SERVICE STATION MANUAL

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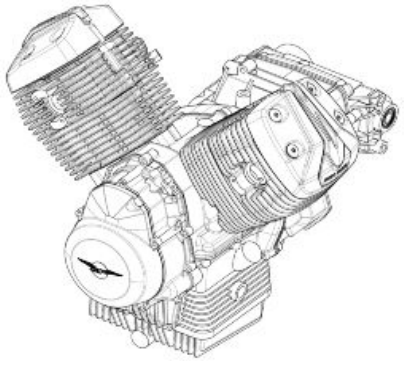

Engine V9 IE MIU G3

SERVICE STATION MANUAL

Engine V9 IE MIU G3

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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SERVICE STATION MANUAL
Engine V9 IE MIU G3

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 scooters. 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, Moto Guzzi 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.

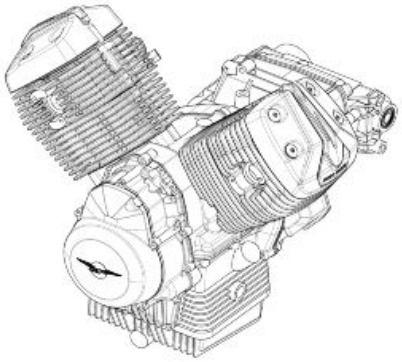
CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

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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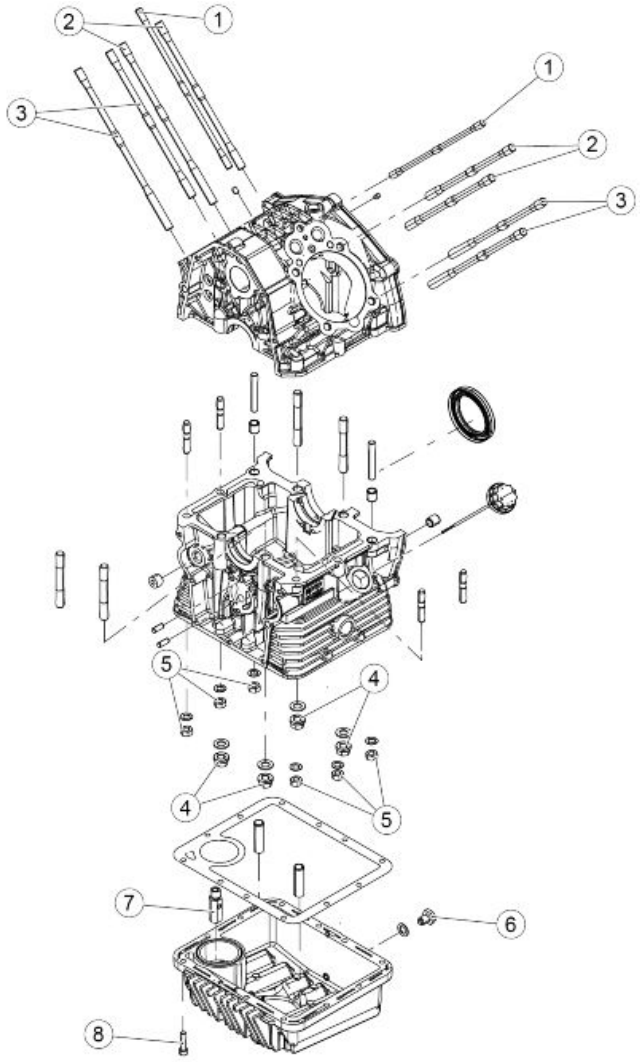
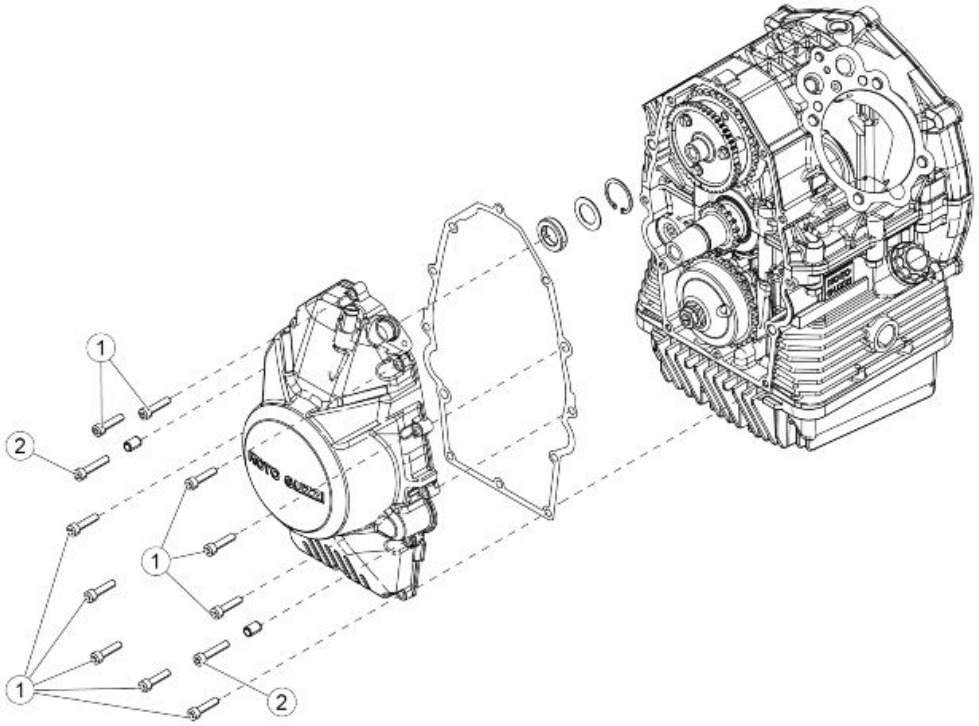
Tightening Torques

Engine



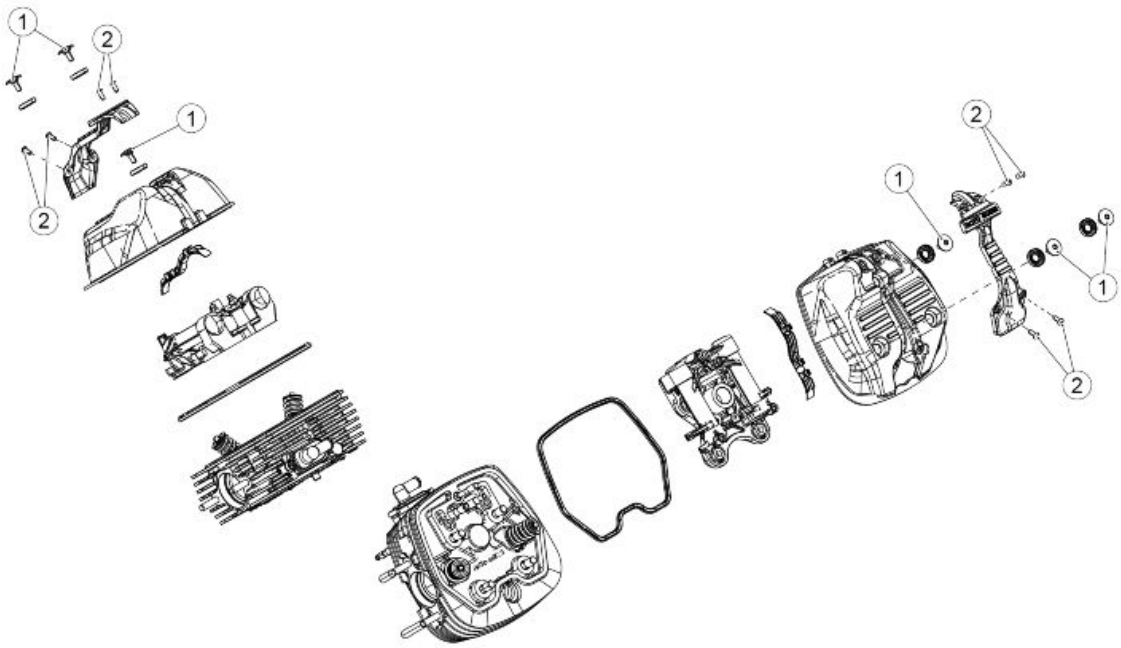
CRANKCASE

pos.	Description	Type	Quantity	Torque	Notes
1	Central stud bolt	M8	2	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
2	Short stud bolt	M10	4	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
3	Long stud bolt	M10	4	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
4	Nut (pre-tightening)	M10	4	24-26 Nm (17.70-19.18 lb ft)	-
4	Nut (tightening)	M10	4	44-49 Nm (32.45-36.14 lb ft)	-
5	Nut	M8	6	22-25 Nm (16.23-18.44 lb ft)	-
6	Oil drainage plug	M10	1	20-22 Nm (14.75-16.23 lb ft)	-
7	Oil filter joint	M12	1	20-24 Nm (14.75-17.70 lb ft)	-
8	Oil sump screws	M6	12	9-11 Nm (6.64-8.11 lbf ft)	-



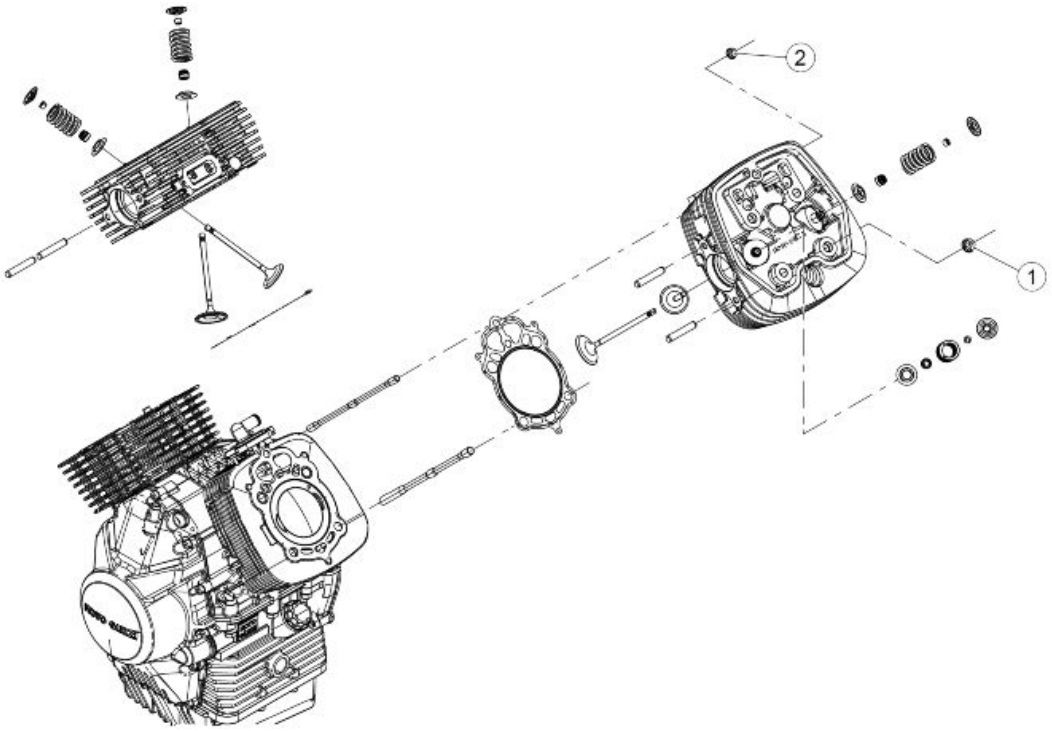
TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	SHC screw	M6	10	9-11 Nm (6.64-8.11 lbf ft)	-
2	SHC screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-
-	Timing sensor screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-



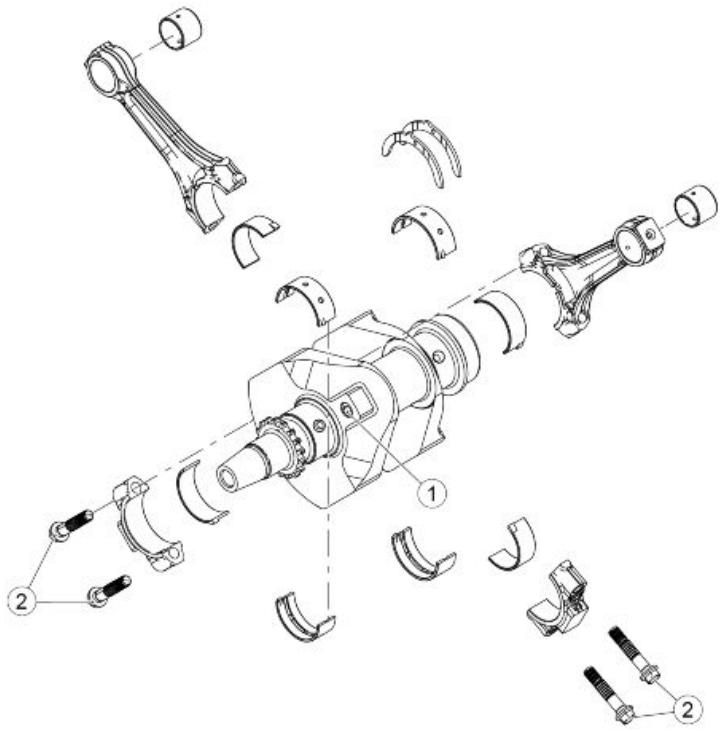
HEADS COVERS

pos.	Description	Type	Quantity	Torque	Notes
1	Head covers fixing screws	M6	6	7-9 Nm (5.16-6.64 lb ft)	-
2	Spark plugs cover TBEI fixing screws	M5x12	8	6-8 Nm (4.42-5.90 lb ft)	-



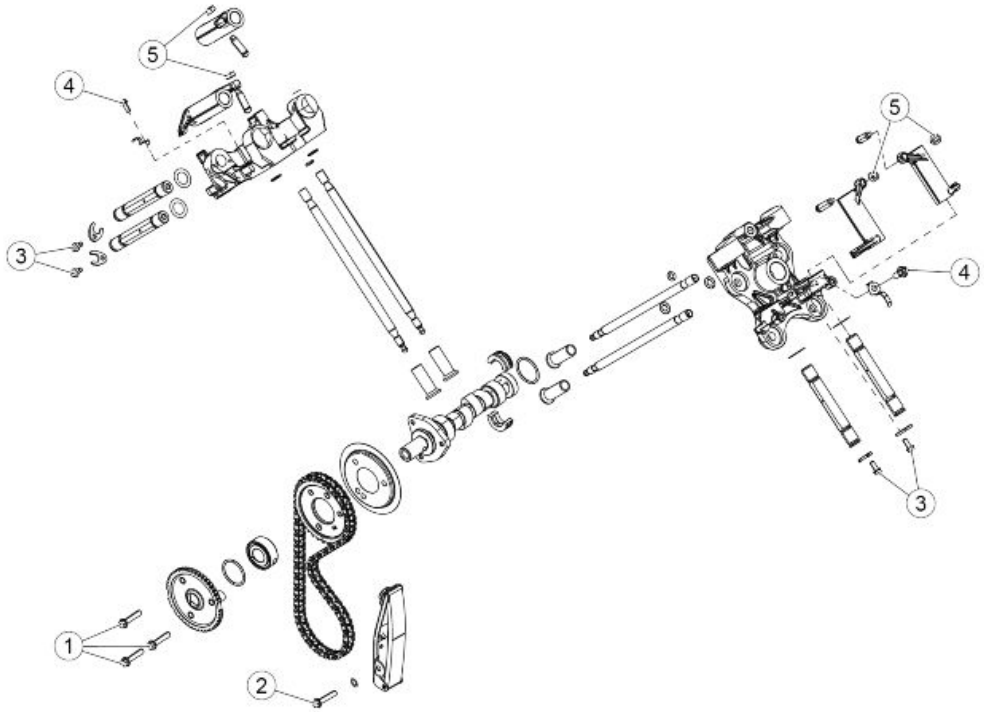
HEADS

pos.	Description	Type	Quantity	Torque	Notes
1	Cylinder-head fixing nut (pre-tightening)	M10x1.25	8	15 Nm (11.06 lb ft)	-
1	Cylinder-head fixing nut (tightening)	M10x1.25	8	26-34 Nm (19.18-25.08 lb ft)	-
2	Cylinder-head fixing nut (pre-tightening)	M8x1.25	2	10 Nm (7.38 lb ft)	-
2	Cylinder-head fixing nut (tightening)	M8x1.25	2	15-19 Nm (11.06-14.01 lb ft)	-



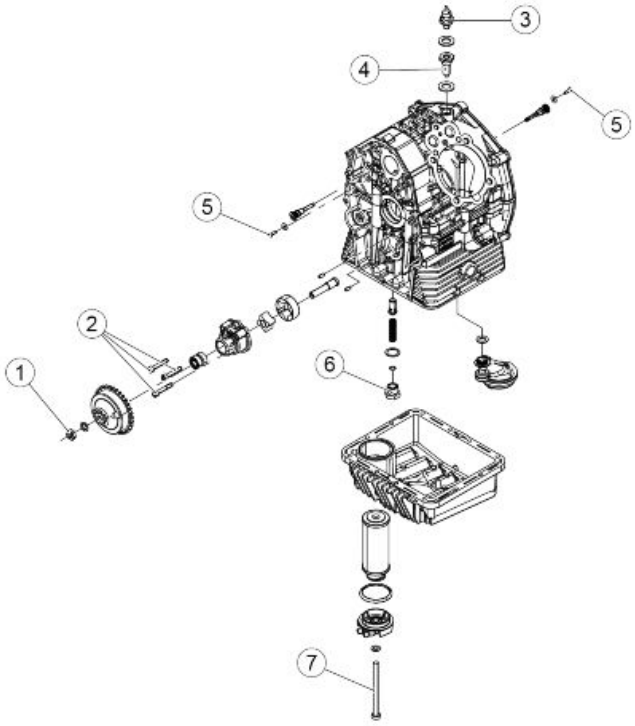
CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Oil plug	M12x1.25	1	15-18 Nm (11.06-13.28 lb ft)	Loct. 648
2	Connecting rod screws - Pre-tightening	M8x1	4	10 Nm (7.38 lb ft)	-
2	Connecting rod screws - Tightening	M8x1	4	34-41 Nm (25.08-30.24 lbf ft) (angle 45°)	-



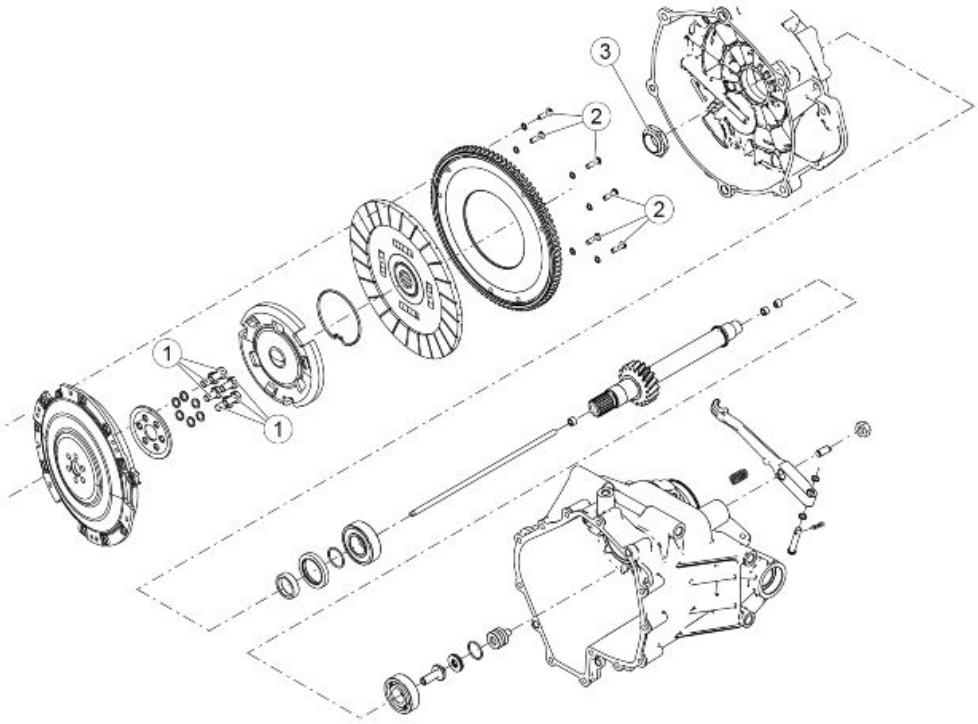
TIMING SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Tone wheel fixing screw	M6	3	12-14 Nm (8.85-10.33 lb ft)	Loct. DRI 2045
2	Chain tensioner fastener screw	M6	1	9-11 Nm (6.64-8.11 lbf ft)	-
3	Rocker pins locking fork screw	M.	4	.. Nm (.. lb ft)	-
4	Ground plate fixing screw	M.	2	.. Nm (.. lb ft)	-
5	Tappet adjuster screw	M8	4	8-10 Nm (5.90-7.38 lb ft)	-



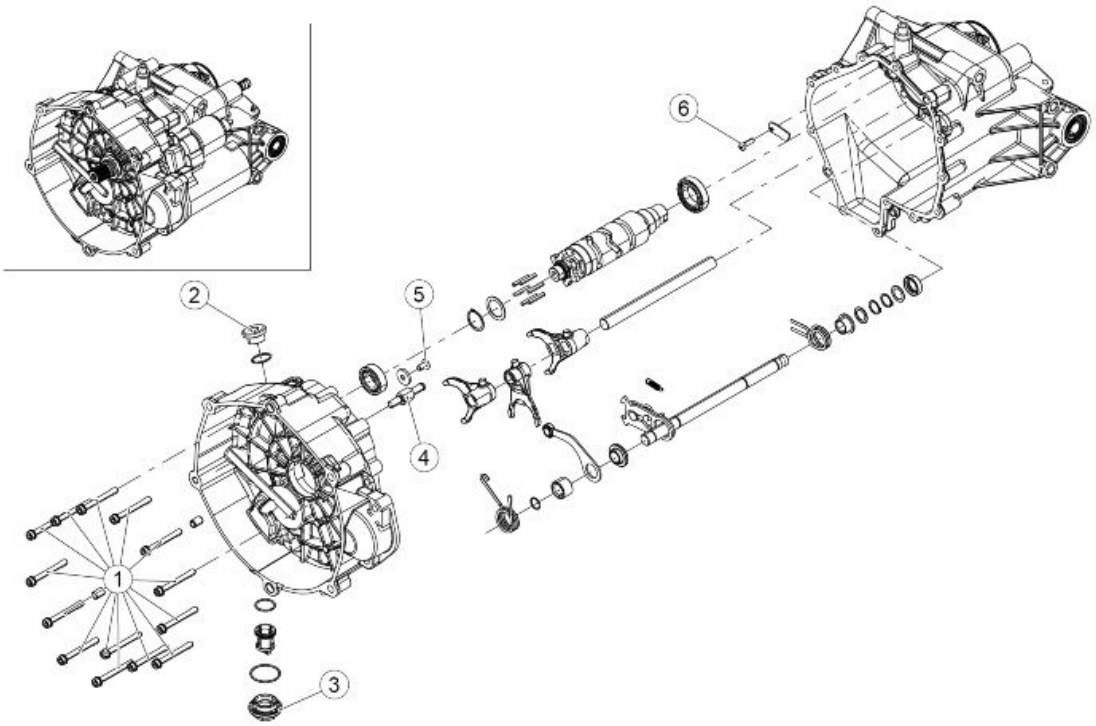
LUBRICATION

pos.	Description	Type	Quantity	Torque	Notes
1	Oil pump gear fastener nut	M10x1.25	1	24-27 Nm (17.70-19.91 lb ft)	Loct. 243
2	Oil pump fixing SHC screw	M6x35	3	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
3	Oil pressure sensor	M10x1	1	30-33 Nm (22.13-24.34 lb ft)	-
4	Oil pressure sensor housing screw	M12x1.5	1	25-28 Nm (18.44-20.65 lb ft)	-
5	Cooling jets fixing torx screws	M4	2	2.8-3.4 Nm (2.06-2.51 lb ft)	Loct. DRI 2045
6	Oil pressure valve cap	M18x1.5	1	20-25 Nm (14.75-18.44 lb ft)	-
7	Cover fixing rod bolt and oil filter cartridge	M8	1	18-22 Nm (13.28-16.23 lb ft)	-



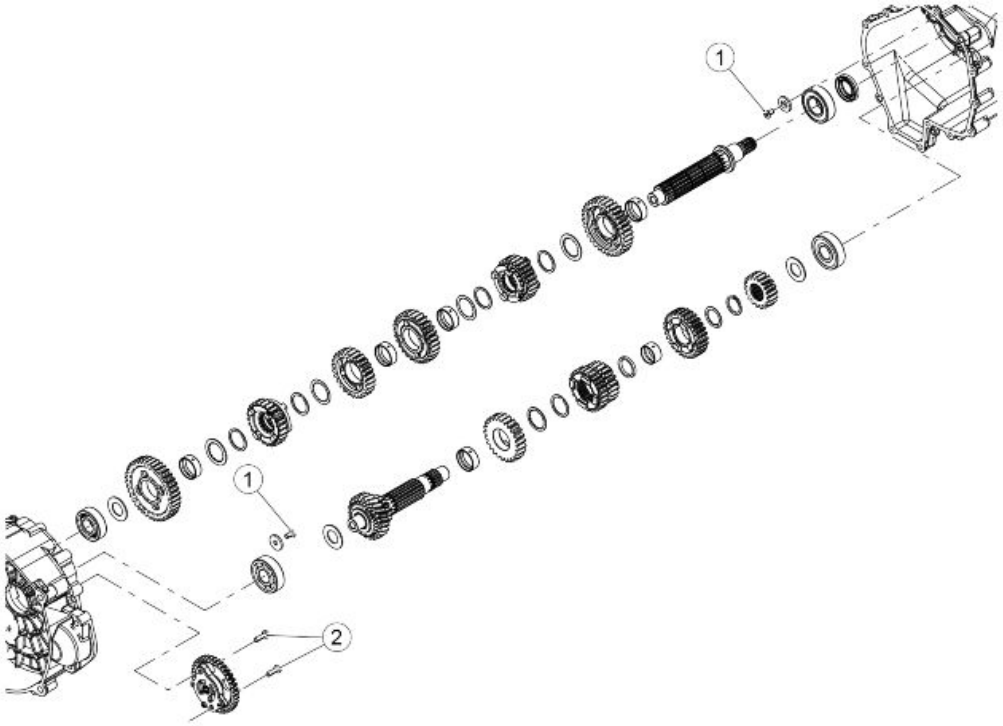
CLUTCH

pos.	Description	Type	Quantity	Torque	Notes
1	Flywheel screws	-	6	.. Nm (.. lb ft)	-
2	Starter sprocket fixing torx screws	M6x20	6	9-11 Nm (6.64-8.11 lbf ft)	Loct. 243
3	Clutch shaft fixing nut	M25z1.5	1	95-105 Nm (70.07-77.44 lb ft)	Loct. 243



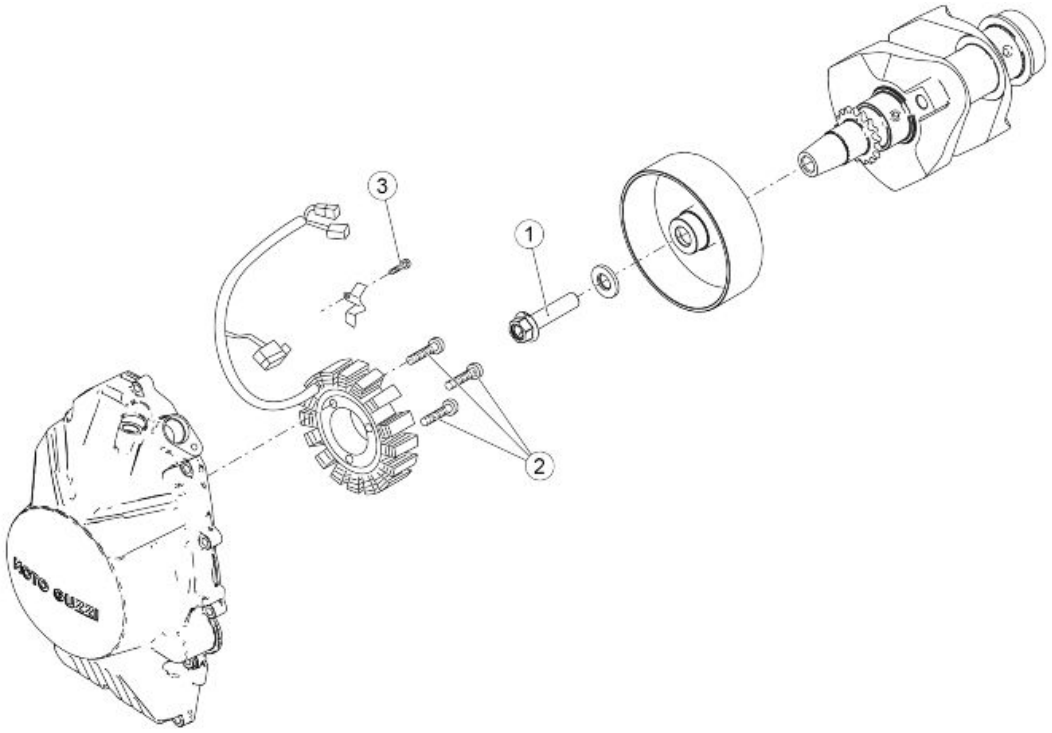
COMPLETE GEAR - SELECTOR - DESMODROMIC

pos.	Description	Type	Quantity	Torque	Notes
1	Gearbox fixing SHC screws	M6x55	14	9-11 Nm (6.64-8.11 lbf ft)	-
2	Oil load cap	M20x1.5	1	23-27 Nm (16.96-19.91 lb ft)	-
3	Oil filter cap	M28x1	1	25-30 Nm (18.44-22.13 lb ft)	-
4	Pre-selector pin	M8	1	18-22 Nm (18.28-16.23 lb ft)	Loct. DRI 2040
5	Washers fixing countersunk head screws	M6x12	5	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
6	Plate fixing torx screw	M5x16	1	6-7 Nm (4.42-5.16 lb ft)	Loct. DRI 2045



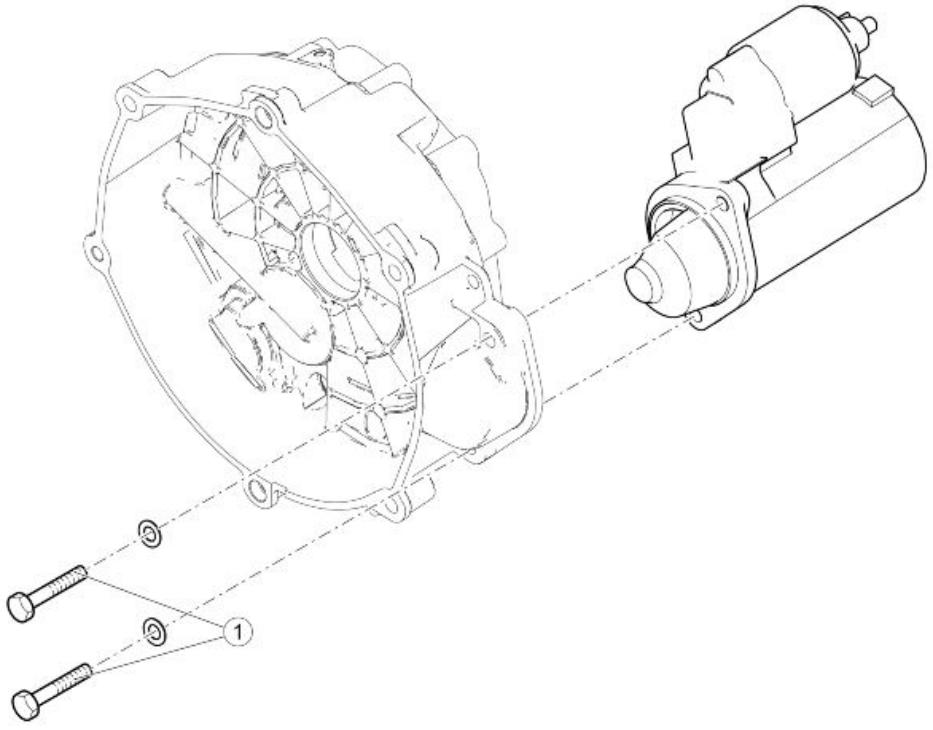
GEARBOX - GEAR

pos.	Description	Type	Quantity	Torque	Notes
1	Washers fixing countersunk head screws	M6x12	5	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
2	Oil pump fixing torx screws	M5x16	2	6-7 Nm (4.42-5.16 lb ft)	Loct. DRI 2045



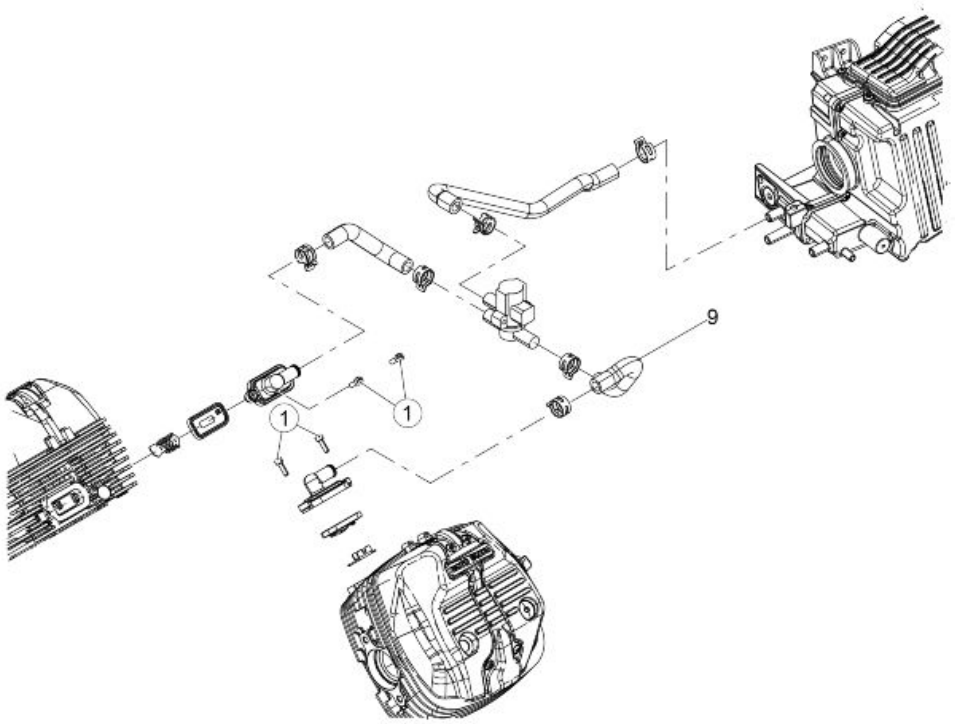
ALTERNATOR

pos.	Description	Type	Quantity	Torque	Notes
1	Magnet flywheel fixing flanged TE screw	M12-1.25x50	1	100 Nm (73.76 lb ft)	-
2	Stator fixing recessed SHC screws	M6x35	3	9-11 Nm (6.64-8.11 lbf ft)	Loct. 243
3	Cable grommet plat fixing fanged TE screw	M5x12	1	5-6 Nm (3.69-4.42 lb ft)	Loct. 243



STARTER MOTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor SHC fastener screw	-	2	... Nm (... lbf ft)	-



SECONDARY AIR SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Red valve cover fixing SHC screws	M5x16	4	3-4 Nm (2.21-2.95 lb ft)	-

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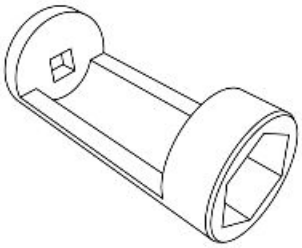
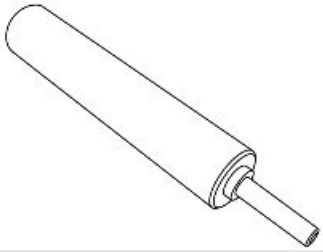
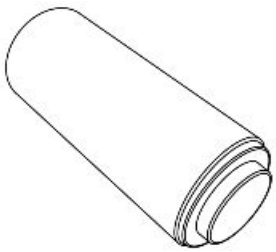
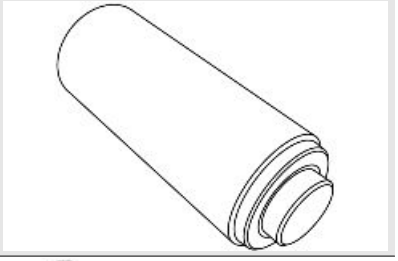
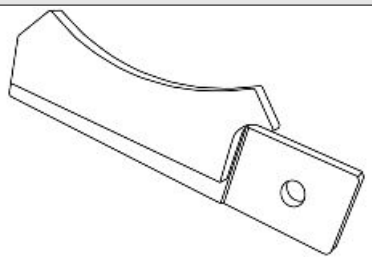
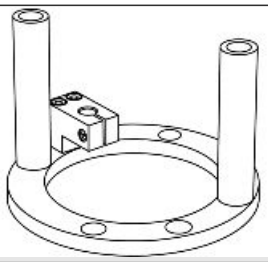
SPECIAL TOOLS

Stores code	Description	
020382Y	Tool to extract valve cotters	
020847Y	Flywheel extractor	
020975Y	Clutch shaft nut key	
19.90.71.60	Clutch shaft locking equipment	
020976Y	Punch for fitting the clutch control dust seal	
020977Y	Punch for refitting the clutch shaft oil seal	

Stores code	Description	
020978Y	Punch for drive shaft secondary oil gaiter refitting	
021001Y	Clutch lock	
020996Y	Piston projection measuring tool	
020995Y	rocker centring pin	
020128Y	Piston assembly band	

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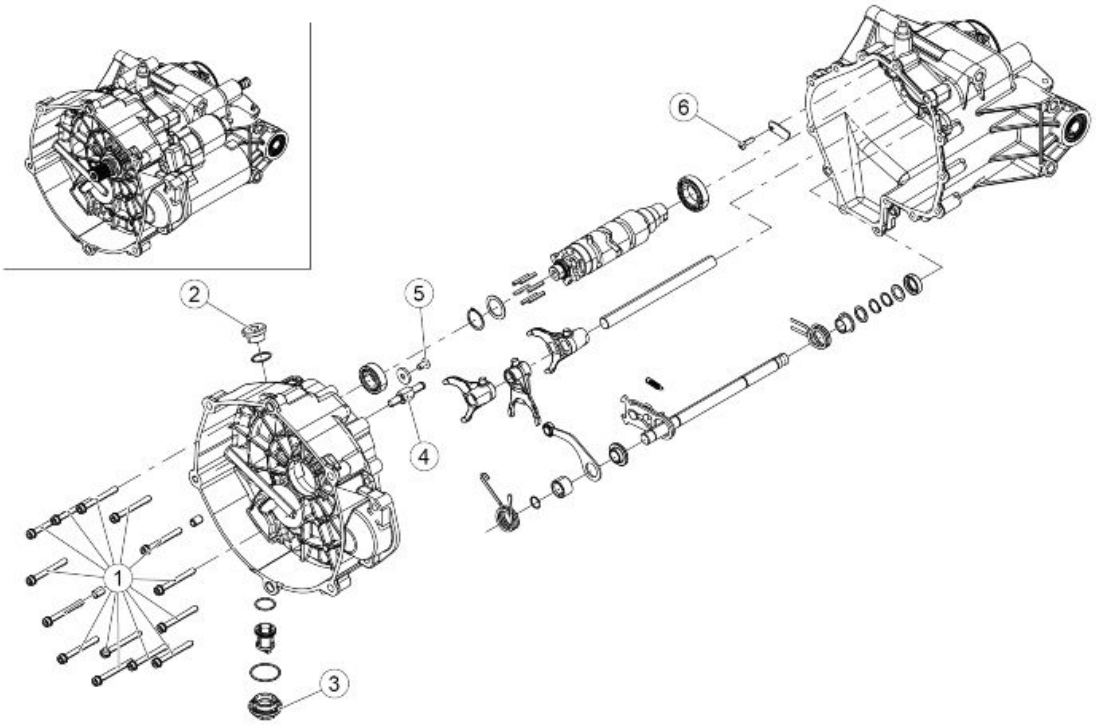
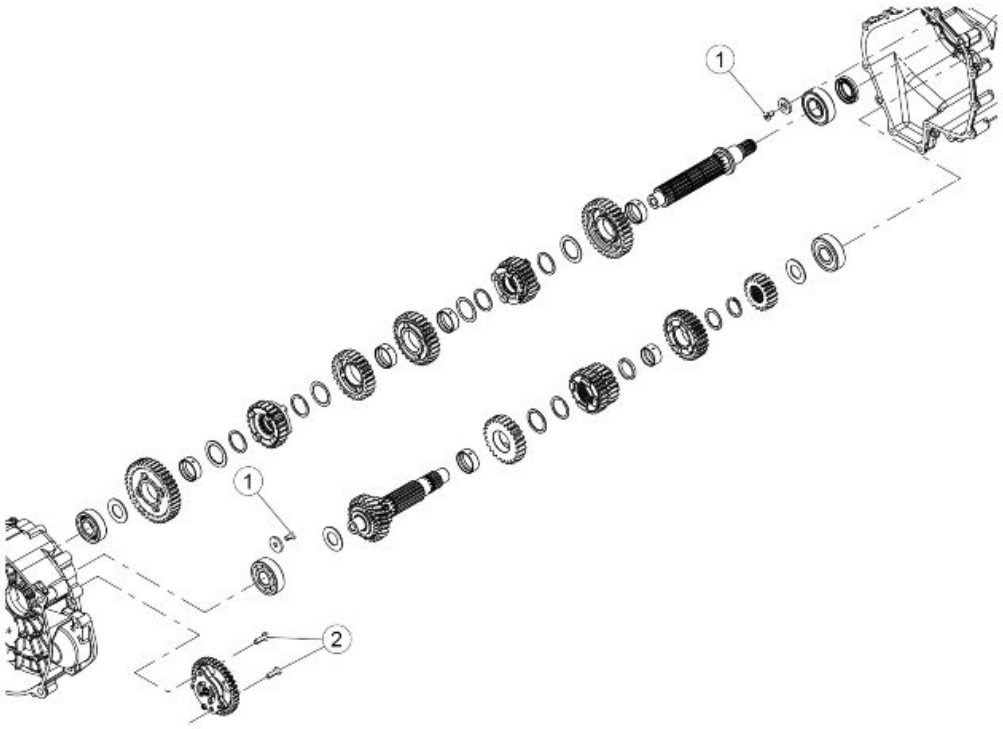
Gearbox



COMPLETE GEAR - SELECTOR - DESMODROMIC

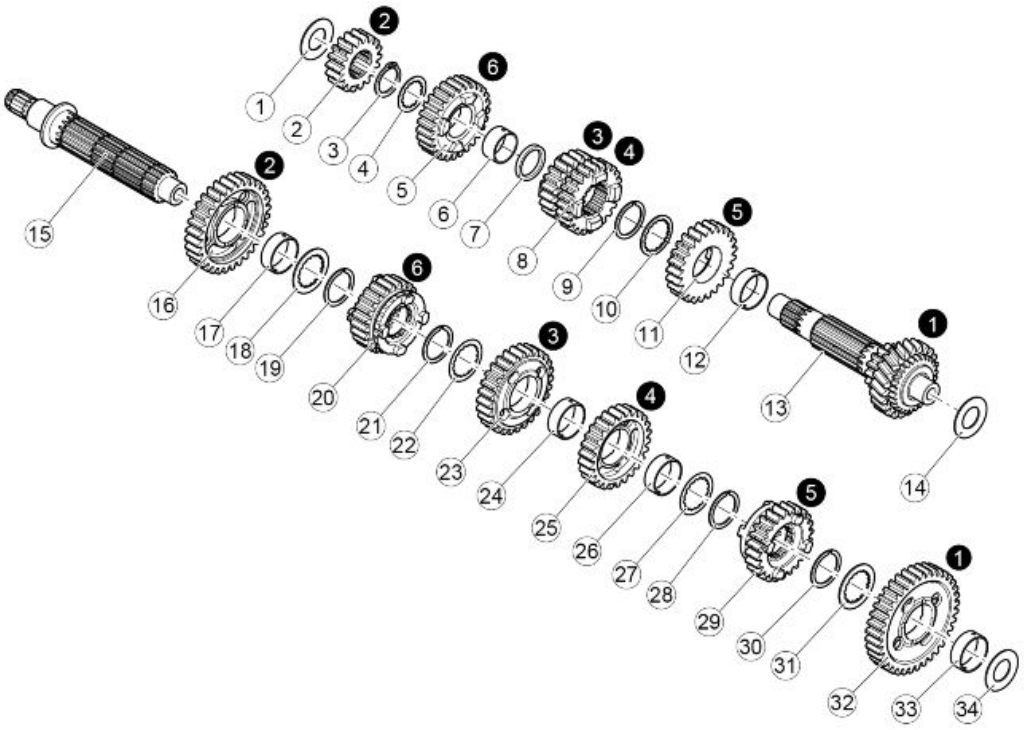
pos.	Description	Type	Quantity	Torque	Notes
1	Gearbox fixing SHC screws	M6x55	14	9-11 Nm (6.64-8.11 lbf ft)	-
2	Oil load cap	M20x1.5	1	23-27 Nm (16.96-19.91 lb ft)	-
3	Oil filter cap	M28x1	1	25-30 Nm (18.44-22.13 lb ft)	-
4	Pre-selector pin	M8	1	18-22 Nm (18.28-16.23 lb ft)	Loct. DRI 2040
5	Washers fixing countersunk head screws	M6x12	5	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
6	Plate fixing torx screw	M5x16	1	6-7 Nm (4.42-5.16 lb ft)	Loct. DRI 2045



GEARBOX - GEAR

pos.	Description	Type	Quantity	Torque	Notes
1	Washers fixing countersunk head screws	M6x12	5	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
2	Oil pump fixing torx screws	M5x16	2	6-7 Nm (4.42-5.16 lb ft)	Loct. DRI 2045

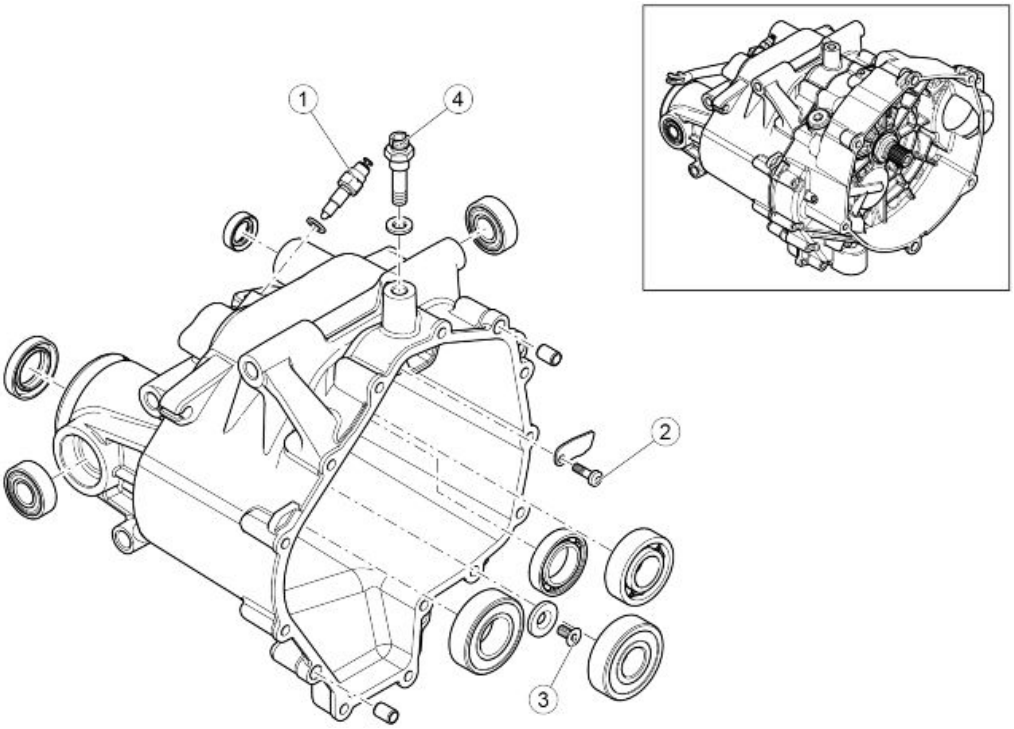
Diagram



key:

1. Thrust washer
2. 2nd speed gear on main shaft
3. Circlip
4. Thrust washer
5. 6th speed gear on main shaft
6. Floating bushing
7. Main shaft thrust washer
8. 3rd and 4th speed sliding gear on main shaft
9. Circlip for the shaft
10. Thrust washer
11. 5th speed gear on main shaft
12. Floating bushing
13. Main shaft with PI
14. Thrust washer
15. Transmission shaft
16. 2nd speed gear on transmission shaft
17. Floating bushing
18. Thrust washer
19. Circlip for the shaft
20. 6th speed gear on transmission shaft
21. Circlip for the shaft
22. Thrust washer
23. 3rd speed gear on transmission shaft
24. Floating bushing
25. 4th speed gear on transmission shaft
26. Floating bushing
27. Thrust washer
28. Circlip for the shaft
29. 5th speed gear on transmission shaft
30. Circlip for the shaft
31. Thrust washer
32. 1st speed gear on transmission shaft
33. Floating bushing
34. Thrust washer

Gearbox

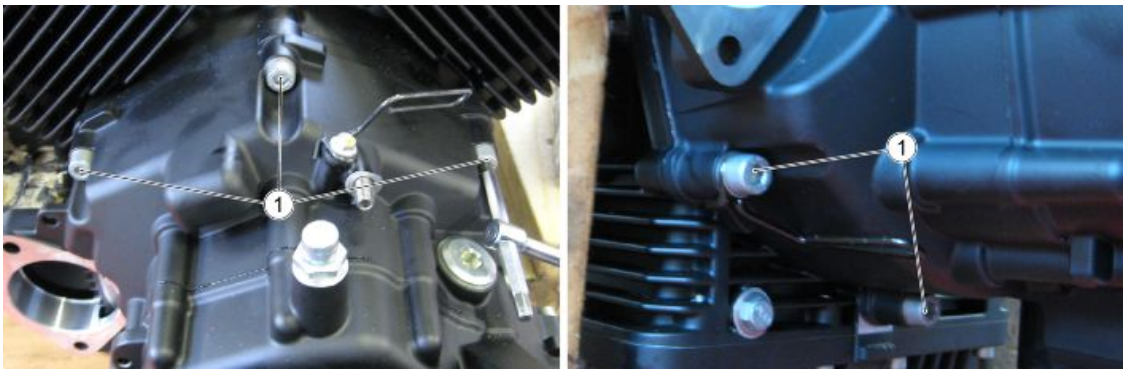


GEARBOX

pos.	Description	Type	Quantity	Torque	Notes
1	Neutral sensor	-	1	10 Nm (7.38 lb ft)	-
2	Plate fixing screw	Torx M5x16	1	4 Nm (2.95 lb ft)	Loct. 243
3	Bearing block washers fixing screw	TSEI	1	10 Nm (7.38 lb ft)	Loct. 243
4	Breather cap	-	1	20 Nm (14.75 lb ft)	-

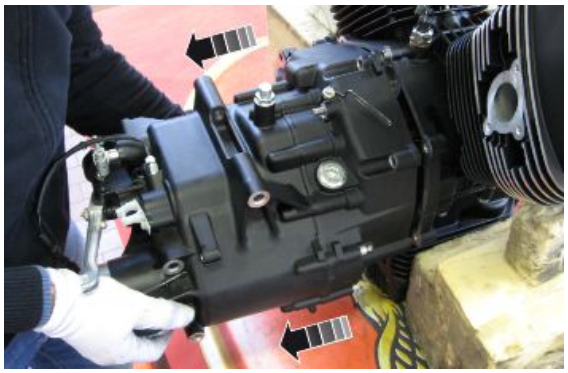
Removing the gearbox

- Remove the 5 screws (1) fixing the gearbox to the engine crankcase



- Remove the fixing screw (2) of the gearbox, placed from the engine crankcase side

- Remove the complete gearbox screw



Filtro olio

- Place a container with 500 cm³ (30.51 cu in) capacity under the drainage plugs (1), remove it and then let the oil drop in the container for some minutes

NOTE

CHECK AND IF NECESSARY, REPLACE THE SEALING WASHER OF DRAINAGE PLUG

- Remove the gear oil filter (2) and thoroughly clean it before refitting it

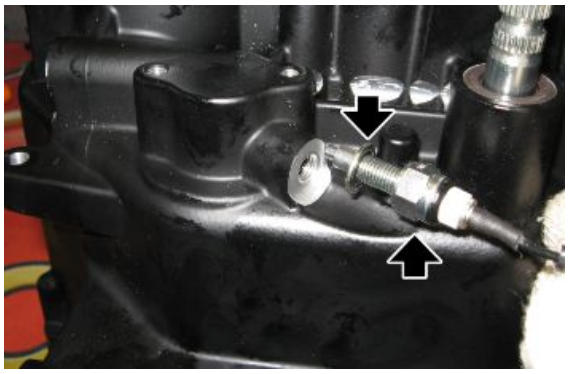
Gearbox shafts

Disassembling the gearbox

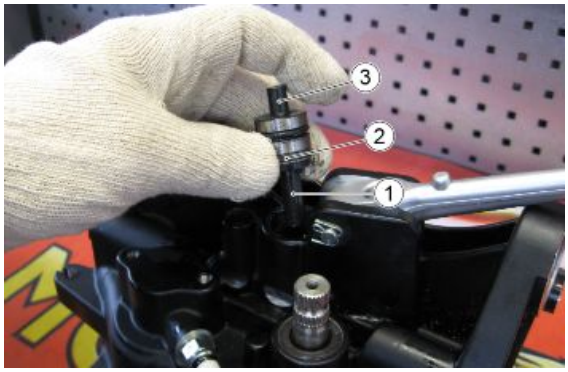
- Remove the 14 fixing screws of the gearbox

- Remove the pusher plate

- Remove the neutral sensor and take the gasket washer



- Remove the intermediary body (1), the thrust bearing (2) and the external body (3)

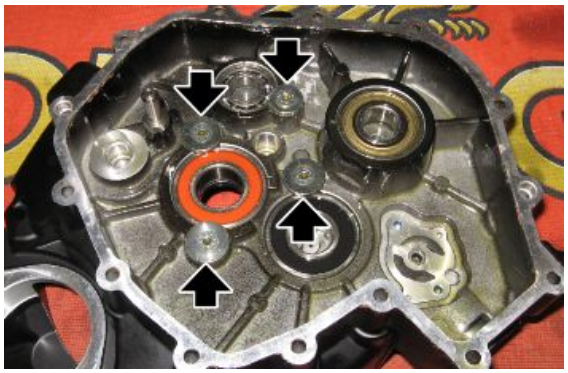


- Remove the gearbox cover with a few mallet strokes

- To remove the bearings fitted in the gearbox crankcases, the safety washer must be removed first

CAUTION

PAY ATTENTION WHEN REMOVING THE BEARING SAFETY WASHERS, THEY HAVE TWO DIFFERENT SIZES. THE SMALL WASHERS MAY BE PLACED ERRONEOUSLY INSTEAD OF THE ONES WITH LARGER SIZE



- The bearings from the gearbox crankcases can be removed using generic extractors.

- Remove the drive shaft secondary oil gaiter

CAUTION

IN CASE OF OIL SEAL REPLACEMENT, USE THE SUITABLE PUNCH UNTIL IT REACHES THE CRANKCASE

Specific tooling

020978Y Punch for drive shaft secondary oil gaiter refitting

Removing the primary shaft

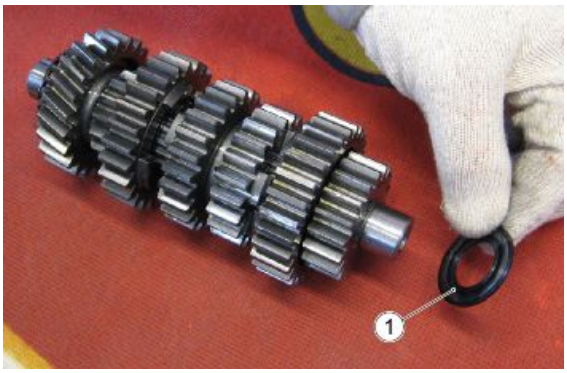
CAUTION

REPLACE THE SEEGER RINGS DURING REFITTING

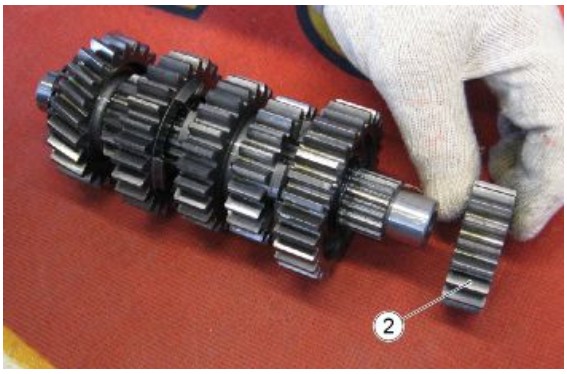
- Remove the gear selector shaft, the desmodromic shaft and the forks with shaft
- Remove the complete gear unit

To dismantle the main shaft, proceed as follows:

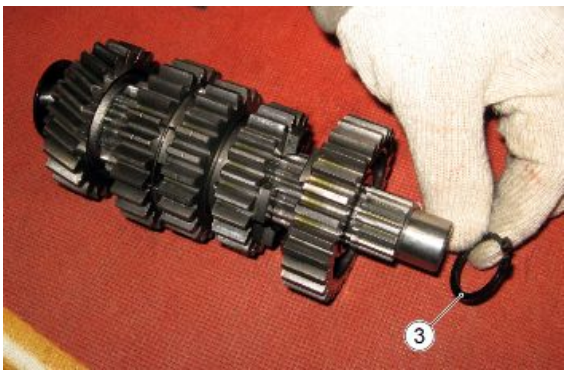
- Remove the shim washer (1)



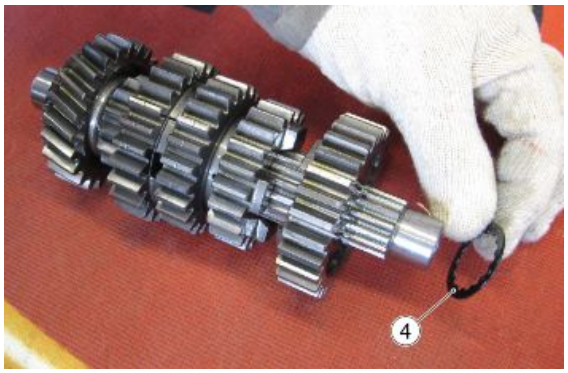
- Remove the gear of the 2nd gear (2)



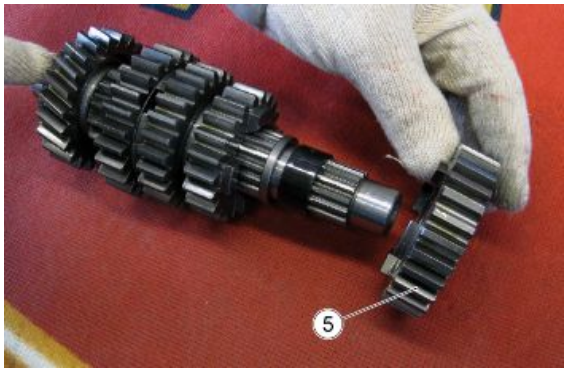
- Remove the seeger ring (3)



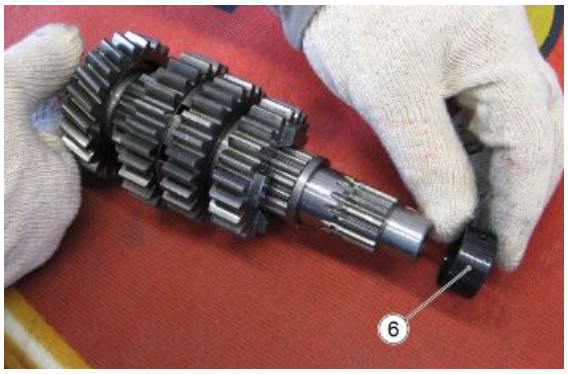
- Remove the spacer (4)



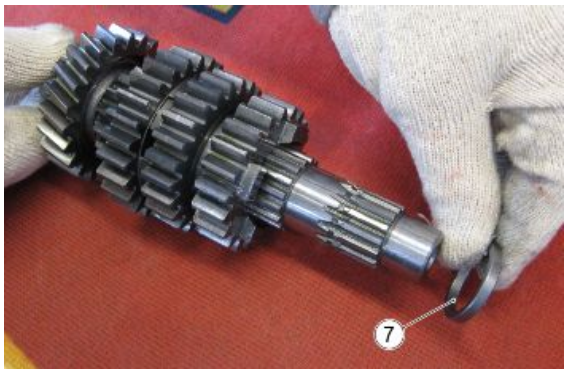
- Remove the gear of the 6th gear (5)



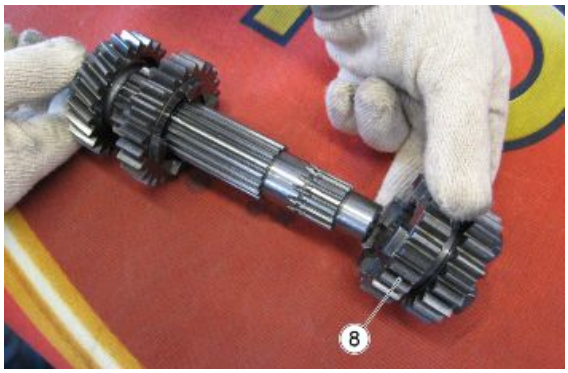
- Remove the bushing (6)



- Remove the spacer (7)

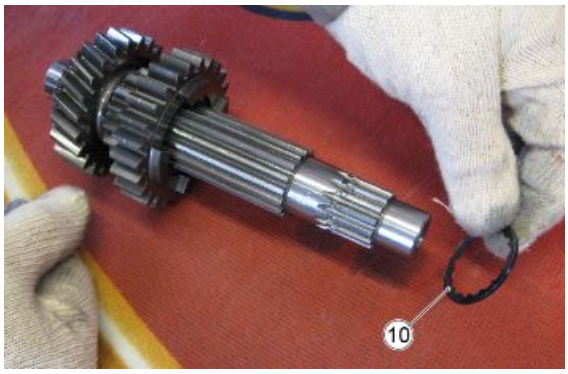


- Remove the gear of the 3-4th gear (8)



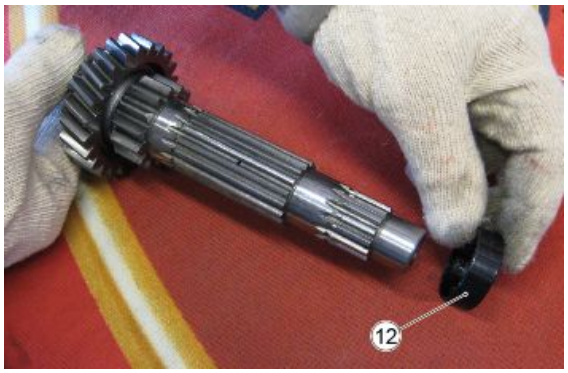
- Remove the seeger ring (9)

- Remove the spacer (10)



- Remove the gear of the 5th gear (11)

- Remove the bushing (12)



- Remove the washer (13) from the main shaft (14)

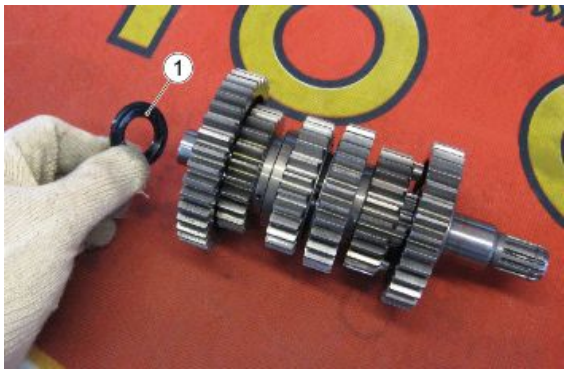
Removing the secondary shaft

CAUTION

REPLACE THE SEEGER RINGS DURING REFITTING

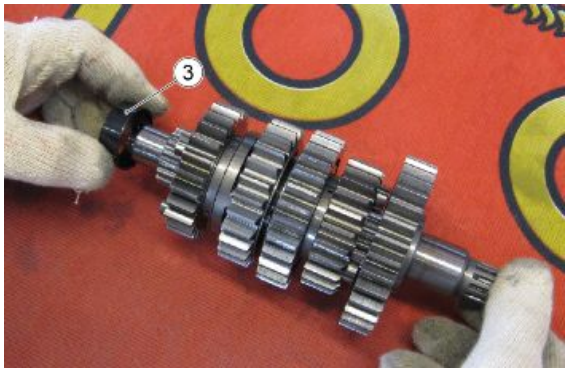
To dismantle the transmission shaft, proceed as follows:

- Remove the shim washer (1)

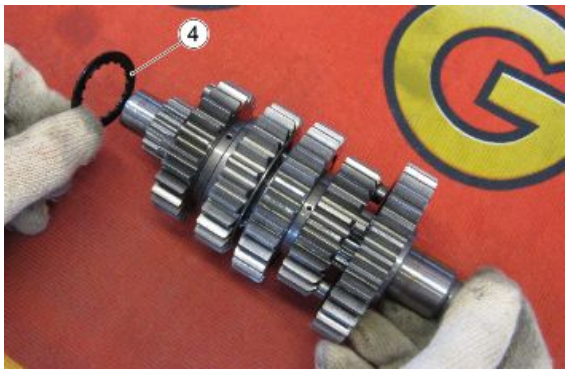


- Remove the gear of the first gear (2)

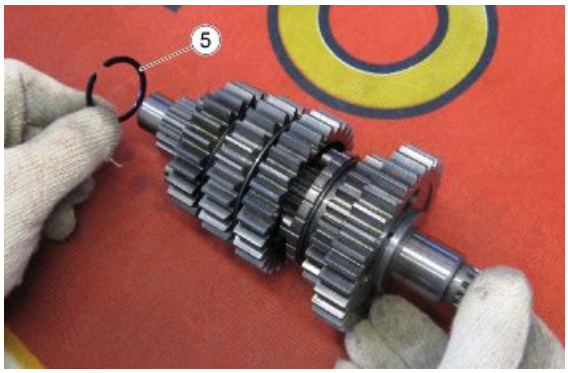
- Remove the bushing (3)



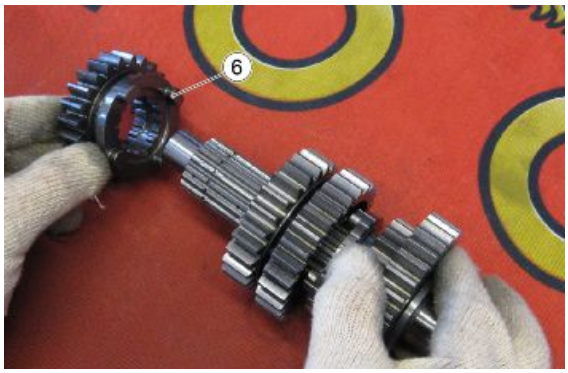
- Remove the shim washer (4)



- Remove the seeger ring (5)



- Remove the gear of the 5th gear (6)

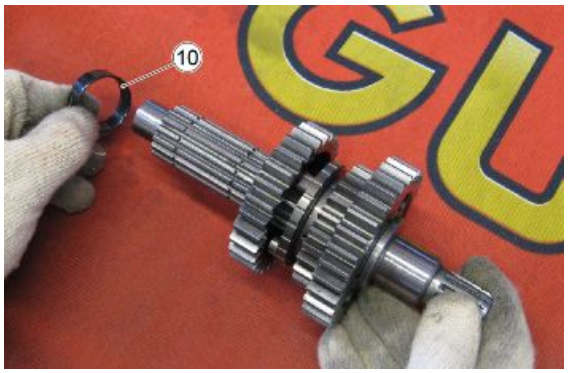


- Remove the seeger ring (7)

- Remove the shim washer (8)

- Remove the gear of the 4th gear (9)

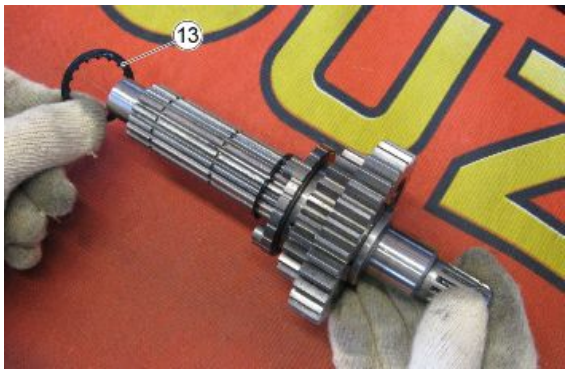
- Remove the bushing (10)



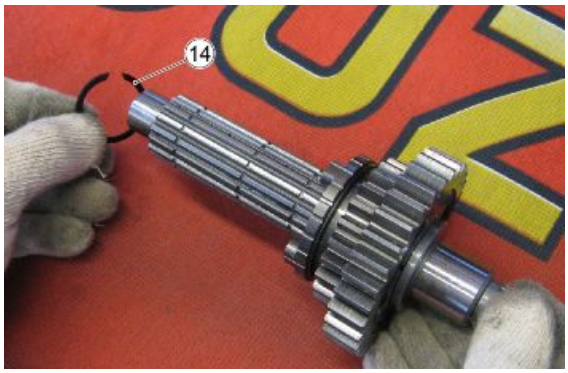
- Remove the gear of the 3rd gear (11)

- Remove the bushing (12)

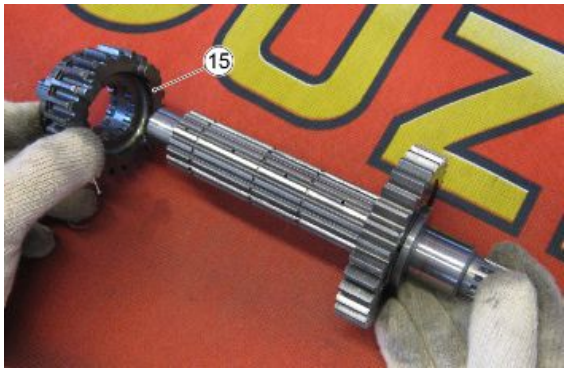
- Remove the shim washer (13)



- Remove the seeger ring (14)

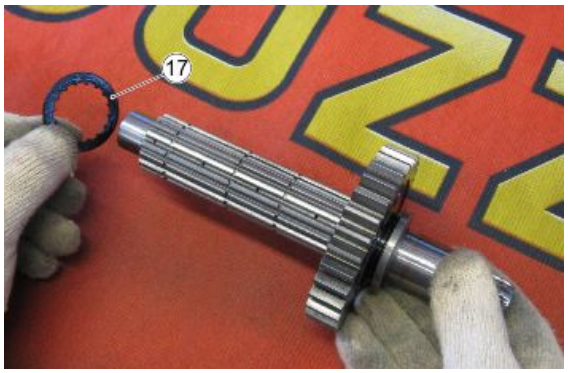


- Remove the gear of the 6th gear (15)



- Remove the seeger ring (16)

- Remove the shim washer (17)



- Remove the gear of the 2nd gear (18)

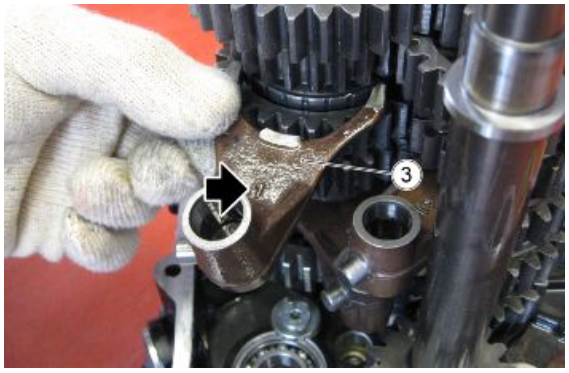
- Remove the bushing (19)

Desmodromic demounting

- Remove the gearbox selector
- Remove the sliding shaft of the forks (1)

- Remove the desmodromic shaft (2)

- The forks are marked with a serial number that indicated the correct positioning.
- Remove the upper fork No.1 (3)



- Remove the central fork No.2 (4)

- Remove the lower fork No.3 (5)

Disassembling the clutch shaft

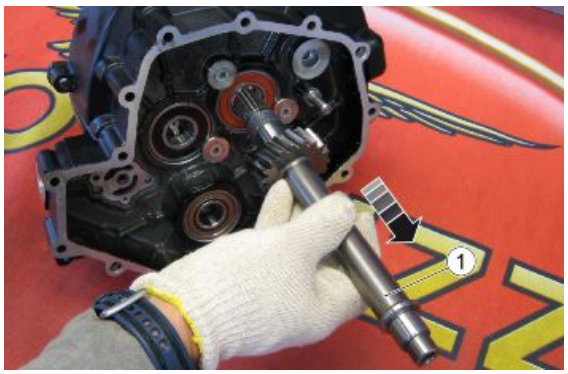
- Using the appropriate specific tools, remove the clutch shaft fastening nut

Specific tooling

020975Y Clutch shaft nut key

19.90.71.60 Clutch shaft locking equipment

- Remove the clutch shaft with a few mallet (1) strokes



- Remove the oil seal from the clutch shaft

CAUTION

IN CASE OF OIL SEAL REPLACEMENT, USE THE SUITABLE PUNCH UNTIL IT REACHES THE CRANKCASE

Specific tooling

020976Y Punch for fitting the clutch control dust seal

- Remove the spacer (2)

CAUTION

DURING REFITTING, PAY ATTENTION TO THE DIRECTION OF THE SPACER, THE CONICAL PART MUST BE ORIENTED INWARD SO AS TO AVOID O-RING DAMAGES

- Remove the O-ring (3)

- Remove the oil seal

CAUTION

IN CASE OF OIL SEAL REPLACEMENT, USE THE SUITABLE PUNCH UNTIL IT REACHES THE CRANKCASE

Specific tooling

020977Y Punch for refitting the clutch shaft oil seal

Controllo alberi

Check transmission gears for signs of pitting and wear and replace damaged gears if necessary.

Check the gear fitting teeth for cracks, damage and wear and replace those damaged if necessary.

Check the transmission gears movement and, if it is not regular, replace the damaged part.

WEAR LIMITS

Specification	Desc./Quantity
Maximum wear limit for the selection gear grooves	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)
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 desmodromic drum

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

Checking the forks

Check that the forks have the work surface well smooth and not worn, so to lose its quenching characteristics and that the nibs that are working in the drum grooves are not too worn, otherwise replace the forks.

CHARACTERISTICS OF THE FORKS

Specification	Desc./Quantity
Maximum selection fork axial clearance	0.3 mm (0.012 in) on the forks and 0.5 mm (0.020) on the middle slide
Minimum wear limit of the selection fork guide pins	13.973 mm (0.5501 in)

Gear selector

Removing the gear selector

- Remove the complete gearbox selector shaft from the crankcase (1)

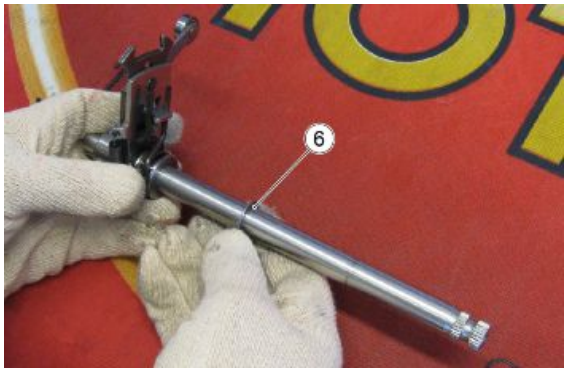
- Remove the spring from the index lever (2)

- Remove the washer (3)

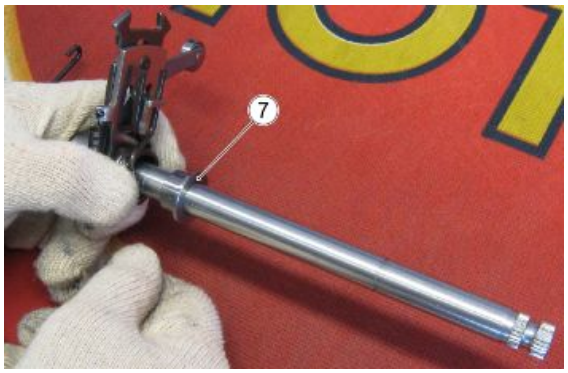
- Remove the ring (9)

- Remove the seeger ring (5)

- Remove the washer (6)



- Remove the bushing (7)



- Remove the selector spring (8)

- Remove the ring (9)

- Remove the bushing (10)

WARNING

DURING REFITTING, PAY ATTENTION TO THE CORRECT POSITIONING OF THE BUSHING, AS THE SIDES ARE NOT SYMMETRICAL

- Remove the index lever (11)

- Remove the bushing (12)

WARNING

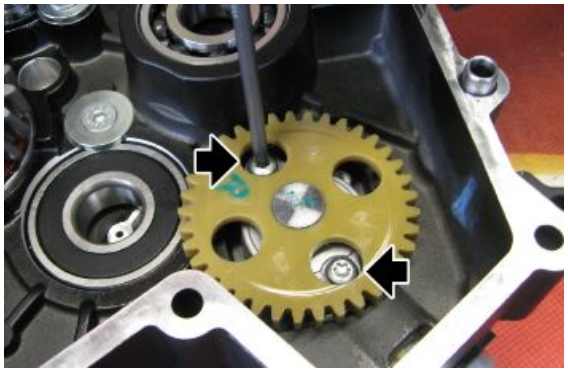
DURING REFITTING, PAY ATTENTION TO THE CORRECT POSITIONING OF THE BUSHING, THE SIDES ARE NOT SYMMETRICAL

- Remove the selector return spring (13)

Oil pump

Removing

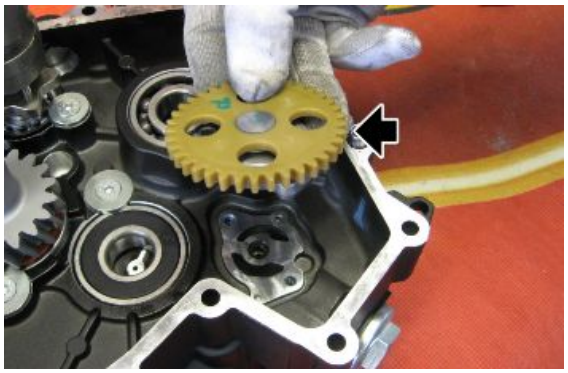
- Remove the two oil pump fixing torx screws



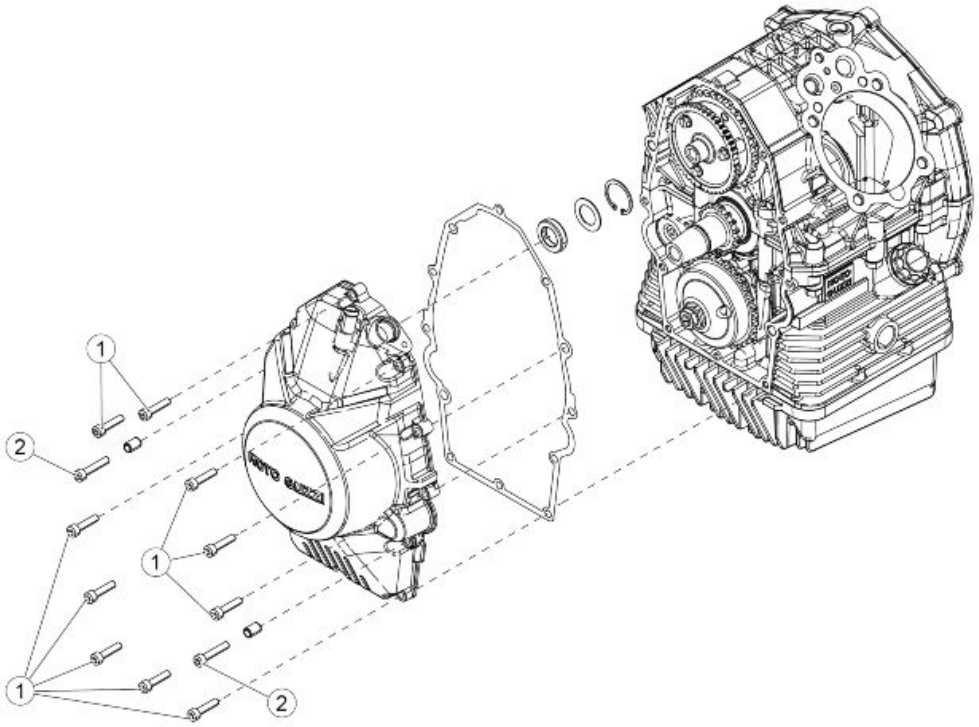
- Remove the complete oil pump

CAUTION

CHECK THE INTEGRITY OF THE GEAR TEETH OF TEFLON AND THE ROTATION FLUIDITY OF THE INTERNAL PROPELLERS IN THE PUMP. IF NECESSARY, REPLACE THE COMPLETE PUMP

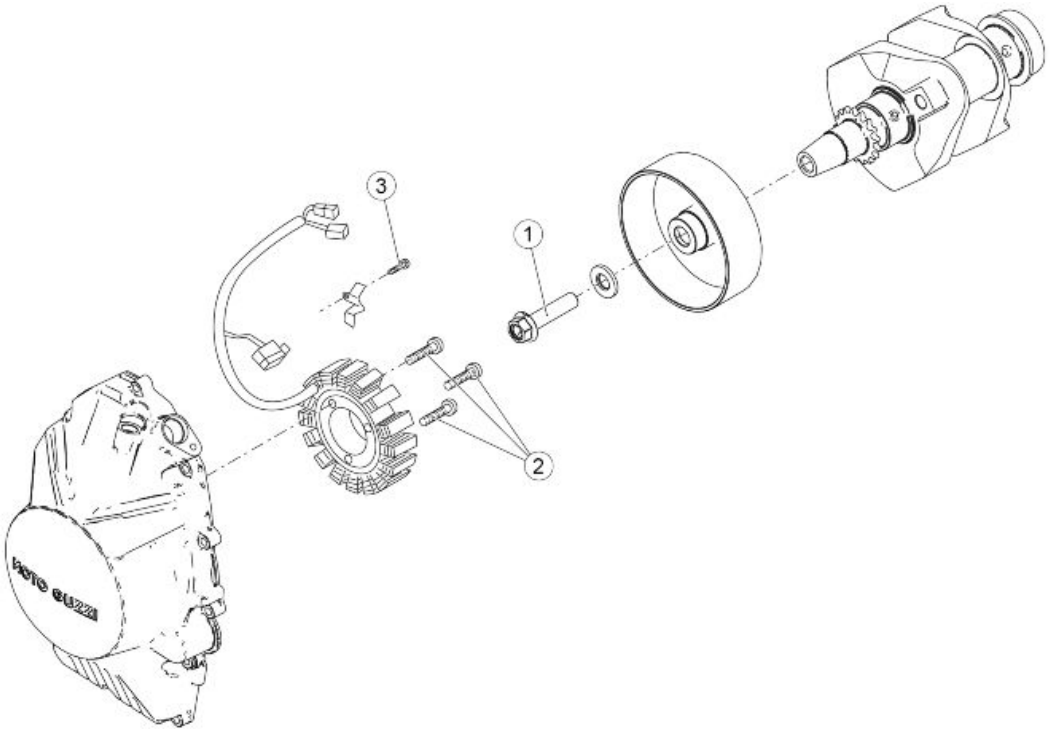


Generatore



TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	SHC screw	M6	10	9-11 Nm (6.64-8.11 lbf ft)	-
2	SHC screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-
-	Timing sensor screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-

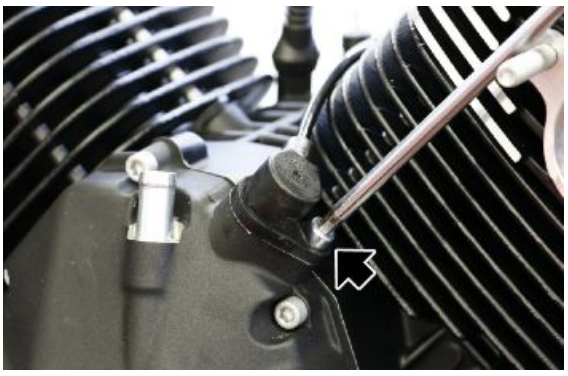


ALTERNATOR

pos.	Description	Type	Quantity	Torque	Notes
1	Magnet flywheel fixing flanged TE screw	M12-1.25x50	1	100 Nm (73.76 lb ft)	-
2	Stator fixing recessed SHC screws	M6x35	3	9-11 Nm (6.64-8.11 lbf ft)	Loct. 243
3	Cable grommet plat fixing fanged TE screw	M5x12	1	5-6 Nm (3.69-4.42 lb ft)	Loct. 243

Rimozione sensore giri

- Undo and remove the fixing screw of the sensor



- Remove the timing system cover sensor

Generator removal

ALTERNATOR COVER REMOVAL

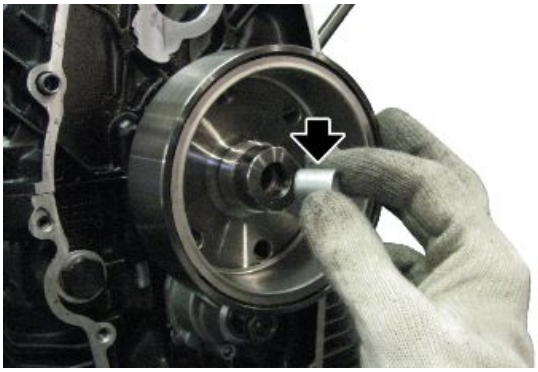
- Remove the alternator cover fixing screws

- Remove the alternator cover and the gasket

ROTOR REMOVAL

- Remove the rotor fixing screw

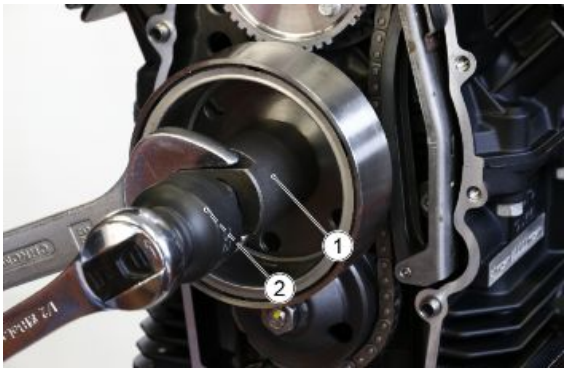
- Insert in the rotor hole the specific spacer



- Place the tool (1) on the rotor, tighten the threaded pin (2) of the tool and proceed with the rotor removal

Specific tooling

020847Y Flywheel extractor

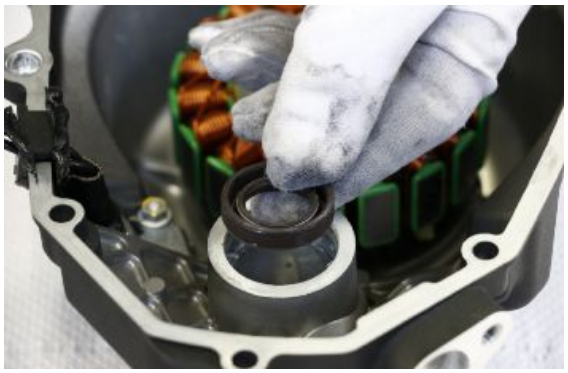


OIL SEAL REMOVAL

- Operating in the alternator cover, to remove the oil seal of engine oil circuit system sealing, the seeger must be removed

- Remove the washer

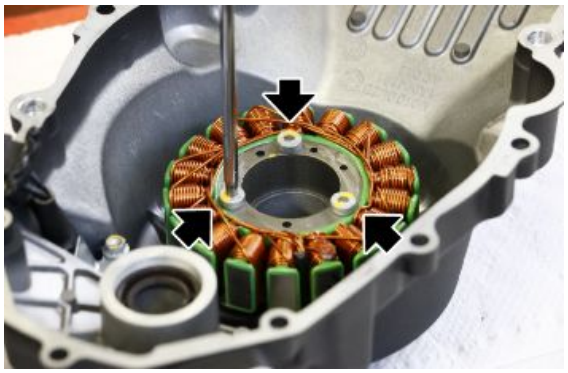
- Remove the oil seal



STATOR REMOVAL

- Remove the stator wiring harness lock plate

- Removing the three stator fixing screws makes it possible to disconnect it



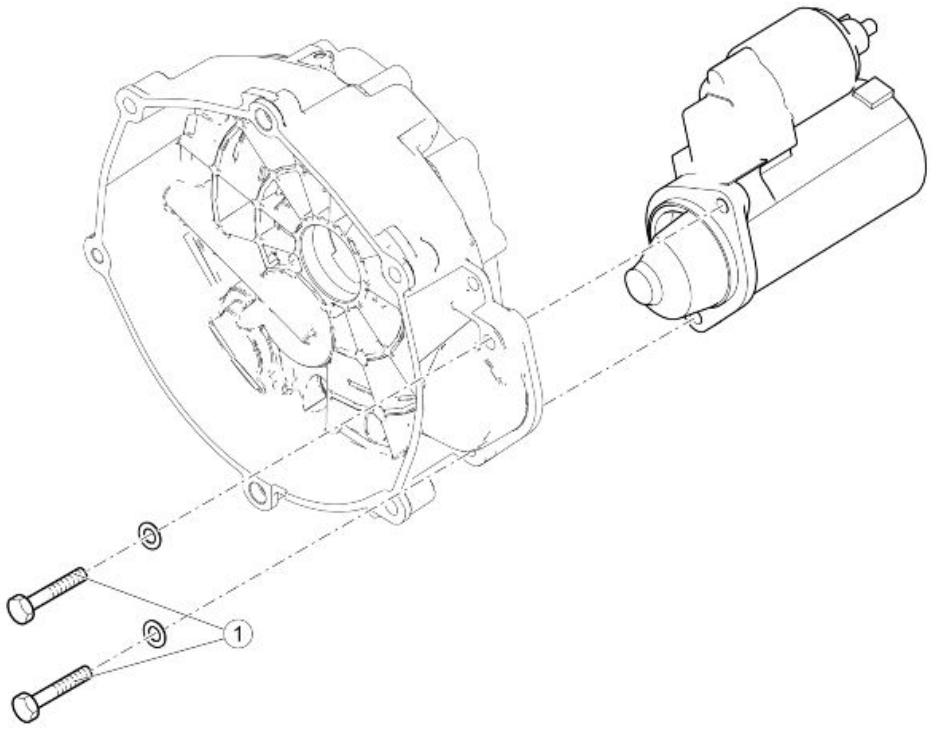
Generator Installation

- During refitting of the flywheel cover it is necessary to apply a great amount of threebond on the cable grommet of the stator before placing it in its seat

- Check that plentiful threebond leaks out and covers all space between the seat on the cover and the cable grommet. Apply another layer of threebond over the cable grommet.

- Refit a new gasket.

Starter motor



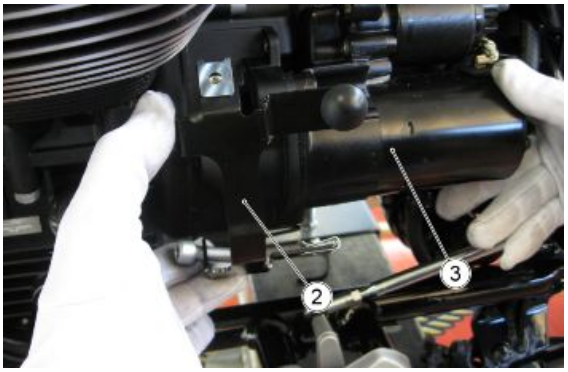
STARTER MOTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor SHC fastener screw	-	2	... Nm (... lbf ft)	-

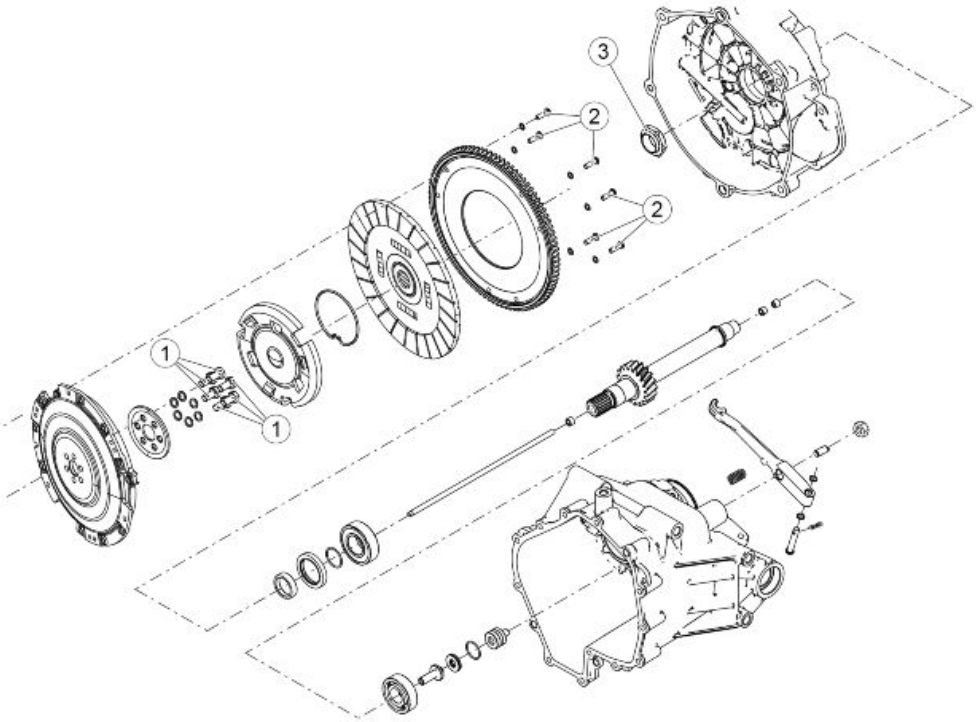
Removing the starter motor

- Remove the starter motor fixing screws (1)

- Remove the supporting clamp of the protection (2) and the starter motor (3)



Clutch side



CLUTCH

pos.	Description	Type	Quantity	Torque	Notes
1	Flywheel screws	-	6	.. Nm (.. lb ft)	-
2	Starter sprocket fixing torx screws	M6x20	6	9-11 Nm (6.64-8.11 lbf ft)	Loct. 243
3	Clutch shaft fixing nut	M25z1.5	1	95-105 Nm (70.07-77.44 lb ft)	Loct. 243

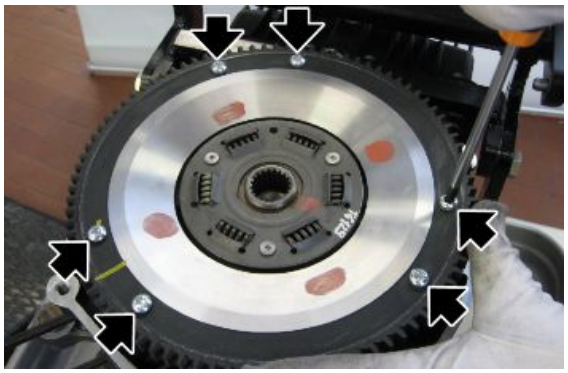
Disassembling the clutch

- Remove the clutch cover
- Lock the clutch with the specific tool

Specific tooling

021001Y Clutch lock

- Remove the 6 fixing screws of the clutch plate complete with starter sprocket



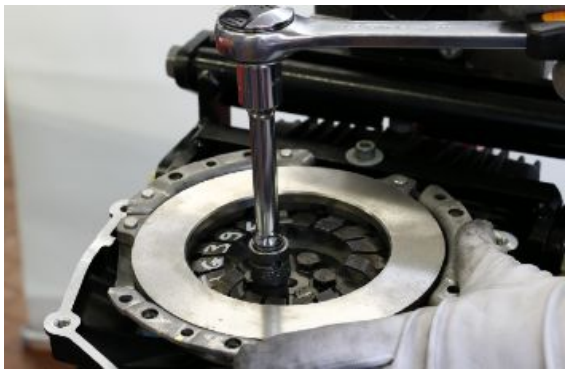
- Remove the clutch plate complete with starter sprocket

- Remove the clutch plate.

- Remove the retainer ring

- Remove the thrust plate

- Remove the 6 fixing screws of the locking plate



- Remove the reinforcement flange of the clutch thrust plate

- Remove the clutch lock complete

Checking the clutch plates

Clutch discs

Make sure that the clutch plate is not scratched or badly worn.

Check the flexible springs and the thickness of the clutch disc

Starting sprocket

Check that the supporting surface with the driven plate is perfectly smooth and even.

Also check that the toothing where the starter motor pinion works is not chipped or scratched; otherwise, replace it.

Assembling the clutch

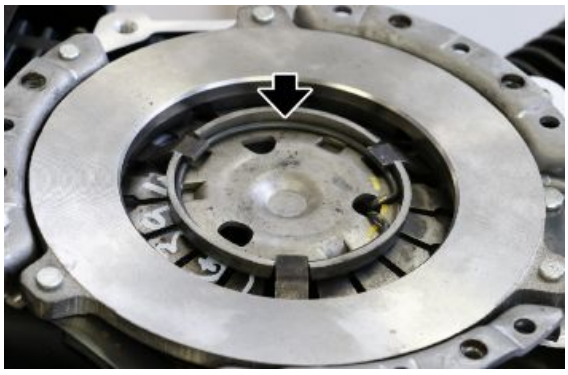
- Insert the clutch block complete on the crankshaft

- Place the reinforcement flange of the clutch thrust plate, aligning the holes with the ones of the clutch base

- Insert the 6 fastening screws complete with washers and tighten to the pre-scribed torque

- Insert the thrust plate cap

- Lock the thrust plate using the special lock ring



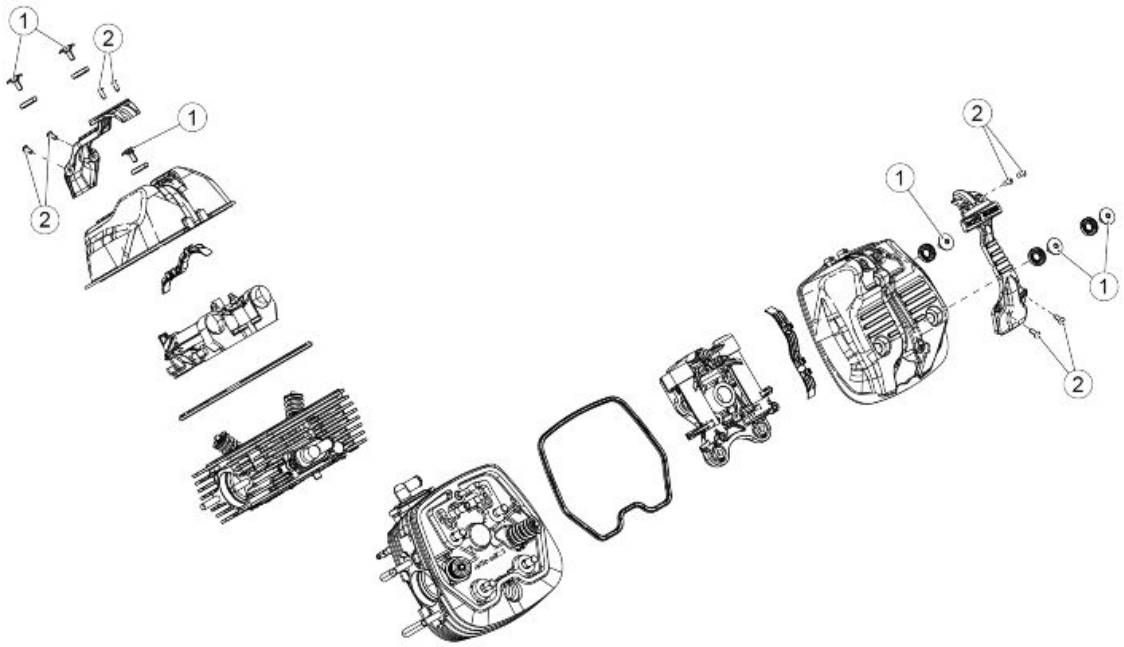
- Place the clutch plate

- Place the starter sprocket and screw the fixing screws by hand

- Using the special tool for the centring of the clutch plate

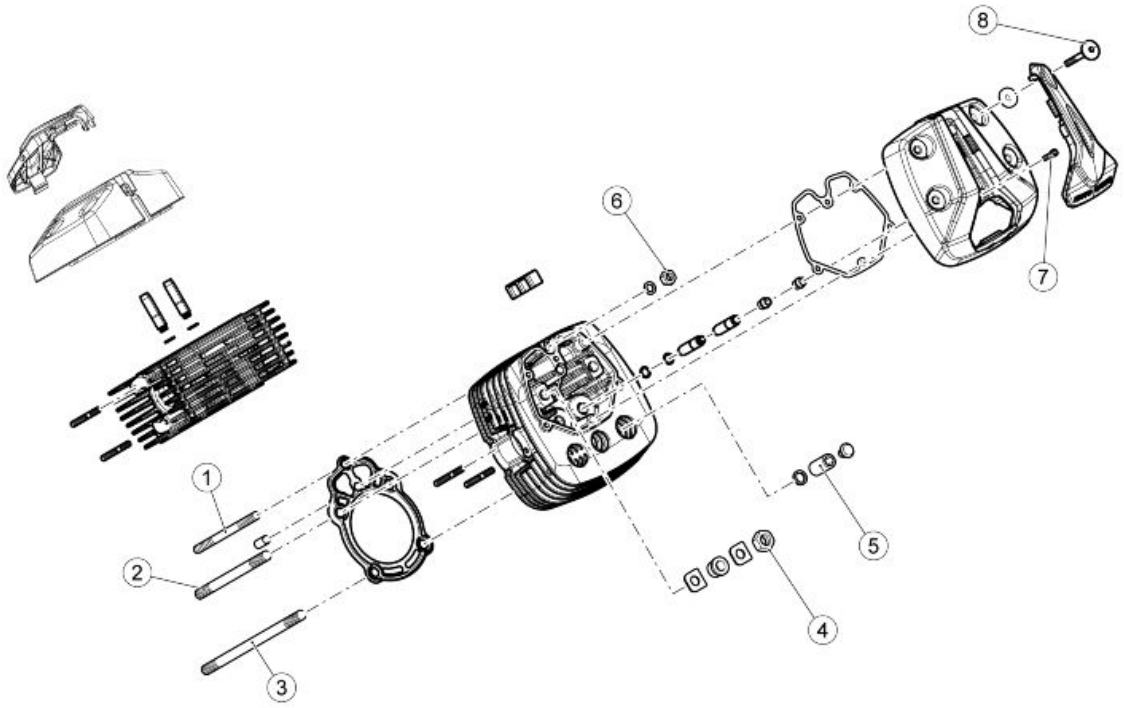
- Fit the assembly on the pressure plate flywheel, insert the six fixing screws and tighten them to the prescribed torque

Head and timing



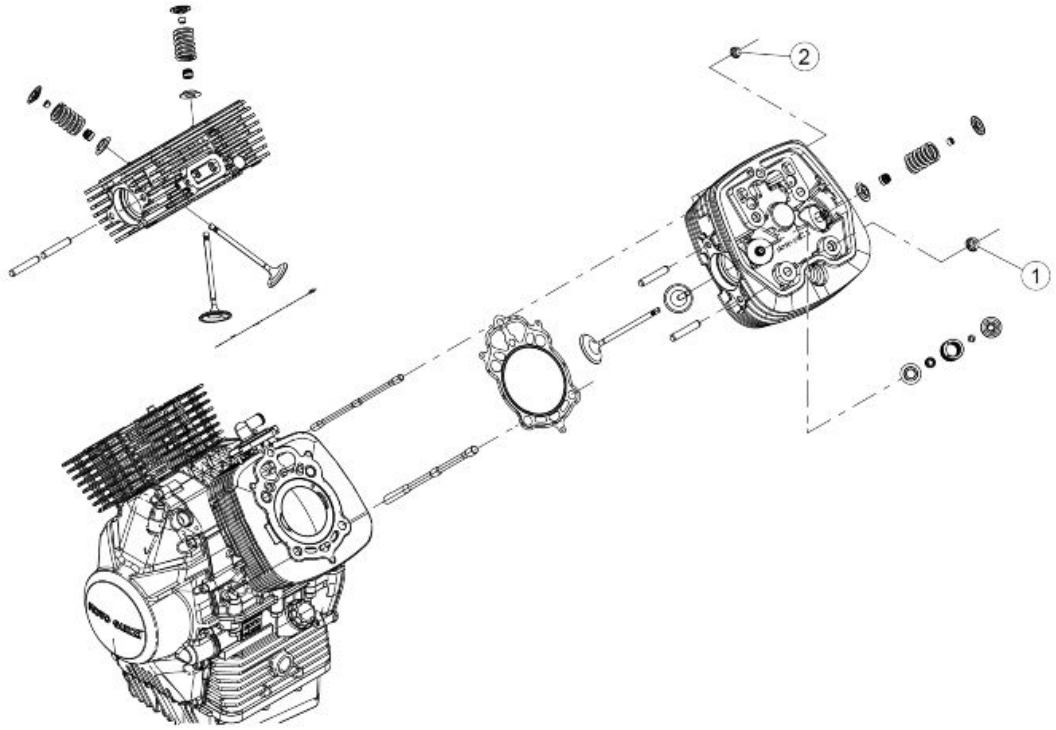
HEADS COVERS

pos.	Description	Type	Quantity	Torque	Notes
1	Head covers fixing screws	M6	6	7-9 Nm (5.16-6.64 lb ft)	-
2	Spark plugs cover TBEI fixing screws	M5x12	8	6-8 Nm (4.42-5.90 lb ft)	-



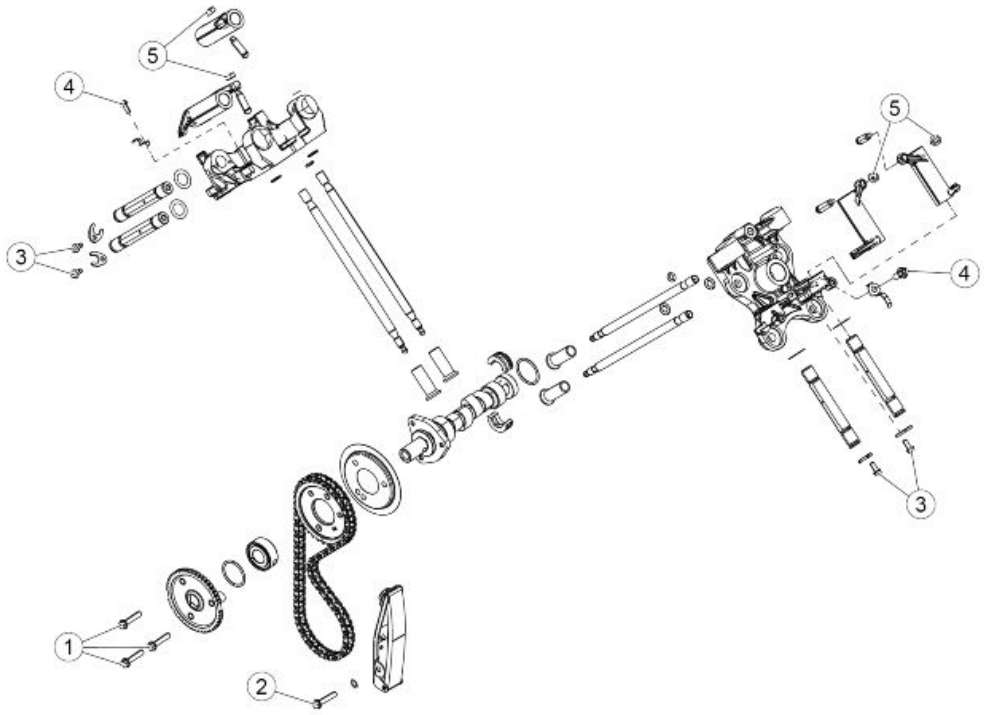
HEAD - CYLINDER

pos.	Description	Type	Quantity	Torque	Notes
1	Central stud bolt	M8x143	2	20 Nm (14.75 lb ft)	Loctite 542
2	Short stud bolt	M10x182	4	42 Nm (30.98 lb ft)	-
3	Long stud bolt	M10x214	4	42 Nm (30.98 lb ft)	-
4	Nuts - pre-tightening	M10x1.5	4	25 Nm (18.44 lb ft)	-
4	Nuts - tightening	M10x1.5	4	42 Nm (30.98 lb ft)	-
5	Column nut - pre-tightening	-	4	25 Nm (18.44 lb ft)	-
5	Column nut - tightening	-	4	42 Nm (30.98 lb ft)	-
6	Nut	-	2	28 Nm (20.65 lb ft)	-
7	Internal Head cover screws	M6x25	4	8-10 Nm (5.90-7.37 lb ft)	-
8	Outer head cover screws	M6x52.5	8	8-10 Nm (5.90-7.37 lb ft)	-



HEADS

pos.	Description	Type	Quantity	Torque	Notes
1	Cylinder-head fixing nut (pre-tightening)	M10x1.25	8	15 Nm (11.06 lb ft)	-
1	Cylinder-head fixing nut (tightening)	M10x1.25	8	26-34 Nm (19.18-25.08 lb ft)	-
2	Cylinder-head fixing nut (pre-tightening)	M8x1.25	2	10 Nm (7.38 lb ft)	-
2	Cylinder-head fixing nut (tightening)	M8x1.25	2	15-19 Nm (11.06-14.01 lb ft)	-



TIMING SYSTEM

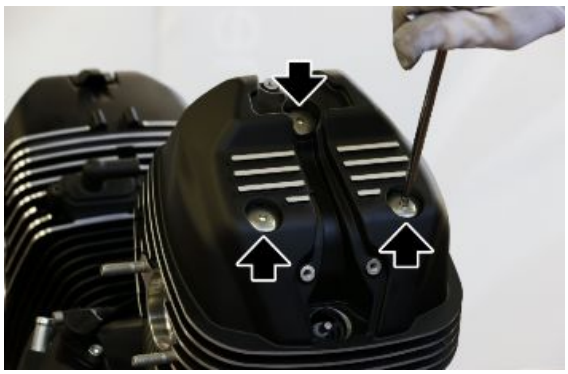
pos.	Description	Type	Quantity	Torque	Notes
1	Tone wheel fixing screw	M6	3	12-14 Nm (8.85-10.33 lb ft)	Loct. DRI 2045
2	Chain tensioner fastener screw	M6	1	9-11 Nm (6.64-8.11 lbf ft)	-
3	Rocker pins locking fork screw	M.	4	.. Nm (.. lb ft)	-
4	Ground plate fixing screw	M.	2	.. Nm (.. lb ft)	-
5	Tappet adjuster screw	M8	4	8-10 Nm (5.90-7.38 lb ft)	-

Removing the head cover

NOTE

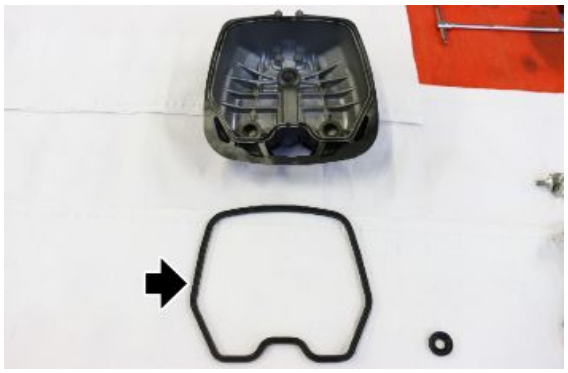
THE OPERATIONS FOR THE REMOVAL OF THE HEAD COVER ARE THE SAME FOR BOTH SIDES

- Remove the spark plug cover
- Disconnect the spark plug tube
- Remove the blow-by pipe
- Undo the three fixing screws of the head cover and remove the gasket



- Remove the head cover together with the gaskets

- Remove the gasket from the head cover



- Check that the mating faces that contact the heads are not damaged or blistered

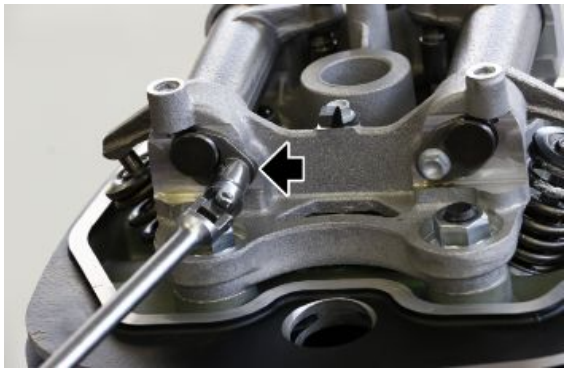
Removing the cylinder head

NOTE

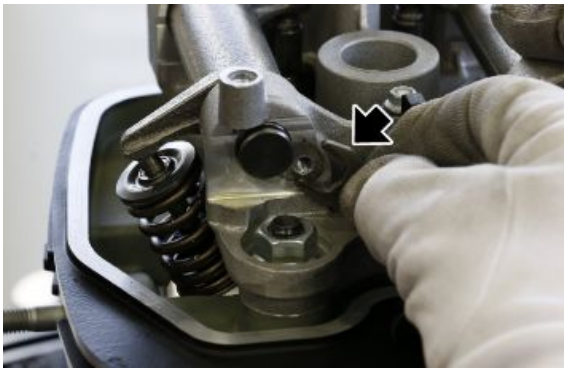
THE HEAD REMOVAL OPERATIONS REFER TO ONE HEAD BUT APPLY TO BOTH

- Remove the head cover
- Unscrew the spark plug

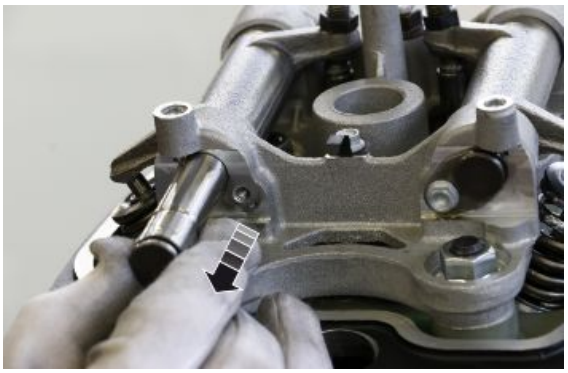
- Remove the fastening screw of the rocker pin retainer fork



- Remove the rocker pin retainer fork



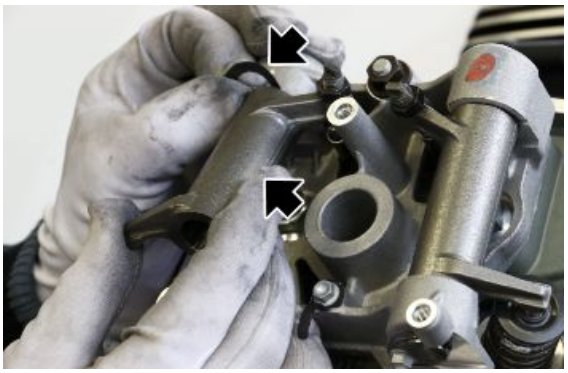
- Remove the rocker pin



- Remove the rocker, being careful to recover the Belleville spring

NOTE

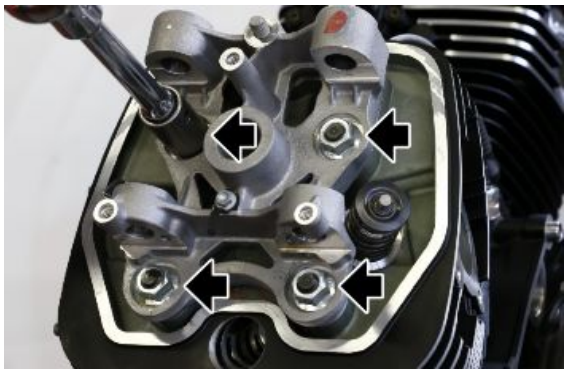
REPEAT THE SAME PROCEDURE TO REMOVE THE OTHER ROCKER



- Remove the rocker rods

- Unscrew and remove the compensation nut of the cam tower

- Undo and remove the fastening nuts of the cam tower

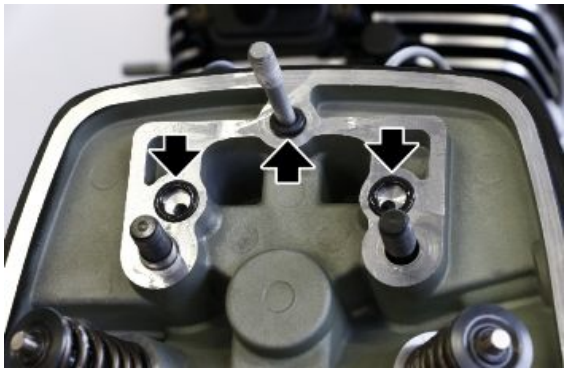


- Remove the cam tower

- Remove the three rubber O-Rings

CAUTION

PAY SPECIAL ATTENTION THAT THE O-RINGS DO NOT ACCIDENTALLY FALL INTO THE PROCESSING HOLES OF THE ROCKERS RODS



- Remove the complete head

- Remove the cylinder head gasket

- Undo and remove the engine oil pressure sensor

- Undo and remove the secondary air valve cover

- Remove the secondary air valve
- check and if necessary replace the external rubber gasket

- Remove the internal filter paying attention to the direction during refitting

Cylinder head

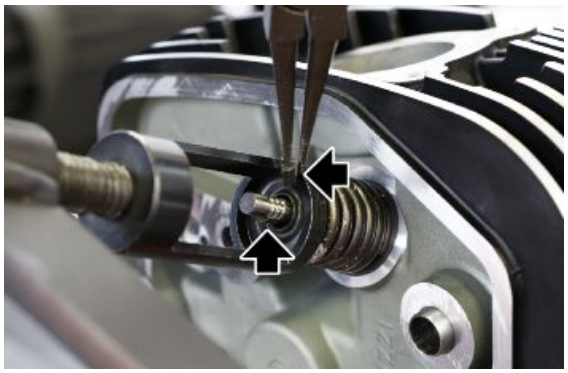
Removing the valves

- Place the special tool on the upper cap of the valve to be removed and at the centre of the head of the valve.

Specific tooling

020382Y Tool to extract valve cotters

- Close the tool to compress the spring, and then hit the tool head with a mallet so that the two cotters get detached from the upper cap



- 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.

Characteristic

Spring free length (WEAR LIMIT)

40.5 mm (1.59 in)

- 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 bolt surface that contacts the rockers is not exceedingly worn.
- Check the rocker to valve and rocker to rod contact surfaces.

Valve check

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

Intake valves:

Characteristic

Coupling clearance between valve and 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

Coupling clearance between valve and 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)

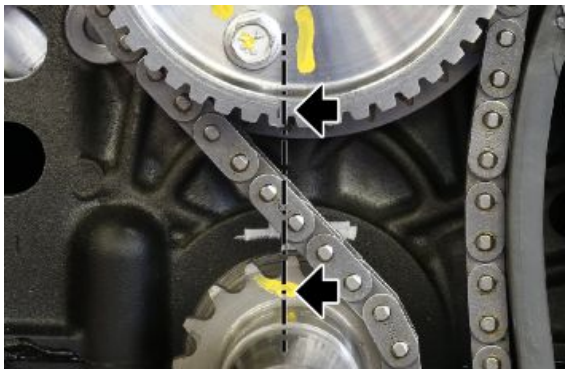
5.92 mm (0.2331 in)

Valve head eccentricity (MAXIMUM ALLOWED VALUE)

0.05 mm (0.0020 in)

Adjusting valve clearance

- Bring the piston of the left cylinder to top dead centre making sure that the reference mark on the crankshaft gear and on the timing system shaft are aligned.



- Use a feeler gauge to check that the clearance between the valve and the set screw corresponds with the indicated values. The corresponding intake and outlet valve clearances are different than what is indicated below, proceed with adjusting them.

Characteristic

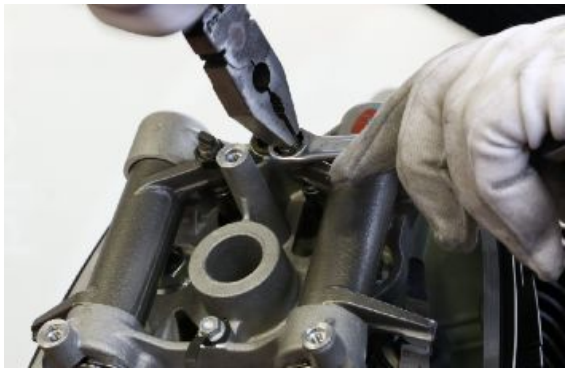
Intake valve clearance

0.10 mm (0.0039 in)

Exhaust valve clearance

0.15 mm (0.0059 in)

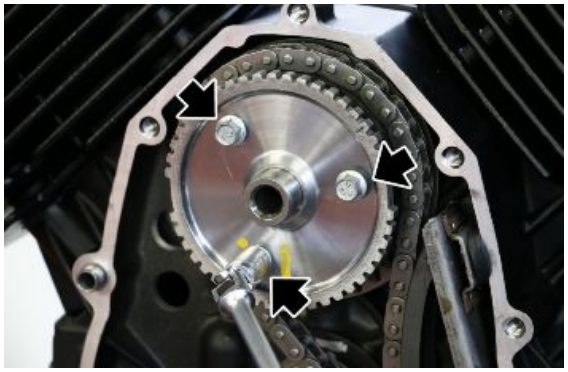
- Loosen the lock nut, adjust the clearance by acting on the adjuster until reaching the prescribed values
- Tighten the lock nut



Timing

Rimozione ruota fonica

- Remove the timing system cover
- Remove the rotor
- Remove the three screws that fix the tone wheel



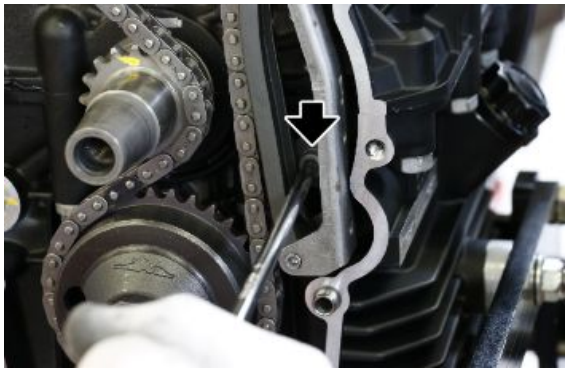
- Remove the tone wheel

- Remove the spacer

- Check and if necessary replace the rubber O-Ring

Removing the chain tensioner

- Remove the timing system cover
- Remove the rotor
- Remove the chain tensioner fixing screw recovering the washer



- Remove the chain tensioner

Chain removal

- Remove the timing system cover, the rotor and tone wheel complete with spacer
- Remove the fixing screw of the oil pump gear paying attention to recover the knurled washer

- Remove the timing chain, removing the camshaft gear and the oil pump gear at the same time

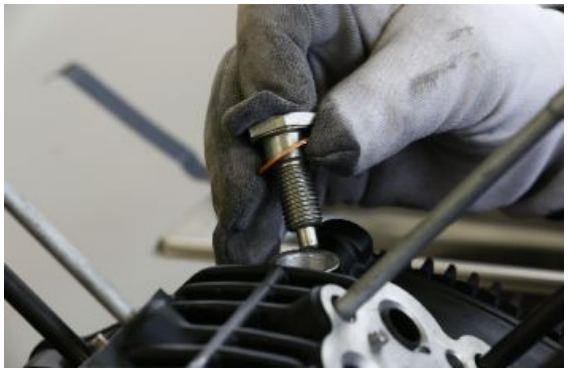
Rimozione piattello blow-by

- Remove the timing system cover, the rotor and tone wheel complete with spacer
- Remove the blow-by cap

Removing the camshaft

- Remove the timing system cover, the rotor, the tone wheel complete with spacer, the timing system chain and the blow-by cap
- Remove the engine oil pressure sensor

- Remove the transmitter joint



- Before removing the camshaft, check that its wear is within the limit.
- Operating with the engine turned, then with the crankcase facing up, remove the camshaft

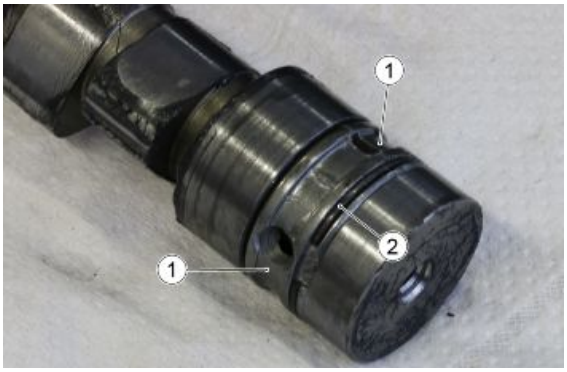
Characteristic

Maximum axial clearance (WEAR LIMIT VALUE)

0.45 mm (0.0177 in)

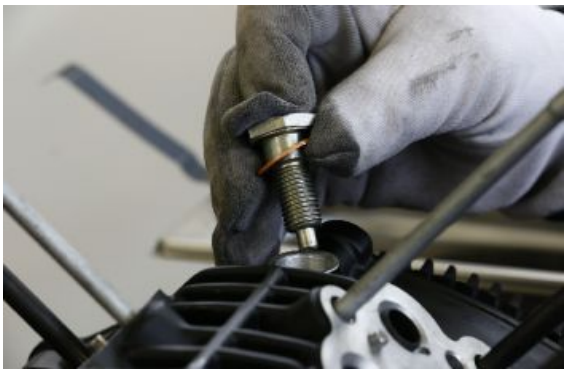
Installing the camshaft

- Assemble the small ends (1) on the camshaft and lock them using the seeger (2)



- Operating with the engine turned, insert the camshaft in the crankcase paying attention that one of the holes of the small ends matches with the hole with transmitter joint

- Insert and tighten the transmitter joint to the specified torque



- Insert and tighten the oil pressure sensor to the specified torque

Installazione piattello blow-by

- Place the blow-by cap on the camshaft making the holes and the special timing plug match

Installazione catena

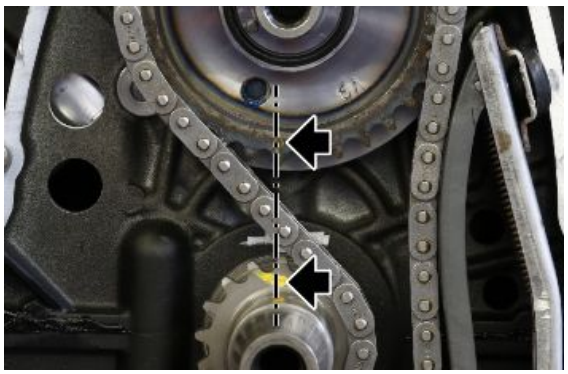
- Fit the chain, together with timing system gear and oil pump gear

CAUTION

IF AN ALREADY USED TIMING SYSTEM CHAIN IS REFITTED, PLACE IT ON THE SAME SIDE WHERE IT WAS REMOVED

CAUTION

ALIGN THE REFERENCE NOTCHES ON THE CRANKSHAFT AND ON THE TIMING SYSTEM GEAR SO AS TO ENSURE THE CORRECT ENGINE TIMING



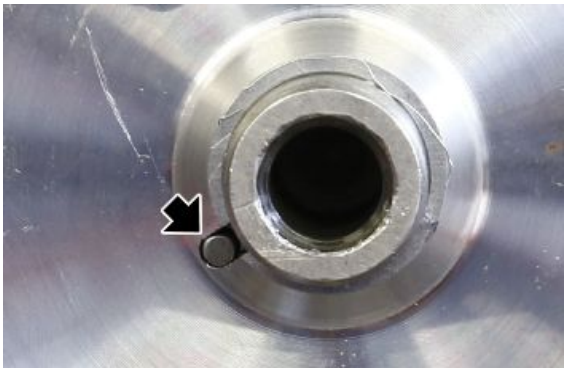
- Turn the pin of the oil pump, until aligning the gear process with the pin milling.
- Fit the safety plug

- Fit the knurled washer and after placing the nut, tighten it to the prescribed torque

Installing the phonic wheel

- Fit the spacer checking the correct positioning on the blow-by cap, using the centring plug

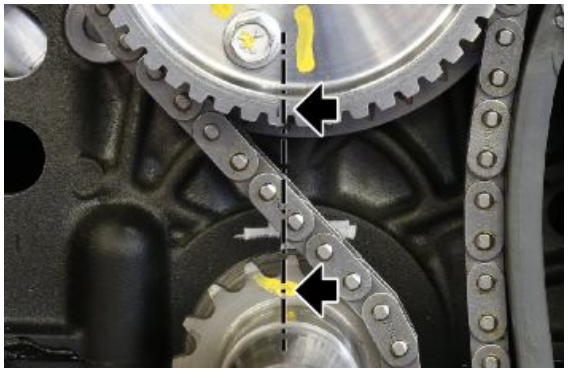
- Fit the tone wheel checking the correct positioning on the spacer, using the centring plug



- Tighten the three fastener screws of the tone wheel to the specified torque

CAUTION

CHECK THE CORRECT INSTALLATION USING THE ALIGNMENT OF THE REFERENCE NOTCHES ON THE CRANKSHAFT AND ON THE TONE WHEEL



Cam timing

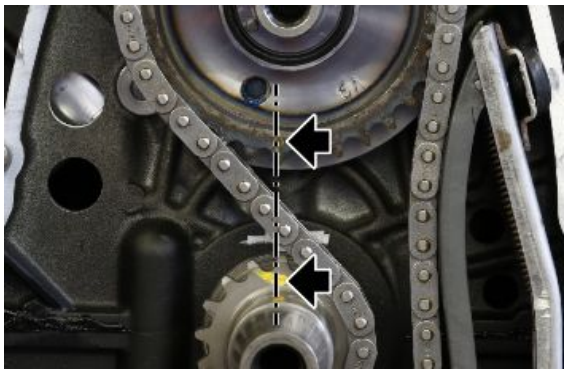
Timing

- Bring the piston of the left cylinder to top dead centre making sure that the reference mark on the crankshaft gear is up on the perpendicular axis and that the rocker have clearance

- Fit the timing chain together with timing system gear and oil pump gear

CAUTION

CHECK THE CORRECT INSTALLATION USING THE ALIGNMENT OF THE REFERENCE NOTCHES ON THE CRANKSHAFT AND ON THE TIMING SYSTEM GEAR

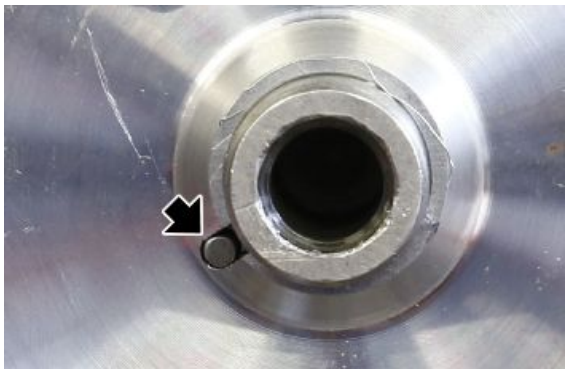


- Turn the pin of the oil pump, until aligning the gear process with the pin milling.
- Fit the safety plug

- Fit the knurled washer and after placing the nut, tighten it to the prescribed torque

- Fit the spacer checking the correct positioning on the blow-by cap, using the centring plug

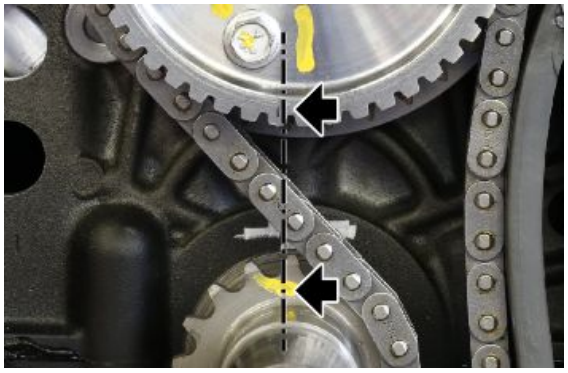
- Fit the tone wheel checking the correct positioning on the spacer, using the centring plug



- Tighten the three fastener screws of the tone wheel to the specified torque

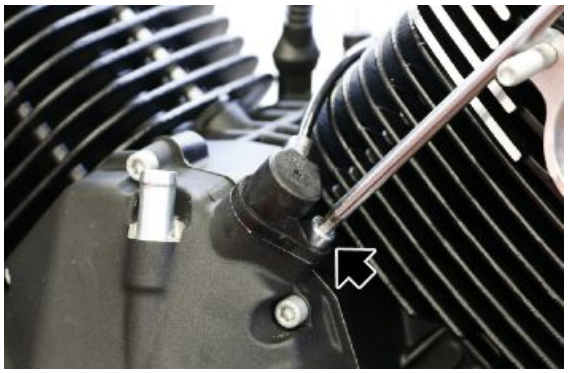
CAUTION

CHECK THE CORRECT INSTALLATION USING THE ALIGNMENT OF THE REFERENCE NOTCHES ON THE CRANKSHAFT AND ON THE TONE WHEEL



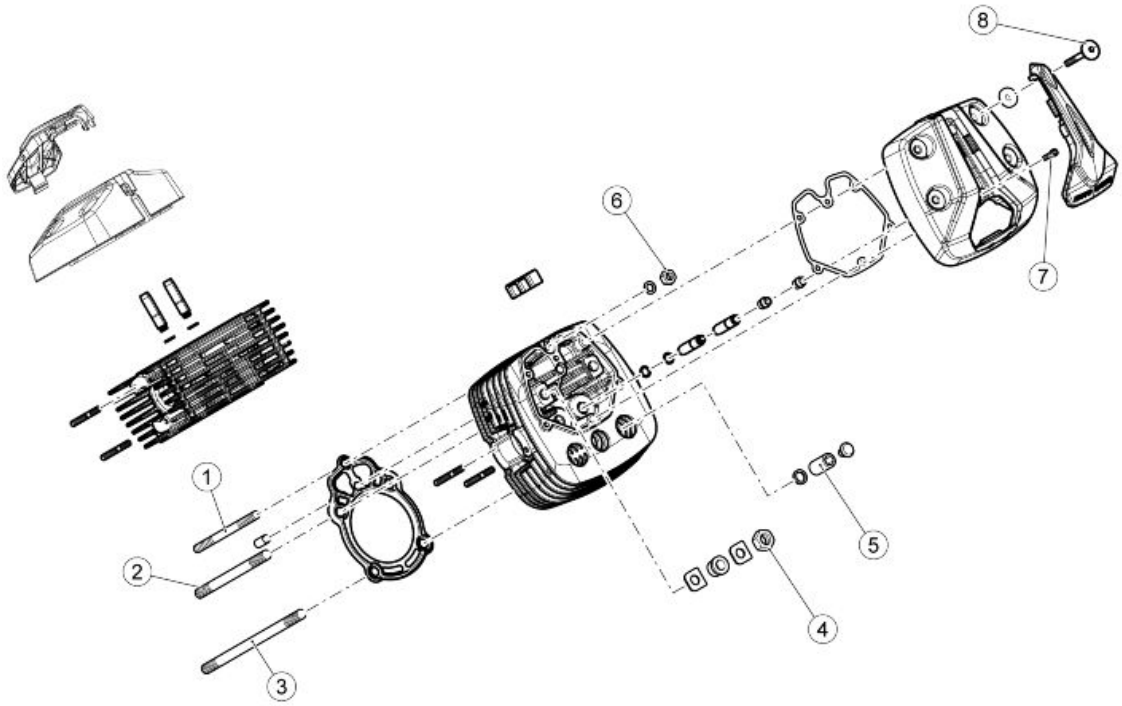
Measuring air gap

- Undo and remove the fixing screw of the sensor



- Remove the timing system cover sensor

Cylinder-piston assembly



HEAD - CYLINDER

pos.	Description	Type	Quantity	Torque	Notes
1	Central stud bolt	M8x143	2	20 Nm (14.75 lb ft)	Loctite 542
2	Short stud bolt	M10x182	4	42 Nm (30.98 lb ft)	-
3	Long stud bolt	M10x214	4	42 Nm (30.98 lb ft)	-
4	Nuts - pre-tightening	M10x1.5	4	25 Nm (18.44 lb ft)	-
4	Nuts - tightening	M10x1.5	4	42 Nm (30.98 lb ft)	-
5	Column nut - pre-tightening	-	4	25 Nm (18.44 lb ft)	-
5	Column nut - tightening	-	4	42 Nm (30.98 lb ft)	-
6	Nut	-	2	28 Nm (20.65 lb ft)	-
7	Internal Head cover screws	M6x25	4	8-10 Nm (5.90-7.37 lb ft)	-
8	Outer head cover screws	M6x52.5	8	8-10 Nm (5.90-7.37 lb ft)	-

Removing the cylinder

- Remove the head.
- Slide off the cylinder from the stud bolts.

- Remove the gasket from the stud bolts

Disassembling the piston

- Remove one of the two retainer rings from the pin paying attention that it does not fall inside the engine

- Before removing the pin, check the mounting clearance between pin and piston. Replace it if the value is out of the limits
- Slide off the pin

Characteristic

Mounting clearance between piston and pin

0.015 mm (0.00059 in)

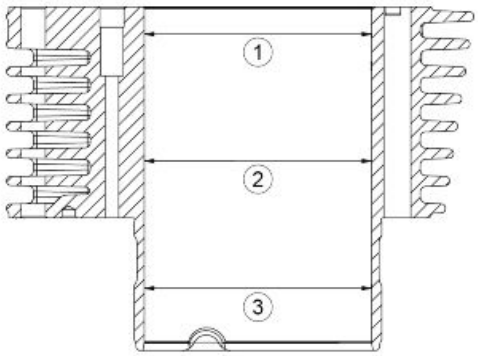
- Remove the piston

CAUTION

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

Checking the cylinder

- After checking for 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:

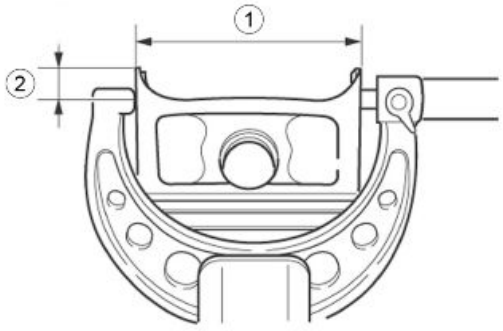
1. 1st measurement
2. 2nd measurement
3. 3rd measurement

CYLINDERS CONTROL

Type	Allowed diameter	Maximum clearance between the piston and cylinder (MAXIMUM WEAR VALUE)
G	84.000-84.007 mm (3.3071-3.3073 in)	0.08 mm (0.0031 in)
H	84.007-84.014 mm (3.3074-3.3076 in)	0.08 mm (0.0031 in)
L	84.014-84.021 mm (3.3076-3.3079 in)	0.08 mm (0.0031 in)
M	84.021-84.028 mm (3.3079-3.3082 in)	0.08 mm (0.0031 in)

Checking the piston

- Measure the piston skirt diameter (1) with a micrometer from the piston lower border (2)=10 mm (0.39 in).
- Replace the cylinder, the piston and the piston ring all together if not complying with specifications.



PISTONS CHECK

Type	Allowed diameter	Maximum clearance between the piston and cylinder (MAXIMUM WEAR VALUE)
G	83.953-83.960 mm (3.3052-3.3055 in)	0.08 mm (0.0031 in)
H	83.960-83.967 mm (3.3055-3.3058 in)	0.08 mm (0.0031 in)
L	83.967-83.974 mm (3.3058-3.3061 in)	0.08 mm (0.0031 in)

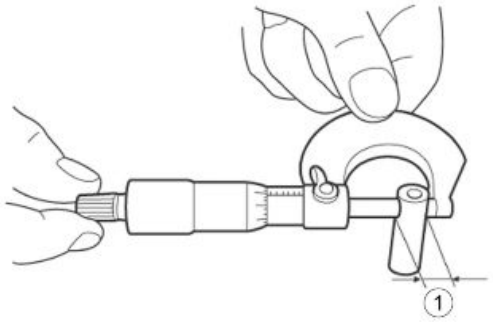
Type	Allowed diameter	Maximum clearance between the piston and cylinder (MAXIMUM WEAR VALUE)
M	83.974-83.981 mm (3.3061-3.3063 in)	0.08 mm (0.0031 in)

Inspecting the wrist pin

PIN

- Clean off combustion residues from the piston crown and from the area above the top ring.
- Check for cracks on the piston and for compression on the piston sliding surface (seizing); Replace the piston if required.

- Measure the pin outside diameter (1) and if not complying with specifications; replace the pin.



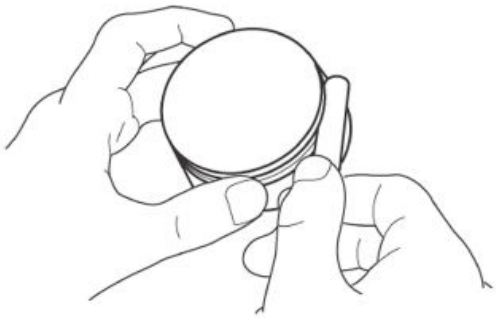
Characteristic

Pin external diameter (MINIMUM WEAR VALUE)

21.993 mm (0.8659 in)

Inspecting the piston rings

- 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.



SEAL RING CLEARANCE (MAXIMUM WEAR VALUES)

Type	Maximum clearance between the rings and cables on the piston	Maximum opening of the rings mounted on the piston
Top ring	0.08 mm (0.0032 in)	Gap1 - 0.8 mm (0.032 in) Gap2 - 0.8 mm (0.032 in)
Middle ring	0.07 mm (0.0028 in)	Gap1 - 0.8 mm (0.032 in) Gap2 - 0.8 mm (0.032 in)
Oil scraper ring	0.22 mm (0.0087 in)	Gap1 - 0.8 mm (0.032 in) Gap2 - 0.8 mm (0.032 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

THE LIGHT OF THE OIL SCRAPER RING END CANNOT BE MEASURED: IF IT HAS EXCESSIVE CLEARANCE REPLACE THE THREE PISTON RINGS.

- Insert the piston rings paying attention to their mounting direction and end gap arrangement; the end gaps must be approximately 120 degrees from each other.

Fitting the piston

- Place the piston on the connecting rod notch

CAUTION

MOUNTING POSITION IS INDICATED BY AN ARROW POINTING IN THE DIRECTION OF TRAVEL

- Insert the pin

- Insert the retainer ring

Installing the cylinder

- Check that the piston ring end gaps are approximately 120 degrees from each other.

- Fit a new gasket

- Place the appropriate ring clamp on the piston
- Place the cylinder so that the piston correctly enters the seat and as soon as the segments zone is exceeded remove the ring clamp

Specific tooling

020128Y Piston assembly band

- After fitting the cylinder it is necessary to check the piston projection for correct head gasket selection.
- Fit a dial gauge on the specific tool and set it to zero on a horizontal plane.
- Fit the tool together with the dial gauge on the cylinder and tighten the fixing nuts.
- Detect the deviation on the dial gauge

Specific tooling

020996Y Piston projection measuring tool

CAUTION

THE PISTON PROJECTION MUST BE DETECTED BY FITTING THE GASKET BETWEEN CRANKCASE AND CYLINDER. BEFORE THE DETECTION TIGHTEN THE CYLINDER UNTIL THE GASKET IS COMPLETELY WOUND

HEAD GASKET SELECTION

Piston projection	Gasket thickness
0.40-0.58 mm (0.0157-0.0228 in)	0.6 +/- 0.05 mm (0.0236 +/- 0.0020 in)
0.20-0.40 mm (0.0079-0.0157 in)	0.8 +/- 0.05 mm (0.0315 +/- 0.0020 in)
0.02-0.20 mm (0.0008-0.0079 in)	1.0 +/- 0.05 mm (0.0394 +/- 0.0020 in)

Installing the cylinder head

- Insert the flame trap of the secondary air valve

- Insert the reed valve

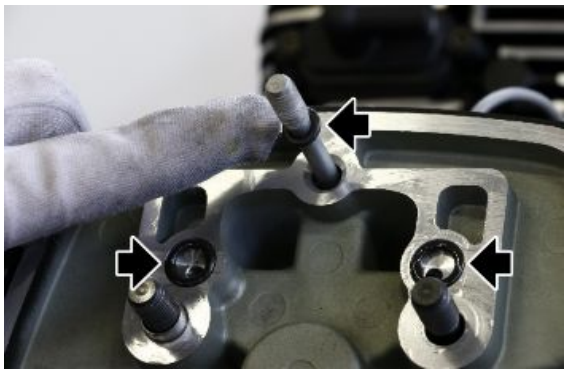
- Fit the cover of the secondary air valve and tighten the screws to the prescribed torque

- Fit the engine oil pressure sensor, only in the left head and tighten it to the prescribed torque

- Place the gasket

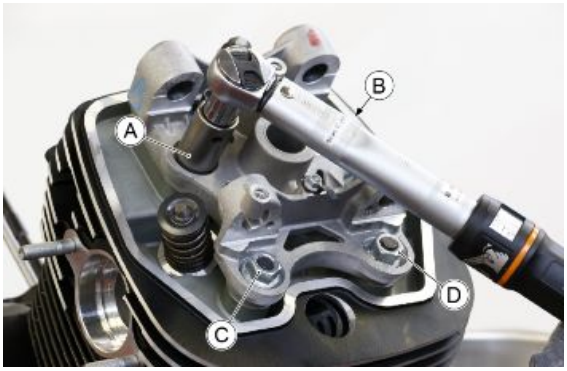
- Place engine head into place

- Place the three rubber O-Rings, particularly apply grease to the O-Ring that will be inserted in the stud bolt in order to avoid damaging it



- Position the cam tower in its seat

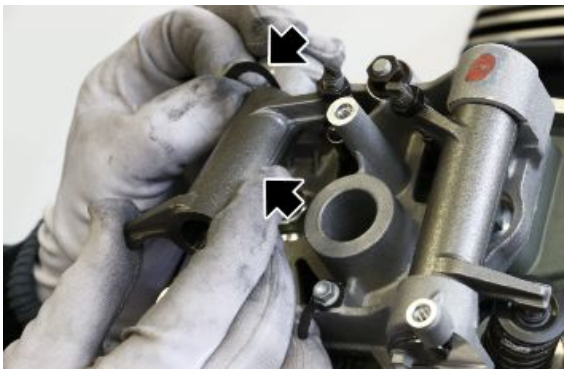
- Following a cross order "A-C-B-D" screw the fixing nuts of the cam tower to the prescribed torque



- Insert and tighten the compensation nut of the cam tower to the prescribed torque

- Insert the rocker rods

- Place the rocker in its seat by inserting the Belleville spring at the same time



- Using the rocker shim centring pin, align the rocker and the Belleville spring with the pin seat for easy insertion

Specific tooling

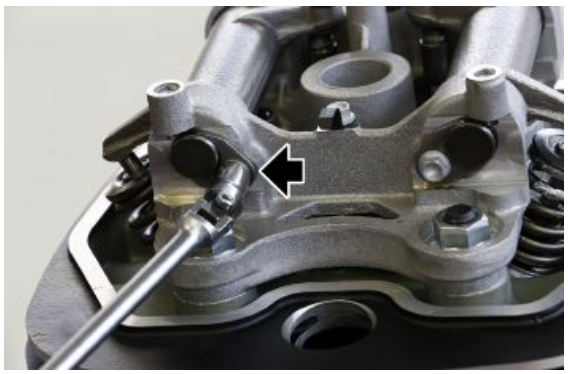
020995Y rocker centring pin

- Insert the rocker pin retainer fork on the pin and insert it in the seat

CAUTION

SLOWLY INSERT THE ROCKER PIN UNTIL THE FORK REACHES THE SUPPORT POINT ON THE CAM TOWER. THE INSERTION OF THE ROCKER PIN WITHOUT THE FORK REACHES A NON-CONTROLLED DEPTH

- Insert and tighten the fixing screw of the rocker pin lock fork to the prescribed torque



- Insert and tighten the spark plug to the prescribed torque

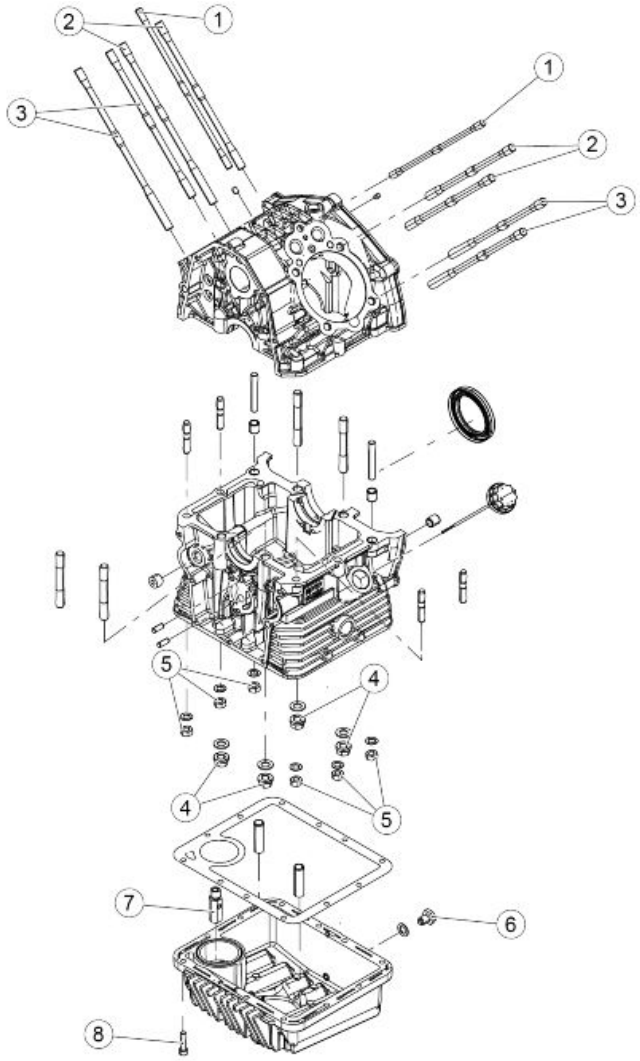
Installing the head cover

- Fit the gasket on the head cover

- Place the head cover together with the gaskets on the seats of the fixing screws

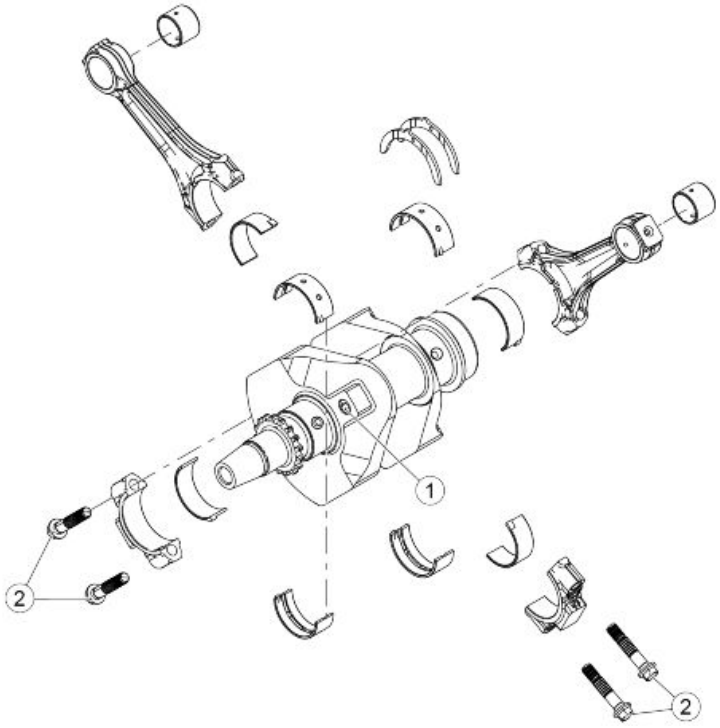
- Place the cover fixing screws and tighten them to the prescribed torque

Crankcase - crankshaft



CRANKCASE

pos.	Description	Type	Quantity	Torque	Notes
1	Central stud bolt	M8	2	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
2	Short stud bolt	M10	4	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
3	Long stud bolt	M10	4	5-6 Nm (3.69-4.42 lb ft)	Loct. DRI-LOC 211
4	Nut (pre-tightening)	M10	4	24-26 Nm (17.70-19.18 lb ft)	-
4	Nut (tightening)	M10	4	44-49 Nm (32.45-36.14 lb ft)	-
5	Nut	M8	6	22-25 Nm (16.23-18.44 lb ft)	-
6	Oil drainage plug	M10	1	20-22 Nm (14.75-16.23 lb ft)	-
7	Oil filter joint	M12	1	20-24 Nm (14.75-17.70 lb ft)	-
8	Oil sump screws	M6	12	9-11 Nm (6.64-8.11 lbf ft)	-

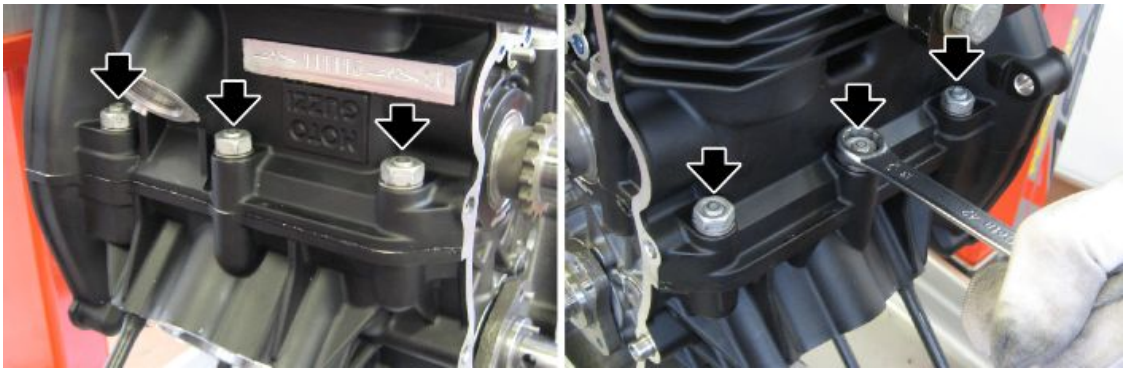


CRANKSHAFT

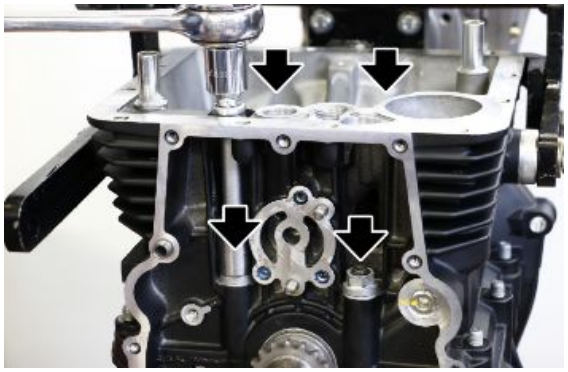
pos.	Description	Type	Quantity	Torque	Notes
1	Oil plug	M12x1.25	1	15-18 Nm (11.06-13.28 lb ft)	Loct. 648
2	Connecting rod screws - Pre-tightening	M8x1	4	10 Nm (7.38 lb ft)	-
2	Connecting rod screws - Tightening	M8x1	4	34-41 Nm (25.08-30.24 lbf ft) (angle 45°)	-

Splitting the crankcase halves

- Unscrew and remove the six external nuts and their washers.



- Undo and remove the four long nuts from the inside of the crankcase.

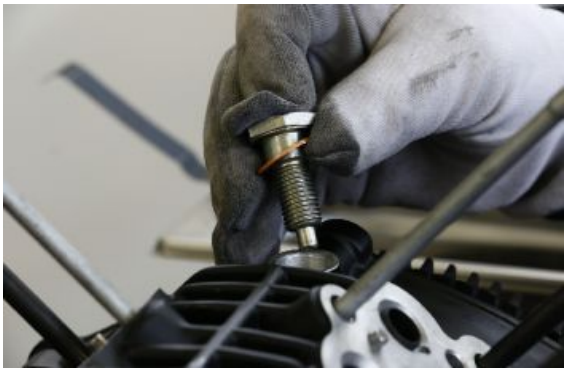


- Remove the upper crankcase being careful not to damage its mating face

- Remove the crankshaft together with connecting rods and small ends

- Remove the engine oil pressure sensor

- Remove the transmitter joint



- Remove the camshaft

- Remove the tappets and classify them

Removing the crankshaft

- Remove the crankshaft connecting rods.
- Unscrew the oil plug and thoroughly clean the oilway and oil passages delivering oil to connecting rods and main journals.

See also

Disassembling the connecting rod

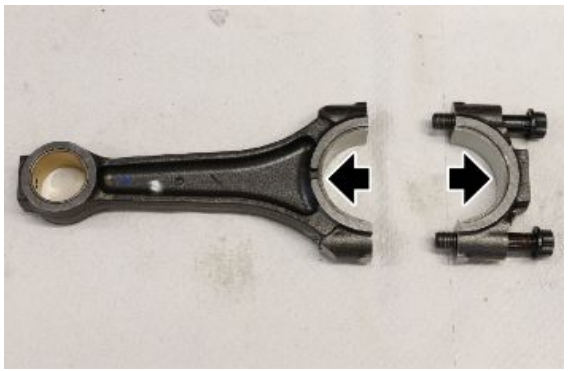
Disassembling the connecting rod

- Remove the screws and separate the connecting rod from the small end paying attention to the reference signs and the mounting direction.

- Remove the half-bearings from connecting rods and small ends.

CAUTION

REPEAT THE PROCEDURE FOR THE OTHER CONNECTING ROD



Inspecting the crankcase halves

- Check that the mating faces are not damaged, dented or scored. Remove the liquid gasket residues.
- Check that the threads of the stud bolts are not dented or stripped; if they are, replace the stud bolt or stud bolts.
- Blow all oil galleries of the two crankcase halves with compressed air.

Inspecting the crankshaft components

- Smear the thread of the cap with threadlocker and tighten the cap firmly.
- Blow with compressed air to clean the lubrication passage seats.

CAUTION

THE CRANKSHAFT IS NITRIDED AND CANNOT BE GROUND; IF WORN, TAPERED OR DEEPLY SCORED, THE CRANKSHAFT MUST BE REPLACED

CRANKSHAFT CHECK - LIMIT VALUES

Specification	Desc./Quantity
Main journal diameter on timing system side (WEAR LIMIT VALUE)	40 mm (1.5748 in)
Main bushing seat diameter on timing system side (MAXIMUM WEAR VALUE)	43.68 mm (1.7197 in)
Thickness for main bushing on timing system side (MAXIMUM WEAR VALUE)	1.78 mm (0.0701 in)

Specification	Desc./Quantity
Clearance between shaft and bushing on timing system side (MAXIMUM WEAR VALUE)	0.08 mm (0.0031 in)
Main journal diameter on clutch side (MINIMUM WEAR VALUE)	43 mm (1.6929 in)
Main bushing seat diameter on clutch side (WEAR LIMIT VALUE)	47.17 mm (1.8571 in)
Total thickness for main bushing on clutch side (MINIMUM WEAR VALUE)	2.04 mm (0.0803 in)
Clearance between shaft and bushing on clutch side (MAXIMUM WEAR VALUE)	0.09 mm (0.0035 in)
Crankshaft thrust height (MAXIMUM WEAR VALUE)	24.81 mm (0.9768 in)
Crankcase thrust height (MINIMUM WEAR VALUE)	2.3 mm (0.0905 in)
Thickness of thrust half-bearings on main bushing on clutch side (MINIMUM WEAR VALUE)	2.3 mm (0.0905 in)
Thrust clearance of crankshaft in crankcase (MAXIMUM WEAR VALUE)	0.3 mm (0.0118 in)
Diameter of crank pin (MINIMUM WEAR VALUE)	39.98 mm (1.5740 in)

The maximum parallelism deviation of the two crankshaft axes (connecting rod pin and main journals on flywheel side and timing system side) should not exceed 0.02 mm (0.0009 in) at 40 mm (1.5748 in) distance.

Checking the connecting rod

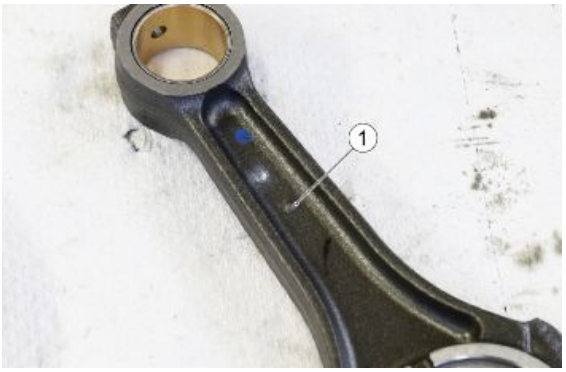
- Check using a micrometer the measure of the connecting rod pin orthogonal axes an in the working area of the small ends, check the measure of the small ends seats on the timing system side and on the flywheel side.
- Assemble the connecting rod without small ends and tighten the connecting rod screws 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)	43.68 mm (1.7197 in)
Thickness of connecting rod head small ends (MINIMUM WEAR VALUE)	1.78 mm (0.0700 in)
Diameter of the small end with pressed and bored bushing (MAXIMUM WEAR VALUE)	22.025 mm (0.8671 in)

Assembling the connecting rod

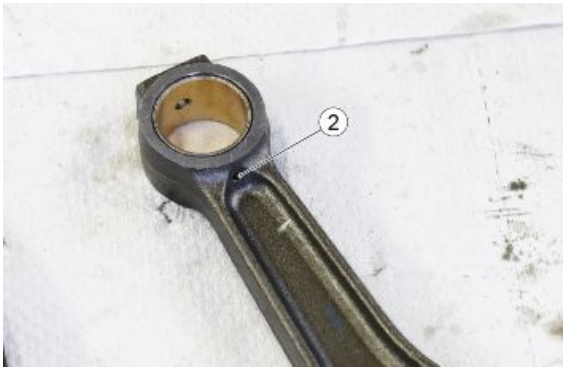
- Before installation, pay attention to reference marks and mounting direction.
- The connecting rods are available in two categories, white and blue point to be connected to the crankshaft for the crank button using the suitable bushing (present in a single class).



CLASSES OF CONNECTING RODS/CRANKSHAFT COUPLING CATEGORIES

Selection class	Diam. rod head	Diam. crankshaft
A (blue)	43.657-46.664 mm (1.7188-1.8372 in)	39.995-40.003 mm (1.5746-1.5749 in)
B (white)	43.664-46.670 mm (1.7191-1.8374 in)	40.003-40.011 mm (1.5749-1.5752 in)

- The burin (1) must be directed to the clutch side for both connecting rods for the correct positioning of the lubrication hole (2) of the main journal bushing



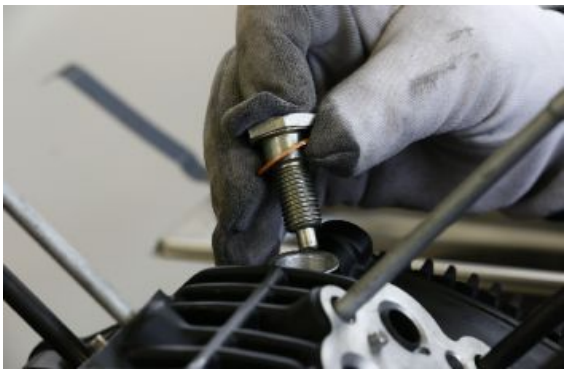
- Before installation, pay attention to reference marks and mounting direction.
- Reassemble the connecting rods on the connecting rod pin in the crankshaft seat and tighten the screws to the prescribed torque.

Refitting the crankcase halves

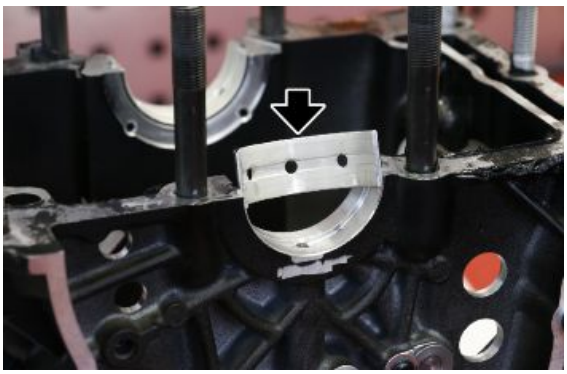
- Insert the tappets after lubricating them properly.

- Operating with the engine turned, insert the camshaft in the crankcase paying attention that one of the holes of the small ends matches with the hole with transmitter joint

- Insert and tighten the transmitter joint to the specified torque



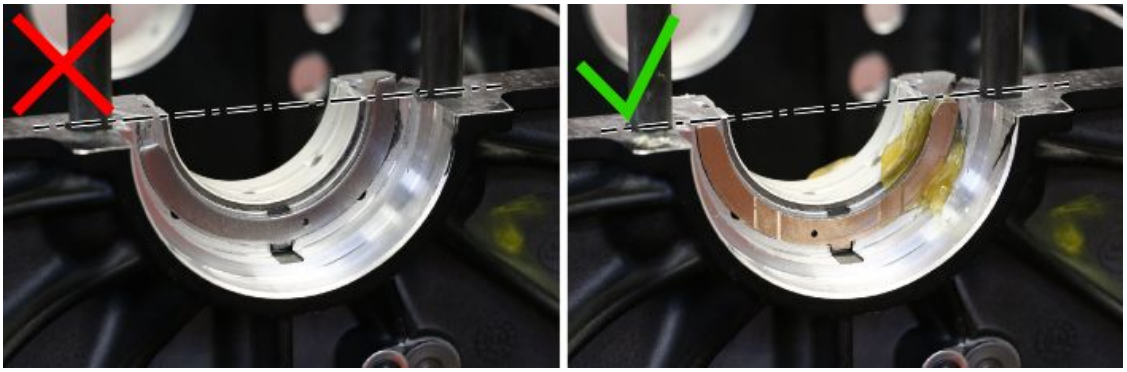
- Insert the small ends timing system side and flywheel side on the upper crankcase paying attention to lubricate them



- With the help of grease, place the thrusts on the upper crankcase from the flywheel side, paying attention to lubricate them in the friction area

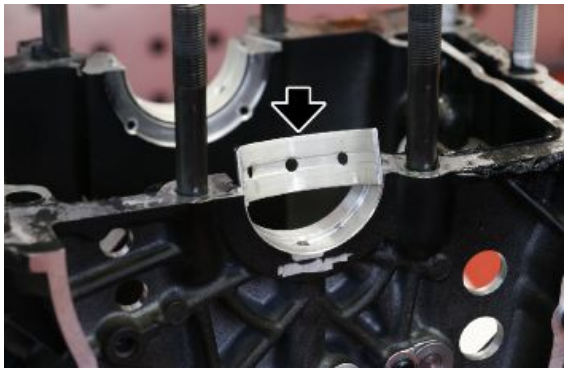
CAUTION

THE MOUNTING DIRECTION OF THE THRUSTS IS UNIQUE



- Insert the seal ring (after lubricating it) on the crankshaft and the assembly onto the engine crankcase making sure that the connecting rods locate correctly into their seats.

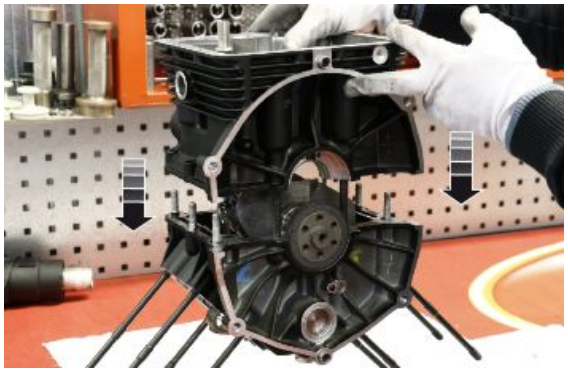
- House the small ends on the lower crankcase lubricating them



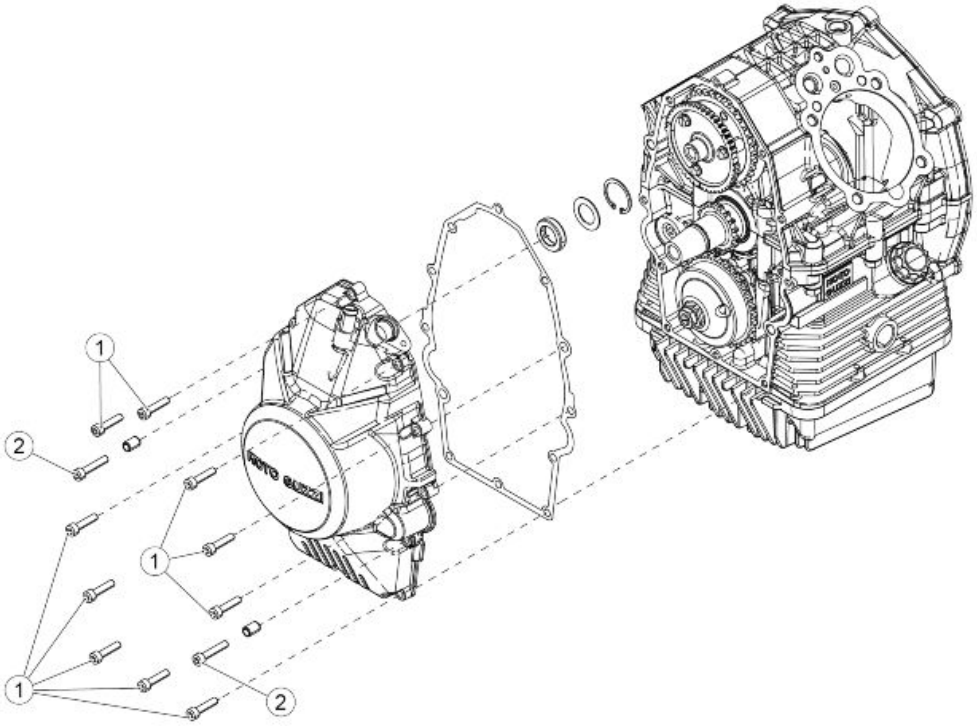
- Smear the crankcases mating faces with the threebond

- Couple the two crankcases making sure by slightly hitting with a mallet, that the two surfaces perfectly adhere

- Insert and screw the four long nuts and the six external nuts together with washers..
- Tighten all nuts to the prescribed torque proceeding with the cross order

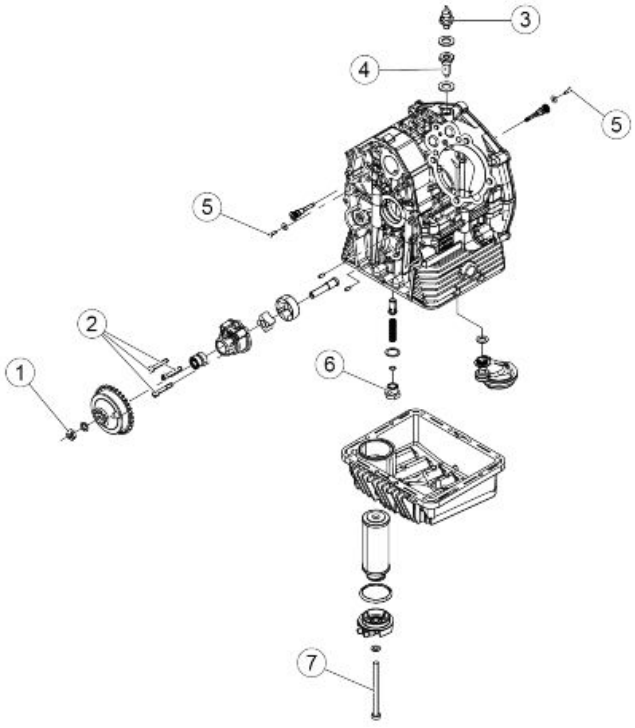


Lubrication



TIMING SYSTEM COVER

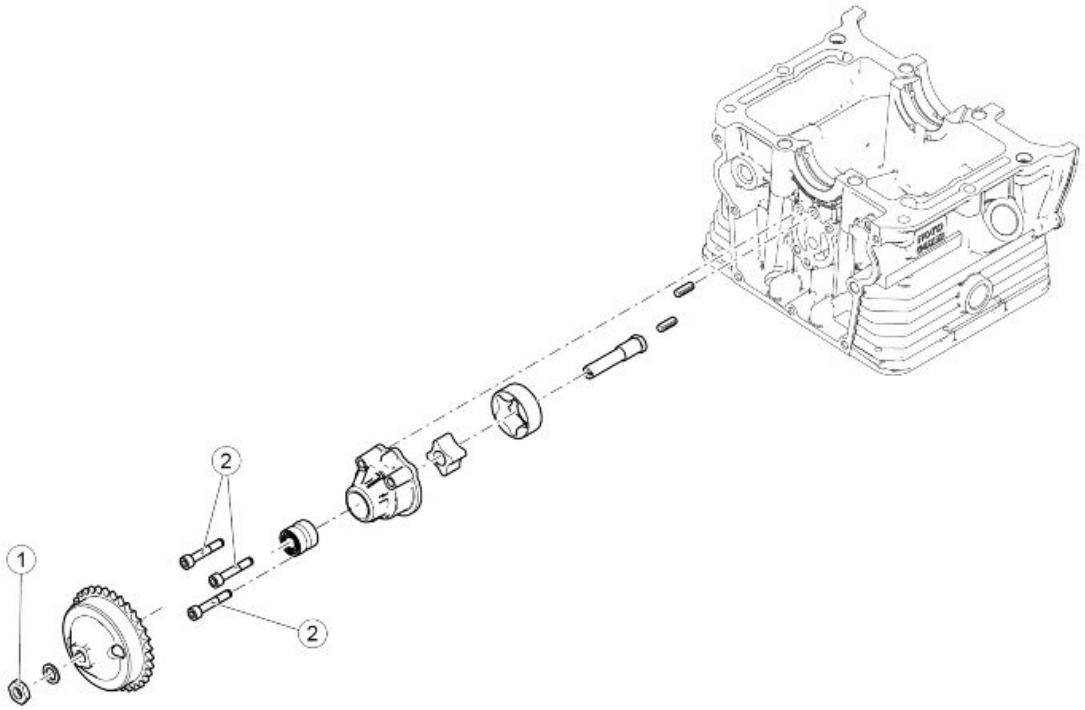
pos.	Description	Type	Quantity	Torque	Notes
1	SHC screw	M6	10	9-11 Nm (6.64-8.11 lbf ft)	-
2	SHC screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-
-	Timing sensor screw	M6	2	9-11 Nm (6.64-8.11 lbf ft)	-



LUBRICATION

pos.	Description	Type	Quantity	Torque	Notes
1	Oil pump gear fastener nut	M10x1.25	1	24-27 Nm (17.70-19.91 lb ft)	Loct. 243
2	Oil pump fixing SHC screw	M6x35	3	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045
3	Oil pressure sensor	M10x1	1	30-33 Nm (22.13-24.34 lb ft)	-
4	Oil pressure sensor housing screw	M12x1.5	1	25-28 Nm (18.44-20.65 lb ft)	-
5	Cooling jets fixing torx screws	M4	2	2.8-3.4 Nm (2.06-2.51 lb ft)	Loct. DRI 2045
6	Oil pressure valve cap	M18x1.5	1	20-25 Nm (14.75-18.44 lb ft)	-
7	Cover fixing rod bolt and oil filter cartridge	M8	1	18-22 Nm (13.28-16.23 lb ft)	-

Oil pump

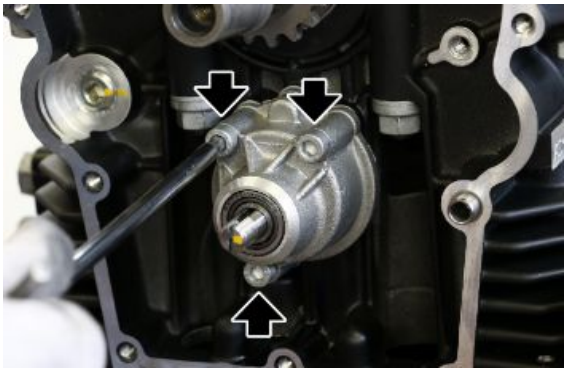


POMPA OLIO

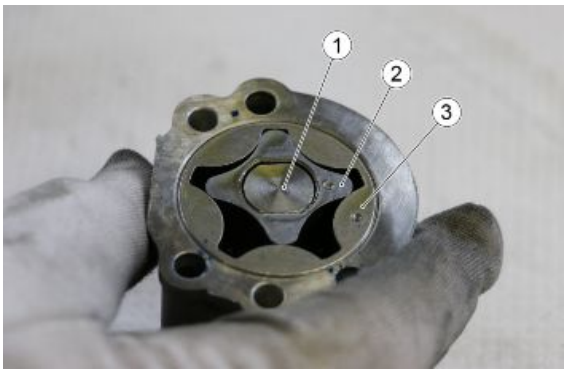
Pos.	Descrizione	Tipo	Quantità	Coppia	Note
1	Oil pump gear fastener nut	M10x1.25	1	24-27 Nm (17.70-19.91 lb ft)	Loct. 243
2	Oil pump fixing SHC screw	M6x35	3	9-11 Nm (6.64-8.11 lbf ft)	Loct. DRI 2045

Removing

- Remove the timing system complete with oil pump gear
- Remove the three fixing screws of the oil pump



- Slide off the pump drive shaft (1) and remove the internal rotor (2) and the external rotor (3)



- Remove the bearing from the pump body

Inspection

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
Diameter external rotor seat (MAXIMUM WEAR VALUE)	40.68 mm (1.6016 in)
Diameter hole for pump drive shaft (MAXIMUM WEAR VALUE)	12.05 mm (0.4744 in)
Diameter seat for roller bearings (MAXIMUM WEAR VALUE)	22.00 mm (0.8661 in)
Thickness of seat for external rotor (MAXIMUM WEAR VALUE)	15.10 mm (0.8661 in)

EXTERNAL ROTOR

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

External rotor specifications:

EXTERNAL ROTOR

Description	Values
External diameter (MINIMUM WEAR VALUE)	40.57 mm (1.5972 in)
Internal diameter (MAXIMUM WEAR VALUE)	24.27 mm (0.9555 in)
Thickness of seat (MAXIMUM WEAR VALUE)	14.92 mm (0.5874 in)

INTERNAL ROTOR

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

Internal rotor specifications:

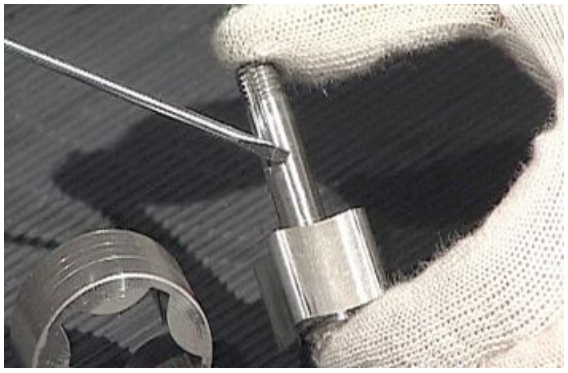
INTERNAL ROTOR

Description	Values
External diameter (MAXIMUM WEAR VALUE)	29.73 mm (0.1705 in)
Internal diameter (MAXIMUM WEAR VALUE)	12.04 mm (0.4740 in)
Thickness (MINIMUM WEAR VALUE)	14.95 mm (0.5886 in)

OIL PUMP DRIVE SHAFT

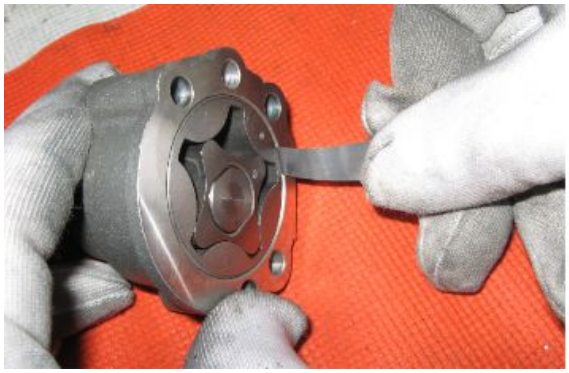
Check shaft and thread for damage; check the keyway for burrs and make sure the head the runs in the rotor is not damaged; replace the shaft if needed.

Shaft specifications:



OIL PUMP DRIVE SHAFT

Description	Values
Diameter for pump body seat (MINIMUM WEAR VALUE)	11.95 mm (0.4705 in)
Diameter seat for roller bearings (MINIMUM WEAR VALUE)	9.95 mm (0.3917 in)



FITTING CLEARANCES

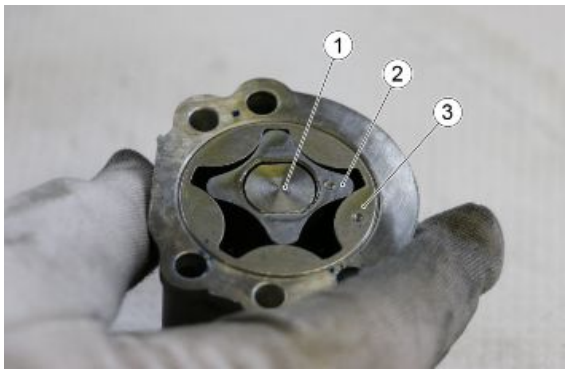
Description	Wear limit	Values
Between pump body and external rotor (MAXIMUM WEAR VALUE)	0.135 mm (0.0053 in)	
Between hole on the internal rotor and the drive shaft (MAXIMUM WEAR VALUE)	0.04 mm (0.0016 in)	
Between hole on the internal body and the drive shaft (MAXIMUM WEAR VALUE)	0.061 mm (0.0024 in)	

FITTING CLEARANCES

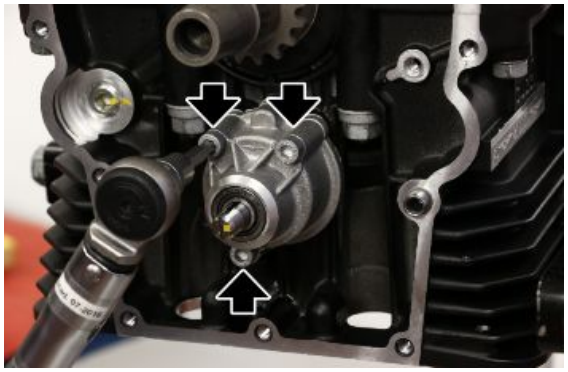
Installing

- Insert the bearing on the pump body

- Insert the external rotor (3), the internal rotor (2) and the pin (1) on the pump body paying attention to match the punching present on the rotors and that both are visible



- Fit the oil pump in its seat, insert and tighten the three fixing screws to the specified torque



Oil sump

Removing the oil sump

- Remove the engine oil filter fixing screw

- Remove the engine oil filter

- -Remove the 14 fastening screws of the oil sump

- Remove the oil sump

- Remove the gasket

- Remove the rose pipe

- Remove the cap and the relative copper gasket

- Remove the spring

- Remove the overpressure valve

Refitting the oil sump

- Install the overpressure valve in the engine crankcase

- Insert the spring and afterwards the cap provided with a new copper gasket, tighten it to the prescribed torque

- Insert the rose pipe

- Place the gasket and insert the oil sump cover

- Insert and tighten the 14 fastening screws of the oil sump to the prescribed torque

- Insert the engine oil filter together with the cover

- Insert and tighten the locking screw of the engine oil filter to the prescribed torque

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