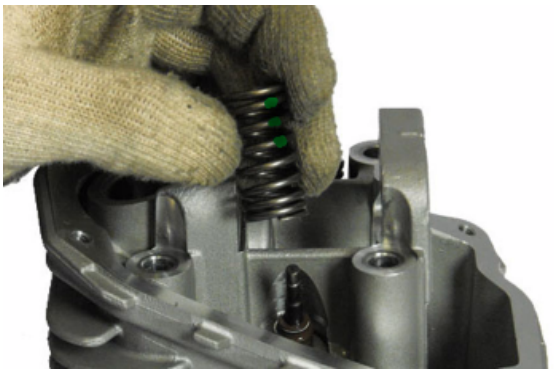
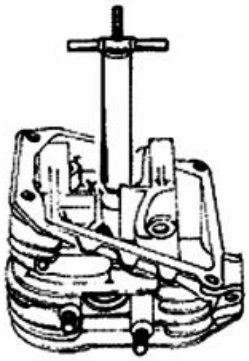


- Use the specific tool to remove the valve oil seal.

Specific tooling

020431Y Valve oil seal extractor



- Slide off the valve and remove the lower support.

Removing the cylinder - piston assy.

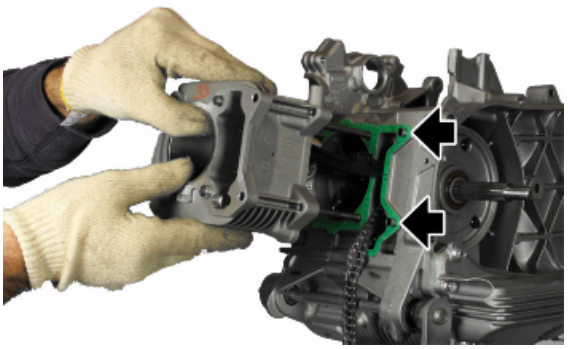
- Remove the cylinder, paying attention to the cylinder-crankcase alignment dowels.

CAUTION

TO PREVENT DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

N.B.

IN ORDER NOT TO DAMAGE THE BASE GASKET WITH THE PISTON LOCK FORK 020426Y DURING THE MOUNTING PHASE, IT IS RECOMMENDED TO INSERT THE ALIGNMENT DOWELS OF THE CYLINDER - CRANKCASE UNDER THE CYLINDER DURING THE ASSEMBLY.

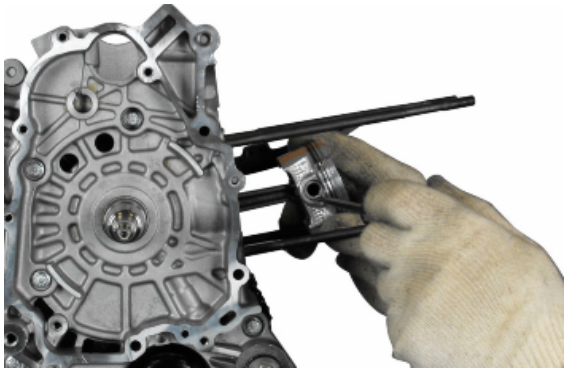


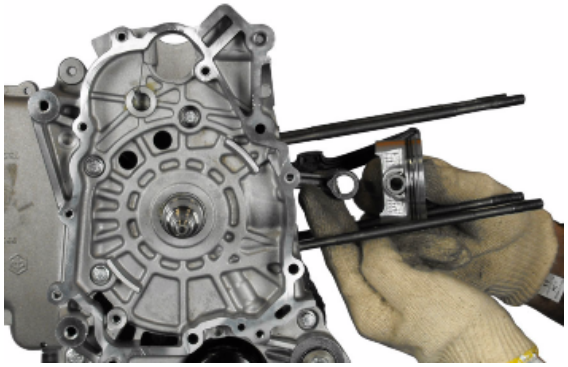
- Remove the base gasket.

- Remove the retainer rings and remove the piston.

N.B.

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.





Inspecting the small end

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the wrist pin

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder - piston assy.

Inspecting the piston

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder - piston assy.

Inspecting the piston rings

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

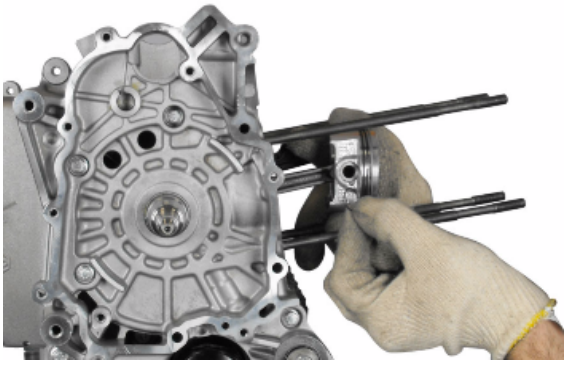
Piston rings

Removing the piston

- Fit the piston and pin onto the connecting rod, aligning the piston arrow towards the engine direction of rotation.

CAUTION

AT EVERY NEW MOUNTING USE RETAINER RING PINS.



Choosing the gasket

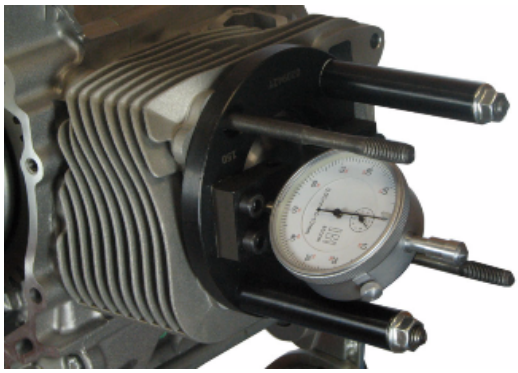
- Provisionally fit the piston into the cylinder, without any base gasket.
- Assemble a dial gauge on the specific tool.

Specific tooling

020942Y Piston protrusion check tool

- Using an abutment plane, reset the dial gauge with a pre-load of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the original head fixing nuts.
- Rotate the crankshaft up to the TDC (the inversion point of the dial gauge rotation).

- Measure the deviation from the reset value.



- By means of the table, see the Specifications chapter identify the cylinder base gasket thickness to be used for refitting. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.

See also

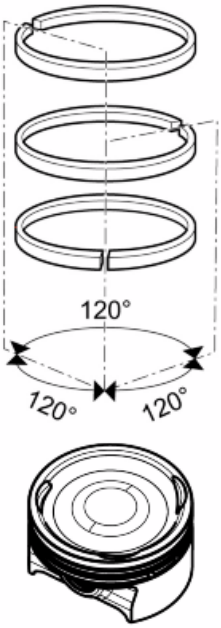
Slot packing system

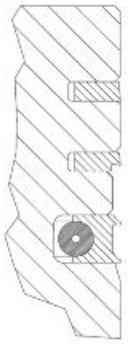
Refitting the piston rings

- Pistons (like cylinders) are supplied in 4 categories: A, B, C and D, and must be fitted so that the reference arrow faces the exhaust duct. The letter is found at the centre of the piston.
- Fit the sealing rings with the word TOP or the identification letter facing upwards. In any case, the step must be facing opposite the piston crown.
- Sealing rings are manufactured with a cylinder contact conical cross-section and piston gaps must be offset by 120° in order to obtain a better bedding.
- Lubricate rings with engine oil when fitting them.

CAUTION

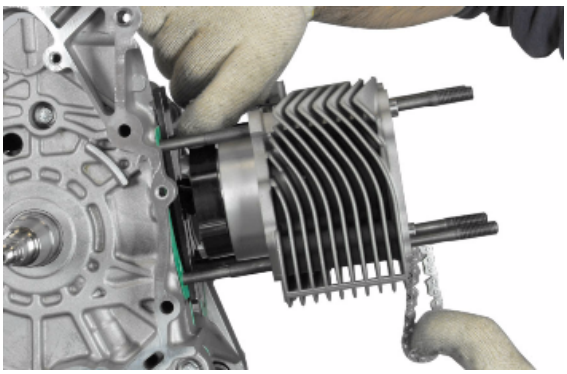
AT EVERY NEW MOUNTING USE RETAINER RING PINS.





Refitting the cylinder

- Insert the cylinder base gasket with the thickness determined above.
- Using the fork support and the piston ring retaining band, refit the cylinder as shown in the figure.



N.B.

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW OUT THE LUBRICATION DUCT AND OIL THE CYLINDER BARREL.

Specific tooling

020426Y Piston fitting fork

020427Y Piston assembly band

Recommended products

Engine oil 5W -40 Synthetic-based lubricant for four-stroke engines.

SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

Inspecting the cylinder head

N.B.

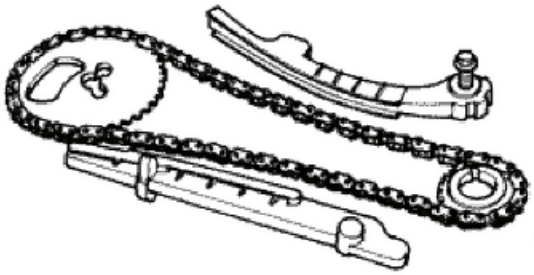
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

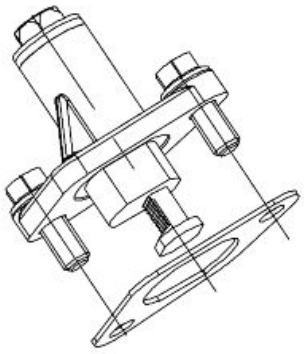
See also

Cylinder Head

Inspecting the timing system components

- Check that the guide slider and the tensioner slider are not worn out.
- Ensure that the camshaft control pulley chain assembly and the sprocket wheel are not worn.
- If you detect wear, replace the parts or, if the chain, sprocket wheel and pulley are worn, replace the whole unit
- Remove the centre screw with the washer and the tensioner spring. Check that the one-way mechanism is not worn.
- Check the condition of the tensioner spring.
- If examples of wear are found, replace the whole unit.





Inspecting the valve sealings

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder Head

Inspecting the valves

N.B.

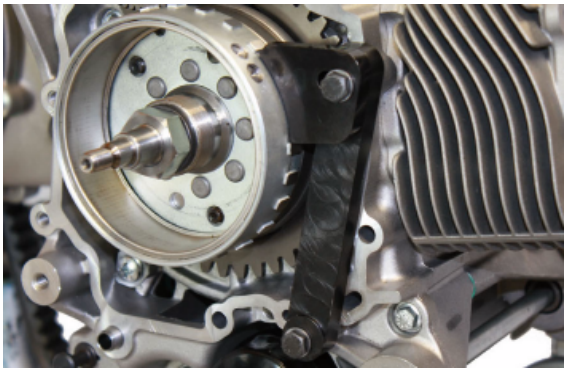
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

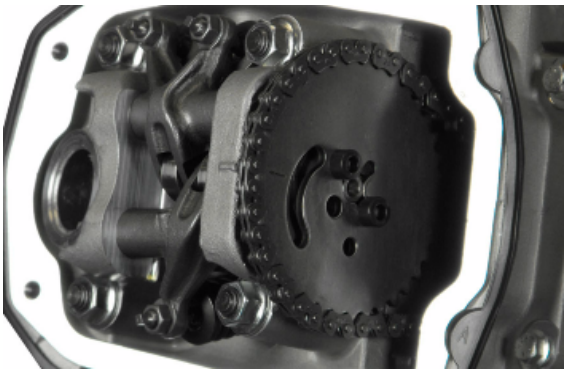
See also

Cylinder Head

VALVE CLEARANCE CHECK

- Remove the cover.
- Position the engine to the TDC in compression.

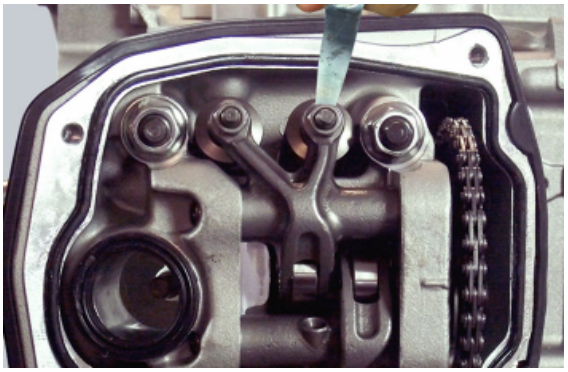




- Using a feeler gauge check the valve clearance.

CAUTION

- USE THE FEELER GAUGE LATERALLY, IN LINE WITH THE VALVES, IN ORDER TO PREVENT ACCIDENTAL BENDING OF THE BLADE THAT MAY AFFECT THE MEASUREMENTS.



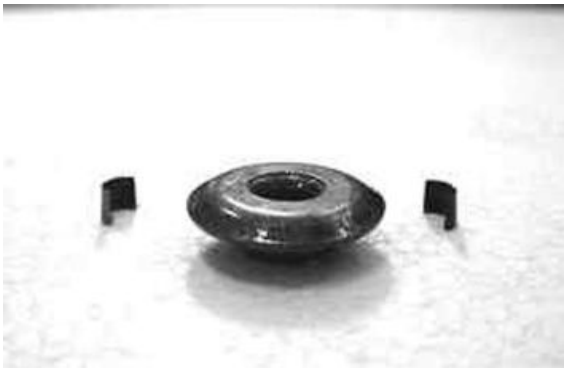
Characteristic

Valve clearance (cold engine)

intake: 0.08 mm outlet: 0.08 mm

Inspecting the springs and half-cones

- Check that the upper and lower supporting spring washers, the cotters and the oil seal show exhibit no signs of abnormal wear. Replace a component when worn.



N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

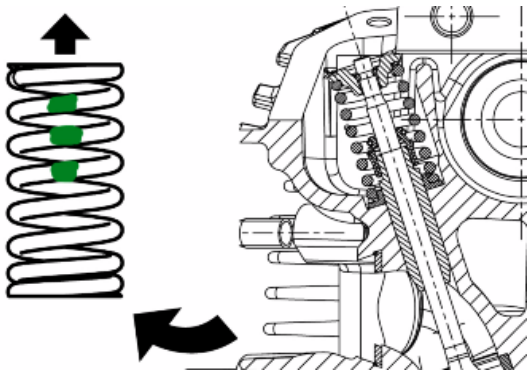
See also

Cylinder Head

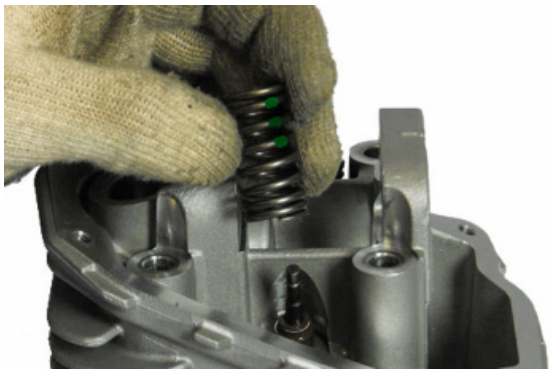
Refitting the valves

CAUTION

MOUNT THE VALVE SPRINGS WITH THE GREEN COL-OURED COIL FACING UPWARD.

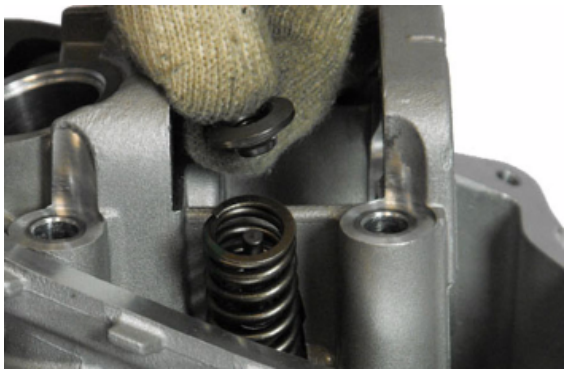


- Lubricate the valve guides with engine oil.
- Place the valve spring supports on the head.
- Using the special punch, fit the three valve seal rings alternately.
- Fit the valves, the springs and the caps. Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.



N.B.

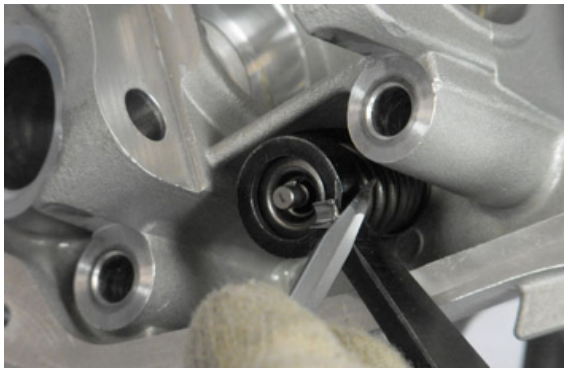
DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON COTTER SIDE (TURNS WITH GREATER PITCH).

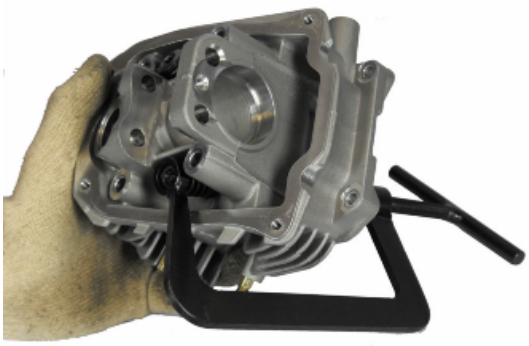


Specific tooling

020382Y Valve fitting/ removal tool

020431Y Valve oil seal extractor





Inspecting the cam shaft

N.B.

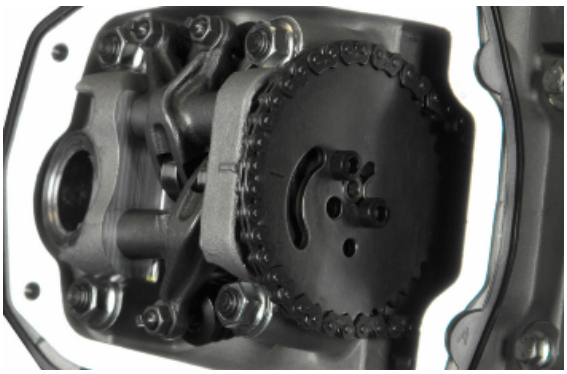
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

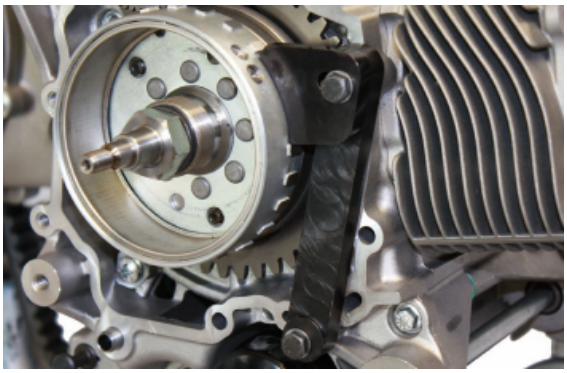
See also

Cylinder Head

Refitting the head and timing system components

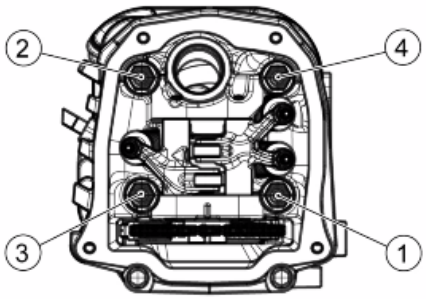
- Position the crankshaft to the TDC in compression.





- Insert the head gasket and check the correct operation of the alignment dowels.
- Insert the chain guide slider.
- Insert the head.
- Lubricate the stud bolt threads with engine oil.

- Tighten the nuts to an initial pre-torque of 9-11 Nm.
- Tighten up the nuts by rotating 270.0±5.0° with crossed sequence.
- Fit the two screws on the outside of the timing chain side and tighten them to the specified torque.



CAUTION

DO NOT PERFORM 270° IN ONE ROTATION. PERFORM WITH THREE GRADUAL ROTATIONS, OBSERVING THE SEQUENCE INDICATED ON THE STUD BOLTS.

N.B.

BEFORE INSTALLING THE HEAD, MAKE SURE THAT THE LUBRICATION CHANNEL IS CLEAN USING A COMPRESSED AIR JET.

CAUTION

ALWAYS USE A NEW HEAD GASKET UPON REFITTING.

Locking torques (N*m)

Cylinder head nut (TIGHTENING) **9 - 11 (Tighten to the prescribed torque and then proceed with 270.0°±5.0° rotation)** **Screws fixing cylinder to crankcase** **10.8 - 12.7**

Refitting the rocker-arms cover

- Remove the cylinder head cover and tighten the four clamping screws to the prescribed torque.
- Pay attention to the integrity of rubber gaskets, replace them if necessary.
- Make sure the gasket is positioned properly.

Locking torques (N*m)

Head cover screws **10.8 - 12.7**

Refitting the intake manifold

- Follow the disassembly process in reverse order to refit.

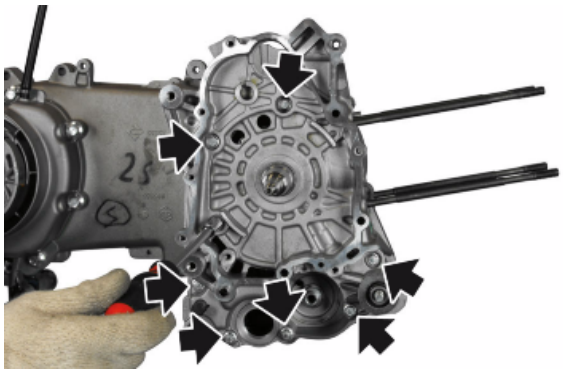
Locking torques (N*m)

Intake manifold fixing screws 10.8 - 12.8

Crankcase - crankshaft

Splitting the crankcase halves

- Undo the eight crankcase coupling screws.
- Separate the crankcase halves while keeping the crankshaft in one of these two halves.
- Only after the halves have been separated, can the crankshaft be checked.



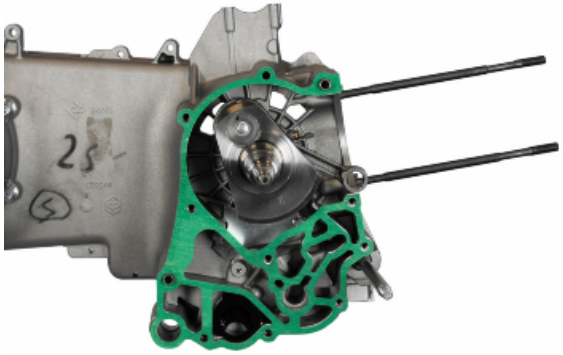
CAUTION

WHILE OPENING THE CRANKCASES AND REMOVING THE CRANKSHAFT, CHECK THAT THE THREADED SHAFT ENDS DO NOT INTERFERE WITH THE MAIN BUSHINGS. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BUSHINGS.

CAUTION

KEEP THE CRANKSHAFT IN ONE OF THE TWO HALVES OF THE CRANKCASE WHEN SEPARATING IT. IF YOU FAIL TO DO THIS, THE CRANKSHAFT MIGHT ACCIDENTALLY FALL.

- Remove the gasket and be careful with the alignment dowels.



Inspecting the crankshaft components

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankshaft alignment

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankcase halves

- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- On the transmission-side crankcase half, take particular care when handling the oil pump compartment and the oil ducts, the by-pass duct, the main bushings and the cooling jet on the transmission side.
- Take particular care, also, that there are no signs wear in the oil by-pass valve housing (see Chapter Lubrication), as this could prevent a good seal in the piston, which regulates the oil pressure.
- On the flywheel side crankcase half, take particular care cleaning the oil ducts for the main bushings, the oil duct for the jet that lubricates the cylinder head and the oil drainage duct at the flywheel side oil seal.
- Inspect the coupling surfaces on the crankcase halves for scratches or deformation, taking particular care with the cylinder/crankcase surfaces and the crankcase halves surfaces.
- Defects in the crankcase coupling gasket between the crankcase halves or the mating surfaces shown in the diagram, could cause a drop in the oil pressure lubricating the main bushings and connecting rod.
- Check the main bearing seats that limit axial clearance in the crankshaft show no signs of wear. The dimension between these seats is measured by way of the procedure described previously for measuring the crankshaft axial clearance and dimensions.

N.B.

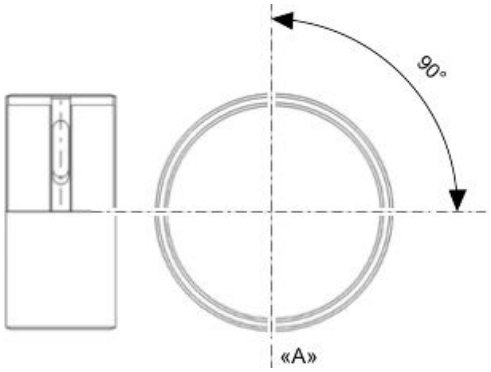
THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES PISTON CROWN COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAKS CAN CAUSE A CONSIDERABLE DROP IN THE LUBRICATION PRESSURE FOR MAIN BUSHINGS AND CONNECTING ROD.

N.B.

THE HEAD LUBRICATION CHANNEL IS PROVIDED WITH A SHUTTER JET;: THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION; THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP. THE JET CLOGGING IMPAIRS THE HEAD LUBRICATION AND THE TIMING MECHANISMS. A JET FAILURE CAUSES A DECREASE OF THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.

Inspecting the crankshaft plain bearings

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure (3.2 bar) and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.



Characteristic

«A»

AXIS CYLINDER

- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Coupling chart

N.B.

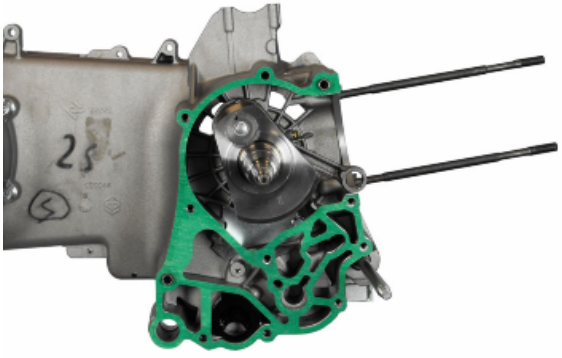
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Refitting the crankcase halves

- Follow the removal steps but in reverse order; be careful to respect the prescribed tightening torques.
- Insert the by-pass.
- Insert a new gasket and be careful with the alignment dowels.
- Maintaining the crankshaft inserted in the flywheel side crankcase, couple the crankcase halves.
- Insert the screws and tighten to specified torque.



CAUTION

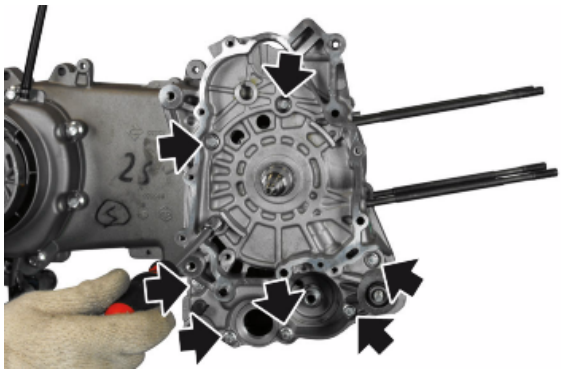
CAREFULLY CHECK THE CLEANING OF THE BY-PASS DUCT.
CHECK THAT THE PISTON SLIDES BY HAND, FREELY AND WITHOUT STICKING.

CAUTION

IT IS ADVISABLE TO INSERT THE CRANKSHAFT IN THE FLYWHEEL SIDE CRANKCASE HALF TO PREVENT, WITH ACCIDENTAL MOVEMENTS DURING INSERTION, THE OIL PUMP CONTROL TOOTHING FROM DAMAGING THE BUSHINGS.

Locking torques (N*m)

Engine-crankcase coupling screws 11 ÷ 13



- Complete the coupling operations with the verification of the crankshaft axial clearance.
- Using specific tools to support the dial gauge, verify that the fitting clearance is within the limits.
- Higher clearances are signs of wear of the crankshaft - crankcase supporting surfaces.

Characteristic

Crankshaft-crankcase axial clearance

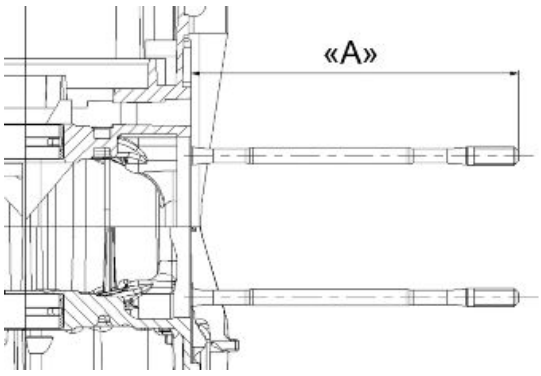
0.2 - 0.5 mm

Studs

- Using two nuts, fitted as nut and lock nut type, remove and then drive from the seat.
- Proceed with a thorough cleaning of the threaded seat on the crankcase.
- Screw the new stud bolts up to the driving depth indicated.

N.B.

NEW STUD BOLTS DO NOT NEED THREADLOCK, AS THEY COME EQUIPPED WITH SCOTCH-GRIP.



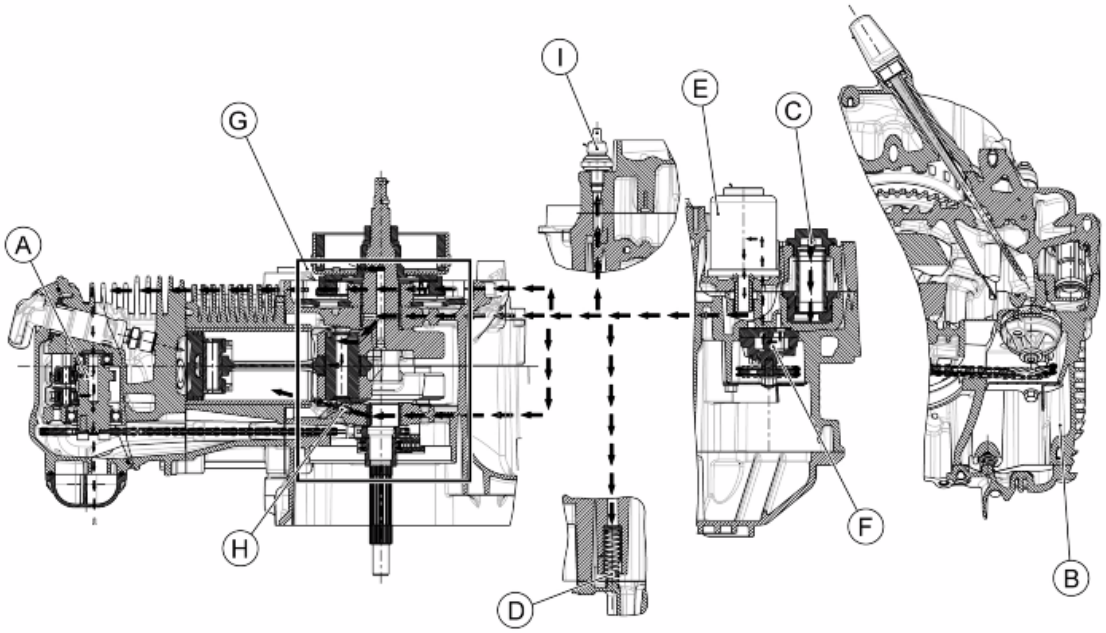
Characteristic

Driving depth of stud bolts «A»

170 mm+ 0.5

Lubrication

Conceptual diagrams



The lobe pump «**F**» sucks the oil from the sump, through the mesh pre-filter «**C**», it pushes it into the cartridge filter «**E**» where there is also a safety valve «**D**».
Through the suitable passages found in the crankcases, the oil enters the crank chamber «**G**» where the main bearings are lubricated and the big end (with high pressure), the piston pin and connecting rod small end via spray «**H**».
Subsequently the oil arrives at the timing system where it lubricates the camshaft «**A**» and from this, valves and rockers. The oil passes through the timing chain duct and returns to the sump «**B**» by gravity.
In the system there is a minimal oil pressure sensor «**I**» and a spray that serves to lubricate the stator «**L**».

Oil pressure check

- After removing the flywheel cover as described in the "Flywheel" chapter, remove the electric connexion of the minimum oil pressure switch and then remove the switch.
- With the engine idling at 1,750 rpm and the oil temperature at ~90°C, check that the oil pressure is between 0.5 - 1.2 atm.
- With the engine idling at 5,000 rpm and the oil temperature at ~90°C, check that the oil pressure is between 3.2 - 4.2 atm.
- Remove the appropriate tools once the measurement is complete, refit the oil pressure switch and washer, tightening it to the specified torque and fit the flywheel cover.
- If the oil pressure is not within the specified limits, in the following order, check: the oil filter, the oil by-pass valve, the oil pump and the crankshaft seals.

N.B.

THE CHECK MUST BE CARRIED OUT WITH OIL AT THE CORRECT LEVEL AND WITH AN OIL FILTER IN PROPER CONDITION.

Characteristic

Oil pressure

Operating pressure

- At 1,750 rpm: (0.5 - 1.2)bar
- At 5,000 rpm: (3.2 - 4.2)bar

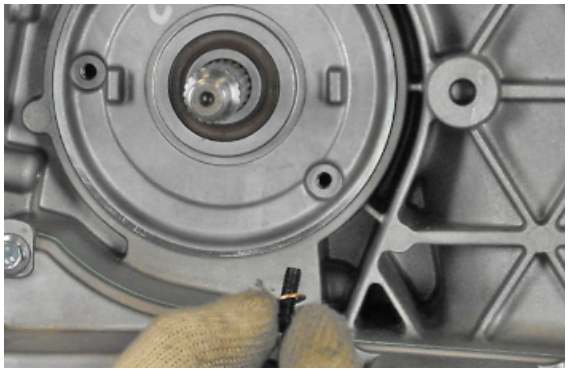
Locking torques (N*m)

Minimum oil pressure sensor **12 - 14**

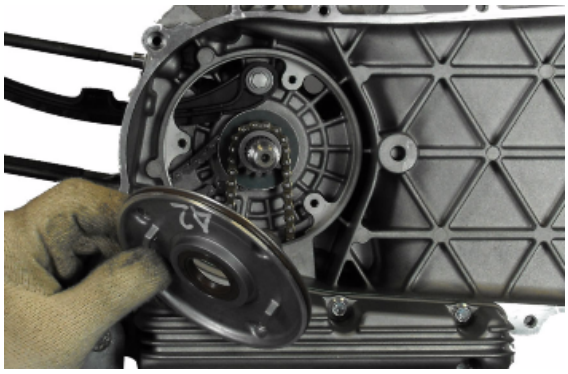
Crankshaft oil seals

Removal

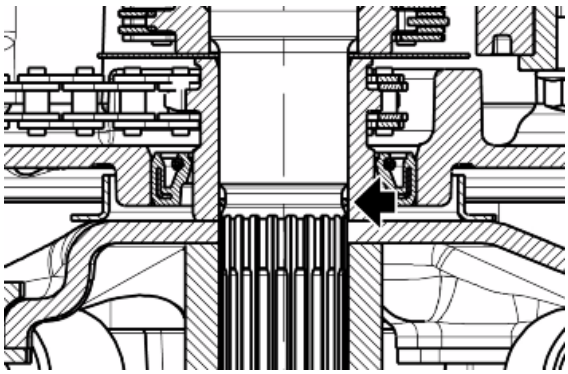
- Unscrew the three screws and remove them, complete with the copper gaskets.



- Using pliers remove the door by acting on the appendices.



- Remove the spacer and the O-ring.



Refitting

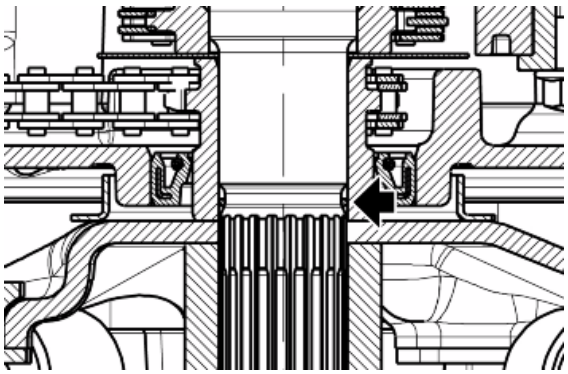
- Insert the components making sure to thoroughly grease the O-ring and the oil seal.
- Follow the steps in reverse order taking care to tighten to torque.

WARNING

IN ORDER TO PREVENT ABNORMAL FORMATIONS OF DIRT DUE TO THE RELEASE OF GREASE, WE RECOMMEND FIRST LUBRICATING THE SEAL RING STOPS WITH A BRUSH.

Locking torques (N*m)

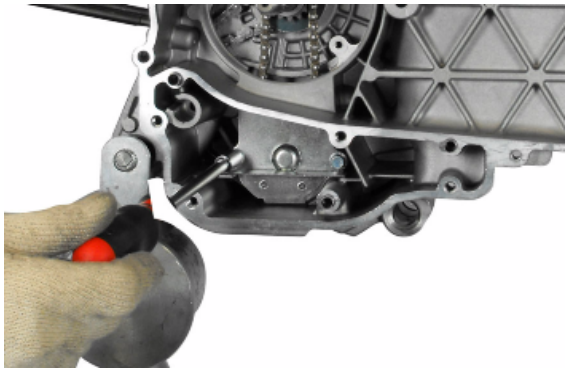
Crankcase timing cover screws 3.5 ÷ 4.5

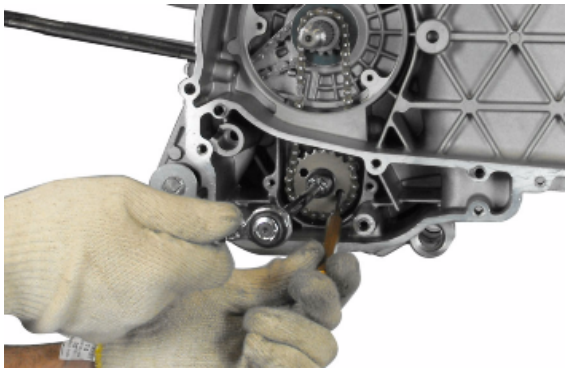


Oil pump

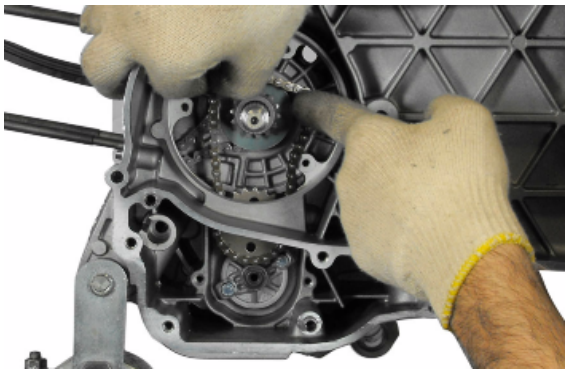
Removal

- Remove the oil sump and the by-pass.
- Remove the oil shield.
- Preventing rotation, unscrew the water pump command screw and collect the washer.

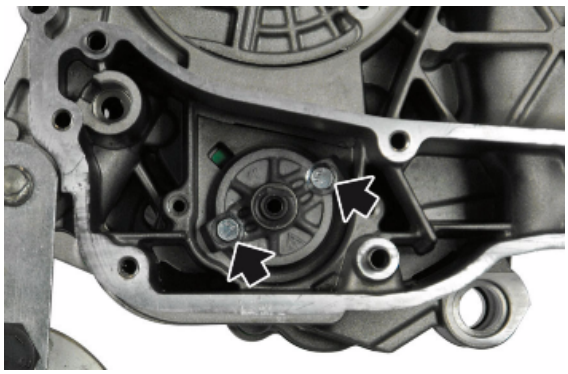




- Remove the oil pump command sprocket complete with chain.



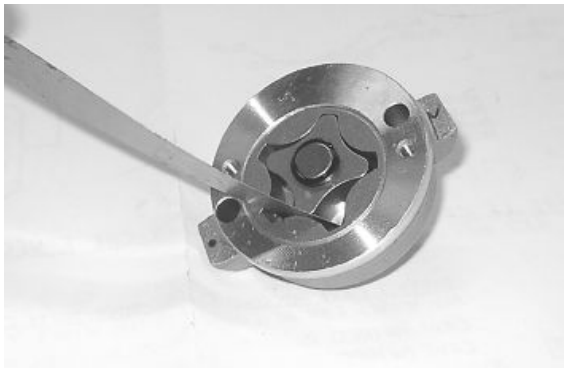
- Unscrew the two screws and remove the oil pump.

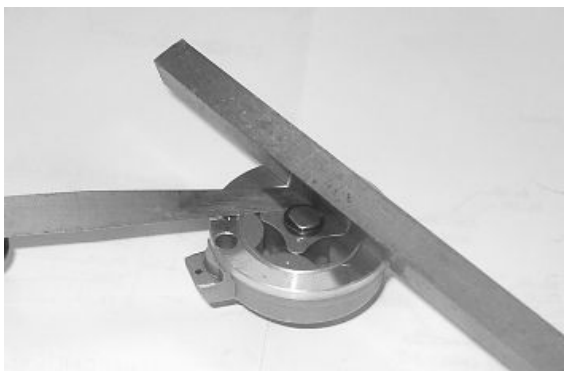


Inspection

- Remove the two screws and remove the oil pump cover.
- Remove and wash the rotors thoroughly with petrol and compressed air.
- Reassemble the rotors in the pump body, keeping the two reference marks visible.
- Using a feeler gauge, check the distance between the rotors in the position shown in the figure.
- Check the distance between the outer rotor and pump body, see figure.

Check the axial clearance of the rotors using a trued bar as shown in the figure.





Characteristic

Axial rotor clearance

Limit value admitted: 0.09 mm

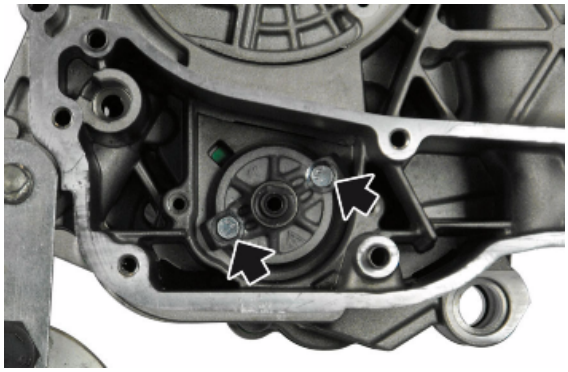
Distance between the outer rotor and the pump body

Admissible limit clearance: 0.20 mm

Distance between the rotors

Admissible limit clearance: 0.12 mm

Refitting



- Follow the steps in reverse order to the removal, tightening the screws to the specified torque.
- Insert the oil pump.
- Insert the control sprocket and the chain.

N.B.

FIT THE BELLEVILLE WASHER SO THAT ITS OUTER RIM TOUCHES THE PULLEY. MAKE SURE THAT THE PUMP TURNS FREELY.

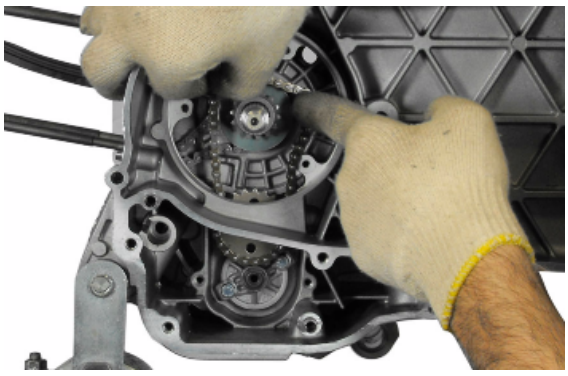
Recommended products

Loctite 243 Medium strength thread-locking sealant.

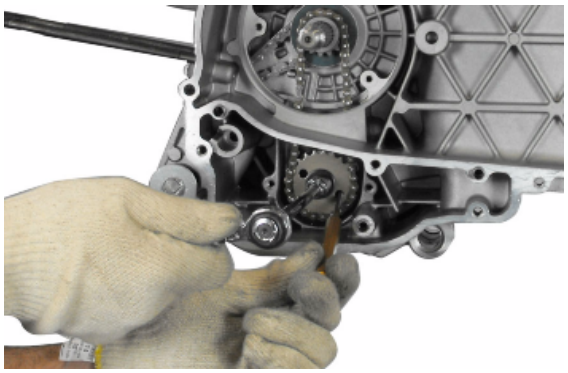
Blue

Locking torques (N*m)

Screws fixing oil pump to the crankcase 5 ÷ 6

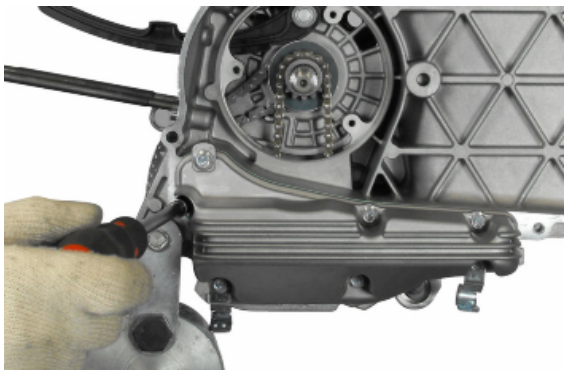


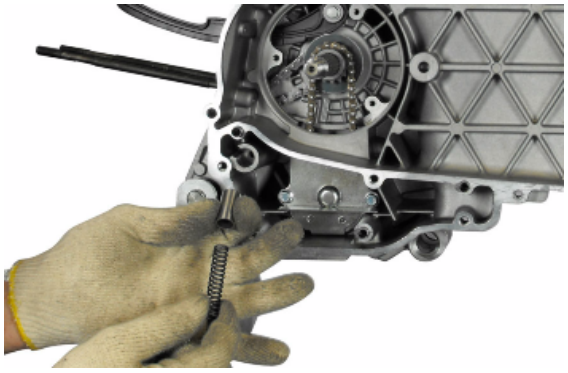
- Preventing rotation, tighten the water pump command screw complete with washer.



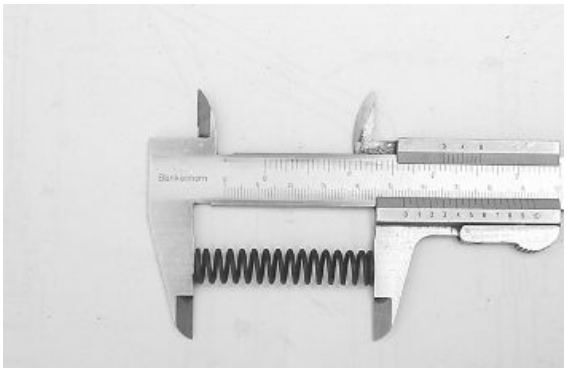
Removing the oil sump

- Remove the oil filler plug, the transmission cover, the complete drive pulley assembly with belt and the sprocket wheel, as described in the Transmission chapter.
- Drain the oil as described above.
- Remove the seven screws indicated in the figure with the two rear brake transmission retainer brackets.
- Remove the washers, the spring and the by-pass piston.





Inspecting the by-pass valve



- Check the unloaded spring length.
- Check that the small piston is not scored.
- Ensure that it slides freely on the crankcase and that it guarantees a good seal.
- If not, eliminate any impurities or replace defective parts.

Characteristic

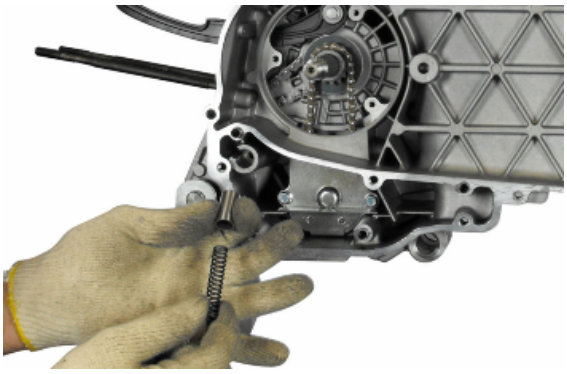
Standard length

52.4 mm

Piston standard diameter

12.861 + 12.843 mm

Refitting the oil sump



- Refit the by-pass piston in its housing.
- Insert the pressure-regulating spring.
- Fit a new sump seal.
- Refit the sump, taking care to locate the spring in the appropriate recess machined into the inside of the sump.
- Refit the rear brake transmission mounting brackets and the screws in the reverse order from which they were removed.
- Tighten the screws to the prescribed torque.
- Refit the driving pulley assembly, the drive belt, the sprocket wheel and the transmission cover, as described in the "Transmission" chapter.
- **When testing the lubrication system, refer to the "Crankcase and Crankshaft" chapter, regarding lubrication of the connecting rod assembly**

Locking torques (N*m)

Tightening torque **11 to 13**

INDEX OF TOPICS

Injection system

This vehicle is fitted with an integrated injection and ignition system.

Injection is indirect in the manifold through an electro-injector.

The injection and ignition are timed on the four-stroke cycle by means of a tone wheel keyed on to the crankshaft (24-2 teeth) and pick-up sensor.

Mixture and ignition are managed on the basis of engine revs and throttle valve opening. Further corrections are made according to the following parameters:

- Engine temperature
- Intake air temperature
- Lambda probe

The system implements cold engine idle fuel/air mixture correction with an adjustment device on a by-pass circuit of the throttle valve. The control unit manages the Stepper motor and the injector opening time, thereby ensuring the idle steadiness and the proper mixture.

In all conditions of use, mixture preparation is managed by modifying the injector opening time.

The fuel system pressure is kept constant in relation to ambient pressure.

The **fuel system circuit** consists of:

- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

The pump, the filter and the regulator are placed inside the fuel tank on a single support.

The injector is connected by a pipe with fast-release fittings. The pressure regulator is located at the beginning of the circuit.

The petrol pump is controlled by the injection control unit; this ensures safety of the vehicle.

The **ignition circuit** consists of:

- H.V. coil
- H.V. cable.
- Shielded cap
- Injection ECU
- Spark plug

The injection control unit manages ignition with the best advance ensuring four-stroke timing (ignition only in the compression phase) at the same time.

The injection/ignition system manages the engine function according to a pre-set program.

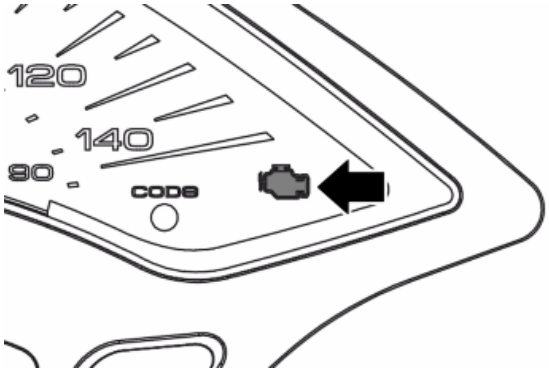
Should any input signals fail, an acceptable working order of the engine is ensured to allow the user to reach a service station.

Of course, this cannot happen when the rpm-timing signal is missing, or when the failure involves the control circuits:

- Fuel pump

- H.V. coil
- Injector

The control unit is fitted with a self-diagnosis system connected to a warning light on the instrument panel.

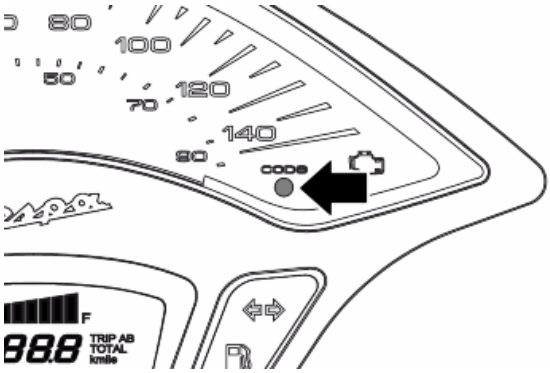


Failures are detected and restored by the diagnostic tester.
In any case, when the fault is no longer present, data storage is automatically wiped clean after 16 cycles of use (cold starting, running at regular engine temperature, stop).
The diagnostic tester is also required to adjust the idle mixture.

Specific tooling

020922Y Diagnosis Tool

The injection control unit has a decoder for the anti-theft immobilizer system.
The injection control unit is connected to a diagnostic LED on the instrument panel that also carries out the deterrent flashing functions.



Precautions

Troubleshooting tips

1 An injection system failure is more likely to be due to the connections than to the components.
Before troubleshooting the injection system, carry out the following checks:
A: Power supply
a. Battery voltage
b. Blown fuse
c. Relays
d. Connectors
B: Frame ground connection
C: Fuel system
a. Faulty fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty spark plug

b. Faulty coil

c. Faulty shielded cap

E: Intake circuit

a. Air filter dirty

b. b. Dirty by-pass circuit

c. Idle speed adjustment device

F: Others

a. Wrong timing system

b. Wrong idle mixture

c. Incorrect reset of the throttle valve position sensor

2 Injection system failure may be caused by loose connectors. Make sure that all connections have been correctly made.

Check the connectors taking into consideration the following point:

A check that the terminals are not bent.

B check that the connectors have been properly connected.

C - Check whether the malfunction can be fixed by shaking the connector slightly.

3 Check the entire system before replacing the injection control unit. If the fault is fixed even by replacing the control unit, install the original control unit again and check if the fault occurs again.

4 For troubleshooting, use a multimeter with an internal resistance of more than 10 KW/V. Improper instruments may damage the injection control unit. The instruments to be preferred have a definition over 0.1V and 0.5W and an accuracy over 2%.

1. Before repairing any part of the injection system, check if any faults have been stored. Do not disconnect the battery before checking for faults.

2. The supply system is pressurised at 250 kPa (2.5 BAR). Before disconnecting the fast-release fitting of the fuel supply pipe, check that there are no naked flames. Do not smoke. Act with caution to avoid spraying fuel to your eyes.

3. When repairing electric components, the battery must always be disconnected unless it is strictly necessary for the battery to be connected.

4. When functional checks are performed, make sure that the battery voltage exceeds 12V.

5. Before attempting to start the vehicle, ensure that there are at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.

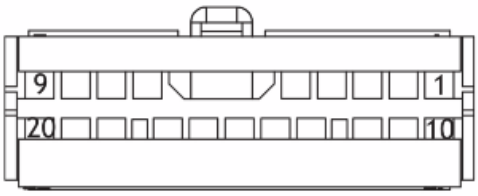
6. If a long period is envisaged with the vehicle not in use, fill the tank to at least the halfway mark. This will ensure the pump will be covered by fuel.

7. When washing the vehicle, do not spray excessive water on electric components and wiring harnesses.

8. In the event of ignition problems, begin troubleshooting from the battery and the injection system connections.
9. Before disconnecting the connector of the injection control unit, perform the following steps in the order shown:
- Set the switch to «OFF»
- Disconnect the battery
Failure to respect this norm may damage the control unit.
10. Do not invert the poles when fitting the battery.
11. To avoid causing any damage, disconnect and reconnect the injection system connectors only if required. Before reconnecting, check that the connectors are dry.
12. When carrying out electric inspections, do not force the tester probes into the connectors. Do not take measurements not specifically foreseen by the manual.
13. At the end of every check performed with the diagnostic tester, remember to protect the system connector with its cap. Failure to observe this precaution may damage the injection control unit.
14. Before reconnecting the quick couplers of the power supply system, check that the terminals are perfectly clean.

Terminals setup

INJECTION ECU



1. Ve - fuel pump
2. MaBi - injection warning light
3. AzRs -lambda probe heater
4. Gi - immobilizer LED
5. RsBi - + battery
6. RsGi - injector ground
7. GrVe - sensor ground
8. RoNe - + H.V. coil
9. NeVe - + loads
10. ArNe - K Line
11. VeGi - ignition activation / VeBi - canister valve (if applicable)
12. Rs - pickup +
13. VeBL - Lambda +
14. ArBi - TPS sensor
15. Ar - side stand switch
16. AzVe - engine temperature sensor
17. BiNe - idle regulator valve

18. RsNe - +5V sensors

19. Ne - ground

20. RsBL - + key-on power

Troubleshooting procedure

Engine does not start

ENGINE DOES NOT START EVEN IF PULLED

Possible Cause	Operation
Immobilizer enabling signal	System not encoded System not efficient, repair according to the indications of the self-diagnosis
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor
Fuel system	Fuel in the tank Fuel pump activation Fuel pressure (low) Injector flow (low)
Power to spark plug	Shielded spark plug cap H.V. coil (secondary insulation)
Parameter reliability	Engine temperature Distribution timing adjustment - injection start Intake air temperature
End of compression pressure	End of compression pressure

Starting difficulties

ENGINE STARTER PROBLEMS

Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature
Starter speed	Starter motor and relay Battery Ground connections
End of compression pressure	End of compression pressure
Power to spark plug	Spark plug Shielded cap H.V. coil. Engine speed timing sensor Ignition advance
Fuel system	Fuel pressure (low) Injector flow (low) Injector sealing (poor)
Correctness of the parameters	Engine temperature Intake air temperature idle speed adjustment device opening times Cleaning the throttle valve, air filter efficiency

Engine stops at idle

ENGINE DOES NOT IDLE/ IDLING IS UNSTABLE/ IDLING TOO LOW

Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature
Ignition efficiency	Spark plug Ignition timing
Correctness of the parameters	Throttle valve position sensor Idle speed adjustment device Engine temperature sensor Intake air temperature sensor
Intake system cleaning	Air filter Diffuser and throttle valve Idle speed adjustment device
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Air cleaner joint Filter housing
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow

Engine does not rev down

ENGINE DOES NOT RETURN TO IDLING SPEED/IDLING SPEED TOO HIGH

Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature
Ignition efficiency	Ignition timing
Correctness of the parameters	Throttle valve position sensor Idle speed adjustment device Engine temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Air cleaner joint Filter housing
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow

Exhaust backfires in deceleration

EXHAUST BACKFIRING WHEN DECELERATING

Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature

Possible Cause	Operation
	Engine temperature Lambda probe
Correctness of the parameters	Throttle valve position sensor Idle speed adjustment device Engine temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Air cleaner joint Filter housing
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow
Exhaust system sealing (infiltrations)	Manifold - head Manifold - silencer silencer welding

Engine revs irregularly

ENGINE IRREGULAR PERFORMANCE WITH VALVE SLIGHTLY OPEN

Possible Cause	Operation
Intake system cleaning	Air filter Diffuser and throttle valve Idle speed adjustment device
Intake system sealing	Air cleaner joint Filter housing
Correctness of the parameters	Throttle valve position sensor Idle speed adjustment device Engine temperature sensor Intake air temperature sensor
Ignition system	Spark plug wear check
TPS reset successful	TPS reset successful
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature Lambda probe

Poor performance at full throttle

POOR ENGINE PERFORMANCE AT FULL POWER/ ENGINE IRREGULAR PERFORMANCE ON PICK-UP

Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature Lambda probe
Power to spark plug	Spark plug Shielded cap H.V. cable H.V. coil
Intake system	Air filter Filter box (sealing) Air cleaner joint (sealing)
Parameter reliability	Throttle valve position signal Engine temperature signal

Possible Cause	Operation
	Intake air temperature signal Ignition advance
Fuel system	Fuel level in the tank Fuel pressure Fuel filter Injector flow

Engine knocking

PRESENCE OF KNOCKING (COMBUSTION SHOCKS)

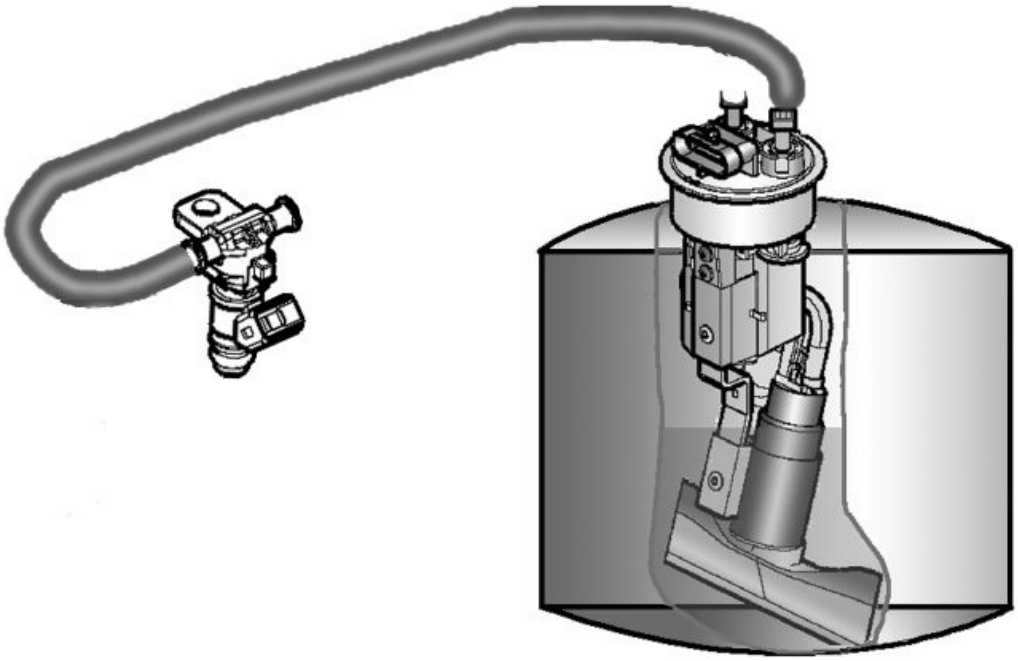
Possible Cause	Operation
Faults detected by self-diagnosis	Pump relay H.V. coil. Injector Engine speed timing sensor Air temperature Engine temperature Lambda probe
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal Engine temperature signal Intake air temperature signal Ignition advance
Intake system sealing	Air cleaner joint Filter housing
TPS reset successful	TPS reset successful
Fuel system	Fuel pressure Fuel filter Injector flow Fuel quality
Selection of the cylinder base gasket thickness	Selection of the cylinder base gasket thickness

Fuel supply system

The fuel system circuit includes the electric pump, the filter, the pressure regulator, the electro-injector and the fuel delivery pipes.

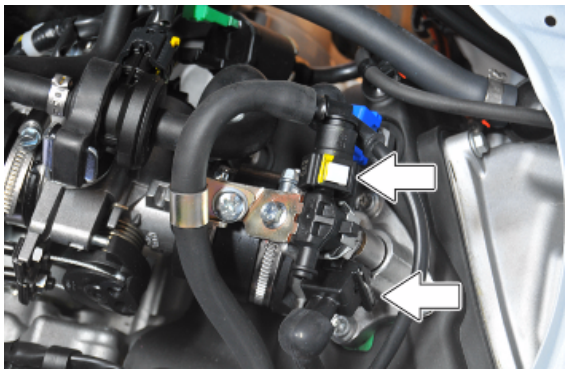
The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.



Removing the injector

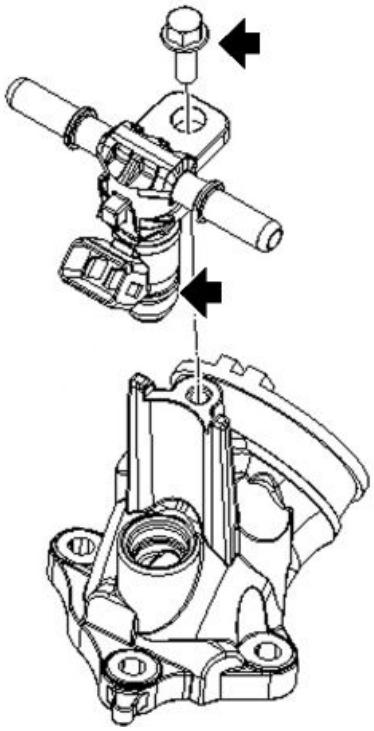
- Remove the helmet compartment.
- Disconnect the connector form the injector.
- Disconnect the quick release of the petrol delivery pipes.



- Undo the fixing screws and slide the injector from the manifold being careful not to damage the sealing OR gasket.

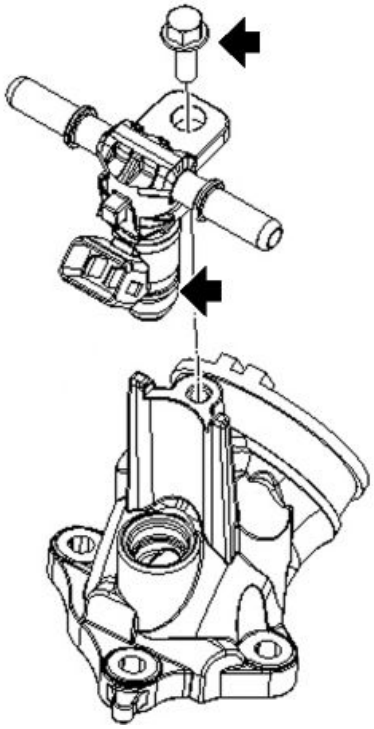
CAUTION

DO NOT DISASSEMBLE THE INJECTOR COMPONENTS.



Refitting the injector

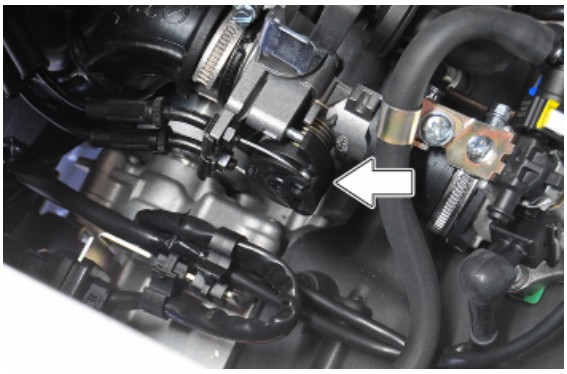
For refitting, perform the removal operations in reverse order and lubricate the sealing OR gasket with grease for internal application before fitting the injector on the manifold.



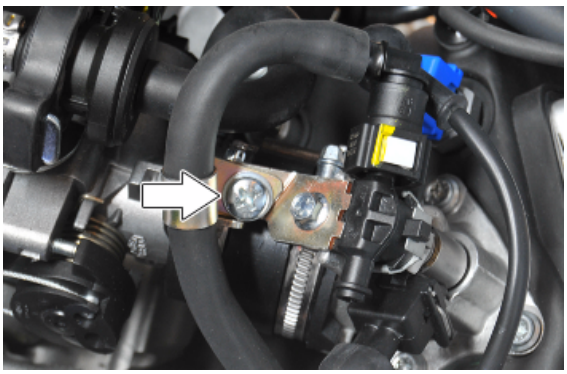
- The injector on this vehicle is a twin head injector with angle different to 90°, an incorrect positioning of the injector in the throttle body can cause serious malfunction; it must be observed that the pin of the spring is placed inside the recess in the injector body as shown in figure.

Removing the butterfly valve

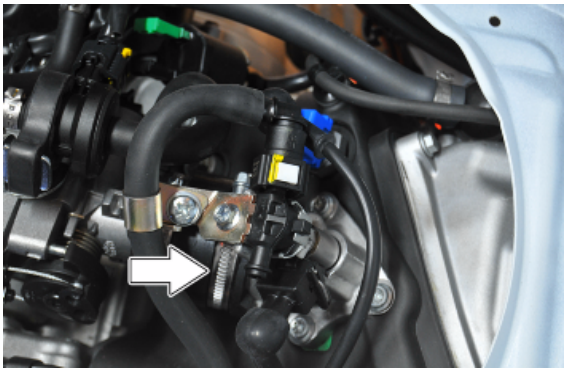
- Remove the throttle grip cables.



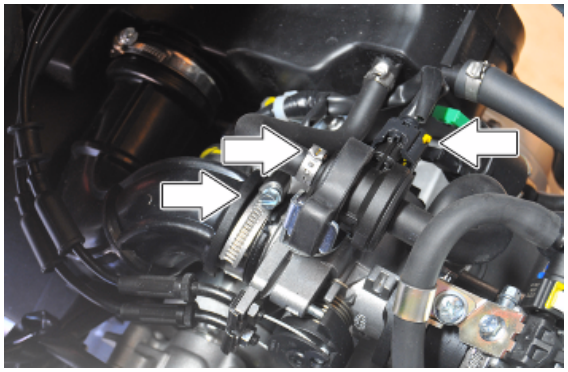
- Remove the indicated screw.



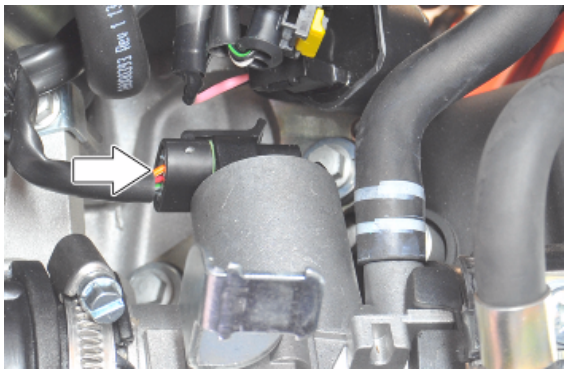
Remove the clamp indicated in the photograph.



- Remove the connector of the idling adjustment device.
- Remove the clamps indicated in the figure.



- Disconnect the throttle position sensor connector.



Refitting the butterfly valve

- To refit, follow the operations, but in reverse order, every time the throttle position sensor is disconnected it is necessary to calibrate the self-adjusting parameters.

Do not tamper with the stop screw under the throttle body.

CAUTION

DO NOT TAMPER WITH THE STOP SCREWS UNDER THE THROTTLE BODY, AS THE IDLE SPEED IS ADJUSTED IN THE FACTORY.

Circuit leak test

Install the specific tool for checking the fuel pressure, with the pipe fitted with the gauge.

Check during regular operation by placing the appropriate tool between the pump and the injector. With the battery voltage > 12 V check that the fuel pressure is 2.5 BAR and that the input current is 1.4 - 1.8 A.

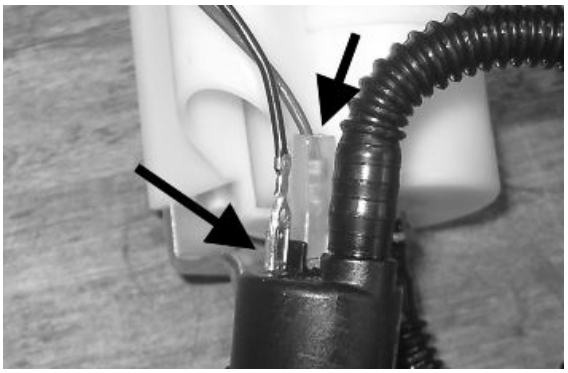
With the battery voltage > 12 V, check the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool. Make a graded burette available with a flow rate of approximately 1 L. Rotate the pump using the active diagnosis of the palm top computer. Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 2.5 bar. Check that within 15 seconds the pump has a flow rate of approx. 110 cm^3.

Specific tooling

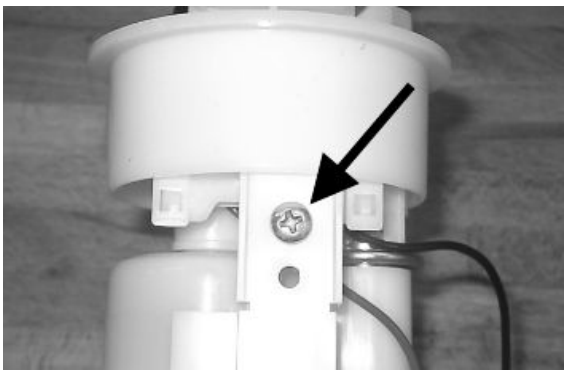
020480Y Fuel pressure measurement kit

Fuel filter check

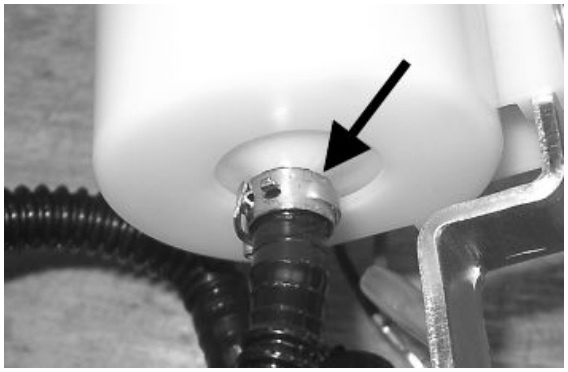
After removing from the tank, disconnect the electric pump terminals.



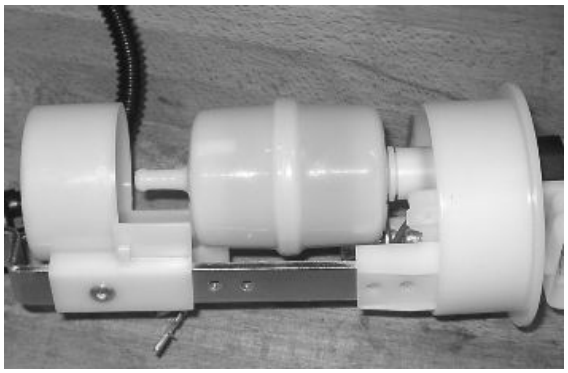
Remove the screw shown in the picture



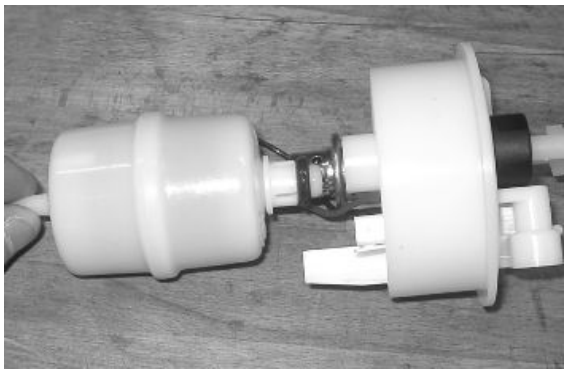
Remove the clamp fixing the piping to the filter shown in the photograph



Separate the lower part of the pump mounting as shown in the picture.



Remove the filter from the pump mounting

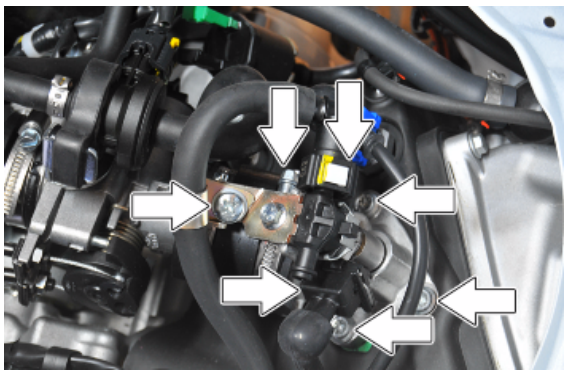


Inspecting the injector hydraulics

To carry out the injector check, remove the intake manifold by removing the three screws, with anti-tampering device, fixing the head and loosening the clamp connecting the throttle body to the manifold.

Disconnect the electrical connector.

Release the injector fuel delivery pipe from the bracket on the throttle body and from the clamp fixing it to the wiring.



Install the specific tool to check the fuel pressure and position the manifold on a graduated container of at least 100 cm³. Connect the injector with the cable that is part of the equipment for the injection tester. Connect the clamps of the cable to an auxiliary battery. Activate the fuel pump with the active diagnosis. Check that, within fifteen seconds, approximately 40 cm³ of fuel is dispensed with an adjustment pressure of approximately 2.5 BAR.

Specific tooling

020480Y Fuel pressure measurement kit

Proceed with the injector seal test.
Dry the injector outlet with a blast of compressed air. Activate the fuel pump. Wait for one minute, making sure there are no leaks coming from the injector. Slight oozing is normal.
Value limit = 1 drop per minute

Zeroing the throttle

Resetting the throttle valve position signal (T.P.S reset)

The throttle body is supplied with throttle valve position sensor and is pre-calibrated.

Pre-calibration entails regulating the minimum opening of the throttle valve to obtain a certain flow of air under pre-set reference conditions.

Pre-calibration ensures optimal air flow to control idling.

This regulation must not be tampered with in any way whatsoever.

The injection system will complete the management of the idling through the related device and the variation of the ignition advance.

The throttle body after the pre-calibration has an opened valve with an angle that can vary depending on the tolerances of the machining of the pipe and the valve itself.

The valve position sensor can also assume various fitting positions. For these reasons the mV of the sensor with the valve at idle can vary from one throttle body to another.

To obtain the optimum fuel mixture, especially at small openings of the throttle valve, it is essential to match the throttle body with the control unit following the procedure known as TPS resetting.
With this operation we inform the control unit, as the starting point, of the mV value corresponding to the pre-calibrated position.
To reset, proceed as follows.

Connect the diagnostic tester.

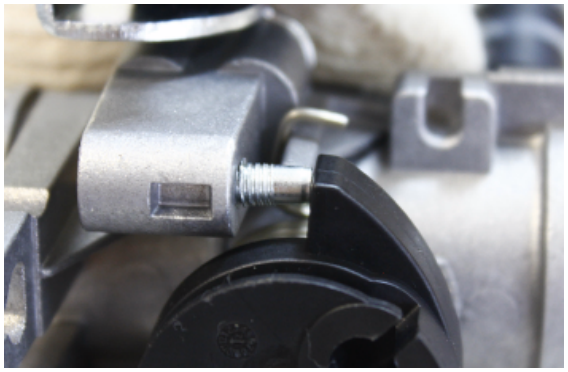
Switch to «**ON**».

Select the functions of the diagnostic tester on «**TPS RESET**».

Specific tooling

020922Y Diagnosis Tool

Make sure that the throttle valve with the control is supporting the stop screw.



With the throttle completely closed, check that the cables have clearance in all steering positions and confirm the position at the diagnostic tool.

Keep the throttle in a completely open position and confirm the position at the diagnostic tool.

CAUTION

DO NOT TAMPER WITH THE STOP SCREWS UNDER THE THROTTLE BODY, AS THE IDLE SPEED IS ADJUSTED IN THE FACTORY.

INDEX OF TOPICS

This section is dedicated to operations that can be carried out on the suspensions.

Front

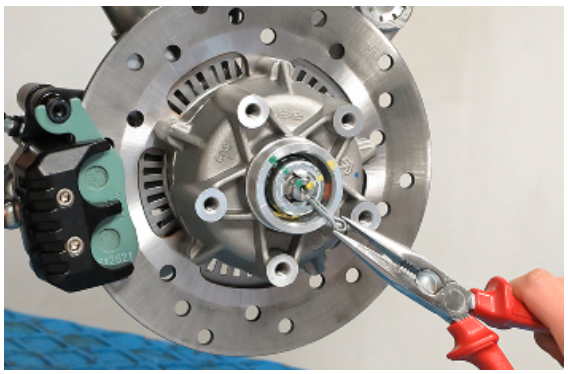
Removing the front wheel

- Support the vehicle adequately.
- Lift the front wheel
- Loosen the screws fixing the wheel to the hub.

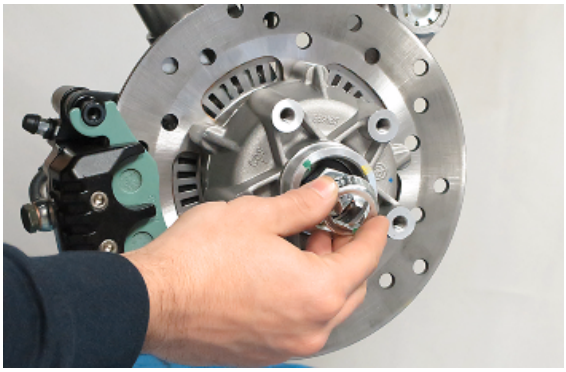
- Remove the front wheel pulling it to the right vehicle side.

Front wheel hub overhaul

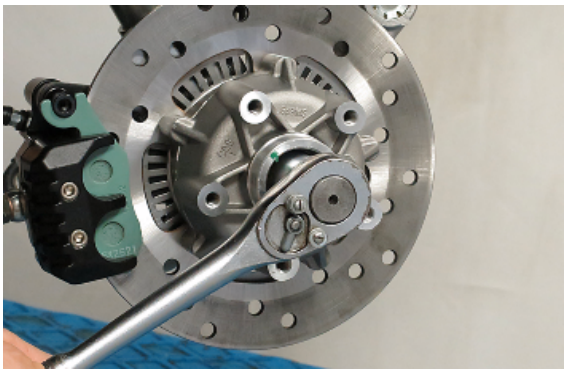
- Remove the wheel.
- Remove the cotter pin.



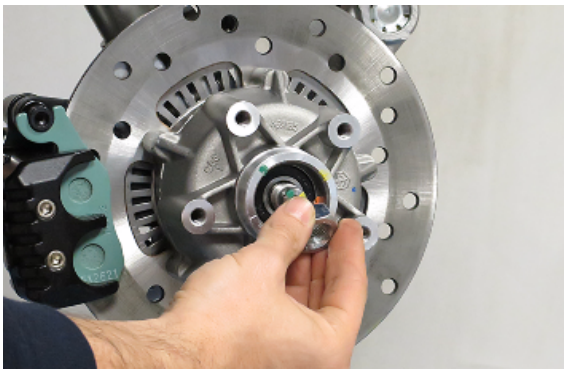
- Remove the cap.



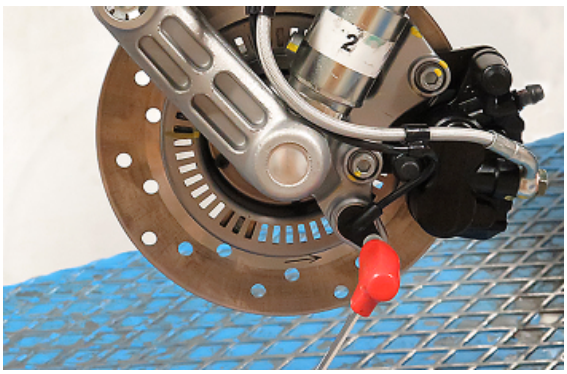
- Unscrew the fixing nut of the hub.



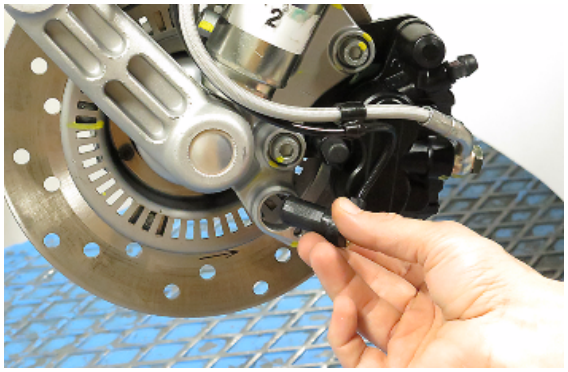
- Remove the nut.



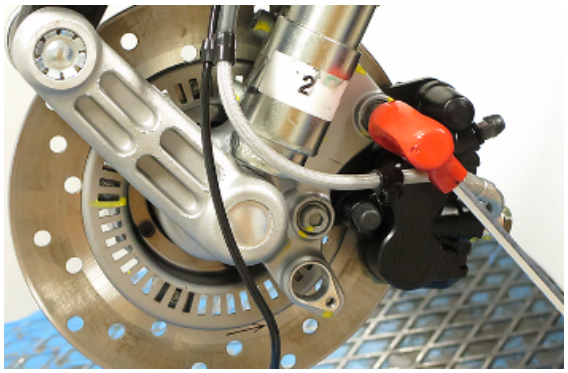
- Unscrew and remove the screw fastening the tone wheel sensor.



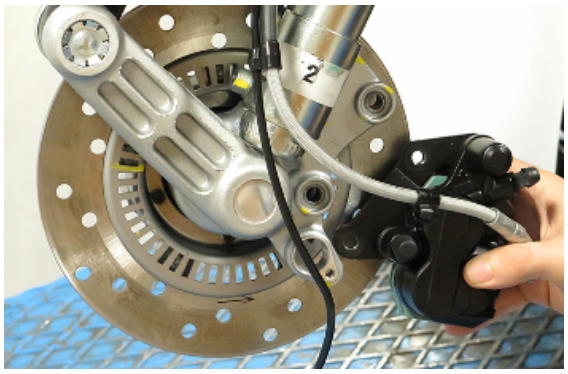
- Remove the tone wheel sensor.



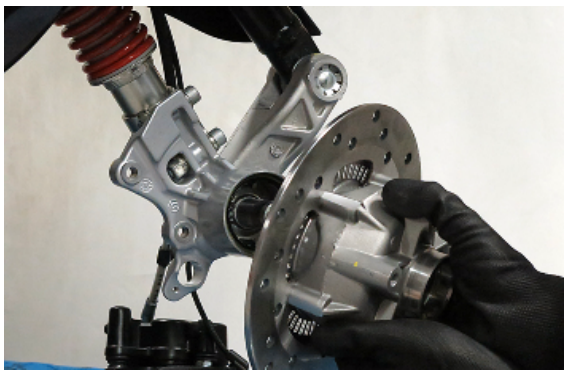
- Unscrew and remove the fixing screws of the brake calliper.



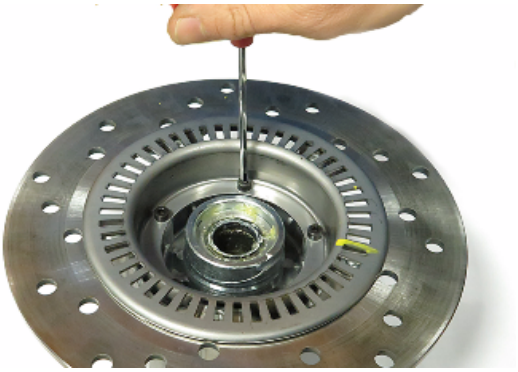
- Disconnect the brake calliper from the support bracket.



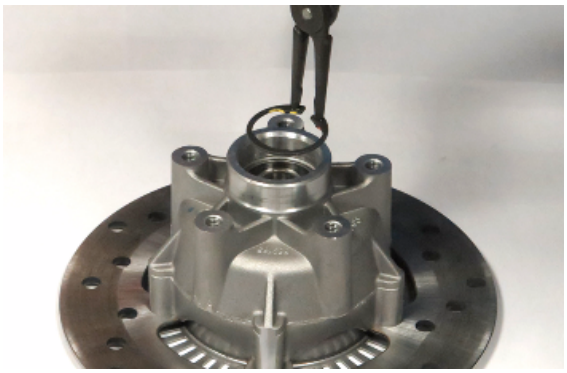
- Extract the wheel hub from the axle.



- Undo and remove the fixing screws of the tone wheel and remove it from the hub.



- Remove the ball bearing retention seeger ring.

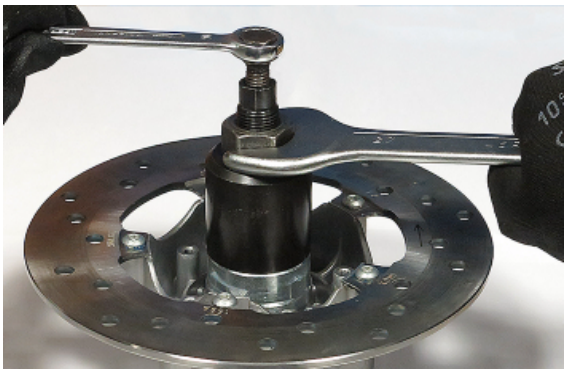


- Remove the roller bearing using the specific tool.

Specific tooling

001467Y006 Brake calliper Ø 17

001467Y017 Bell Ø 35

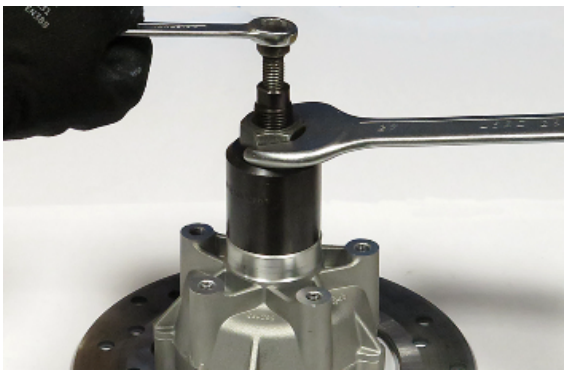


- Turn the hub.
- Remove the ball bearing using the specific tool.

Specific tooling

001467Y014 Calliper to extract ø 15-mm bearings

001467Y017 Bell Ø 35



- Heat the bearing seat with a heat gun.
- Use the specific tool to introduce and push the new ball bearing until it stops, with the shielded side facing out.

Specific tooling

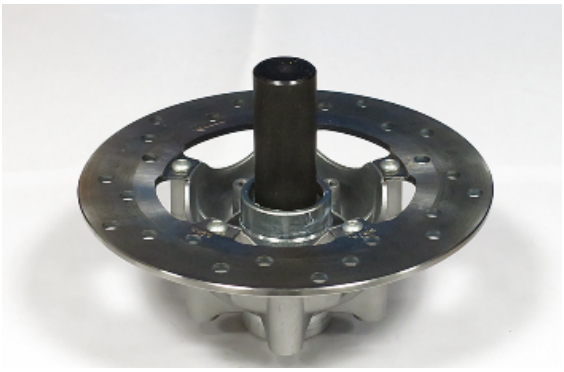
020357Y 32 x 35-mm Adaptor

020412Y 15-mm guide

020376Y Adaptor handle

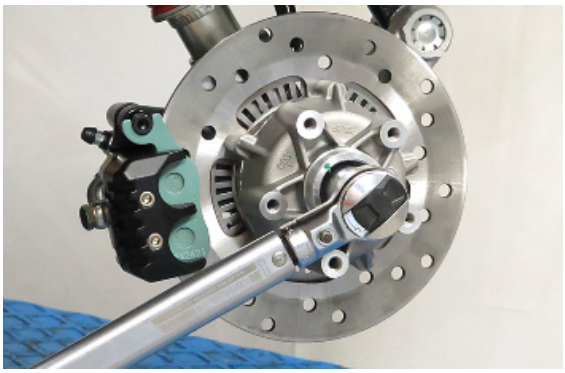
- Insert the ball bearing retention seeger ring.

- Turn the hub.
- Use the specific tool to fit and push the new roller casing until it stops.



- Place the hub on the axle.

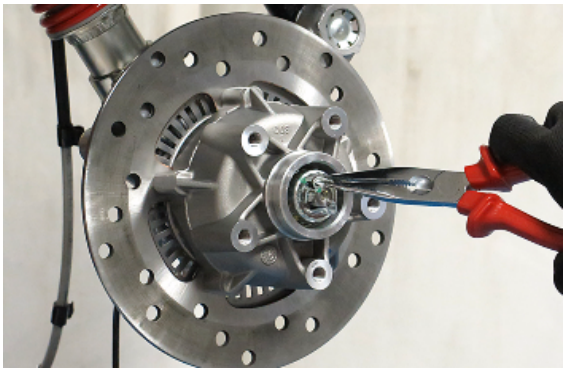
- Insert the fixing nut and tighten it to the prescribed torque.



Locking torques (N*m)

Hub - Wheel axle 74 - 88 Nm

-Insert the cotter pin and bend the flaps on the cotter pin.



Refitting the front wheel

- insert the front wheel on the hub.
- Align the holes.

- Insert the screws fixing the wheel to the hub.
- Tighten the screws to the prescribed torque.

Locking torques (N*m)

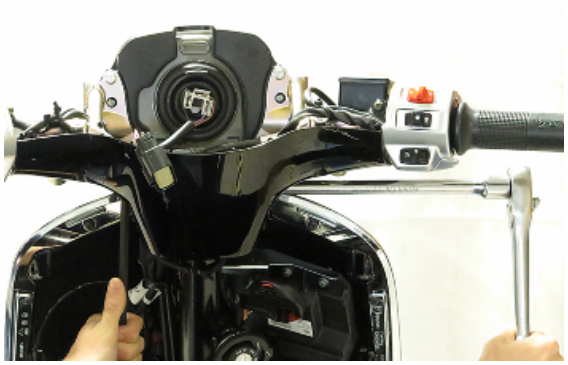
Wheel rim screws **20 - 25**

Handlebar

Removal

- Remove the front headlights frame.
- Remove the upper handlebar cover.
- Remove the two side caps.

- Undo the screw fixing the handlebar to the steering tube.



N.B.

IF THE HANDLEBAR IS BEING REMOVED TO REMOVE THE STEERING, IT IS ONLY NECESSARY TO TILT THE HANDLEBAR FORWARD ONTO THE FRONT PART OF THE VEHICLE WITHOUT REMOVING THE PARTS FITTED SO AS TO AVOID DAMAGING THE SHAFTS.

WARNING

DO NOT LEAVE THE REMOVED INSTRUMENT DANGLING OR UPSIDE DOWN AS THIS COULD DAMAGE IT IRREPARABLY. FAILURE TO OBSERVE THIS INSTRUCTION CAUSES THE LOSS OF CALIBRATION OF THE INSTRUMENT PANEL WHICH, ALTHOUGH OPERATIONAL, INDICATES INCORRECT VALUES.

Refitting

- Position the handlebars on the steering tube.
- Insert the handlebar fixing screw on the steering tube and tighten it to the specified torque.

Locking torques (N*m)

Handlebar locking screw 40 - 45

- Insert the two side caps.
- Fit the upper handlebar cover.
- Fit the front headlights frame.

Steering column

Removal

- Suitably support the vehicle so the front wheel is lifted.
- Remove the front wheel.
- Remove the brake calliper and disconnect it from the brake tube.
- Remove the hub, shock absorber and the brake calliper and shock absorber support.
- Undo and remove the fixing screw of the front brake tube.

- Remove the handlebar.
- Undo the upper steering ring nut using the special tool.

Specific tooling

020055Y Wrench for steering tube ring nut

- Remove the shield.

- Undo the lower steering ring nut using the special tool.

Specific tooling

020055Y Wrench for steering tube ring nut

Remove the steering tube.

Overhaul

Servicing the front suspension-steering assembly, described below, deals mainly with replacing parts (pin- NADELLA roller bushings - sealing rings unit and dust gaiter) which connect the steering tube to the front wheel holder swinging hub.

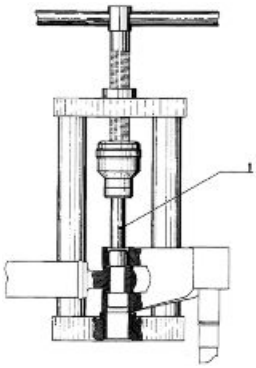
N.B.

BEFORE PROCEEDING WITH THE DESCRIBED SERVICE, CHECK THAT THE STEERING TUBE AND THE WHEEL HOLDER HUB ARE IN EXCELLENT CONDITIONS: ONLY THEN IS THE SERVICE JUSTIFIABLE.
MOREOVER, REMEMBER THE STEERING TUBE SHOULD BE REPLACED WITH A NEW ONE WHEN DEFORMED.

a = Ø 12 Punch

b = Sharp-edged end

Use a suitable punch with the dimensions indicated on the figure; hit with a mallet until the wedging washer is crushed and then extract it with the help of a pointed end.



Repeat the operation for the second washer using the punch on the side opposite to the one shown in the figure.

Use the tool fitted with part 1 as shown in the figure and move the tool hand-grip until the pin and the NADELLA are simultaneously ejected in the direction opposite the tool thrusting force.

After removing the pin and the first NADELLA, the swinging hub gets detached from the steering tube.

To remove the second NADELLA, use the tool fitted with part 2 instead of part 1, on the side opposite the one shown in the figure.

N.B.