



Sales division
Technical network leadership

WORKSHOP MANUAL



**400/500CC 4-STROKE ENGINE
4 VALVES
PIAGGIO**

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PRODUCTS DANGER SYMBOLS USED

Protection of individuals and of the environment.

	Möbius band	Recyclable	Means that the product or the package can be recycled. However, this does not guarantee that the product will be recycled
	Irritant	The product can irritate the skin, eyes and respiratory organs.	Avoid contact with the skin and clothes. Wear gloves, safety glasses and appropriate clothes such as a cotton overall. Do not breath fumes. If in contact, wash thoroughly with water
	Flammable	The product is flammable.	Keep it away from any flame or heat source (barbecue, radiator, heating device, etc.). Do not leave the product in the sun
	Corrosive	The product can damage living tissues or other surfaces	Avoid contact with the skin and clothes. Wear gloves, safety glasses and appropriate clothes such as a cotton overall. Do not breath fumes
	Explosive	The product can explode under certain circumstances (flame, heat, impact, friction)	Avoid impacts, friction, sparks and heat
	Hazardous to the environment	The product affects fauna and flora. Do not dump it in garbage cans, sinks or nature	The ideal solution is to bring this product to your nearest household waste recycling centre
	Toxic	The product can seriously affect health if it is inhaled, ingested or in contact with skin	Avoid direct contact with body even by inhalation. If you feel unwell, seek medical advice immediately
	Do not throw away into a garbage can	One of the product's component is toxic and can be hazardous to environment. For example: Used batteries	This symbol informs the consumer that the used product shall not be thrown away into a garbage can, but shall be brought back to the merchant or dropped at a specific collection point.
	Compulsory gloves	Operation that can be dangerous for people	People's safety can be seriously affected if the recommendations are not fully respected



	People's safety	Operation that can be dangerous for people	People's safety can be seriously affected if the recommendations are not fully respected
	Important	Operation that can be hazardous to the vehicle	Indicate the specific procedures that shall be followed in order not to damage the vehicle
	Good operating condition of the vehicle	The operation must be carried out in strict compliance with the documents	Serious damage to the vehicle and in certain cases a cancellation of the warranty can be involved if the recommendations are not fully respected
	Note	Operation that can be difficult	Indicate a note which gives key information to make the procedure easier
	Lubricate	Lubricate the parts to be assembled	Indicate the specific procedures that shall be followed in order not to damage the vehicle
	Grease	Grease the parts to be assembled	Indicate the specific procedures that shall be followed in order not to damage the vehicle
	Glue	Glue the parts to be assembled	Indicate the specific procedures that shall be followed in order not to damage the vehicle
	New part	Use a new part	Indicate the specific procedures that shall be followed in order not to damage the vehicle



CHARACTERISTICS

	400 cc	500 cc
Marking	M564M	M563M
Type	4-stroke single-cylinder 4 valves per cylinder with chain driven overhead camshaft	
Cooling	Liquid	
Bore x stroke	85.8 x 69 mm	94 x 71 mm
Cubic capacity	398.9 cc	492.7 cc
Max. power output	24 kW at 7250 rpm	27.5 kW at 7000 rpm
Max. torque rating	5250 rpm	
Compression ratio	10.6 bars	
Lubrication	Trochoidal pump	
Transmission	By 2 variable pulleys and V-type belt	
Clutch	Centrifugal automatic	
Exhaust	Catalytic	
Starter motor	Mitsuba	
Spark plug	1 spark plug NGK CR7EKB Electrode gap 0.7-0.8 mm	2 spark plugs
Magneto flywheel	Mitsuba 900 W	
Fuel supply	Indirect electronic injection Magneti-Marelli	

■ **Capacities.**

Engine oil	1.7 l SAE 5W40 Minimum grade: API SJ
Relay box oil	0.25 l SAE 80W90 Minimum grade: API GL4



SPECIAL IMPORTANT POINTS

■ Oil and fuel



**This engine is designed to run on 95 or 98 unleaded fuel only.
Never run the machine with a petrol/oil mixture.**



**Fuel pipes must absolutely be changed if there are any signs of wear, cracks, etc.
The clips are specific, they must always be changed each time they are removed and replaced
with new genuine parts clips.**



**Petrol is highly inflammable, do not smoke in the working area and avoid proximity to flames or
sparks.**



SERVICE SCHEDULE AND COMMISSIONING

Heavy duty servicing is for vehicles used under "harsh" conditions: door-to-door deliveries, intensive urban use (courier), short journeys with engine cold, dusty areas, ambient temperature over 30°C.

Service operations	1000 kms or 1 months	Every 10000 kms	Every 20000 kms
Heavy duty servicing	500 kms	Every 5000 kms	Every 10000 kms
Spark plug		R	
Valve clearances			C
Inlet silencer/air filter		N	
Transmission air filter		N	
Drive pulley bearings and guides.#		C	
Transmission belt		R	
Belt anti-flapping roller		C	
Driven pulley: Moving flange and needle bush		G	
Engine oil (+ clean strainer)	R	R	
Engine oil filter	R	R	
Relay box oil	R	C	
Coolant	Once every 2 years		

C: Check.

N: Clean.

R: Change.

G: Check and lubricate.

#: Change if necessary.

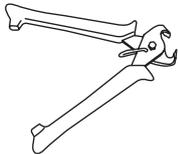
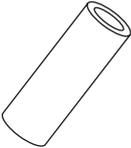
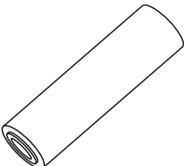
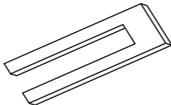
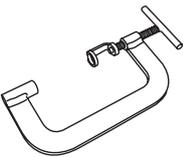
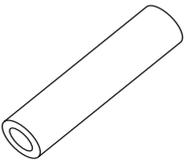
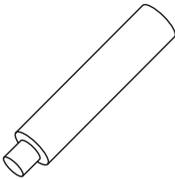
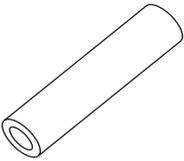


TIGHTENING TORQUES

Drive pulley	17 m.daN
Driven pulley	9.6 m.daN
Clutch plate and shoes	7 m.daN
Belt anti-flapping roller	1.8 m.daN
Transmission cover; • 6 mm diameter screw • 8 mm diameter screw	1.2 m.daN 2.4 m.daN
Relay box cover	2.5 m.daN
Relay box drain plug	1.5 m.daN
Flywheel magneto cover	1.2 m.daN
Stator	1 m.daN
Engine speed sensor	0.5 m.daN
Rotor	12 m.daN
Freewheel	1.4 m.daN
Starter motor	1.2 m.daN
Automatic tensioner	1.2 m.daN
Automatic tensioner plug	0.5 m.daN
Spark plug	1.2 m.daN
Decompressor valve balance weight	0.8 m.daN
Decompressor valve housing	3.2 m.daN
Chain tensioner	1.2 m.daN
Camshaft stop plat	0.5 m.daN
Cylinder head. (Guide pins)	Procedure
Cylinder head bolts and nuts	1.2 m.daN
Cylinder head cover	0.8 m.daN
Inlet manifold	1.2 m.daN
Engine temperature sensor	1.1 m.daN
Injection ECU	1.2 m.daN
Injection rail	0.3 m.daN
Oil pressure switch	1.2 m.daN
Oil pump	0.6 m.daN
Oil filter	1.4 m.daN
Oil pump cover	0.9 m.daN
Crankcase	1.2 m.daN
Conrod and crankshaft assembly gear	1.1 m.daN
Balancing shaft	2.8 m.daN
Engine drain plug	2.5 m.daN
Water pump cap	0.4 m.daN
Water pump impeller	0.5 m.daN

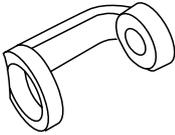
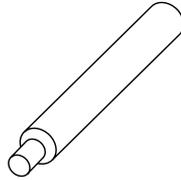
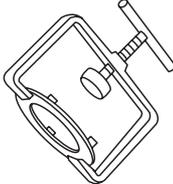
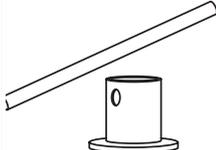
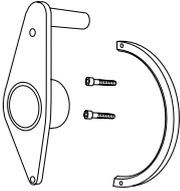
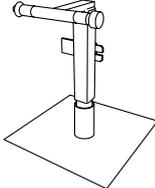
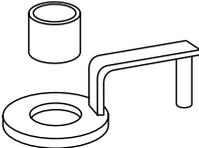
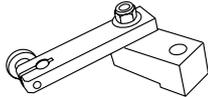
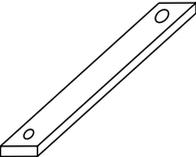
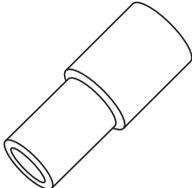


SPECIAL TOOLS

	Tool N°	Designation	Used with		Tool N°	Designation	Used with
	750539	Tie-wrap pliers			756057	Water pump lip seal fitting tool	
	752000	Piston circlip pliers			756532	Pulley bearing drift	
	752237	Adjustable pin wrench			756574	Pulley bearing drift	
	754007	Water pump seal drift			756575	Piston locking fork	758940
	754035	Valve lifter	758595		757988	Pulley bearing drift	
	754041	Pulley bearing drift			757990	Seal piston	

(*)New or modified tool.

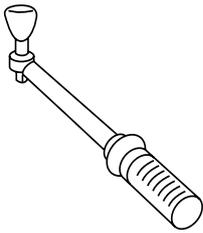
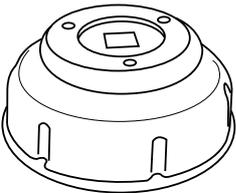
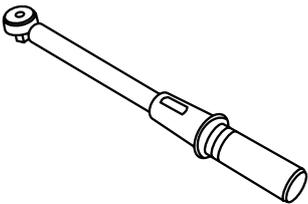
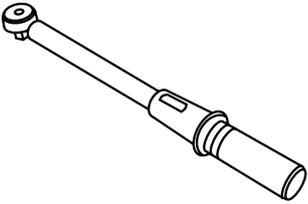
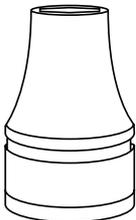
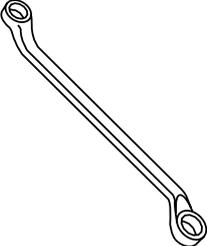
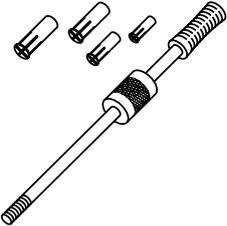
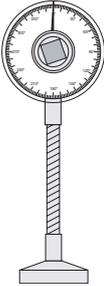
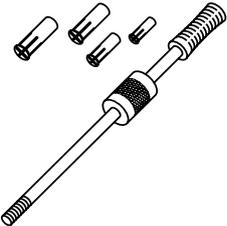


	Tool N°	Designation	Used with		Tool N°	Designation	Used with
	758595	Valve spring lifter adapter	754035		759473	Balance shaft set rod (*)	
	758938	Flywheel puller			759474	Clutch compression tool (*)	759475
	759468	Piston ring installation collar (*)	756575		759475	55 mm pipe casing seal drift (*)	759474
	759469	Fixed flange locking tool (*)			759476	Engine mount adapter (*)	
	759470	Flywheel magneto holder tool (*)			759477	Piston over-travel tool (*)	
	759471	Balance shaft holder plate (*)			759788	Seal piston (*)	

(*)New or modified tool.



■ Standard tools

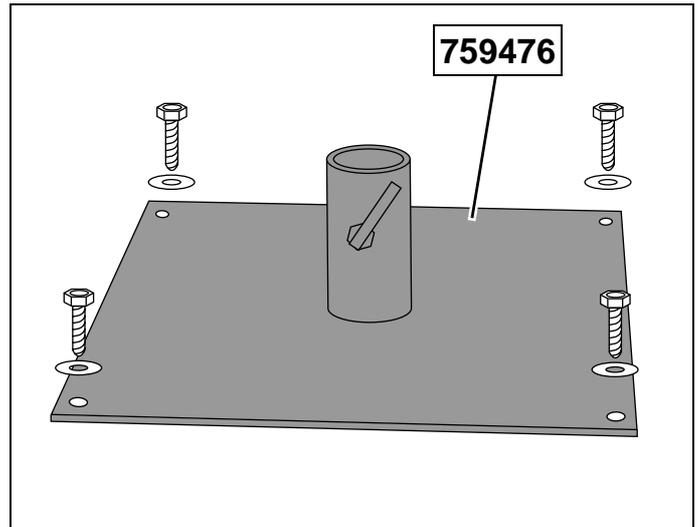
	<p>Heat gun</p>		<p>Automatic resetting type torque wrench 5 to 25 Nm Type: Facom R.306A25</p>
	<p>Oil filter notched cap wrench Type: Facom D155</p>		<p>Automatic resetting type torque wrench 10 to 50 Nm Type: Facom J.208A50</p>
	<p>Torx end of 55</p>		<p>Automatic resetting type torque wrench 40 to 200 Nm Type: Facom S.208A200</p>
	<p>10 mm hex type (6 sided) socket with 1/2" square</p>		<p>Dial indicator</p>
	<p>21 mm offset box-end wrench</p>		<p>Inertia type extractor tool for bearings from 6 to 18 mm Type: Facom U.49PJ3</p>
	<p>Protractor</p>		<p>Inertia type extractor tool for bearings from 18 to 50 mm Type: Facom U.49PJ2</p>



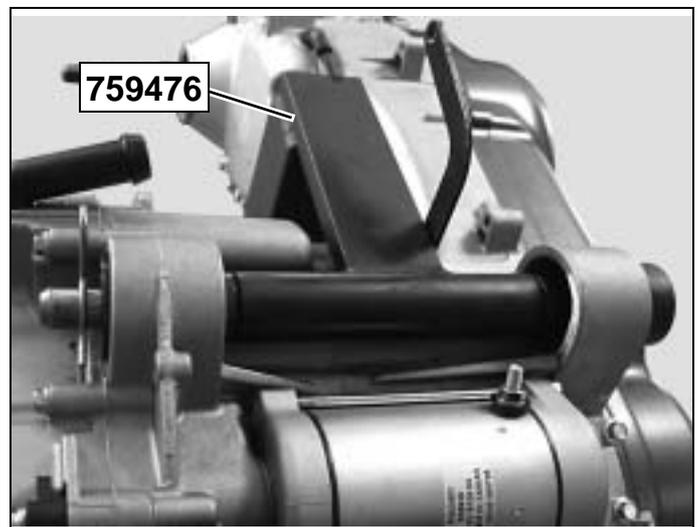
TRANSMISSION

■ Putting the engine on the stand.

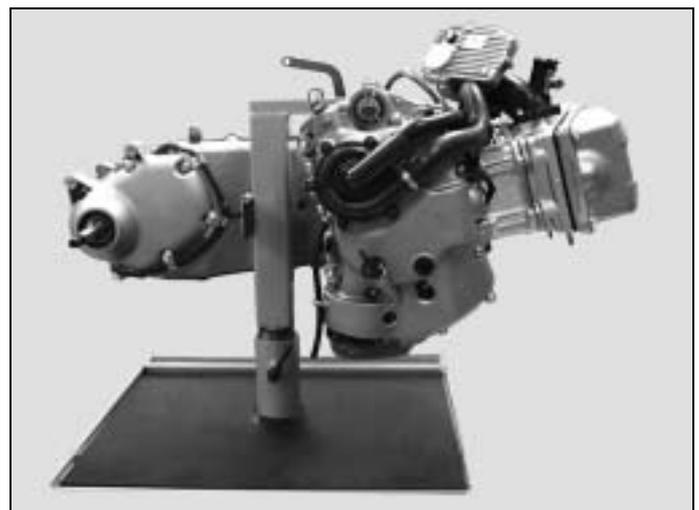
- By means of 4 screws, secure the engine holder P/N 759476 to a stable support.



- Assemble the engine angle bracket 759476 and the engine using the pin and the spacers that are provided.



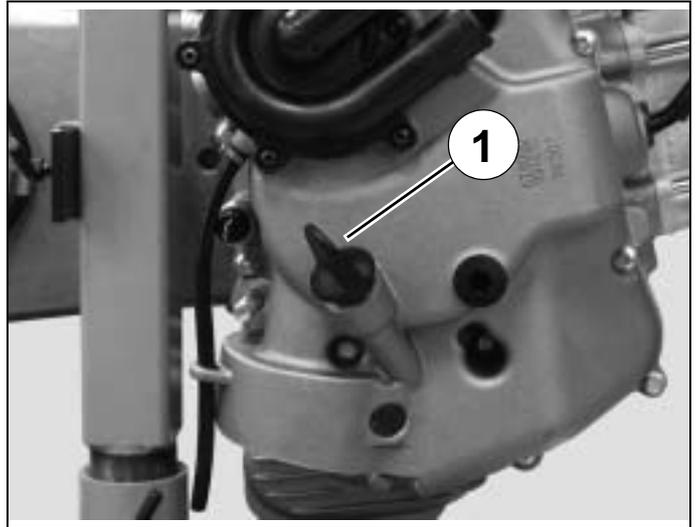
- Fit the angle bracket & engine assembly into the engine support.



■ Changing the engine oil.

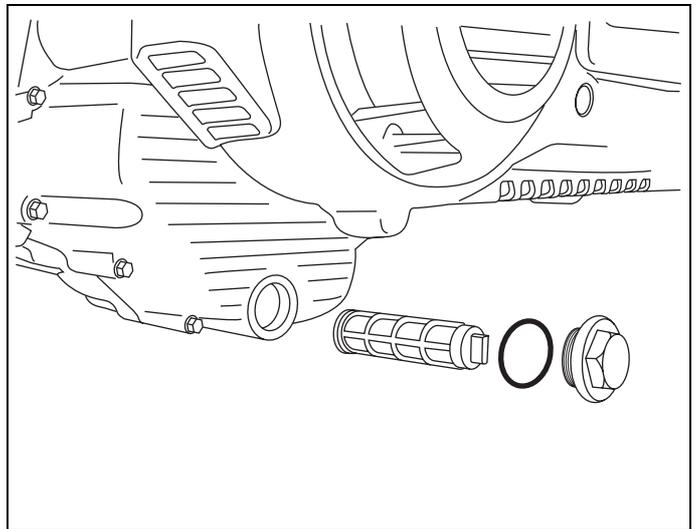


- Remove the engine's oil filler cap. (1).



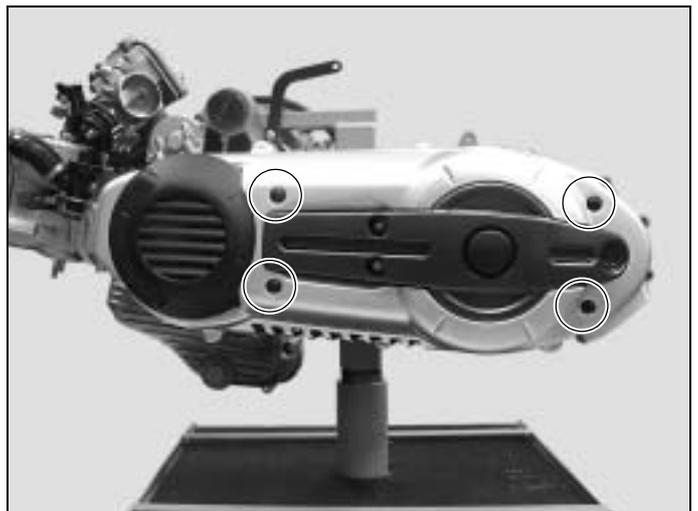
- Remove the cap and the filter to drain oil from the engine (check the condition of the O-ring and change it if necessary).

Tightening torque: 2.5 m.daN.

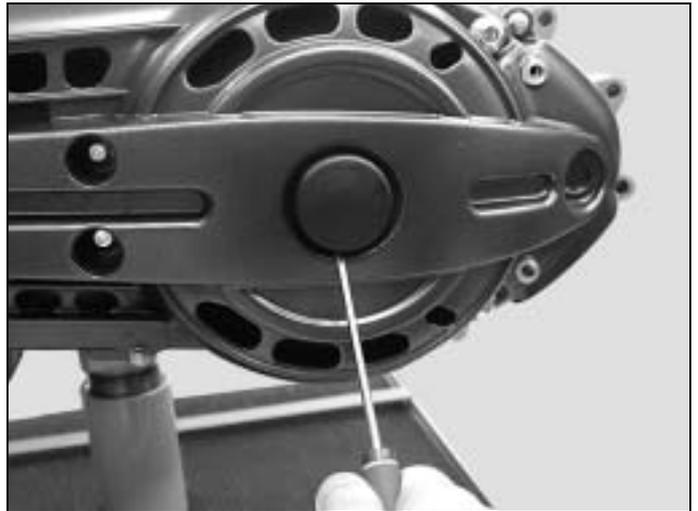


■ Removal of the primary transmission cover.

- Remove the transmission cover trim. (4 screw).



- Remove the plastic cover.



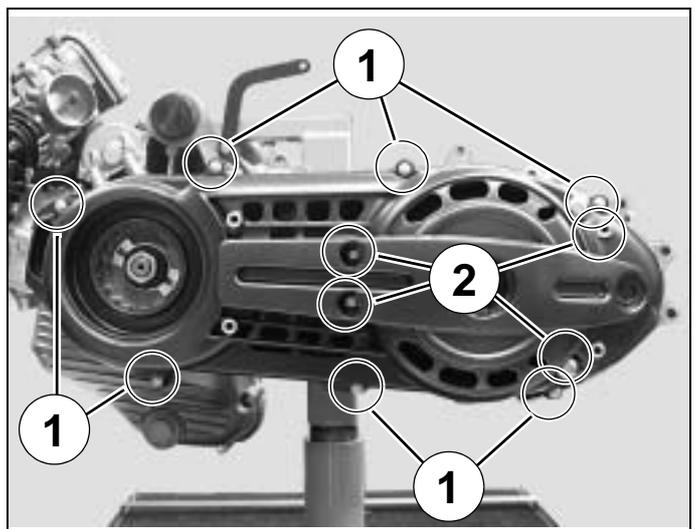
- Hold the input shaft using a hex socket (6 sided) with a 1/2" square
- Loosen the nut using an offset box-end wrench.



Important: Owing to the considerable tightening torque, you must absolutely use an hex (6 sided) socket with a 1/2" square.

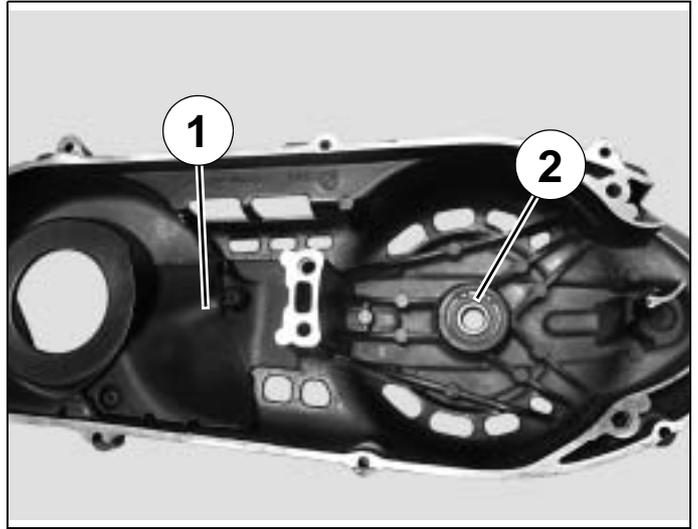
If you use a different socket, you might damage the shaft or the even the socket.

- Remove the nut and the 2 washers.
- Remove the 7 bolts: Diameter. 6 mm. (1)
- Remove the 4 bolts: Diameter. 8 mm. (2)
- Remove the transmission cover.
- Remove the spacer and the clutch cover.



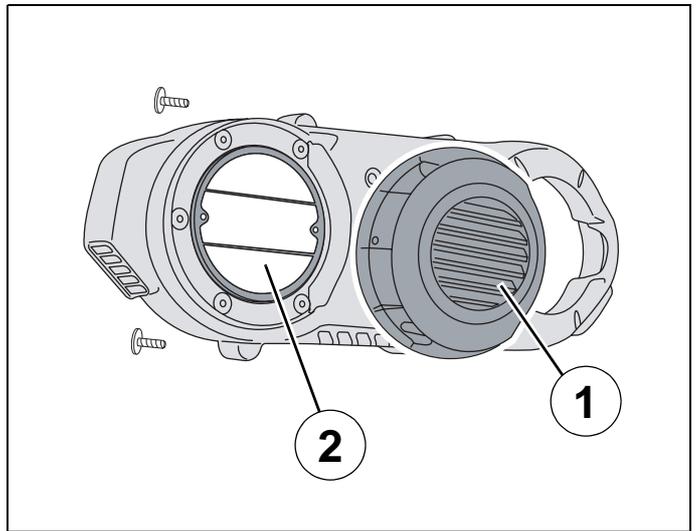
■ Replacing the driven pulley shaft bearing.

- Remove the air duct. (1) (2 screw).
- Remove the circlip. (2)
- Place the cover on its gasket seat surface, heat it (80 to 90°C) until the bearing falls out by itself.
- While the casing is expanded fit the new bearing fully home in its housing.



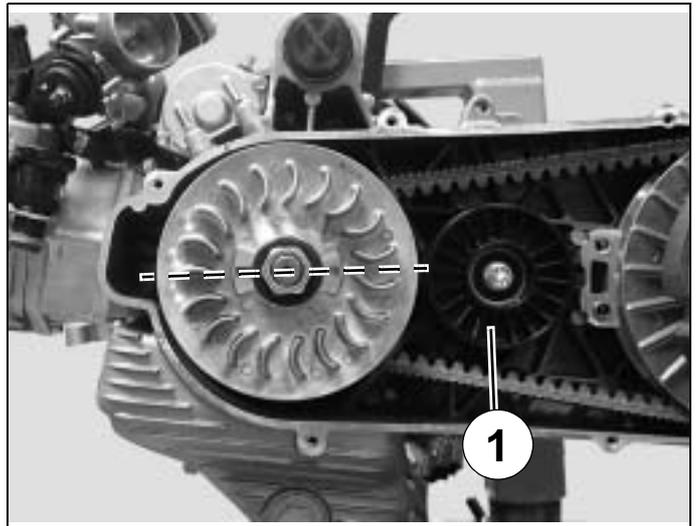
■ Removal of the transmission air filter.

- Remove the transmission cover hood. (1)
- Remove the transmission air filter. (2)
- Blow the air filter with compressed air.

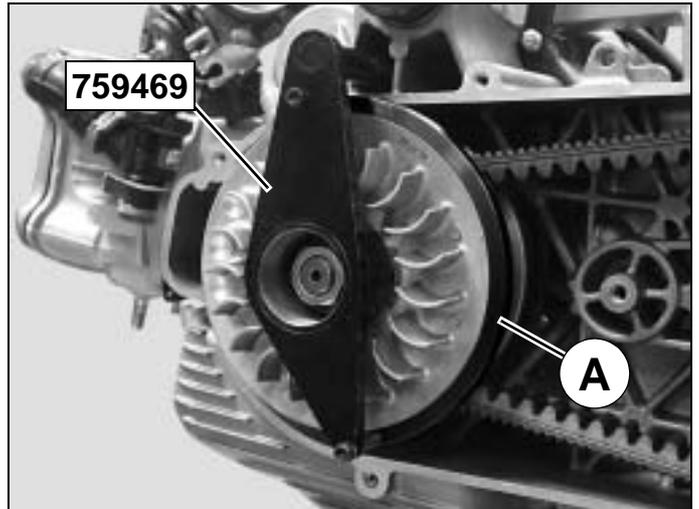


■ Removal of the primary drive.

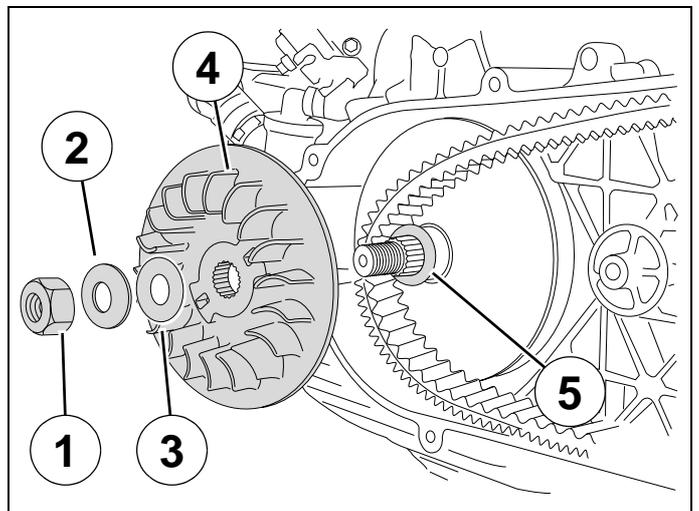
- Remove the belt anti-flapping roller (1).
- Place the pins of the stationary clutch plate horizontal.



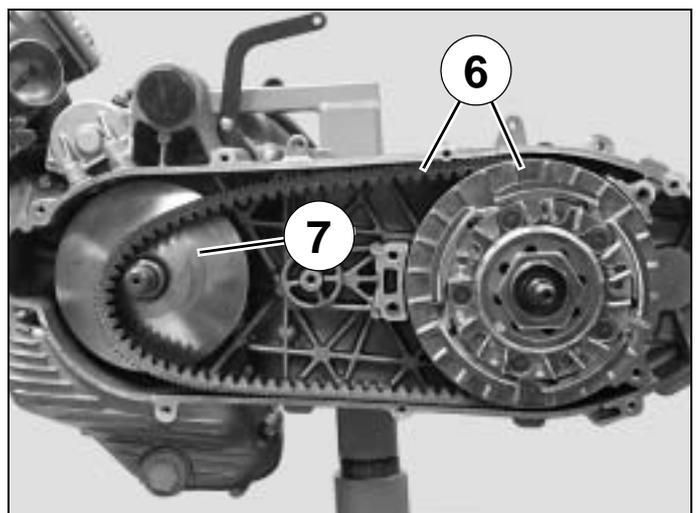
- Fit the pins of the tool P/N 759469 into the pins of the stationary clutch plate, fit the retaining ring (A), and then tighten the 2 screws.



- Remove:
 - The nut. (1)
 - The tapered washer. (2)
 - The plain washer. (3)
 - The plate. (4)
 - The washer (5)

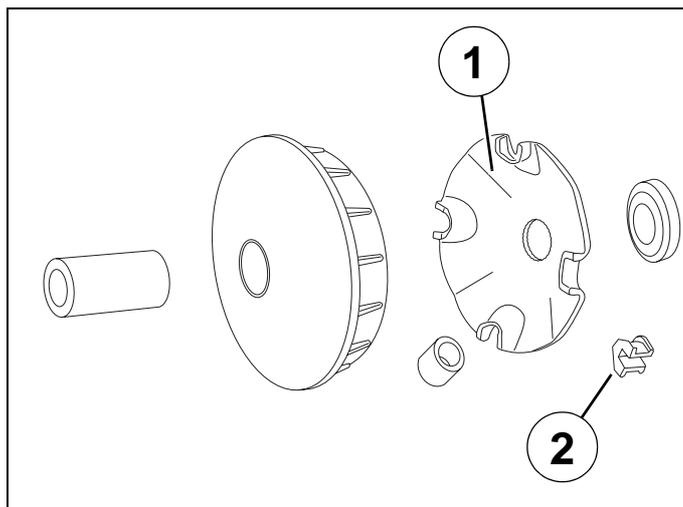


- Remove the clutch and driven pulley assembly together with the belt. (6).
- Remove the drive pulley (7) together with the guide hud.

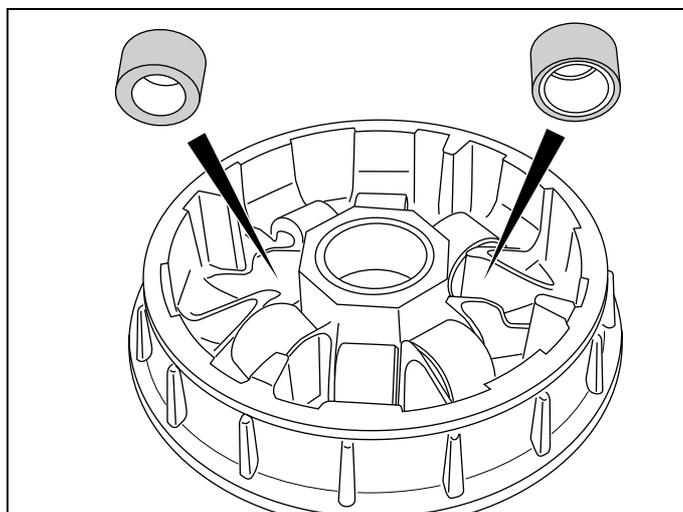


■ Checking the drive pulley.

- Remove the ramp (1) and its 4 guides (2).
- The bearings must be changed if they show major signs of wear.
- The guides shall be replaced if they show signs of wear.



- When refitting, respect the way the rollers are installed.



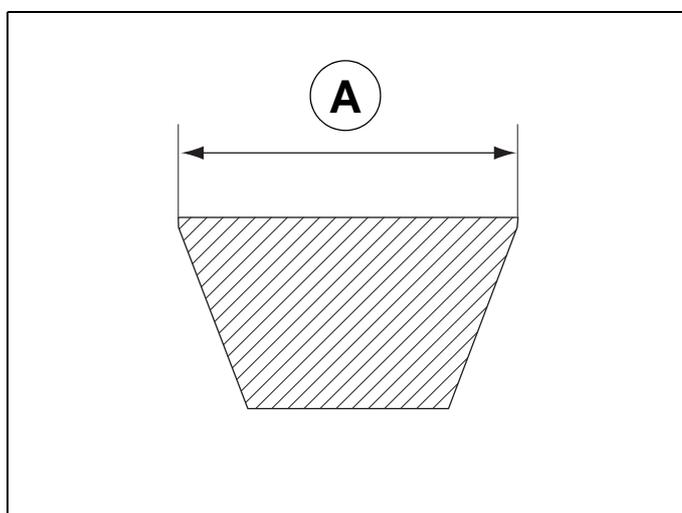
■ **Checking the belt anti-flapping roller.**

- Make sure the roller and ball bearing are not worn.



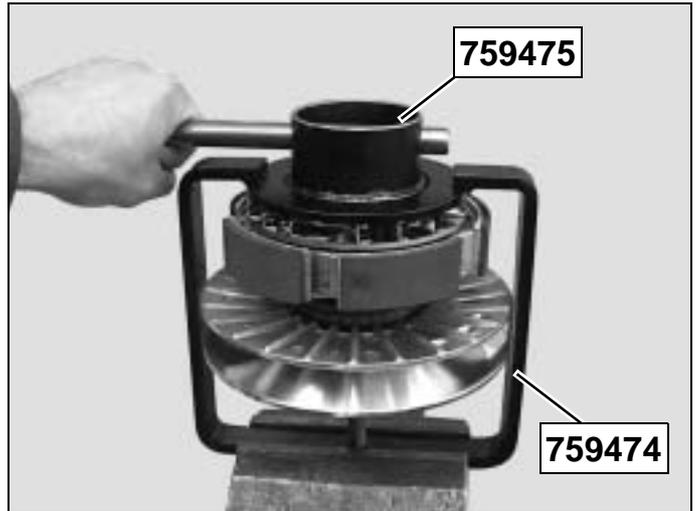
■ **Checking the drive belt.**

- Measure the width of the belt. (A)
- Minimum width: 25 mm.**
- Make sure the belt is not cracked.

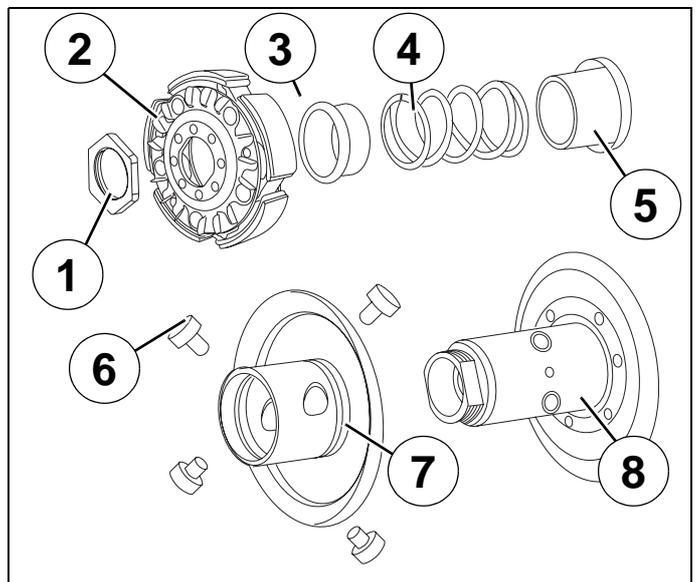


■ Removal of the clutch lining assembly.

- Compress the clutch drive pulley and driven pulley assembly with the tool P/N 759474 clamped in the jaws of a vice.
- Remove nut using spanner P/N 759475.
- Slacken tool P/N 759474.



- Remove the clutch linings (2), the upper centring sleeve (3), the spring (4), and the lower centring sleeve (5).
- Remove the 4 pins (6) from the variable speed drive seat.
- Separate the fixed (7) and rotating (8) flanges.

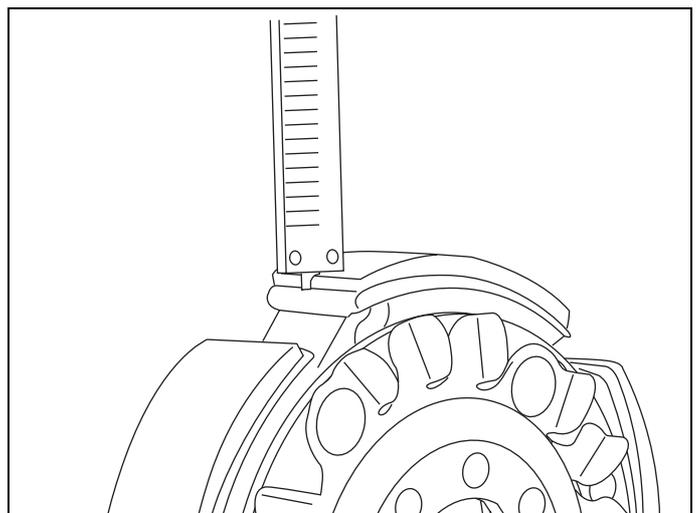


■ Checking the clutch linings.

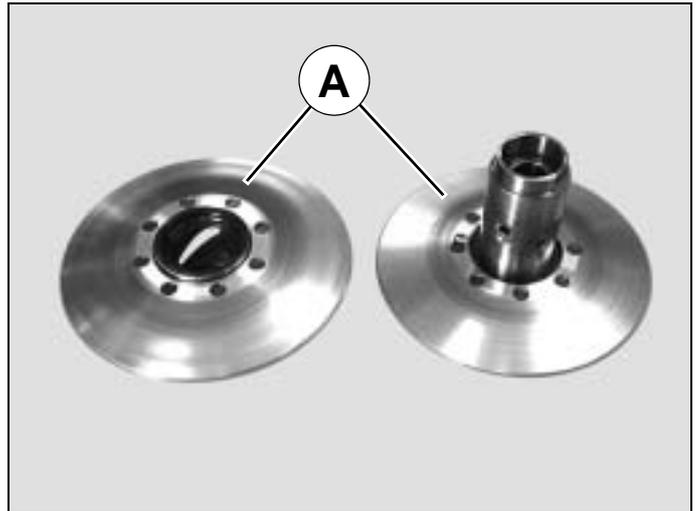
- Using the depth calliper, measure the thickness of the clutch linings.

Mini. thickness: 1 mm.

Note: The balance of the clutch jaw assembly is factory set, and therefore the assembly cannot be dismantled.

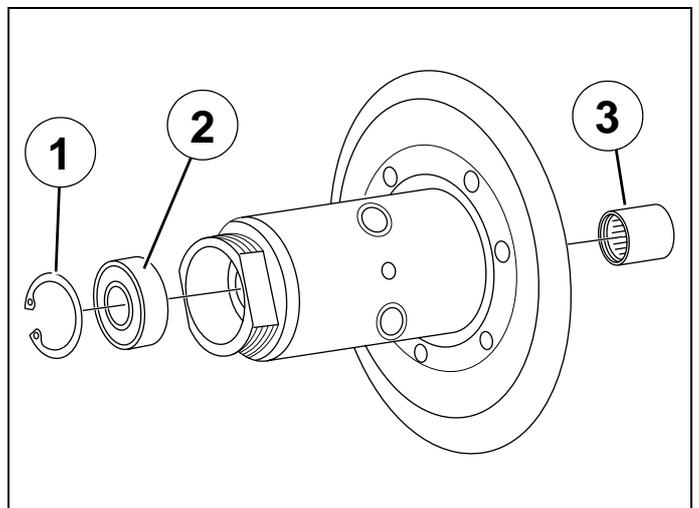


- Make sure surface of the plates in contact with the belt does not show any cracks or signs of abnormal wear. (A)

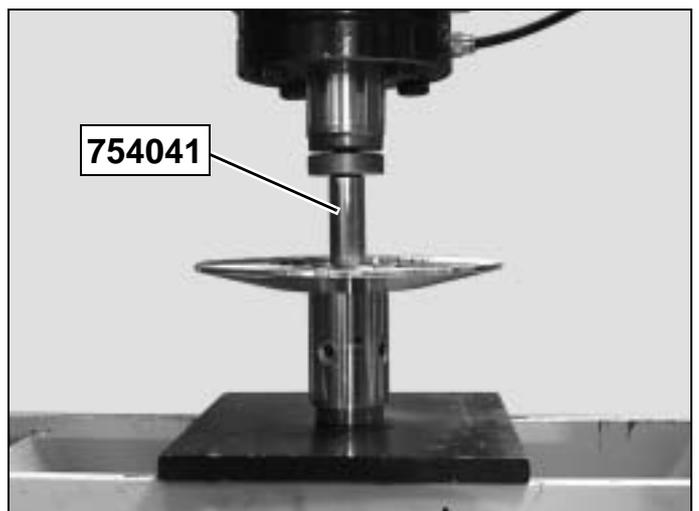


■ **Changing the bearings of the driven pulley stationary clutch plate.**

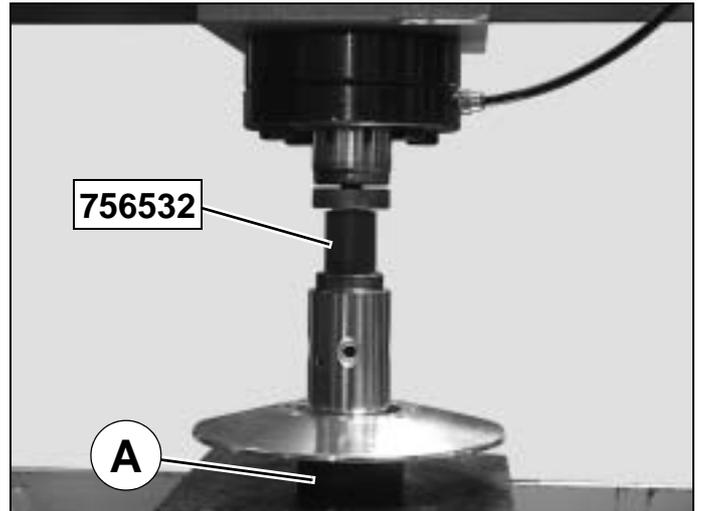
- Remove the circlip, using a circlip plier. (1)



- Using a press and push tool P/N 754041, remove the ball bearing. (2).



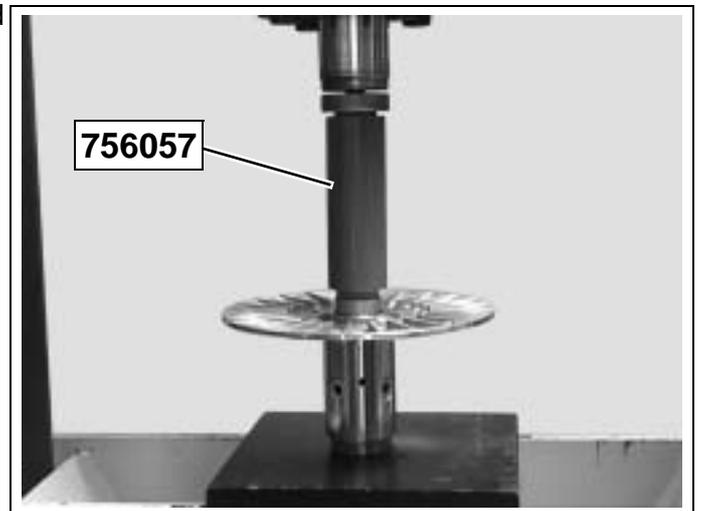
- In order not to damage the fixed clutch plate, use tool P/N 759475 as a support. (A)
- Using a press and push tool P/N 756532, remove the needle bearing. (3)



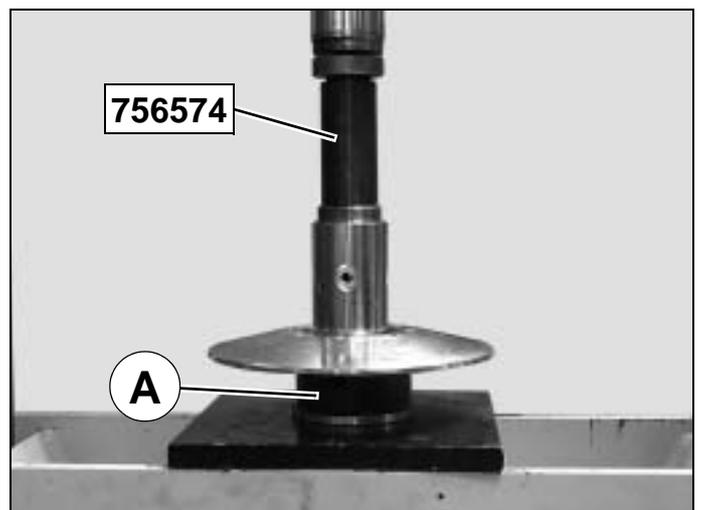
Using push tool P/N 756057, install a new caged needle bearing.

Note: Install the caged needle bearing with the seal outwards.

The caged needle bearing is set back 6 mm from the fixed clutch plate.

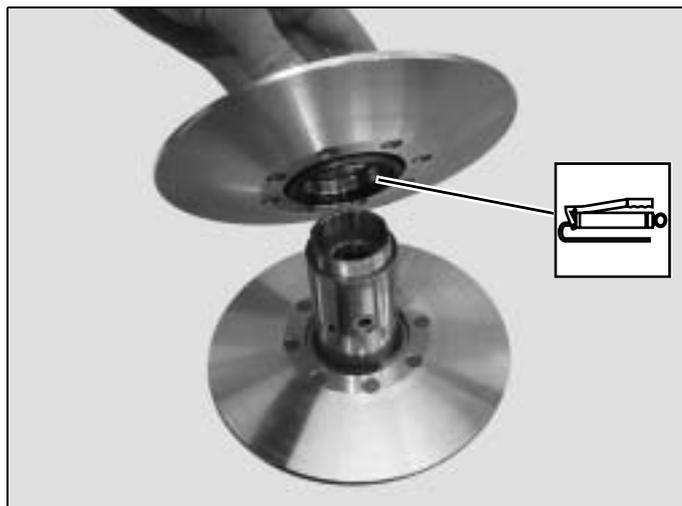


- In order not to damage the fixed clutch plate, use tool P/N 759475 as a support. (A)
- Install a new bearing using tool P/N 756574.
- Install the circlips.

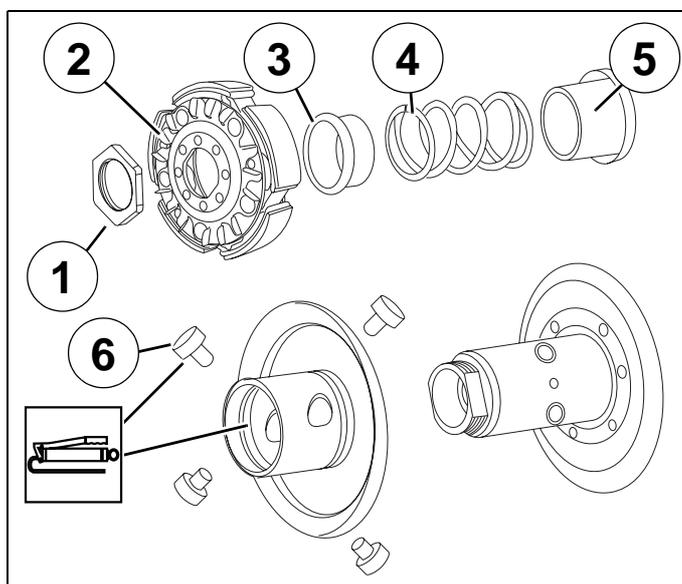


■ **Assembling the driven pulley.**

- Fit new lipped seals and O-rings on the movable clutch plate.
- Slightly lubricate the bore of the movable clutch plate. (high temperature grease).
- Lubricate the lip seals.
- Place the movable clutch plate on the fixed clutch plate while making sure not to damage the lip seals.

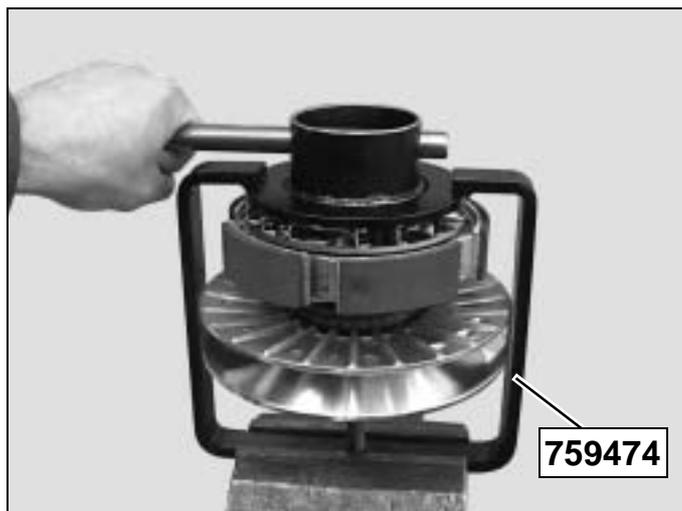


- Grease and fit the 4 guide pins. (6)
- Fit the lower centring sleeve. (5)
- Fit the spring (4) and its upper centring sleeve. (3)
- Install the clutch lining assembly. (2)



- Compress the clutch drive pulley and driven pulley assembly with the tool P/N 759474 clamped in the jaws of a vice.
- Tighten the nut. (1)

Tightening torque: 7 m.daN.

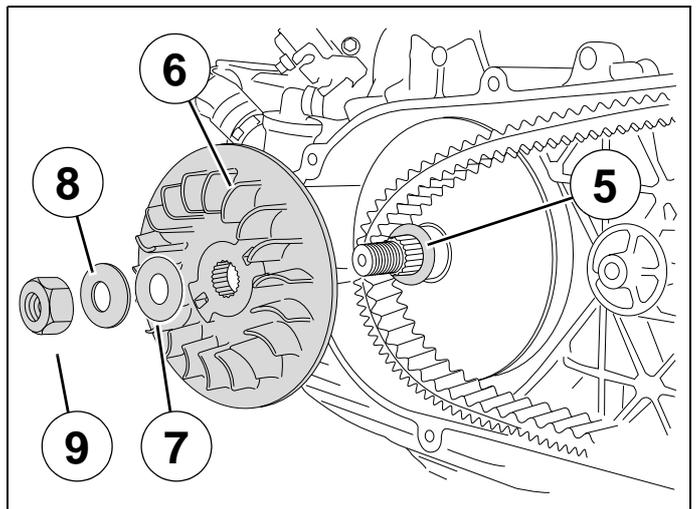
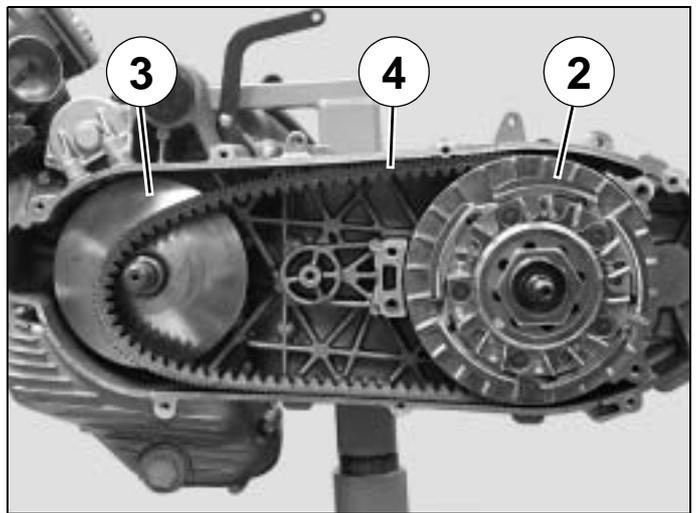
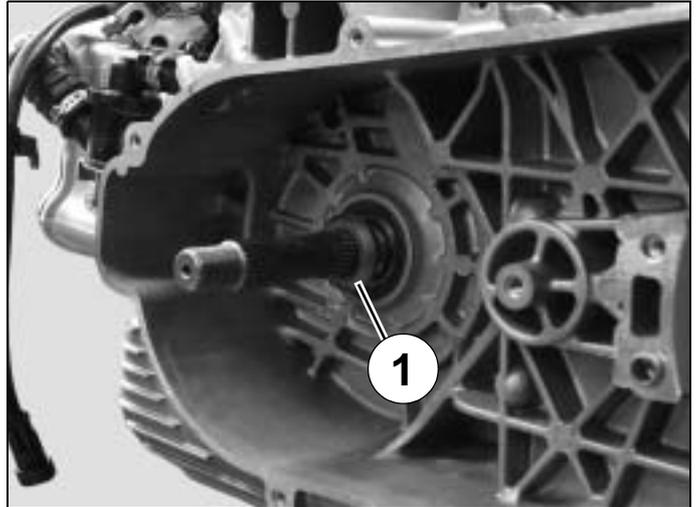


■ Installing the primary drive.

Note: Before fitting the clutch drive pulley and driven pulley to the input shaft, fit the belt into the pulley bottom by opening the flanges by hand. Respect the direction of rotation of the belt which is shown by an arrow.

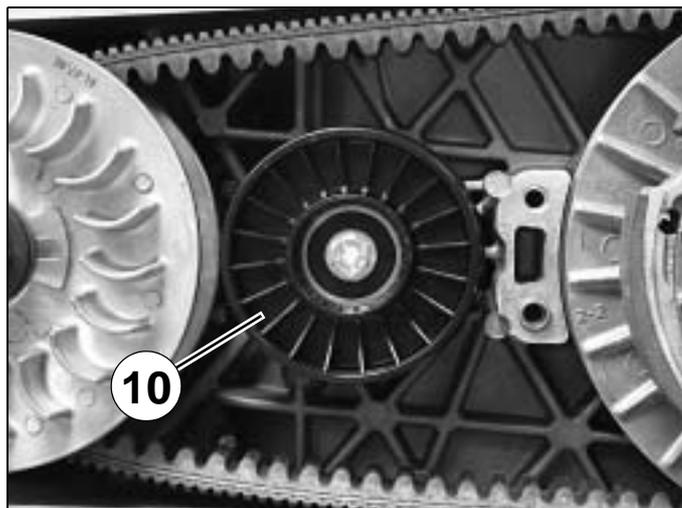
- Check that the washer is provided. (1)
(Inside chamfer towards the crankshaft).
- Fit the clutch drive pulley and driven pulley assembly. (2)
- Fit the drive pulley with its guide hub (3) onto the crank assembly.
- Fit the belt (4) to the guide hub.
- Fit washer. (5)
- Fit the fixed flange (6) to the crank assembly checking it is properly positioned on the crank assembly splines.
- Fit the plain washer. (7)
- Fit the spring washer (8) and the nut (9) and hand tighten.
- Hold the fixed flange with tool P/N 759469..
- Tighten the nut.

Tightening torque: 17 m.daN.



- Install the belt anti-flapping roller. (10)

Tightening torque: 1.8 m.daN.

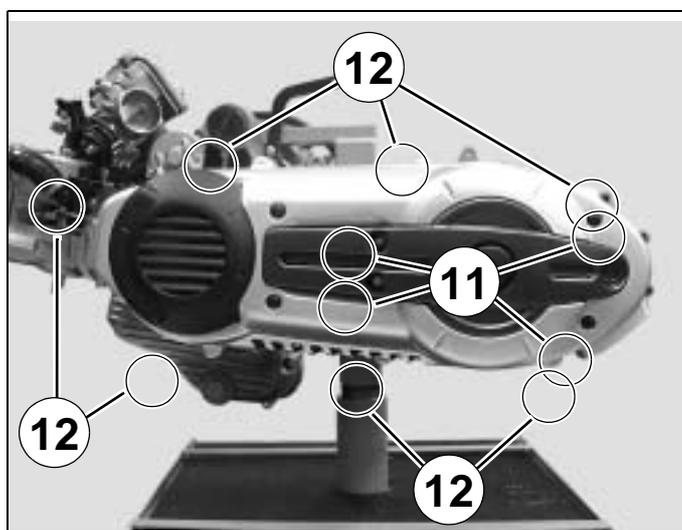


- Install the transmission cover.
- Fit and tighten the 4 fixing bolts (11).

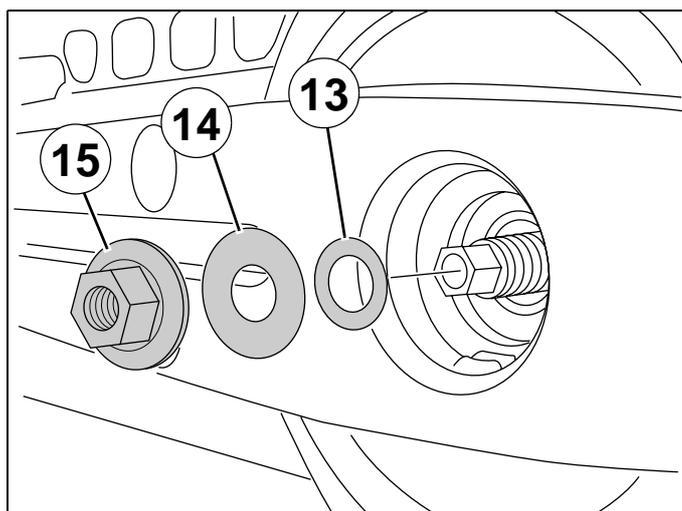
Tightening torque: 2.4 m.daN.

- Fit and tighten the 7 fixing bolts (12).

Tightening torque: 1.2 m.daN.



- Fit the small plain washer. (13)
- Fit the large plain washer. (14)
- Fit the nut. (15)



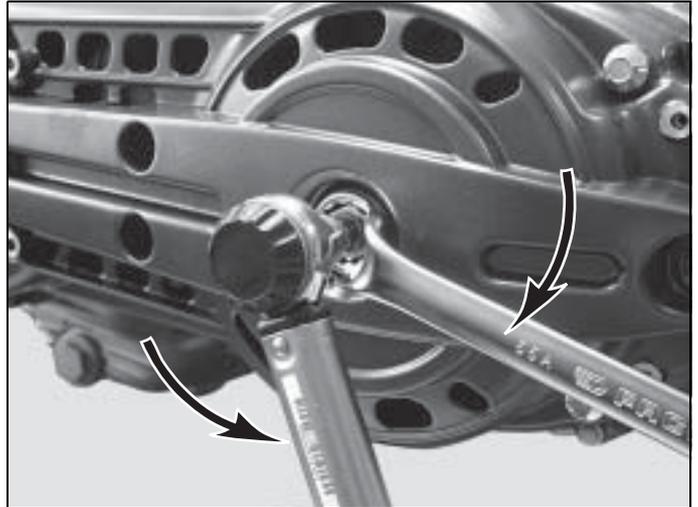
- Hold the input shaft using a torque wrench provided with an hex (6 sided) socket featuring a 1/2" square.
- Tighten the nut using an offset box-end wrench.

Tightening torque: 9.6 m.daN.

Important: Owing to the considerable tightening torque, you must absolutely use an hex (6 sided) socket with a 1/2" square.

If you use a different socket, you might damage the shaft or the even the socket.

- Fit the plastic cover.
- Fit the transmission cover trim. (4 screw).



■ **Removal of the secondary transmission cover.**

- Remove the primary drive.



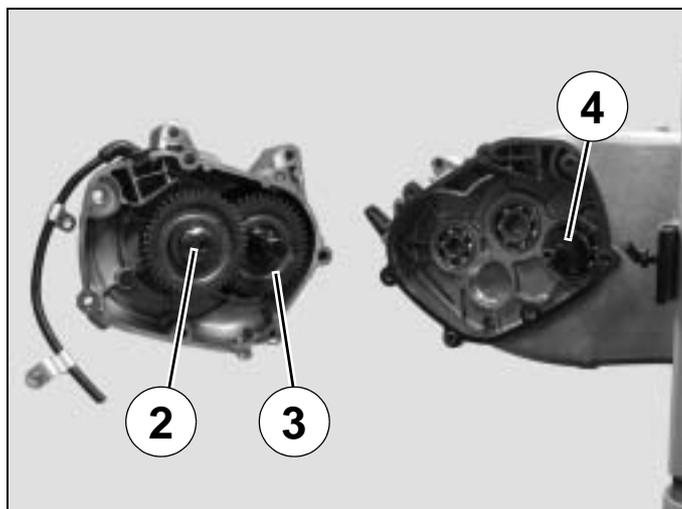
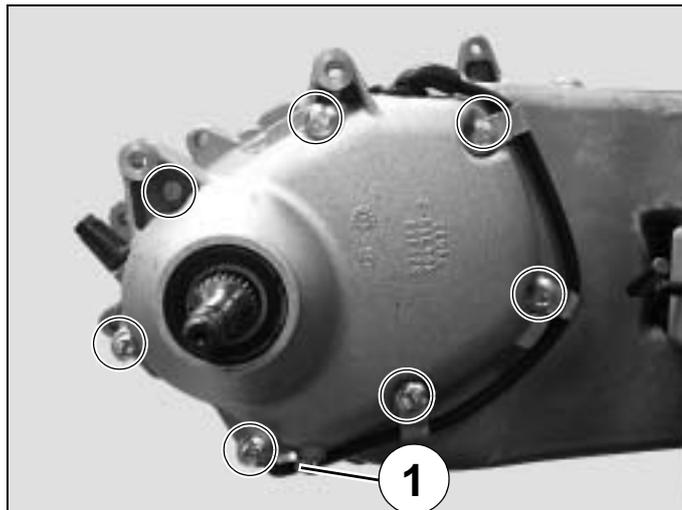
- Remove the screw (1) in order to drain the relay box.

Tightening torque: 1.5 m.daN.

- Remove the transmission cover 7 fixing bolts.
- Remove the cover with the primary shaft.

Tightening torque: 2.5 m.daN.

- Remove the paper gasket.
- Remove the countershaft. (2)
- Remove the secondary shaft. (3)
- Remove the primary shaft. (4)



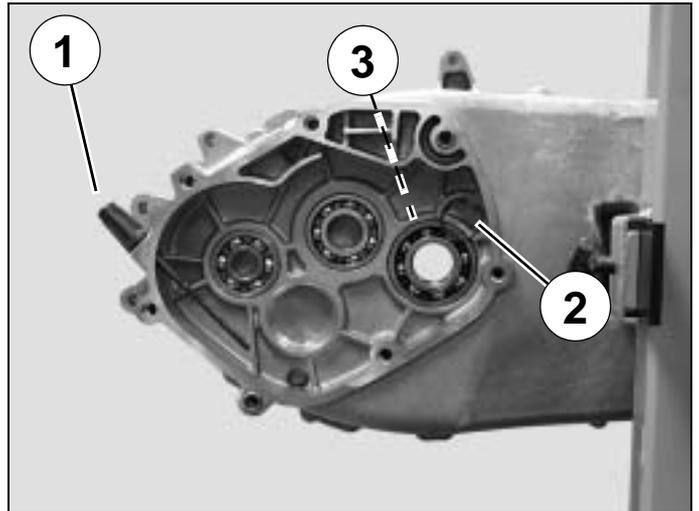
- Check the condition of every gear.



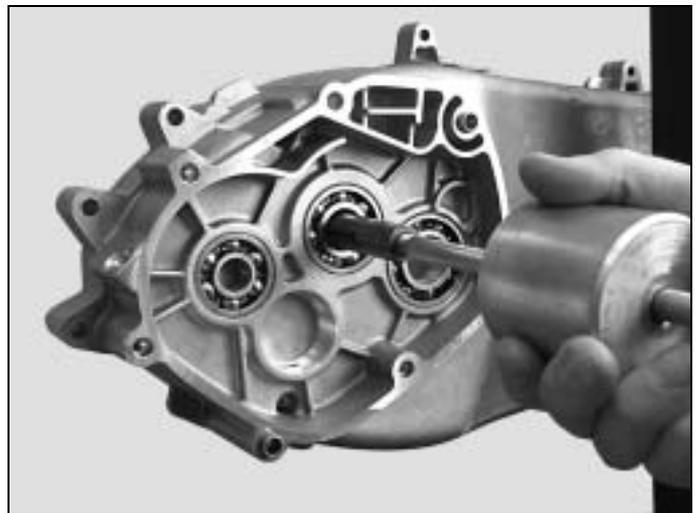
■ Replacing the bearings of the relay box.

Crankcase

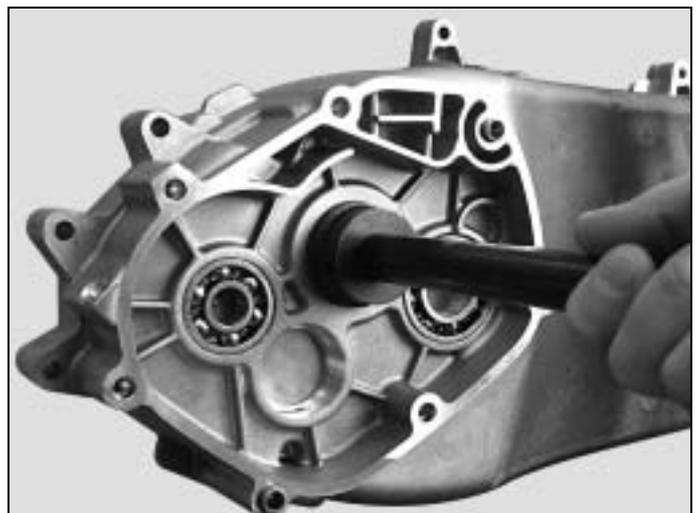
- Remove the oil gauge. (1)
- Remove the circlip. (2)
- Remove the seal. (3)



- Using a heat gun, heat the crankcase to a temperature between 80 and 90°C. Use an inertia type extractor tool to remove the bearings.



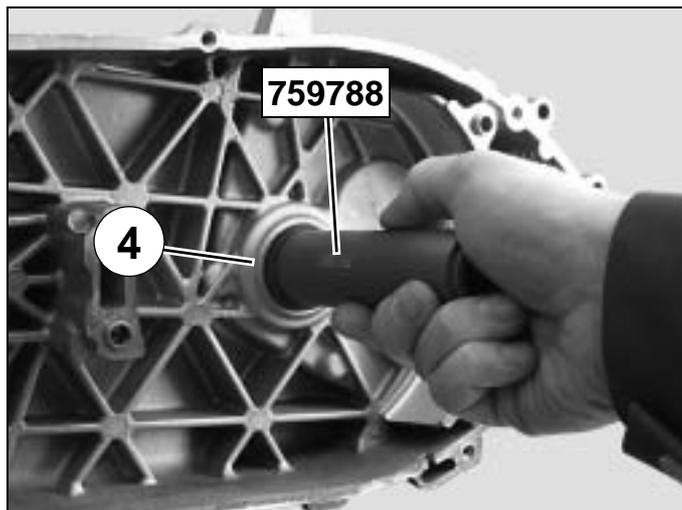
- While the casing is expanded fit the new bearing using a push tool, by pushing against the outer cage of the bearing.
- Install the circlips.



The bearings provided with plastic cages shall be installed with the cage towards the crankcase.

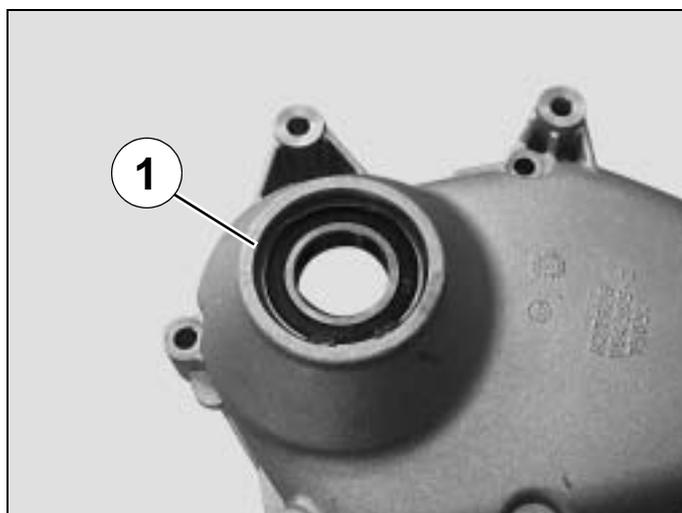


- Using fitting tool P/N 759788, fit a new lightly greased gasket (4).

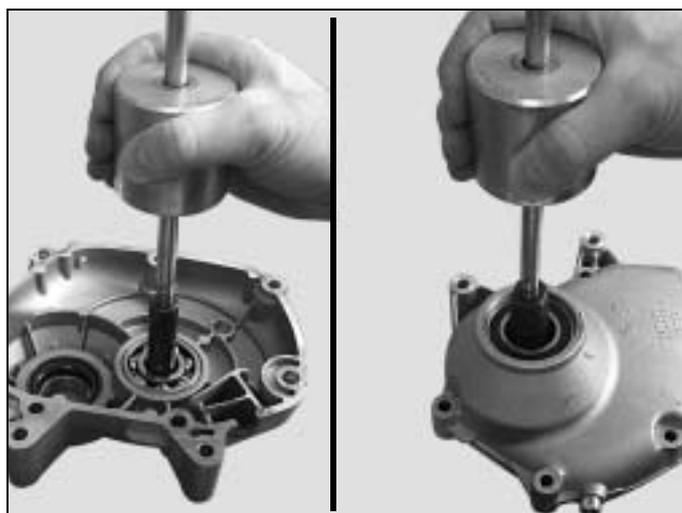


Relay box cover

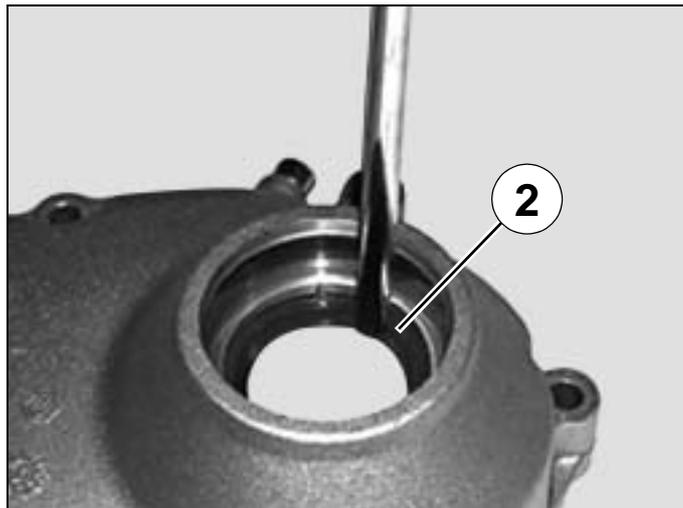
- Remove the circlip. (1)



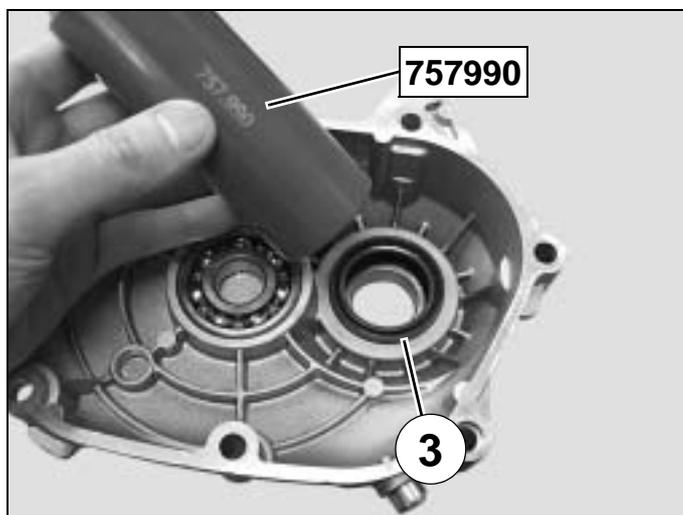
- Using a heat gun, heat the crankcase to a temperature between 80 and 90°C. Use an inertia type extractor tool to remove the bearings.



- Remove the seal. (2)
- While the casing is expanded fit the new bearing using a push tool, by pushing against the outer cage of the bearing.



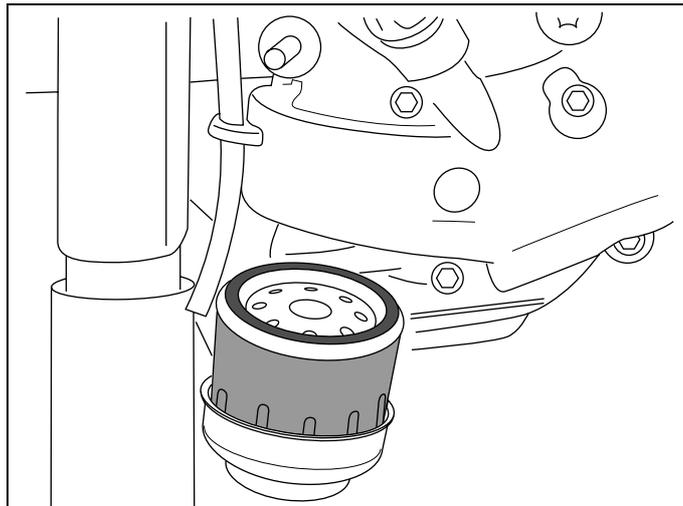
- Using fitting tool P/N 757990, fit a new lightly greased gasket (3).
- Install the circlips.



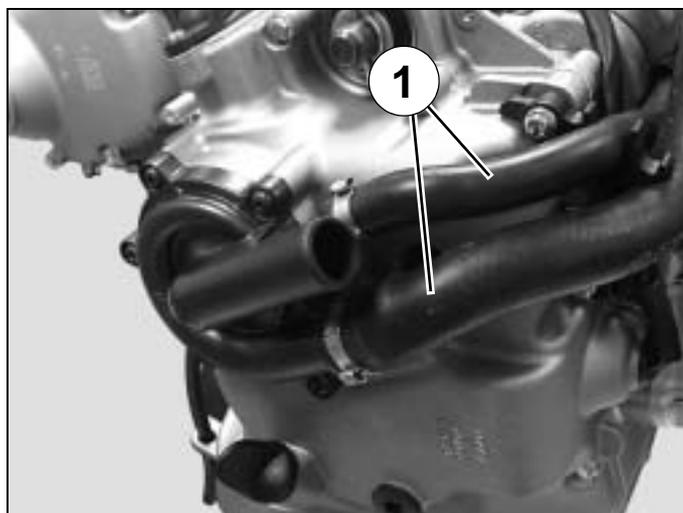
WATER PUMP/MAGNETO FLYWHEEL

■ Removal of the flywheel magneto cover.

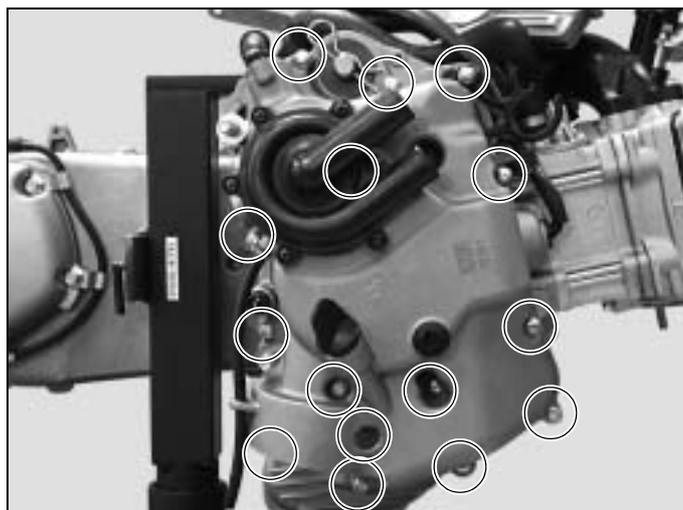
- Empty the oil from the engine.
- Using a facom D155 type oil filter notched cap wrench, remove the oil filter.



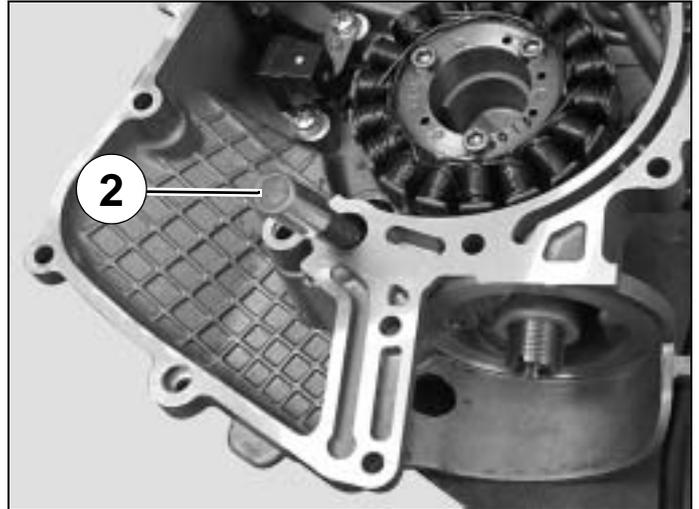
- Remove the collars of the 2 hoses (cylinder cooling and cylinder head by-pass). (1)
- Disconnect the hoses.



- Remove the 14 bolts that secure the cover (including 2 wiring harness brackets).
- Remove the flywheel magneto cover.
- Remove the paper gasket.



- Remove the oil discharge valve and its spring. (2)

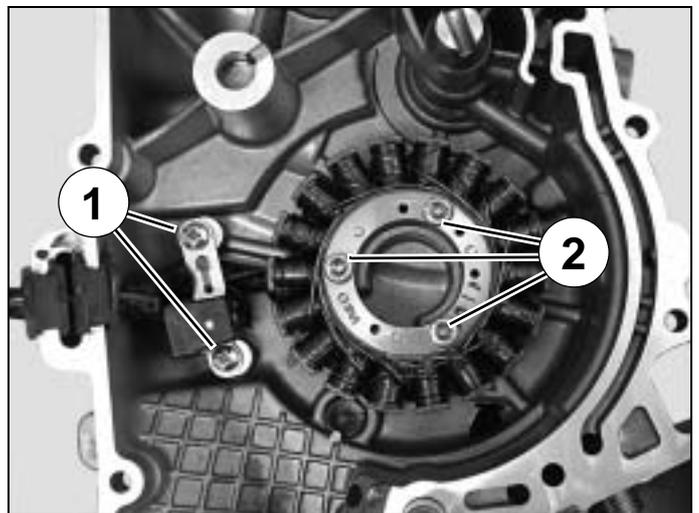


■ Removal of the starter motor.

- Remove the engine speed sensor 2 fixing bolts (1) and the stator assembly 3 fixing bolts (2).

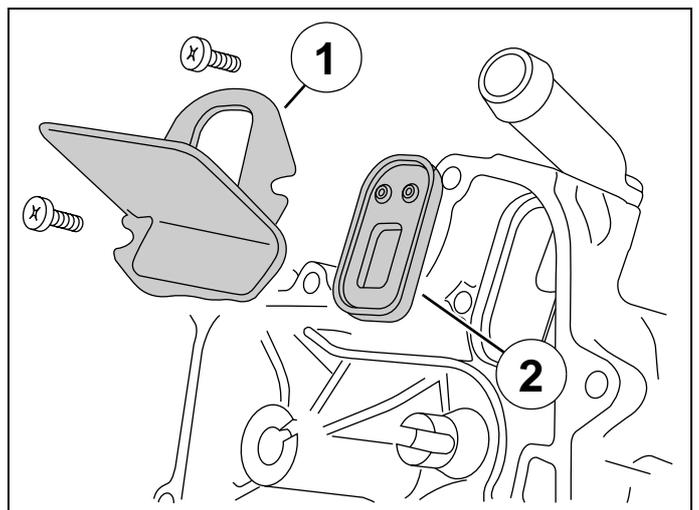
Tightening torques:

- Stator: 1 m.daN.
- Sensor: 0.5 m.daN.



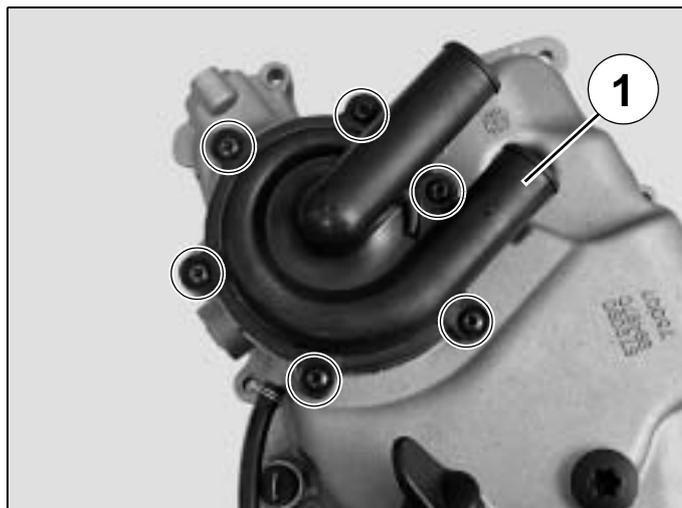
■ Removal of the oil vapour suction valve.

- Remove the flap valve cover (1). (2 screw).
- Remove the flap valve. (2)

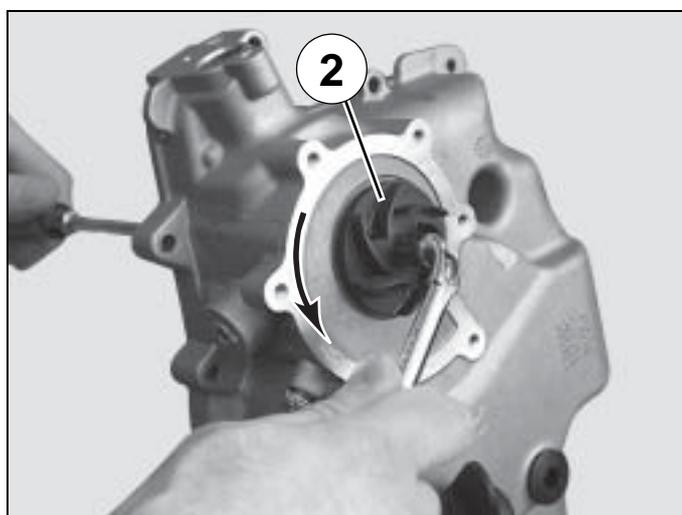


■ **Removal of the water pump.**

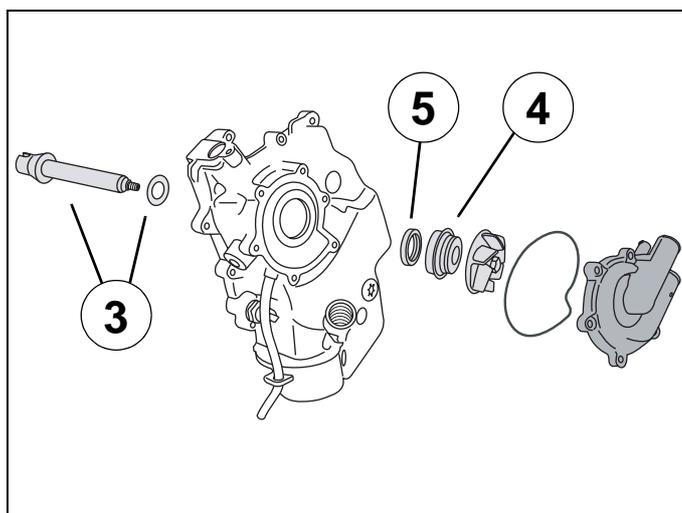
- Remove the water pump cover (1) 6 fixing bolts.
- Remove the cover and the O-ring.



- Using a screwdriver, hold the pump shaft and unscrew the turbine. (2).



- Drive out the water pump shaft and its washer. (3).
- Drive out the mechanical joint (4) from the turbine side.
- Remove the lip seal. (5)



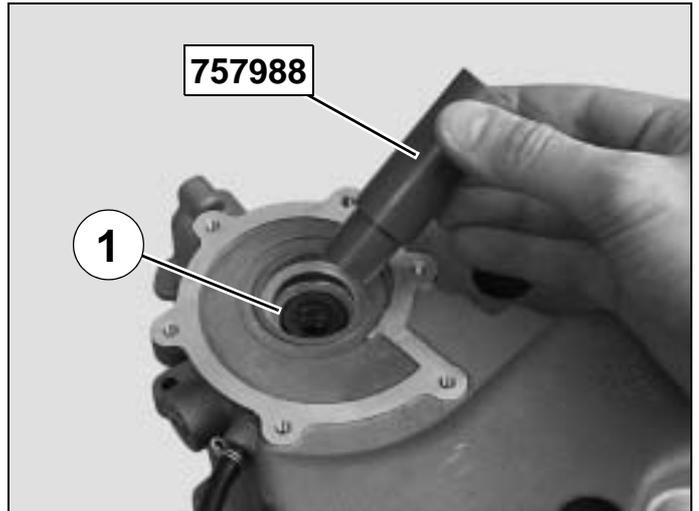
All the components must be changed every time the pump is serviced..



■ **Assembling the water pump.**

Note: Before refitting, blow on every lubrication duct.

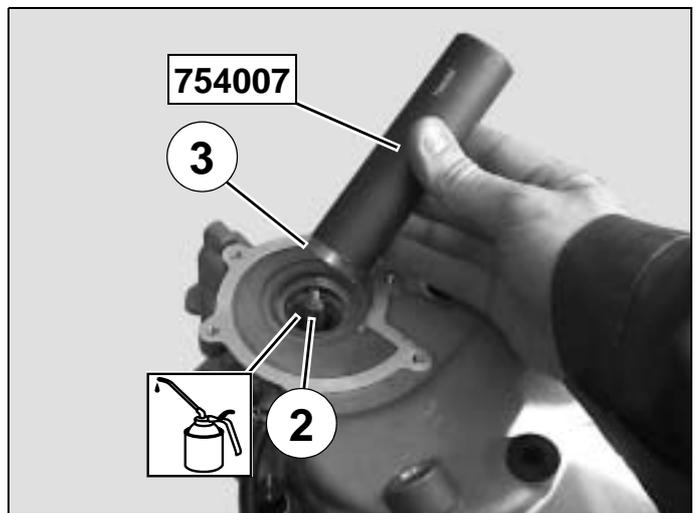
- Fit the lip seal (1) using the drift P/N 757988, the lips shall be directed towards the inside.



- Lubricate the water pump shaft. (2)
- Fit the water pump shaft and its washer.
- Fit the mechanical joint (3) using the seal drift. P/N. 754007.

Note: Check the mechanical seal housing is perfectly clean.

The new mechanical joint is delivered with a blocking product coated on the surface which is in contact with the casing. Make sure not to damage this product when handling the joint.

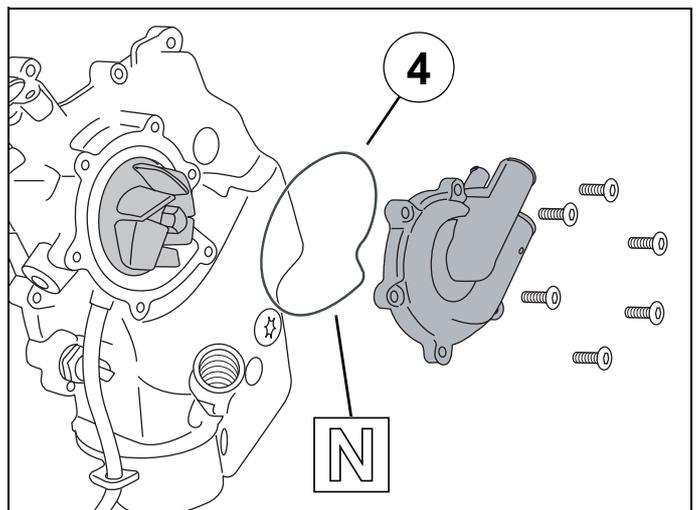


- Install the turbine.

Tightening torque: 0.5 m.daN

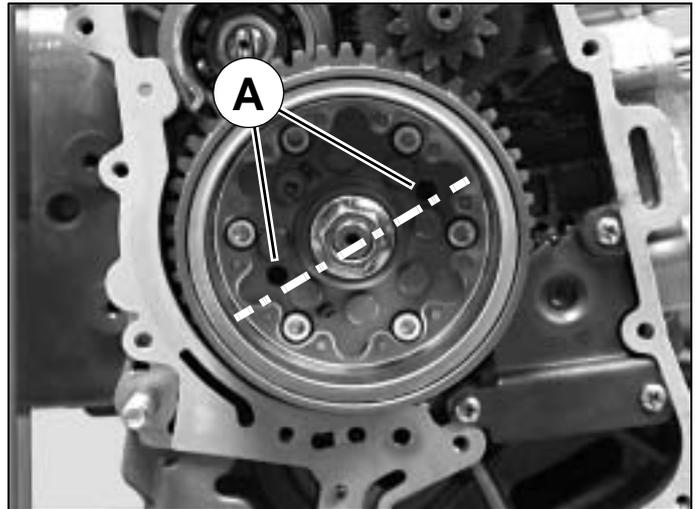
- Install the water pump cover and a new O-ring. (4)

Tightening torque: 0.5 m.daN.

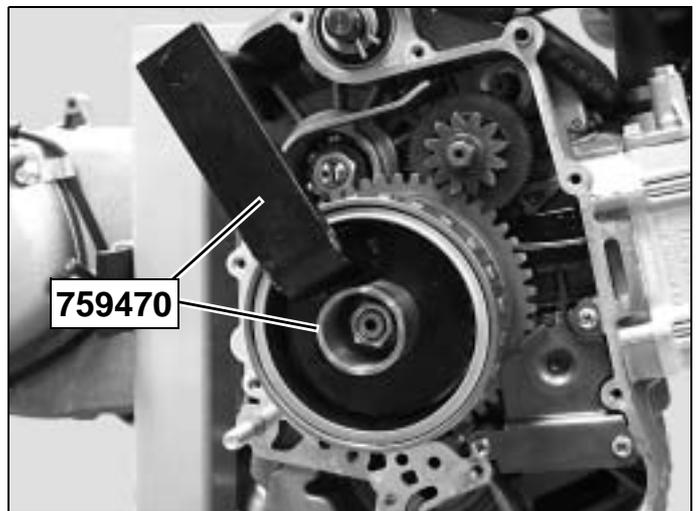


■ **To remove the magneto flywheel.**

- Rotate the flywheel magneto to position the 2 holes (A) as shown in the picture.



- Screw the centring device and fit the holding tool P/N 759470 while engaging the 2 pins into the 2 holes of the flywheel magneto.
- Remove the nut and the washer.



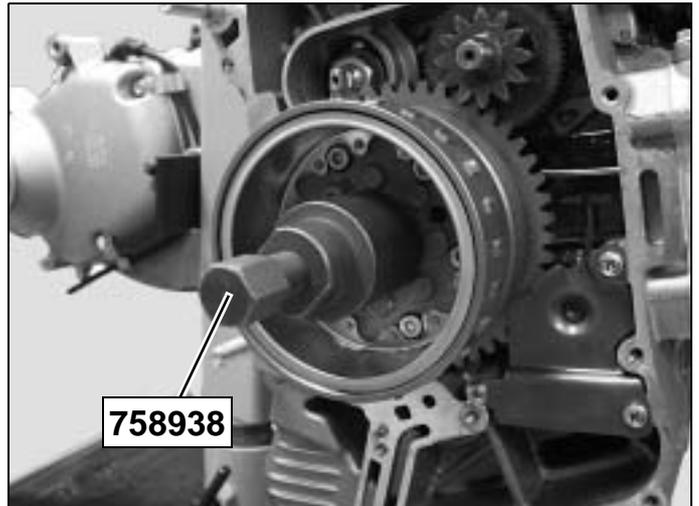
- Screw the nut (without the washer) until it is flush with the crankshaft threading.



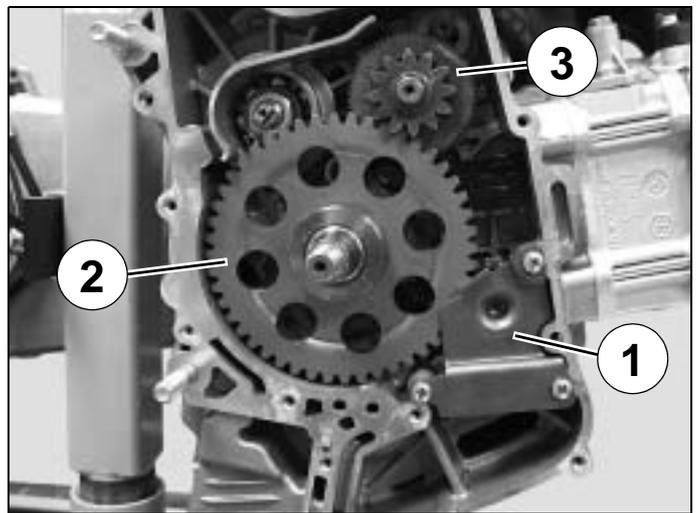
It is necessary to install the nut, otherwise the flywheel magneto could fall off and so would its magnets, when the cones let go.



- Tighten flywheel extractor P/N 758938 on the rotor.
- Lock the flywheel extractor and turn the thrust bolt until the rotor is released.
- Remove the flywheel extractor.
- Remove the nut.
- Remove the flywheel magneto.
- Remove the key from the crankshaft.

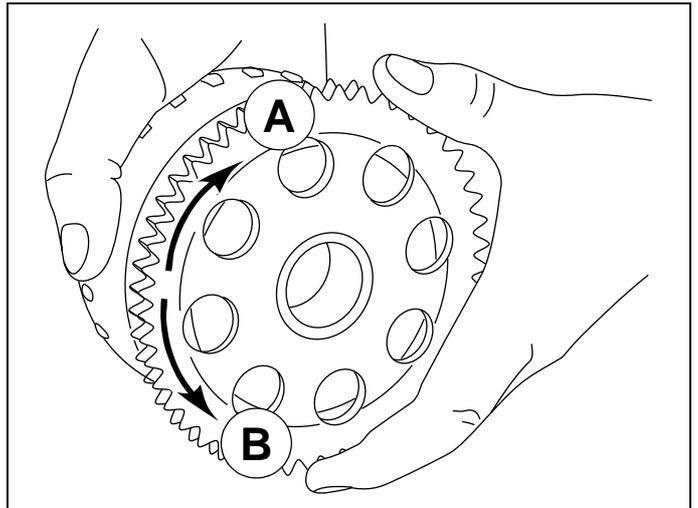


- Remove the starter sprocket retainer plate. (1)
- Remove the starter ring. (2)
- Remove the starter drive pinion. (3)



■ **Checking the overrunning clutch.**

- Remove the starter sprocket retainer plate.
- Rotate the overrunning clutch by hand.
 - It must rotate in direction (A).
 - It must be block in direction (B).
- If it doesn't, replace the overrunning clutch.



- Remove the 6 screws that secure the overrunning clutch.
- Remove the overrunning using 2 screws as shown.



- When re-installing, fit a screw with standard thread lock.

- Check the condition of the teeth of the starter pinion.
- The starter pinion cannot be repaired.

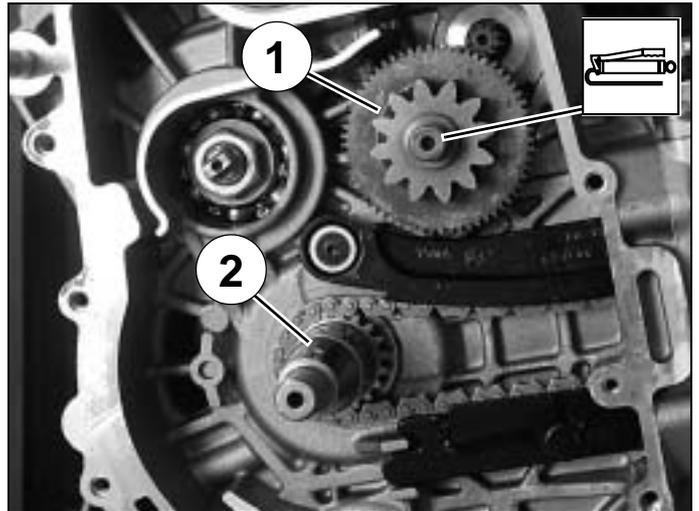
Note: The purpose of the starter is to transmit and to restrict the torque to 10 m.daN.

When starting the engine and when the piston kicks back (reversed rotation of the crankshaft), the starter pinion avoids a counter-rotation of the starter motor.

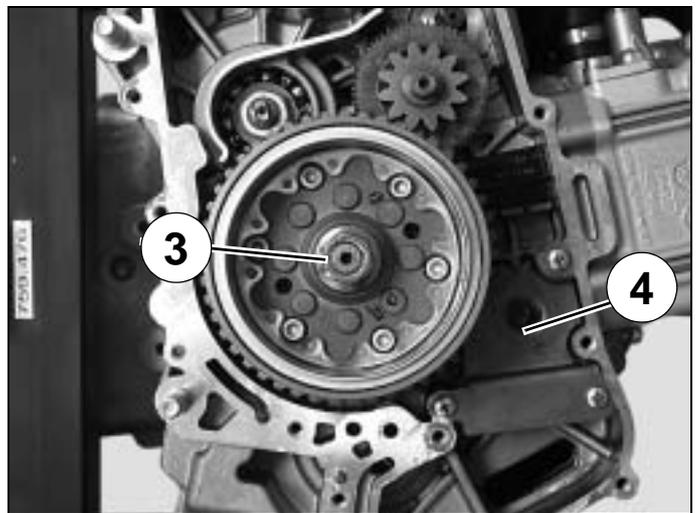


■ To fit the magneto flywheel.

- Install the starter pinion (1).
- Fit the key (2) to the crank.

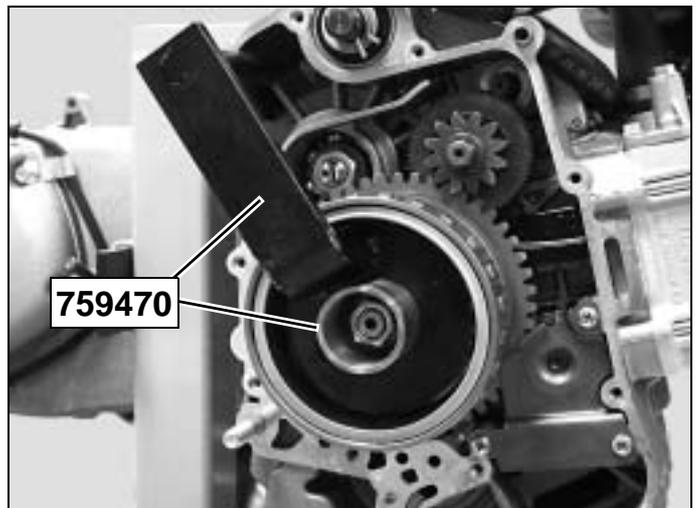


- Fit the flywheel magneto and overrunning clutch assembly.
- Fit the washer and the nut (3) and hand tighten.
- Fit the starter sprocket retainer plate. (4)



- Screw the centring device and fit the holding tool P/N 759470 while engaging the 2 pins into the 2 holes of the flywheel magneto.
- Tighten the nut.

Tightening torque: 9.5 m.daN.



■ Installing the flywheel magneto cover.



Align the groove of the water pump shaft with the starter motor pinion housing.

- Fit the discharge flap valve and its spring.



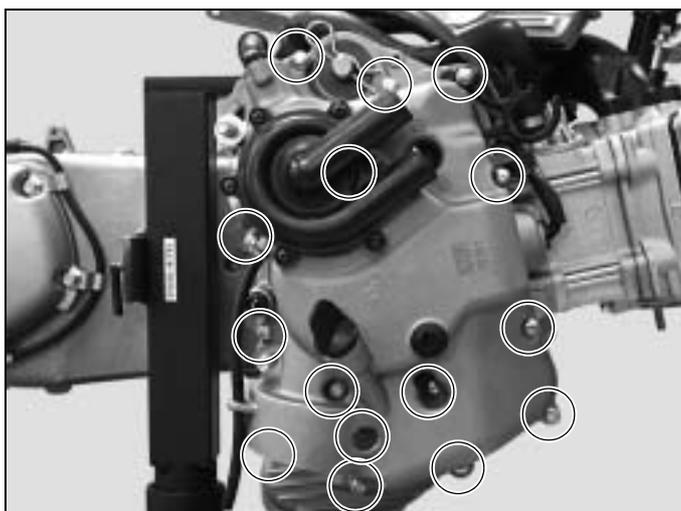
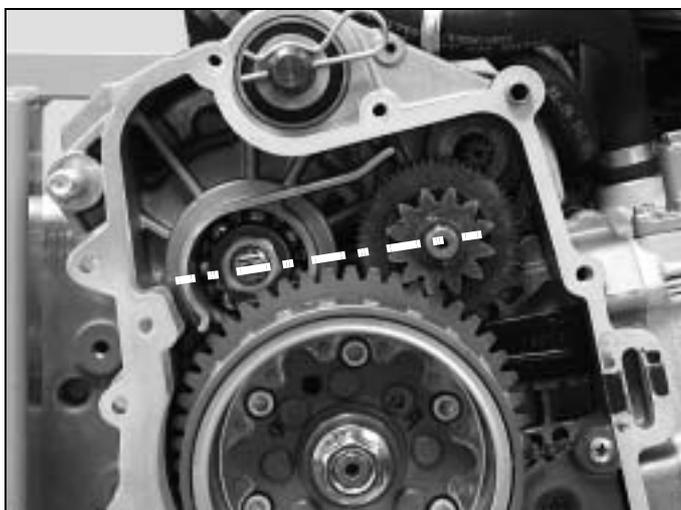
Align the balance shaft driver with the starter motor pinion.

- Fit the gasket and the flywheel magneto cover. (14 screw).

Tightening torque: 1.2 m.daN.

- Connect the hoses. (Use new clips).
- Lubricate the rubber seal of a new oil filter.
- Using a facom D155 type oil filter notched cap wrench, install the oil filter.

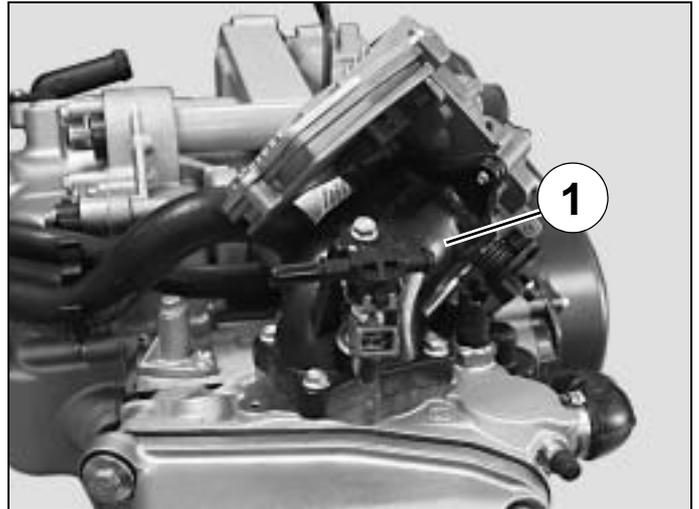
Tightening torque: 1.4 m.daN.



CYLINDER HEAD/CYLINDER/PISTON**■ Removal of the intake pipe.**

- Remove the inlet coupling. (1) (3 screw).

Tightening torque: 1.2 m.daN.

**■ Removal of the injection manifold.**

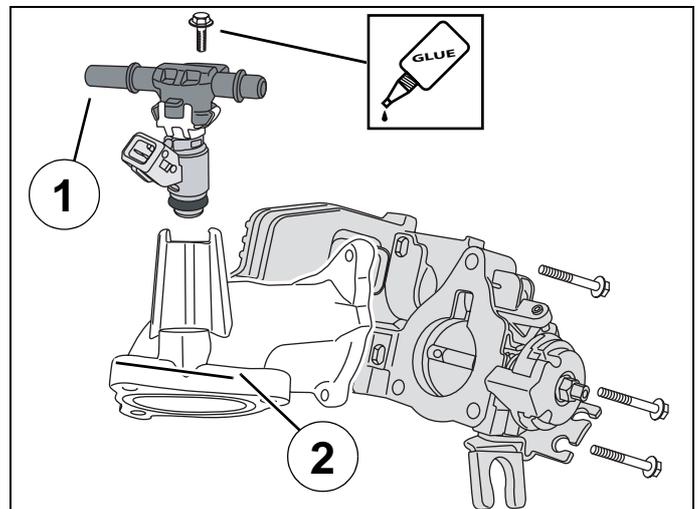
Note: This part shall be removed only if it is absolutely necessary.

- Remove the screw that secures the injection manifold (1).

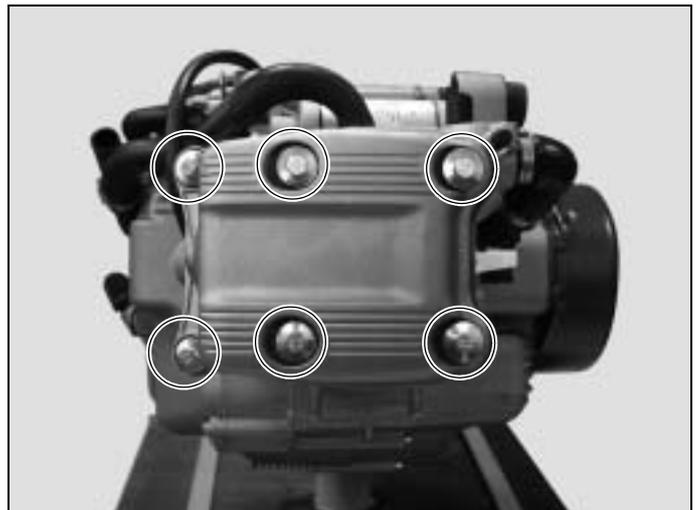
Tightening torque: 0.3 m.daN.

- Remove the manifold / fuel injector assembly from the intake pipe (2).

Tightening torque: 1.2 m.daN.

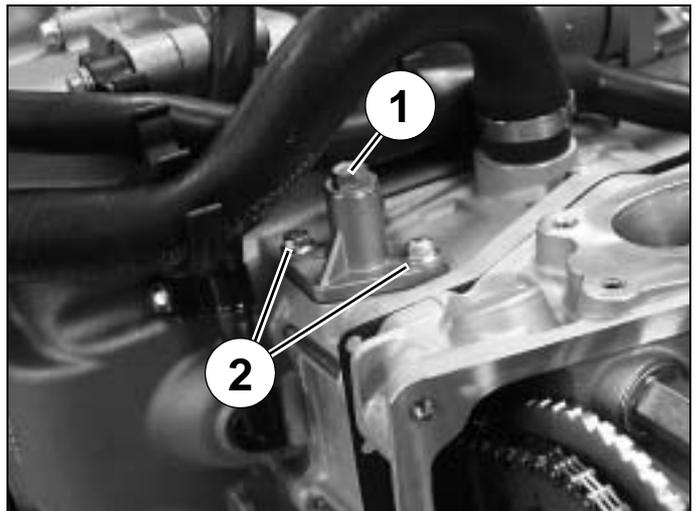
**■ Removal of the rocker cover.**

- Remove the 6 fixing bolts.
- Remove the cylinder head cover equipped with its rubber gasket.

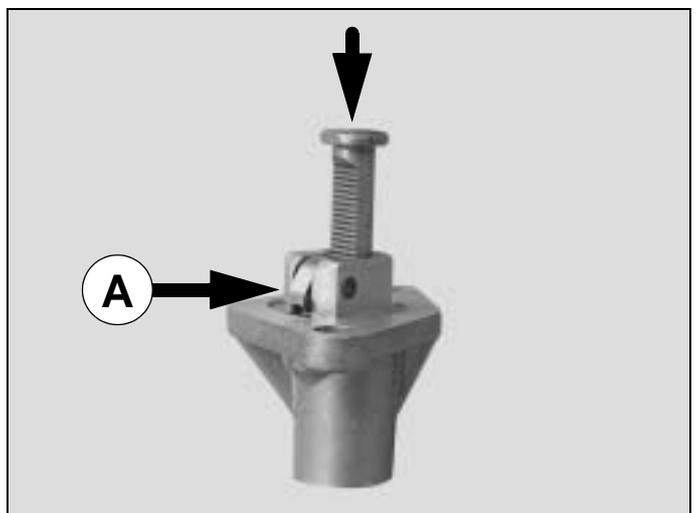


■ **Removal of the chain tensioner.**

- Remove the screw and spring from the tensioner (1).
- Remove the 2 mounting screws (2) from the tensioner body.

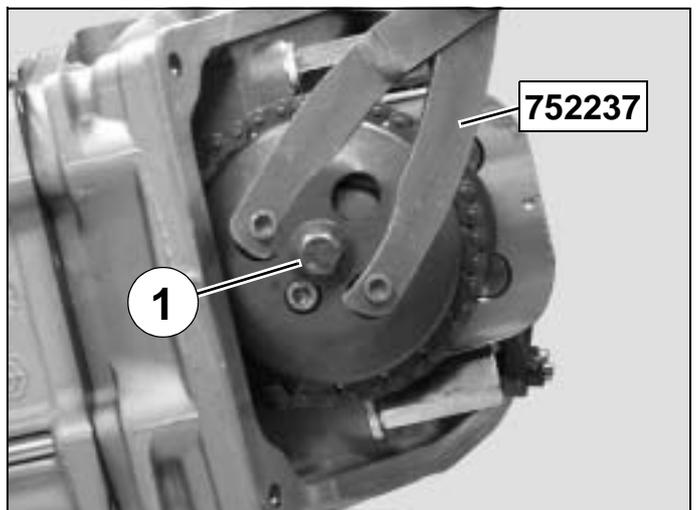


- Remove the chain tensioner and slacken it by pressing the ratchet tooth (A).
- Remove the paper gasket.

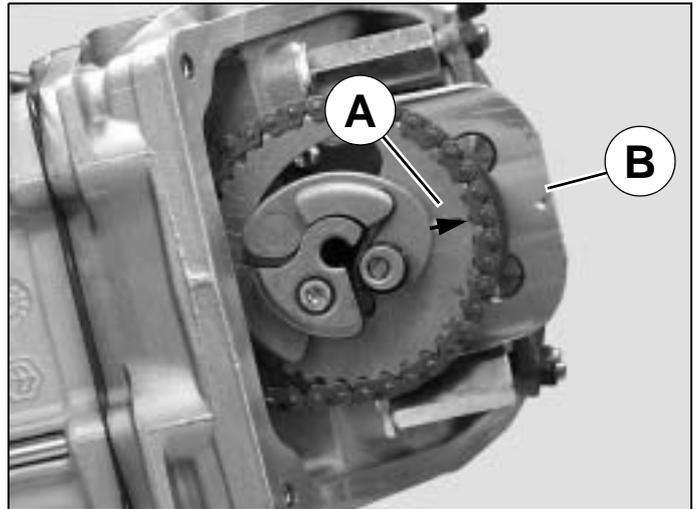


■ **Removal of the automatic decompressor valve. (500 cc).**

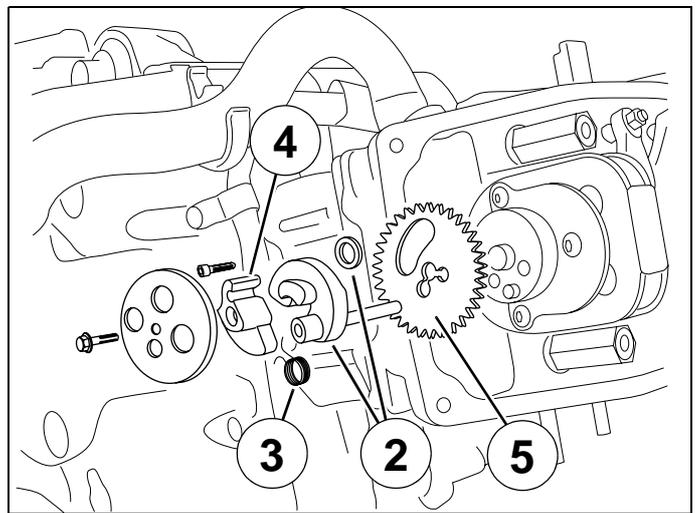
- Hold the cover with the pin wrench P/N 752237.
- Remove the fastening screw (1).
- Remove the cover.



- Rotate the engine by hand in the operating direction in order to align the (A) mark on the pinion with the mark on the cylinder head. (B).
- Remove the balance weight (2), the plastic spacer and the spring (3).
- Remove the counter weight. (4).



- Remove the camshaft gear. (5)

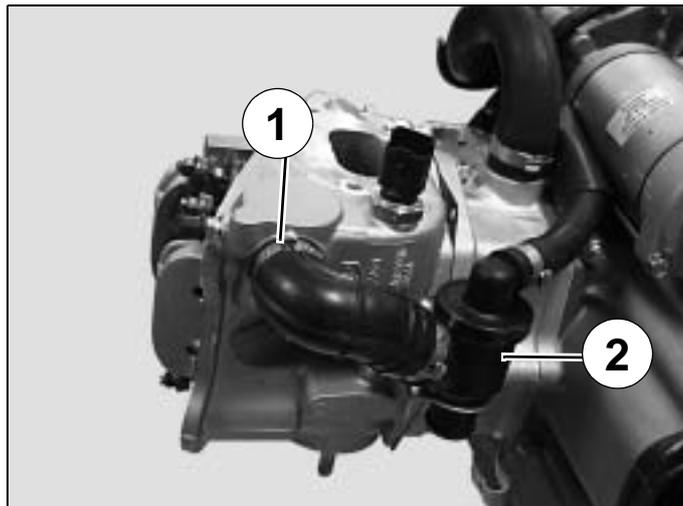


Tie a wire to the timing chain in order to prevent it from falling into the crankcase.

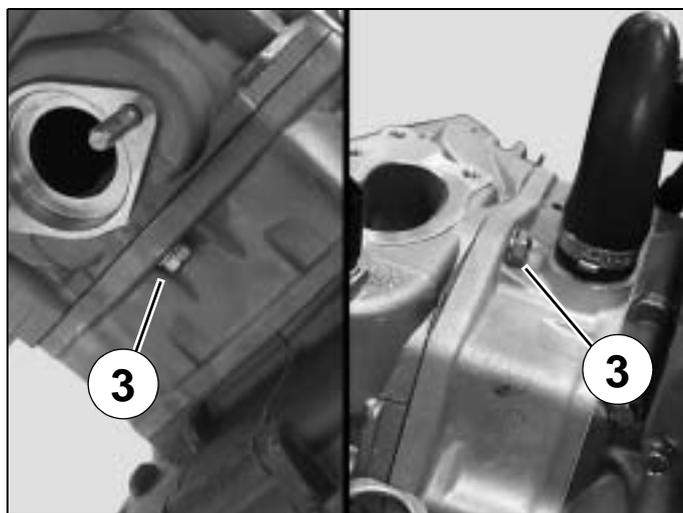


■ **Removal of the cylinder head.**

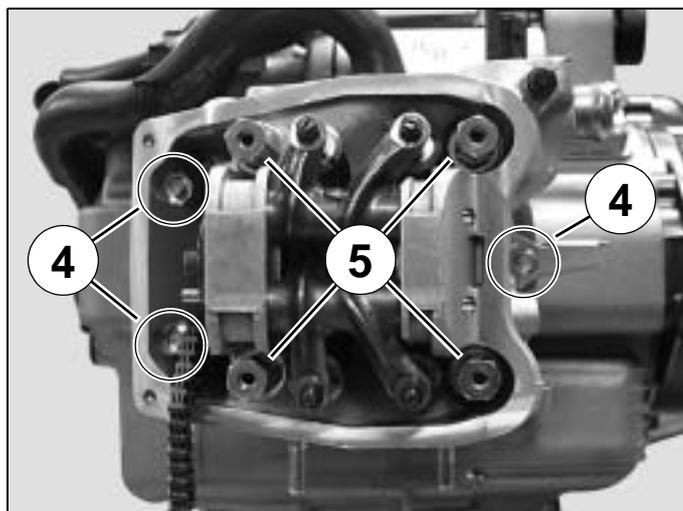
- Disconnect the cylinder head hose. (1)
- Takee the thermostat off its holder. (2)



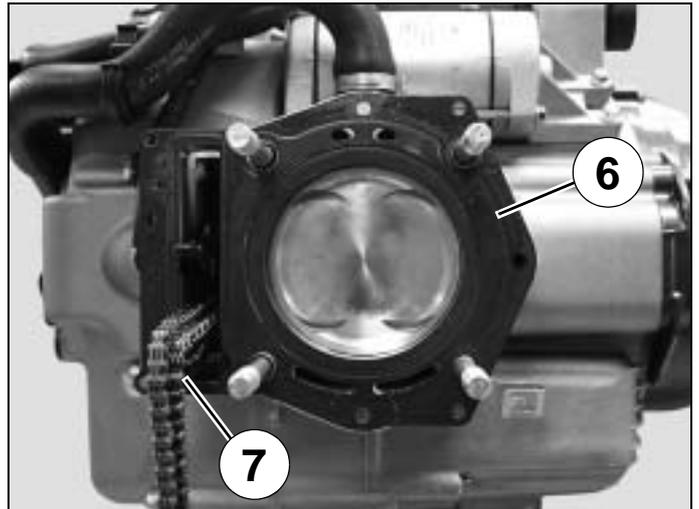
- Loosen the 2 fixing nuts under the cylinder head. (3)



- Loosen the 3 washers screws (4).
- Gradually loosen in a crosswise order the 4 nuts which secure the cylinder head (5).
- Remove the cylinder head.

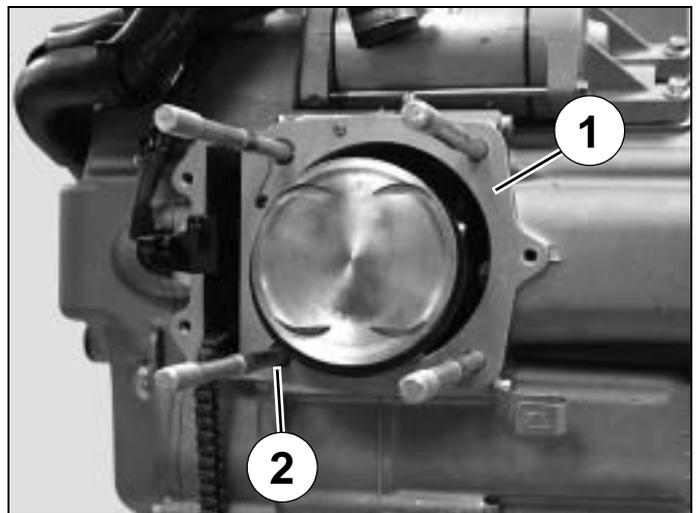


- Remove the cylinder head gasket. (6)
- Remove the chain guide pad (7).

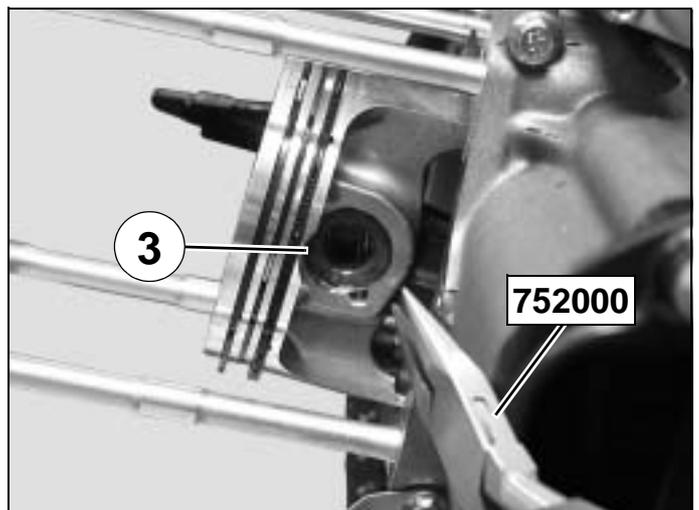


■ Removal of the cylinder / piston.

- Remove the cylinder and the bottom seal. (1)
- Remove the centring pin. (2)

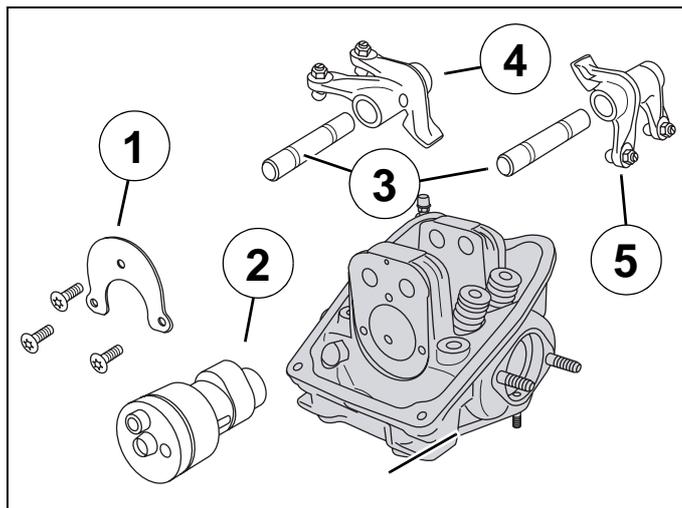


- Remove one of the spring clips (3) using pliers P/N 752000..
- Remove the gudgeon pin.
- Remove the piston.



■ **Removal of the camshaft and/or rockers.**

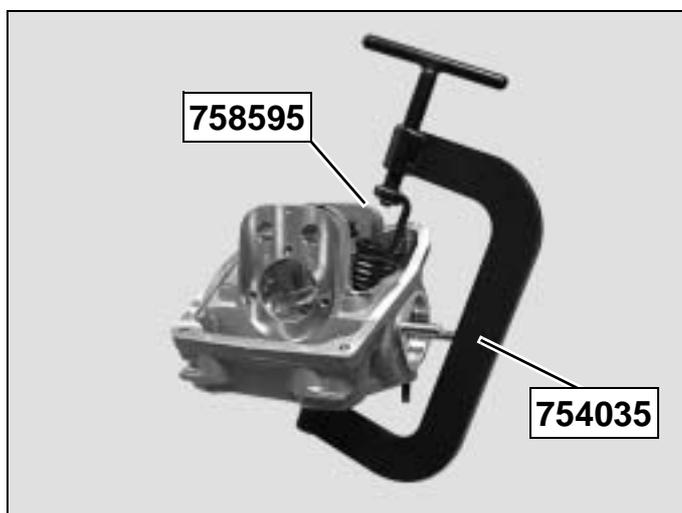
- Remove the stopper plate. (1) (3 screw).
- Remove the camshaft (2).
- Remove the cam follower shafts. (3).
- Remove the inlet (4) and exhaust (5) rockers.



■ **Removal of the valves or valve stem seals.**

- Compress the spring of one of the valves using the valve lifter P/N 754035.
- Remove the 2 half cones.
- Uncompress the spring and remove the tool.

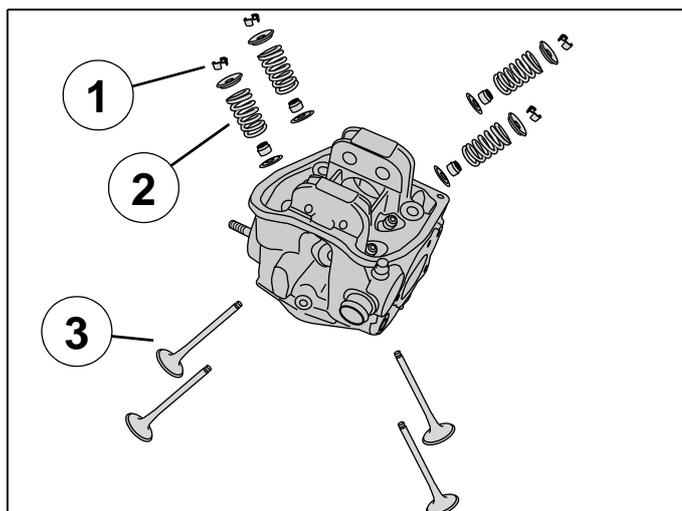
Note: Use the valve lifter provided with adaptor P/N 758595.



Remove:

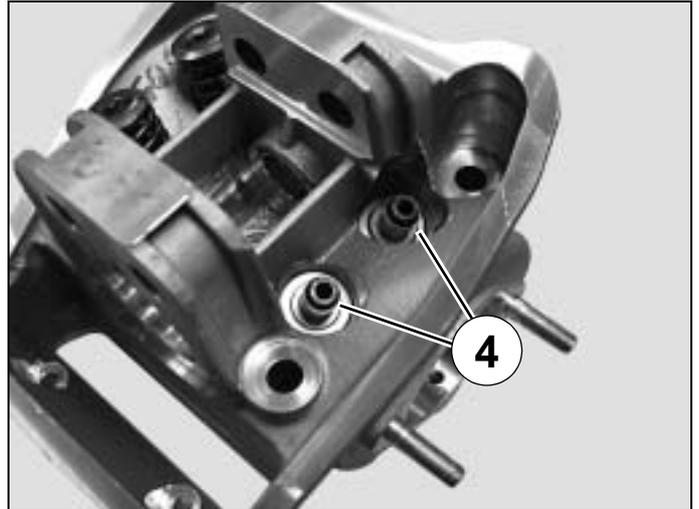
- The upper cup (1).
- The spring (2).
- The valve (3).
- Remove the other valves in the same way.

Note: when dismantling notice in which direction they are, so that you will replace them in their initial position when reassembling.

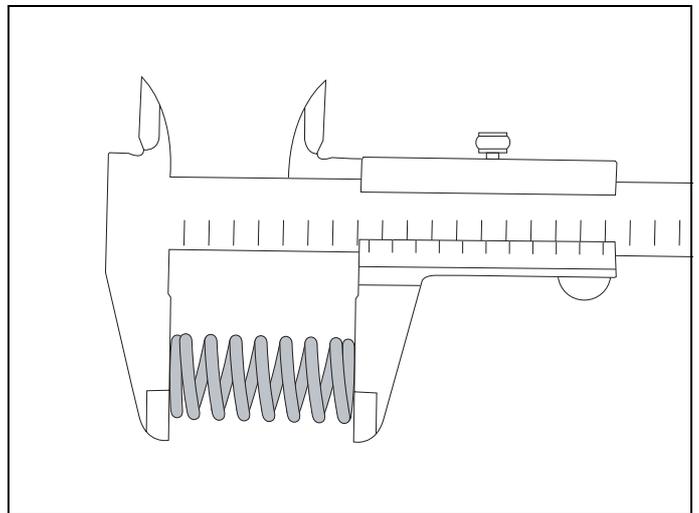


Note: When removing a valve, always change the valve stem seal. (4)

Before refitting, blow on every lubrication duct.



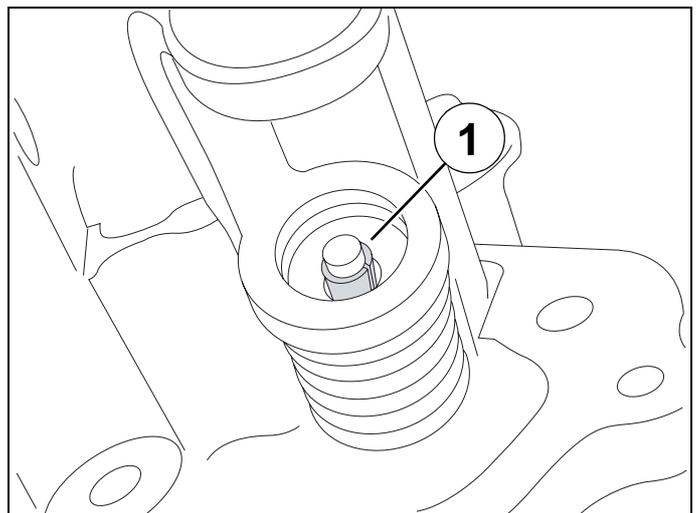
- Measure the unloaded length of the springs
 - Minimum length: 42.4 mm.



Note: When re-installing, fit the valve springs, the closest coils against the cylinder head.

When re-installing, lubricate the 2 half cones (1) so as to hold them in the groove of the valve's stem.

Do not place the 2 half cones into the cup forcefully with the tool when decompressing the spring.



When re-installing, the camshaft bearings, the rocker shafts and the contact between the rockers and the valves shall well lubricated in order to avoid any risk of seizure when starting the engine.

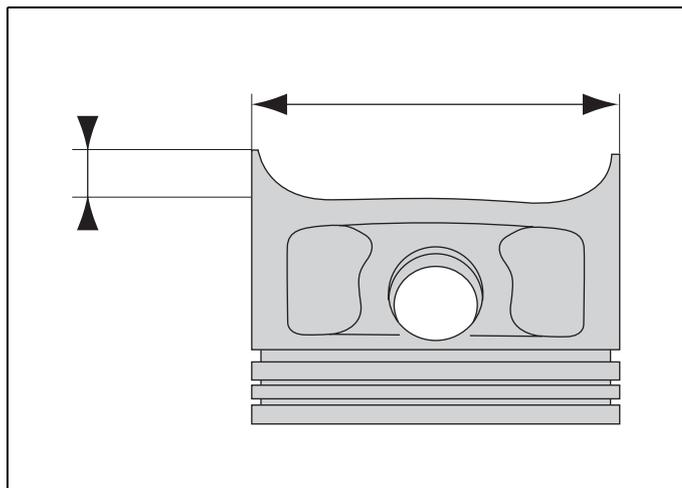


■ **Checking the cylinder.**

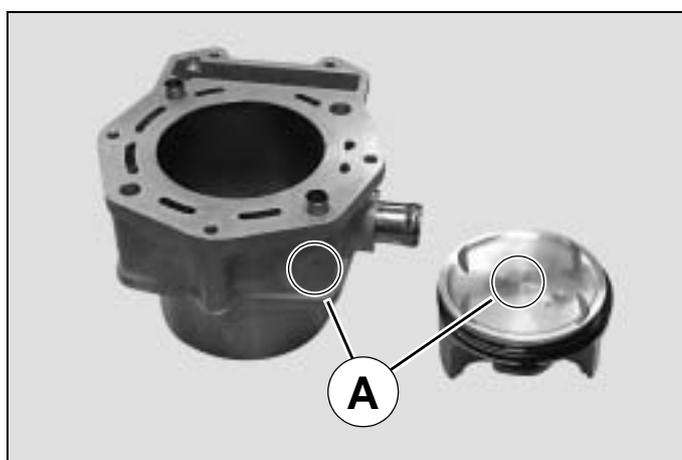
- The cylinder should show no traces of scoring or seizure.

■ **Checking the piston.**

- The piston should show no traces of scoring or seizure.
- The rings must be free in their grooves.
- Measure the piston diameter at 10 mm from the piston skirt.



- Check the cylinder/piston assembly pairing (A).
- The cylinder and the piston are paired up. (A. A / B. B / C. C / D. D)



Pairing. 400 cc			
Identification	Cylinder	Piston	Cylinder & piston set
A	85.790/85.797 mm	85.754/85.761 mm	0.029/0.043 mm
B	85.797/85.804 mm	85.761/85.768 mm	
C	85.804/85.811 mm	85.768/85.775 mm	
D	85.811/85.818 mm	85.775/85.782 mm	
Pairing. 500 cc			
Identification	Cylinder	Piston	Cylinder & piston set
A	93.990/93.997 mm	93.954/93.961 mm	0.029/0.043 mm
B	93.997/93.004 mm	93.961/93.968 mm	
C	94.004/94.011 mm	93.968/93.975 mm	
D	94.011/94.018 mm	93.975/93.982 mm	

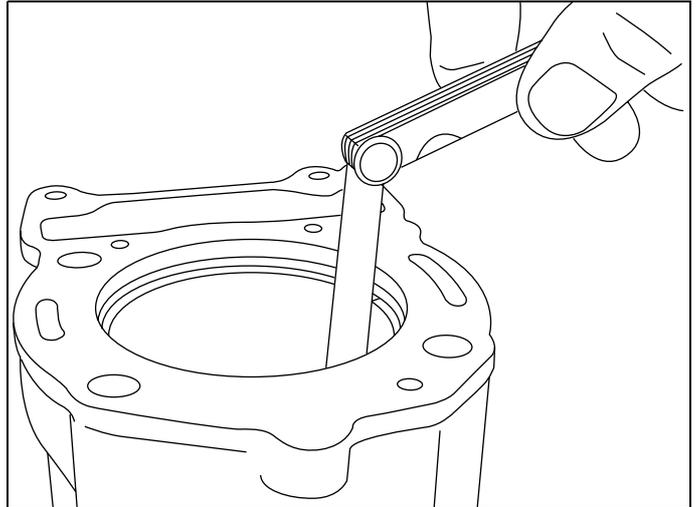


■ Checking the piston rings.

- Carefully remove the piston rings.
- Place a ring in the bore parallel to it and measure the gap using a feeler gauge.

Piston ring gap:

- Top compression ring gap: 0.15 to 0.50 mm.
- Compression ring gap: 0.25 to 0.65 mm.
- Oil control ring gap: 0.25 to 0.65 mm.

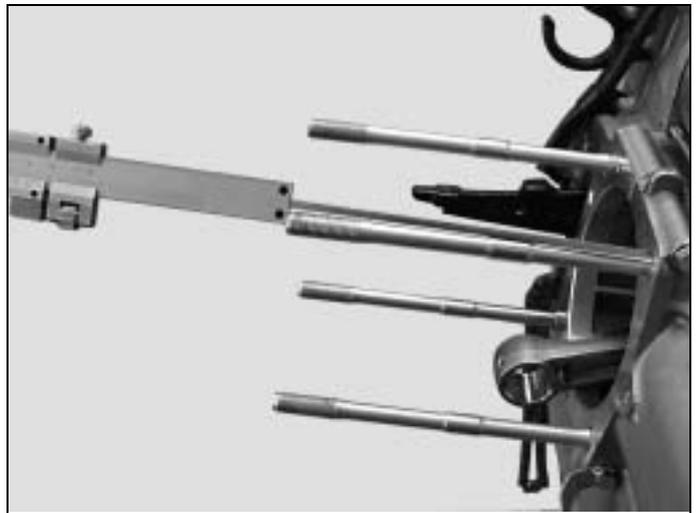


■ Checking the length of the studs.

- Check the length of the studs from the casing mating surface.

Stud length: 138 ± 0.5 mm.

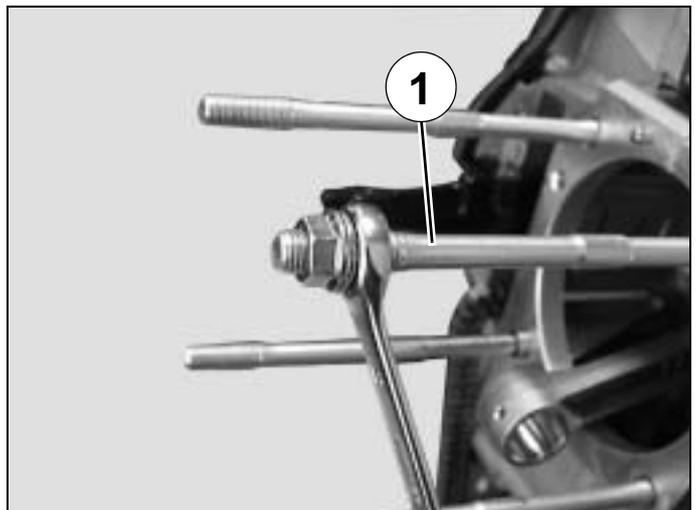
- Replace them if they exceed the specified dimension.



- Using a nut and a check nut, remove the studs. (1)

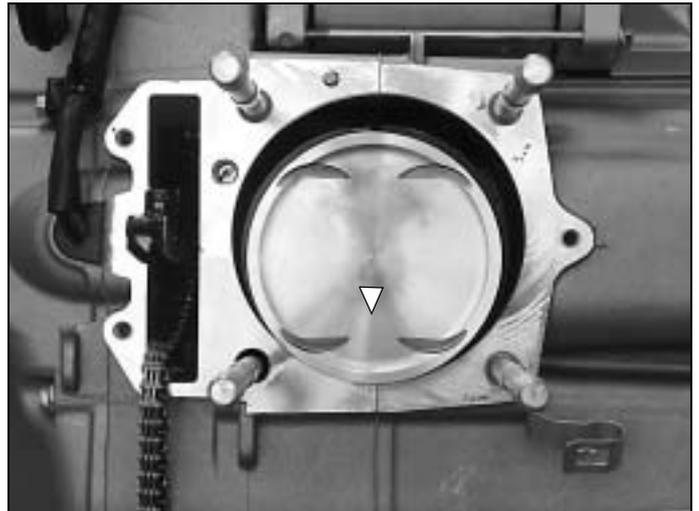


- Put strong thread lock on the studs and install them at the specified dimension.



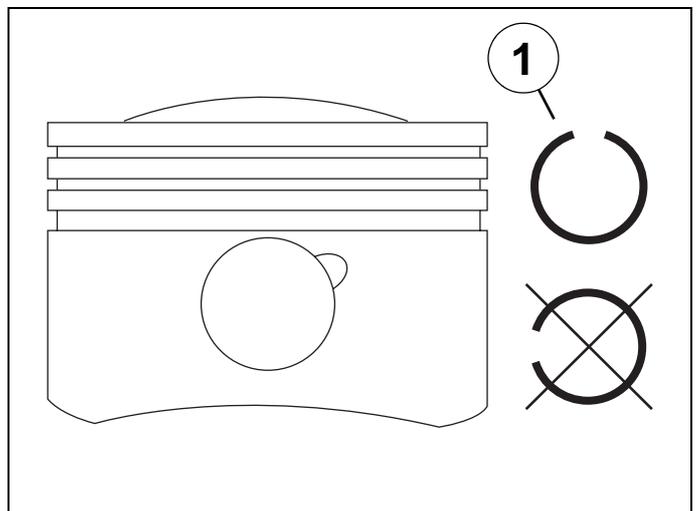
■ **Fitting the piston.**

- Install the piston with its arrow stamped into the piston crown pointing at the exhaust.
- Fit the gudgeon pin and circlips.



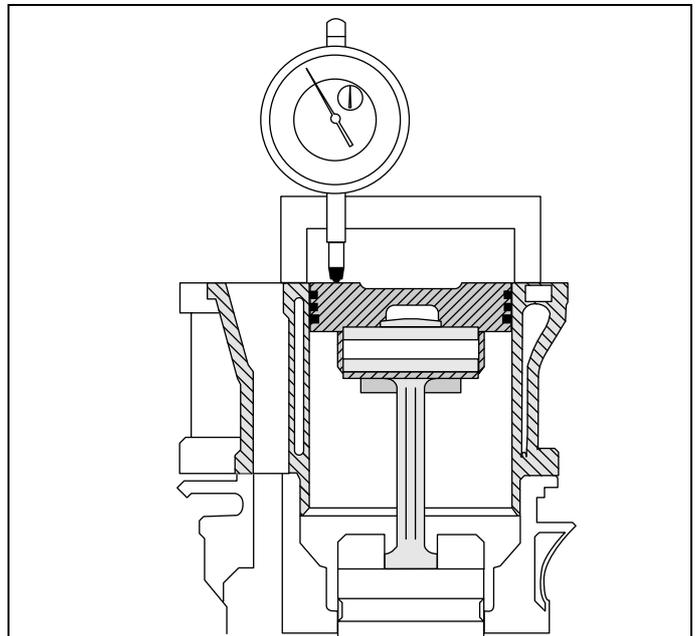
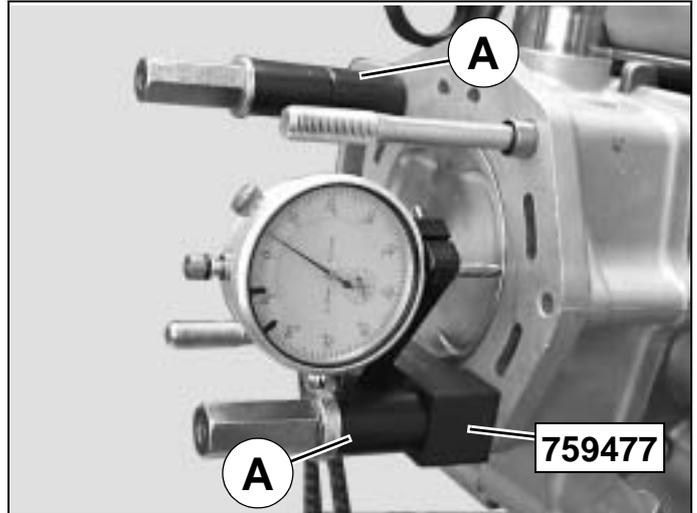
- The circlip gaps (1) must face upwards or downwards, but under no circumstances to the side.

Note: The circlips must be changed every time they are removed.



■ Checking the piston shrinkage.

- Install the cylinder on the piston without the bottom gasket.
 - Install a dial gauge on a gauge holder. P/N 759477.
 - Put and tighten the dial gauge holder on a stud, using the spacers that are provided. (A)
 - Place the dial gauge feeler plunger on the cylinder gasket seat surface and set the gauge to zero.
 - Put the dial gauge feeler plunger on the edge of the piston and set the piston to its top dead centre.
-
- Read the dial gauge value.
 - Using the table below, determine the thickness of the cylinder gasket.
 - Remove the dial gauge.
 - Remove the cylinder.

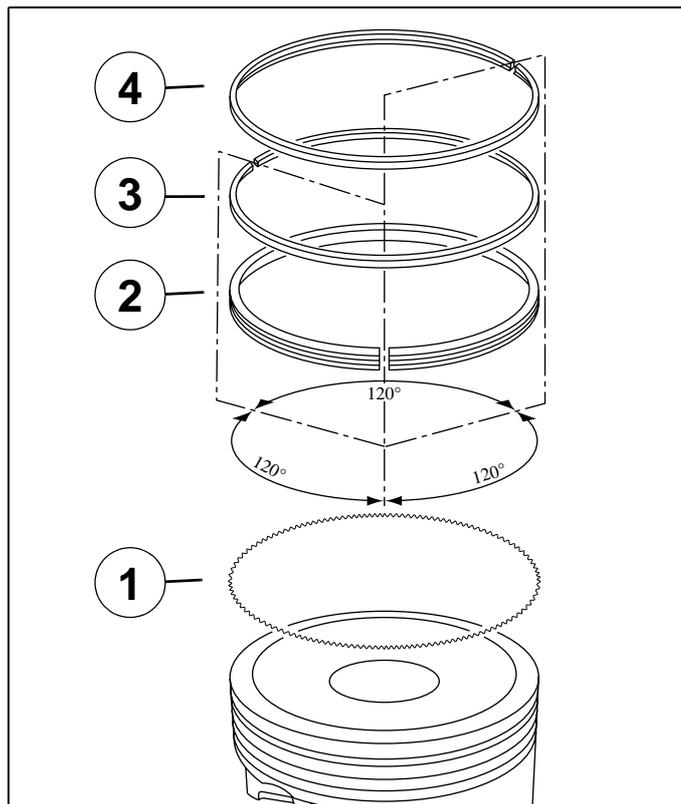


Measured value	Gasket thickness
-0.185/-0.10 mm	0.4 mm
-0.10/+0.10 mm	0.6 mm
+0.10/+0.185 mm	0.8 mm



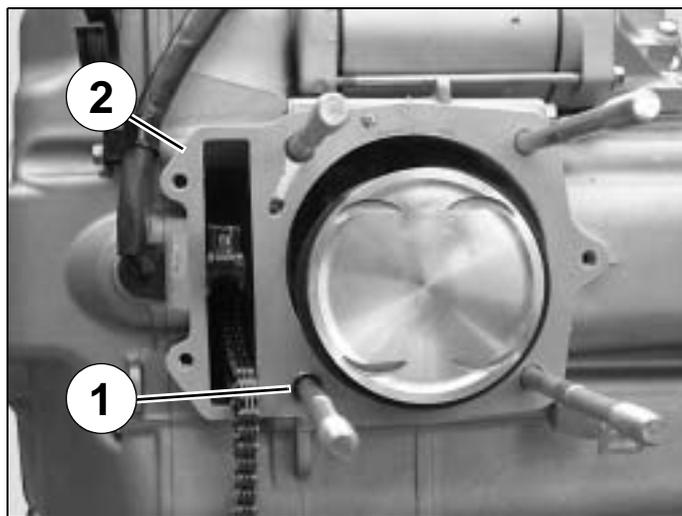
■ Installing the piston rings on the piston.

- Proceed in the following order in order to install the oil control ring:
 - Install the spring (1).
 - Install the oil control ring (2) by placing the "TOP" mark upwards.
- Install the compression ring (3) by placing the "TOP" mark upwards.
- Install the top compression ring (4). (The piston ring has an L-shaped section).
- Move the piston ring gap by 120°.

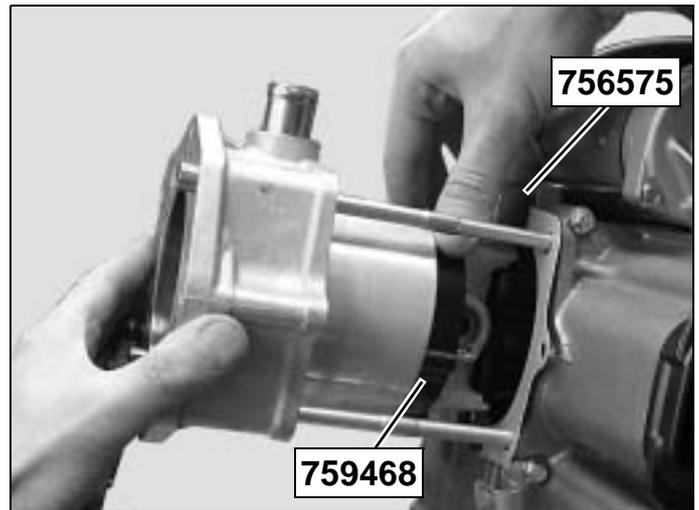


■ Fitting the cylinder.

- Before refitting, blow on every lubrication duct.
- Fit the centring pin. (1)
- Install a new base gasket (2) (with the thickness as determined previously) on the cylinder, while respecting the direction of installation, without using any oil or grease.

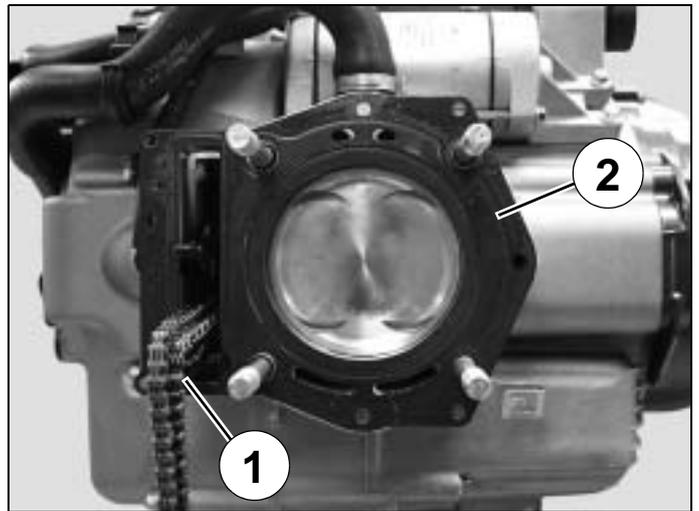


- Lubricate the cylinder.
- Fit the timing belt through the cylinder timing well.
- Using a piston locking fork P/N 756575 and a piston ring installation collar 759468, install the cylinder.



■ Fitting the cylinder head.

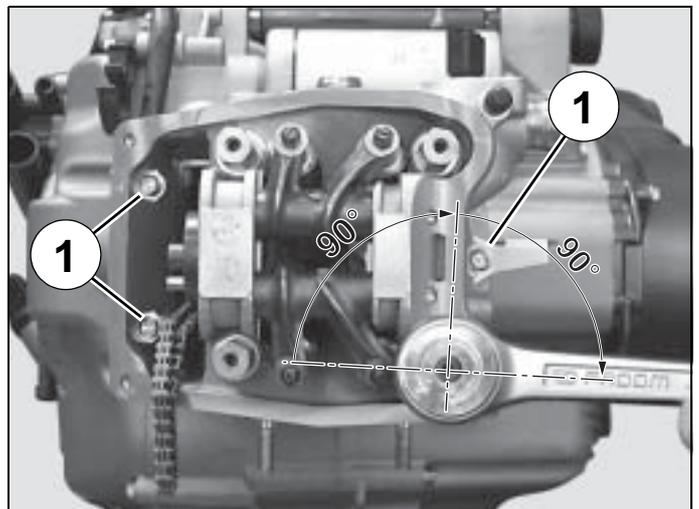
- Fit the chain pad (1).
- Fit the metal gasket on the cylinder. (2) (respect the right way of installation).
- Fit the timing chain through the cylinder head timing well.
- Fitting the cylinder head.



■ Method for tightening the cylinder head.

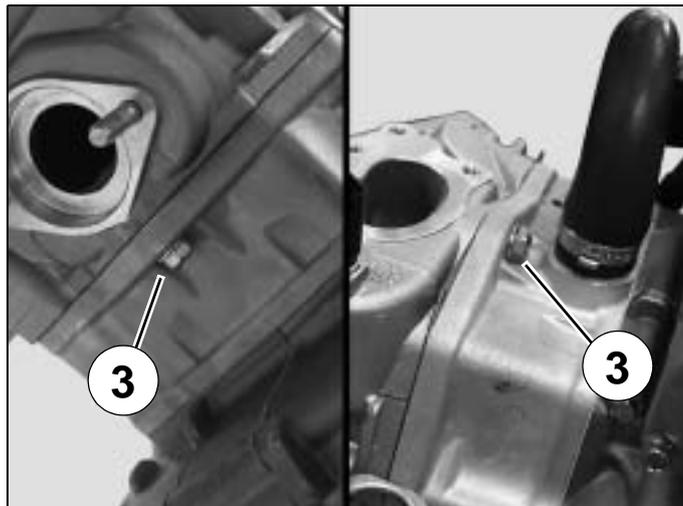
- Fit the 4 nuts.
- Pre-tighten the nuts in a crosswise order to a torque of: 0.7 m.daN.
- Put a protractor and rotate 90° for the 4 nuts.
- Rotate a second time 90° for final tightening.
- Fit the 3 screws. (1)

Tightening torque: 1.2 m.daN.



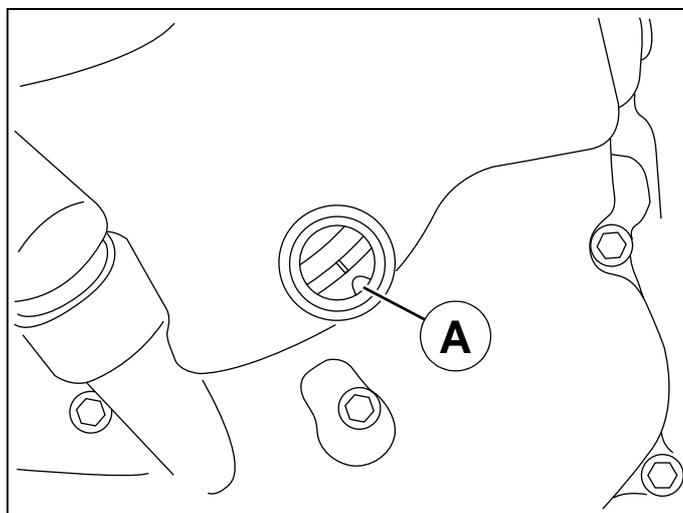
- Tighten the 2 fixing nuts under the cylinder head. (3)

Tightening torque: 1.2 m.daN.

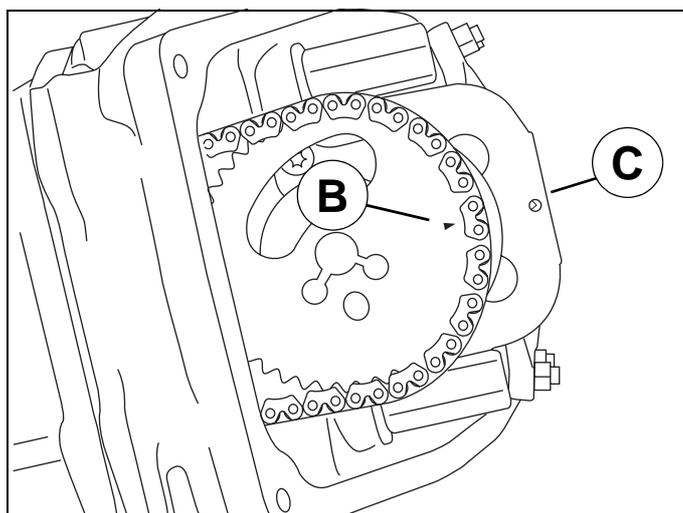


■ **Setting the timing.**

- Rotate the conrod and crankshaft assembly so as to align the marks of flywheel magneto with the mark (A) of the cover.

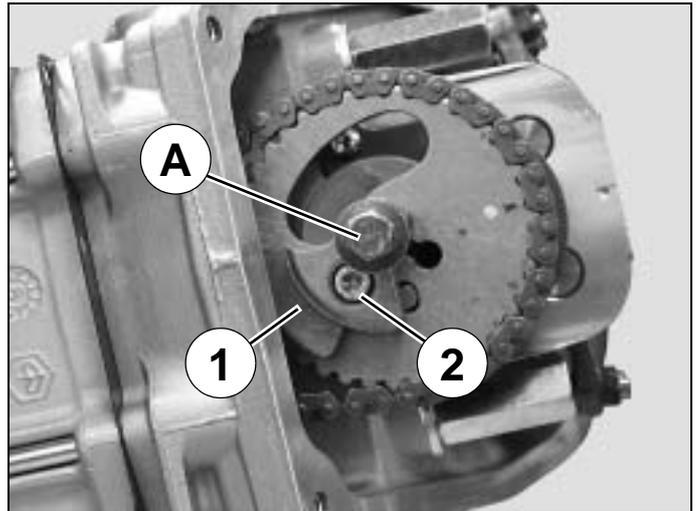


- Fit the gear in the chain on one of the sides.
- Make sure the mark (B) of the camshaft gear is aligned with the mark (C) of the cylinder head.
- If necessary, dislodge the gear from the camshaft without removing it and move the chain around the gear on the required side.



- Fit the counter weight. (1)
- Centre the counterweight by using the cover's fixing bolt. (A)
- Fit and tighten the bolt. (2)

Tightening torque: 0.8 m.daN.

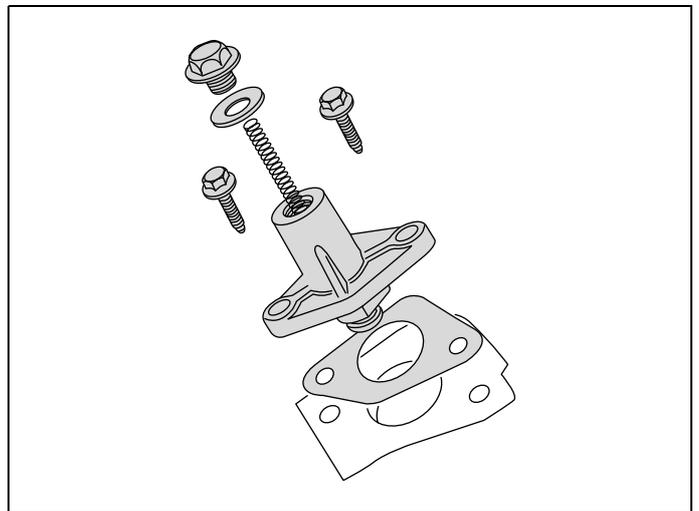


- Fit the chain tensioner seal (respect the position of installation).
- Install the chain tensioner and the 2 attachment screws.

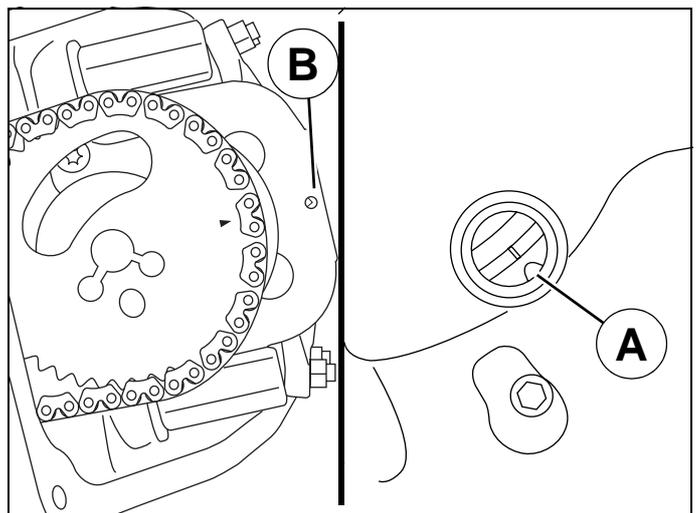
Tightening torque: 1.2 m.daN.

- Install the tensioner cap.

Tightening torque: 0.5 m.daN.



- Rotate the engine twice: 2 revolutions in the engine's operating direction.
- Check the alignment of the timing marks of the flywheel magneto with the mark (A) of the cover, and of the camshaft gear with the mark (B) of the cylinder head.
- In case of misalignment, start the operation again from the beginning.

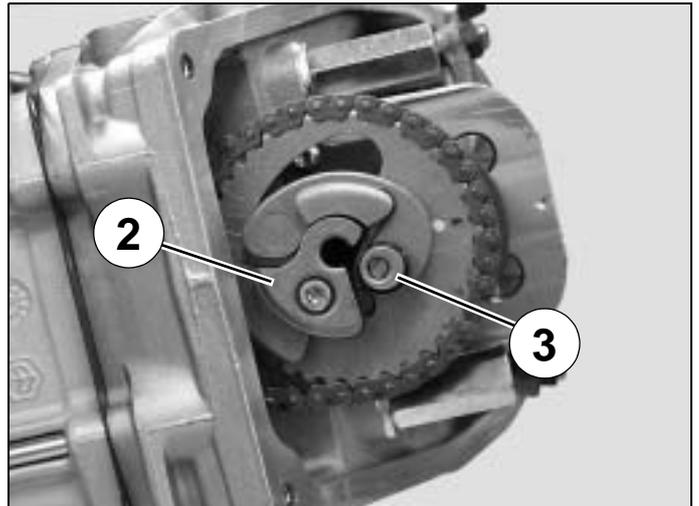


- Fit the balance weight (2) together with the spacer and the spring (3).
- Install the cover.

Tightening torque: 1.2 m.daN.

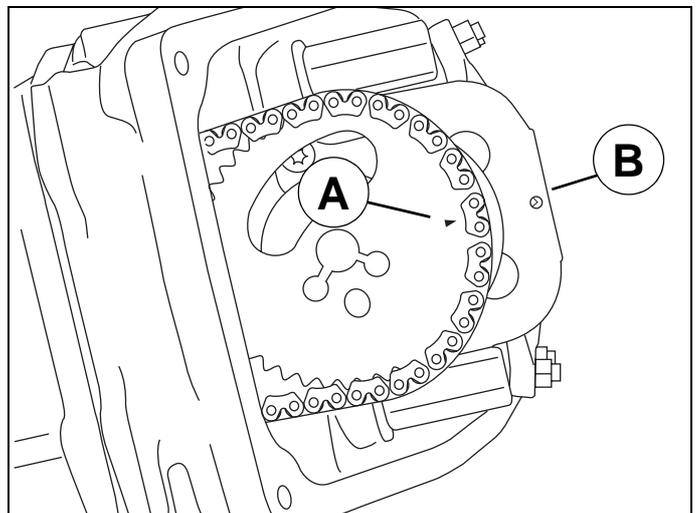
- Install the rocker cover and its 6 screws.

Tightening torque: 1.2 m.daN.



■ **Installing the valve clearance.**

- Remove the rocker cover. (6 screw).
- Rotate the engine by hand in the operating direction in order to align the (A) mark on the pinion with the mark on the cylinder head. (B)



- Loosen the lock nut of the rocker adjustment screw.
- By means of feeler gauges, adjust the clearance of every valve by acting on the rocker set screw.

Clearances:

- 0.15 at the intake.
- 0.15 at the exhaust.
- Immobilize the rocker set screw.
- Tighten the locknut without altering the adjustment.

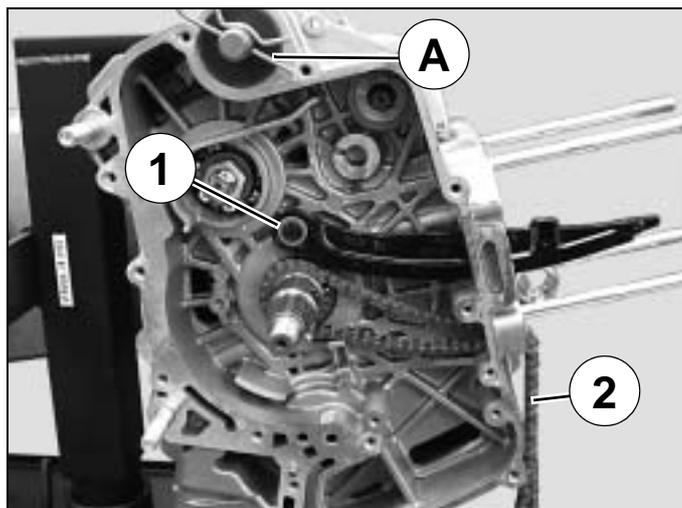


CRANKCASE

■ Removal of the crankshaft.

- Remove the primary drive.
- Remove the cylinder and the piston.
- Remove the rotor and the overrunning clutch.
- Remove the starter motor.

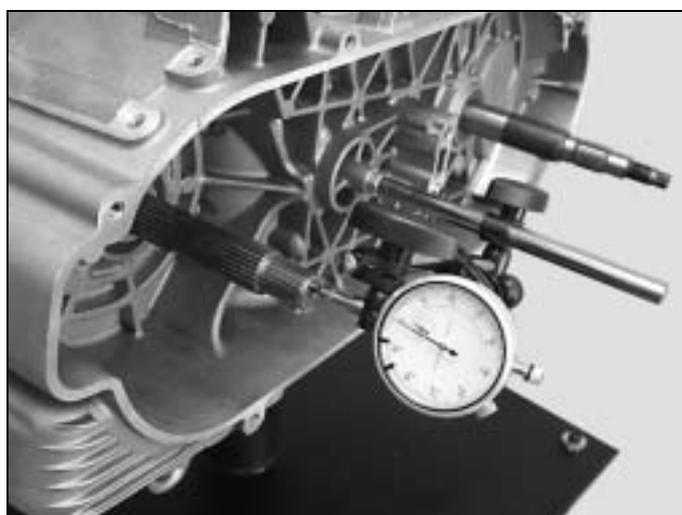
- Remove the chain tensioner slipper. (1)
- Remove the timing chain and notice its direction of rotation. (2)
- Remove the pin and the washer. (A)



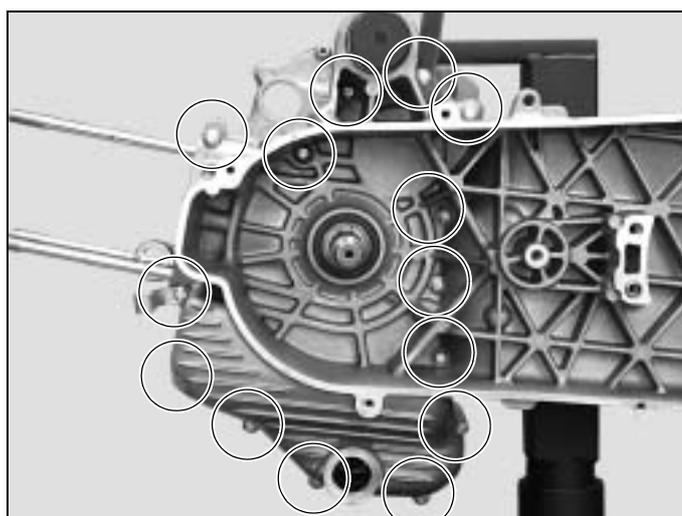
- Before opening the crankcase, measure the crankshaft's axial clearance.

Maximum clearance: 0.60 mm.

- A bigger clearance means that the surfaces between the crankcases and the crankshaft are worn.

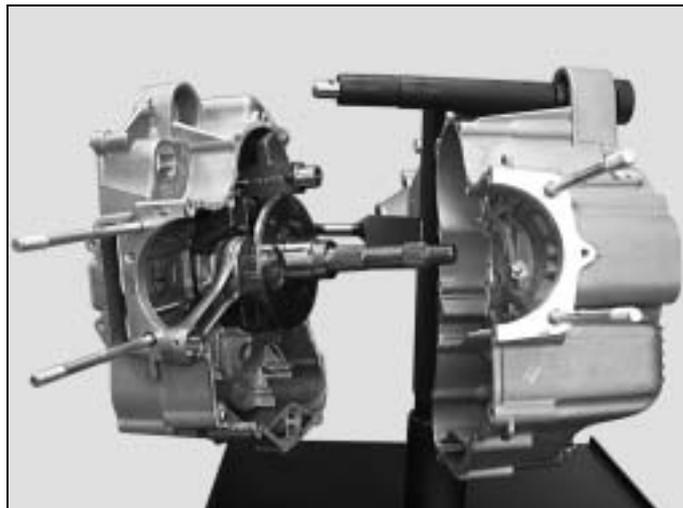


- Remove the 14 screws that secure the RH half casing.

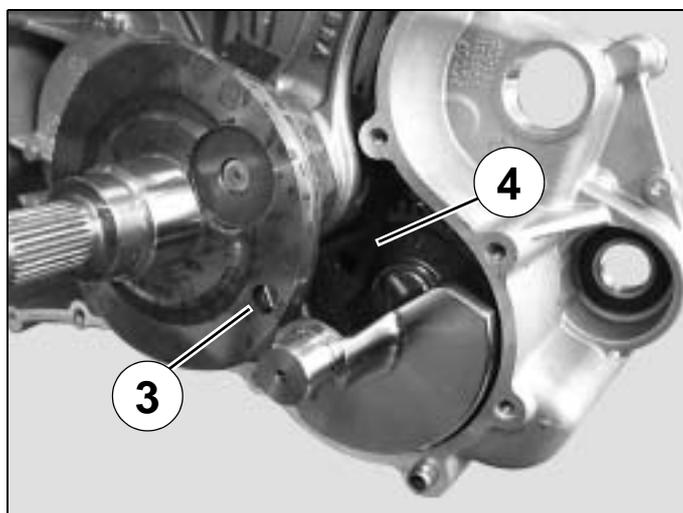


- Remove the RH half casing and the the crankshaft and balance shaft.
- Remove the paper gasket.

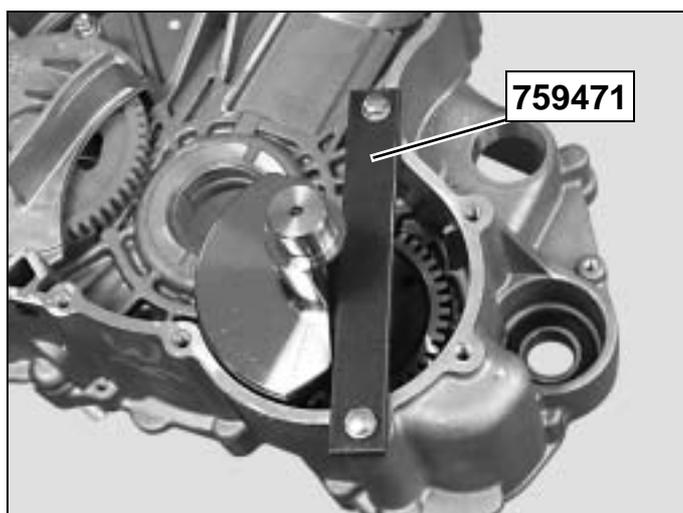
Note: When splitting open the crankcases and when pulling out the crankshaft make sure not to damage the bushings with the threaded ends of the crankshaft.



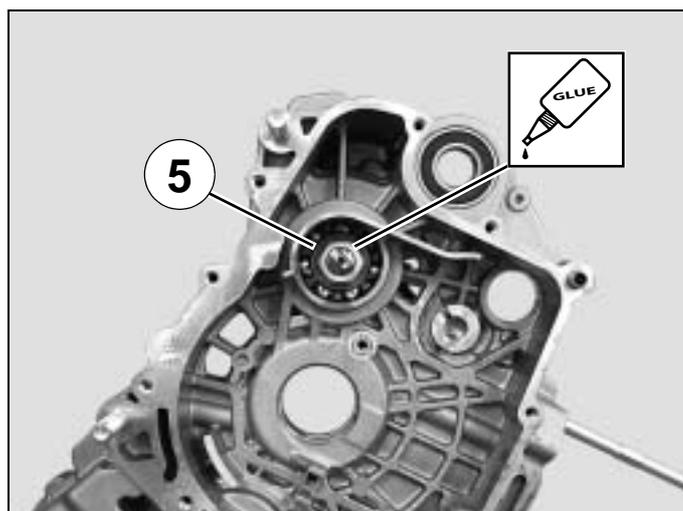
- Align the 2 pin gauge holes of the crankshaft (3) and balancing shaft. (4)
- Remove the crankshaft and its timing washer.



- Hold the balancing shaft using tool P/N 759471 and the 2 screws.

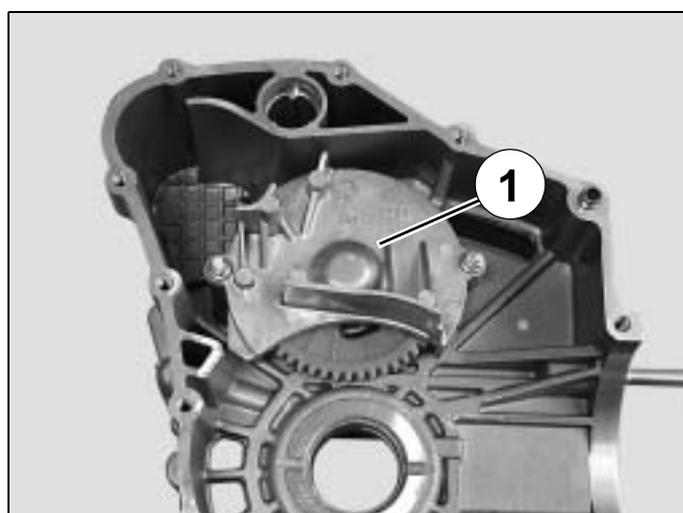


- Remove the nut and the washer. (5)
- Remove the locking tool.
- Remove the balancing shaft.
- Remove the locking tool.



■ Removal of the oil pump.

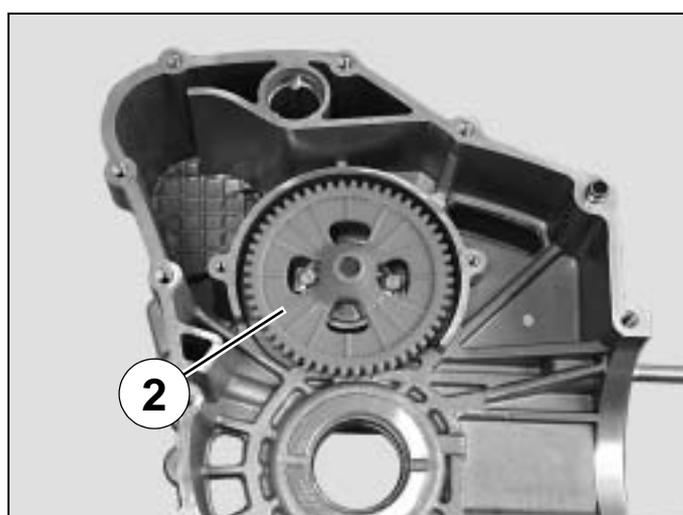
- Remove the oil pump cover. (1) (2 screw).



- Remove the oil pump and its gasket. (2) (2 screw).

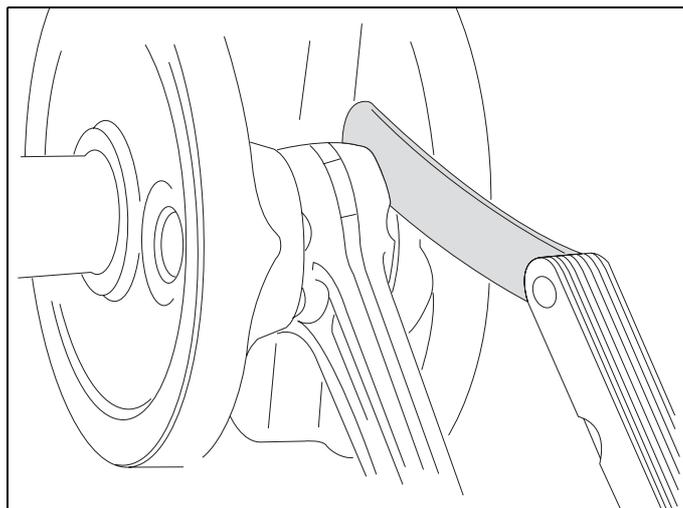
Note: The oil pump cannot be overhauled.

In case of abnormal oil pressure, replace the complete oil pump.

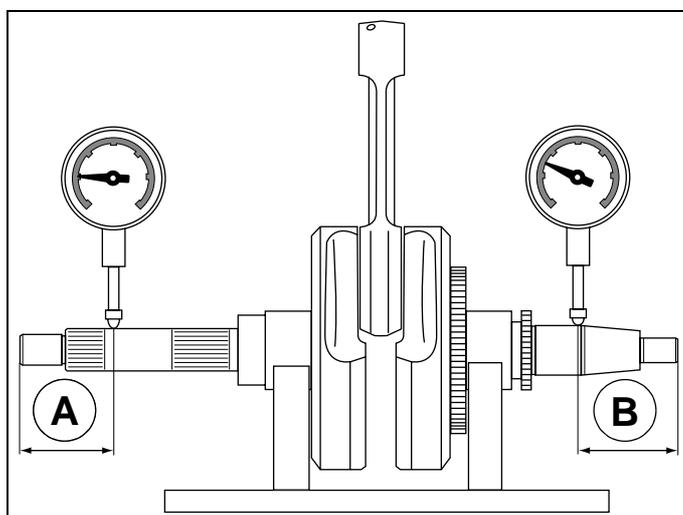


■ **Checking the crankshaft and conrod assembly.**

- Using a set of shims, check the big end side play.
- The maximum side play on the conrod end must not exceed: 0.5 mm.



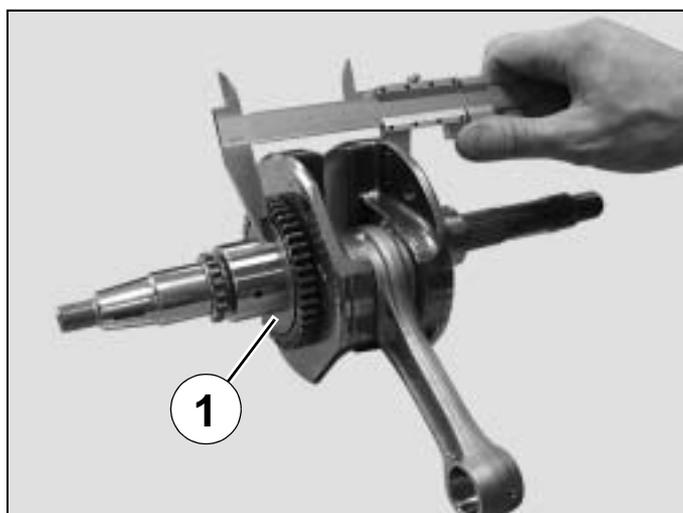
- The runout at the crankshaft ends shall not exceed 0.10 mm and shall be measured at:
 - A. 45 mm from the transmission side end.
 - B. 50 mm from the flywheel magneto end.



- Measure the width of the crankshaft with the timing washer. (1)

Width: 73.8- 74.0 mm.

If the axial clearance is over 0.6 mm and if the crankshaft width is correct, this means that the crankcase seat surfaces are worn.

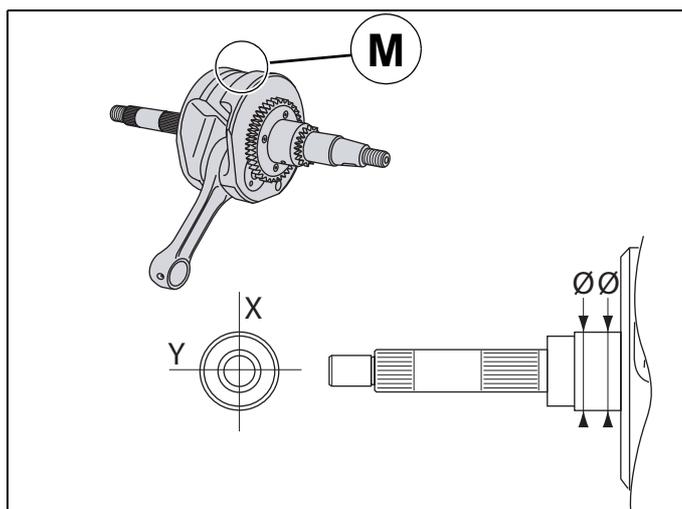


- The complete crankshafts are classified in 2 classes:

Class 1: 40.020 - 40.026 mm.

Class 2: 40.026 - 40.032 mm.

M. Class identification.



■ **Checking the bushings.**

- The bushings are classified in 4 classes.

Red - Class A.

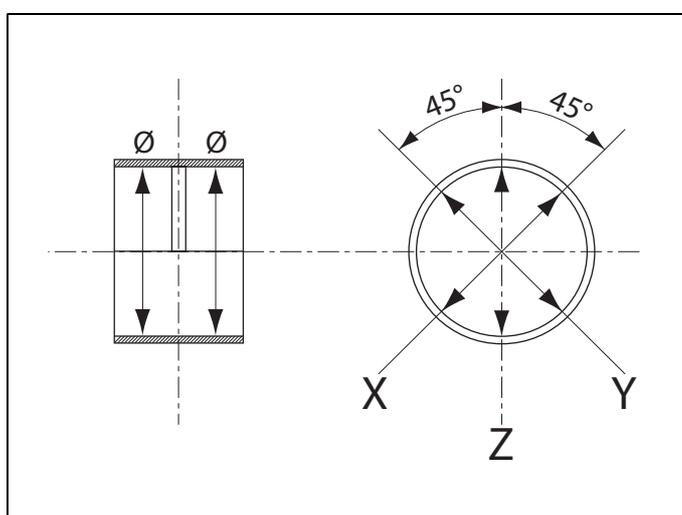
Blue - Class B.

Yellow - Class C.

Green - Class D.

The crankcases are classified in 3 classes.

Maximum permissible clearance between the crankshaft bearings and the bushings: 0.08 mm.



■ **Crankshaft & crankcase coupling chart.**

		Conrod and crankshaft assembly	
		1	2
Crankcase	1	B	A
	2	C	B
	3	D	C

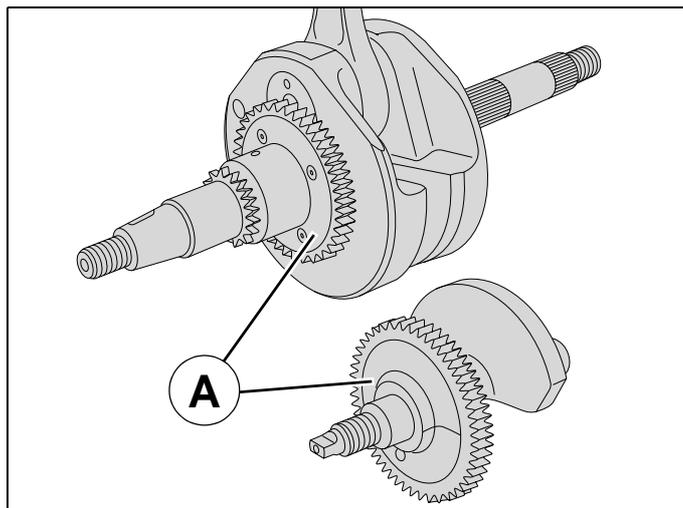


The crankcases have no marking. If you want to replace them, replace also the complete crankshaft and the balancing shaft.



■ **Checking the balance shaft.**

- Check the condition of every gear. (A)
- When changing a pinion, we recommend changing the opposite one on the other shaft.

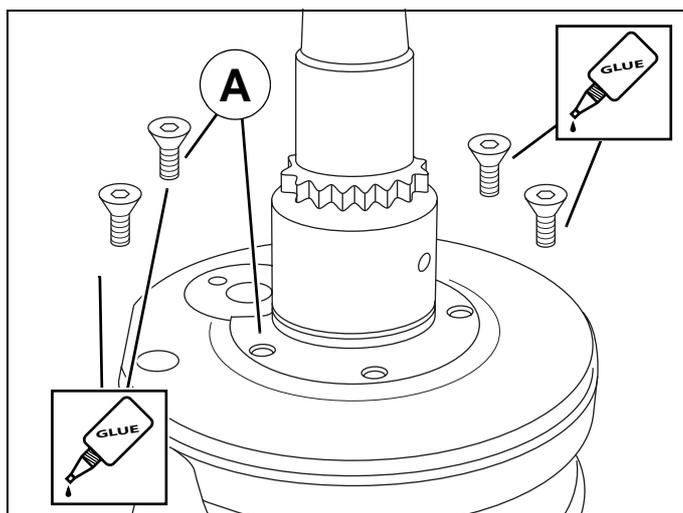


■ **Replacing the balance shaft pinion.**

- Remove the balancing shaft pinion. (4 screw).



- Using a wire brush, remove all the old glue from the crankshaft and clamping bolts. (A)
- Remove grease from the crankshaft and clamping bolts.
- Fit a new pinion over the crankshaft.
- Spread standard thread lock on the bolts.
- Fit and tighten the 4 clamping bolts

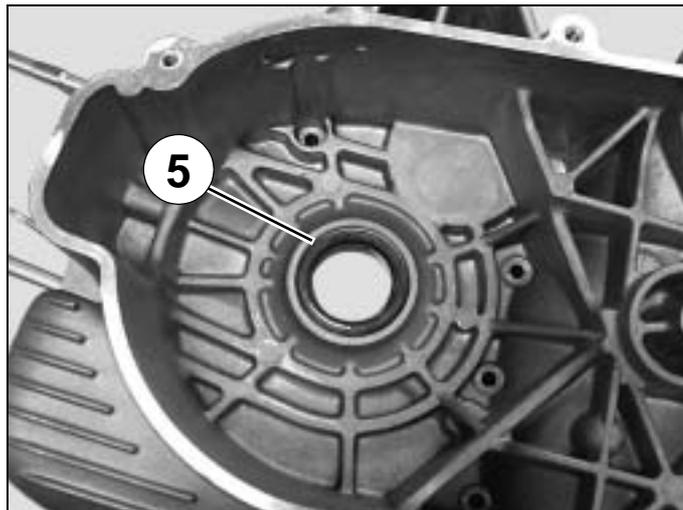


Tightening torque: 1.1 m.daN.

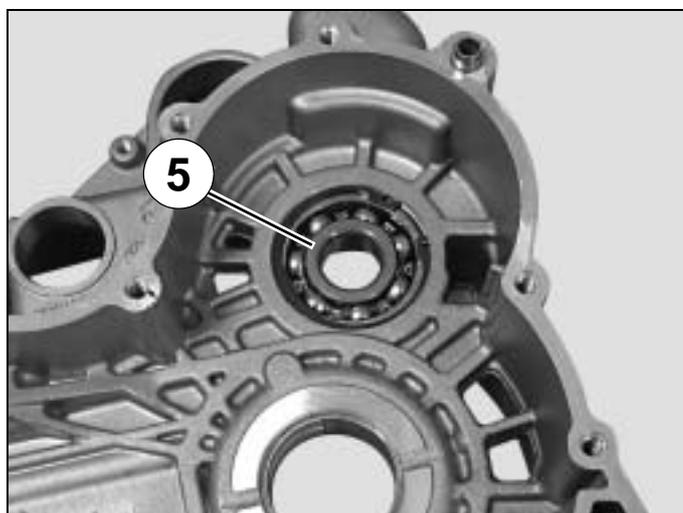


■ Replacing the balance shaft bearings.

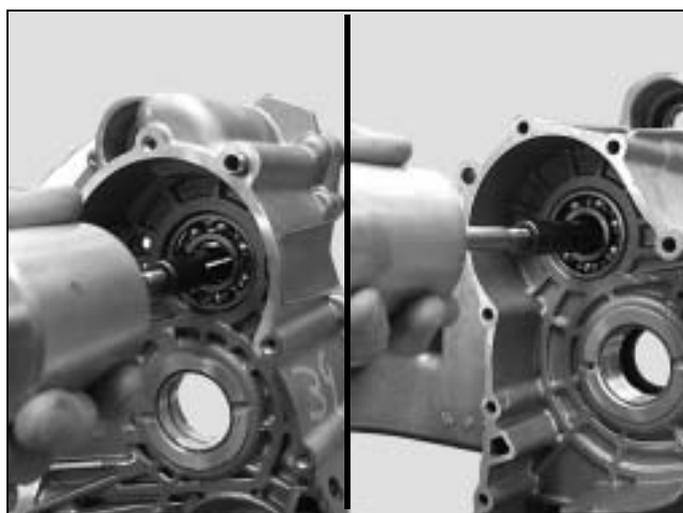
- Remove the seal. (1)



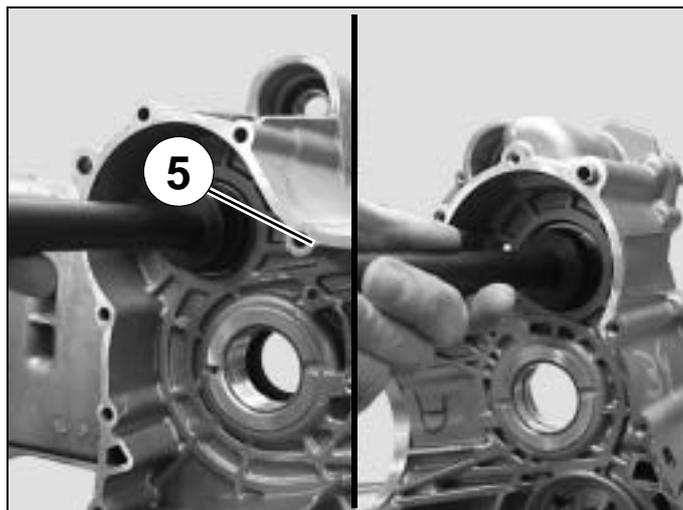
- Remove the circlip. (2)



- Using a heat gun, heat the crankcase to a temperature between 80 and 90°C. Use an inertia type extractor tool to remove the bearings.



- While the casing is expanded fit the new bearing using a push tool, by pushing against the outer cage of the bearing.
- Install the circlips.



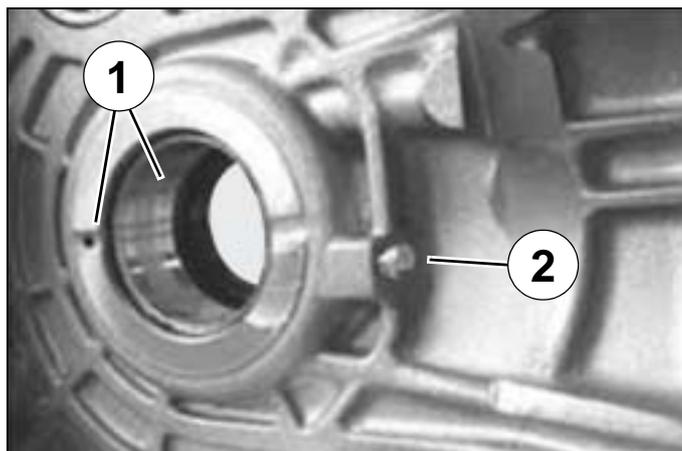
- Using fitting tool P/N 759788, fit a new lightly greased gasket .



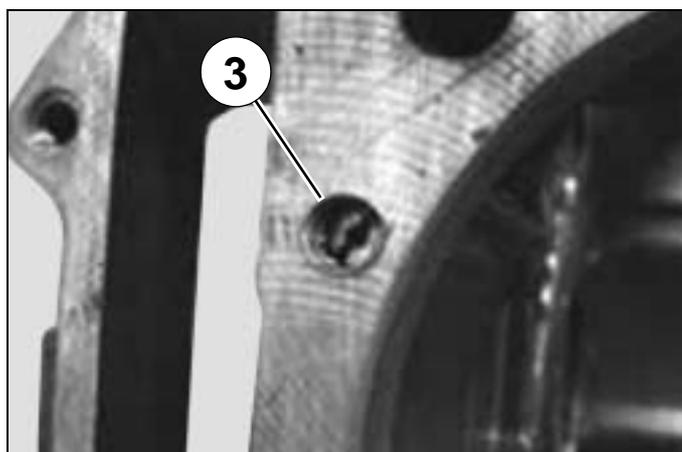
■ Assembly of the engine casings.

Note: Before refitting, blow on every lubrication duct.

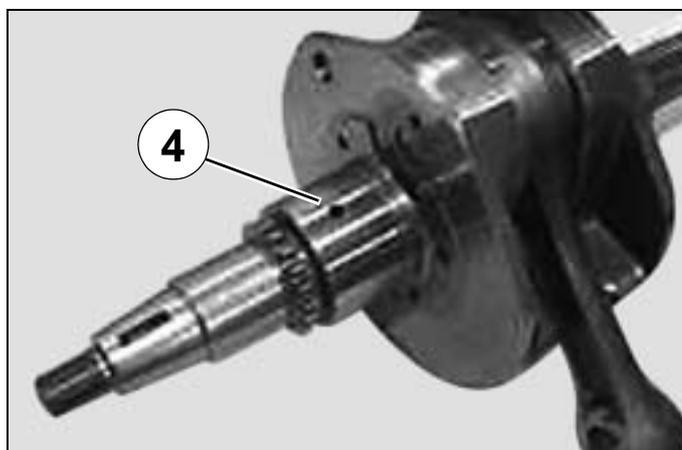
- Among others, blow on:
 - The bushings and ducts. (1)
 - The piston cooling jet. (2)



- Cylinder head oil supply jet. (3)



- The conrod lubrication duct. (4)

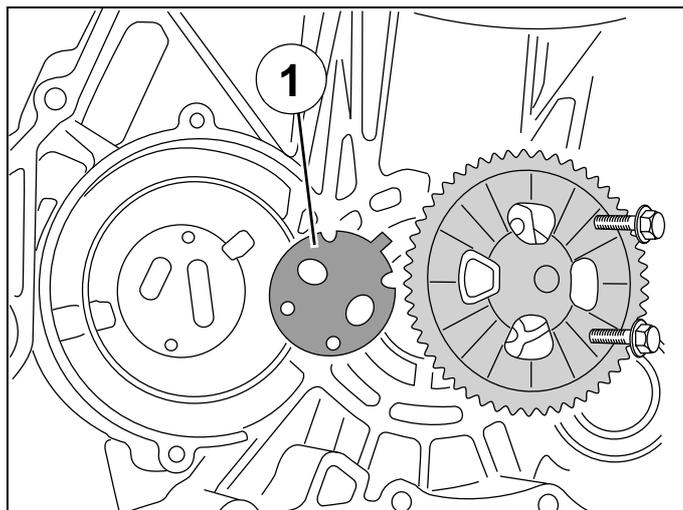


■ **Fitting the oil pump.**

Note: Before re-assembling, lubricate the oil pump by dipping it into a pan containing clean motor oil.

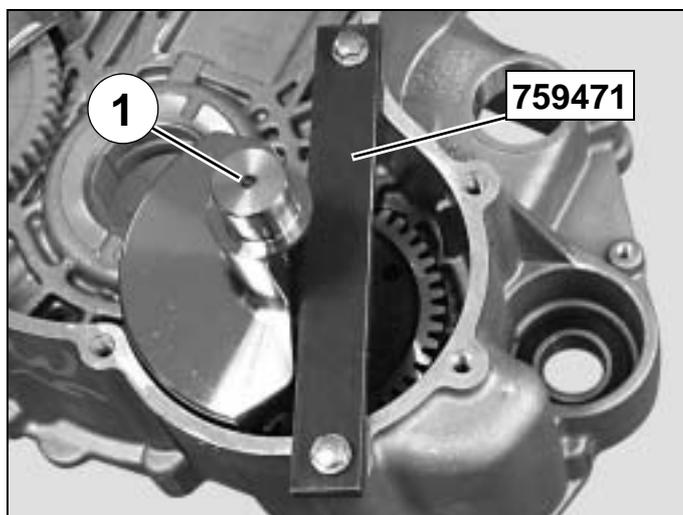
- Install the oil pump and a new gasket (1)

Tightening torque: 0.6 m.daN.



■ **To fit the balance shaft.**

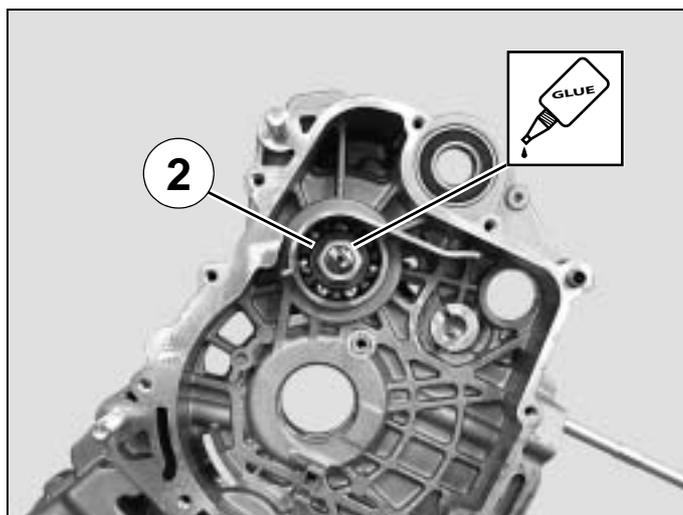
- Fit the balancing shaft (1) in the RH casing.



- Spread standard thread lock on the shaft's threading.
- Fit the washer and the nut (2) and hand tighten.
- Hold the balancing shaft using tool P/N 759471 and the 2 screws.
- Tighten the nut.

Tightening torque: 2.8 m.daN.

- Remove the locking tool.



■ Fitting the conrod and crankshaft assembly.

- Place the RH casing on 2 wooden blocks.
- Insert the timing pin P/N 759473 into the hole of the balancing shaft pinion.



- Lubricate the crankshaft assembly and the 2 bushings with 4 stroke motor oil.
- Fit the crankshaft with its washer by inserting the timing pin into the crankshaft holes.

Note: Make sure not to damage the bushing with the threaded end of the crankshaft.



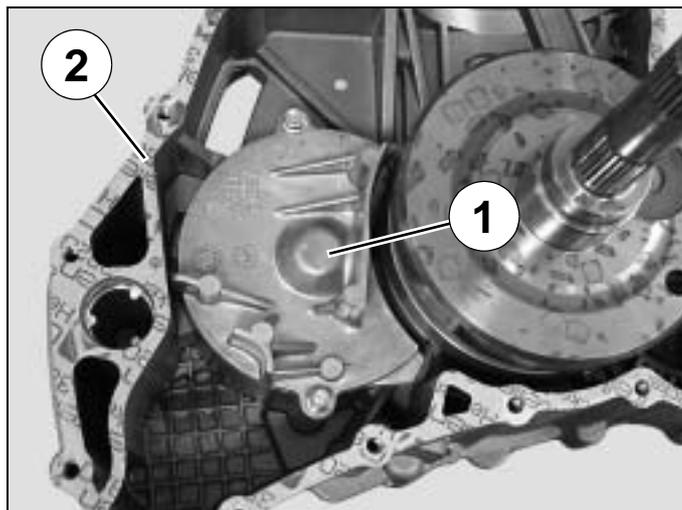
- Turn the oil pump pinion by hand so that it coincides with the crankshaft pinion.
- Remove the timing pin.



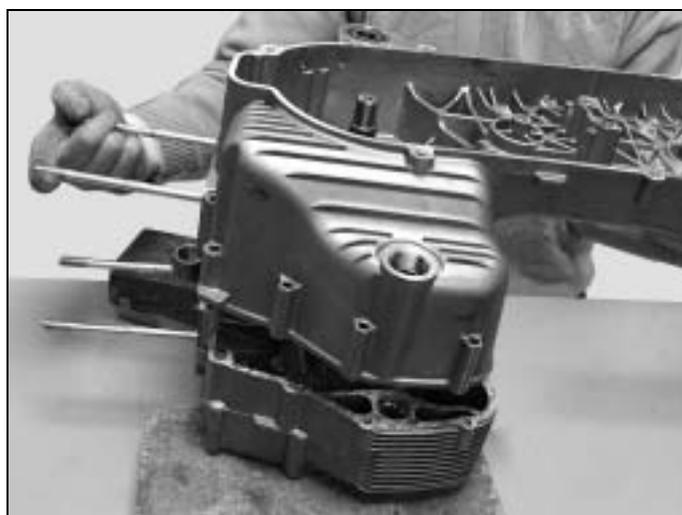
- Fit the oil pump cover. (1) (2 screw).

Tightening torque: 2.8 m.daN.

- Install a new paper gasket. (2)



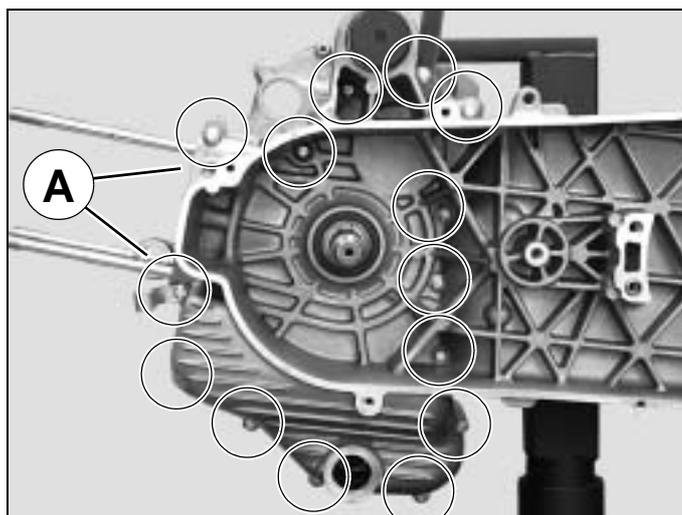
- Fit the LH casing to the RH casing and crankshaft, while making sure you do not damage the bushing and the seal with the threaded end of the crankshaft.
- Fit the 2 screws diagonally in order hold the 2 casings.
- Place the casing assembly on the engine support.



- Fit and tighten the 14 clamping bolts.

Tightening torque: 1.2 m.daN.

- Check the crank assembly turns freely in the casings.
- Trim the casing gasket in (A).









 **UTAC**
CERTIFICATION
SYSTEMES QUALITE
ISO 9001
Certificat n° SQ/0766-3

P/N 759533

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