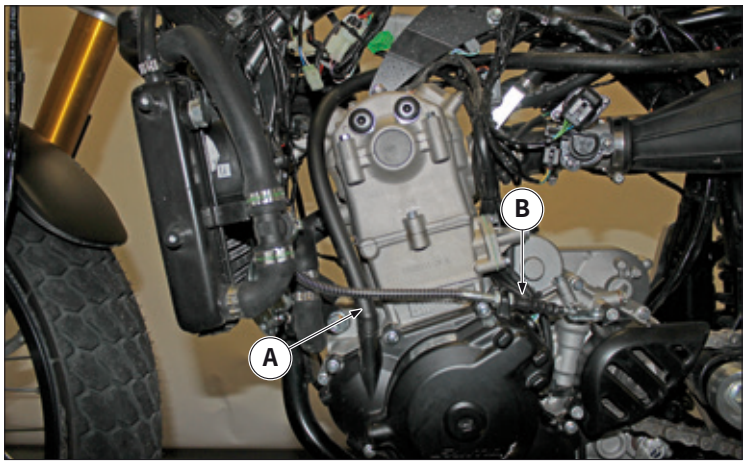
13.1 COMPLETE ENGINE REMOVAL

⚠ **Position the vehicle on a central stand and support its rear weight with straps and hoist.**

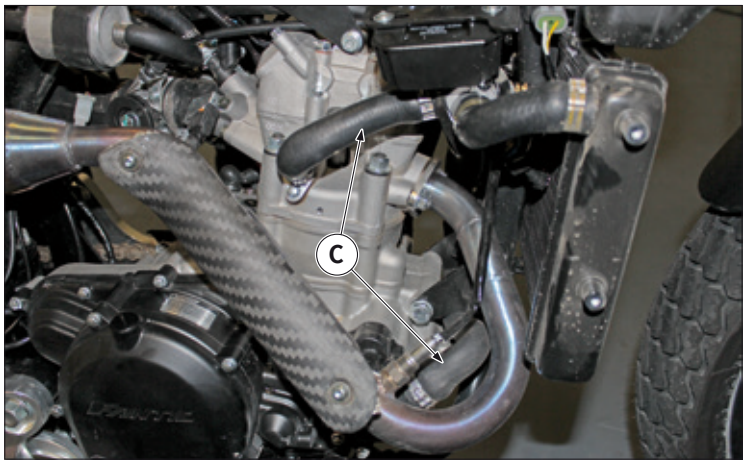
Remove:

- Saddle, refer to “12.1 Seat removal” on page 122“;
- Tank, refer to “12.8 Fuel tank removal” on page 128“;
- Exhaust system, refer to “12.20 Exhaust system removal” a pagina 160“;
- Chain, refer to “12.14 Chain removal” on page 143“;
- Conveyors, refer to “12.7 Underbody and conveyors removal” on page 127“,

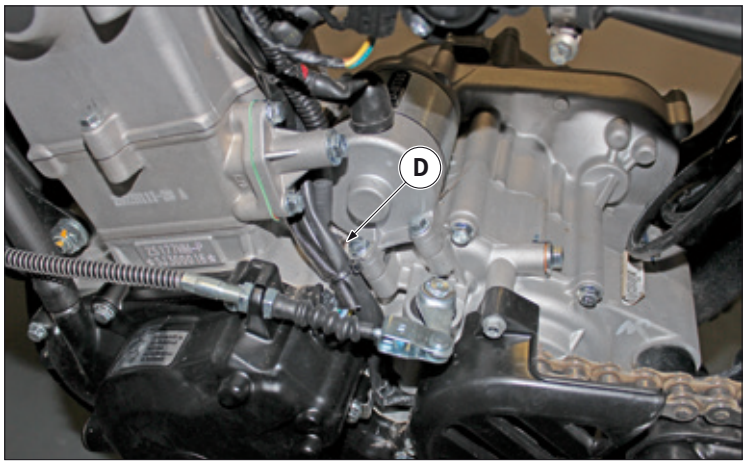


- Side panel, refer to “12.5 Side panel removal” on page 126“;
- Radiator, refer to “12.21.2 Radiator removal” on page 161“,
- Throttle body, refer to “13 Engine” on page 173“.

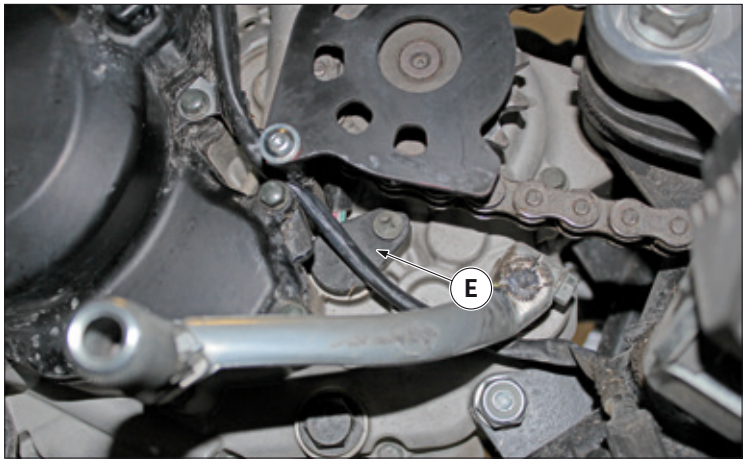
Remove the air tube “A” and the clutch cable “B”.



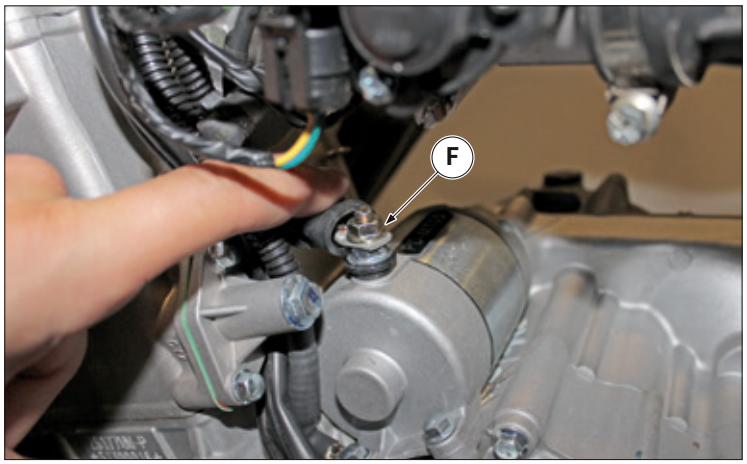
Remove the two cooling system pipes “C”.



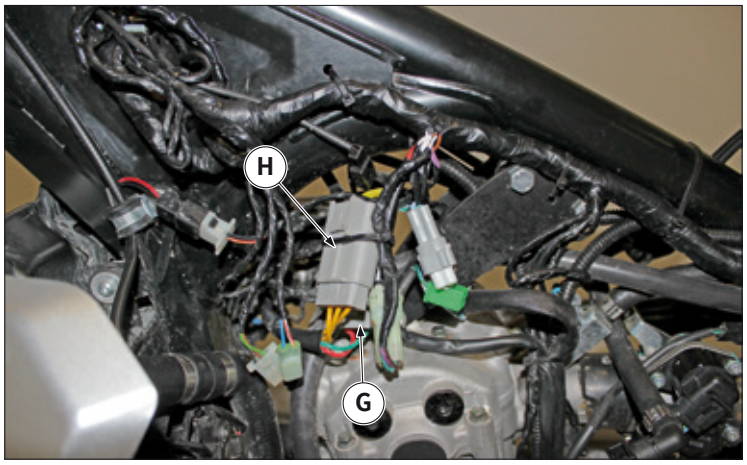
Remove the engine ground cable “D”.



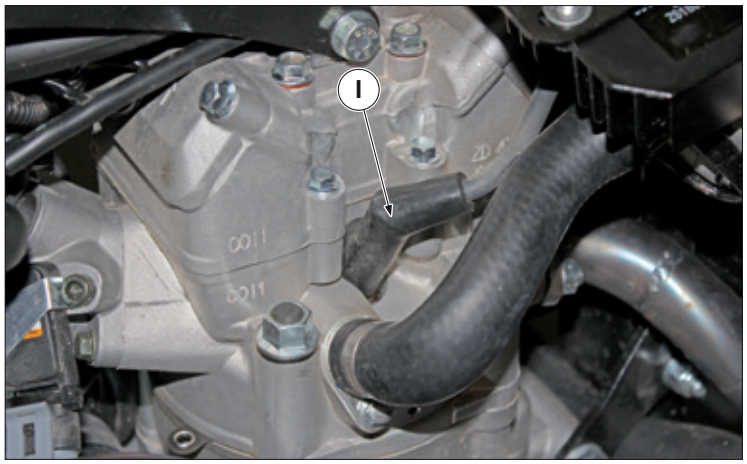
Remove the neutral sensor “E”.



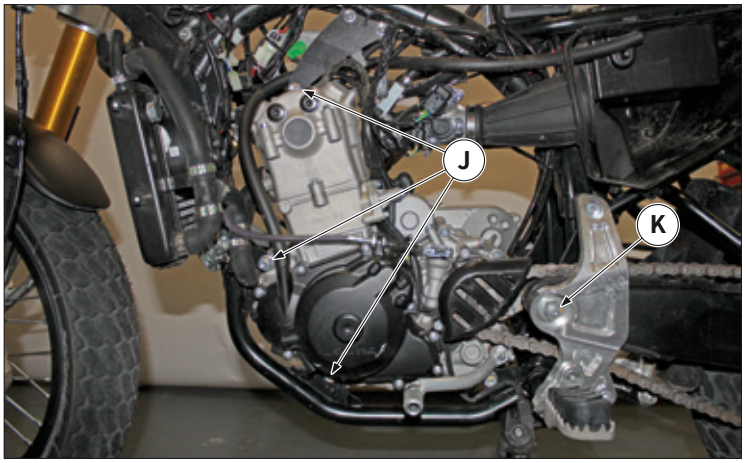
Remove the starter motor cable “F”.



Remove the pick up “G” and alternator “H” connectors.



Remove the spark plug tube “I”.



Remove the three engine connections “J” and the swingarm pivot “K”.

Remove the engine from the vehicle.

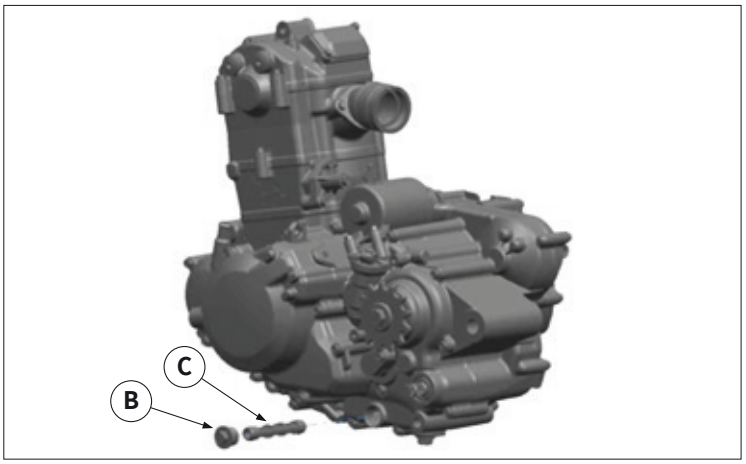
Tightening torques:
- **M10 screws: 50 Nm (5.0 m•kg, 36 ft•lb)**
- **M8 screws: 27 Nm (2.7 m•kg, 20 ft•lb)**

Proceed in the reverse order for reassembling.

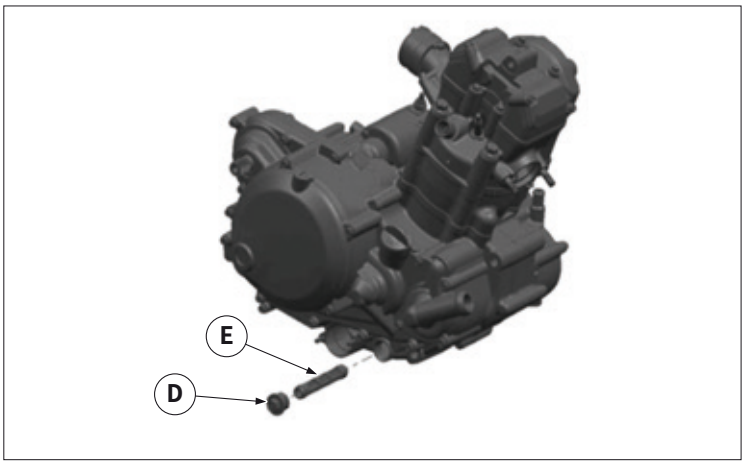
13.2 ENGINE OIL AND ENGINE OIL FILTERS CHANGE

Place the motorcycle in vertical and upright position.

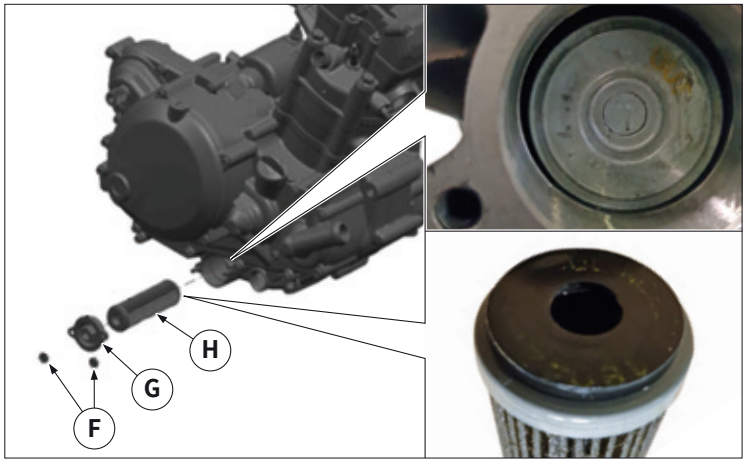
Remove the oil drain bolt M16 “A” at the bottom of engine.



Remove the bolt M20 “B” from the primary filter on the left side of the engine and remove the primary filter “C”.



Remove the bolt M20 “D” from the primary filter on the right side of the engine and remove the primary filter “E”.



Remove the two bolts M5 “F” from the thin filter on the right side of the engine and remove the spring “G” and the thin filter “H”.

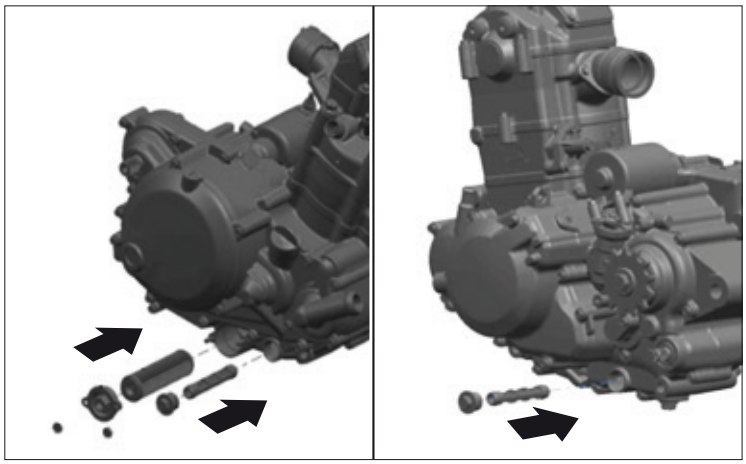
ⓘ The thin filter is made of paper.

⚠ The filter must be replaced every time it is removed.

Drain the oil for 5 minutes or wait until there is no more oil.

At the same time, clean the primary filter and prepare a new thin filter.

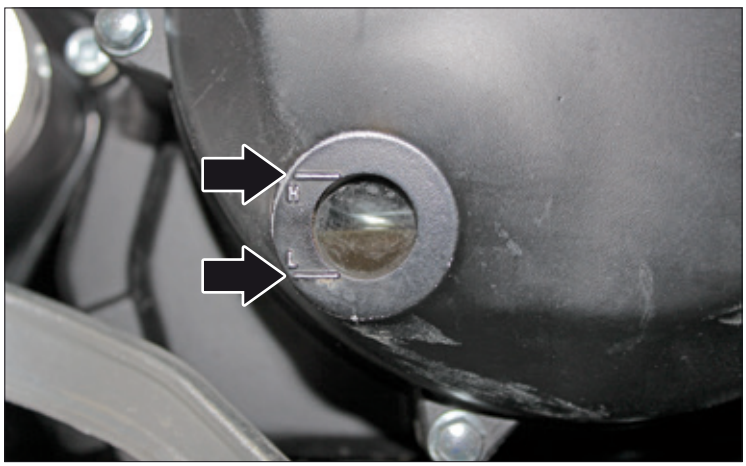
Insert it with the opening towards the engine.



Install all components previously removed in the sequence in which they were disassembled.

ⓘ Install the filter with the black plastic facing inward.

Measure 1500-1600 ml of oil with the meter and fill the engine from the filling opening on the clutch cover.



13.3 ENGINE OIL VOLUME

Put in neutral and start the engine letting it run for 2 minutes before stopping it.

Place the vehicle vertically.

Keep the vehicle stationary for 5 minutes.

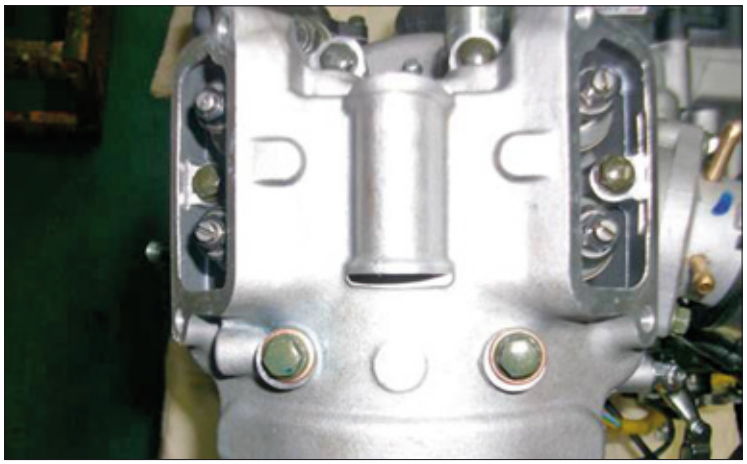
Observe if the oil level is between H-L. If so, it means there is sufficient engine oil.

13.4 CYLINDER HEAD AND VALVE

13.4.1 Remove the cylinder head cover

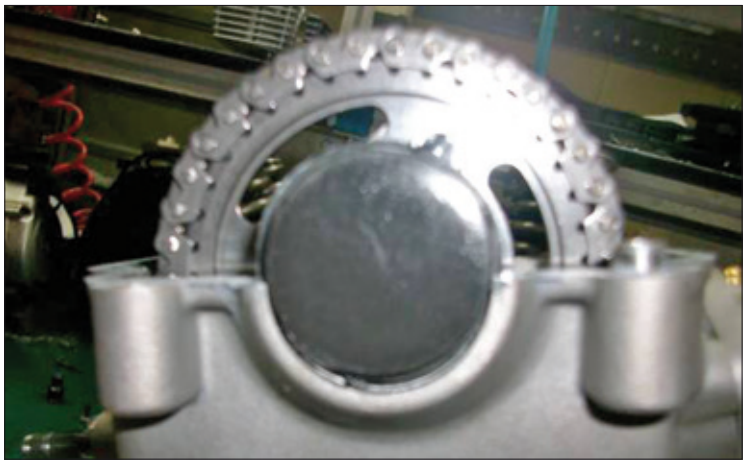
Remove the 4 bolts M6×20 from the valve covers on the intake and exhaust sides respectively.

Remove the valve covers from the cylinder head on the intake and exhaust sides respectively.



Remove 2 bolts M6×60, 2 bolts M6×35, 4 bolts M6×30 from the cylinder head cover.

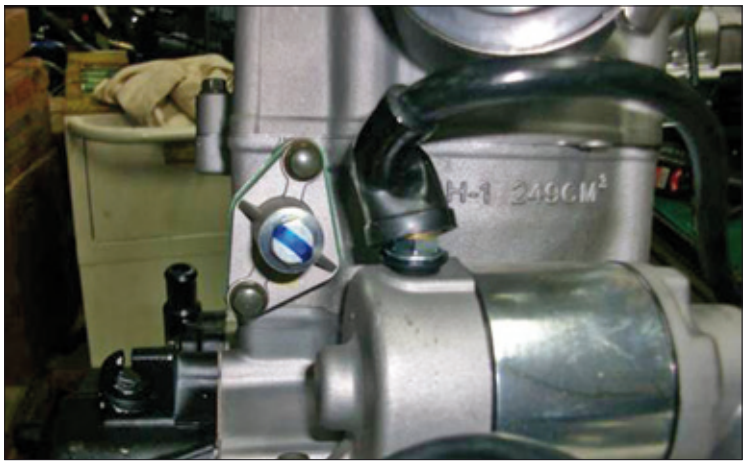
Remove the cylinder head cover.



13.4.2 Remove the cylinder head

Remove the cylinder head sealing sheath and the camshaft baffle.

Remove the bolt M6×16 and the washer 6.5×1.5×18 of the positioning plate.

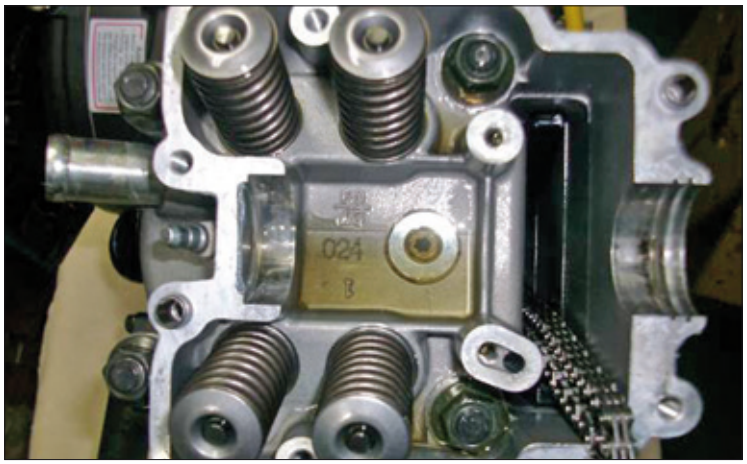


Remove the 2 bolts M6×20 from the tensioner and remove the bolt from the tensioner, the tensioner assembly and the tensioner seal.

Remove the timing chain from the gear wheel.

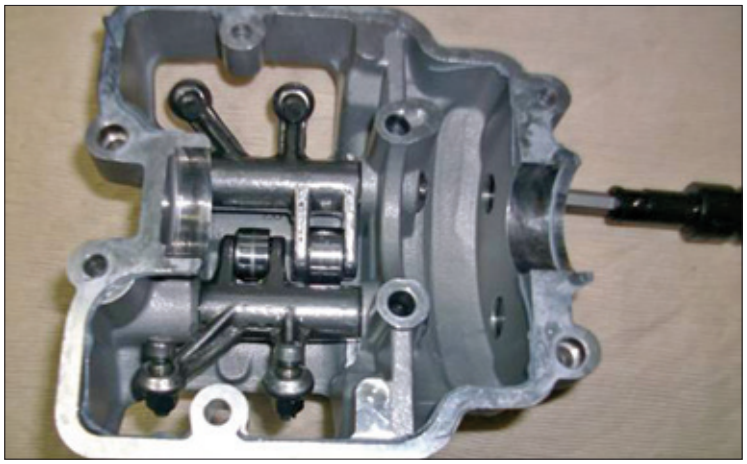
Remove the camshaft assembly.

Remove the M6×25 bolt from the head and from the cylinder block.



Remove the 4 nuts M10×1.25 and remove 4 washers of the bolts 10.5×2×20.

Remove the cylinder head.



13.4.3 Cylinder head cover dismantling

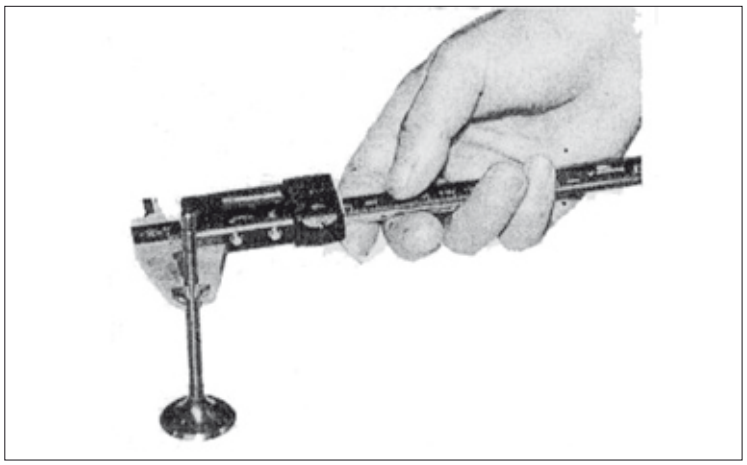
Remove the 2 bolts M14×1 from the positioning plate on the rocker arm shaft on the cylinder head cover.

Remove the intake and exhaust rocker arm shaft and the intake and exhaust rocker arm.

13.4.4 Disassemble the cylinder head

Press the valve spring using the appropriate tool and remove the valve cotters, springs and valves.

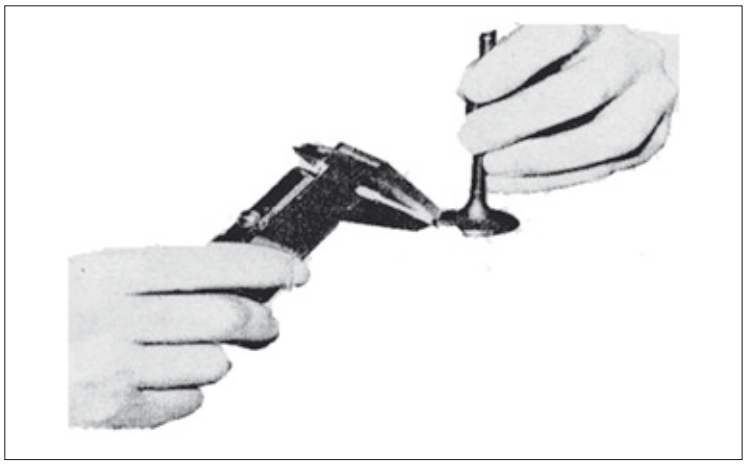
⚠ **Mark all components removed and make sure they are installed where they were.**



13.4.5 Inspect the valve and the valve spring

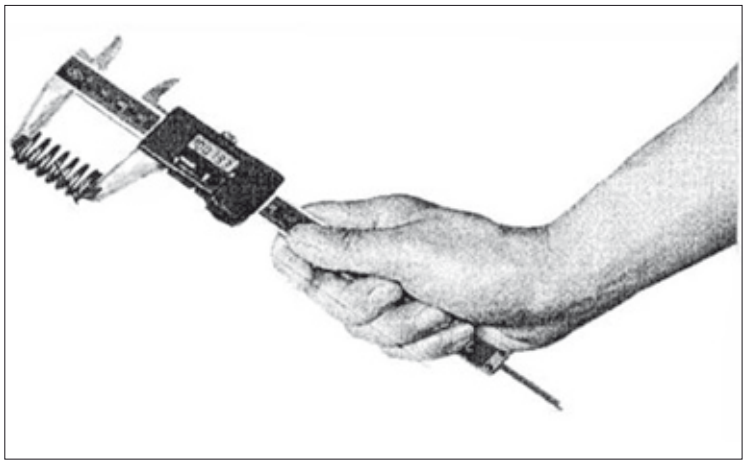
Check that the valve is not bent or burned and that the stem is not excessively worn and measure the outer diameter of the stem.

Maintenance limit value: Ø 4.94 mm



Holding limit on the contact surface width: 1.5 mm.

If the contact surface of the valve is very rough or has excessive wear and corrosion and has incorrect contact with the valve seat, it is difficult to obtain the desired seal and it is necessary to install a new valve.



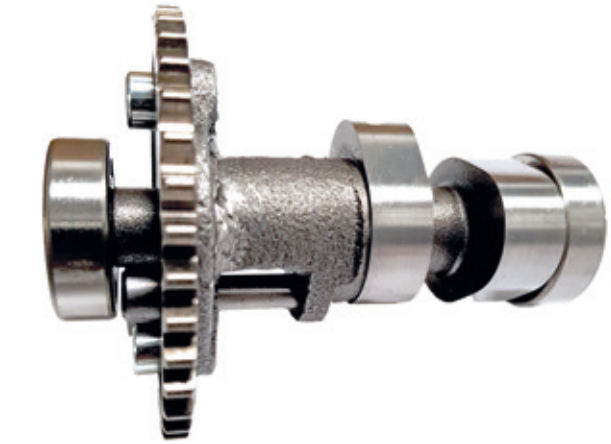
Valve spring free length measurement: 48.35 mm

Spring maintenance limit value : 47.5 mm

13.4.6 Inspect the rocker arm and the rocker arm shaft

Check that there is no wear and damage to the rocker arm and inspect the axial clearance of the rocker arm roller. In case of wear or great damage, or excessive axial space of the rocker arm roller, install a new rocker arm.

Check that the rocker arm shaft is not worn. In the event of significant wear, it is necessary to install a new one.



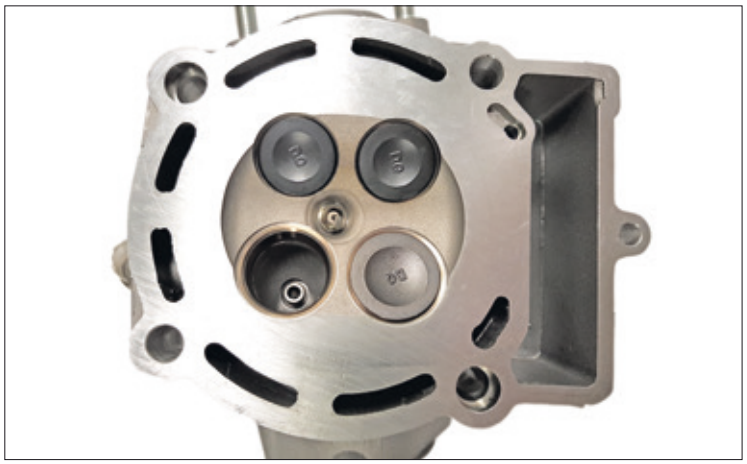
13.4.7 Inspect the camshaft components

Check that the camshaft has no worn or damaged surface and no slow rotation of the bearings on both sides of the camshaft.

In case of major wear or difficult rotation, it is necessary to install new camshaft components.

Check that there are no cracks or breaks in the camshaft pressure relief valve gear set and check if the centrifugal system of the exhaust valve and the shaft are loose.

In one of these situations, it is necessary to install a new exhaust valve assembly.

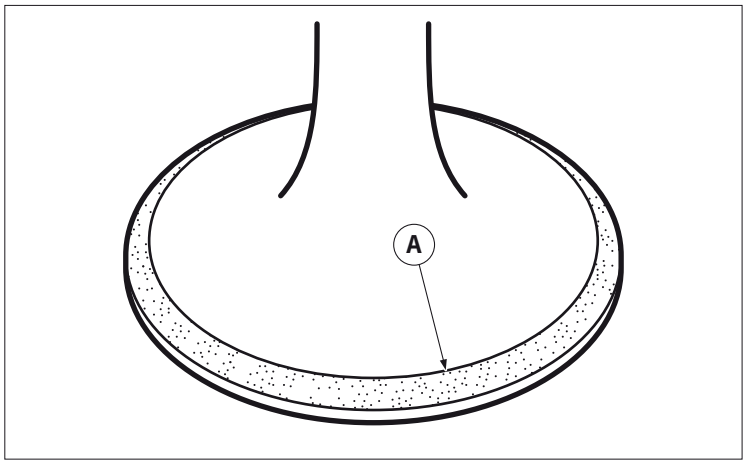


13.4.8 Inspect the cylinder head

Check if the cylinder head has insufficient air tightness. If so, it is necessary to install a new cylinder or valve head.

Check that the spark plug hole and the valve seat are free from cracks.

Check that the cylinder is not deformed and measure the cylinder head flatness using a metal ruler and a thickness gauge.

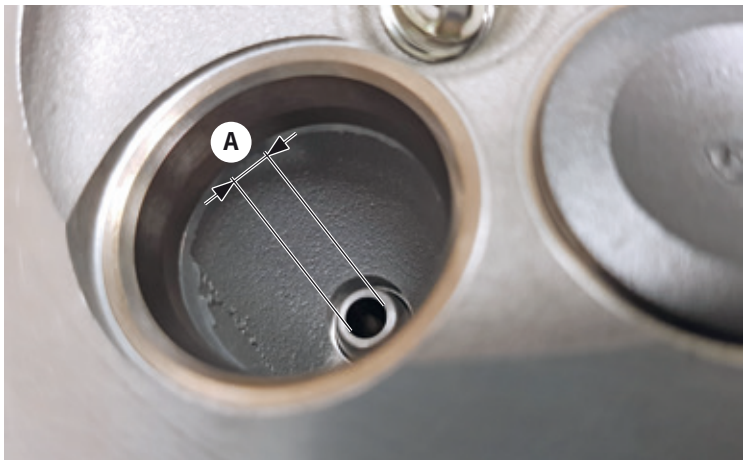


13.4.9 Inspect and grind valve seat

Clean the coal deposit from the combustion chamber.

Apply a homogeneous and thin layer of red ink on the valve seat “A” and carefully insert the valve into the seat by tapping on the valve and holding it in place. Then turn it over and check for signs of interruption on the contact surface of the valve. If so, grind the valve seat.

First clean the coal deposit from the intake and exhaust valve seats, then apply abrasive material to the valve seat and suck the valve with a grinding tool equipped with a rubber terminal.

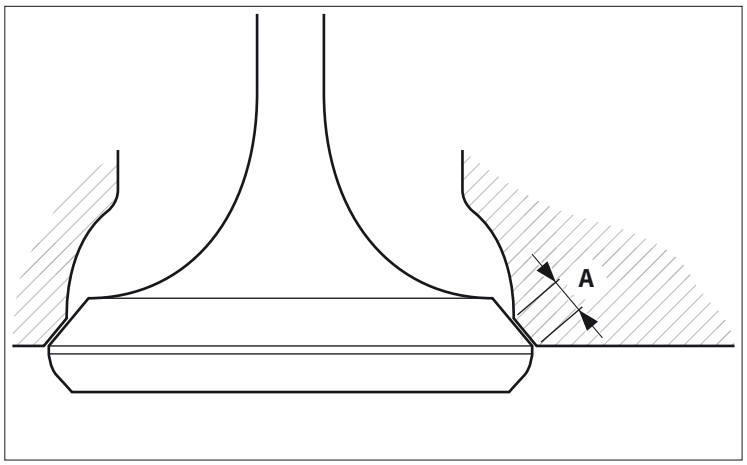


13.4.10 Inspect valve guide

Measure the inside diameter “A” of each valve guide using a dial gauge and carry out the checks.

Maintenance limit value: Ø 5.035 mm

Remove the carbon deposit from the valve guide before measuring the guide diameter.

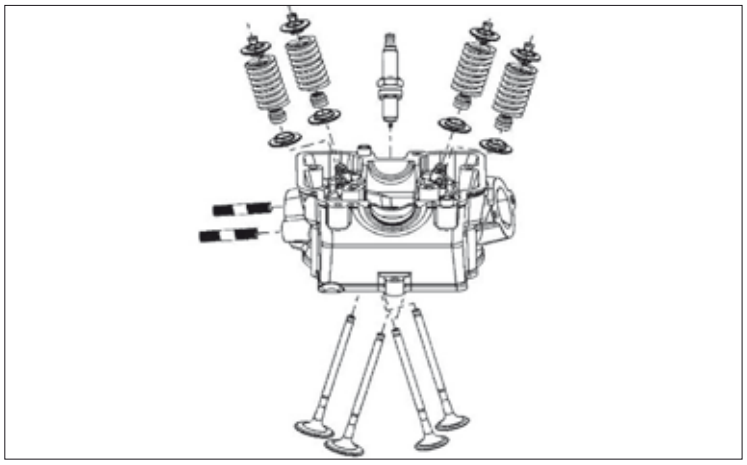


13.4.11 Measure the width of the contact surface of the valve seat

Maintenance limit value: 1.5 mm

If the width of the valve seat “A” is not adequate or the seat has dents, it must be ground to reach the right sealing level.

Check that the sealing line between the valve and the seat stroke has been obtained with the grinding. If not, proceed with the grinding. If the desired result is not achieved, install a new valve or a new cylinder head.



13.4.12 Assemble the cylinder head

Insert the lower seat of the valve spring and the oil drip tray onto the valve guide.

Insert the stem of the intake and exhaust valve applying lubricant inside the valve guide.

Insert the valve spring, the upper seat and the valve cone wrench.

Press the spring with a valve extractor before inserting the cone wrench into the spring.

⚠ To avoid permanent deformation of the valve spring, keep the spring moderately compressed. It is sufficient that the valve wrench can be inserted.

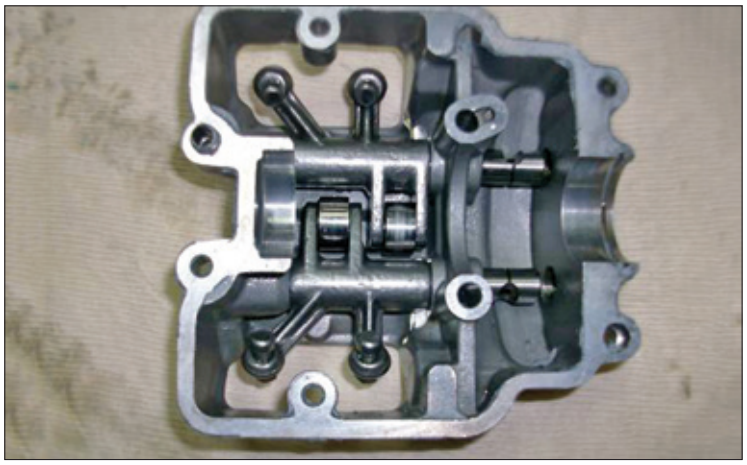
Check that the valve cone wrench fits properly.

Check the air tightness of the assembled cylinder head assembly. If there are no leaks, proceed to the next step.

13.4.13 Assemble the cylinder head cover

Insert the arms of the intake and exhaust rocker arms into the cylinder head cover before moving them through the cover, observing the intake and exhaust rocker arm holes.

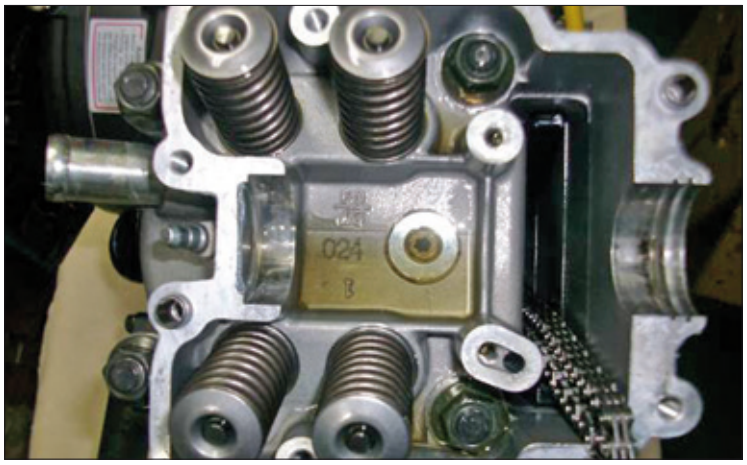
As the arrow indicates, they are tangent to the rocker arm shaft. Keep the tangents turned towards the upper holes of the head cover when assembling the rocker arm shaft.



Then insert the rocker arm shaft positioning bolt onto the head cover and tighten the bolt.

Insert the rocker arm shaft with the tangent side facing the hole of the head cover. When the head cover is installed, rotate the arm of the rocker arm. The arm of the rocker arm wheel must be able to rotate freely without difficult movement.

Tightening torque:
Rocker arm shaft positioning plate bolts
16 ~ 20 Nm (1.6 ~ 2 m kgf, 11.8 ~ 14.7 ft lbf)



13.4.14 Install the cylinder head

Remove the used head seal and install a new one with the positioning pin.

Install the cylinder head, insert the washers and nuts.

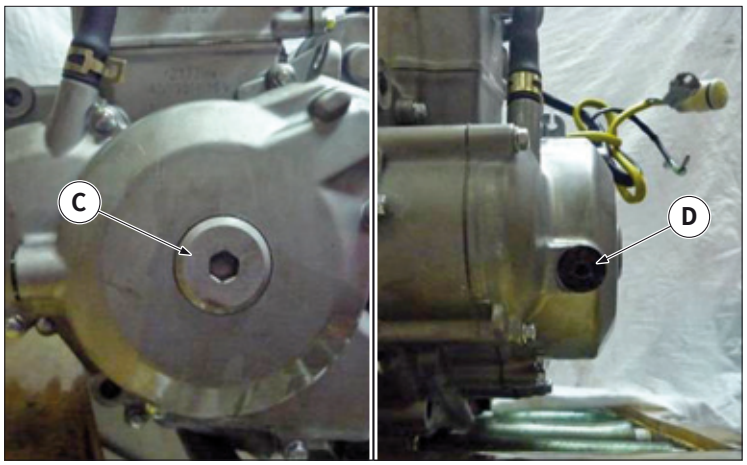
Prevent dust and foreign matter from entering the cylinder.

Tightening torque:
Nuts on pivot for engine head fastening
55 ~ 60 Nm (5.5 ~ 6 m kgf, 40.5 ~ 44.2 ft lbf)

Insert the M6 × 25 bolts of the cylinder block-cylinder into the holes and tighten them.

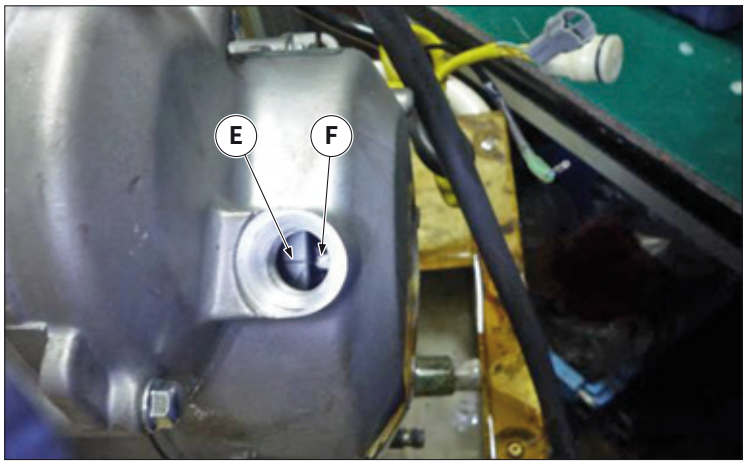
Tightening torque:
Bolts fastening the head to the cylinder block
11 ~ 13 Nm (1.1 ~ 1.3 m kgf, 8.1 ~ 9.6 ft lbf)

Install the camshaft on the head before inserting the timing chain on the gear wheel of the camshaft, then check if the timing is correct. If not, adjust it until it is correct.

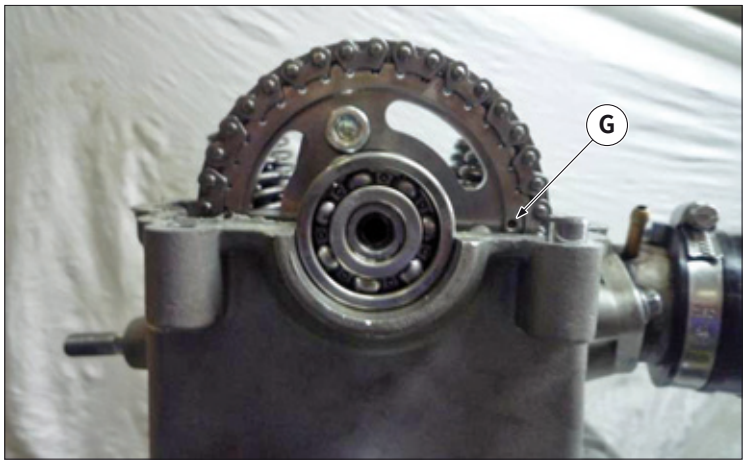


13.4.15 Install cylinder head

1. Remove the cap “D” of the access hole on the left and the cap “C”.



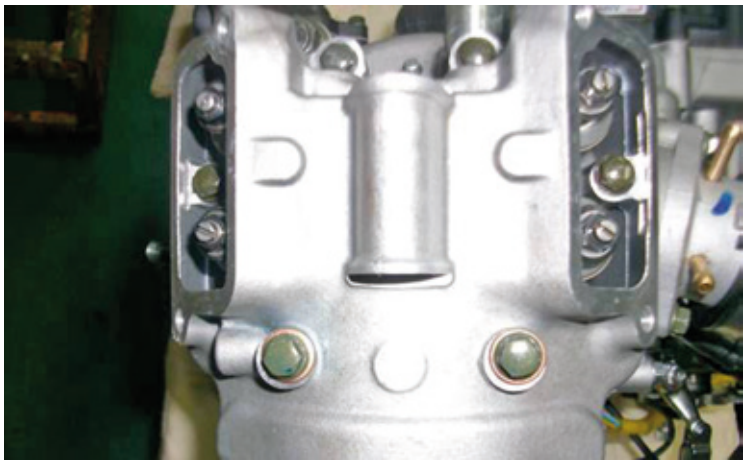
2. Turn the lock nut of the magnet with the appropriate wrench and checking if the timing “-” on the rotor of the magnet “E” is aligned with the timing mark on the left and central cover “F”.



3. When the above marking is aligned, check whether the marking “G” and the coupling surface are on the same plane.

⚠ **The timing is correct only when points 2 and 3 are met.**

Install the tensioner on the cylinder block inserting it in the appropriate hole and tighten it with 2 bolts M6×20 before positioning the tensioner spring, the sealing ring and the bolt.



13.4.16 Install the cylinder head cover

Apply a homogeneous layer of silicone sealant on the coupling side of the cylinder head cover.

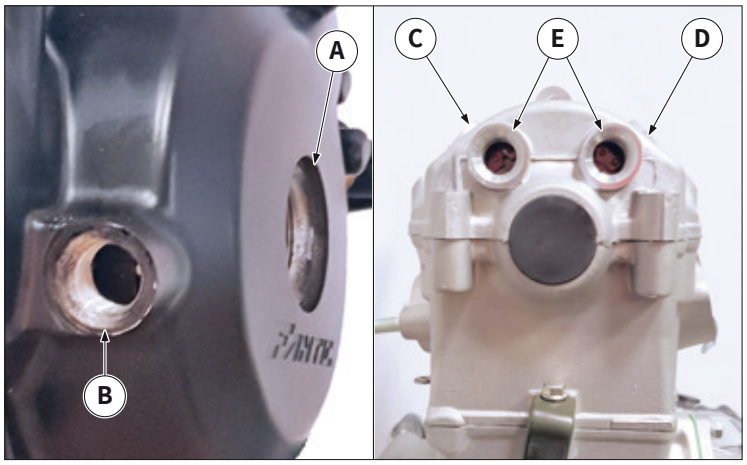
Place the cover on the cylinder head.

Tightening torque:
Cylinder head cover fastening bolts
11 ~ 13 Nm (1.1 ~ 1.3 m kgf, 8.1 ~ 9.6 ft lbf)

Adjust the intake and exhaust valve clearance: 0.5 ~ 0.7 mm.

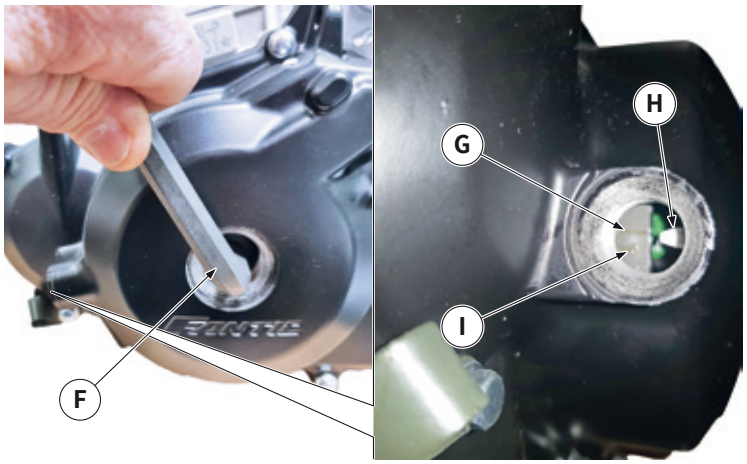
Insert the valve cover onto the cylinder head cover and tighten.

Tightening torque:
Cylinder head cover fastening bolts
11 ~ 13 Nm (1.1 ~ 1.3 m kgf, 8.1 ~ 9.6 ft lbf)



13.4.17 Tappet control and adjustment

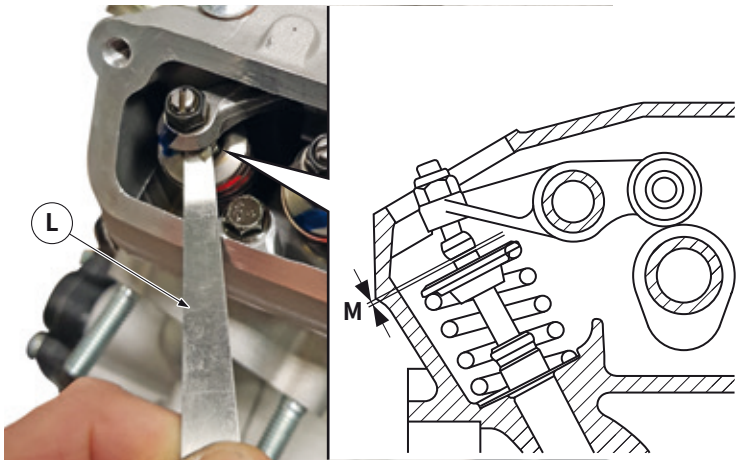
With the engine cold, on the left side of the engine, remove the caps "A" and "B" from the ignition cover, the caps "C" and "D" from the tappet cover, the covers "E" on the head and the spark plug.



Insert the special wrench "F" in the hole of the cover.

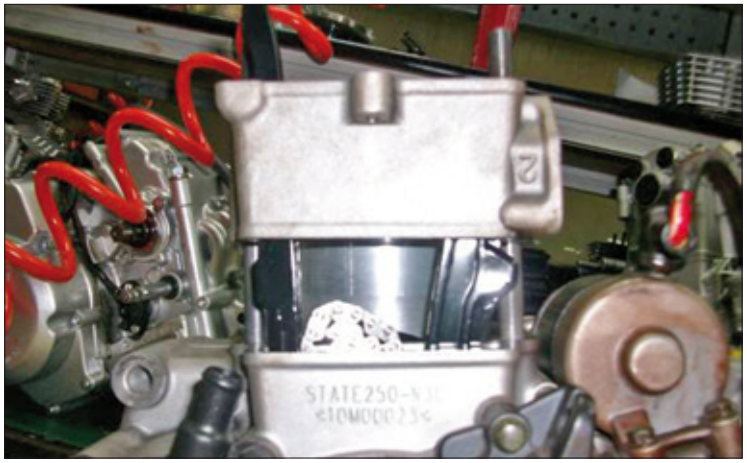
Turn the engine anticlockwise and make the points "G" and "H" coincide.

The point "I" corresponds to the engine ignition moment phase position.



Insert the thickness gauge "L" and record with the correct value.

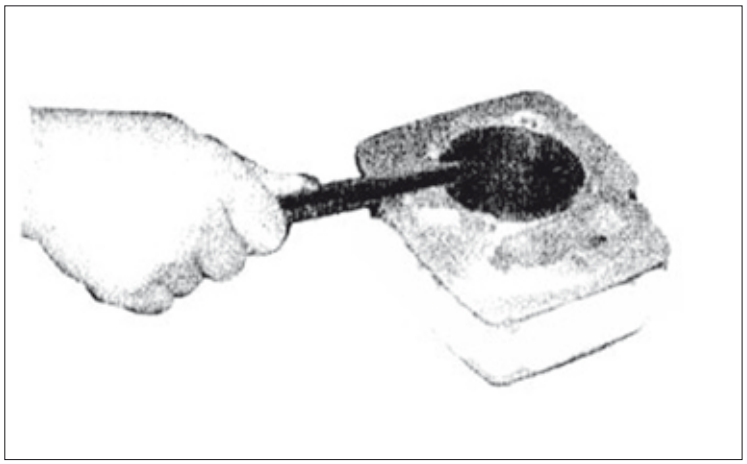
Tappet adjustment thickness "M": 0,5 mm ~ 0,7 mm.



13.5 CYLINDER AND PISTON

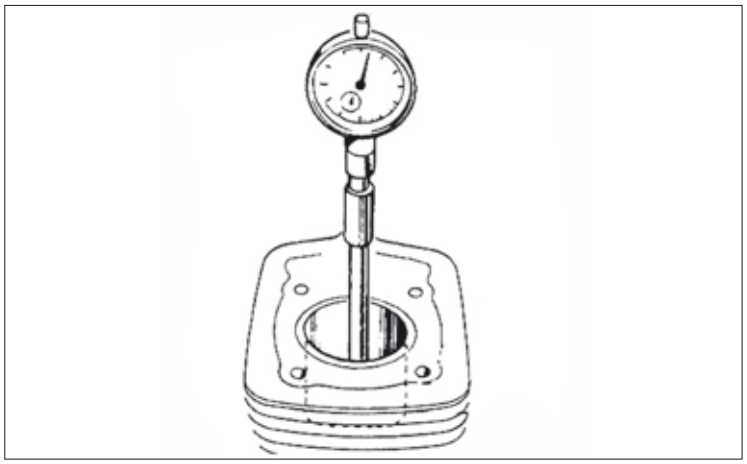
13.5.1 Remove cylinder

Remove the chain tensioner and the cylinder block.



Remove the seal residues from the cylinder surface using a scraper.

⚠ **The deposit can more easily be removed by immersing it in gasoline. Avoid damaging the contact area of the cylinder during the operation.**



13.5.2 Inspect the cylinder block

Check that the cylinder block is not worn or damaged.

Measure the inside diameter of the cylinder in three distinct points, i.e. at the top, in the center and at the base, during the entire stroke of the piston.

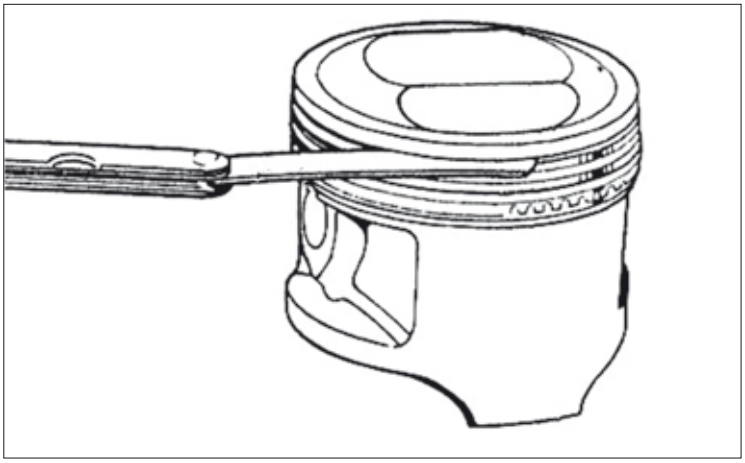
Measure the inside diameter of the cylinder at two points perpendicular to each other.

Maintenance limit value: φ 77.018 mm

13.5.3 Remove the piston

Remove the piston pin retaining ring using the pliers and remove the piston pin and piston.

⚠ **When removing the piston pin retaining ring, be careful not to let it fall into the crankcase.**



13.5.4 Piston and piston rings inspection

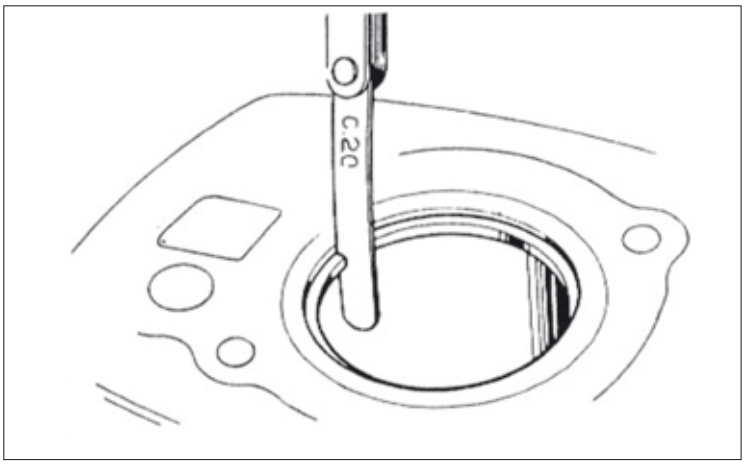
Remove piston ring:

⚠ **Keep the piston rings intact when removing them.**

Measure the distance between the piston rings and the piston seats.

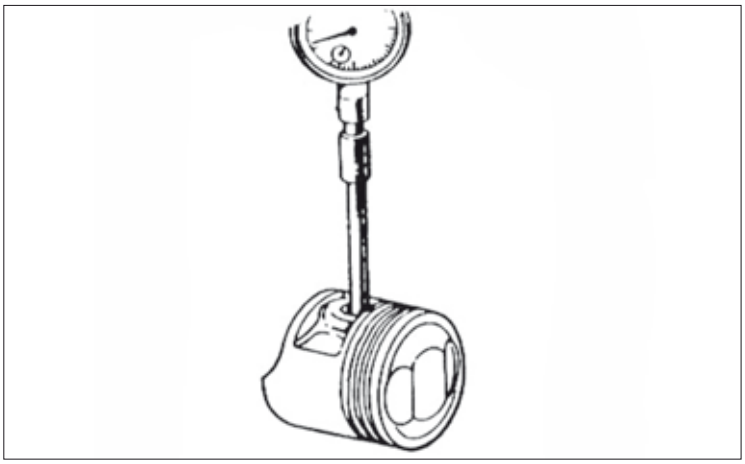
Maintenance limit value:
1st ring: 0.08 mm
2nd ring: 0.08 mm
Scraper ring: 0.08 mm

Check that the piston has no wear or cracks and that the seat is not worn.



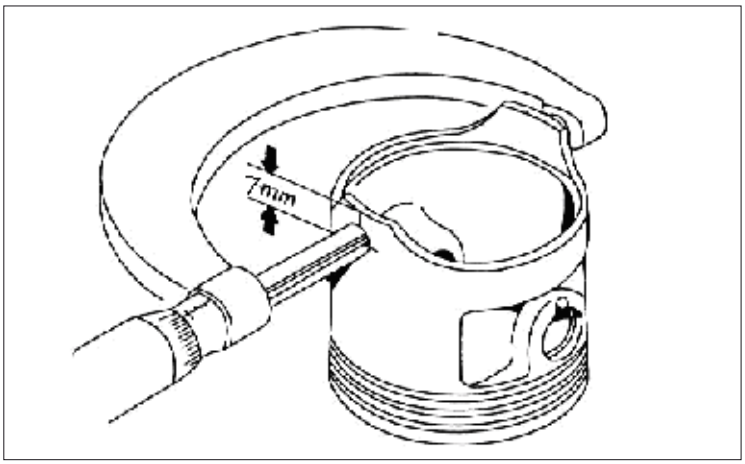
Insert the piston ring into the cylinder.

Maintenance limit value:
1st ring: 0.5 mm
2nd ring: 0.5 mm
Scraper ring: 1.4 mm



Measure the inside diameter of the piston pin seat.

Maintenance limit value: φ 16.015 mm

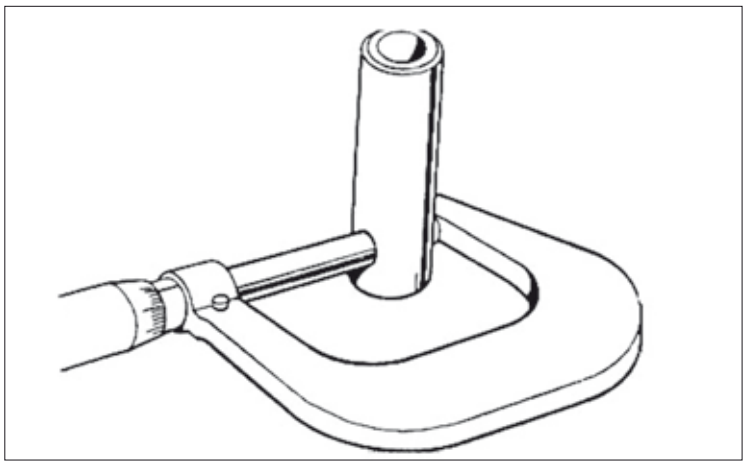


Measure the outside diameter of the piston at a distance of 7 mm from the end of the piston skirt.

Maintenance limit value: φ 76.94 mm

Measure the space between the cylinder and the piston.

Maintenance limit value: 0.1 mm

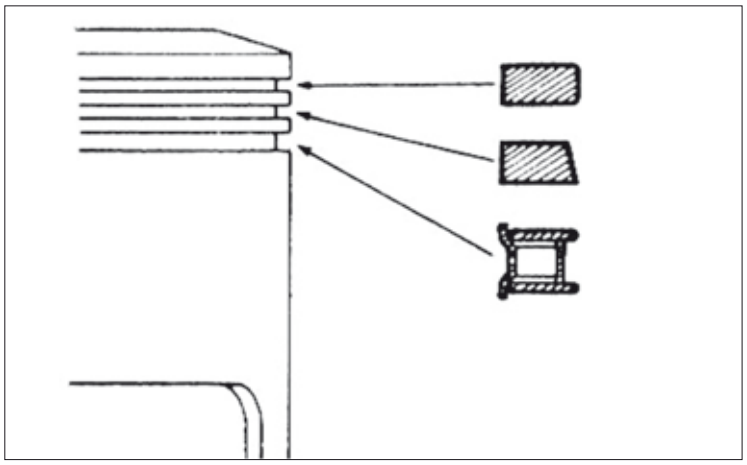


GMeasure the outside diameter of the piston pin.

Maintenance limit value: 15.99 mm

Measure the space between the piston and the piston pin.

Maintenance limit value: 0.025 mm

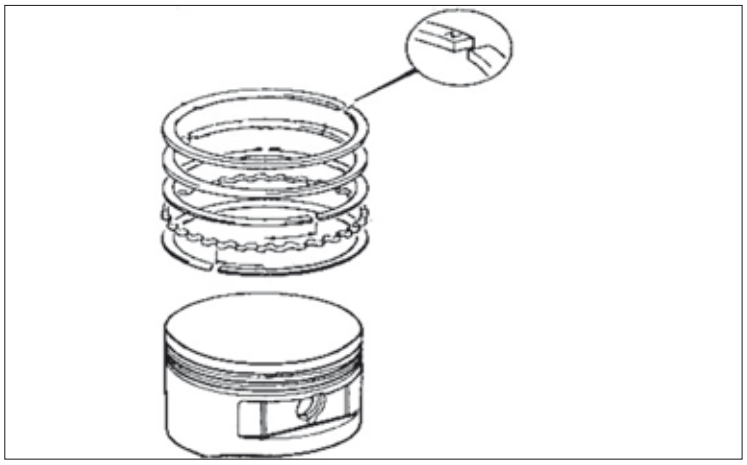


13.5.5 Install the piston rings

Clean the piston rings groove.

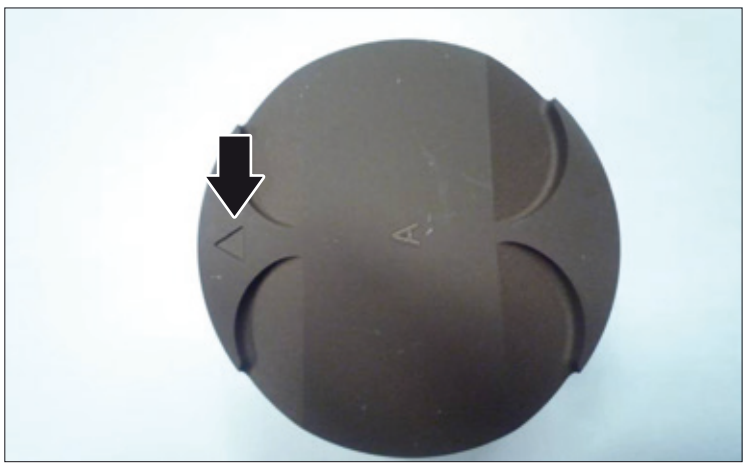
Install the piston rings.

Do not invert the 1st and 2nd piston rings. Install the 1st and 2nd piston rings with the markings facing the piston head. The piston rings must rotate freely when installed.



The opening of the scraper piston ring must align correctly with the openings of the spacer piston rings.

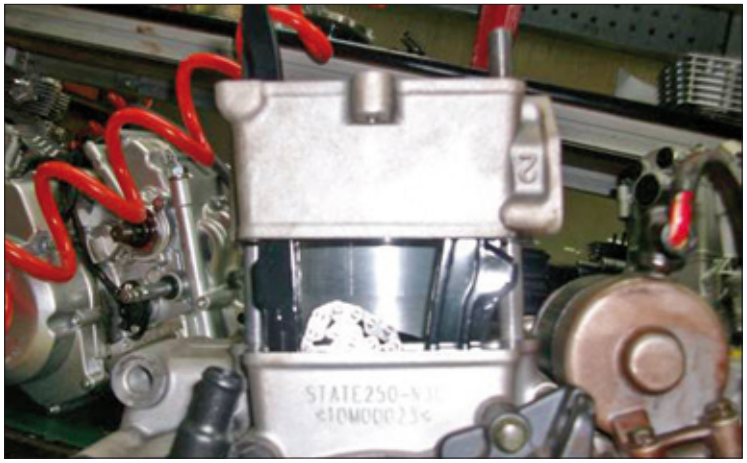
Install the spacer piston rings before the scraper ring, then install the piston guide rings.



13.5.6 Install piston

Install the piston, the pin and the new retaining rings.

Install the piston with the side marked with "◄" towards the exhaust side. The opening of the end clearance of the piston pin retaining ring is facing downwards. Install new retaining rings if they are severely deformed.



13.5.7 Install the cylinder block

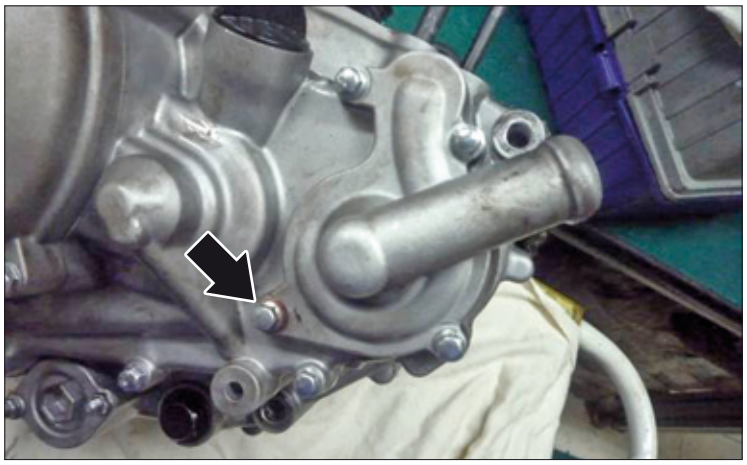
Install the cylinder block positioning bush and new cylinder seals.

Apply a homogeneous layer of oil to the cylinder block, the piston and the piston ring.

Space out the openings of all piston rings at an angle of 120° and position the cylinder block.

Position the chain guide.

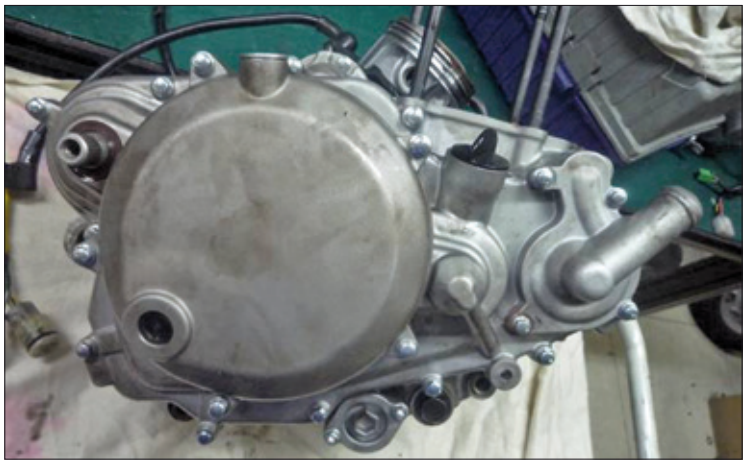
⚠ **Do not damage the piston rings when installing the cylinder block.**



13.6 CLUTCH, DRIVE WHEEL, FREE WHEEL, OIL PUMP AND GEAR SHIFT

13.6.1 Remove the water pump impeller

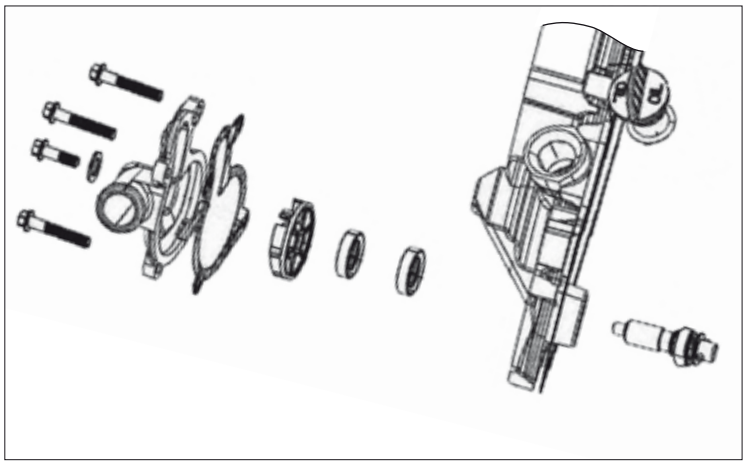
Remove the drain bolt from the pump cover, drain the coolant from the bolt and remove the pump cover and impeller until the water stops flowing out.



13.6.2 Remove the crankcase cover on the right side of the engine.

Drain the oil completely (remove the oil filters on the right and left, remove the filter unit from the crankcase and wait until the oil is completely drained).

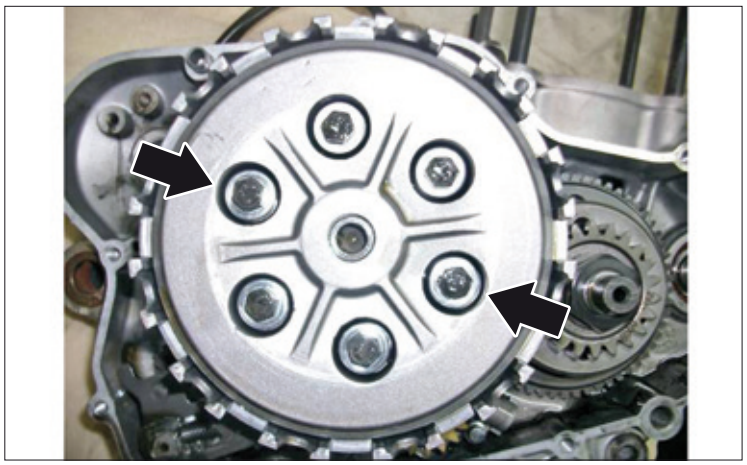
Remove the connection screw on the cover and the crankcase on the right side of the engine.



13.6.3 Remove the water pump shaft, the water seal assembly and the oil seal

Remove the retaining ring from the groove in the hole on the water pump shaft and remove the shaft.

Remove the water seal assembly and the oil seal from the hole on the water pump shaft.



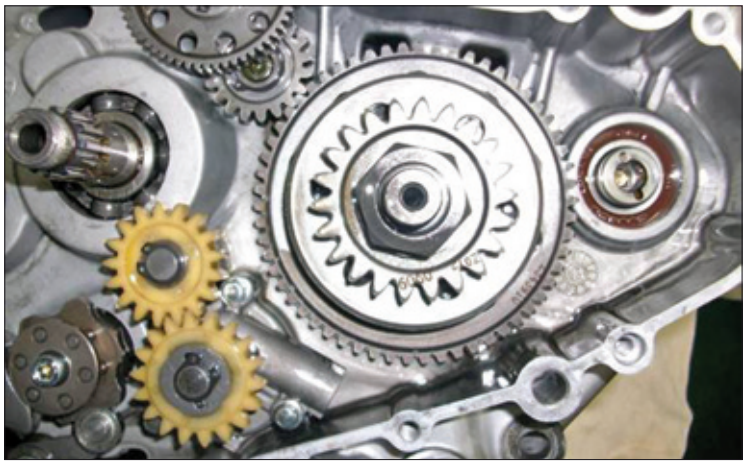
13.6.4 Remove the clutch

Remove the clutch pressure plate and remove the bolts from the plate in 2 or 3 separate points positioned opposite one another. Remove the clutch pressure plate, tie rod and clutch plate.

Remove the lock nut and the clutch spacer.

Remove the clutch central bushing, the outer shield, the shaft sleeve and the clutch spacer.

Remove the clutch pressure pin from the central hole in the main shaft.

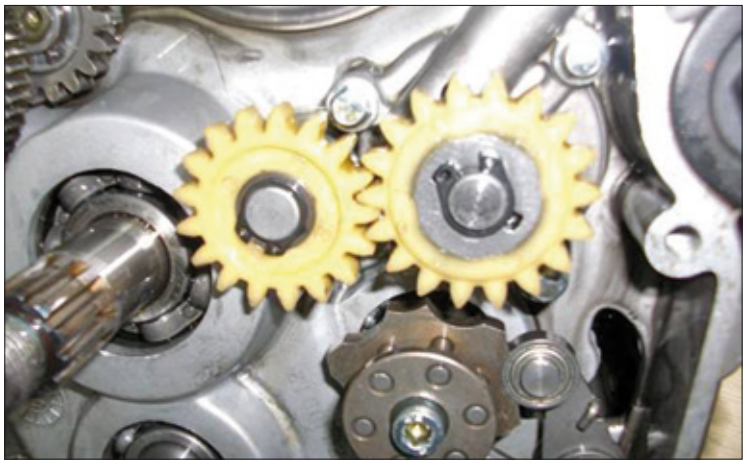


13.6.5 Remove the drive wheel, free wheel and starter gear

Remove the drive wheel lock nut and its washer.

Remove the free wheel and the starter gear.

⚠ **Remove the starter gear spacer together with the gear itself when removing the gear assembly and be very careful to the washer.**



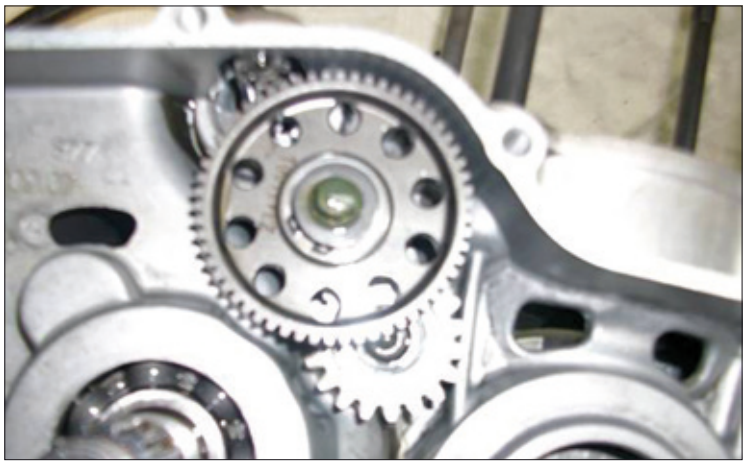
13.6.6 Remove the oil pump on the right side

Remove the oil pump intermediate gear and the oil pump gear assembly retainer.

Remove the oil pump intermediate gear washer, the intermediate gear and the gear assembly.

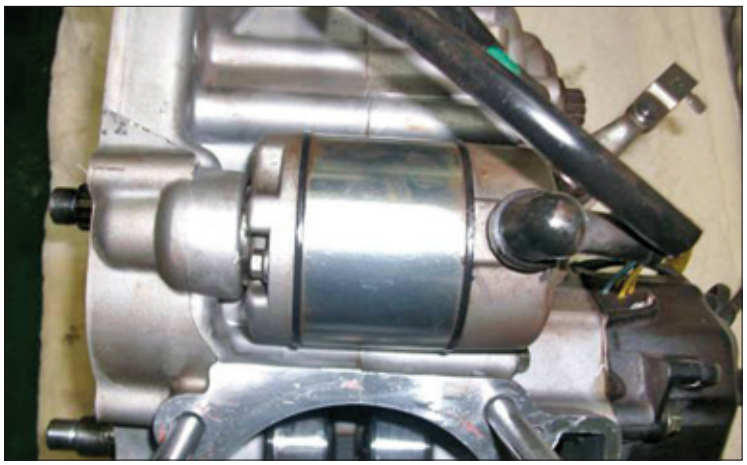
Remove 3 bolts from the oil pump cover plate on the right side and detach the cover plate assembly and the inner and outer rotor assembly of the oil pump.

⚠ **In the upper and lower ends of the oil pump intermediate gear there is an intermediate gear pump washer in the oil pump. Be very careful to the retaining ring, washer and oil pump pin removed.**



13.6.7 Remove the double gear

Remove the retaining ring from the groove of the twin gear shaft retainer and detach the double gear washer before removing the gear.



13.6.8 Remove the starter motor

Remove the fastening screw from the starter motor and remove the starter motor.

13.6.9 Remove the gear shift

Remove the fastening screws from the pentagonal plate.

Remove the gear lever components.

Remove the fastening screws from the positioning plate assembly and remove the washer and the positioning plate assembly.

13.6.10 Inspect the crankcase cover on the right side

Check that there is no damage to the crankcase cover oil seal on the right side.

If the seal is damaged, replace it

⚠ **Check that the oil seal is stable. The oil seal is located on the end side of the crankshaft oil seal. Install the oil seal with the marking facing outwards.**

Check that the starter shaft oil seal is not damaged. If the seal is damaged, replace it.

13.6.11 Inspect the water pump shaft, the impeller, the water seal assembly and the oil seal

Check that the oil pump impeller is not damaged or loose. If so, replace the impeller.

Check that the water seal assembly and the oil seal are not damaged and that the water pump shaft is not excessively worn or bent. If so, replace the water seal assembly, the oil seal and the water pump shaft.

Recommendations for installing the water seal assembly, oil seal and water pump shaft:

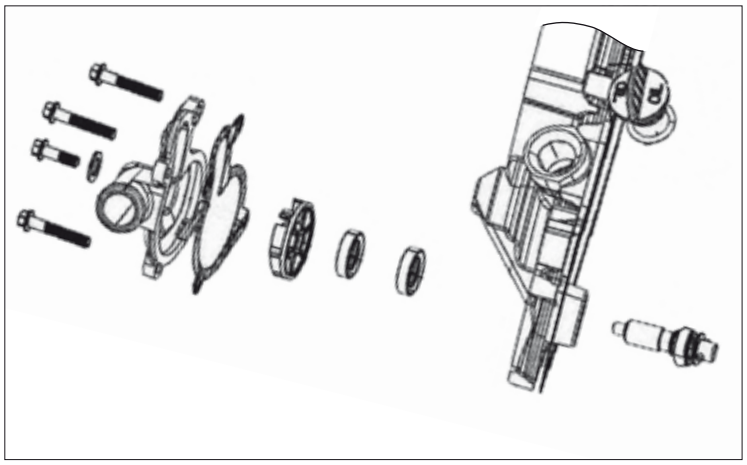
Apply a moderate amount of oil in the water pump shaft hole, press and insert the oil seal using the dedicated tool while the end side of the seal is facing outwards.

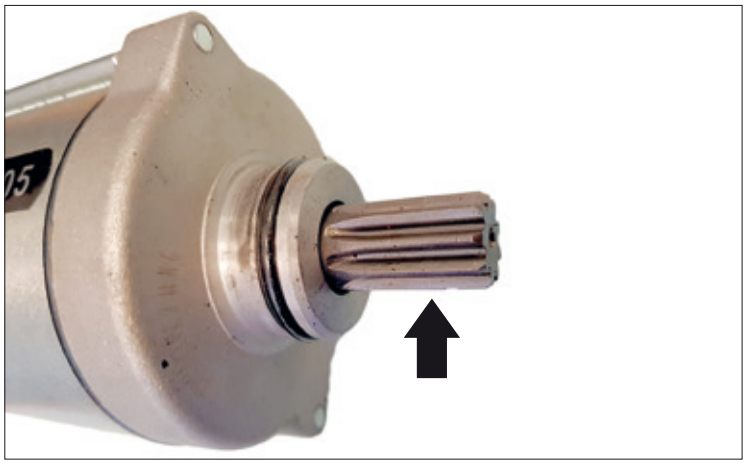
Press and insert the pump shaft water seal system using the dedicated tool while it is positioned 0.5 mm below the end side. When installing the water seal system, keep the marking on the end side facing inward.

Apply a small amount of silicone lubricating grease to the main lip of the water seal system.

Press and insert a new water pump shaft using the dedicated tool.

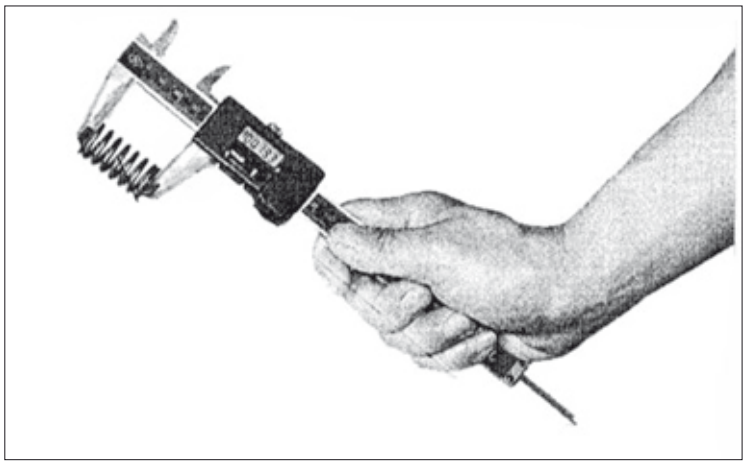
Insert the retaining ring in the dedicated groove of the hole on the water pump shaft; the water pump shaft installed can rotate freely.





13.6.12 Inspect the starter shaft

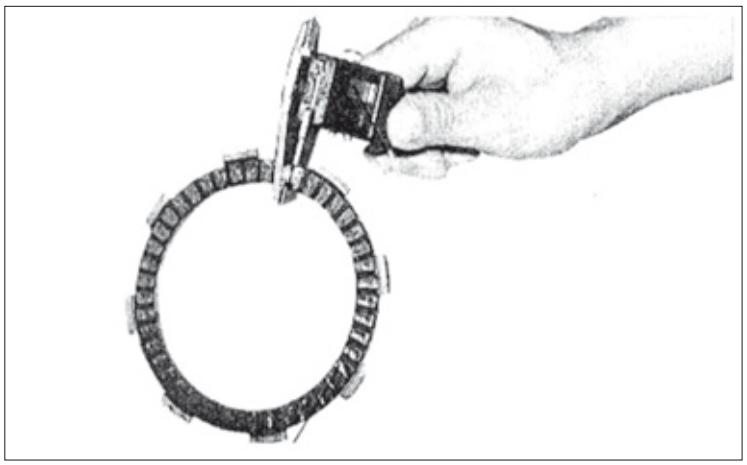
Check that the starter shaft is not worn. Only for engines with exclusively electric starting, it is not necessary to check the starter shaft gear wear.



13.6.13 Inspect the clutch spring

Measure the free length of the clutch spring.

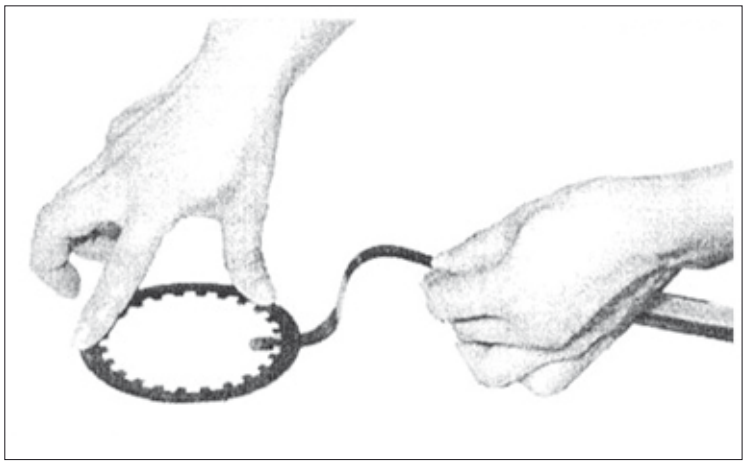
Maintenance limit value: 32.3 mm



13.6.14 Inspect the clutch disc

Replace the clutch disc if it is faulty. Measure the thickness of each disc.

Maintenance limit value: 2.85 mm



Check that the surface of the clutch disc is not deformed. A gauge is used for inspection.

Maintenance limit value: 0.14 mm

Inspect the space between the clutch housing and the clutch disc.

Maintenance limit value: 0.6 mm

13.6.15 Inspect the clutch housing

Check that the teeth on the clutch housing have no gaps or scratches due to friction. In the presence of severe signs, replace the shield.

13.6.16 Inspect the drive wheel

Check that the drive wheel is not worn or damaged. In the presence of severe signs, replace it.

13.6.17 Inspect the free wheel

Remove the retainer from the end of the free wheel and check that the components show no signs of wear or damage.

13.6.18 Inspect the main starter gear

Check that the main starter gear is not worn or damaged.

13.6.19 Inspect the oil pump on the right side of the engine housing

Check the internal rotor of the oil pump for wear or damage. In the presence of severe signs, replace it.

Check that the oil pump intermediate gear and the gear assembly do not show any cracks. If so, replace them.

Check that the oil pump cover on the right side is not worn or damaged. If so, replace it.

13.6.20 Inspect the starter motor and the double gear.
Check that the teeth on the starter motor are not damaged and that the double gear has no wear or damage.

13.6.21 Inspect the gearshift
Check that the positioning plate roller has no wear or difficulty in movement.

13.6.22 Assemble the starter shaft
Insert the starter shaft into the appropriate hole on the right side of the engine housing. This step is not necessary for motorcycles equipped with electric starter only.

13.6.23 Assemble the double gear
Insert the double gear into the appropriate shaft on the right side of the engine housing.

Install the double gear washer on its end side.

Install the retaining ring on the groove of the retainer on the double gear shaft.

13.3.24 Assemble the gearshift
Insert the positioning plate assembly on the right side of the engine housing and tighten.

Insert the pentagonal plate into the selector drum.

13.6.25 Assemble the oil pump on the right side of the engine housing
Insert the oil pump pin into the hole on the pump shaft.

Insert the rotor assembly into the hole on the right side of the engine housing and tighten the oil pump cover plate assembly onto the rotor using 3 screws M5×18.

⚠ **Install the oil pump rotor with the rotor inner and outer marked side facing the same direction.**

Tightening torque: Oil pump cover plate screws: 7 ~ 9 Nm

⚠ **When assembling the cover plate, make sure that the pump shaft can rotate freely.**

Install the oil pump gear assembly on the pump shaft and insert a retaining ring into the groove of the pump shaft retainer.

Insert the washer of the oil pump intermediate gear onto the gear shaft before inserting the gear itself. Then install the intermediate gear washer on the gear before inserting the retaining ring on the retainer groove on the gear shaft.

13.6.26 Assemble the free wheel
Install the wedge on the outer shield of the free wheel.

⚠ **Make sure that the wedge is correctly positioned during assembly.**

13.6.27 Install the main gear and the free wheel
Insert the main gear washer onto the crank on the right side.

Insert the main gear and the free wheel on the crank on the right side.

⚠ **Apply a layer of lubricating grease in the hole of the main gear before installing the main gear.**

13.6.28 Install the drive wheel
Install the drive wheel on the crank on the right side.

Insert the washer of the drive wheel lock nut onto the drive wheel.

Apply sealant on 3-4 threads of the drive wheel lock nut.

Tightening torque: Driving wheel lock nuts: 150 ~ 160 Nm

13.6.29 Install the clutch

Install the clutch housing washer, clutch shaft sleeve, housing outer sleeve and washer of the housing central bushing on the main shaft.

⚠ **Apply a layer of lubricating grease to the inner ring of the clutch shaft sleeve.**

Install the clutch central bush and the housing lock nut washer on the main shaft and apply sealant on 3-4 threads of the housing lock nut, then insert and close the nut on the main shaft.

Tightening torque: Clutch lock nuts: 80 ~ 90 Nm

Insert the clutch disc into the clutch central hub and into the outer shield of the housing before inserting the clutch pressure pin into the central hole of the main shaft.

Then insert the clutch pressure pin in the central hole of the main shaft before inserting the thrust bearing and washer on the tie rod.

Insert the clutch pressure plate, the relative spring, the screw and close the screws of the pressure plate using a torque wrench.

Tightening torque: Clutch pressure plate screws: 8 ~ 10 Nm

13.6.30 Assemble the starter motor

Apply a homogeneous layer of oil on the ends of the groove of the starter motor teeth before installing the motor and tighten it with 2 bolts.

Tightening torque: Starter motor fastening bolts: 11 ~ 13 Nm.

13.6.31 Install the crankcase cover on the right side.

Remove the used seal from the crankcase on the right side and replace it.

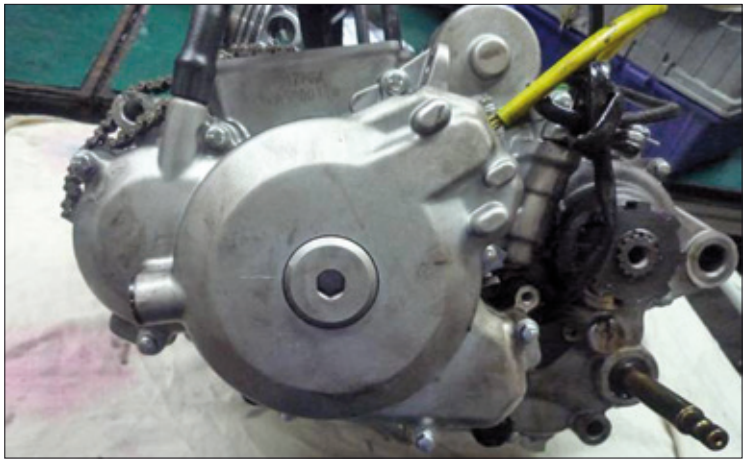
Insert the crankcase cover on the right side and tighten with 10 bolts M6 × 30.

Tightening torque: Right side crankcase cover bolts: 11 ~ 13 Nm

Insert the water pump impeller onto the pump shaft and tighten it.

Insert the water pump cover seal before installing the cover and tighten it with 3 bolts M6×35 and a bolt M6×20.

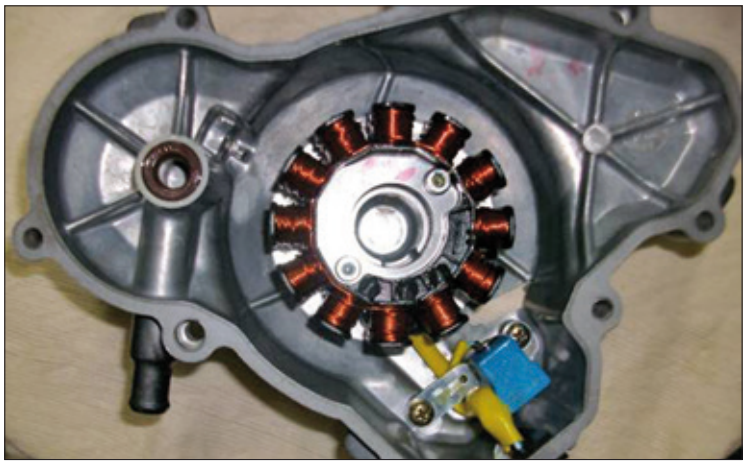
Tightening torque: Water pump impeller bolts: 2 ~ 4 Nm



13.7 GENERATOR, CRANKSHAFT BALANCING AND DRIVEN WHEEL

13.7.1 Remove the crankcase cover on the left side

Remove the lock bolts on the front and left cover and remove the crankcase cover on the left side.



13.7.2 Remove the generator stator

Remove 2 screws M5×10 from the sensor.

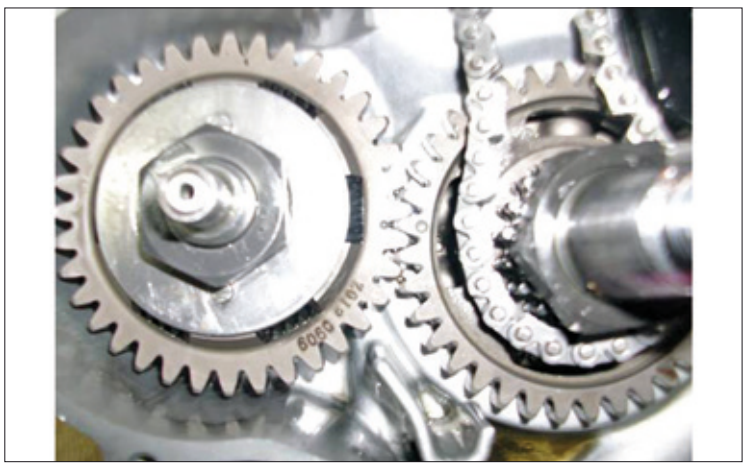
Remove 2 screws M5×30 from the stator coil and remove the generator stator assembly from the left side crankcase cover.

13.7.3 Remove the generator rotor

Remove the lock nut from the magnet rotor and remove the rotor using the appropriate tool.

⚠ **Only use the dedicated tool to remove the rotor. Do not tap on the rotor.**

⚠ **In case of unexpected impact against the magnet during removal or assembly, for example due to falling on the ground or a blow from a foreign object, replace it.**



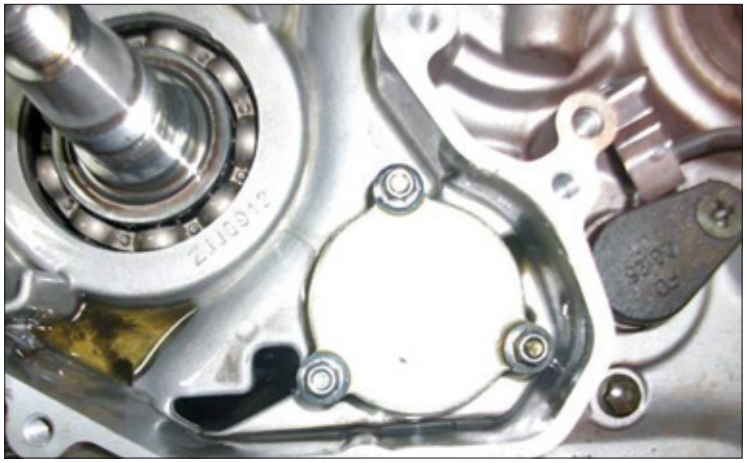
13.7.4 Remove the balancing drive wheel and the driven wheel

Disconnect the timing chain and the chain tensioning pad before removing the lock nut and washer from the balancing drive wheel.

Remove the crankshaft gear wheel and balancing drive wheel.

Remove the lock nut from the balancing drive wheel and disc washer.

Remove the balancing driven wheel, the crankshaft sleeve and the balancing shaft tab.



13.7.5 Remove the oil pump on the left side

Remove the 3 bolts from the oil pump cover plate on the left side.

Remove the oil pump cover plate and the oil pump rotor assembly on the left side.

⚠ **Be very careful to the oil pump pin.**

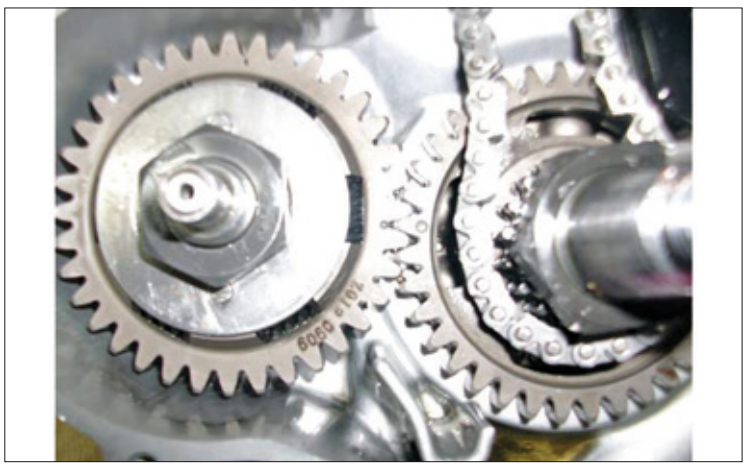
13.7.6 Inspect the crankcase cover on the left side

Check the compensation shaft oil seal on the left side of the crankcase cover for damage. If so, replace it.

13.7.7 Inspect the generator rotor and the stator

Check that the magnetic shoe of the magnet stator has no cracks or damage. If so, install a new generator rotor.

Check the generator rotor for wear or damage. If so, install a new generator rotor.



13.7.8 Inspect the balancing drive wheel and the driven wheel

Check that the balancing drive wheel and the driven wheel are not worn or damaged.

13.7.9 Inspect the left side oil pump
Check the left side oil pump for wear or damage.

Check the oil pump cover plate for wear or damage.

13.7.10 Install the left side oil pump
Insert the oil pump in the appropriate holes on the left side.

Tighten the oil pump cover plate on the left side with 3 bolts M5×10.

⚠ **Install the oil pump rotor with the rotor inner and outer marked side facing the same direction.**

Closing torque: Oil pump cover plate bolts on the left side: 7 ~ 9 Nm.

⚠ **When assembling the cover plate, make sure that the pump shaft can rotate freely.**

13.7.11 Install the balancing drive wheel and the driven wheel
Install the crankshaft sleeve on the compensation shaft and install the compensating shaft tab in the compensation hole before inserting the compensation shaft driven wheel onto the compensation shaft.

Install the balancing drive wheel on the left side crank before inserting the drive shaft gear onto the left side crank.

⚠ **Match the gear of the drive wheel with the distribution marking with the gear of the driven wheel with the distribution marking during assembly.**

Insert the washer of the balancing drive wheel lock nut and the disc washer respectively onto the crankshaft timing pinion and onto the compensation shaft driven wheel.

Apply sealant on 3-4 threads of the lock nut M24×1 of the compensation shaft and of the clutch lock nut M16×1 before inserting them on the crankshaft and compensating shaft and tighten them.

Closing torque: Balancing drive wheel and driven wheel nut: 80 ~ 90 Nm.

Closing torque: Driven wheel nut: 80 ~ 90 Nm.

13.7.12 Install the generator rotor
Install the magnet rotor on the crankshaft on the left side and apply sealant on 3-4 threads of the nut on the magnet before tightening the nut on the crankshaft.

Closing torque: Generator rotor nut: 85 ~ 90 Nm.

13.7.13 Install the generator stator
Tighten the magnet stator assembly on the crankshaft on the left side with 2 screws M5×10 and 2 screws M5×30.

Tightening torque: Generator stator screws: 7 ~ 9 Nm.

13.7.14 Install the crankcase cover on the left side
Remove the used seal and replace it.

Insert the crankcase cover on the left side and tighten the bolts M6×35.

Tightening torque: Crankcase cover bolts on the left side: 11 ~ 13 Nm.

13.8 CRANKCASE, CRANKSHAFT, TRANSMISSION AND COMPENSATION SHAFT

13.8.1 Crankcase disassembly

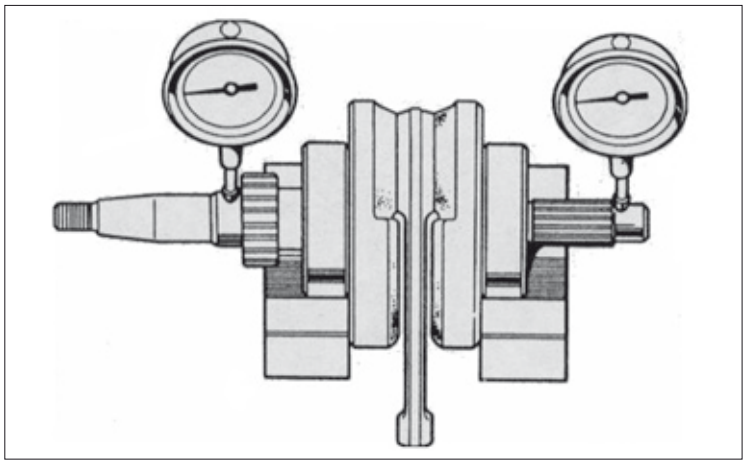
Place the crankcase on the left side facing up.

Remove 8 bolts M6×65 and 5 bolts M6×45, separate the left side of the crankcase from the right and remove the 2 positioning pins.

13.8.2 Remove the crankshaft, compensation shaft, main shaft and counter-shaft

Remove the crankshaft assembly, compensation shaft, gearshift fork shaft, gearshift fork, selector drum, main shaft assembly and the counter-shaft assembly.

⚠ **Do not forget any components of the main shaft assembly and counter-shaft assembly**

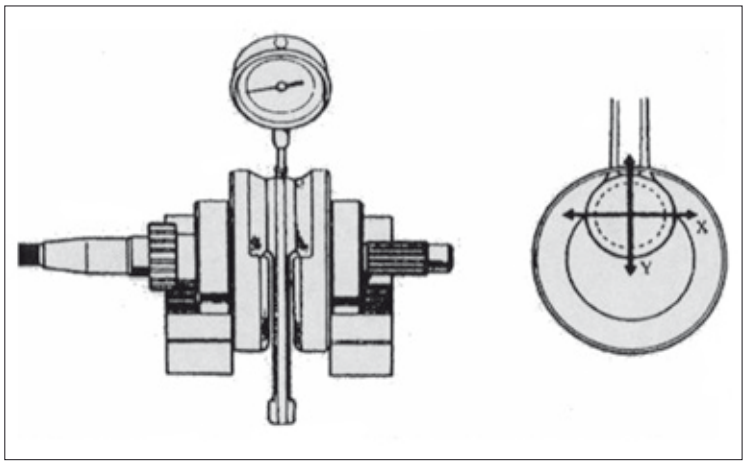


13.8.3 Inspect the crankshaft

Place the crankshaft on the V-shaped support.

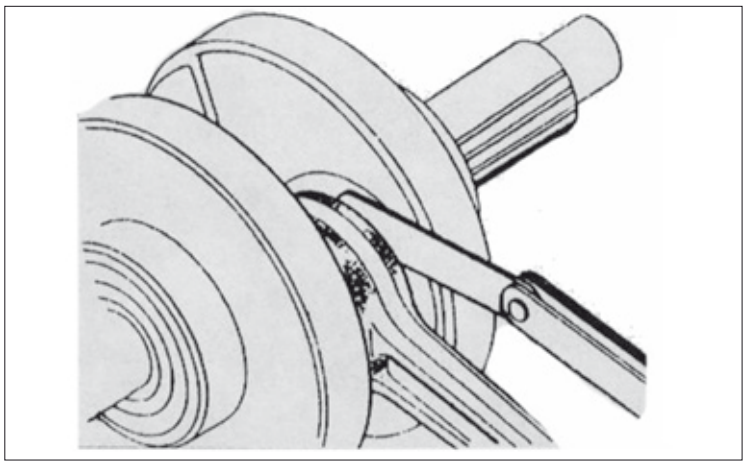
Measure the radial deformation of the crankshaft diameter using a dial gauge.

Maintenance limit value: 0.1 mm



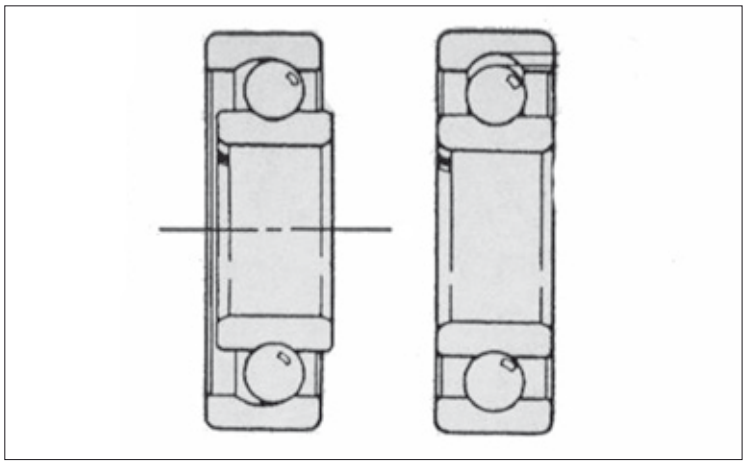
Measure the radial deformation of the large end of the crank pin at two points in both the X and Y directions.

Maintenance limit value: 0.02 mm



Measure the side space of the large end of the crank pin with a thickness gauge.

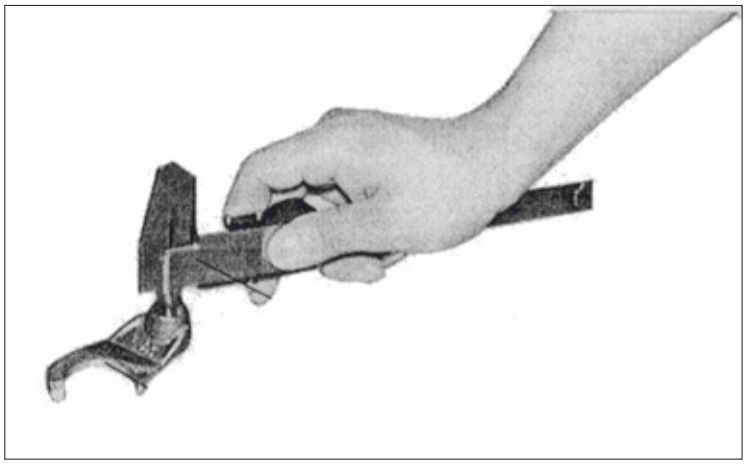
Maintenance limit value: 0.7 mm



13.8.4 Inspect the bearings on the left and right sides of the crankcase

Check for all the bearings on the left and right sides of the crankcase that the rotation is not slowed down, if so, install new bearings of the same type.

Remove the bearings from the crankcase to check their eccentricity and the presence of blocks in the rotation. In case of noise, excessive eccentricity or blockages, install new bearings.

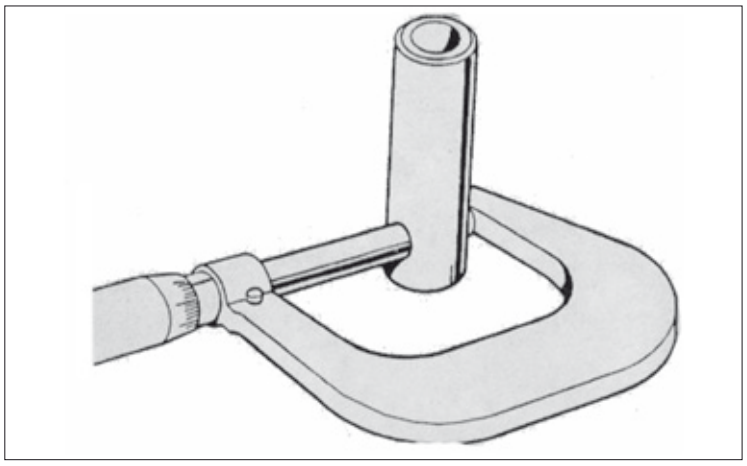


13.8.5 Inspect the gearshift fork, fork shaft and selector drum

Check the gearshift forks for wear, bending or other defects and measure the inside diameter of the gearshift fork.

Maintenance limit value for the shift fork: φ 12.45 mm

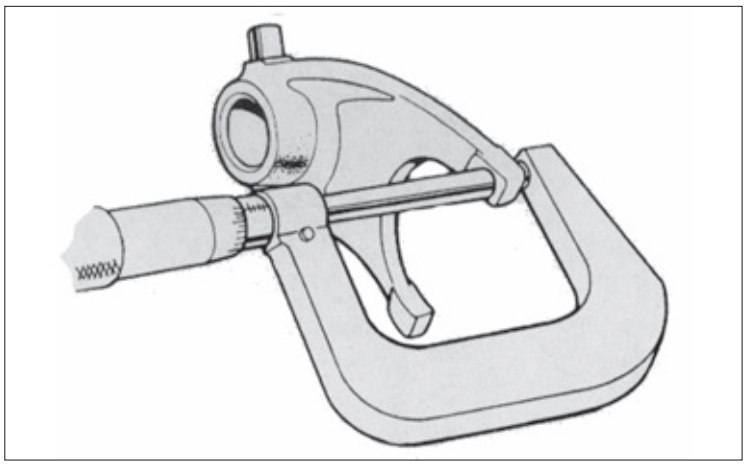
Maintenance limit value for the counter-shaft fork: φ 14.45 mm



Check the main shaft and counter-shaft fork is not worn, damaged or bent and measure the outside diameter.

Maintenance limit value for the main fork shaft: φ 11.95 mm

Maintenance limit value for the counter-shaft fork shaft: φ 13.95 mm



Measure the thickness of the ends.

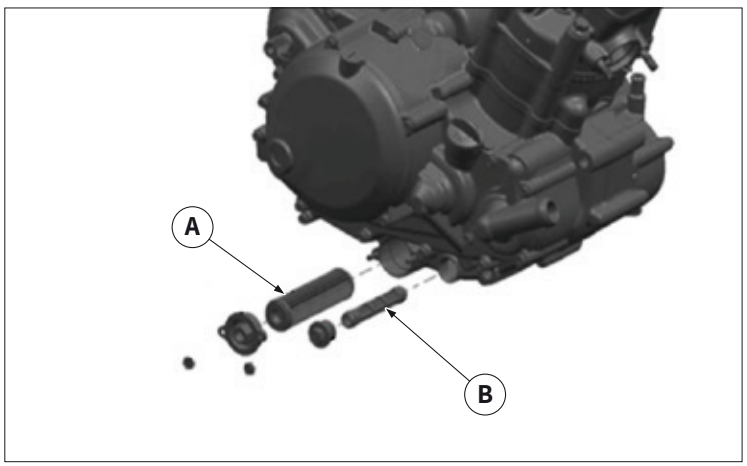
Maintenance limit value: 4.7 mm

Check that the surface of the selector drum and groove are not worn or damaged.

13.8.6 Inspect the main shaft assembly and the counter-shaft assembly

Check that all the gears of the main shaft and counter-shaft do not show excessive or improper wear.

Check that all the retainers between the gears are not deformed or out of place.



13.8.7 Inspect the oil filters and its components

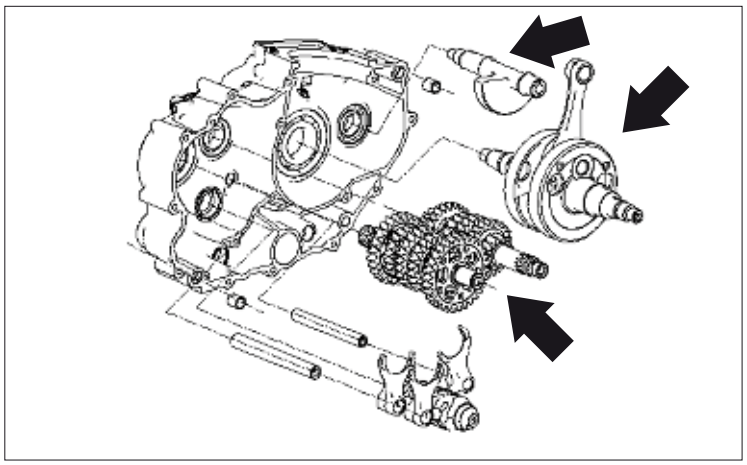
Check that the oil filters and their components are clean, if they are dirty, clean them with clean petrol.

Inspect oil filter components and oil strainer for damage; if any, install new oil filter components and a new oil strainer.

The thin filter "A" is made of paper: do not use gasoline to clean it.

The primary filter "B" is made of metal.

Check that the oil filters and their components are not damaged, if so replace them.

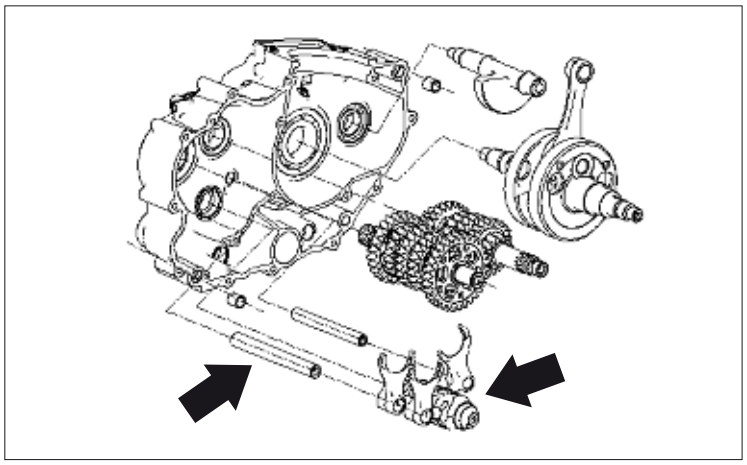


13.8.8 Assemble transmission, crankshaft and compensation shaft

Insert the crankshaft and the compensation shaft into the appropriate holes on the left side of the crankcase.

Insert the main shaft and counter-shaft components into the appropriate holes on the left side of the crankcase and insert the fork in the right position.

⚠ **Insert the fork marked with R inside the counter-shaft on the right side, the fork marked with L inside the counter-shaft on the left side and the fork marked with C inside the main shaft.**



Insert the selector drum into the appropriate holes on the left side of the crankcase and the other end of the fork on the selector drum in the appropriate seats before inserting the fork shaft in the appropriate fork.

⚠ **Move the longer shaft of the fork through the forks marked with R and L and the shorter one through the fork marked with C.**

13.8.9 Assemble the left and right parts of the crankcase and the filter

Apply a layer of silicone sealant to the coupling side on the right side of the crankcase, insert the positioning pin in the appropriate hole on the left side of the crankcase, couple the right side of the crankcase with the left one, insert 5 bolts M6×45 and 8 bolts M6×65 in the appropriate holes on the left side of the crankcase and tighten them.

Tightening torque:
Left and right crankcase parts assembly bolts: 11 ~ 13 Nm

Insert the oil filter components into the appropriate seats on the crankcase.

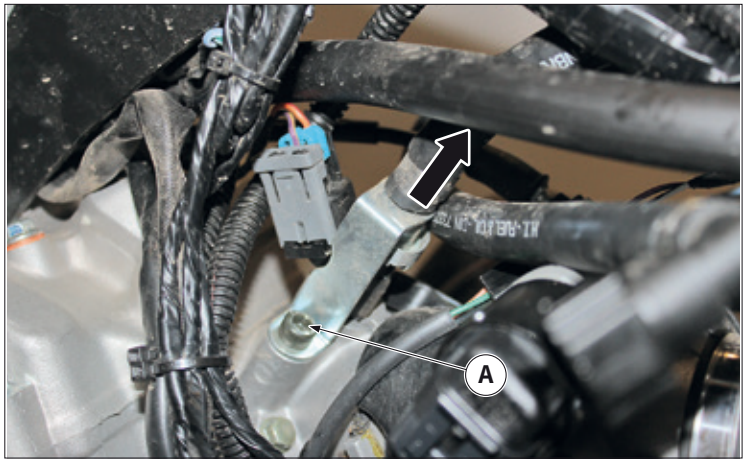
⚠ **When installing the oil filter, keep the opening turned towards the left side of the crankcase.**

Install the filter cap on the pin and tighten it with 2 nuts M5.

Tightening torque: Engine oil filter cap nuts: 7 ~ 9 Nm.

Insert the oil filter assembly into the appropriate seats on the left and right sides of the crankcase before tightening the filter cap.

Tightening torque: Oil filter assembly fasteners: 11 ~ 13 Nm.



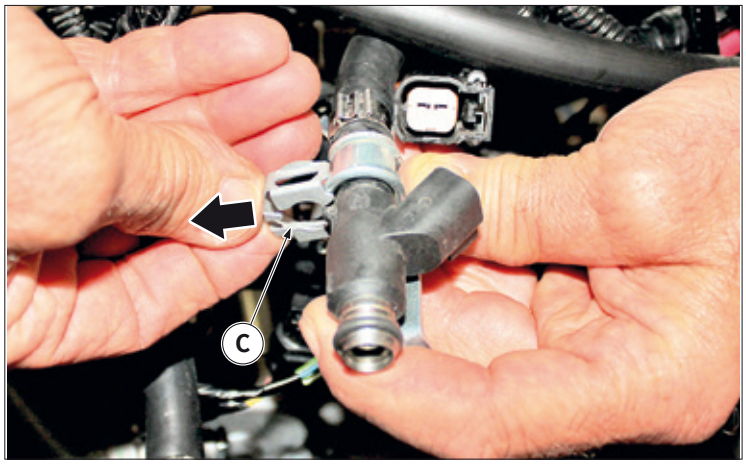
13.9 ELECTRONIC INJECTION REMOVAL

13.9.1 Injector removal

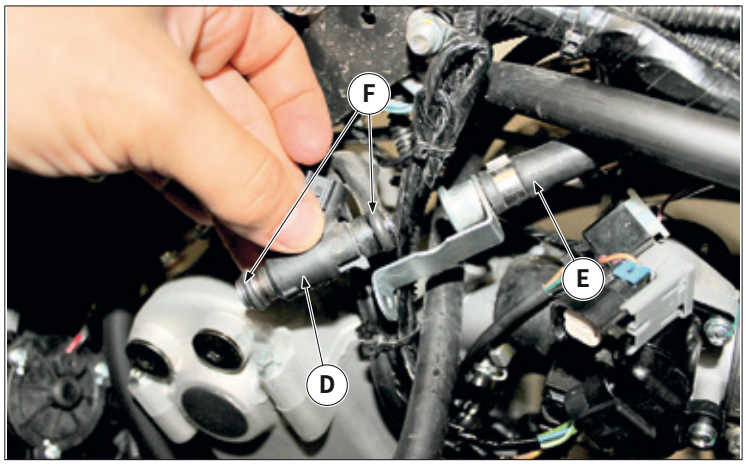
Remove the fastening screw “A” and disconnect the fuel injector from the flange on the engine.

Disconnect the fuel injector connector “B”.

⚠ **There may be fuel residues inside the injector and its hose.**



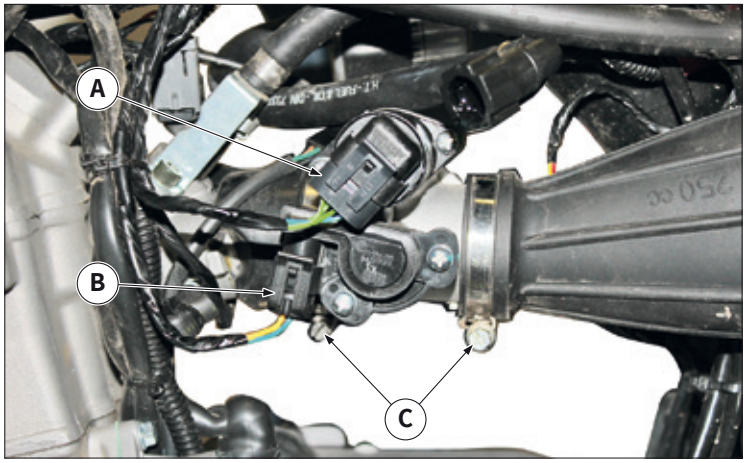
Release the retaining clip “C” from the injector.



Remove the fuel injector “D” from the fuel pipe “E”.

ⓘ **Proceed in the reverse order for reassembling.**

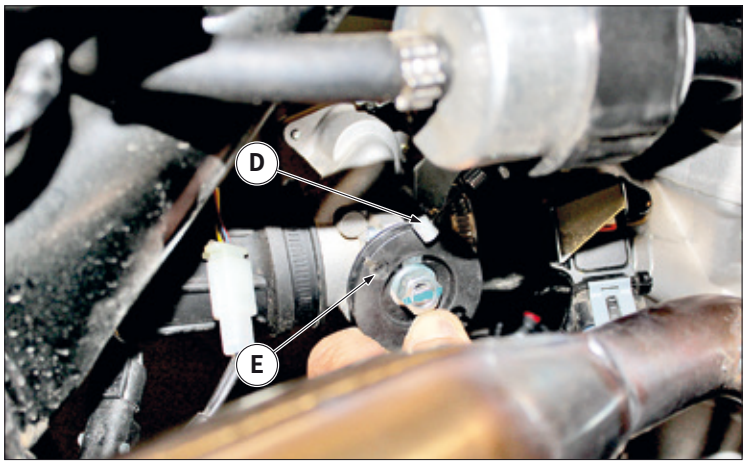
⚠ **Replace the O-rings . “F ”every time the fuel injector is disassembled.**



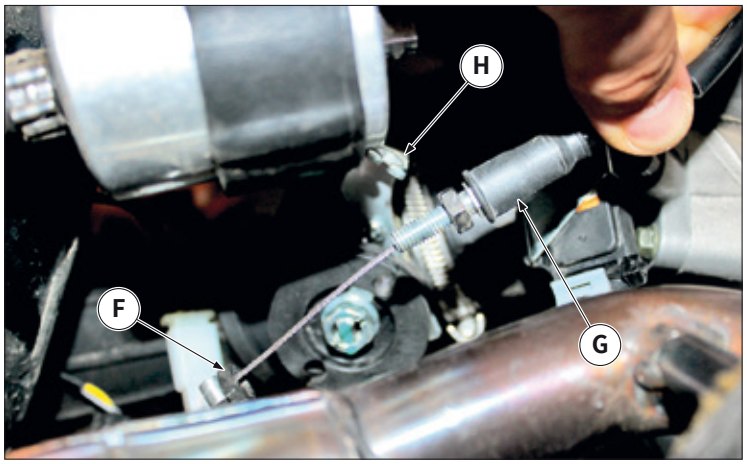
13.9.2 Throttle body removal

Disconnect the stepper motor connector “A” and the TPS sensor connector “B”.

Loosen the metal clamps “C”.

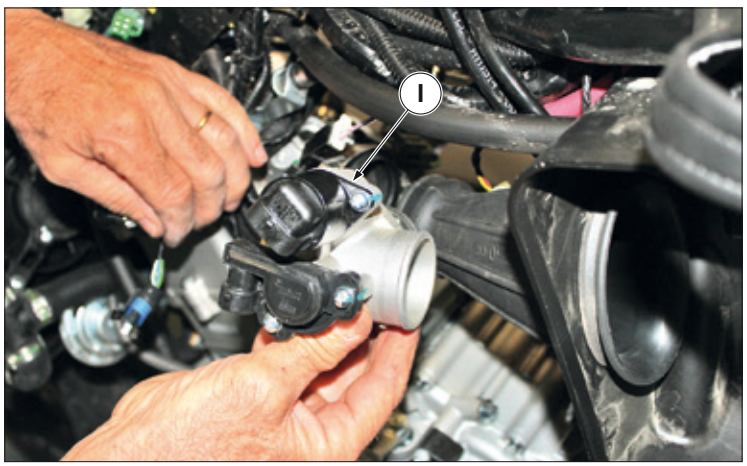


Remove the throttle cable pin “D” from the throttle body coupling “E”.



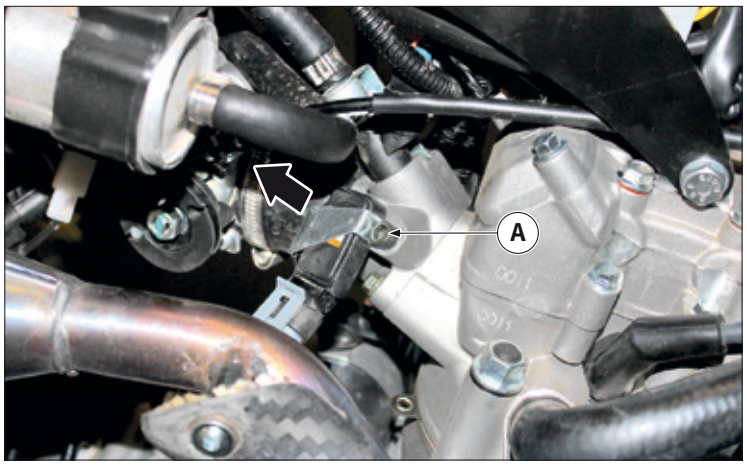
Completely unscrew the fastening nut “F” of the accelerator cable.

Release the throttle cable “G” from the throttle body bracket “H”.



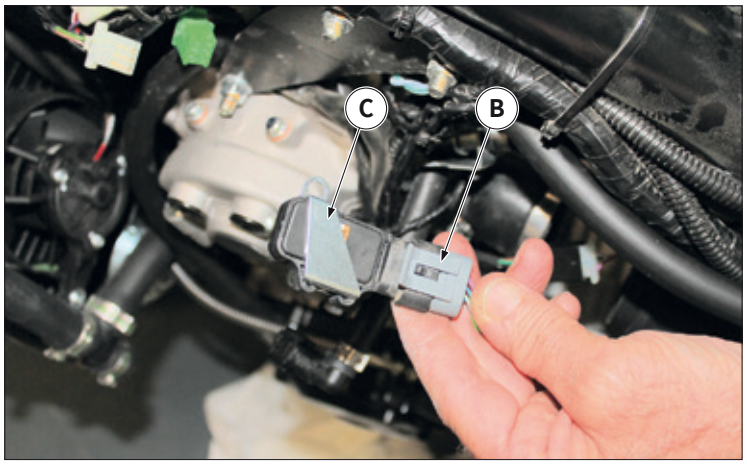
Remove the throttle body “I” from the manifolds.

Proceed in the reverse order for reassembling.



13.9.3 MAP sensor removal

Remove the screw “A” and disconnect the MAP sensor from its seat on the engine.



Disconnect the connector “B” and the retaining bracket “C” from the MAP sensor.

Proceed in the reverse order for reassembling.