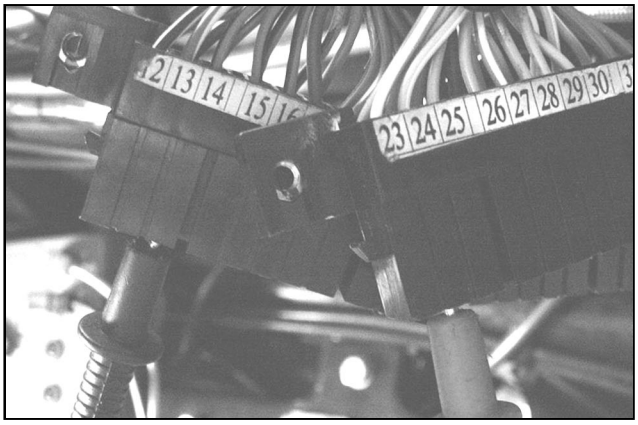
NO

Repair or replace the harness.

YES

Connect the stepper connector.
Repeat continuity control of the tool pins.

14-24 = ~ 51 Ω
6-21 = ~ 51 Ω



NO

Check the harness and connectors more accurately.

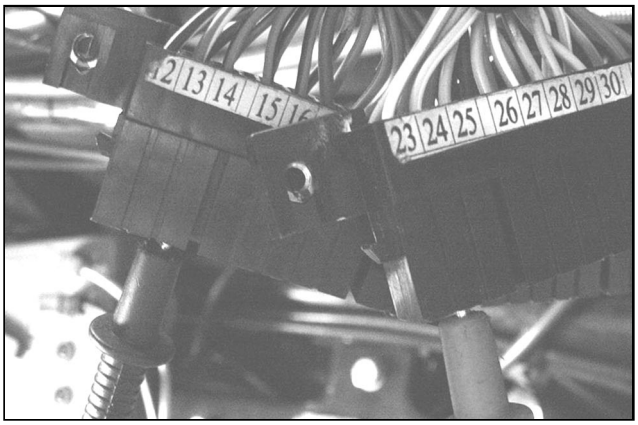
YES

Connect the control unit connector.
Set ignition to position "ON" with switch on "RUN" and side stand raised.

Repeating the communications "ON" "OFF" "ON", check the presence of tension pulses on the command wires of the stepper.
Arrange continuous tension measurements.

14-24 = V (pulses for a few seconds)
6-21 = V (pulses for a few seconds)

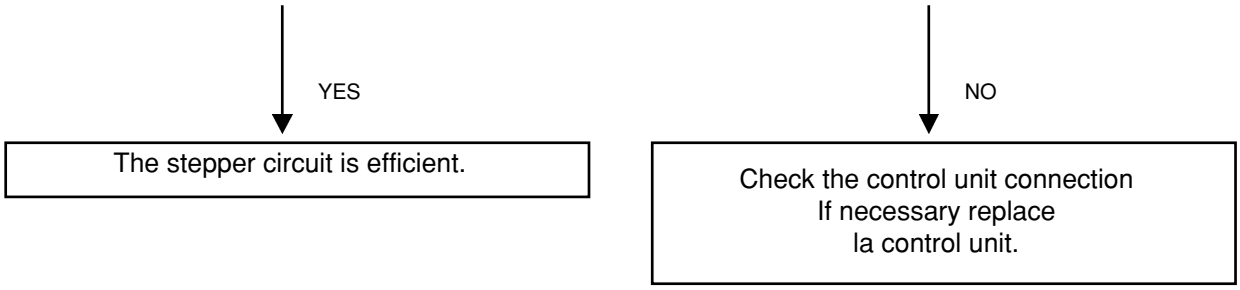
NOTE
The pulses serve to modify the stepper position. On reaching optimum position feed tension becomes zero.



YES

NO

9


YES
The stepper circuit is efficient.
NO
Check the control unit connection
If necessary replace
la control unit.

MINIMUM CARBURATION REGULATION

The fuel injection system control unit is programmed to guarantee optimum carburation during use on the road. Minimum carburation necessitates a refinement destined to compensate for the productive tollerances and adjustments of the engine.
This regulation is carried out by modifying the opening time of the injector when the engine is idling.

To carry out the regulation, proceed as follows:

Minimum carburation regulation must be carried out on an engine in good working condition.
Preventive checks:
- spark plug
- air filter
- good air intake system seal
- good exhaust system seal
- valves play
- fuel filter
- fuel pressure

↓

Preheat and check reset of the exhaust gas analyzer 494929.
Remove the plug of the exhaust manifold and connect the extension with the intake for the analyser tube.

↓

Connect the diagnosis tester 020460Y see page 9-17.
Set ignition to "ON" with switch in position "RUN" and side stand raised.

↓

Select the “ERRORS “ function from the menu
Check the presence of any anomalies.

NO ↓

Select the “PARAMETERS “ function from the menu

↓

YES ↓

Repair according to the indications given.

↓

9

Start the engine and allow it to warm up until the following conditions are reached:
- coolant temperature = more than 70°C
- air intake temperature = 25 - 30°C

Activate the exhaust gas analyser and check the following conditions:
- CO = 1.25±0.25%
- CO2 = 14.50±1%

YES

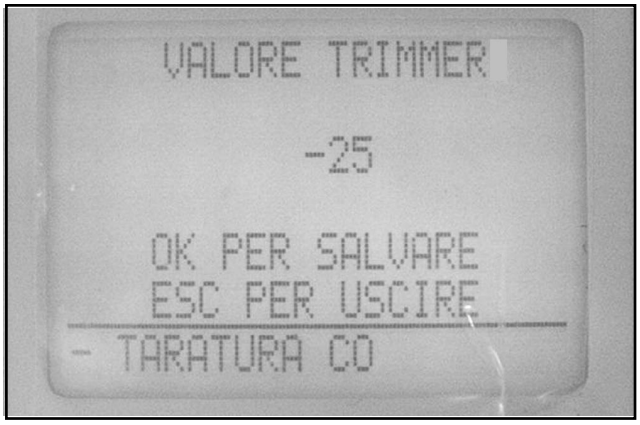
Regulation is correct.

NO

On revealing non-conformant CO values adjust fuel injection timing to minimum.

Select the “CO PRECALIBRATION” function from the diagnosis tester menu
Activate the adjusting function.

The display shows the words "TRIMMER VALUE".
The numeric indication may be positive or negative.



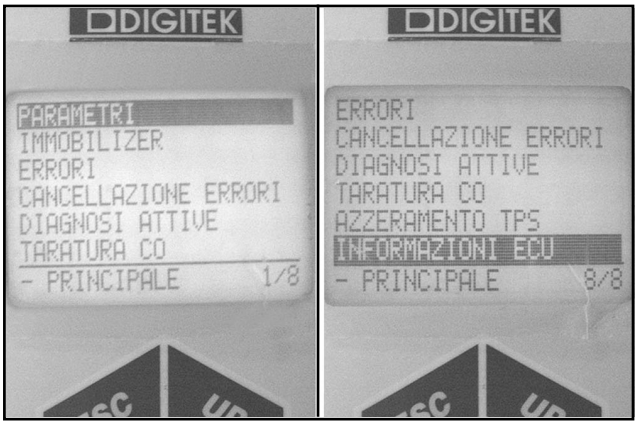
To increase CO it is necessary to increase fuel injection timing.
To decrease CO it is necessary to decrease fuel injection timing.
Regulate the trimmer value according to indications given in the table:

TRIMMER VALUE	FUEL INJECTION TIMING	C O
+100	HIGH	INCREASES
+ 50	⇑	⇑
+ 10		
0	MEDIUM	
- 10		
- 50	⇓	⇓
-100	LOW	DECREASES

NOTE: A trimmer value of 0 corresponds to medium fuel injection.
After regulation, engines may find carburation with either positive or negative trimmer values. This is due to normal production tolerance.

After varying the trimmer value, wait for the CO to adjust itself.
When regulation is shown to be correct, press OK to memorize the value in the control unit.

Select the menu to "PARAMETERS" and "ECU INFORMATION" to receive confirmation that the new trimmer variation has been memorized.



NOTE: When the CO percentage is correct and the CO_2 value does not fall within the preset values, LAMBDA value will also be false.
In this case check accurately the exhaust system seal.

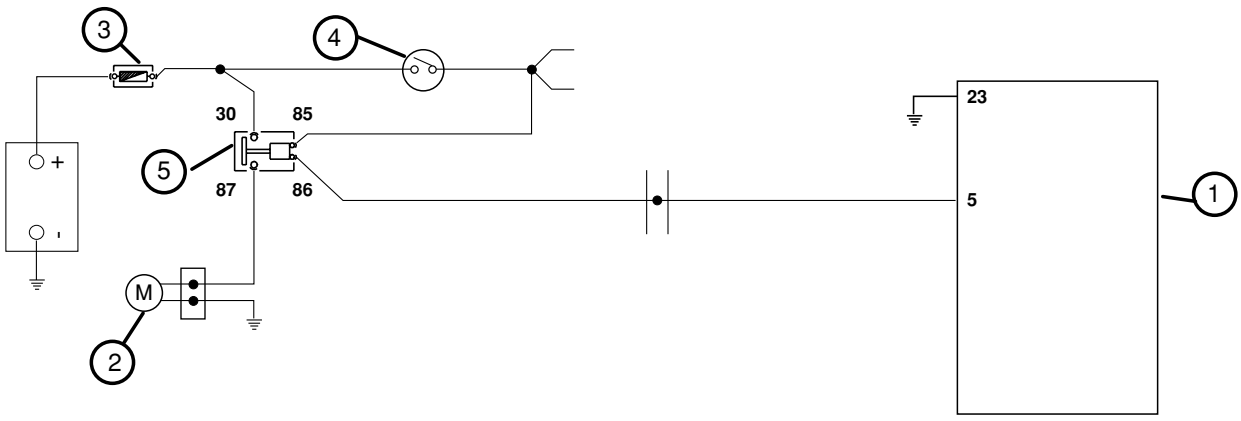
When the CO percentage is correct and the HC (PPM) value is greater than the maximum allowed limit, check:
- spark plug
- valves play
- timing phase
- exhaust valve seal

If it proves necessary to replace the control unit it is important to carry out TPS reset and preventively preset the trimmer value of the original control unit (if available).
In all cases check the CO value again.

ELECTRICAL FAN CONTROL CIRCUIT

Terminals	Conditions	Standard
5-23	Set ignition to position "ON" Switch on "RUN" Side stand raised Electrical fan stopped	Battery tension

CIRCUIT DIAGRAM



1	CONTROL UNIT	4	KEY IGNITION
2	ELECTRICAL FAN	5	ELECTRICAL FAN ELECTROMAGNETIC SWITCH
3	30A FUSE		

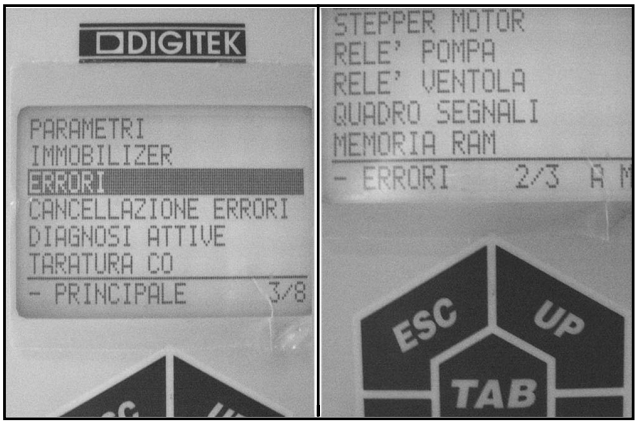
The electrical ventilation system is fed by an electromagnetic switch connected under the panel and controlled by the fuel injection control unit.

The fuel injection control unit manages control of the electrical fan on the basis of temperatures revealed by the engine.
If a prolonged rotation of the electrical fan should occur, before proceeding with electrical system controls, check accurately:
- level of the expansion tank
- drain from the tube leading to the engine
- drain on outlet from the cylinder head
- thermostat efficiency
- pump efficiency.

For these controls, see chapter 11-COOLING.

To control the circuit, proceed as follows:

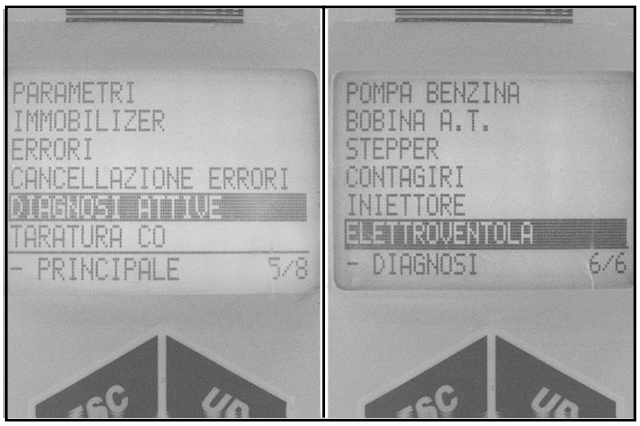
Connect the diagnosis tester 020460Y
see page 9-17.
Set ignition to "ON" with switch in position "RUN" and side stand raised.
Select the “ERRORS “ function from the menu
Check if the control unit has registered anomalies concerning the electrical ventilation control circuit.



NO

YES

Select the “ACTIVE DIAGNOSIS“ function from the menu
Activate the electrical fan diagnosis function
Check acoustically the electrical fan rotation.
Await the results from the diagnosis tester.



YES

Test completed successfully.
The fan rotates.

The electrical ventilation system conforms.

NO

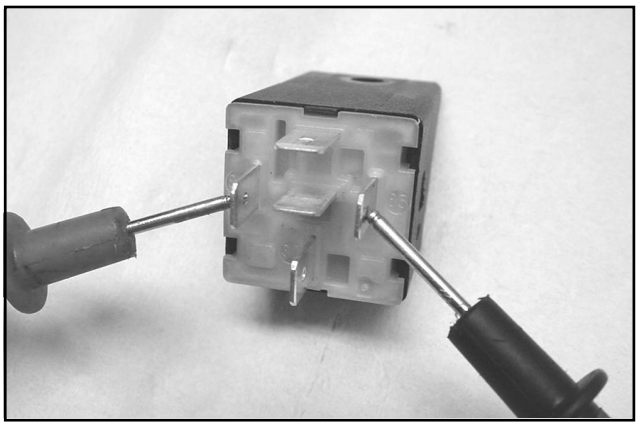
NO

Test failed.
The fan does not rotate.

Test completed successfully.
The fan has not worked.

The electromagnetic switch control circuit is efficient.
Check the electrical fan connection, electromagnetic switch contact efficiency, positive wires, negative wire and the electrical fan motor.

Disconnect the electrical fan control electromagnetic switch
Check continuity of the excitation coil.
85 - 86 = 150±50 Ω



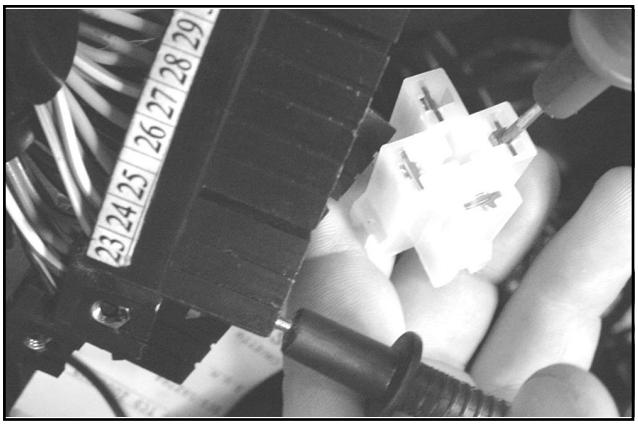
YES

NO

Replace the electromagnetic switch.

Connect the special tool, 020481Y between the control unit and the fuel injection system (see page 9-8)
Do not connect to the control unit.

Check the presence of battery positive tension at 85 of the electromagnetic switch connector.
85 (white) - 23 = battery tension with ignition set to "ON".



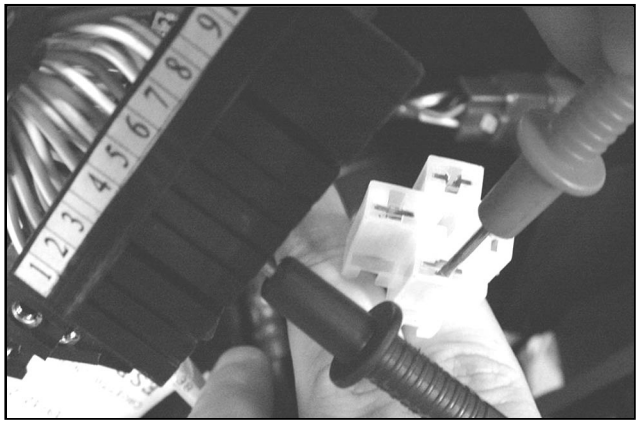
YES

NO

Reset or replace the harness.

9

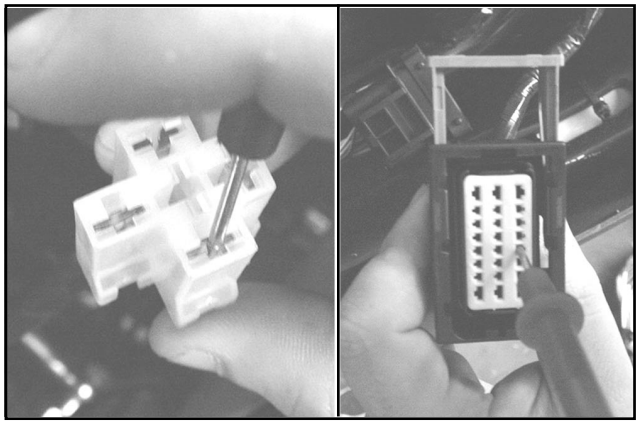
Keeping the electromagnetic switch disconnected, check continuity between 86 of the electromagnetic switch connector and 5 of the control unit.
86 (Green-White) - 5 = 0 Ω (continuity)



YES

NO

Disconnect the connector between the vehicle system and fuel injection system.
Check the connector and repeat continuity controls.
86 - Green-White = 0 Ω (continuity)
Green-White - 5 = 0 Ω (continuity)



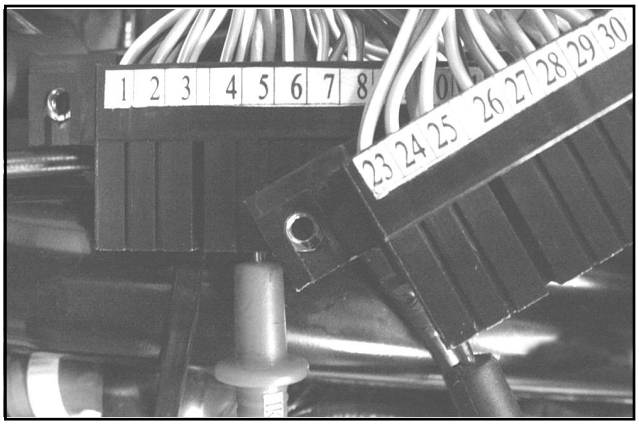
Check the earthing isolation.
5 - 23 > 1MΩ (infinity).

YES

NO

Repair or replace the harness.

Connect the electromagnetic switch and check the presence of tension between terminals 5 and 23 with the key switch set to "ON".
5 - 23 = battery tension with panel set to "ON".



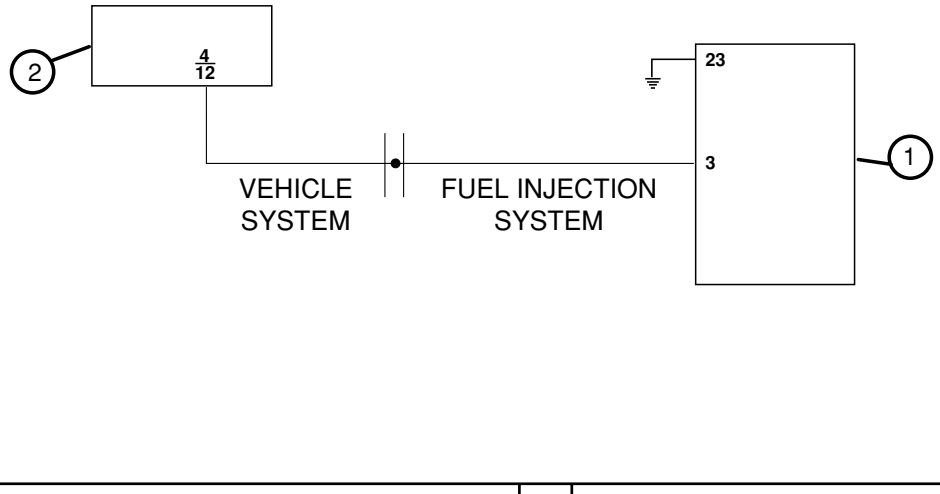
Repeat the control with the control unit connected and the engine cold.
5 - 23 = battery tension with panel set to "ON".

If the anomaly persists replace the control unit.

REVOLUTIONS COUNTER CONTROL CIRCUIT

Terminals	Conditions	Standard
3 - 23	Ignition set to "ON" Switch set to "RUN" Side stand raised Engine stopped	9 - 10 Volt

CIRCUIT DIAGRAM



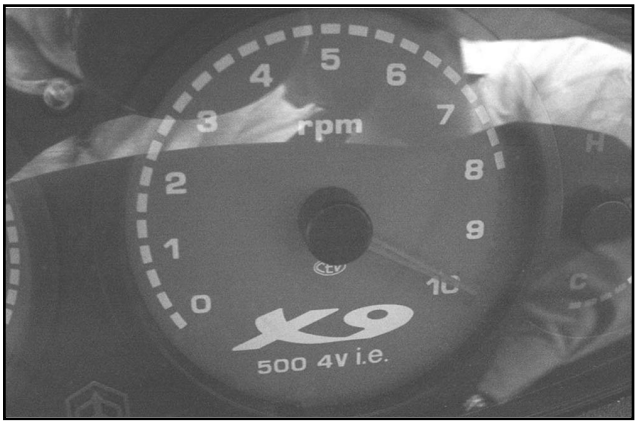
1	CONTROL UNIT	2	DIGITAL INSTRUMENT

The analog revolutions counter receives commands from the digital instrument panel which in turn receives signals from the fuel injection control unit.

To control the revolutions counter and related circuit, proceed as follows:

While pressing down both the clock and “S” buttons, set ignition to “ON”.
The digital instrument commands general check of the warning lights and instrument.

Check if the revolutions counter has reached the bottom scale.



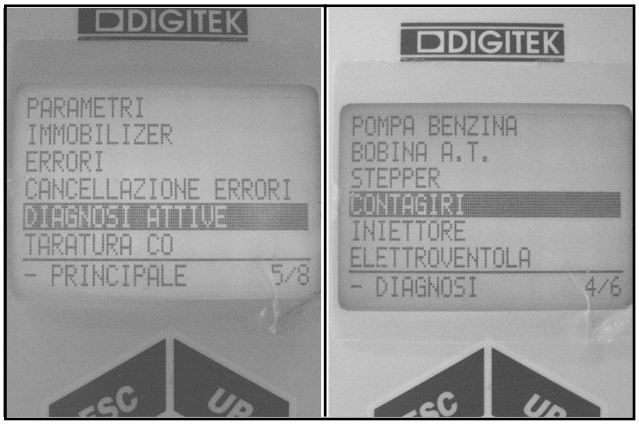
YES

NO

Check the analog instrument and the digital instrument panel.

Connect the diagnosis tester, 020460Y see page 9-17
Set ignition to "ON" with switch in position "RUN" and side stand raised.

Select Active diagnosis on the menu
Activate diagnosis of the revolutions counter.
Check that revolutions counter instrument rises from zero to 3500 revolutions before returning to zero.



YES

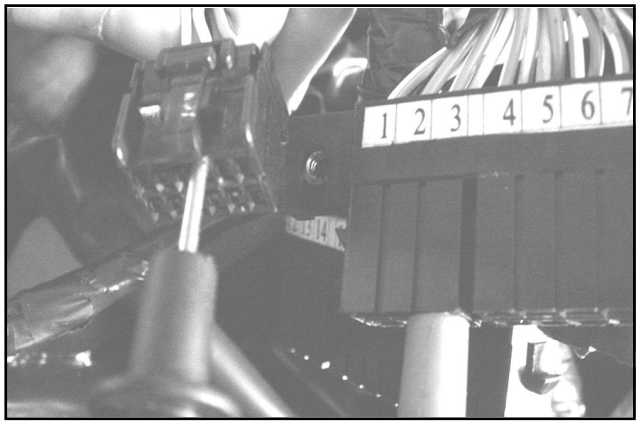
The control circuit of the revolutions counter is working.

NO

Connect the special tool, 020481Y, to the fuel injection system. See page 9-8.

9

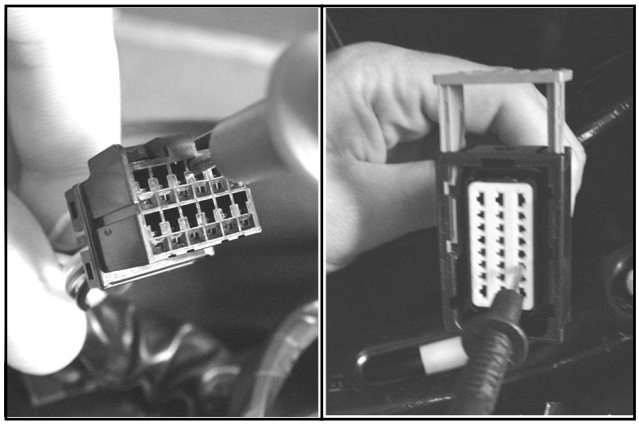
Disconnect the digital instrument.
Keep the control unit disconnected.
Check continuity of the wire from the control unit to the digital instrument.
Yellow (terminal 4/12) - 3 = 0 Ω (continuity)



YES

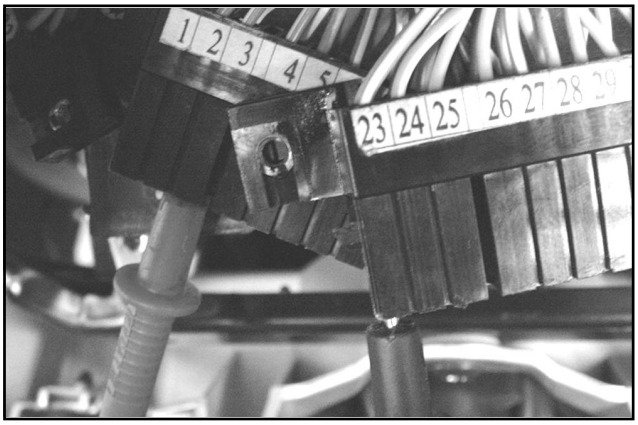
NO

Disconnect the connection between the vehicle system and the fuel injection system.
Repeat continuity control of the two wires.
Terminal 4/12-yellow = 0 Ω (continuity)
Yellow-3 = 0 Ω (continuity)



Reset or replace the harness.

Check the earthing isolation of wire
3 - 23 >1MΩ (isolation)



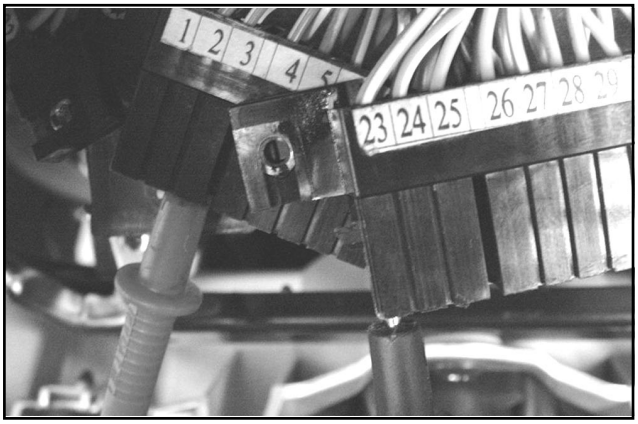
YES

Repair or replace the harness.

YES

Connect the control unit.
Ignition set to "ON"' with switch on "RUN" and side stand raised.

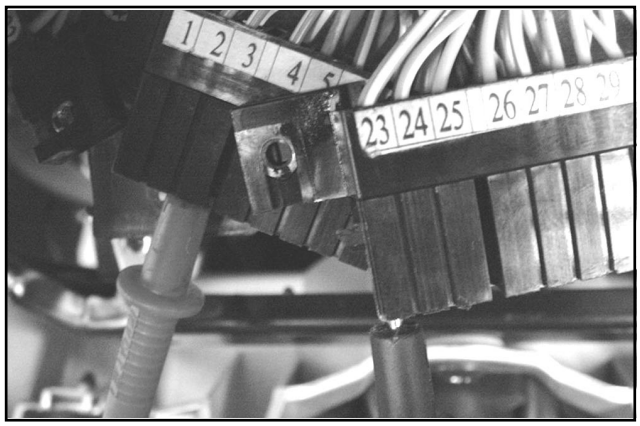
Measure the tension between pins 3 and 23 with engine stopped.
3 - 23 = 9 - 10 V



YES

NO

Using the diagnosis tester carry out a revolutions counter control.
Measure tension again.
3 - 23 = less than 1V for a few seconds.



YES

NO

The control circuit of the revolutions counter is working.

Replace the fuel injection control unit.

9

TABLE OF CONTENTS

LUBRICATION 10

SPECIFICATIONS

Sump capacity	Overhaul	1.7 litres
	Oil and filter change	1.5 litres
Recommended engine oil	Selenia HI Scooter - 4Tech 5W/40	specification API SJ

Oil pump	Type	Trochoidal
	Rotor thicknesses	8 mm
	Assembly clearances	lobe ends 0.05 - 0.008 mm
	Radial play of the external rotor	0.05 - 0.12 mm
	End play of the rotors	0.025-0.065 mm
By-pass	Type	piston
	Piston diameter	Ø13.9 $^{-0.039}_{-0.057}$ mm
	Free length of spring	62.5 mm
	Calibration pressure	4 bar
Pre-filter	Type	plastic mesh
Oil filter	Type	paper with overpressure by-pass and antidraining
Minimum oil pressure signal switch	Calibration	0.3 - 0.6 bar
Head ubrication control jet	Diameter	Ø 1 $^{\pm 0.05}$ mm tightening torque 5-7 N·m
Piston cooling nozzle	Diameter	Ø 0.8 $^{\pm 0.05}$ mm
Crankcase ventilation control	Device	metal reed valve and decanting chamber

GENERAL CHARACTERISTICS OF THE LUBRICATION SYSTEM

The lubrication system is divided into two sections:
- **high pressure**
- **low pressure**

All the components forming part of the high pressure section are situated on the engine crankcase; whilst the low pressure section exclusively concerns the thermal unit.
The trochoidal pump is installed in the sump and is controlled by means of a pair of drive wheels.
To guarantee pump integrity a pre-filter is used.
The pre-filter is of a pull-out type and the related plug also acts as engine oil drain.
The pump delivery is controlled by a piston by-pass calibrated to 4 bar. This is positioned prior to the cartridge filter and both are installed on the flywheel cover, and as such its gasket is subject to system pressure.
The by-pass positioned prior to the cartridge filter improves the working conditions of the filter itself, especially with cool oil.
The filter is supplied with a antidraining valve and a overpressure valve; the latter intervenes when the filter mass causes a pressure drop greater than 1 ± 0.2 bar.
Of course, these conditions are met only by cool oil and a high engine running speed or by a dirty filter.
The filtered oil is used to lubricate the water pump spindle and, on reaching the engine crankcase, to lubricate the main bearings, the housing of the big end of the connecting rod and of the cooling piston nozzle, set in the housing on the transmission side.
The main bearing, transmission side, is provided with a oil seal and related exhaust tube.
Leading from the housing on the flywheel side is the timing feed tube; the delivery at the head is controlled by the special jet screwed into the engine crankcase.
The timing components work with low pressure lubrication.
The camshaft housings are set directly in the aluminium of the head; the camshaft end play is recovered in part from the oil sent to the smallest diameter housing.
The camshaft provides for lubrication of the equalizers by means of special holes; these are set in such a position as to guarantee lubrication after vehicle parking. This result is achieved by the position most probably assumed by the camshaft during the engine stop phase.
The oil used for lubrication of the head, returns to the sump via the chain housing channel and as such also provides lubrication to the chain itself.
To avoid fumes recovered from the crankcase transporting quantities of oil, a unidirectional valve and a decanting chamber are used. The unidirectional valve is of the metal reed valve type; the decanting chamber is supplied with a drainage hole. Any inefficiency in these may lead to the presence of oil in the air feed tube to the engine.
An excess of oil fumes may cause occlusions in the channels set in the throttle body.
For indicating minimum oil pressure of the system a pressure switch situated immediately after the filter outlet is used.
The lubrication circuit does not concern the countershaft, which is lubricated by the oil transported by the drive wheels or by that centrifuged from the engine driving shaft.
The same thing occurs for the piston and the gudgeon pin, although in this case the cooling nozzle is particularly relevant.

DIAGNOSTICS GUIDE

Lighting up of the minimum oil pressure indicator with a warm engine.

↓

Remove the electrical connector of the minimum pressure switch.
Check that the indicator lamp turns off.

YES ↓ — NO ↓

Control the actual oil pressure.

Check and reset the electrical system.

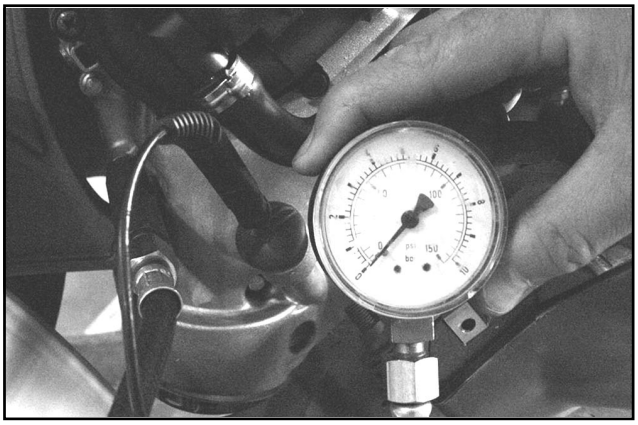
↓

- Remove the switch and install the special tool and related gasket.

Specific tools:
Manometer 020193Y
Manometer union 020434Y

- Remove the dipstick with the oil loading plug and insert a plug prepared with a temperature probe as part of the specific tool.
  Insert the probe until it comes into contact with the bottom of the crankcase then pull it back a few millimetres.

Specific tool:
Multimeter with temperature probe 020331Y



↓

Measure the pressure with a cold idling engine.
Standard values: 20°C Temperature 1400 rpm. ⇒ ~ 4.5 bar

NOTE: The revolutions may be revealed by either the exhaust gas analyser or diagnosis tester 020460Y.

NO ↓ — YES ↓

Allow the engine to warm up and repeat the control with warm oil.
Standard values: 80°C Temperature 1400 rpm. ⇒ ~ 1,5 bar

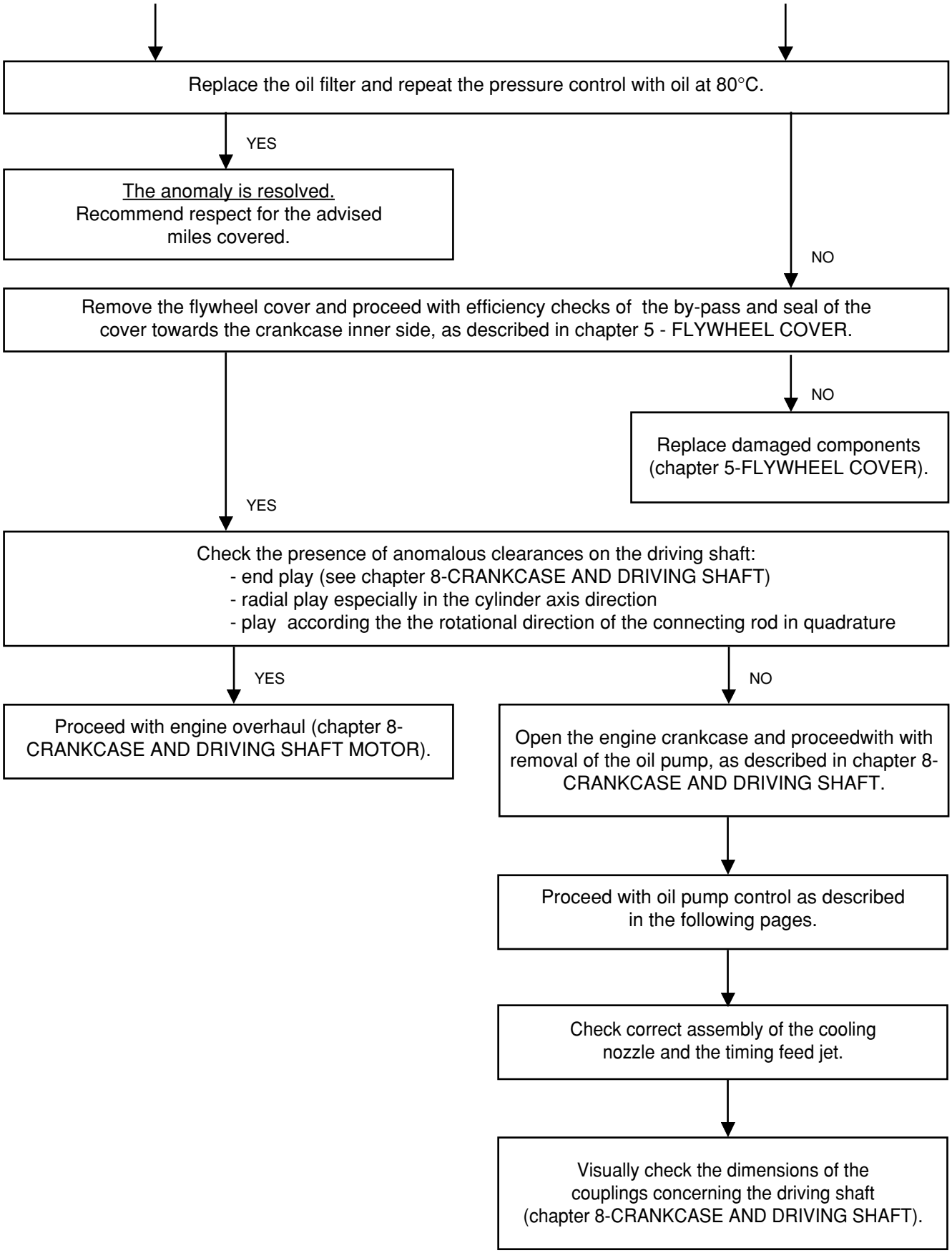
YES ↓ — NO ↓

Pressures of less than 4 bar revealed.

Replace the minimum oil pressure switch.

Pressures of less than 1.3 - 1.5 bar revealed.

↓

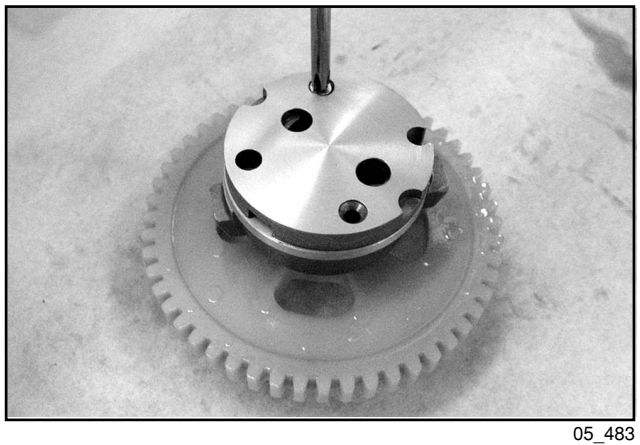


NOTE: Any anomalies discovered in the couplings and timing components are not revealable through lubrication pressure control. These may occur with a noise increase.

NOTE: Revealing pressure anomalies on the crankcase it is always advisable to proceed with visual and dimensional controls of the timing components (see chapter 7-THERMAL UNIT AND TIMING SYSTEM).

Checking the oil pump

- Remove the two screws and the oil pump cover.



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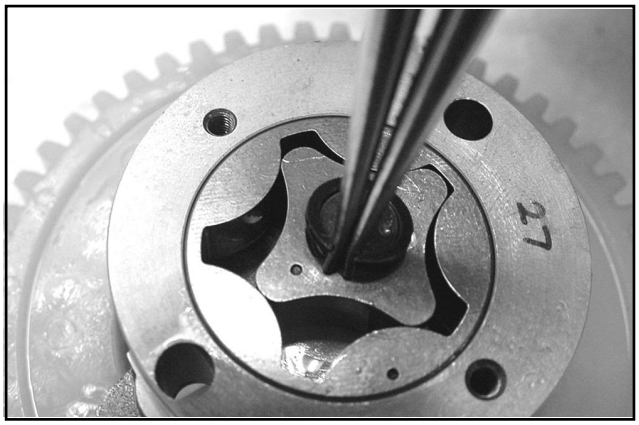
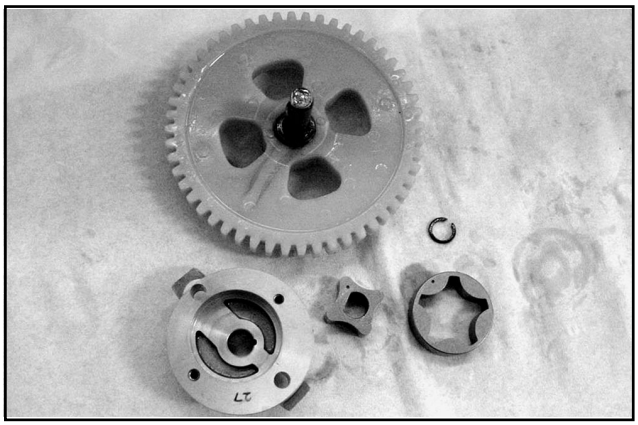
- Remove the internal rotor retaining ring turning it so that the opening is in correspondence with the shaft facing.



05_484

- Remove the rotors and clean them accurately with petrol and compressed air.
- Pull out the shaft complete with drive wheel to check its condition and any signs of wear the shaft itself.



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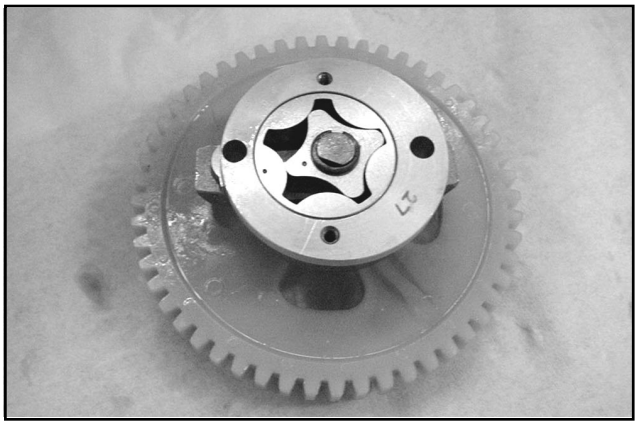
- Reassemble the rotors on the pump casing keeping the 2 references in sight.
- Insert the shaft and drive wheel and assemble the retaining ring and rotate it with the opening on the opposite side of the shaft facing.
- Check any anomalous plays between the shaft and pump casing.



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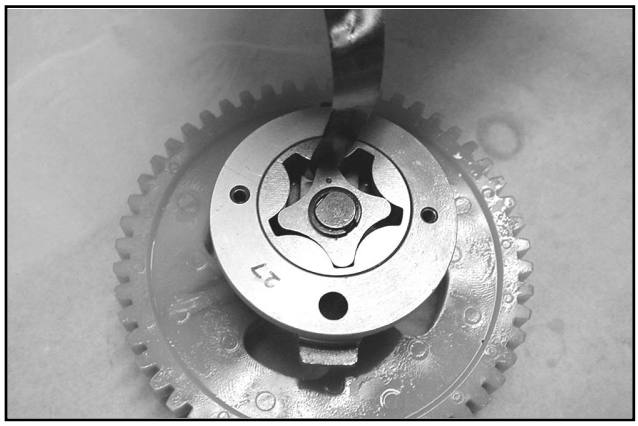
- Using a thickness gauge check the distance between the rotors in the position shown in the figure.

Clearance limit allowed: 0.012 mm



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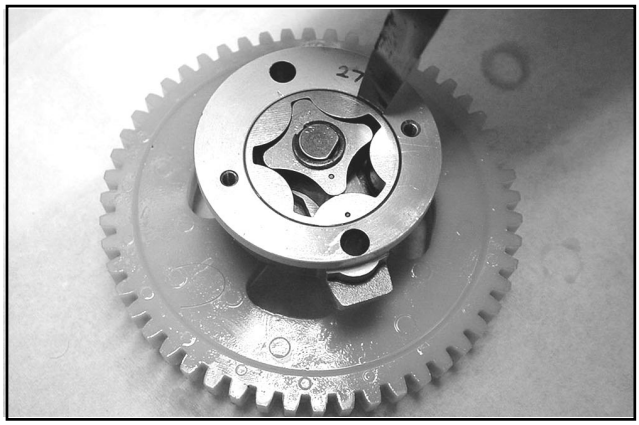
- Check the distance between the external rotor and the pump casing, see figure.

Clearance limit allowed: 0.25 mm



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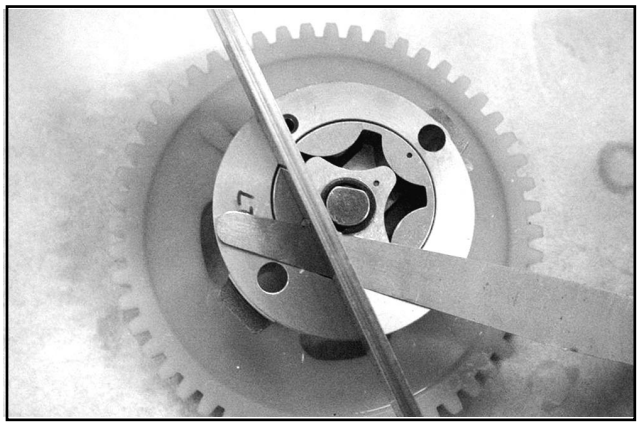
- Check the rotors end play using a ground bar as a reference plane as shown in the figure.

Value limit allowed: 0.1 mm



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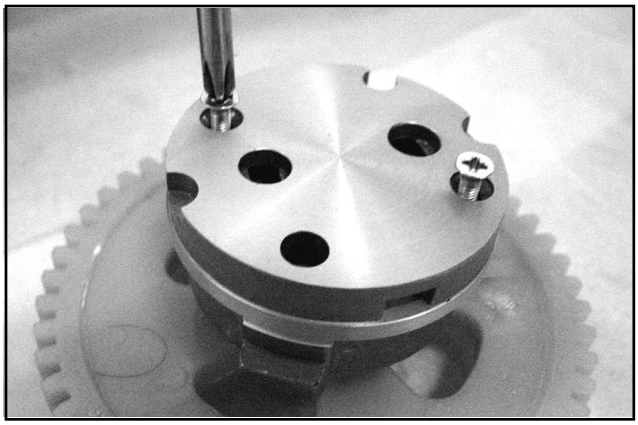
Oil pump assembly
- Lubricate the internal rotors.
- Check that the pump cover does not show signs of wear or scratching.
- On revealing non-conformant values or scratches, proceed with replacement.
- Assemble the pump cover in the position giving alignment of the holes for the fixing screws to the crankcase.

- Block the two fixing screws to the torque prescribed.

Tightening torque:
Oil pump coupling screws 0.7 - 0.9 N·m



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DIAGNOSTICS GUIDE

On discovering an oil leak from the coupling gasket of the flywheel cover or from the oil filter, proceed with lubrication pressure control.

↓

Install the specific tool.
Specific tools:
Manometer 020193Y
Adapter 020434Y

↓

- Check the system pressure with cold engine and medium-high running speed.
Standard pressure < 6 bar

YES ↓ Proceed with replacement of the damaged components.

NO ↓ Check the adjusting by-pass efficiency (see chapter 5-FLYWHEEL COVER) and reset the correct flow.

NOTE: The standard pressures are obtained using oil of the recommended viscosity. A greater viscosity leads to an increase in system pressure.

On discovering oil consumption greater than 250 gr/1000 km in a run in engine proceed as described below.

↓

Check the presence of oil in the recovery duct on the filter box.

YES ↓ Proceed with efficiency checks of the unidirectional reed valve and the drainage hole of the decanting chamber.

NO ↓ Reset efficiency of the valve or the drainage hole.

YES ↓ Proceed with seal checks of the thermal unit (elastic clamps, valve guides and oil seals), see chapter 7-THERMAL UNIT AND TIMING SYSTEM.

NO ↓ Proceed with seal checks of the thermal unit (elastic clamps, valve guides and oil seals), see chapter 7-THERMAL UNIT AND TIMING SYSTEM.

NOTE: Such an anomaly may occur also if the oil level is too high.
In this case the anomaly could be linked also to a malfunctioning of the fuel injection system due to occlusion of the throttle body ducts (see chapter 9- FUEL INJECTION).

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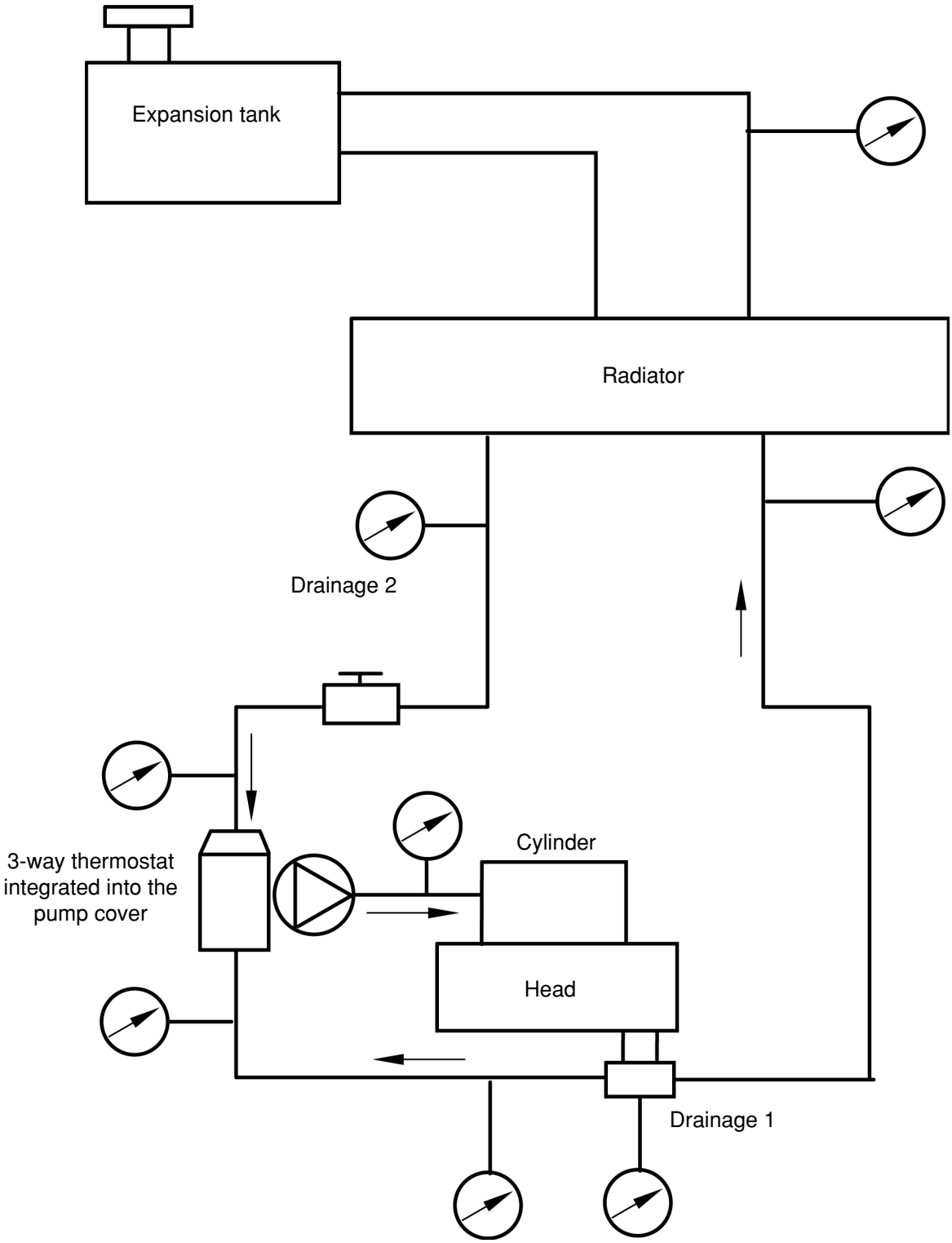
COOLING SYSTEM 11


Expansion tank
Radiator
Drainage 2
3-way thermostat
integrated into the
pump cover
Cylinder
Head
Drainage 1

05_491

SPECIFICATIONS

Cooling system capacity	1.8 l
Recommended fluid	50% mixture of water and sealed circuit fluid (PARAFLU 11 FE)
Seal pressure	Plug calibrated to 0.9 bar

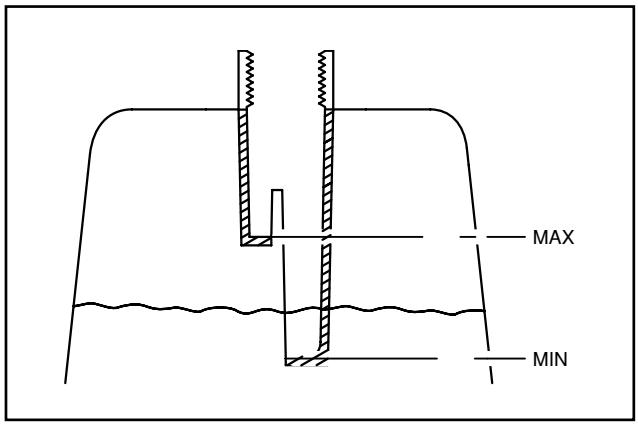
THERMOSTAT	Type	wax, with switch
	Initial opening	75 ± 2 °C
	Opening stroke at 90° C	4 mm
ELECTROVENTILATION	Type	injection operated
	Initial electroventilation	106° C
	End electroventilation	98° C
WATER PUMP	Type	centrifuge
	Command	coaxial to the counter shaft
RADIATOR	Type	in aluminium with horizontal circulation
EXPANSION TANK	Type	self-discharging, parallel to the radiator

System description

The cooling system is made with a centrifuge pump coaxial to the counter shaft and as such completes a number of revolutions identical to that of the driving shaft.
The pump has two ducts, one for inlet and one for outlet.
The outlet duct feeds the cylinder and consequently the head; the inlet duct leads from the head and its entrance to the pump is controlled by the thermostat plate.
The main seal of the thermostat acts instead on the main pump inlet duct leading from the radiator.
The radiator is fed from the head outlet; the expansion tank is inserted parallel to the radiator with the ducts on two levels: the delivery high up (in the air) and the fluid backflow low down (in the fluid).
The system composed in this way is a 2-way type.
The first way is the internal engine circulation and involves the pump, cylinder and head; this circulation is fully active when the thermostat is fully closed.
The second way is active with the thermostat fully open and is the main circulation which involves the pump, cylinder, head, radiator and expansion tank; for medium openings of the thermostat, however, the two circuits are both partially inserted, therefore the two ways are superimposed.
This kind of circuit is defined as the type with inlet thermostat. The thermostat is crossed by an inverted flow, that is with cold water which tends to lower the temperature of the wax cell.
This system allows optimization of the engine heating phases.
The expansion tank, parallel to the radiator and inserted on the main circuit, guarantees self-drainage when working.
For the filling stages of the system there are two drains: one on entry to the pump and one exiting from the head (see filling rules).
The electrical fan is operated by the fuel injection system with temperature measured on the engine head.

System filling rule

- Prepare the 50-50 mixture of water and coolant;
- Fill the system up to the level between MIN and MAX shown on the filling hole of the expansion tank;
- Do not close the expansion tank with the plug.



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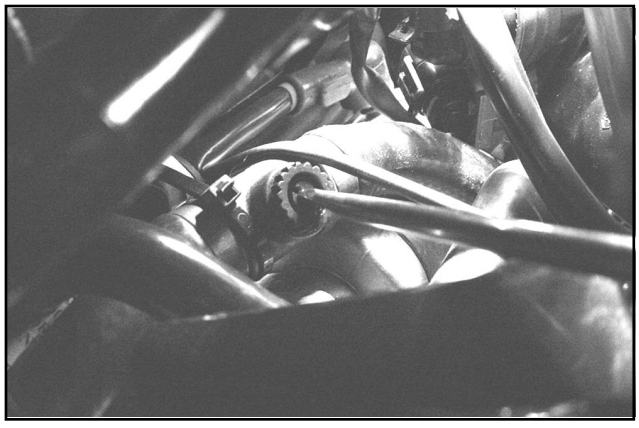
- Loosen the drain screw situated on the pump intake sleeve controlled by the thermostat;
- Keep it open until the air discharge has stopped completely;
- Retighten the drain screw.



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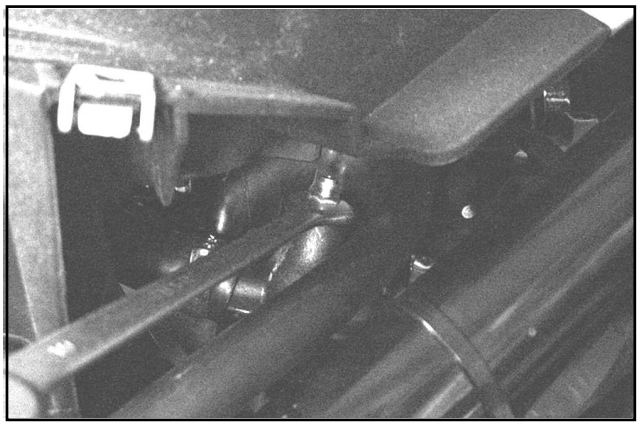
- Loosen the drain situated on the joint exiting from the head;
- Keep it open until the air discharge has stopped completely;
- Retighten the drain screw;
- Start the engine for a few seconds;
- Repeat the drain operation at the head exit;
- Repeat these operations several times until only fluid is discharged;
- Reset the level in the expansion tank and screw on the plug;
- Start the engine and allow it to warm up until the electroventilation temperature is reached;
- Stop the engine;
- Reset the level with a cold engine.



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Warning - The electroventilation is controlled through the temperature measured at the head.
Activation of the fan cannot be considered an indication of completed discharge.
The discharge can be considered complete when a temperature increase is noted in the expansion tank.

Thermostat control

Before dismantling it is advisable to carry out certain checks:
- Connect the diagnosis tester and select the “PARAMETERS” function(see Chapter 4-FUEL INJECTION);
- Start the engine from cold and allow it to warm.

Specific tool:
Fuel injection diagnosis tester: 020460Y

- Check manually the moment in which heating commences in the left box of the radiator;
- Check the temperature indicated on the diagnosis tester.

Initial thermostat opening: ~ 75° C

N.B.: The temperature measured by the tester is that of the head outlet, whilst the true thermostat temperature is referred to the pump inlet.

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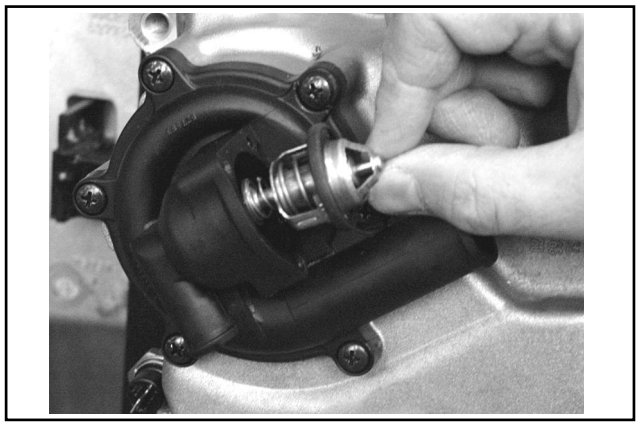
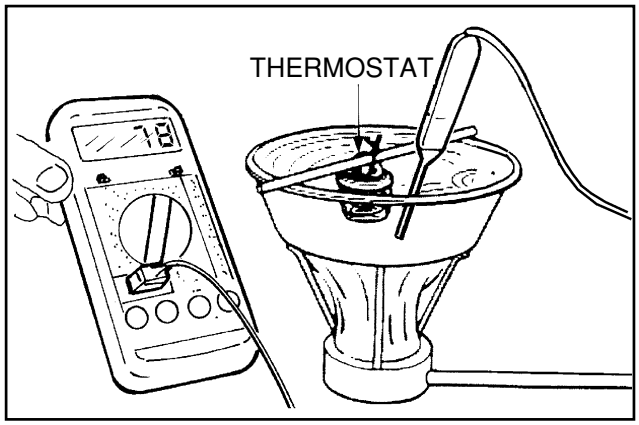
- On revealing values or gradual heating considerably different to that of the engine, proceed with thermostat control;
- Remove the thermostat cover and the thermostat itself as described in Chapter 5- FLYWHEEL COVER.



05_084

- Visually check that the thermostat has no mechanical damage;
- Prepare a metal container with ~ 1 litre of water;
- Immerse the thermostat keeping it to the centre of the container;
- Immerse the thermometer probe of the multimeter near to the thermostat;
- Heat the container with a heat gun;
- Check the temperature at initial opening of the thermostat.



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Initial opening temperature: ~ 75° C

Specific tools:

Multimeter	**020331Y**
Heater	**020151Y**

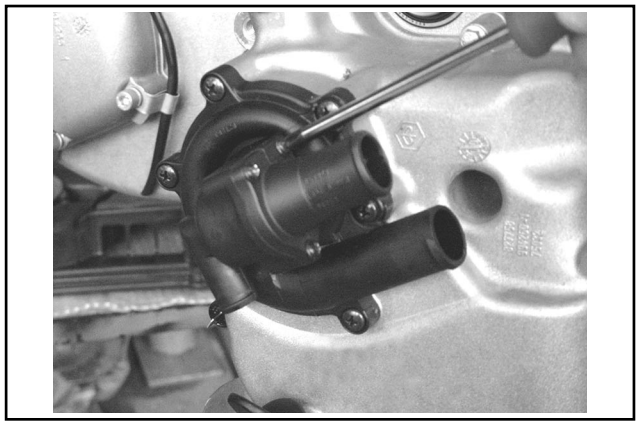
- Continue to heat until the thermostat is fully opened:

Opening length: 4 mm a 90 ± 2 °C

N.B.: Heating must be seen as gradual.

Warning - For correct trial testing, avoid direct contact between the thermostat and the container.

- On revealing incorrect values, replace the thermostat;
- Reassemble the thermostat and its cover as described in Chapter 5-FLYWHEEL COVER;
- Repeat the procedure from filling to discharge.

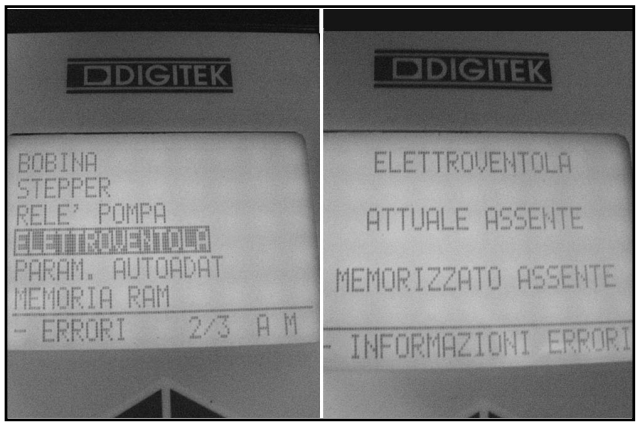


05_083

Electroventilation control

- Connect the fuel injection diagnosis tester and select the “ERRORS” function from the menu.
- Check the presence of anomalies in the electrical fan control circuit (See Chapter “FUEL INJECTION”).

Specific tool:
Fuel injection diagnosis tester 020460Y



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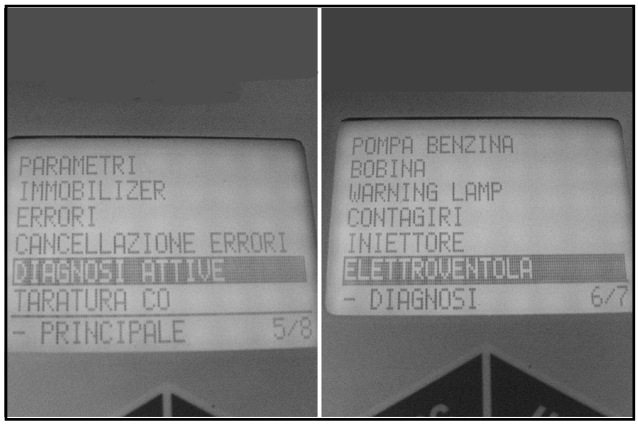
- Select the “ACTIVE DIAGNOSIS” function from the menu and command working simulation of the electrical fan (see Chapter 9-FUEL INJECTION);
- With a certainly efficient electrical fan, check the initial temperature after ventilation.



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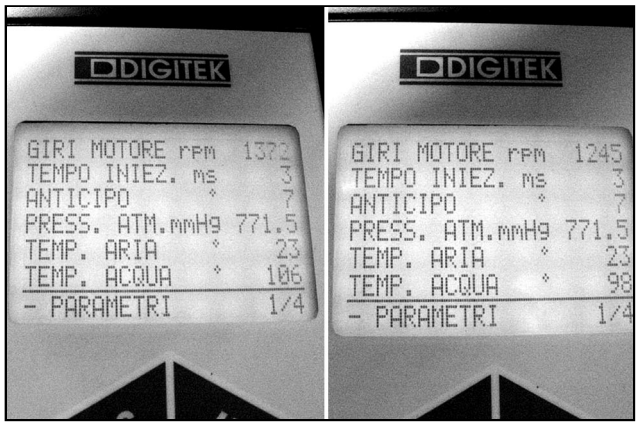
- Select the “PARAMETERS” function from the menu, visualizing the coolant temperature.

Electrical fan activation: 106° C
Electrical fan disactivation: 98° C

- On revealing non-conformant values proceed with replacement of the fuel injection control box (see Chapter 9-FUEL INJECTION);
- If the temperature indication on the analogic instrument is close to the red area, but the indication in degrees on the diagnosis tester is less than the electrical fan temperature, proceed with a check on the head temperature sensor and related fuel injection circuit (see Chapter 9-FUEL INJECTION);



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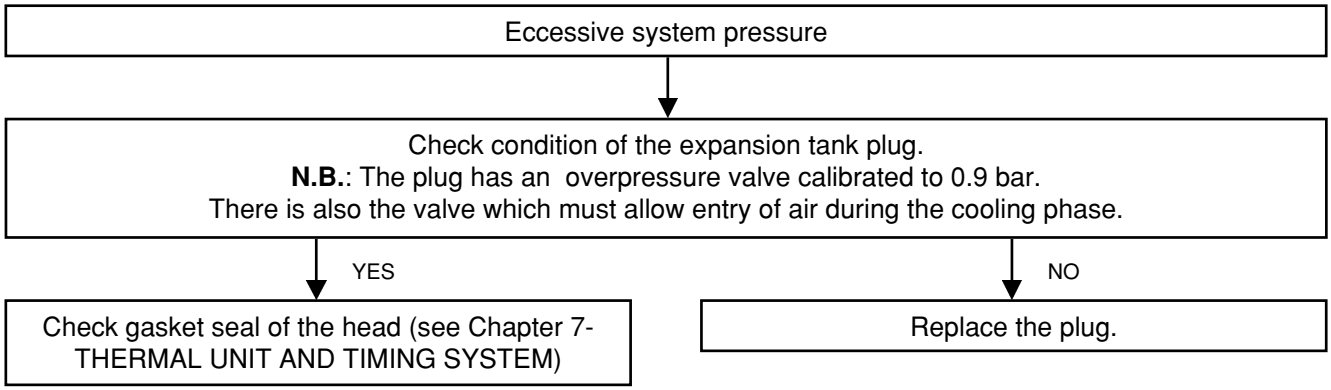
N.B.: The electroventilation temperature of 106° C is manageable only with a system filled with a 50-50 mixture and pressurized to 0.9 bar.
Avoid engine functioning without pressurization so as not to risk overheating the engine without having first inserted the electrical fan.
If the electroventilation times increase, check the initial opening temperature of the thermostat and the correctness of coolant density.
Optimum density is obtained with a 50-50 mixture of water and circuit coolant.

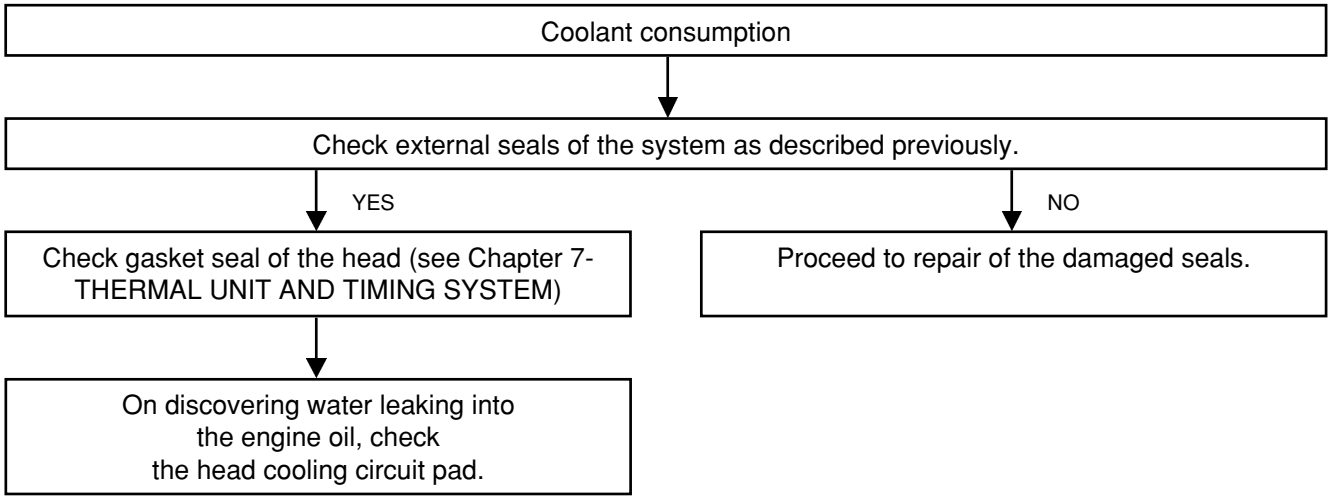
System seal control

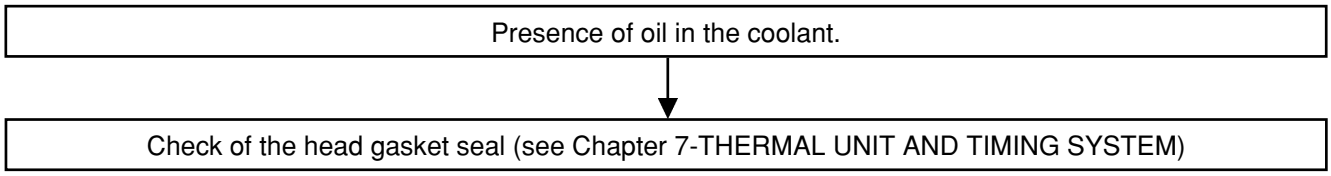
- Check adequate seal of the circuit when it is under pressure and heated;
- For a more complete control wait until the system has cooled because small leaks, invisible due to evaporation phenomena, may occur;
- The water pump has a drainage hole for any leaks resulting from mechanical seal of the cooling system or of the oil seal from the spindle seal;
- On discovery of coolant or oil leaks, proceed with overhaul of the pump (see Chapter 5-FLYWHEEL COVER).

N.B.: During repairs on the cooling system, do not use grease or oils. Failure to respect this regulation causes permanent deformation of the gasket seals.

Diagnostics guide







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STARTING 12

SPECIFICATIONS

STARTING MOTOR	Type	MITSUBA SM13D
	Power	0.9 kW
BATTERY	Capacity	14Ah
	Starting current	125 A
SOLENOID STARTER	Type	HERMETIC
	Capacity	150A continuous
STARTING TRANSMISSION	Crown and free wheel coaxial to the flywheel. Idler gear integrated with torque limiter.	

Starting system description

The starting system transmission is between the rotor of the motor and driving shaft with free wheel coaxial to the flywheel and torque limiter on the intermediate shaft.
The limiter is calibrated to 10 Kgm (100 N·m); the function of this component is to safeguard engine structure and engine ignition kinematism in case of incorrect engine ignition manoevre with subsequent voltage build-up of inverse revolution.
The free wheel allows a suitably silent starting.
Command of the starting (excitation of the solenoid starter) is slaved by consensus of the side stand and the OFF/RUN emergency switch, thus not allowing ignition in dangerous conditions.
The engine ignition command circuit is not controlled by the immobilizer system, so before activating the engine ignition system in an anomalous manner, check the consensus of the immobilzer.
With regard to checking the consensus circuit, see Chapter 4-ELECTRICAL EQUIPMENT in the X9 500 cc vehicle Service Station Manual; whilst for controls of the driving shaft command transmission, take action as described in Chapter 6-FLYWHEEL AND ENGINE IGNITION SYSTEM.

Controls and diagnostics guide

The starting motor is marketed as complete.
Before deciding to replace it, it is necessary to proceed with the following checks:

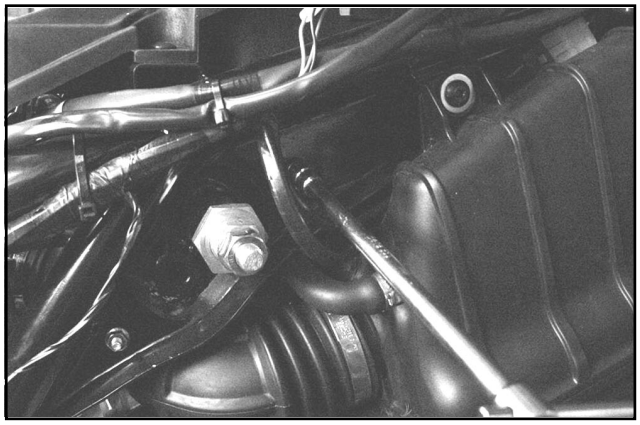
Battery
Check repose tension (several hours).
Tension > 12,5 V.
Check the electrolyte density of each element.
Bé = 30 - 32
Specific weight: 1.25 - 1.26

NO

Recharge and if necessary replace the battery

YES

Check correct connection of the negative terminals (battery negative and starting motor negative) between themselves and the chassis.

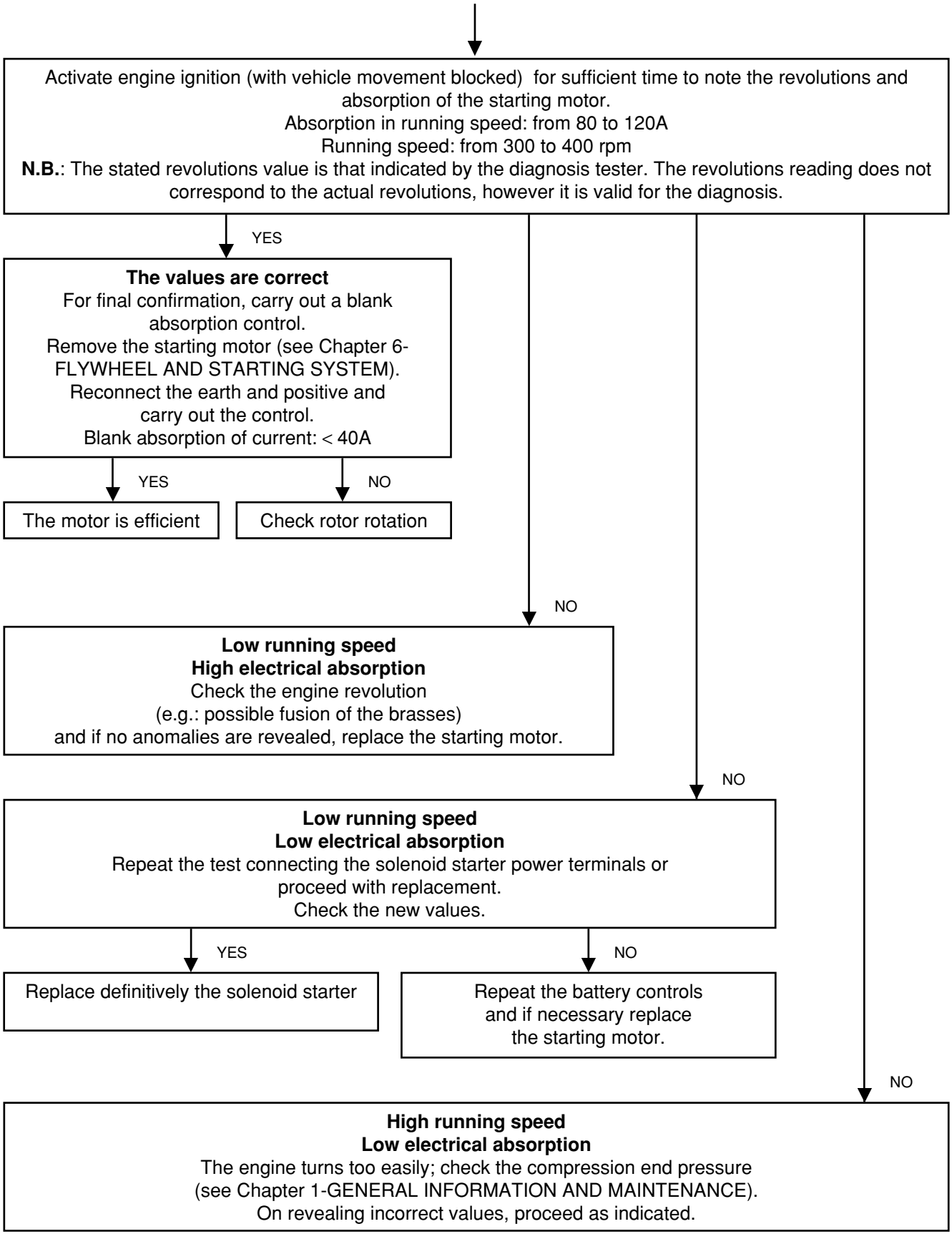


NO

Reset the connections.

YES

Connect the diagnosis tester di 020460Y (see Chapter 9-FUEL INJECTION).
Connect the induction pliers of an amperometer to the positive feed cable of the starting motor.
Remove the 10A fuse N° 2 (see Chapter 9-FUEL INJECTION).
Set to "ON" with the switch on "RUN" and side stand raised.
Select the "PARAMETERS" function, page 1-3.



N.B.: If the running speed of the driving shaft proves to be low and is coupled with anomalous noise, proceed with checks of the free wheel and the torque limiter (see Chapter 6- MAGNETO FLYWHEEL AND STARTING SYSTEM.