MOTO GUZZI®

PROUDLY AUTHENTIC MOTORCYCLES. SINCE 1921.

SERVICE STATION MANUAL

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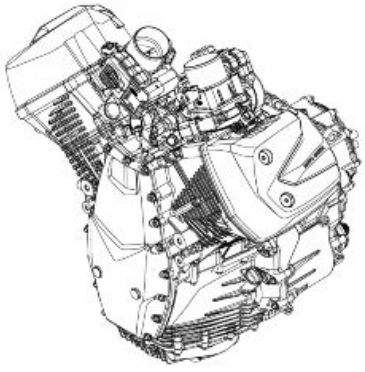

Engine V100

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SERVICE STATION MANUAL

Engine V100

THE VALUE OF SERVICE

As a result of continuous updates and specific technical training programmes for Moto Guzzi products, only **Moto Guzzi** Official Network mechanics know this vehicle fully and have the specific tools necessary to carry out maintenance and repair operations correctly.

The reliability of the vehicle also depends on its mechanical conditions. Checking the vehicle before riding it, its regular maintenance and the use of **original Moto Guzzi spare parts** only are essential factors!

For information on the nearest **Official Dealer and/or Service Centre** consult our website:

www.motoguzzi.com

Only by requesting Moto Guzzi original spare parts can you be sure of purchasing products that were developed and tested during the actual vehicle design stage. All Moto Guzzi original spare parts undergo quality control procedures to guarantee reliability and durability.

The descriptions and images in this publication are given for illustrative purposes only and are not binding. While the basic characteristics as described and illustrated in this booklet remain unchanged, Piaggio & C. S.p.A. reserves the right, at any time and without being required to update this publication beforehand, to make any changes to components, parts or accessories, which it considers necessary to improve the product or which are required for manufacturing or construction reasons.

Not all versions/models shown in this publication are available in all countries. The availability of individual versions should be checked with the Official Moto Guzzi sales network.

The Moto Guzzi brand is owned by Piaggio & C. S.p.A.

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www.piaggio.com

SERVICE STATION MANUAL
Engine V100

This manual provides the main information to carry out regular maintenance operations on your vehicle. This manual is intended to **Moto Guzzi Dealers** and their qualified mechanics; several concepts have been deliberately omitted as they are considered unnecessary. As it is not possible to include complete mechanical notions in this manual, users should have basic mechanical knowledge or minimum knowledge about the procedures involved when repairing vehicle. Without this knowledge, repairing or checking the vehicle may be inefficient or even dangerous. As the vehicle repair and check procedures are not described in detail, be extremely cautious so as not to damage components or injure individuals. In order to optimise customer satisfaction when using our vehicles, **Piaggio & C. S.p.a.** commits itself to continually improve its products and the relative documentation. The main technical modifications and changes in repair procedures are communicated to all **Moto Guzzi Sales Outlets and its International Subsidiaries**. These changes will be introduced in the subsequent editions of the manual. In case of need or further queries on repair and check procedures, consult **Moto Guzzi CUSTOMER DEPARTMENT**, which will be prepared to provide any information on the subject and any further communications on updates and technical changes related to the vehicle.

NOTE Provides key information to make the procedure easier to understand and carry out.

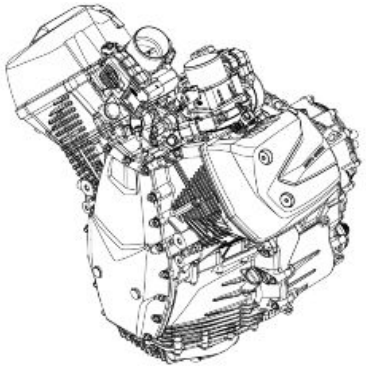
CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

WARNING Refers to specific procedures to carry out to prevent injuries to the repairer.

Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.

Safeguarding the environment Sections marked with this symbol indicate the correct use of the vehicle to prevent damaging the environment.

Vehicle intactness The incomplete or non-observance of these regulations leads to the risk of serious damage to the vehicle and sometimes even the invalidity of the guarantee



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INDEX OF TOPICS

Tightening Torques

If the following tables do not expressly indicate the tightening torque values, refer to the table with the generic torque values indicated below.

GENERAL TIGHTENING TORQUES

	M4	M5	M6	M8	M10	M12
Metric tightening torque: TE - TEFL - SHC - TBEI - TCC - TS	3 Nm (2.21 lbf ft)	6 Nm (4.43 lbf ft)	10 Nm (7.38 lbf ft)	25 Nm (18.44 lbf ft)	50 Nm (36.88 lbf ft)	80 Nm (59.00 lbf ft)

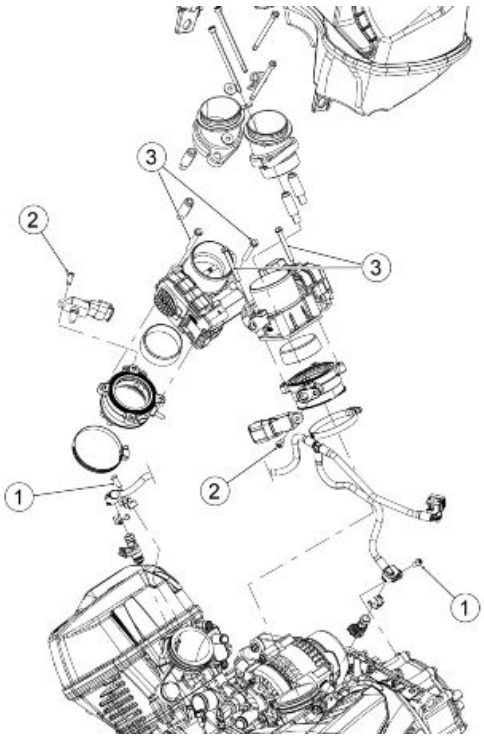
GENERAL TIGHTENING TORQUES FOR SELF TAPPING SCREWS FOR PLASTIC

	2.9 mm	3.9 mm	4.2 mm	5 mm
Tightening torque	2 Nm (1.48 lbf ft)	2 Nm (1.48 lbf ft)	3 Nm (2.21 lbf ft)	3 Nm (2.21 lbf ft)

CAUTION

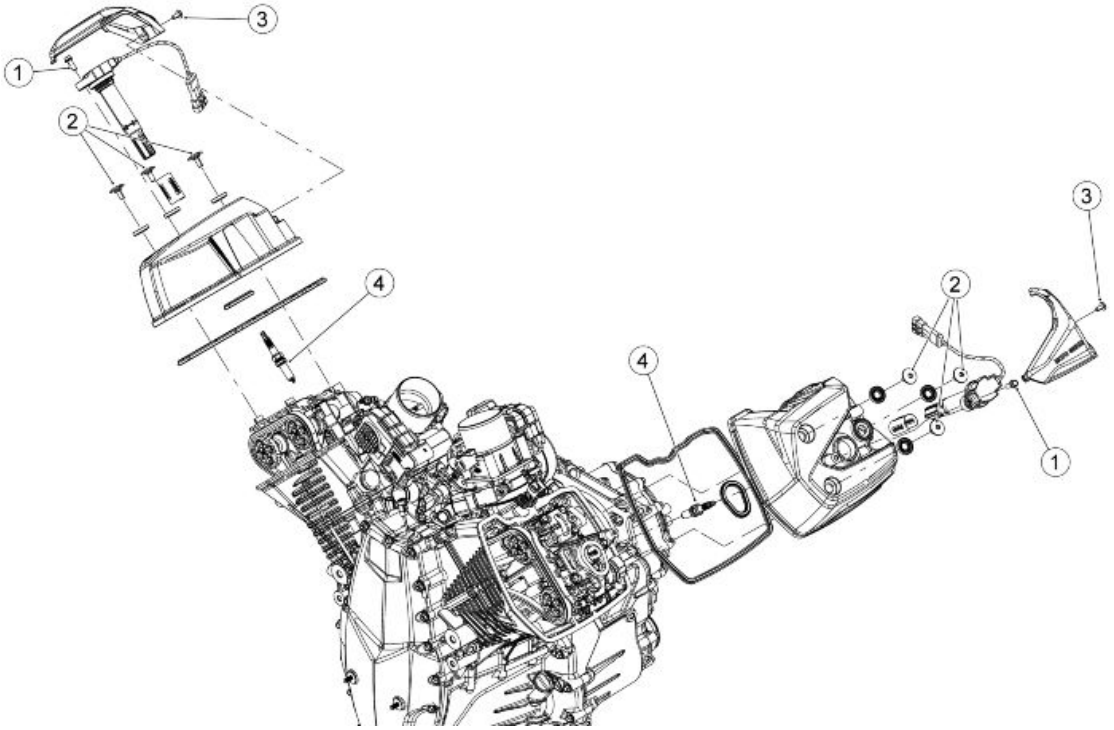
THE SCREWS WITH THREAD-LOCK SEALANT (PRE-IMPREGNATED) MUST BE REPLACED WITH NEW SCREWS AFTER THEY HAVE BEEN LOOSENED.
BEFORE FITTING THE NEW SCREWS, CLEAN THE THREADED HOLES CAREFULLY, MAKING SURE THAT ALL TRACES OF THE OLD THREAD-LOCK SEALANT HAVE BEEN ELIMINATED.

Engine



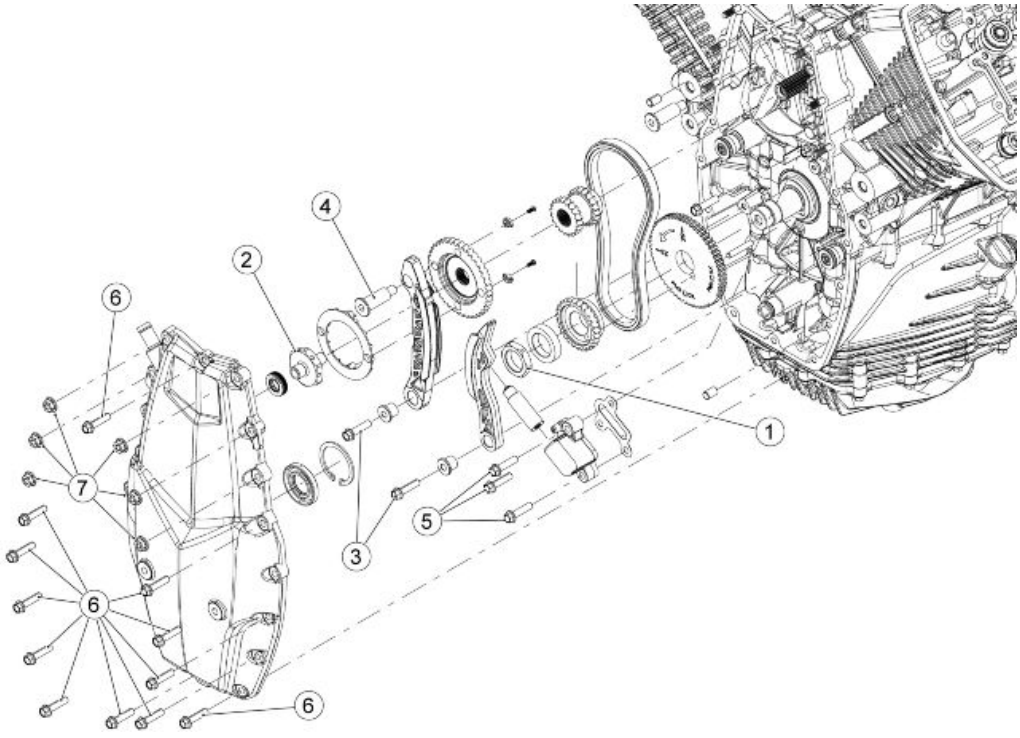
THROTTLE BODIES

Pos.	Description	Type	Quantity	Torque	Note
1	Injector mounting fixing screw	M6	2	11 ÷ 13 Nm (8.11 ÷ 9.59 lbf ft)	-
2	Air temperature/pressure sensor fastening screw	M6	2	11 ÷ 13 Nm (8.11 ÷ 9.59 lbf ft)	-
3	Throttle body fastening screw	M6	4	9 ÷ 11 Nm (6.64 ÷ 8.11 lbf ft)	-



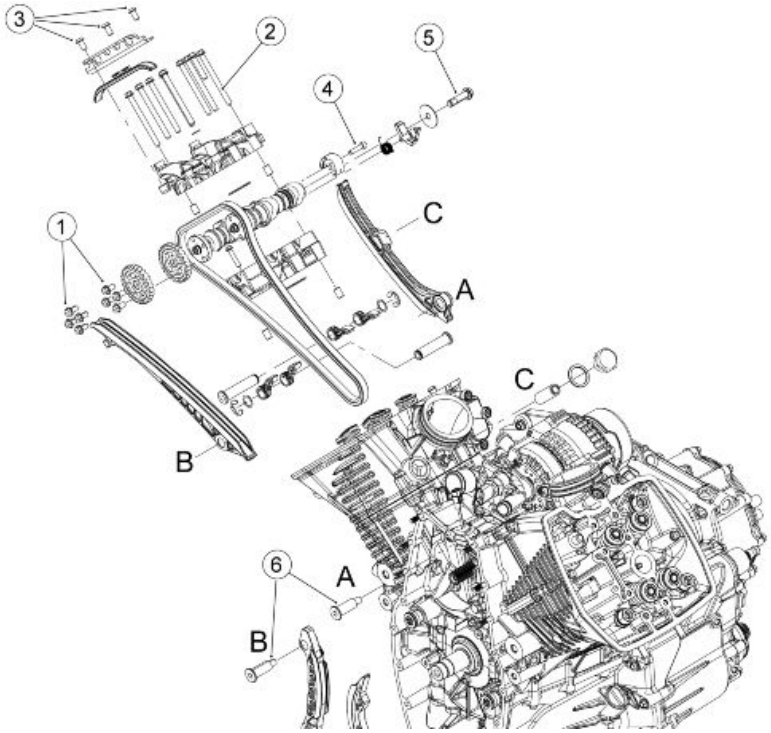
HEADS COVERS

Pos.	Description	Type	Quantity	Torque	Note
1	H.V. coil fixing screw.	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-
2	Head cover fastening screw	M6	6	9÷11 Nm (6.64÷8.11 lb ft)	-
3	Screw fastening the spark plug cover	M5	2	2.7÷3 Nm (1.99÷2.21 lb ft)	-
4	Spark plug tightening	M10 x 1	2	10÷12 Nm (7.38÷8.85 lb ft)	-



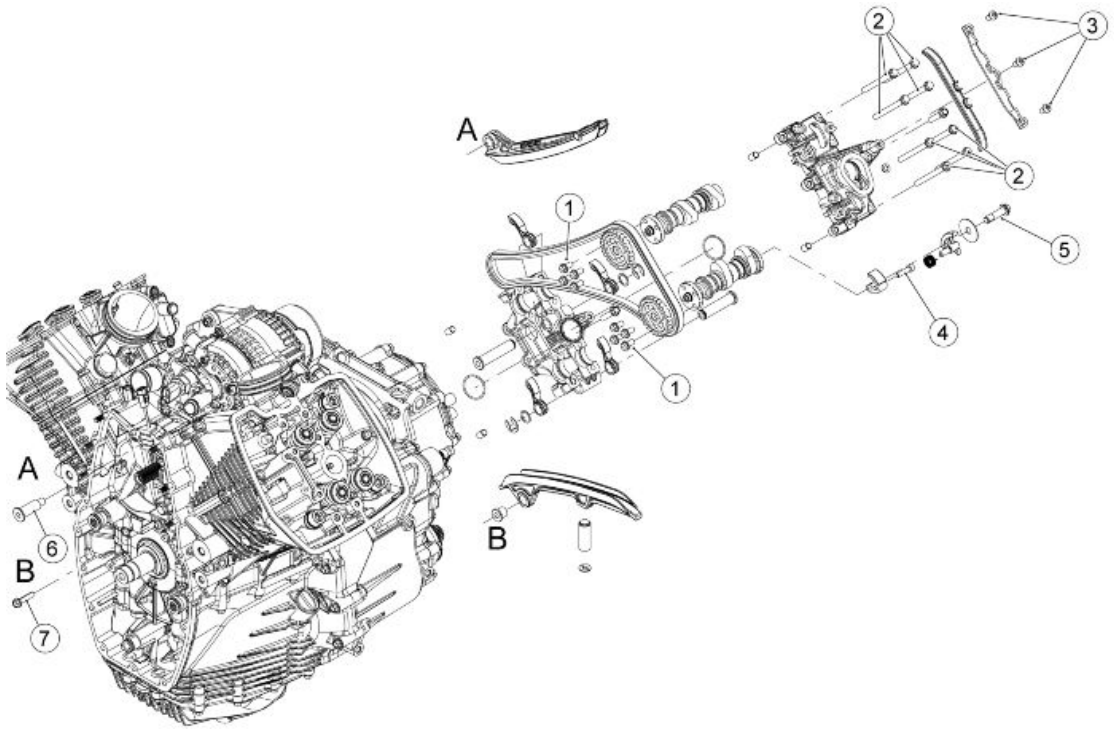
TIMING

Pos.	Description	Type	Quantity	Torque	Note
1	Nut fastening to the crankshaft timing system	M22 x 1	1	63÷70 Nm (46.47÷51.63 lb ft)	-
2	Special screw for fastening the timing system to the countershaft	M10 x 1.25	1	40÷45 Nm (29.50÷33.19 lb ft)	-
3	Chain tensioner slider fastening screw	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-
4	Chain tensioner slider fastening screw spacer	M8	1	20÷24 Nm (14.75÷17.70 lb ft)	3M SCOTCHGRIP 2353 or PRELOK PRECOTE 80 or LOCTITE 2045
5	Screw for fastening the chain tensioner support	M6	3	11÷13 Nm (8.11÷9.59 lb ft)	-
6	Timing cover fastening screw	M6	12	9÷11 Nm (6.64÷8.11 lb ft)	-
7	Timing cover fastening nut	M6	6	9÷11 Nm (6.64÷8.11 lb ft)	-



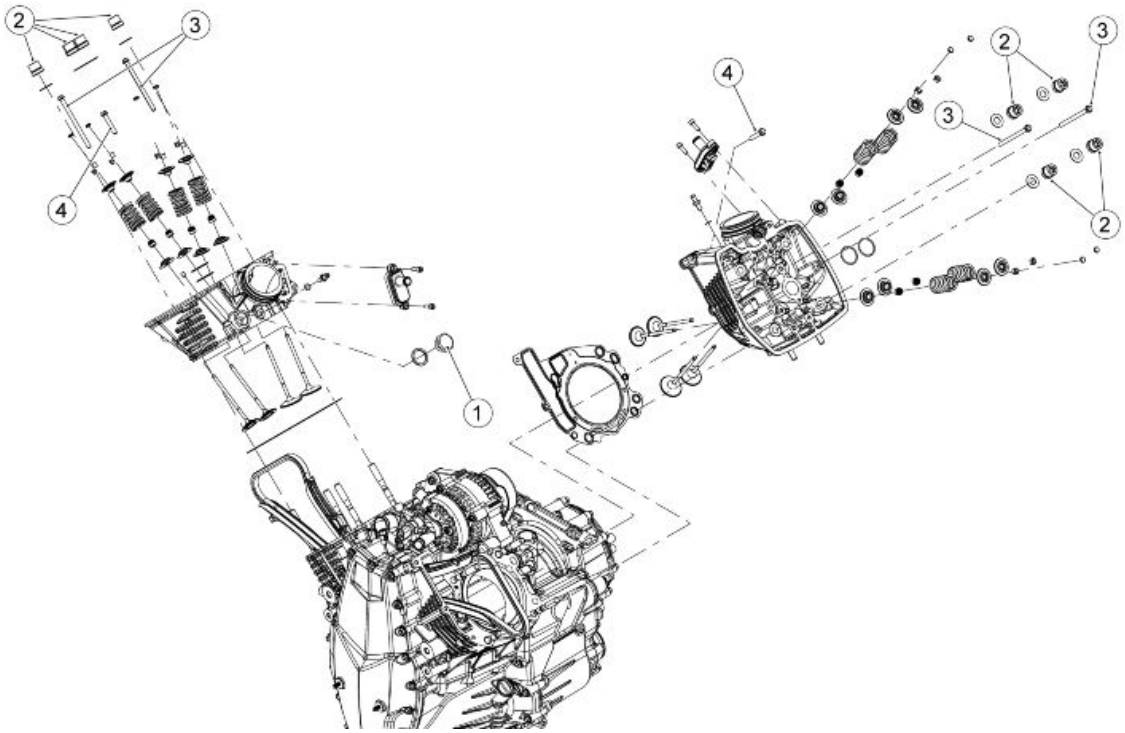
RH TIMING SYSTEM

Pos.	Description	Type	Quantity	Torque	Note
1	Timing system gear sprocket fixing screw	M6	8	11÷13 Nm (8.11÷9.59 lb ft)	-
2	Camshaft support fastening screw	M6 x 1	8	11÷13 Nm (8.11÷9.59 lb ft)	-
3	Upper chain slider fastening screw	M6 x 1	3	11÷13 Nm (8.11÷9.59 lb ft)	3M SCOTCHGRIP 2353 or PRELOK PRECOTE 80 or LOCTITE 2045
4	Pressure reducer counterweight retainer screw	M5 x 0,8	1	5÷6 Nm (3.69÷4.43 lb ft)	LOCTITE DRILOC 211 or 3M SCOTCH GRIP 2510
5	Decompressor fastening screw	M8 X 1.25	1	20÷24 Nm (14.75÷17.70 lb ft)	-
6	Chain tensioner slider fastening screw spacer	M8	2	20÷24 Nm (14.75÷17.70 lb ft)	3M SCOTCHGRIP 2353 or PRELOK PRECOTE 80 or LOCTITE 2045



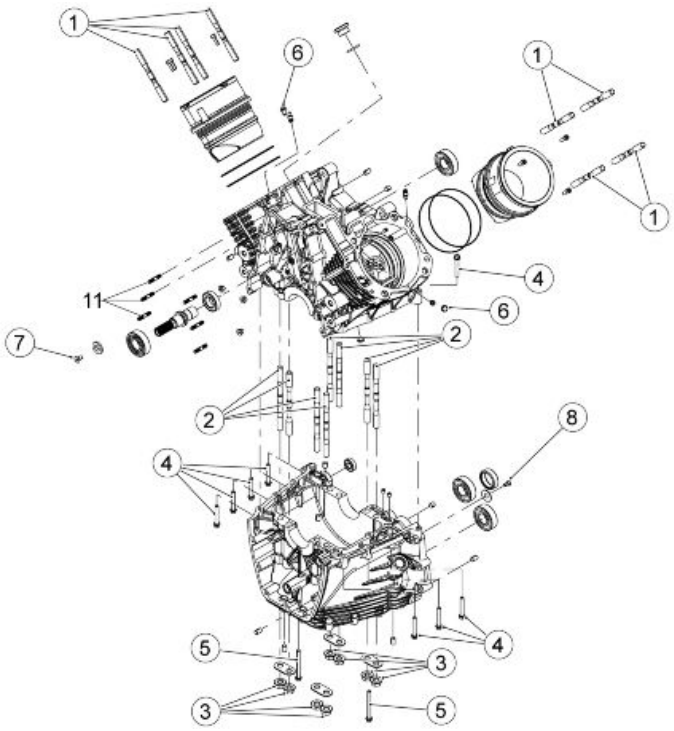
LH TIMING SYSTEM

Pos.	Description	Type	Quantity	Torque	Note
1	Timing system gear sprocket fixing screw	M6	8	11÷13 Nm (8.11÷9.59 lb ft)	-
2	Camshaft support fastening screw	M6 x 1	8	11÷13 Nm (8.11÷9.59 lb ft)	-
3	Upper chain slider fastening screw	M6 x 1	3	11÷13 Nm (8.11÷9.59 lb ft)	3M SCOTCHGRIP 2353 or PRELOK PRECOTE 80 or LOCTITE 2045
4	Pressure reducer counterweight retainer screw	M5 x 0,8	1	5÷6 Nm (3.69÷4.43 lb ft)	LOCTITE DRILOC 211 or 3M SCOTCH GRIP 2510
5	Decompressor fastening screw	M8 X 1.25	1	20÷24 Nm (14.75÷17.70 lb ft)	-
6	Chain tensioner slider fastening screw spacer	M8	1	20÷24 Nm (14.75÷17.70 lb ft)	3M SCOTCHGRIP 2353 or PRELOK PRECOTE 80 or LOCTITE 2045
7	Chain tensioner slider fastening screw	M6	1	11÷13 Nm (8.11÷9.59 lb ft)	-



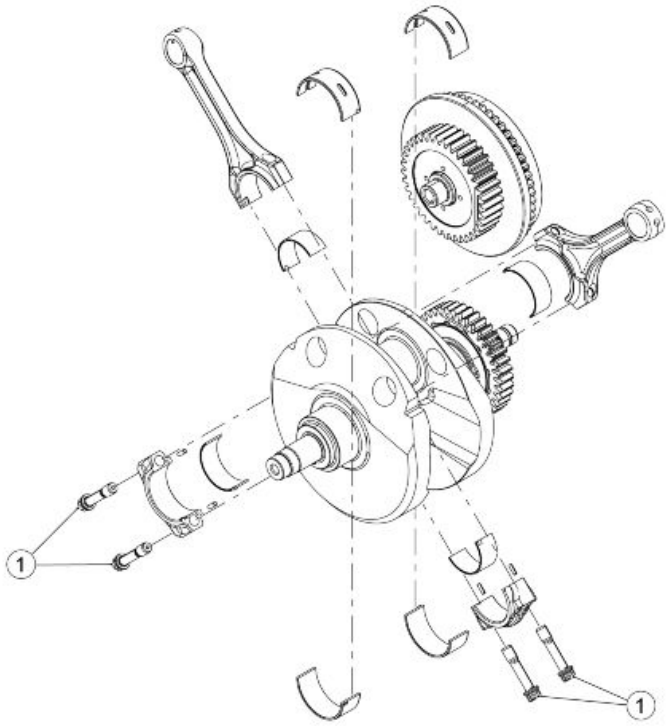
HEAD - VALVES

Pos.	Description	Type	Quantity	Torque	Note
1	Chain tensioner cap	M22 x 1.25	1	24÷27 Nm (17.70÷19.91 lb ft)	-
2	Head fixing nut (pre-tightening)	M10 x 1.25	8	18÷22 Nm (13.28÷16.23 lb ft)	Lubricate the threads and support surface with MOLY-KOTE G RAPID PLUS SPRAY grease
2	Head fixing nut (1st angle)	M10 x 1.25	8	43° ÷ 47°	Lubricate the threads and support surface with MOLY-KOTE G RAPID PLUS SPRAY grease
2	Head fixing nut (2nd angle)	M10 x 1.25	8	43° ÷ 47°	Lubricate the threads and support surface with MOLY-KOTE G RAPID PLUS SPRAY grease
3	Head fastening screw	M6	4	11÷13 Nm (8.11÷9.59 lb ft)	-
4	Head fastening screw	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-



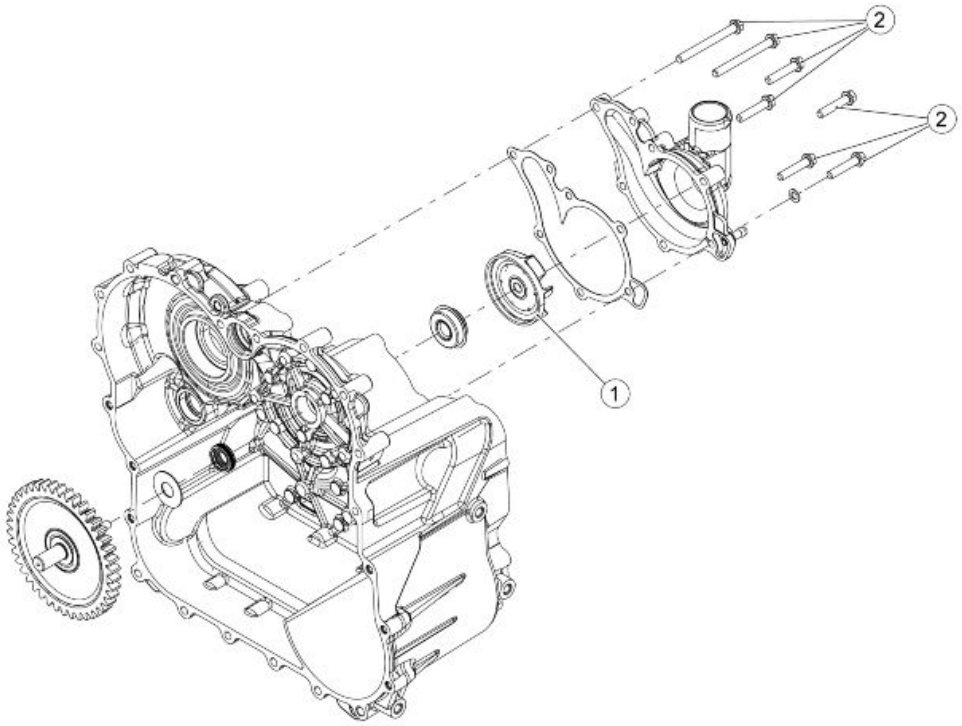
CRANKCASE

Pos.	Description	Type	Quantity	Torque	Note
1	Stud bolt fixing the head to the crankcase	M10 x 1.25	8	5÷6 Nm (3.69÷4.43 lb ft)	-
2	Stud bolt fastening to the upper crankcase	M10 x 1.25	2	22÷25 Nm (3.69÷4.43 lb ft)	-
3	Crankcase fastening nut (1st tightening)	M10 x 1.25	8	9÷11 Nm (6.64÷8.11 lb ft)	Lubricate the threads and support surface with MOLYKOTE G RAPID PLUS SPRAY grease
3	Crankcase fastening nut (2nd tightening)	M10 x 1.25	8	19÷21 Nm (14.01÷15.49 lb ft)	Lubricate the threads and support surface with MOLYKOTE G RAPID PLUS SPRAY grease
3	Crankcase fastening nut (final tightening)	M10 x 1.25	8	90 ± 2°	Lubricate the threads and support surface with MOLYKOTE G RAPID PLUS SPRAY grease
4	Crankcase fastening screw	M6x40	8	11÷13 Nm (8.11÷9.59 lb ft)	-
5	Crankcase fastening screw	M6x60	2	11÷13 Nm (8.11÷9.59 lb ft)	-
6	Cooling nozzle fastening screw	M5	2	5÷6 Nm (3.69÷4.43 lb ft)	-
7	Bearing retaining screw on upper crankcase.	M6x12	1	9÷11 Nm (6.64÷8.11 lb ft)	SCOTCH GRIP 2353 or LOCTITE DRILOC 2045 BLU
8	Bearing retaining screw on upper crankcase.	M5	3	6÷8 Nm (4.43÷5.90 lb ft)	-



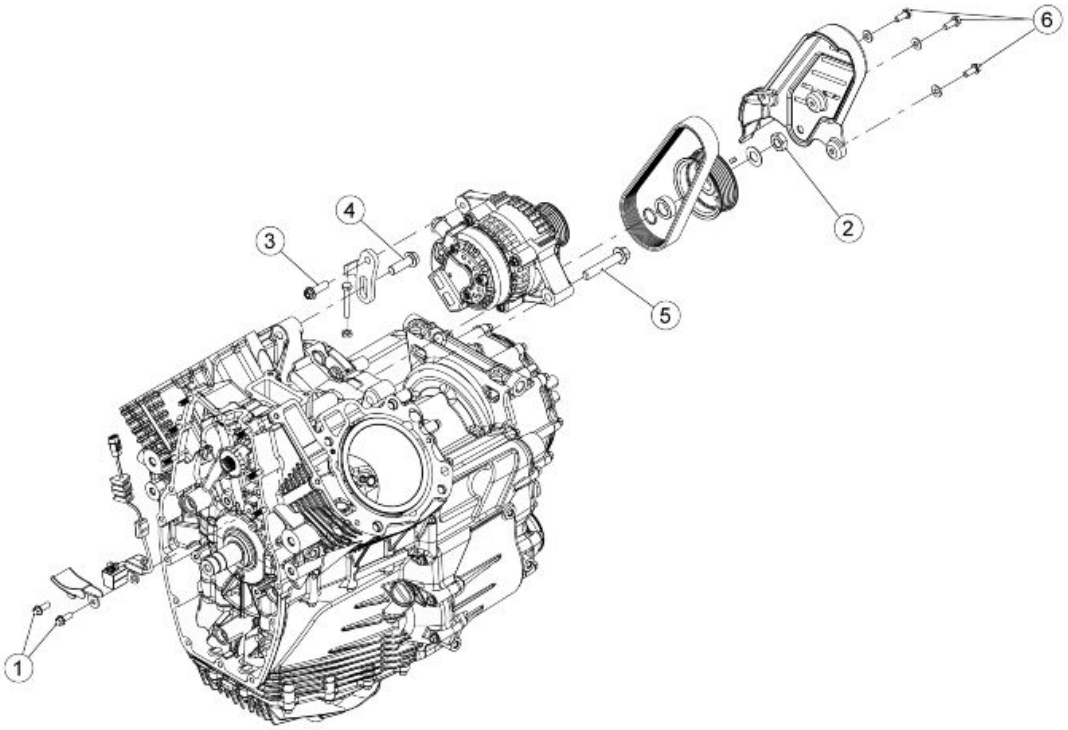
CRANKSHAFT

Pos.	Description	Type	Quantity	Torque	Note
1	Connecting rod screw (1st coupling)	MJ9x1	4	10 Nm (7.38 lbf ft)	Lubricate the thread and underhead with Pankl PLB 03
1	Connecting rod screw (2nd coupling)	MJ9x1	4	25 Nm (18.44 lbf ft)	Lubricate the thread and underhead with Pankl PLB 03
1	Connecting rod screw (final tightening)	MJ9x1	4	105° ± 2°	Lubricate the thread and underhead with Pankl PLB 03



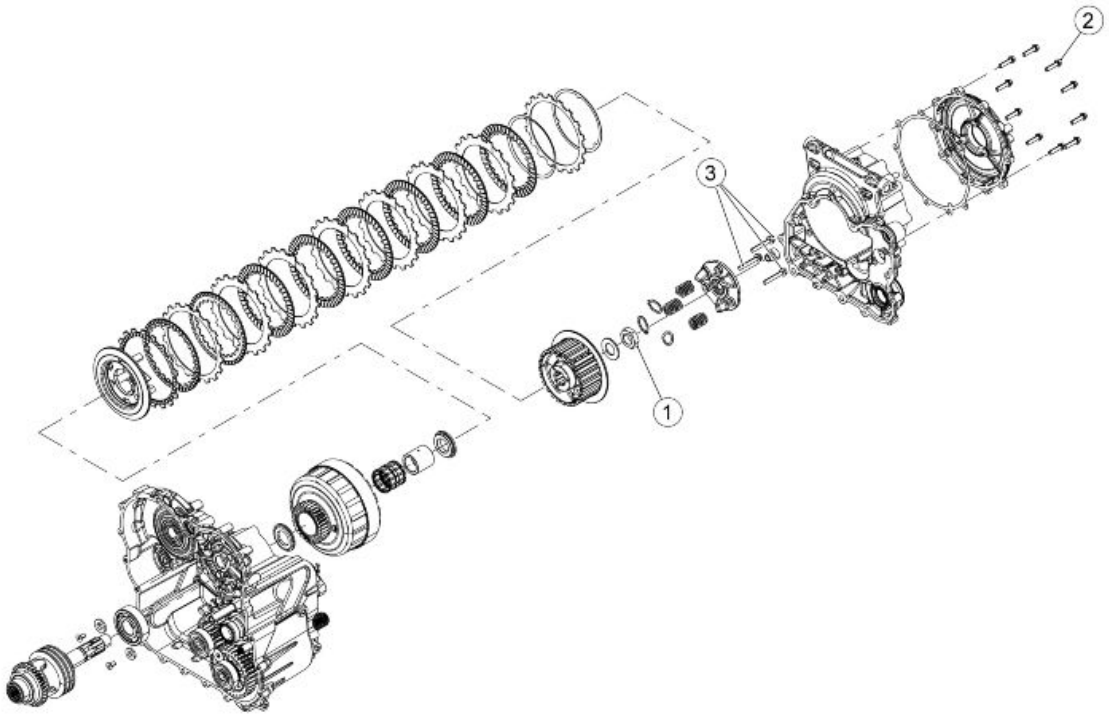
WATER PUMP

Pos.	Description	Type	Quantity	Torque	Note
1	Water pump impeller	M6 x 1	1	5÷6 Nm (3.69÷4.43 lb ft)	-
2	Water pump cover fastening screw	M6	7	11÷13 Nm (8.11÷9.59 lb ft)	-



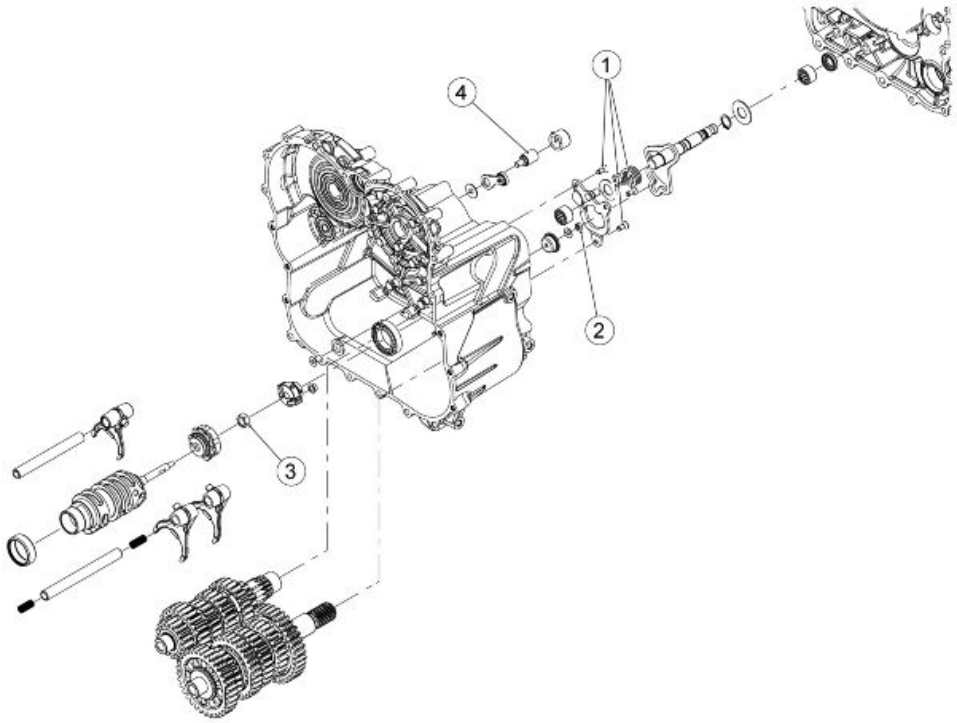
ALTERNATOR

Pos.	Description	Type	Quantity	Torque	Note
1	Pick-up plate fastening screw	M6 - 6g	2	9÷11 Nm (6.64÷8.11 lb ft)	-
2	Alternator pulley fastening nut	M12 x 1.5	1	48÷54 Nm (35.40÷39.83 lb ft)	-
3	Adjuster bracket fastening screw	M10 x 1.5	1	45÷50 Nm (33.19÷36.88 lb ft)	-
4	Screw fastening alternator to adjuster	M8 X 1.25	1	20÷24 Nm (14.75÷17.70 lb ft)	-
5	Alternator fixing screw	M10 X 1.5	1	45÷50 Nm (33.19÷36.88 lb ft)	-
6	Belt cover fixing screw	M6	3	8÷10 Nm (5.90÷7.38 lb ft)	-



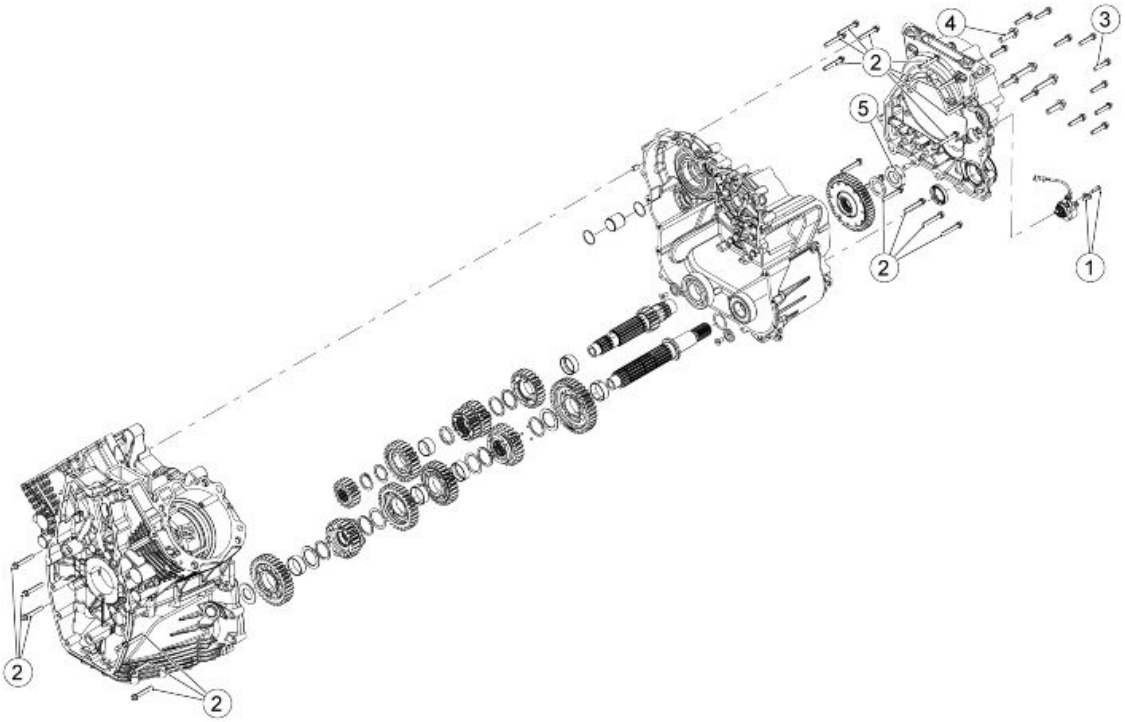
CLUTCH

Pos.	Description	Type	Quantity	Torque	Note
1	Clutch hub fixing nut	M20 x 1	1	225÷255 Nm (165.95÷188.08 lb ft)	-
2	Clutch cover fixing screw	M6	10	11÷13 Nm (8.11÷9.59 lb ft)	-
3	Thrust plate fixing screw	M6	3	3÷4 Nm (2.21÷2.95 lb ft)	-



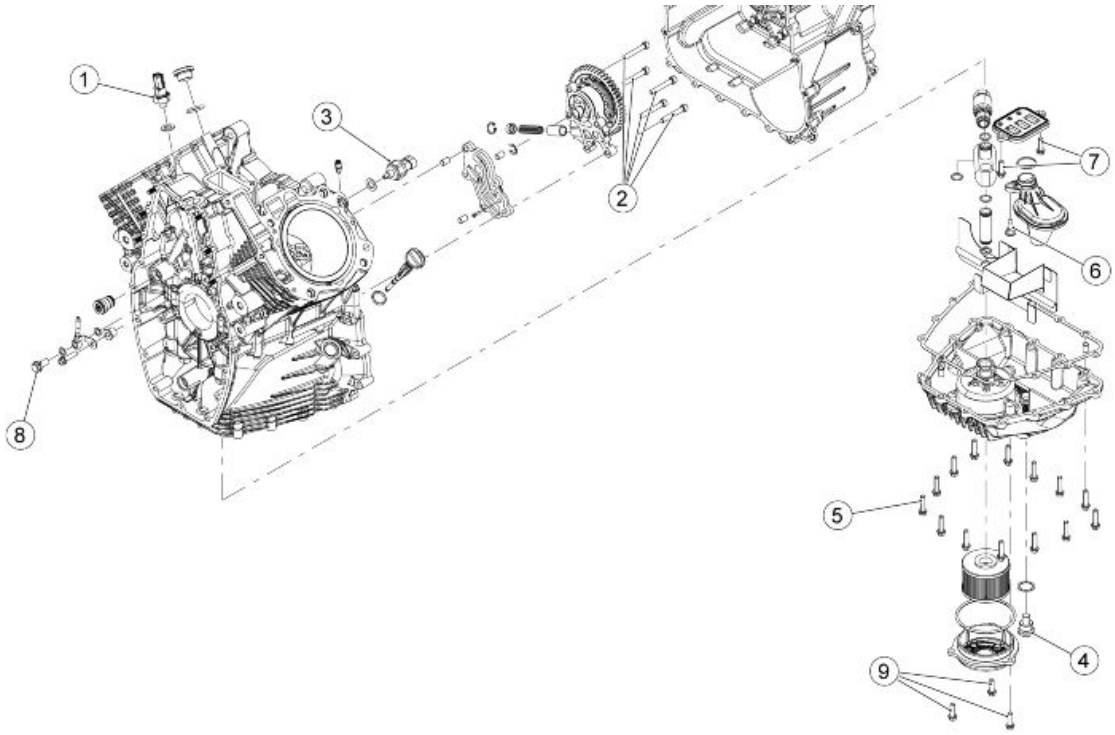
SELECTOR - DESMODROMIC

Pos.	Description	Type	Quantity	Torque	Note
1	Retainer plate fixing screw	M5	3	6÷8 Nm (4.43÷5.90 lb ft)	-
2	Gear sensor sprocket fastening nut	M5	1	5÷6 Nm (3.69÷4.43 lb ft)	-
3	Desmodromic drum fastening nut	M10 x 1	1	20÷24 Nm (14.75÷17.70 lb ft)	-
4	Index lever fixing pin	M6	1	5÷6 Nm (3.69÷4.43 lb ft)	-



GEARBOX HOUSING

Pos.	Description	Type	Quantity	Torque	Note
1	Gear sensor fastening screw	M5	2	6÷8 Nm (4.43÷5.90 lb ft)	-
2	Gearbox fixing screw	M6	20	11÷13 Nm (8.11÷9.59 lb ft)	-
3	Gearbox cover fastening screw	M6	11	11÷13 Nm (8.11÷9.59 lb ft)	-
4	Gearbox cover fastening screw	M8	5	30÷34Nm (22.13÷25.08 lb ft)	-
5	Nut fastening gear on primary shaft	M24 x 1.5	1	225÷255 Nm (165.95÷188.08 lb ft)	-

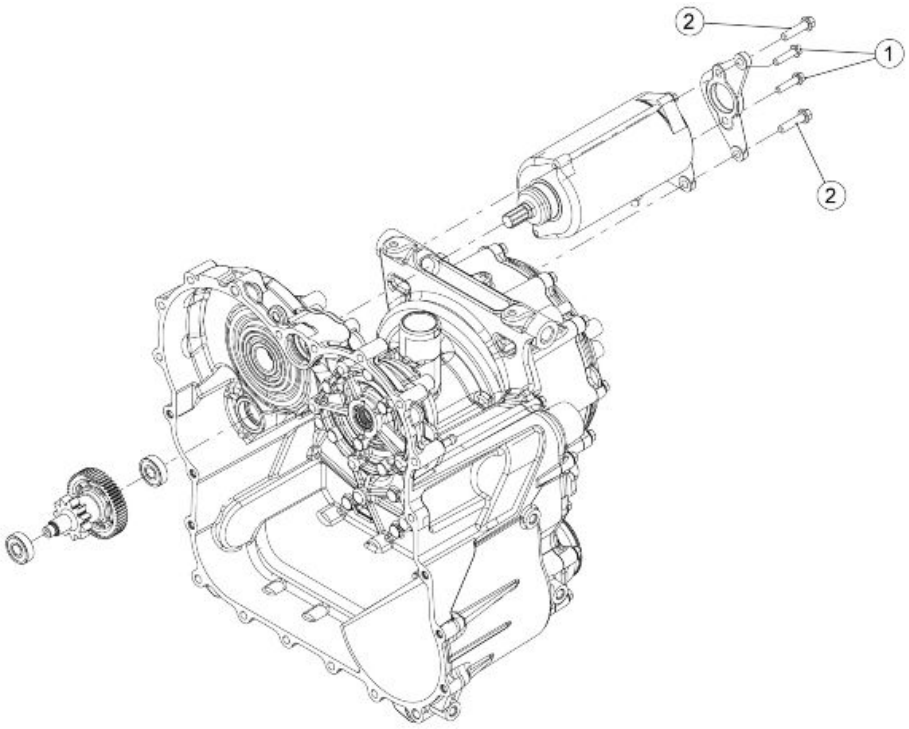


LUBRICATION

Pos.	Description	Type	Quantity	Torque	Note
1	Minimum oil pressure sensor	M10 x 1	1	12÷14 Nm (8.85÷10.33 lb ft)	-
2	Oil pump fastener screw	M6 x 1	5	9÷11 Nm (6.64÷8.11 lb ft)	-
3	Oil temperature sensor	M10 x 1	1	12÷14 Nm (8.85÷10.33 lb ft)	-
4	Engine oil drainage plug	M18 x 1.5	1	18÷22 Nm (13.28÷16.23 lb ft)	-
5	Oil sump fixing screw	M6	14	11÷13 Nm (8.11÷9.59 lb ft)	-
6	Rose pipe fixing screw	M6	1	5÷6 Nm (3.69÷4.43 lb ft)	-
7	Reed valve fixing screw	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-
8	Chain lubrication nozzle fastening screw	M8 x 1	1	16÷18 Nm (11.80÷13.28 lb ft)	-

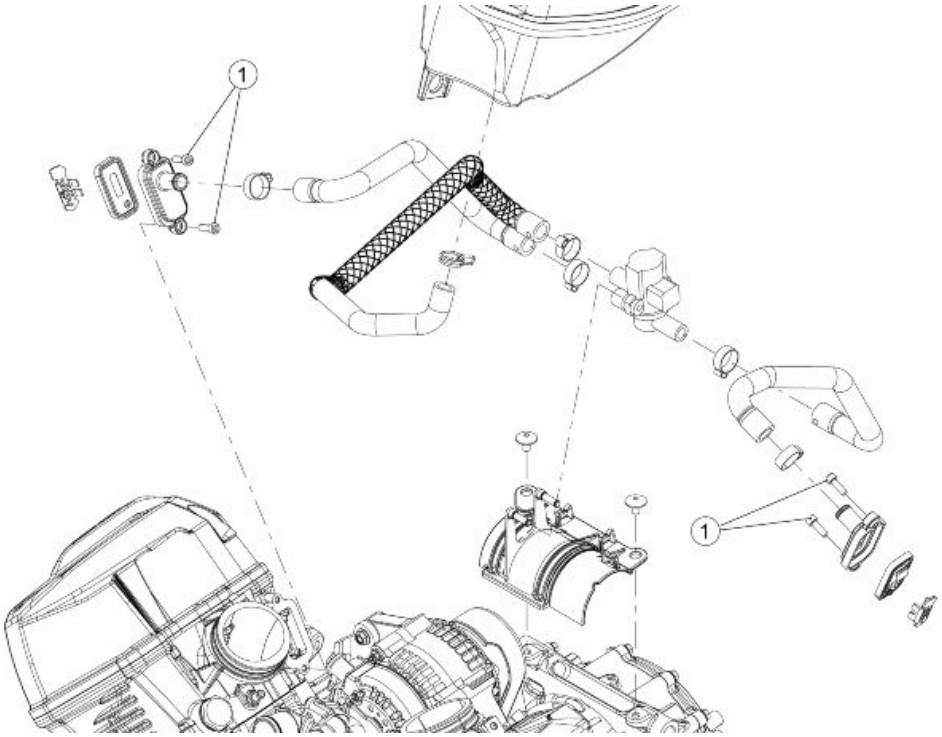
ELECTRIC STARTER

Pos.	Description	Type	Quantity	Torque	Note
1	Screw fixing the bracket to the starter motor	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-
2	Screw fixing the bracket to the crank-case	M6	2	11÷13 Nm (8.11÷9.59 lb ft)	-



SECONDARY AIR SYSTEM

Pos.	Description	Type	Quantity	Torque	Note
1	SAS valve cover fastening screw	M5	2+2	3÷4 Nm (2.21÷2.95 lb ft)	-



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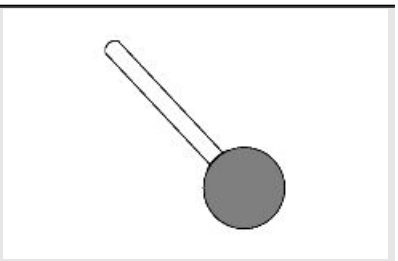
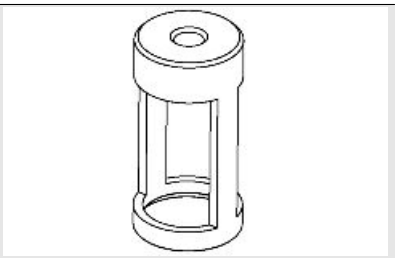
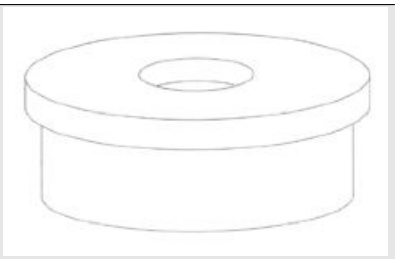
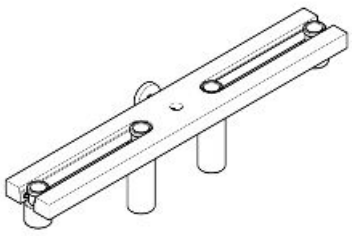
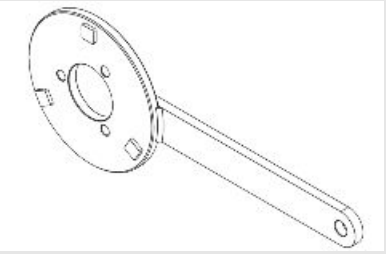
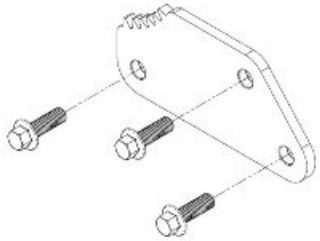
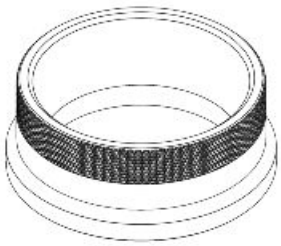
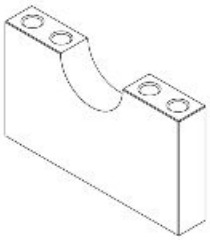
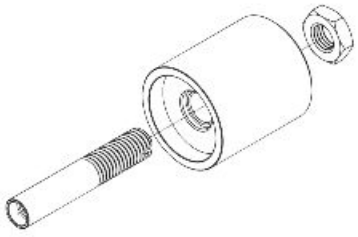
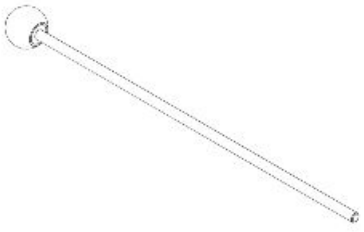
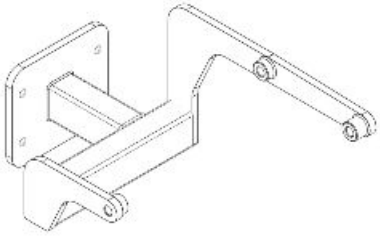
SPECIAL TOOLS

Stores code	Description	
020851Y	Camshaft timing pin	
020382Y	Valve cotters equipped with part 012 removal tool	
020853Y	Compresses intake valve springs	
020376Y	Adaptor handle	
020360Y	52 x 55 mm adaptor	
020714Y	Dial gauge mount	

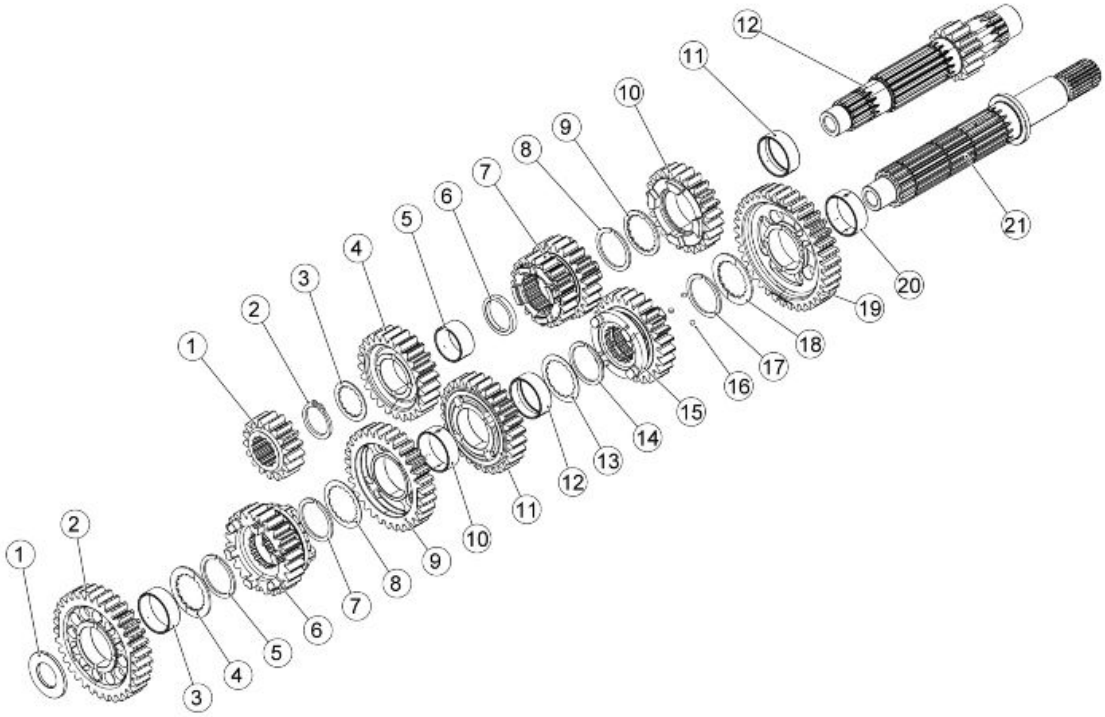
Stores code	Description	
021058Y	Clutch retainer	
021059Y	Primary retainer	
021061Y	Ring clamp	
021062Y	Crankshaft support U-bolt	
021063Y	Water pump seal insertion tool	
021064Y	Large pin for engine timing	
021065Y	Engine support frame	

Stores code	Description	
021072Y	Right chain tensioner	
021073Y	Central chain tensioner	
021074Y	Left chain tensioner	

INDEX OF TOPICS

Gearbox

Diagram



Key:

Primary shaft

1. 2nd gear;
2. Seeger;
3. Spacer;
4. 6th gear;
5. Bushing;
6. Spacer ring;
7. 3rd and 4th gear;
8. Snap ring;
9. Spacer;
10. 5th gear;
11. Bushing;
12. Primary shaft with integrated 1st gear.

Transmission shaft

1. Shim;
2. 2nd gear;

3. Bushing;
4. Spacer;
5. Snap ring;
6. 6th gear;
7. Snap ring;
8. Spacer;
9. 3rd gear;
10. Bushing;
11. 4th gear;
12. Bushing;
13. Spacer;
14. Snap ring;
15. 5th gear;
16. Balls;
17. Snap ring;
18. Spacer;
19. 1st gear;
20. Bushing;
21. Transmission shaft.

Gearbox shafts

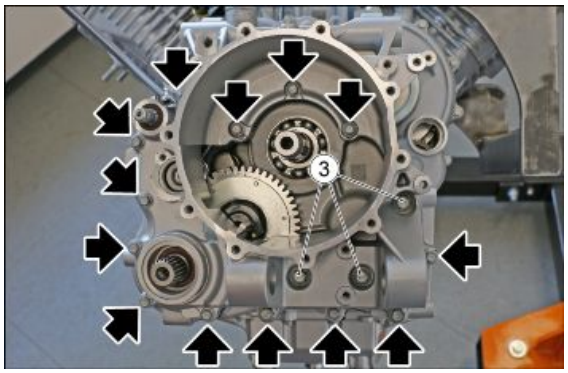
Disassembling the gearbox

First remove the clutch.

- Remove the two fastening screws (1).

- Remove the neutral position sensor (2) from the clutch housing.

- Unscrew the screws used to fasten the clutch crankcase the gearbox.
- Start with the 10 mm hex head screws (3).

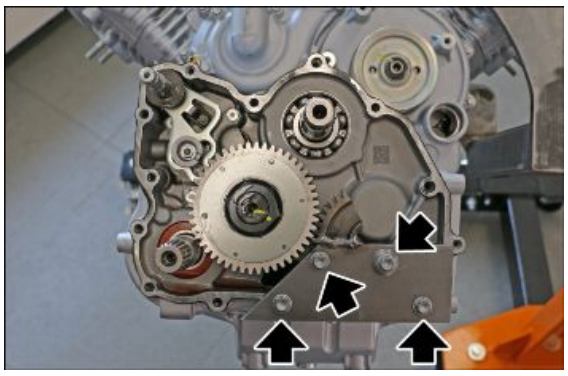


- Remove the clutch crankcase from the gearbox, making use of a Teflon hammer to tap the crankcase.

- Using four fixing screws of the clutch crankcases, install the specific tool on the rear part of the gearbox, so as to lock the rotation of the gearbox primary shaft.

Specific tooling

021059Y Primary retainer

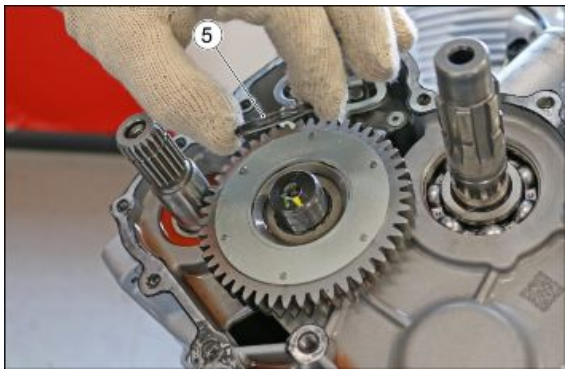


- Unscrew the fixing nut (4).

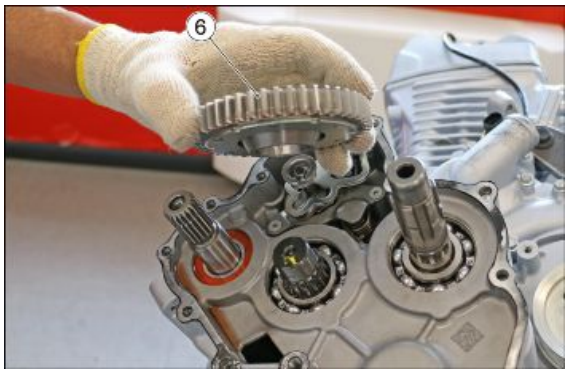
CAUTION

NUT WITH LEFT-HAND THREAD.

- Remove the spring washer (5).

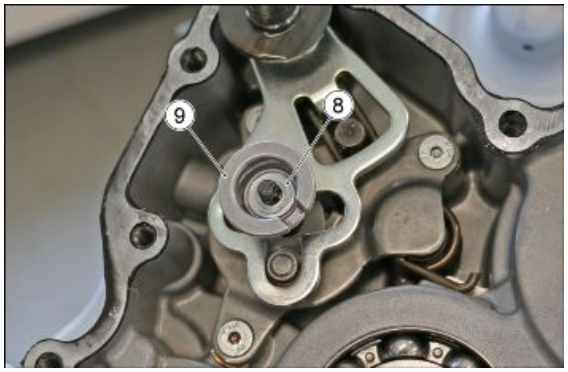


- Remove the gear (6).



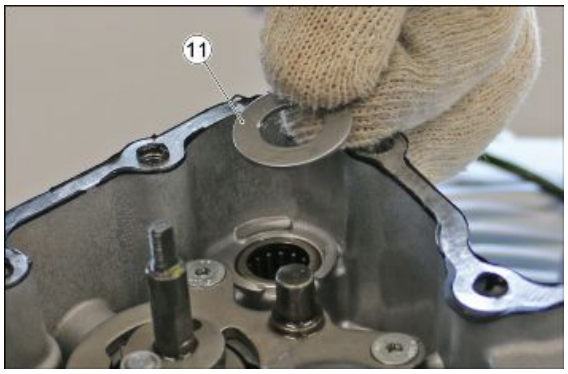
- Remove the nut (7) from the gearbox lever transmission.

- Remove the washer (8) and the shielded bulb of the neutral position sensor (9).



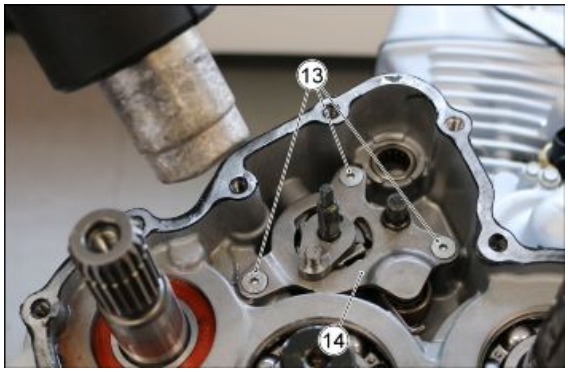
- Remove the gear lever transmission (10).

- Remove the shim washer (11).

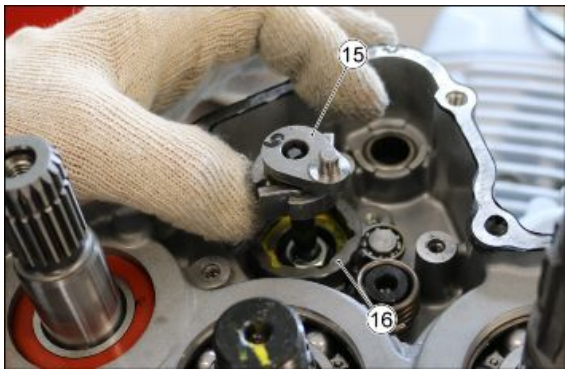


- Retrieve the bushing (12).

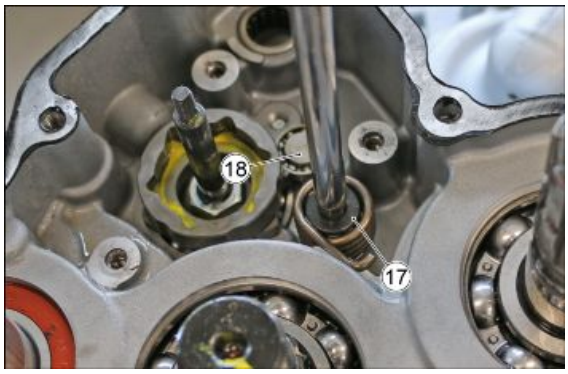
- Using a workshop hot air gun heat well the gearbox crankcase near the three screws (13).
- Remove the three screws (13), paying careful attention not to strip them, then remove the retainer plate (14).



- Remove the complete selection lever (15) from the gearbox drum (16).



- Unscrew the fixing screw (17) of the gearbox selector stop lever (18).



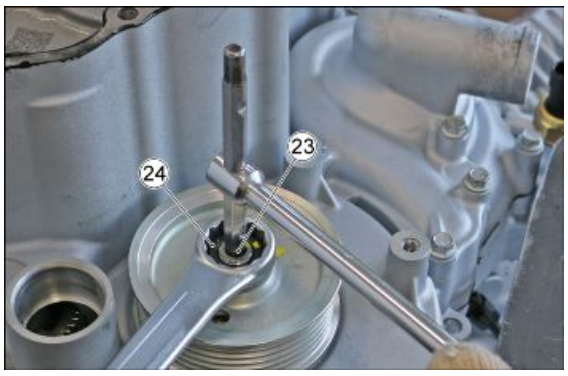
- Remove the stop lever (18) together with the spring (19) and the washer (20).

- Collect the shim washer (21) from its fitting on the stop lever.

- Unscrew the nut (22).

- Remove the gearbox drum (16).

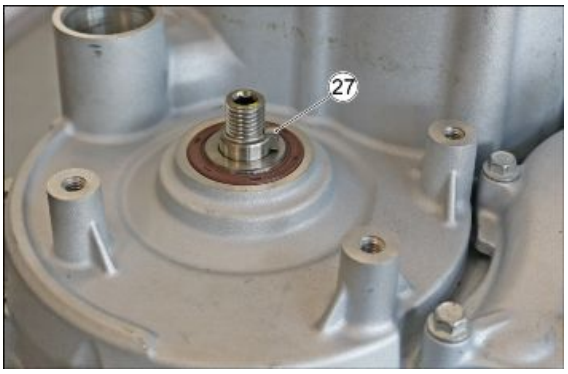
- Using an Allen key (23), hold the pulley shaft in position and unscrew the nut (24).



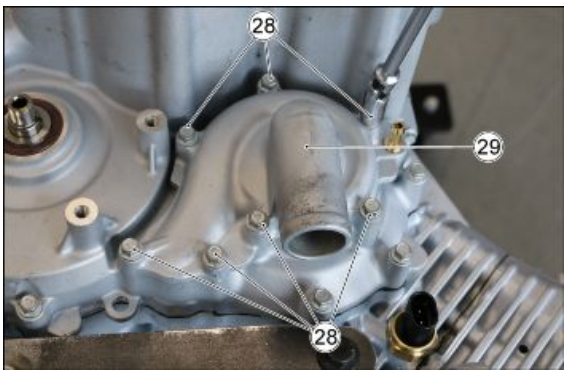
- Remove the washer (25).

- Remove the pulley (26).

- Retrieve the wrench (27) from the shaft.

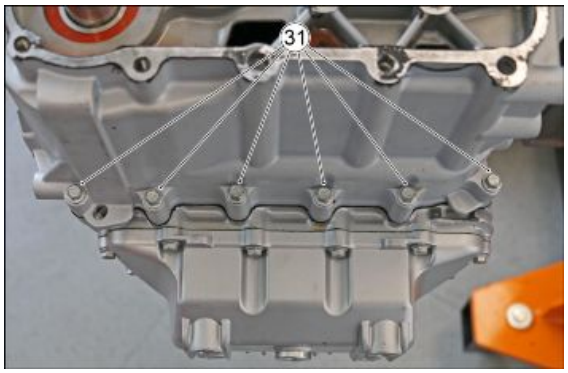


- Remove the fixing screws (28) and remove the worm screw of the water pump (29).

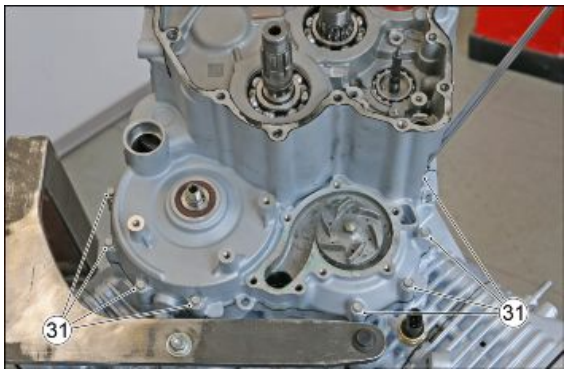


- Working from the front side of the engine, remove the six fixing screws (30) indicated in the figure.

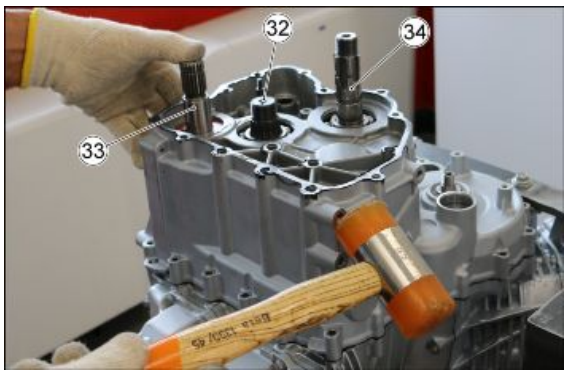
- Operating from the rear side of the engine (gearbox side), remove the fixing screws of the gearbox (31).



- Remove the fixing screws of the gearbox (31).



- Remove the gearbox crankcase by sliding it off the primary (32) and secondary (33) gearbox shaft and from the clutch shaft (34), making use of a Teflon hammer to tap the crankcase.

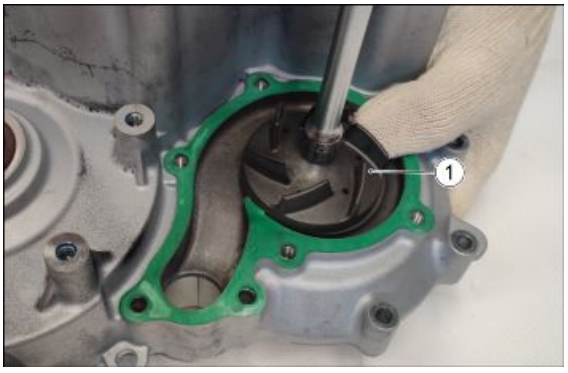


- Make sure that the shim washer (35) stays on the secondary shaft of the gearbox.

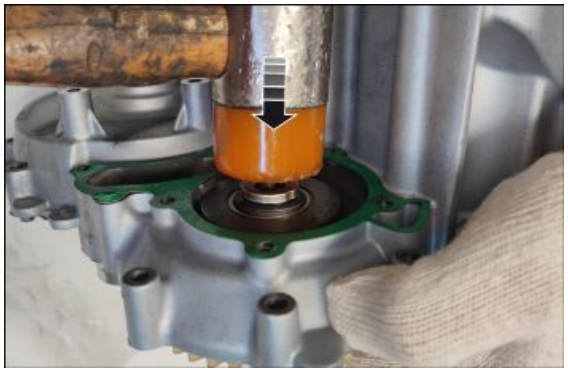
- Make sure that the O-ring. (36) stays on the counter-rotating shaft.

REMOVING THE WATER PUMP

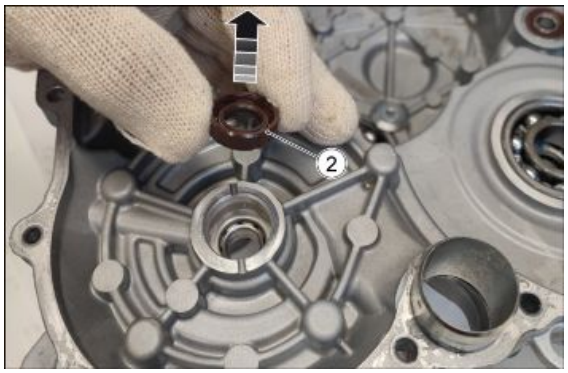
- First remove the gearbox crankcases.
- Holding the gear with one hand, unscrew the impeller (1) of the water pump and remove it.



- With a Teflon hammer, tap the water pump shaft from outside the bearing, taking care not to damage the thread.

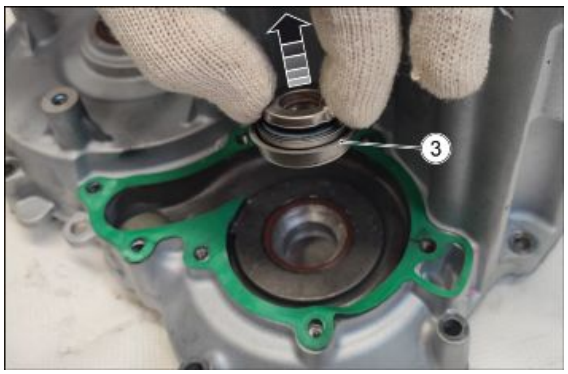


- Remove the oil seal (2) from inside the gearbox housing.



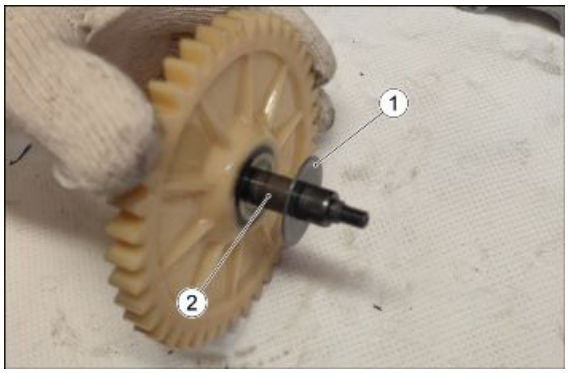
- Operating from the inside of the gear-box casing, using a pin punch tap the bearing out from the relative seat.

- Remove the bearing of the water pump (3) from its housing.



FITTING OF WATER PUMP

- Insert the shim washer (1) on the water pump shaft (2).



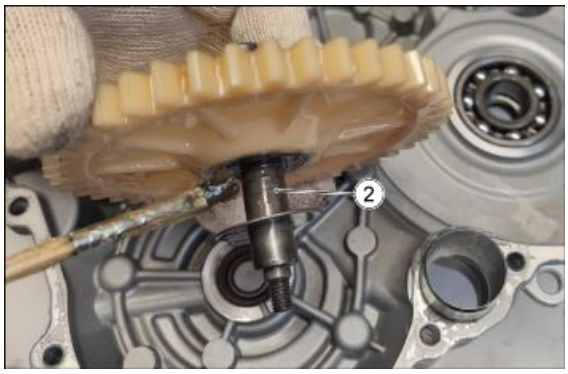
- Operating from the inside of the gear-box, insert a new oil seal (3) and bring it flush with the lower corner of the in-sertion chamfer.

- Insert a new bearing (4) in the specific seat, respecting the direction shown in the figure.

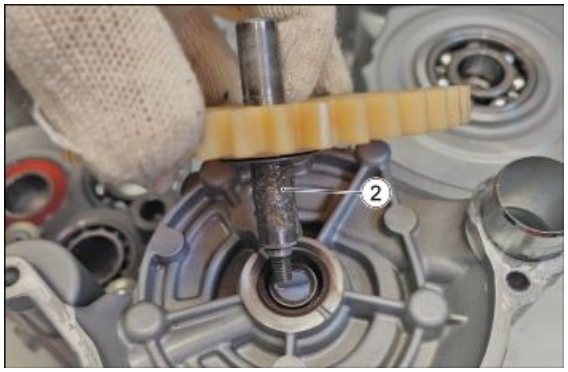
NOTE

Carefully clean the bearing seat before inserting it.

- Apply grease to the water pump shaft (2).



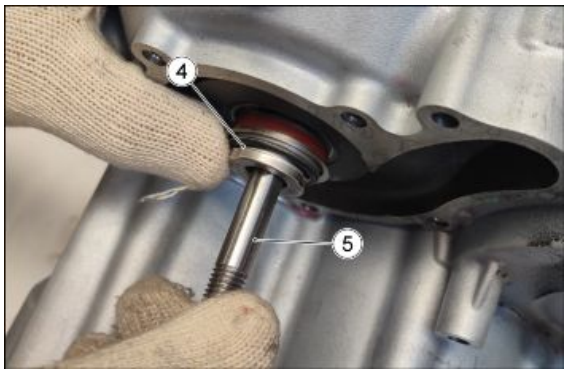
- Insert the shaft (2) inside the gearbox casing, respecting the direction shown in the figure.



- Install the movable body (5) of the special tool on the shaft of the water pump.

Specific tooling

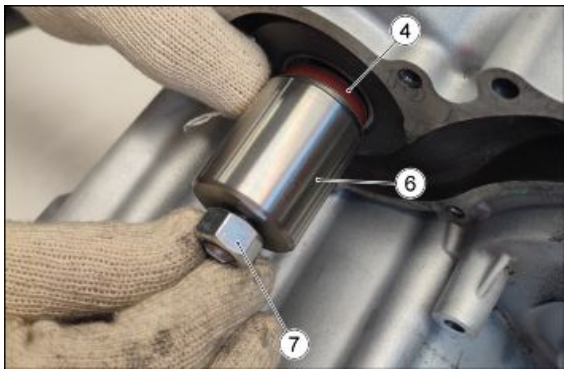
021063Y Water pump seal insertion tool



- Insert the fixed body (6) and the nut (7) until the mobile body (6) is against the external ring of the bearing (4).

Specific tooling

021063Y Water pump seal insertion tool



- Holding the water pump shaft, tighten the nut (7) until bringing the bearing to stop with the casing.
- Remove the special tool from the water pump.

- Fit the impeller (8) of the water pump on the shaft and holding the shaft, tighten the impeller to the specified torque.

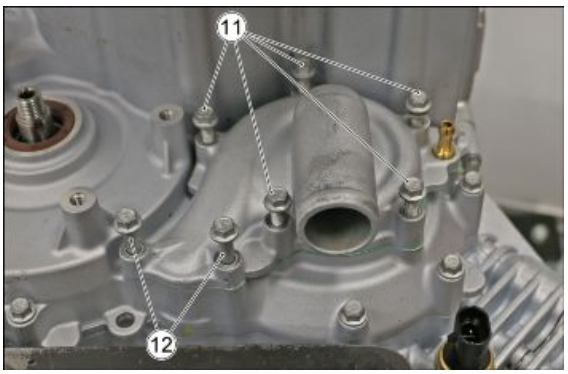
Locking torques (N*m)

Water pump impeller fastening 5 6 Nm (3.69 4.43 lb ft)

- Install the gearbox.
- Install a NEW gasket (9).

- Fit the water pump cover (10).

- Insert the fixing screws (11) and the two long screws (12).
- Tighten the fixing screws (11) and (12) to the specified torque.

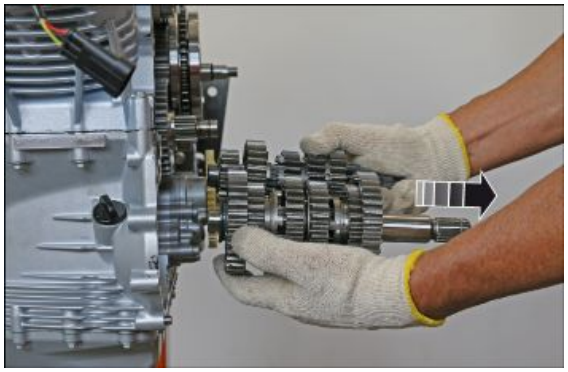


Locking torques (N*m)

Water pump impeller fastening 5 6 Nm (3.69 4.43 lb ft)

Removing the primary shaft

- First remove the desmodromic shaft.
- With the engine upright, remove the gearbox primary and secondary shafts.



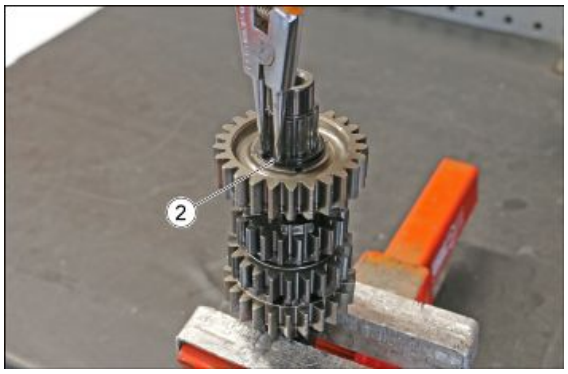
To remove the primary shaft, proceed as follows:

- Lock the shaft in a vice and check that is equipped with suitable jaws for the operation.
- Remove the gear of the 2nd gear (1).

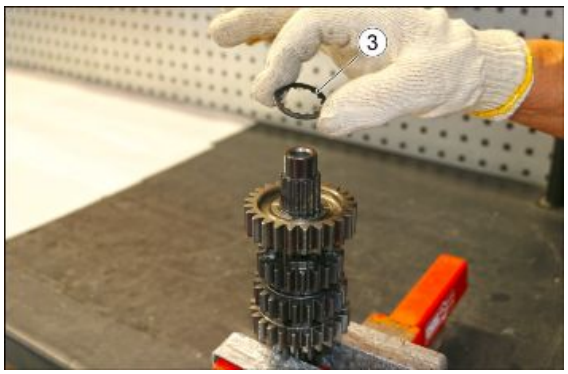
- Using the clamps for external seeger ring, remove the seeger ring (2).

CAUTION

DURING REFITTING, USE A NEW SEEGER RING.

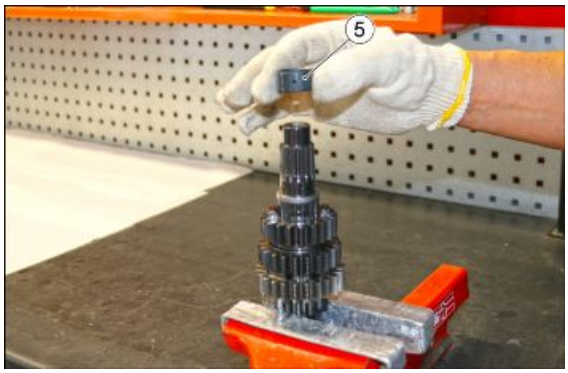


- Remove the spacer (3).

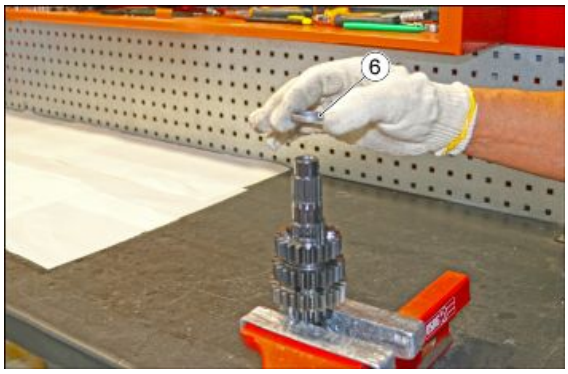


- Remove the gear of the 6th gear (4).

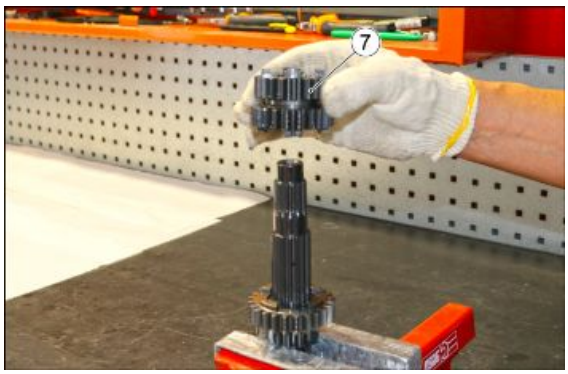
- Remove the bushing (5).



- Remove the spacer ring (6).



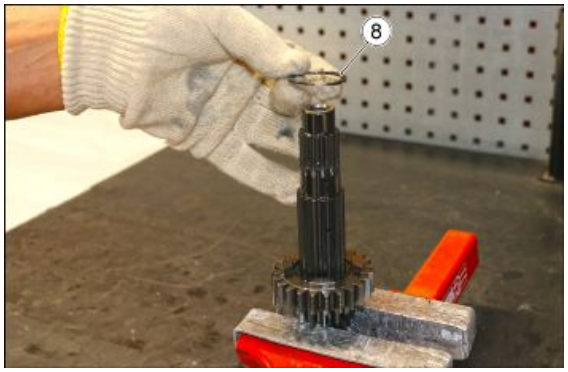
- Remove the gears of the 3rd and 4th gear (7).



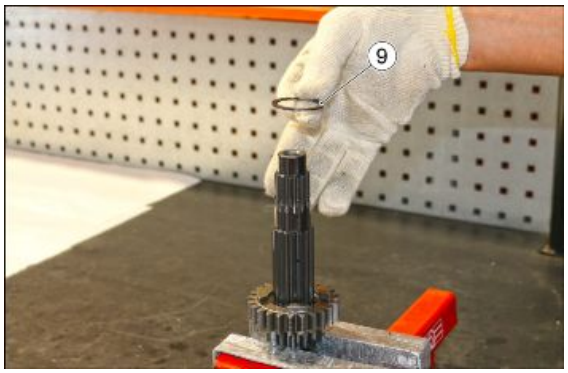
- Remove the circlip (8).

CAUTION

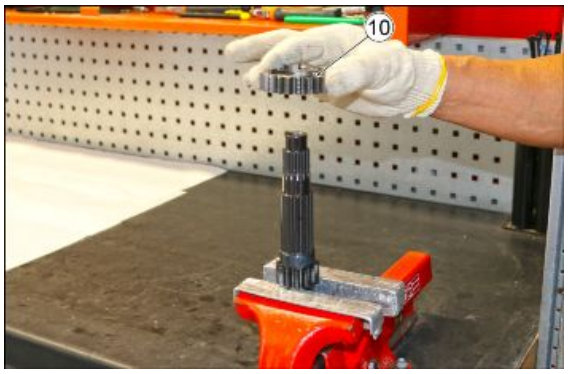
DURING REFITTING, USE A NEW CIRCLIP.



- Remove the spacer (9).

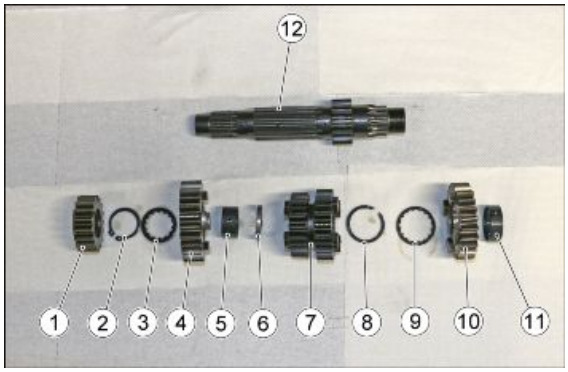


- Remove the gear of the 5th gear (10).



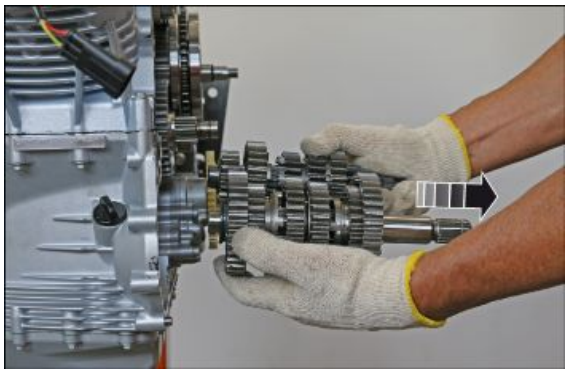
- Remove the bushing (11).

- The gear of the 2nd gear (1);
- Seeger (2);
- Spacer (3);
- The gear of the 6th gear (4);
- Bushing (5);
- Spacer ring (6);
- Gears of the 3rd and 4th gear (7);
- Circlip (8);
- Spacer (9);
- The gear of the 5th gear (10);
- Bushing (11);
- Primary shaft with integrated 1st gear (12).



Removing the secondary shaft

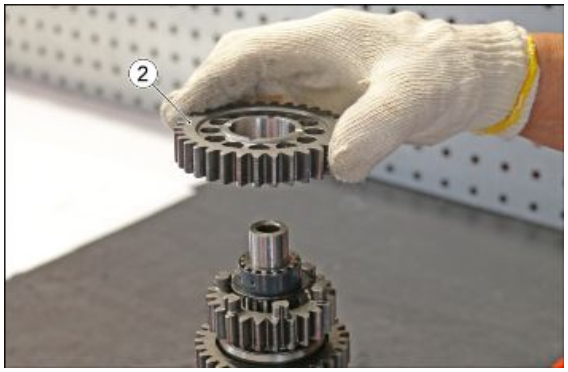
- First remove the desmodromic shaft.
- With the engine upright, remove the gearbox primary and secondary shafts.



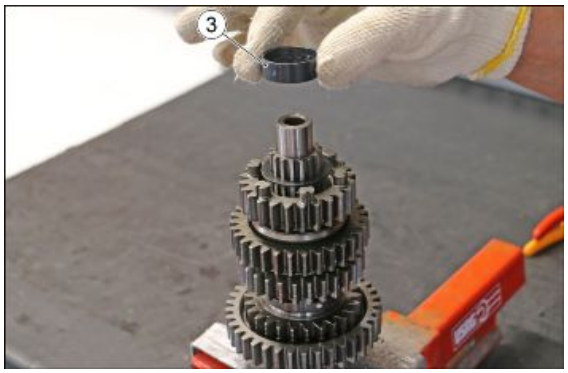
To remove the secondary shaft, proceed as follows:

- Lock the shaft in a vice, making sure that it is equipped with suitable jaws for the operation.
- Remove the shim washer (1).

- Remove the gear of the 2nd gear (2).



- Remove the bushing (3).

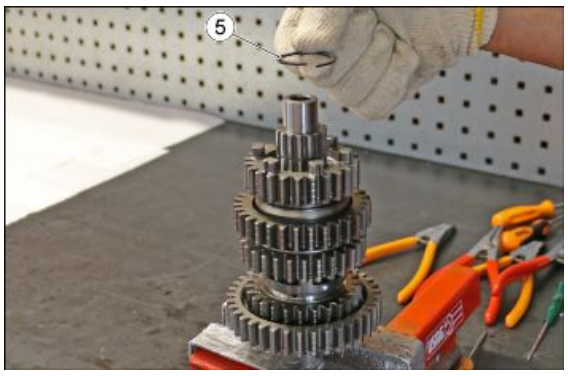


- Remove the spacer (4).

- Remove the circlip (5).

CAUTION

DURING REFITTING, USE A NEW CIRCLIP.

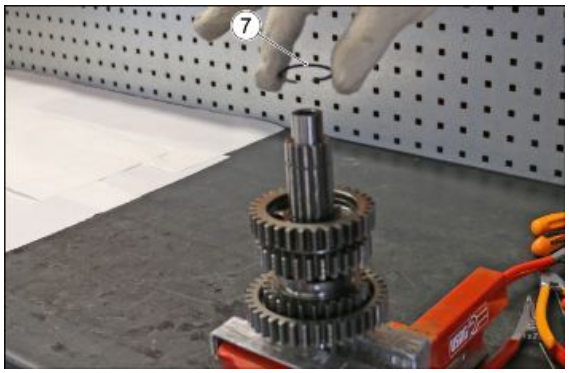


- Remove the gear of the 6th gear (6).

- Remove the circlip (7).

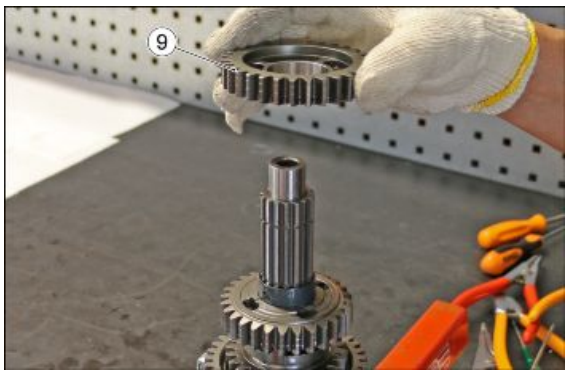
CAUTION

DURING REFITTING, USE A NEW CIRCLIP.

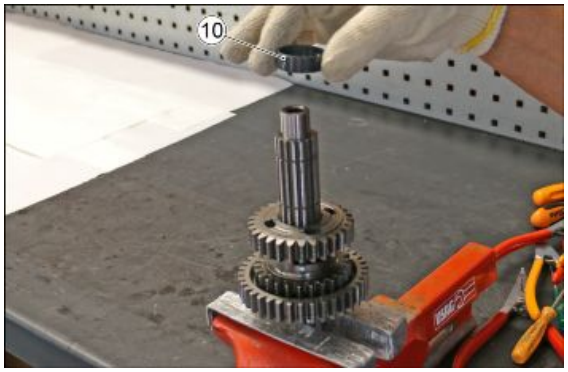


- Remove the spacer (8)

- Remove the gear of the 3rd gear (9).



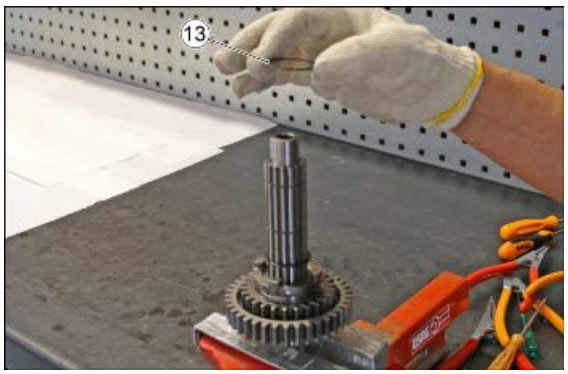
- Remove the bushing (10).



- Remove the gear of the 4th gear (11).

- Remove the bushing (12).

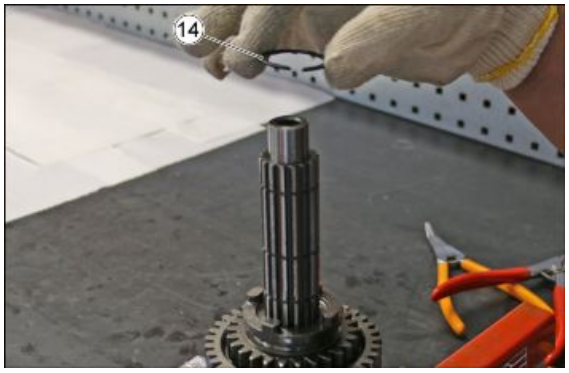
- Remove the spacer (13).



- Remove the circlip (14).

CAUTION

DURING REFITTING, USE A NEW CIRCLIP.

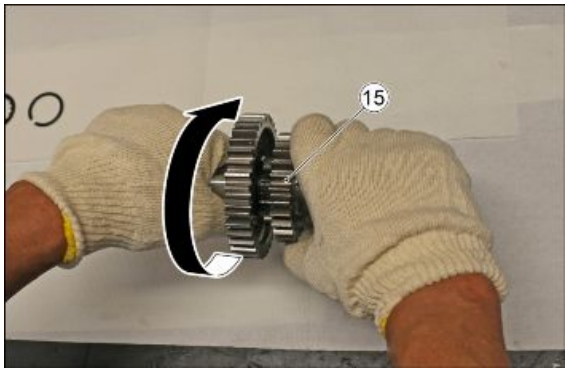


WARNING

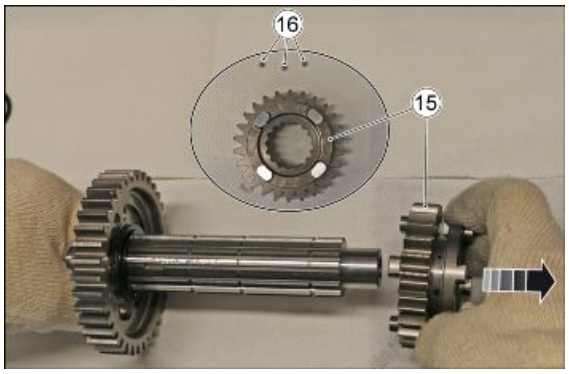
TO CARRY OUT THE FOLLOWING OPERATION, BRING THE GEARBOX SHAFT ON THE BENCH.

The gear of the 5th gear (15) has three balls inside. To be able to remove it from the shaft, proceed as follows:

- Support the secondary shaft;
- Rotate the gear of the 5th gear (15) fast enough to allow the balls inside the gear to expand;



- During the rotation, pull the gear (15) in the direction shown in the figure. If the rotation speed is enough, the balls (16) will expand and will be possible to extract the gear from the shaft.

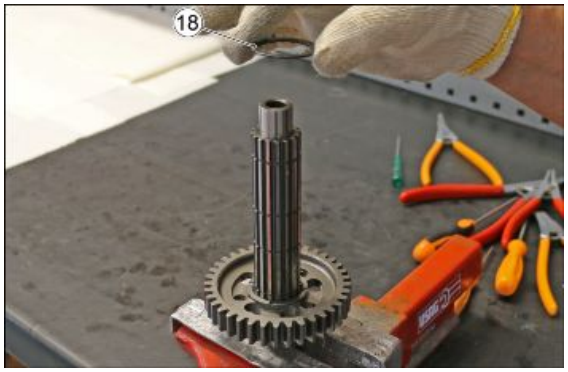


- Remove the circlip (17).

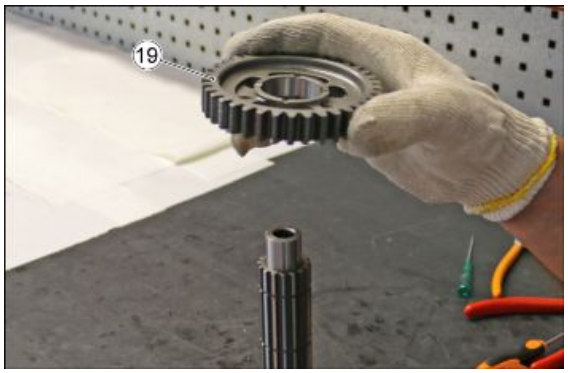
CAUTION

DURING REFITTING, USE A NEW CIRCLIP.

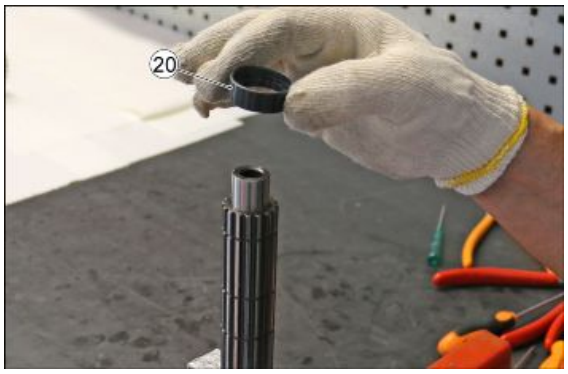
- Remove the spacer (18).



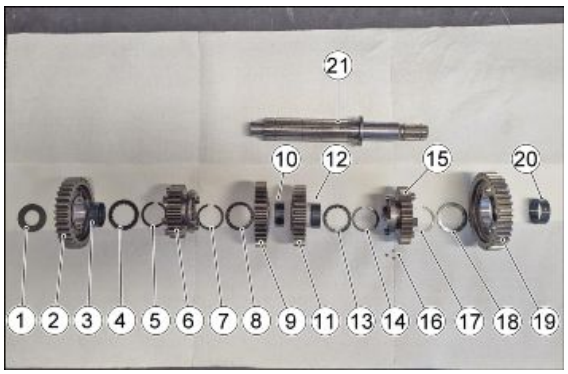
- Remove the gear of the 1st gear (19).



- Remove the bushing (20).



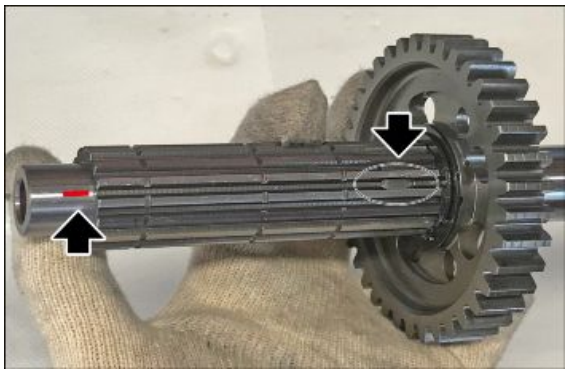
- Shim washer (1);
- The gear of the 2nd gear (2);
- Bushing (3);
- Spacer (4);
- Circlip (5);
- The gear of the 6th gear (6);
- Circlip (7);
- Spacer (8);
- The gear of the 3rd gear (9);
- Bushing (10);
- The gear of the 4th gear (11);
- Bushing (12);
- Spacer (13);



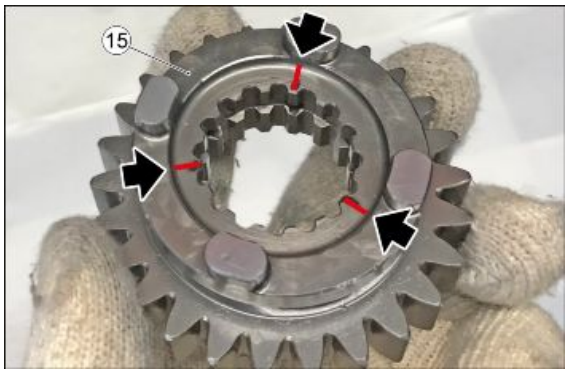
- Circlip (14);
- The gear of the 5th gear (15);
- Balls (16);
- Circlip (17);
- Spacer (18);
- The gear of the 1st gear (19);
- Bushing (20);
- Secondary shaft (21).

REFITTING

To reassemble the secondary shaft, follow the removal procedure in reverse order. However, to refit the gear of the 5th gear (15), follow the procedures below:



- Using a felt-tip pen, mark the position of the seats of the balls on the secondary shaft.

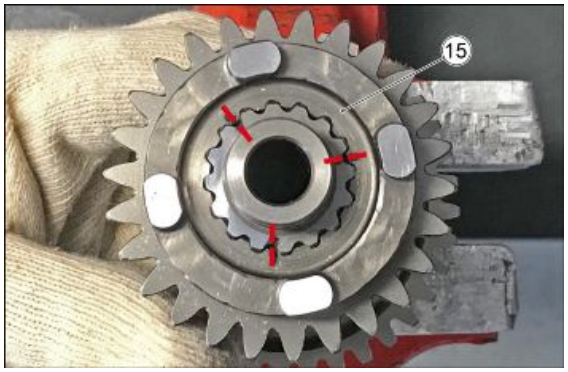


- Using a felt-tip pen, mark the position of the ball seat holes in the gear (15).

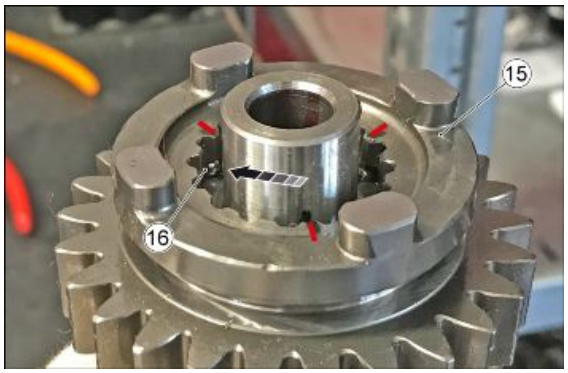
CAUTION

THE CORRECT HOLES ARE THE THREE THAT HAVE TWO CONCENTRIC DIAMETERS.

- Insert the gear (15) on the secondary shaft, aligning the previously marked references.



- At this point, lift the gear (15) so as to allow access to the ball housing holes.
- Insert the three balls (16) in the corresponding housing holes and then slide the gear in position (15).
- Check that the assembly has been successful by trying to extract the gear (15). Without rotation it must not be possible to pull it off the shaft.

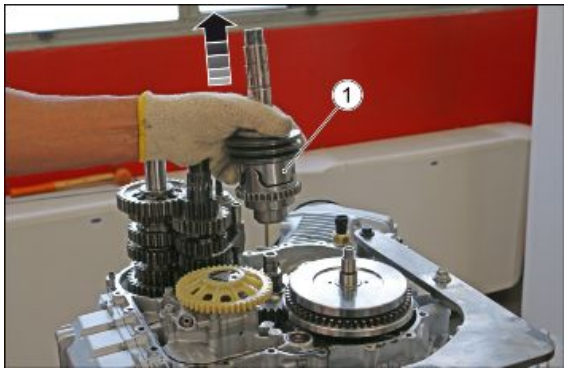


CAUTION

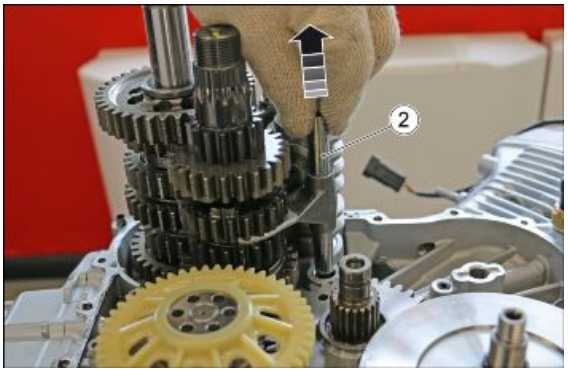
DO NOT USE GREASE OR OTHER ADHESIVES FOR ASSEMBLY, THE BALLS MUST BE INSERTED EXCLUSIVELY IN A "DRY" STATE.

Desmodromic demounting

- Remove the gearbox crankcase as shown in the chapter "Gearbox removal".
- Remove the clutch shaft (1) sliding it upward.



- Remove the sliding rod (2) of the fork of the primary shaft.

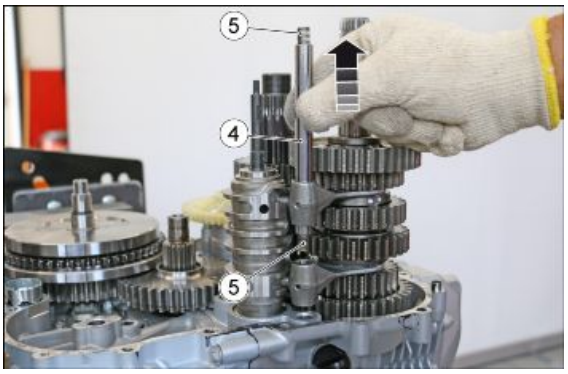


Remove the fork (3).

CAUTION

DURING REFITTING, OBSERVE THE ORIGINAL POSITION OF THE FORKS.

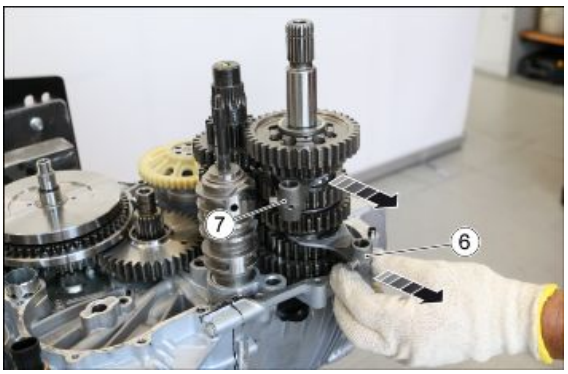
- Remove the sliding rod (4) of the forks of the secondary shaft, together with the springs (5).



- Remove the fork (6) marked with "S1A".
- Remove the fork (7) marked with "S2B".

CAUTION

DURING REFITTING, OBSERVE THE ORIGINAL POSITION OF THE FORKS.

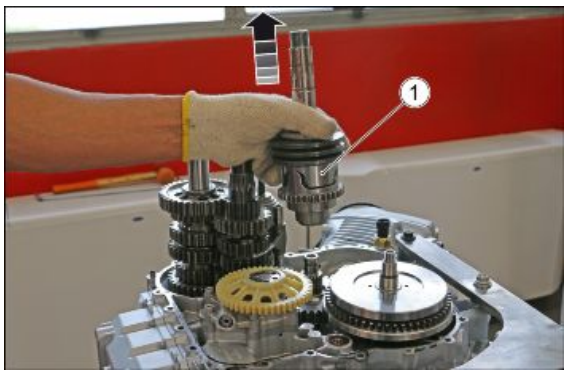


Remove the desmodromic shaft (8).

Disassembling the clutch shaft

- Open the gearbox housing as shown in the chapter "Gearbox removal".

- Remove the clutch shaft (1) from the crankshaft sliding it upward.



Controllo alberi

Check transmission gears for any signs of pitting or wear, and replace the defective gears if necessary.
Check the gears' engagement teeth for any signs of cracks, damage or wear, and replace the defective ones if necessary.
Check the transmission gears' movement and, if irregular, replace the defective part.

WEAR LIMITS

Specification	Desc./Quantity
Maximum wear limit for selector gear splines	22.78 mm (0.896 in) with rollers diam. 3.5 mm (0.14 in)
Minimum wear limit of the cardan shaft side secondary shaft seats	23.294 mm (0.9171 in) with rollers diam. 3.0 mm (0.12 in)

Specification	Desc./Quantity
Minimum wear limit of the clutch side primary and secondary shaft seats	24.112 mm (0.9493 in) with rollers diam. 2.0 mm (0.08 in)

Checking the clutch shaft

Check for pitting, wear, cracks or damage, signs of deterioration on the teeth of the primary drive gear and replace the gear if necessary

WEAR LIMITS

Specification	Desc./Quantity
(1) Minimum wear limit of the rotation point on the gearbox cover bearing	19.975 mm (0.7864 in)
(2) Minimum wear limit of the rotation point on the gearbox cover base	24.987 mm (0.9837 in)

Checking the desmodromic drum

Check the desmodromic drum for damage, scratches and wear and replace the assembly if required.

Checking the forks

Check that the forks work area are well levelled and are not worn, so as to have lost the toughening characteristics and that the nose-pieces operating in the drum splines are not excessively worn, otherwise replace the forks.

WEAR LIMITS

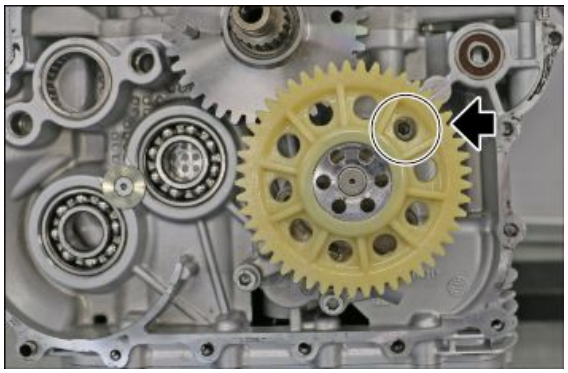
Specification	Desc./Quantity
(1) Minimum thickness of the tines	4.75 mm (0.19 in)
(2) Guide pins minimum diameter	8 mm (0.31 in)
(3) Sliding hole minimum diameter	14 mm (0.55 in)

Assembling the gearbox

GEARBOX FITTING

- Fit the oil pump in the crankcase.

- Tighten the five fixing screws of the oil pump to the specified torque.
- Turn the toothed wheel to match the holes on the sprocket with the fixing screws to be worked on.

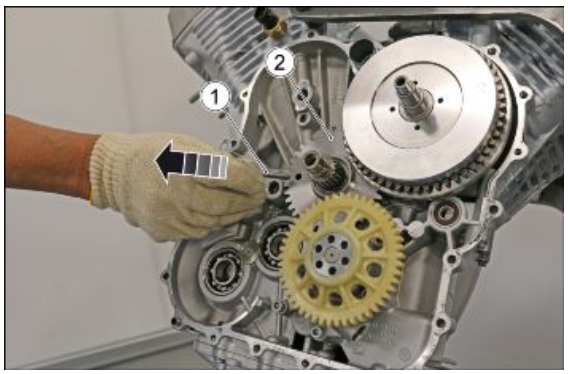


Locking torques (N*m)

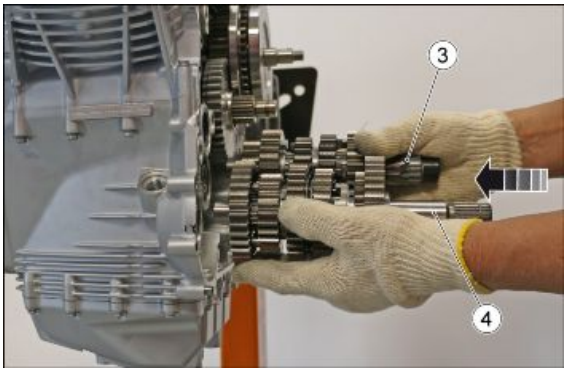
Oil pump fastener screw **9 - 11 Nm (6.64 - 8.11 lb ft)**

- Fit the counter-rotating shaft.

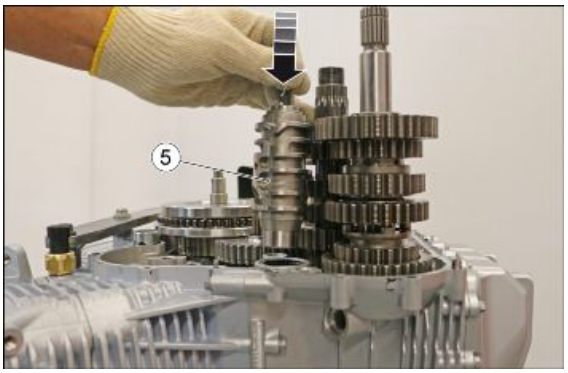
- Remove the pin (1) from the crankshaft gear (2).



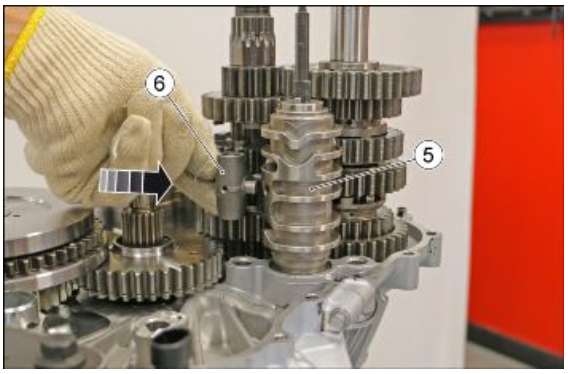
- Install the primary (3) and the secondary (4) shaft of the gearbox.



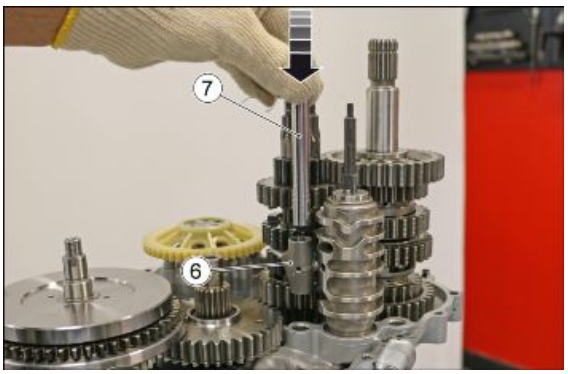
- Insert the desmodromic (5) in the corresponding bearing.



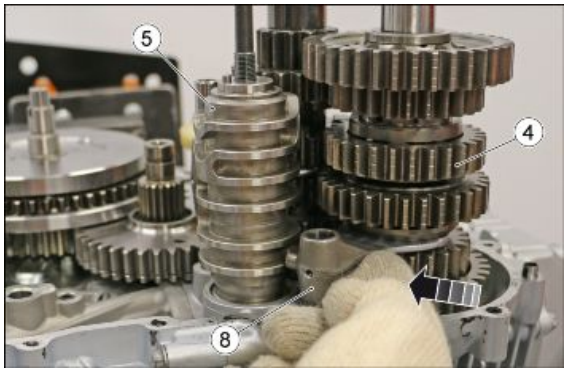
- Insert the fork (6) with the marking "S2A" on the primary shaft and the relative track of the desmodromic (5).



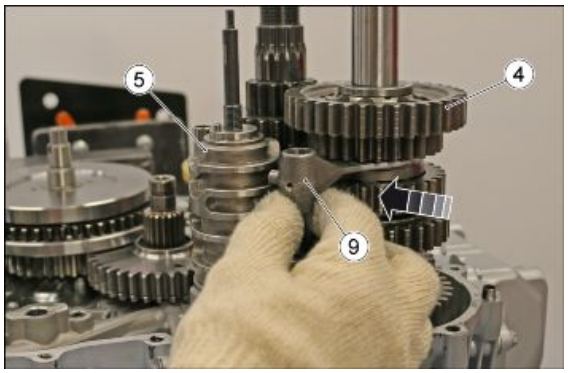
- Insert the dipstick (7) in the fork (6) until the relative seat in the crankcase.



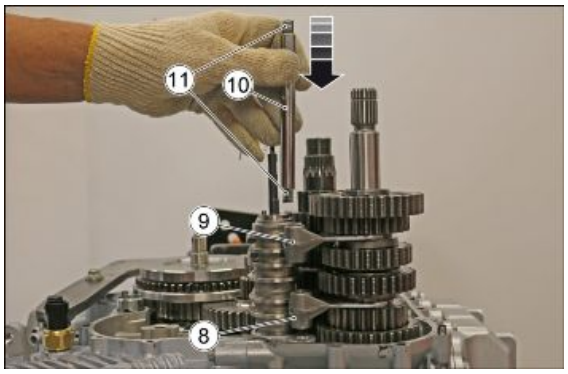
- Insert the fork (8) with the marking "S1A" in the secondary shaft (4) and on the relative track of the desmodromic (5).



- Insert the fork (9) with the marking "S2B" in the secondary shaft (4) and on the relative track of the desmodromic (5).



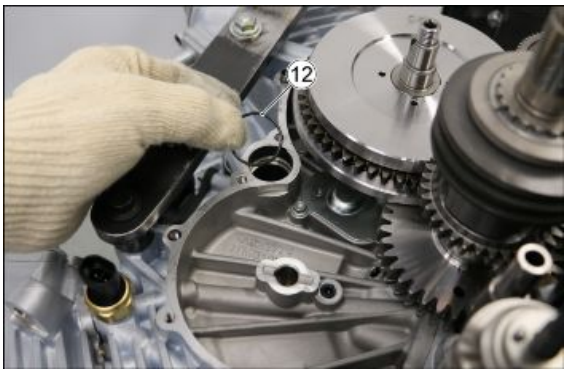
- Insert the dipstick (10) complete with spring (11) in the forks (8) and (9) until the relative seat in the crankcase.



- Insert the clutch shaft.

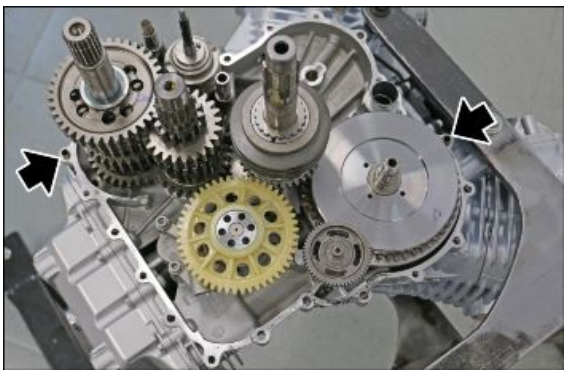
- Insert the starter transmission.

- Insert a new O-ring (12) in the duct of the cooling circuit.



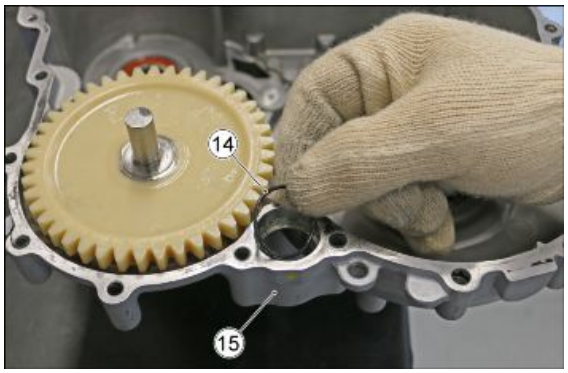
- Insert the metal sleeve (13) in the crankcase.

- Check the presence of the two centring bushings in the coupling surfaces of the crankcase.



- Apply a layer of ThreeBond 1207 D to the coupling surface of the crankcase, checking that is not damage along the surface.

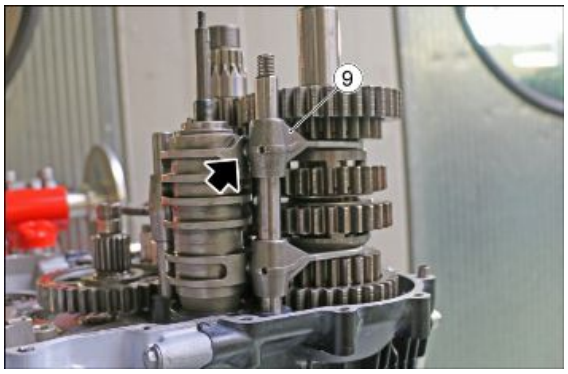
- Insert a new O-Ring (14) in the cooling duct of the gearbox (15).



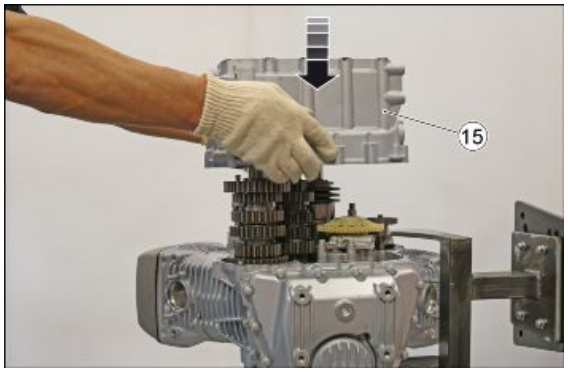
- Insert the first gear. To do this, turn the fork (9) of the secondary shaft with the "S2B" mark all the way with the first track from the top of the desmodromic shaft. As shown in the figure.

CAUTION

THIS OPERATION IS MANDATORY AND ESSENTIAL TO ENSURE THE CORRECT HOUSING OF THE GEARBOX ON ITS SHAFTS.



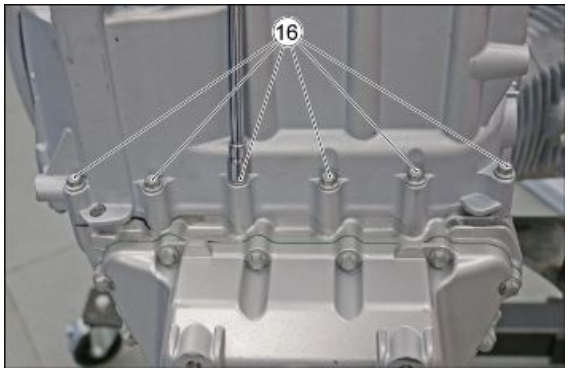
- Fit the gearbox (15) on the crankcase.

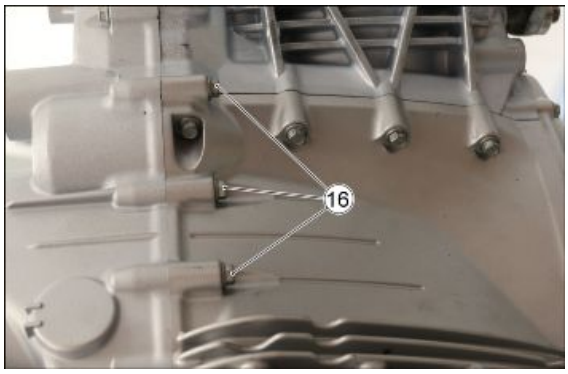


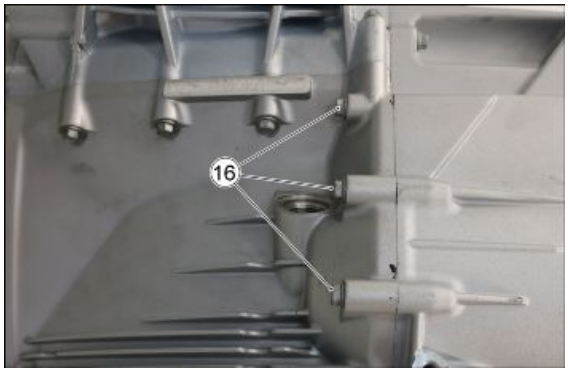
- Tighten the fixing screws of the gearbox (16) to the prescribed torque.

Locking torques (N*m)

Gearbox fixing screw **11-13 Nm (8.11 - 9.59 lbf ft)**



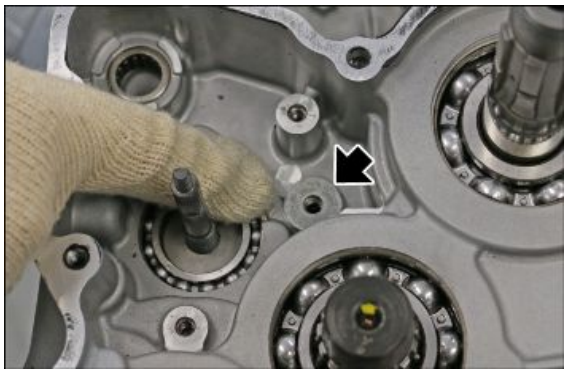




- After tightening the gearbox screws (16), put the gearbox in neutral and check that the shafts turn freely and without jamming.

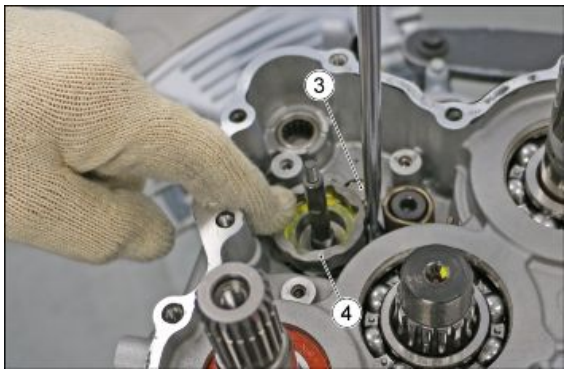
FITTING THE CLUTCH CASING

- Fit the gearbox housing.
- Insert the washer.



- Install the assembly of screw (1), spring (2) and stop lever (3) and tighten the screw (1) to the specified torque.
- Make sure that the spring (2) is positioned correctly, supporting to the crankcase.

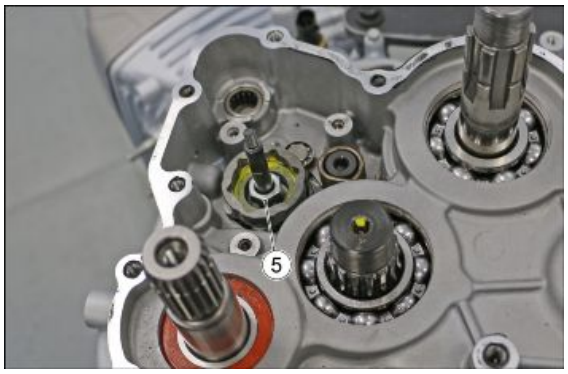
- Install the desmodromic drum (4), using a screwdriver to move the stop lever (3) during the operation.



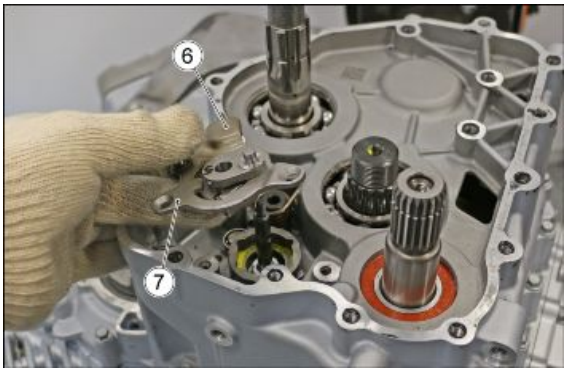
- Install a NEW pre-impregnated nut (5) and tighten it to the specified torque.

Locking torques (N*m)

Desmodromic drum fastening nut **20 24 Nm (14.75 17.70 lb ft)**



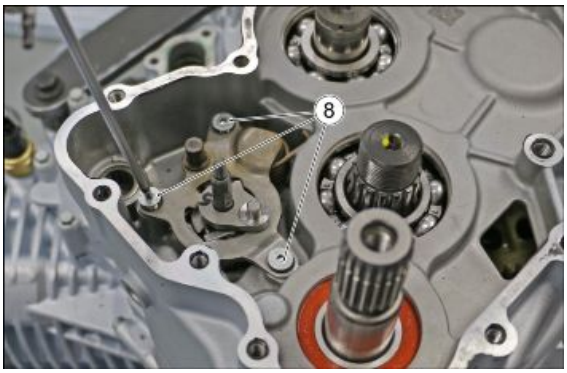
- Install the gear selector lever (6) together with the retainer plate (7).



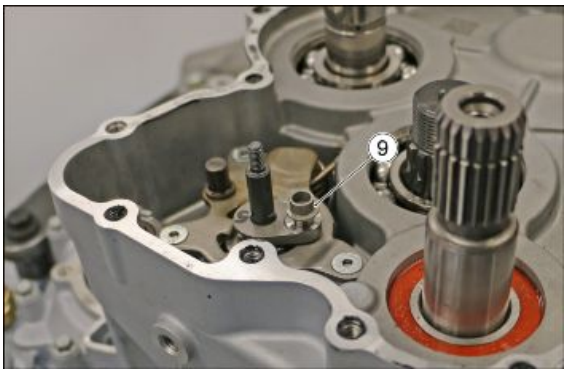
- Fit three NEW pre-impregnated screws (8) and tighten them to the specified torque.

Locking torques (N*m)

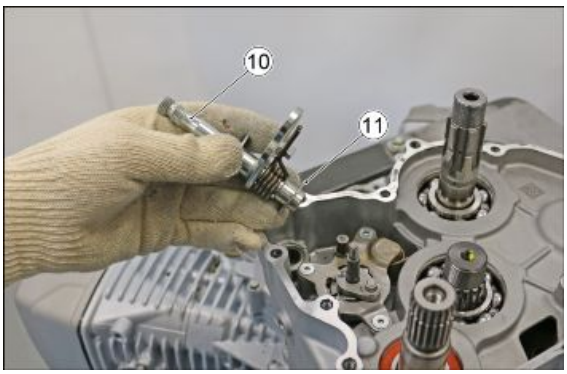
Selector plate fastening screw 6 8 Nm (4.43 5.90 lb ft)



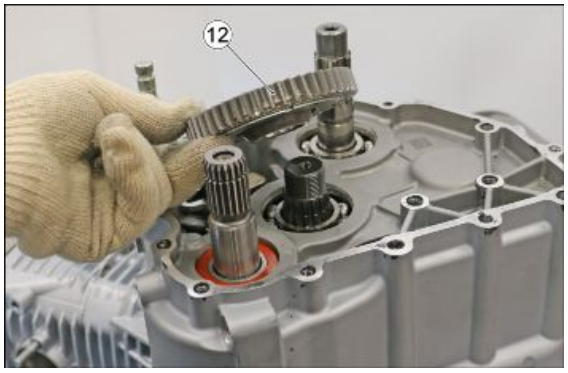
- Insert the bushing (9) on the gear selector lever.



- Insert the selector shaft (10), together with the shim washer (11).



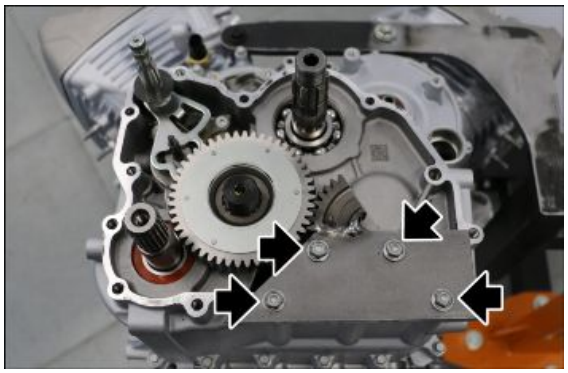
- Insert the toothed wheel (12), respecting the direction shown in the figure.



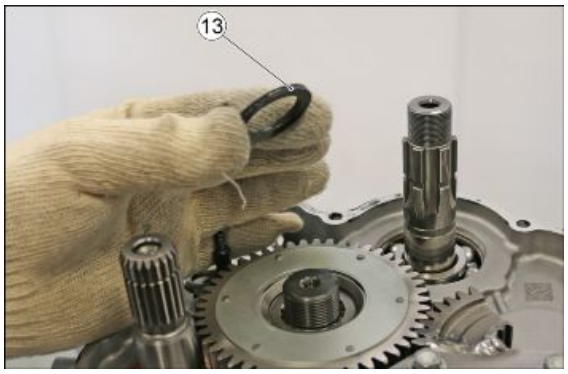
- Using four fixing screws of the clutch crankcases, install the specific tool on the rear part of the gearbox, so as to lock the rotation of the gearbox primary shaft.

Specific tooling

021059Y Primary retainer

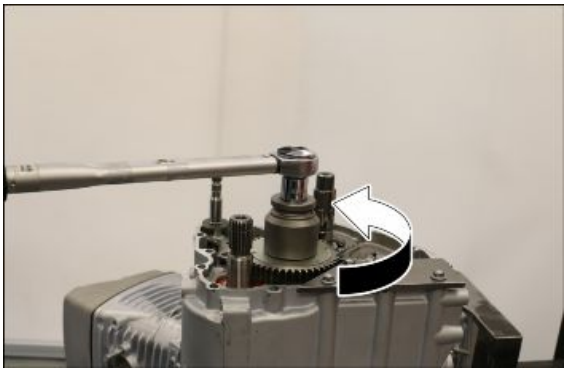


- Insert the washer (13) with the curvature facing upwards.



- Install the nut (14).

- Tighten the nut to the specified torque.
- Remove the specific tool from the crankcase.



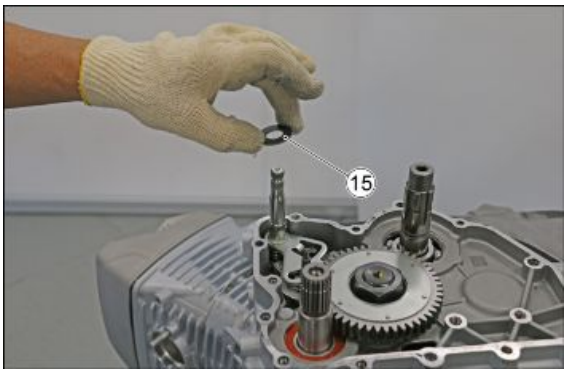
CAUTION

NUT WITH LEFT-HAND THREAD.

Locking torques (N*m)

Primary gear fastener nut **225 255 Nm (165.95 188.08 lb ft)**

- Install the washer (15) on the selector shaft.



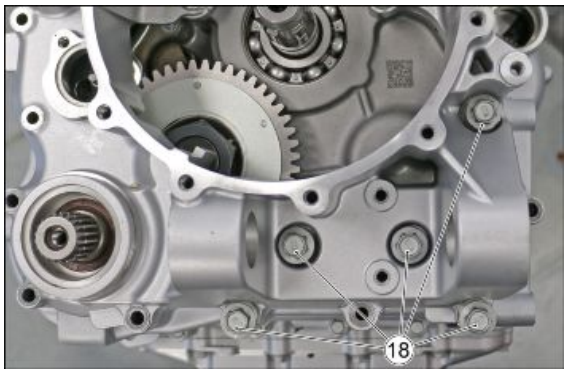
- Apply a layer of ThreeBond 1207 D to the coupling surface and the surfaces of the two threaded holes indicated in the figure.

- Install the clutch casing (16).

WARNING

BE CAREFUL NOT TO DAMAGE THE OIL SEAL (17) OF THE SECONDARY SHAFT OF THE GEAR DURING INSTALLATION OF THE CRANKCASE CLUTCH.

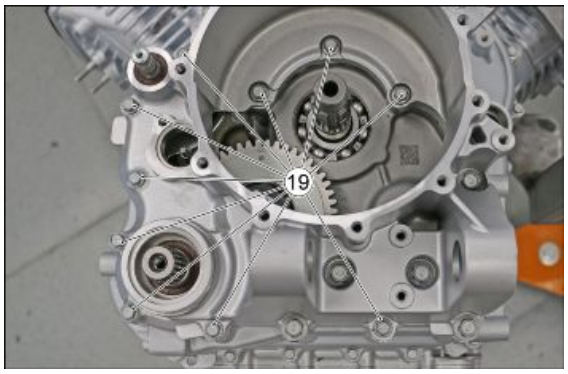
- Install the five fixing screws (18).



- Install the fixing screws (19).
- Tighten the screws (18) and (19) to the prescribed torque.

Locking torques (N*m)

Screw (18) used to fasten the clutch crankcases 30 34 Nm (22.13 25.08 lb ft) Screw (19) used to fasten the clutch crankcases 11 - 13 Nm (8.11 - 9.59 lb ft)

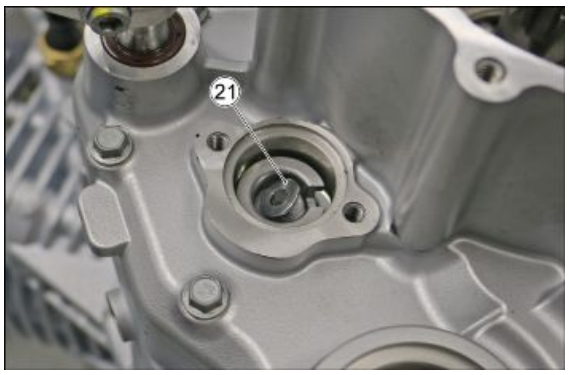


- Bring the gearbox in neutral position.
- Insert the shield (20) on the threaded shaft of the desmodromic.

NOTE

The shield (20) has an obligatory mounting position.

- Insert the washer (21).



- Insert a new pre-impregnated nut (22) and tighten it to the specified torque.

Locking torques (N*m)

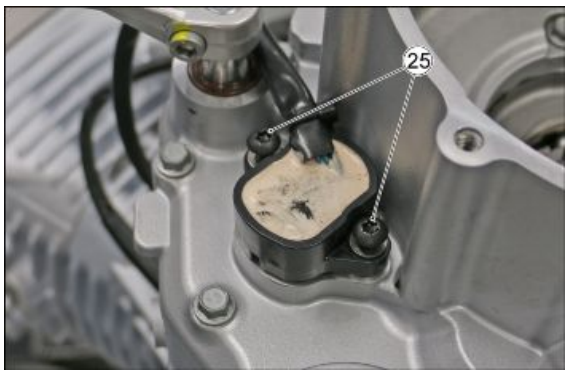
Nut fastening the gear sensor shield 5 6 Nm (3.69 4.43 lb ft)

- Install a new O-ring (23).
- Install the gear position sensor (24) by inserting the peg in the notch of the shield.

- Tighten the two fixing screws (25) to the specified torque.

Locking torques (N*m)

Gear position sensor fastening screw 6 8 Nm (4.43 5.90 lb ft)



Generator

Tensioning the belt

- Mount the belt on the pulleys, with the markings oriented as shown.

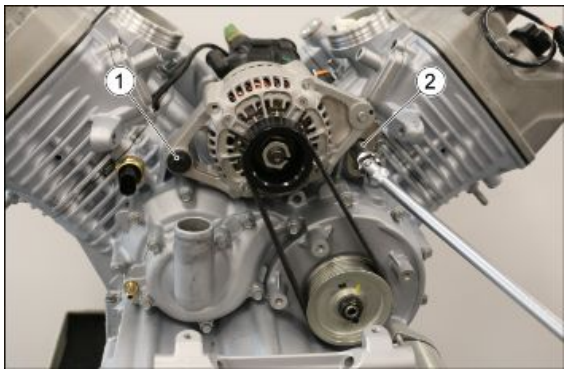
- Using a digital frequency meter, measure the belt tensioning frequency by vibrating it with your finger.

Characteristic

Alternator belt frequency

180 Hz

- Loosen the screws (1) and (2) fastening the alternator.



- Loosen the lock nut of the adjuster screw.

- Act on the adjuster screw, screwing it in to decrease the tensioning frequency or unscrewing it to increase it.

- Tighten the fixing screws (1) and (2) of the alternator to the specified torque.

WARNING

It is essential to tighten the fixing screws to measure the tensioning frequency correctly.

Locking torques (N*m)

Fixing screw (1) 45 - 50 Nm (33.19 - 36.88 lb ft) Fixing screw (2) 20 - 24 Nm (14.75 - 17.70 lb ft)

- Measure the tensioning frequency of the alternator belt again.

Characteristic

Alternator belt frequency

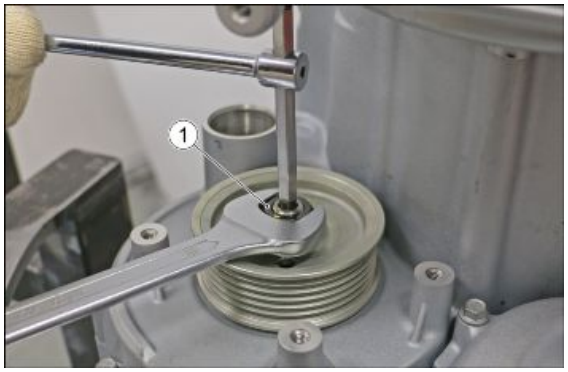
180 Hz

- If the tension is correct, tighten the lock nut of the adjuster screw.
- Otherwise, repeat the operations for the belt tensioning.

Removing the generator

Alternator pulley removal

- Holding the shaft with an Allen key, unscrew the nut (1).



- Remove the washer (2).

- Remove the pulley (3) and retrieve the wrench from the shaft.

- Remove the bushing (4).

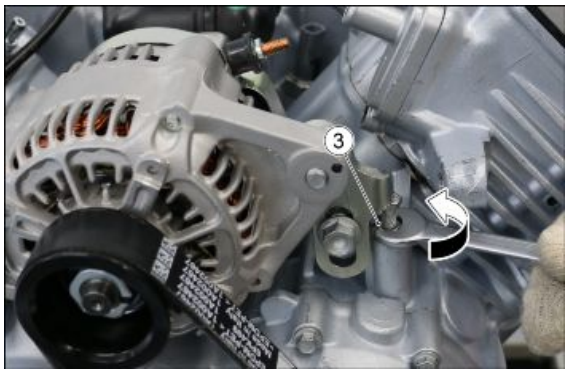
- Remove the O-ring (5) from the shaft.

Alternator removal

- Loosen the fastening screw (1).

- Loosen the fastening screw (2).

- Loosen the lock nut (3) of the adjuster.



- Tighten the adjuster screw (4) sufficiently to bring the alternator to the minimum set of the adjuster travel.

- Push the alternator downwards until bringing the adjuster to stop.

- Remove the belt (5) from the alternator's pulley.
- Remove the fixing screws (1) and (2) and then remove the alternator from the engine.

Installing the generator

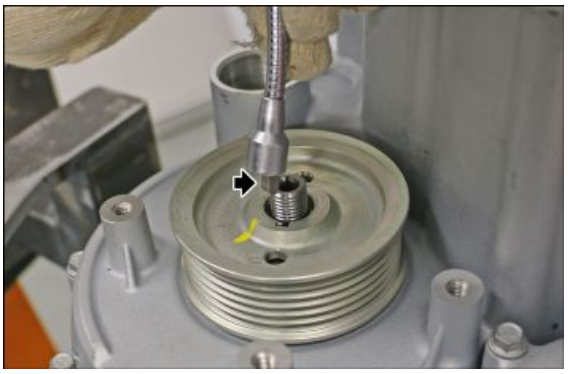
Alternator pulley installation

- Insert the O-ring (5) on the pulley.

- Insert the bushing (4).

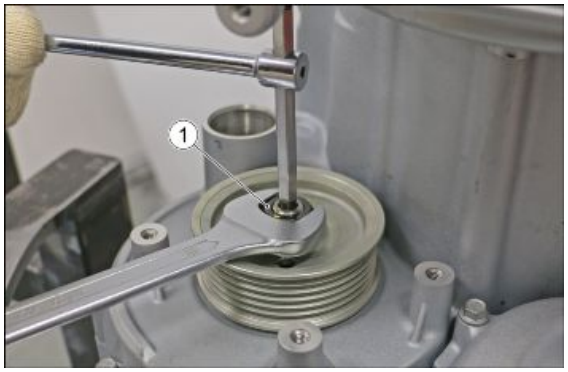
- Fit the pulley (3) on the shaft.

- Align the seats on the shaft and of the pulley from one another, then insert the wrench.



- Insert the washer (2) on the shaft.

- Holding the shaft with an Allen key, tighten the nut (1) to the specified torque.



Locking torques (N*m)

Alternator pulley fastening nut 48 54 Nm (35.40 39.83 lb ft)

Alternator installation

NOTE

Fit the belt with the writing aligned as shown in the figure.

- Follow the removal in reverse order.
- Tighten the fixing screws (1) and (2) of the alternator to the specified torque.
- Once the alternator assembly is complete, tension the belt.

WARNING

It is essential to tighten the fixing screws to measure the tensioning frequency correctly.

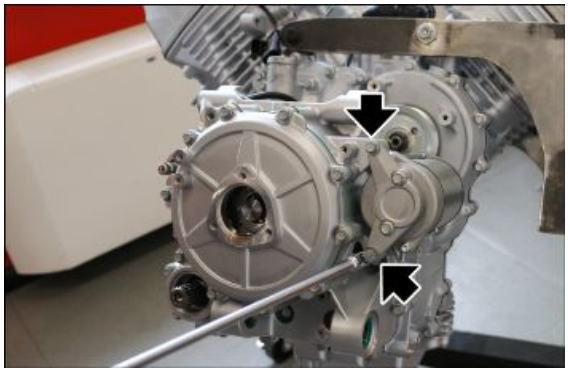
Locking torques (N*m)

Fixing screw (1) 45 - 50 Nm (33.19 - 36.88 lb ft) Fixing screw (2) 20 - 24 Nm (14.75 - 17.70 lb ft)

Starter motor

Removing the starter motor

- Remove the two fixing screws shown in the figure.

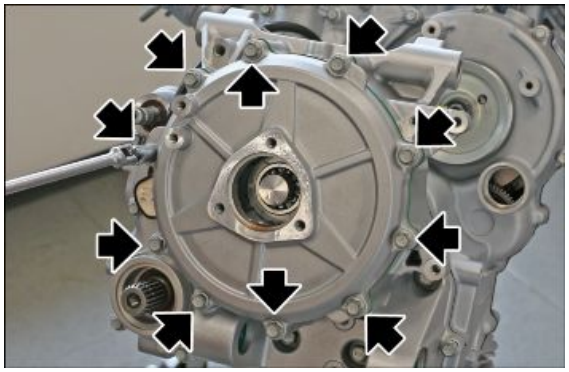


- Extract the starter motor from its seat in the gearbox housing, to remove it from the engine.

Clutch side

Removing the clutch cover

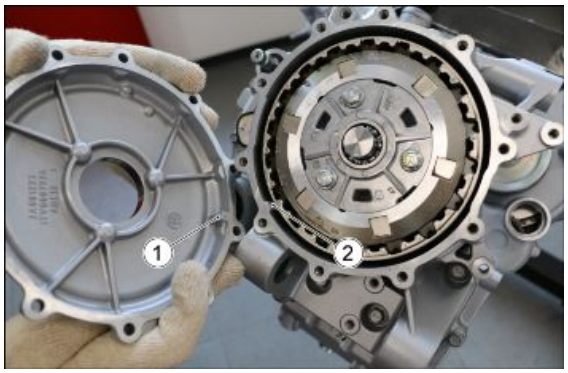
- Remove the ten fixing screws of the clutch cover.



- Remove the clutch cover from the engine.

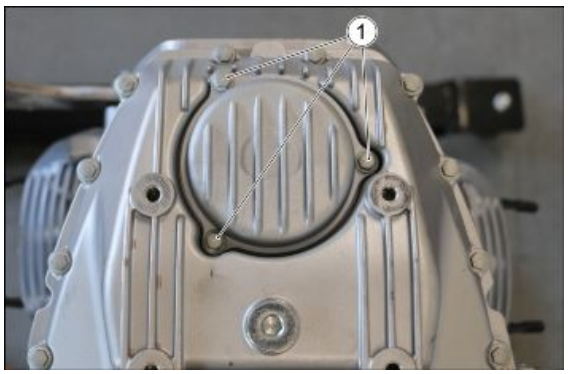
NOTE

- During refitting, align the reference (1) of the clutch cover to the reference (2) on the engine.
- Always use a new gasket and align it as well with the previously mentioned references.



Smontaggio filtro olio completo

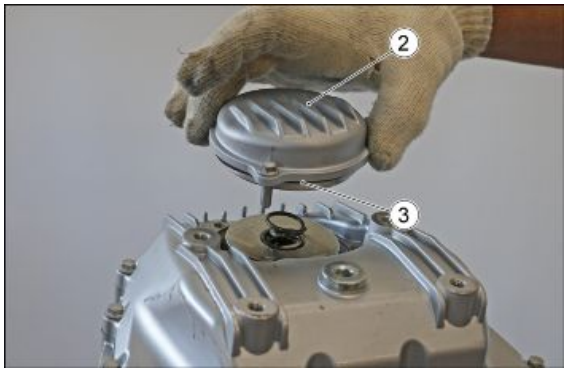
- Remove the three fixing screws (1).



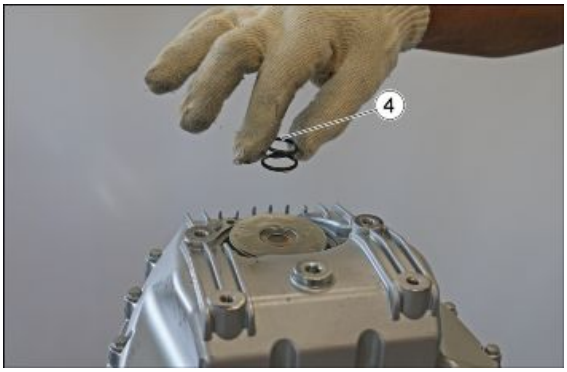
- Remove the cover of the oil filter (2) from the oil sump.

WARNING

DURING REFITTING, FIT A NEW O-RING (3).



Remove the spring (4).



- Remove the oil filter (5).

Disassembling the clutch

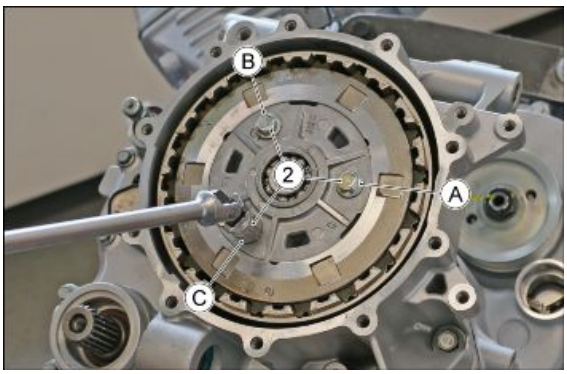
First remove the clutch cover.

- Remove the thrust plate (1) from the thrust bearing.

- Carefully and progressively unscrew the three screws (2) securing the thrust plate following the order A-B-C.

CAUTION

PAY CAREFUL ATTENTION WHILE LOOSENING AND TIGHTENING THE THREE SCREWS (2). ALWAYS PROCEED GRADUALLY AND PROGRESSIVELY ON EACH SCREW.

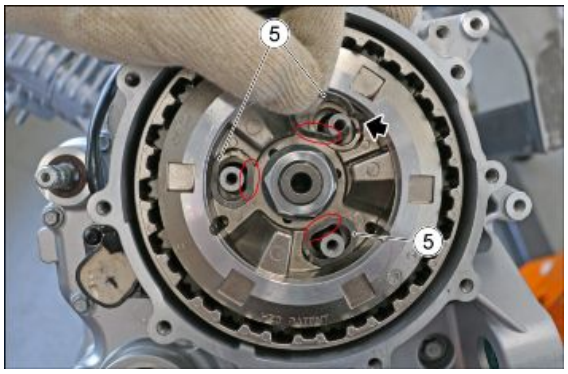


- Remove the thrust plate (3) together with the screws.

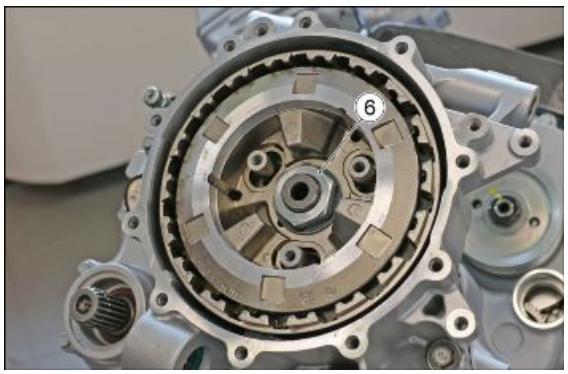
- Remove the springs (4).

NOTE

- It is not required to remove stop rings of the washers (5); however, in case of leaks from the seats, pay attention to correctly insert the tabs into their seats of the clutch hub.
- Also check that the rounded part of the rings is facing the inner side (near the fixing nut of the hub).

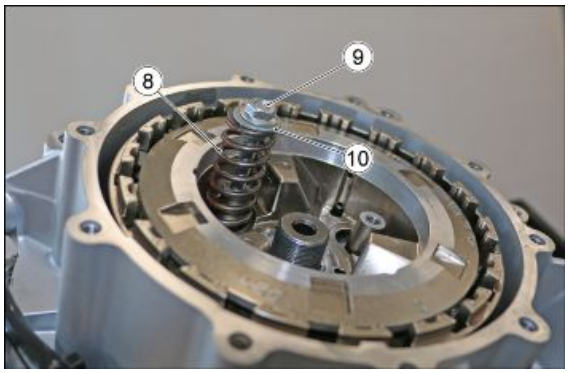


- Using a pneumatic gun, unscrew and remove the central nut (6) that fastens the clutch hub.

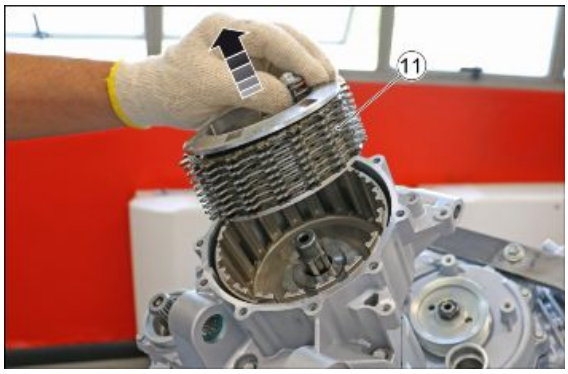


- Remove the washer (7).

- To facilitate the removal of the clutch hub/discs assembly, fit a spring (8) with a screw (9) and washer (10) on the clutch hub.

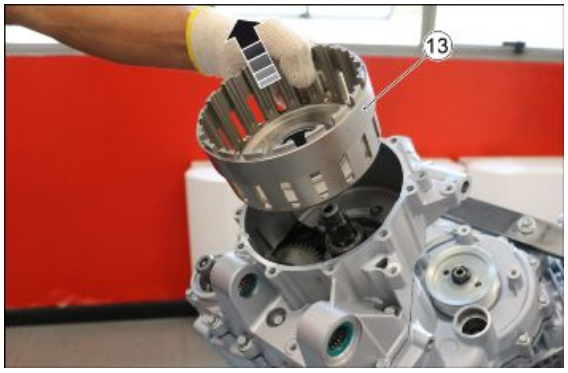


- Remove the clutch hub/discs assembly (11) from the clutch housing.



- Remove the thrust washer (12).

- Remove the clutch housing (13).



- Remove the roller bearing cage (14).

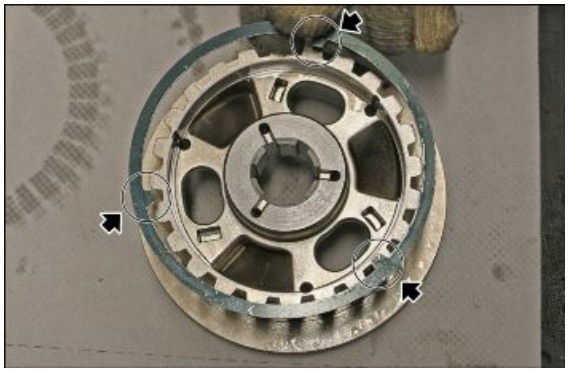
- Remove the bushing (15).

- Remove the special washer (16).

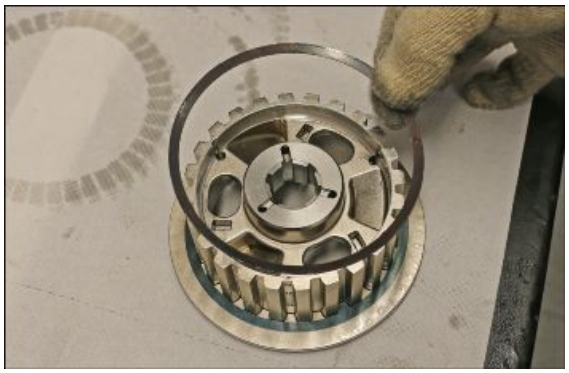
Assembling the clutch

This engine is equipped with a clutch with reverse architecture; In order to be able to fit the clutch, it is necessary to pre-mount the discs in the clutch hub, which will then be inserted in a single block in the housing. To carry out this pre-assembly, follow the procedures below.

- Insert the shim with the three teeth in the clutch hub.

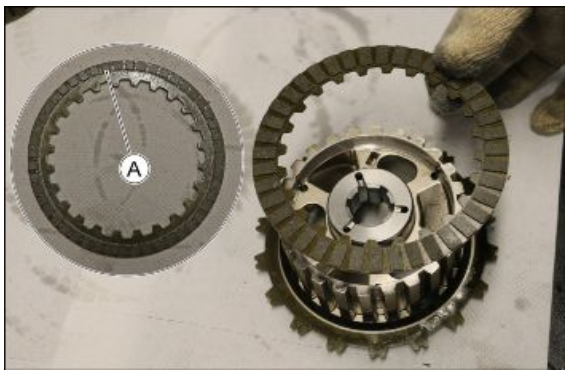


- Insert the spring into the hub, with the concave part facing upwards.



- Insert the driven clutch diss only from one side, with the crankset facing the hub.

- Insert the driving clutch disc with the crankset different on both sides, in the hub; by turning the crankset with the thin track (A) towards the hub.



- Insert a driven disc.

- Insert a driving disc.

- Insert a driven disc.

- Insert a driving disc.

- Insert a driven disc.

- Insert a driving disc.

- Insert a driven disc.

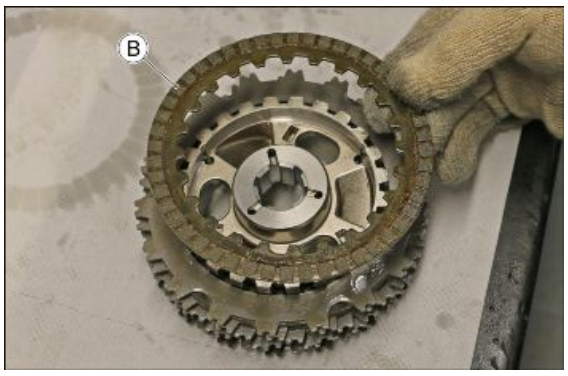
- Insert a driving disc.

- Insert a driven disc.

- Insert a driving disc.

- Insert a driven disc.

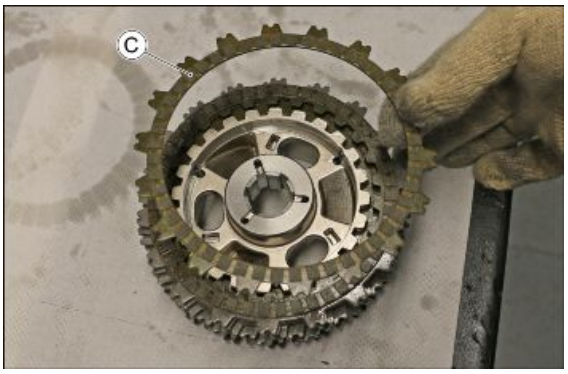
- Insert the driving clutch disc with the crankset different on both sides, in the hub; by turning the crankset with the thin track (B) upwards.



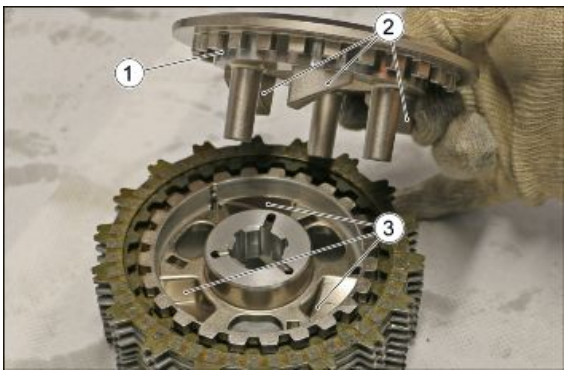
- Insert the driven disc with the thin track.

- Insert the driving disc with the thin track.

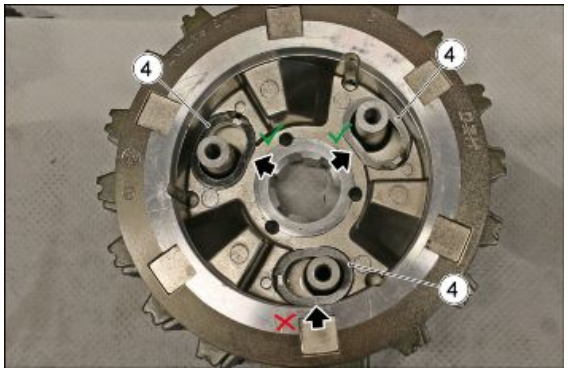
- Insert the driven disc with the thin track and crankset only from one side, with the crankset (C) facing upward.



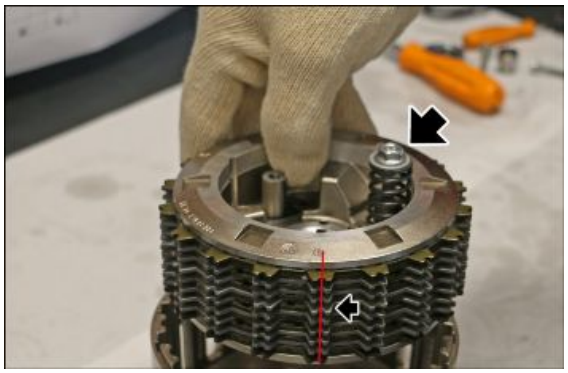
- Insert the spring carrier plate (1) into the hub, centring the anti-juddering wedges (2) with their seats (3) in the hub.



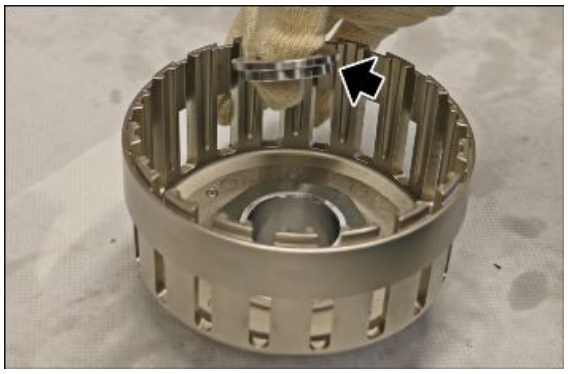
- Rotate the hub and insert the stop rings (4) of the springs.
- Ensure that the tabs of the stop rings are inserted correctly into the seats of the hub and that the rounded part of the rings faces the clutch shaft.



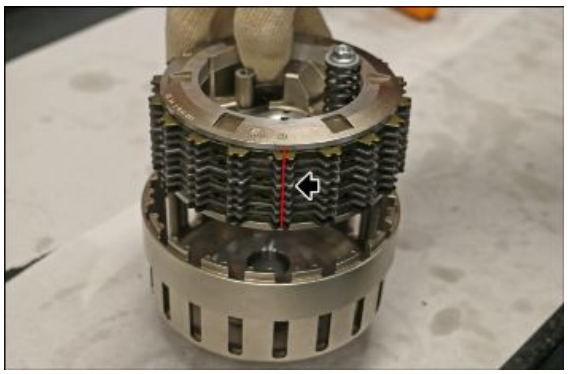
- Align the the teeth of driven discs to allow the insertion in the clutch housing.
- Install a spring with screw and washer, screw it in fully to preload the disc plate to make it stand still.



- Insert the washer with thrust into the clutch housing. respecting the direction shown in the figure. Make sure to insert it correctly in its seat.



- Insert the hub, with the discs already pre-fitted, in the clutch housing.

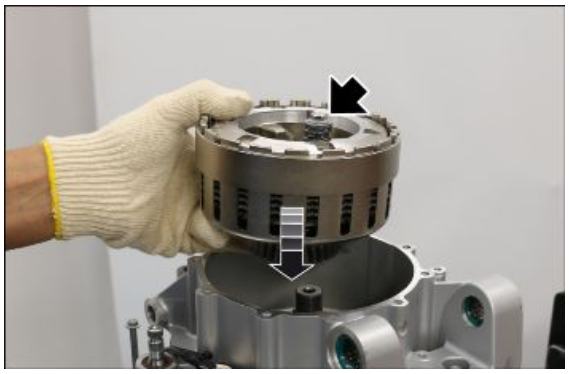


- Pre-assemble the clutch discs and hub into the housing, as shown in the previous paragraph.
- Fit the washer on the shaft, respecting the direction shown in the figure.

- Insert the bushing into the clutch shaft.

- Insert the roller cage on the bushing.

- Install the clutch housing, complete with discs and hub in the clutch shaft.
- Remove the screw, washer and spring used for the pre-assembly from the clutch hub.



- Insert the washer.

- Apply threadlock to the nut and install it on the clutch shaft.

Recommended products

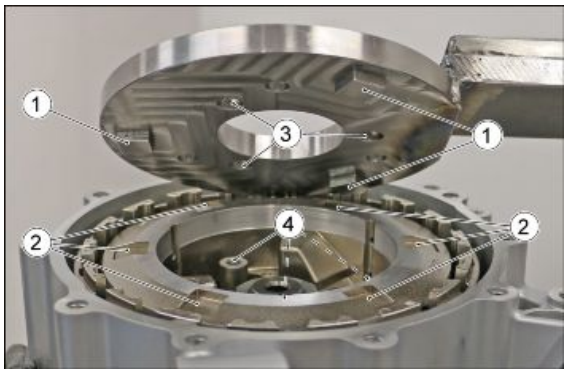
Loctite 2045 Medium strength thread-locking sealant.

Blue

- Install the special tool on the clutch housing, aligning the teeth of the tool (1) with three grooves of the hub (2) and the holes of the tool (3) with the spring holders (4).
- Tighten three screws in order to secure firmly the tool to the clutch hub.

Specific tooling

021058Y Clutch retainer



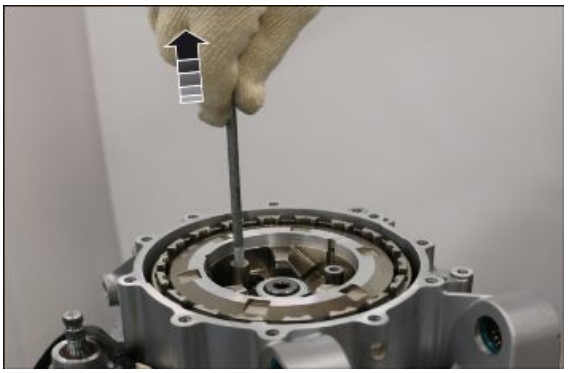
- Tightening the clutch nut to the specified torque and remove the special tool.

Locking torques (N*m)

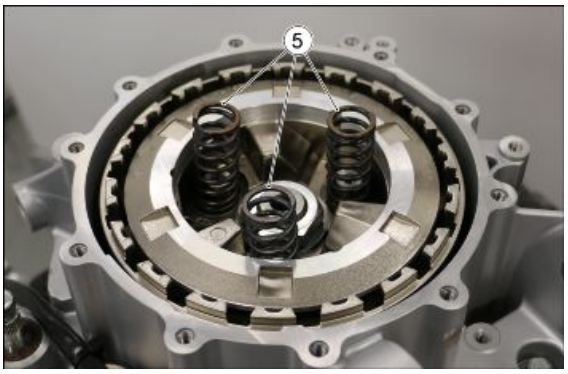
Clutch hub fixing nut **225 255 Nm (165.65 188.08 lb ft)**

- Check that the spring holder stud bolts are at the centre of the slots, as shown in the figure.

- Check that the discs are in the correct position and free to slide in the housing tracks, inserting a long screw in the hub and sliding it upwards for the entire travel.

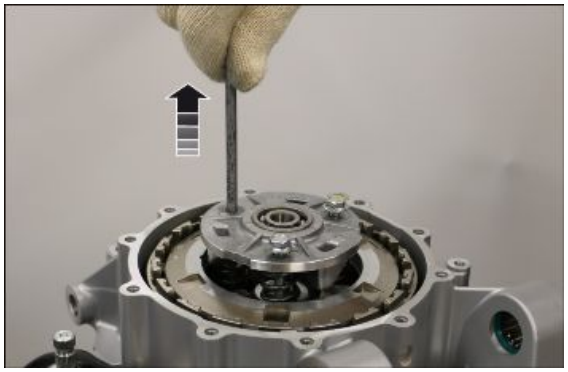


- Remove the long screw and insert the three springs (5).

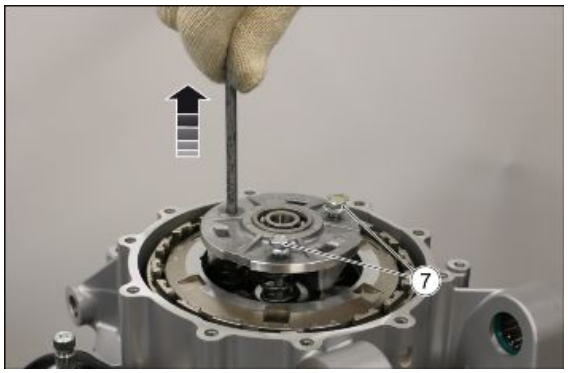


- Install the thrust plate (6).

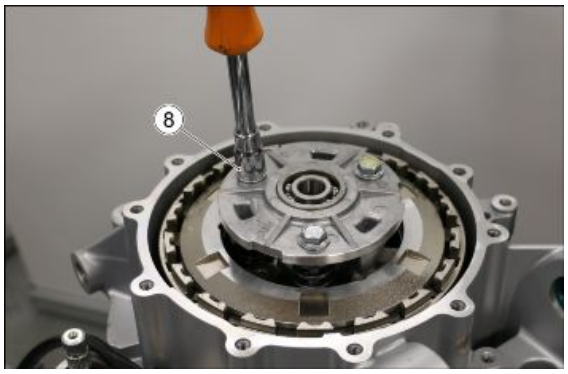
- Reinsert the long screw on a stud bolt and bring the discs to pack pulling the screw upwards.



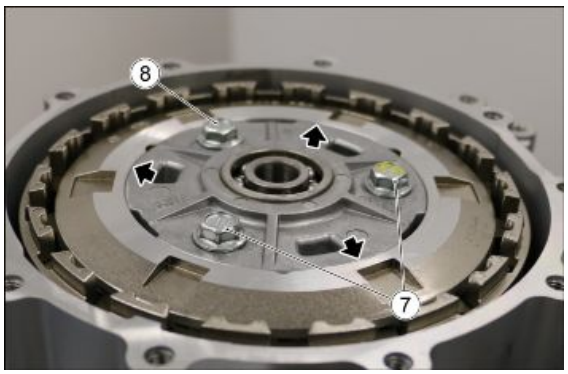
- Keeping the clutch discs to pack, insert two screws (7) and tighten them to pre-load the discs pack so it remains in position.



- Remove the long screw and insert the third clutch screw (8).



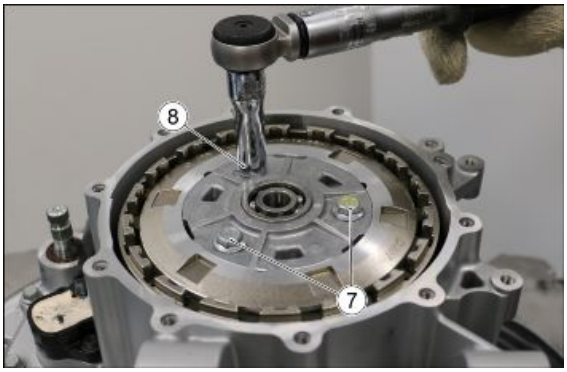
- Bring the screws (7) and (8) to the stop, tightening them gradually and check that the thrust plate is aligned with the hub.
- Otherwise, repeat the procedure for the installation of discs.



- Tighten the screws (7) an (8) of the thrust plate to the specified torque.

Locking torques (N*m)

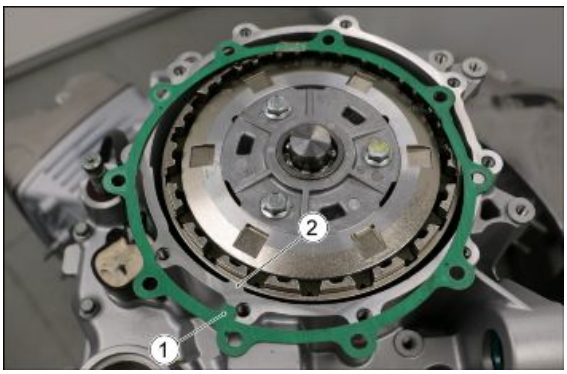
Thrust plate fixing screw 12 Nm (8.85 lb ft)



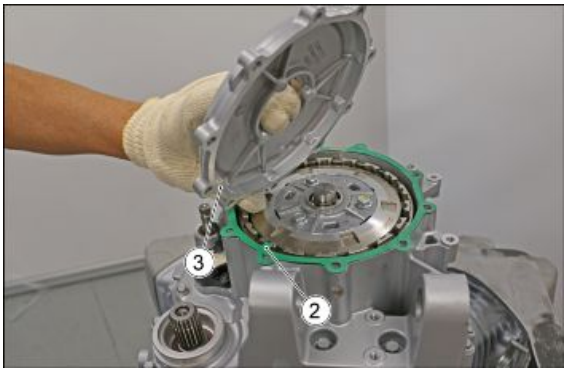
- Install the bushing (9) on the thrust bearing.
- Fit the clutch cover.

Installing the clutch cover

- Install a new gasket, aligning the reference (1) of the gasket to the reference (2) of the crankcase.



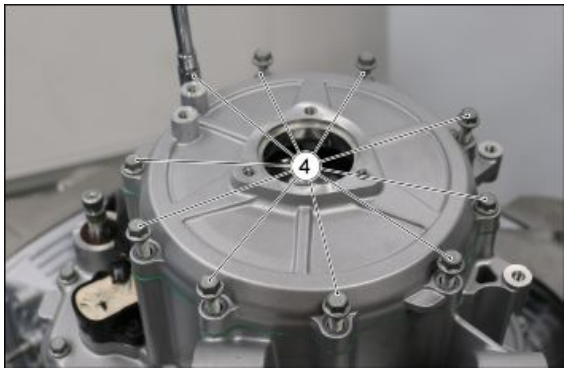
- Fit the cover, aligning the reference (3) to the reference (2) on the crankcase.



- Tighten the fixing screws (4) to the specified torque.

Locking torques (N*m)

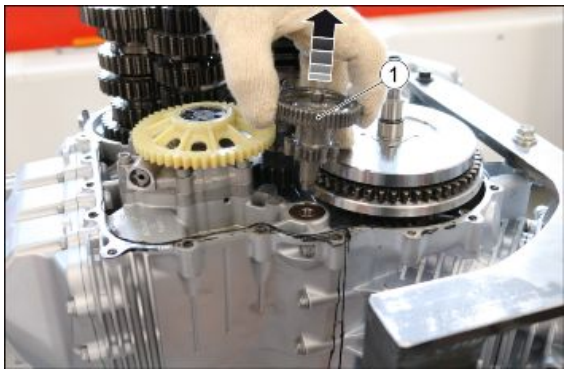
Clutch cover fixing screw 11 - 13 Nm (8.11 - 9.59 lb ft)



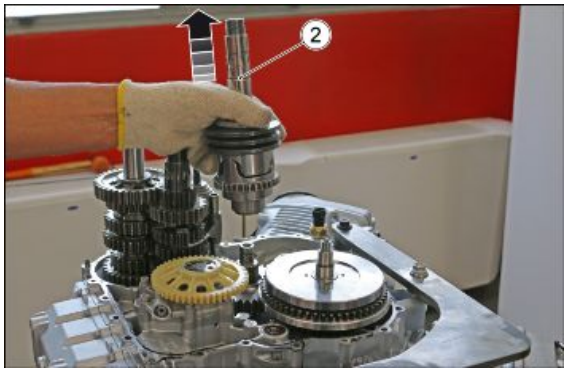
Crankcase

Balancing countershaft removal

- Open the gearbox housing.
- Remove the starter motor transmission (1).



- Remove the clutch shaft (2).



- Insert a 6 mm diam. ground pin (3) into the crankshaft pinion (4) so that it holds the two parts (A) and (B) of the pinion in position.

NOTE

IF THE PIN INSERTION HOLE IS DIFFICULT TO REACH, ROTATE THE CRANKSHAFT UNTIL IT IS MORE ACCESSIBLE.

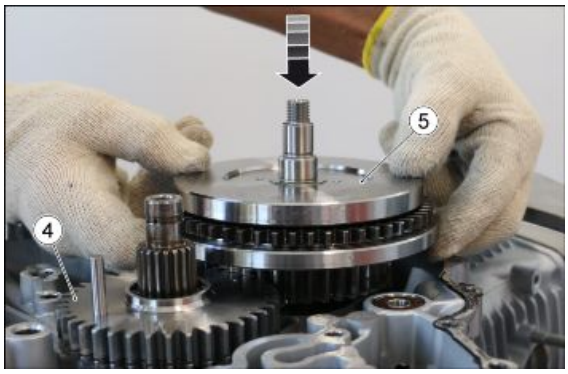
- Remove the countershaft (5) from the engine.

CAUTION

ONCE THE COUNTER SHAFT (5) HAS BEEN REMOVED, DO NOT REMOVE THE PIN FROM THE CRANKSHAFT PINION.

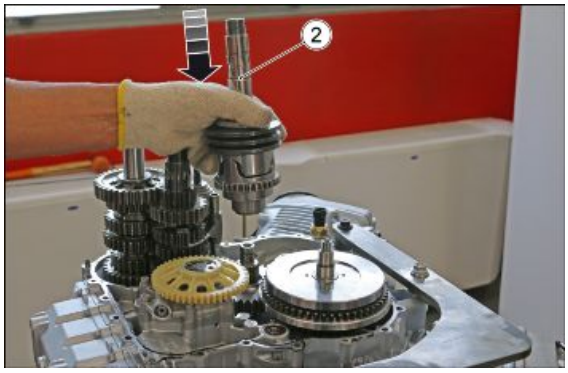
Balancing countershaft fitting

- Refit the countershaft (5) on its bearing, engaging it with the pinion (4) of the crankshaft.

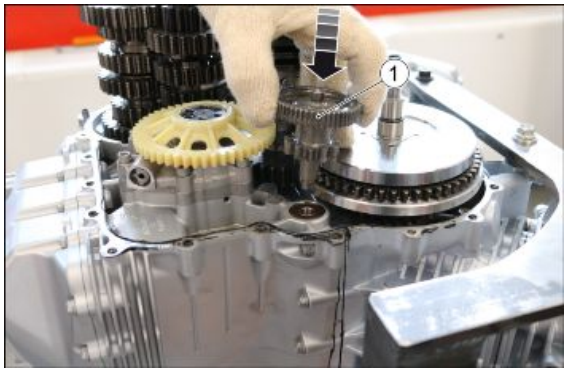


- Remove the ground pin (3) from the sprocket (4) of the crankshaft.

- Install the clutch shaft (2).



- Install the starter motor transmission (1).



- Install a new O-ring (6) on the counter-shaft.

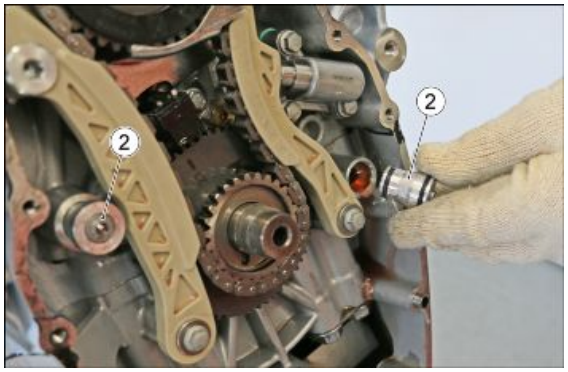
Crankcase opening

- First remove the complete gearbox, the clutch shaft, the countershaft, both heads, the oil pump and the oil sump.
- From the timing system side, remove the oil sleeve (1).

- Retrieve the two oil check valves (2).

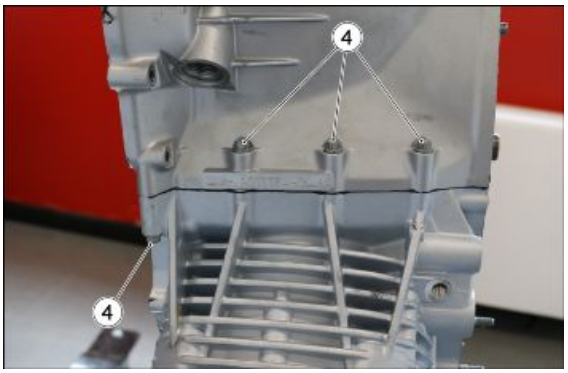
NOTE

WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"

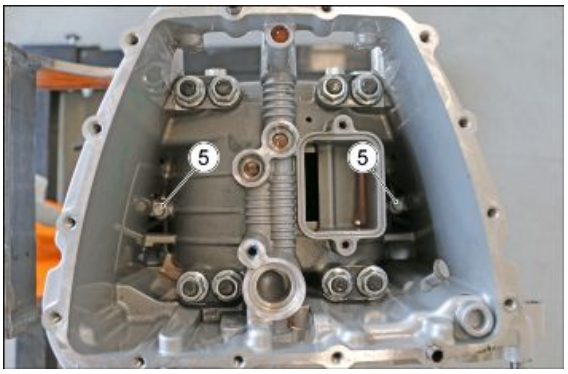


- Remove the four fixing screws (3) on the right-hand side of the engine.

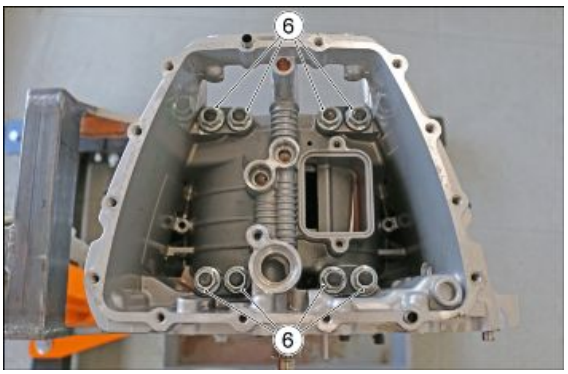
- Remove the four fixing screws (4) on the left-hand side of the engine.



- Remove the fixing screws (5).

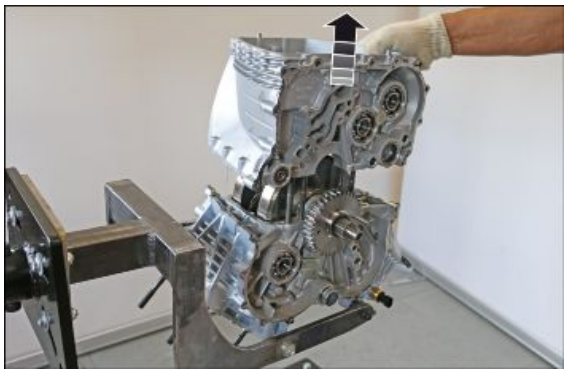


- Remove the eight fixing nuts (6).



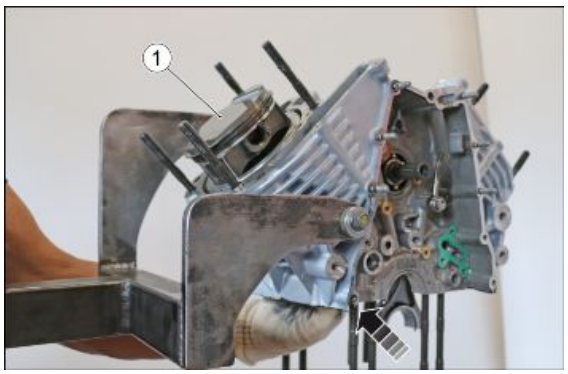
- Retrieve the relative plates (7) under each pair of nuts.

Remove the lower crankcase, taking particular care not to damage the mating surfaces of both crankcases.

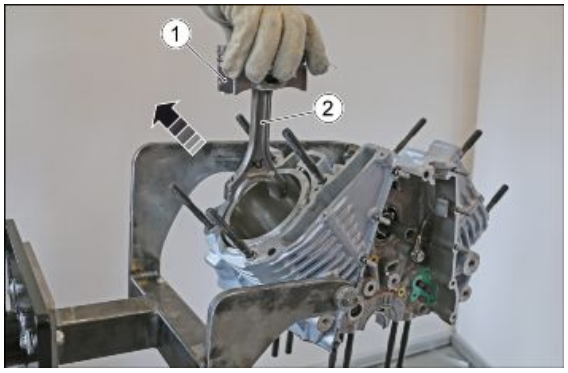


Removing connecting rods - pistons

- First remove the crankshaft.
- Push the connecting rod head upward in motion so that the piston (1) comes out of its cylinder.



- Grasp the piston (1) and remove the piston-connecting rod assembly (2) from the cylinder.
- Repeat for the piston on the opposite side.

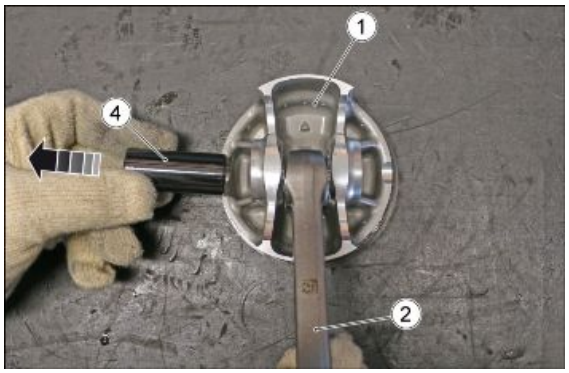


NOTE

RECORD THE POSITION OF THE CONNECTING ROD-PISTON ASSEMBLIES. OBSERVE THE ORIGINAL POSITIONS WHEN REFITTING.

- Working on a bench, remove a circlip (3) from the piston.

- Remove the pin (4) from the piston.
- Separate the piston (1) from the connecting rod (2).



- Remove the two rings (5) and the oil scraper ring (6) from the piston.

CAUTION

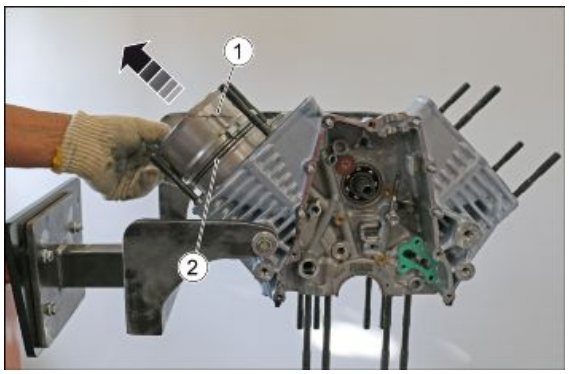
DURING SERVICING, CLEAN OFF ANY DEPOSITS FROM PISTON CROWN AND CIRCLIP GROOVES

Cylinder liner removal

- Using an appropriately sized Teflon pad, tap the cylinder liner (1) from the underside until the O-rings (2) come out of the cylinder.
- Grasp the liner (1) at the top and pull it out of the cylinder.

CAUTION

TAP THE LINER (1) ON THE OUTSIDE OF THE BOTTOM SIDE. TAKE EXTRA CARE NOT TO SCRATCH THE CYLINDER LINER DURING THE OPERATION.



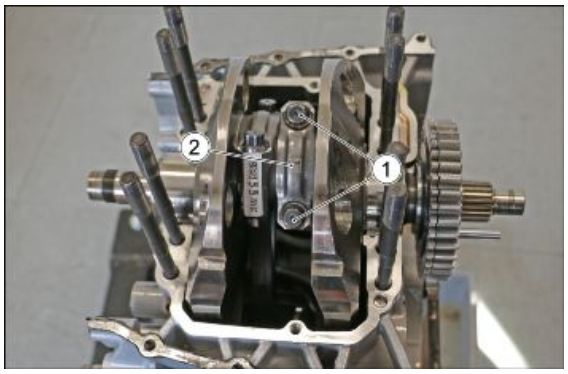
- Remove the O-rings (2) from the outside of the cylinder liner (1).

NOTE

WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"

Crankshaft removal

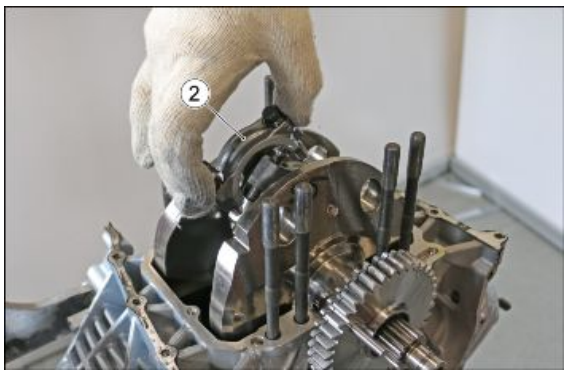
- After opening the crankcase, unscrew the screws (1) of the connecting rod cap (2).



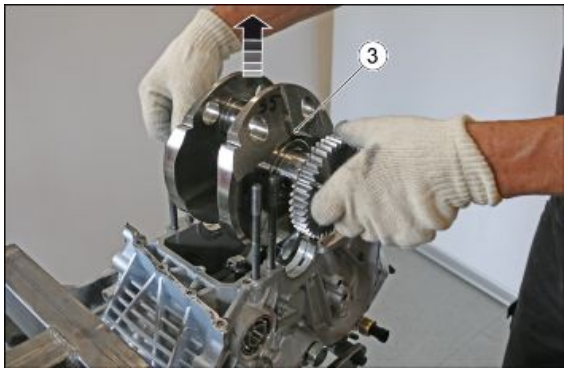
- Remove the connecting rod cap (2).
- Repeat for the second connecting rod.

NOTE

RECORD THE POSITION AND THE DIRECTION OF ASSEMBLY OF THE CONNECTING ROD CAPS (2).



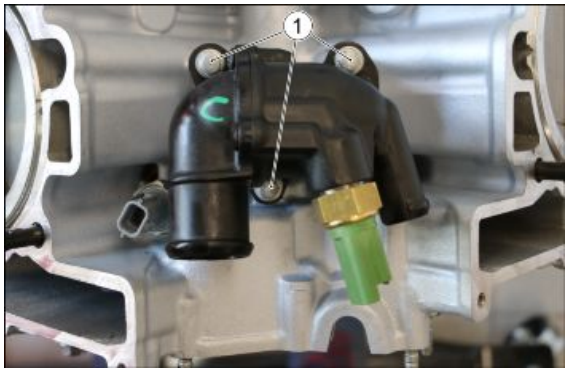
- Remove the crankshaft (3) from the crankcase.



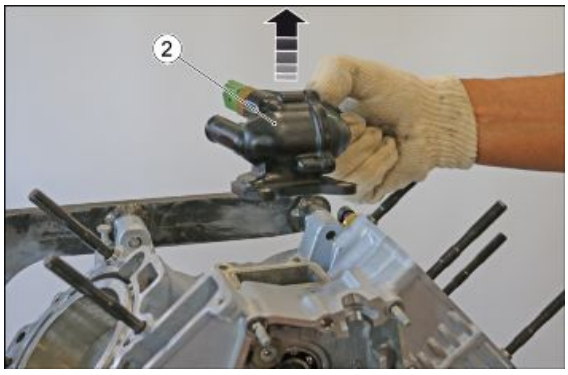
Crankcase check

- Check that the mating surfaces are intact, free of dents and/or scoring. Remove any liquid sealant from all mating surfaces.
- Check the stud bolt threads are not damaged or stripped; Otherwise, replace the affected stud bolt(s).
- Carry out a thorough cleaning of the crankcases and, using compressed air, blow all lubrication channels of both crankcases. To do this, remove from the crankcases the components shown below.

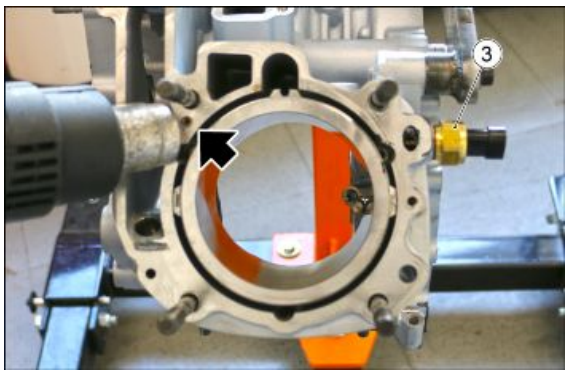
- Remove the three fixing screws (1) and the relative washers.



- Remove the thermostatic valve (2).



- Working on the left cylinder, remove the engine oil pressure sensor (3).
- Heat the cylinder at the point indicated in the figure.



- Remove the calibrated nozzle (4).

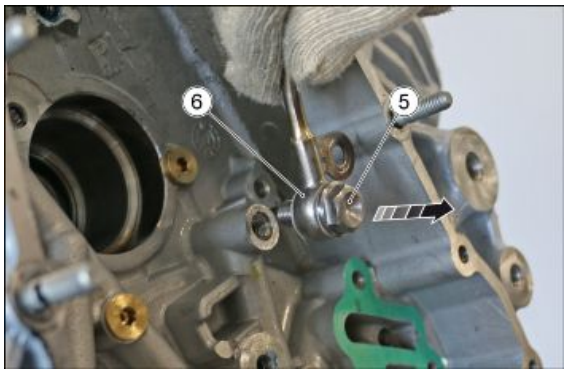
CAUTION

This nozzle is NOT present on the right-hand cylinder.

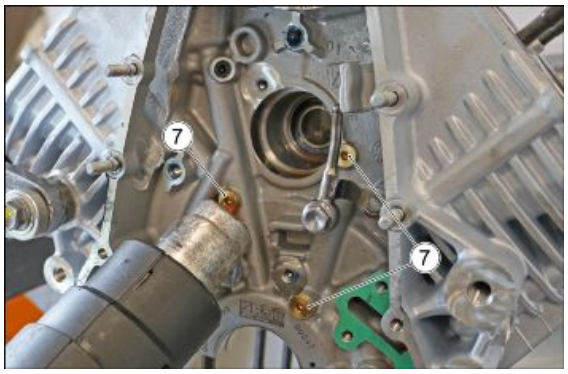
CAUTION

When refitting, apply Loctite DRI LOC 2045 BLU to the thread of the nozzle.

- Operating on the upper crankcase, from the timing system side, unscrew the special screw (5) and remove the nozzle (6).



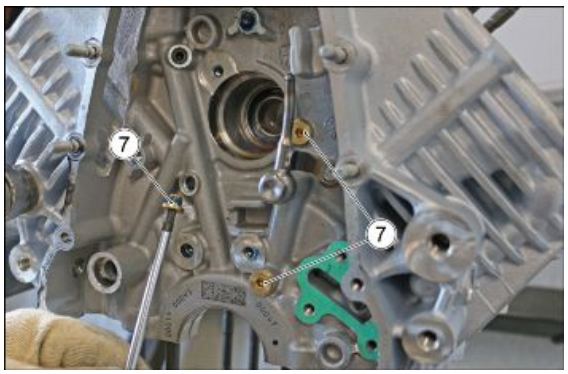
- Heat the crankcase, near the calibrated nozzles (7).



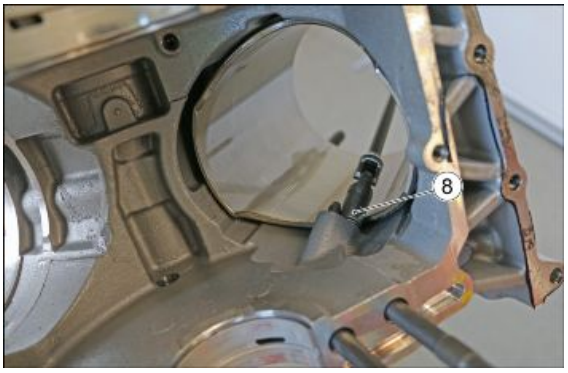
- Remove the calibrated nozzles (7).

CAUTION

When refitting, apply Loctite DRI LOC 2045 BLU to the thread of the nozzle.

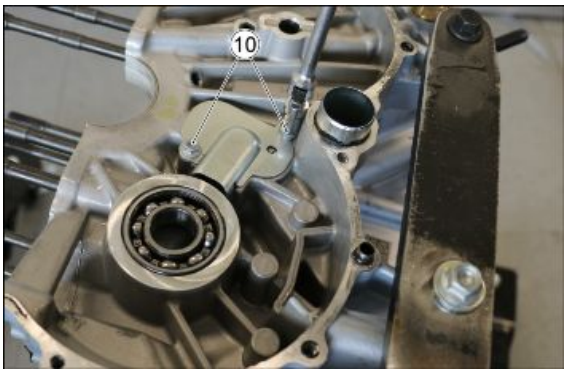


Remove the fixing screw (8).

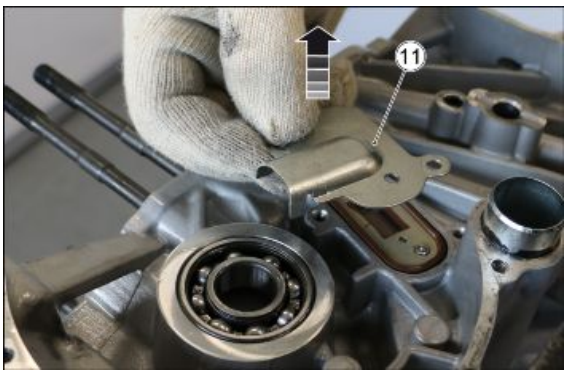


Remove the lubrication nozzle of the cylinder (9).

- Remove the two fastening screws (10).



- Remove the plate (11).

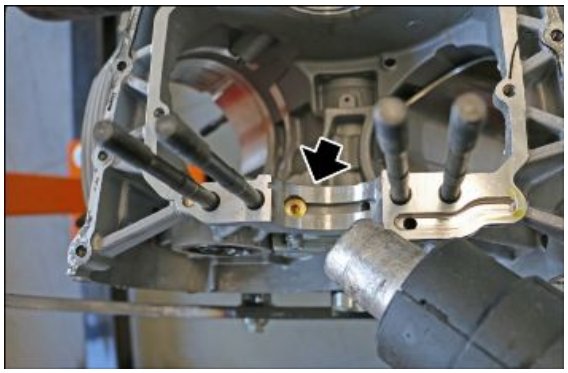


- Remove the Blow-by valve (12).

WARNING

DURING REFITTING, OBSERVE THE VALVE ASSEMBLY DIRECTION.

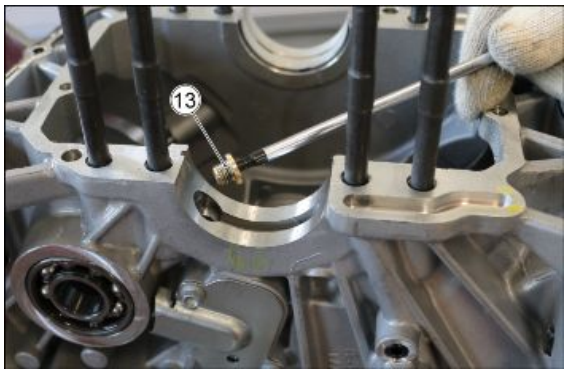
- Remove the main bushing and heat the seat with a workshop hot air gun.



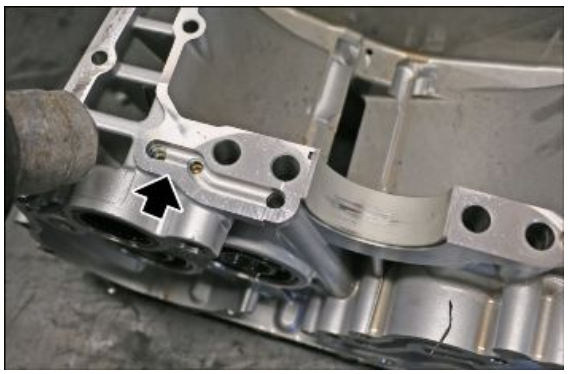
- Remove the calibrated nozzle (13) from the seat of the main bushing.
- Repeat the operation for the calibrated nozzle under the main bushing on the opposite side.

CAUTION

When refitting, apply Loctite DRI LOC 2045 BLU to the thread of the nozzle.



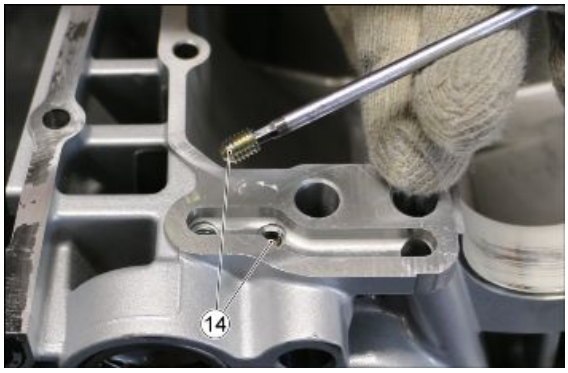
- Working on the lower crankcase, heat the area shown with a workshop hot air gun.



- Remove the two calibrated nozzles (14).

CAUTION

When refitting, apply Loctite DRI LOC 2045 BLU to the thread of the nozzle.



- Working on the RIGHT HEAD, heat the area near the calibrated nozzle (15) and remove it from the head.

CAUTION

This nozzle is NOT present on the left head.

CAUTION

When refitting, apply Loctite DRI LOC 2045 BLU to the thread of the nozzle.

Connecting rod check

- Check using a micrometer the measure of the connecting rod pin orthogonal axes an in the working area of the small ends, check the measure of the small ends seats on the timing system side and on the flywheel side.
- Assemble the connecting rod without small ends and tighten the connecting rod screws to the prescribed torque. Measure the outer diameter of small ends seats with a dial gauge graduated in hundredths of a millimetre and the thickness of both small ends with a round tip micrometer.
- Check the bushings pressed in the small end of the connecting rod for notches due to seizing or deep scoring; replace as required.

CONNECTING ROD CHECK

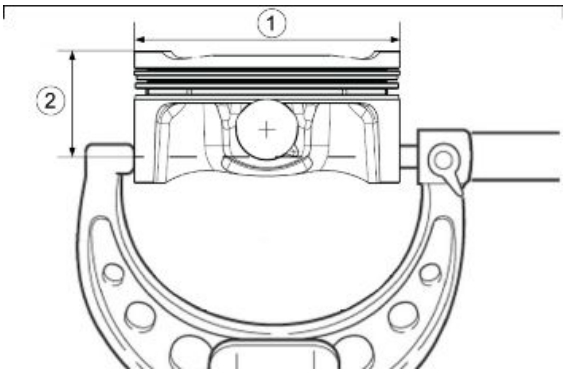
Specification	Desc./Quantity
Diameter connecting rod head seat (MAXIMUM WEAR VALUE)	43.67 mm (1.7193 in)
Thickness of connecting rod head small ends (MINIMUM WEAR VALUE)	1.807 mm (0.0711 in)
Diameter of the small end with pressed and bored bushing (MAXIMUM WEAR VALUE)	20.015 mm (0.7880 in)

Inspecting pistons

- Clean off combustion residues from the piston crown and from the area above the top ring.
- Check that there are no signs of detonation on the piston crown.

- Check the piston skirt for cracks and/or compression (seizure).
- Replace the piston if required.

- Using a micrometre, measure the piston skirt diameter (1) to the distance (2) as shown in the figure. (2) = 38.5 mm (1.5157 in)
- If the diameter is out of specification, replace the complete piston and its cylinder as a set.

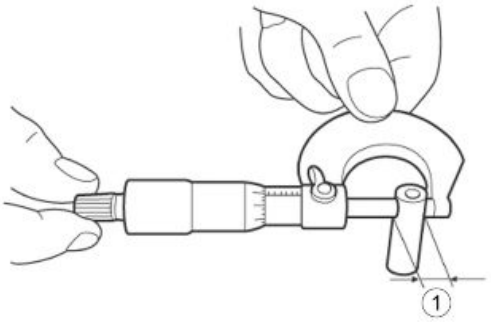


PISTONS CHECK

Type	Allowed diameter	Assembly clearance between piston and cylinder
C	95.937-95.944 mm (3.7770-3.7773 in)	0.045-0.059 mm (0.0018-0.0023 in)
D	95.944-95.951 mm (3.7773-3.7776 in)	0.045-0.059 mm (0.0018-0.0023 in)
E	95.951-95.958 mm (3.7776-3.7779 in)	0.045-0.059 mm (0.0018-0.0023 in)

PISTON PIN CHECK

- Measure the outside diameter (1) of the piston pin.
- If it is out of specification, replace the piston pin.



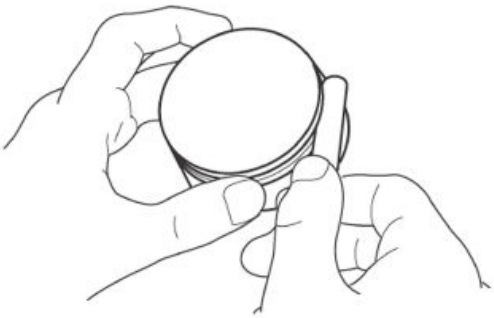
Characteristic

Piston pin external diameter (MINIMUM PERMITTED)

xxx mm (xxxx in)

PISTON RING CHECK

- Clean off any carbon deposits from the grooves in the piston rings and from the rings themselves.
- Measure the piston ring side clearance and replace the piston and the piston rings all together if not complying with specifications.



PISTON RING CLEARANCES (MAXIMUM PERMITTED VALUES)

Type	Maximum clearance between rings and slots on the piston	Maximum opening of the rings fitted on the piston
Upper ring	xxx mm (xxx in)	xxx - xxx mm (xxx - xxx in)
Intermediate ring	xxx mm (xxx in)	xxx - xxx mm (xxx - xxx in)
Oil scraper ring	xxx mm (xxx in)	xxx - xxx mm (xxx - xxx in)

- Fit the piston ring to the cylinder.

- Level the installed piston ring with the piston crown.
- Measure piston ring port and replace it if not complying with specifications.

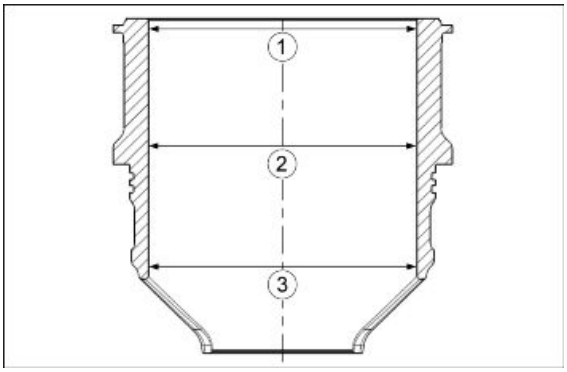
CAUTION

IT IS NOT POSSIBLE TO MEASURE THE CLEARANCE OF THE END OF THE OIL SCRAPER RING: IF THERE IS EXCESSIVE PLAY, REPLACE THE THREE ELASTIC RINGS.

- Insert the piston rings paying attention to their mounting direction and end gap arrangement; the end gaps must be approximately 180 degrees from each other.

Cylinders control

- After checking that there is no scoring, check cylinder surface wear using a dial gauge graduated in hundredths of a millimetre.
- Measure the inner diameter of the cylinders at three different heights, turn the dial gauge (graduated in hundredths of a millimetre) 90° and repeat the measurements; set the dial gauge graduated in hundredths of a millimetre to zero using a ring gauge before measuring.



Key:

1. 1st measurement
2. 2nd measurement
3. 3rd measurement

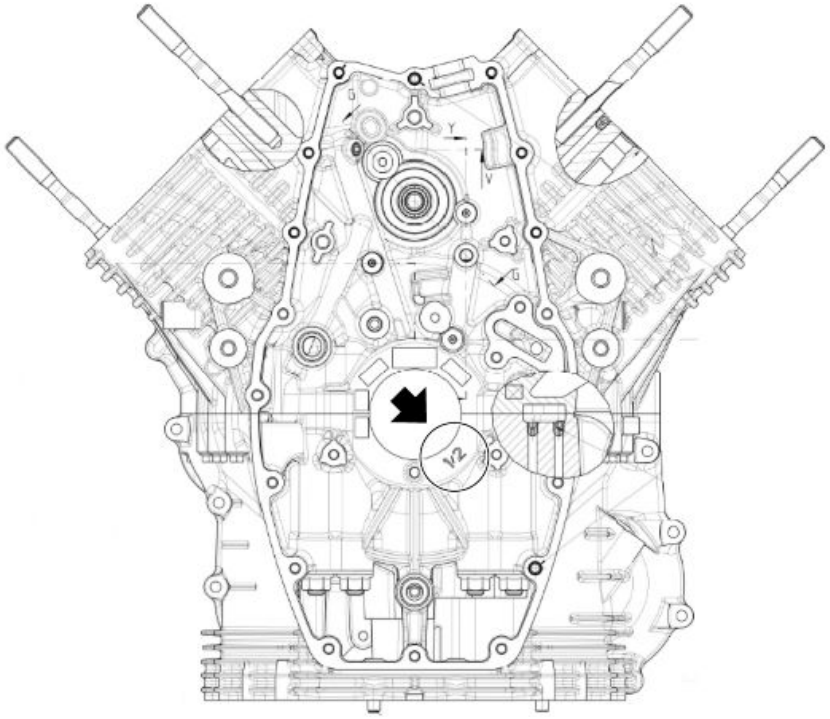
CYLINDERS CONTROL

Type	Allowed diameter	Assembly clearance between piston and cylinder
C	95.989-95.996 mm (3.7791-3.7794 in)	0.045-0.059 mm (0.0018-0.0023 in)
D	95.996-96.003 mm (3.7794-3.7796 in)	0.045-0.059 mm (0.0018-0.0023 in)
E	96.003-96.010 mm (3.7796-3.7799 in)	0.045-0.059 mm (0.0018-0.0023 in)

Bushing selection

CRANKCASE

Two crankcase classes can be selected; The classes of the crankcases are stamped near the main hole of the lower crankcase, on the timing system side.



CRANKCASE CLASSES

Specification	Desc./Quantity
Class 1	Diameter 53.959 ÷ 53.965 mm (2.1244 ÷ 2.1246 in)
Class 2	Diameter 53.965 ÷ 53.971 mm (2.1246 ÷ 2.1248 in)

Crankcase hole diameter ø54 -0.029 -0.041 mm (ø2.126 -0.00114 -0.00161 in)

Three categories of main bushings can be selected:

- Category "B" Blue: 1.977 1.982 mm (0.077835 0.078031 in)
- Category "G" Yellow: 1.980 1.985 mm (0.077953 0.07815 in)
- Category "V" Green: 1.983 1.988 mm (0.078071 0.078268 in)

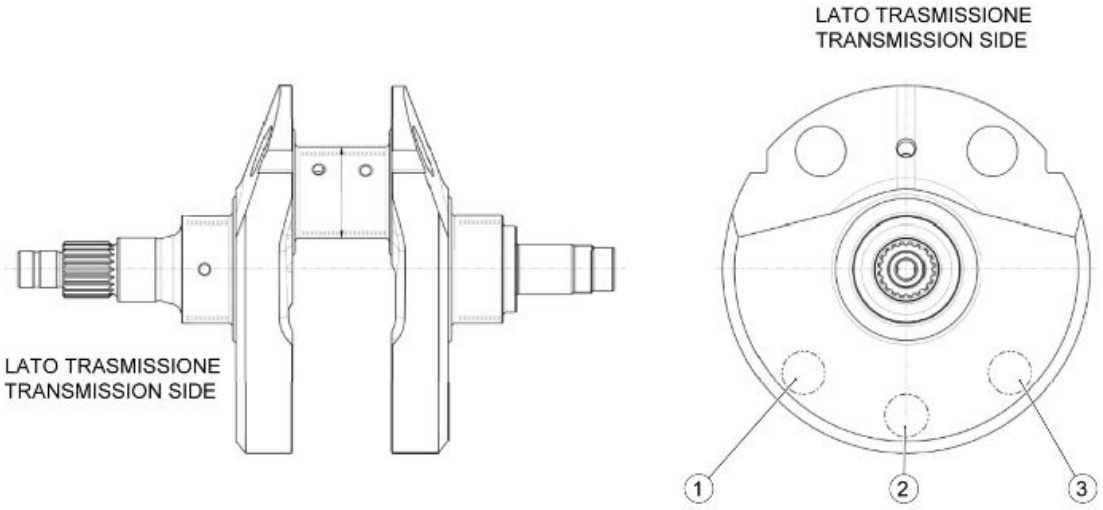
Choose the bushing category based on the table below.

SELECTING MAIN BUSHINGS

Crankshaft class	Crankcase class 1	Crankcase class 2
4 timing system side - 6 transmission side	G + G	V + V
5 timing system side - 7 transmission side	B + B	G + G

CRANKSHAFT

- Four classes of crankshaft main journal can be selected; Two for the transmission side pin and two for the timing system side pin. The classes of the transmission side pins (1) and timing system side pins (2) are stamped on the transmission-side shoulder of the crankshaft.
- Two classes of pins of the crankpin (3) can be selected; The classes of the crankpin are also stamped on the transmission-side shoulder of the crankshaft.



MAIN JOURNALS CLASSES

Specification	Desc./Quantity
Class 4 (TIMING SYSTEM)	Diameter 46.964 ÷ 46.970 mm (1.849 ÷ 1.8492 in)
Class 6 (TRANSMISSION)	Diameter 46.964 ÷ 46.970 mm (1.849 ÷ 1.8492 in)
Class 5 (TIMING SYSTEM)	Diameter 46.970 ÷ 46.976 mm (1.8492 ÷ 1.8494 in)
Class 7 (TRANSMISSION)	Diameter 46.970 ÷ 46.976 mm (1.8492 ÷ 1.8494 in)

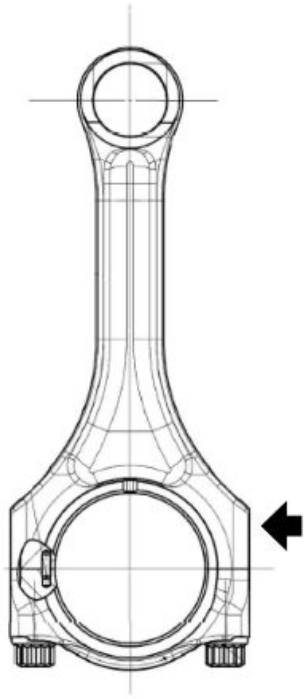
Main journal diameter ø50 -0.024 -0.036 mm (ø1.969 -0.00094 -0.00142 in)

CRANKPIN CLASSES

Specification	Desc./Quantity
Class A	Diameter 41.994 ÷ 42.000 mm (1.6533 ÷ 1.6535 in)
Class B	Diameter 42.000 ÷ 42.006 mm (1.6535 ÷ 1.6538 in)

CONNECTING ROD

- Two connecting rod classes can be selected; The connecting rod classes are stamped in the area indicated in the figure.



CONNECTING ROD CLASSES

Specification	Desc./Quantity
Class A	45.000 45.006 mm (1.7717 1.7719 in)
Class B	45.006 45.012 mm (1.7719 1.7721 in)

Three categories of connecting rods can be selected:

- Category "V" Green: 1.485 1.488 mm (0.058465 0.058583 in)
- Category "R" Red: 1.488 1.491 mm (0.058583 0.058701 in)
- Category "B" Blue: 1.491 1.494 mm (0.058701 0.058819 in)

Choose the bushing category based on the table below.

CONNECTING ROD BUSHING SELECTION

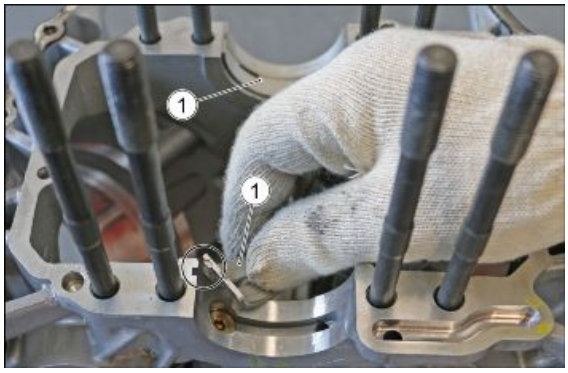
Connecting rod class	Class A crankpin	Class B crankpin
Class A	R - R	V - V
Class B	B - B	R - R

Crankshaft fitting

CAUTION

SELECT THE BUSHINGS FOR THE CONNECTING ROD HEAD AND THE CRANKCASE FOLLOWING THE TABLE IN THE SECTION "BUSHING SELECTION".

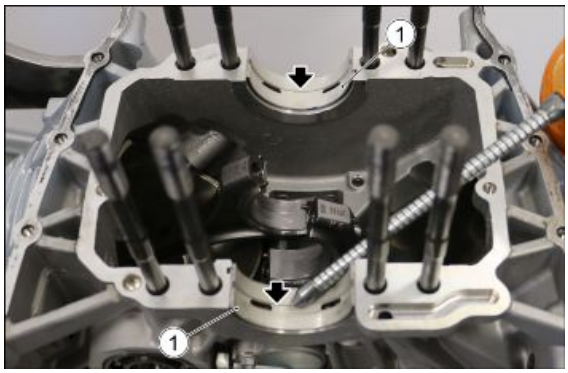
- Install the main bushings (1) in the upper crankcase, making sure to insert the reference of the bushing into its seat of the crankcase.



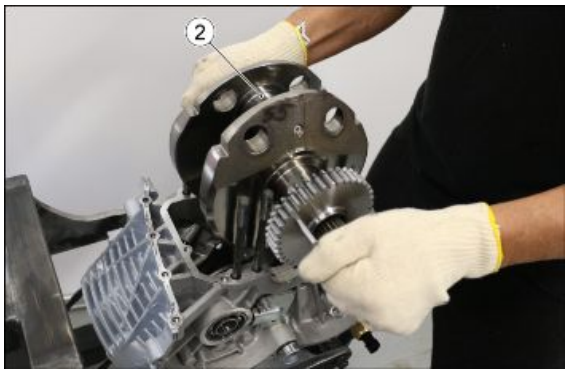
- Lubricate the bushings (1) with engine oil.

NOTE

THE UPPER CRANKCASE BUSHINGS DIFFER FROM THE LOWER ONES IN THE PRESENCE OF THE CUTOUT.

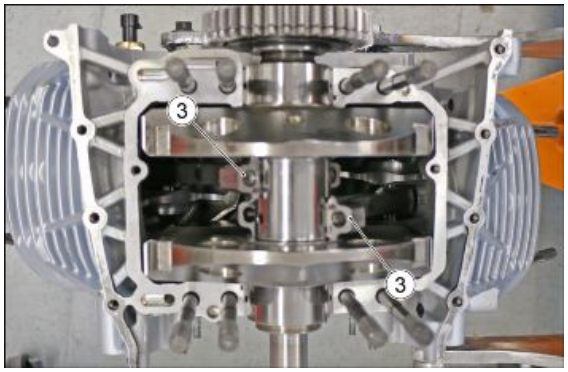


- To install the crankshaft in the crankcase, making sure to place the crankpin (2) towards the sump oil.



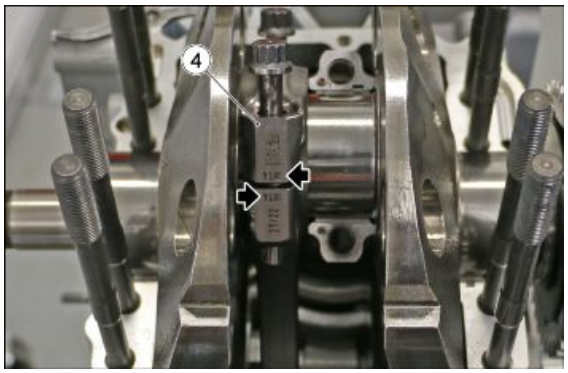
- Lubricate the crankpin (2).

- Insert the heads of the connecting rods (3) on the crankpin.



- Install the caps of the connecting rod (4).

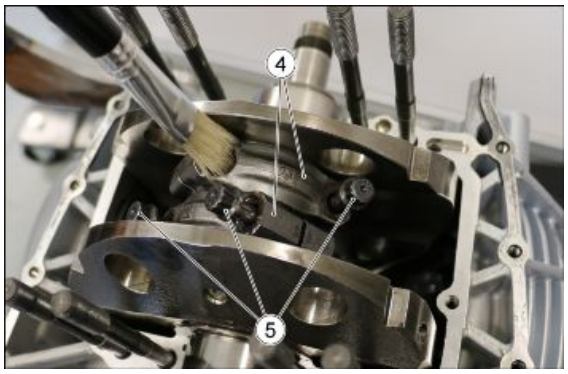
CHECK THAT THE NUMBER ON THE CAP IS THE SAME OF THE CONNECTING ROD ON WHICH IT IS INSTALLED.



- Lubricate the coupling surfaces of the connecting rod caps (4) and the threads of the screws (5) with the product PANKL-PLB- 03.

CAUTION

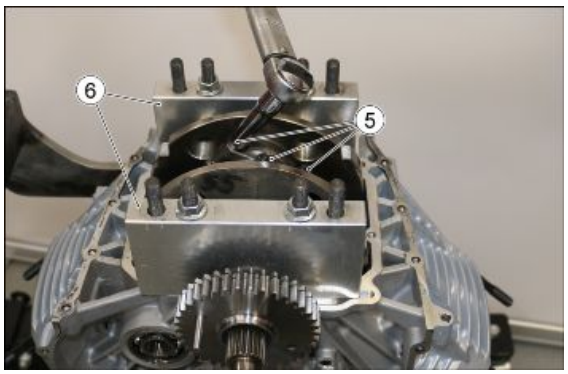
THE SCREWS (5) MUST BE REINSTALLED IN THE HOLE FROM WHICH THEY WERE REMOVED.



- Install the specific tool (6) on the stud bolts of the crankcase.
- Tighten the screws (5) of the connecting rod caps, following the specified tightening sequence.

Locking torques (N*m)

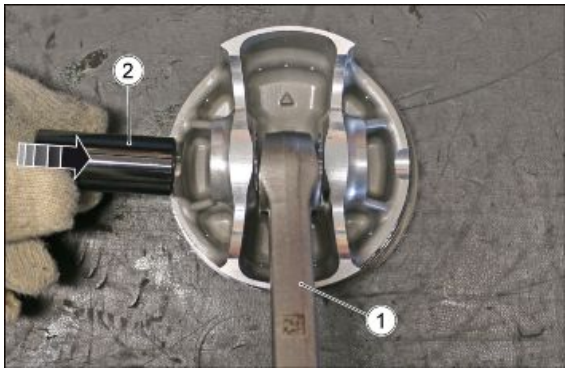
1st PRETIGHTENING 10 Nm (7.38 lbf ft) 2nd PRETIGHTENING 25 Nm (18.44 lbf ft) TIGHTENING 105° ± 2°



Installing connecting rods - pistons

- Install the connecting rod (1) and the pin (2) in the piston.

LUBRICATE THE PISTON PIN AND CONNECTING ROD FOOT WITH ENGINE OIL.

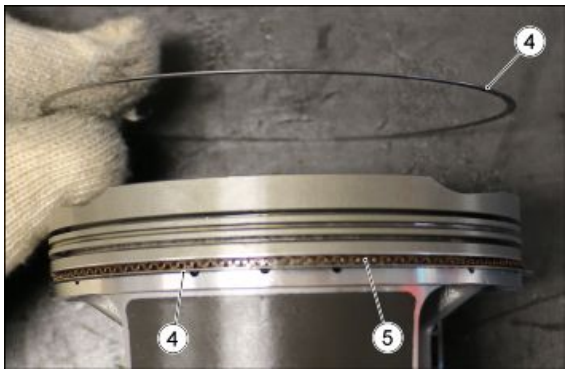


- Install the seeger ring (3) in the piston, on both sides.

CAUTION

INSERT THE HOOK IN THE SEEGER RINGS INTO THE LOWER SIDE OF THE PISTON RECESS, AS SHOWN IN THE FIGURE.

- Insert the spacers rings (4) and the oil scraper ring (5) in the first slot of the piston.



- Insert the segments (6) and (7) in their slots of the piston.

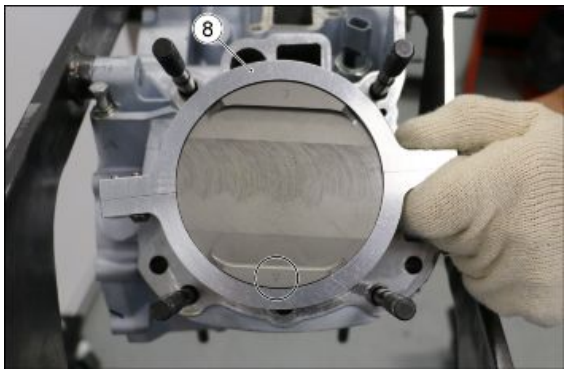
CAUTION

FIT THE SEGMENTS (6) AND (7) WITH THE REFERENCE FACING UPWARDS.

NOTE

POSITION THE OPENINGS OF THE SEGMENTS AND OIL SCRAPER RINGS AT 90° TO EACH OTHER.

- Use the special tool ring clamp (8), insert the piston on the cylinder liner pointing the arrow on the top towards the exhaust.
- Repeat the operations described above, for the piston on the opposite side.



Specific tooling

021061Y Ring clamp

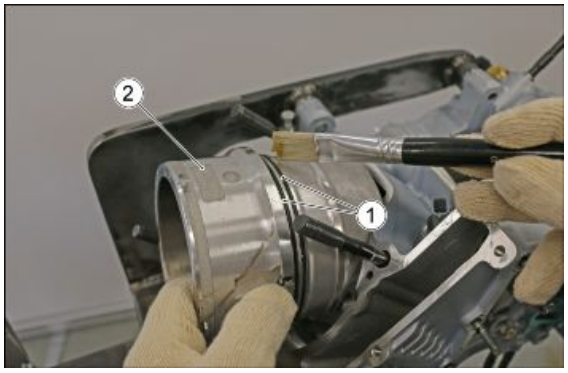
Crankcase closing

FITTING THE ZYLINDER LINER

CAUTION

REASSEMBLE THE CYLINDER LINERS IN THE SEATS FROM WHICH THEY WERE REMOVED; IT IS ABSOLUTELY FORBIDDEN TO INVERT THEM.

- Insert the new O-rings (1) in the seats on the external wall of the cylinder liner (2) and lubricate them.

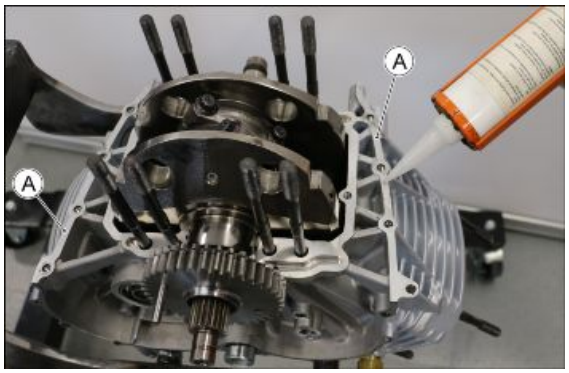


- Insert the cylinder liner (2) in the upper crankcase.
- Insert the liner with the upper reference (A) at 12 o'clock so that the three notches match with the threaded holes in the crankcase (machining holes, will not be used when refitting).

- Insert the cylinder liner (2) completely into the crankcase, exerting in the operation with a Teflon hammer.
- Repeat the operation for the liner of the second cylinder.

CLOSING THE CRANKCASE

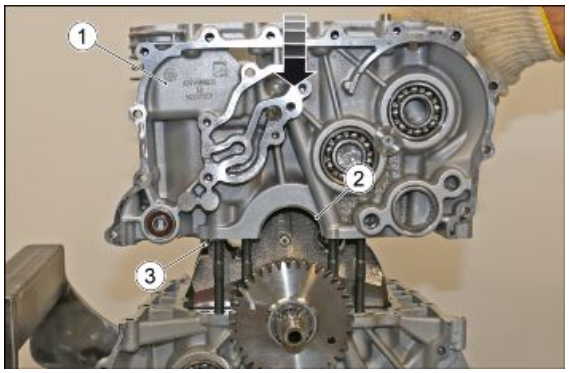
- First fit the crankshaft.
- Check that the surfaces of the crankcase are clean and not damaged.
- Apply a layer of ThreeBond 1207 D to the external coupling surfaces (A) of the crankcase.



- Install the lower crankcase (1), complete with bushings (2) and centring bushings (3).

NOTE

To select the bushings, refer to the section "BUSHING SELECTION".

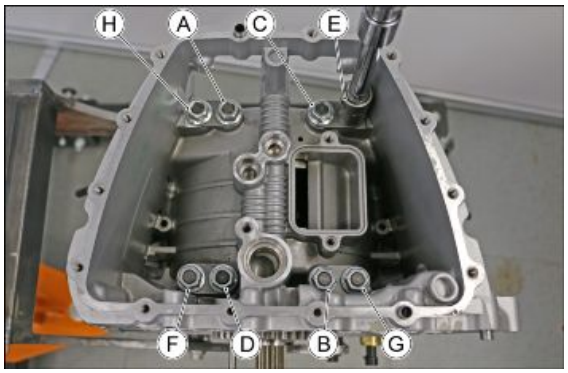


- Insert the plates (4) on the stud bolts.

- Lubricate the nuts with grease MOLY-KOTE G RAPID PLUS and tighten them to the specified torque following the sequence A-B-C-D-E-F-G-H and the indicated tightening order.

Locking torques (N*m)

1st PRETIGHTENING 9 - 11 Nm (6.64 - 8.11 lb ft) 2nd PRETIGHTENING 19 21 Nm (14.01 15.49 lb ft) TIGHTENING 90° ± 2°



- Tighten the two hexagonal screws (5) inside the oil sump to the specified torque.

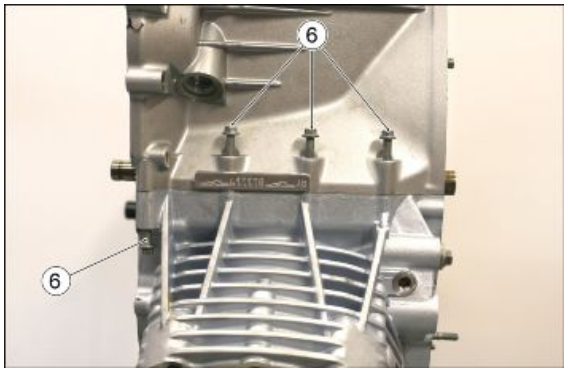
Locking torques (N*m)

Crankcase halves closing screws 11 - 13 Nm (8.11 - 9.59 lb ft)

- Tighten the four screws (6) on the left side to the specified torque.

Locking torques (N*m)

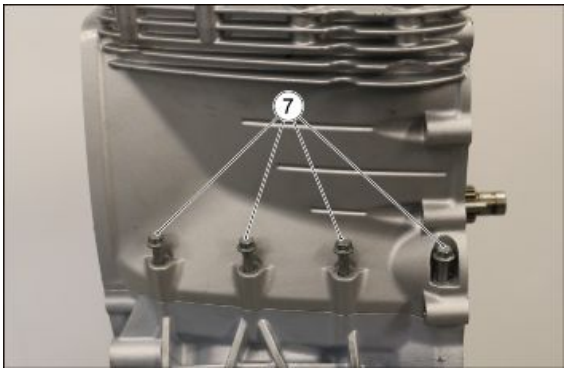
Crankcase halves closing screws 11 - 13 Nm (8.11 - 9.59 lb ft)



- Tighten the four screws (7) on the right side to the specified torque.

Locking torques (N*m)

Crankcase halves closing screws 11 - 13 Nm (8.11 - 9.59 lb ft)



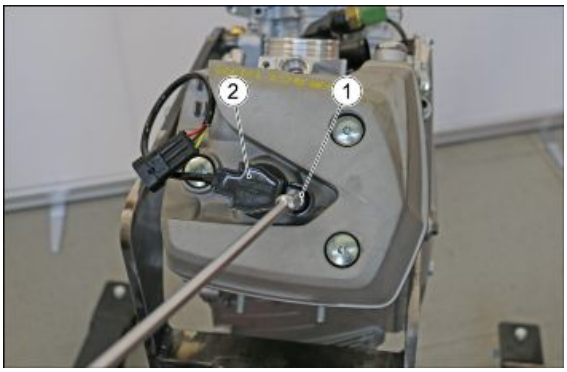
Head and timing

Removing the head cover

NOTE

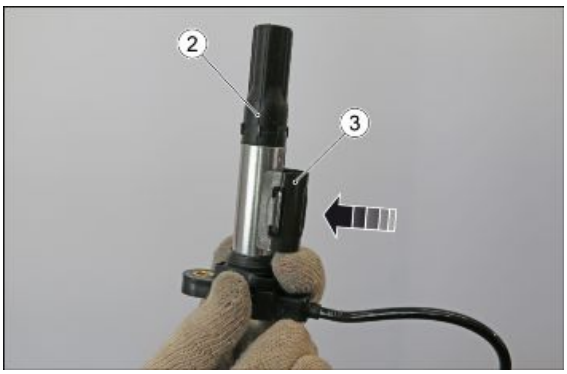
THE OPERATIONS FOR THE REMOVAL OF THE HEAD COVER ARE THE SAME FOR BOTH SIDES

- Unscrew the fixing screw (1) and remove the tube/coil of the spark plug (2).

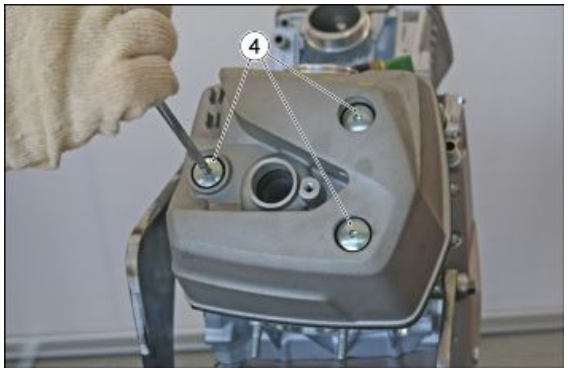


NOTE

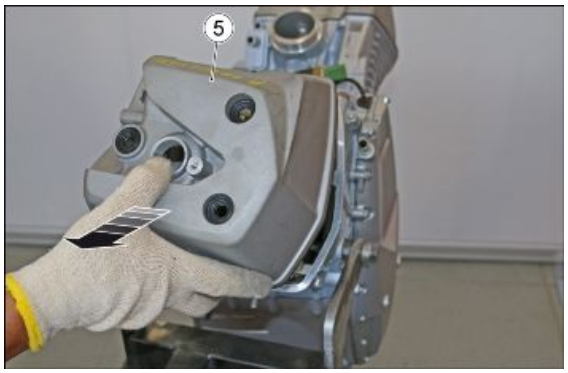
CHECK THAT THE SPRING (3) IS PRESENT ON THE TUBE (2), OTHERWISE IT MEANS THAT IT HAS REMAINED IN THE SPARK PLUG HOLE. IN THIS CASE, RETRIEVE IT AND INSTALL IT IN POSITION.



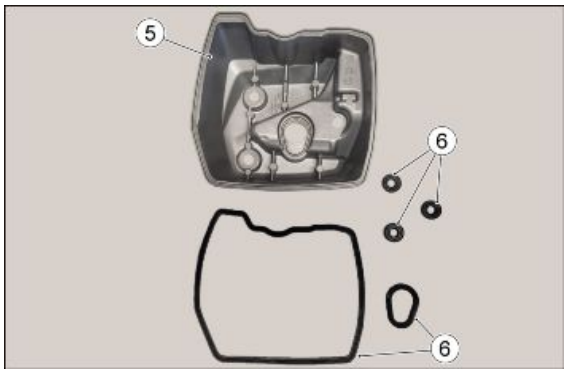
- Remove the fixing screws (4) of the head cover.



- Remove the head cover (5) from the engine.



- Remove the gaskets (6) from the head cover (5).
- Check that the supporting surface of the head is not damaged and that there are no blowholes.



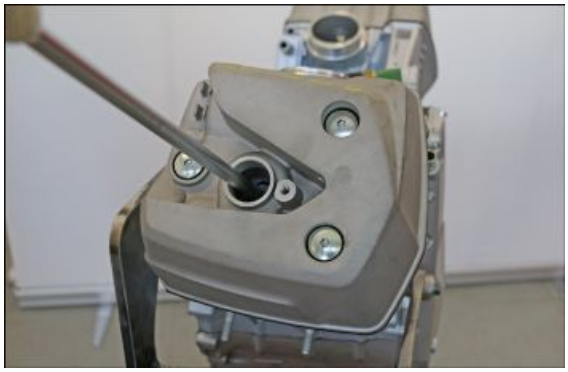
Removing the cylinder head

RIGHT-HAND HEAD (FRONT)

NOTE

IF NECESSARY TO REMOVE BOTH HEADS, BEGIN WITH THE REMOVAL OF THE HEAD ON THE RIGHT.

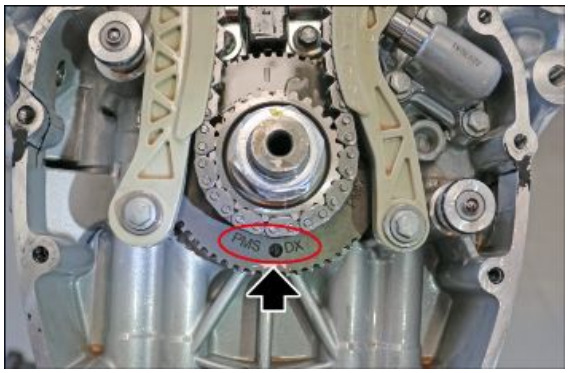
- Remove the head cover
- Unscrew the spark plug



- Remove the timing system cover.
- Bring the right piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "RH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



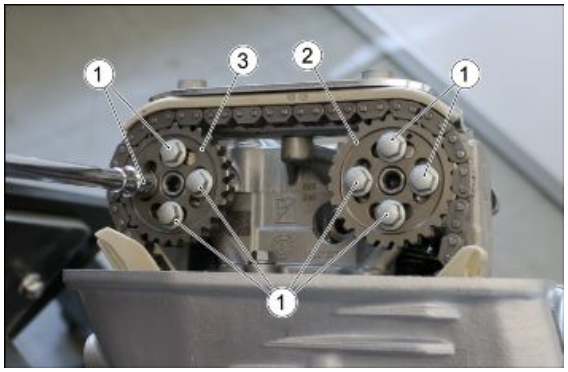
- Check that with the right piston at TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crank-case.

Specific tooling

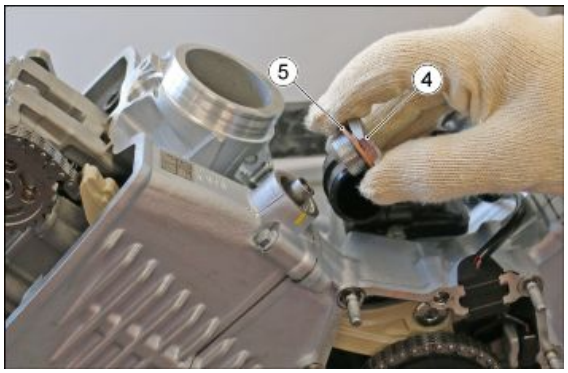
020851Y Camshaft timing pin

- Using a workshop hot air gun, heat the camshafts and remove the fixing screws (1) of the intake (2) and exhaust (3 sprockets.

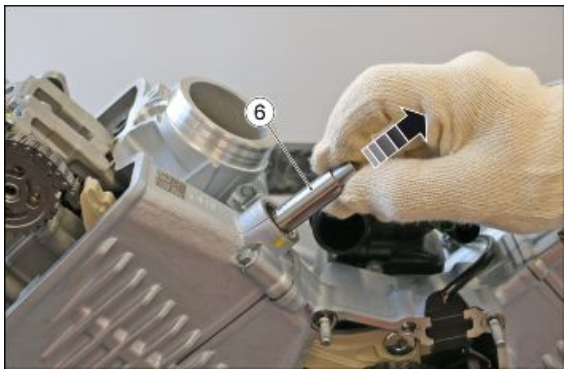


- Remove the chain tensioner cap (4) and the corresponding sealing washer (5).

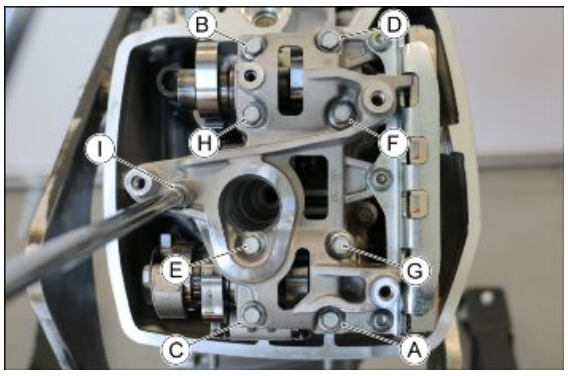
DURING REFITTING, USE NEW SEALING WASHERS.



- Remove the chain tensioner (6) from the head.



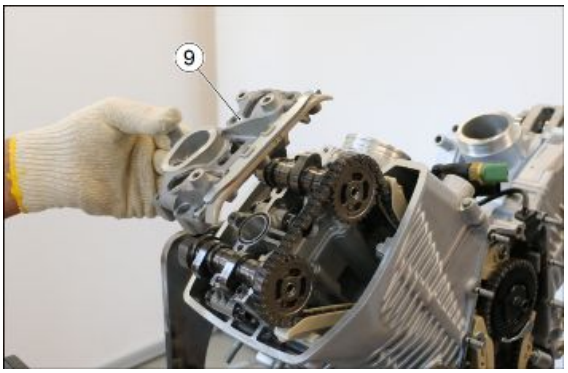
- Remove the fixing screws of the upper mounting, following the sequence A-B-C-D-E-F-G-H- I.



NOTE

The screw (7) in the hole of the spark plug has a washer, while the screw (8) is the single shorter screw compared to the others.

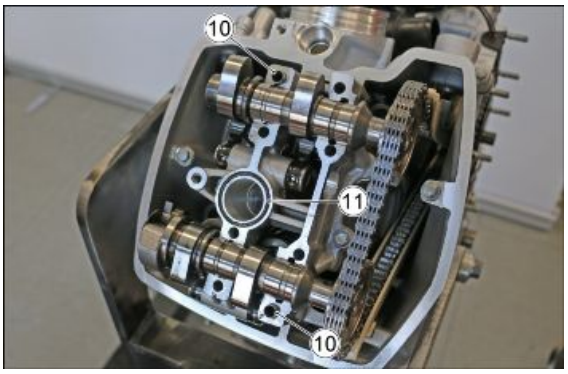
- Remove the upper mounting (9) together with chain guide upper slider.



- Retrieve the centring bushings (10) and the O-ring (11).

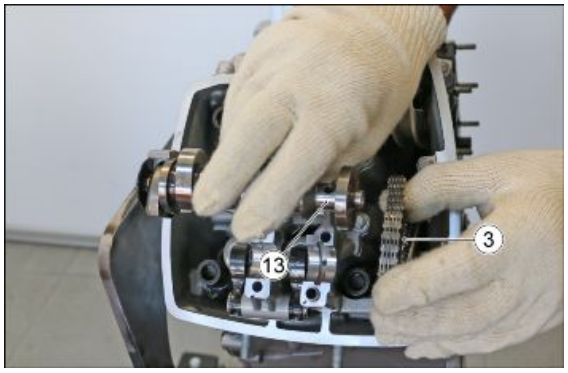
NOTE

WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"

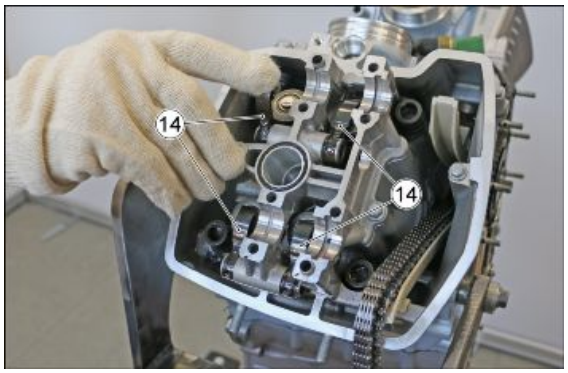


- Remove the intake camshaft (12) and collect the relative sprocket (2).

- Remove the exhaust camshaft (13) and collect the relative sprocket (3).



- Lift the rockers (14) from the valves.



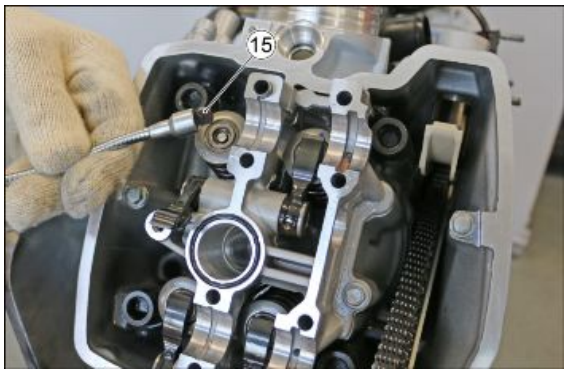
- Using a magnet, remove the calibrated pads (15) from the valves.

WARNING

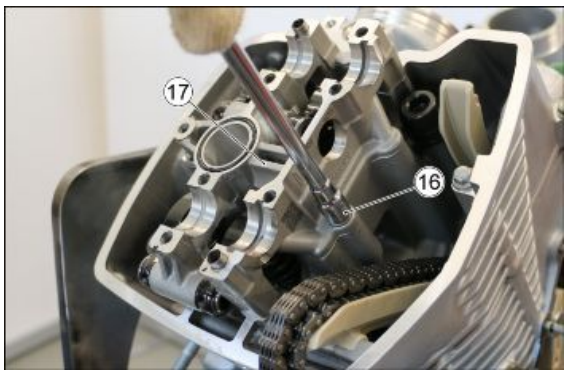
RECORD THE POSITION OF EACH PAD TO ENSURE THE CORRECT REFITTING.

CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.



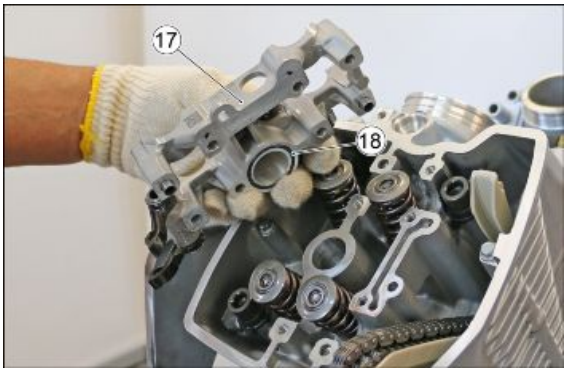
- Remove the fixing screw (16) of the lower mounting (17).



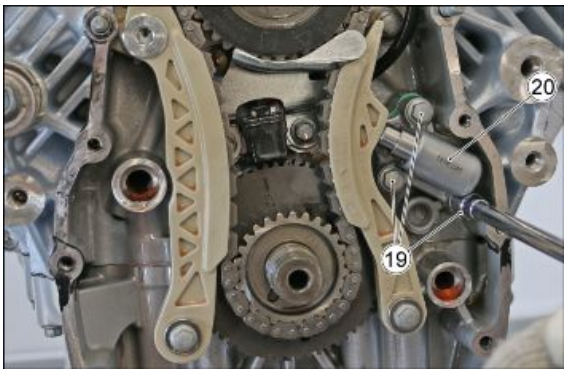
- Remove the lower mounting (17) together with the O-ring (18).

NOTE

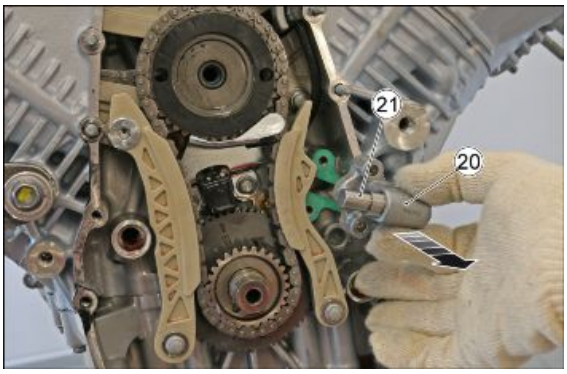
WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



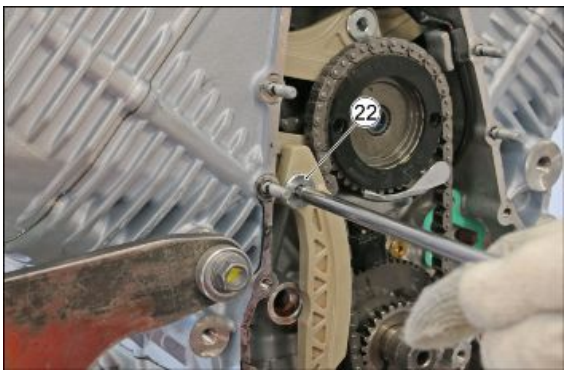
- Remove the three fixing screws (19) of the chain tensioner support (20).



- Remove the support (20) together with chain tensioner (21).

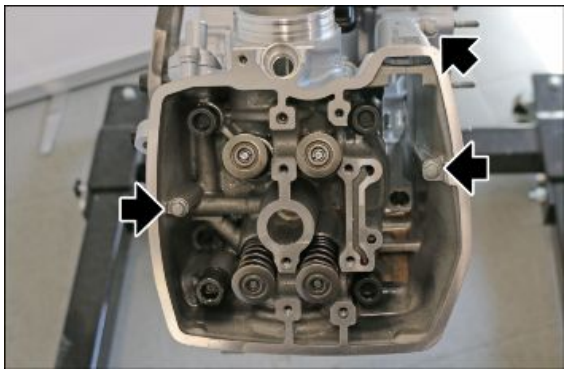


- Remove the fixing screws (22).

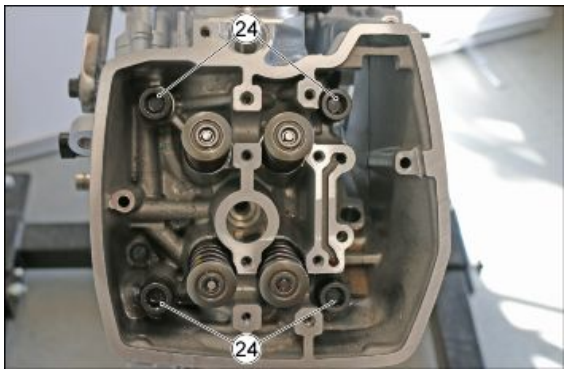


- Remove the fixed chain tensioner slider (23) from the right head.

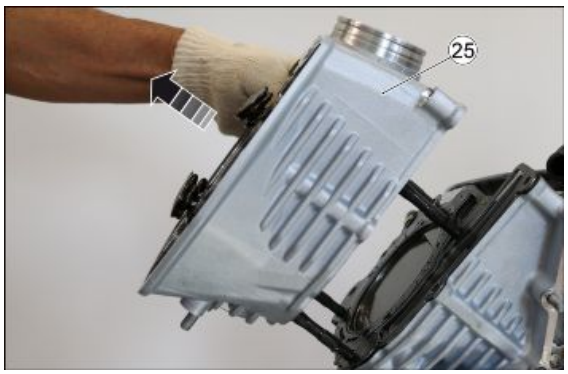
- Remove the three fixing screws shown in the figure.



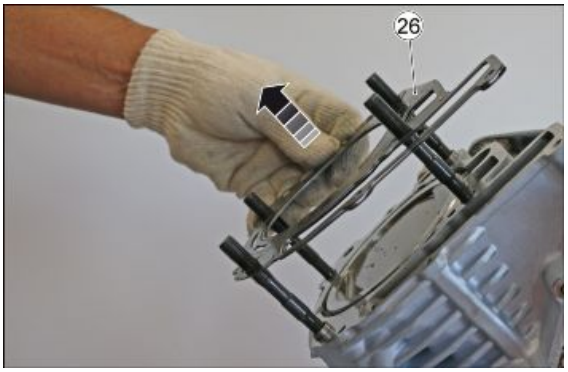
- Remove the four fixing nuts (24).



- Remove the right head (26) from the cylinder.



- Remove the gasket (27) off the cylinder.



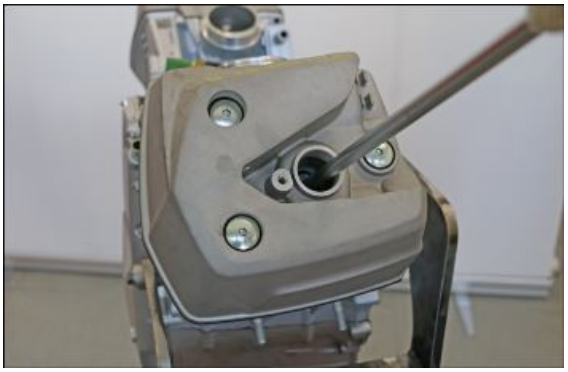
LEFT HEAD (REAR)

- First remove the camshafts of the right head, as shown in the procedure for the right head removal.

NOTE

IF NECESSARY TO REMOVE BOTH HEADS, BEGIN WITH THE REMOVAL OF THE HEAD ON THE RIGHT.

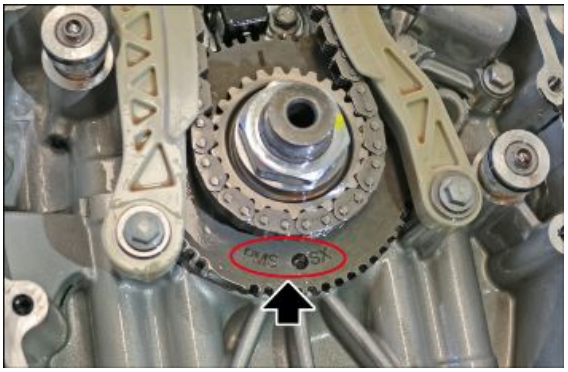
- Remove the head cover
- Unscrew the spark plug



- Bring the left-hand piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "LH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



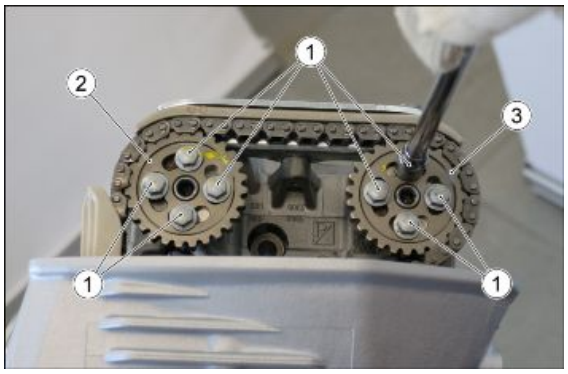
- Check that with the left-hand piston to the TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crank-case.

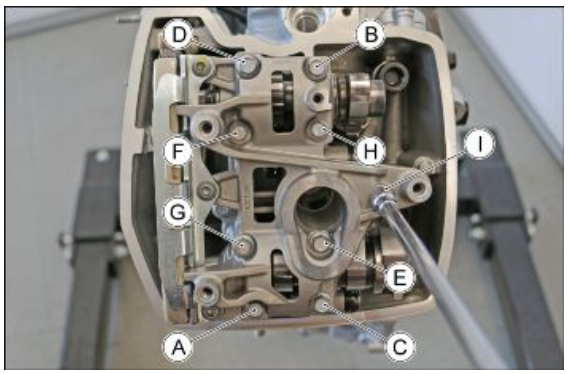
Specific tooling

020851Y Camshaft timing pin

- Using a workshop hot air gun, heat the camshafts and remove the fixing screws (1) of the intake (2) and exhaust (3 sprockets.



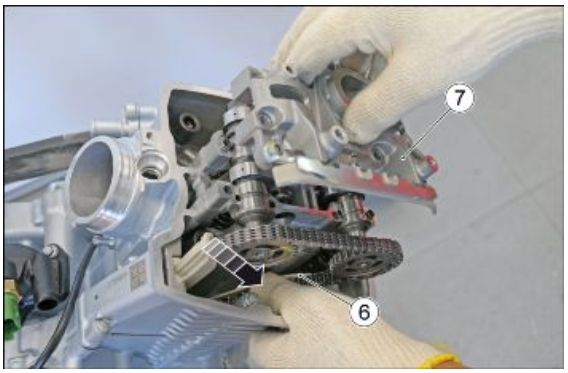
- Remove the fixing screws of the upper mounting, following the sequence A-B-C-D-E-F-G-H- I.



NOTE

The screw (4) in the hole of the spark plug has a washer, while the screw (5) is the single shorter screw compared to the others.

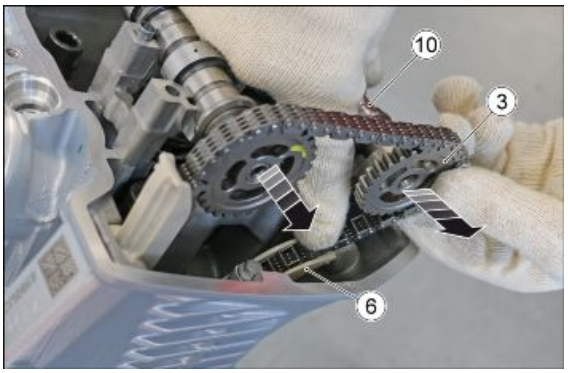
- Press the chain tensioner slider (6) so as to release the tension on the timing chain.
- Remove the upper mounting (7) together with chain guide upper slider.



NOTE

DO NOT RELEASE THE CHAIN TENSIONER SLIDER (8) DURING THE OPERATIONS FOR THE REMOVAL OF THE MOUNTING (9). THE CHAIN TENSIONER, STILL LOADED WITH OIL, WILL TENSION THE CHAIN AND CAUSE THE CAMSHAFTS TO FALL OFF THE HEAD.

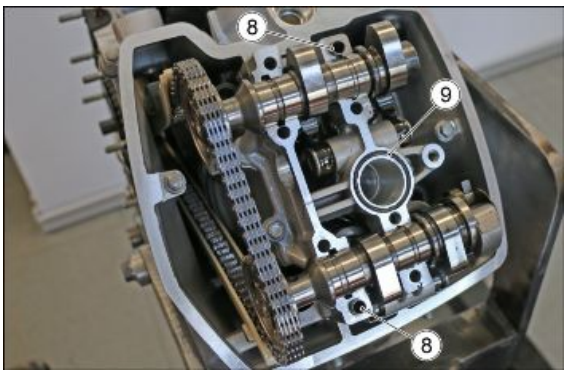
- While maintaining pressure on the slider (6), extract the exhaust sprocket (3) from the relative camshaft (10) and release it from the timing chain.



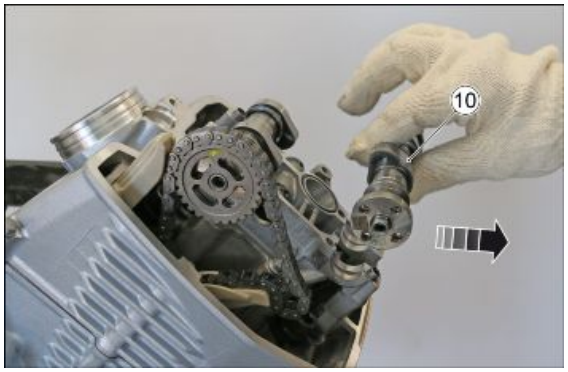
- Retrieve the centring bushings (8) and the O-ring (9).

NOTE

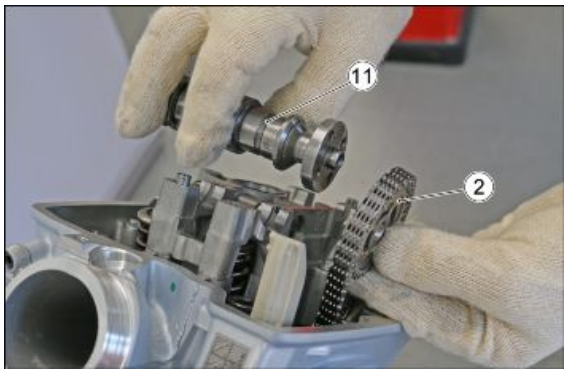
WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



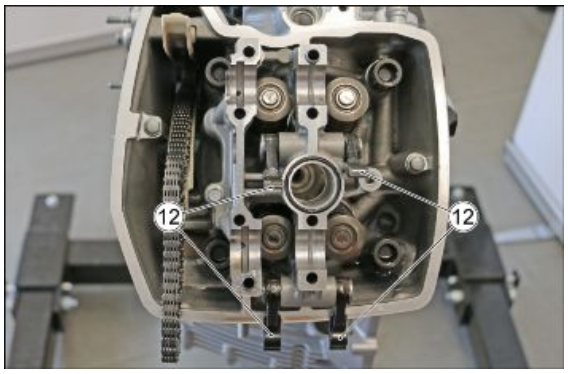
- Remove the exhaust camshaft (10) from the head.



- Remove the intake camshaft (11) and collect the relative sprocket (2).



- Lift the rockers (12) from the valves.



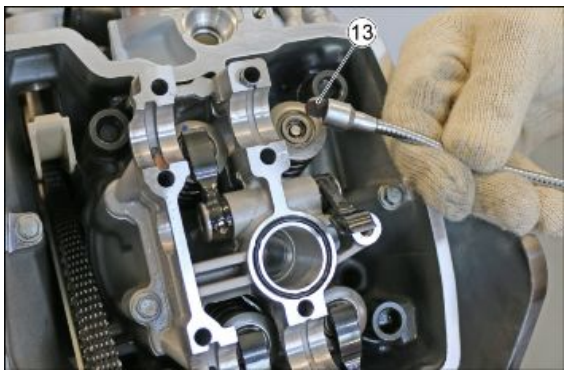
- Using a magnet, remove the calibrated pads (13) from the valves.

WARNING

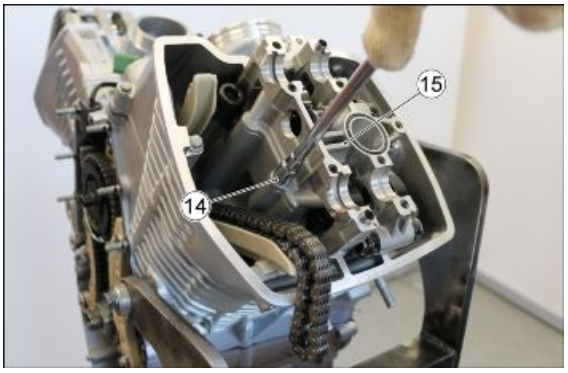
RECORD THE POSITION OF EACH PAD TO ENSURE THE CORRECT REFITTING.

CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.



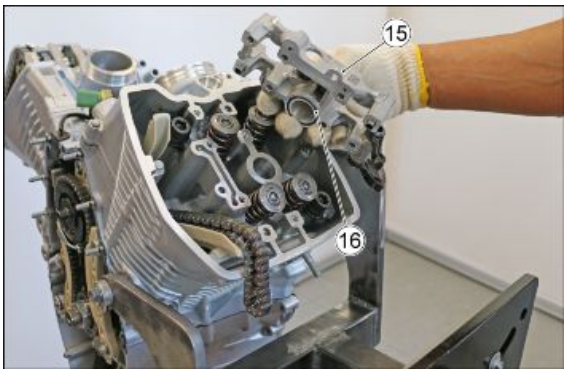
- Remove the fixing screw (14) of the lower mounting (15).



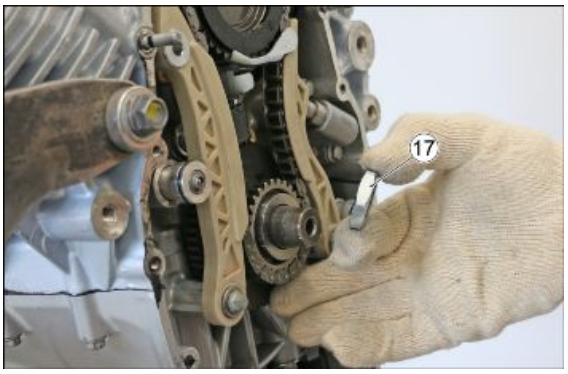
- Remove the lower mounting (15) together with the O-ring (16).

NOTE

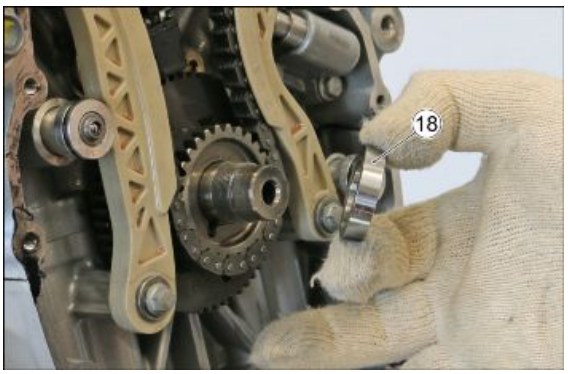
WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



- Remove the fixing nut (17) from the crankshaft.

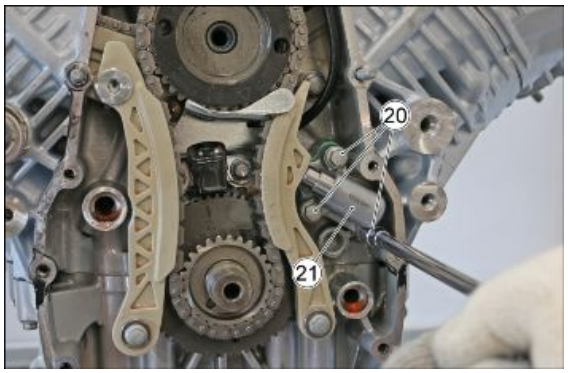


- Retrieve the bushing (18).

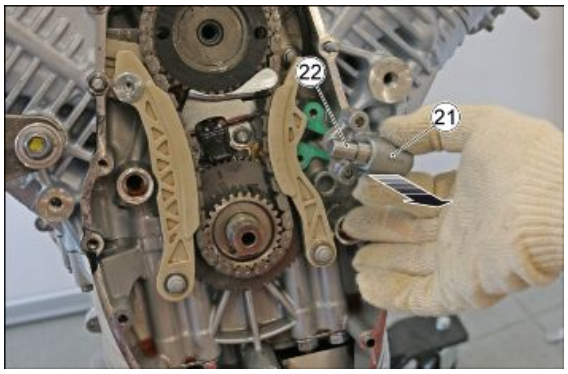


- Remove the special nut (19).

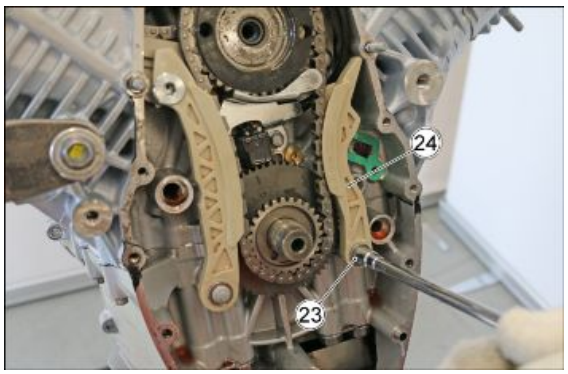
- Remove the three fixing screws (20) of the chain tensioner support (21).



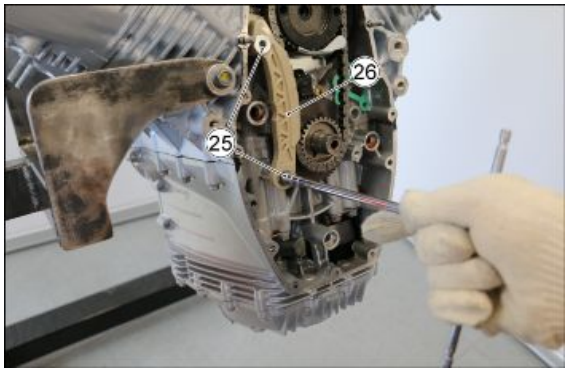
- Remove the support (21) together with the chain tensioner (22).



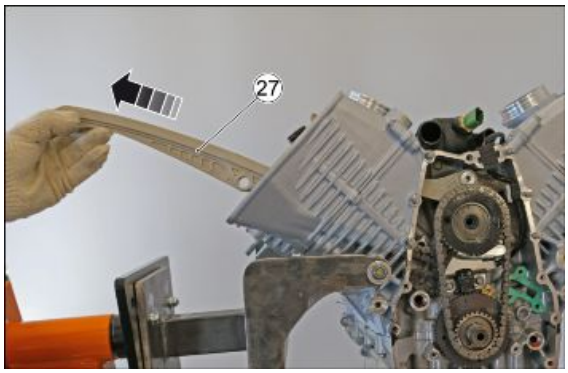
- Remove the fixing screw (23) and remove the slider (24).



- Remove the two fixing screws (25) and remove the slider (26).

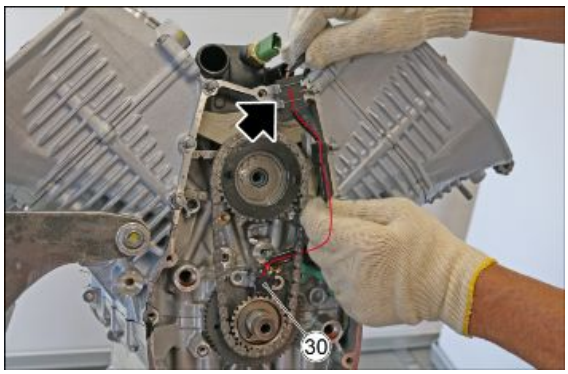


- Remove the fixed slider (27) from the right head.

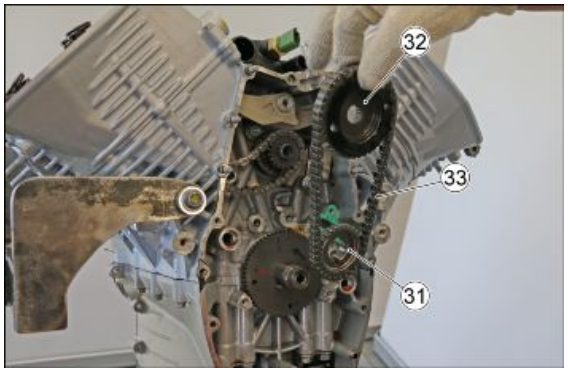


- Remove the two fixing screws (28) and remove the chain guide plate (29)

- Release the wiring harness of the pick-up at the point indicated in the figure, then remove the pick-up (30) from the engine.

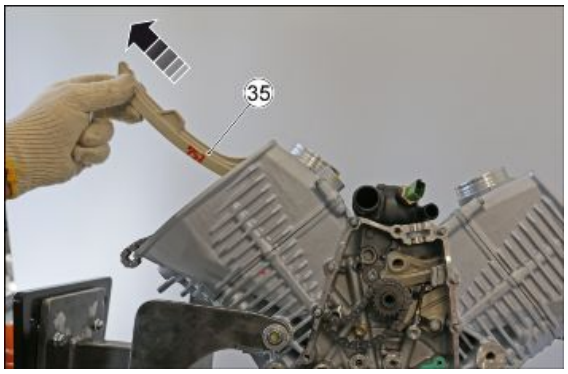


- Remove the toothed wheels (31) and (32) and the timing chain (33).

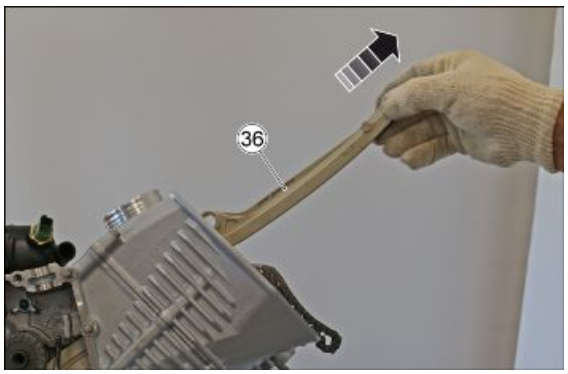


- Remove the fixing screw (34).

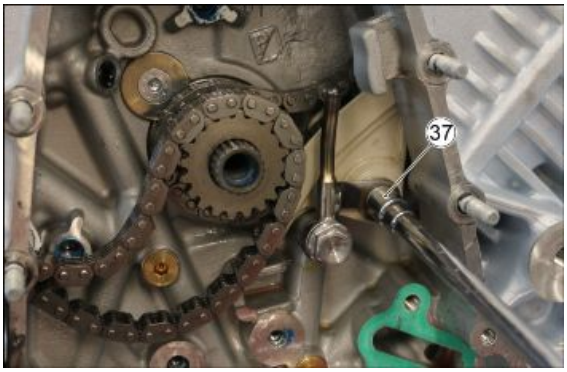
- Remove the mobile slider (35) from the right head.



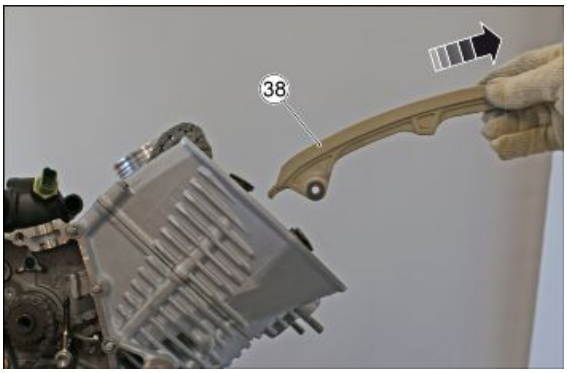
- Remove the fixed slider (36) from the left head.



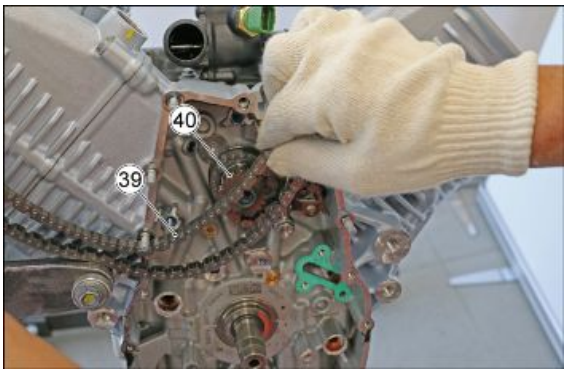
- Remove the fixing screw (37).



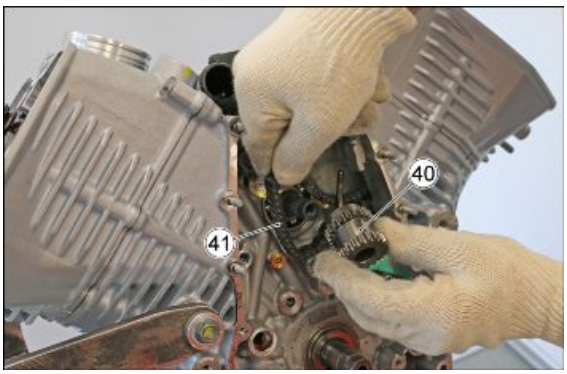
- Remove the mobile slider (38) from the left head.



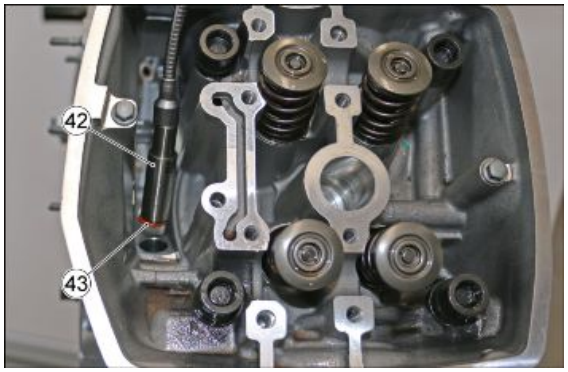
- Remove the right-hand timing chain (39) from the toothed wheel (40).



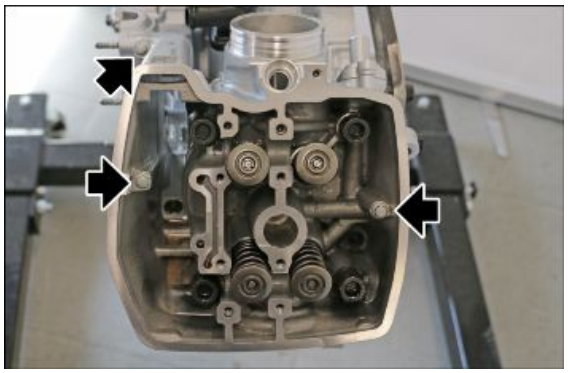
- Remove the left-hand timing chain (41) from the toothed wheel (40).



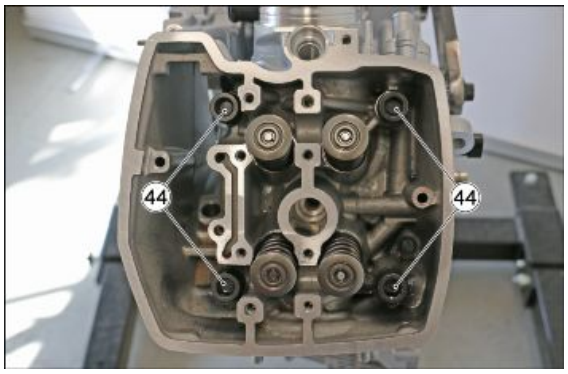
- Using a magnet, remove the chain tensioner (42) from the left head.
- Make sure there is also the preload washer (43).



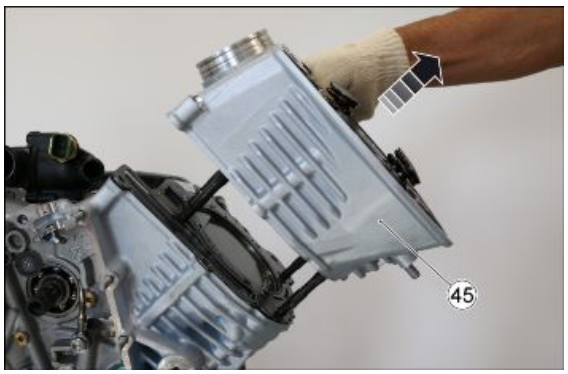
- Remove the three fixing screws shown in the figure.



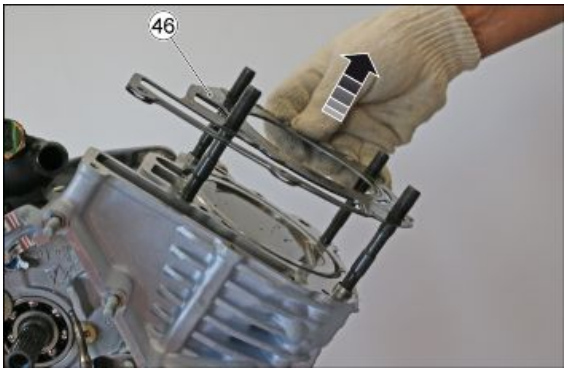
- Remove the four fixing nuts (44).



- Remove the left head (45) from the cylinder.



- Remove the gasket (46) off the cylinder.

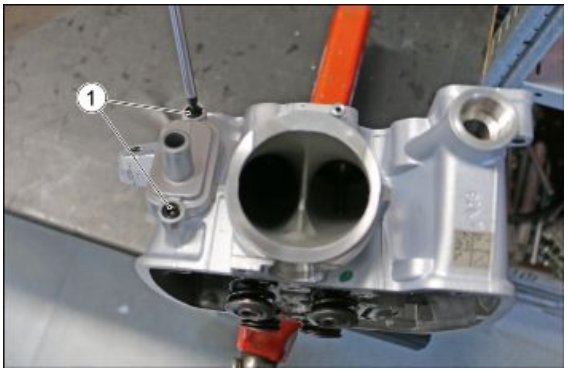


REMOVING THE SECONDARY AIR VALVE

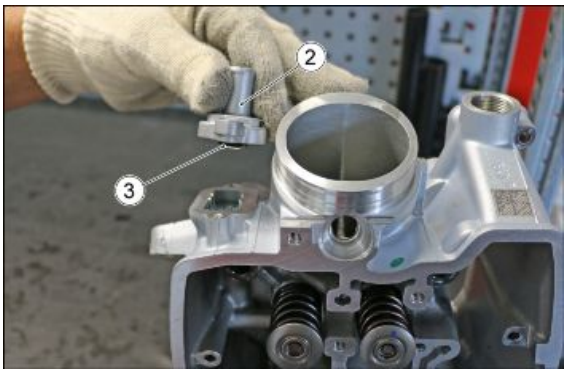
NOTE

THE FOLLOWING PROCEDURE APPLIES TO BOTH HEADS.

- Remove the two fastening screws (1).



- Remove the cover (2) and the secondary air valve (3).

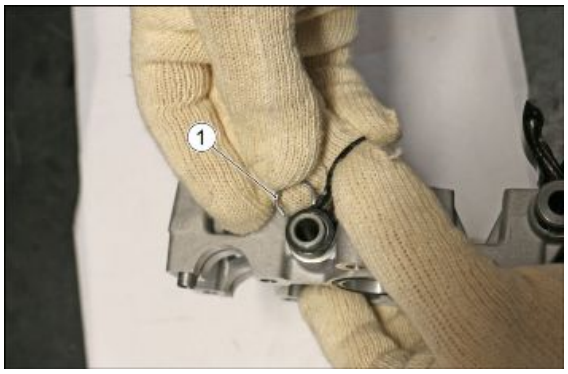


- Remove the internal filter (4), paying attention to the direction during refitting

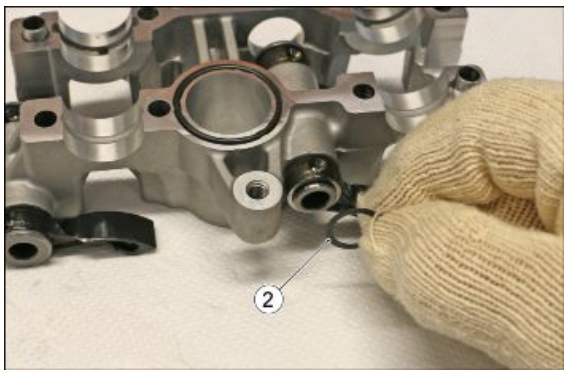
Cylinder head

Removing the rocker arms

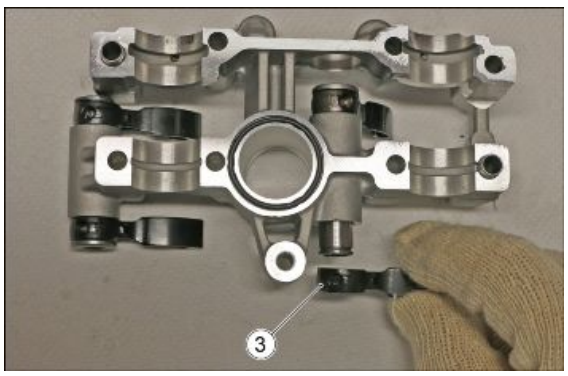
- First remove the lower frame from the big end.
- Remove the retaining ring (1).



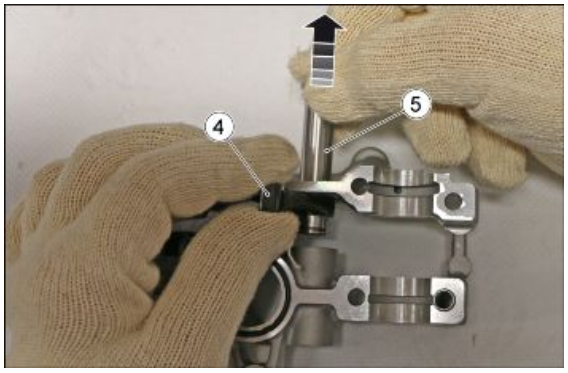
- Remove the shim washer (2).



- Remove the rocker (3).

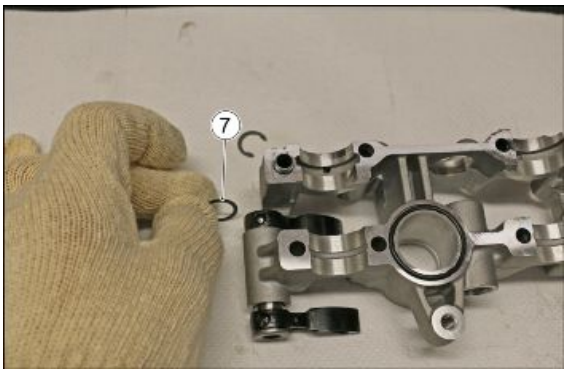


- Remove the pin (4) and remove the second rocker (5).

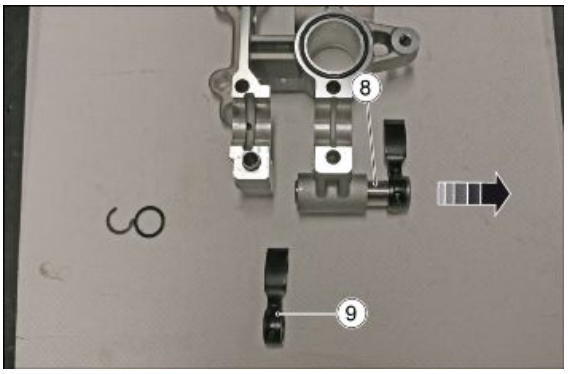


- Remove the retaining ring (6).

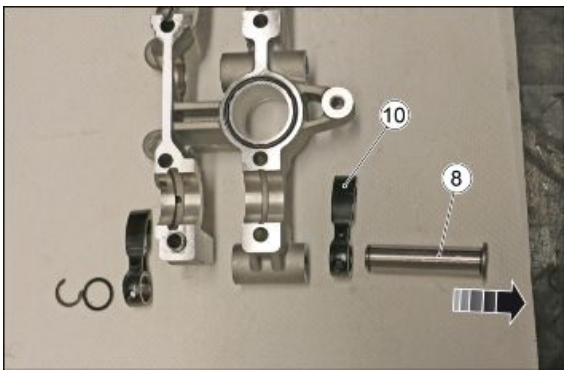
- Remove the shim washer (7).



- Remove the pin (8) in order to remove the rocker (9).



- Remove the pin (8) from the lower frame and remove the second rocker (10).

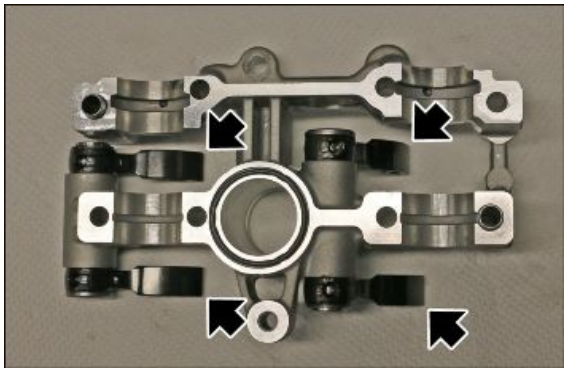


REFITTING

- Follow the procedure for removal in reverse order, taking care to observe the direction of the rockers shown in the figure.

NOTE

LUBRICATE THE PINS OF THE ROCKERS WITH ENGINE OIL.



Removing the valves

NOTE

THE PROCEDURE AND THE SPECIFIC TOOLS INDICATED BELOW ARE VALID FOR EACH VALVE OF BOTH HEADS.

- Place the specified tool on the upper cap of the valve to be removed and, on the opposite side, at the centre of the mushroom.
- Close the tool to compress the spring sufficiently to release the two half-cones.
- Using a magnet, remove both half-cones.

Specific tooling

020382Y Valve semi-cone extractor tool

020853Y Compresses intake valve springs

- Unscrew the tool and remove it from the head
- Remove the upper cap

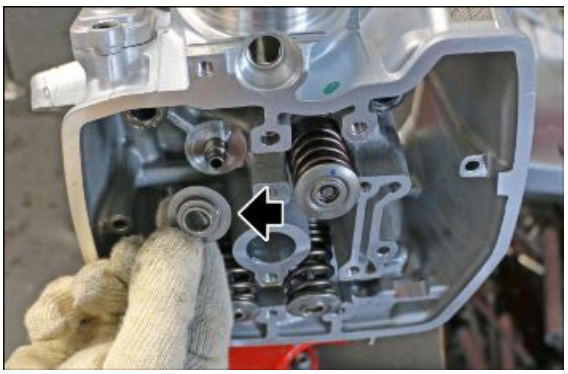
- Remove the spring and replace it if it is out of the wear limit.

- Remove the valve from the head

- Remove the gasket of the valve guide

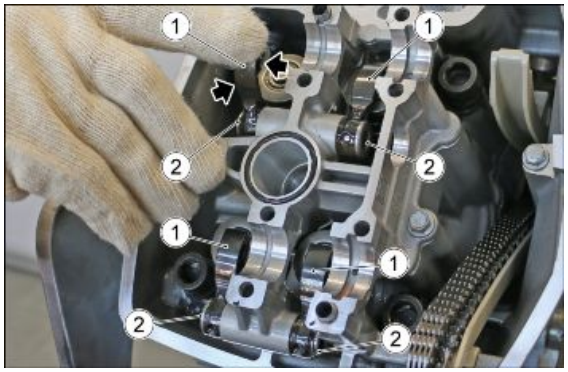
VALVE GUIDES MUST BE REPLACED WHEN THEY ARE WORN TO THE POINT THAT REPLACING THE VALVE ALONE IS NOT ENOUGH TO ELIMINATE CLEARANCE BETWEEN VALVE STEM AND VALVE GUIDE BORE.

- Remove the lower cap of the spring



Checking the rocker arms

- Check that the rockers (1) move freely on the relative pins (2).
- Check that the sliding surface of the camshaft and the one that comes into contact with the valve does not show signs of wear and / or damage.



Valve check

If the below shown values are out of the limits of the component wear, replace it

Intake valves:

Characteristic

Assembly clearance between valve and valve guide (WEAR LIMIT)

0.05 mm (0.0020 in)

Valve stem distortion (MEASURED ON 45°)

0.03 mm (0.0012 in)

Valve stem diameter (MINIMUM WEAR VALUE)

5.95 mm (0.2342 in)

Valve head eccentricity (MAXIMUM ALLOWED VALUE)

0.05 mm (0.0020 in)

Outlet valves:

Characteristic

Assembly clearance between valve and valve guide (WEAR LIMIT)

0.06 mm (0.0024 in)

Valve stem distortion (MEASURED ON 45°)

0.03 mm (0.0012 in)

Valve stem diameter (MINIMUM WEAR VALUE)

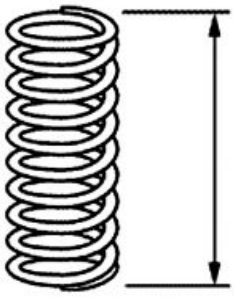
5.92 mm (0.2331 in)

Valve head eccentricity (MAXIMUM ALLOWED VALUE)

0.05 mm (0.0020 in)

Inspecting the springs and half-cones

- Check that the upper spring caps and the half-cones show no signs of abnormal wear.
- Check the unloaded spring length.



Characteristic

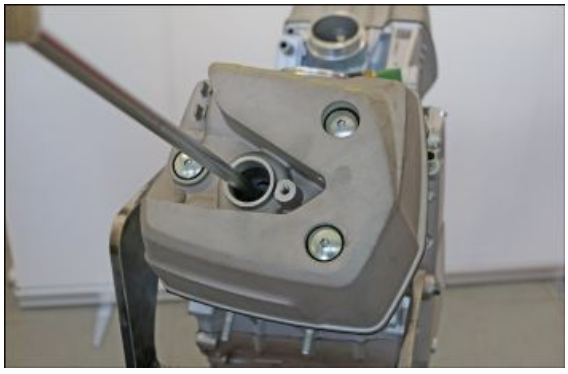
Spring free length (WEAR LIMIT)

45.9 mm (1.81 in)

Adjusting valve clearance

RIGHT HEAD VALVE CLEARANCE ADJUSTMENT (FRONT)

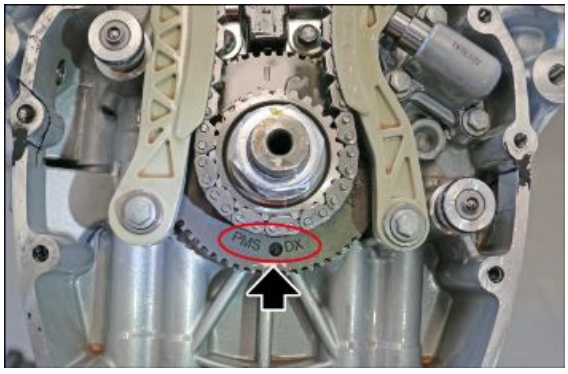
- Remove the head cover
- Unscrew the spark plug



- Remove the timing system cover.
- Bring the right piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "RH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



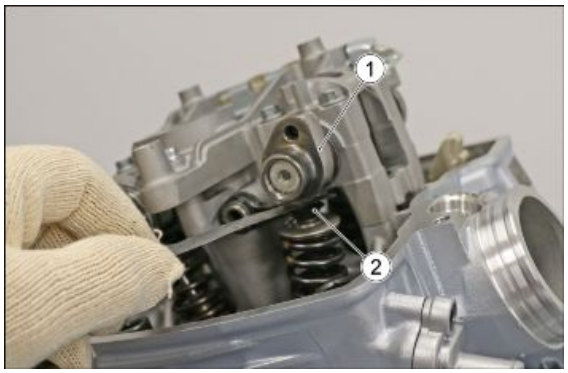
- Check that with the right piston at TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crank-case.

Specific tooling

020851Y Camshaft timing pin

- Reed using a feeler gauge, check that the clearance between the cam (1) and the rocker (2) is within the specified values.
- Repeat the operation for the remaining valves.



Characteristic

Intake valve clearance

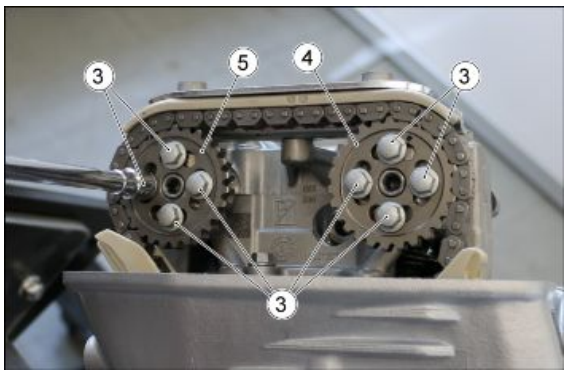
0.10 - 0.15 mm (0.0039 - 0.0059 in)

Exhaust valve clearance

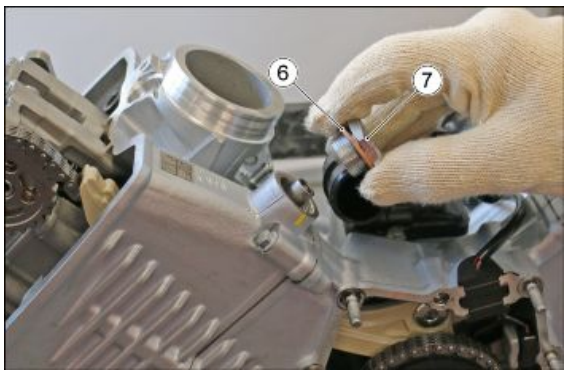
0.30 - 0.35 mm (0.0118 - 0.0138 in)

If the values are not correct, adjust the valve clearance according to the procedure below:

- Using a workshop hot air gun, heat the camshafts and remove the fixing screws (3) of the intake (4) and exhaust (5) sprockets.

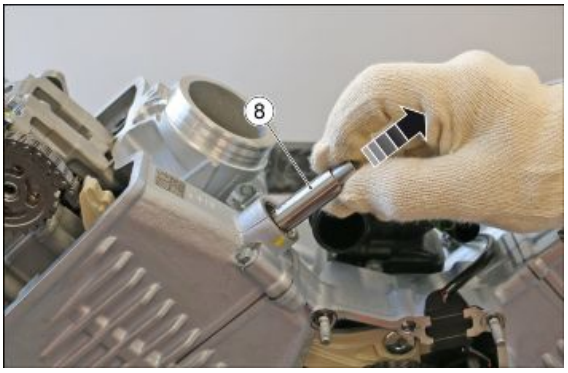


- Remove the chain tensioner cap (6) and the corresponding sealing washer (7).

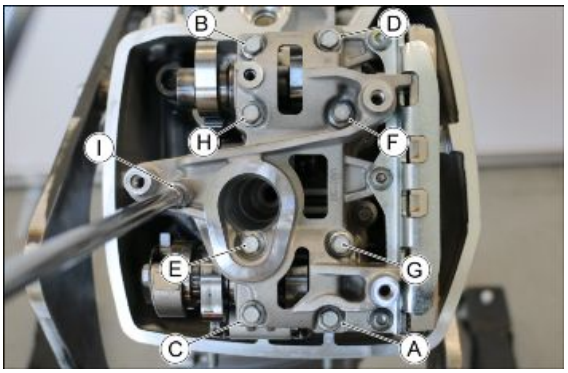


DURING REFITTING, USE NEW SEALING WASHERS.

- Remove the chain tensioner (8) from the head.



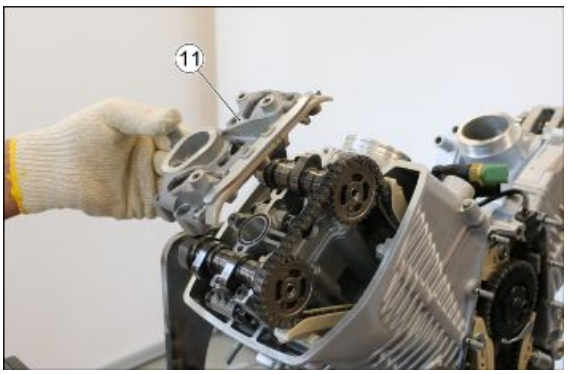
- Remove the fixing screws of the upper mounting, following the sequence A-B-C-D-E-F-G-H- I.



NOTE

The screw (9) in the hole of the spark plug has a washer, while the screw (10) is the single shorter screw compared to the others.

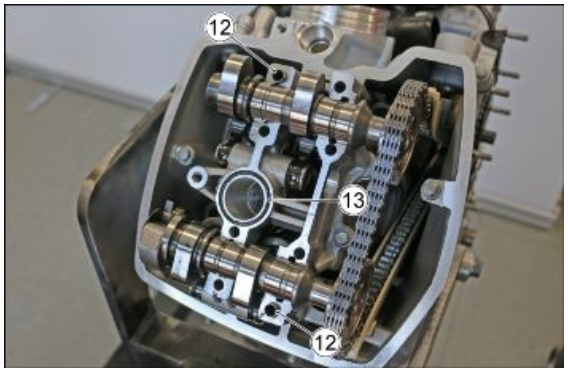
- Remove the upper mounting (11) together with chain guide upper slider.



- Retrieve the centring bushings (12) and the O-ring (13).

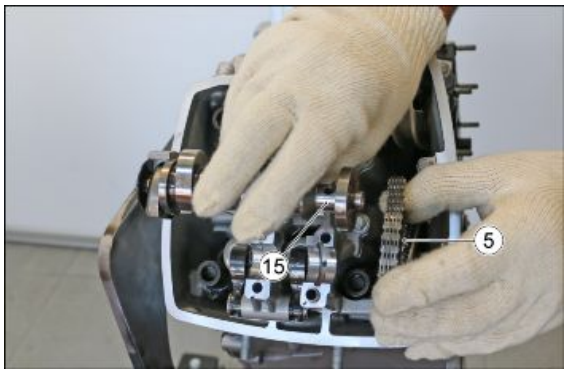
NOTE

WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



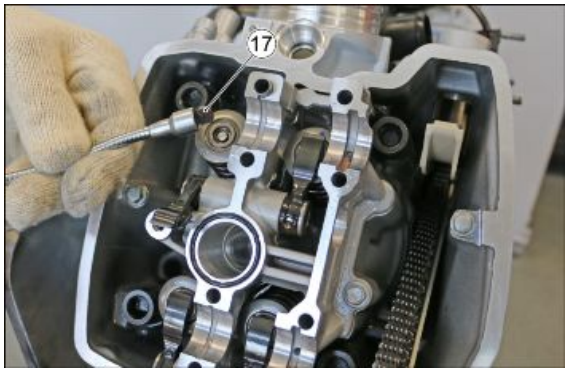
- Remove the intake camshaft (14) and collect the relative sprocket (4).

- Remove the exhaust camshaft (15) and collect the relative sprocket (5).



- Lift the rockers (16) of the valves to be adjusted.

- Using a magnet, remove the calibrated pads (17) from the valves to be adjusted and replace them with pads of a suitable thickness to achieve the specified valve clearance.



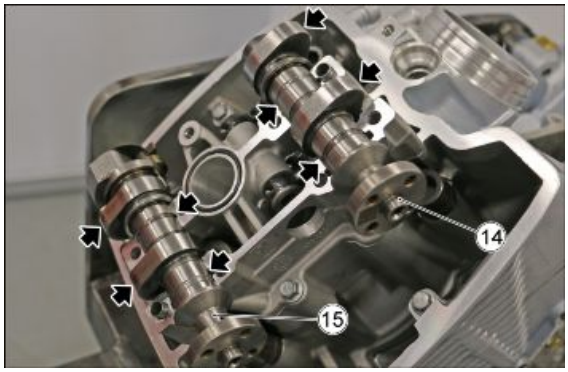
To find the thickness of the pads to be installed, use the following formula:

Installed pad thickness **+** measured clearance **-** specified clearance **=** new pad thickness

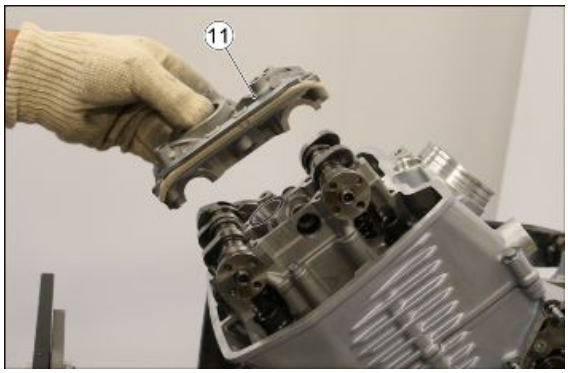
CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.

- Install the intake camshaft (14) and the exhaust camshaft (15).
- Lubricate the camshafts with engine oil in the points indicated in the figure.



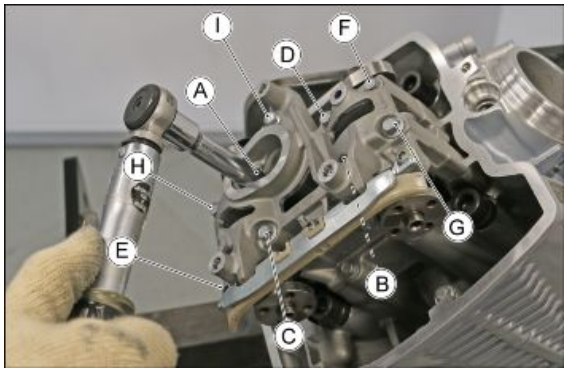
- Install a new O-ring in the hole of the spark plug and install the upper mounting (11).



- Install the fixing screws and tighten them to the specified torque, following the sequence A-B-C-D-E-F-G-H- I.

Locking torques (N*m)

Camshaft support screw 11-13 Nm (8.11 - 9.59 lbf ft)



- Make sure to position the shafts with the cams diverging from each other.

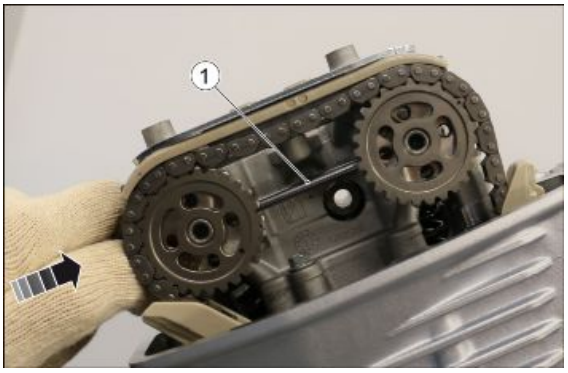
Insert the sprockets, with the timing chain already fitted, on the right head camshaft.

- Insert the special tool (1) into the hole on the exhaust camshaft.

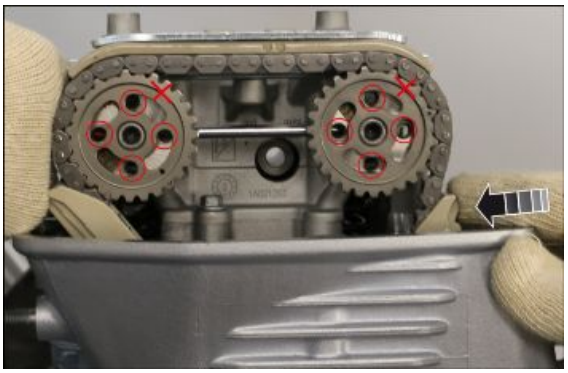
Specific tooling

021064Y Large pin for engine timing

- Continue to insert the tool (1) to intercept the hole on the intake manifold.



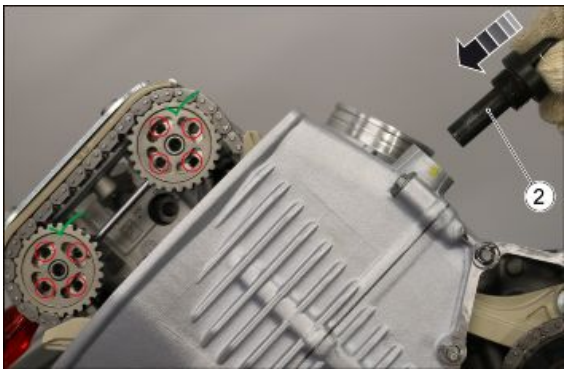
- Press the chain tensioner slider so as to tension the timing chain.
- Check that the threaded holes of the camshafts are at the centre of the slots of the sprockets; otherwise, reposition the sprockets of the timing chain.



- Screw the special tool (2) until it stops into the hole in the right chain tensioner.

Specific tooling

021072Y Right chain tensioner

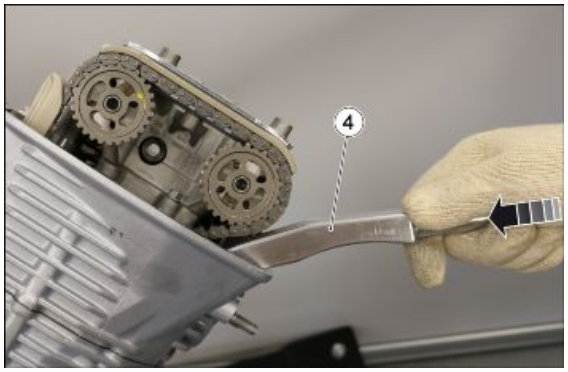


- Insert the special tool (3) by resting it to the mobile slider of the primary timing chain and secure it to a stud bolt of the timing system cover.

Specific tooling

021073Y Central chain tensioner

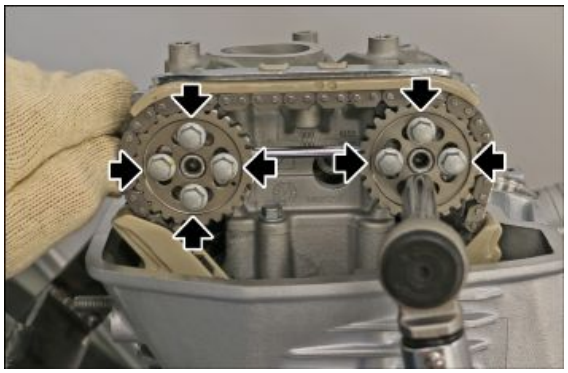
- Insert the special tool (4) in the left head, inserting it between the mobile slider and the chain tensioner.



Specific tooling

021074Y Left chain tensioner

- Tighten the screws fixing the timing system sprockets of the right head to the specified torque.



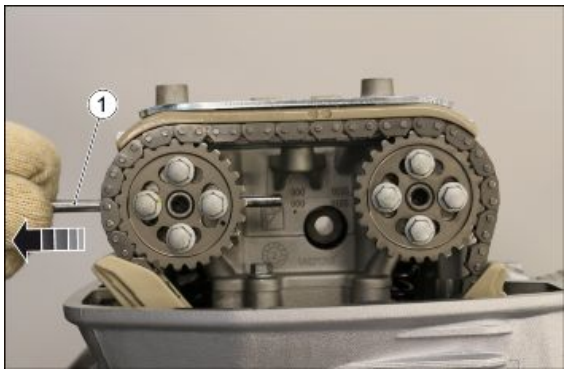
CAUTION

USE NEW PRE-IMPREGNATED SCREWS AT EACH REFITTING.

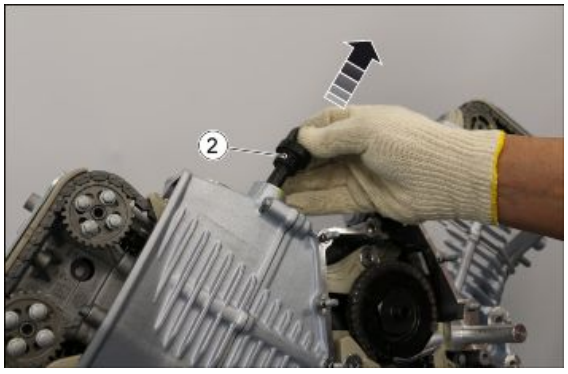
Locking torques (N*m)

Timing system gear sprocket fixing screw 11-13 Nm (8.11 - 9.59 lbf ft)

- Remove the special tool (1) from the camshafts.

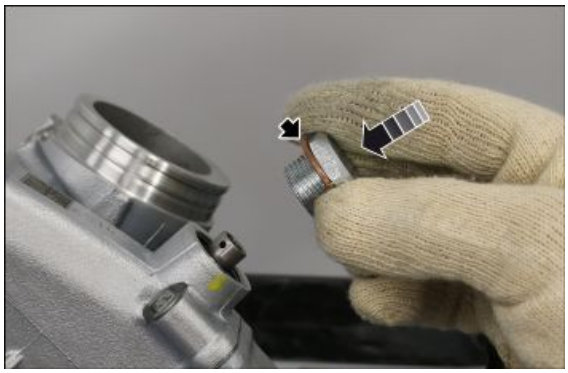


- Remove the special tool (2) from the hole of the right head chain tensioner.

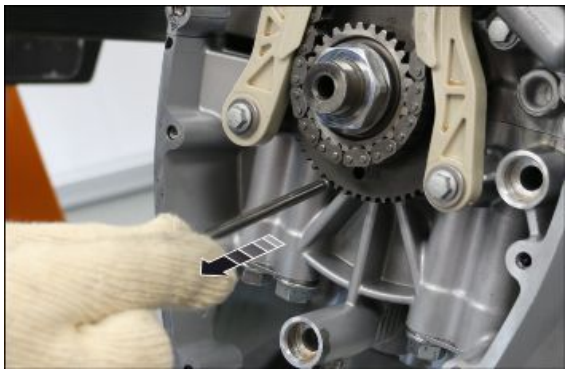


- Insert the chain tensioner in the right head, respecting the fitting direction shown in the figure.

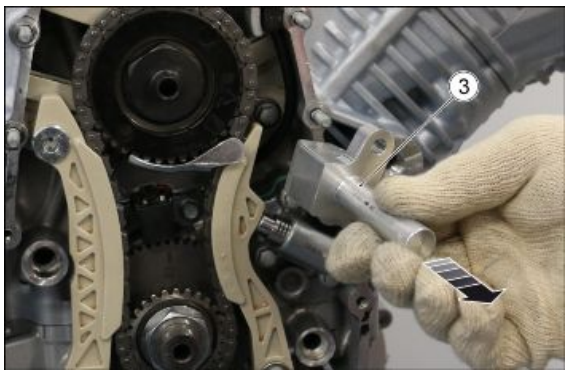
- Insert the chain tensioner cap, with a NEW sealing washer.



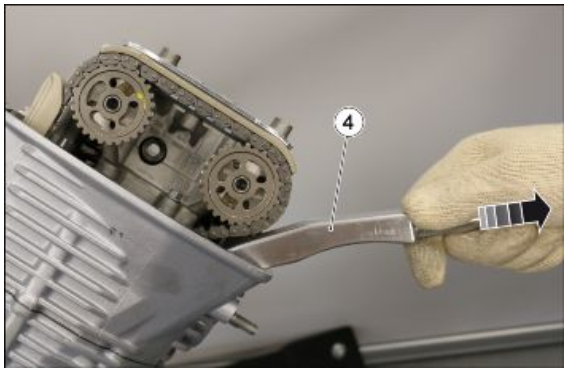
- Remove the pin from the crankshaft.



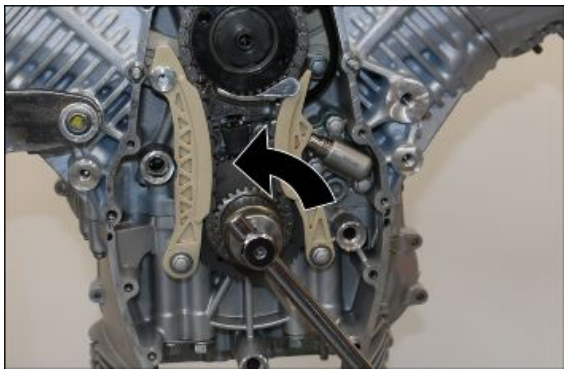
- Remove the special tool (3) from the primary timing system.



- Remove the special tool (4) from the left head.

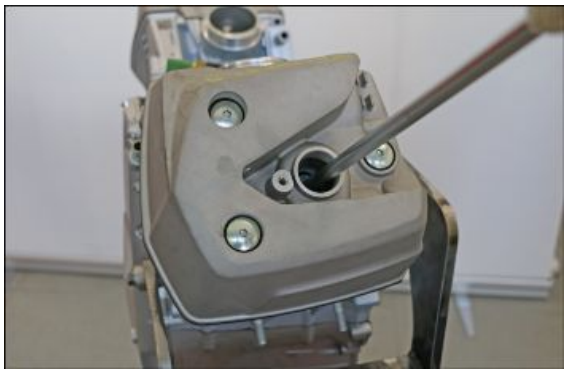


- Make two complete rotations of the crankshaft, ANTI-CLOCKWISE to ensure that there is no interference in the rotation of the engine.
- Install the timing system cover.
- Install the valve covers, the spark plugs and the coils.



VALVE CLEARANCE ADJUSTMENT FOR THE LEFT-HAND HEAD (REAR)

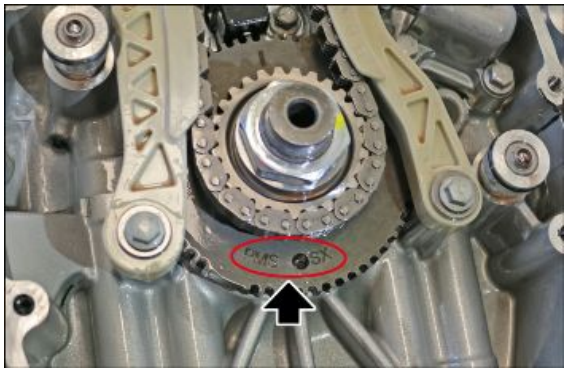
- Remove the head cover
- Unscrew the spark plug



- Bring the left-hand piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "LH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



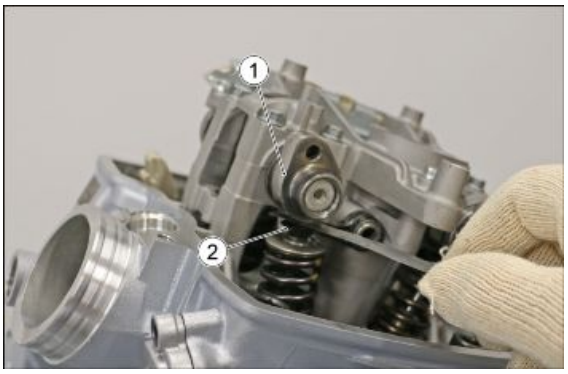
- Check that with the left-hand piston to the TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crank-case.

Specific tooling

020851Y Camshaft timing pin

- Reed using a feeler gauge, check that the clearance between the cam (1) and the rocker (2) is within the specified values.
- Repeat the operation for the remaining valves.



Characteristic

Intake valve clearance

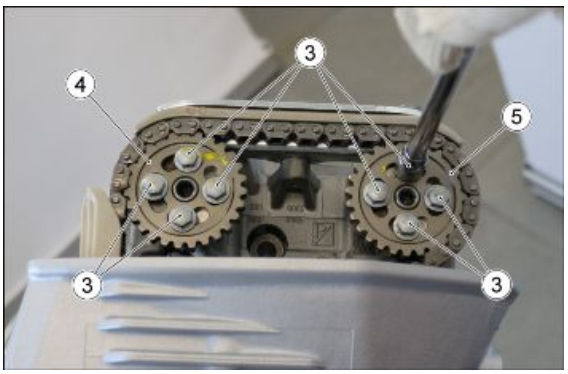
0.10 - 0.15 mm (0.0039 - 0.0059 in)

Exhaust valve clearance

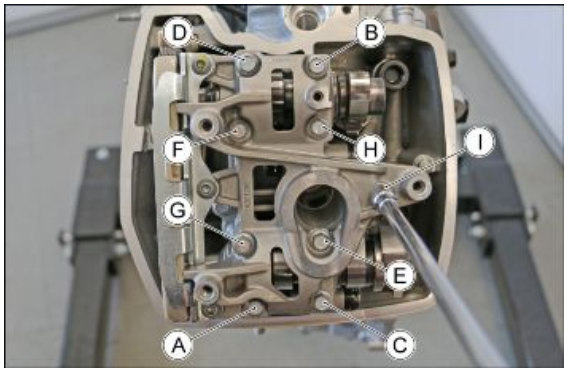
0.30 - 0.35 mm (0.0118 - 0.0138 in)

If the values are not correct, adjust the valve clearance according to the procedure below:

- Using a workshop hot air gun, heat the camshafts and remove the fixing screws (3) of the intake (4) and exhaust (5) sprockets.



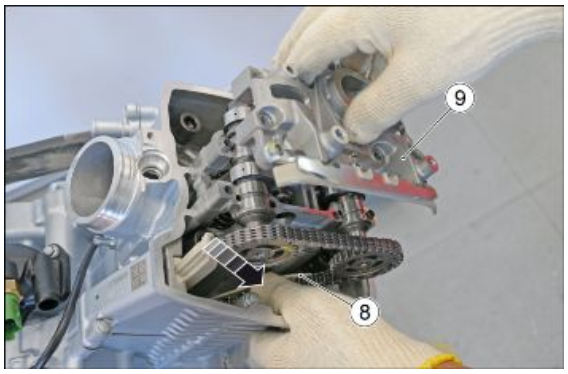
- Remove the fixing screws of the upper mounting, following the sequence A-B-C-D-E-F-G-H- I.



NOTE

The screw (6) in the hole of the spark plug has a washer, while the screw (7) is the single shorter screw compared to the others.

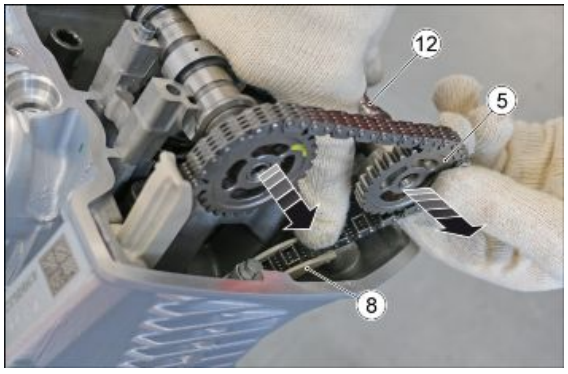
- Press the chain tensioner slider (8) so as to release the tension on the timing chain.
- Remove the upper mounting (9) together with chain guide upper slider.



CAUTION

DO NOT RELEASE THE CHAIN TENSIONER SLIDER (8) DURING THE OPERATIONS FOR THE REMOVAL OF THE MOUNTING (9). THE CHAIN TENSIONER, STILL LOADED WITH OIL, WILL TENSION THE CHAIN AND CAUSE THE CAMSHAFTS TO FALL OFF THE HEAD.

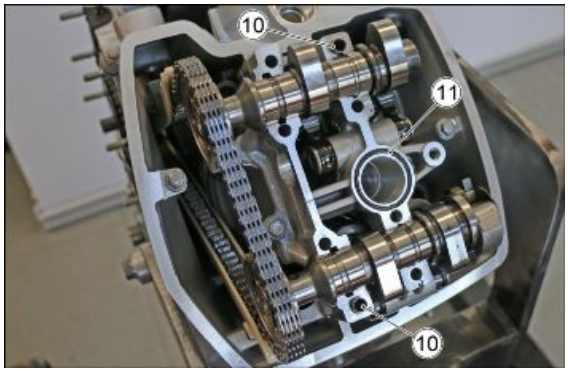
- While maintaining pressure on the slider (8), extract the exhaust sprocket (5) from the relative camshaft (12) and release it from the timing chain.



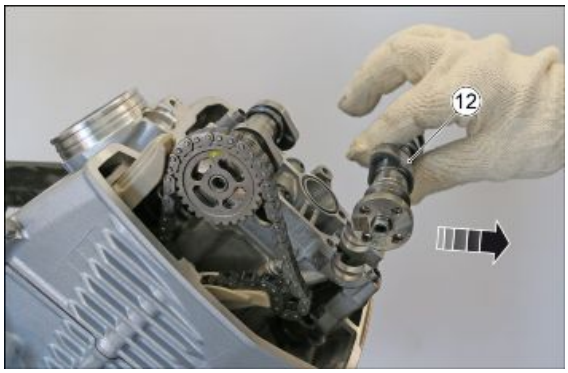
- Retrieve the centring bushings (10) and the O-ring (11).

NOTE

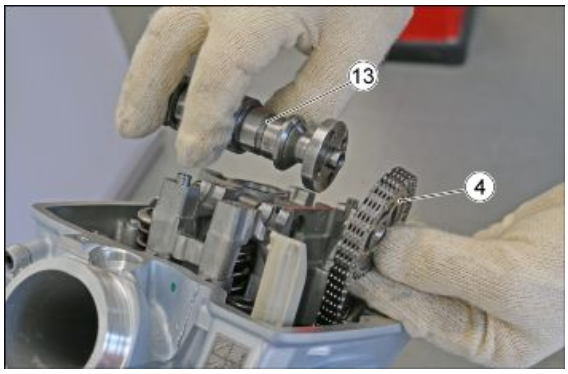
WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



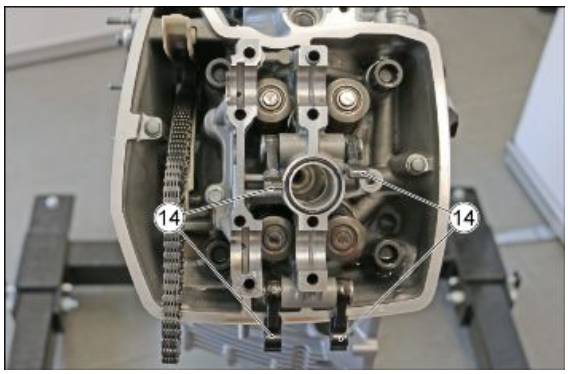
- Remove the exhaust camshaft (12).



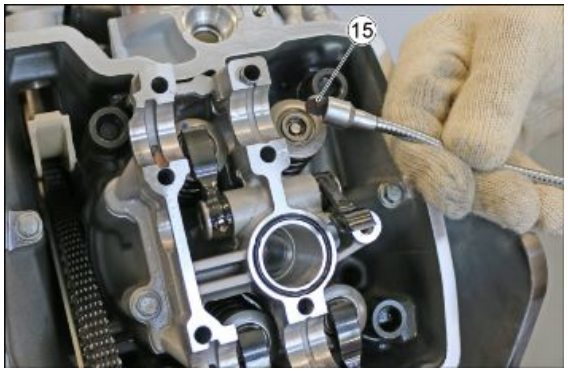
- Remove the intake camshaft (13) and collect the relative sprocket (4).



- Lift the rockers (14) of the valves to be adjusted.



- Using a magnet, remove the calibrated pads (15) from the valves to be adjusted and replace them with pads of a suitable thickness to achieve the specified valve clearance.



To find the thickness of the pads to be installed, use the following formula:

Installed pad thickness **+** measured clearance **-** specified clearance **=** new pad thickness

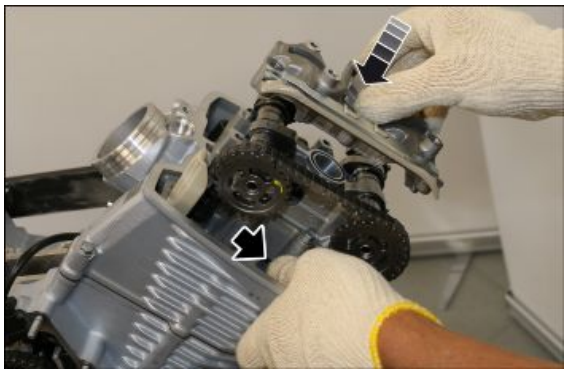
CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.

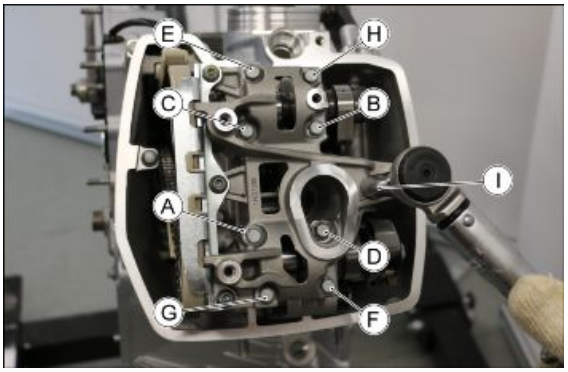
LEFT CYLINDER HEAD TIMING

- Press the mobile slider and insert the sprockets, with the timing chain already fitted, on the left head camshaft.
- Take care that the chain, under tension, does not cause the camshafts to fall out of their seats.

- Install a new O-ring in the spark plug hole of the upper mounting.
- Press and hold the chain tensioner slider, fit the upper mounting of the left head.



- Tighten the fixing screws to the specified torque, following the sequence A-B-C-D-E-F-G-H- I.



Locking torques (N*m)

Camshaft support screw **11-13 Nm (8.11 - 9.59 lbf ft)**

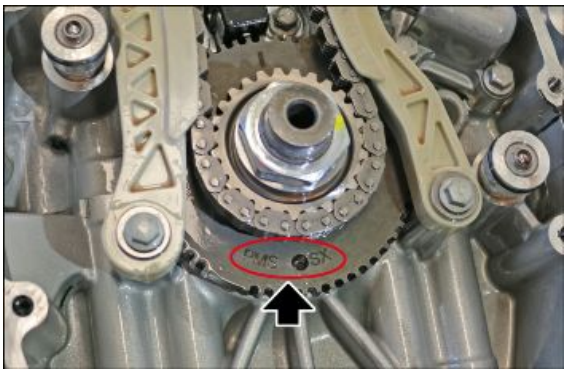
- Turn the crankshaft ANTI-CLOCKWISE until arriving the left TDC.

NOTE

THE HOLE ON THE PINION MARKED "LH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.

CAUTION

IF THE TDC. IS EXCEEDED, MAKE TWO COMPLETE ENGINE ROTATIONS TO INTERCEPT THE CORRECT LEFT TDC.



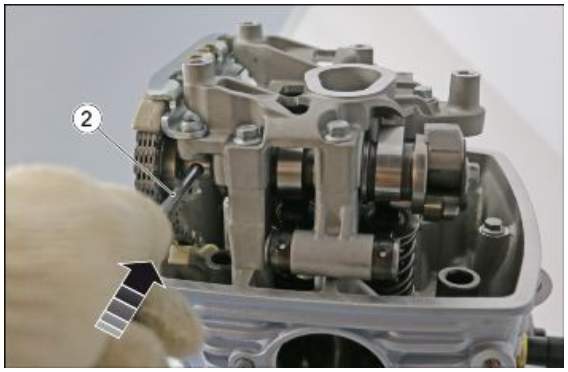
- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crankcase.

Specific tooling

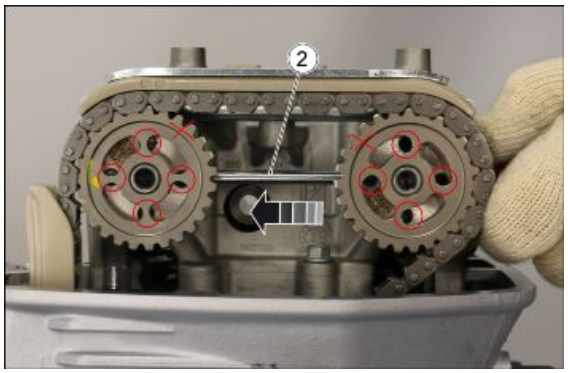
020851Y Camshaft timing pin

- Check that the cam lobes converge with each other.

- Insert the special tool (2) into the hole on the exhaust camshaft.



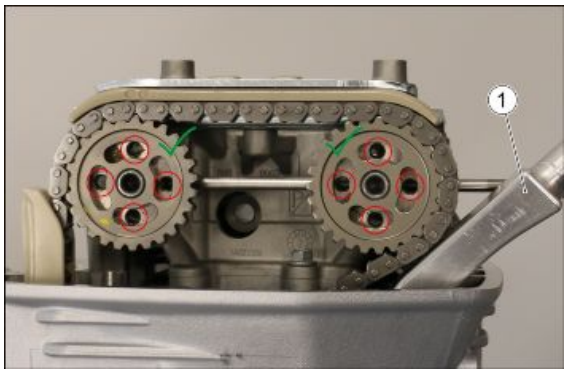
- Continue to insert the special tool (2) to intercept the hole on the intake manifold.
- Check that the threaded holes of the camshafts are at the slots of the sprockets.



- If necessary, align the threaded holes of the camshaft to the slots of the sprockets.
- Insert the special tool (1) in the left cylinder head between the mobile slider and the chain tensioner.

Specific tooling

021074Y Left chain tensioner

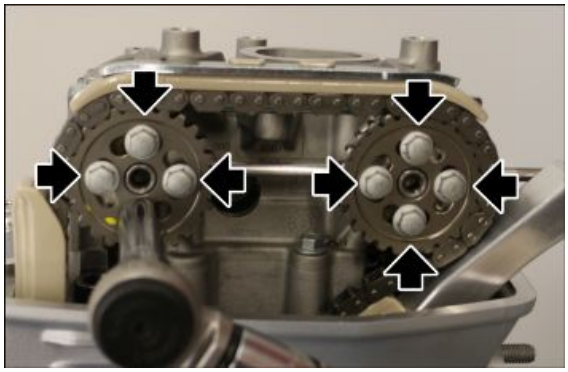


- Insert the special tool (3) by resting it to the mobile slider of the primary timing chain and secure it to a stud bolt of the timing system cover.

Specific tooling

021073Y Central chain tensioner

- Tighten the screws fixing the timing sprockets of the left head to the specified torque.



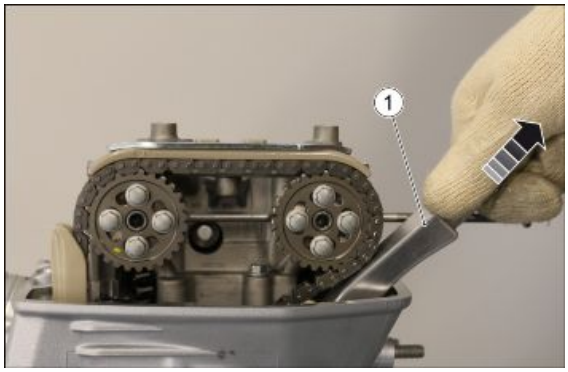
CAUTION

USE NEW PRE-IMPREGNATED SCREWS AT EACH REFITTING.

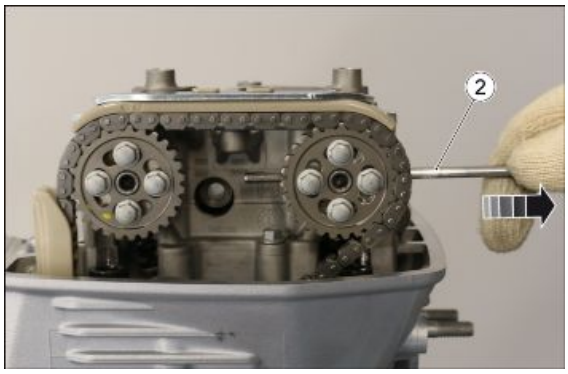
Locking torques (N*m)

Timing system gear sprocket fixing screw **11-13 Nm (8.11 - 9.59 lbf ft)**

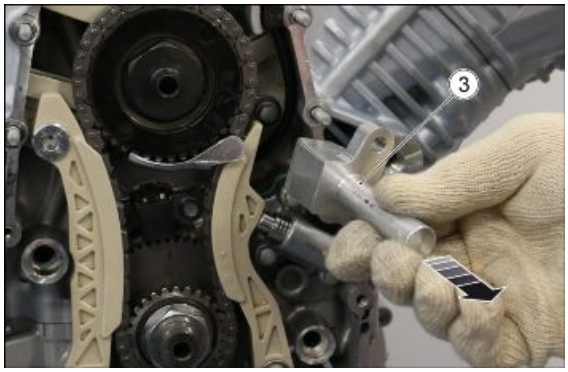
- Remove the special tool (1) from the left head.



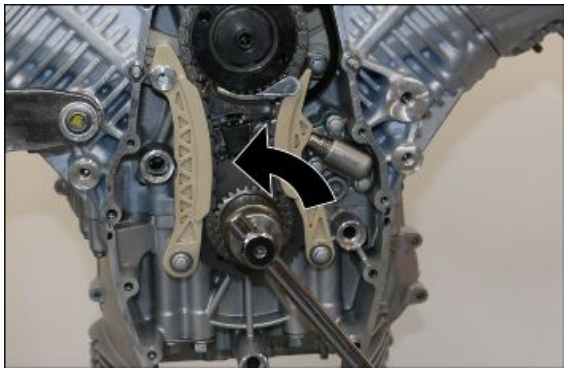
- Remove the special tool (2) from the camshafts.



- Remove the special tool (3) from the primary timing system.



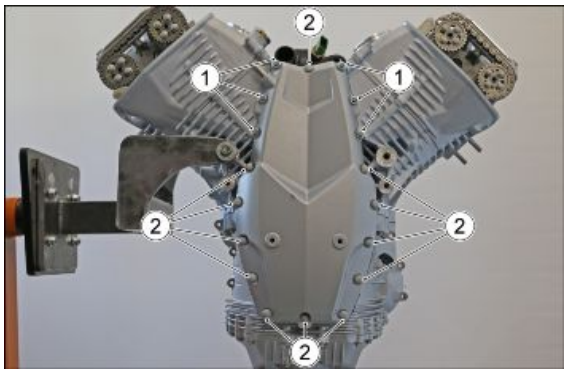
- Make two complete rotations of the crankshaft, ANTI-CLOCKWISE to ensure that there is no interference in the rotation of the engine.
- Install the timing system cover.
- Install the valve covers, the spark plugs and the coils.



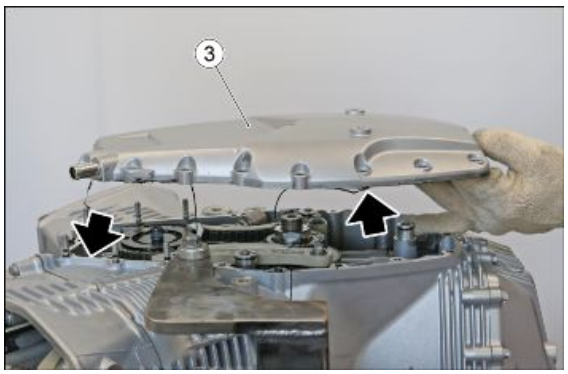
Timing

TIMING SYSTEM COVER REMOVAL

- Unscrew the fixing nuts (1).
- Unscrew the fixing screws (2).



- Remove the timing system cover (3) from the engine.
- Carefully clean the coupling surfaces and the cover and engine surfaces from any sealing residues.

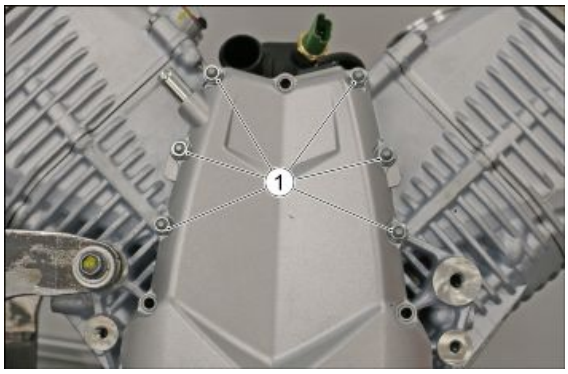


- Apply a layer of ThreeBond 1207 D to the pick-up wiring retention rubber grommet.

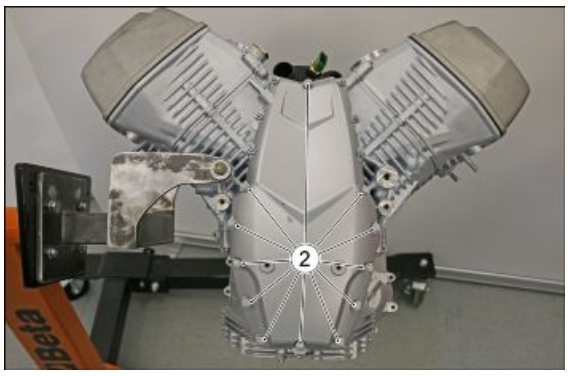
- Apply a layer of ThreeBond 1207 D to the support surface of the crankcase.

- Install the timing cover, ensuring that the two centring bushes are present.

- Tighten the six fixing nuts (1) to torque.



- Tighten the twelve fixing screws (2) to torque.



Rimozione ruota fonica

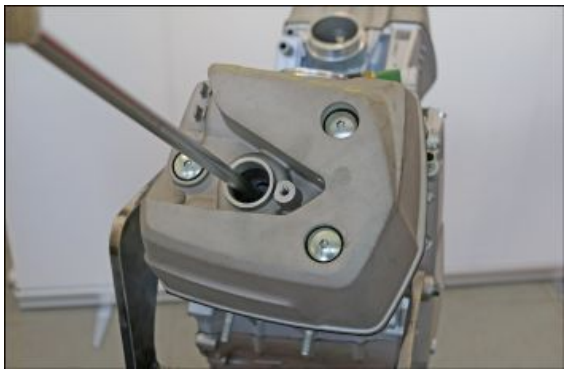
The removal and installation of the tone wheel are described in the section "**Timing**".

Removing the chain tensioner

This engine is equipped with three timing chains and three chain tensioners. The following steps are required in order to remove each of the three chain tensioners

Right chain tensioner removal

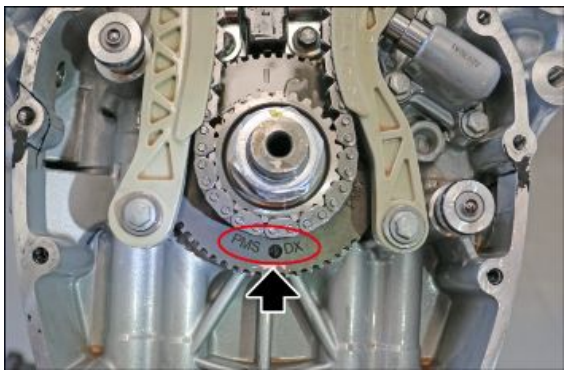
- Remove the right-hand head cover.
- Remove the spark plug.



- Remove the timing system cover.
- Bring the right piston to the TDC.

NOTE

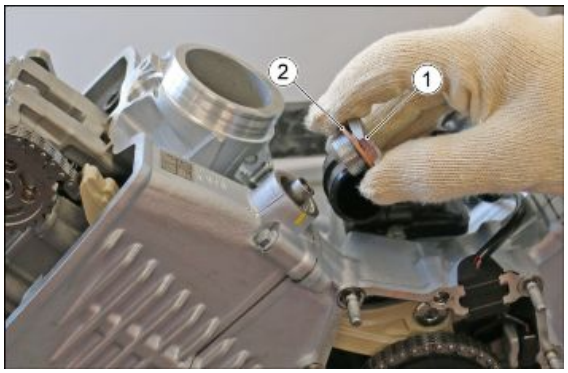
THE HOLE ON THE PINION MARKED "RH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



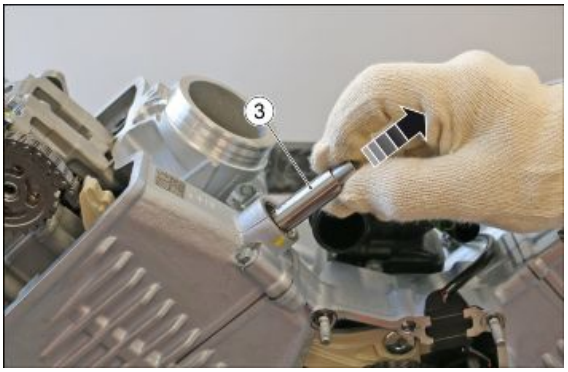
- Check that with the right piston at TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Remove the chain tensioner cap (1) and the corresponding sealing washer (2).

DURING REFITTING, USE NEW SEALING WASHERS.

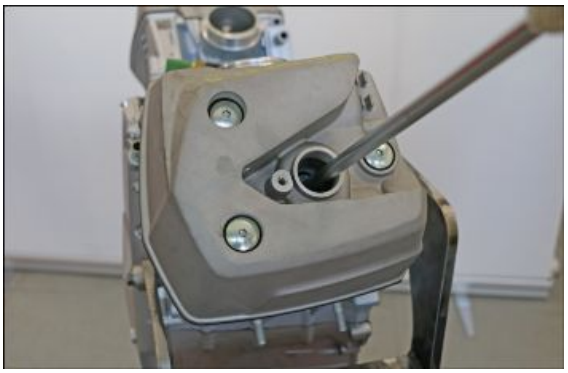


- Remove the chain tensioner (3) from the right-hand head.



Removing the left-hand chain tensioner

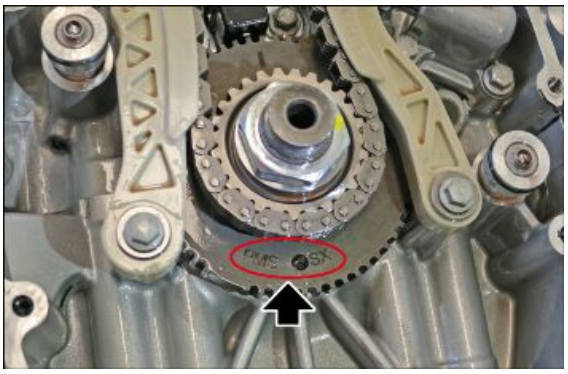
- Remove the left-hand head cover.
- Remove the spark plug.



- Bring the left-hand piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "LH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.



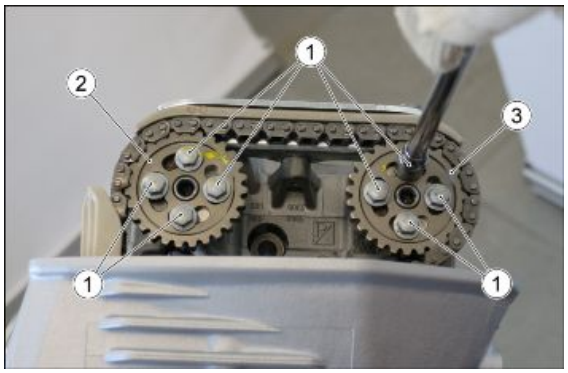
- Check that with the left-hand piston to the TDC, the camshafts of the relative big end have the lobes facing upward and are convergent.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crankcase.

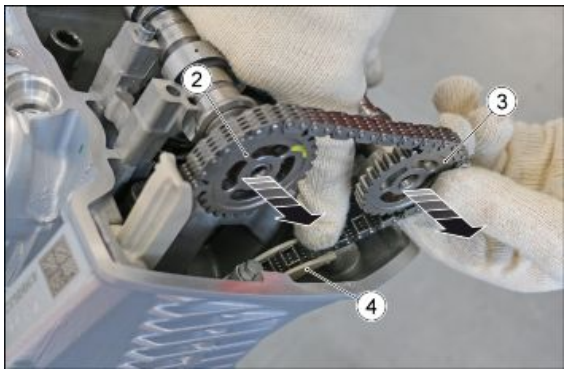
Specific tooling

020851Y Camshaft timing pin

- Using a workshop hot air gun, heat the camshafts and remove the fixing screws (1) of the intake (2) and exhaust (3 sprockets.



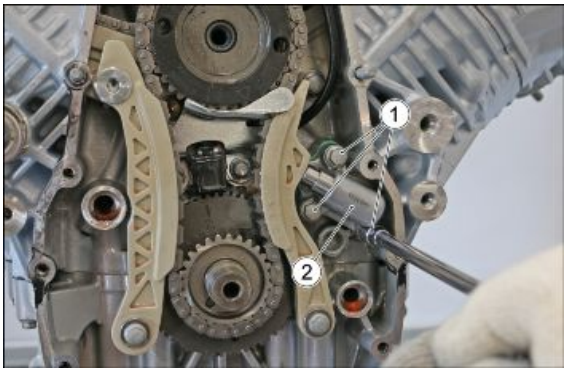
- Press the chain tensioner slider (4) so as to release the tension on the timing chain.
- Remove the exhaust (3) and intake (2) sprockets from the camshafts and release them from the timing chain.



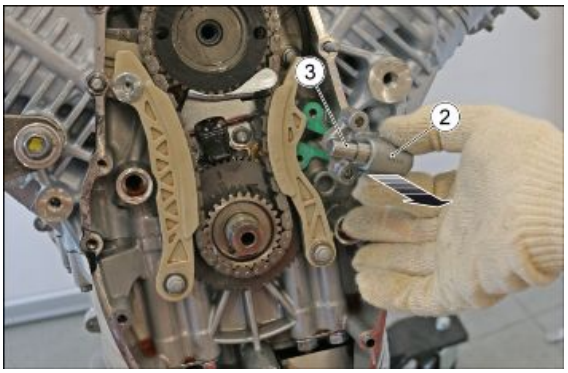
- Using a magnet, remove the chain tensioner (5) from the its seat in the left-hand cylinder.
- Check that there is a pre-load washer (6).

Central chain tensioner removal

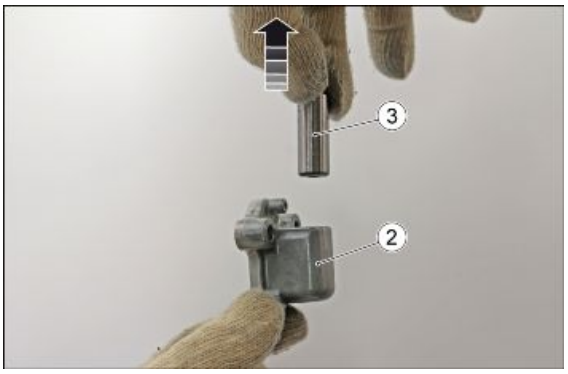
- Remove the timing system cover.
- Remove the three fixing screws (1) of the chain tensioner support (2).



- Remove the support (2) together with the chain tensioner (3).



- Once removed from the engine, extract the chain tensioner (3) from the support (2).



Chain removal

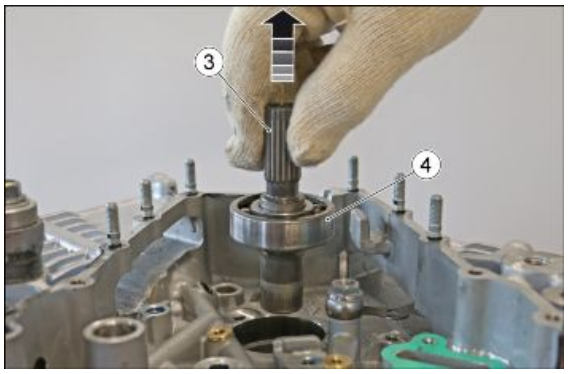
- There are three timing chains in this engine. For the removal procedures of all the three chains, refer to the procedures for the removal of the LEFT head.

Service shaft removal

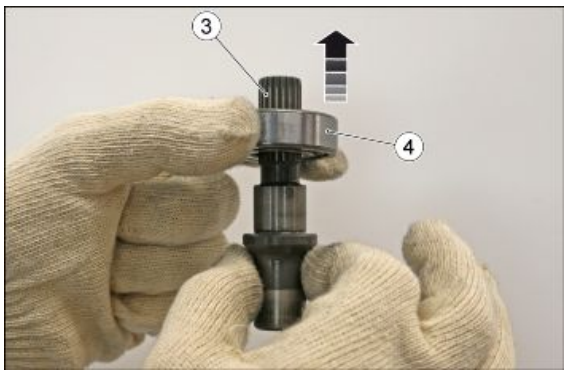
- First remove all three timing chains.
- Remove the fixing screw (1).

- Remove the bearing retainer (2).

- Extract the service shaft (3) including the external bearing (4).



- Remove the bearing (4) from the service shaft (3).



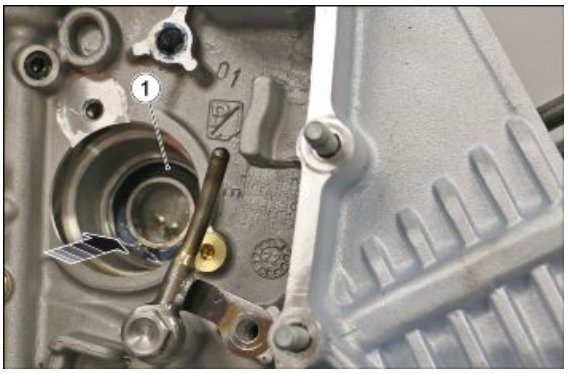
- Using an extractor for internal bearings, extract the internal bearing (5) from the upper crankcase.

Installing the service shaft

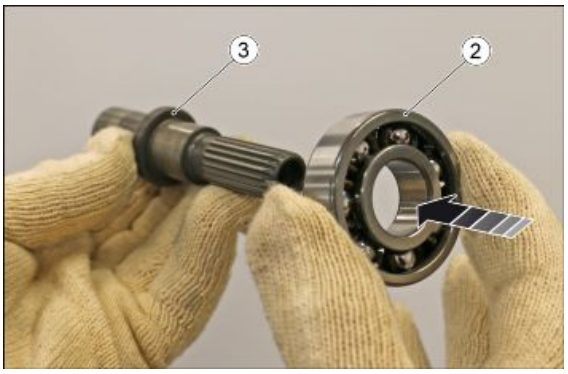
- Heat up the crankcase with a workshop heat gun.
- Insert the internal bearing (1) in the crankcase completely, until it reaches the upper crankcase. For this operation, use a punch acting on the bearing outer ring.

NOTE

Face the bearing shield outwards.



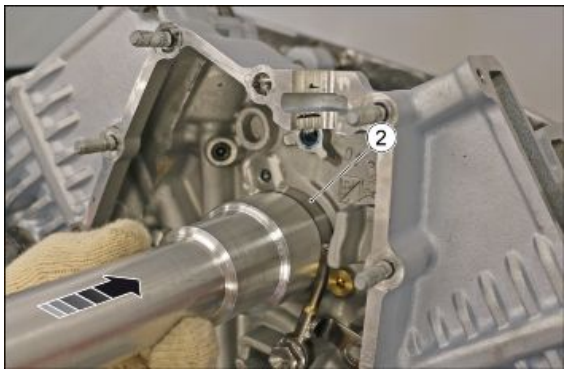
- Install the external bearing (2) on the service shaft (3), observing the direction shown in the figure.



- Heat up the crankcase with a workshop heat gun, taking care not to damage the shielding of the internal bearing (1).

- Install the shaft (3) with the bearing (2) in its seat of the upper crankcase.

- Bring the bearing (2) up against the upper crankcase. For this operation, use a punch acting on the bearing outer ring.



- Install the retainer (4) using a NEW pre-impregnated screw (5) and tighten it to the prescribed torque.

Locking torques (N*m)

Screw for fastening the bearing retainer 9 - 11 Nm (6.64 - 8.11 lb ft)

Installazione catena

- For the installation of the timing chain, it is necessary to carry out the "Timing" procedure, therefore consult the specific chapter.

Cam timing

Timing

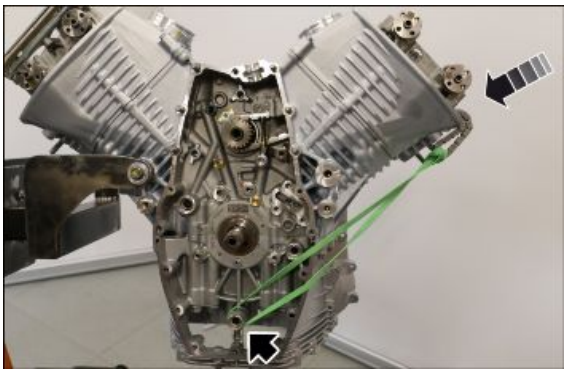
NOTE

THE CAMSHAFTS OF THE LEFT (REAR) HEAD MUST BE FITTED DURING THE TIMING PROCEDURE IN ORDER TO PROCEED WITH THE TIMING CHAIN ASSEMBLY AND SUBSEQUENT ENGINE TIMING. THOSE OF THE RIGHT (FRONT) HEAD CAN ALREADY BE INSTALLED BEFORE THE FOLLOWING STEPS.

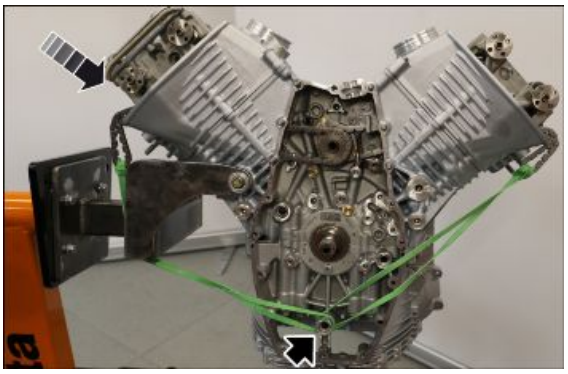
TIMING CHAIN INSTALLATION

- Fit the sprocket on the service shaft, respecting the direction shown in the figure.

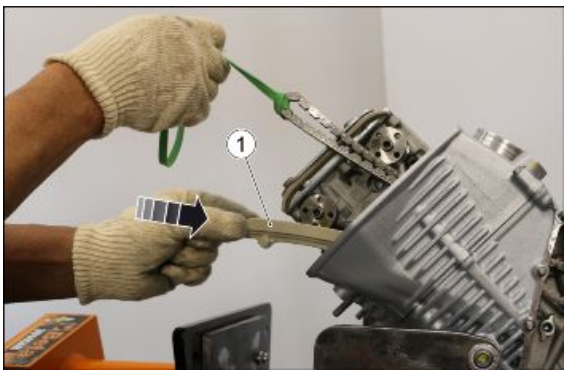
- Fit the left timing chain in the inner track of the sprocket, then secure it to a fixed point so that it does not fall off the sprocket.



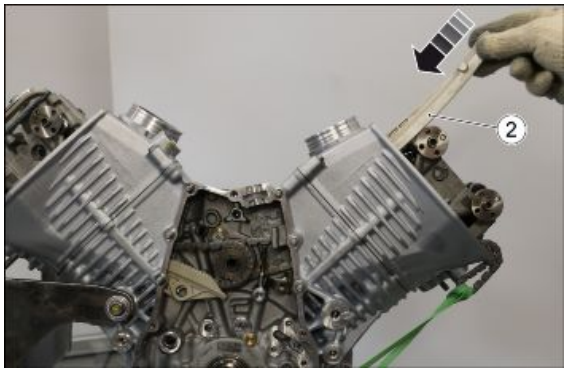
- Fit the right timing chain in the the outer track of the sprocket, then secure it to a fixed point so that it does not fall off the sprocket.



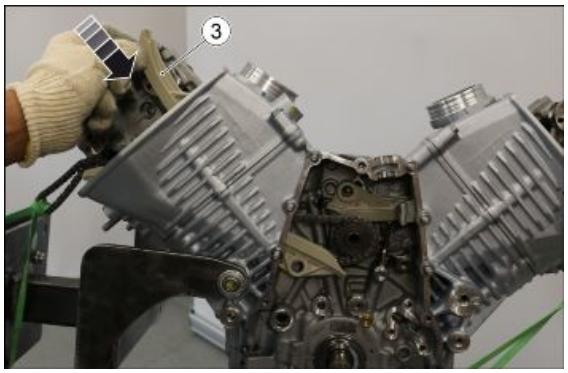
- Insert fixed right slider (1) while tensioning the right timing chain.
- Once the slider is inserted, retighten the chain.



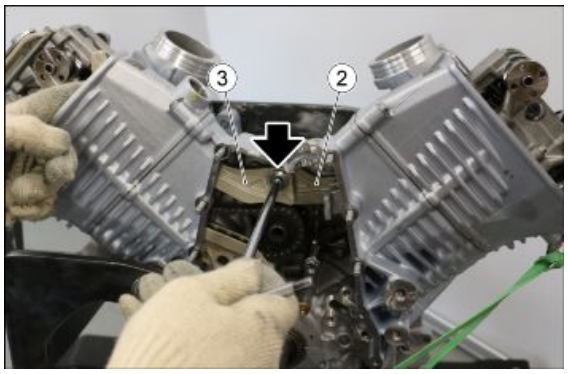
- Insert fixed left slider (2).



- Insert the mobile right slider (3).



- Apply threadlock and tighten the fixing screw that fastens the mobile right slider (3) and the left fixed slider (2) together and tighten it to the specified torque.



Recommended products

Loctite 2045 Medium strength thread-locking sealant.

Blue

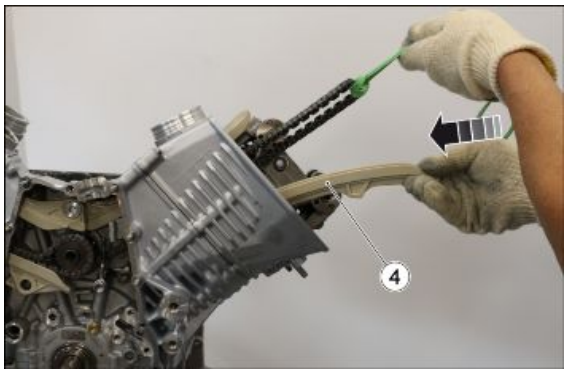
Locking torques (N*m)

Chain tensioner slider fastening screw spacer 20÷24 Nm (14.75 ÷ 17.70 lb ft)

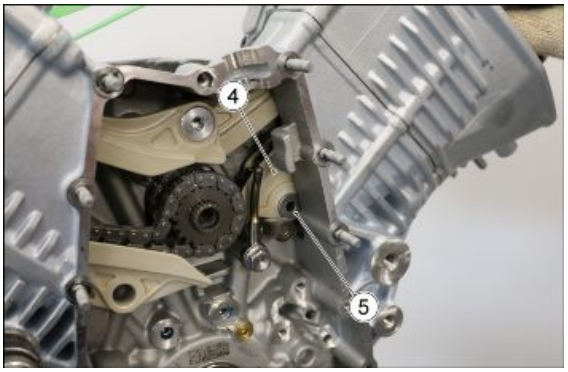
- Insert the mobile left slider (4), while tensioning the left timing chain.
- Once the slider is inserted, retighten the chain.

NOTE

THE LEFT CHAIN TENSIONER MUST ALREADY BE PRESENT IN THE LEFT HEAD.



- Install bushing (5) in the slider (4).



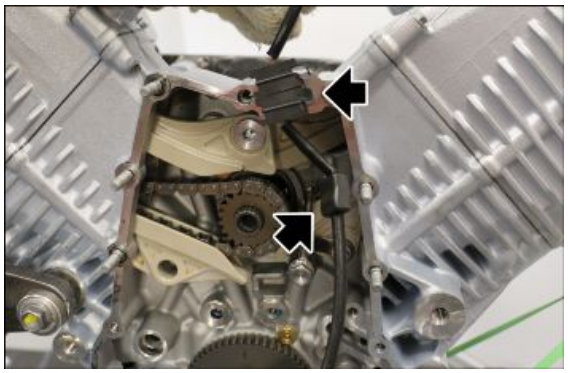
- Tighten the screw that fastens the slider (4) and the lubricating nozzle of the timing chain.

- Insert the timing pin in the hole of the crankshaft.

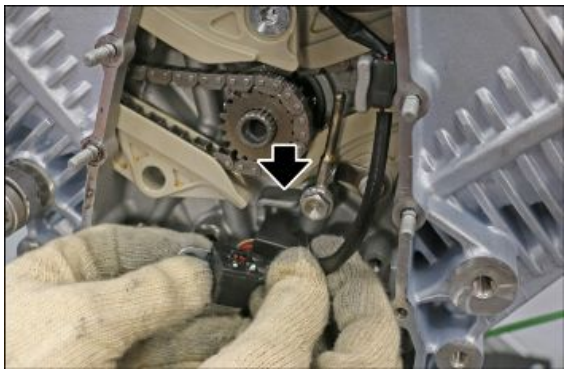
- Fit the tone wheel (6).

- Apply a layer of ThreeBond 1207 D to the pick-up wiring harness.

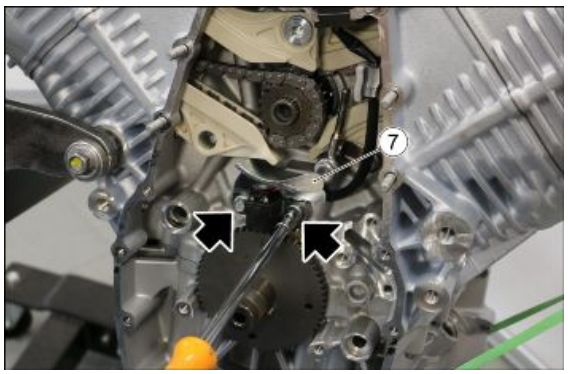
- Insert the wiring harness in the crankcase, at the points indicated in the figure.



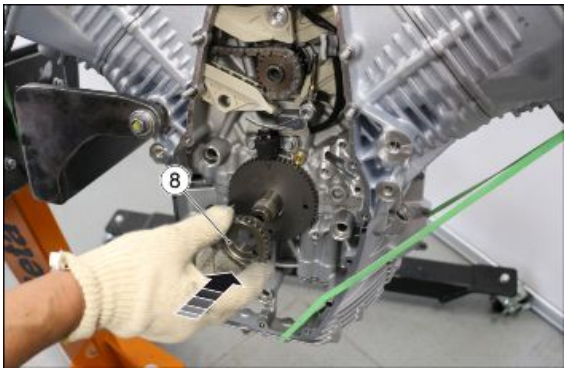
- Insert the wiring harness in the crankcase, at the point shown in the figure.



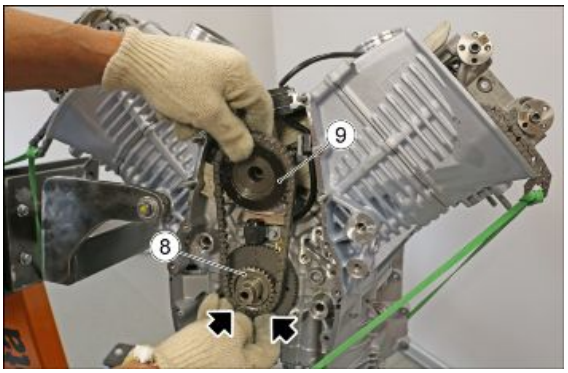
- Install the chain guide plate (7) and bring the fixing screws to the stop, without tightening them but leaving the plate (7) free to move.



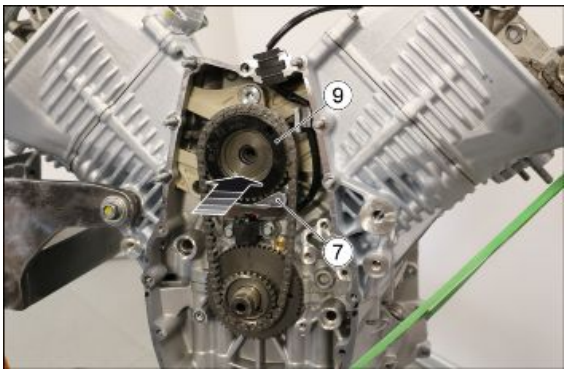
- Install the timing system sprocket (8) on the crankshaft.



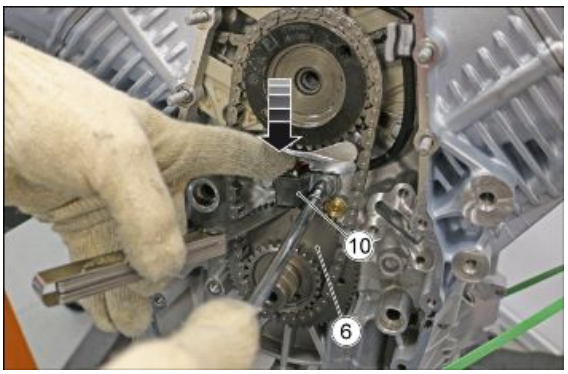
- Fit the timing chain, with the pre-fitted sprocket (9) on it, on the pinion of the crankshaft (8).



- Fit the sprocket (9) on the service shaft, paying attention to the plate (7).



- Insert a shim thickness of 0.5 mm between pick-up (10) and tone wheel (6), then tighten the fixing screws with the pick-up (10) pressed against the feeler gauge.



- Install the fixed slider (11), respecting the direction shown in the figure.

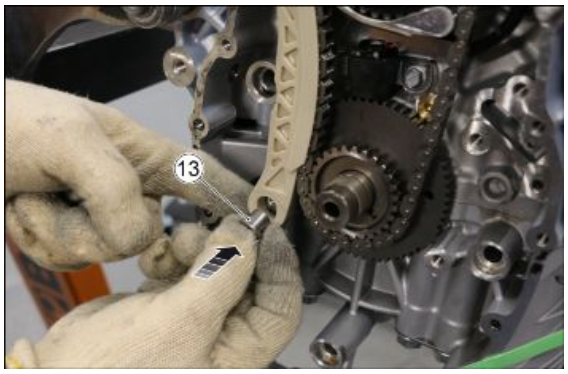
- Apply threadlock to the threads, then insert the upper fixing screw (12).

Recommended products

Loctite 2045 Medium strength thread-locking sealant.

Blue

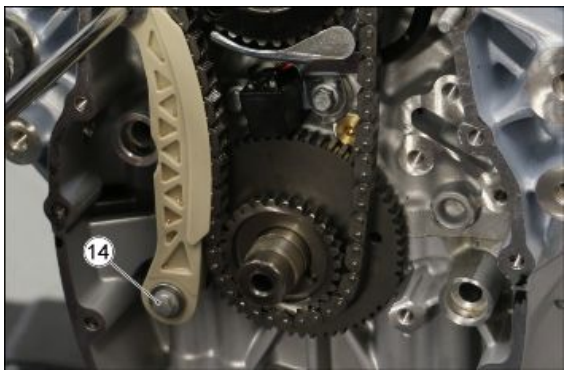
- Insert the bushing (13) in the lower fixing hole.



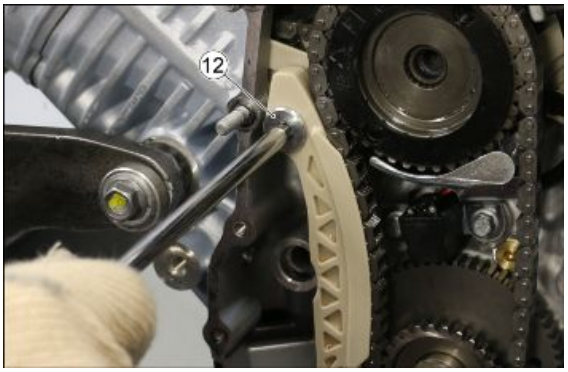
- Insert the lower fastening screw (14) and tighten it to the specified torque.

Locking torques (N*m)

Chain tensioner slider fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)



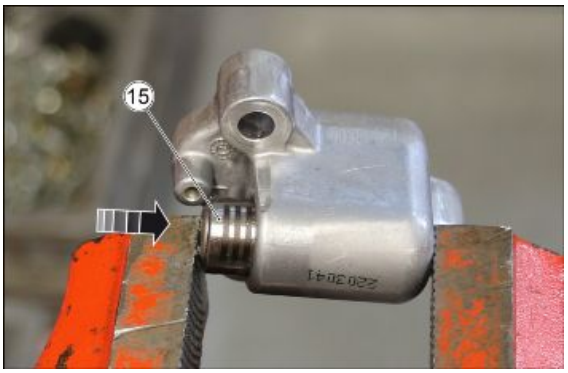
- Tighten the upper fastener screw (12) to the specified torque.



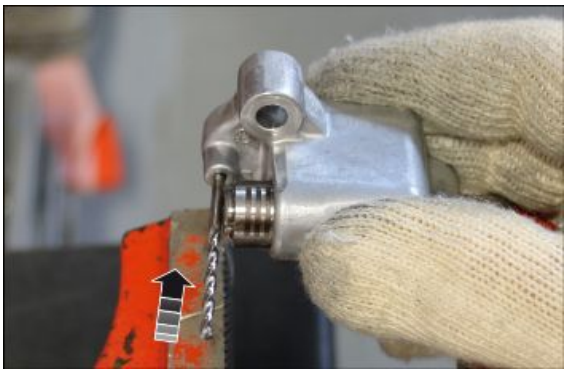
Locking torques (N*m)

Chain tensioner slider fastening screw spacer 20÷24 Nm (14.75 ÷ 17.70 lb ft)

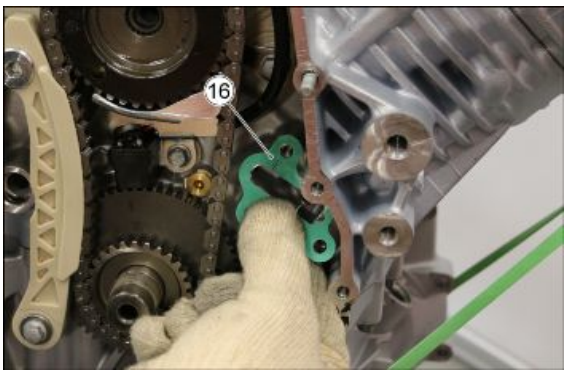
- Insert the chain tensioner (15) in its support.
- Using a vice, gently close the chain tensioner, taking care not to damage either the support or the chain tensioner.



- Insert a pin of 3mm in the hole on the chain tensioner.

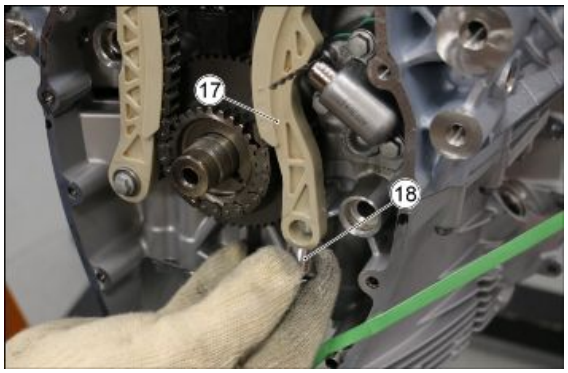


- Install a new gasket (16).



- Install the support, complete with chain tensioner, and tighten the fastener screws.

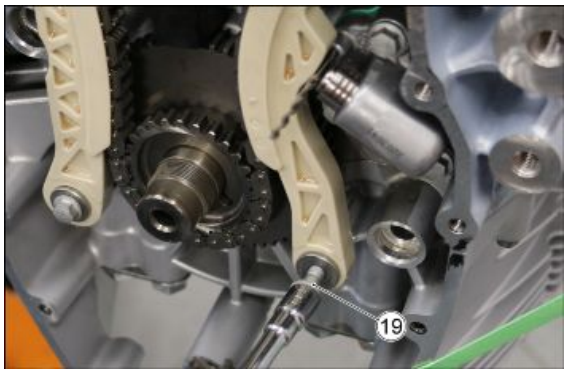
- Install the mobile chain tensioner slider (17) and insert the relevant bushing (18).



- Tighten the lower fastener screw (19).

Locking torques (N*m)

Chain tensioner slider fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)



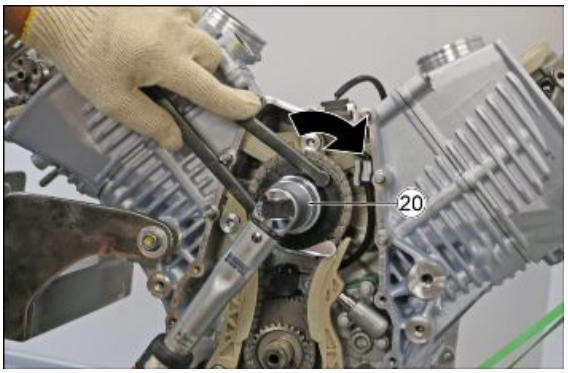
- Remove the pin from the chain tensioner support.

- Insert the special screw (20) on the service shaft.

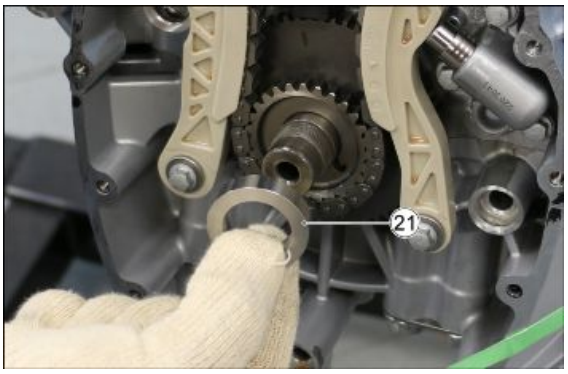
- Tighten the special screw (20) to the specified torque, locking the rotation with a spanner.

Locking torques (N*m)

Special screw for fastening the timing system gear to the countershaft 40÷45 Nm (29.50 ÷ 33.19 lbf ft)



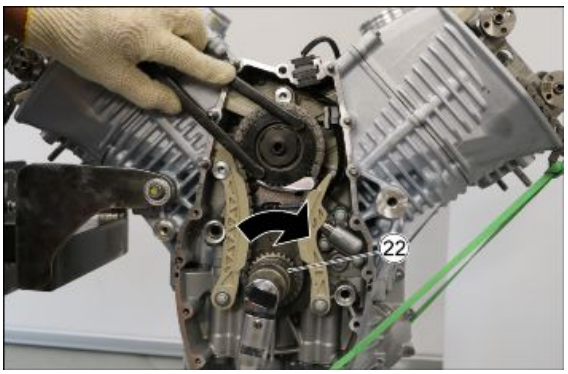
- Insert the spacer (21) on the crank-shaft.



- Install the nut (22) on the crankshaft and tighten it to the specified torque, locking the rotation with a spanner.

Locking torques (N*m)

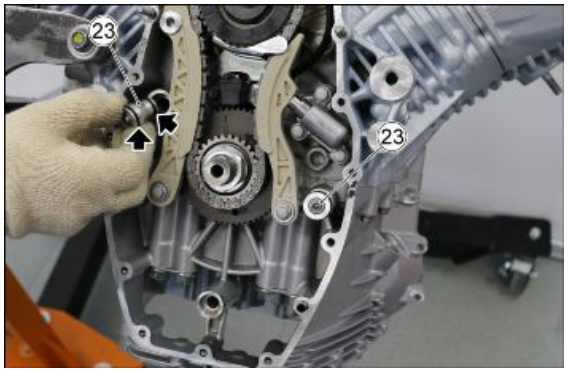
Nut fastening pinion of timing system to the crankshaft 63÷70 Nm (46.47 ÷ 51.63 lbf ft)



- Apply grease to the O-Ring and install the two one-way valves (23).

NOTE

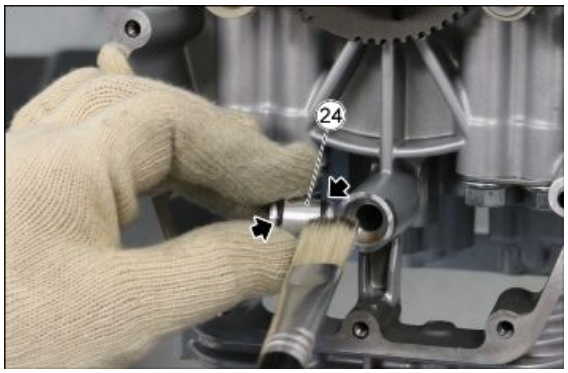
WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



Apply grease to the O-Ring and insert the rigid sleeve (24).

NOTE

WHEN REMOUNTING THE PUMP, REPLACE THE "O-RINGS"



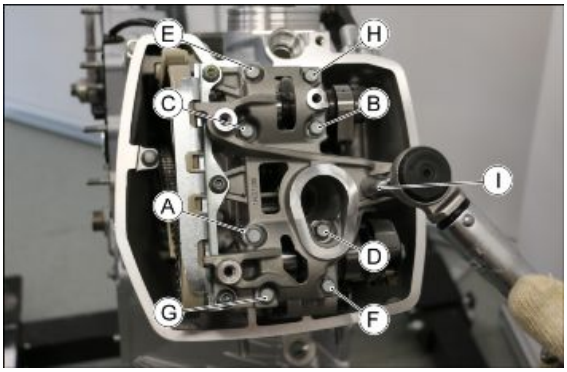
WARNING

FOR COMPLETE ENGINE TIMING, START WITH THE RIGHT HEAD. THE FOLLOWING OPERATIONS ARE DIFFERENTIATED BETWEEN RIGHT AND LEFT HEAD AND CAN BE CARRIED OUT INDIVIDUALLY. HOWEVER, PAY PARTICULAR ATTENTION TO THE NOTES AT THE BEGINNING OF EACH PROCEDURE.

- Press the mobile slider and insert the sprockets, with the timing chain already fitted, on the left head camshaft.
- Take care that the chain, under tension, does not cause the camshafts to fall out of their seats.

- Install a new O-ring in the spark plug hole of the upper mounting.
- Press and hold the chain tensioner slider, fit the upper mounting of the left head.

- Tighten the fixing screws to the specified torque, following the sequence A-B-C-D-E-F-G-H- I.



Locking torques (N*m)

Camshaft support screw **11-13 Nm (8.11 - 9.59 lbf ft)**

NOTE

The screw (1) in the hole of the spark plug has a washer, while the screw (2) is the single shorter screw compared to the others.

CAUTION

CAMSHAFT INSTALLATION OPERATIONS ARE ONLY CARRIED OUT IN THE CASE OF COMPLETE TIMING. IN THE EVENT THAT ONLY THE RIGHT (FRONT) HEAD HAS BEEN WORKED ON AND NOTHING HAS BEEN REMOVED FROM THE LEFT TIMING SYSTEM, THE ABOVE OPERATIONS SHOULD BE DISREGARDED.

HEAD RIGHT TIMING

- First fit the camshafts from the right head.
- Insert the sprockets, with the timing chain already fitted, on the right head camshaft.

- Bring the right piston to the TDC.

NOTE

THE HOLE ON THE PINION MARKED "RH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crankcase.

Specific tooling

020851Y Camshaft timing pin

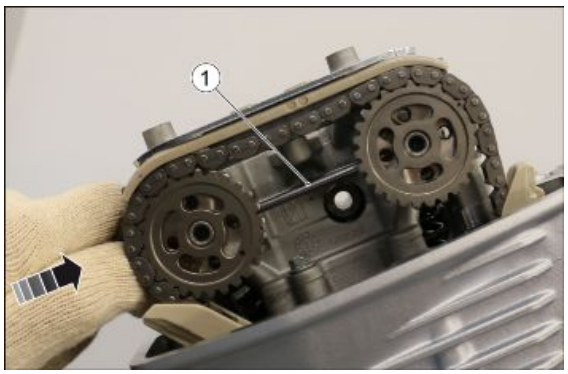
- Make sure to position the shafts with the cams diverging from each other.

- Insert the special tool (1) into the hole on the exhaust camshaft.

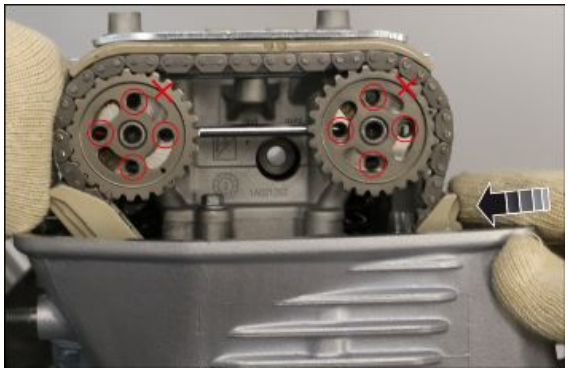
Specific tooling

021064Y Large pin for engine timing

- Continue to insert the tool (1) to intercept the hole on the intake manifold.



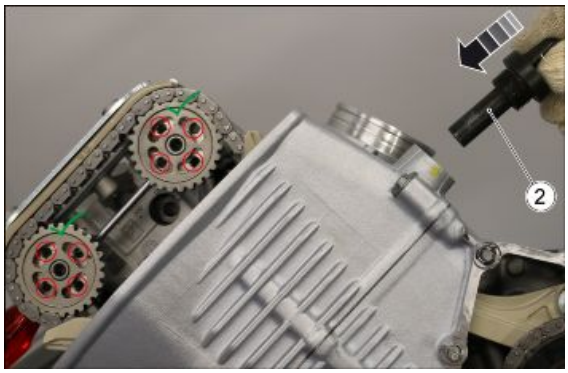
- Press the chain tensioner slider so as to tension the timing chain.
- Check that the threaded holes of the camshafts are at the centre of the slots of the sprockets; otherwise, reposition the sprockets of the timing chain.



- Screw the special tool (2) until it stops into the hole in the right chain tensioner.

Specific tooling

021072Y Right chain tensioner



- Insert the special tool (3) by resting it to the mobile slider of the primary timing chain and secure it to a stud bolt of the timing system cover.

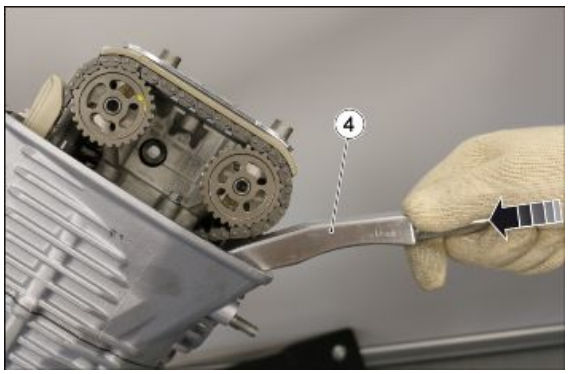
Specific tooling

021073Y Central chain tensioner

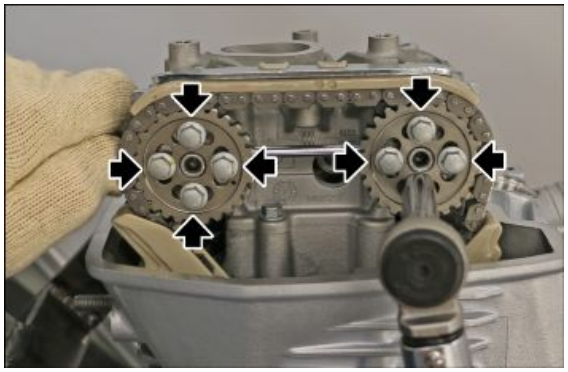
- Insert the special tool (4) in the left head, inserting it between the mobile slider and the chain tensioner.

Specific tooling

021074Y Left chain tensioner



- Tighten the screws fixing the timing system sprockets of the right head to the specified torque.



CAUTION

USE NEW PRE-IMPREGNATED SCREWS AT EACH REFITTING.

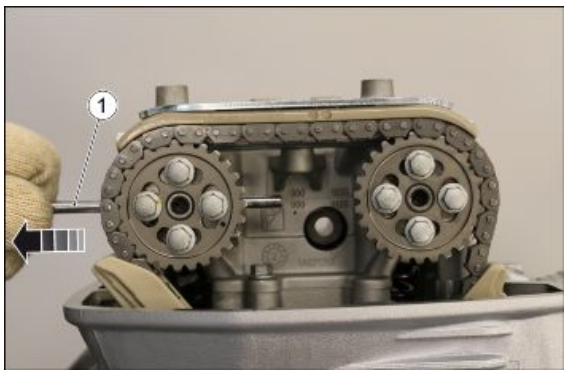
Locking torques (N*m)

Timing system gear sprocket fixing screw **11-13 Nm (8.11 - 9.59 lbf ft)**

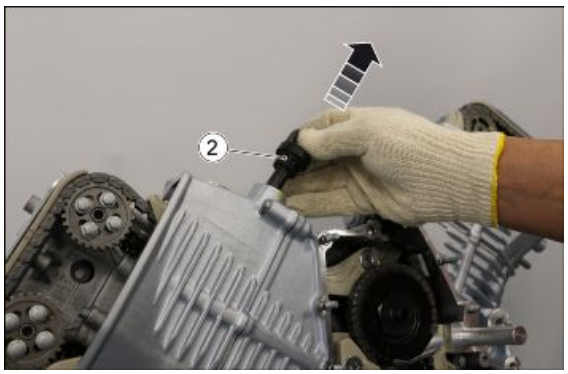
CAUTION

FROM NOW ON, ONLY TURN THE MOTOR SHAFT ANTI-CLOCKWISE.

- Remove the special tool (1) from the camshafts.

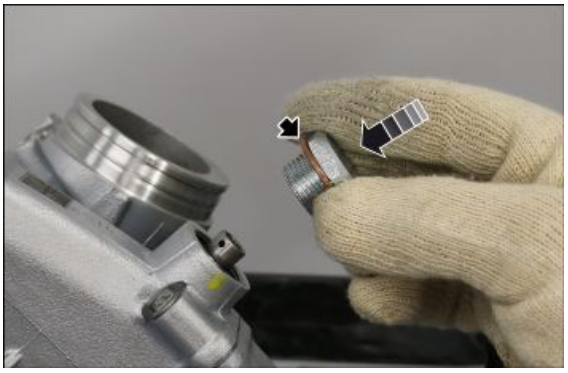


- Remove the special tool (2) from the hole of the right head chain tensioner.

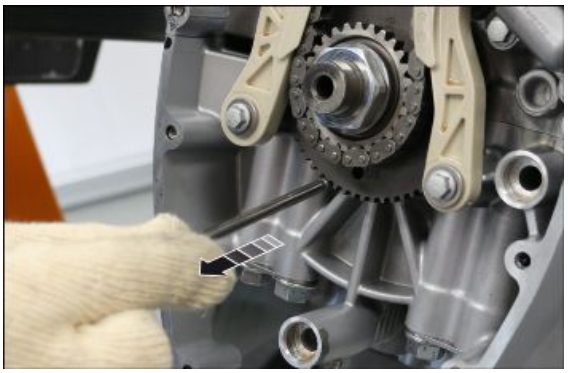


- Insert the chain tensioner in the right head, respecting the fitting direction shown in the figure.

- Insert the chain tensioner cap, with a NEW sealing washer.



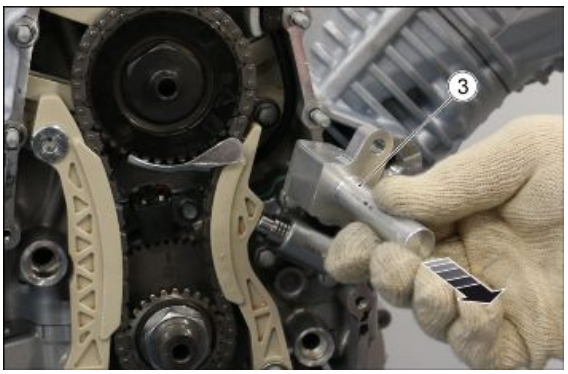
- Remove the pin from the crankshaft.



- Remove the special tool (3) from the primary timing system.

NOTE

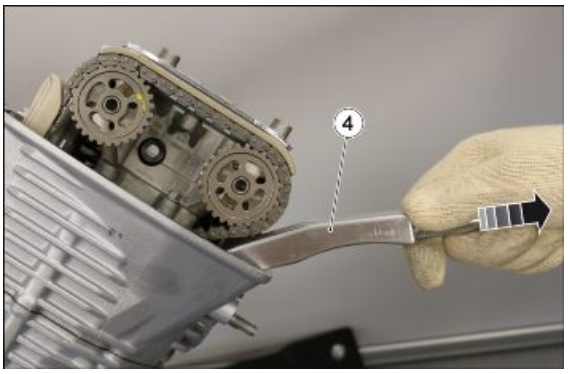
THIS OPERATION SHALL ONLY TO BE CARRIED OUT IN THE CASE OF TIMING OF THE RIGHT HEAD ONLY, IN THE CASE OF COMPLETE ENGINE TIMING, CONTINUE WITH THE PROCEDURE FOR TIMING THE LEFT HEAD.



- Remove the special tool (4) from the left head.

NOTE

THIS OPERATION SHALL ONLY TO BE CARRIED OUT IN THE CASE OF TIMING OF THE RIGHT HEAD ONLY, IN THE CASE OF COMPLETE ENGINE TIMING, CONTINUE WITH THE PROCEDURE FOR TIMING THE LEFT HEAD.



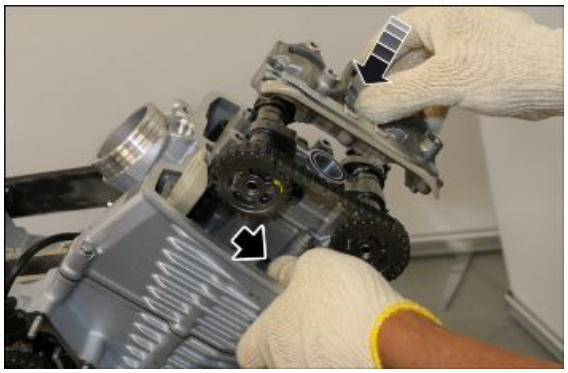
LEFT CYLINDER HEAD TIMING

WARNING

FOR COMPLETE ENGINE TIMING, START WITH THE RIGHT HEAD. THE FOLLOWING OPERATIONS ARE DIFFERENTIATED BETWEEN RIGHT AND LEFT HEAD AND CAN BE CARRIED OUT INDIVIDUALLY. HOWEVER, PAY PARTICULAR ATTENTION TO THE NOTES AT THE BEGINNING OF EACH PROCEDURE.

- Press the mobile slider and insert the sprockets, with the timing chain already fitted, on the left head camshaft.
- Take care that the chain, under tension, does not cause the camshafts to fall out of their seats.

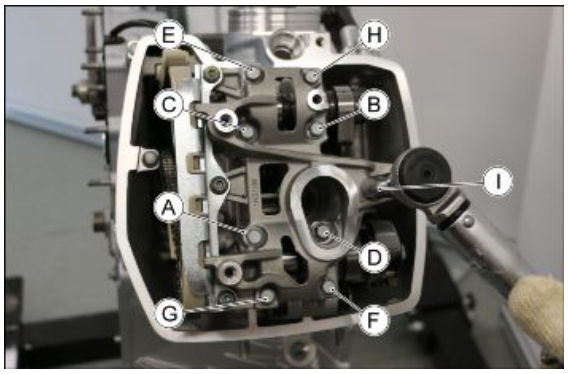
- Install a new O-ring in the spark plug hole of the upper mounting.
- Press and hold the chain tensioner slider, fit the upper mounting of the left head.



- Tighten the fixing screws to the specified torque, following the sequence A-B-C-D-E-F-G-H- I.

Locking torques (N*m)

Camshaft support screw 11-13 Nm (8.11 - 9.59 lbf ft)



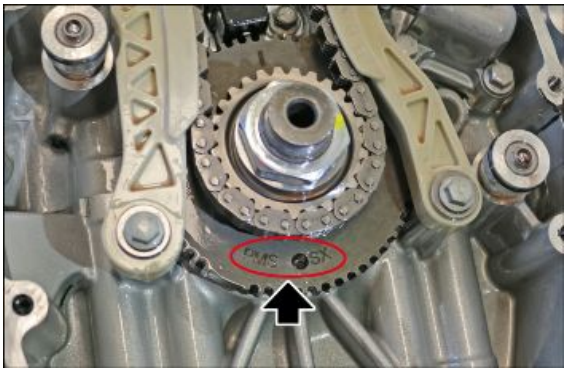
NOTE

The screw (1) in the hole of the spark plug has a washer, while the screw (2) is the single shorter screw compared to the others.

NOTE

The above operations are only to be carried out in the case of timing of the left head only. In case of complete timing of the engine, resume the timing operations from the step after the one described above.

- Turn the crankshaft ANTI-CLOCK-WISE until arriving the left TDC.



NOTE

THE HOLE ON THE PINION MARKED "LH TDC" MUST BE ALIGNED WITH THE HOLE ON THE CRANKCASE.

CAUTION

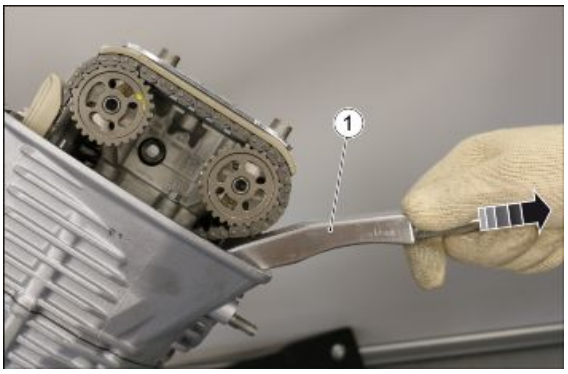
IF THE TDC. IS EXCEEDED, MAKE TWO COMPLETE ENGINE ROTATIONS TO INTERCEPT THE CORRECT LEFT TDC.

- Insert the centring pin in the crankshaft pinion, making sure to intercept the holes of the pinion and of the crankcase.

Specific tooling

020851Y Camshaft timing pin

- Remove the special tool (1) from the left head.

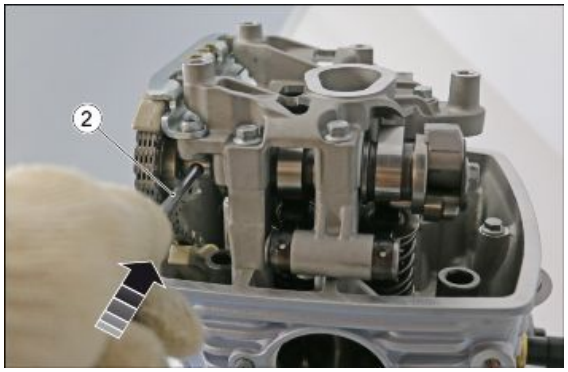


NOTE

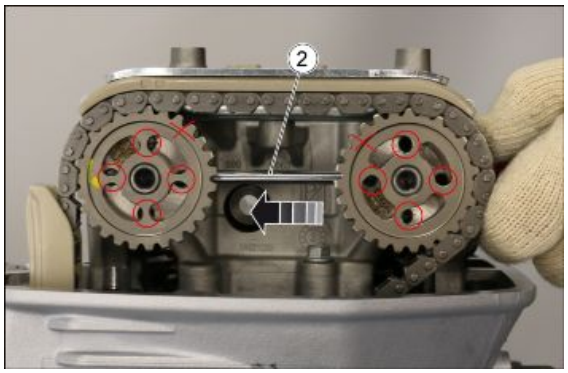
Operation to be carried out only in the case of complete engine timing.

- Check that the cam lobes converge with each other.

- Insert the special tool (2) into the hole on the exhaust camshaft.



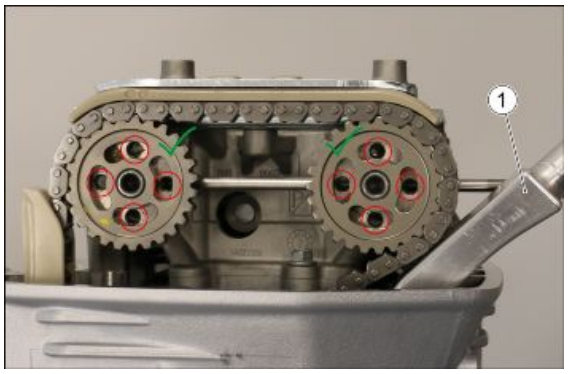
- Continue to insert the special tool (2) to intercept the hole on the intake manifold.
- Check that the threaded holes of the camshafts are at the slots of the sprockets.



- If necessary, align the threaded holes of the camshaft to the slots of the sprockets.
- Insert the special tool (1) in the left cylinder head between the mobile slider and the chain tensioner.

Specific tooling

021074Y Left chain tensioner

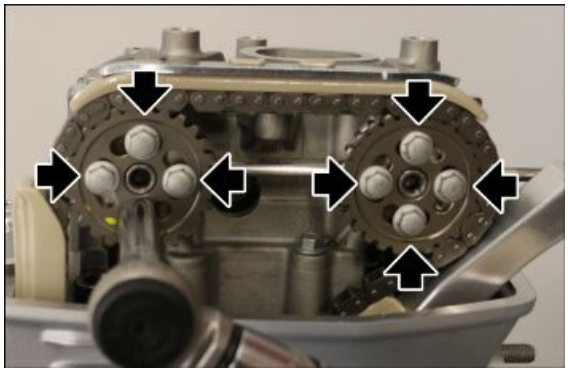


- Insert the special tool (3) by resting it to the mobile slider of the primary timing chain and secure it to a stud bolt of the timing system cover.

Specific tooling

021073Y Central chain tensioner

- Tighten the screws fixing the timing sprockets of the left head to the specified torque.



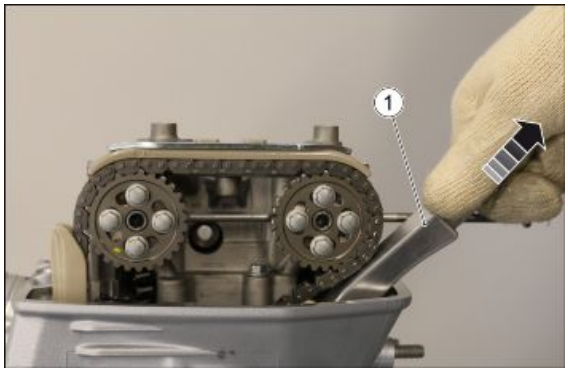
CAUTION

USE NEW PRE-IMPREGNATED SCREWS AT EACH REFITTING.

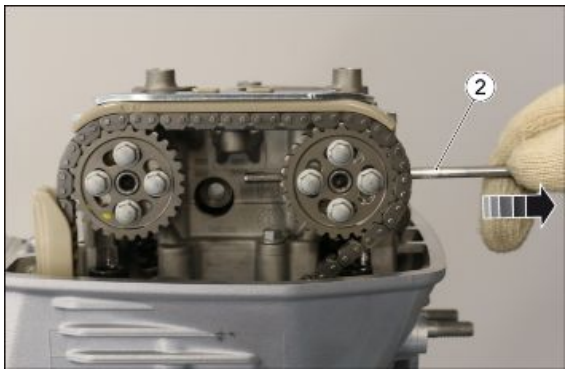
Locking torques (N*m)

Timing system gear sprocket fixing screw **11-13 Nm (8.11 - 9.59 lbf ft)**

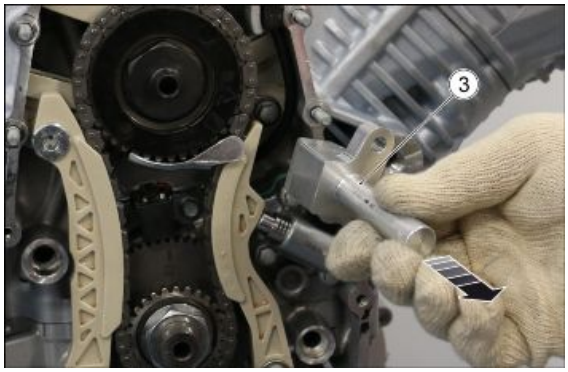
- Remove the special tool (1) from the left head.



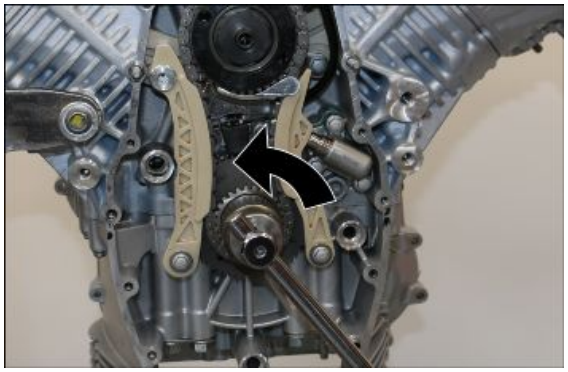
- Remove the special tool (2) from the camshafts.



- Remove the special tool (3) from the primary timing system.

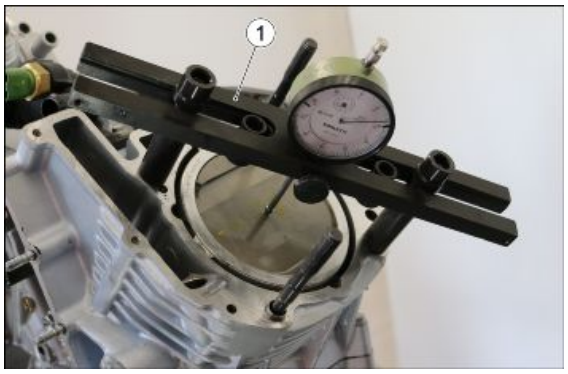


- Make two complete rotations of the crankshaft, ANTI-CLOCKWISE to ensure that there is no interference in the rotation of the engine.
- Install the timing system cover.
- Install the valve covers, the spark plugs and the coils.



Installing the cylinder head

FITTING THE RIGHT CYLINDER HEAD (FRONT)



- Before proceeding with the fitting of the head, it is necessary to measure the piston projection for the correct head gasket selection.
- Install a dial gauge on the specific tool (1) and reset the dial gauge installed on the tool, on a reference surface.
- Install the specific tool (1) and the dial gauge on two stud bolts, place the dial gauge at the centre of the piston crown and measure the deviation.

WARNING

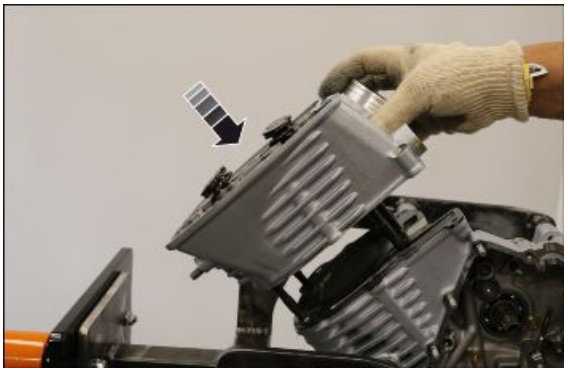
THE SPECIAL TOOL (1) MUST BE RESTING AGAINST THE CRANKCASE AND NOT THE CYLINDER LINER.

Specific tooling

020714Y Dial gauge mount

- Install the head gasket with the suitable thickness, based on the previous measurement.

- Install the head on the stud bolts.

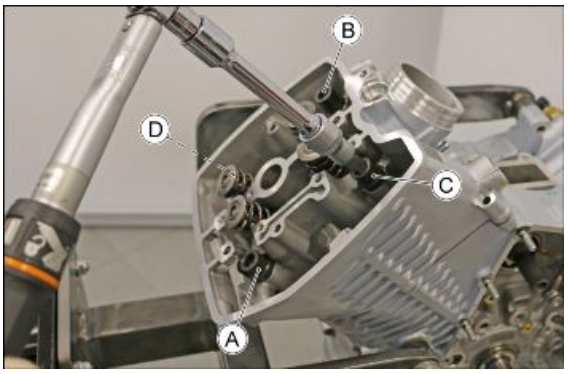


- Apply grease MOLYKOTE G RAPID PLUS to the threads of the stud bolts (2) and the coupling surfaces of the nuts (3).

- Install the nuts (3) and pre-tighten to the specified torque following the sequence A-B-C- D.

Locking torques (N*m)

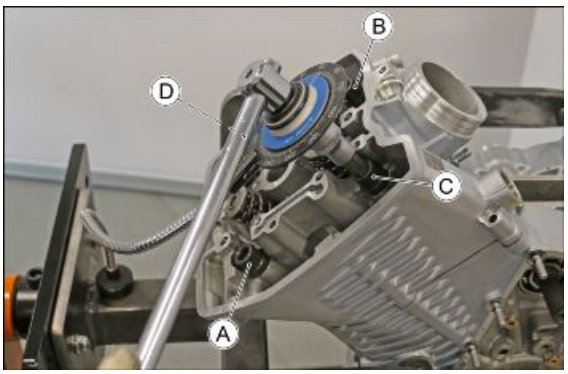
PRE-TORQUE 18 22 Nm (13.28 16.23 lb ft)



- Tighten the nuts by tightening them twice to specified torque, following the sequence A-B-C- D.

Locking torques (N*m)

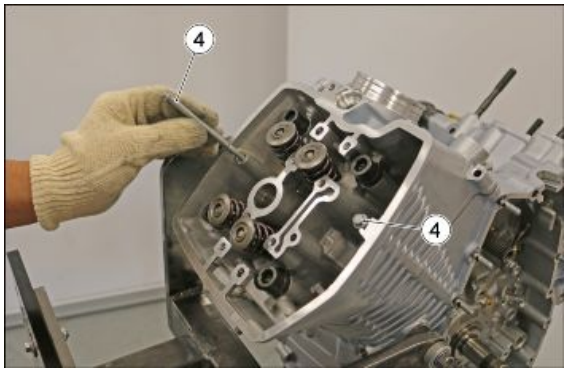
1st TIGHTENING 43° ÷ 47° 2nd TIGHTENING 43° ÷ 47°



- Insert the two screws (4) and tighten them to the specified torque.

Locking torques (N*m)

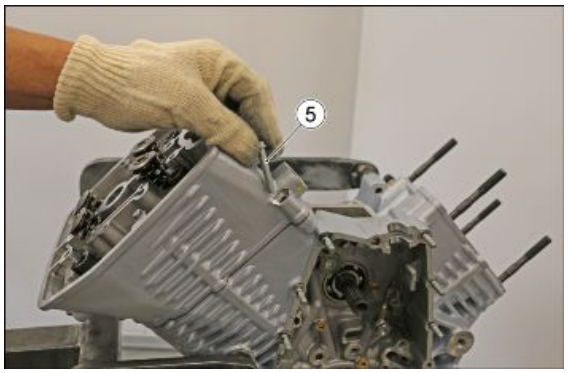
Head fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)



- Insert the screw (5) and tighten it to the specified torque.

Locking torques (N*m)

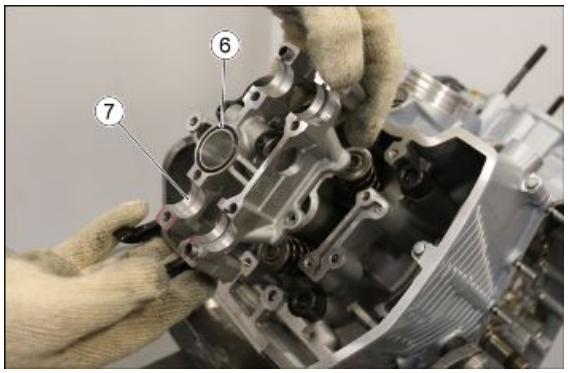
Head fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)



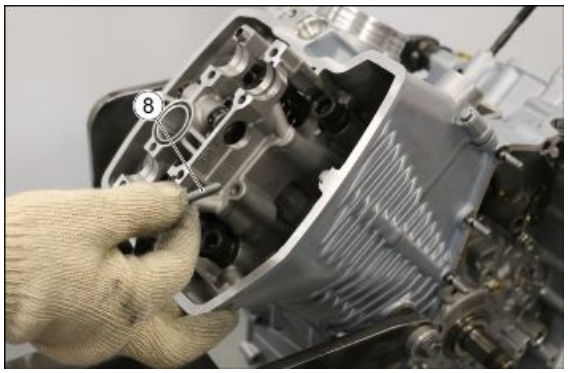
- Install the new O. R. (6) on the lower side as well as on the upper side of the lower mounting (7).
- Install the lower mounting (7), taking care to keep the rockers of the valves facing upwards.

CAUTION

BE SURE TO FIT THE MOUNTING OF THE VALVES OF THE RELEVANT HEAD FROM WHICH IT WAS REMOVED. THE MOUNTINGS CANNOT BE INVERTED BETWEEN HEADS.



- Install the fastening screw (8) (complete thread).

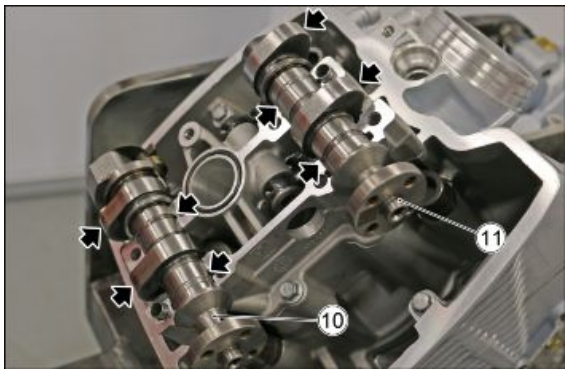


- Insert the calibrated pads (9) on the valves stanchions.

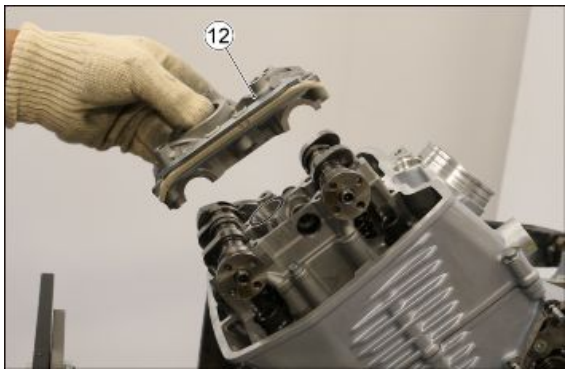
CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.

- Install the exhaust camshaft (10) and intake camshaft (11).
- Lubricate the camshafts with engine oil in the points indicated in the figure.



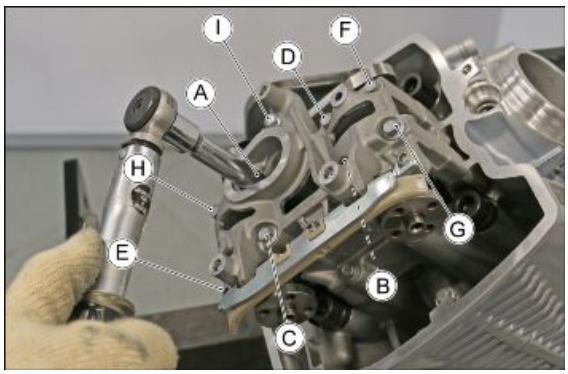
- Install a new O-ring in the hole of the spark plug and install the upper mounting (12).



- Install the fixing screws and tighten them to the specified torque, following the sequence A-B-C-D-E-F-G-H- I.

Locking torques (N*m)

Camshaft support screw **11-13 Nm (8.11 - 9.59 lbf ft)**

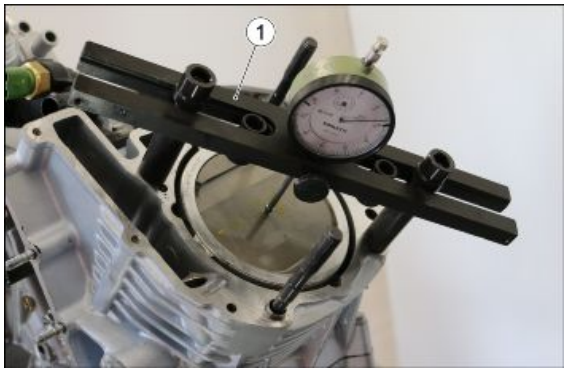


NOTE

The screw (13) in the hole of the spark plug has a washer, while the screw (14) is the single shorter screw compared to the others.

FITTING THE LEFT CYLINDER HEAD (REAR)

- Prima di procedere al montaggio della testa, è necessario misurare la sporgenza del pistone per la scelta della corretta guarnizione di testa.
- Installare un comparatore sull'attrezzo specifico (1) ed azzerare il comparatore, installato sull'attrezzo, su un piano di riscontro.
- Installare l'attrezzo specifico (1) ed il comparatore su due prigionieri, appoggiare il comparatore al centro del cielo del pistone e misurare lo scostamento.



WARNING

THE SPECIAL TOOL (1) MUST BE RESTING AGAINST THE CRANKCASE AND NOT THE CYLINDER LINER.

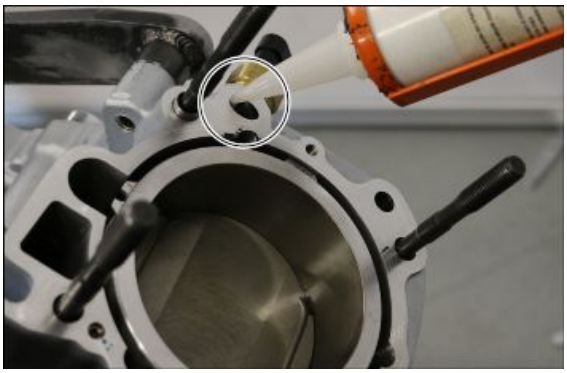
Specific tooling

020714Y Dial gauge mount

- Install the preload washer into the seat of the chain tensioner.

- Install the chain tensioner in the relative seat on the crankcase, respecting the direction shown in the figure.

- Apply a layer of ThreeBond 1207 D to the crankcase, in the area near the oil pressure sensor.

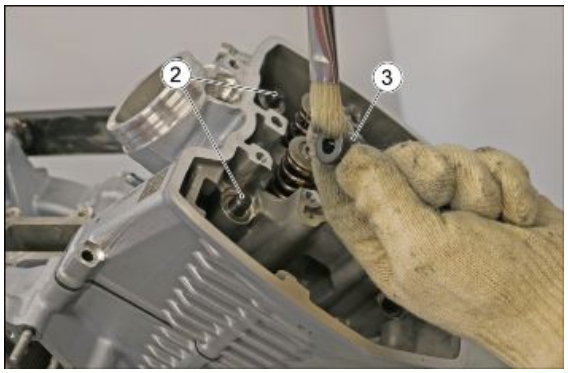


- Install the head gasket with the suitable thickness, based on the previous measurement.

- Apply a layer of three Bond 1207 D on the head gasket, in the area near the oil pressure sensor.

- Install the head on the stud bolts.

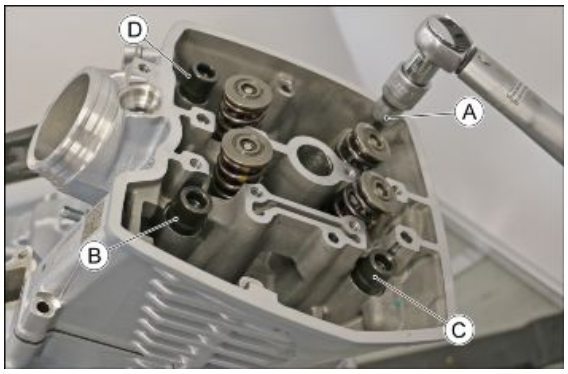
- Apply grease MOLYKOTE G RAPID PLUS to the threads of the stud bolts (2) and the coupling surfaces of the nuts (3).



- Install the nuts (3) and pre-tighten to the specified torque following the sequence A-B-C- D.

Locking torques (N*m)

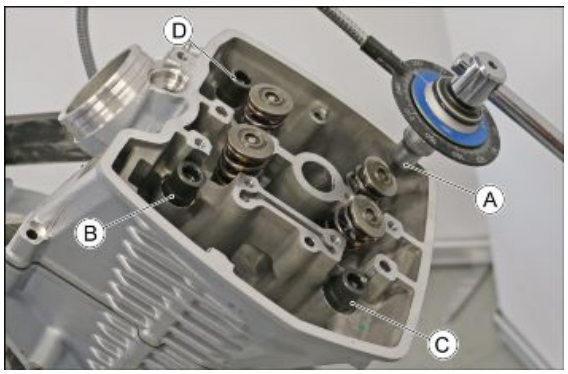
PRE-TORQUE 18 22 Nm (13.28 16.23 lb ft)



- Tighten the nuts by tightening them twice to specified torque, following the sequence A-B-C- D.

Locking torques (N*m)

1st TIGHTENING 43° ÷ 47° 2nd TIGHTENING 43° ÷ 47°



- Insert the two screws (4) and tighten them to the specified torque.

Locking torques (N*m)

Head fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)

- Insert the screw (5) and tighten it to the specified torque.

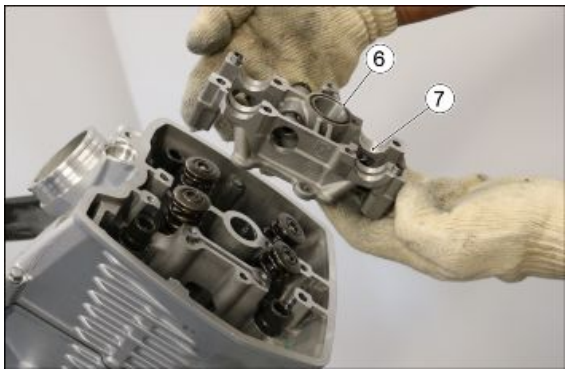
Locking torques (N*m)

Head fastening screw 11÷13 Nm (8.11 ÷ 9.59 lbf ft)

- Install the new O. R. (6) on the lower side as well as on the upper side of the lower mounting (7).
- Install the lower mounting (7), taking care to keep the rockers of the valves facing upwards.

CAUTION

BE SURE TO FIT THE MOUNTING OF THE VALVES OF THE RELEVANT HEAD FROM WHICH IT WAS REMOVED. THE MOUNTINGS CANNOT BE INVERTED BETWEEN HEADS.



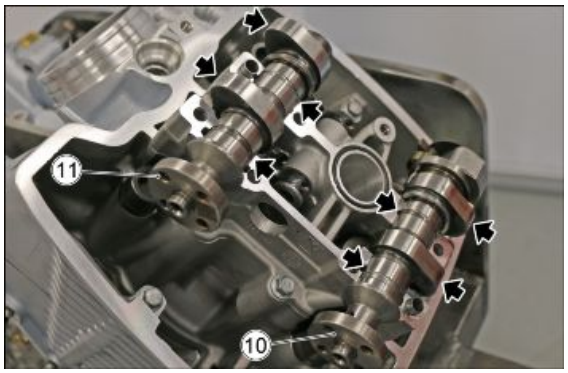
- Install the fastening screw (8) (complete thread).

- Insert the calibrated pads (9) on the valves stanchions.

CAUTION

PAY CLOSE ATTENTION NOT TO DROP THE CALIBRATED PADS INTO THE ENGINE.

- Install the exhaust camshaft (10) and intake camshaft (11).
- Lubricate the camshafts with engine oil in the points indicated in the figure.



The installation of the upper mounting must be performed during the timing procedure. Continue assembly by following the left head timing procedures as shown in the 'TIMING' section.

Installing the head cover

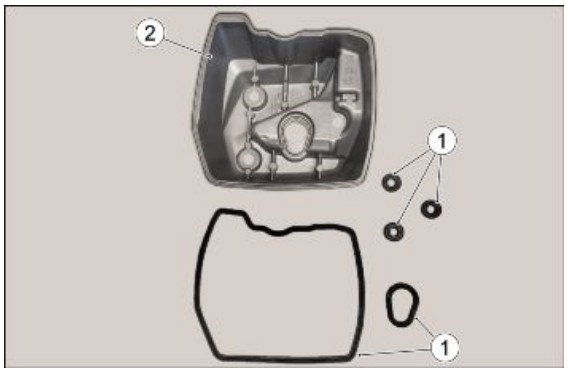
NOTE

THE OPERATIONS FOR FITTING THE HEAD COVER ARE THE SAME FOR BOTH SIDES

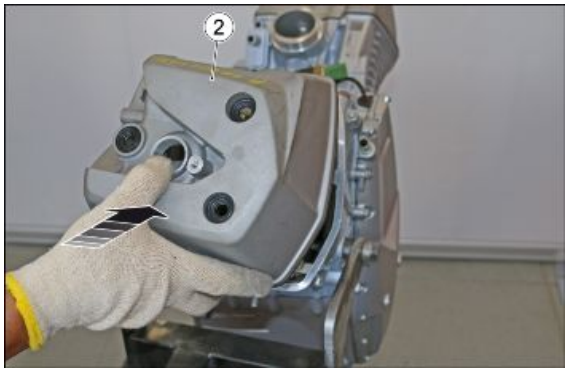
- Install the gaskets (1) on the head cover (2).

NOTE

If there were no leaks or losses from the gaskets (1), the existing gaskets can be reused. Otherwise, replace them with new gaskets.



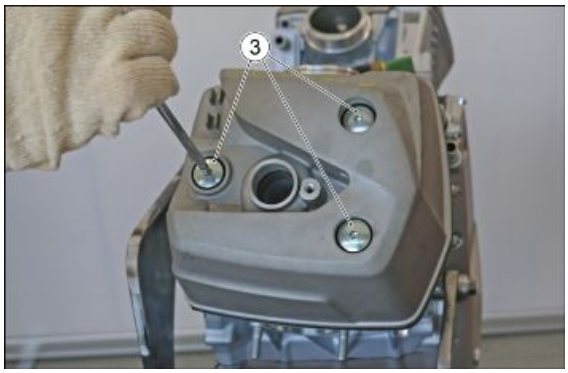
- Place the head cover (2) on the head.



- Install the fixing screws (3) and tighten them to the specified torque.

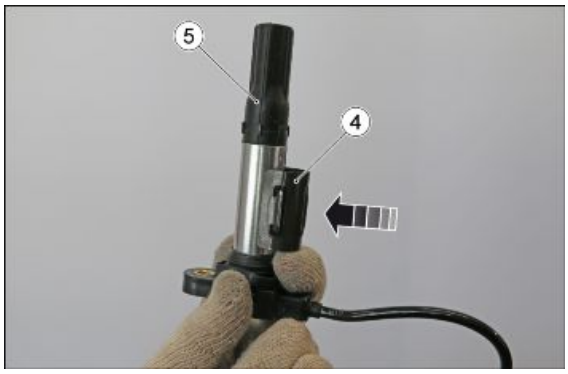
Locking torques (N*m)

Head cover screw 9 - 11 Nm (6.64 - 8.11 lb ft)

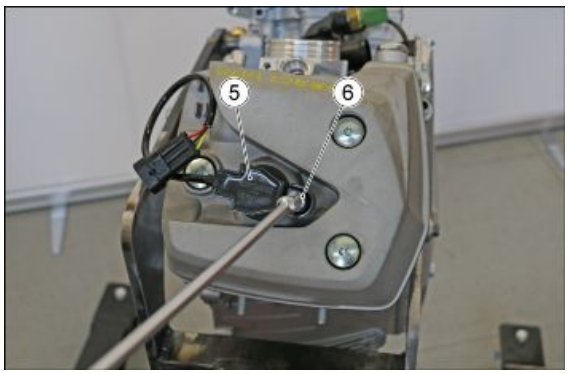


NOTE

CHECK THAT THE SPRING (4) IS PRESENT ON THE TUBE (5), OTHERWISE IT MEANS THAT IT HAS REMAINED IN THE SPARK PLUG HOLE. IN THIS CASE, RETRIEVE IT AND INSTALL IT IN POSITION.



Insert the tube / coil (5) in its seat and tighten the fixing screw (6).

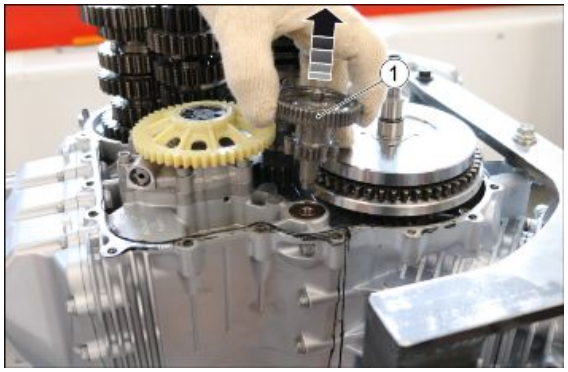


Lubrication

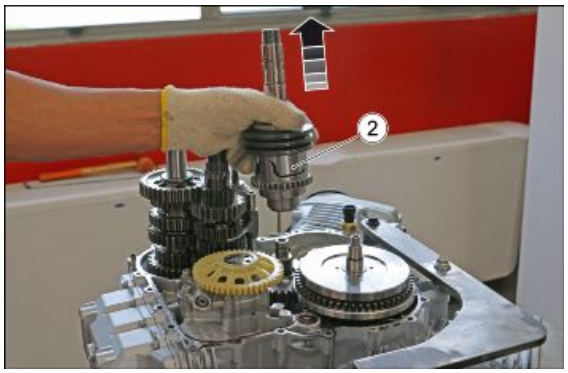
Oil pump

Removing

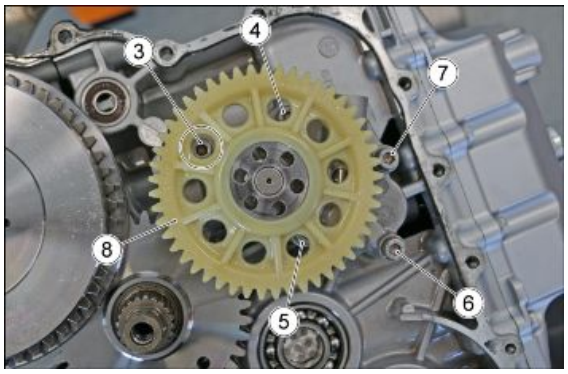
- Open the gearbox housing.
- Remove the starter motor transmission (1).



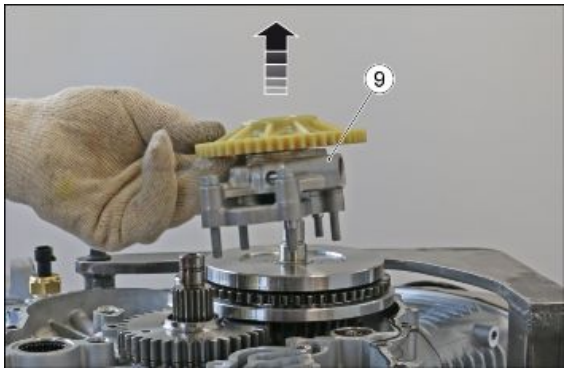
- Remove the clutch shaft (2).



- Remove the five fixing screws of the oil pump, from (3) to (7).
- To remove the screws (3) (4) and (5) turn the toothed wheel (8) until one of the holes matches with the screw in question.



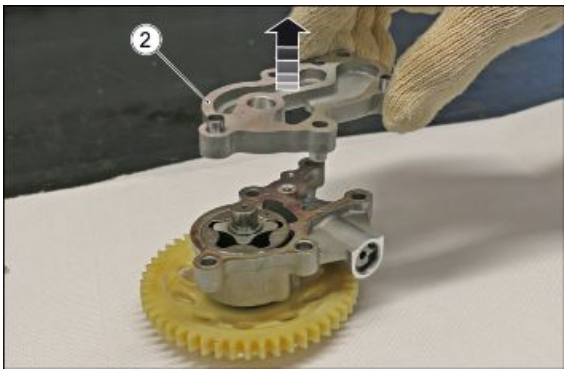
- Remove the oil pump from the crank-case (9).



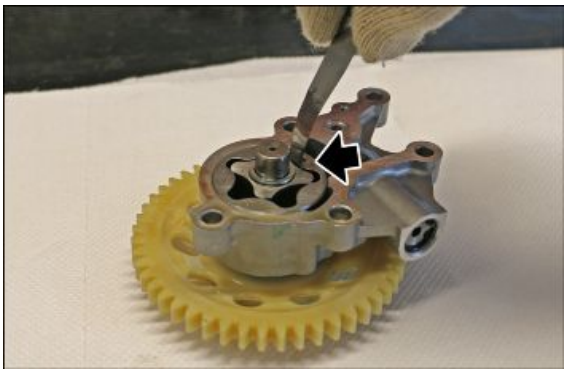
Inspection

- Remove the screw (1).

- Remove the lower body (2) of the pump.



- Using a feeler gauge, measure the clearance between the lobes of the rotors of the pump.

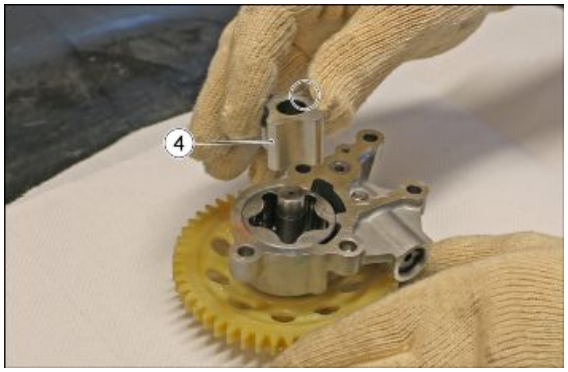


- Remove the seeger ring (3) from the shaft.

- Remove the internal rotor (4).

CAUTION

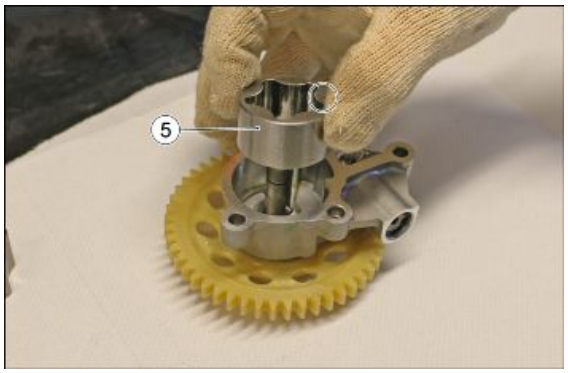
WHEN REASSEMBLING, TURN THE REFERENCE UPWARDS.



- Remove the external rotor (5).

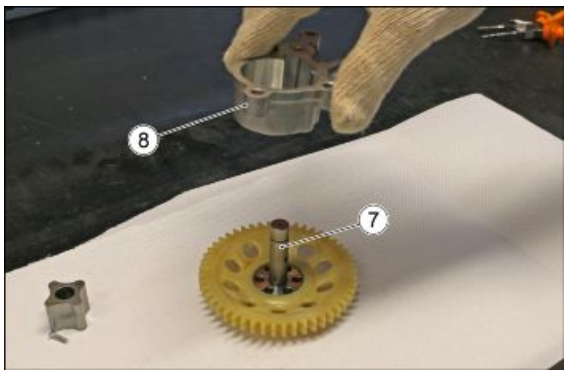
CAUTION

WHEN REASSEMBLING, TURN THE REFERENCE UPWARDS.



- Remove the pin (6) from the shaft.

- Remove the shaft (7), complete with toothed wheel, from the oil pump's body (8).



OIL PUMP BODY

Check that the faces and inner seats of the oil pump body are not scored, damaged or dented.

Pump body specifications:

OIL PUMP BODY

Description	Values
External rotors seat diameter (MAXIMUM WEAR VALUE)	40.675 mm (1.6014 in)
Diameter hole for pump drive shaft (MAXIMUM WEAR VALUE)	15.995 mm (0.6297 in)

EXTERNAL ROTORS

Check that the inner and outer surfaces and the flat faces are not scored, damaged or dented; if they are, replace both rotors of the side in question.

Data of the external rotors:

EXTERNAL ROTOR (ROTOR SIDE)

Description	Values
External diameter (WEAR LIMIT VALUE)	40.54 mm (1.5961 in)
Internal diameter (MAXIMUM WEAR VALUE)	24.23 mm (0.9539 in)
Thickness of seat (MAXIMUM WEAR VALUE)	12.07 mm (0.4752 in)

EXTERNAL ROTOR (CRANKCASE SIDE)

Description	Values
External diameter (WEAR LIMIT VALUE)	40.54 mm (1.5961 in)
Internal diameter (MAXIMUM WEAR VALUE)	24.23 mm (0.9539 in)
Thickness of seat (MAXIMUM WEAR VALUE)	14.07 mm (0.5539 in)

INTERNAL ROTORS

Check that the inner and outer surfaces and the flat faces are not scored, damaged or dented; if they are, replace both rotors of the side in question.

Data of the internal rotors:

INTERNAL ROTOR (ROTOR SIDE)

Description	Values
External diameter (MAXIMUM WEAR VALUE)	29.749 mm (0.1712 in)
Internal diameter (MAXIMUM WEAR VALUE)	12.018 mm (0.4731 in)
Thickness (MINIMUM WEAR VALUE)	11.97 mm (0.4713 in)

INTERNAL ROTOR (CRANKCASE SIDE)

Description	Values
External diameter (MAXIMUM WEAR VALUE)	29.749 mm (0.1712 in)
Internal diameter (MAXIMUM WEAR VALUE)	12.018 mm (0.4731 in)
Thickness (MINIMUM WEAR VALUE)	13.97 mm (0.5500 in)

OIL PUMP DRIVE SHAFT

Check shaft and thread for damage; check the keyway for burrs and make sure the head the runs in the rotor is not damaged; replace the shaft if needed.

Shaft specifications:

OIL PUMP DRIVE SHAFT

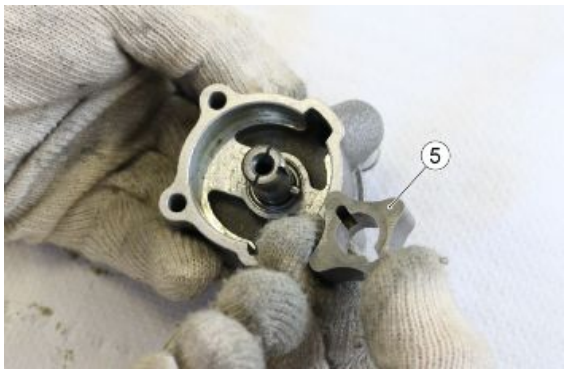
Description	Values
Diameter for pump body seat (MINIMUM WEAR VALUE)	11.989 mm (0.4720 in)
Diameter for roller bearings (MINIMUM WEAR VALUE)	9.991 mm (0.3933 in)

Installing

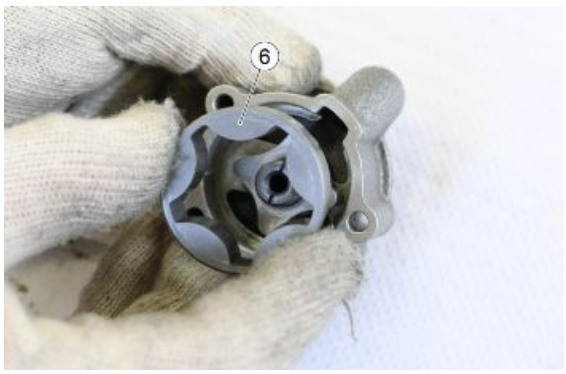
- Working from the rear side of the oil pump, insert the pump drive shaft (1) the internal rotor (2) and the external rotor (3).

- Working from the front of the oil pump, insert the internal rotor retaining pin (4).

- Insert the internal rotor (5) paying attention that the pin enters the machining seat.

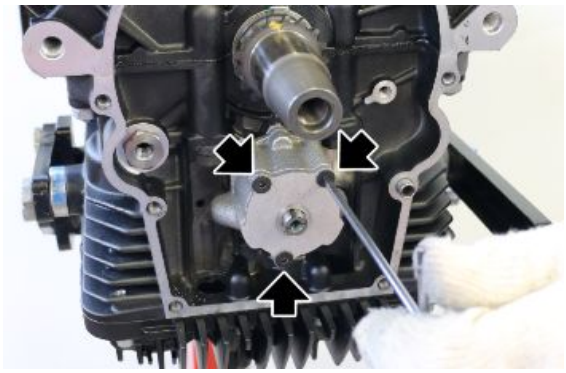


- Insert the external rotor (6) paying attention to the punch mark that must be facing outwards.



- After inserting the cover, position the complete oil pump in place.

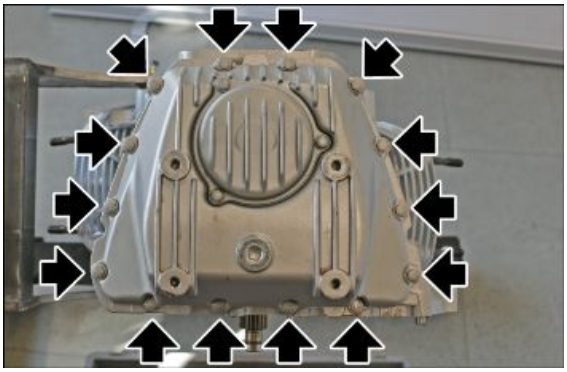
- Insert the three oil pump retaining screws and tighten them to the pre-defined tightening torque.



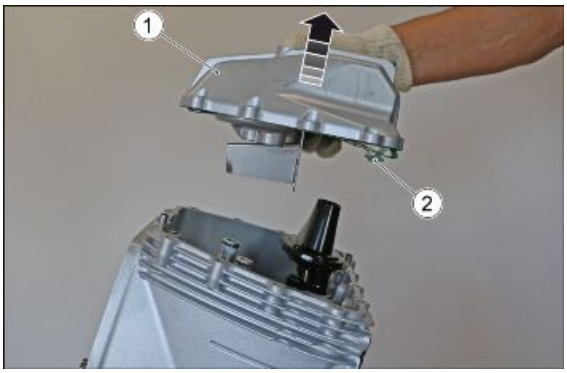
Oil sump

Removing the oil sump

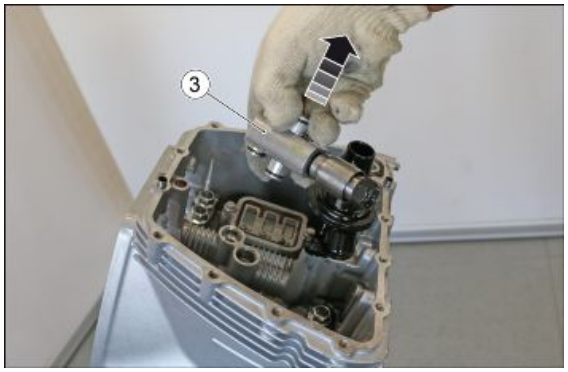
- Remove the fixing screws of the oil sump.



- Remove the oil sump (1) and the relevant gasket (2) from the engine. If the removal is difficult, lightly tap the oil sump with a Teflon hammer.

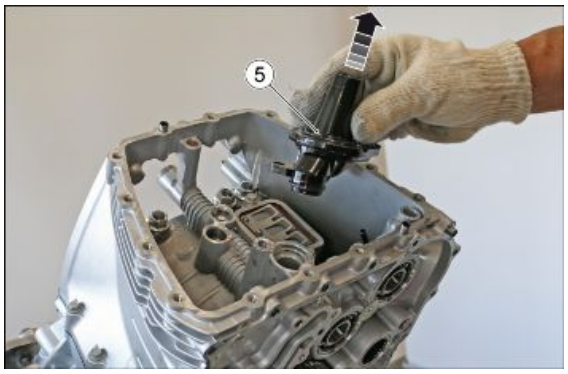


- Remove the assembly of the overpressure valve (3) by sliding it upward.

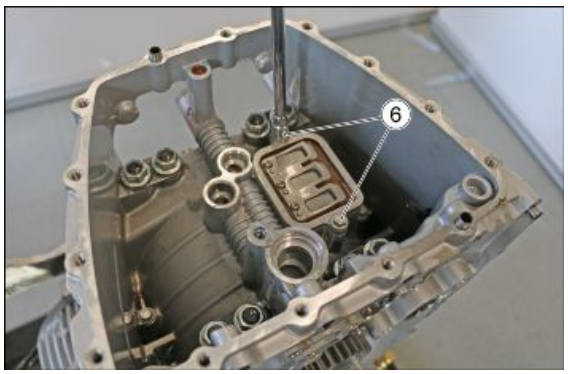


- Remove the fixing screw (4) of the rose pipe.

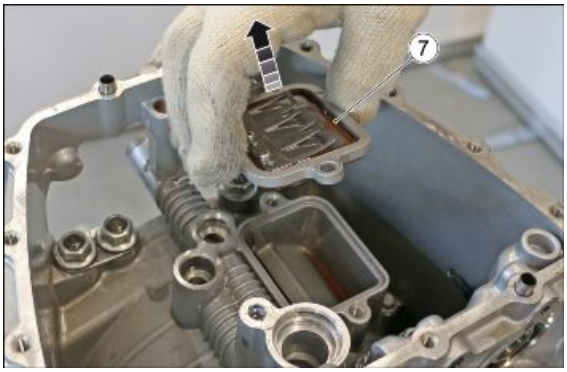
- Remove the rose pipe (5) from the engine.



- Remove the fixing screws (6).



- Remove the one-way reed valve (7) from the engine.



Refitting the oil sump

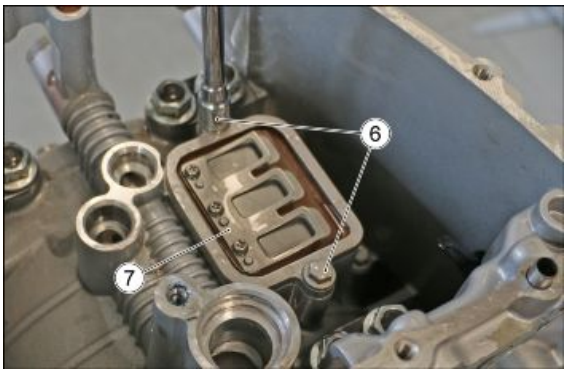
- Install the one-way reed valve (7) in the corresponding seat and tighten the fixing screws (6) to the prescribed torque.

NOTE

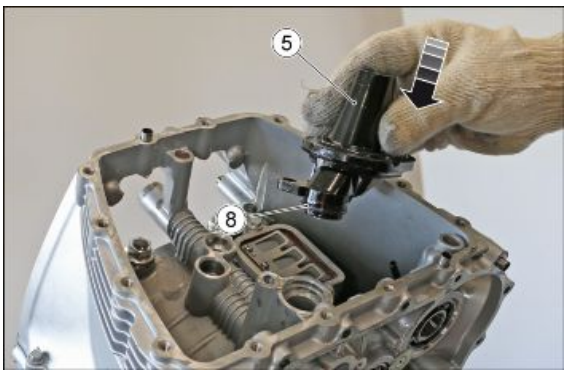
AS THE CONNECTION RADIUS IS SMALLER THAN THE OTHER THREE, THE MOUNTING POSITION OF THE VALVE MUST OBSERVE THE ANGLE SHOWN IN THE FIGURE.

Locking torques (N*m)

Reed valve fixing screw 11 - 13 Nm (8.11 - 9.59 lb ft)

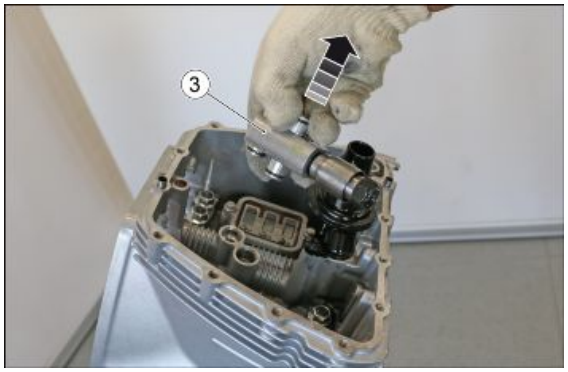


- Install the rose pipe (5) in its housing.
- Check that the O-ring (8) is in good state, otherwise replace it.

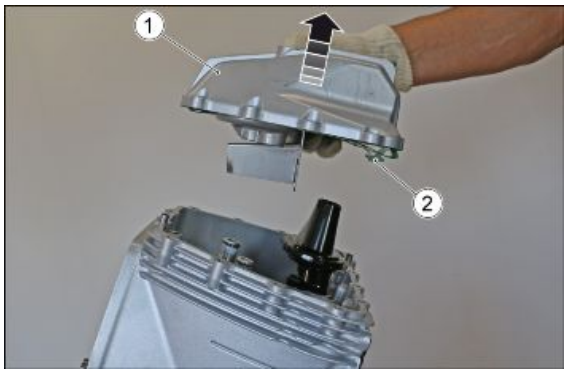


- Tighten the fixing screw (4).

- Install the assembly of the overpressure valve (3), making sure that the related O-ring are in good state; otherwise, replace them.



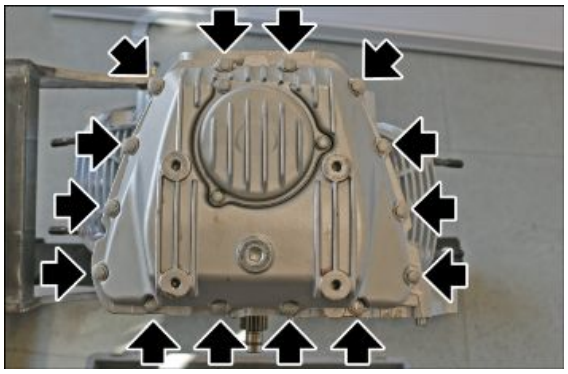
- Install a new gasket (2) and fit the oil sump (1) on the engine.



- Tighten the fixing screws of the oil sump to the prescribed torque.

Locking torques (N*m)

Oil sump fixing screw **11 - 13 Nm (8.11 - 9.59 lb ft)**



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