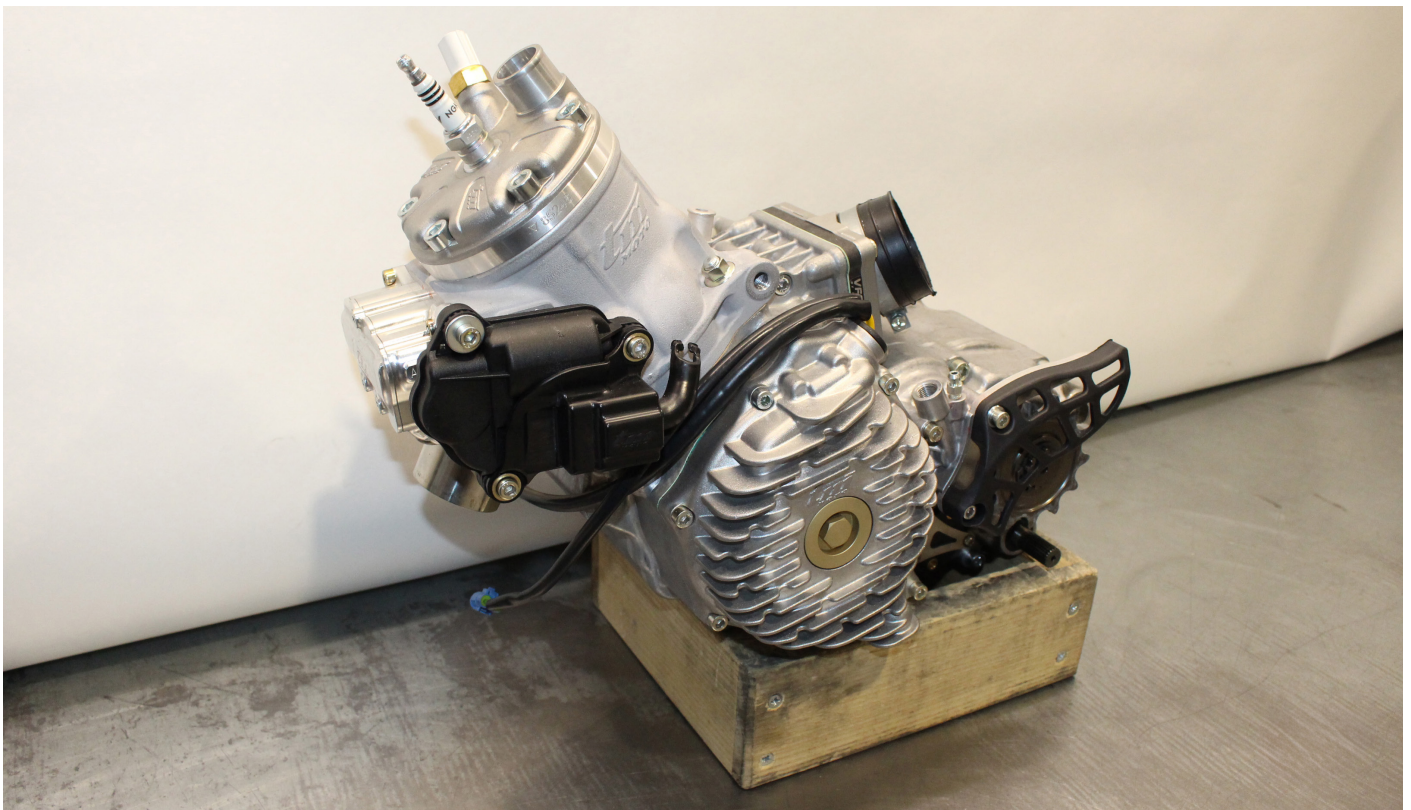




# Workshop Manual



## 2 STROKE ENGINE

MX - EN - SMK - SMR

# 125





## Foreword

This publication, to be used by TM Moto workshops, has been drawn-up to assist authorised personnel in the maintenance and repair of motorcycles handled. Perfect knowledge of the technical data stated herein is decisive for the most complete professional training of the operator.

In order to make it easier to understand, the paragraphs have been distinguished by schematic illustrations, which highlight the topic in question.

Always operate in compliance with the accident-prevention regulations in force, using suitable PPE.

---

## COOLANT LIQUID

### DANGER

**FIRE RISK: IN SOME CONDITIONS, THE COOLANT IS FLAMMABLE. ITS FLAMES ARE INVISIBLE, BUT CAN CAUSE BURNS.**

**DO NOT POUR COOLANT ONTO EXHAUST SYSTEM COMPONENTS OR ONTO ENGINE COMPONENTS, SINCE THEY COULD BE HOT AND IGNITE THE COOLANT, WITH THE RISK OF BURNS. KEEP IN MIND THAT THE FLAMES ARE INVISIBLE.**

**COOLANT MAY IRRITATE THE SKIN AND IS TOXIC IF SWALLOWED.**

**KEEP COOLANT OUT OF THE REACH OF CHILDREN**

**COOLANT IS HIGHLY POLLUTANT. THEREFORE, AFTER USE, IT MUST BE DISPOSED OF AT SPECIAL COLLECTION CENTRES IN COMPLIANCE WITH THE REGULATIONS IN FORCE IN THE COUNTRY IN WHICH THE MOTORCYCLE IS USED.**

---

## USED ENGINE OIL AND GEARBOX OIL

### DANGER

**KEEP OUT OF THE REACH OF CHILDREN.**

**ENGINE OIL AND GEARBOX OIL CAN SERIOUSLY DAMAGE SKIN IF HANDLED REGULARLY OVER LONG PERIODS OF TIME.**

**WASH YOUR HANDS THOROUGHLY AFTER HANDLING THE OIL.**

**WEAR LATEX GLOVES OR EQUIVALENT DURING MAINTENANCE WORK ON THE MOTORCYCLE.**

**OIL IS HIGHLY POLLUTANT. THEREFORE, AFTER USE, IT MUST BE DISPOSED OF AT SPECIAL COLLECTION CENTRES IN COMPLIANCE WITH THE REGULATIONS IN FORCE IN THE COUNTRY IN WHICH THE MOTORCYCLE IS USED.**

**DO NOT POUR USED OIL INTO DRAINS OR RIVERS. DISPOSE OF FILTERS AT SPECIAL COLLECTION CENTRES IN COMPLIANCE WITH REGULATIONS IN FORCE IN THE COUNTRY IN WHICH THE MOTORCYCLE IS USED.**

## Useful advice

In order to prevent problems on reaching an excellent final result, **TM Moto** recommends that the following generic regulations are complied with:

- in the event of any repair, assess the impressions of the Customer reporting the operating anomalies of the motorcycle and formulate appropriate questions in order to clarify the symptoms of the problem;
- clearly diagnose the cause of the anomaly. From this manual it is possible to assimilate the essential theoretical bases, which, moreover, must be integrated by personal experience;
- plan the repair rationally, in order to prevent downtimes, receiving spare parts, preparation of tools etc.;
- reach the item to repair, limiting to the essential operations.

In this regard, consulting the disassembly sequence shown in this manual, will be of great help.

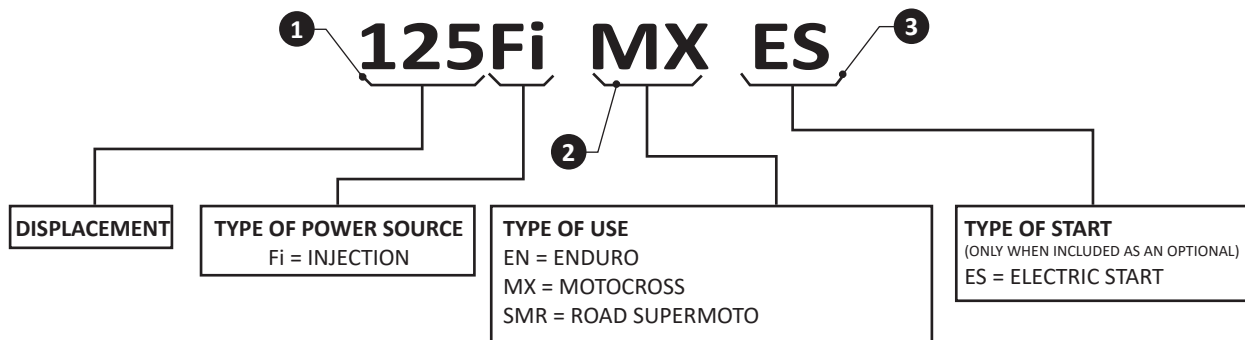
## General repair-related regulations

- 1 Always replace the gaskets, sealing rings and the cotter pins with new parts.
- 2 When loosening/tightening nuts or screws, always start with the largest ones or from the centre. Lock at the coupling torque prescribed, following a crosswise pathway.
- 3 Always mark all parts or positions that could be exchanged on re-mounting.
- 4 Use original spare parts and recommended lubricants.
- 5 Use special tools, where specified.
- 6 Consult official Technical Memos, since they could contain more updated state adjustment data and methods of intervention, with respect to this manual.

**TM Moto SRL**, declines all liability for any errors in the compilation of this manual, and reserves the right to make any modifications required for the development of its products. Illustrations shown are approximate and, in some cases, may not precisely correspond with the part referred to. Reproduction of this publication, even partial, without written authorisation is prohibited.

## RECOGNIZING TM RACING MOTORCYCLE MODELS

### EXAMPLE OF MOTORCYCLE MODEL



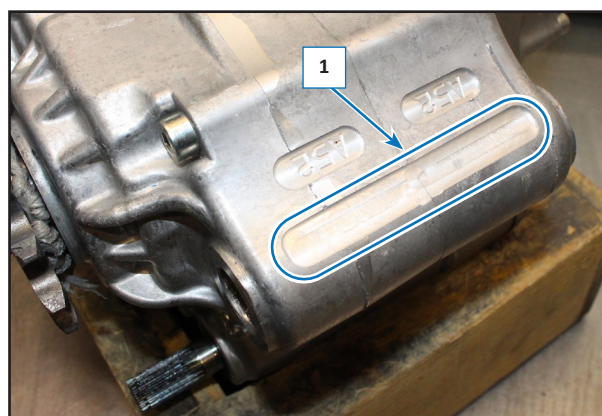
The displacement, type of power source and type of use define the motorcycle model and engine of each TM Racing motorcycle. The combination of codes 1 and 3 identifies the standard engine type. The combination of the three codes fully identifies the motorcycle model. All 3 codes are usually used in this Manual, to specify the motorcycle model to which certain information refers. If only codes 1 and 3 are indicated, followed by the word "ALL", it means that the information relates to all motorcycles with standard engine, regardless of the type of use. Code 2 (Type of Use) used alone means that the information refers to all motorcycles with that type of use, regardless of displacement and power source. All EN/SMR/SMM models are equipped as standard with electric start (ES) as well as kick start (KS). MX/SMX models have KS as standard and may be equipped with ES as an option.

Please make a note of your motorcycle's serial numbers in the boxes below. When it is necessary to contact TM for spare parts, updates or to report any issues, always quote the model, displacement, year of manufacture and, above all, the frame serial number and engine serial number.

### ENGINE SERIAL NUMBER

The engine serial number (1) is embossed into the rear part of the engine, near to the shock absorber.

Make a note of this number in the relevant space at the beginning of the manual.



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**ENGINE TECHNICAL DATA 125 MX**

ENGINE		125
Tipo		Single cylinder 2-stroke, liquid-cooled
Displacement		124,6 cm <sup>3</sup>
Bore/stroke		54x54,4
Compression		14.8:1
Fuel		(E5) / (E10) super unleaded fuel mixed with oil at 3%
Squish height		1.0/1.1 mm
Piston height from the cylinder surface to the PMS		- 1.6 mm
Piston cylinder tolerance		0,05 / 0,06
Engine shaft supports		1 roller (LH) + 1 ball (RH)
Small-end bearing		Silver-coated shims roller bearings cage
Big-end bearing		needle roller cage
Piston		cast in light alloy
Segments		2 segments (GAP 0.40 / 0.45)
Gearbox oil quantity		800 cc
Primary transmission		straight-tooth gears 18/63
Clutch		multiple disc oil bath
Gearbox (with front couplings)		6 gears
Gear ratios	1 <sup>a</sup>	15-31
	2 <sup>a</sup>	16-29
	3 <sup>a</sup>	18-27
	4 <sup>a</sup>	18-23
	5 <sup>a</sup>	21-23
	6 <sup>a</sup>	22-22
Generator		KOKUSAN
Spark plug		CR9EIX
Electrodes distance		0,7-0,8 mm
Cooling		fluid, 40% antifreeze, 60% water (up to -25°C), circulation forced with pump
Fluid amount		1 liter (see page 4-92)
Engine control unit		eMoticom - em103
Exhaust valve actuator		SBS



## ENGINE TECHNICAL DATA 125 EN - SMR

ENGINE		125 EN	125 SMR
Tipo		Single cylinder 2-stroke, liquid-cooled	
Displacement		124,6 cm <sup>3</sup>	
Bore/stroke		54x54,4	
Compression		14.8:1	14.3:1
Fuel		(E5) / (E10) super unleaded fuel	
Engine lubrication		separated with Mikuni pump driven by engine ECU	
Squish height		1.0/1.1 mm	
Piston height from the cylinder surface to the PMS		- 1.6 mm	
Piston cylinder tolerance		0,05 / 0,06	
Engine shaft supports		1 roller (LH) + 1 ball (RH)	
Small-end bearing		Silver-coated shims roller bearings cage	
Big-end bearing		needle roller cage	
Piston		cast light alloy	
Segments		2 segments (GAP 0.40 / 0.45)	
Gearbox oil quantity		800 cc	
Primary transmission		straight-tooth gears 18/63	
Clutch		multiple disc oil bath	
Gearbox (with front couplings)		6 gears	
Gear ratios	1 <sup>a</sup>	13-32	
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	3 <sup>a</sup>	18-27	
	4 <sup>a</sup>	18-23	
	5 <sup>a</sup>	21-23	
	6 <sup>a</sup>	22-20	
Generator		KOKUSAN	
Regulator		SRU - eMoticom	
Spark plug		CR9EIX	
Electrodes distance		0.8-1 mm	
Cooling		fluid, 40% antifreeze, 60% water (up to -25°C), circulation forced with pump	
Fluid amount		1 liter (see page 4-92)	
Engine control unit		CDI eMoticom - em103	
Exhaust valve actuator		SBS	

## CARBURETTORS SETTING

KEIHIN	125 MX (carburettor)
Needle	N1EH
Needle position	3 <sup>a</sup> mark
Guillotine	7
Maximum jet	180
Idle jet	55
Air screw turns	1/ ¾
Float position	16 mm standard

## ENGINE TIGHTENING TORQUES

Carter Allen screw, transmission torque, clutch torque, ignition torque	M 6	12 Nm
Oil drain screw cap	M14x1.5	20 Nm
Oil load screw cap	M14x1.5	20 Nm
Laminated body Allen screw	M6	12 Nm
Cylinder-head tightening flange screw	M 7	16 Nm
Base-cylinder tightening flange nuts	M 8	28 Nm
Water pump cover Allen screw	M 6	12 Nm
Water pump rotor	M 6	Loctite 243 + 15 Nm
Clutch hub nut	M14x1.5	Loctite 243 + 70 Nm
Clutch springs Allen screw	M 5	8 Nm
Ignition stator Allen screw	M 6	Loctite 243 + 10 Nm
Allen screw for gear blocker	M 6	Loctite 243 + 10 Nm
Gearbox lever Allen screw	M 6	Loctite 243 + 10 Nm
Generic screws/nuts	M 5	8 Nm
Generic screws/nuts	M 6	10 Nm
Generic screws/nuts	M 8	25 Nm
Primary shaft gear nut	M18	70 Nm

## LUBRICATION

Gearbox Oil	Motorex Cross Power 4T – 10W-50
Automatic Mixer Oil	Motorex Cross Power 2T Fully Synthetic
Oil for mix	Motorex Cross Power 2T Fully Synthetic
Clutch Oil	DOT 4
Brakes Oil	DOT 4
Radiator liquid	Motorex Coolant M5.0 ready to use

## MAINTENANCE TABLE

A CLEAN MOTORCYCLE CAN BE INSPECTED FASTER AND AT A LOWER COST

	After 1 hour	Every 15 hours	Every 30 hours (after every ride)	Every 45 hours	Every 80 hours	Every 95 hours	Every 135 hours (75 hours of sports use)	Every year
Clean exhaust screw magnet		•	•					
Check tightness of engine fixing screws		•	•					
Replace spark plug and check cap							•	
Check exhaust valves				•	•			
Check cylinder and piston wear				•				
Fully change piston				•	•			
Exhaust valve actuator clearance check			•					
Exhaust valves replacement					•			
Fully change conrod							•	
Check clutch discs				•				
Check clutch springs				•				
Check transmission and gearbox							•	
Mixer oil pump replacement					•			
Fully change engine bearings						•		
Fully change engine oil seal						•		
Exhaust valve electric motor replacement					•			

**⚠ WARNING**

Change affected components if a defect is found or wear limits exceeded.  
The above operations must be performed by an authorized TM workshop or by specialized personnel.  
The hour meter is built into the dash.

Problem	Cause	Solution
The engine does not start or struggles to start	<b>Insufficient compression</b>	
	<ol style="list-style-type: none"> <li>1. Piston seizing</li> <li>2. Rod head or foot seizing</li> <li>3. Worn piston segments</li> <li>4. Worn cylinder</li> <li>5. Insufficient cylinder head tightening</li> <li>6. Insufficient head gasket sealing</li> <li>7. Spark plug loosened</li> </ol>	Replace Replace Replace Replace Tighten Replace Tighten
	<b>Spark weak or non-existent</b>	
	<ol style="list-style-type: none"> <li>1. Faulty spark plug</li> <li>2. Spark plug encrusted or wet</li> <li>3. Excessive distance between spark plug electrodes</li> <li>4. Apertures or short circuits in the high-voltage cables</li> <li>5. Faulty ECU</li> </ol>	Replace Clean or dry Adjust Check Replace
The engine stops easily		
	<ol style="list-style-type: none"> <li>1. Spark plug encrusted</li> <li>2. Faulty ECU</li> <li>3. Low idle speed</li> </ol>	Clean Replace Adjust
The engine is noisy	<b>The noise seems to come from the piston</b>	
	<ol style="list-style-type: none"> <li>1. Excessive play between cylinder and piston</li> <li>2. Segments or their housing in the piston worn</li> <li>3. Excessive accumulation of carbon deposits in the combustion chamber or on the piston crown</li> </ol>	Replace Replace Clean
	<b>The noise seems to come from the crankshaft</b>	
	<ol style="list-style-type: none"> <li>1. Bench bearings worn</li> <li>2. Rod head radial or axial play high</li> <li>3. Crankshaft gear damaged</li> <li>4. Crankshaft fix. nut loosened</li> </ol>	Replace Replace Replace Tighten
	<b>The noise seems to come from the clutch</b>	
	<ol style="list-style-type: none"> <li>1. Discs worn</li> <li>2. Excessive play between clutch bell and drive discs</li> </ol>	Replace Replace
	<b>The noise seems to come from the gearbox</b>	
	<ol style="list-style-type: none"> <li>1. Gears worn</li> <li>2. Brake grooves consumed</li> </ol>	Replace Replace
The clutch slips		
	<ol style="list-style-type: none"> <li>1. Weakened clutch springs</li> <li>2. Clutch discs worn</li> </ol>	Replace Replace
The clutch opposes resistance		
	<ol style="list-style-type: none"> <li>1. Spring load not even</li> <li>2. Clutch discs bent</li> </ol>	Replace Replace
The gears do not engage		
	<ol style="list-style-type: none"> <li>1. Gearbox fork bent or seized</li> <li>2. Gear ratchets worn</li> <li>3. Forks command pins damaged</li> <li>4. Gears locking ratchets springs broken</li> </ol>	Replace Replace Replace Replace

Problem	Cause	Solution
The shift control pedal does not go back into position	<ol style="list-style-type: none"> <li>1. Selector switch recall spring weakened or broken</li> <li>2. Gear forks worn</li> </ol>	Replace Replace
The gears disengage	<ol style="list-style-type: none"> <li>1. Sliding gears couplings consumed</li> <li>2. Brake grooves worn</li> <li>3. Housings for couplings on the gears worn</li> <li>4. Grooves on the forks command shaft worn</li> <li>5. Forks command pins worn</li> </ol>	Replace Replace Replace Replace Replace
Insufficient engine power	<ol style="list-style-type: none"> <li>1. Air filter dirty</li> <li>2. Low fuel quality</li> <li>3. Intake coupling loosened</li> <li>4. Excessive distance between spark plug electrodes</li> <li>5. Insufficient compression</li> <li>6. Reed valve pack plates broken</li> </ol>	Clean Replace Tighten Adjust Check the cause Replace
The engine overheats	<ol style="list-style-type: none"> <li>1. Combustion chamber and/or piston crown encrusted with carbon residues</li> <li>2. Obstructions to the air flow on the radiator</li> <li>3. Cylinder head gasket sealing faulty</li> <li>4. The clutch slips</li> </ol>	Clean Clean Replace Adjust

## ELECTRIC PART

Problem	Cause	Solution
The spark plug electrodes overheat	<ol style="list-style-type: none"> <li>1. Insufficient distance between electrodes</li> <li>2. Heat rating too high</li> </ol>	Adjust Replace with recommended spark plug
The starter motor does not start or slips	<ol style="list-style-type: none"> <li>1. Faulty starter motor</li> <li>2. Starter gears worn</li> </ol>	Repair or replace Replace





## 1. ADJUSTMENTS/REPLACEMENTS

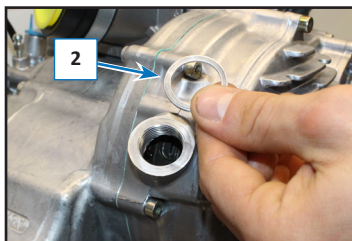
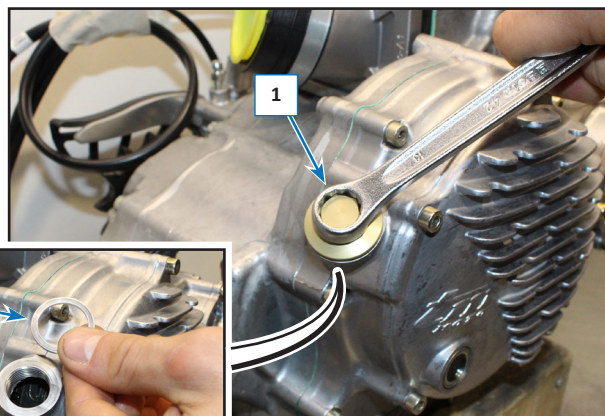
## 1.1 ENGINE OIL AND FILTER CHANGE

The oil must be changed with the engine off but still warm enough to allow the waste oil to flow out easily.

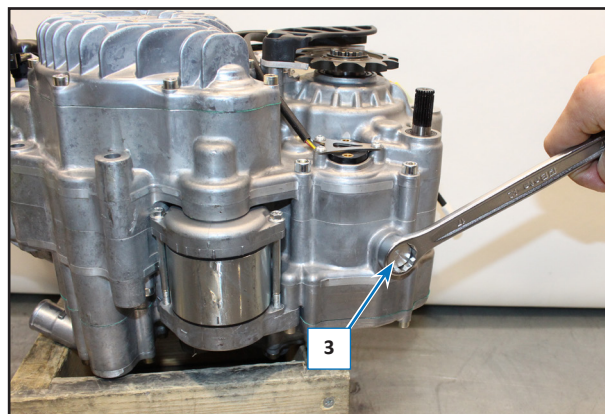
Position the motorcycle on a flat surface and prepare a suitable recipient under the same.

Loosen the introduction cap (1) positioned on the right side of the engine (clutch cover).

Collect the aluminum washer (2).



Unscrew the drain cap (3) located on the lower side of the engine and collect the aluminum washer (4).



Wait for the oil to drain completely through the hole, clean the sealing surfaces, replace the aluminium washers (2 and 4), remove any magnetic debris (5) of the drain cap (3) and screw the cap back on, tightening to 20 Nm (2 kgm, 14,75 ft/lb).

Prepare a measure with the amount of the prescribed engine oil necessary (see table) and pour from the introduction hole.

Repeat the oil level check operation.

Check sealing of the filter cover introduction and drain caps.

### **⚠ DANGER**

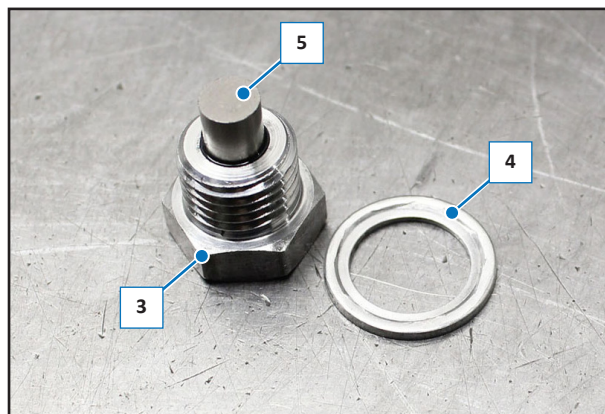
- PAY ATTENTION TO THE HOT OIL AND PARTS OF THE ENGINE; THERE IS A BURNS HAZARD.

### **⚠ WARNING**

- A level that is too low, poor quality oil or maintenance intervals longer than those prescribed, cause serious damage to the gearbox. Do not introduce an excessive amount of oil into the gearbox. If this should happen, drain it as described previously.

### OIL CHANGE QUANTITY TABLE

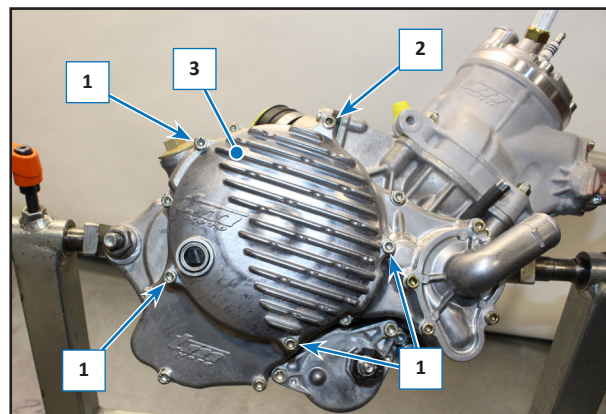
Change oil.....800 gr.



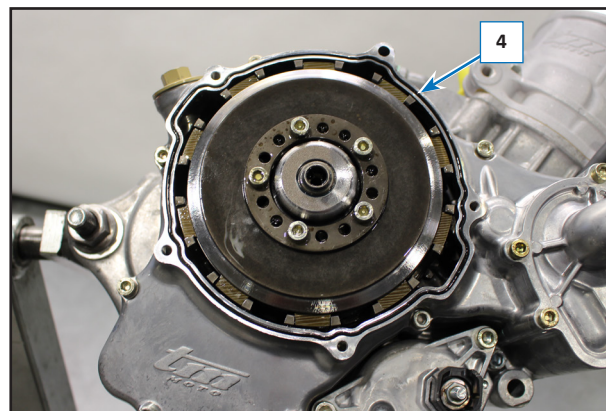


## 1.2 STANDARD CLUTCH REPLACEMENT

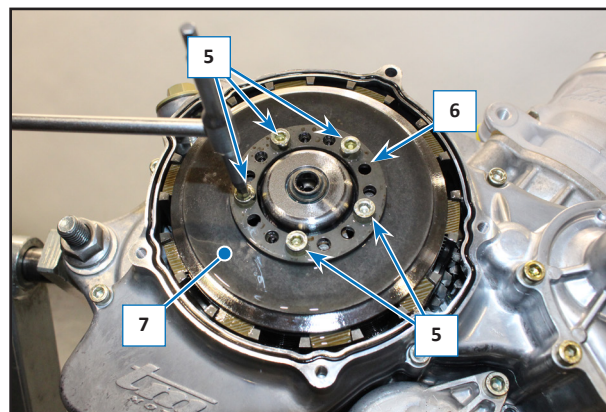
Drain the engine oil as described in the relative paragraph.  
Unscrew M5-55 (1) screws and the M5-L20 (2) screw, then remove the clutch cover (3).



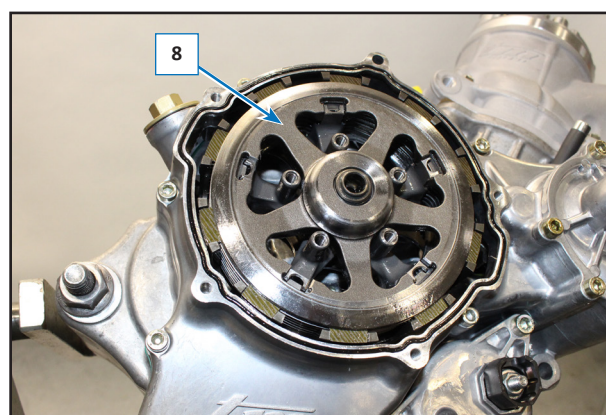
Remove the OR gasket (4).



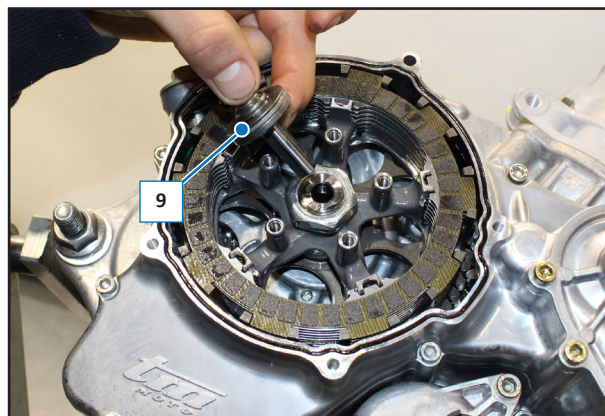
Remove the screws (5) of the clutch pack, loosening them a little at a time until they are completely unscrewed, then remove the ring nut (6) with the relevant cup spring (7).



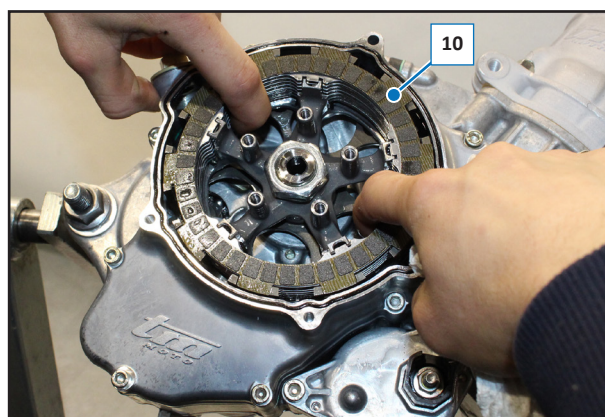
Remove the pressure plate (8).



Remove the pressure plate (9).

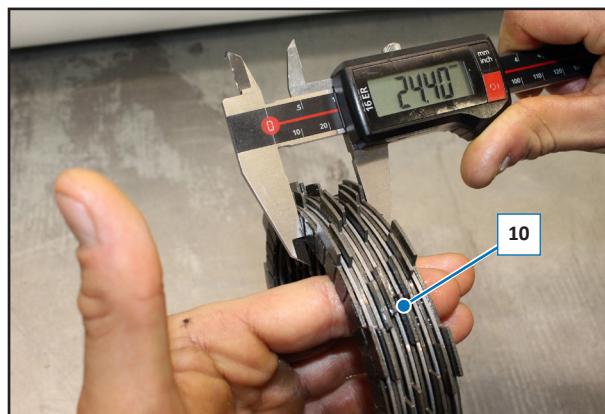


Remove the discs (10).

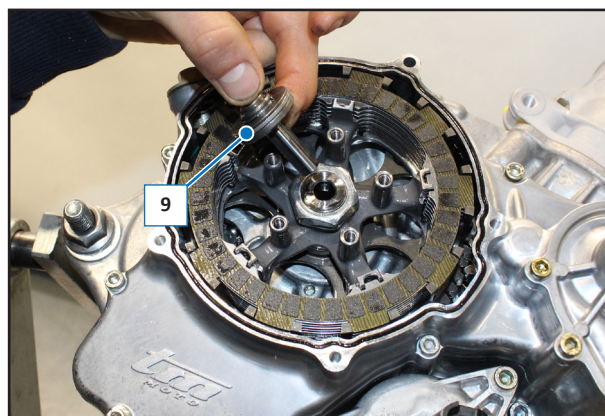


Measure the new clutch pack (10) which must be 24.40 mm. The clutch pack consists of 8 garnished discs and 7 steel discs.

**NOTE:** When reassembling the new discs (10), lubricate them with engine oil and ensure the first and last disc are garnished.

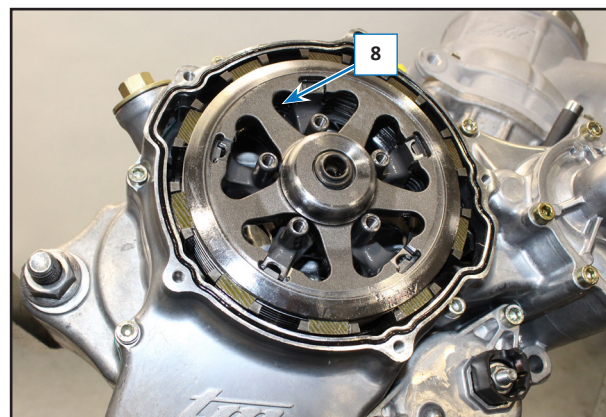


Reassemble the disc pressure plate (9).

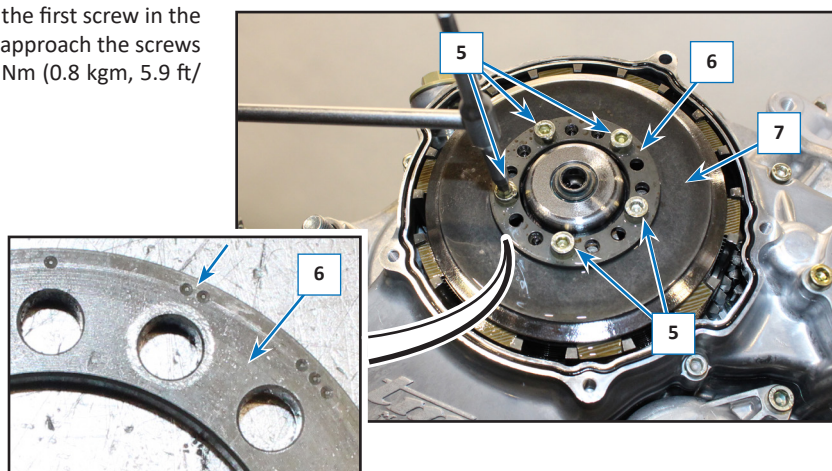




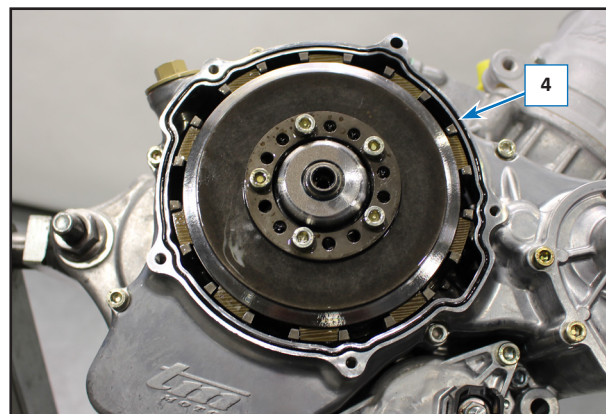
Reassemble the disc pressure plate (8)



Assemble the cup spring (7) and ring nut (6) inserting the first screw in the hole of the ring nut (6) marked with “ • • • ”, then approach the screws (5) alternatively and tighten them with a torque of 8 Nm (0.8 kgm, 5.9 ft/lb).

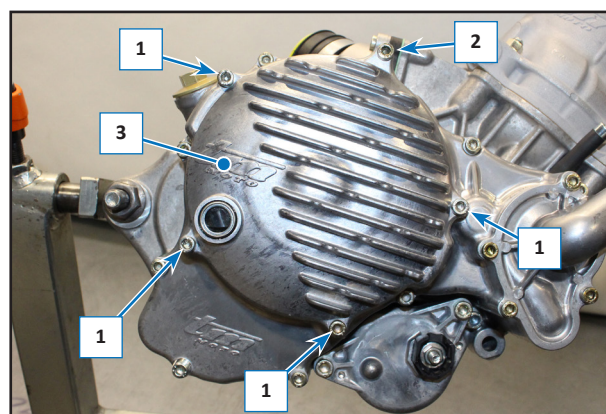


Install a new “OR” seal (4).



Mount the clutch guard (3) and tighten the screws (1), (2) and (3) gradually with a torque of 8 Nm (0.8 kgm/ 5.9 ft/lb).

Introduce oil into the engine oil as described in the relative paragraph.



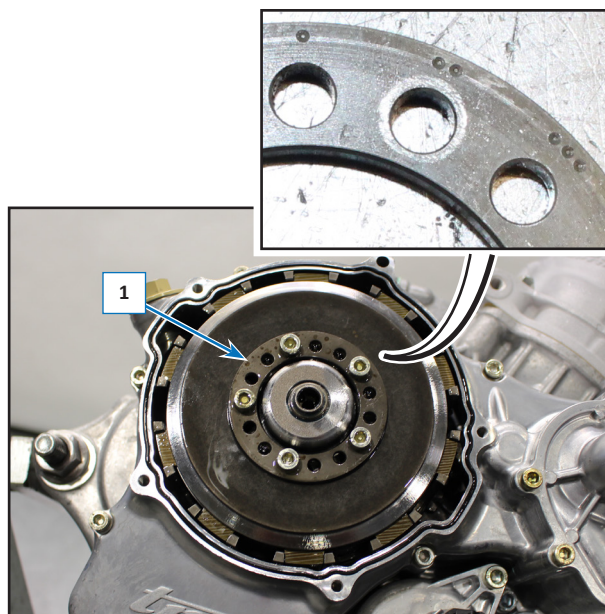


## 2.22.1 Adjusting the spring pre-loading

The ring nut (1) has three assembly positions, indicated by “ • • • • • ”, “ • • • • • ”, “ • • • • • ”.

- “ • • • • • ” The first screw is normally assembled in this “Standard position”;
- “ • • • • • ” Assembling the first screw in this position, the spring pre-loading is decreased slightly;
- “ • • • • • ” Assembling the first screw in this position, the spring pre-loading is increased slightly;

If the clutch does not operate properly even when increasing or decreasing the spring pre-loading, it must be replaced.



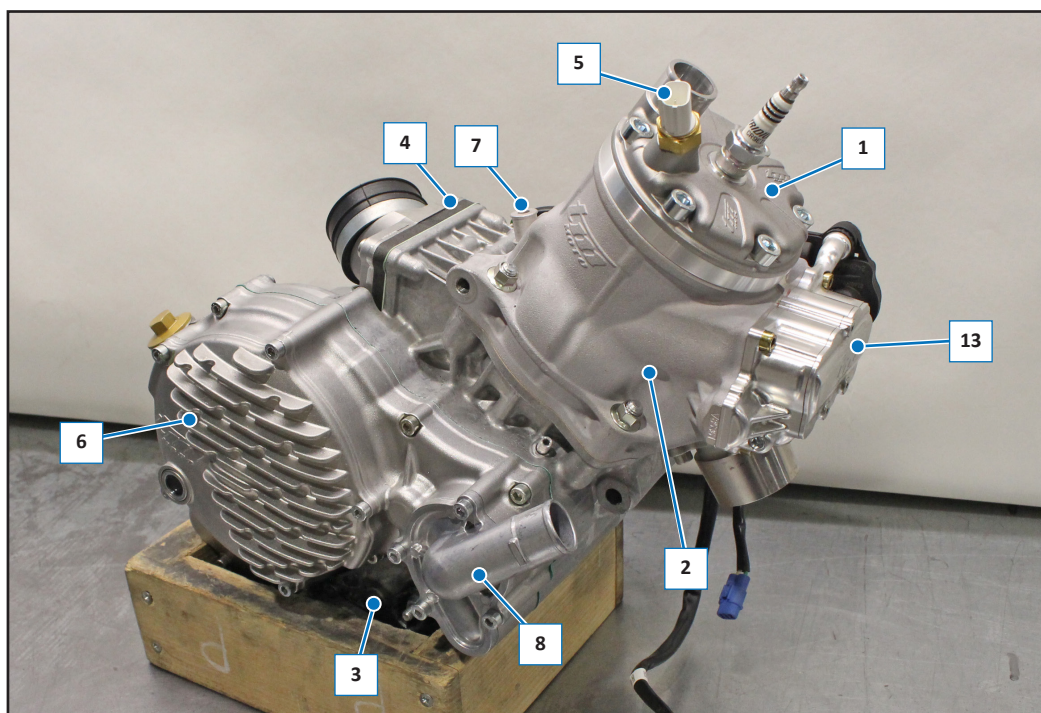
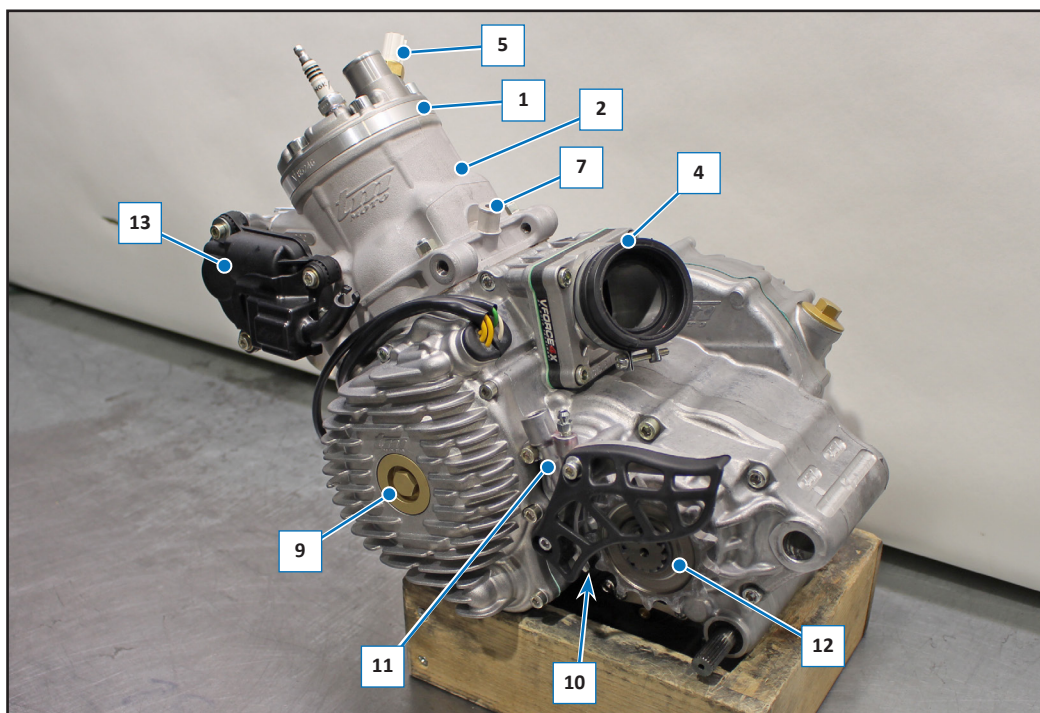


## 2. ENGINE DISASSEMBLY



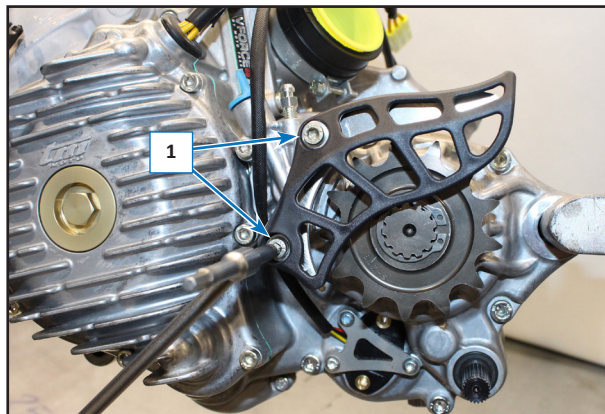
## 2.1 ENGINE COMPONENTS LAYOUT

- 1 Cylinder head
- 2 Cylinder
- 3 Starter motor
- 4 Reed valve pack
- 5 (EN - SMR) Water temperature sensor
- 6 Transmission cover
- 7 (EN - SMR) Pressure sensor fitting
- 8 Water pump
- 9 Ignition cover
- 10 Gear sensor
- 11 Clutch actuator
- 12 Pinion
- 13 Drain valve



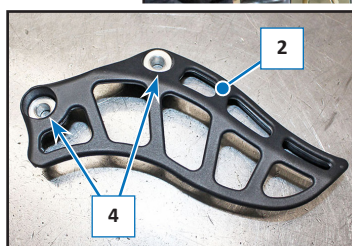
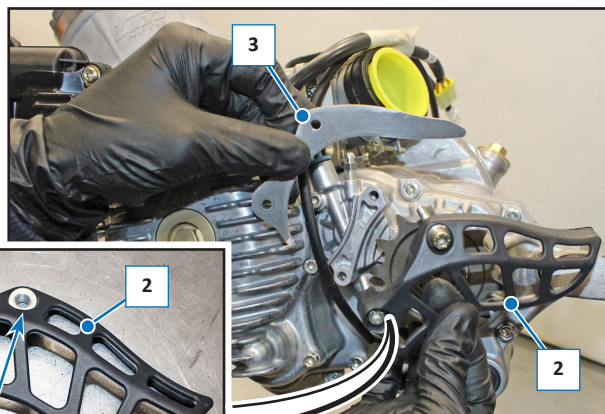
## 2.2 REMOVING THE PINION COVER

Unscrew the two screws (1).



Remove the pinion cover (2) and the protection bracket (3).

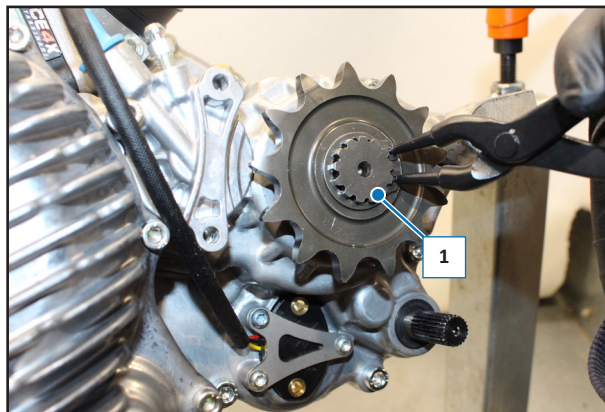
**NOTE:** Upon reassembly, make sure that the two bushes (4) are present on the pinion cover (2). Tighten the two screws (1) with a torque of 15 Nm (1,5 kgm, 11,6 ft/lb)



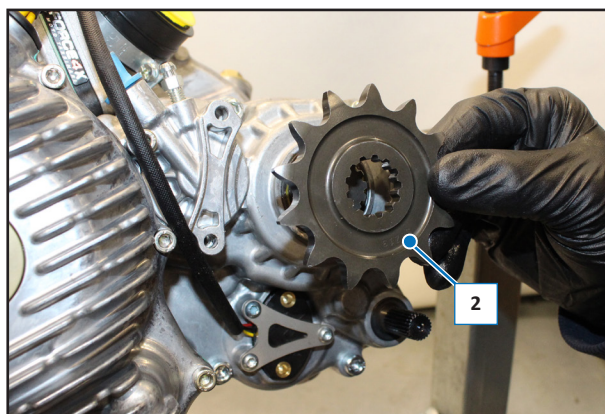
## 2.3 PINION REMOVAL

Remove the pinion cover casing, as described in the relative paragraph.

Remove the seeger ring (1).



Remove the pinion (2).



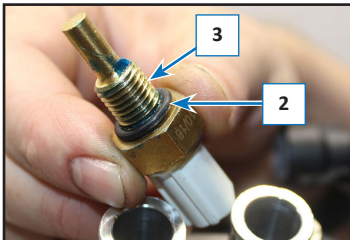
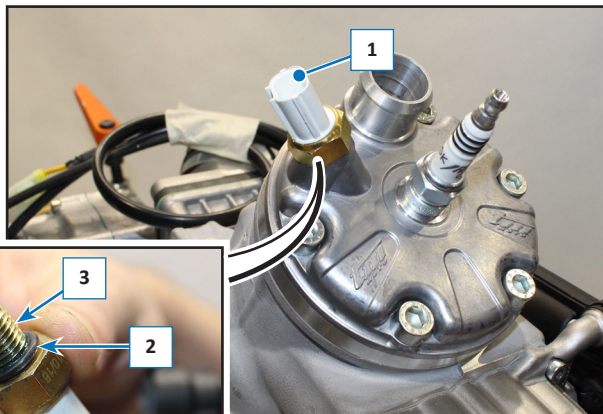


## 2.4 TEMPERATURE SENSOR REMOVAL

Unscrew the sensor (1) and remove it from the head.

Check that the OR gasket (2) is not damaged.

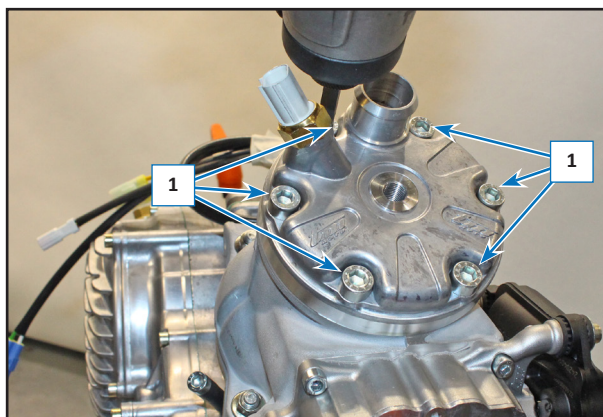
When refitting, smear the thread (3) with lithium grease and screw with a torque of 30 Nm (3,0 Kgm, 22,12ft/lb)



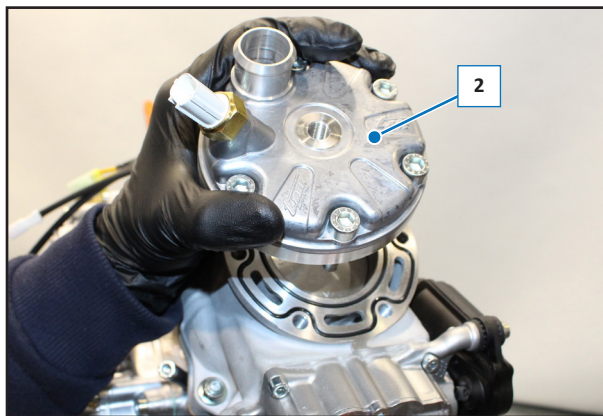
## 2.5 HEAD REMOVAL

Remove the spark plug and the temperature sensor as described in the relative paragraph.

Undo the screws (1).



Remove the head (2).



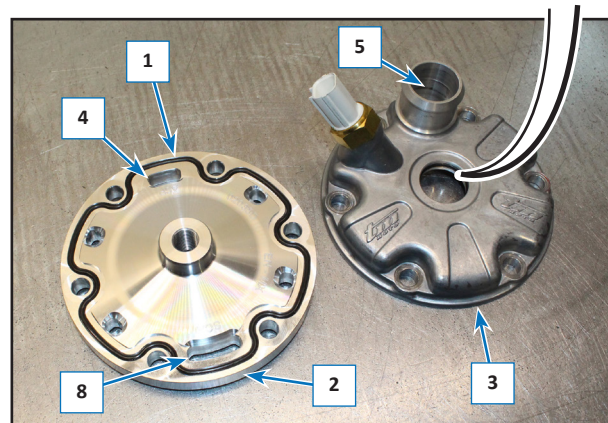
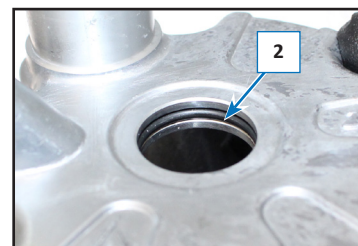
**NOTE:** Upon reassembly, replace the seals (3) and screw the screws (1) without tightening, then tighten them crosswise with a torque of 20 Nm (2,0 kgm, 14,75 ft/lb).



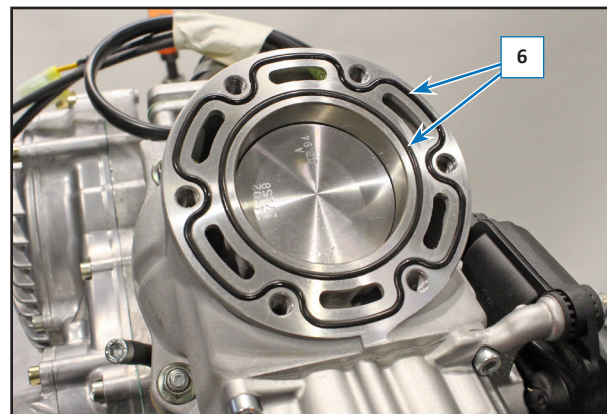
## 2.6 OVERHAULING AND REASSEMBLING THE HEAD

Disassemble the head and replace the seals (1) and (2).

**NOTE:** When reassembling, check proper assembly of the head between the bottom part (2) and the top part (3). The “small” intake hole (4) must be placed at the intake duct (5).

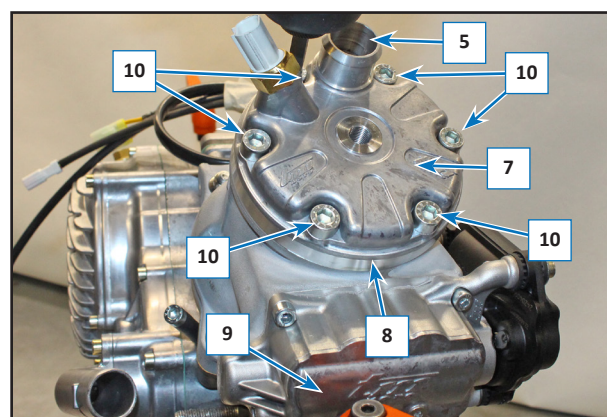


Replace the seals (6) on the cylinder.



Assemble the head (7) on the cylinder, positioning the intake duct on the top of the cylinder so that the exhaust hole (8) is at the exhaust valve (9).

Screw in the screws (10) without tightening them, then tighten them cross-wise at a torque of 20 Nm (2.0 kgm, 14.75 ft/lb).



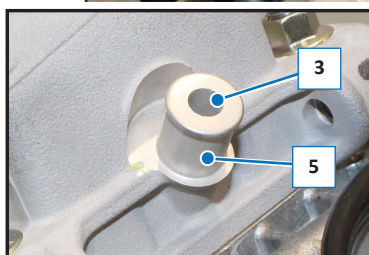
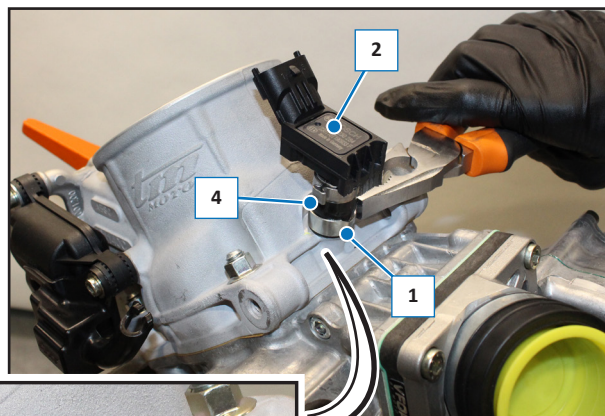
## 2.7 PRESSURE SENSOR DISASSEMBLY

Use pliers to widen the clamp (1).

Raise and remove the sensor (2) and the clamp (1).

Cap the hole (3) using adhesive tape so as that dirt does not enter.

Upon reassembly, work in reverse order checking that the rubber hose (4) enters correctly into the seat (5) and that the hole (3) is not clogged.

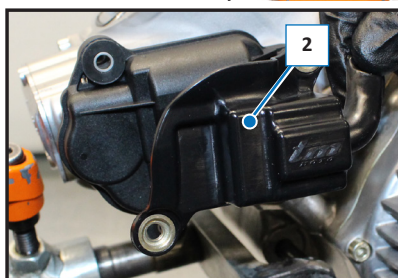
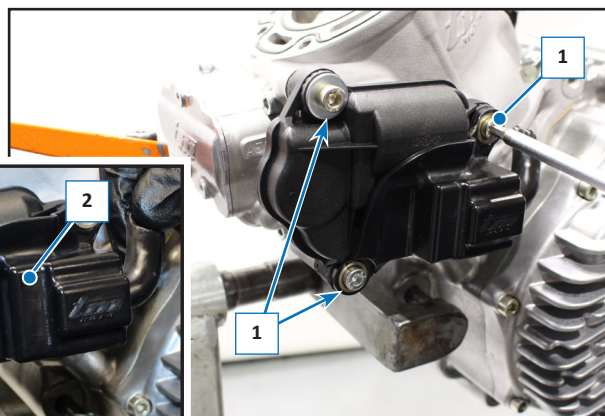


## 2.8 CYLINDER AND PISTON

### 2.8.1 Removing the exhaust valve motor.

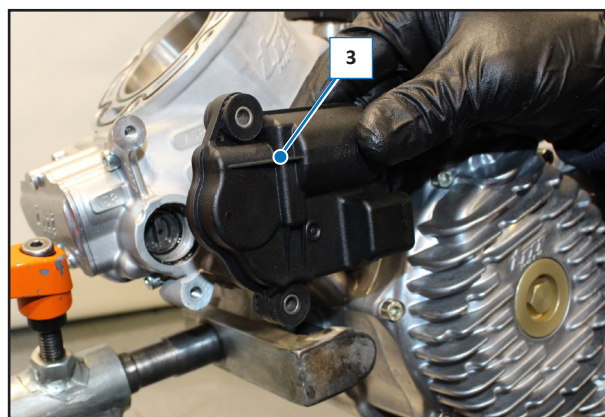
Undo the screws (1).

Remove the connector cover (2).



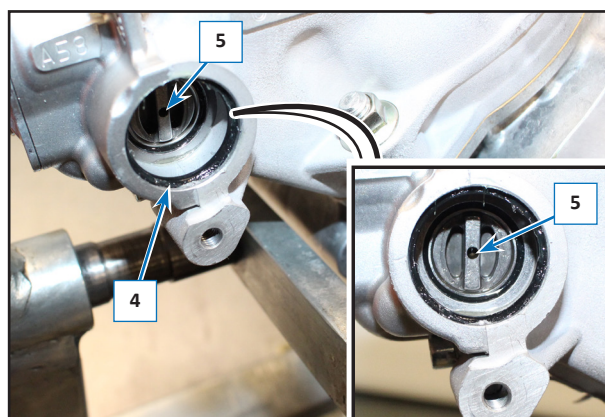
Remove the valve motor (3).

**NOTE:** Do not turn the pin of the valve actuator manually.



Check the condition of the OR seal (4) and replace it if damaged.

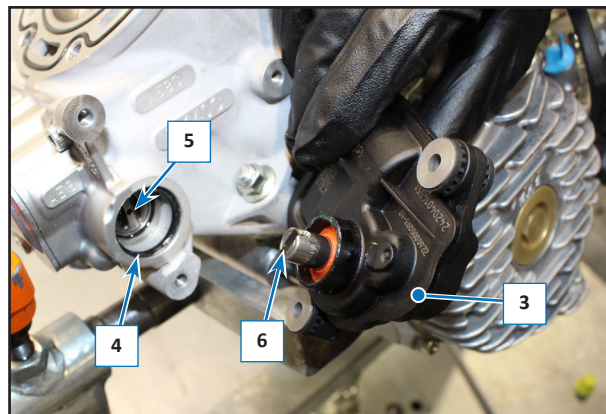
When reassembling, check that the position of the valve (5) is vertical, or turn it manually with pliers if it is not.





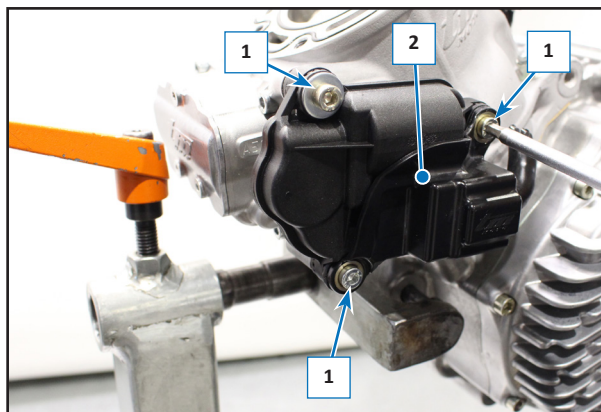
Spread a thin layer of grease on the OR seal (4) and reassemble the motor (3) fitting the ground part of the pin (6) into the valve (5).

**NOTE:** Do not turn the pin (6) manually as the motor may be broken.



Assemble the connector cover (2).

Screw in the screws (1).

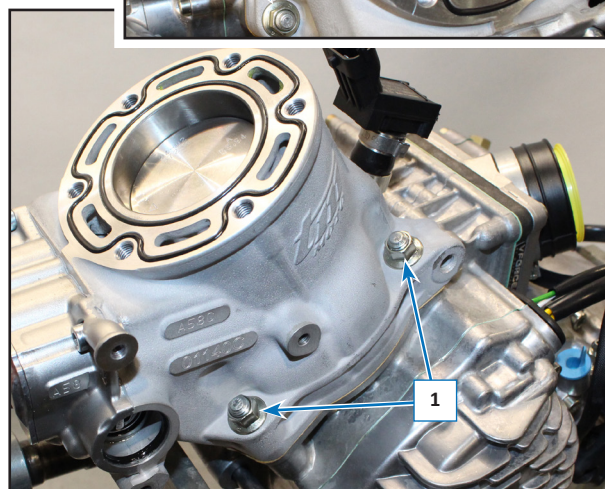
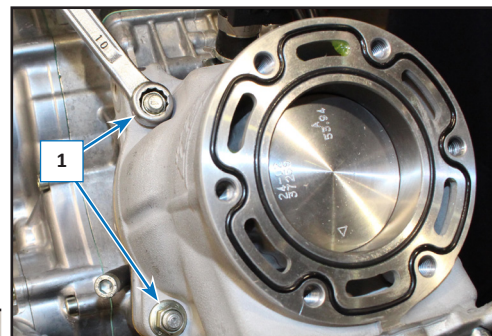


### 2.8.2 Cylinder and piston removal

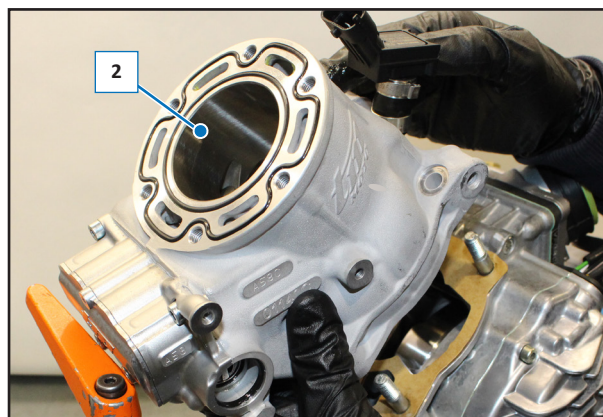
Remove the head and the pressure sensor as described in the relative paragraphs.

Unscrew the nuts (1) as follows:

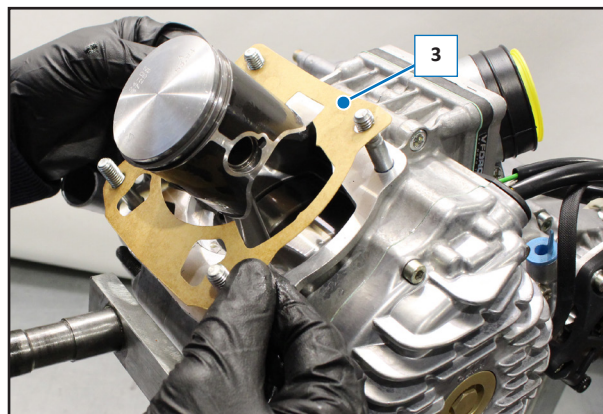
- 1) Loosen the nuts (1);
- 2) Completely unscrew the nuts (1).



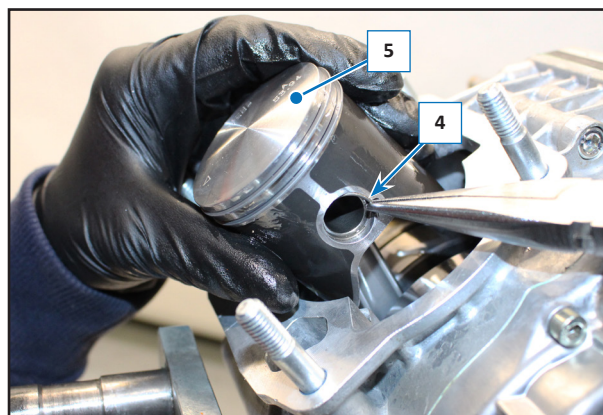
Remove the cylinder (2) by sliding it from the stud bolts.



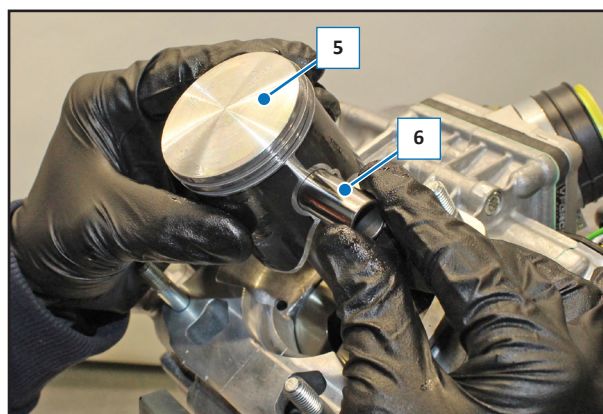
Remove the gasket (3).



Remove the lock ring (4) of the piston (5)

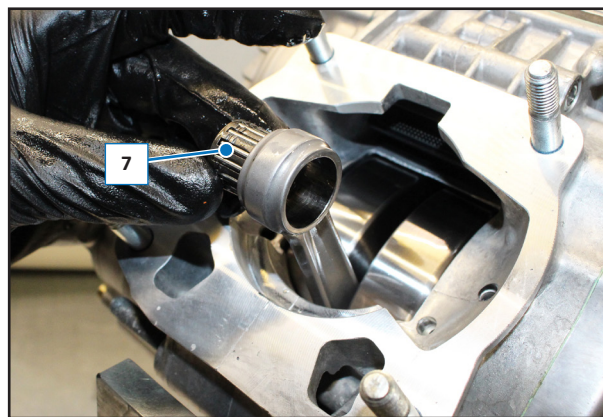


Extract the pin (6) and remove the piston (5).





Remove the roller cage (7).



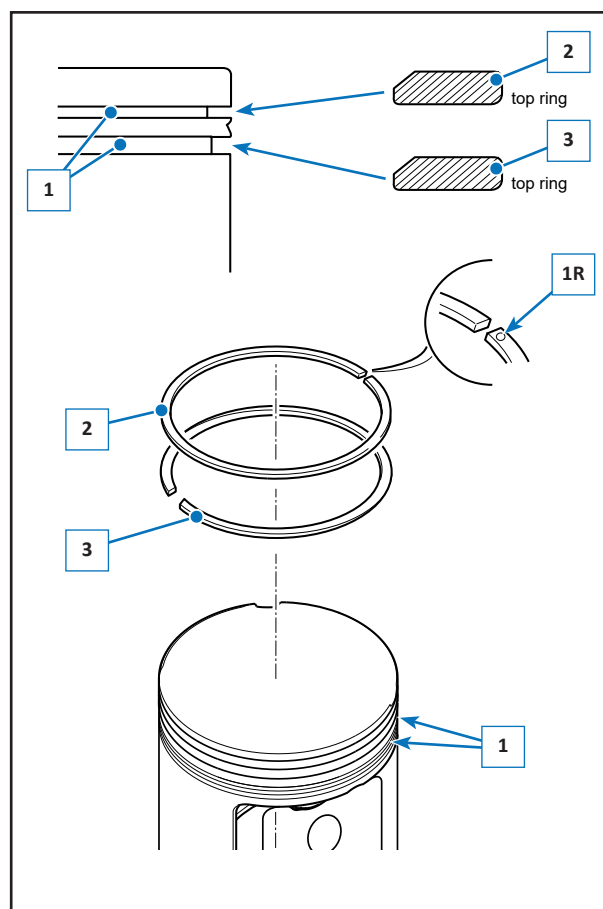
### 2.8.3 Ring mounting

Clean the housing (1) of the rings on the piston from any carbon deposits.

**NOTE:** Apply engine oil on the rings before mounting them on the piston.  
Be careful not to scratch the piston when re-mounting.  
Do not widen the rings excessively during mounting, so that they are not damaged.

Install the rings (2 and 3) positioning them with the face engraved with "1R" on the upper part.

Assemble the straps at the strap stop (4) assembled on the piston.



### 2.8.4 Piston replacement

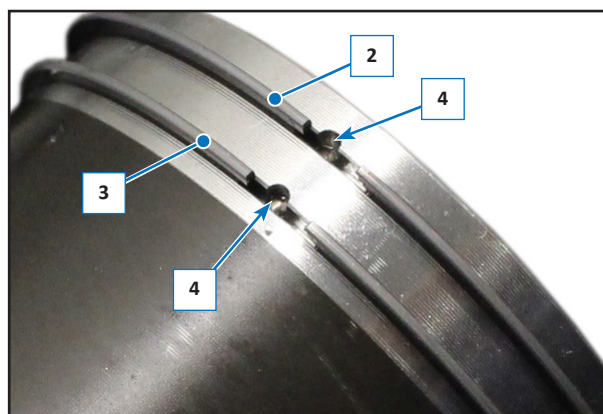
Remove the piston and cylinder as described in the relative paragraph.

### 2.8.5 Piston replacement with intact cylinder

Check the integrity of the cylinder barrel, if the barrel is intact and not scored, clean with scotch brite and wash.

Order the piston and rings of the same size as the original equipment piston:  
tolerance between cylinder and piston 0,05 mm (0,0019 in).

Fit the rings on the piston as described in the relative paragraph.

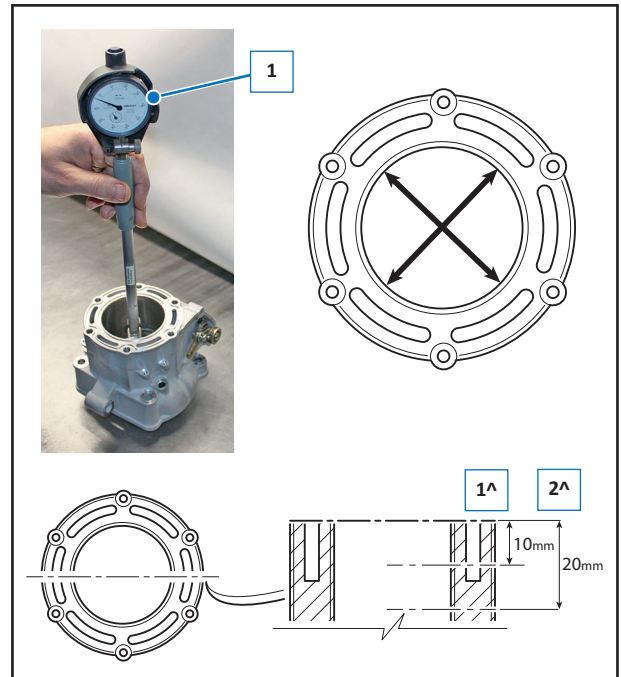


## 2.8.6 Piston replacement with cylinder to be machined

If the barrel of the cylinder is scratched, it is necessary to lap the barrel itself.

After processing it is necessary to measure, with an micrometer (1) for insides, the diameter of the barrel crosswise at 90° first at a distance of 10 mm (0,393 in) from the top of the cylinder and then at a distance of 20 mm (0,787 in) from the top of the cylinder.

Once the measurement has been carried out, order the piston so that the cylinder and piston coupling is 0,05 mm (0,0019 in).

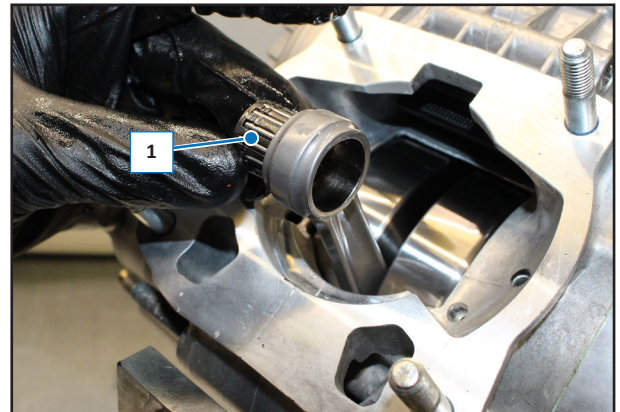


## 2.8.7 Cylinder replacement

When there is a need to replace the cylinder, the piston must also be replaced so that the cylinder and piston are correctly coupled as described in the previous paragraphs.

## 2.8.8 Cylinder and piston re-mounting

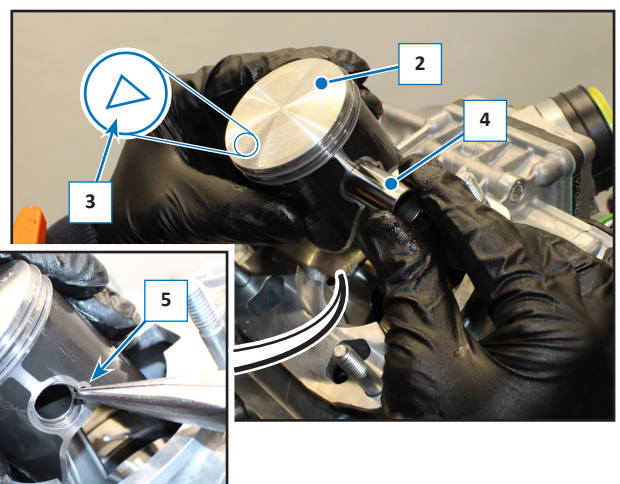
Check the condition of the roller cage (1), if worn replace and reassemble on the connecting rod.



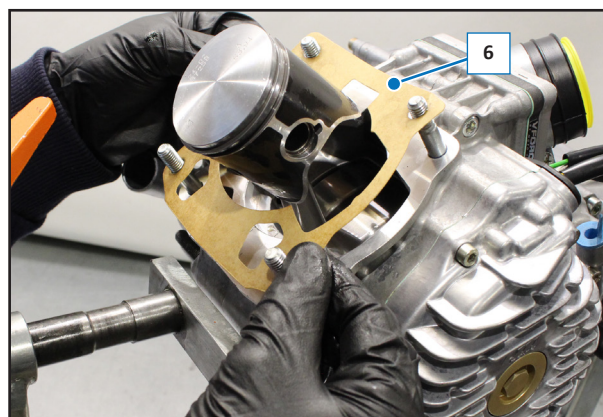
Re-mount the piston (2) on the rod, paying attention that the arrow (3) is positioned towards the exhaust and then insert the pin (4) and relative lock ring (5).

Check that the rings are positioned as indicated in the "Ring replacement and mounting" paragraph.

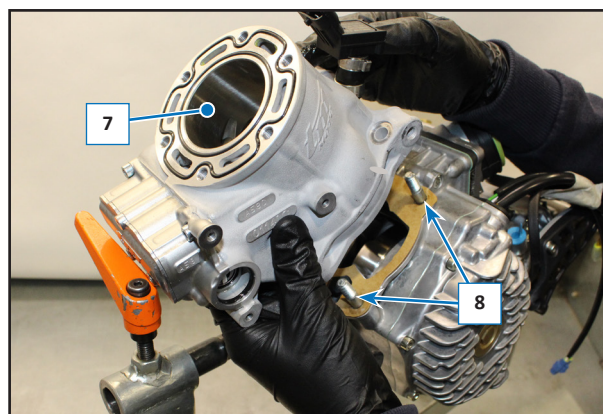
Oil the cylinder barrel with engine oil.



Fit a new gasket (6).

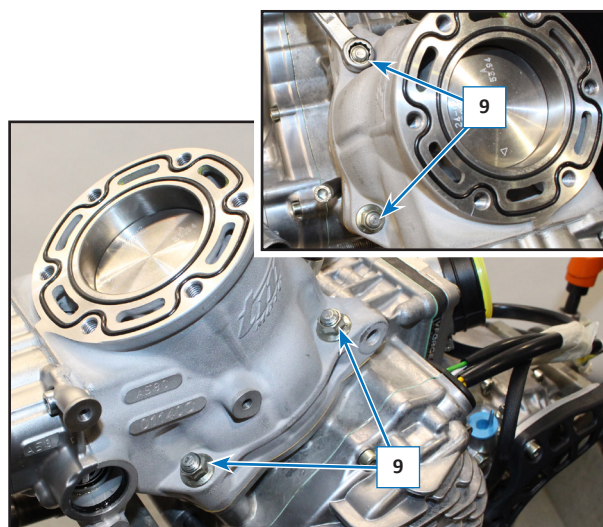


Insert the cylinder (7) onto the studs (8).



Screw without tightening the nuts (9) then tighten crosswise with a torque of 26 - 28 Nm (2,6 - 2,8 Kgm, 19,18 - 20,65 ft/lb).

**NOTE:** If the cylinder has been replaced, it is necessary to check the squish as described in the paragraph "Checking the squish".

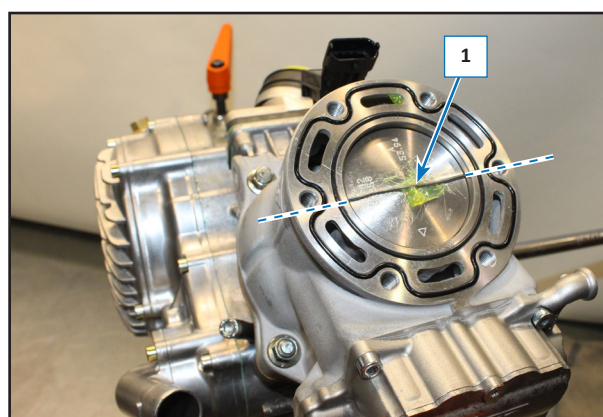


## 2.9 CHECKING THE SQUISH

Cut a piece of tin as straight as possible of the length equal to the diameter of the cylinder and with a minimum diameter of 1,5 mm (0,059 in).

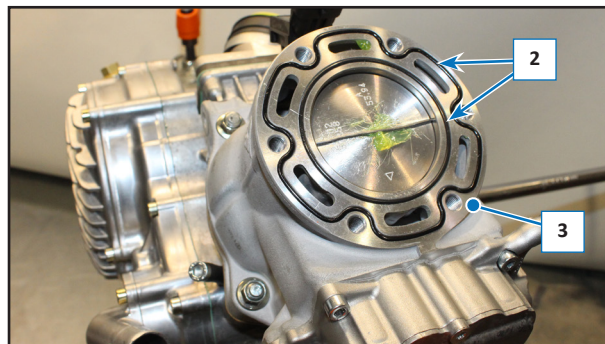
Apply a small amount of grease to the centre of the piston.

Position the tin (1) previously prepared on the grease so that it is aligned with the piston pin.

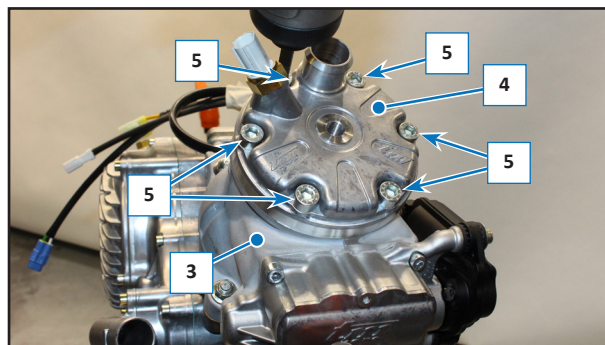




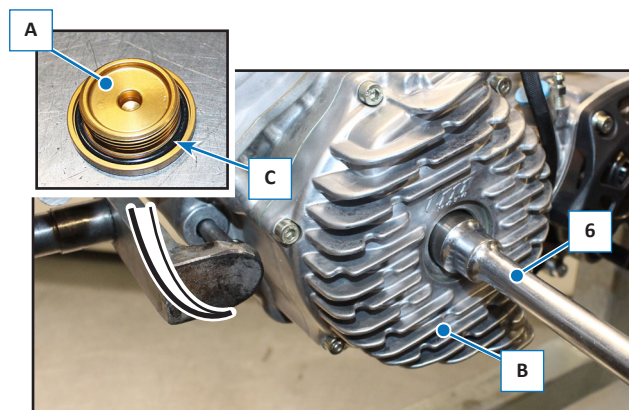
Fit the new gaskets (2) on the upper part of the cylinder (3).



Mount the head (4) on the cylinder (3) and screw the screws (5) without tightening then tighten them crosswise with a torque of 20 Nm (2,0 kgm, 14,75 ft/lb).



Remove the cap (A) from the generator cover (B).  
Check the condition of the gasket (C), if damaged, replace.  
Using a socket wrench (6), alternately move the piston, passing repeatedly to the TDC until the resistance of the tin is no longer felt.



Undo the screws (5) and remove the head (4).

Take the piece of tin (1) from the piston and measure the thickness (squish) on both sides which must be between  $1 \pm 0,05$  mm ( $0,039 \div 0,0019$  in).

**NOTE:** If the measured measurement is not within the established measurement, the base gasket (7) of the cylinder must be replaced with one of a thickness suitable for the detected measurement.

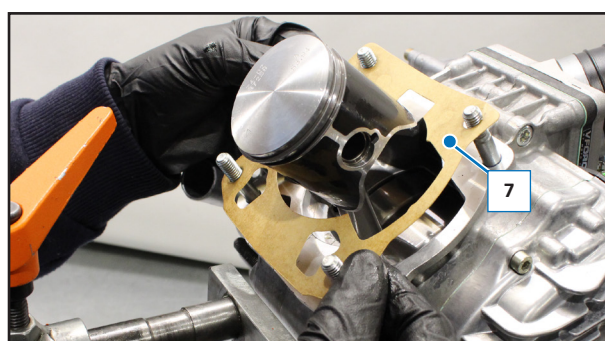
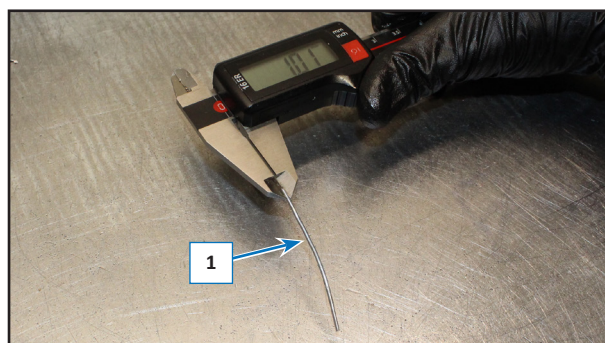
For example:

- if the measured measurement is greater than 1,8 mm (0,07 in) it will be necessary to insert a gasket (7) with a lower thickness than the one fitted;
- if the measured measurement is less than 1,7 mm (0,06 in) it will be necessary to insert a gasket (7) with a thickness greater than the one installed.

For the gasket replacement operations, refer to the previous paragraphs.

Repeat the squish check operation to verify that it is within the established size.

Refit the cap (A).



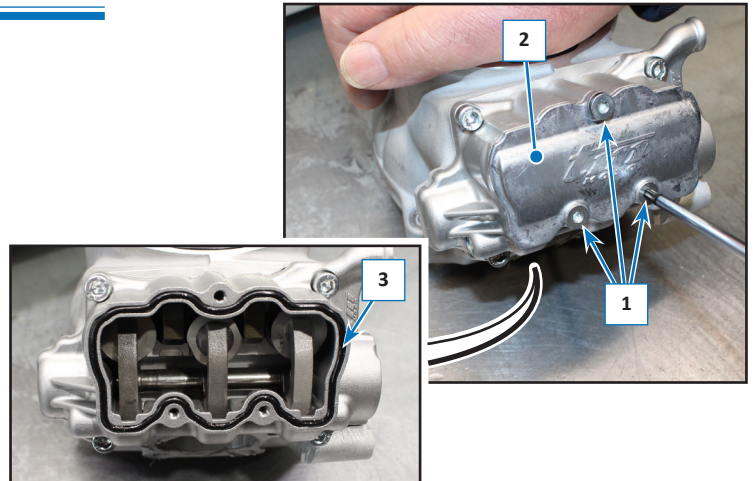


## 2.10 EXHAUST VALVE MAINTENANCE

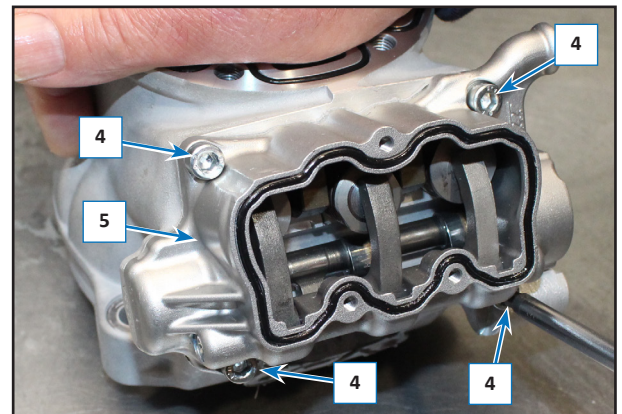
### 2.10.1 Removing the valve

Unscrew the screws (1) and remove the cover (2).

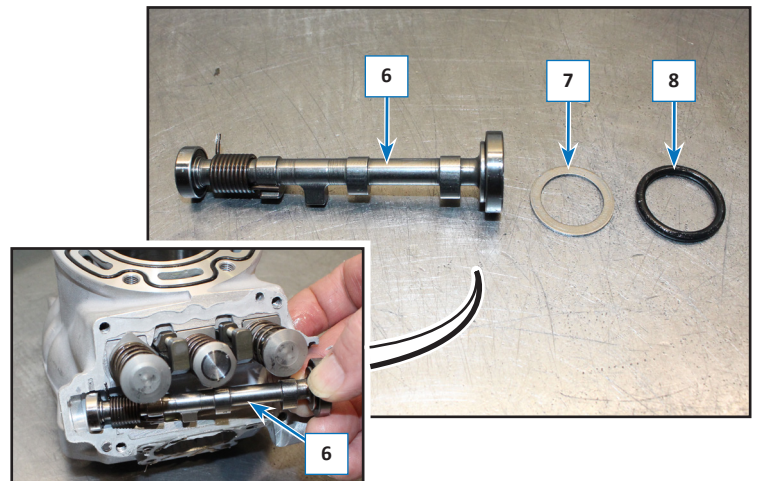
Check the condition of the seal (3) and replace it if damaged.



Unscrew the screws (4) and remove the rocker frame (5).

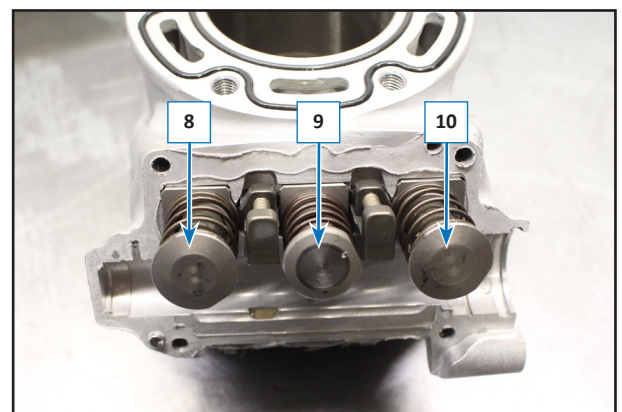


Unscrew the screws (4) and remove the rocker frame.

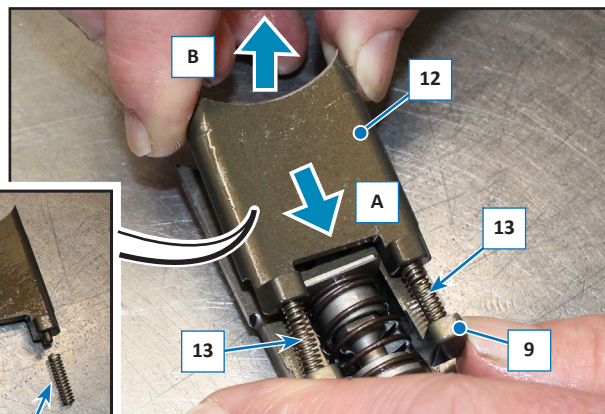
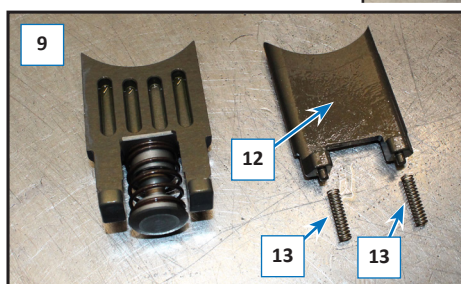


Disassemble the three valves (8), (9) and (10) pulling them out.

**NOTE:** Mark the valves (8) and (10) so as not to invert them when reassembling them.

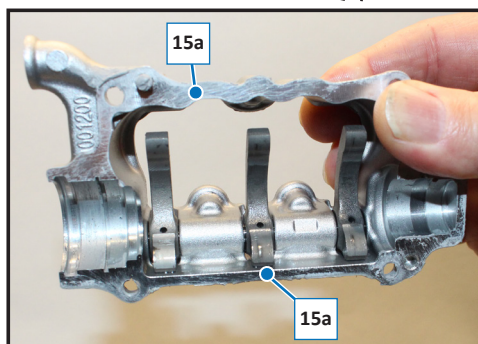
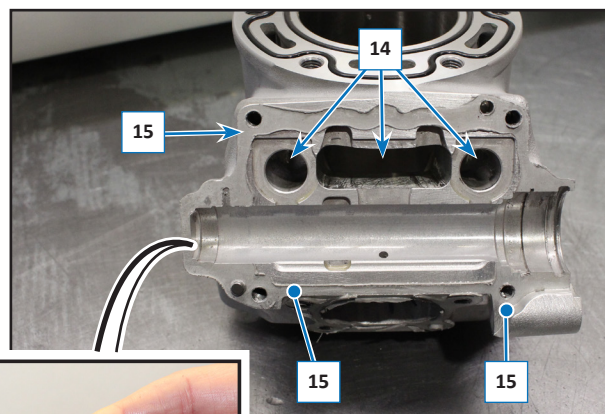


Disassemble the valve (9), pushing the guillotine (12) "A" in order to compress the springs (13) and lift "B".



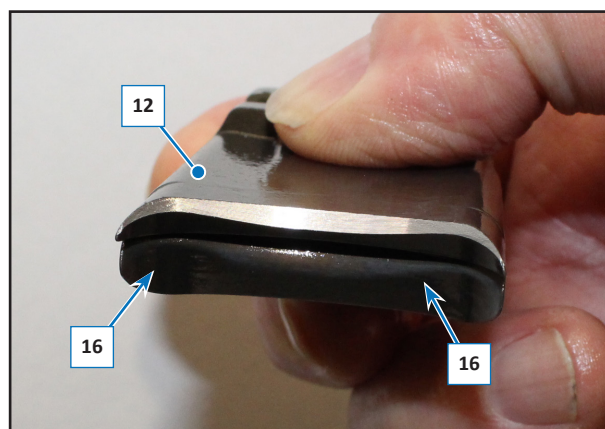
Clean all parts of the valve with an appropriate degreasing agent, clean the exhaust ducts (14) of the cylinder with brushes with soft bristles without damaging the ducts.

Remove the sealing paste from the contact surfaces (15) of the cylinder and the rocker frame (15a).



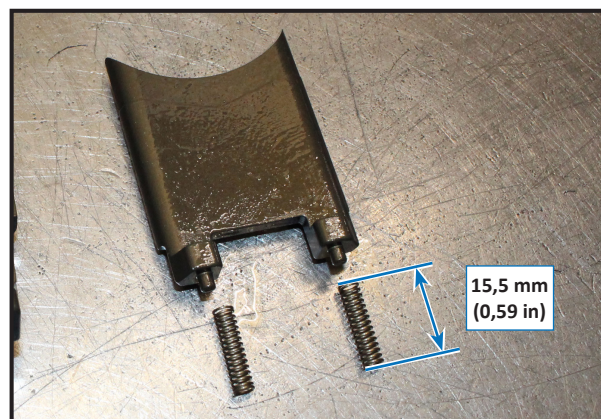
## 2.10.2 Reassembling the valve

Check that the edges (16) of the guillotine (12) of the valve (9) are not damaged by the contact of the piston strap with the valve. If they are damaged, call the TM technical support service.

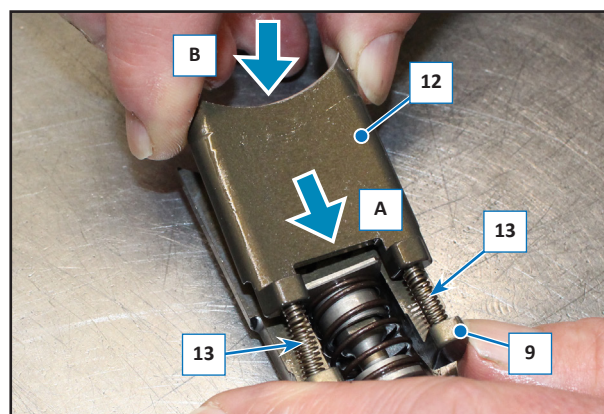




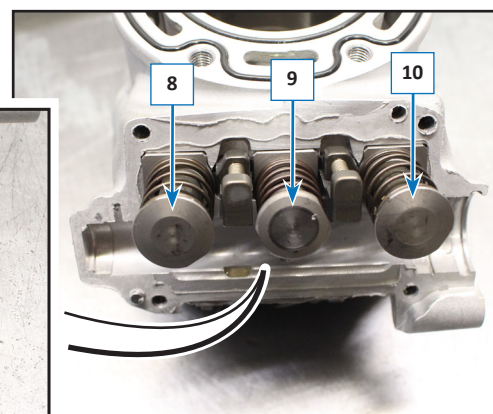
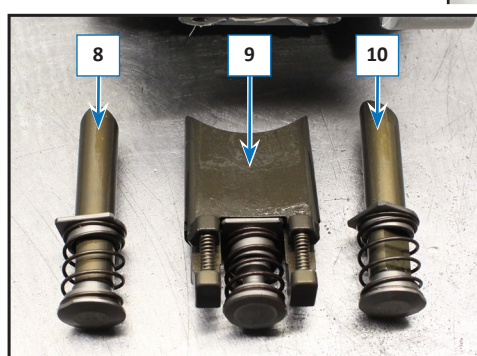
Check the length of the springs (13) which must be 15.5 mm (0,59 in); if it is wrong and the springs are damaged, they must be replaced.



Insert the springs (13) in the relevant seat of the valve (9), insert the pins of the guillotine (12) in the springs (13) and push "A" and lower "B" positioning the guillotine in the relevant seat.



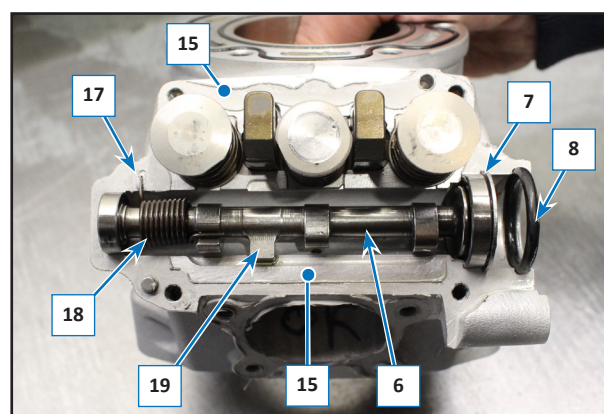
Reassemble the valves (8), (9) and (10) in cylinder (17) positioning them as they were originally.



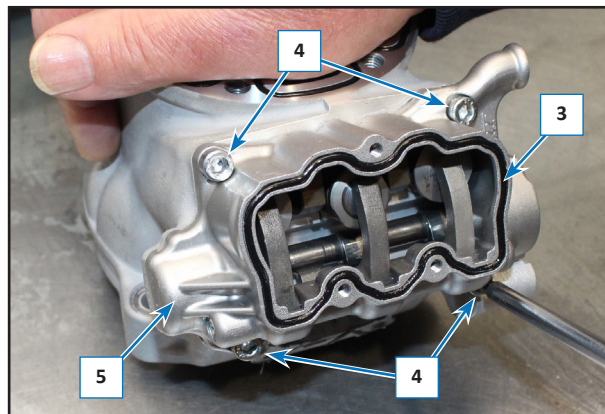
Reassemble the shaft (6) paying attention to position the stop (17) of the spring (18) and the stroke end lug (19) of the shaft in the relevant seats and reassemble the washer (7) and OR seal (8).

Spread TREEBOND 12.15 sealing paste on the contact surfaces (15) of the valve seat.

**NOTE:** Check that the stroke end stop is in the proper position (19).



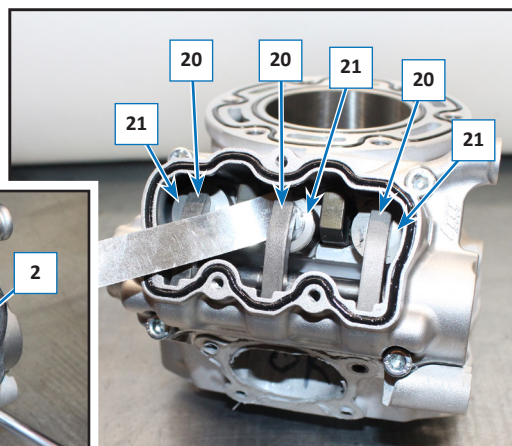
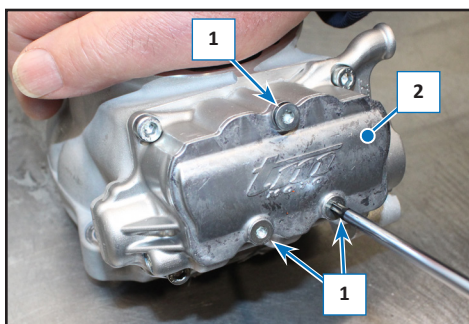
Assemble the rocker frame (5) screwing in the screws (4), check the condition of the seal (3), replace it if damaged.



Check that the clearance between rockers (20) and the relevant valve heads (21) is 0.35 mm (0.10 in)  $\pm$  0.05 mm (0.02 in). If the clearance is different, contact the TM technical support service.

Before closing the cylinder, check that the valve is 0.30mm from the piston, increase the clearance if necessary

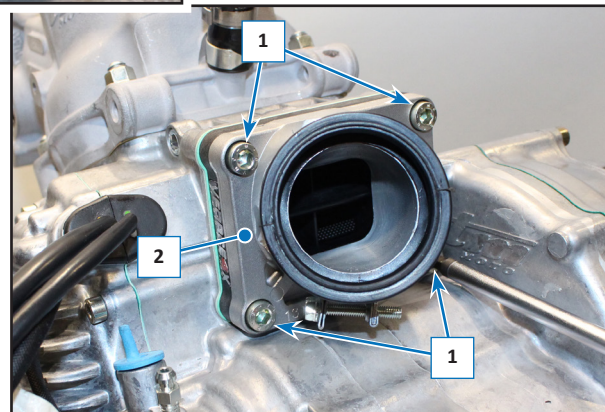
Assemble the cover (2) by screwing screws (1).



## 2.11 REED VALVE PACK

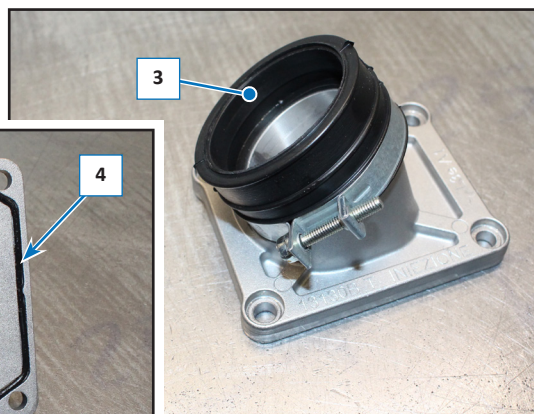
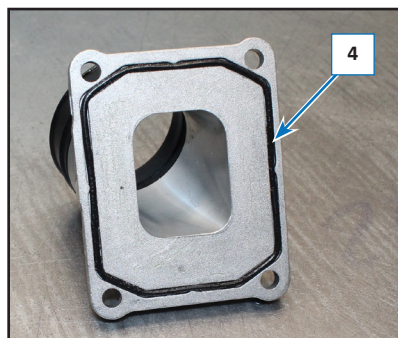
Check and/or replace the blades.

Unscrew the screws (1) that fix the external frame (2) of the reed valve pack.



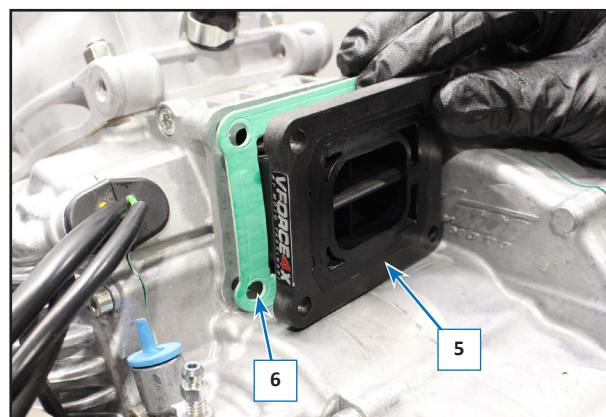
Check the rubber fitting (3) on the carburettor/throttle body, if damaged, cracked, etc. replace.

Check the OR gasket (4); if damaged, replace.





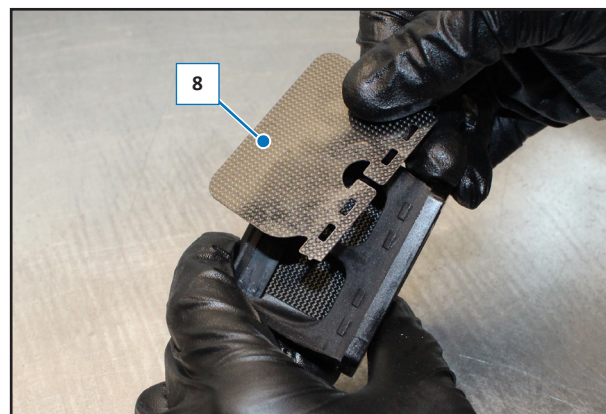
Remove the reed valve pack (5) and the relative gasket (6); if damaged, replace.



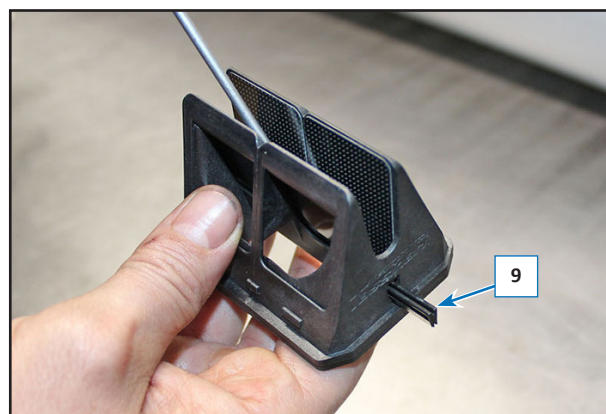
Remove the internal frame (7).



Remove the external blades (8).



With a screwdriver, slide out the two internal stops (9).

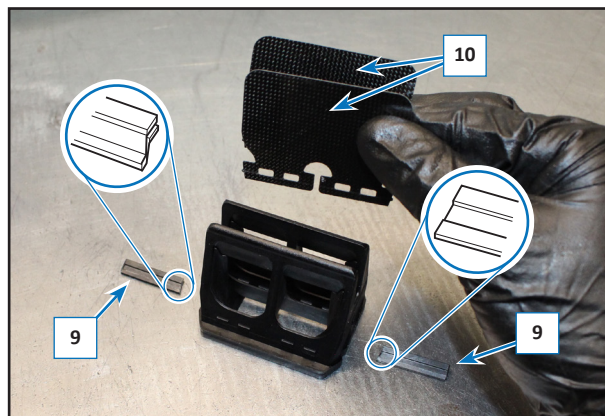


Remove the internal blades (10).

Check the state of the blades, if chipped or deformed, they must be replaced.

To reassemble, proceed in reverse order of disassembly.

**NOTE:** Insert the stops (9) with the sloping part inward.

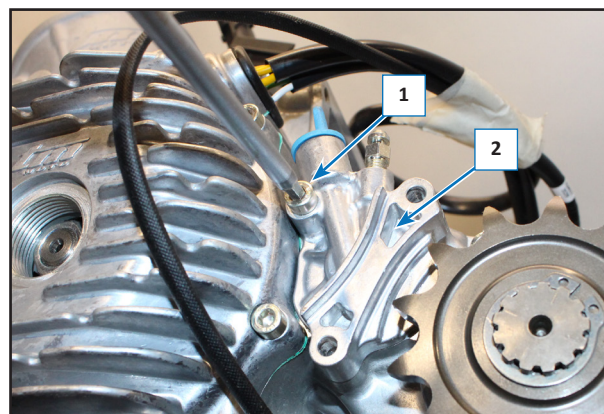


## 2.12 CLUTCH

### 2.12.1 Clutch actuator removal

Remove the sprocket cover as described in the relative paragraph.

Unscrew the screw (1) and remove the actuator (2).



### 2.12.2 Actuator dismantling

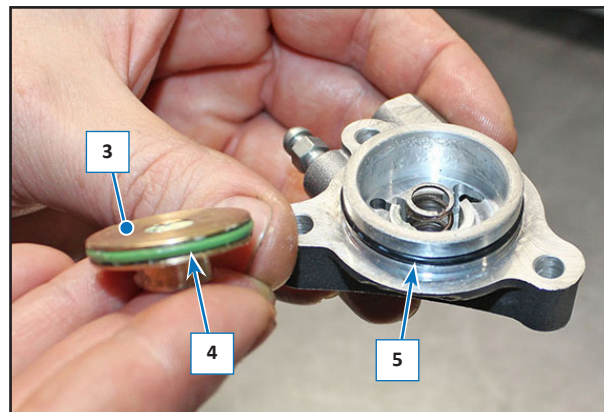
Remove the piston (3).

Check the conditions of the OR gaskets (4 and 5); replace them if ruined.

**NOTE:** On re-mounting, lubricate the gaskets with clutch oil.

Re-mount everything, proceeding in the opposite order to disassembly.

Tighten the screws (1) with a torque of 8 Nm 0.8 kgm/ 5.9 ft/lb.



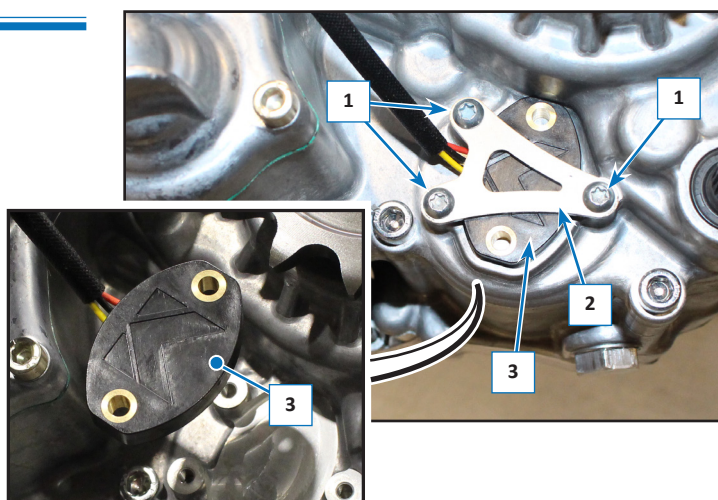
## 2.13 GEAR SENSOR

Undo the screws (1).

Remove the stop (2) and sensor (3).

**NOTE:** When reassembling, assemble the sensor (2) with the printed symbol facing out.

**NOTE:** Refit everything operating in reverse order from removal.

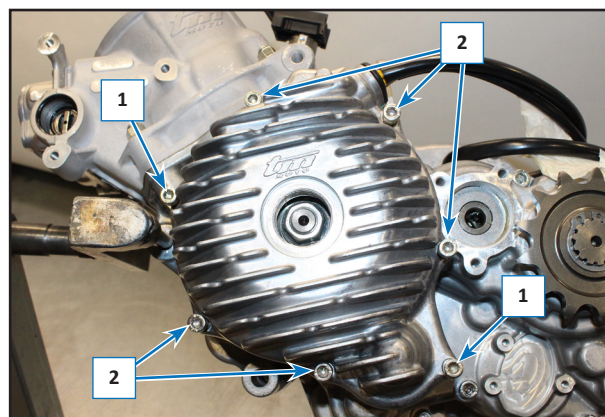




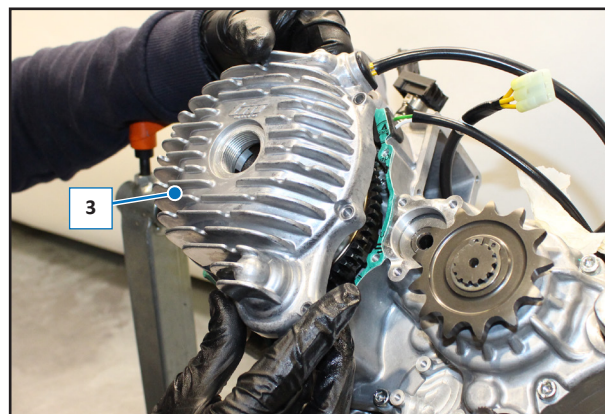
## 2.14 FLYWHEEL REMOVAL

### 2.14.1 Flywheel cover

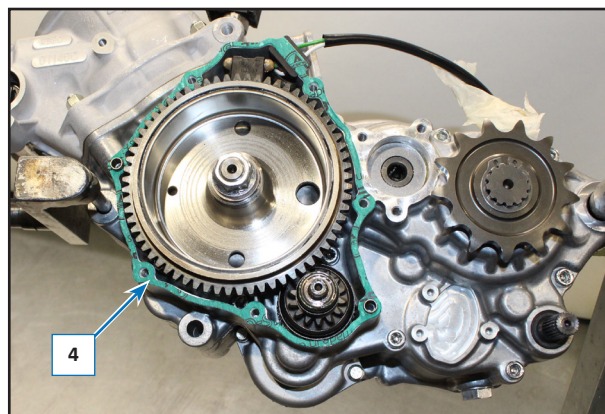
Unscrew the M5-L25 screws (1) and the screws (2) M5-L20.



Remove the flywheel cover (3).

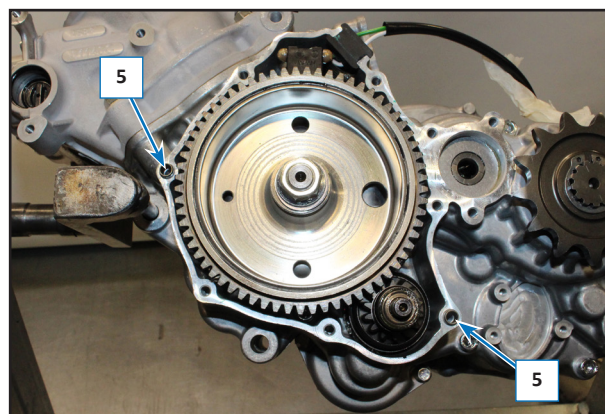


Remove the gasket (4).



Retrieve the two centring bushes (5).

**NOTE:** On re-mounting, check that the two centring bushes (5) are positioned correctly.  
Clean the surface of the cover and the split crankcase of any residues and replace the gasket (4).  
Tighten the screws (1 and 2) with a torque of 10 Nm (1 kgm, 7,37 ft/lb).



## 2.14.2 Stator

### Disassembly

Remove the flywheel cover as described in the relative section.

Unscrew the screws (1) that secure the stator (2).

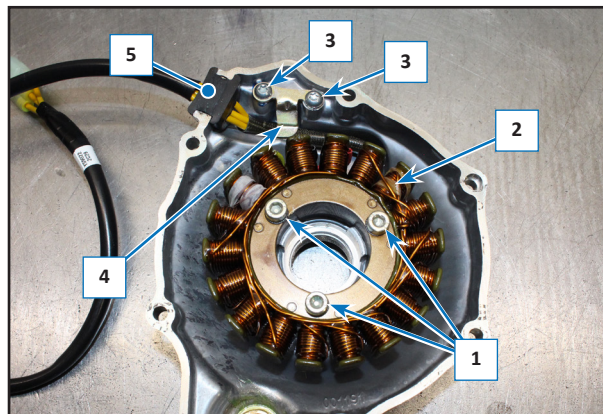
Unscrew the screws (3) and remove the stop plate (4).

Remove the stator (2) with the relative cabling.

### Mounting

Re-mount the stator (2), tightening the screws (1) with the relevant washer to a torque value of 8 Nm (0.8 Kgm - 5.9 ft/lb + Loctite 243).

Make sure the rubber cap (5) is fitted correctly on the cover and then tighten the two screws (3) of the stop plate (4) with a torque of 5 Nm (0.5 kgm, 3.68 ft/lb).



## 2.14.3 Pick-up

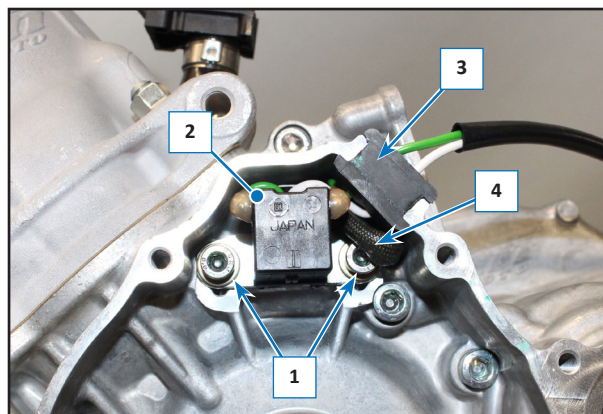
Remove the rotor and flywheel as described in the relative paragraphs.

Unscrew the two screws (1) and remove the pick-up (2).

On re-mounting, check that the washers notched under the screws (1) are positioned correctly.

Tighten the two screws (1) with a torque of 8 Nm (0.8 kgm, 5.9 ft/lb) + Loctite 243.

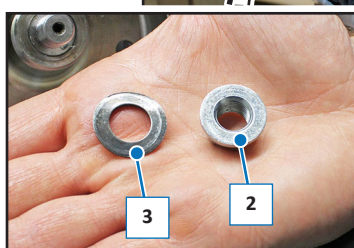
Make sure the rubber cap (3) is fitted correctly on the guard and that cable (4) is positioned and folded as shown in the image, checking it does not touch the crown of the flywheel.



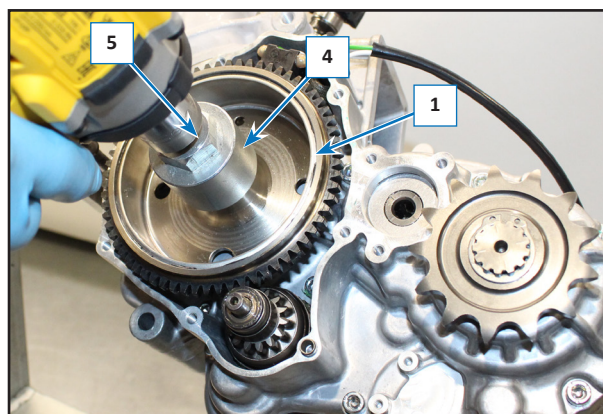
## 2.14.4 Rotor

### Disassembly

Block rotor rotation (1) and use an impact gun to loosen the nut (2) with relative curve washer (3).

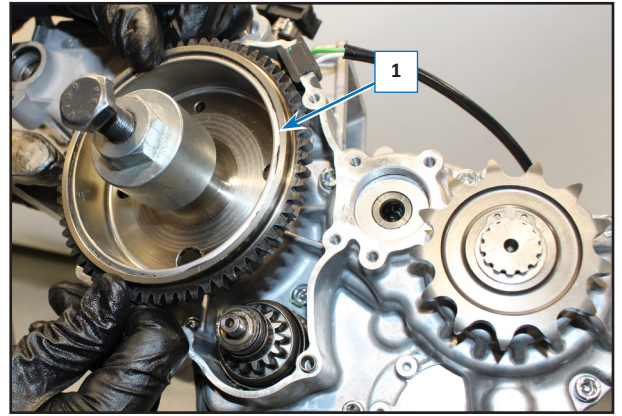


Screw the extractor (4) onto the thread of the rotor (1) and tighten the screw (5) to detach the rotor (1) from the crankshaft.

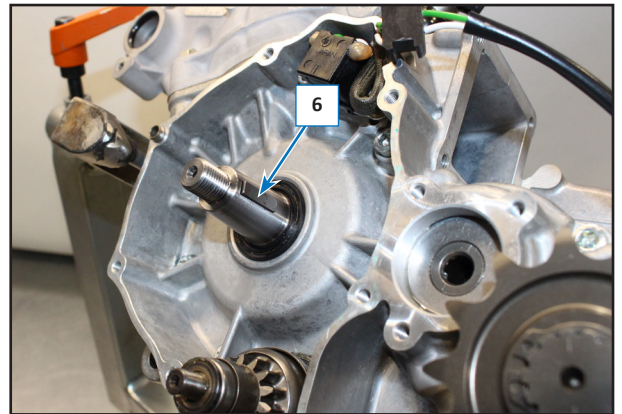




Remove the complete rotor (1).

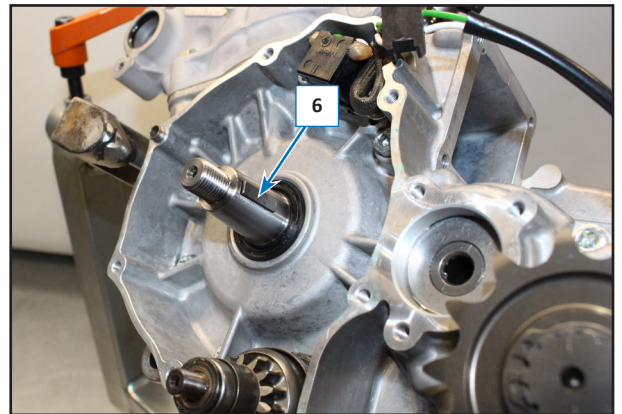


Retrieve the key (6).



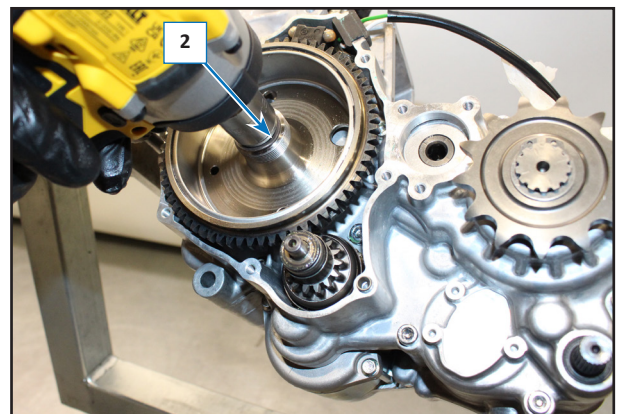
### **Re-mounting**

Make sure the key (6) is properly positioned in its housing.



Re-mount the fly wheel (1).

Tighten the nut (2) with relative curve washer with a torque of 60 Nm (6 kgm/ 44.2 ft/lb).

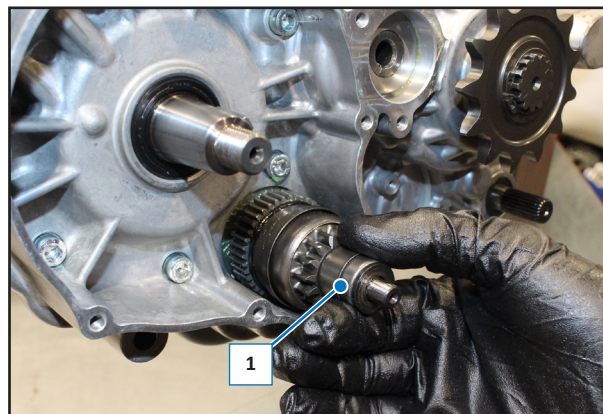


## 2.15 STARTER MOTOR

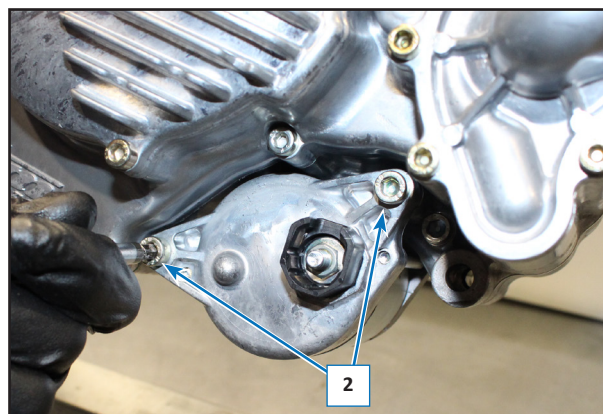
### 2.15.1 Disassembly

Remove the flywheel cover and flywheel, as described in the relevant paragraphs.

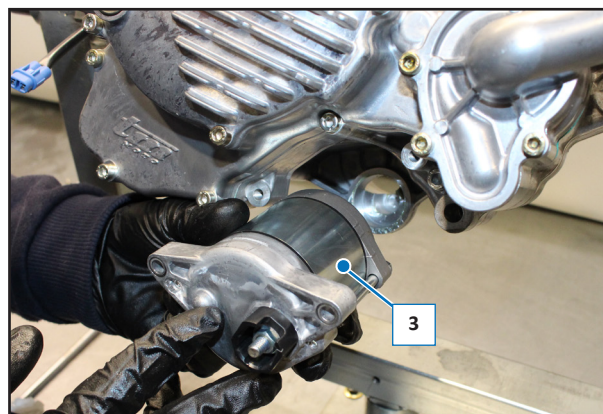
Remove the Bendix starter (1).



Unscrew the M6-L25 two starter motor fastening screws (2).



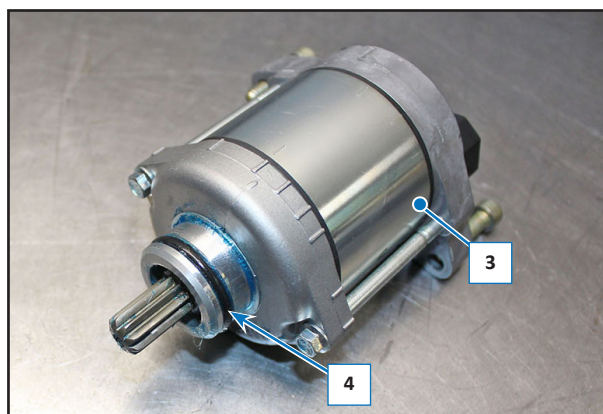
Remove the starter motor (3).



### 2.15.2 Re-mounting

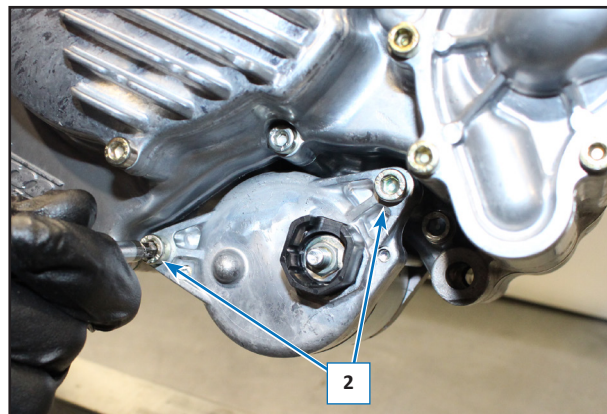
Check the status of the "OR" gasket (4) positioned on the starter motor (3); replace it if ruined.

Lubricate the gasket (4) with generic grease and then mount the starter motor (3).

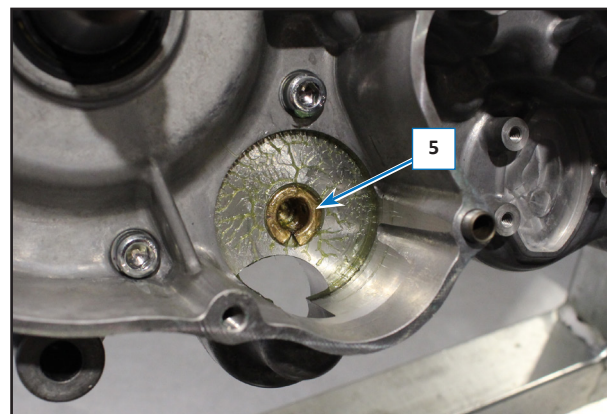




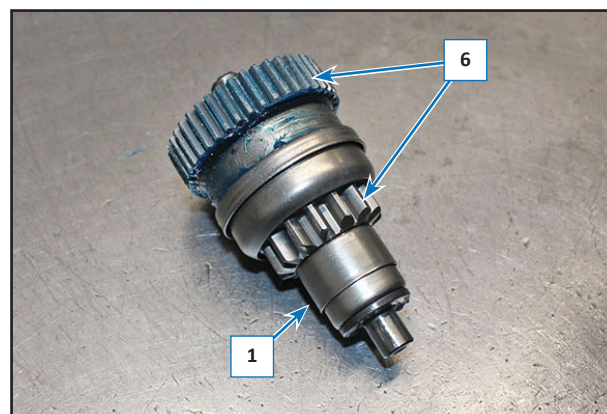
Tighten the screws (2) with a torque of 10 Nm (1,0 kgm, 7,38 ft/lb).



Grease the bronze bush (5) with graphite grease.

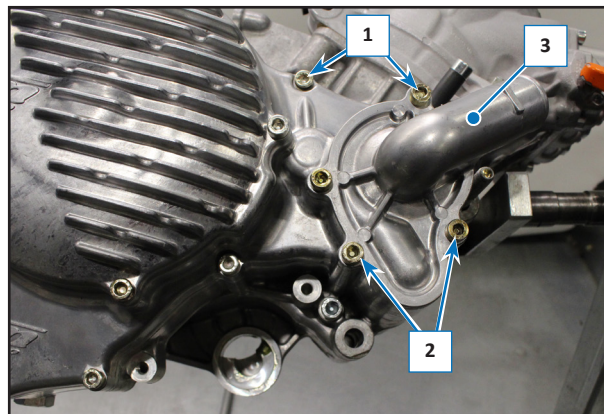


Grease the gears (6) of the Bendix (1) and reassemble it in the bronze bush (5).

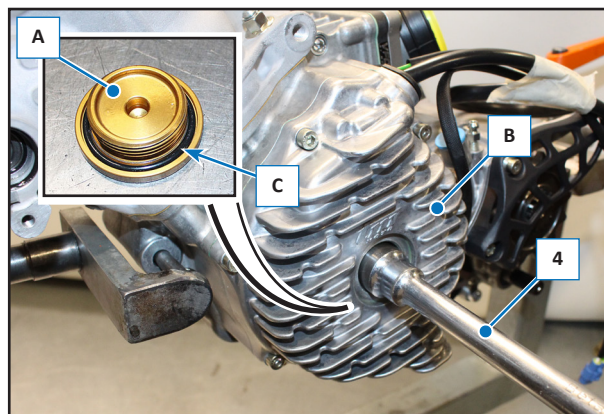


## 2.16 REMOVING THE WATER PUMP AND REPLACING THE SEALING GASKET

Unscrew the screws (1) M5-L26 and the screws (2) M5-L55 on the pump cover (3) and remove the pump cover (3).

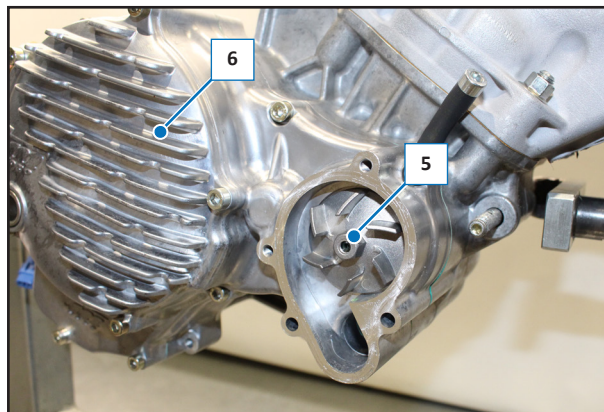


Remove the cap (A) from the generator cover (B). Check the condition of the gasket (C), if damaged, replace. Insert a "T" wrench (4) through the flywheel cover to block the rotation of the crankshaft.



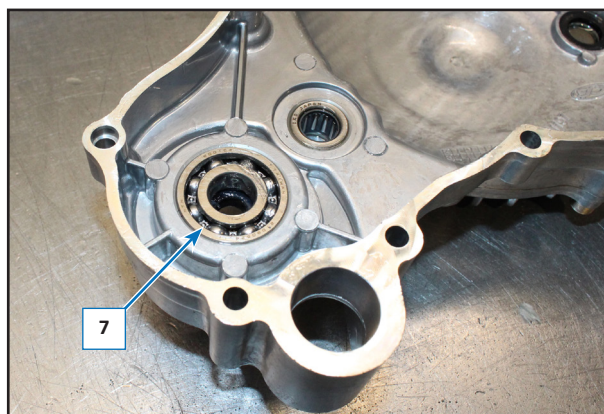
Unscrew the impeller (5) of the pump.

Remove the transmission guard (6) as described in the relevant paragraph.



Check the correct functioning of the bearing (7), if it does not slide freely replace; to replace, heat the crankcase to a temperature of 50° C and with a punch remove the bearing and reassemble the new one.

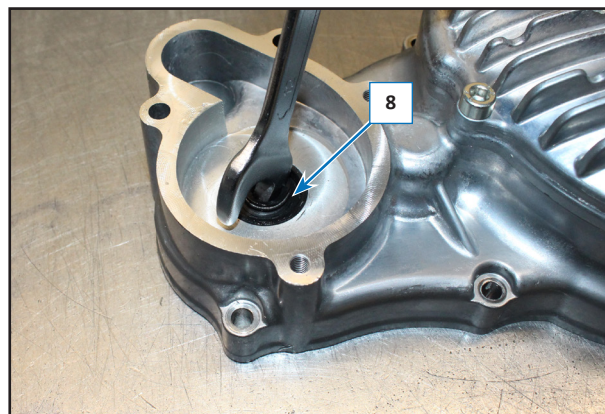
**WARNING:** Use suitable personal protection equipment;  
Burns hazard.





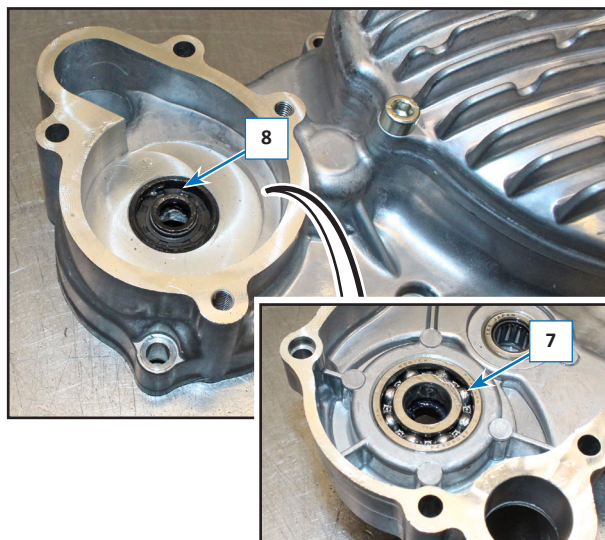
Remove the seal (8) with a screwdriver or a key and replace it.

**NOTE:** Lubricate the new seal (8) with engine oil before fitting it.



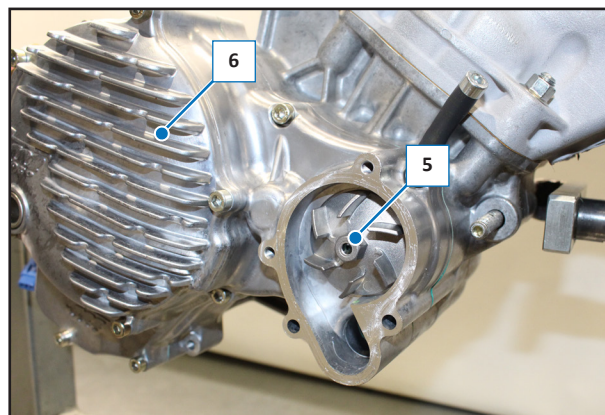
### 2.16.1 Reassembling the water pump

Grease the bearing (7) with graphite grease and lubricate the sealing gasket (8) with engine oil.

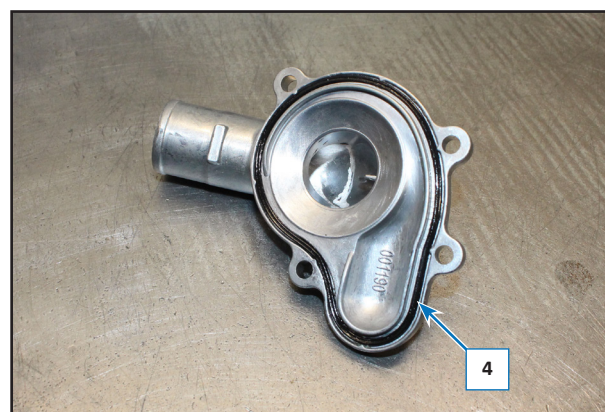


Reassemble the transmission guard (6) as described in the relevant paragraph.

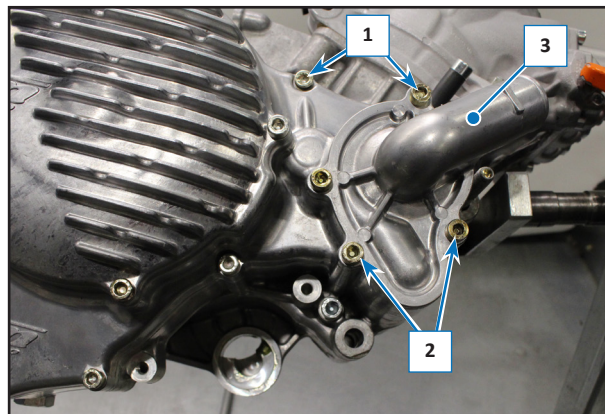
Screw the impeller (5), greasing the thread, with a torque of 6 Nm (0,6 kgm, 4,42 ft/lb), blocking the rotation of the motor shaft with the key (4).



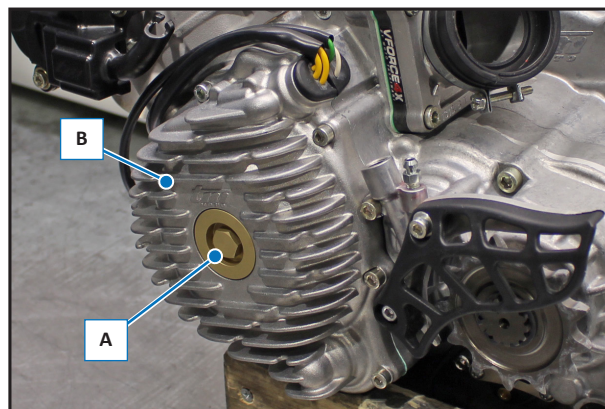
Check the condition of the gasket (4) if damaged, replace.



Refit the pump cover (3) by tightening the screws (1) with a torque of 8Nm (0,8 kgm, 5,9 ft/lb) by replacing the aluminum washer (2) of the screw (1a).



Reassemble the cap (A) on cover (B) of the generator.

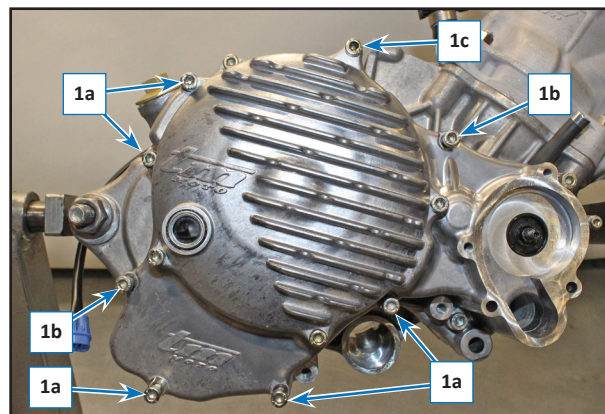


## 2.17 TRANSMISSION GUARD

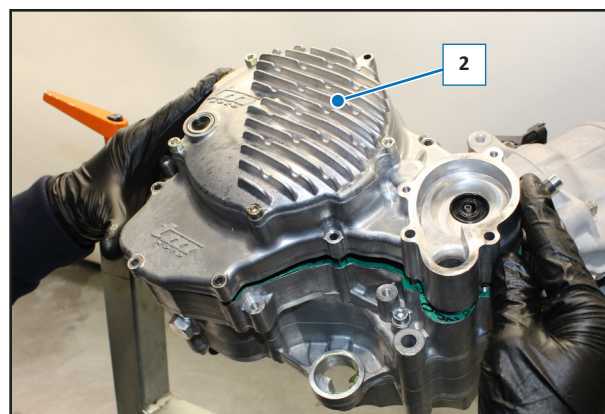
Remove the water pump as described in the relevant paragraph.

Unscrew the screws (1):

- 1a) M5-L25 screw
- 1b) M5-L30 screw
- 1c) M5-L55 screw



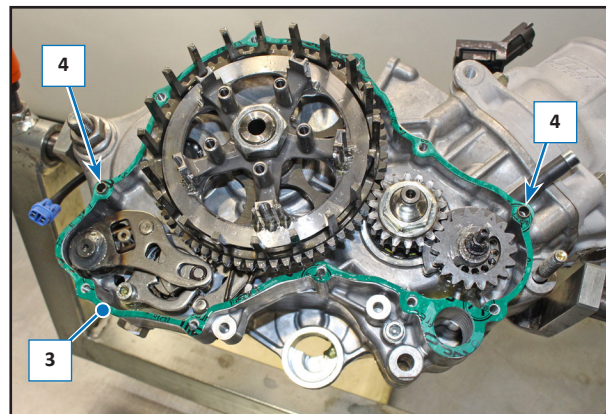
Remove the guard (2), with the aid of a rubber hammer.





Remove the gasket (3).

Recover the three centring bushes (4).

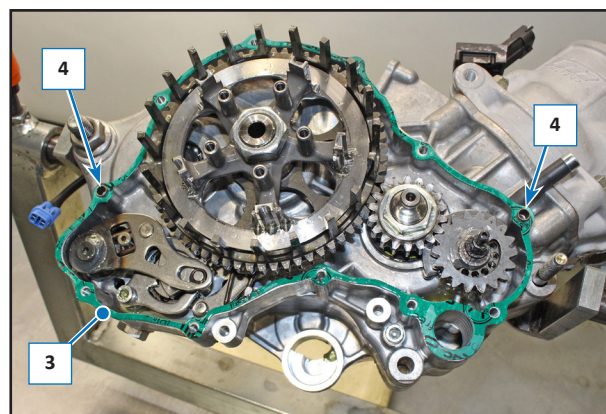


### 2.17.1 Transmission cover re-assembly

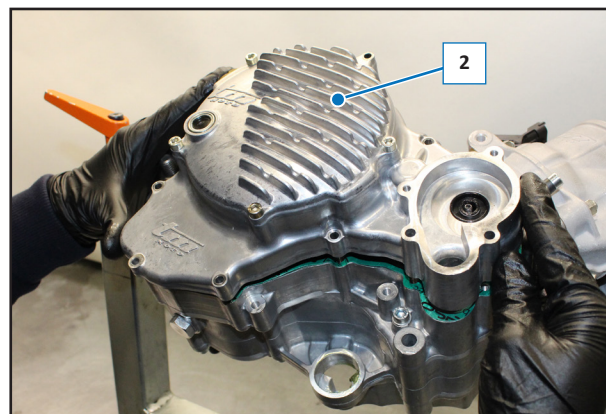
Clean the surface of the lid and the semicase from any residues.

Check that the two centring bushes (4) are in their respective housing.

Replace and re-mount the gasket (3).



Mount the cover (2), centring it on the bushes (4), paying attention not to ruin the seals.

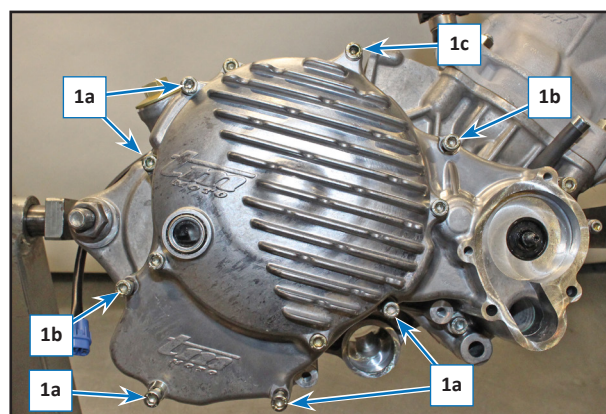


Tighten the screws (1) crosswise, positioning them in the relative housing, depending on their length.

- 1a) M5-L25 screw
- 1b) M5-L30 screw
- 1c) M5-L55 screw

Assemble the water pump as described in the relevant paragraph.

First screw without tightening with a torque of 8 Nm (0.8 kgm/ 5.9 ft/lb).



## 2.18 DRUM AND CLUTCH BELL

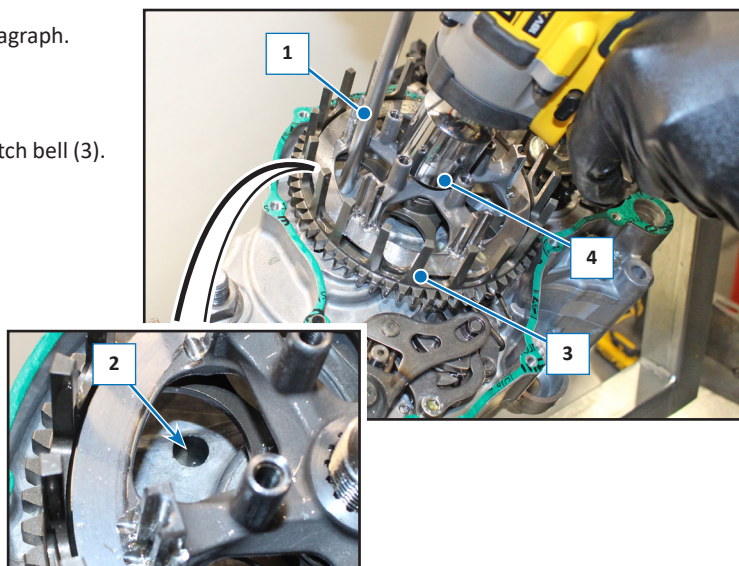
### 2.18.1 Disassembly

Remove the transmission cover as described in the relative paragraph.

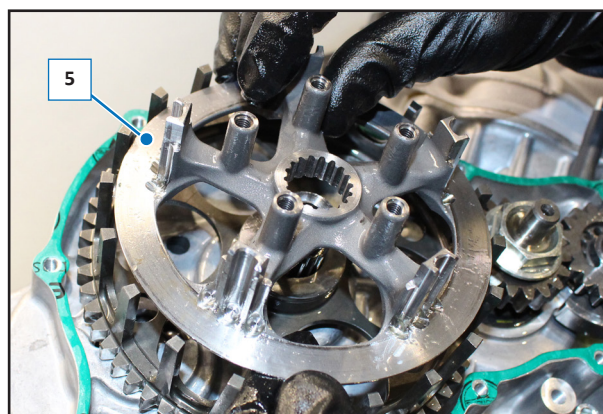
Remove the clutch discs as described in the relative paragraph.

Insert a "T" wrench (1) in hole (2) to lock the rotation of the clutch bell (3).

Unscrew the nut (4) and remove the relevant washer.

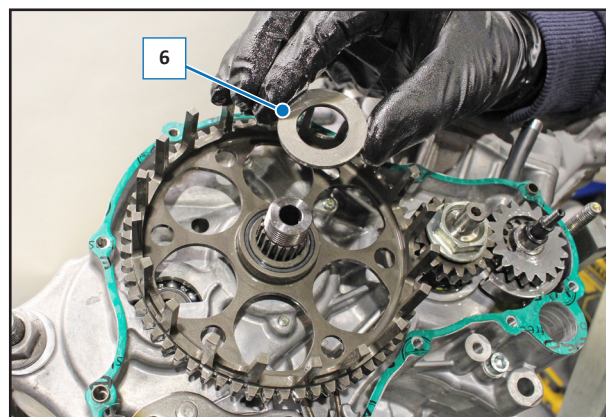


Remove the drum (5).

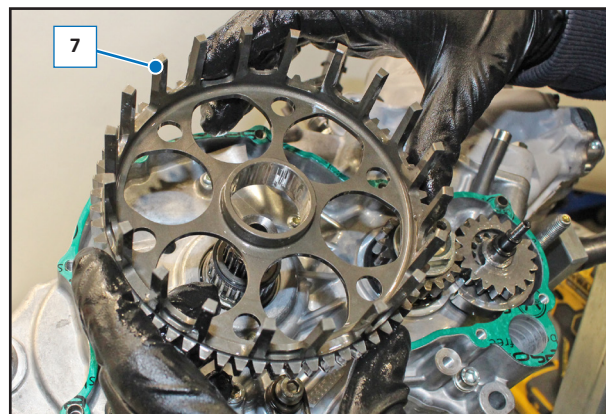




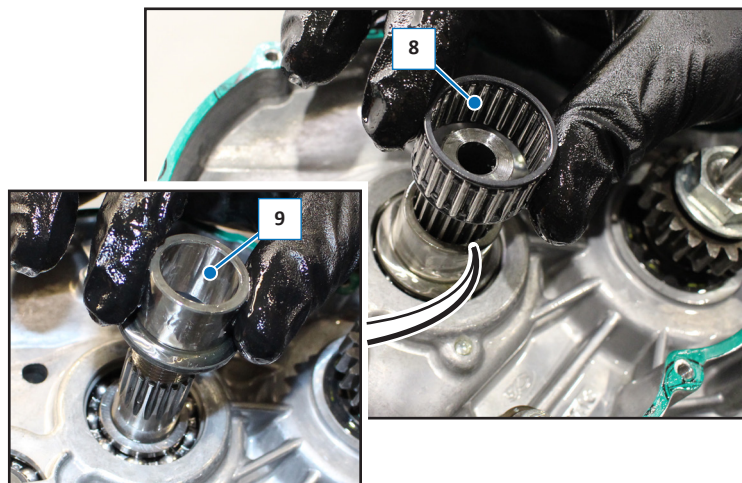
Remove the washer (6).



Remove the bell (7).



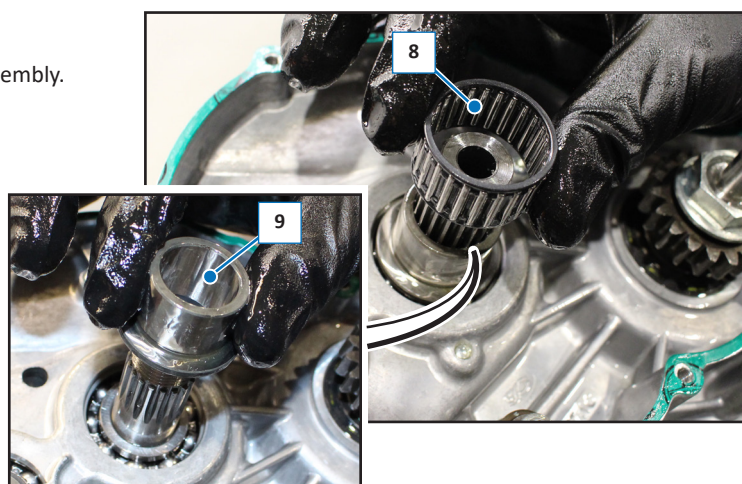
Remove the two roller bearing (8) and the spacer (9).



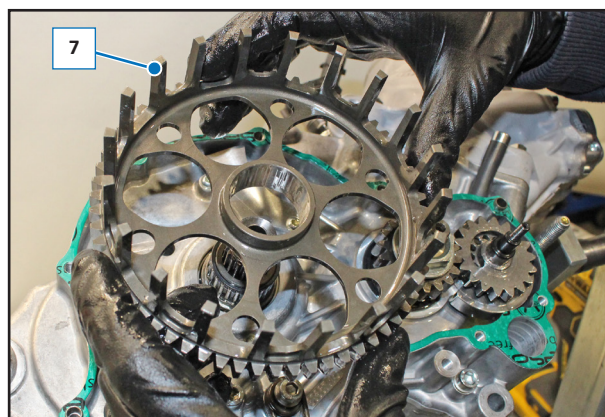
### 2.18.2 Re-mounting

Re-mount everything, proceeding in the reverse order to disassembly.

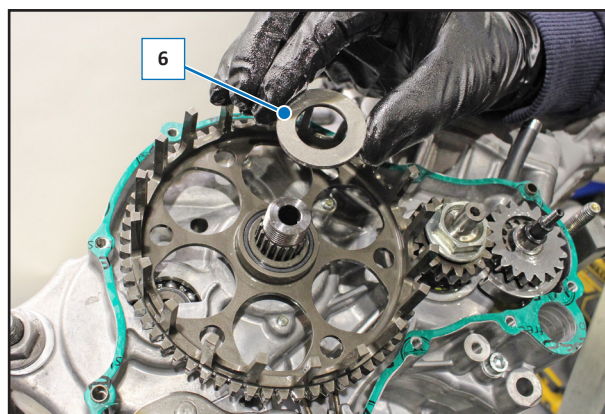
Make sure that the spacer (7) and ball bearing cage (6) are re-mounted correctly and lubricate them with engine oil.



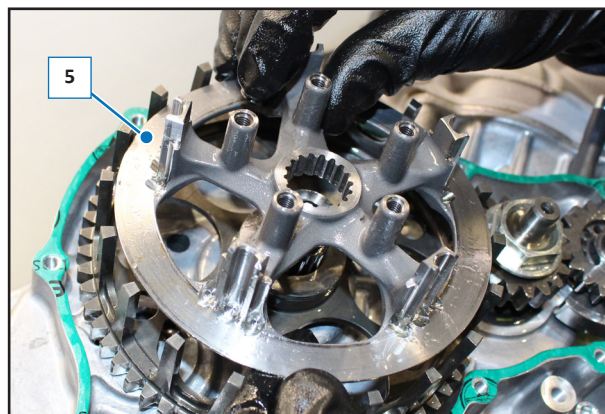
Re-mount the bell (7).



Insert the washer (6).

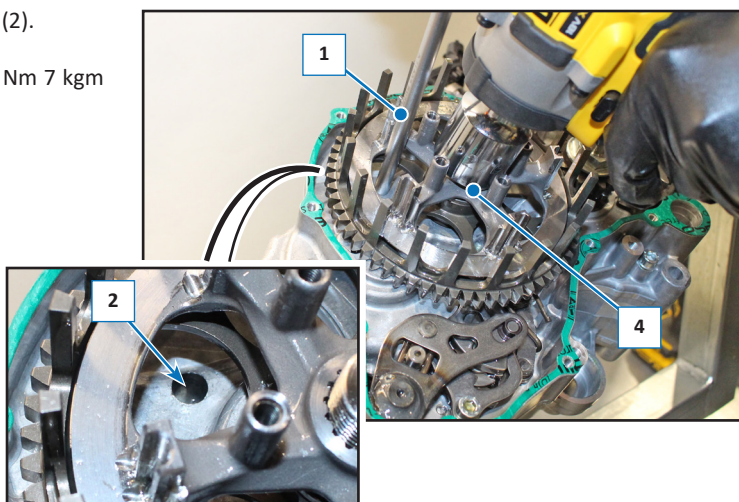


Reassemble the drum (5).



Lock the rotation by insert a "T" wrench (1) in the existing hole (2).

Mount the nut (4) with the relevant washer with torque of 70 Nm 7 kgm 51,63 ft/lb + Loctite.

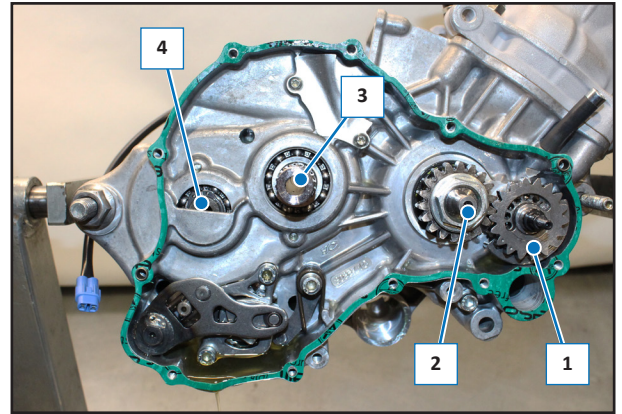




## 2.19 TRANSMISSION SIDE COUNTER GEARS

Components layout:

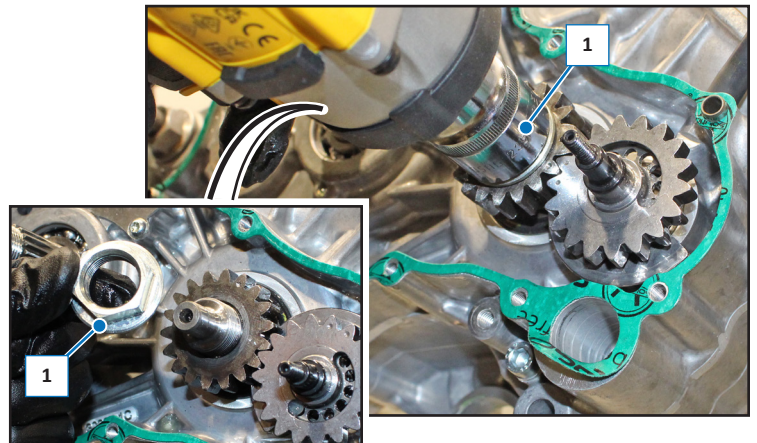
- 1) Countershaft gear and water pump
- 2) Crankshaft gear
- 3) Gearbox primary shaft
- 4) Gearbox command shaft



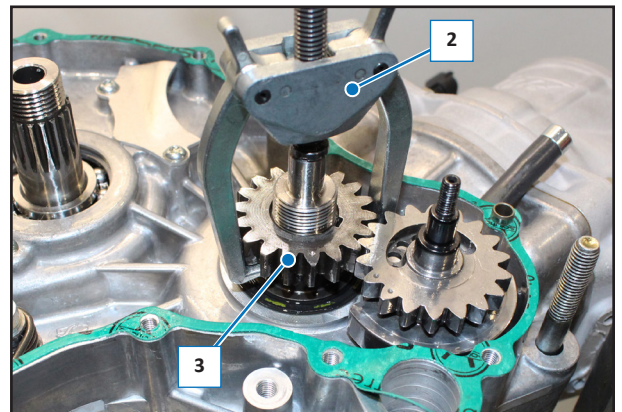
### 2.19.1 Gears removal

Unscrew the flanged nut (1) of the drive shaft gear.

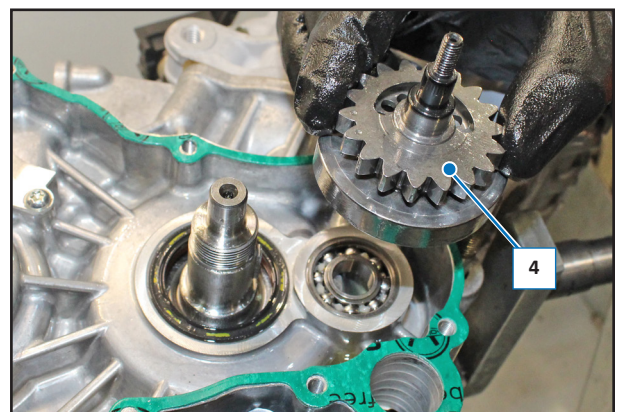
Remove the flanged nut (1).



Using an extractor (2), remove the gear (3) taking care to retrieve the relevant tab.



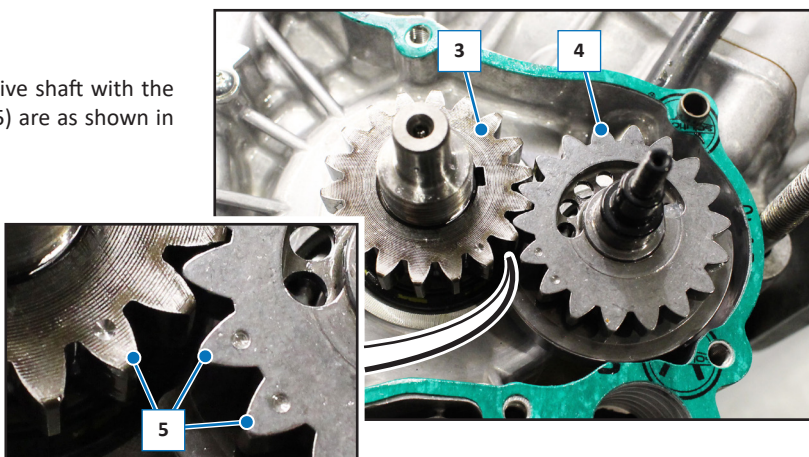
Remove the countershaft (4).



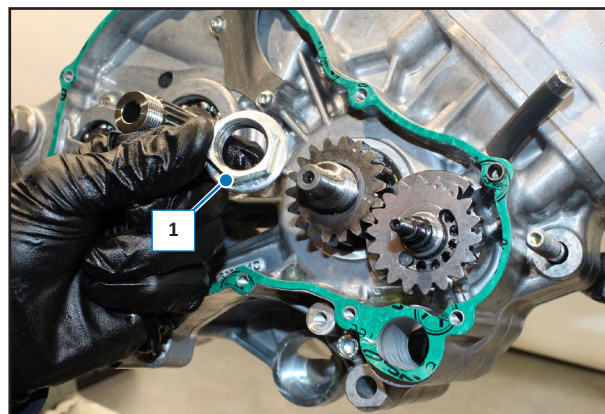


### 2.19.2 Reassembling the gears

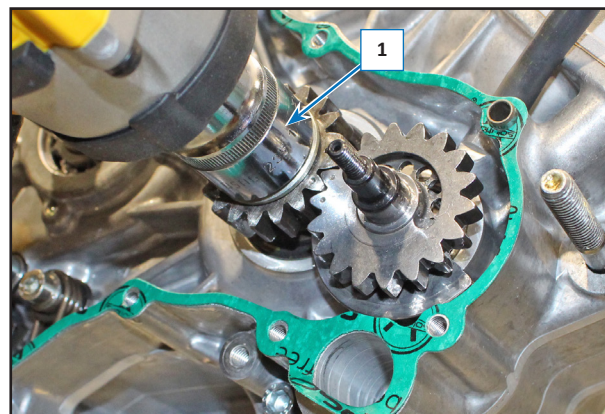
Reassemble the countershaft (4) and gear (3) of the drive shaft with the relevant tab, placing them so that the reference dots (5) are as shown in the figure.



Assemble the flanged nut (1).



Screw in the flanged nut (1) at a torque of 70 Nm (7 kgm, 51.63 ft/lb).



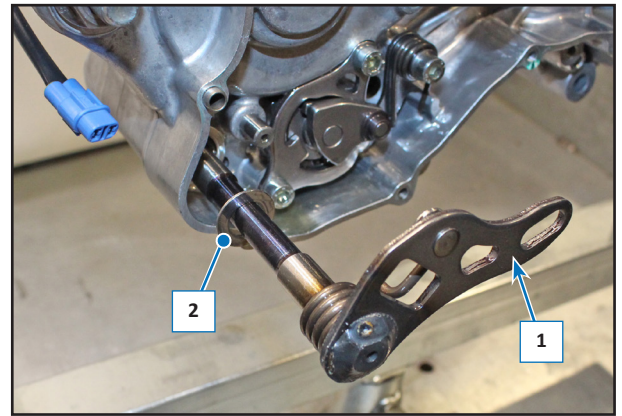
## 2.20 GEARBOX CONTROL SHAFT AND RATCHETS HOLDER REMOVAL

### Disassembly

Turn the gearbox putting the 5th or 6th gear according to the type of engine.

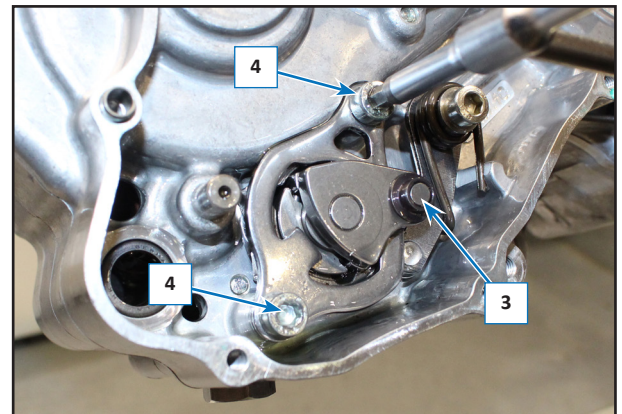
Remove the transmission casing and the clutch bell as described in the relevant paragraph.

Remove the gearbox control shaft (1) and recover the shim (2).



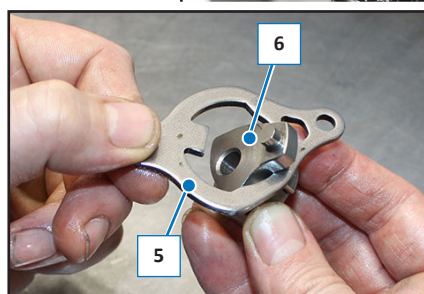
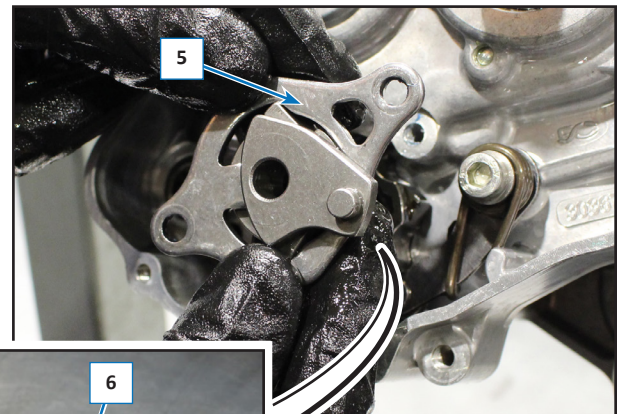
Remove the socket (3).

Unscrew the two screws (4).



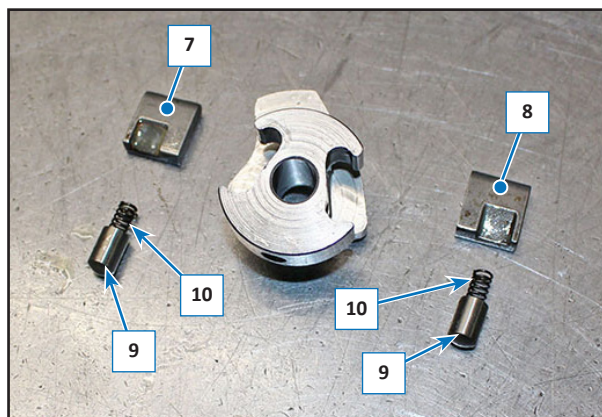
Remove the pawl ratchet plate (5).

Remove the ratchet support (6) from the plate (5).



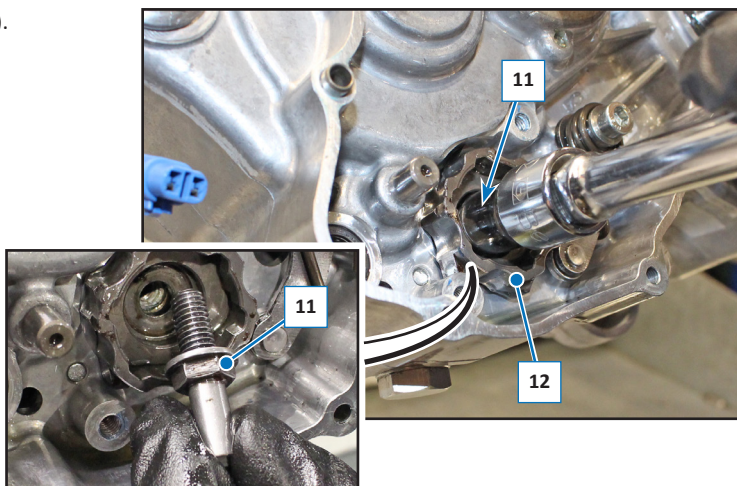


Dismantle the ratchets (7) and (8) with the relative tips (9) and the springs (10).

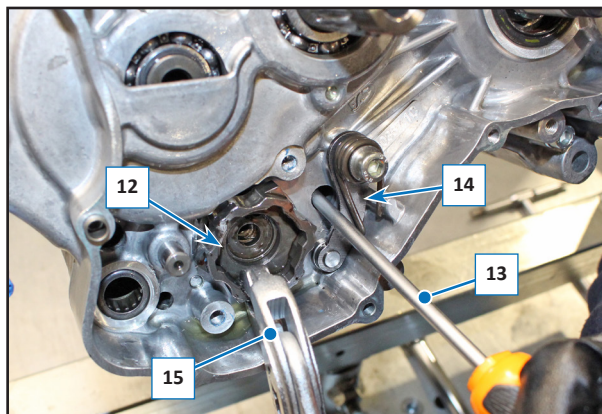


Unscrew the pin (11) securing the desmodromic shaft head (12).

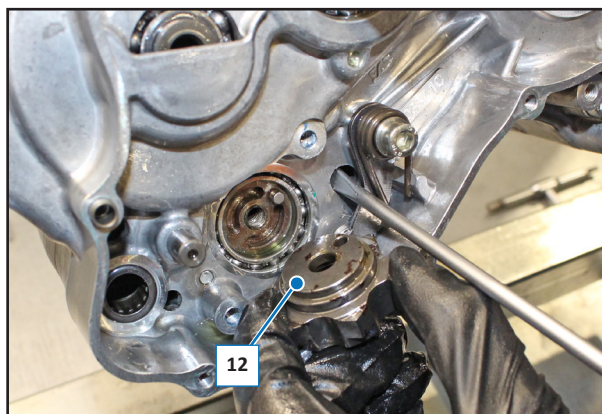
Remove the pin (11).



With a screwdriver (13) move the rod (14) and with a pipe wrench (15) lever to remove the ring nut (12).

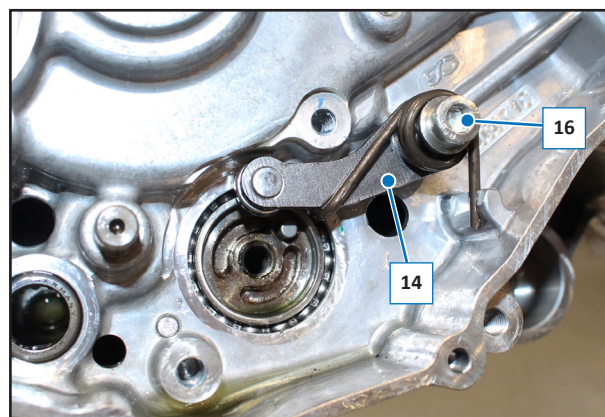


Remove the ring nut (12).



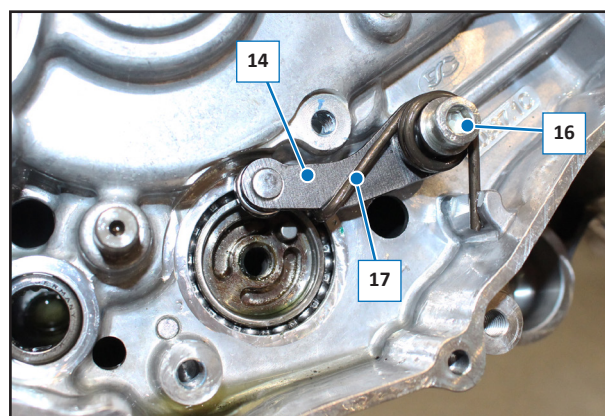


To remove the rod (14) unscrew the screw (16).

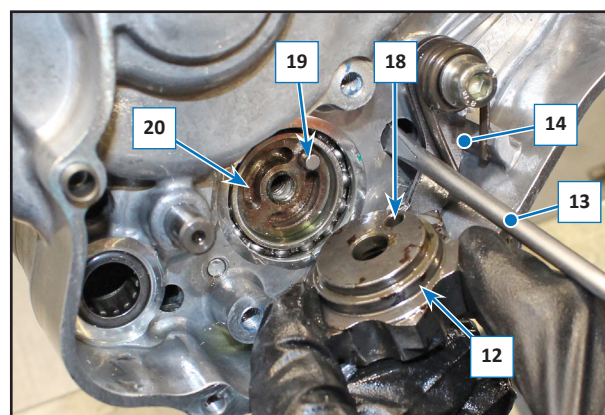


### Reassembly

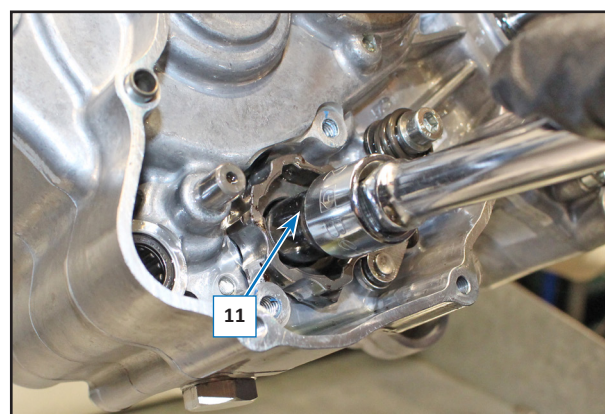
Reassemble the rod (14) by correctly positioning the spring (17) and tightening the screw (16) with a torque of 10 Nm (1 kgm, 7,37 ft/lb)



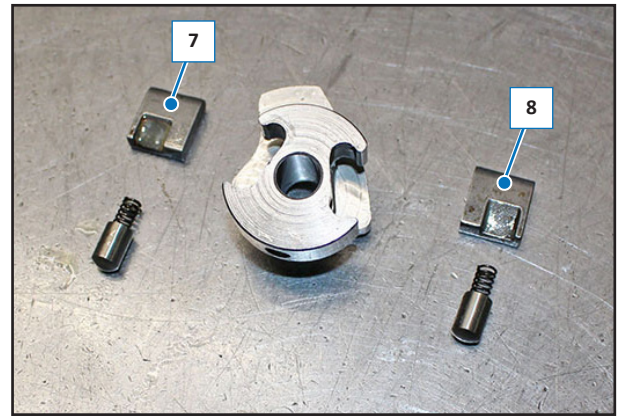
Use a screwdriver (13) to move the rod (14) and fit the gear selection ring (12) by inserting the hole (18) in the pin (19) of the drum (20).



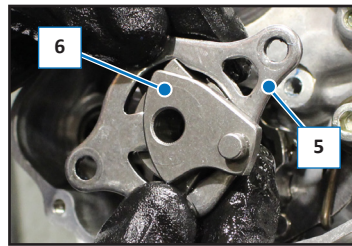
Screw the pin (11) with a torque of 10 Nm (1 kgm, 7,37 ft/lb) + Loctite 243.



Reassemble the rod making sure that the ratchets (7) and (8) fit correctly into their seats; the two ratchets cannot be reversed.

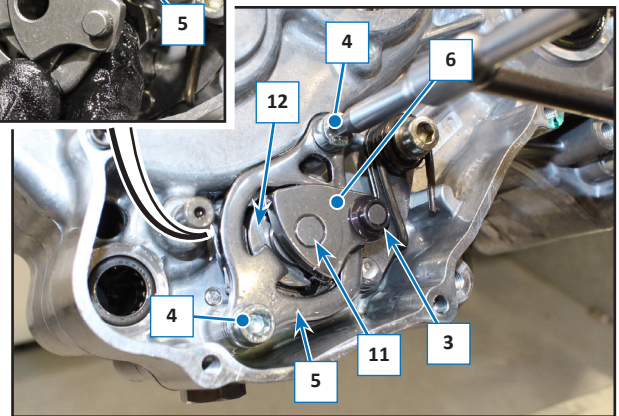


Fit the ratchet support (6) on the plate (5).

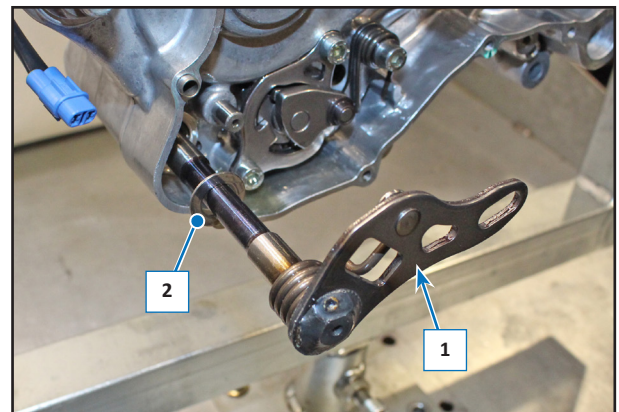


Fit the plate (5) on the pin (11) by inserting the ratchet support (6) in the ring nut (12), tighten the screws (4) with a torque of 10 Nm, (1 kgm, 7,37 ft/lb + Loctite 243).

Mount the socket (3).



Insert the gearbox control shaft (1) with the shim (2).





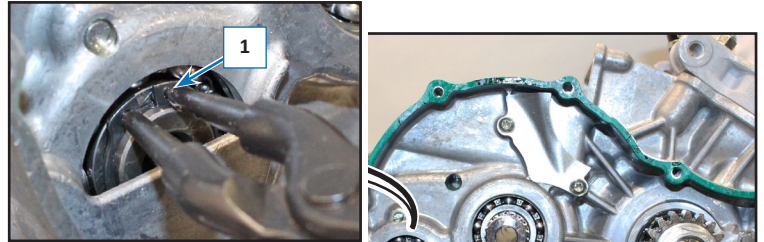
## 2.21 SEMICASE

Remove the heating unit as described in the relevant paragraph.

Remove all parts on the flywheel side and transmission side as described in the relative paragraphs.

### 2.21.1 Opening

On the transmission side, remove the gearbox secondary shaft locking seeger (1).

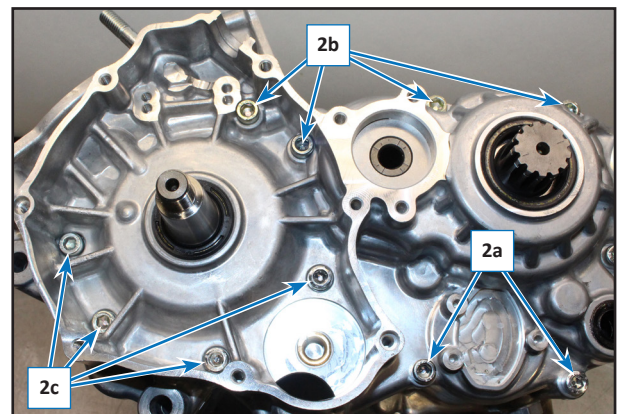
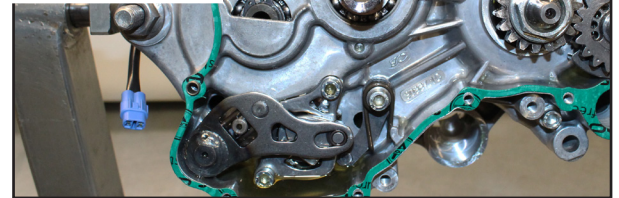


Undo the screws (2).

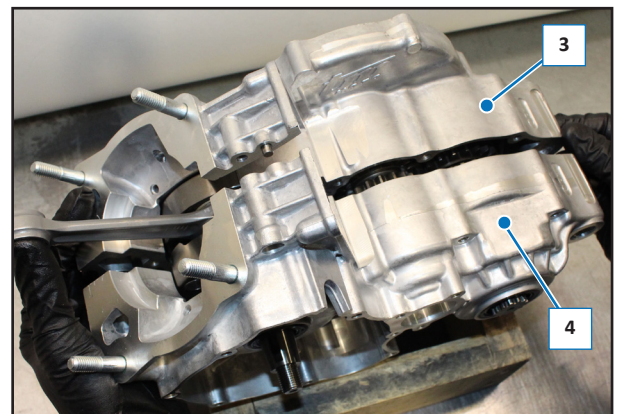
2a = M6 x 45

2b = M6 x 55

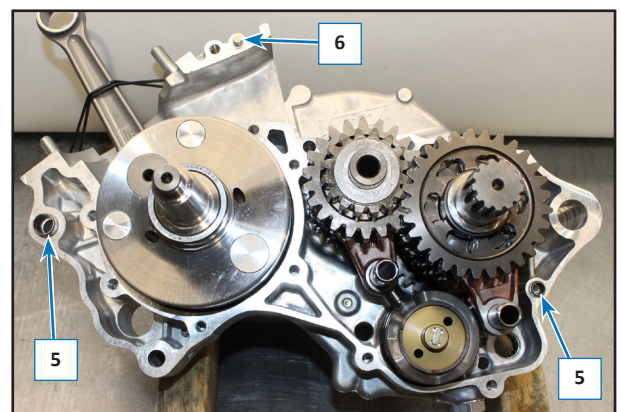
2c = M6 x 60



With a rubber hammer open the two split crankcases (3) and (4).



Retrieve the two centring bushings (5) and pin (6).

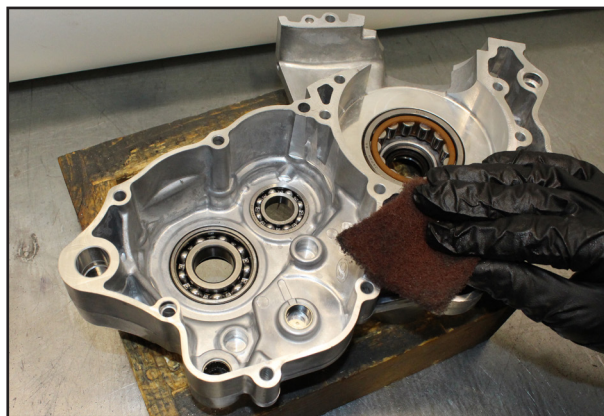
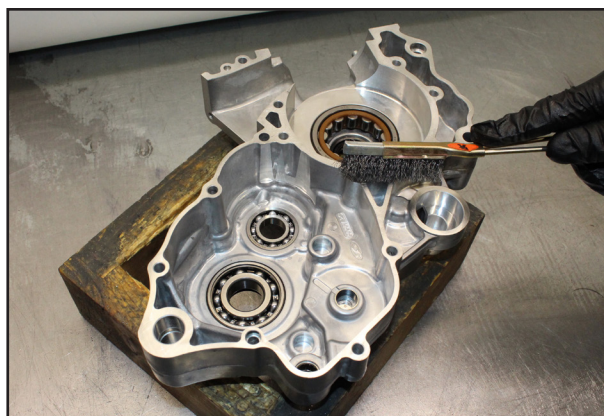
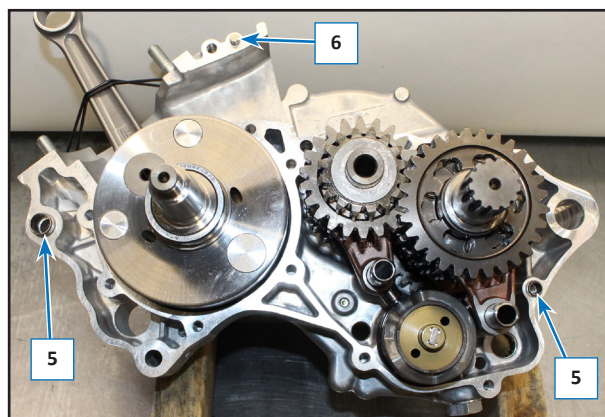




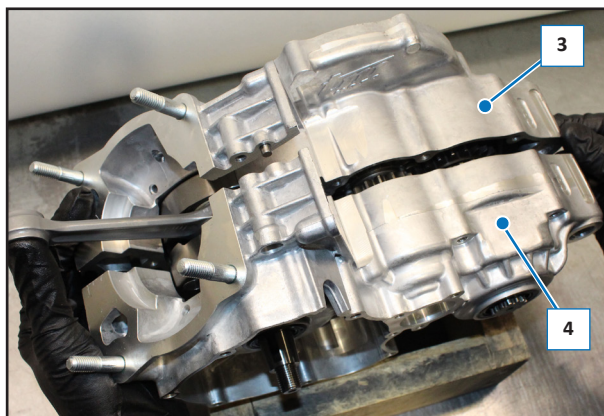
## 2.21.2 Re-assembly

Check that all components are correctly positioned in their housing and that the centring bushes (5) and the pin (6) are mounted.

Clean, first with an iron spatula and then with scotch-brite, the contact surface from any residual sealant paste and then spread a Treebond type sealing paste.



Couple the two split crankcases (3) and (4).

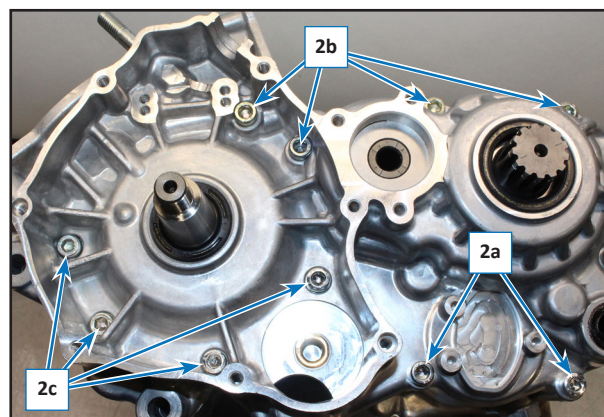


Re-position the screws (2) in the relative housing depending on their length and tighten them with torque of 12 Nm (1.2 kgm, 8.68 ft/lb):

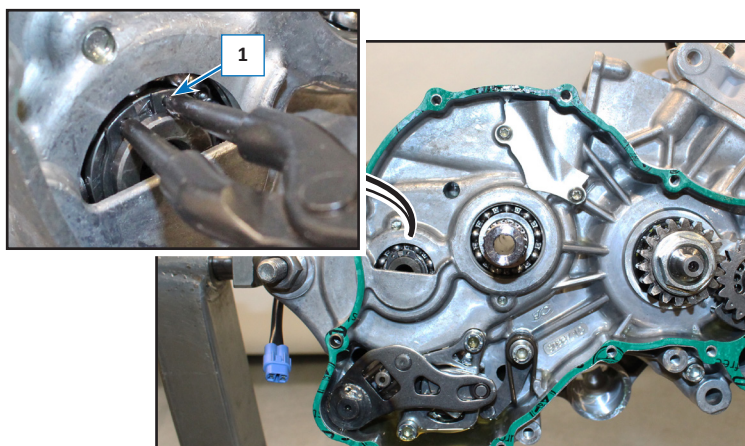
**2a = M6 x 45**

**2b = M6 x 55**

**2c = M6 x 60**



On the transmission side, replace the gearbox secondary shaft locking seeger (1).



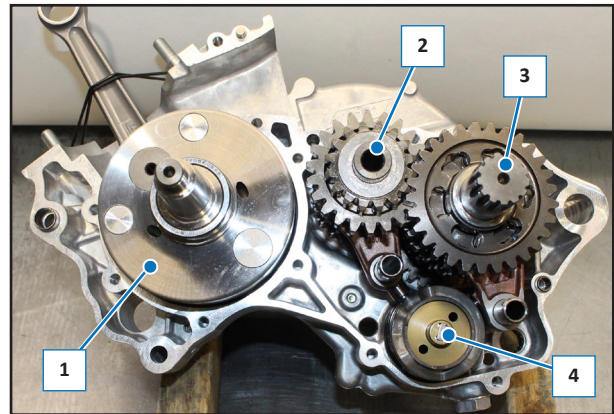


## 2.22 CRANKSHAFT, GEARBOX, GEARS DRUM

Open the guards as indicated in the relative section.

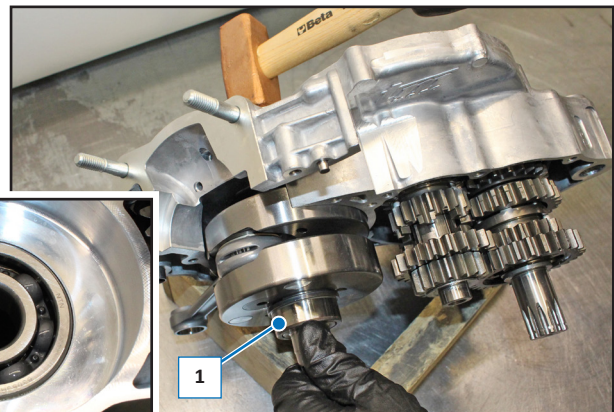
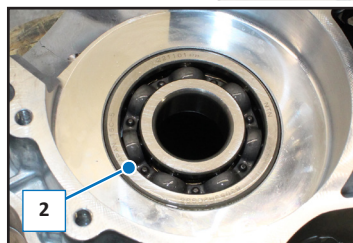
### 2.22.1 Components position

- 1) Crankshaft
- 2) Gearbox primary shaft
- 3) Gearbox secondary shaft
- 4) Gears selector drum (desmo)



### 2.22.2 Crankshaft removal

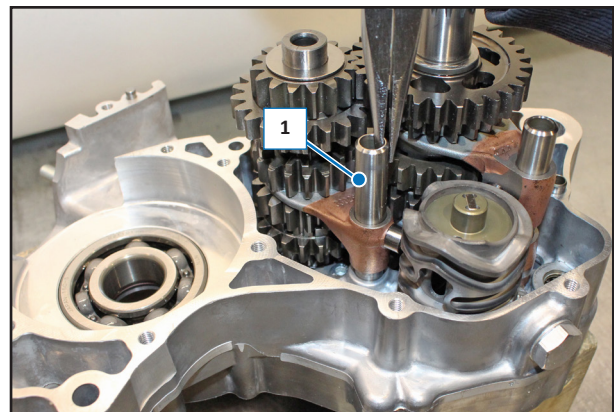
Using a rubber hammer, slide the complete crankshaft (1) from the semicase. If necessary, heat the bearing to facilitate removal of the crankshaft.



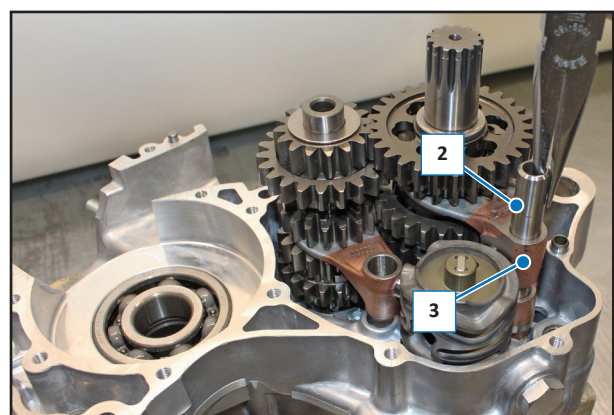
**NOTE:** Upon reassembly, heat the inside of the bearing (2) of the crankshaft before inserting the crankshaft (1).

### 2.22.3 Gear shafts removal

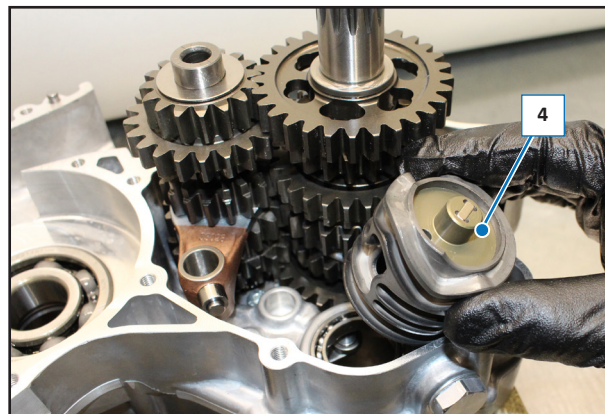
Slide the primary shaft fork pin (1) out.



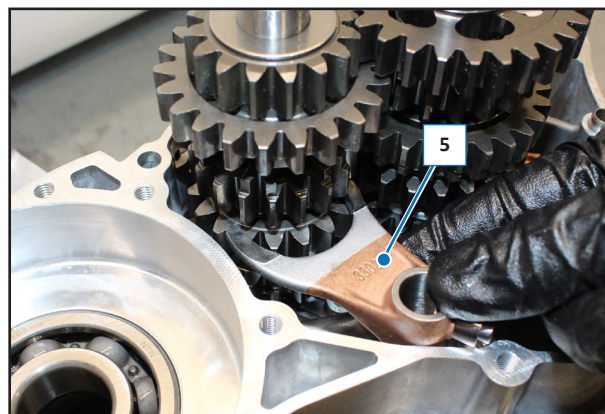
Extract the secondary shaft fork pin (2) complete with fork (3).



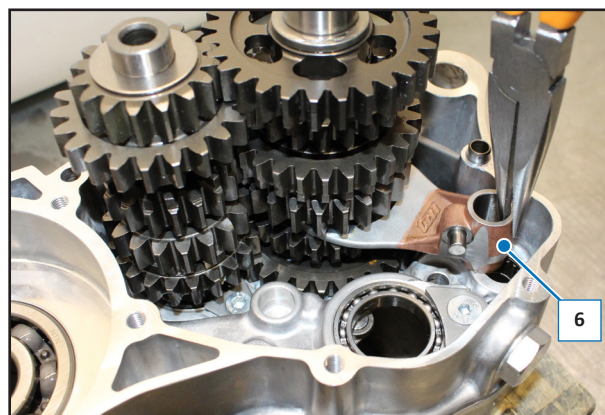
Remove the gear selector drum (4) (desmo).



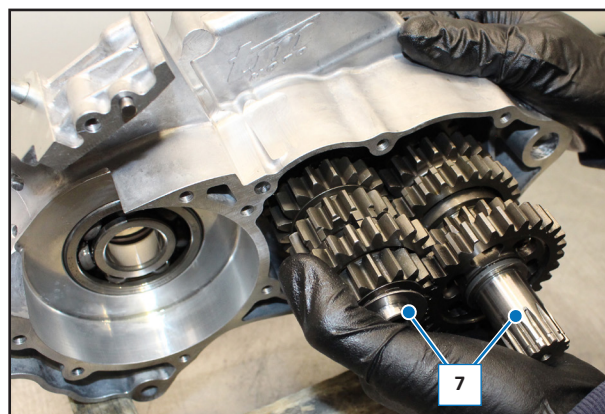
Remove the fork (5) of the primary shaft.



Remove the fork (6) of the secondary shaft.



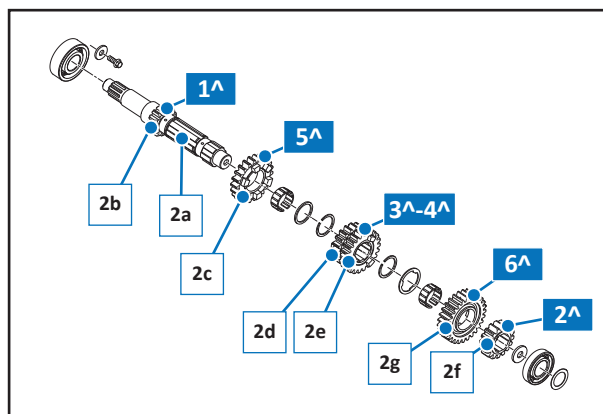
Remove the complete gear assy (2).





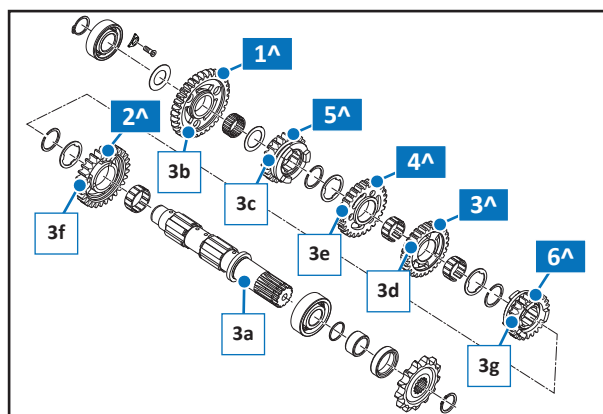
## 2.22.4 Primary shaft, gear sequence (6 gears)

- 2a) Primary shaft
- 2b) First
- 2c) Fifth
- 2d) Third
- 2e) Fourth
- 2f) Second
- 2g) Sixth



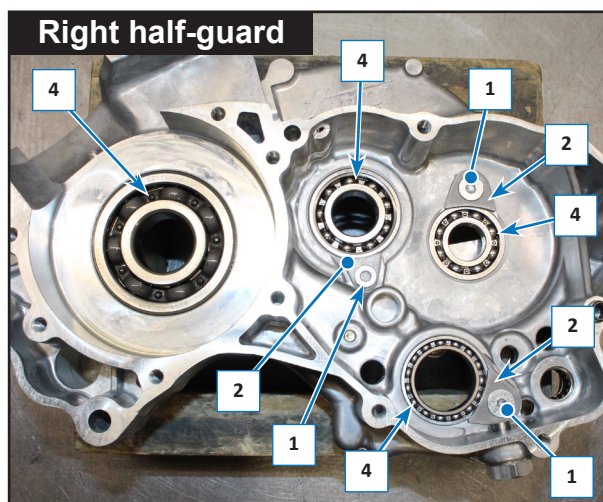
## 2.22.5 Secondary shaft, gear sequence (6 gears)

- 3a) Secondary shaft
- 3b) First
- 3c) Fifth
- 3d) Third
- 3e) Fourth
- 3f) Second
- 3g) Sixth

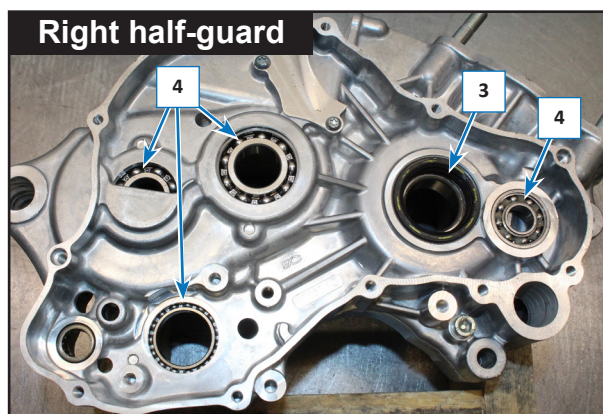


## 2.22.6 Bearings replacement

Unscrew the screws (1) that block the bearing and remove the plates (2).



Remove all seals (3).

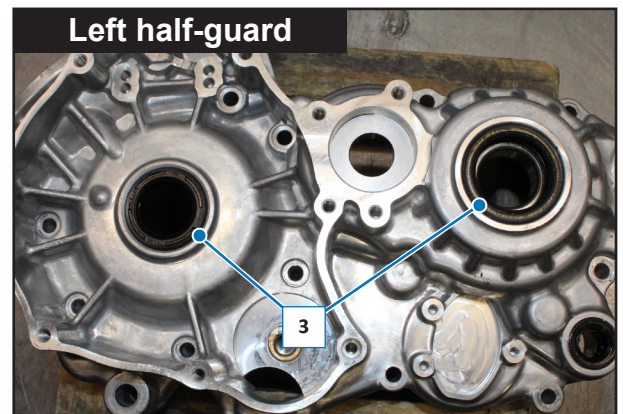
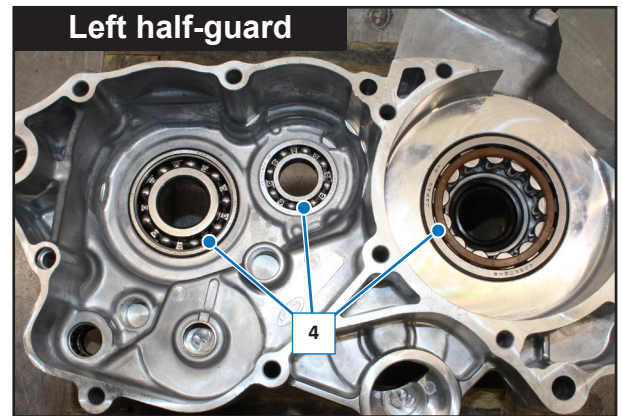


Heat the guards and remove the bearings (4).

**NOTE:** After having replaced the bearings, re-position the safety washers and tighten the screws again and applying Loxeal 82-33 on the thread.

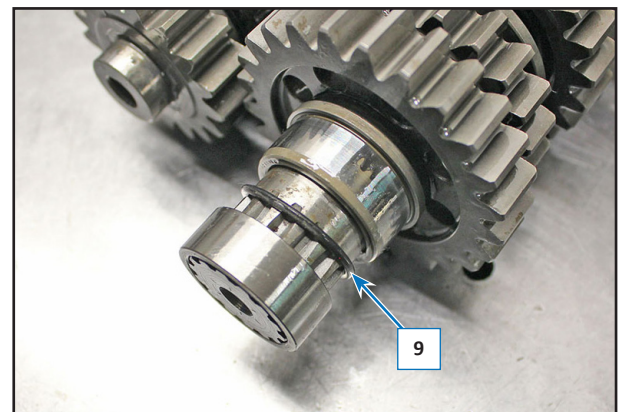
Replace the seals and reassemble them in their relative positions paying attention to the insertion side.

Spread graphite grease on the seals.

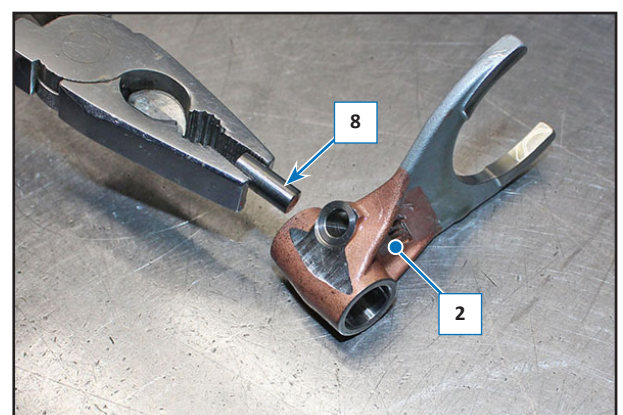


## 2.22.7 Components re-mounting

Check the condition of the OR gasket (9); if damaged, replace.



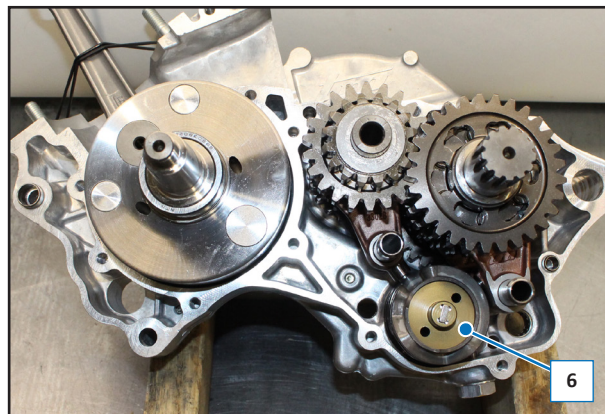
**NOTE:** Check that the pin (8) of the fork (2) is not worn, if worn replace.





Check that the fork rollers are correctly inserted in the relative hollows on the drum (6).

**NOTE:** The forks are different from each other, do not reverse.



Re-mount the components, proceeding in reverse order to disassembly, lubricating with engine oil and, when re-mounting the gearbox unit, paying attention to correctly position the forks (2, 5 and 7) in the relevant positions:

Fork (2) cod. 33027 between the 6th and 3rd gear.

Fork (7) cod. 33023 between the 4th and 5th gear.

Fork (5) cod. 33028 between the 3rd and 4th gear.

