EVO

EVO 2T

2016



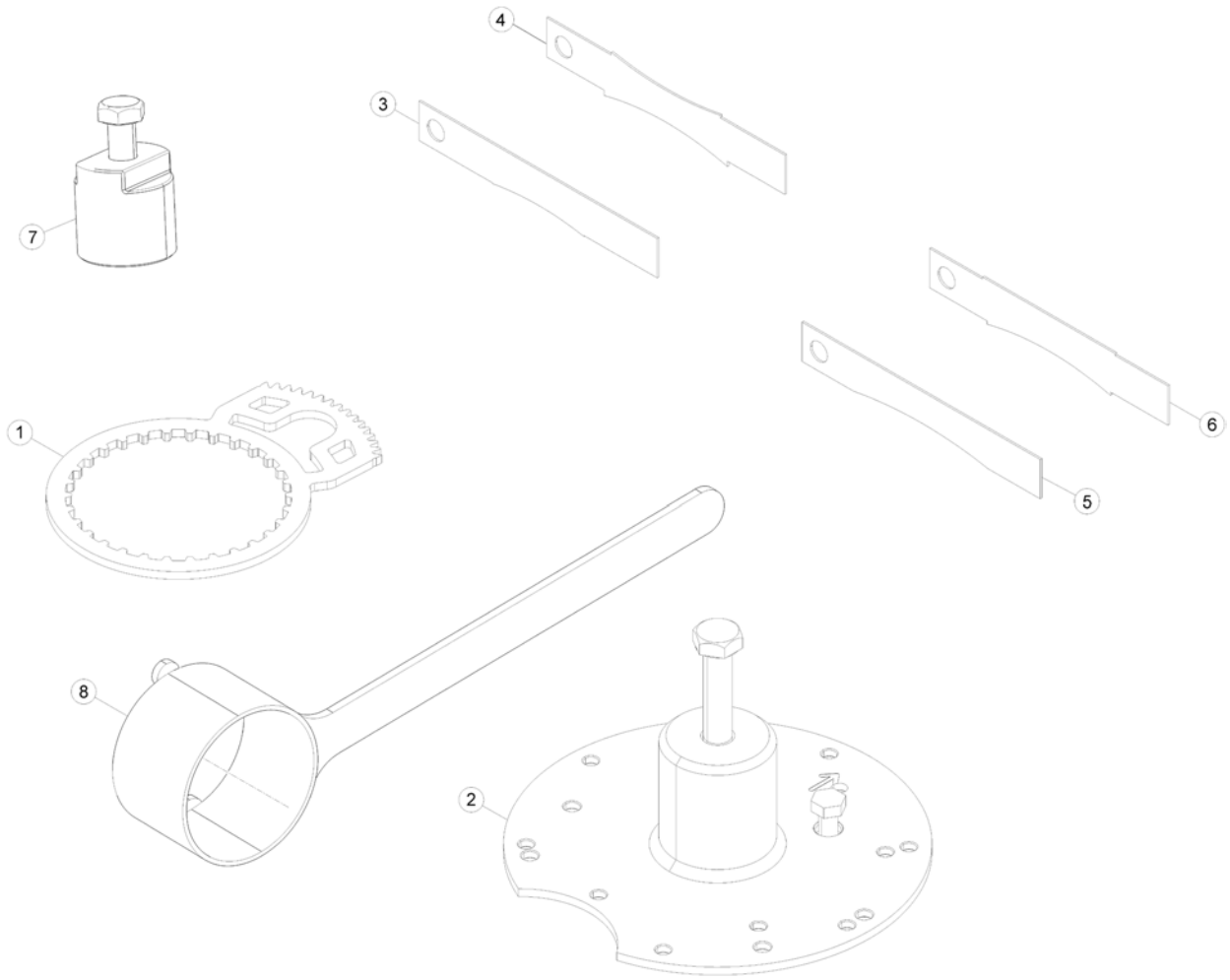
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MANUALE DI OFFICINA
WORKSHOP MANUAL
MANUEL D'ATELIER
WERKSTATTHANDBUCH
MANUAL DE TALLERES

Beta
motorcycles

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SPECIAL EQUIPMENT



1.	*Primary tool*	*code 007.14.000.00.00*
2.	*Crankcase uncoupler*	*code 007.14.010.80.00*
3.	*Squish tool 125cc*	*code 007.44.010.00.00*
4.	*Squish tool 200/250GBcc*	*code 007.44.011.00.00*
5.	*Squish tool 250*	*code 007.44.012.00.00*
	Squish tool 250cc from no. ZD3B9T-F 2501001	*code 007.44.011.00.00*
6.	*Squish tool 300cc*	*code 007.44.014.0.00*
7.	*Flywheel extractor*	*code 01.00040.000*
8.	*Holding Tool, Flywheel*	*code 026.14.005.50.00*

Symbology

6Nm

Value
Tightening torque

Loctite 243/
Sichel 100M

Silicone paste

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ENGLISH

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FOREWORD

This manual has been drafted for the motorcycle user and Technical Support operator, whereby it provides understandable information pertaining to the necessary operations of engine inspection, maintenance and repair.

This manual must be thoroughly read before operating the engine. Engine life is prolonged by having a good knowledge of all the components and all the procedures to be followed when carrying out inspection and maintenance operations.
Schematic illustrations that highlight the subject matter have been included within the paragraphs for the reader to immediately understand that being read.

Informative note

Betamotor S.p.A. is committed to continuously improve its products. For this reason, there may be slight differences between that provided in this manual and the vehicle onto which you are to perform maintenance and/or repair operations. The Betamotor S.p.A. models are exported to many countries where different standards apply in relation to the Highway Code and approval procedures. Betamotor S.p.A. relies on your comprehension of the information, therefore it considers it necessary to reserve the right to effect changes to its products and technical documentation at any given time and without prior notice.

Respecting and protecting the environment

All that we do has repercussions on the entire planet and its resources. In order to protect the Community, Betamotor S.p.A. raises awareness amongst its Clients and Technical Support operators in order for them to use the vehicle and dispose of its parts in compliance with applicable regulations in terms of environmental pollution, disposal and recycling waste.

SAFETY

Carbon Monoxide

- *The exhaust gases contain carbon monoxide, which is a poisonous gas. Carbon monoxide can cause loss of consciousness and lead to death. When starting-up the engine, ensure the area is well-ventilated. Never start-up the engine indoors.*
- *The engine can only be started-up indoors if there are appropriate means to evacuate exhaust gases.*

Petrol

- *Petrol is extremely flammable and in certain conditions, explosive.*
- *Keep sources of heat, sparks and flames away from the work area.*
- *Always work in a well-ventilated area.*
- *Never use petrol as a cleaning solvent. Avoid handling petrol, unless absolutely necessary.*
- *Do not use petrol to clean the components – use compressed air.*
- *Keep out of reach of children.*

Engine oil

- *Engine oil can cause skin diseases if repeated and/or prolonged contact is made with skin.*
- *If engine oil comes in contact with your skin, wash with soap and water as soon as possible.*
- *If contact is made with your eyes, rinse thoroughly with water and consult a doctor.*
- *If swallowed, do not induce vomiting so as to prevent it from being absorbed into the lungs. Consult a doctor immediately. If you think the product has been absorbed into the lungs, the person in question is to be taken immediately to hospital.*
- *Spent oil contains hazardous substances that are harmful to the environment. When this is replaced, you must have the right equipment for its disposal in compliance with applicable regulations.*
- *Do not dispose of spent oil in the environment.*
- *Keep out of reach of children.*

Coolant

- *In certain situations, the ethylene glycol contained in the coolant is flammable and its flame is invisible. Should the ethylene glycol ignite, even though its flame is invisible, it will cause burns.*
- *Prevent the coolant from coming into contact with hot parts. These parts can be hot enough to ignite the flame.*
- *The coolant (ethylene glycol) may cause skin irritation and is poisonous if swallowed.*
- *If the coolant comes into contact with your skin, immediately remove any contaminated clothes or shoes and wash with soap and water. If contact is made with your eyes, rinse thoroughly with clean water and consult a doctor immediately. If swallowed, do not induce vomiting so as to prevent it from being absorbed into the lungs. The person in question must drink clean water and must also be taken immediately to hospital. The product must be shown to the medical staff.*
- *In case of exposure to a high concentration of vapours, the person in question must be moved to an unpolluted area and if necessary, a doctor must be called.*
- *Do not remove the radiator cap when the engine is still hot. Since the coolant is under pressure, it can spurt out violently and cause burns.*
- *Coolant contains hazardous substances that are harmful to the environment. When replacing the coolant you must have the right equipment for its disposal, in compliance with applicable regulations.*
- *Do not dispose of coolant in the environment.*
- *Keep out of reach of children.*

Hot parts

- *The engine and the exhaust system become very hot and remain so for some time, even after the engine is switched off. Wait for them to cool before handling or intervening in parts that are around them. Also use insulating gloves.*

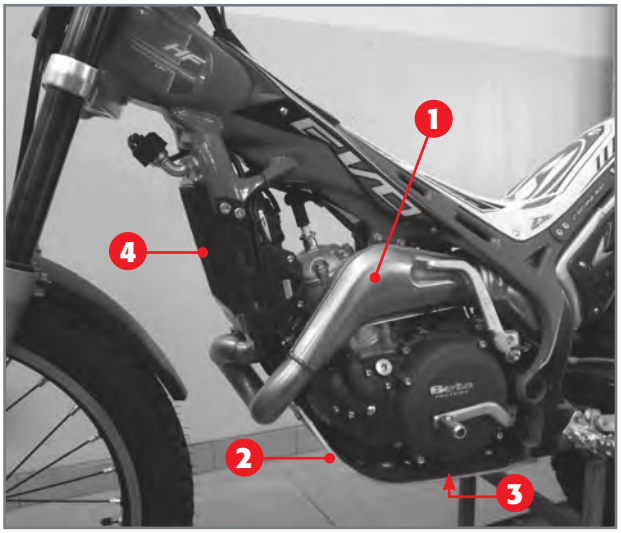
WARNINGS

The information contained in this paragraph is important for any operation to be carried out correctly on the engine without causing damage.

- *Thoroughly clean the motorcycle before disassembling any parts.*
- *When disassembling, clean all the components and put them in containers maintaining the same order of disassembly.*
- *Always use special tools where necessary and every time this is required.*
- *Always use the adhesives, sealants and lubricants where stipulated. Adhere with the guidelines given regarding their technical specifications.*
- *Always replace parts such as seals, O-rings and safety washers with brand new parts.*
- *When loosening or tightening nuts or screws, always start with the larger ones or from the centre. Always adhere with the tightening torque values given.*
- *Solely Betamotor original parts are to be used.*

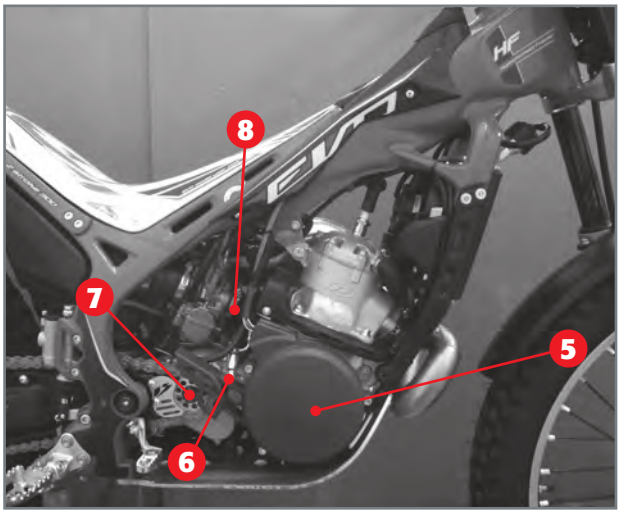
REMOVING THE ENGINE FROM THE VEHICLE

Before removing the engine from the vehicle, thoroughly clean the entire motorbike and let it dry, then place it on a stable kickstand.
Pictures 1 and *2* show the engine coupled with the vehicle, seen from both the left and right side, showing all the main components that must be removed for the engine to be removed from the vehicle.



Picture 1
Left view of the engine coupled with the vehicle.

1- Exhaust manifold
2- Engine protection plate
3- Oil drain plug
4- Cooling radiator



Picture 2
Right view of the engine coupled with the vehicle.

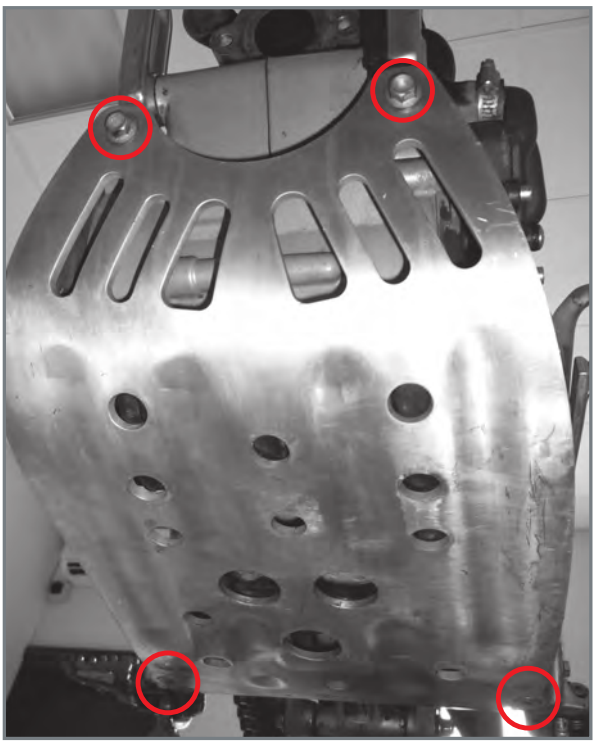
5- Flywheel casing
6- Clutch actuator
7- Pinion
8- Carburettor clamp



The two bolts of the exhaust manifold flange.

1.1 EXHAUST MANIFOLD

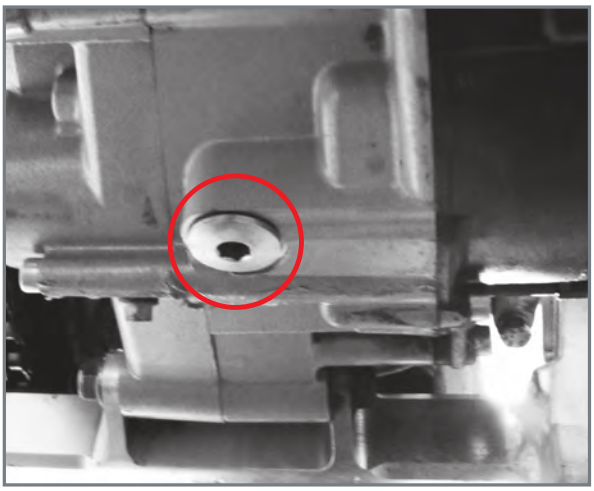
Unscrew the two bolts that fasten the manifold flange to the cylinder in order to remove the exhaust manifold.
To make this procedure easier, we recommend turning the handlebar to one of the two sides.



The four screws of the engine protection plate.

1.2 ENGINE PROTECTION PLATE

Remove the engine protection plate by removing the four fastening screws from the frame. Should the protection plate be particularly deformed, it is recommended to carefully beat it back into place or replace it.

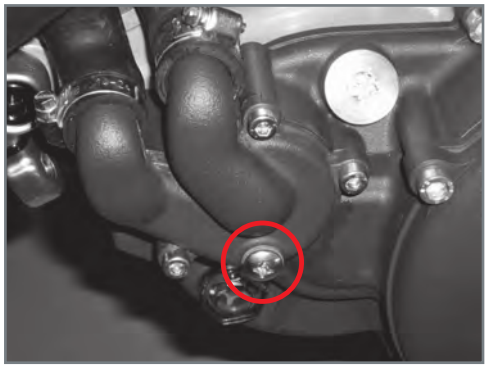


The plug where the transmission oil is drained from.

1.3 TRANSMISSION OIL PLUG

Drain the transmission oil by removing the relative plug.

Caution!
Spent oil contains hazardous substances that are harmful to the environment. When replacing the oil you must have the right equipment for its disposal, in compliance with applicable regulations.
Do not dispose of spent oil in the environment.



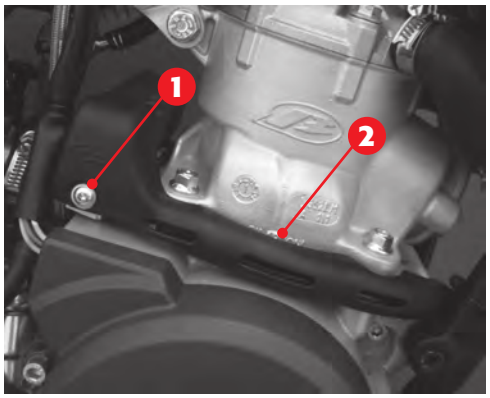
Liquid drain plug.

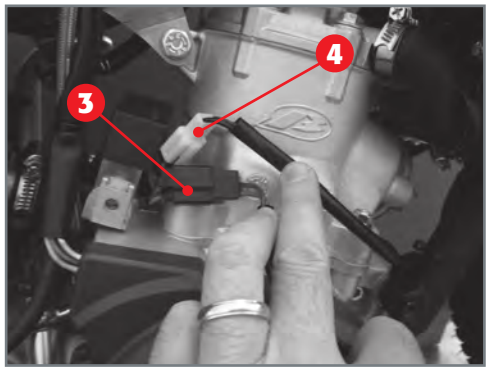


The screw that fastens the coil support to the radiator.



Double bit dip lights/switch removal.





Connectors A and B.

1.4 WATER COOLING RADIATOR

Before removing the water radiator you should empty the cooling system by removing the drain screw found on the pump body. Open the radiator cap and slightly tilt the vehicle to the left to facilitate the liquid flow.

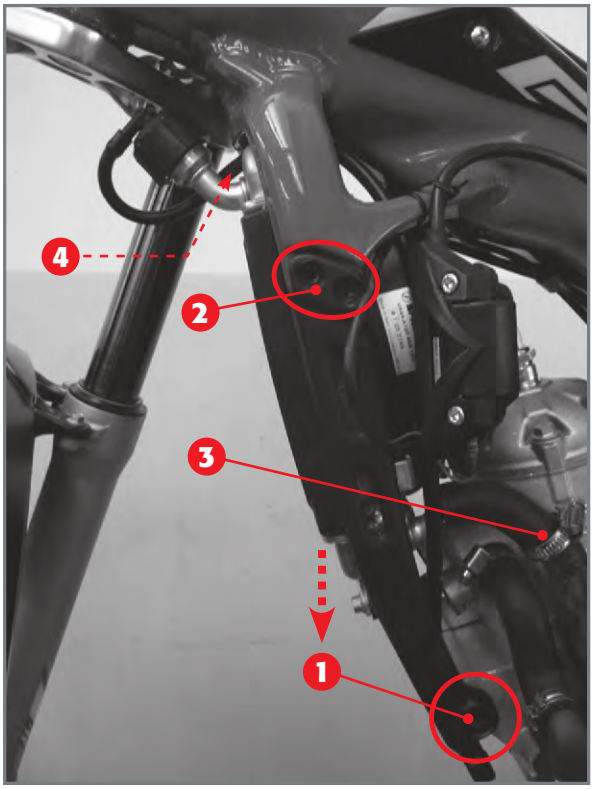
It is recommended to perform this operation after having removed the protection plate so as to prevent the coolant from remaining on the plate.
The liquid can be reused if it has a clear blue colour.

Loosen the screw that fastens the coil support to the radiator. Once this is implemented, the coil and its support will be fastened to the vehicle solely by the high and low voltage cables.
Remove the screw which blocks the double bit dip lights/switch.

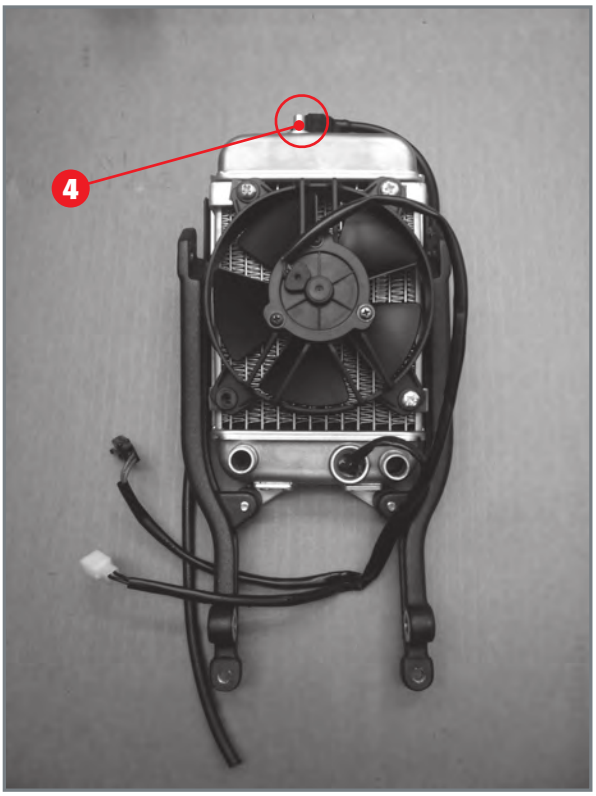
In order to prevent the cables from being stretched, it is recommended to disconnect the pipette -high voltage cable- from the spark plug and connecting the assembly to the frame with straps.

You must disconnect the thermal bulb and the fan from the electrical system in order to remove the radiator. To allow access to the relative connectors, loosen screw **1** and remove guard **2**;

disconnect connectors **3** and **4** relative to the solenoid valve and thermal bulb.

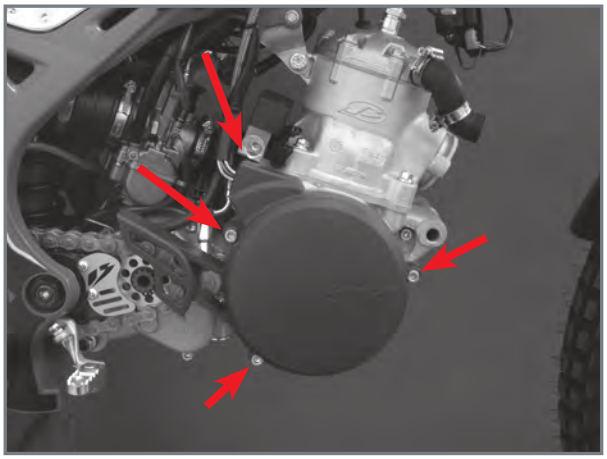


Disassembling the radiator.

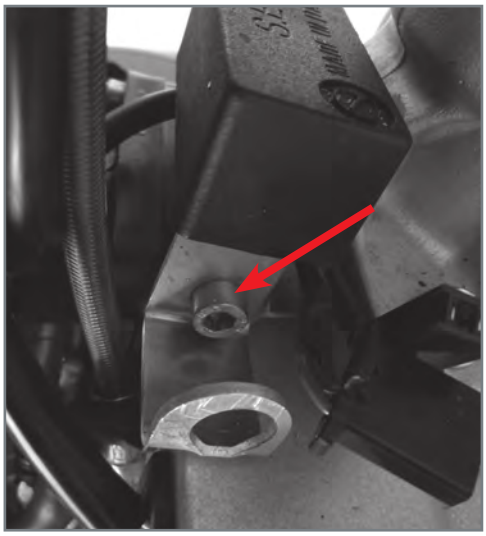


Complete radiator: the upper pin (D) is highlighted.

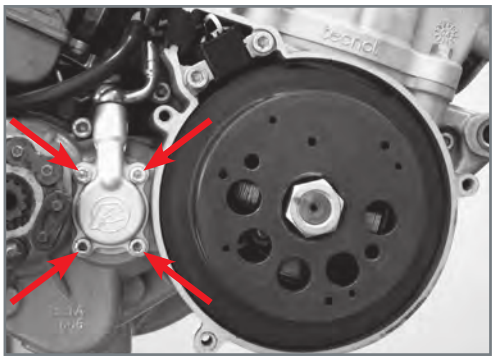
1.4 Unscrew the lower pin **1**, the four upper screws **2** (two on each side) and loosen the two clamps **3** (one on each side) that connect the radiator to the engine.
Slightly turn the radiator forward and remove its two water pipes, simultaneously.
Lower the radiator in such a way that the upper pin **4** comes out of its housing.



The three screws of the flywheel casing.



Regulator screw



The four screws of the clutch actuator. (versions 125cc - 200cc)

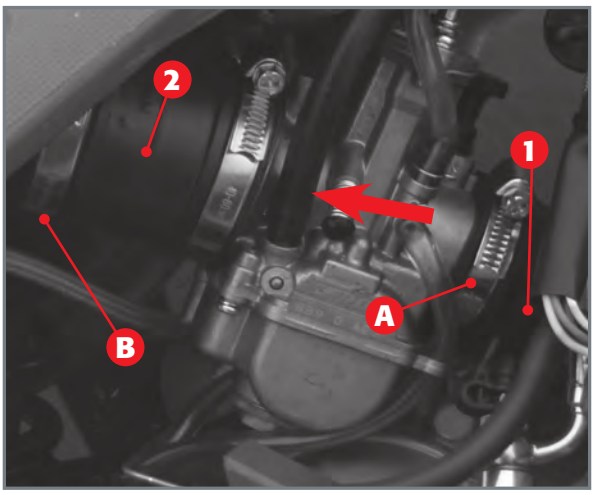


The four screws of the clutch actuator. (versions 250cc - 300cc)

1.5 FLYWHEEL COVER (125-200), CLUTCH ACTUATOR, PINION AND REGULATOR

In versions 125-200, loosen the three screws that secure the flywheel guard to the engine. This will let you access the clutch actuator.
Remove the screw in the figure that fastens the regulator to the engine.

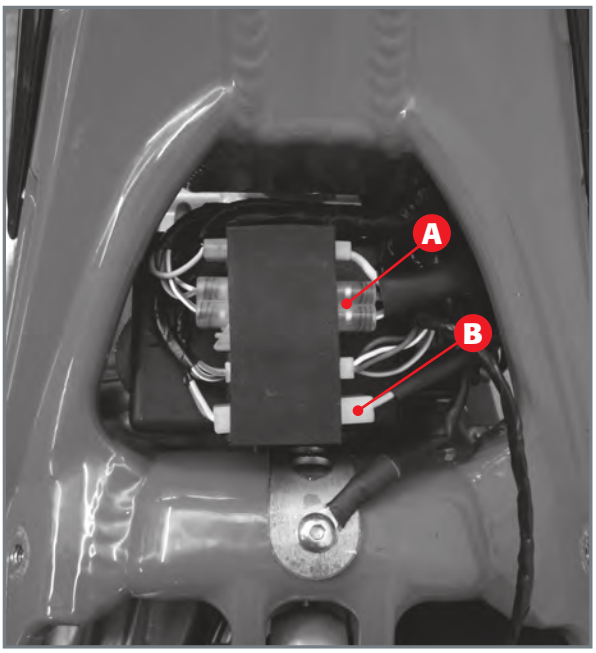
The clutch actuator is removed from the engine by loosening the four screws indicated.
Remove the screw which fastens the regulator to the engine.



Mode for detaching the carburettor from the engine.

1.6 CARBURETTOR CLAMP

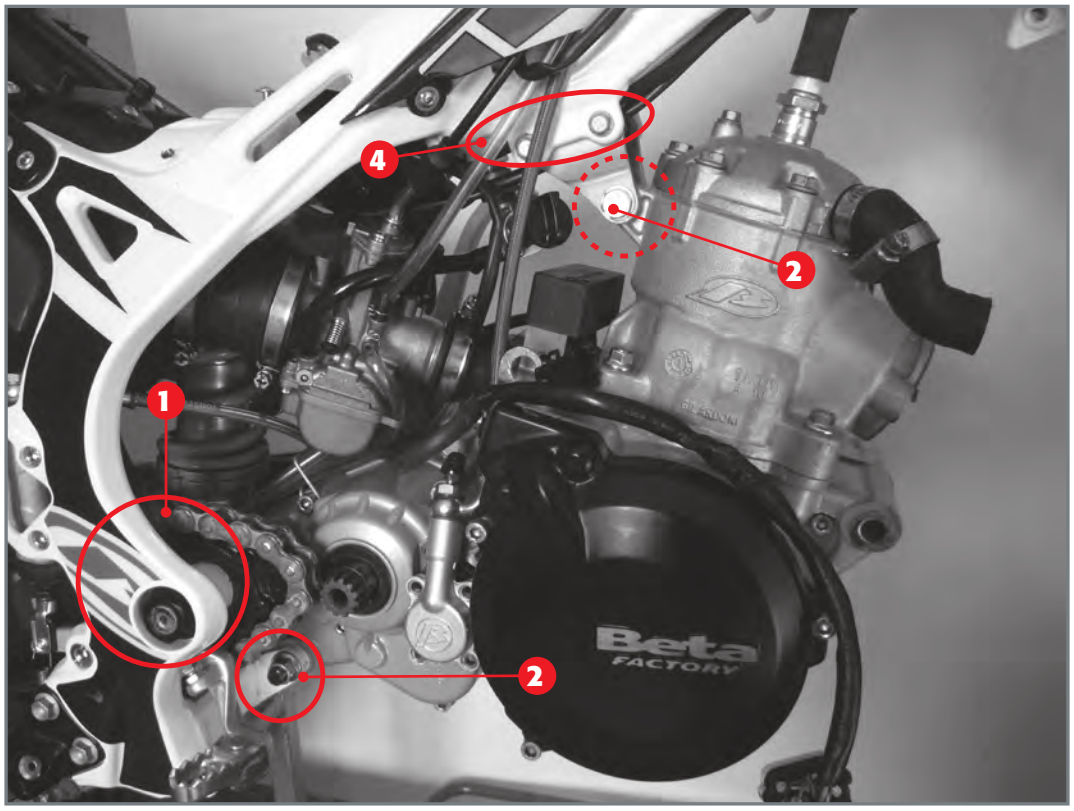
In order to remove the carburettor from the engine you must loosen the two flaps **A** and **B** that fold around the intake collector **1** and sleeve **2** respectively, which connect it to the filter box. Then pull the carburettor towards the back part of the vehicle until it is released from its housing inside the container.



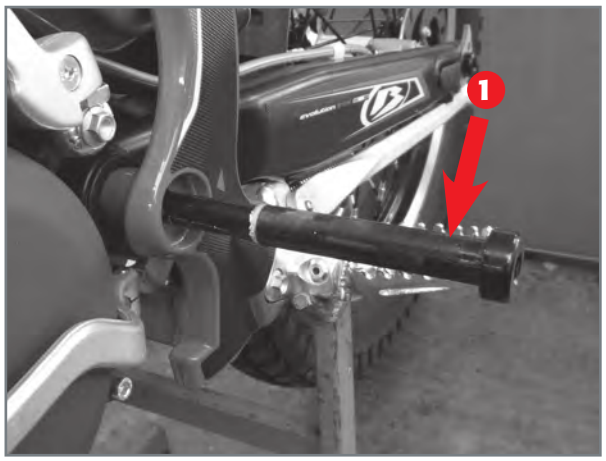
Quadripole and monopole connector.

1.7 RELEASING CONNECTORS

Loosen the screws that fasten the rear mudguard to the frame and remove the mudguard by disconnecting the power cable of the backlight.
Eliminate the straps, remove the control unit support fixing screw and extract the complete connector support control unit.
Disconnect connectors **A** and **B** and take out the control unit.



ENGINE BOLTS:
1) fork pin;
2) upper pin;
3) lower pin;
4) bracket screws.



Swing arm bolt not being removed completely.

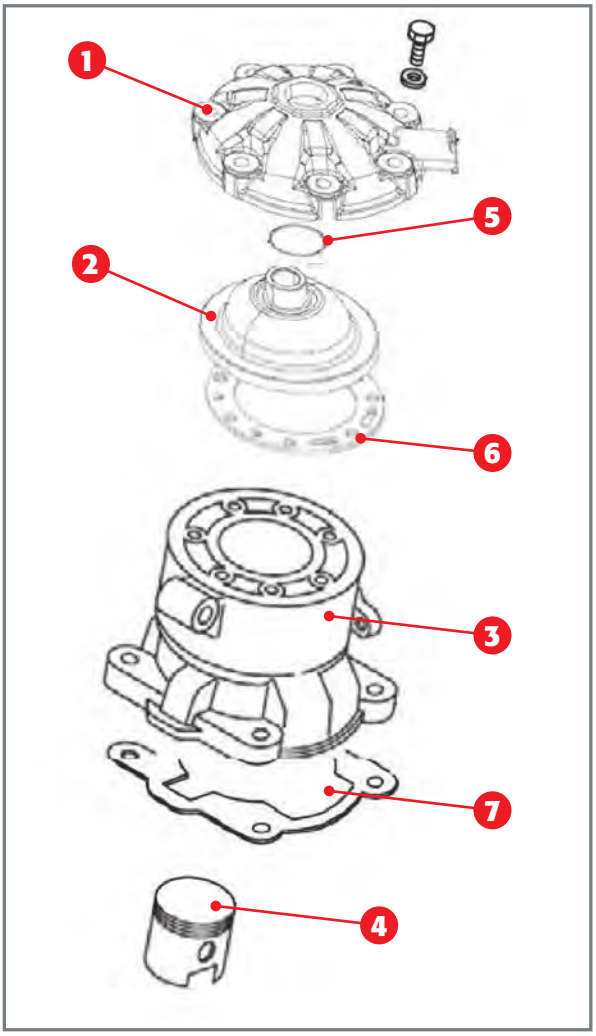
1.8 ENGINE BOLTS

The engine is fastened to the frame by four bolts: one at the front, one at the bottom, one at the top and one at the back. The description of the first of these four bolts being removed is found in paragraph 1.4, removal of the radiator. It is recommended to remove the engine from the frame by first removing bolt **1** at the back (swing arm bolt), then the upper bolt **2** and lastly the lower bolt **3**.

We also recommend loosening screws **4**, to make it easier to take the engine out of the frame and put it back in again.

Please note that bolt B does not have to be removed completely for the engine to be removed. In fact, it must be loosened enough for the engine to be removed from the frame, thereby you will avoid removing the swing arm from the frame.

DISASSEMBLING THE ENGINE

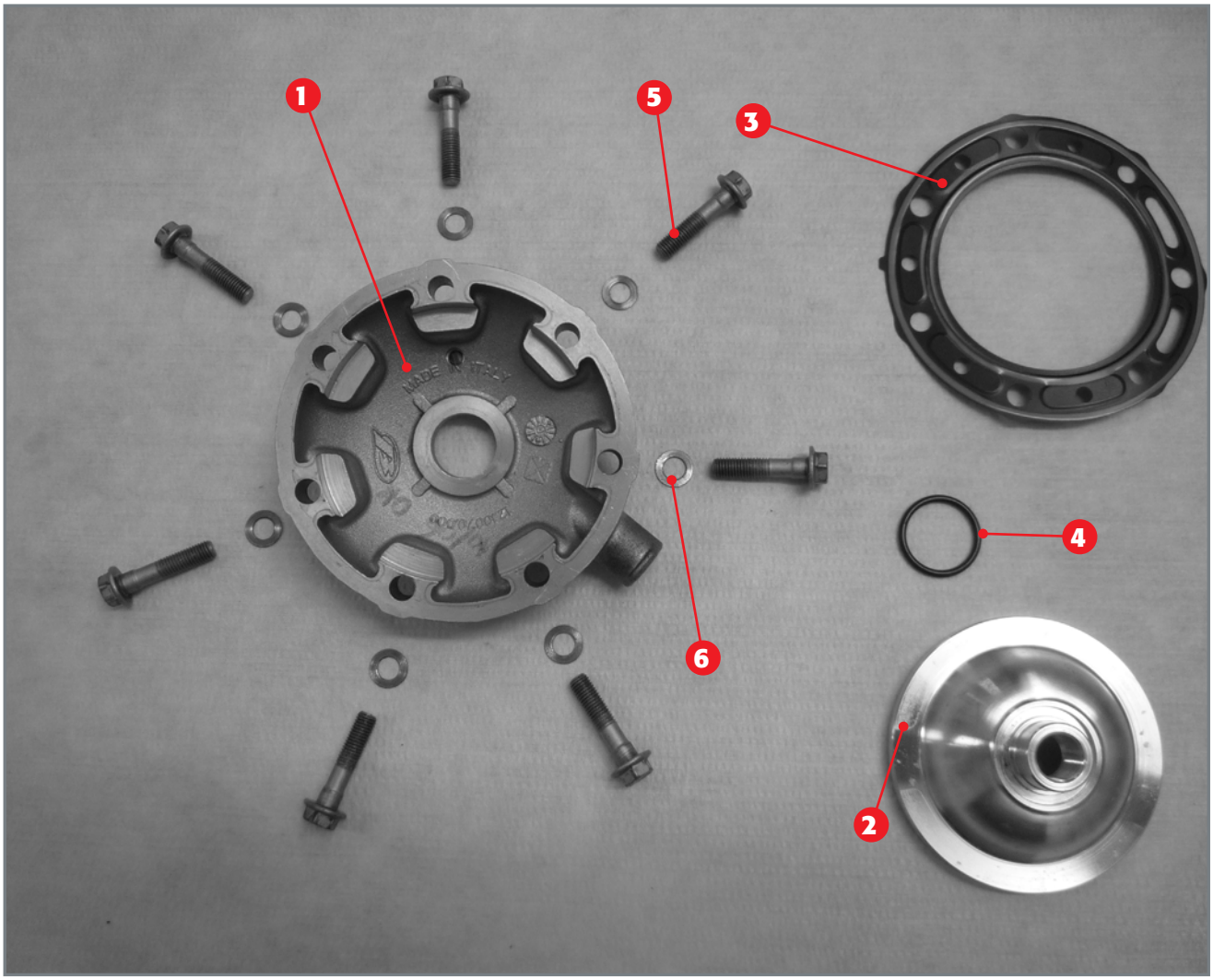


Exploded view of the thermal unit.

Fasten the engine onto a solid and safe support so as to work with ease and safely. Then proceed as follows.

2.1 THERMAL UNIT

The thermal unit consists of the external cap **1**, the combustion chamber **2**, the cylinder **3** and the piston **4**. Assembly is completed with the O-ring **5**, the seal head **6**, the casing-cylinder seal **7** and the seven copper washers with the respective special screws M7x31.
The description of these parts being disassembled is found further on.

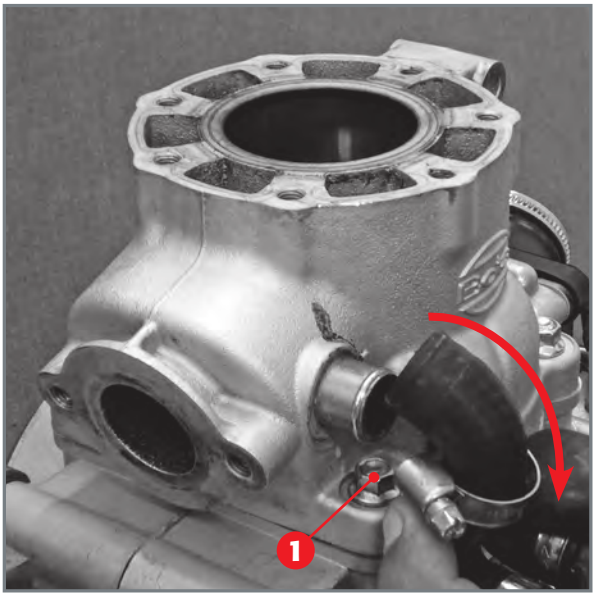


HEAD ASSEMBLY.

1) External cap.
2) Combustion chamber.
3) Seal head.
4) O-ring.
5) Screws.
6) Copper washers 7x12x0.5

2.1.1 HEAD

Once the water circuit is emptied, it is recommended to blow compressed air into the sleeve connected to the head in order to be sure there is no fluid in the thermal unit.
Once the water sleeve is disconnected, loosen the spark plug, then the seven screws that fasten the external cap to the cylinder. Lift the head and once it is placed on a level surface, remove the spark plug. Lightly press the spark plug housing to decouple the combustion chamber from the external cap. If necessary, proceed with the descaling procedures of the combustion chamber and the internal part of the cap.

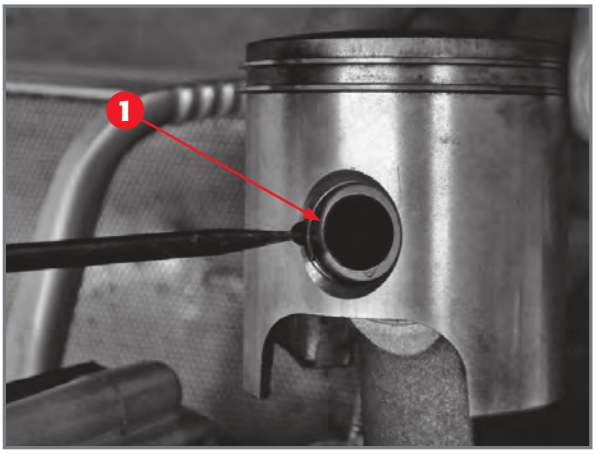


Disassembling the cylinder.

2.1.2 CYLINDER

Remove the rubber tube that connects the cylinder to the water pump after having loosened the clamp; turn the motor shaft until the piston lies in the top dead centre and loosen the four bolts A that fasten the cylinder to the base unit. Then gently remove the cylinder by pulling it upwards.

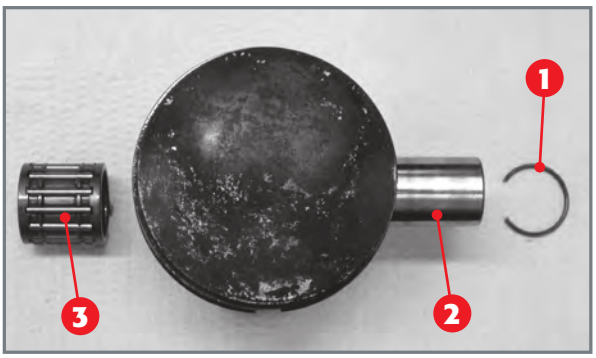
> ***Note**: Should the cylinder be stuck to the base unit, gently strike the cylinder in various points with a rubber mallet.*



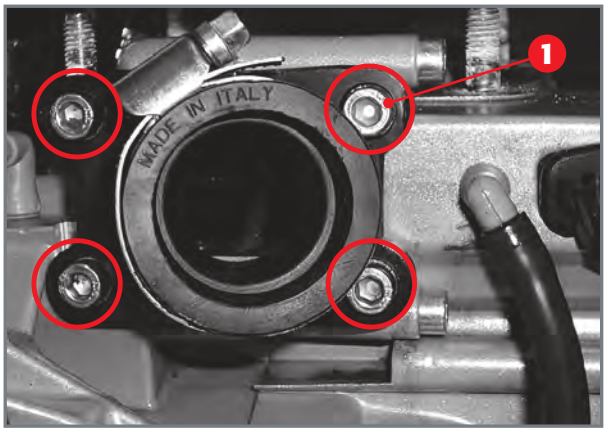
Disassembling snap ring A.

2.1.3 PISTON

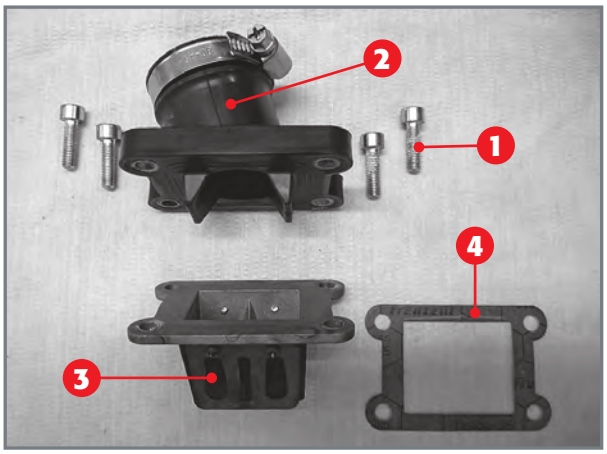
Place a clean cloth in the area below the piston, between the two casings, in order to prevent any foreign objects or solid residues from falling into the base unit. Then use a suitable tool to remove the piston pin lock ring **1**. Working from the other side, unthread piston pin **2** as much as is needed to release the piston assembly from the connecting rod. Remove the bearings assembly **3** from the connecting rod.



Complete piston: 1) piston pin lock ring; 2) piston pin; 3) bearings assembly.



Disassembling the intake manifold and lamella pack.



EXPLODED VIEW OF THE INTAKE CONTAINER.

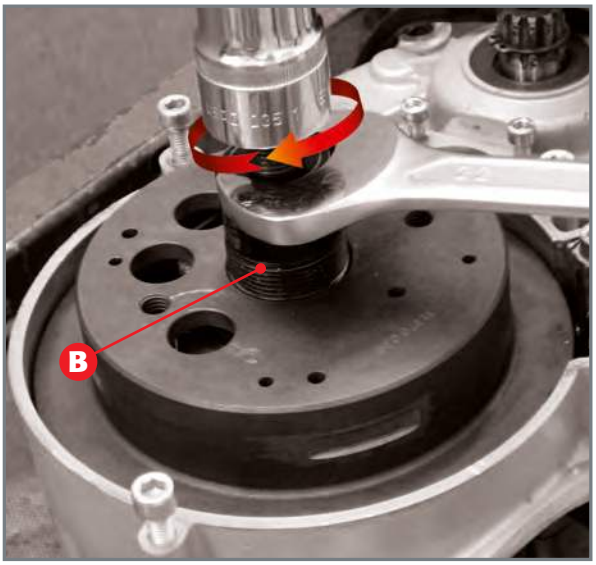
1) screws;
2) intake container;
3) lamella pack;
4) seal.

2.2 INTAKE SYSTEM

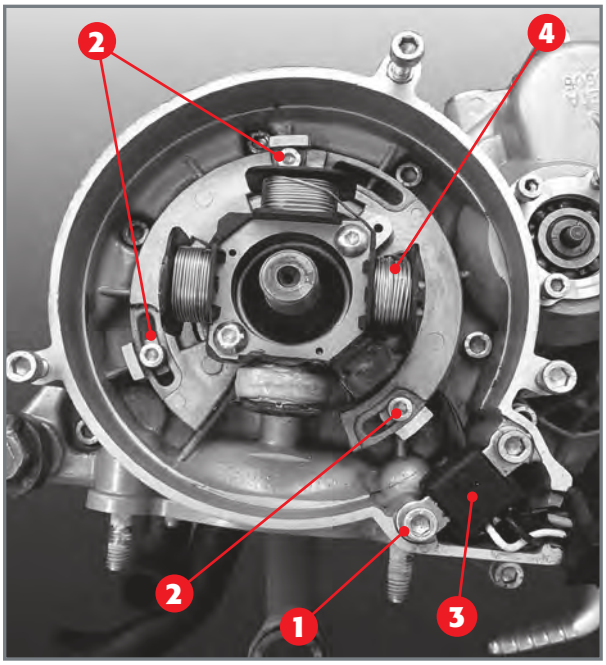
The intake system consists of the intake manifold **2** and the lamella pack **3**. To disassemble this, remove the four screws **1** that fasten the intake manifold and the lamella pack to the casings. Decouple the intake manifold and seal **4** from the lamella pack.



Removal of flywheel nut.



Flywheel nut removal with reversible gear puller.



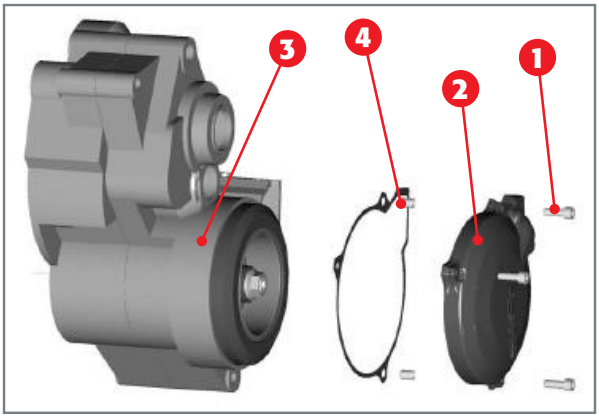
Stator 1 and pick-up 2 assembly.

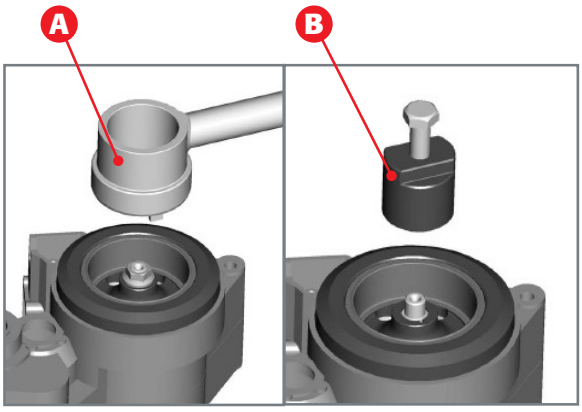
2.3 IGNITION SYSTEM

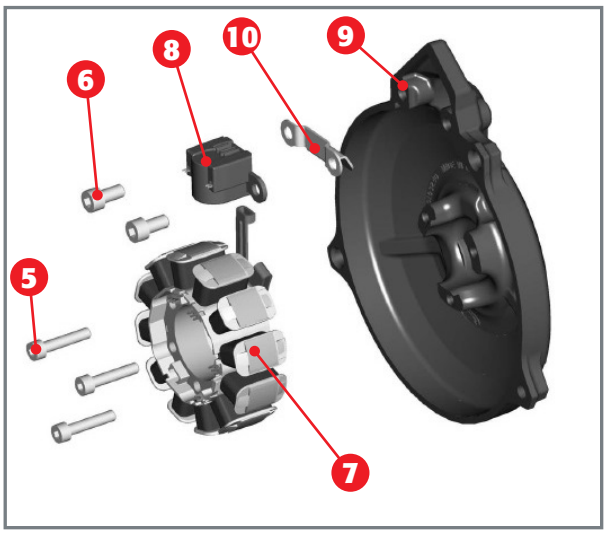
The ignition system consists of the flywheel, the stator windings *(stator for short)* and the magnetic pick-up.

2.3.1 Removing the ignition system, versions 125cc - 200cc

- Remove the flywheel cover (par. 1.5)
- Remove the flywheel as follows:
  - Block the flywheel using a specific universal device **A**
  - Remove the nut that locks the flywheel to the crankshaft.
  - Apply the specific gear puller (code 1480210 000) **B** in the thread on the flywheel.
  - Tighten the centre screw on the gear puller. In this phase, keep the flywheel blocked with the flat spanner. .
  - Remove the flywheel.
- Remove the two screws **1** and the three screws **2** fastening the pick-up **3** and stator **4** to the engine crankcase. Remove the assembly.





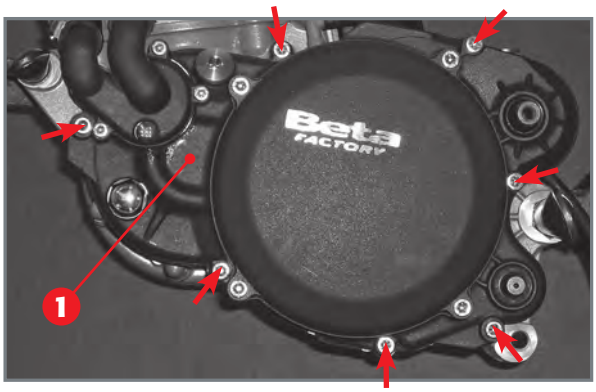


2.3.2 Removing the ignition system versions 250cc – 300cc

- Remove screws **1** fastening the flywheel cover **2** to the left crankcase **3**.
- Remove the cable gland from the crankcase.
- Remove the flywheel cover and the gasket placed between the crankcase and the cover. Pay attention to the two centring pins **4** on the crankcase.

• Remove the flywheel as follows:
- Block the flywheel using the special device **A** (cod.026140040 000)
- Remove the nut that locks the flywheel to the crankshaft.
- Apply the specific gear puller (code 0100040 000) **B** in the thread on the flywheel.
- Tighten the centre screw on the gear puller. In this phase, keep the flywheel blocked with the flat spanner.
- Remove the flywheel.

- Remove screws **5** and **6** that fasten stator **7** and pick up **8** to flywheel cover **9**. Remove plate **10**.

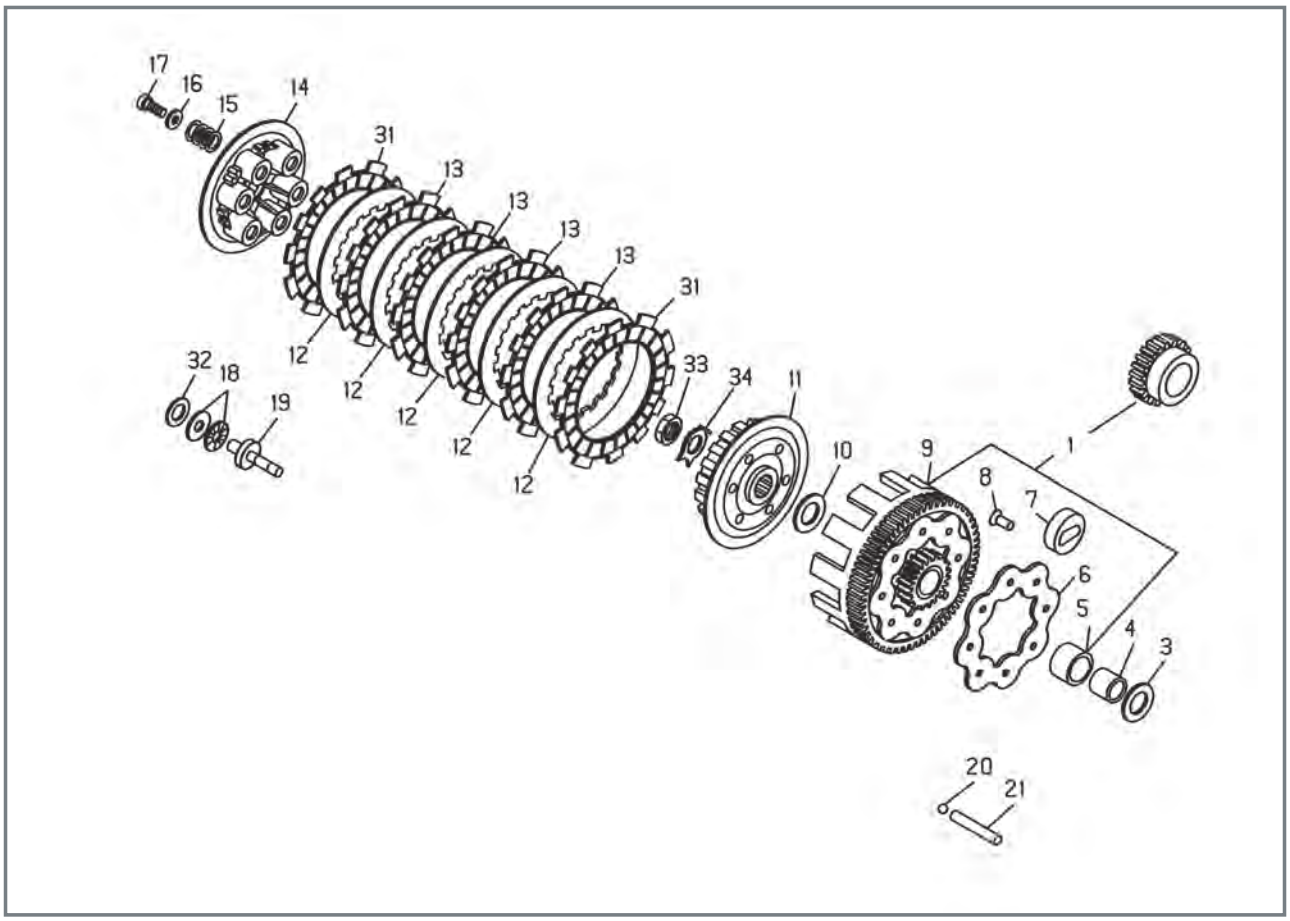


The seven screws coupling the internal clutch cover to the crankcase.

2.4 CLUTCH UNIT

You must remove the transmission control lever and start-up lever to access the clutch unit. Loosen the seven screws shown in the picture that couple the internal cover of the clutch **1** to the casing.

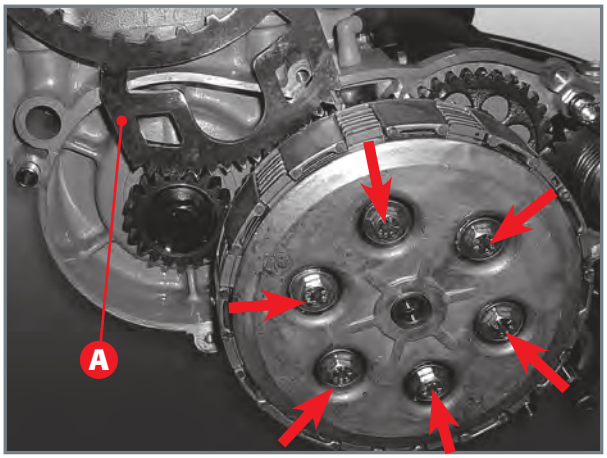
The clutch unit consists of the components shown in the picture below.



CLUTCH UNIT: MAIN COMPONENTS.

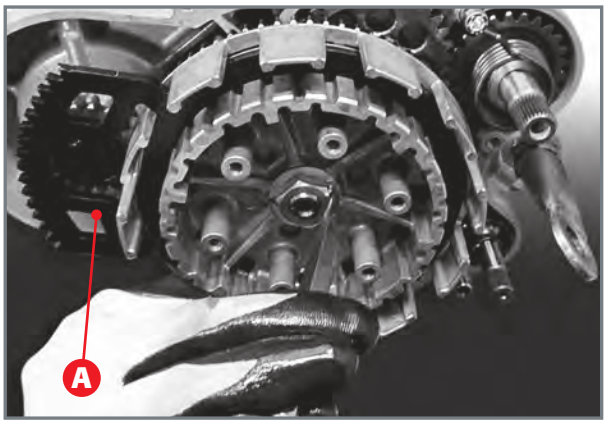
3) Washer 20x35x1;
4) Bushing;
9) Clutch bell;
10) Special washer;
11) Clutch drum;
12) Steel disc (No. 5);
13) Friction disc (2.7 mm thickness n°4);
14) Pressure plate cap;
15) Spring (No. 6);
16) Washer 6x18 (No. 6);
17) Screw 6x16 (No. 6);
18) Thrust bearing cage 15x18x2;
19) Pressure plate;
20) Ball;
21) Clutch control rod;
31) Friction disc (3 thickness n°2);
32) Thrust 1mm thickness;
33) Special nut 14x1.25x6;
34) Safety washer;

To remove this, unthread the clutch control rod **21** and bend it to the right of the engine for the ball **20** to come out.



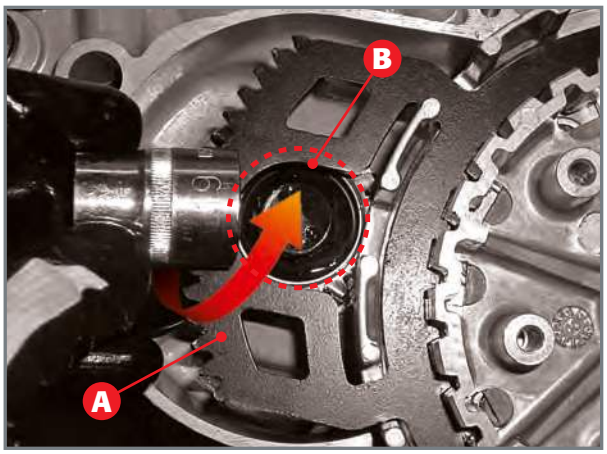
Disassembling the fastening screws of the pressure plate cap to release it from the friction bell.

2.4 Whilst keeping the clutch unit blocked in place by means of the special primary tool **A** *(code 008.14.000.0.0)*, loosen the six screws in order to release the pressure plate cap from the clutch bell.
Remove the springs and washers, the pressure plate cap, the thrust bearing unit and the eleven clutch discs.



Opening the flaps of the safety washer.

Insert the special primary tool **A** ensuring its internal teeth engage with those on the drum and then push it until it reaches the drum's stop limit. Open the two flaps of the washer with a chisel or similar tool.



Applying the socket spanner into the opening of the special tool.

Disassemble the nut that blocks the clutch bell to the primary shaft as follows. Whilst keeping the special primary tool **A** in the position described above, turn the clutch bell so that the opening **B** overlaps the screw of the primary pinion. Insert a socket spanner (size 19) into the opening and engage it with the hexagonal head screw below.



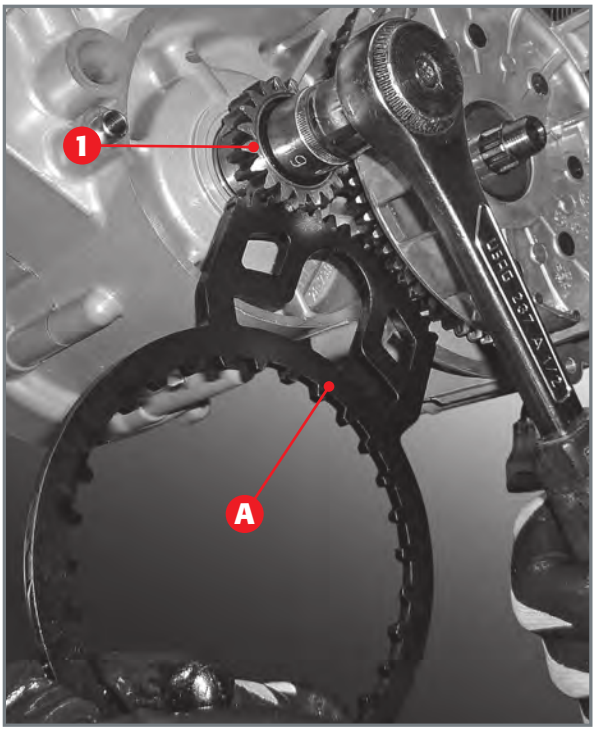
Disassembling the nut that blocks the clutch bell to the primary shaft.

Whilst keeping the socket spanner pressed firmly in place, unscrew the relative nut.

2.5 PRIMARY GEAR

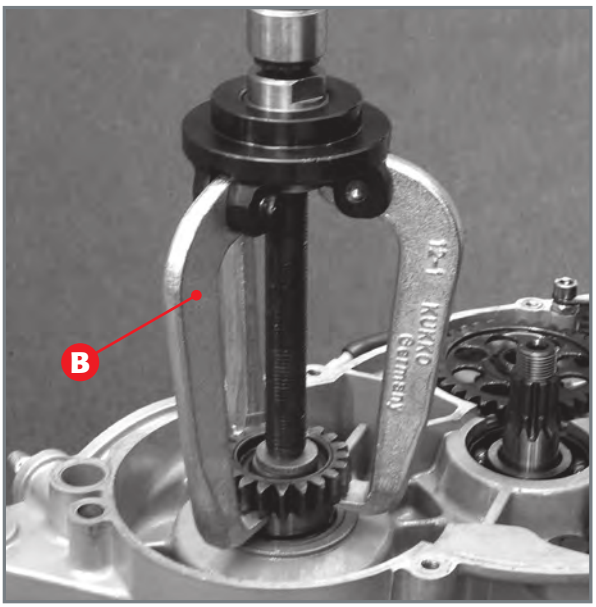
The clutch bell must be in its housing for the primary gear to be disassembled. You must remove the internal cover of the clutch to access the primary gear. This procedure is described in paragraph 2.4.

Use the special primary tool **A** *(code 007.14.000.0.0)* to loosen the screw that fastens the primary gear 1 to the motor shaft.

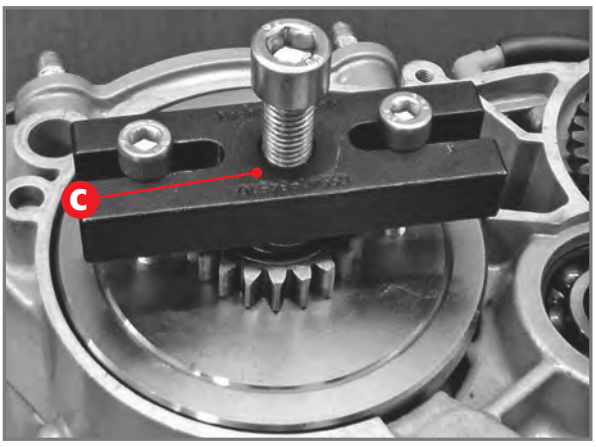


Disassembling the screw that blocks the primary gear to the motor shaft.

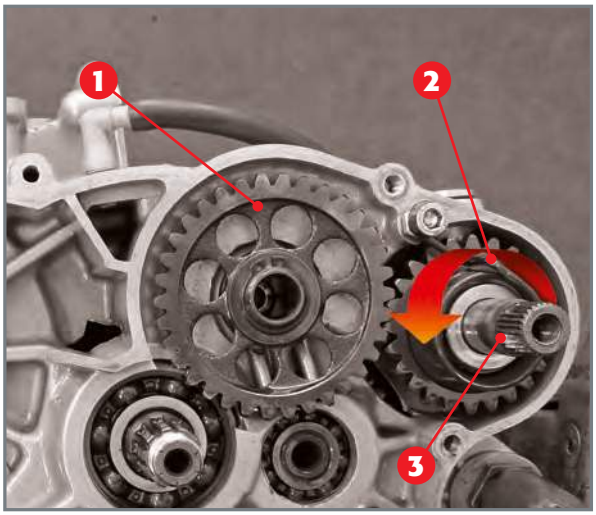
If the motor has a displacement of 125cc, 200cc, 250cc and 300cc , the primary gear can be disengaged from the crankshaft with three-jaw reversible gear puller **B**; with displacements of 250cc GB and 300cc GB, it is possible to use universal reversible gear puller **C**.



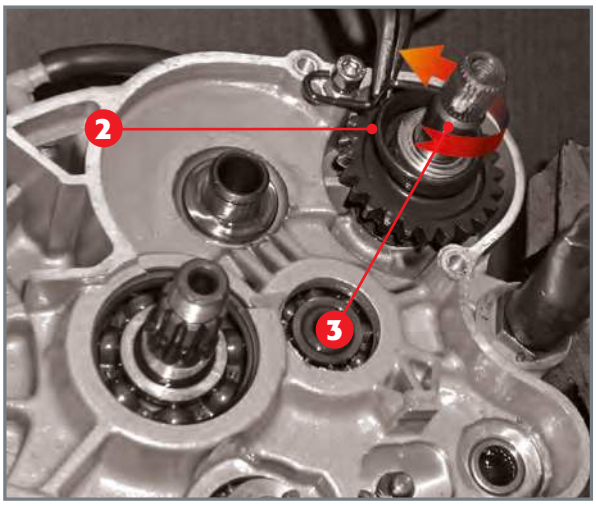
Disassembling the primary gear in a 125 cc and 300 cc engine.



Disassembling the primary gear in 250cc GB and 300cc GB engines.



Idler wheel of the start-up device.



Disassembling the spring and the ignition shaft.

2.6 START-UP DEVICE

To take down the kickstart you will need to take out the seeger dedicated to the idler wheel **1** and specific thrust washer. Then, proceed to take out the idler wheel and relative roller cage.

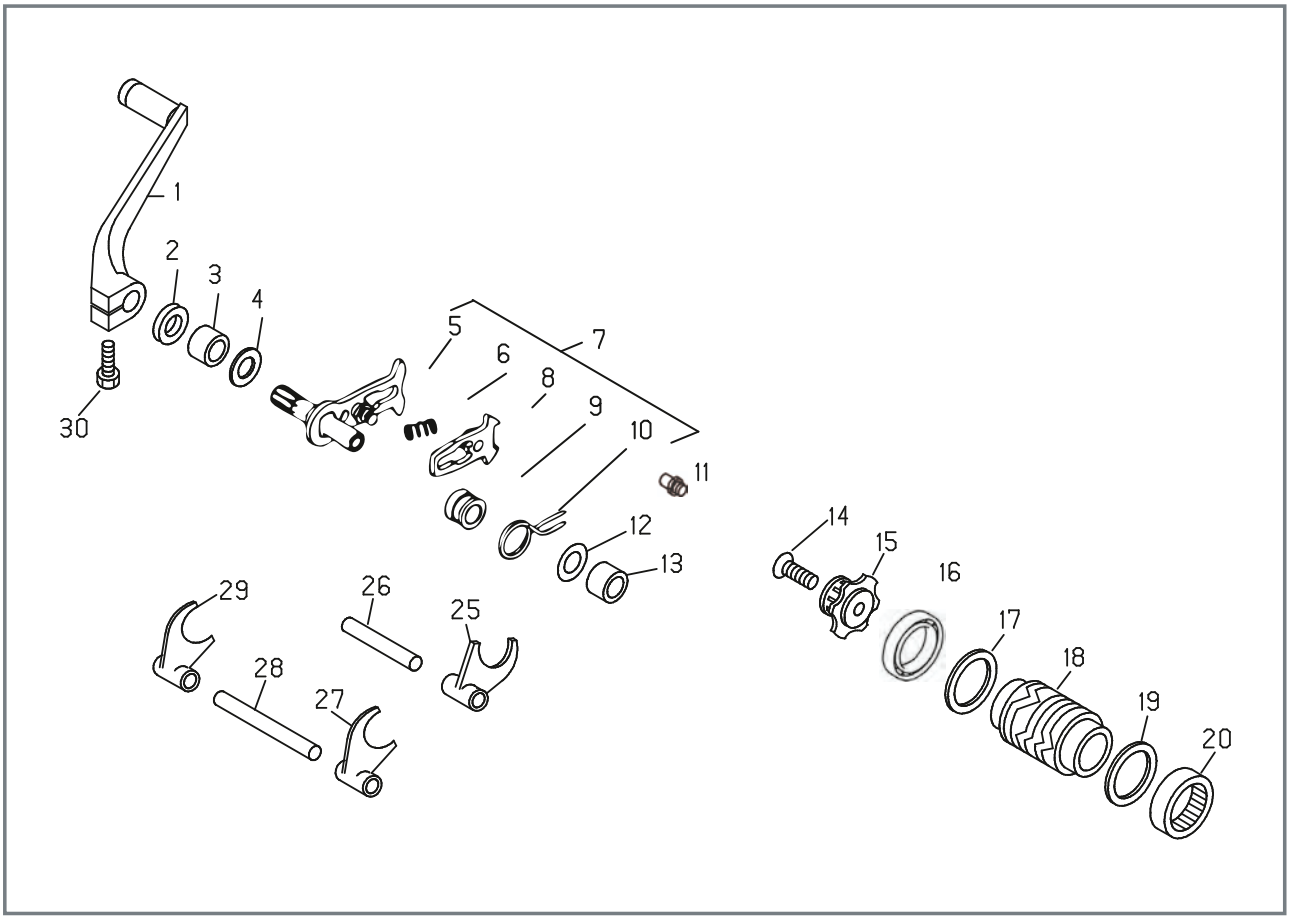
Release spring **2** by turning it anti-clockwise and remove the complete ignition shaft **3**.

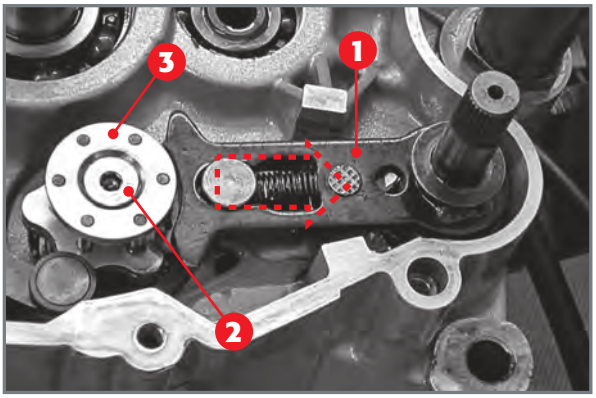
2.7 GEARBOX UNIT

The gearbox unit consists of the control and gear unit. The control is in turn split into internal and external controls. The external control consists of a control lever **1** and assembly of components **7**, **14** and **15**, which are found in the casing on the side of the clutch, whereas the internal control consists of components **18**, **25**, **26**, **27**, **28** and **29** and is found inside the two casings together with the gears.

GEARBOX CONTROL UNIT: MAIN COMPONENTS.

1) Start-up lever;
7) Complete gear shaft;
14) Screw 6x30;
15) Gear stop cam;
18) Desmodromic device;
25) 27) 29) Fork;
26) 28) Fork pin.

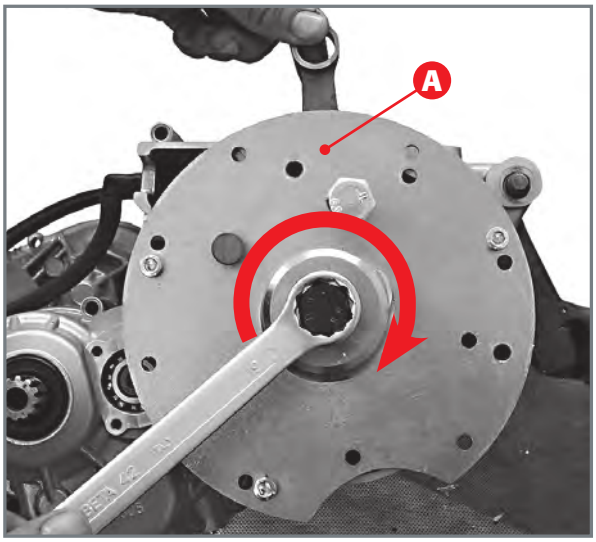




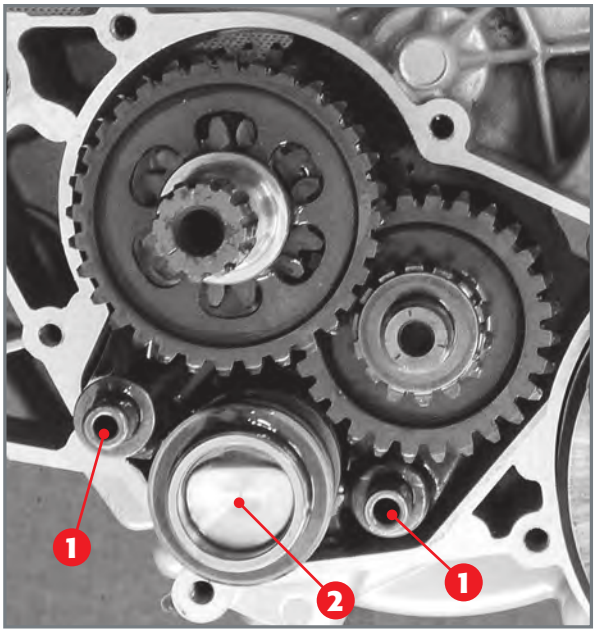
Gear lever and stop cam assembly.

2.7.1 EXTERNAL TRANSMISSION CONTROL

Remove the complete transmission control shaft **1** whilst keeping the spring compressed.
Take out screw **2** and slide out stop cam **3**.



Crankcase uncoupling procedure.



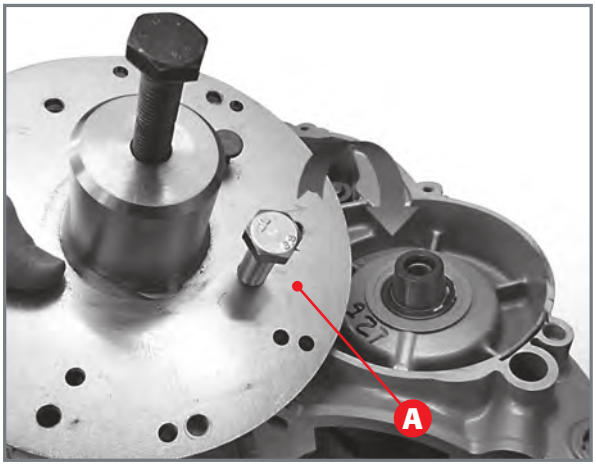
Forks, desmodromic control and gears.

2.7.2 INTERNAL TRANSMISSION CONTROL AND TRANSMISSION GEARS

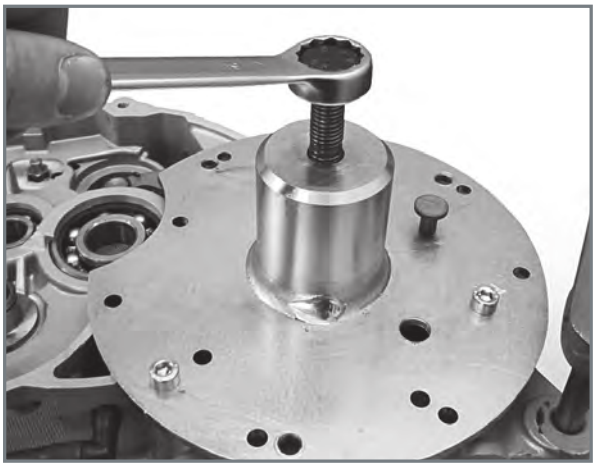
The internal transmission control is enclosed inside the two engine casings. To access this, you must remove the eleven screws that couple the two engine casings, then decouple these with the use of the special tool **A** *(code 01.00042.000)*.
Tool **A** must be mounted onto the right casing so as to cover the flywheel housing and fastened to the three threaded holes of the flywheel cover.
Then tighten the upper screw on the tool, whilst holding the motor shaft still (e.g. by holding the connecting rod), until the casings are completely decoupled from each other.

Attention: *pay attention to the two centring bushings placed between the crankcases.*

Unthread the two fork pins **1** as much as is needed to decouple them from their respective housing. Turn the pin-fork assembly outwards, remove the desmodromic device **2**, then the shaft-fork assembly. Remove the complete gear unit whilst paying attention to the shim washers.



Removing the crankshaft.



2.8 MOTOR SHAFT

Remove the M12 screw present on the special equipment A and apply it to the crankshaft (left side). Tighten so that the screw is inserted about 10 mm into the crankshaft.

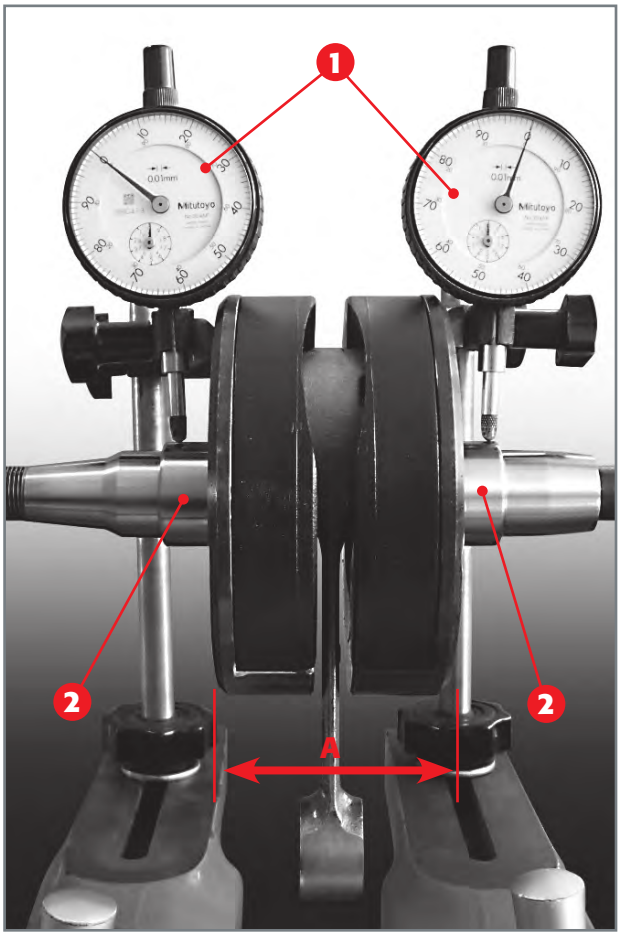
Mount tool **A** *(code 01.00042.000)* onto the left casing so as to cover the primary gear housing, fastening it to the three threaded holes of the right casing.
Then tighten the upper screw on the tool, until the motor shaft is completely unthreaded.

2.9 BEARINGS AND OIL SEALS

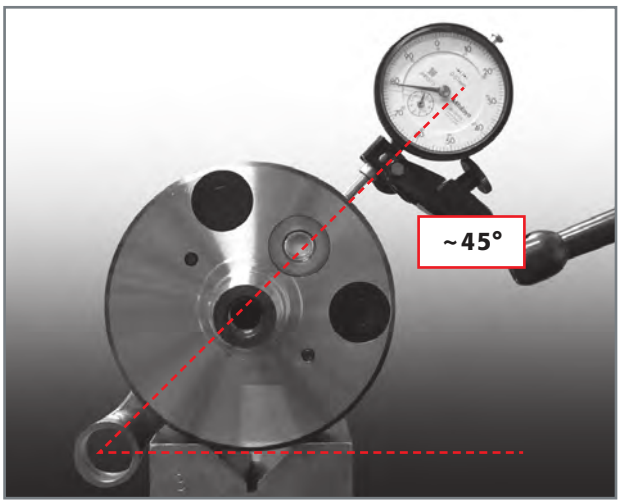
Remove all oil seals which will be replaced during re-assembly. It is recommended to extract all bearings while hot by placing the casings in an oven at a temperature of 150 °C for about twenty minutes, thereby allowing the bearings to be easily unthreaded.
Check the wear-and-tear state of the bearings and replace them if any loosening or blockage is noticed.
To insert the bearings once again, insert the half-casings in an oven at 150 °C for approximately twenty minutes. Cold bearings enter their housing very easily. If the bearings are not blocked firmly, once cooled, replace the Crankcase half.

ASSEMBLING AND TESTING THE ENGINE

Before reassembling the engine you must perform a number of fundamental tests to guarantee that the engine functions properly.
Hereunder are the main steps and checks.
Before reassembling the parts, grease the oil seals and oil all the bearings.



Verify half shaft alignment and torsion.



Verify radial play.

3.1 TESTING THE MOTOR SHAFT AND CONNECTING ROD

Firstly verify the wear-and-tear state of the coupled surfaces.
Test the misalignment of the axes of the half-shafts by placing the motor shaft between two tailstocks or similar tools and verify the maximum variation in one revolution by means of comparators **1** being placed on the coupled surfaces with the main bearings **2**.
Limit value allowed: 0.08 mm.

Should a difference be noticed in the readings of the two half-shafts, this will be due to the torque of the shaft itself.
Limit value allowed in the difference: 0.03 mm.

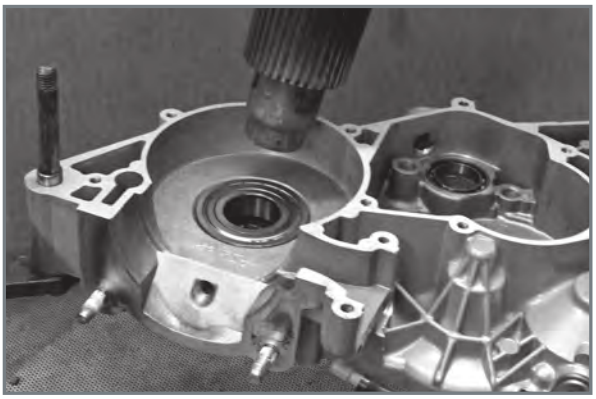
Moreover, verify any axial loosening between the head of the connecting rod and the internal part of the half-shafts.

Displacement	Axial Play
125	0,43÷067
200 - 250 - 300	0,39÷072

Verify distance **A** between the two external surfaces of the half-shafts that must be

Displacement	Quota A
125-200-250-300	62±0,05

Verify that radial play of the connecting rod head bearing by placing the crankshaft on a stable support and with the connecting rod axis tilted **45°** compared to horizontal.
Position a comparator in axis with the connecting rod and verify, slightly pressing in the direction, making sure that the measurement does not exceed the maximum service limit of **0.03 mm**.
If play is greater, replace the connecting rod.



Heating the bearing.

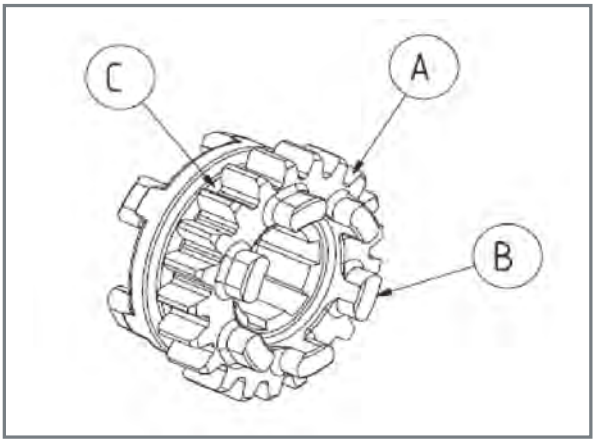
3.2 MOUNTING THE COMPLETE MOTOR SHAFT

The complete motor shaft is first coupled with the left casing. To do so, you must heat the main bearing and the area around it. Continue heating until the motor shaft is inserted into the bearing with minimal hindrance.
Before starting the heating process it is recommended to grease the oil seal found on the outer side of the casing.

Attention!
Be careful not to deteriorate the oil seal during heating.

3.3 GEARBOX UNIT: TESTING AND REASSEMBLING

As seen in paragraph **1.7**, the gearbox unit consists of the control and the gearbox itself. The control is in turn split into internal and external controls.
Hereunder are the tests and reassembly procedures of such units to the engine.



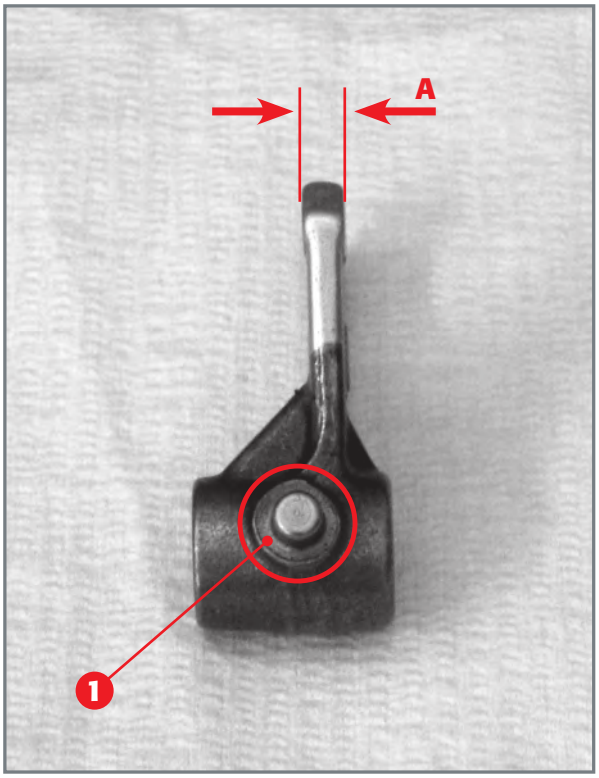
Verifications to be performed on the toothed wheels

3.3.1 TESTING THE TOOTHED WHEELS AND SHAFTS

Perform the following inspections on all toothed wheels:

- verify the wear-and-tear of the sliding surfaces;
- verify there are no cracks and abnormal wear-and-tear on the sides of the teeth **A**;
- verify that the engagement parts **B** of the toothed wheels are not chipped or rounded;
- verify that the areas **C** that make contact with the forks are not particularly worn.

Moreover, verify that the shafts supporting the toothed wheels do not present any signs of seizing or wear-and-tear.



Testing the wear-and-tear of the forks.

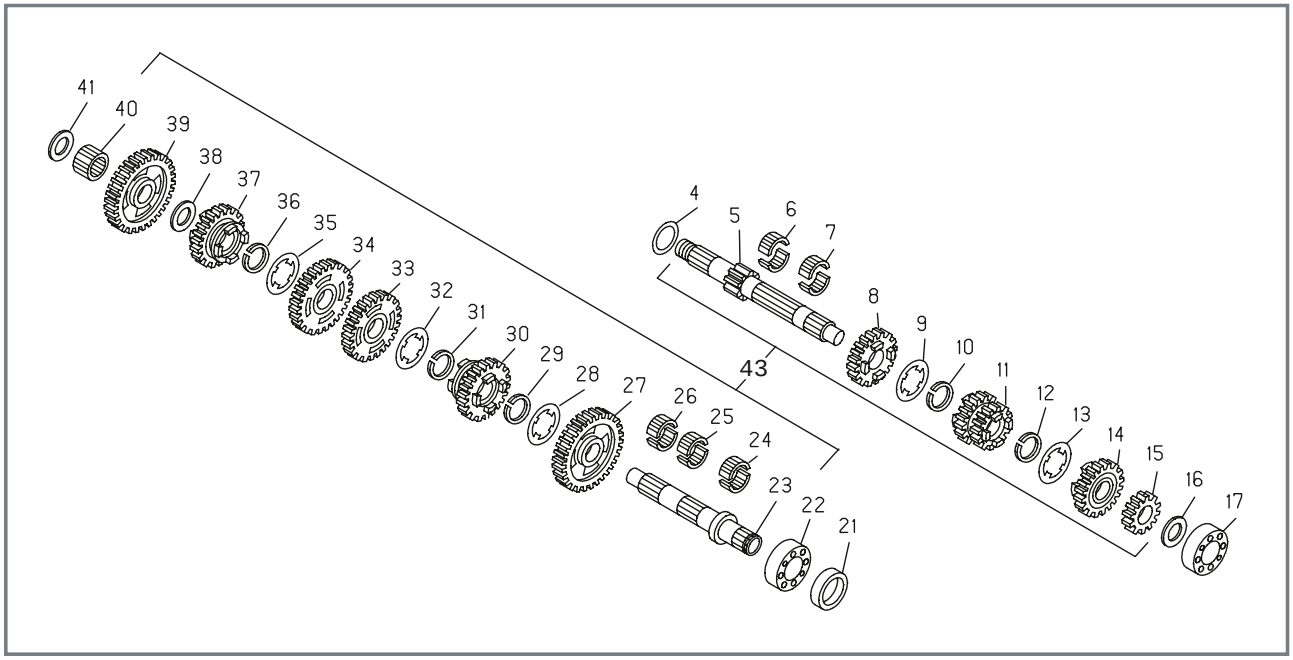
3.3.2 TESTING THE FORKS, FORK PINS AND DESMODROMIC DEVICE

Verify that the guide pins 1, which engage in the desmodromic control, do not present any signs of seizing or abnormal wear-and-tear and that distance A between the external surfaces of the fork is not less than the below-mentioned minimum.
Minimum acceptable distance: 4.4 mm.

Verify that the fork pins onto which the forks slide, are not particularly worn or corroded. Verify that the desmodromic control device does not have any corroded and/or worn areas, especially the grooves in which the guide pins of the forks are engaged.

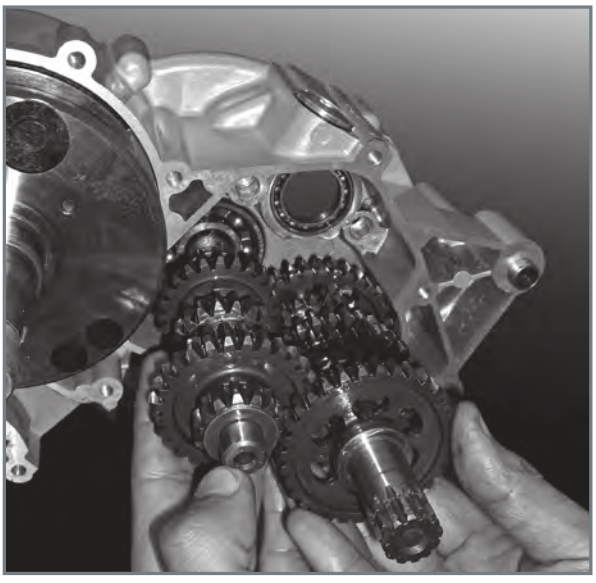
3.3.3 ASSEMBLING THE INTERNAL TRANSMISSION CONTROL

Assemble the gearbox according to the exploded view hereunder, externally from the engine after having verified the wear-and-tear state of the washers and six shim washers.



GEARBOX EXPLODED VIEW:

4) Thrust washer 20x30x0.5 for versions 250cc and 300cc 20x30x1 for other displacements;
5) Primary shaft;
6) 7) Roller assembly 16x21x10;
8) 5vp gear;
9) Slotted washer;
10) Seeger 19sw;
11) 3 / 4vp gear;
12) Seeger 19sw;
13) Slotted washer;
14) 6vp gear;
15) 2vp gear;
16) Thickness washer 15x25x0.5 for versions 250cc and 300cc 15x25x0.4 for other displacements;
20) Seeger 20e;
21) Oil seal ring;
23) Secondary shaft;
24) 25) 26) Roller cage 18x22x10;
27) 2vs gear;
28) Slotted washer;
29) Seeger 20sw;
30) 6vs gear;
31) Seeger 20sw;
32) Slotted washer;
33) 3vs gear;
34) 4vs gear;
35) Slotted washer;
36) Seeger 20sw;
37) 5vs gear;
38) Shim washer 18x27x0.8;
39) 1vs gear;
40) Assembly 18x22x10;
41) Spacer washer 15x25x0.5 for 300 15x25x0.8 for other displacements.

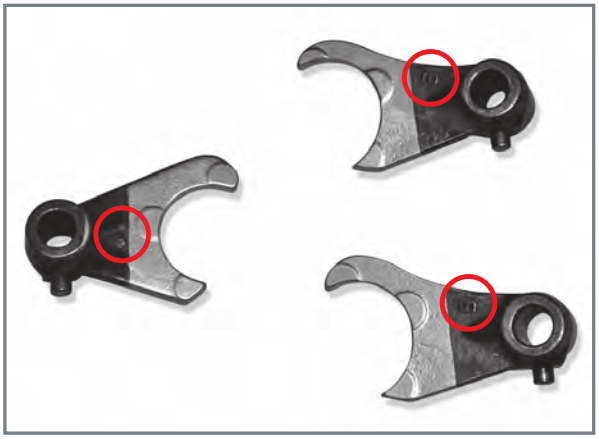


Inserting the gear in the left casing .

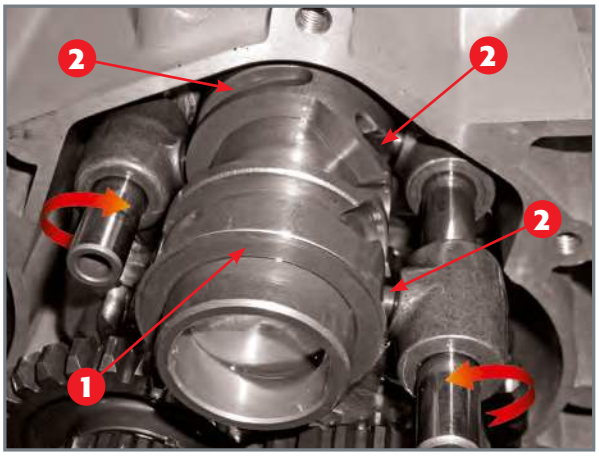
Insert both primary and secondary units, simultaneously, in the respective housing in the left casing.
Remember to heavily oil the gears and the shafts that support them.
It is recommended to verify that all components slide perfectly.



Turning the fork-pin assembly outwards and inserting the desmodromic control device.



Symbols marked on forks.



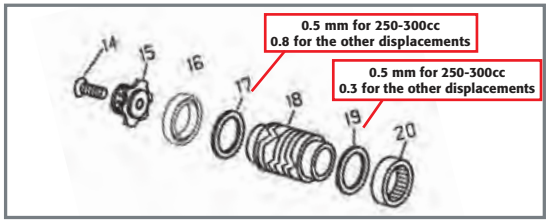
Turning the fork-pin assembly inwards and inserting the fork pins into their respective housing.
Inserting the fork guide pins 2 into the slots of the desmodromic device.

Insert the gear, then mount the fork-fork pin assembly, whilst ensuring to first insert the fork into the path of the specific gears. Then turn the fork-pin assembly outwards for the bolts to remain in the casing and not enter their housing.

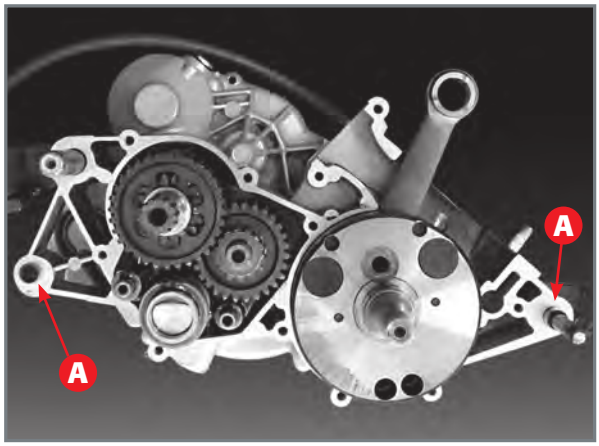
CAUTION!
Each fork is marked with a symbol that must face the casing.
The forks must be applied according to the mark indicated in the images. The upper part of fork "A" is higher than fork "B".

Insert the desmodromic control **1** and turn the fork-pin assembly inwards for the fork pins to enter their respective housing in the casing. For this to occur, the guide pins **2** on the forks must engage with the slots on the desmodromic control.

ATTENTION!
Pay attention to thrust washers to be applied to the desmodromic command.



To verify that all operations pertaining to the reassembly of the gear to the casing function properly you must simply ensure that the toothed wheels turn freely.



3.4 CLOSING THE ENGINE CASING

Insert two centring bushes A and replace the gasket with a new one. Once the seal is replaced with a new one, heat the main bearing and the area around it on the right casing. Continue heating until the casing enters the motor shaft with minimal hindrance.
Before starting the heating process it is recommended to grease the oil seal found on the outer side of the half-casing.

ATTENTION!
Be careful not to deteriorate the oil seal while heating the bearing

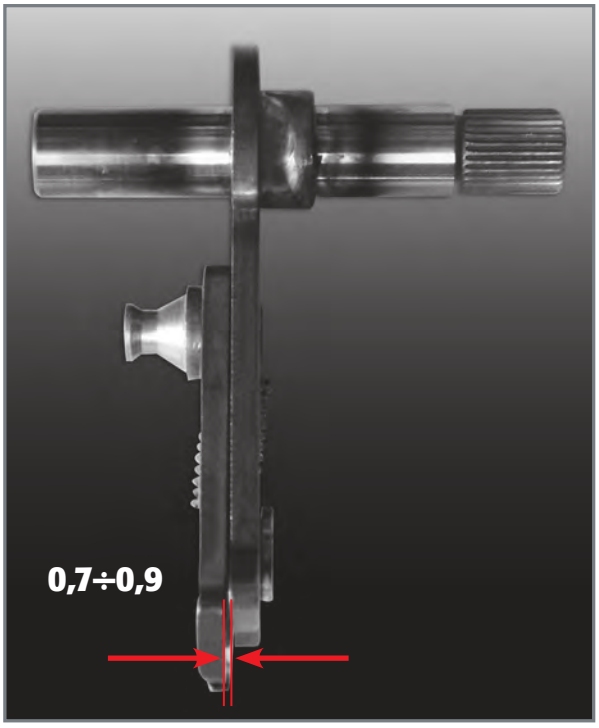
Press the right half-casing towards the left half, ensuring that the shafts, bolts and pins on the casings are inserted into their respective housing and the half-casing is positioned correctly. To make it easier to draw the two half-casings closer together and line them up, it is possible to use two screws, or more, on opposite sides and tighten them gradually. If the casings do not remain in their correct position, do not tighten further but loosen the screws and set the casings back into their correct position.
Ensure that the two casings fit perfectly then mount and tighten the recessed hexagonal head screws (M6x50), whose tightening torque must be 10Nm. It is recommended to tighten the screws in a cross-wise pattern.
Then carefully cut the excess parts of the seal in the cylinder area and intake pipe.
Give a few blows to the end-parts of the motor shaft with a rubber hammer in direction of the axes so as to release any residual stress on the casings caused by the heating process.

3.5 EXTERNAL TRANSMISSION CONTROL

Before reassembling the external transmission control you should check the wear-and-tear state of the device. With regards to the stop cam, simply ensure that there is no abnormal wear-and-tear and/or seizing, whereas the gear shaft requires more elaborate verification.

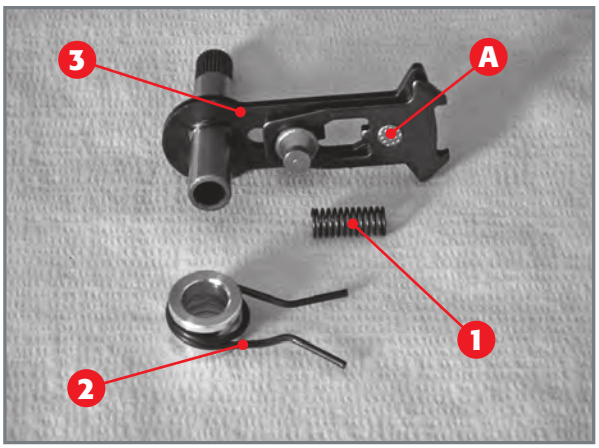
3.5.1 TESTING THE COMPLETE GEAR SHAFT

With the device completed, verify the distance between the mobile pawl and the control shaft falls between 0.70 and 0.90 mm.
If the measurement exceeds this, you must replace the mobile pawl.



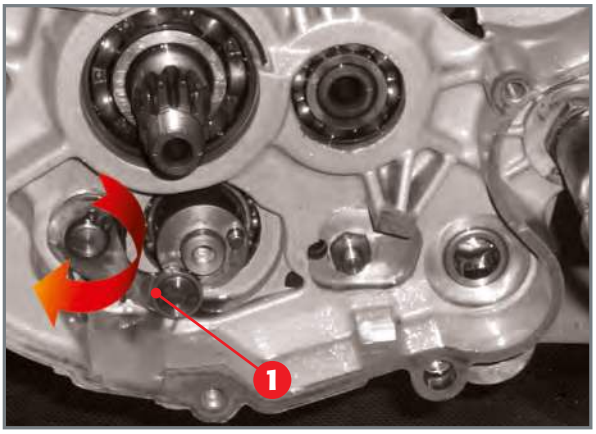
Admissible distance between shaft and pawl

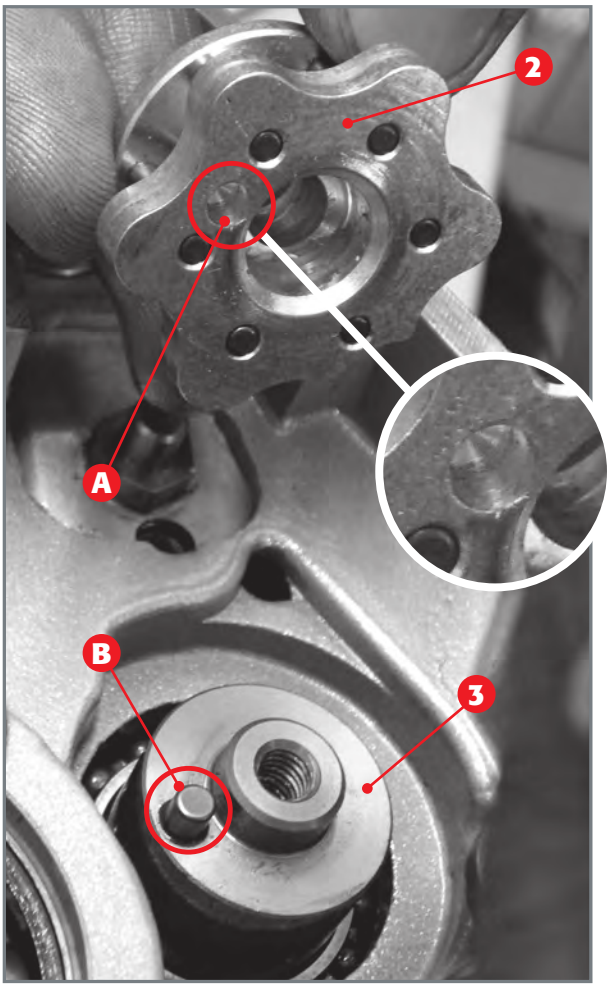
To replace the mobile pawl you must remove the pawl spring **1** and the return spring of the transmission control **2**. Drill a hole in zone **A** with a 5 mm tip for the return spring pin in which it is riveted until it is disassembled.
Then rest the new mobile pawl onto the control shaft **3**, insert the new spring return pin and rivet the excess part of the pin. Remount the pawl spring and the transmission control spring return.



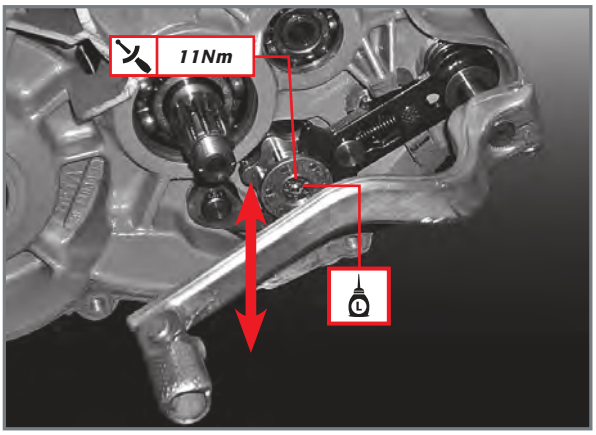
COMPLETE CONTROL SHAFT:

1) Pawl spring;
2) Spring return transmission control;
3) Control shaft;
A) Area pertaining to the spring return pin.





Positioning the stop cam onto the desmodromic device.



Verify operation of the clutch unit.

3.5.2 ASSEMBLING THE EXTERNAL TRANSMISSION CONTROL

While keeping the stopping device **1** moved, position the stop cam **2** on the protruding end-part of the desmodromic control **3**, for opening **A**, which is in the lower part of the cam, to engage with pin **B**, which is found on the protruding end-part of the desmodromic control.
Then mount the TSPCE fastening screw M6x30 between the stop cam and the desmodromic control, after placing the medium resistant thread stoppers: tighten to 11Nm.
Insert the transmission control shaft into its housing applying two specific thrust washers at the two ends of the small shaft.

Should you wish to test the entire gearbox unit and ensure it functions properly, temporarily couple the external control lever and simulate a gear shifting operation by lifting and lowering the control lever. If no abnormal blockage occurs, the entire device is functioning correctly.

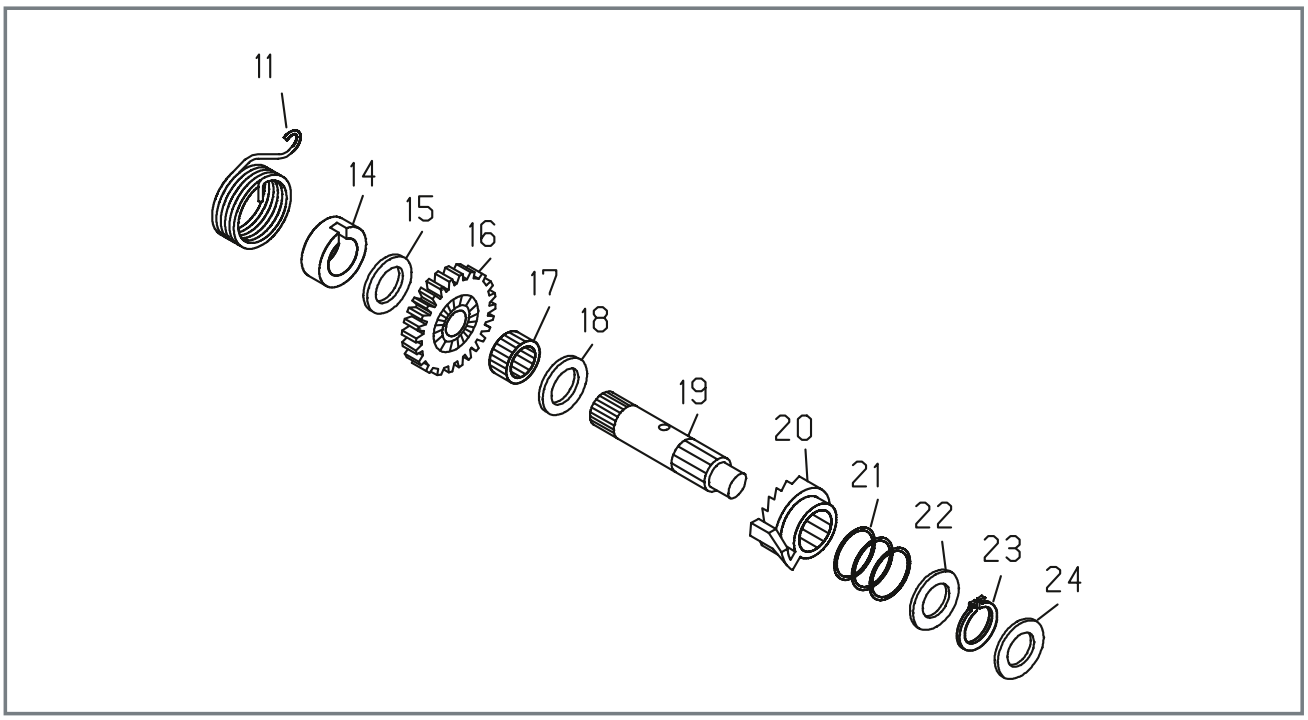
Please note that if the unit is operated without oil, the device will be noisier than usual.

3.6 START-UP DEVICE

Before reassembling the start-up device you must perform some important verifications.

3.6.1 TESTING THE IGNITION SHAFT AND THE ASSEMBLY

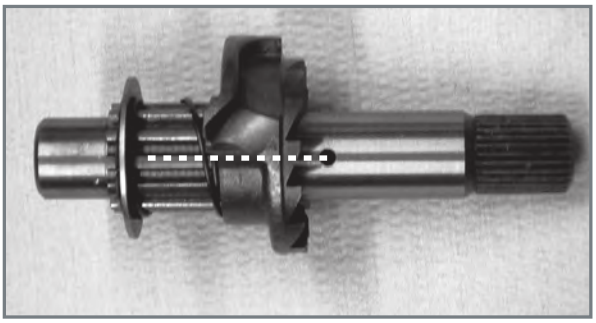
To disassemble all components of the ignition shaft you must remove the spring return lever **11** and spacer **14**. Open the Seeger **23**, which allows you to remove all the other components.



EXPLODED VIEW OF THE COMPLETE IGNITION SHAFT:

11) Spring return lever;
14) Spacer;
15) Washer-spacer;
16) Start-up gear;
17) Cage 16x20x10;
18) Washer-spacer 16x25;
19) Ignition shaft;
20) Ignition sleeve;
21) Sleeve spring;
22) Shim washer 20x30x0.5;
23) Seeger 20;
24) Washer-spacer 15x25

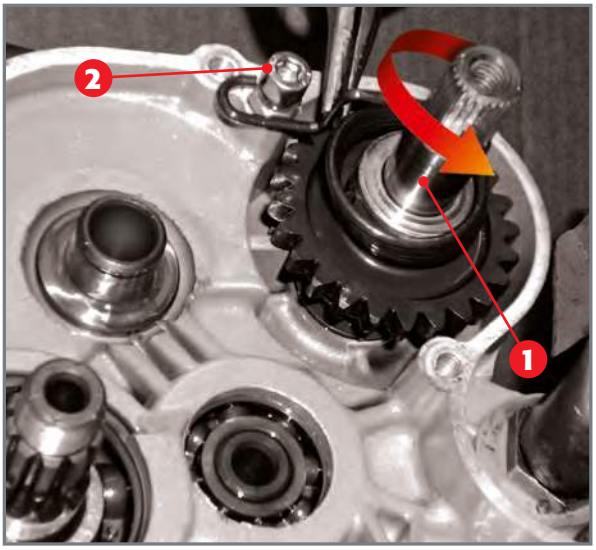
Verify that the sides of the teeth of the start-up gear **16** do not present any signs of seizing or particular superficial wear-and-tear and that the front teeth (on the side of sleeve **20**) do not have any cracks. If so, replace the component.
Verify that the front teeth of sleeve **20** are not cracked and that the spring **21** exerts enough pressure onto the sleeve for wheel **16** to be driven by sleeve **20**.
Moreover, verify that all the washers and shim washers are not abnormally or excessively worn. If so, replace them. Verify that spring **11** is not cracked or abnormally deformed. Should it fail to bring the external start-up lever back to its idle position, replace it.



Positioning the sleeve onto the spindle.

3.6.1 To reassemble this, insert Seeger **23**, shim washer **22**, spring **21** and sleeve **20** in such a way that the opening that will block spring **11**, is aligned with the left border of the ramp on the sleeve.

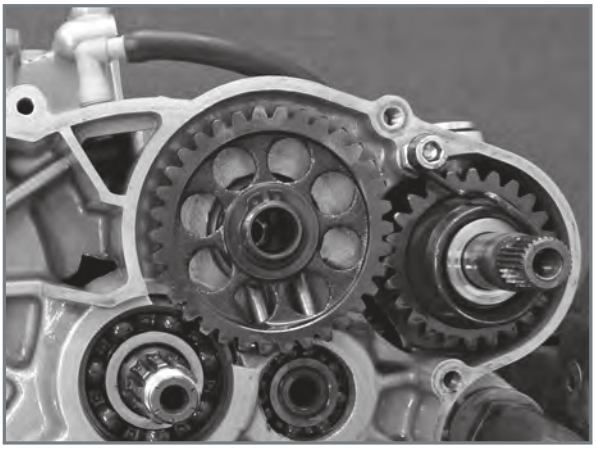
Then insert the shim washer **18**, cage **17**, gear **16**, shim washer **15**, spring **11** and spacer **14**.



Coupling of the complete ignition shaft to the casing.

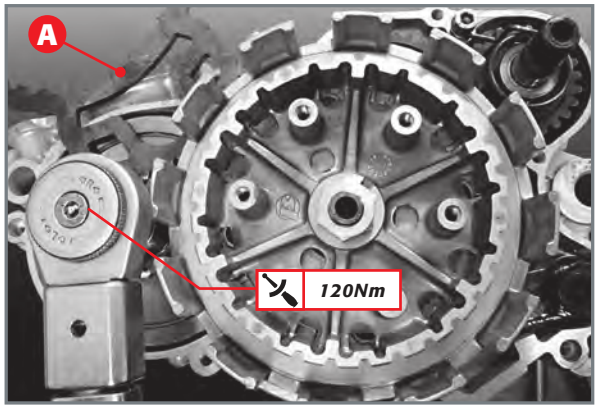
3.6.2 MOUNTING THE START-UP DEVICE

Insert the complete ignition shaft **A** into the relative housing whilst keeping the spline facing outwards.
Turn the shaft anti-clockwise until the stop limit is reached and then hook the spring return lever to the cylindrical head screw B. If this screw (M6x20) has been disassembled, tighten it with a torque of 10Nm.



Start-up device assembly coupled with the casing.

Insert the idler gear into the relative pin and the washer-spacer 18x27 and close the assembly with the Seeger (18). Lubricate the assembly with transmission oil and mount the external lever temporarily to then simulate ignition so as to verify that no abnormal blockage occurs.

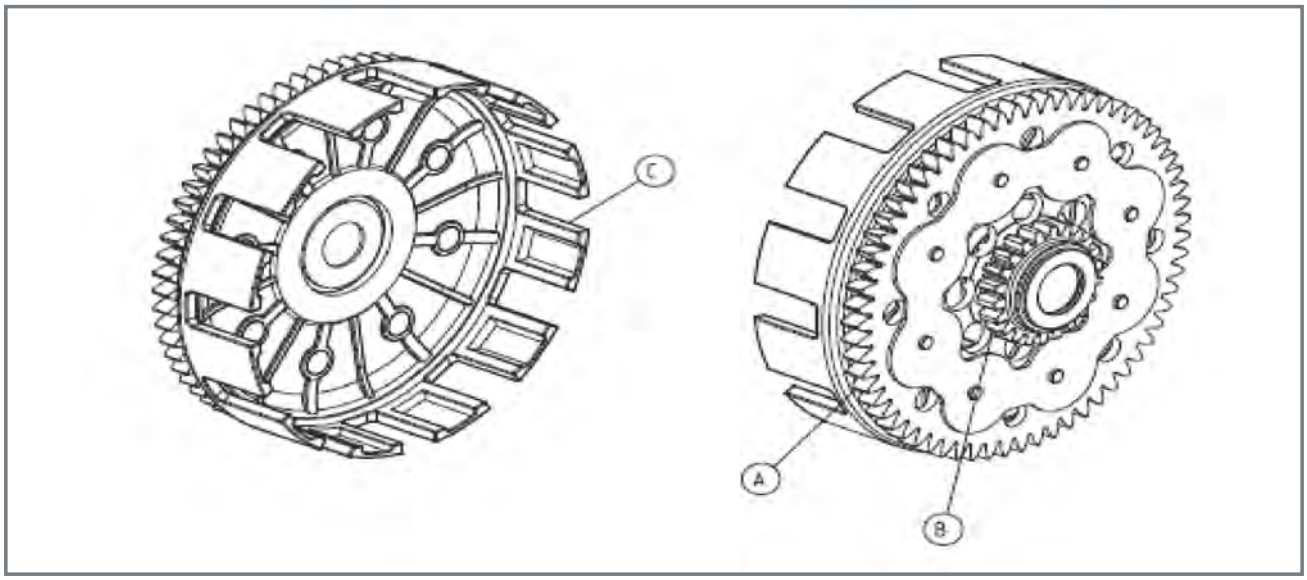


3.7 PRIMARY GEAR AND CLUTCH UNIT

After having verified that the teeth of the primary gear do not have any dents and/or abnormal wear-and-tear, insert the primary gear into the conical part of the motor shaft (left side) straight after having thoroughly degreased the part of the shaft in question and the opening on the gear. Then insert the fastening screw as far as possible.
The fastening screw between the motor shaft and the primary gear must have a torque of 120Nm. This operation is possible once the clutch case and bushing are set up using the special primary tool **A** *(code 007.14.000.0.0)*.

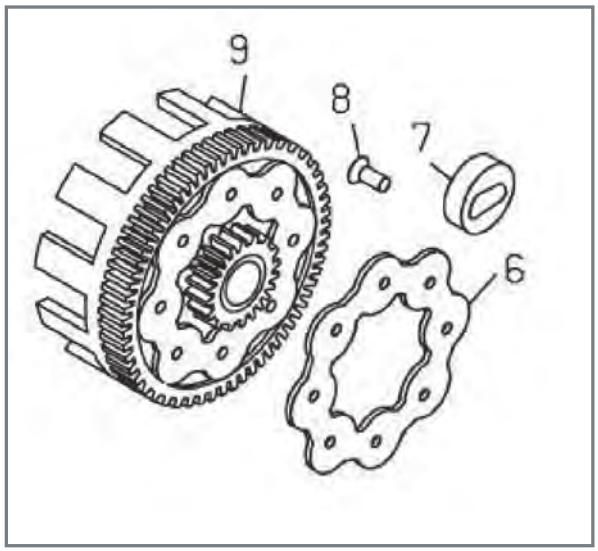
3.7.1 TESTING THE CLUTCH BELL AND REPLACING THE SILENT-BLOCK

Before remounting the clutch bell, check that the sides of the teeth **A**, which pertain to primary transmission and **B**, which pertains to the seizing process with the start-up idler gear, do not have any superficial corrosion or are abnormally worn.
Carefully analyse the teeth **C**, with which the conductor discs engage, to ensure they are not cracked or worn.
If any damage is caused, replace the components.



CLUTCH BELL:

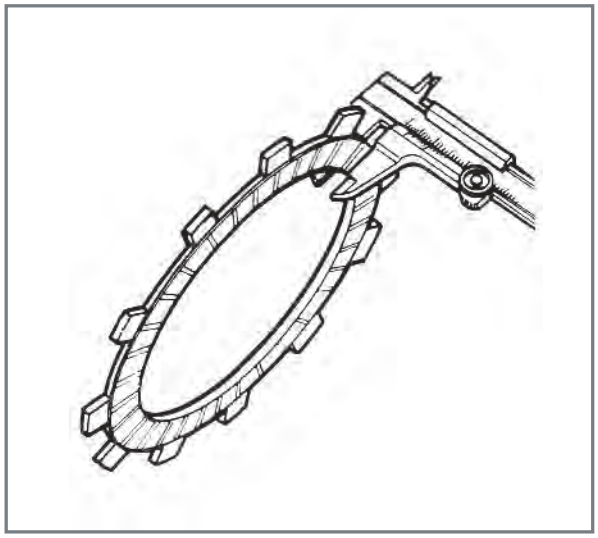
A) Teeth engaged with the primary gear;
B) Teeth engaged with the start-up idler gear;
C) Teeth engaged with the conductor discs.



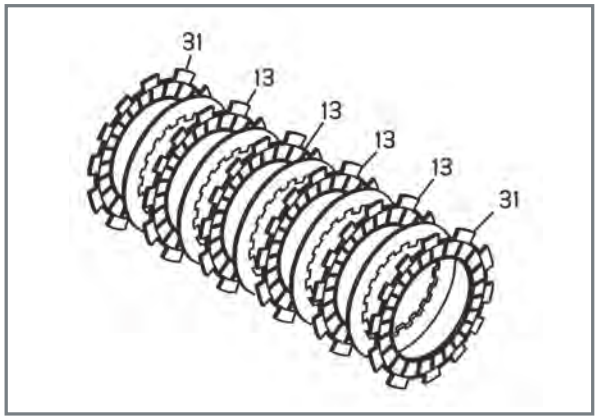
Exploded view of the clutch bell. Verifying the silent-blocks 7.

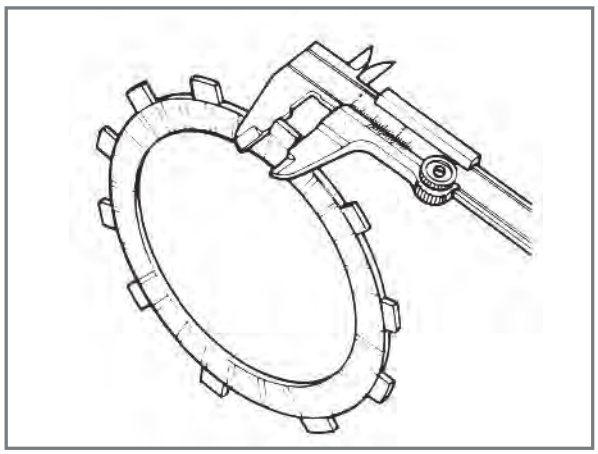
Verify the wear-and-tear state of the silent-blocks **7** as follows. Whilst keeping the toothed wheel with the wider diameter in place, make the clutch bell **9** turn. Should there be loosening between the two components, the silent-blocks must be replaced.
The silent-blocks are replaced by piercing the riveted part of rivet **8** with a 5 mm tip. Place the bell in such a way for the retaining disc to be mounted from above, and then couple the new silent-blocks to the clutch bell in the relative housing.

Bring the retaining disc towards the bell and insert the rivets (5x15) and rivet them (rivet height approximately 0.8mm).

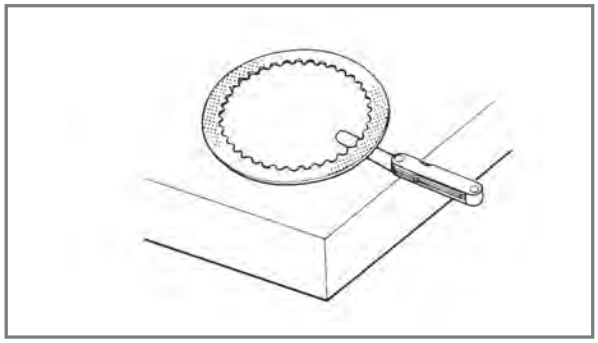


Minimum distance between two opposite inserts.





Minimum tooth thickness of the driving discs.



Measuring the distortion of the driven discs.

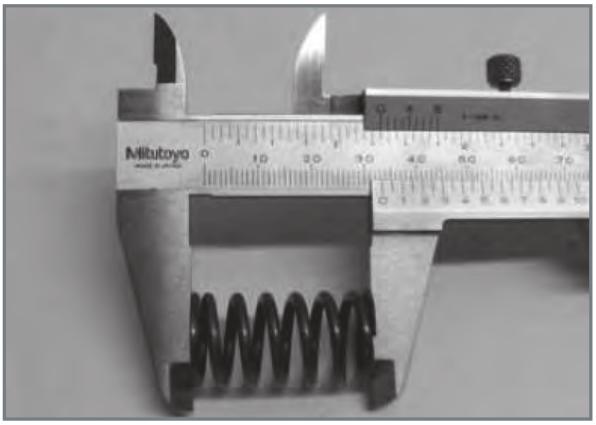
3.7.2 TESTING THE CLUTCH DISCS

The clutch discs are divided into driving and driven elements: six driving discs and five driven discs.
Both sides of the driving discs have cork inserts that become worn due to the sliding movement with the driven discs.
You must verify that the thickness between two inserts placed on opposite sides of each driving disc is not less than the minimum value set at:

Disc no. 31	Disc no. 13
2,8 mm	2,5 mm

Another value you must verify is the tooth thickness of each driving disc and this must not be less than the minimum value set at: **minimum tooth thickness of the driving discs: 13.5 mm.**

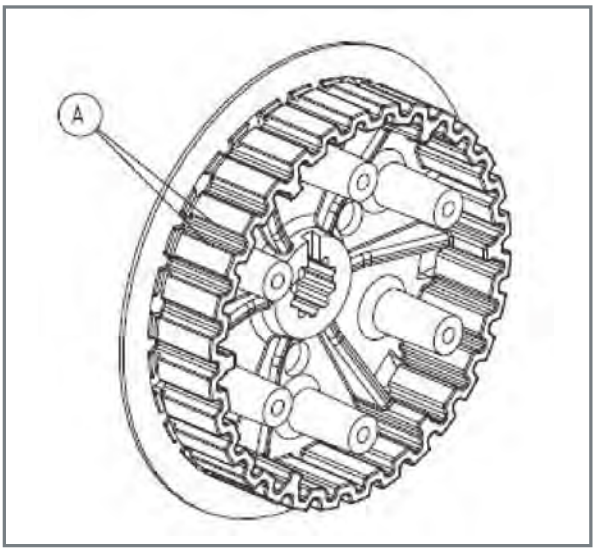
Moreover, verify the distortion of the driven discs. This is implemented by resting the driven discs onto a perfectly flat surface and with the use of a feeler blade verify that the gap between the disc and surface does not exceed: **acceptable distortion of the driven discs: 0.10 mm.**



Measuring the length of the clutch springs.

3.7.3 TESTING THE SPRINGS

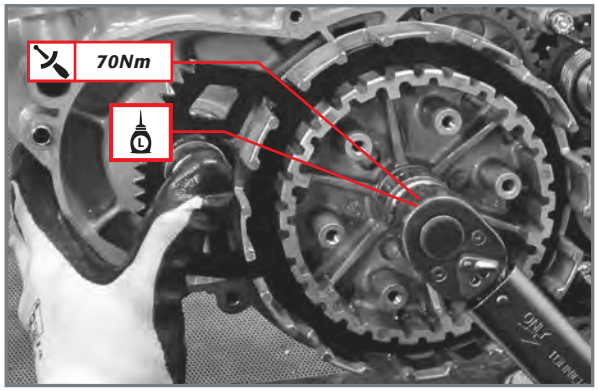
To ensure that the pressure between the clutch discs is correct, you must verify the wear-and-tear state of the springs. The minimum acceptable length is:
minimum length of the clutch springs: **33.3 mm (new springs 33.8 mm).**



Testing the teeth of the clutch drum.

3.7.4 TESTING THE CLUTCH DRUM

The clutch drum is engaged with the driven clutch discs by means of teeth **A**: verify that the teeth do not present any seizing or abnormal wear-and-tear. If so, replace the drum.



Tightening the nut that blocks the clutch bell to the primary shaft.

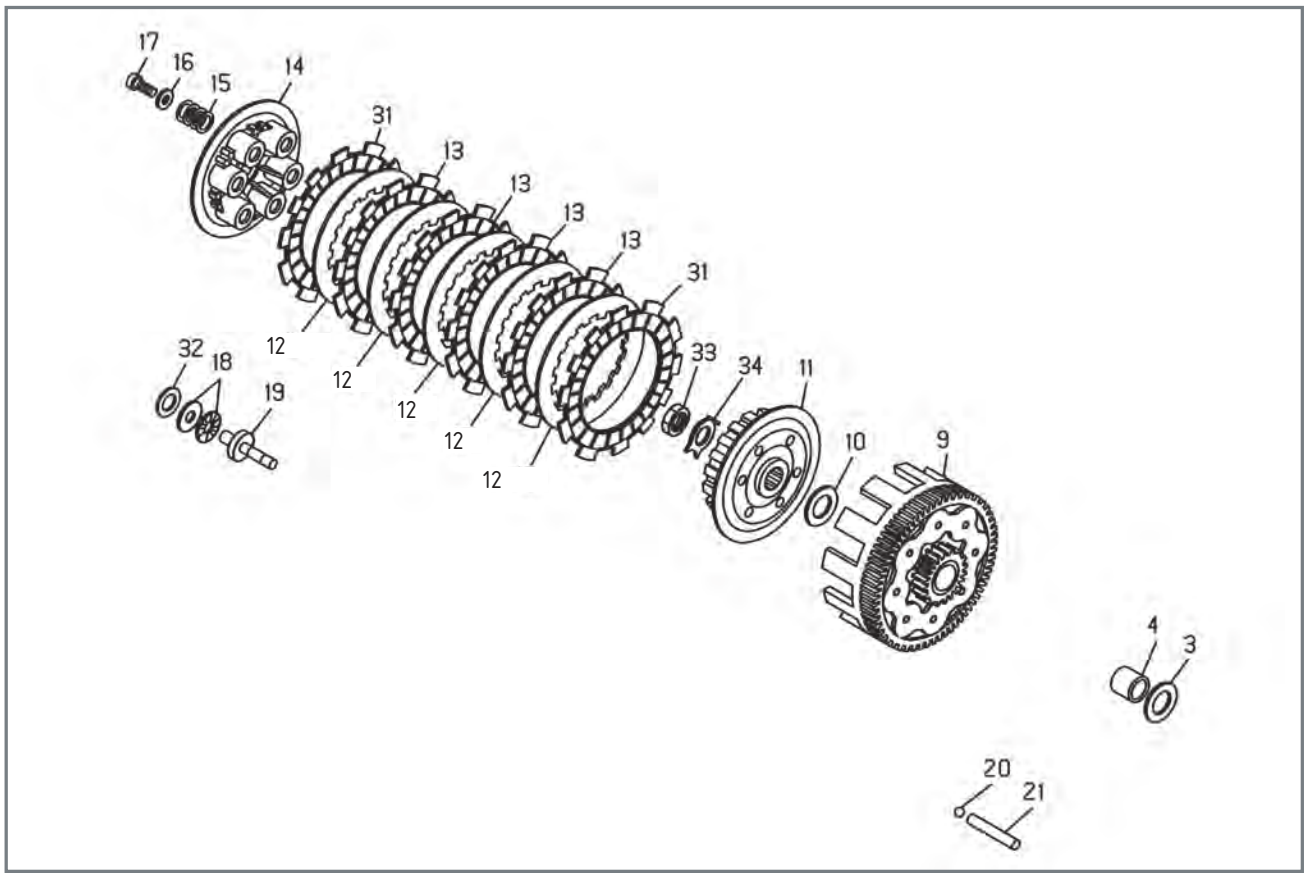
3.8 ASSEMBLING THE CLUTCH

Insert washer **3** 20x35x1 and bushing **4** on the primary shaft continuing with assembly of clutch case **9**. Verify that at this point radial play between clutch case and bushing is between

0.01÷0.11mm

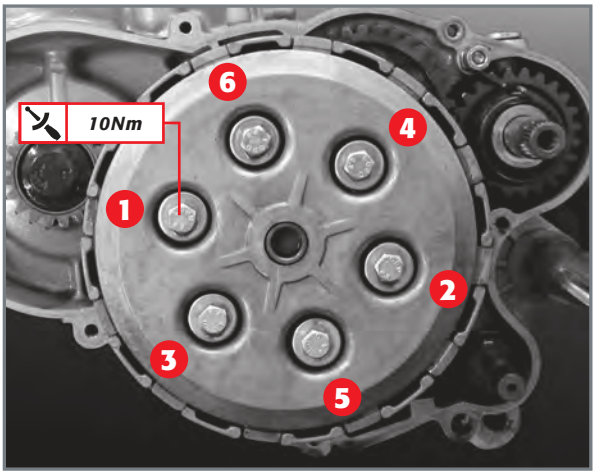
Next insert a new special washer **10**, the clutch drum **11**, the new safety washer **34** and the nut **33** after placing average intensity threadlock.

Tightness of this screw must be at a torque of 70Nm, keeping the clutch case-primary gear assembly is blocked using the primary special tool **A** *(cod. 0071400 000)* see paragraph **2.4** for its correct use.



EXPLODED VIEW OF CLUTCH:

3) Washer 20x35x1;
4) Bush;
9) Clutch case;
10) Special washer;
11) Clutch drum;
12) Driven disc;
13) Driven disc-thickness 2.7mm;
14) Pressure plate cap;
15) Spring;
16) Washer;
17) Screw M6x16;
18) Thrusting cage;
19) Pressure plate;
31) Driven disc-thickness 3mm;
32) Special washer thickness 1mm
33) Nut;
34) Safety washer.



Tightening order of the clutch bell bolts.

3.8 Once this is tightened well, fold the two flaps on the safety washer for them to rest onto the nut.

Oil the clutch discs with clutch oil and first insert a driven disc 3 mm thick and then a steel disc. Next, alternate a driven disc 2.7 mm thick with a driven one. Lastly apply a 3 mm thick driven disc.

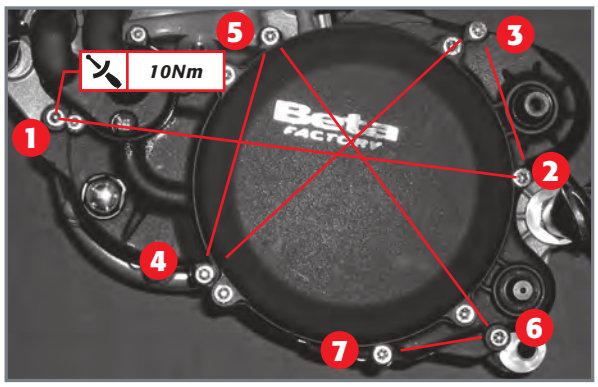
Introduce the longest portion of thrusting plate **19** in the crankcase present on the primary shaft, the thrusting bearing **18**, the special washer **32**.

Close the clutch case with the pressure plate cap **13**, insert the screws in the respective housings present in the cap following the washers **15** 6x18 and the **16** M6x16 screws which must be tightened at 10Nm in criss-cross order, keeping the clutch assembly blocked using the special primary tool *(cod. 0071400 000)*.

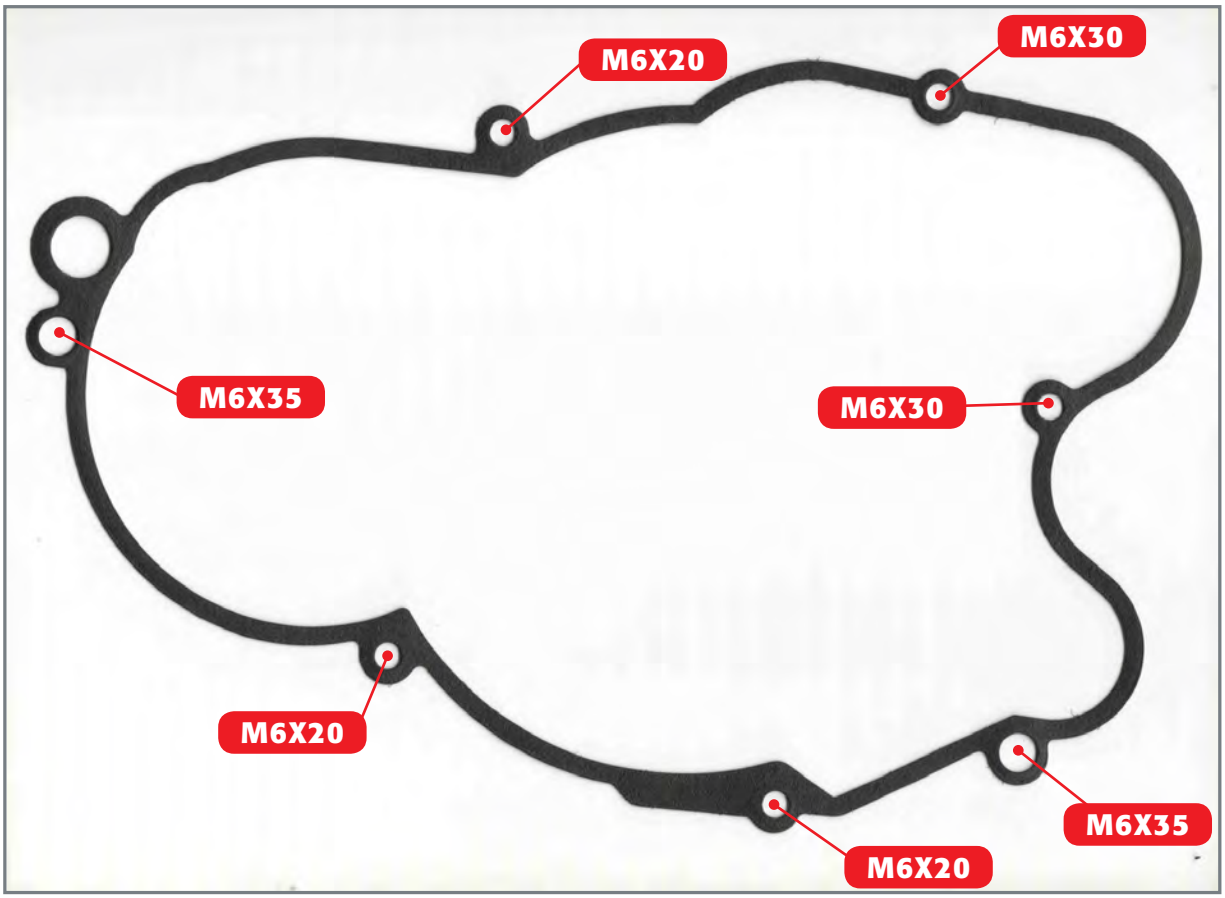
3.9 INTERNAL COVER OF THE CLUTCH

Couple a new seal with the left casing after inserting centering pins and the internal cover of the clutch.

The layout of the bolts is shown in the picture and these must be tightened to a torque of 10Nm by following a cross-wise pattern as shown in the picture below.



Layout of the screws on the internal cover of the clutch.



Tightening order of the casing cover bolts.

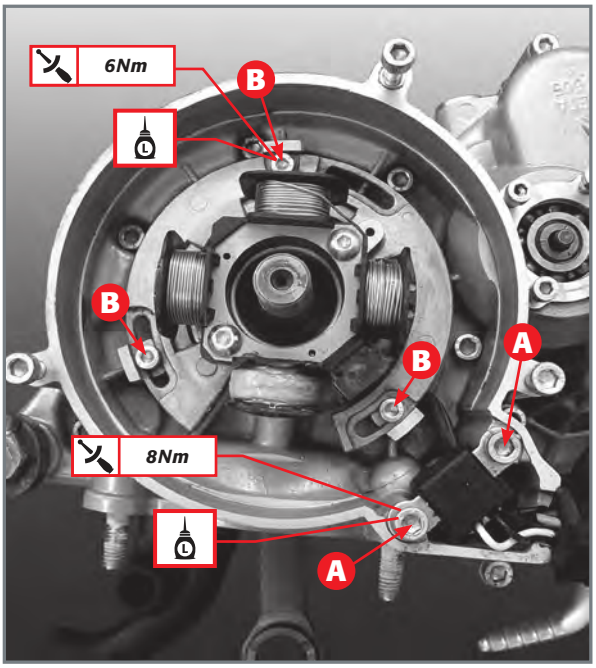
3.10 IGNITION SYSTEM

Before reassembling the ignition system, you should carry out the following inspection.

3.10.1 TESTING THE IGNITION STATOR

The stator winding must be inspected while the temperature of the component is approximately 20 °C.
The inspection may also be performed with the generator coupled to the engine.
Disconnect the 12-way black connector between the generator and CDI and with the use of a multimeter, verify that the resistances read between the terminals shown below fall within the prescribed range.

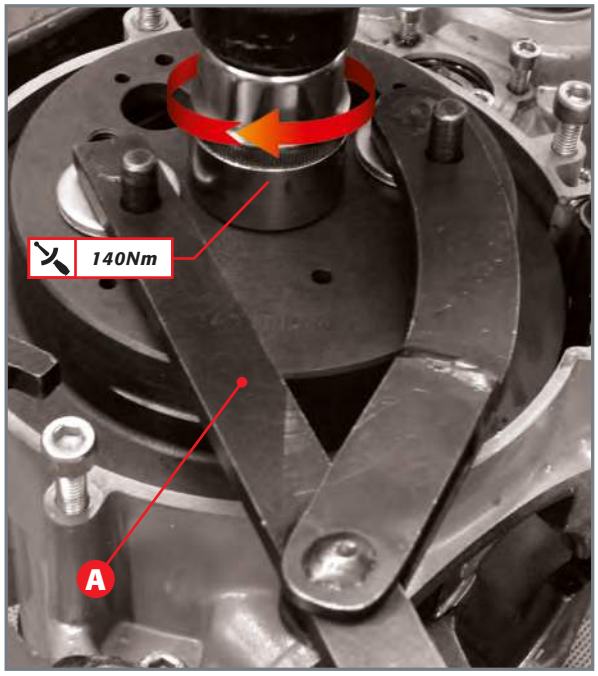
Versions	125cc - 200cc	250cc - 300cc
black-white	320 ohm±15%	320 ohm±15%
red-blue	300 ohm±15%	15 ohm±15%
yellow-brown	0,45 ohm±15%	0,6 ohm±15%



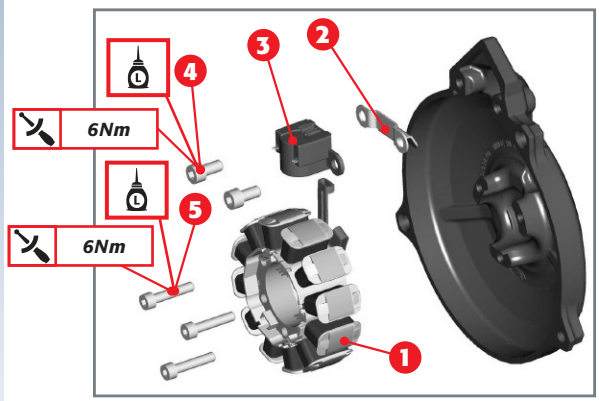
Pickup and stator screw tightness.

3.10.2 Assembling ignition system versions 125cc - 200cc

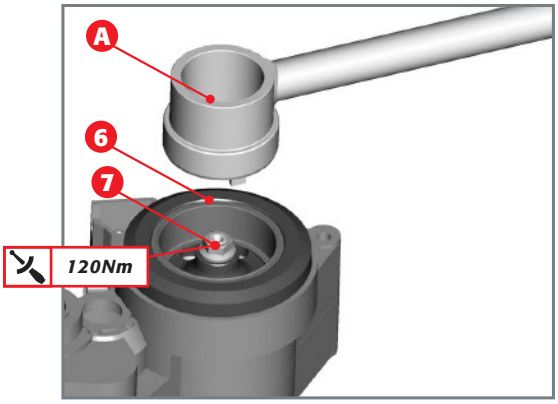
- Insert the stator winding and the pick-up in the relative crankcases paying attention not to crush the cables between stator and pick-up. Apply medium-intensity threadlocker to screws **A** and **B**.
- Tighten the two screws **A** at a torque of 8Nm and the three screws **B** at a torque of 6Nm.
- Degrease the conical surfaces and insert the flywheel in the specific compartment on the right side of the engine. Make sure that the groove obtained on the flywheel fits in the disc flap.



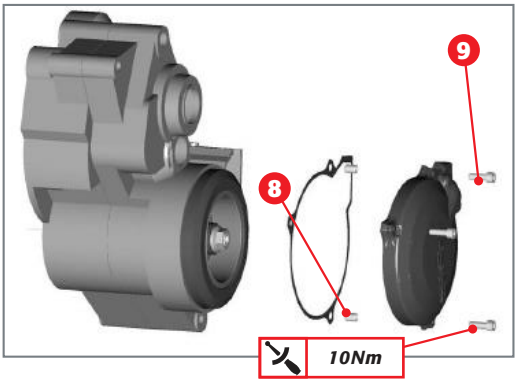
Mounting the flywheel onto the motor shaft.



Screw tightening and stator pick up.



Mounting the flywheel to the crankshaft.



- Insert the special washer and the nut that tightens the flywheel to the crankshaft.
- Block the flywheel using a specific universal device **A** and tighten at 140Nm.

To apply the flywheel cover, refer to par. 4.3

3.10.3 Assembling ignition system, versions 250cc – 300cc

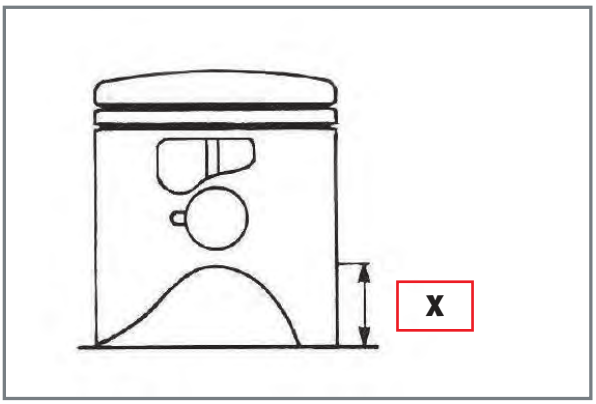
- Couple stator **1**, plate **2** and pick up **3** to the flywheel cover with screws **4** and **5**
- Apply the threading with medium strength threadlocker and tighten them at a torque of 6 Nm.
- Insert the cable gland in the specific seat of the engine crankcase and check its perfect sealing.

- Couple flywheel **6** and nut **7**.
- Fasten the nut to torque 120Nm, keeping the flywheel blocked with special tool **A** (code 026140040 000).

- Insert the centring pins **8** on the crankcase and fasten a new gasket. .
- Apply the flywheel cover, screws **9**. Tighten in a criss-cross pattern at a torque of 10Nm.

3.11 THERMAL UNIT

Before assembling the thermal unit you must perform thorough verifications on the cylinder, piston, piston pin, piston rings and head as described below.



Height at which the external diameter of the piston is measured.

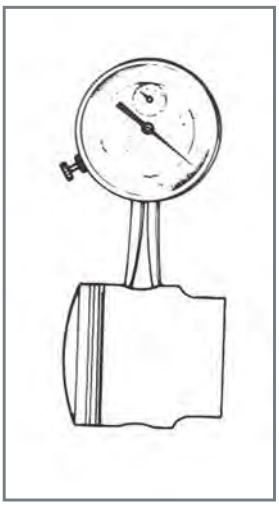
3.11.1 TESTING THE PISTON, PISTON PIN AND PISTON RINGS

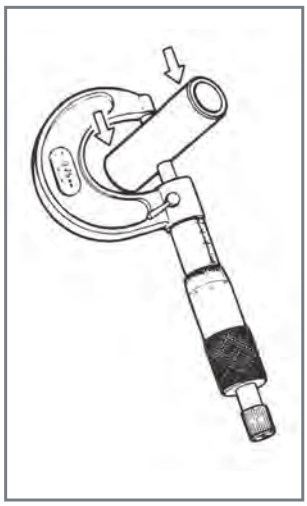
Remove the carbon deposits from the piston crown and wash the entire plunger with a special degreasing product. Do not use pointed or sharp tools for the cleaning process. Then carefully analyse the piston, which must have no strains, scratches, cracks or any kind of damage.

Then analyse the external diameter of the plunger - the limit of service is given in the table below, relative to the specific category. The diameter must be measured at X from the bottom of the mantle, perpendicular to the axis of the piston pin.

The category is marked on the piston crown.

Cubic Capacity [cm³]	Height X [mm]	Limit of service according to the category			
		A	B	C	D
125	11.5	53.935	53.945	53.955	
200	12	63.935	63.945	63.955	63.965
250	13.5	72.445	72.455	72.465	
300	10	78.925	78.935	78.945	

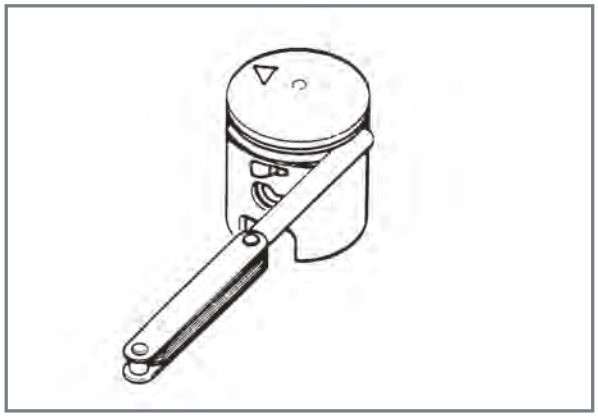




Measuring the piston pin and its housing.

Verify the size of the piston pin and its housing found on the piston. The piston pin must be measured from its extreme ends, which engage with the piston.

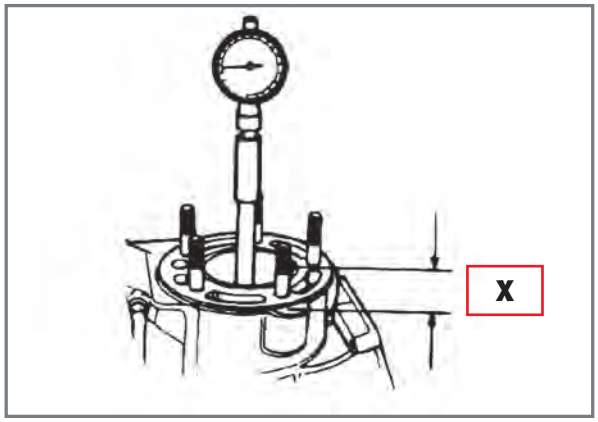
Displacement [cm³]	Size limit [mm]	
	Pin bolt seat	Pin bolt
125-200	16.02	15.99
250	18.02	17.99
300	18.02	17.99



Testing the loosening between the housings and piston rings.



First verification of the piston rings.



Placing the gauge to measure the bore.

3.11.1 Verify the loosening between the housings and piston rings by placing a caliper in between.

Cubic Capacity [cm³]	Limit of service [mm]
125	0.18
200	0.18
250	0.14
300	0.14

To verify the wear-and-tear state of the piston rings you must insert the piston ring into the cylinder for its axis to be collinear with the cylinder's axis. Then measure the distance between the two opposite edges.

Cubic Capacity [cm³]	Limit of service [mm]
125	0.60
200	0.60
250	0.60
300	0.60

3.11.2 TESTING THE CYLINDER AND HEAD

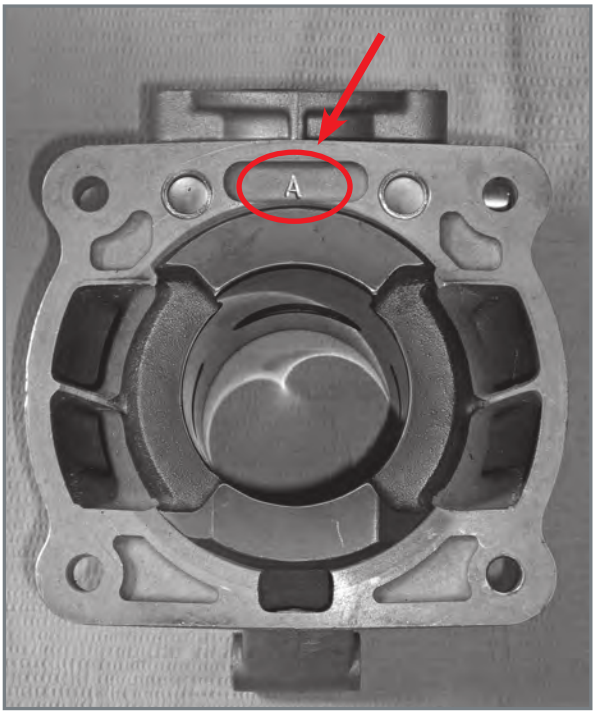
Verify that the bore falls within the limits of service in respect to the category shown in the table below, whilst ensuring to measure it at the distance of **X** from the upper edge of the cylinder itself.

Please note that this measurement is to be taken by placing the bore gauge with its axis perpendicular to the axis of the motor shaft.

Cubic Capacity [cm³]	Height X [mm]	Limit of service according to the category			
		A	B	C	D
125	10.0	54.005	54.015	54.025	
200	10	64.005	64.015	64.025	64.035
250	10	72.515	72.525	72.535	
300	10	79.015	79.025	79.035	

3.11.2 The maximum loosening between the cylinder and the piston must be within the values given in the table below. To evaluate the loosening, you must apply the difference between the diameter on the cylinder and that on the piston at the height of **X** as stipulated in the tables above. Should the difference exceed those stipulated in the table below, replace the piston with another from the same category that is marked on the piston crown.

Cubic Capacity [cm³]	Loosening limit between the cylinder and piston (worn)			
	A	B	C	D
125	0,06	0,07	0,07	
200	0,07	0,07	0,07	0,07
250	0,07	0,07	0,07	
300	0,06	0,06	0,06	



Position of the class marking on the cylinder.

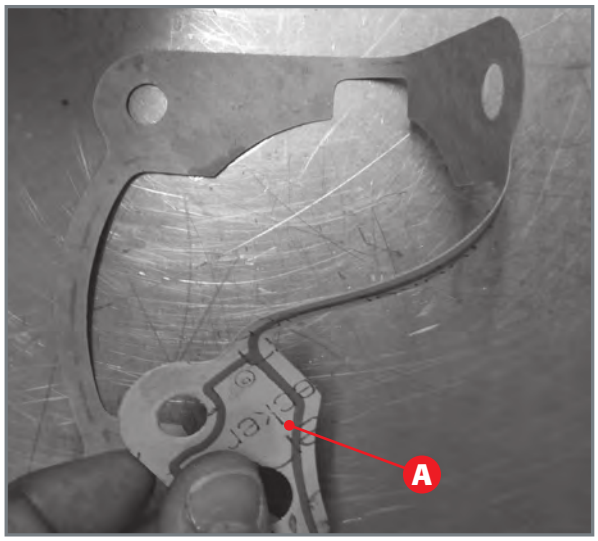
Should the result exceed those stipulated, replace the piston with another from the same category that is marked on the piston crown.

Verify that the cylinder is perfectly smooth. Otherwise, replace the element.
The cylinder class is marked on the lower part of the cylinder, on the side of the exhaust manifold.

Verify that the coupling surface between the cylinder and head is flat. This can be carried out by resting the surface of the cylinder onto a smooth surface and verifying that the gap does not exceed 0.05 mm when measured with a caliper.
The same test is performed on the head, where the cylinder and head are coupled.

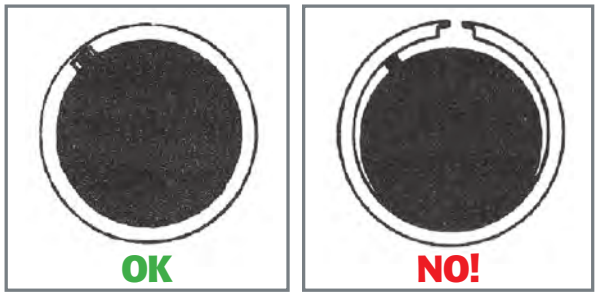
3.12 ASSEMBLING THE PISTON, PISTON RING, PISTON PIN, CRANK CASE/CYLINDER GASKET AND CYLINDER

Insert a circlip to retain the piston pin in one of the housings on the sides of the piston by placing the open part of the seeger towards the top or the bottom.
Oil the piston pin and insert in the piston; then couple the piston pin with piston on the opposite side of the circlip, leaving enough space to allow the connecting rod to be couple with the piston.
Insert the roller cage into the connecting rod, place the piston with the arrow facing to the exhaust side .
Insert the second circlip.



Detail of the paper seal that is to be mounted between the base unit and the cylinder.

Insert the cylinder base gasket on the cylinder and crank cases. The rubber lip A must be facing the crank cases.
To have the correct gasket thickness, read the 3.12.1 par.
First We suggest to use a new gasket with the same thickness as the old one.



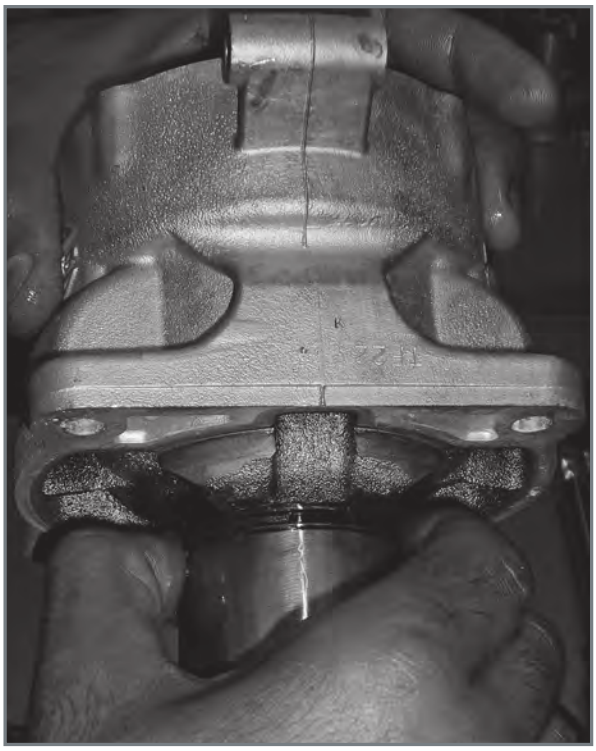
Positioning the piston rings onto the piston.

Heavily oil the piston with motor oil, then insert the piston rings, the edges of which must face the stop-pin area. The 125cc, 200cc, 250cc, 300cc piston rings, have a letter marked on one side, which will be applied facing the top piston.



The letter marked on the piston rings.

Carefully oil all the cylinder with motor oil and insert the piston into the cylinder.
Pressing the piston rings with your fingers



Inserting the piston into the cylinder.

3.12 and push the piston into cylinder. The exhaust port on the cylinder must be facing the front of the engine.
Push the cylinder towards the crank cases and tighten the four nuts in criss-cross pattern. The nuts must be tightened at a torque of 23Nm.

3.12.1 THICKNESS CHECK OF CYLINDER/CRANKCASES GASKET

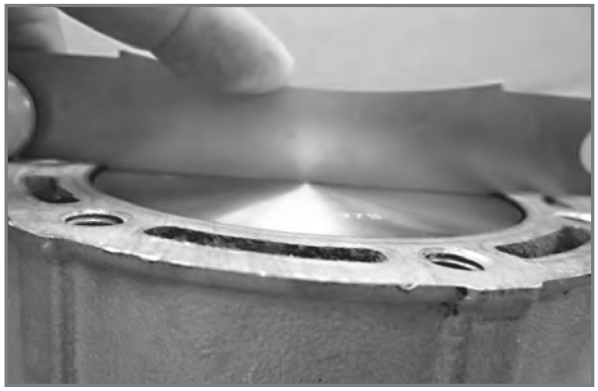
The thickness check of cylinderbase gasket must be do whenever:

- Cylinder is changed
- Piston is changed
- Crankshaft is changed
- Con road
- Crankcases are changed

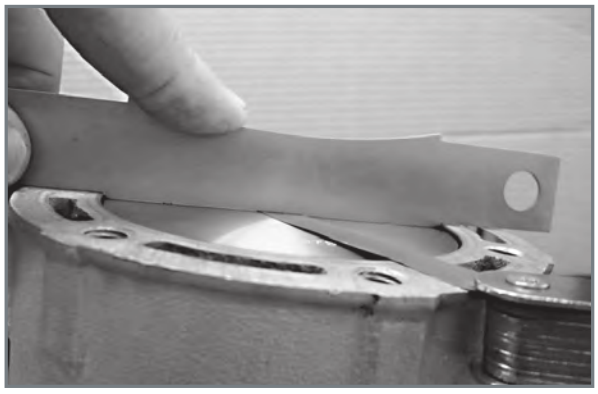
This check is very important to have a good performance of engine.
The thickness check must be do by special tools. The table shows the special tools in correspondence to Displacement and Model Year.

Displacement [cc]	Model Year	Code	Side
125	from 2012	007440100 000	B
200	from 2012	007440110 000	B
250GB	from 2012		A
250	MY'16 at no. XXXXXXXXXXXX	007440120 000	A
250	2016 from motor no. ZD3B9T-F 2501001	007440110 000	A
300	from 2011 to 2015	007440140 000	A
	2013 factory		B





The tool touches the cylinder and the piston.



The tool touches the cylinder but don't touches the piston: Measure the clearance between piston and tool.



The piston moves the tool on the top.

3.12.1 The special tools must be use in this way:

- Lean on cylinder the special tool as shows the picture.

- Bring the piston to the TDC; the clearance between tool and piston must be 0÷0,10mm. Measure the clearance using the thickness gauge.

If the clearance is >0,10mm, it is necessary reduce the gasket thickness.

If the piston push upward the tool is necessary increase the gasket thickness.

The gaskets have four thickness:
- 0,2mm;
- 0,3mm;
- 0,5mm;
- 1,0mm

It is possible to stack the gaskets.

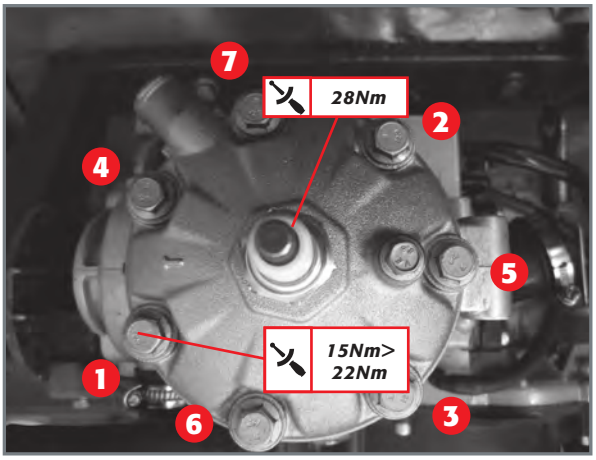


Seal head with highlighted reference to the mount.

3.13 ASSEMBLING THE HEAD

Turn the flywheel to ensure that the crankshaft functions correctly.
Put grease inside the threaded holes where the head locking screws will be placed. Remove the excessive grease on the surface where the head gasket will be placed.
Place the gasket on the cylinder taking care that the reference label A on the gasket must be placed aligned with exhaust flange.

The reference label on the gasket
Place the O-ring in its seat on the upper external area of combustion chamber and place the combustion chamber into the head cover.
Place the head on the gasket taking care that the arrow printed on the head cover must be pointed towards the exhaust flange.
Place screws (M7x31) in place together with copper washers (7x12x0,5) and screw by hand till they keep head cover in place.



Lock the screws by following 2 times the sequence listed below. Use the following listed torque according to locking sequence:

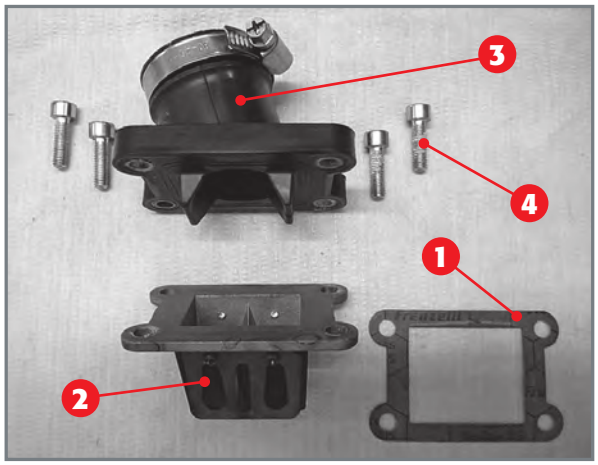
- first lock 15Nm
- second lock 22Nm
- tighten the spark plug at a torque of 28Nm

3.14 INTAKE SYSTEM

You must also verify the efficiency of the intake system in order to be sure of the established performance. Particular reference is made to the lamella pack as well as the integrity of the intake manifold and seal.

3.14.1 TESTING THE LAMELLA PACK

The lamella pack consists of the support, lamellas and stoppers.
Verify that the lamellas are not broken, cracked or deformed. This test requires you to simply observe the complete pack so as to verify whether there are any gaps between the lamellas and the support. If so, replace the lamellas.
However, it is recommended to replace the entire pack every 40 hours of operation.
Do not mount lamellas that are made of a different material than that stipulated.



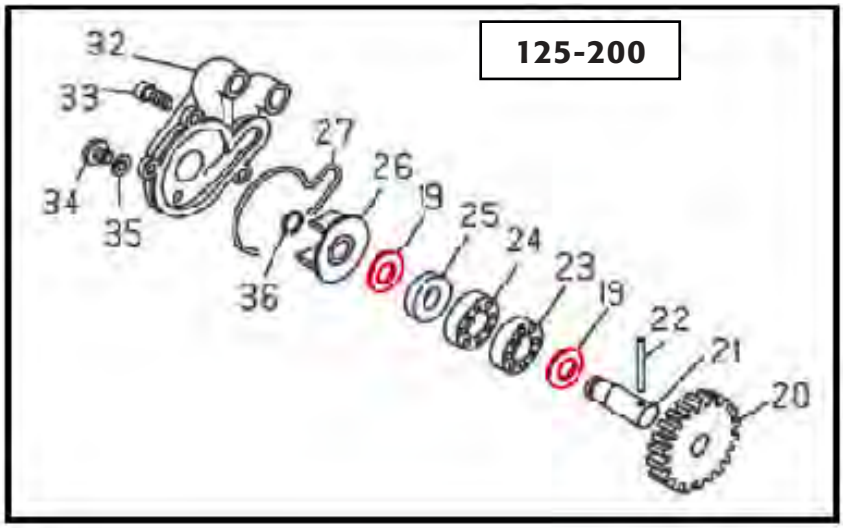
EXPLODED VIEW OF THE INTAKE SYSTEM.
1) Bolts;
2) Intake manifold;
3) Lamella pack;
4) Seal

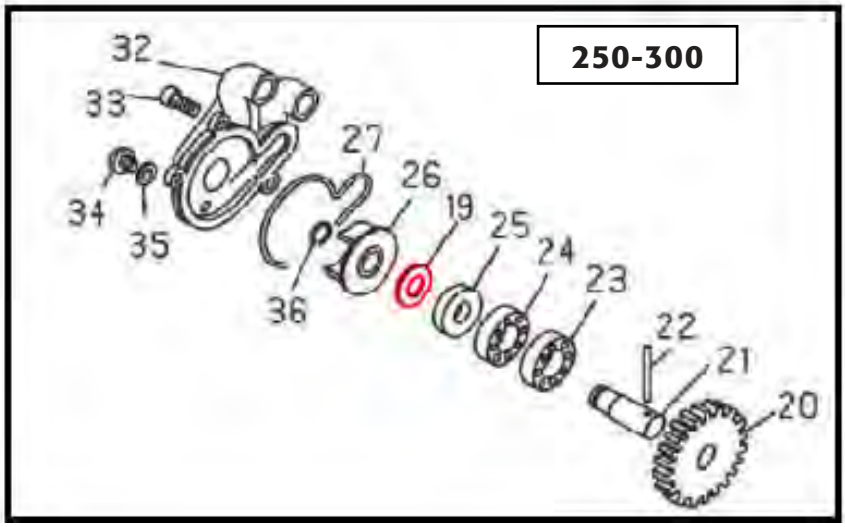
3.14.2 MOUNTING THE INTAKE SYSTEM

Couple the seal **D**, the complete lamella pack **C** and the intake manifold **B** to the base unit.
Fasten it all by tightening the four bolts **A** with a torque of 7Nm.

3.15 WATER PUMP UNIT

The pump unit consists of a centrifugal impeller **26** that supports the shaft **21**, which is fastened to the pump gear **20** by means of the roller **22**. The impeller is closed with cover **32** by means of three bolts **33** and sealed with O-ring **27** and oil seal **25**.





Attention:
Note the different assembly of thrust washers **19** between the various versions.

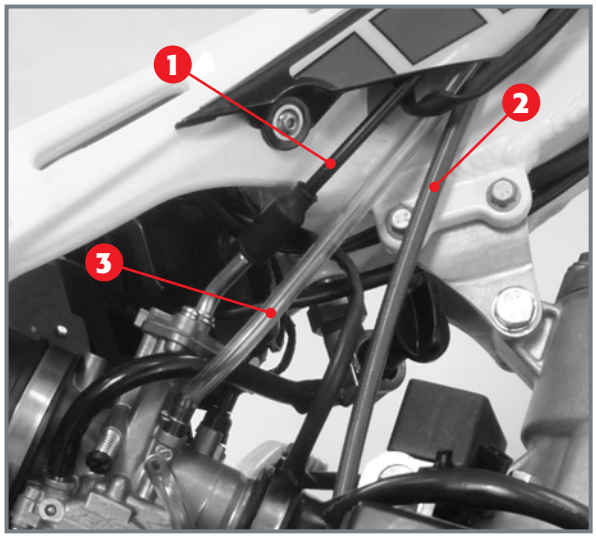
EXPLODED VIEW OF THE PUMP UNIT:

20) Pump gear (Z18 for 125-200-250cc; Z16 for 300);
19) Thrust 20x10x0.5;
21) Shaft;
22) Roller;
23) Bearing 10x22x6;
24) Bearing;
25) Oil seal 10x18x4;
26) Impeller;
27) O-ring;
32) Cover;
33) Screw M5x16;
34) Screw M6x8;
35) Seal 6x12x1.5;
36) Seeger 9e

3.15.1 DISASSEMBLING AND REASSEMBLING THE WATER PUMP

Should it be necessary to intervene on the two bearings or oil seal, you must disassemble the shaft and then the entire clutch casing.
To access the impeller to verify its wear-and-tear state you must remove the pump cover by loosening the three screws that fasten the cover to the internal casing of the clutch. Then open the special snap ring **36** and extract the impeller.
Verify that the front part of the impeller is not damaged. Otherwise, replace the element.
Check the wear-and-tear state of the oil seal and replace it if not intact.

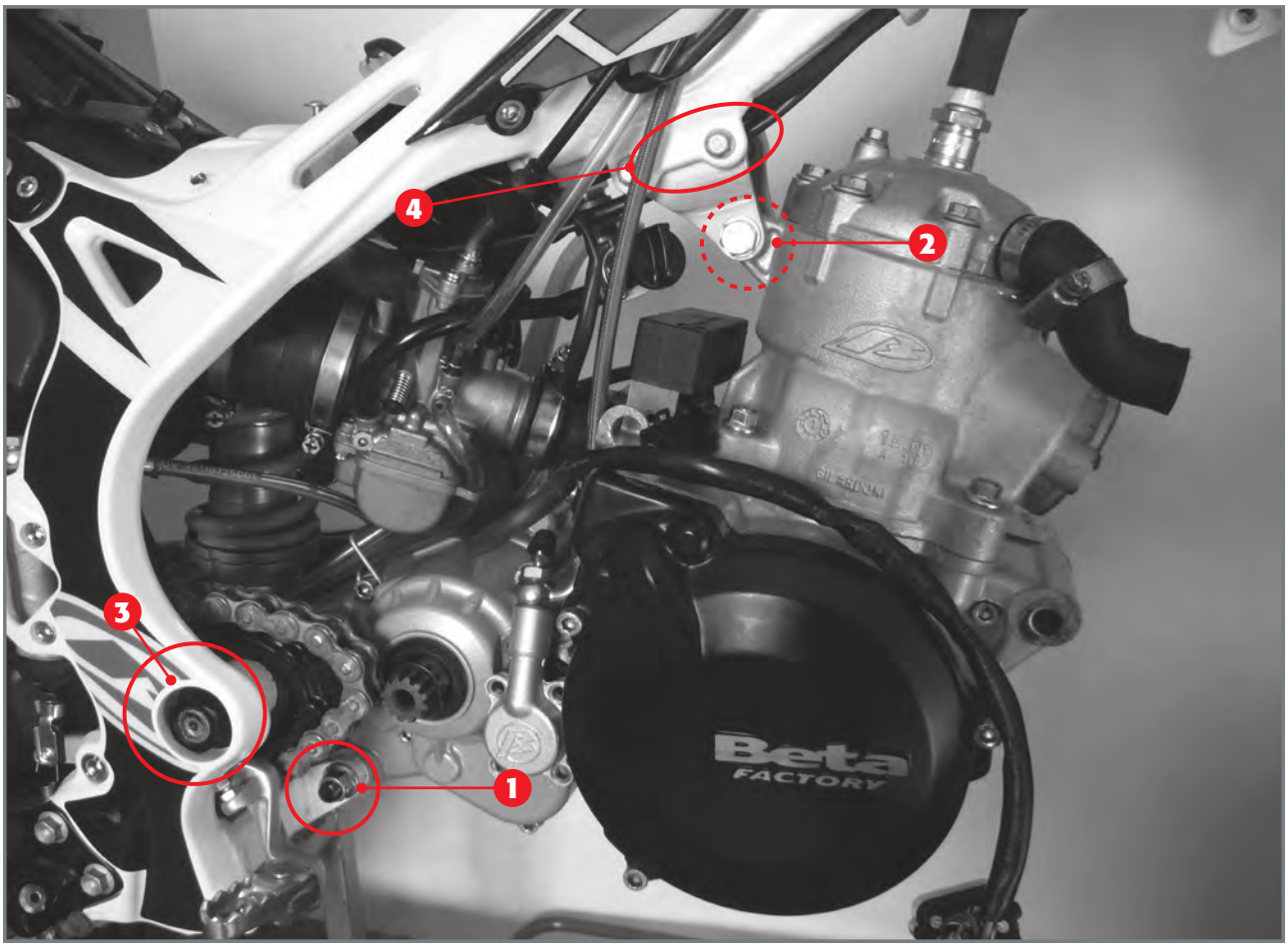
MOUNTING THE ENGINE ON THE VEHICLE AND REPOSITIONING THE COMPONENTS



Passing the pipes and cables.

4.1 GENERAL GUIDELINES

Before reassembling the engine onto the vehicle, it is recommended to follow a number of preparatory steps in order to prevent blockage or entanglement occurring due to the cables, pipes or metal clamps.
It is recommended to keep the cables on the right side of the engine unit and place the clamps onto the water sleeves in such a way so as to facilitate the tightening process.
Ensure that the vapour vents pass through the specific metal cable duct.
On the frame side, the accelerator cable **1**, clutch tube **2**, and carburator vent **3** must pass through the right side as indicated in the image.

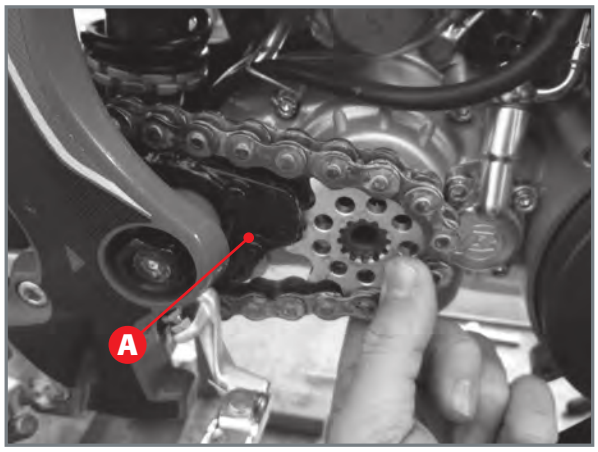


Positioning the pins to anchor the engine to the vehicle.

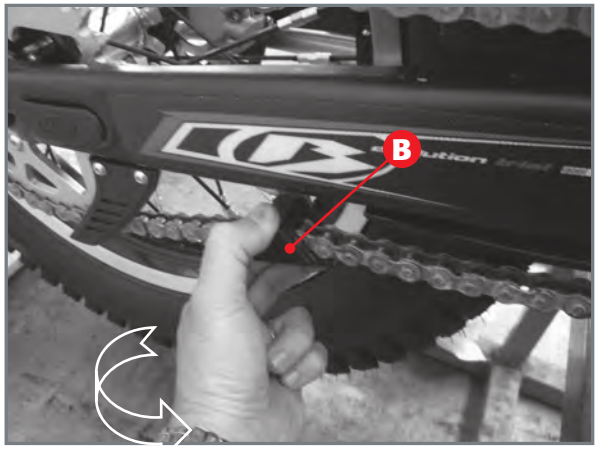
4.2 COUPLING THE ENGINE TO THE FRAME

Place the engine beneath the vehicle, lift it and insert the following in the same order:
The lower bolt **1**;
The upper bolt **2**;
The swing arm bolt **3**.

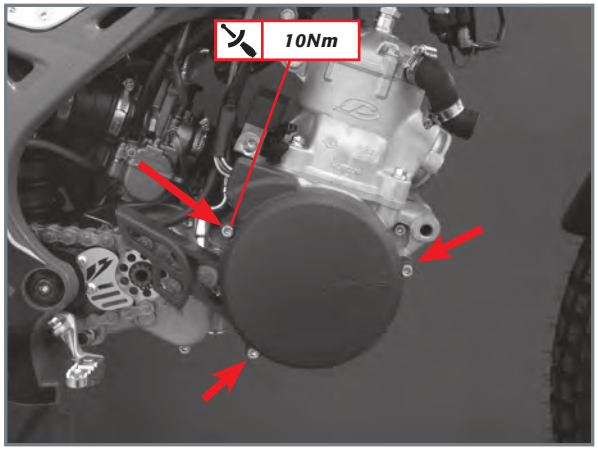
*It is recommended to loosen the screws **4** to make it easier to insert the engine between the two upper brackets.*



Inserting the pinion into the output shaft.



Rotating the chain tensioner



The three screws of the flywheel casing. (versions 125cc - 200cc).

4.3 FLYWHEEL COVER (125-200), CLUTCH ACTUATOR, PINION AND REGULATOR

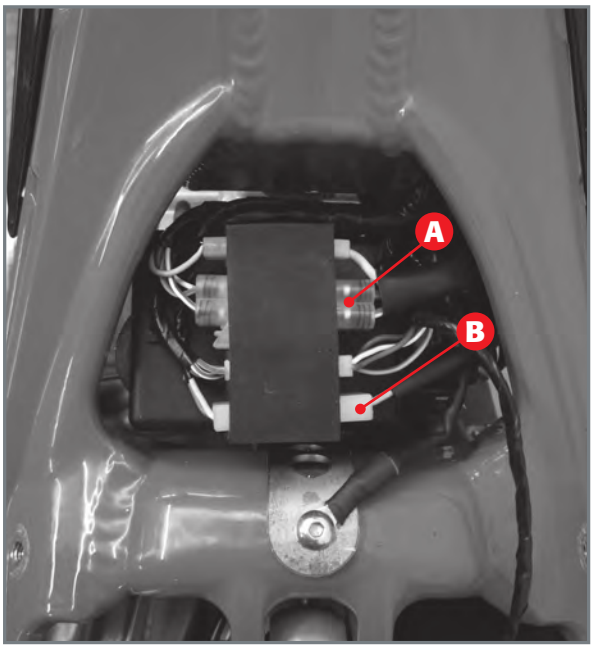
Place the clutch actuator in its housing and tighten the four bolts (M5x12) with a torque of 6Nm.
Proceed as follows to insert the pinion onto the output shaft.
Ensure that the chain is channelled into the guide found on the protection block **A** on the swing arm. Insert the pinion into the chain and whilst turning the tensioner **B** downwards, insert the pinion onto the output shaft until it reaches the Seeger mounted onto the shaft. Insert the external Seeger. Let the tensioner go and whilst turning the wheel ensure that no blockage occurs.

4.3.1 Flywheel covers, versions 125cc - 200cc

Then couple the flywheel casing with the engine by means of the three bolts M6x20 that are to be tightened with a torque of 10Nm.
Fix the regulator to the specific screw and tighten to 10Nm.

4.3.2 Flywheel covers, versions 125cc - 200cc

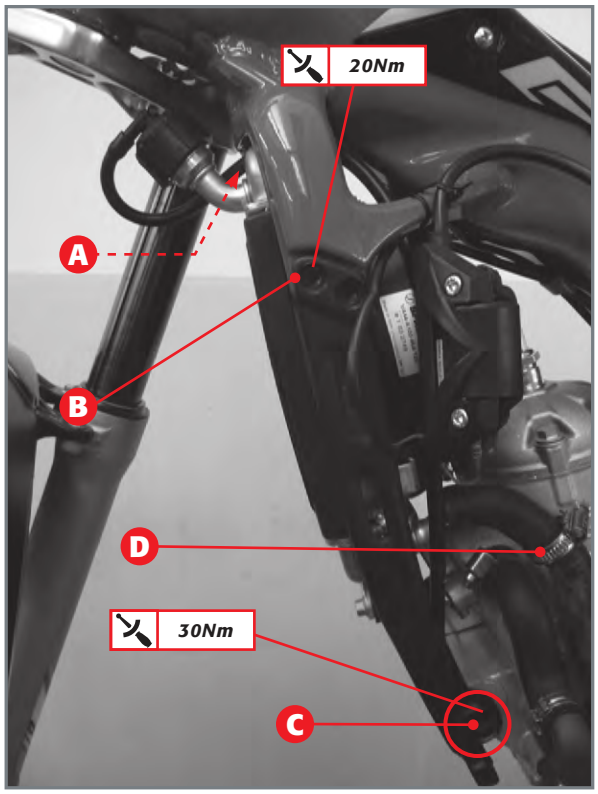
To assemble the flywheel cover of¬ versions 250cc - 300cc, refer to par.3.10.3



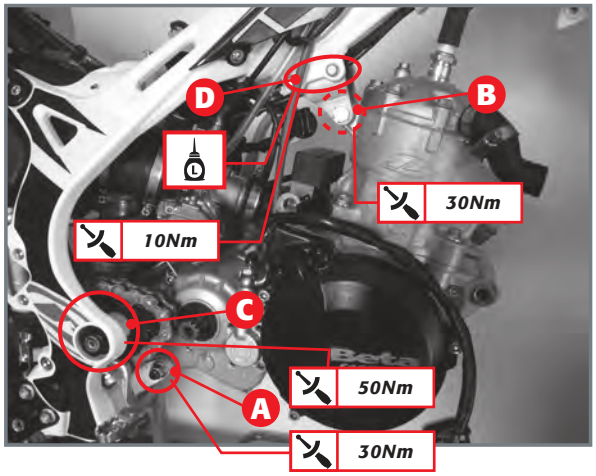
Control unit connectors.

4.4 ELECTRIC CONNECTIONS

Connect the control unit to its connector and reconnect connectors **A** and **B**.
Apply the control unit support complete with control unit and connectors to the frame and fasten it with the screw **A**. Tighten to 5Nm.
Then reassemble the rear mudguard by tightening its bolts with a torque of 5Nm after having connected the relative connector to the back light.



Reassembling the water radiator.





Reassembling the coil and support.

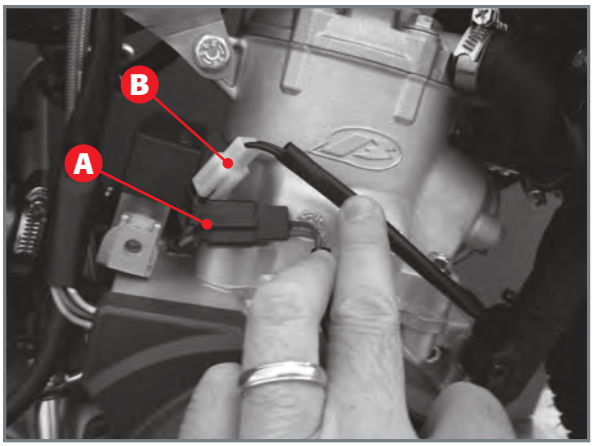
4.5 REMOUNTING THE COMPLETE WATER RADIATOR AND COIL

Insert the upper bolt **A** of the radiator into the special housing found on the frame and insert the four bolts **B** (two on each side), without tightening them well, which fasten the engine brackets to the frame. Then insert the front engine bolt **C**.
Tighten the four bolts **B** (M6x1.25x16) that fasten the engine brackets to the frame with a torque of 20Nm and then the front engine bolt **C** (M10x1.5x127) with a torque or 30Nm.
Then tighten the anchor nuts and bolts between the engine and frame as explained in paragraph 4.2, with the following torque values.

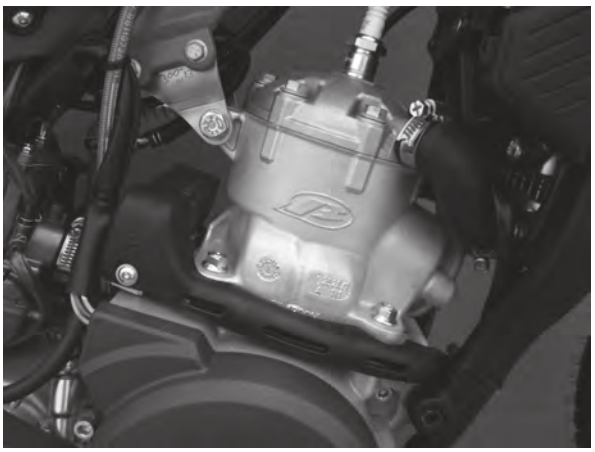
Component	Tightening torque [Nm]
Lower bolt A (10x1,25x100)	30
Upper bolt B (8x1,25x55)	30
Swing arm bolt C (16x1,25x155)	50
Screw (6x20) D + threadlock	10

Connect the water pipes to the radiator, reposition the metal clamps and tighten.

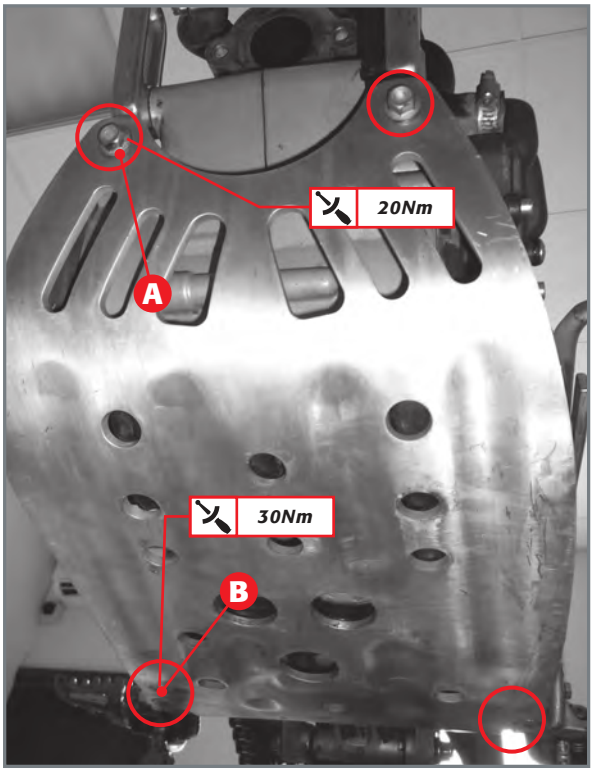
Put the coil, with its support, back in its housing in the radiator. Put the screw in and tighten.



Reconnect the relative connectors **A** and **B** respectively to the solenoid valve and to the thermal bulb.



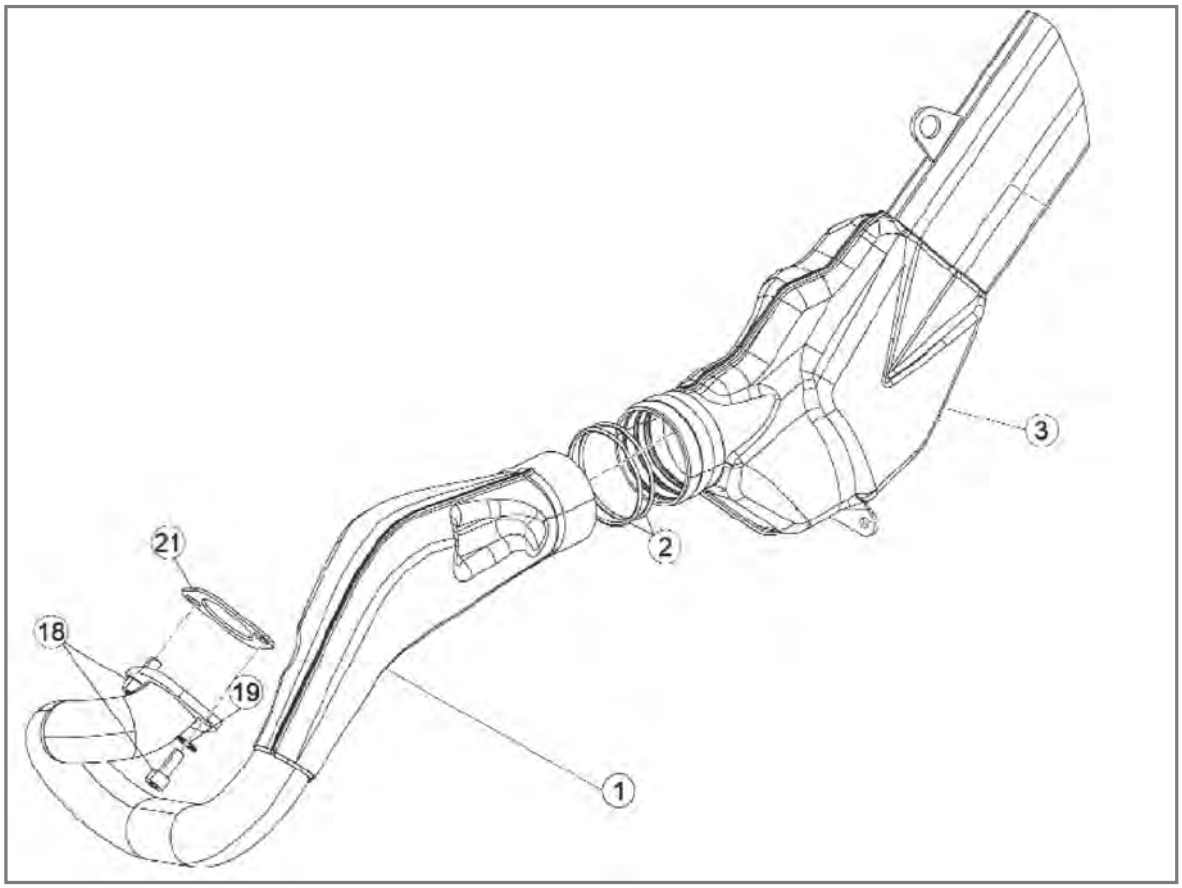
Apply the specific wiring protection and fix it with the screw M5x12.



Engine protection plate.

4.6 ENGINE PROTECTION PLATE

Put the rubber engine protection and the link protection back on the plate, bring the assembly close to the engine, insert and tighten the respective bolts.
The screws **A** must be tightened at 20Nm; the **B** ones at 30Nm.



EXHAUST PIPE EXPLODED VIEW:
1) Exhaust manifold;
2) O-ring;
3) Silencer;
18) Bolt 8x20;
19) Grover washer;
21) Seal

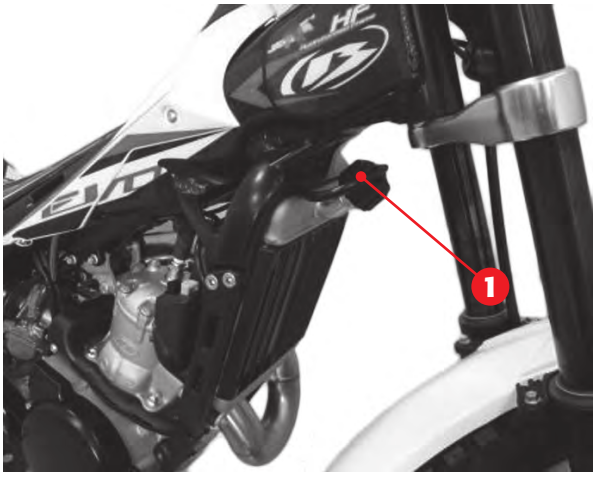
4.7 EXHAUST MANIFOLD

Reposition the exhaust manifold 1 onto the vehicle for the two flange openings to be close to the respective openings on the cylinder. Couple the manifold with the silencer 3, interpose the seal 21 between the cylinder and the exhaust manifold and insert bolt 18 (M8x1.25x20) into the opening on the right side of the cylinder. Push the manifold into the silencer whilst paying utmost attention to O-rings 2 so as to ensure they do not get entangled and break.
Insert the second bolt 18 (M8x1.25x20) into the left opening on the manifold flange and tighten the two bolts 18 with a torque of 23Nm. To facilitate the tightening process, it is recommended to turn the handlebar to either side so as to leave more handling space when using a hexagonal spanner with a spherical head.

4.8 START-UP AND GEAR LEVER

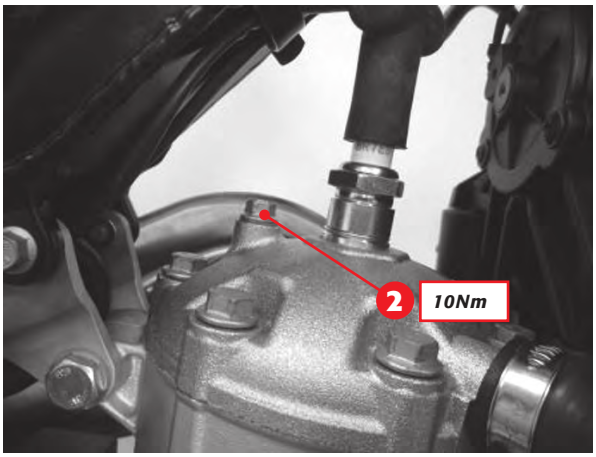
Insert the start-up lever into the specific slotted shaft and place it in such a way that when idle, the foldable part is inserted into the housing on the exhaust manifold. Tighten the bolt M6x16 with a torque of 23Nm after having applied the thread stoppers 100m sp sichel.
Insert the transmission control lever into the specific slotted shaft by placing it in a horizontal position or in the most comfortable position for the user. Tighten the locking screw M6x25 with a torque of 10Nm.

FILLING THE COOLING CIRCUIT



To fill the cooling circuit proceed as follows:

- Loosen cap **1**.



- Loosen bleed screw **2** and fill with liquid until it comes out from the screw.
- Tighten screw **2**.



- Position the vehicle as indicated in the figure and proceed filling.
- Reapply filling cap **1**.

TABLE OF TIGHTENING TORQUES OF THE ENGINE COMPONENTS

Fastening	Component	Cl.R.	Pcs.	Thread stoppers	Torque [Nm]
THERMAL UNIT					
Head - Cylinder *(head with internal cap)*	Special bolt M7x31	12.9	7		20-22
H2O pump cover	Allen screw M5x16	8.8	3		6
	TTLIC Screw M6x8	4.8	1		5
CRANKSHAFT UNIT					
Primary gear screew	Special screw M12x1.25	10.9	1		120
Flywheel-nut	Special nut M16x1.25 ch24	8	1		140
Flywheel nut 250-300	Spec. nut M14x1,5 ch 19	X	1		120
BASE UNIT					
Right casing - Left casing	Allen screw M6x50	8.8	11		10
Clutch casing - Left casing	Screw M6x20	8.8	3		10
	Screw M6x30	8.8	2		10
	Screw M6x35	8.8	2		10
Cylinder - Casing	Stud bolt M8x46	8.8	4		20-23
*Cylinder - Casing	Stud bolt M8x41	8.8	4		20-23
Special flanged nut	M8 ch10	8	4		20-23
Flywheel cover	Allen screw M6x20	8.8	3		10
Clutch cover	Allen screw M6x20	8.8	4		10
Intake manifold	Allen screw M6x20	8.8	4		7
Oil level cap	M16x1.25	-	1		10
Oil indicator cap	M16x1.5	-	1		-
Oil drain cap with magnet	M16x1.25	-	1		10
IGNITION UNIT					
Pick-up fastening	Allen screw M6x12	8.8	2	Medium resistant thread stoppers	8
Stator fixing 125-200	Allen screw M5x12	8.8	3	Medium resistant thread stoppers	6
Stator fixing 250-300	Allen screw M5x25	8.8	3	Medium resistant thread stoppers	6
Kickstart idler clutch pin	Allen screw M8x20	8.8	1		23
Start-up lever	Bolt M8x16 ch10	8.8	1	Medium resistant thread stoppers	23
Spring return start-up lever	Allen screw M6x20	8.8	1		10
	Nut M6x3.5 ch10	04	1		10
Sleeve	Special bolt M12x1.25	-	1		10
Spark plug	N7YCC M14x1.25	-	1		25-30
GEARBOX UNIT					
Gear stop cam	Screw M6x30 TSPCE	10.9	1	Medium resistant thread stoppers	11
Gearbox control lever	Bolt 6x25	8.8	1	Medium resistant thread stoppers	10
CLUTCH UNIT					
Clutch-nut	Special Nut M14x1,25x6 ch10	0,4	1	Medium resistant thread stoppers	70
Clutch cap	Bolt M6x16 ch10	8.8	6		10

** For a 125 cc engine*

TABLE OF TIGHTENING TORQUES OF THE ENGINE-FRAME

Fastening	Component	Cl.R.	Pcs.	Thread stoppers	Torque [Nm]
ENGINE TO FRAME ANCHOR					
Front fitting	Bolt M10x1.5x127	5.8	1		25
Rear fitting	Bolt M10x1.25x100	5.8	1		30
Engine head fitting	Bolt M8x1.25x55	8.8	1		30
Engine bracket fitting	Bolt M6x1x50	8.8	2		10
Engine/Swing arm/Frame	Bolt M16x1.25x255	5.8	1		50
Engine arms/Frame	Screw M8x1.25x16	8.8	4		20
ENGINE PROTECTION PLATE UNIT					
Engine protection plate *(front)*	Screw M8x1.25x16	8.8	2		20
Engine protection plate *(rear)*	Screw M8x1.25x20	8.8	2		30

ENGINE SPECIFICATIONS

Type	2-stroke single-cylinder liquid-cooled			
	EVO125	EVO200	EVO250	EVO300
Bore for Stroke	54 x 54	64 x 60.5	72,5 x 60.5	79 x 60.5
Displacement [cm³]	123.6	194.6	249.7	296.5
Compression ratio	16.1:1	11.8:1	8.9:1	10.2:1
IGNITION SYSTEM				
Electronic: Hidria 12V-85W				
Spark plug: NGK BR7ES (250cc)				
Spark plug: NGK IR GR7CI-8 (300cc)				
IGNITION SYSTEM 250cc - 300cc				
Electronic: Hidria 12V-110W				
Spark plug: BPR7ES (250cc)				
Spark plug: NGK IR GR7CI-8 (300cc)				
TRANSMISSION				
	EVO125	EVO200	EVO250	EVO300
Primary transmission	20/71	20/71	22/69	22/69
1st gear ratio	12/34	12/34	12/34	12/34
2nd gear ratio	14/32	14/32	14/32	14/32
3rd gear ratio	15/29	15/29	15/29	15/29
4th gear ratio	18/27	18/27	18/27	18/27
5th gear ratio	24/22	24/22	24/22	24/22
6th gear ratio	28/18	28/18	28/18	28/18
Secondary transmission	9/43	11/42	11/41	11/41
CARBURETOR				
	EVO125	EVO200	EVO250	EVO300
Carburetor type	PWK F28	PWK F28	PWK F28	PWK F28
Main jet	130	125	125	125
Slow jet	55	48	48	48
Ignition jet	60	60	60	60
Needle	JJH	JJH	JJH	JJH
Needle position (from top)	4	4	4	4
Air mixture screw turns (from all closed)	1+1/2	2+1/2	2+1/2	2+1/2

RECOMMENDED LUBRICANTS AND LIQUIDS

APPLICATION	PRODUCT	QUANTITY			
Gearbox and clutch box	LIQUI MOLY RACING 4T 10W-30	550 ml			
Supply	LIQUI MOLY RACING SYNTH 2T	1,5% (percentage of oil with respect to fuel)			
Cooling system	LIQUI MOLY COOLANT READY MIX RAF12 PLUS	Displacement	125	200	250-300
		With dry circuit [ml]	630	585	530
		With empty circuit [ml]	530	485	420

NOTES:

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