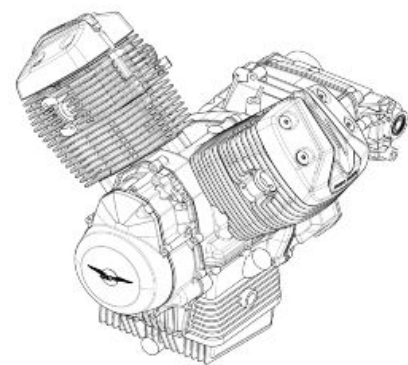




SERVICE STATION MANUAL

B043109



Engine V750 IE MIU G3



SERVICE STATION MANUAL

Engine V750 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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Piaggio & C. S.p.A. Viale Rinaldo Piaggio, 25 - 56025 PONTEDERA (PI), Italy

www.piaggio.com

SERVICE STATION MANUAL

Engine V750 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 motorcycles. 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 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.



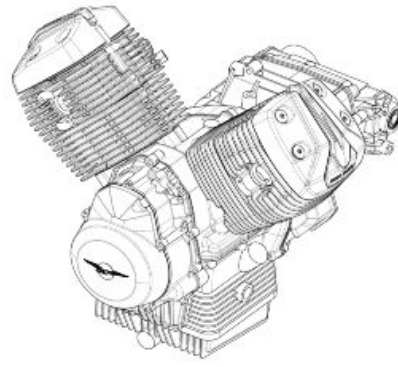
Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.



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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S-TOOLS

ENGINE

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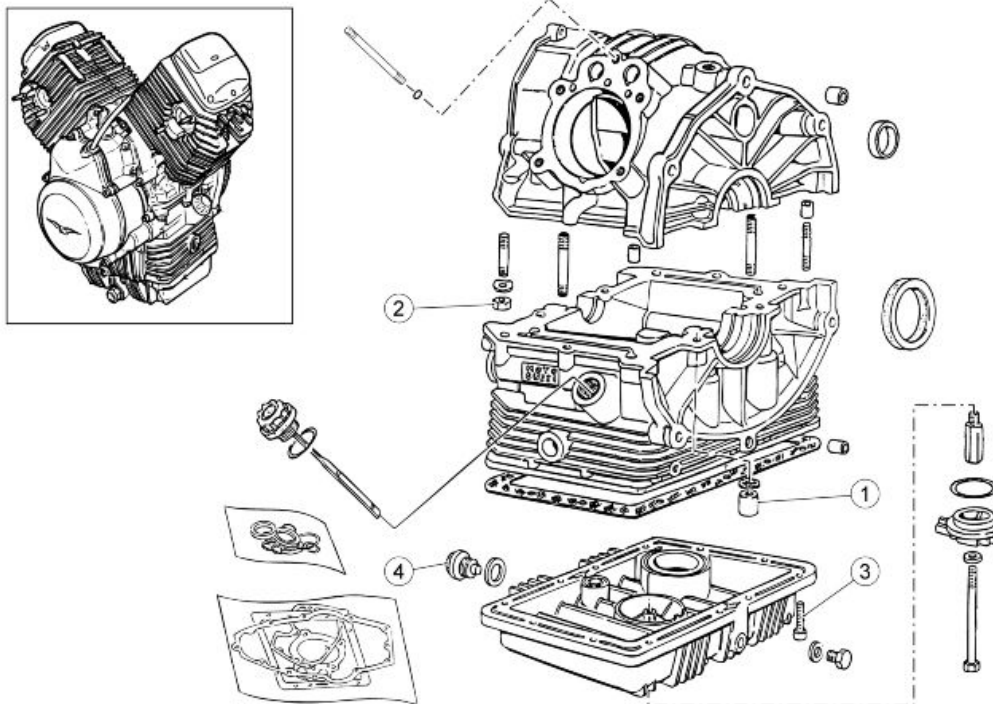
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CHARACTERISTICS

CHAR

Tightening Torques

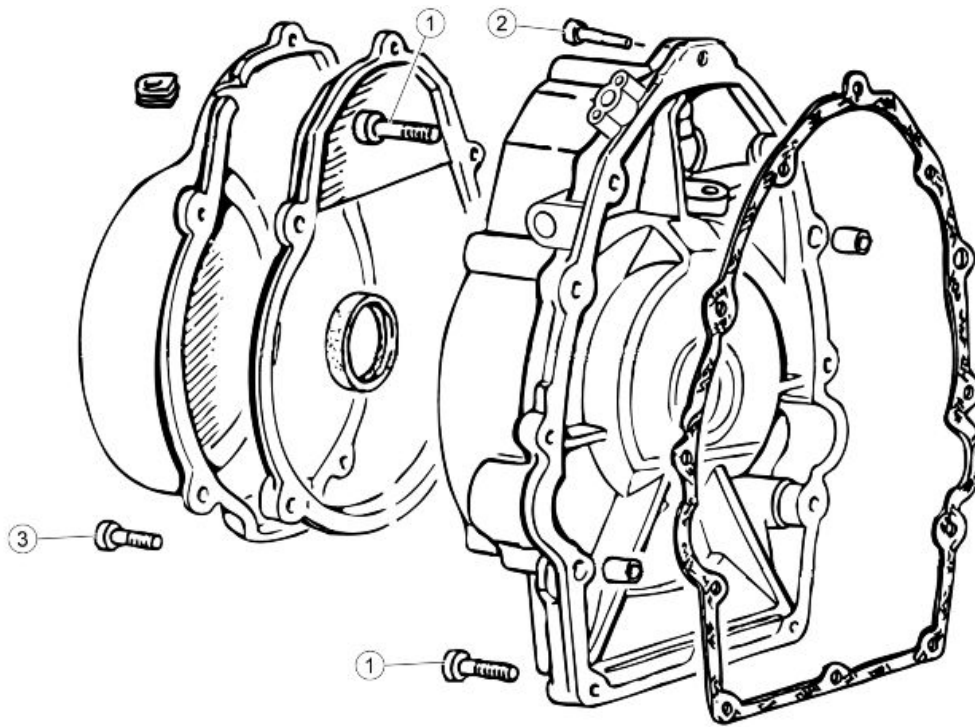
Engine



CRANKCASE

pos.	Description	Type	Quantity	Torque	Notes
1	Column nuts	-	4	42 Nm (30.98 lbf ft)	-
2	Nut	M8x1.25	6	22 Nm (16.22 lbf ft)	-
3	TCEI screw	M6x25	12	10 Nm (7.37 lbf ft)	-
4	Oil drainage plug	M10x1	1	40 Nm (29.5 lbf ft)	-
-	Spark plugs	-	2	30 Nm (22.13 lbf ft)	-

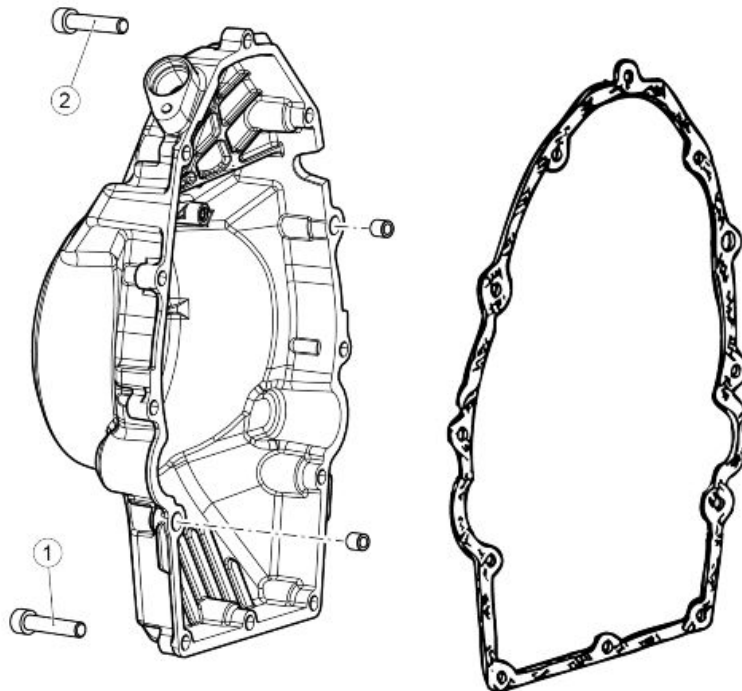
OPTION 01



TIMING SYSTEM COVER

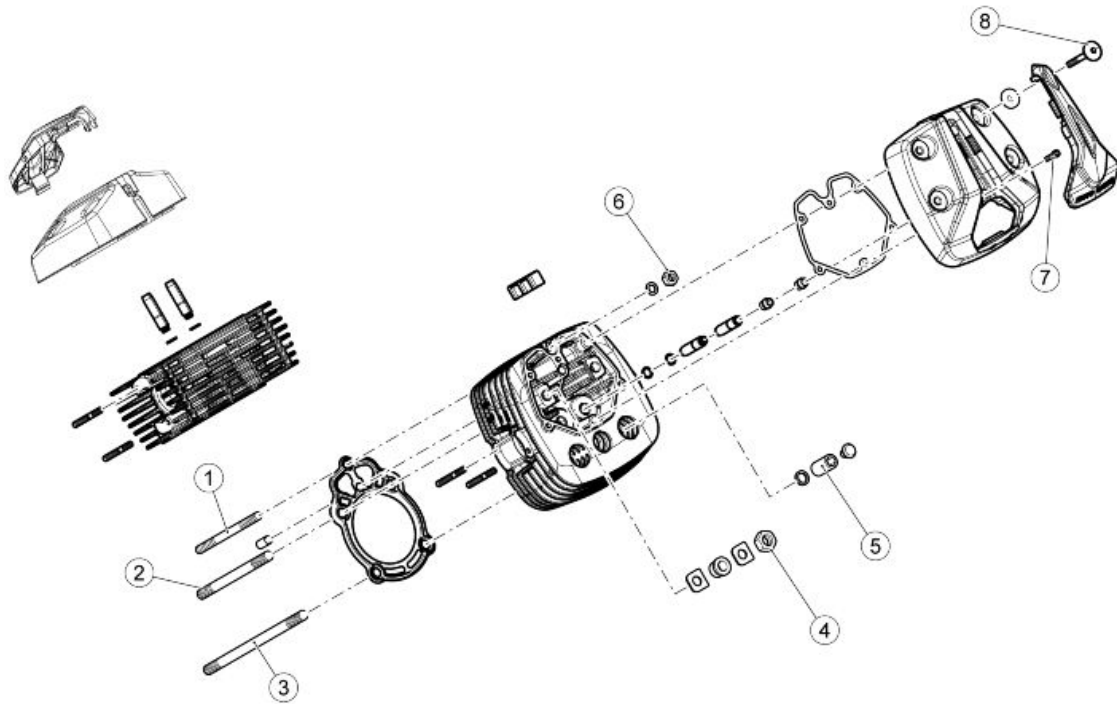
pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M6x25	10	10 Nm (7.37 lb ft)	-
2	TCEI screw	M6x30	2	10 Nm (7.37 lb ft)	-
3	Alternator cover screws	M6x35	5	10 Nm (7.37 lb ft)	Loctite 243

OPTION 02



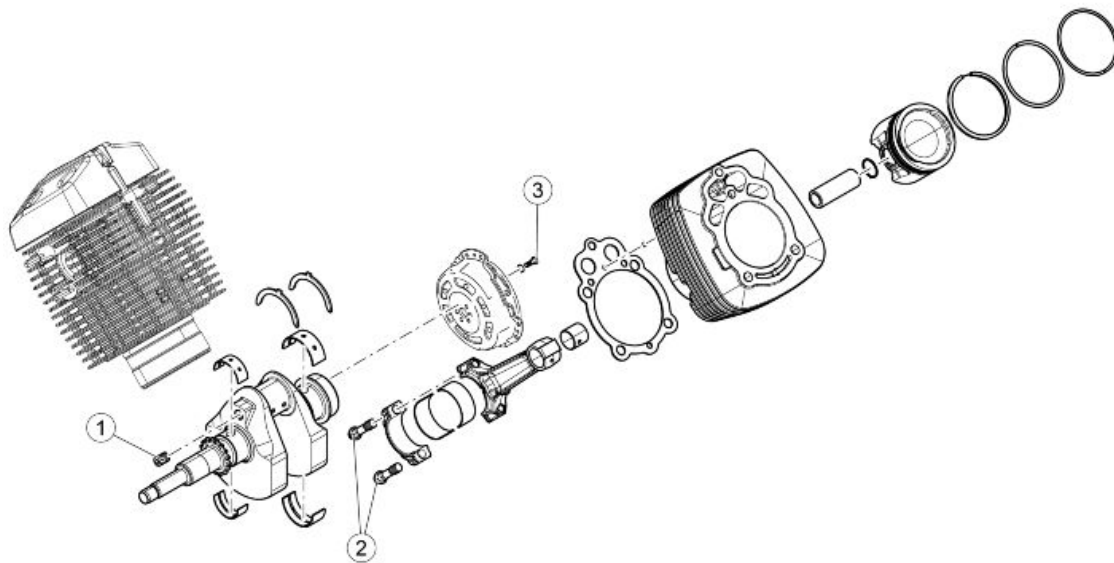
TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M6.15x11	10	10 Nm (7.37 lb ft)	Loct. 243
2	TCEI screw	M6.15x0.8	1	10 Nm (7.37 lb ft)	Loct. 243



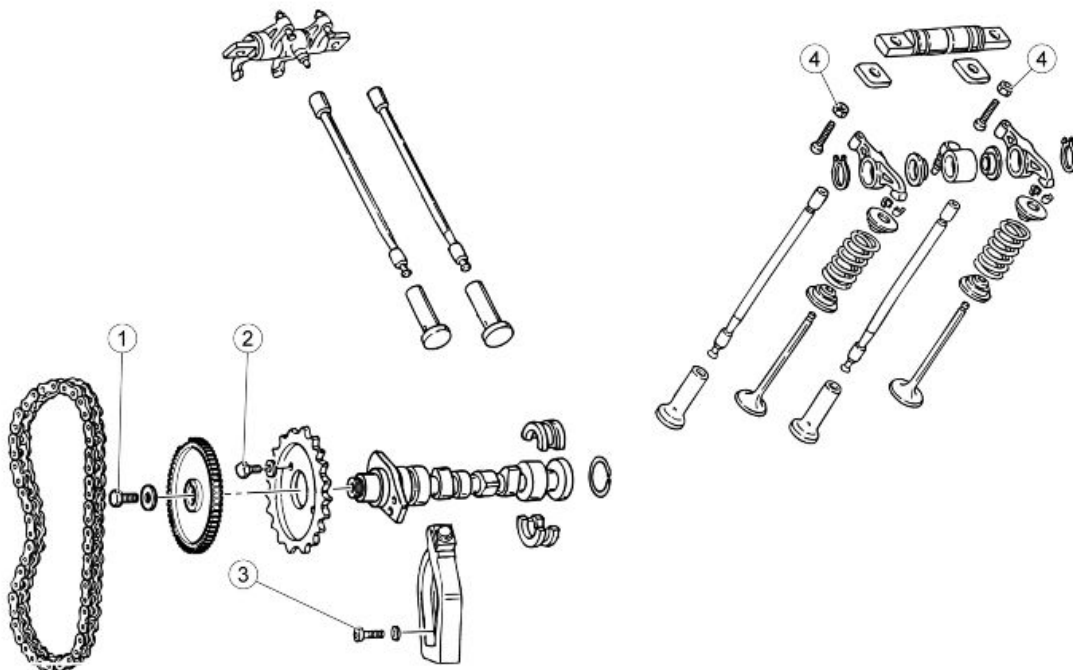
HEAD - CYLINDER

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	-	4	25 Nm (18.44 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)	-



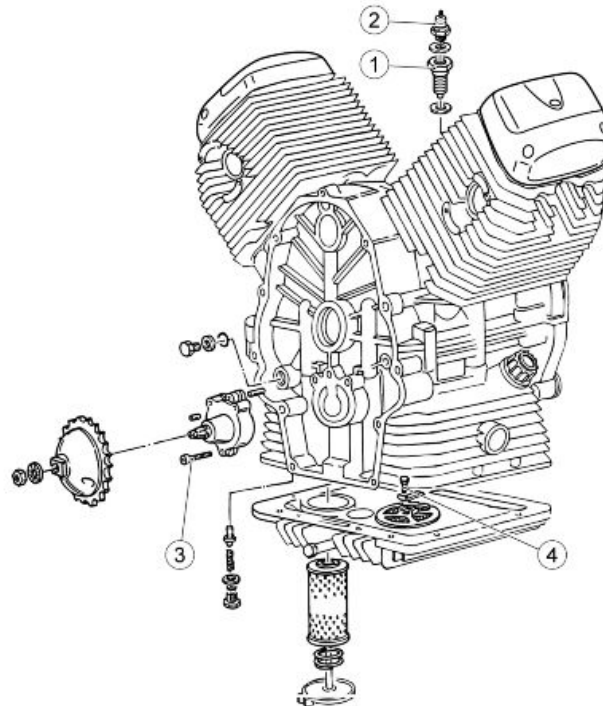
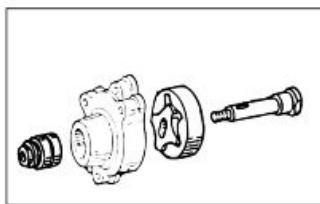
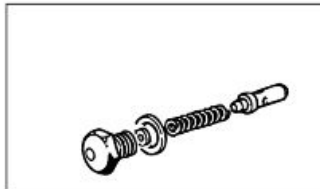
CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Oil plug	-	1	15 Nm (11.06 lbf ft)	Loctite 601
2	Connecting rod screws	-	4	33 Nm (24.34 lbf ft)	-
3	Flywheel screws	-	6	42 Nm (30.98 lbf ft)	Loctite 243



TIMING SYSTEM

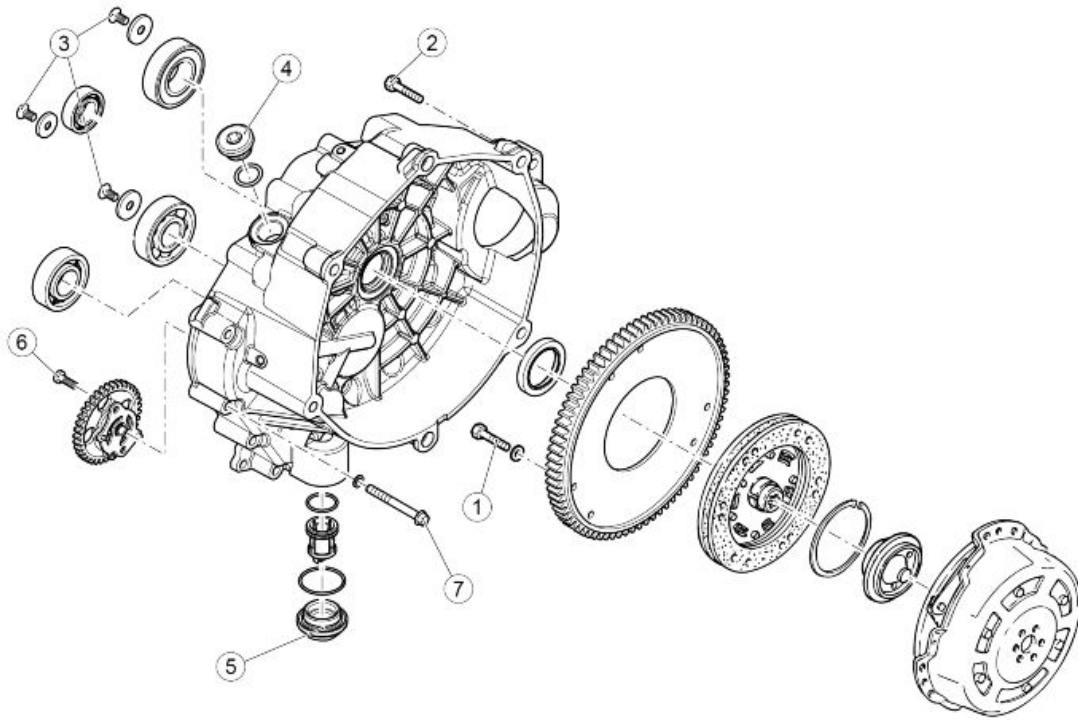
pos.	Description	Type	Quantity	Torque	Notes
1	Tone wheel screw	M8x22	1	25 Nm (18.44 lb ft)	-
2	Timing system gear screws	-	2	25 Nm (18.44 lb ft)	Loctite 243
3	Chain tensioner screw	M6x16	1	10 Nm (7.38 lb ft)	-
4	Valve clearance adjuster screw	M6x1	4	10 Nm (7.38 lb ft)	-



OIL PUMP

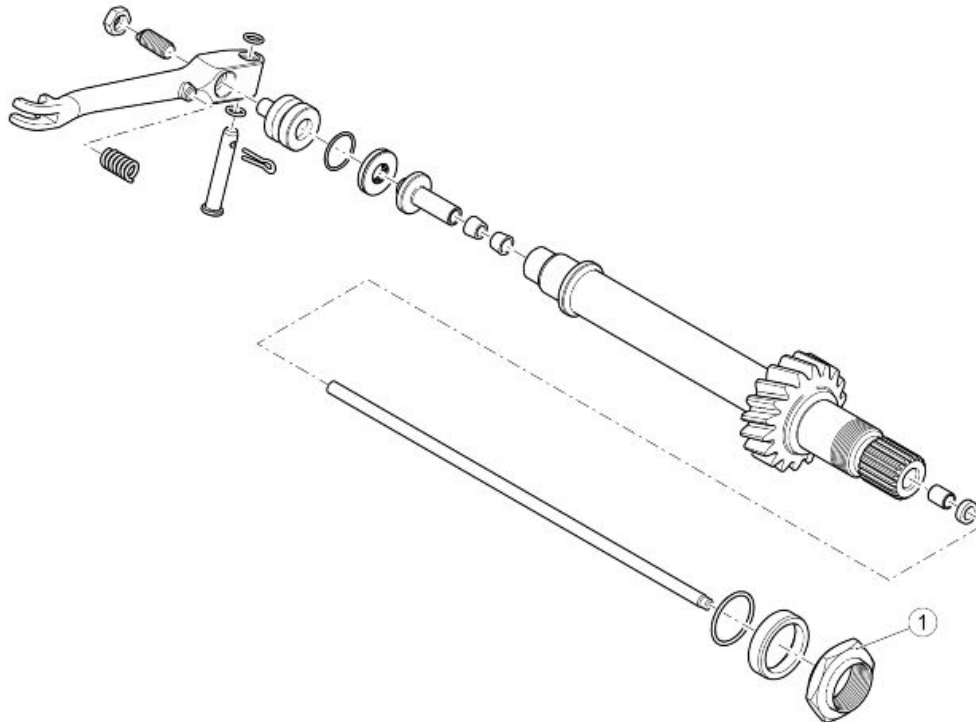
pos.	Description	Type	Quantity	Torque	Notes
1	Transmitter joint	-	1	25 Nm (18.44 lbf ft)	-
2	Oil pressure sensor	-	1	30 Nm (22.13 lbf ft)	-
3	Oil pump screws	M6x35	3	10 Nm (7.38 lbf ft)	Loctite 648
4	Oil filter screw	-	1	6 Nm (4.43 lbf ft)	-

OPTION 01



CLUTCH I

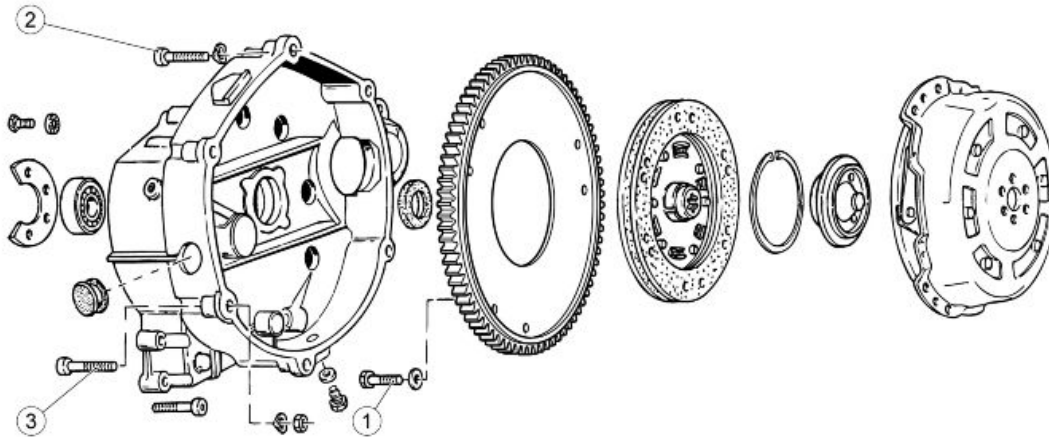
pos.	Description	Type	Quantity	Torque	Notes
1	Crown screws	M6x16	6	10 Nm (7.38 lb ft)	Loctite 243
2	Gearbox screws	M8x35	5	25 Nm (18.44 lb ft)	-
3	Bearing block washers fixing screws	TSEI	4	10 Nm (7.38 lb ft)	Loct. 243
4	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
5	Oil filter cap	-	1	.. Nm (... lb ft)	-
6	Oil pump fixing screw	Torx M5x16	1	6 Nm (4.42 lb ft)	Loct. 243
7	Gearbox fixing screws	TCEI M6x55	14	10 Nm (7.38 lb ft)	-



CLUTCH II

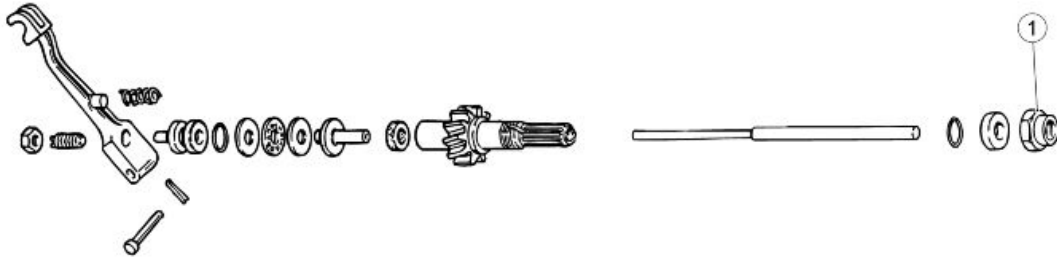
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch shaft nut	-	1	100 Nm (73.76 lb ft)	Loctite 243

OPTION 02



CLUTCH I

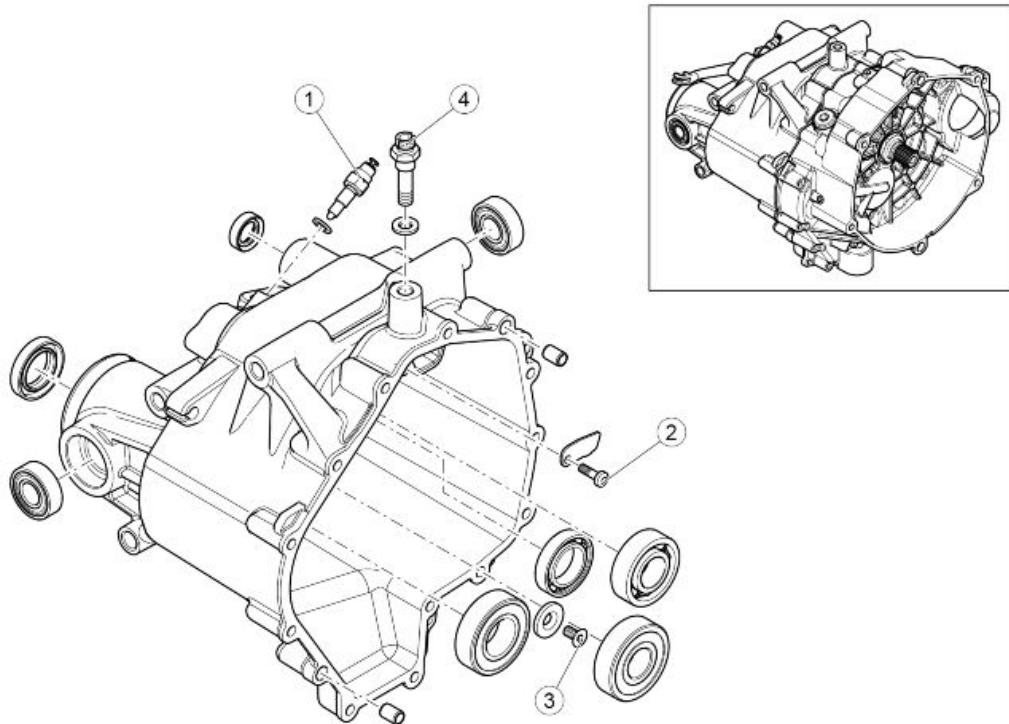
pos.	Description	Type	Quantity	Torque	Notes
1	Crown screws	M6x16	6	10 Nm (7.38 lb ft)	Loctite 243
2	Gearbox screws	M8x35	5	25 Nm (18.44 lb ft)	-
3	Clutch belt cover screws	M6x30	11	10 Nm (7.38 lb ft)	Loctite 243



CLUTCH II

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch shaft nut	-	1	100 Nm (73.76 lb ft)	Loctite 243

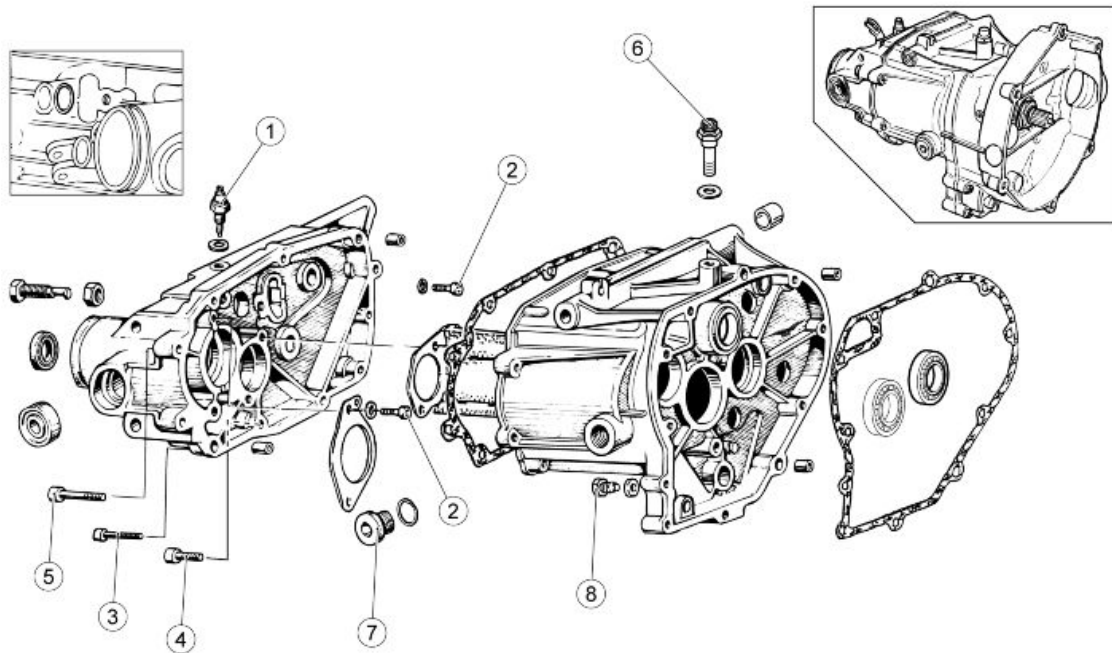
OPTION 01



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)	-

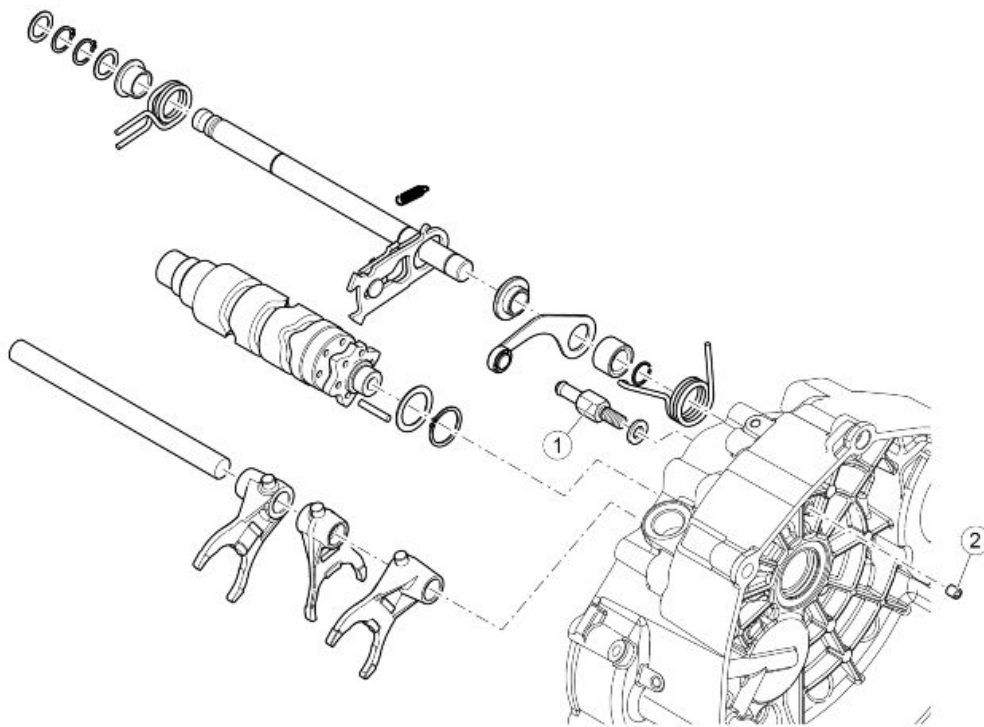
OPTION 02



GEARBOX

pos.	Description	Type	Quantity	Torque	Notes
1	Neutral sensor	-	1	8 Nm (5.90 lb ft)	-
2	Screws	M6x14	4	10 Nm (7.38 lb ft)	-
3	Gearbox cover screws	M6x30	5	10 Nm (7.38 lb ft)	-
4	Gearbox cover screws	M6x35	2	10 Nm (7.38 lb ft)	-
5	Gearbox cover screws	M8x35	4	22 Nm (16.23 lb ft)	-
6	Oil breather plug	-	1	20 Nm (14.75 lb ft)	-
7	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
8	Oil drainage plug	M10x1	1	20 Nm (14.75 lb ft)	-

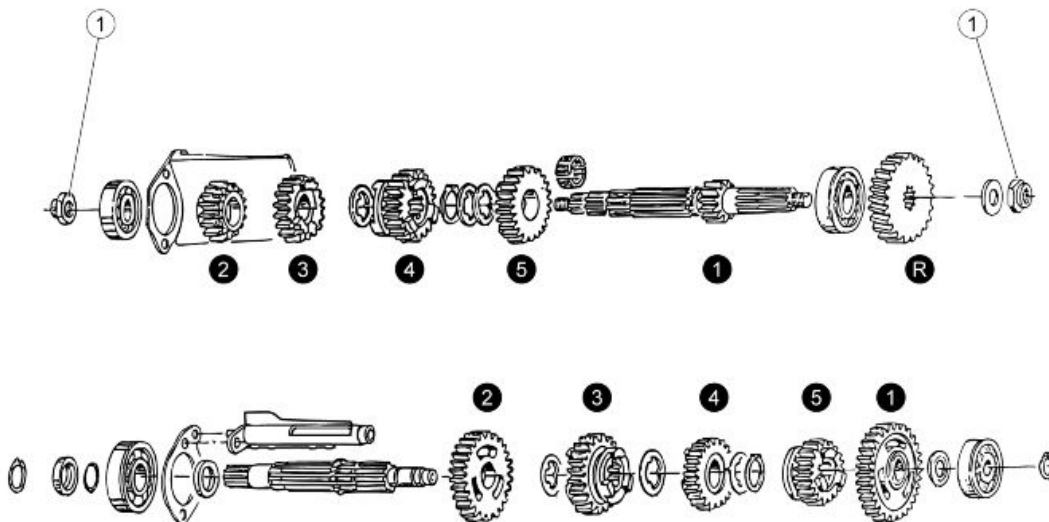
OPTION 01



GEAR SELECTOR

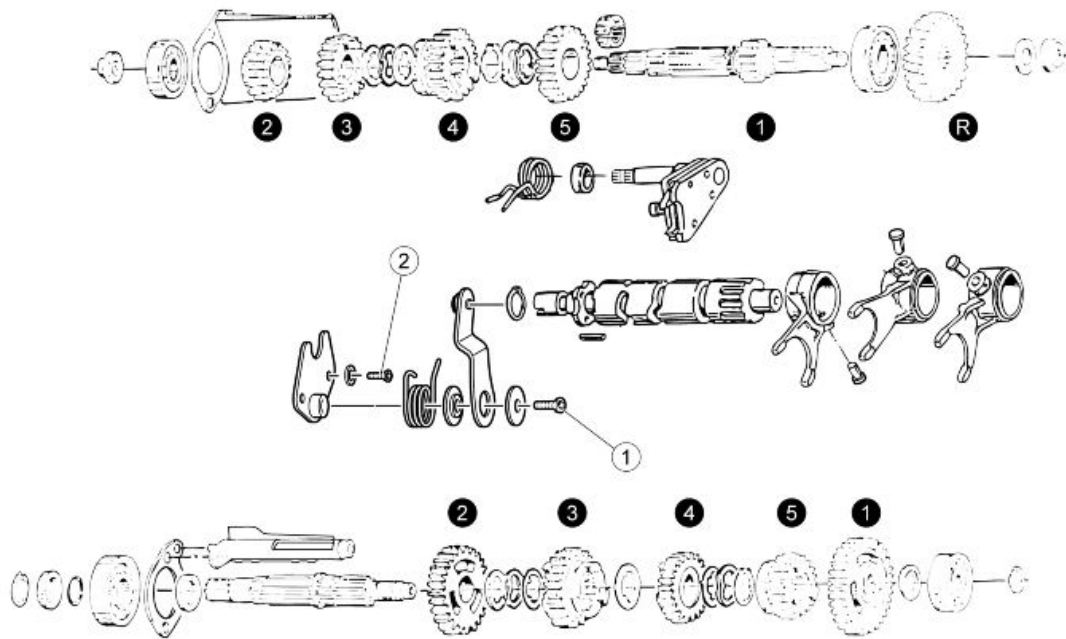
pos.	Description	Type	Quantity	Torque	Notes
1	Selector pin (Option 01)	-	1	25 Nm (18.44 lb ft)	-
2	Selector nut (Option 01)	-	1	25 Nm (18.44 lb ft)	-
1	Selector pin (Option 02)	-	1	25 Nm (18.44 lb ft)	-

OPTION 02



GEARBOX

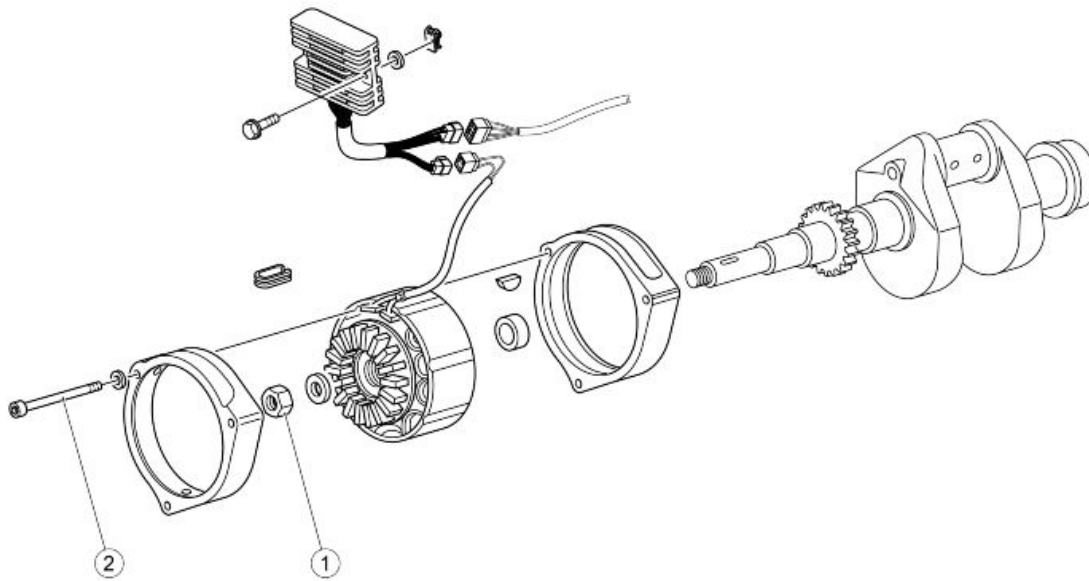
pos.	Description	Type	Quantity	Torque	Notes
1	Main shaft nuts	-	2	60 Nm (44.25 lb ft)	-



GEAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Index lever screw	M6x12	1	10 Nm (7.38 lb ft)	Loctite 243
2	Screws	M6x16	2	10 Nm (7.38 lb ft)	-

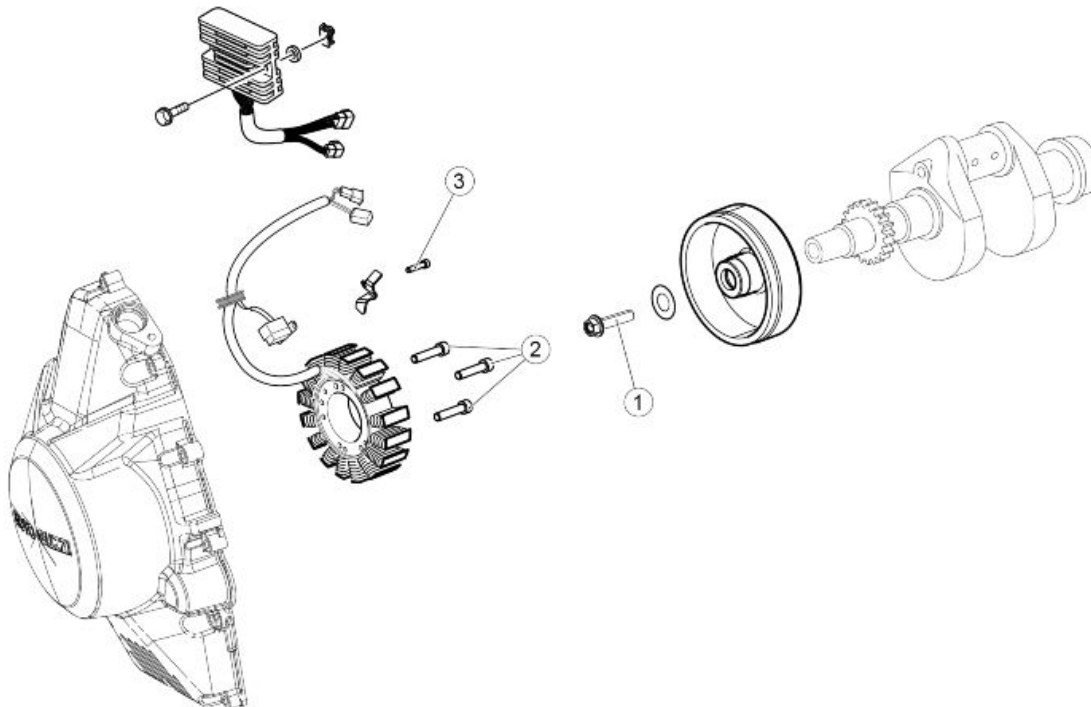
OPTION 01



ALTERNATOR - REGULATOR

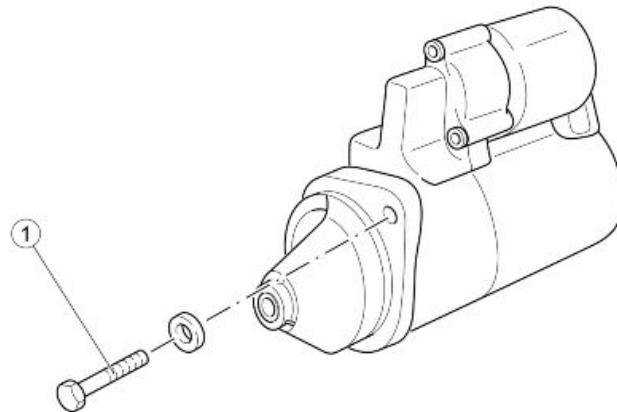
pos.	Description	Type	Quantity	Torque	Notes
1	Alternator nut	M16	1	90 Nm (66.38 lb ft)	Loctite 243
2	Front cover fixing screws	M5x65	3	6 Nm (4.43 lb ft)	-

OPTION 02



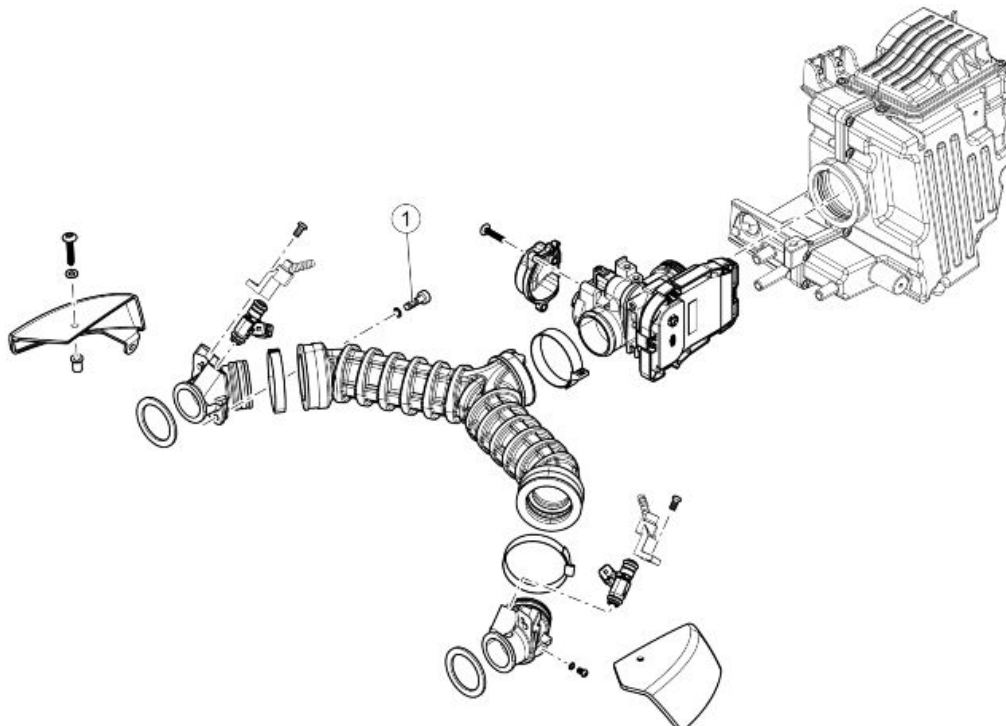
ALTERNATOR - REGULATOR

pos.	Description	Type	Quantity	Torque	Notes
1	TE Flanged screw	M12 - 1.25x50	1	100 Nm (73.76 lb ft)	-
2	Recessed TCEI screws	M6 x 35	3	10 Nm (7.38 lb ft)	Loct. 243
3	TCEI screw	M5 x 12	1	10 Nm (7.38 lb ft)	Loct. 243



STARTER MOTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor fixing screws	M8x35	2	25 Nm (18.44 lb ft)	-



THROTTLE BODY


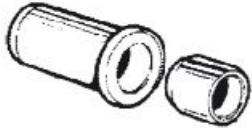
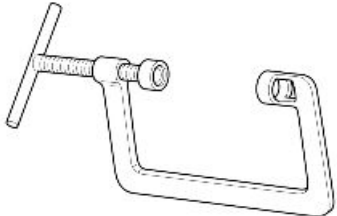
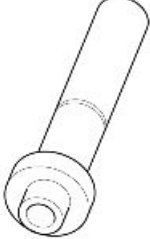

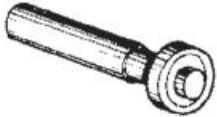
pos.	Description	Type	Quantity	Torque	Notes
1	Pipe fixing screw	M6x22	4	10 Nm (7.38 lb ft)	-

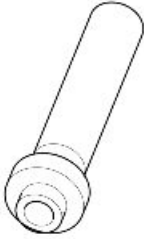

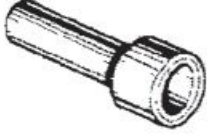
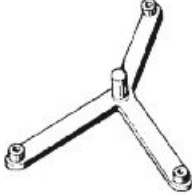


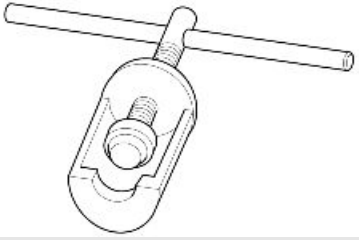
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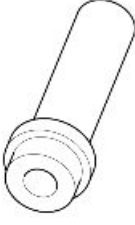
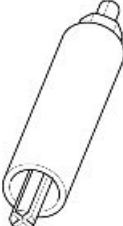
SSPECIAL TOOLS




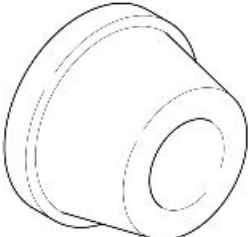
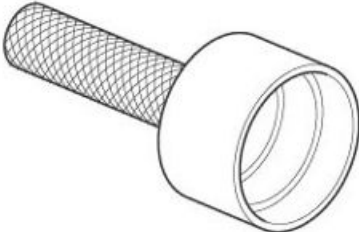
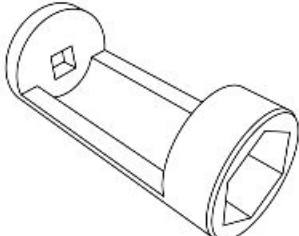

S-TOOLS

SPECIAL TOOLS

Stores code	Description	
19.92.73.00	Bushing for fitting seal ring on secondary shaft	
19.92.72.20	Tool for fitting seal ring on timing system cover	
10.90.72.00	Tool for valve removal and refitting	
19.92.61.00	Punch for seal ring of bevel gear set pinion	
19.92.88.00	Bevel gear set alignment pre-fitting tool	
19.92.94.00	Punch for clutch shaft bearing on housing	

Stores code	Description	
19.92.60.00	Punch for gearcase sealing ring	
19.90.59.00	Punch for seal ring on clutch shaft	
19.92.72.00	Punch for fitting seal ring on gearbox cover (secondary shaft)	
19.90.65.00	Tool for clutch plate fitting/centring	
19.91.18.00	Flywheel locking tool	
19.92.72.02	Spacer for fitting ring on secondary shaft	
19.90.70.00	Extractor for internal ring on drilled bolt	

Stores code	Description	
19.92.75.00	Extractor for external ring of gearcase bearing	
19.92.62.00	Punch for bearing on bevel gear set pinion	
19.92.77.00	Transmission gear locking tool for gearbox removal	
19.92.63.00	Punch for primary shaft bearing on gearbox	
19.92.64.00	Punch for external ring of tapered bearing on bevel gear set pinion holding body	
19.92.65.00	Punch for external ring of gearcase bearing	
19.92.76.00	Extractor for swinging arm holder bearing on gearbox cover	

Stores code	Description	
020847Y	Flywheel extractor	
19.92.78.00	Adapter bushing for valve removing tool	
19.92.79.00	Punch for pressing bearing inner ring on-to drilled pin	
12.91.20.00	Tool to fit the flywheel-side flange together with seal ring on the crankshaft	
19.92.71.00	Tool to fit the seal ring on the flywheel-side flange	
020975Y	Clutch shaft nut key	
19.90.71.60	Clutch shaft locking equipment	

Stores code	Description
-------------	-------------

19.90.25.00

Gearbox support



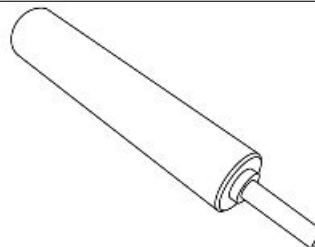
19.92.60.20

Punch for cap installation on valve guide.



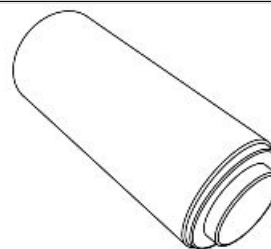
020976Y

Punch for fitting the clutch control dust seal



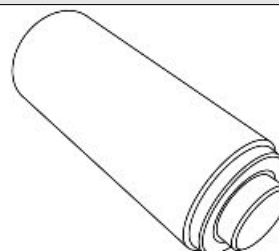
020977Y

Punch for refitting the clutch shaft oil seal



020978Y

Punch for drive shaft secondary oil gaiter refitting



19.92.73.20

Tool for fitting seal ring on camshaft timing system cover



19.92.64.60

Inserting tool for outer ring of secondary shaft bearing



INDEX OF TOPICS

ENGINE

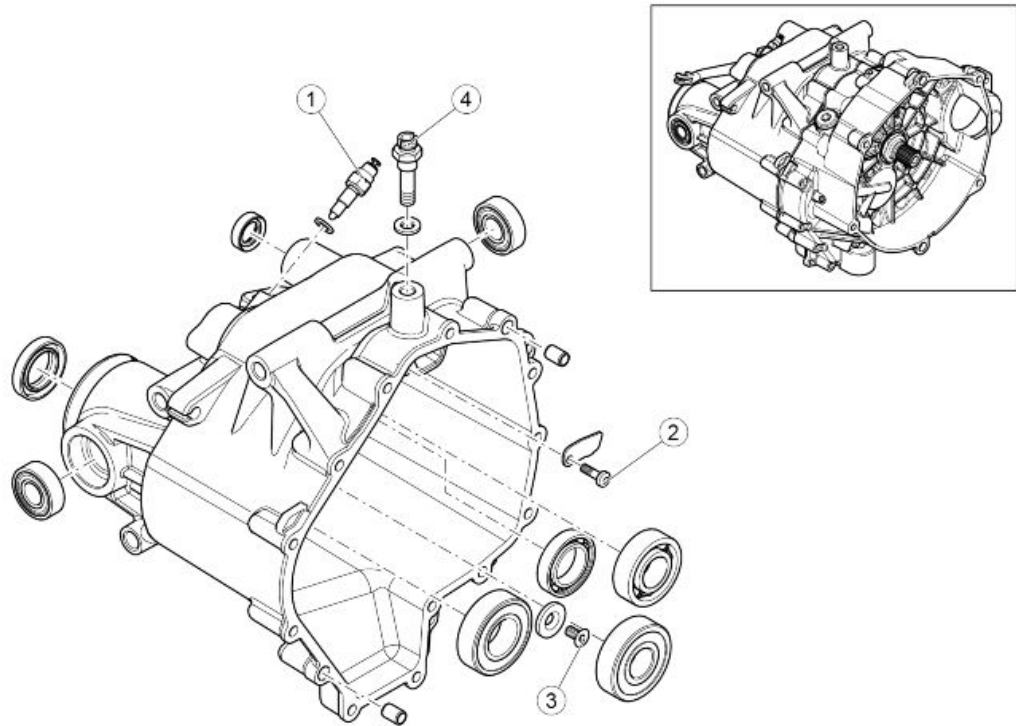
ENG

Gearbox

CAUTION

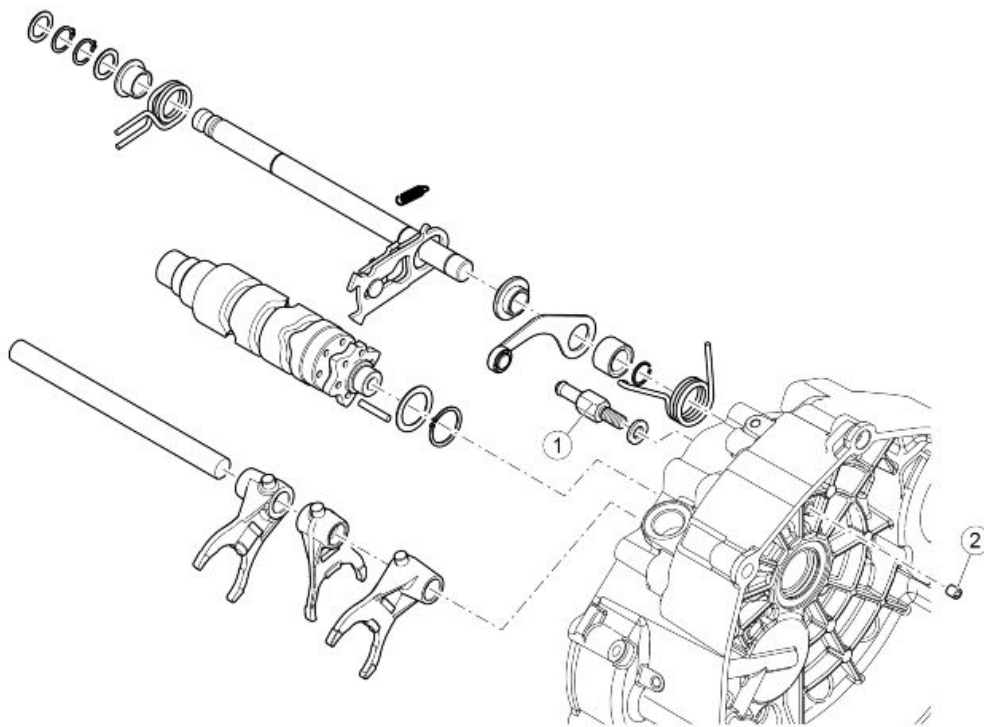
THERE CAN BE TWO DIFFERENT TYPES OF GEARBOX ON THE ENGINE WITH 6 GEAR SPEEDS (OPTION 01) OR WITH 5 GEAR SPEEDS (OPTION 02)

OPTION 01



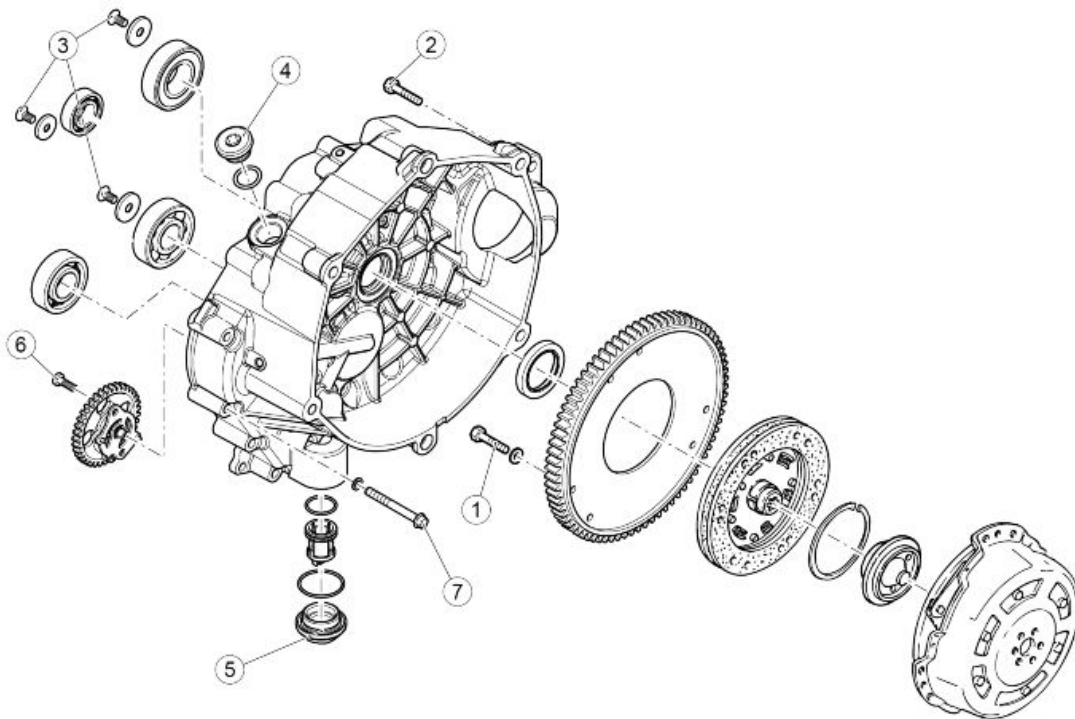
GEARBOX

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)	-



GEAR SELECTOR

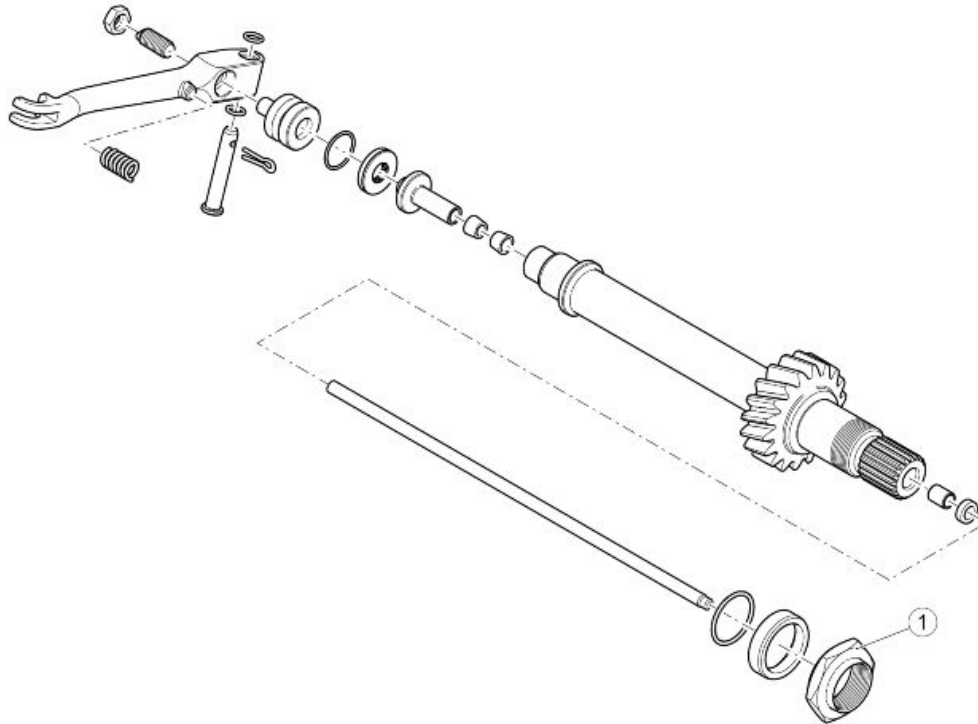
pos.	Description	Type	Quantity	Torque	Notes
1	Selector pin (Option 01)	-	1	25 Nm (18.44 lb ft)	-
2	Selector nut (Option 01)	-	1	25 Nm (18.44 lb ft)	-
1	Selector pin (Option 02)	-	1	25 Nm (18.44 lb ft)	-



CLUTCH I

pos.	Description	Type	Quantity	Torque	Notes
1	Crown screws	M6x16	6	10 Nm (7.38 lb ft)	Loctite 243

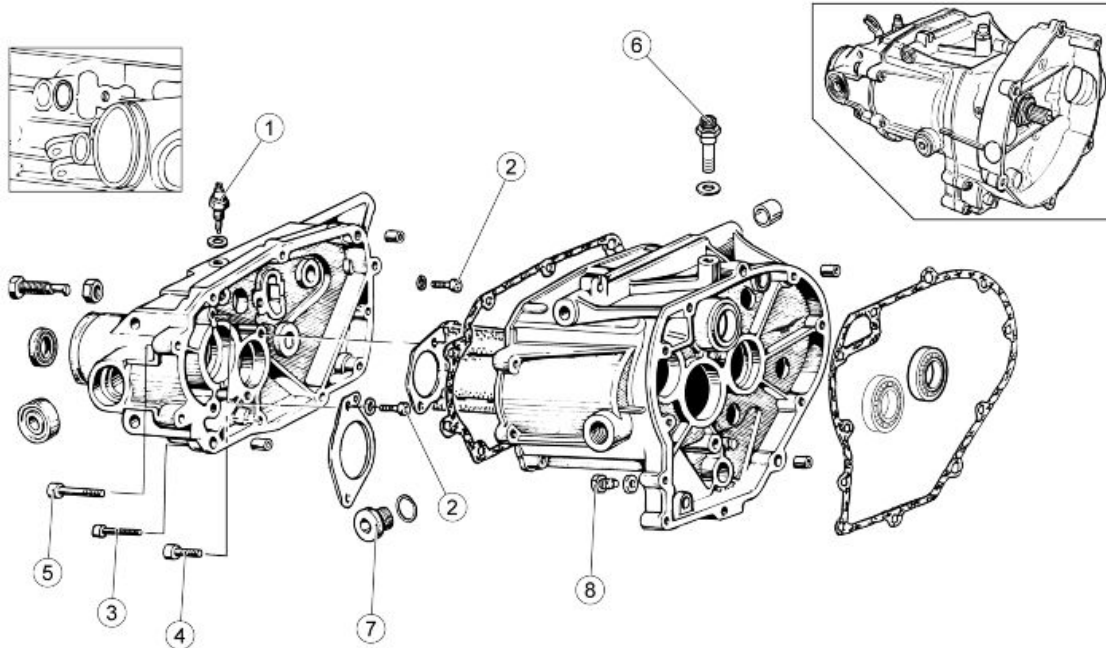
pos.	Description	Type	Quantity	Torque	Notes
2	Gearbox screws	M8x35	5	25 Nm (18.44 lb ft)	-
3	Bearing block washers fixing screws	TSEI	4	10 Nm (7.38 lb ft)	Loct. 243
4	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
5	Oil filter cap	-	1	.. Nm (... lb ft)	-
6	Oil pump fixing screw	Torx M5x16	1	6 Nm (4.42 lb ft)	Loct. 243
7	Gearbox fixing screws	TCEI M6x55	14	10 Nm (7.38 lb ft)	-



CLUTCH II

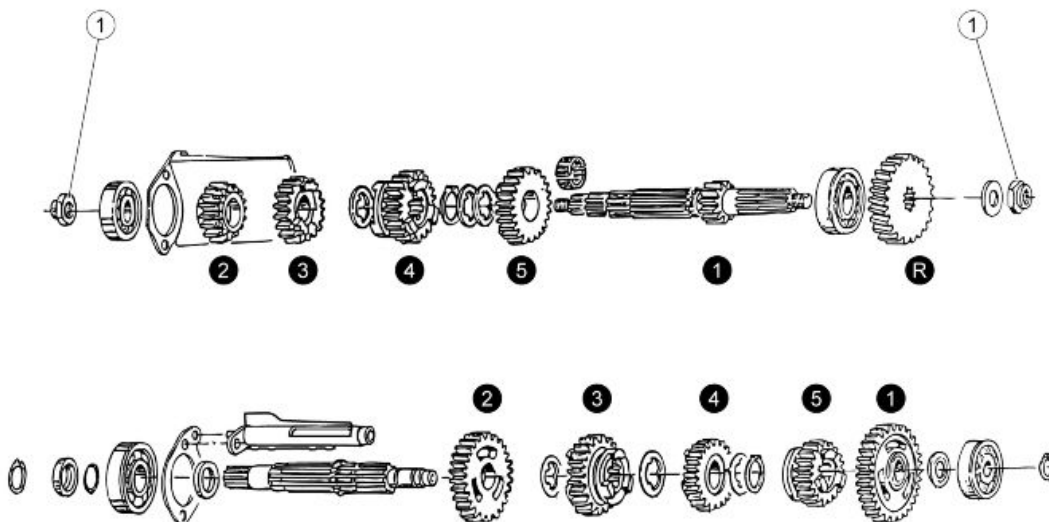
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch shaft nut	-	1	100 Nm (73.76 lb ft)	Loctite 243

OPTION 02



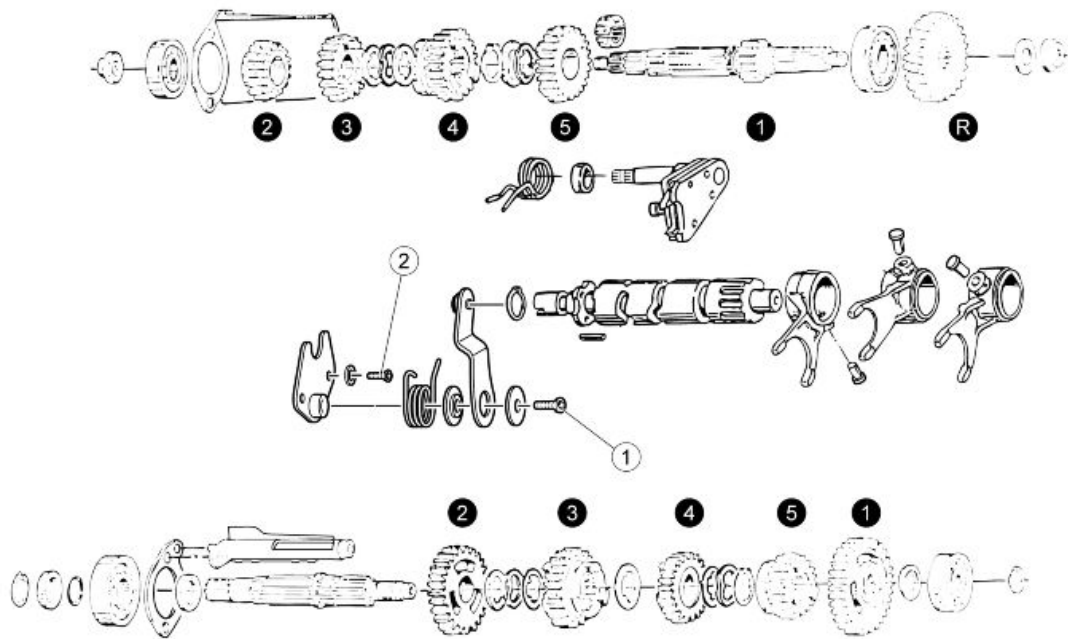
GEARBOX

pos.	Description	Type	Quantity	Torque	Notes
1	Neutral sensor	-	1	8 Nm (5.90 lb ft)	-
2	Screws	M6x14	4	10 Nm (7.38 lb ft)	-
3	Gearbox cover screws	M6x30	5	10 Nm (7.38 lb ft)	-
4	Gearbox cover screws	M6x35	2	10 Nm (7.38 lb ft)	-
5	Gearbox cover screws	M8x35	4	22 Nm (16.23 lb ft)	-
6	Oil breather plug	-	1	20 Nm (14.75 lb ft)	-
7	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
8	Oil drainage plug	M10x1	1	20 Nm (14.75 lb ft)	-



GEARBOX

pos.	Description	Type	Quantity	Torque	Notes
1	Main shaft nuts	-	2	60 Nm (44.25 lb ft)	-

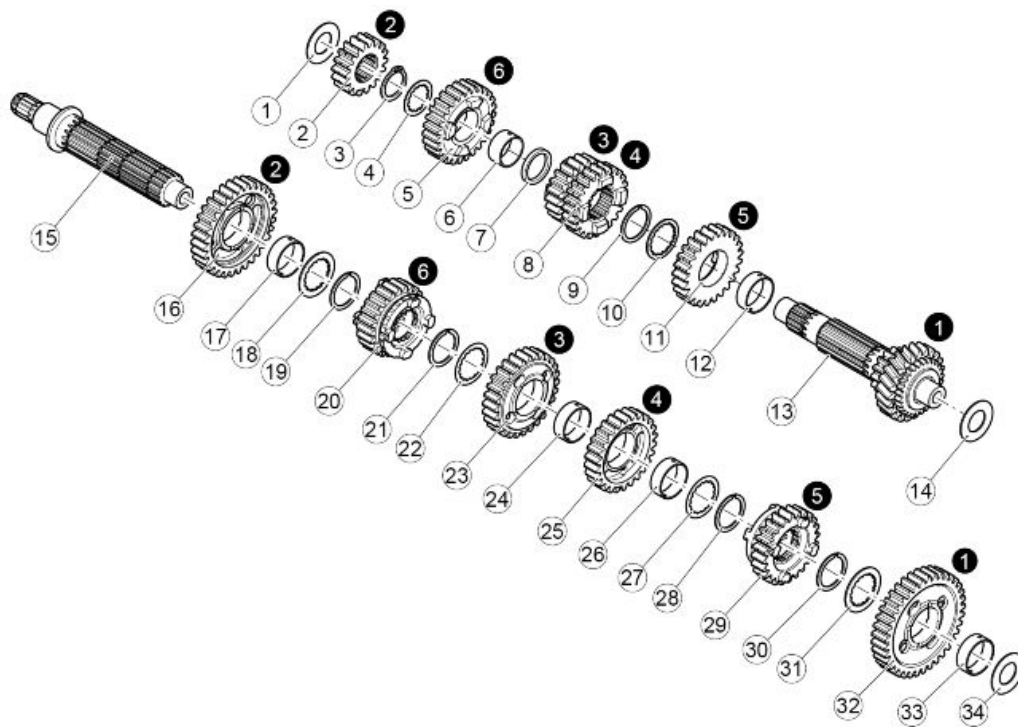


GEAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Index lever screw	M6x12	1	10 Nm (7.38 lb ft)	Loctite 243
2	Screws	M6x16	2	10 Nm (7.38 lb ft)	-

Diagram

OPTION 01

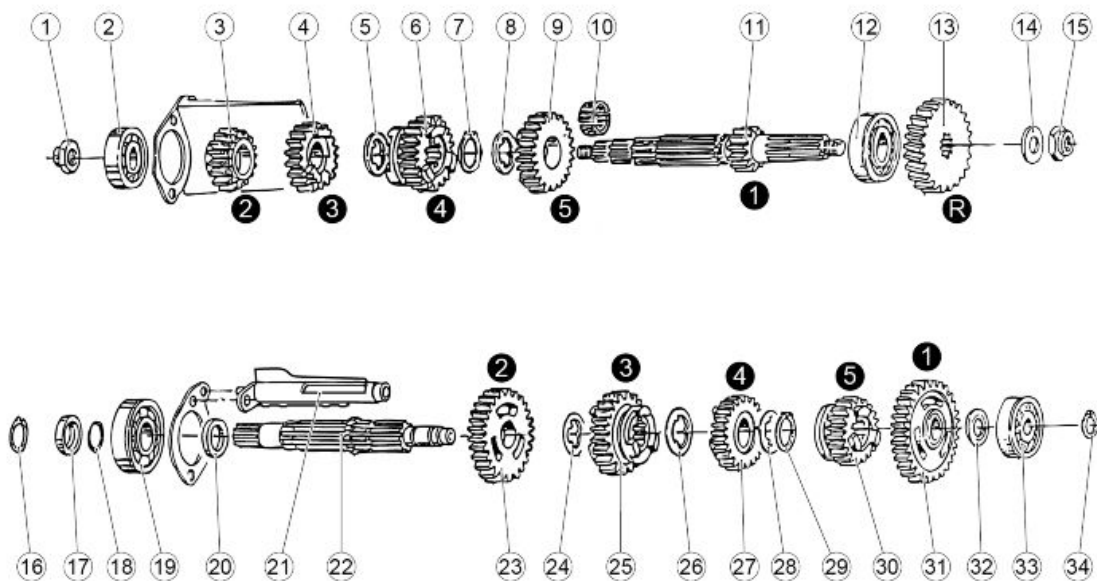


key:

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

OPTION 02



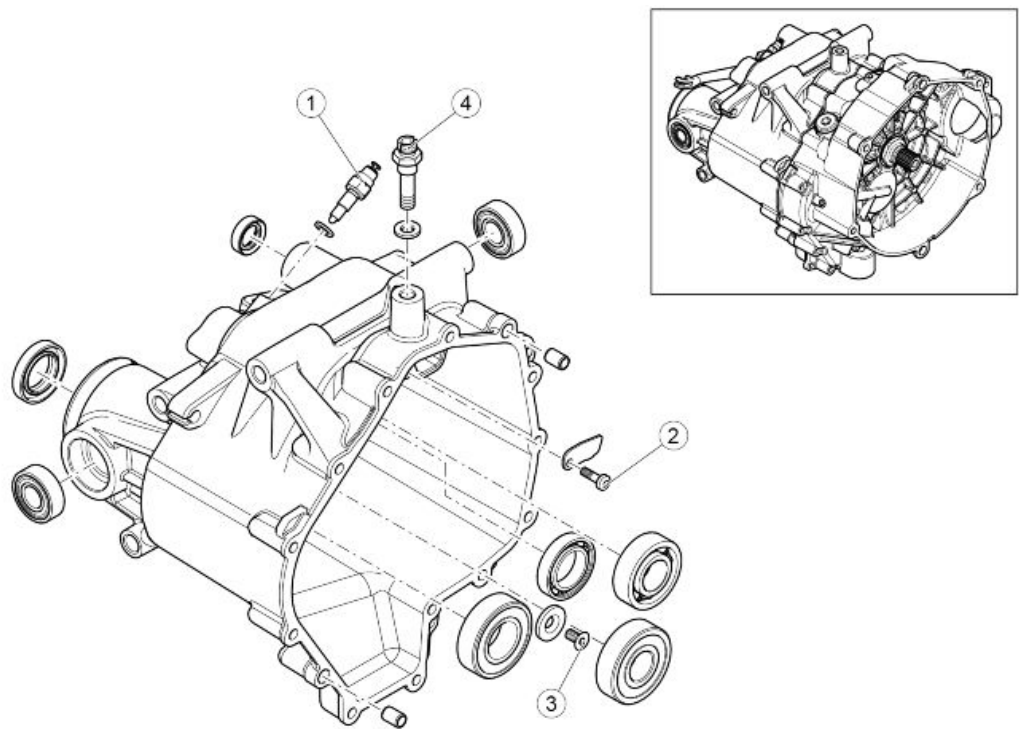
key:

- 1. Safety nut
- 2. Bearing AP 17x40x17.5
- 3. 2nd gear AP Z=14
- 4. 3rd gear AP Z=18
- 5. Shim washer
- 6. 4th gear AP Z=18

7. Seeger ring
 8. Shim washer
 9. 5th gear AP Z=25
 10. Roller cage
 11. Main shaft Z=11
 12. Bearing AP 20x37x17
 13. Transmission gear AP Z=21
 14. Thrust washer
 15. Safety nut
 16. Seeger ring
 17. Spacer
 18. Sealing ring 18.77x1.78
 19. Bearing 20x47x14
 20. Spacer
 21. Drip unit
 22. Transmission shaft
 23. 2nd gear AS Z=23
 24. Thrust washer
 25. 3rd gear AS Z=23
 26. Shim washer
 27. 4th gear AS Z=19
 28. Shim washer
 29. Seeger ring
 30. 5th gear As Z=22
 31. 1st gear AS Z=26
 32. Thickness
 33. Bearing
 34. Seeger ring
-

Gearbox

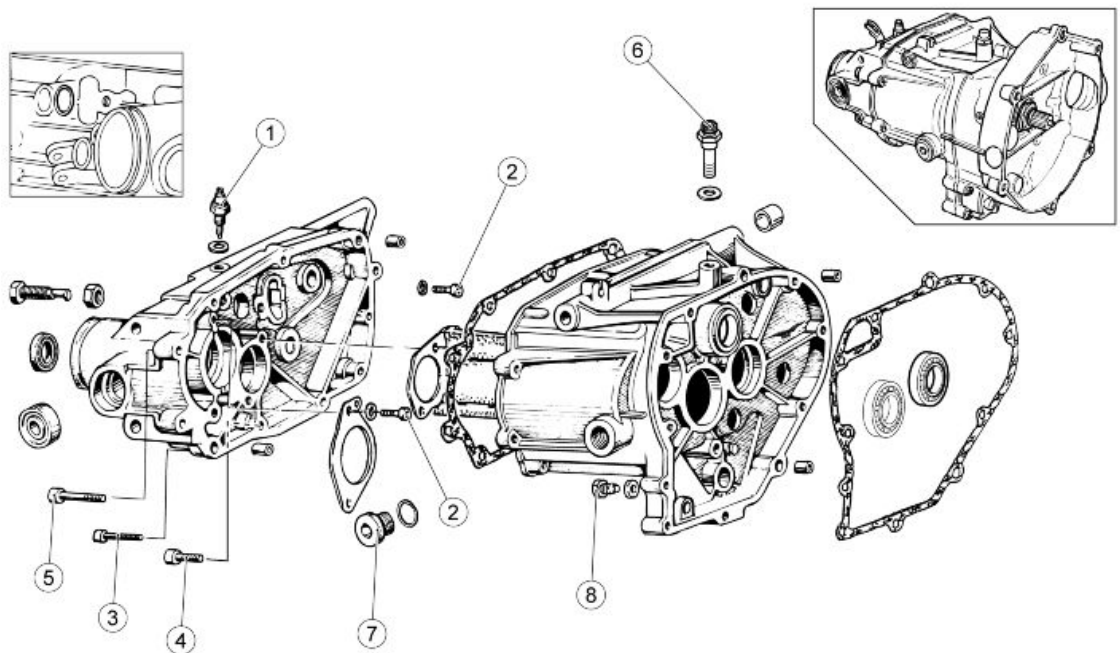
OPTION 01



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)	-

OPTION 02

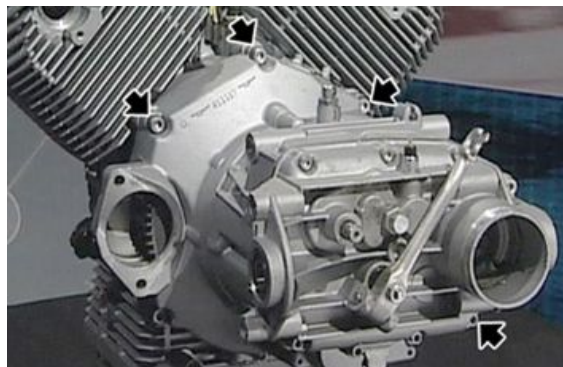


GEARBOX

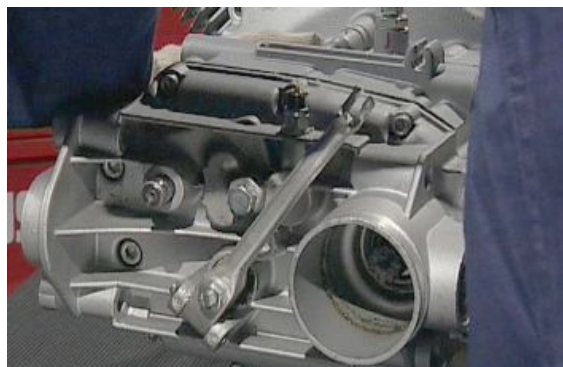
pos.	Description	Type	Quantity	Torque	Notes
1	Neutral sensor	-	1	8 Nm (5.90 lb ft)	-
2	Screws	M6x14	4	10 Nm (7.38 lb ft)	-
3	Gearbox cover screws	M6x30	5	10 Nm (7.38 lb ft)	-
4	Gearbox cover screws	M6x35	2	10 Nm (7.38 lb ft)	-
5	Gearbox cover screws	M8x35	4	22 Nm (16.23 lb ft)	-
6	Oil breather plug	-	1	20 Nm (14.75 lb ft)	-
7	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
8	Oil drainage plug	M10x1	1	20 Nm (14.75 lb ft)	-

Removing the gearbox

- Remove the gearbox fixing screws from the engine.



- Remove the gearbox.



Gearbox shafts

Disassembling the gearbox

OPTION 01

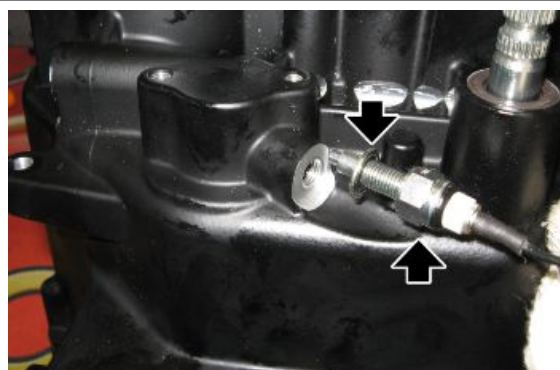
- Remove the 14 fixing screws of the gearbox



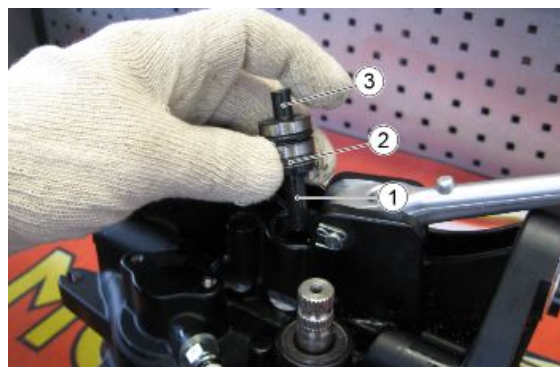
- Remove the pusher plate



- Remove the neutral sensor and take the gasket washer



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



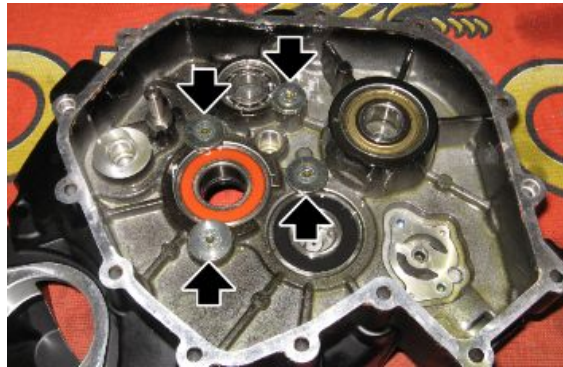
- Remove the gearbox cover with a few mallet strokes



- 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



OPTION 02

- Remove the gearbox
- Fit the clutch shaft onto the gearbox so that the gear becomes engaged with the primary shaft gear.



- Install the specified locking tool onto the clutch shaft splines.



- Unscrew the transmission gear retaining nut and slide off the thrust washer.



- Remove the gear and the clutch shaft.



- Unscrew the breather cap with its pawl.



- Unscrew and remove the neutral indicator.



- Unscrew the gearbox cover bolts and remove the cover tapping it with a mallet.



- Slacken the lock nut and unscrew the pre-selector positioning eccentric screw.





- Slide off the pre-selector and remove the pre-selector seal ring.



- After unscrewing the retaining plate fixing screws, remove the complete set of gears, shafts and forks.

See also

[Removing the gearbox](#)

Removing the primary shaft

CAUTION

REPLACE THE SEEGER RINGS DURING REFITTING

OPTION 01

- 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)



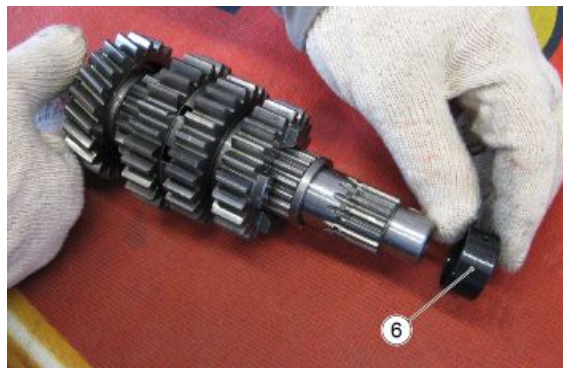
- Remove the spacer (4)



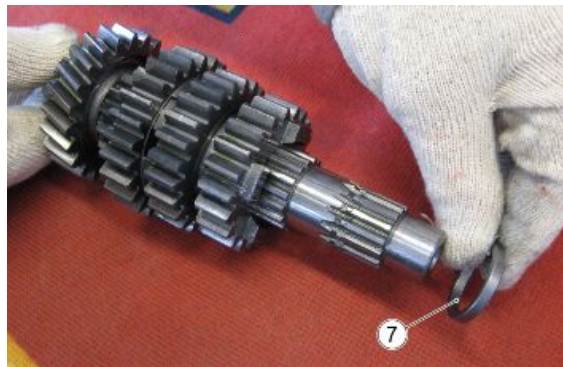
- Remove the gear of the 6th gear (5)



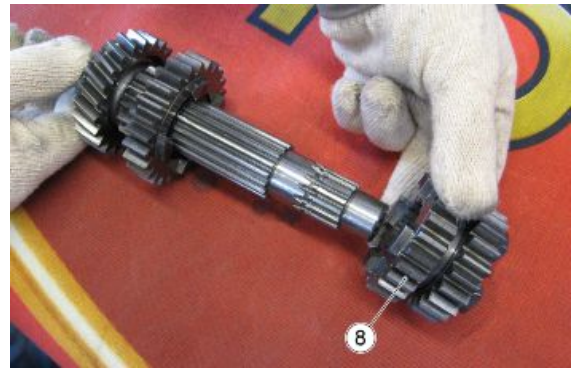
- Remove the bushing (6)



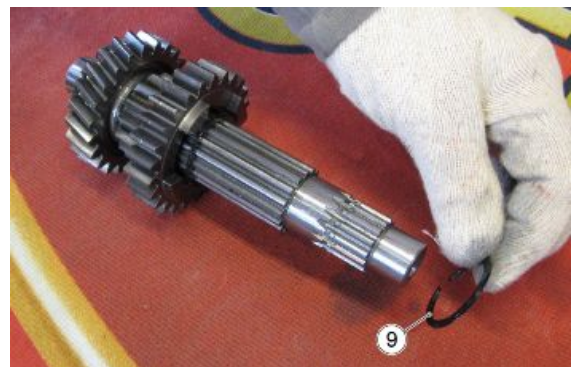
- Remove the spacer (7)



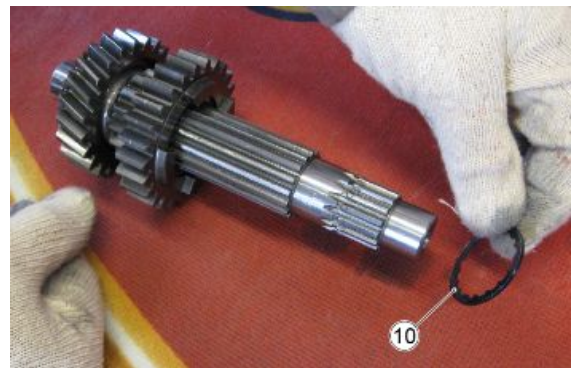
- Remove the gear of the 3-4th gear (8)



- Remove the seeger ring (9)



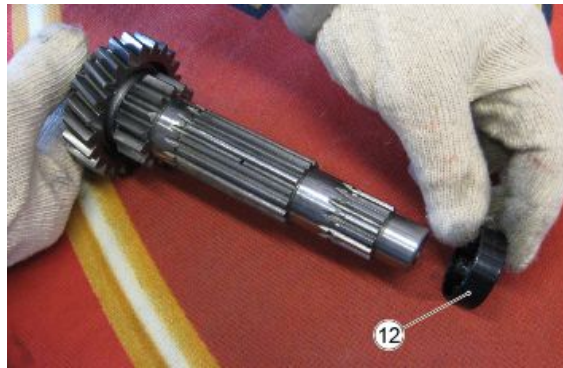
- Remove the spacer (10)



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



- Remove the bushing (12)



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



OPTION 02

- Remove the fastening nut (1) of the bearing on the main shaft



- Remove the bearing (2) using a generic bearing extractor



- Remove the retaining plate (3)



- Remove the gear of the 2nd gear (4)



- Remove the gear of the 3rd gear (5)



- Remove the shimming washer (6)



- Remove the gear of the 4th gear (7)



- Remove the seeger ring (8)



- Remove the shim washer (9)



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



- Remove the roller semi-cases (11)



Removing the secondary shaft

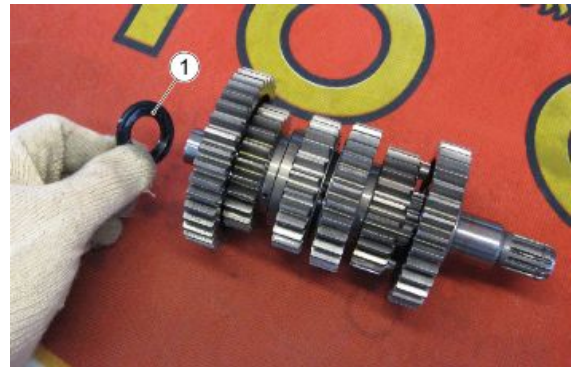
CAUTION

REPLACE THE SEEGER RINGS DURING REFITTING

OPTION 01

To dismantle the transmission shaft, proceed as follows:

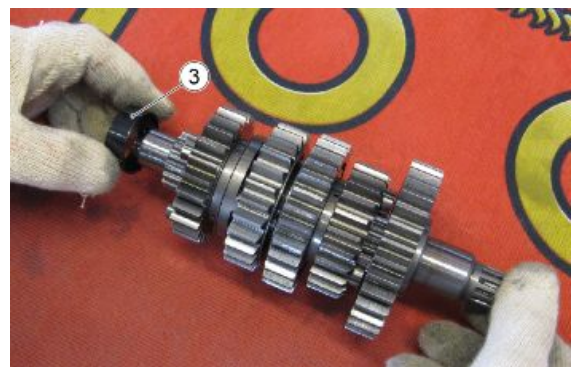
- Remove the shim washer (1)



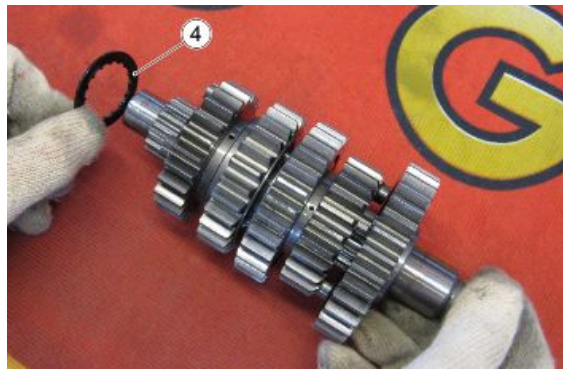
- Remove the gear of the first gear (2)



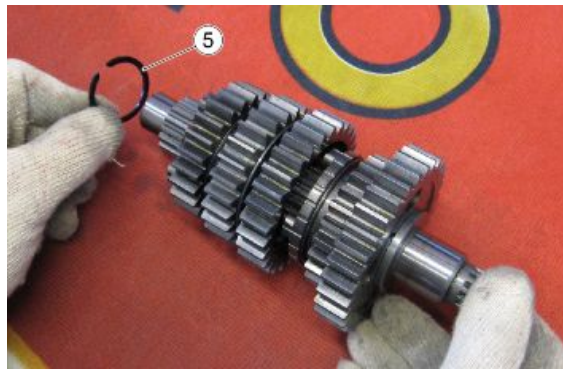
- Remove the bushing (3)



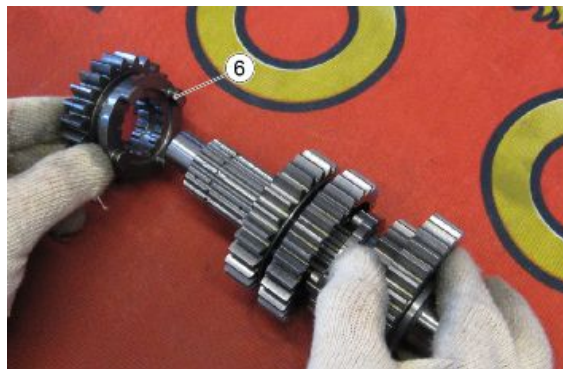
- Remove the shim washer (4)



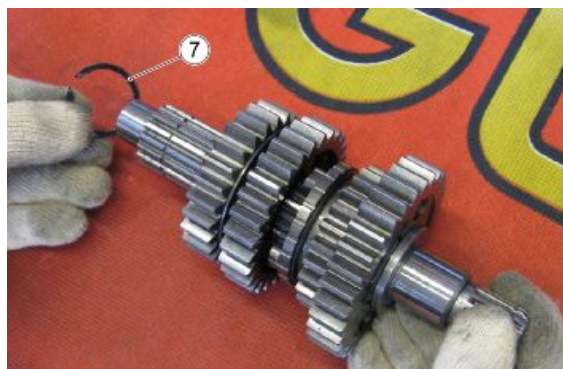
- Remove the seeger ring (5)



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



- Remove the seeger ring (7)



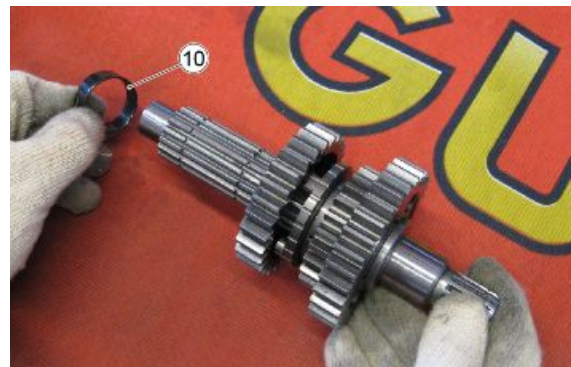
- Remove the shim washer (8)



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



- Remove the bushing (10)



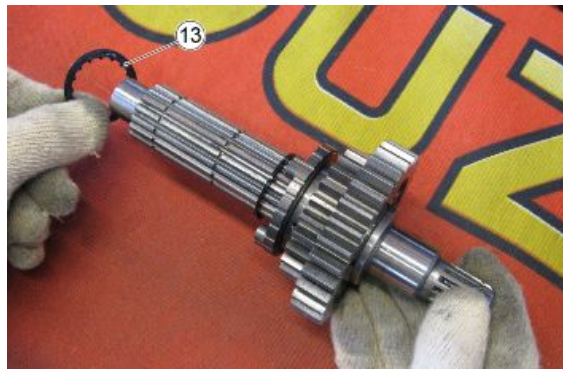
- Remove the gear of the 3rd gear (11)



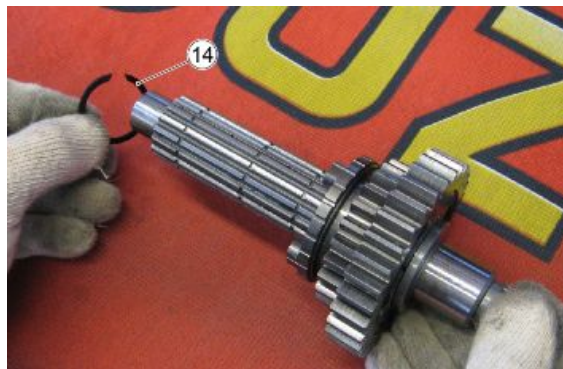
- Remove the bushing (12)



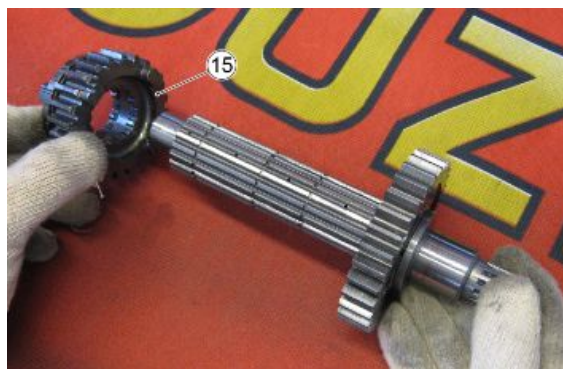
- Remove the shim washer (13)



- 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)

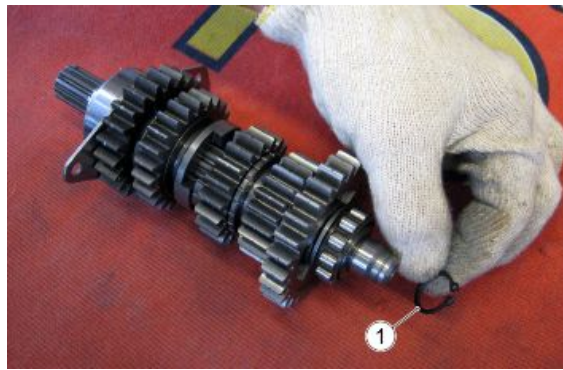


- Remove the bushing (19)



OPTION 02

- Remove the seeger ring (1)



- Remove the bearing (2)



- Remove the washer (3)



- Remove the gear of the 1st gear (4)



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



- Remove the seeger ring (6)



- Remove the shim washer (7)



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



- Remove the shim washer (9)



- Remove the rubber sealing ring (10)



- Remove the bearing (11)



- Remove the retaining plate (12)



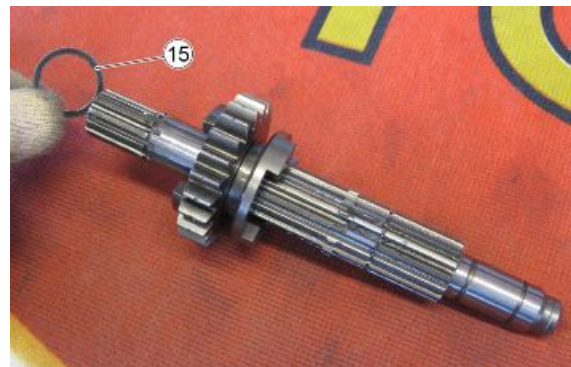
- Remove the spacer (13)



- Remove the gear of the 2nd gear (14)



- Remove the thrust washer (15)



- Remove the gear of the 3rd gear (16)



Desmodromic demounting

OPTION 01

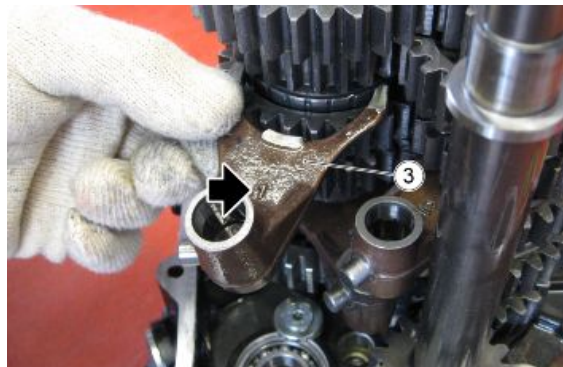
- Remove the gearbox selector
- Remove the sliding shaft of the forks (1)



- 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)

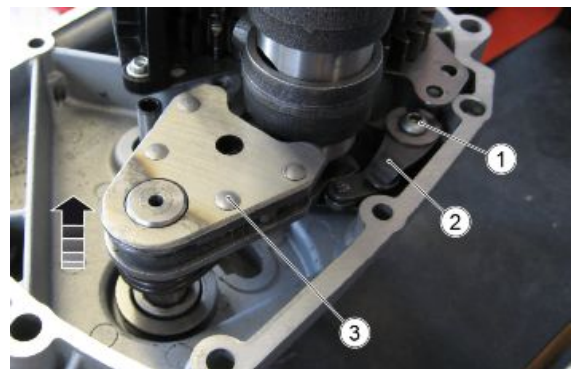


- Remove the lower fork No.3 (5)



OPTION 02

- Remove the fixing screw (1) of the index lever (2)
- Remove the gear selector (3)



- Remove the fixing screws (4) of the retaining plate



- Remove the complete gear unit from the gearbox and remove the retaining plate (5)



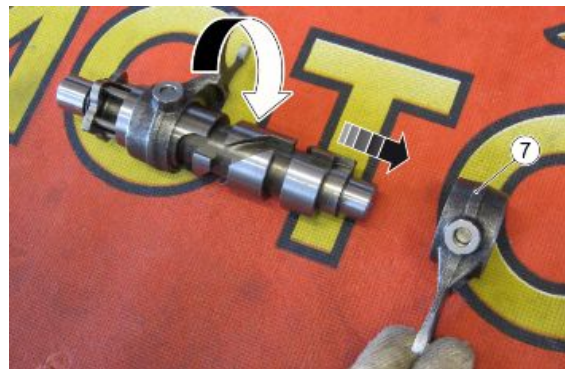
- Release the main shaft (6) and the transmission shaft (7) from the forks



- Remove the upper fork (6) from the desmodromic shaft by sliding the guide towards the grooves of the guide itself



- Remove the central fork (7) from the desmodromic shaft by turning and sliding the guide towards the grooves of the guide itself



- Remove the lower fork (8) from the desmodromic shaft by turning and sliding the guide towards the grooves of the guide itself



Disassembling the clutch shaft

OPTION 01

- 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

**OPTION 02**

- Remove the clutch bell.
- Undo the three screws with washers and remove the bearing retaining plate.



- Undo the clutch shaft fixing nut.



- Slide off the clutch shaft and remove the seal ring.



See also

Clutch bell removal

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.

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.

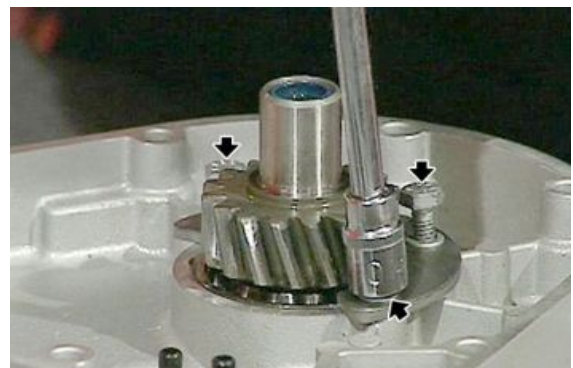
Assembling the clutch shaft

- Fit the clutch shaft using a plastic mallet and refit circlip and seal ring.





- Position the retaining plate and tighten the screws with their washers with threadlocker.



Gear selector

Removing the gear selector

OPTION 01

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



- Remove the spring from the index lever (2)



- Remove the washer (3)



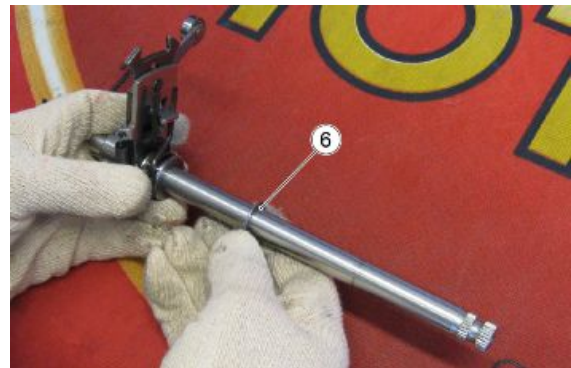
- Remove the ring (9)



- Remove the seeger ring (5)



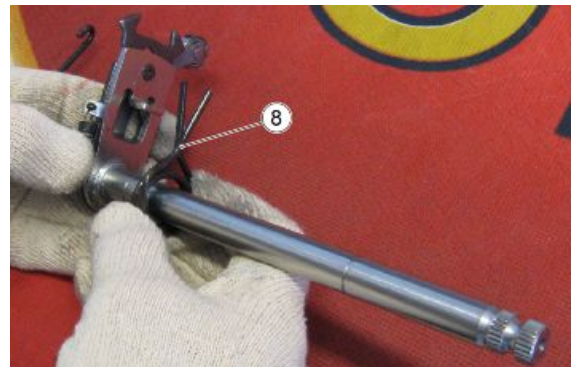
- Remove the washer (6)



- Remove the bushing (7)



- Remove the selector spring (8)



- Remove the ring (9)



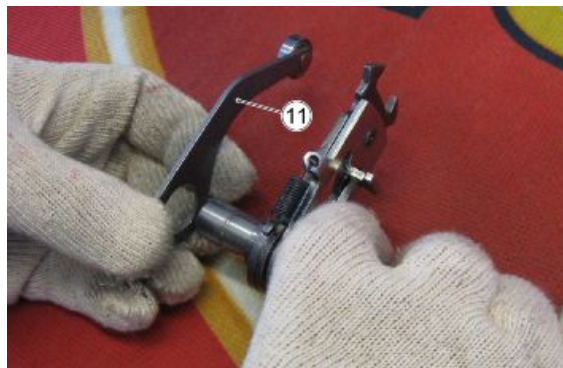
- Remove the bushing (10)

WARNING

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



- Remove the index lever (11)



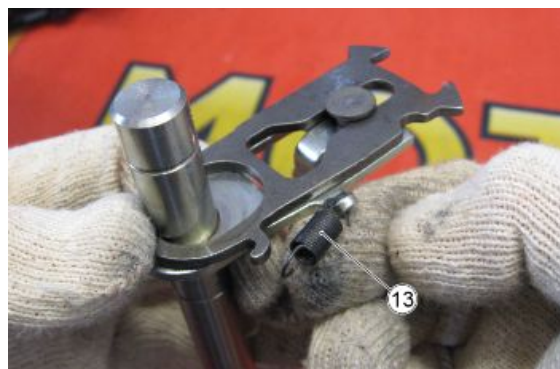
- Remove the bushing (12)

WARNING

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



- Remove the selector return spring (13)



OPTION 02

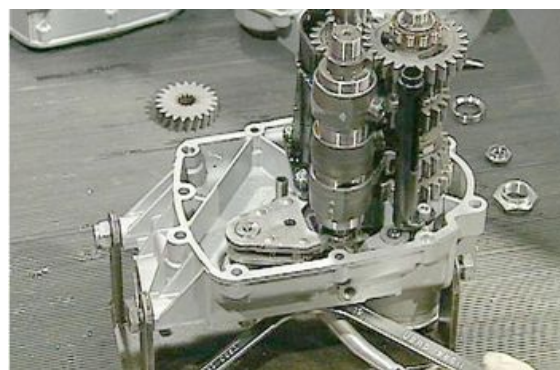
- Remove the complete pre-selector (1) sliding it off from the crankcase



- Remove the spring (2) and the spacer



- Remove the counter nut and the fixing nut of the eccentric screw



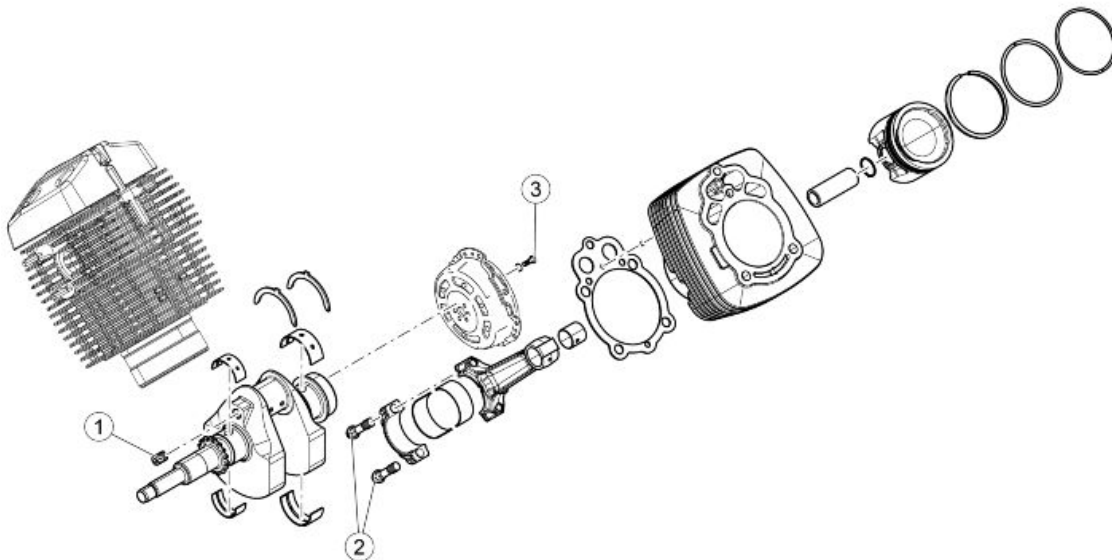
- Remove the eccentric screw



- Remove the selector spacer



Flywheel



CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Oil plug	-	1	15 Nm (11.06 lbf ft)	Loctite 601
2	Connecting rod screws	-	4	33 Nm (24.34 lbf ft)	-

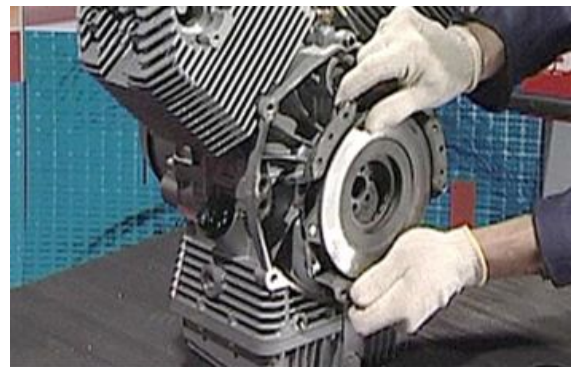
pos.	Description	Type	Quantity	Torque	Notes
3	Flywheel screws	-	6	42 Nm (30.98 lbf ft)	Loctite 243

Removing the flywheel

- Remove the gearbox.
- Remove the retainer ring and the clutch engagement/disengagement cap.



- Unscrew the screws securing the pressure plate flywheel to the crankshaft and then remove it.



Checking

- Check that the flywheel surface that contacts the plate is not scratched.
- Check that the contact faces on the crankshaft are not distorted; if they are, replace the flywheel.



Installing the flywheel

- When refitting the pressure plate flywheel onto the crankshaft, make sure the "yellow mark" on the shaft is perfectly aligned with the slot on the engine flywheel.



- Tighten the screws and fit the specified flywheel locking tool.



Specific tooling

19.91.18.00 Flywheel locking tool

- Tighten the screws following a criss-cross pattern with a torque wrench set to the prescribed torque. It is advisable to change the fixing screws securing flywheel to crankshaft.

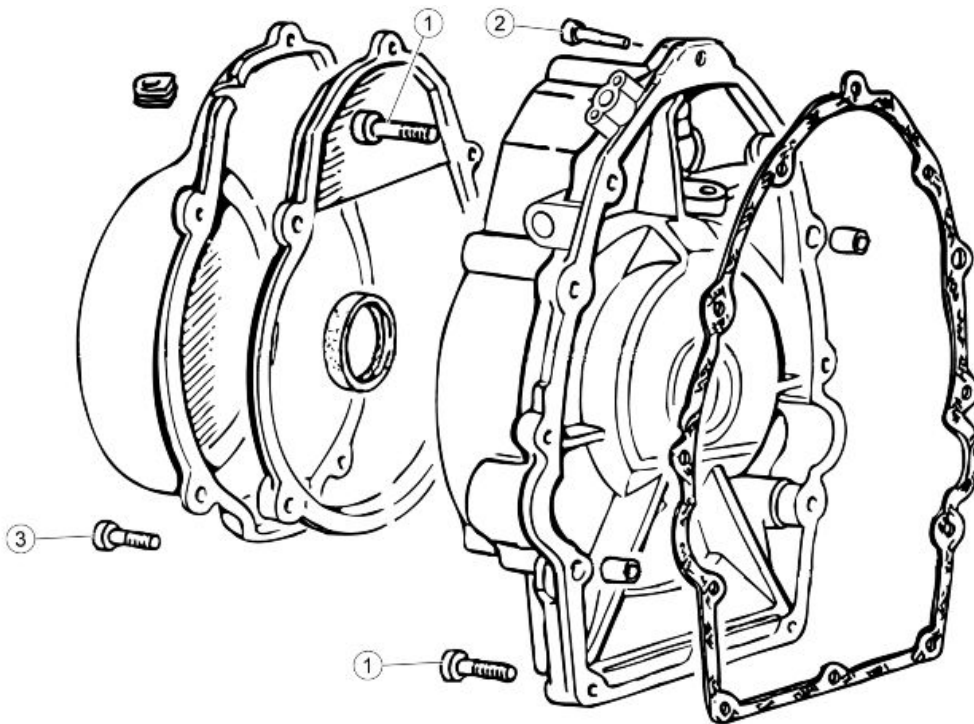


- Insert the clutch engagement/disengagement cap with its retainer ring.



Generator

OPTION 01

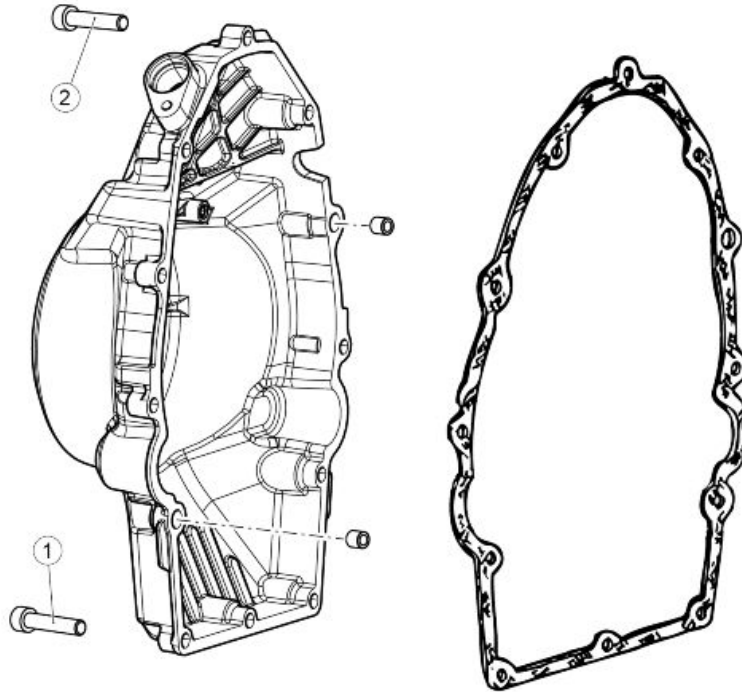


TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M6x25	10	10 Nm (7.37 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	TCEI screw	M6x30	2	10 Nm (7.37 lb ft)	-
3	Alternator cover screws	M6x35	5	10 Nm (7.37 lb ft)	Loctite 243

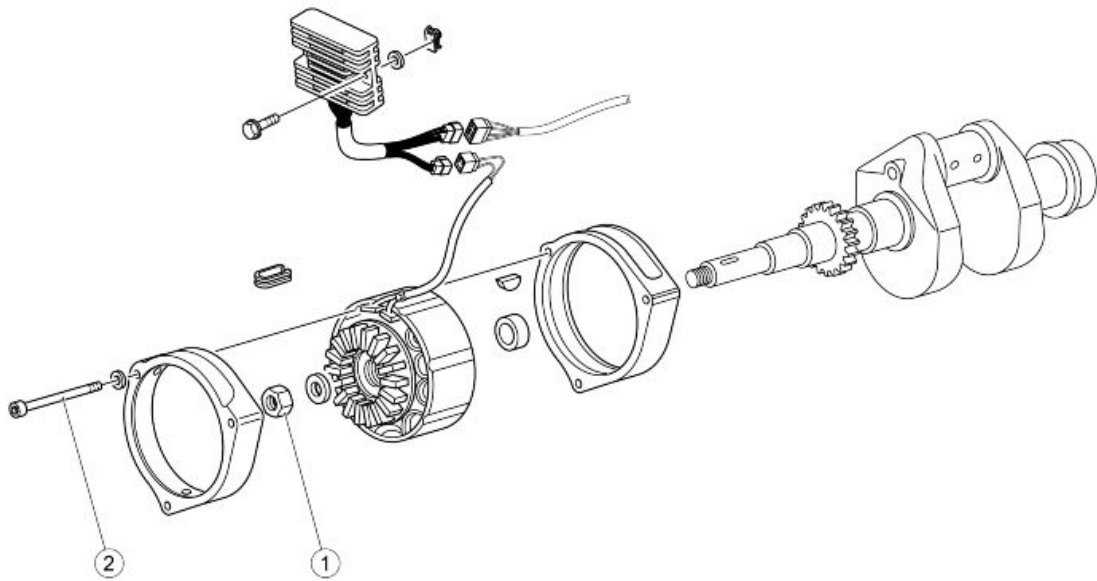
OPTION 02



TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M6.15x11	10	10 Nm (7.37 lb ft)	Loct. 243
2	TCEI screw	M6.15x0.8	1	10 Nm (7.37 lb ft)	Loct. 243

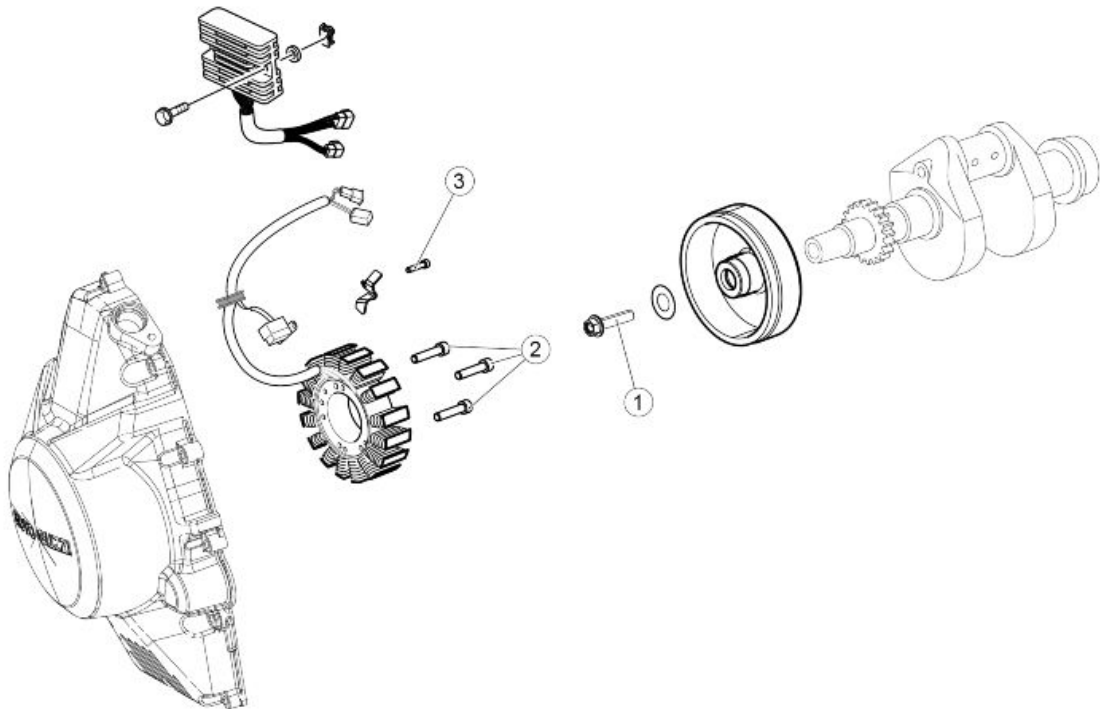
OPTION 01



ALTERNATOR - REGULATOR

pos.	Description	Type	Quantity	Torque	Notes
1	Alternator nut	M16	1	90 Nm (66.38 lb ft)	Loctite 243
2	Front cover fixing screws	M5x65	3	6 Nm (4.43 lb ft)	-

OPTION 02



ALTERNATOR - REGULATOR

pos.	Description	Type	Quantity	Torque	Notes
1	TE Flanged screw	M12 - 1.25x50	1	100 Nm (73.76 lb ft)	-
2	Recessed TCEI screws	M6 x 35	3	10 Nm (7.38 lb ft)	Loct. 243
3	TCEI screw	M5 x 12	1	10 Nm (7.38 lb ft)	Loct. 243

Revolution sensor

- Undo and remove the two screws and remove the sensor.



- Position the engine speed sensor on the timing system cover and tighten the two fastening screws to the prescribed torque.

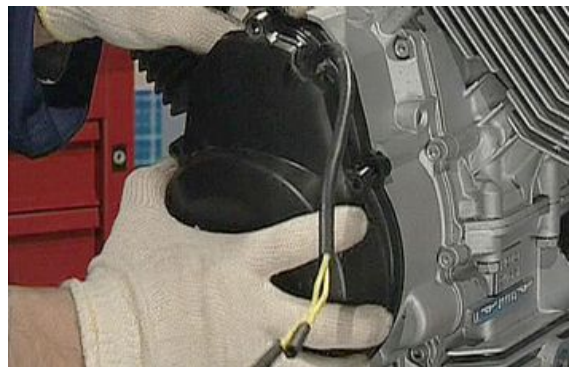
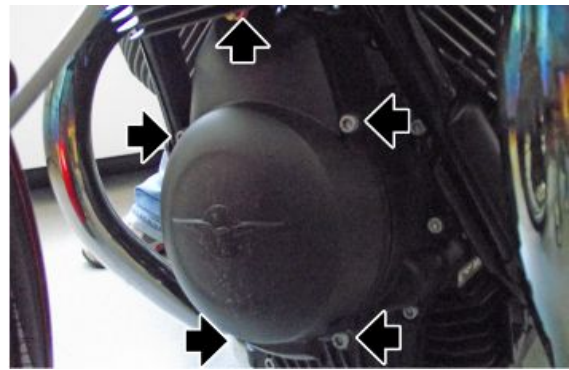
**Generator removal****CAUTION****NOTE**

THERE ARE TWO DIFFERENT TYPES OF FLYWHEEL/ALTERNATOR IN THIS ENGINE. THE COMPONENTS CANNOT BE INTERCHANGED AS WELL AS THE TOOLS USED FOR THEIR LOCKING AND REMOVAL.

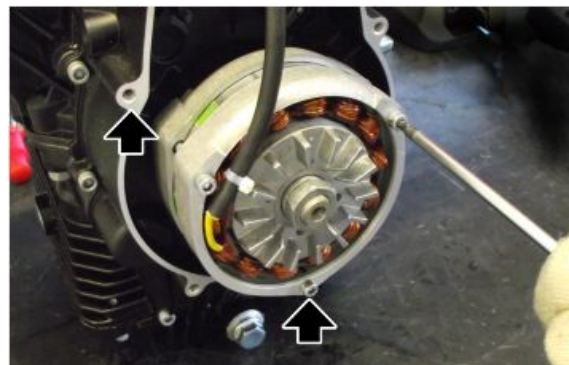
BELOW ARE SHOWN THE PROCEDURES FOR THE REMOVAL AND INSTALLATION OF THE FLYWHEELS/ ALTERNATORS.

OPTION 01

- Unscrew the fixing screws and remove the alternator unit protection covers



- Unscrew the screws fixing the stator to the timing system cover and slide off the stator.

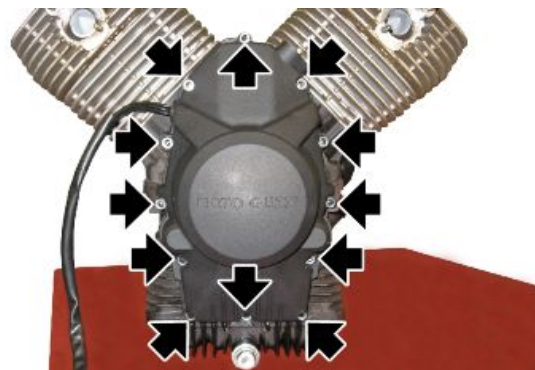


- Unscrew the nut fixing the rotor to the crankshaft, slide off the rotor, remove the key and collect the washer.



OPTION 02

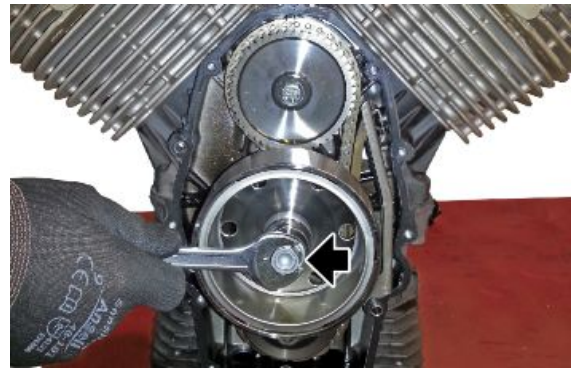
- Remove the alternator cover fixing screws



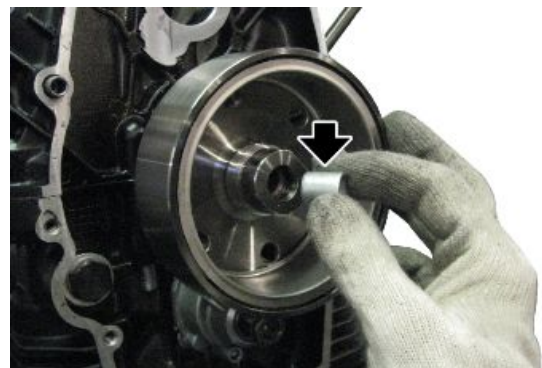
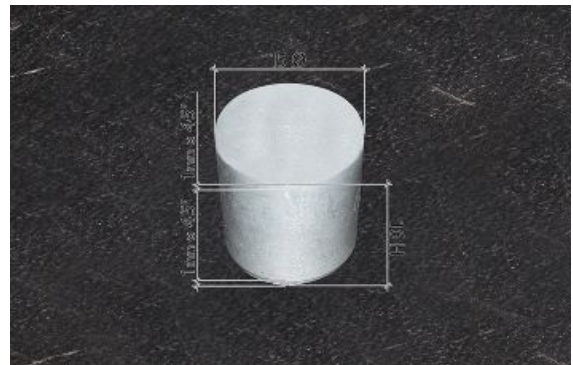
- Remove the alternator cover



- Remove the rotor fixing screw



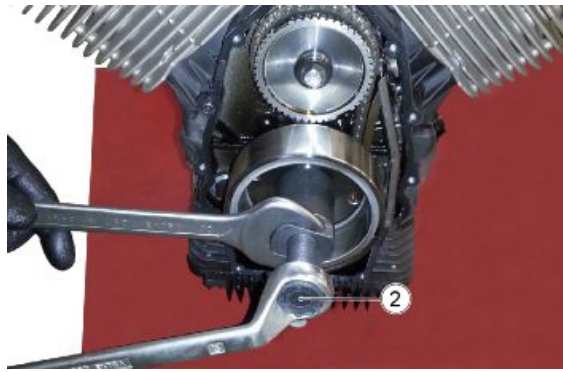
- Insert in the rotor hole the specific spacer



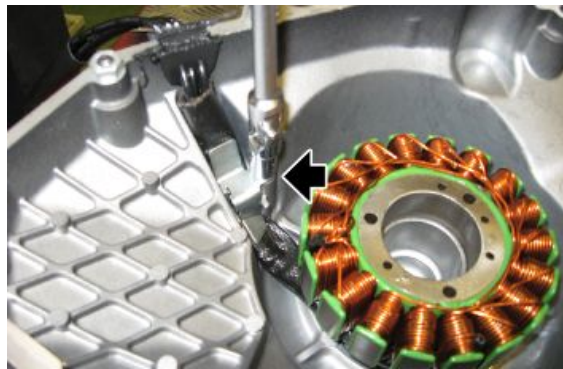
- Place and tighten the tool (1) on the rotor.



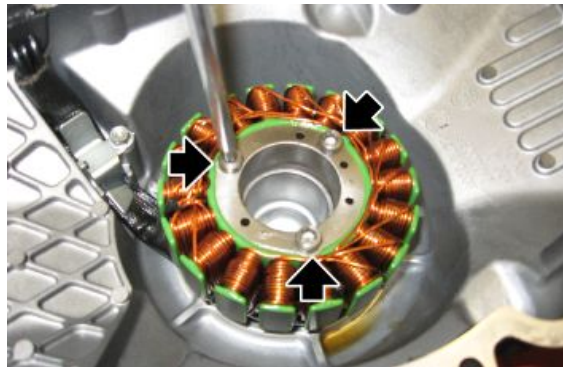
- Tighten the threaded pin (2) of the tool and proceed with the rotor removal.



- Operating on the alternator cover, proceed with the removal of the stator wiring lock plate



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



Generator Installation

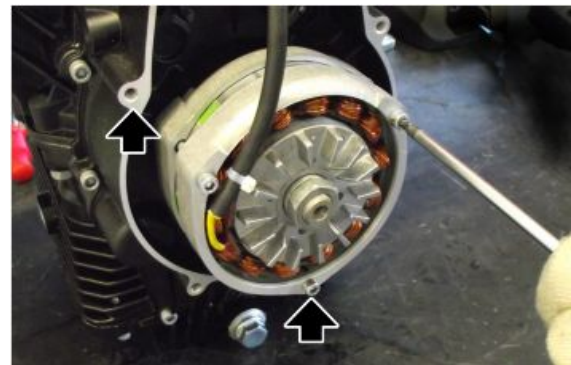
OPTION 01

- Insert supporting washer, key and rotor, and tighten the nut to the prescribed torque with a torque wrench.





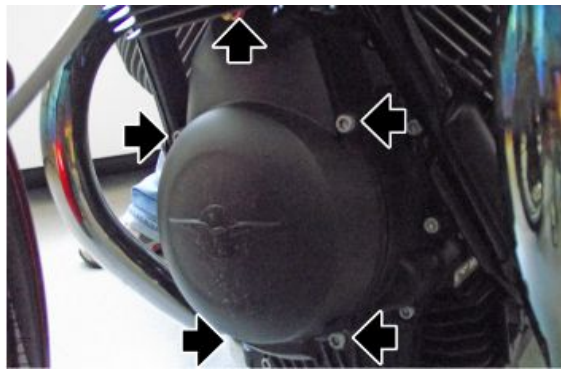
- Fit stator and cover and tighten the three screws.



- Fit stator cover.



- Tighten the five cover fixing screws to the prescribed torque.

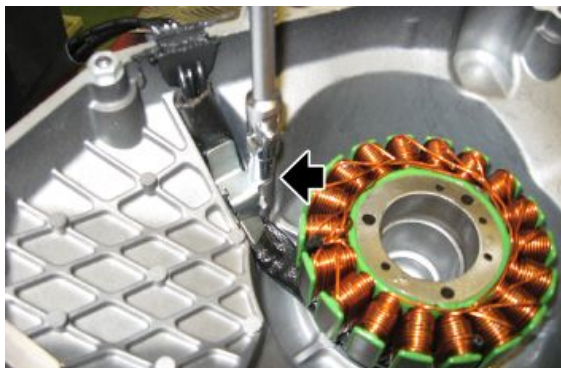


OPTION 02

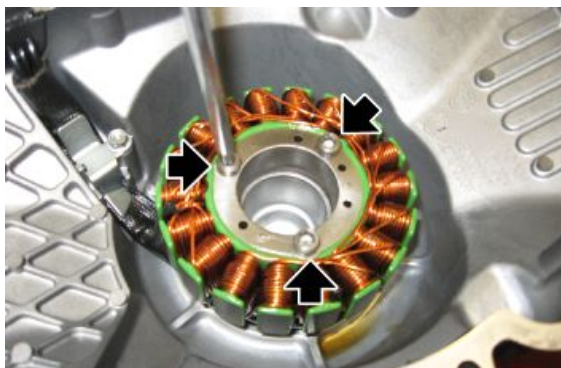
- Place the stator and its wiring on the cover

PAY ATTENTION TO APPLY ON THE RUBBER COMING OUT OF THE COVER THE ThreeBond SEALANT.

- Place the wiring locking plate and fix it with the specific screw.



- Fix the stator with the three screws.



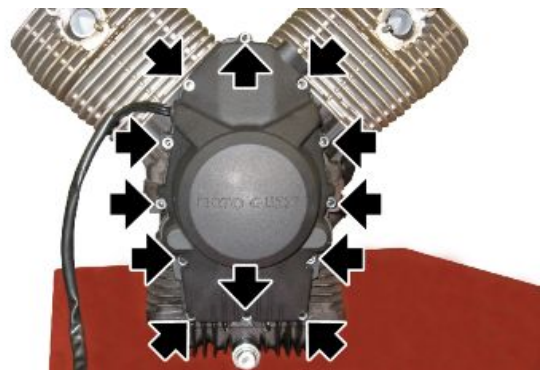
- Place the rotor and fix it with the screw



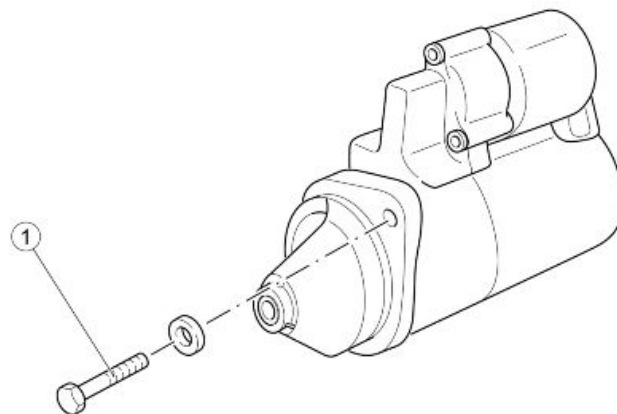
- Place the timing system cover and pay attention to place the gasket



- Place the 12 cover fixing screws and tighten them to the prescribed torque



Starter motor

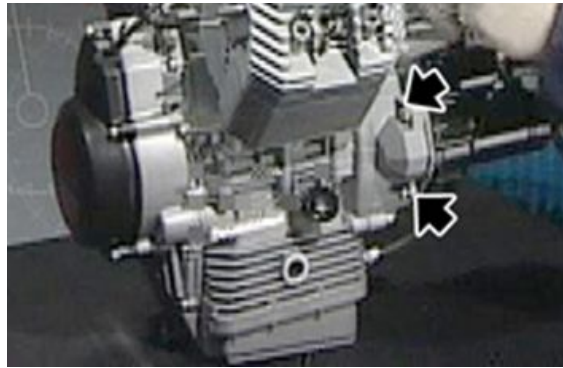


STARTER MOTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor fixing screws	M8x35	2	25 Nm (18.44 lb ft)	-

Removing the starter motor

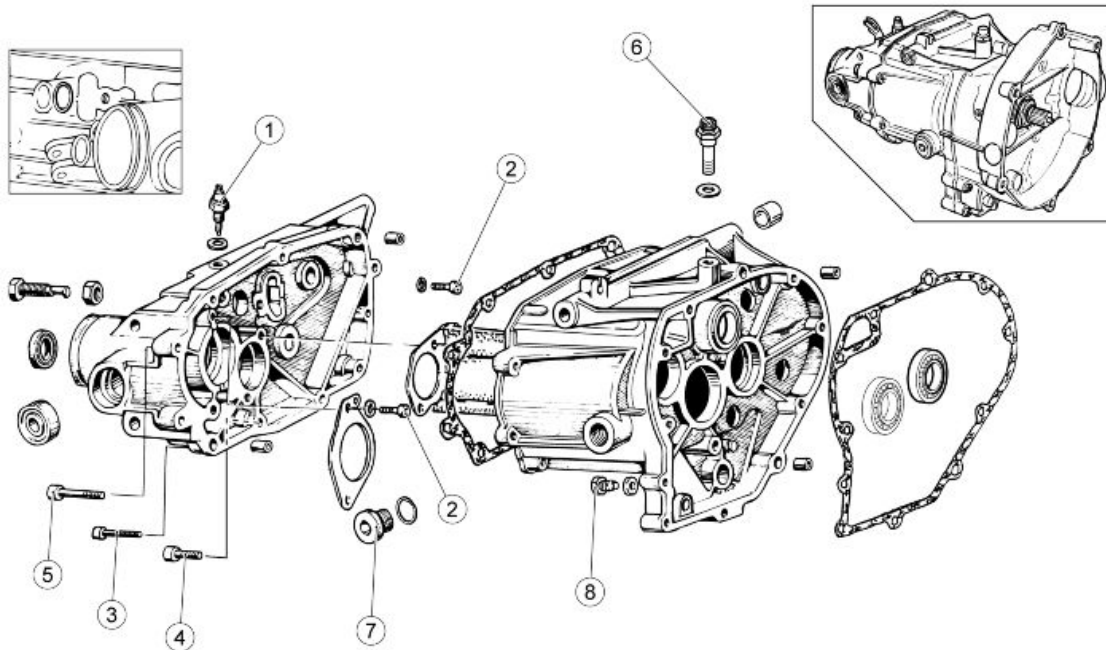
- Remove the starter motor fixing screws.



- Slide off the starter motor.

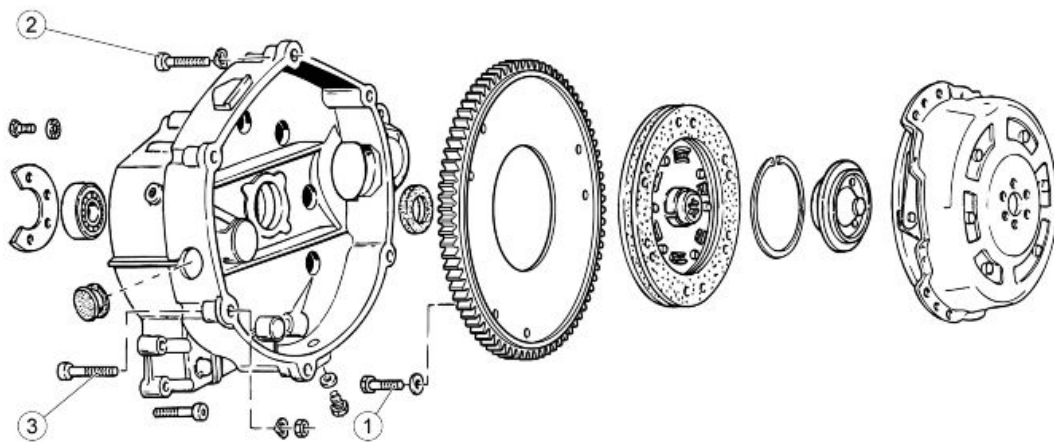


Clutch side



GEARBOX

pos.	Description	Type	Quantity	Torque	Notes
1	Neutral sensor	-	1	8 Nm (5.90 lb ft)	-
2	Screws	M6x14	4	10 Nm (7.38 lb ft)	-
3	Gearbox cover screws	M6x30	5	10 Nm (7.38 lb ft)	-
4	Gearbox cover screws	M6x35	2	10 Nm (7.38 lb ft)	-
5	Gearbox cover screws	M8x35	4	22 Nm (16.23 lb ft)	-
6	Oil breather plug	-	1	20 Nm (14.75 lb ft)	-
7	Oil load cap	-	1	25 Nm (18.44 lb ft)	-
8	Oil drainage plug	M10x1	1	20 Nm (14.75 lb ft)	-



CLUTCH I

pos.	Description	Type	Quantity	Torque	Notes
1	Crown screws	M6x16	6	10 Nm (7.38 lb ft)	Loctite 243
2	Gearbox screws	M8x35	5	25 Nm (18.44 lb ft)	-
3	Clutch belt cover screws	M6x30	11	10 Nm (7.38 lb ft)	Loctite 243

Clutch bell removal

- Secure gearbox/clutch bell to the support clamped in a vice, fit the nut locking tool and turn the shaft using the suitable tool to loosen the nut.



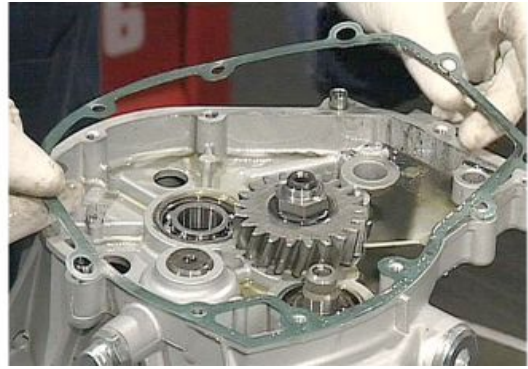
- Loosen the Allen screws that secure the clutch bell to the gearbox.



- Detach and remove the clutch bell together with the clutch shaft tapping lightly around clutch bell edge.



- Remove the gasket.

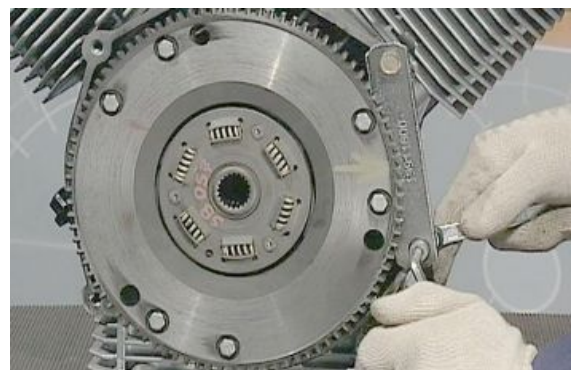


Disassembling the clutch

- Remove the clutch cover.
- Fit the specified flywheel locking tool on the crankcase.

Specific tooling

19.91.18.00 Flywheel locking tool



- Unscrew the clutch plate fixing screws and remove clutch plate together with starting sprocket.



See also

Clutch bell removal

- Remove the clutch plate.



Checking the clutch plates

Clutch plates

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

Check the flexible coupling springs and make sure that clutch plate thickness is not lower than the specified value: if so, replace the clutch plate.



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

- Install the flywheel locking tool.

Specific tooling

19.91.18.00 Flywheel locking tool



- Insert the cap with its seal ring.



- Position the specified clutch plate centring tool on the plate and fit the plate into place.

Specific tooling

19.90.65.00 Tool for clutch plate fitting/centring



- Fit the assembly on the pressure plate flywheel and tighten the screws to the prescribed torque.



Clutch bell fitting

- Fit the clutch shaft.
- Position the clutch bell gasket and fit the clutch bell into place.



See also

[Assembling the clutch shaft](#)

- Snug the Allen nuts and the external screws and tighten them to the prescribed torque.



- Tighten the clutch shaft nut using the suitable tool and squash.

Specific tooling

19.90.71.60 Clutch shaft locking equipment



- Insert the breather cap.



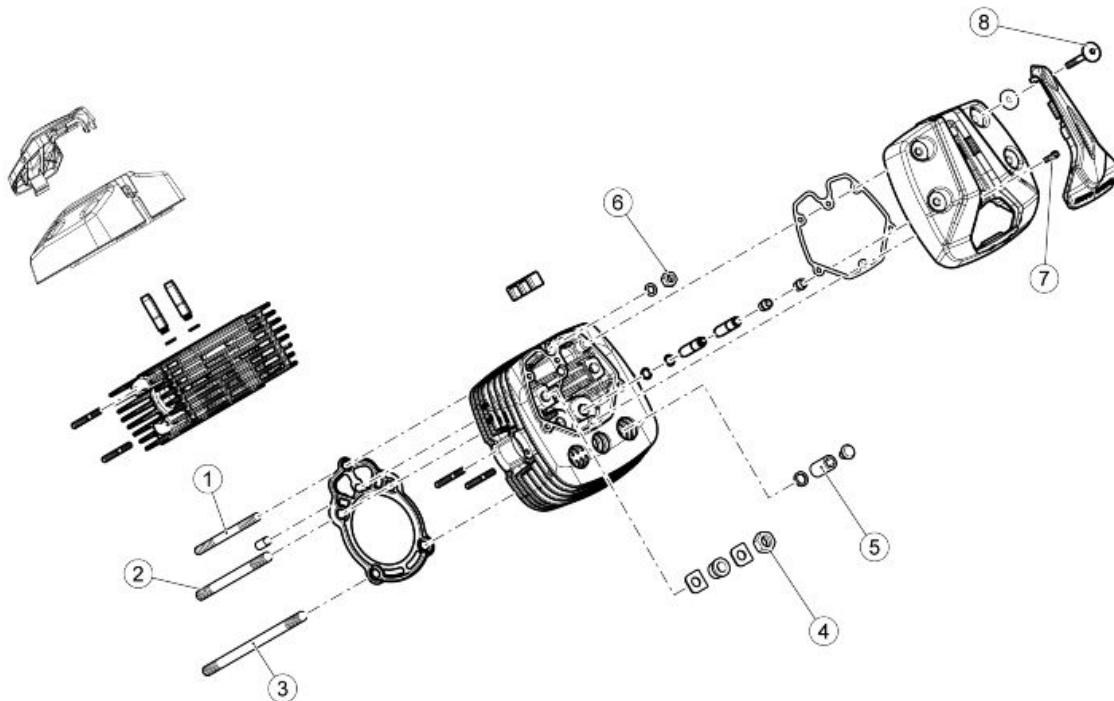
- Tighten the neutral switch.



- Insert the clutch control rod into the shaft with the larger diameter facing the control lever.



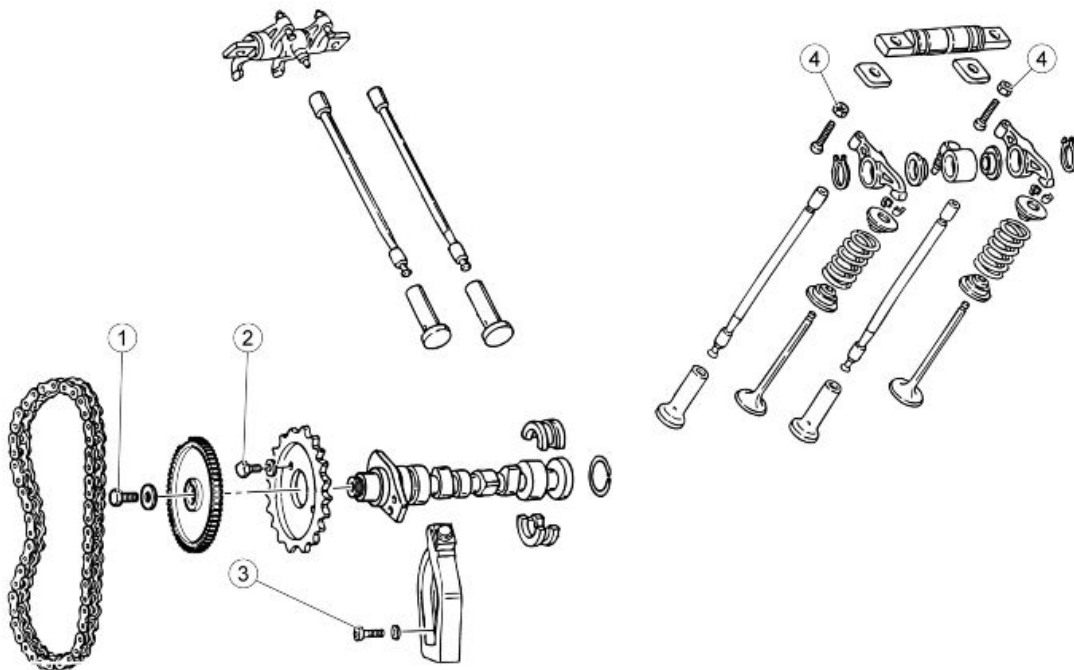
Head and timing



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)	-

pos.	Description	Type	Quantity	Torque	Notes
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	-	4	25 Nm (18.44 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)	-



TIMING SYSTEM

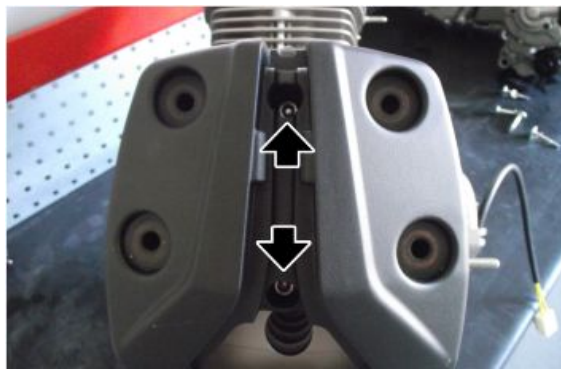
pos.	Description	Type	Quantity	Torque	Notes
1	Tone wheel screw	M8x22	1	25 Nm (18.44 lb ft)	-
2	Timing system gear screws	-	2	25 Nm (18.44 lb ft)	Loctite 243
3	Chain tensioner screw	M6x16	1	10 Nm (7.38 lb ft)	-
4	Valve clearance adjuster screw	M6x1	4	10 Nm (7.38 lb ft)	-

Removing the head cover

- Remove the spark plug cover
- Disconnect the spark plug tube
- Remove the blow-by pipe
- Undo the head cover fixing screws



- Loosen the central fastening screws



- Remove the head cover



- Remove the gasket



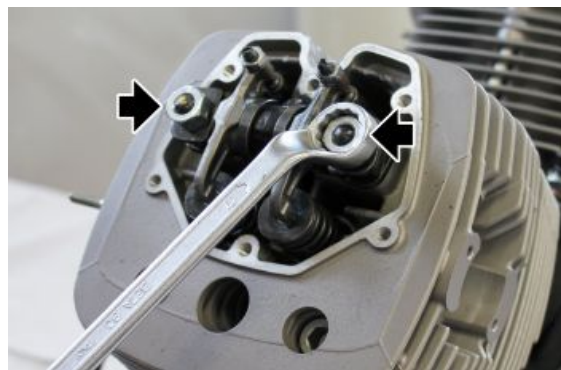
- Check that the mating faces that contact the heads are not damaged or blistered.

Removing the cylinder head

- The following instructions refer to one head, but apply to both.
- Remove the head cover.
- Unscrew the spark plug



- Loosen the fastening nuts of the rocker cam tower.



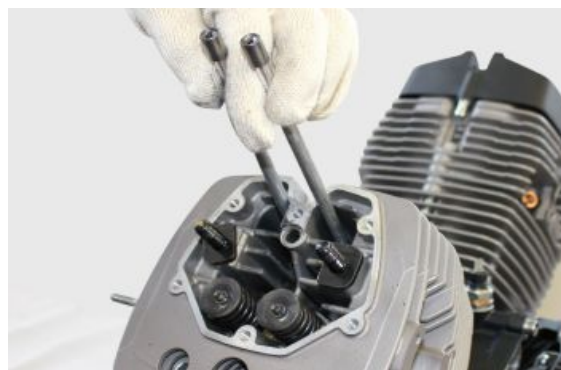
See also

[Removing the head cover](#)

- Remove the rocker cam tower and collect the plates



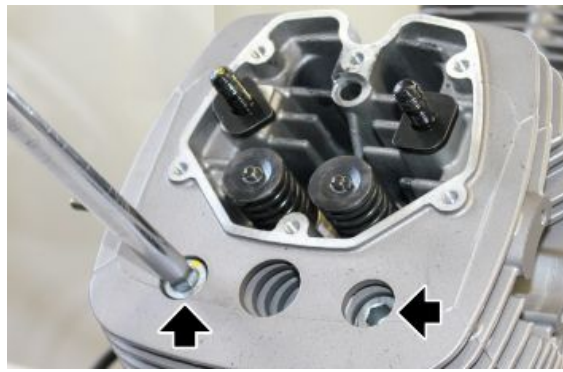
- Remove the rocker rods



- Remove the outer nuts that fix the head to the cylinder and collect the washer



- Remove the internal screws fixing the head to the cylinder



- Remove the complete head from the cylinder



- Remove the cylinder head gasket



Cylinder head

Removing the rocker arms

NOTE

THE FOLLOWING OPERATIONS REFER TO REMOVING ONLY ONE HEAD BUT APPLY TO BOTH HEADS.

- Remove the head cover.

- Remove the circlips, slide off the two rockers and the oil delivery fitting.



See also

[Removing the head cover](#)



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.

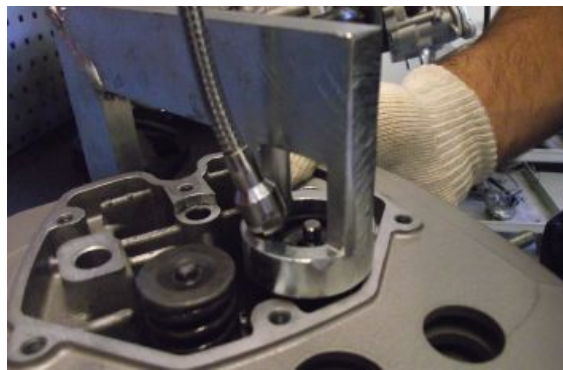
Specific tooling

10.90.72.00 Tool for valve removal and refitting

19.92.78.00 Adapter bushing for valve removing tool



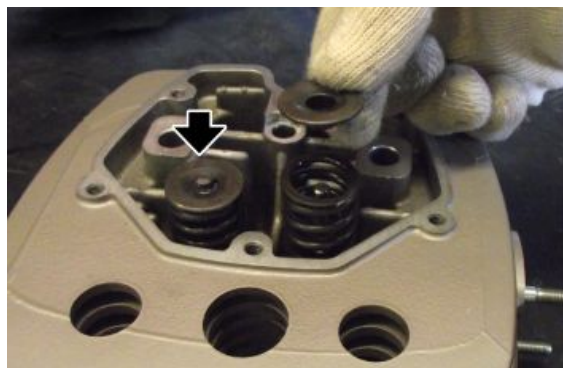
Close the tool to compress the spring, and then hit the tool head with a mallet so that the two cotters get detached from the upper cap.



- Unscrew the tool and remove it from the head.



- Slide off the upper cap, the spring and finally the valve.





- Remove the valve guide seals and extract the lower cap of the springs.



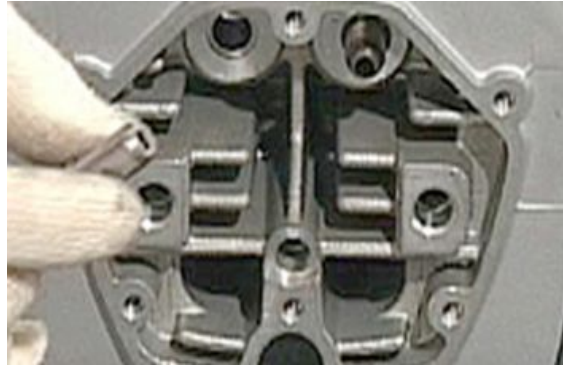
VALVE GUIDES MUST BE REPLACED WHEN THEY ARE WORN TO THE POINT THAT REPLACING THE VALVE ALONE IS NOT ENOUGH TO ELIMINATE CLEARANCE BETWEEN VALVE STEM AND VALVE GUIDE BORE.



- Valve guides need to be knocked out tapping from the inside with punch and mallet; heat the head up to approximately 50-60 °C to aid removal.

Specific tooling

19.92.60.20 Punch for cap installation on valve guide.



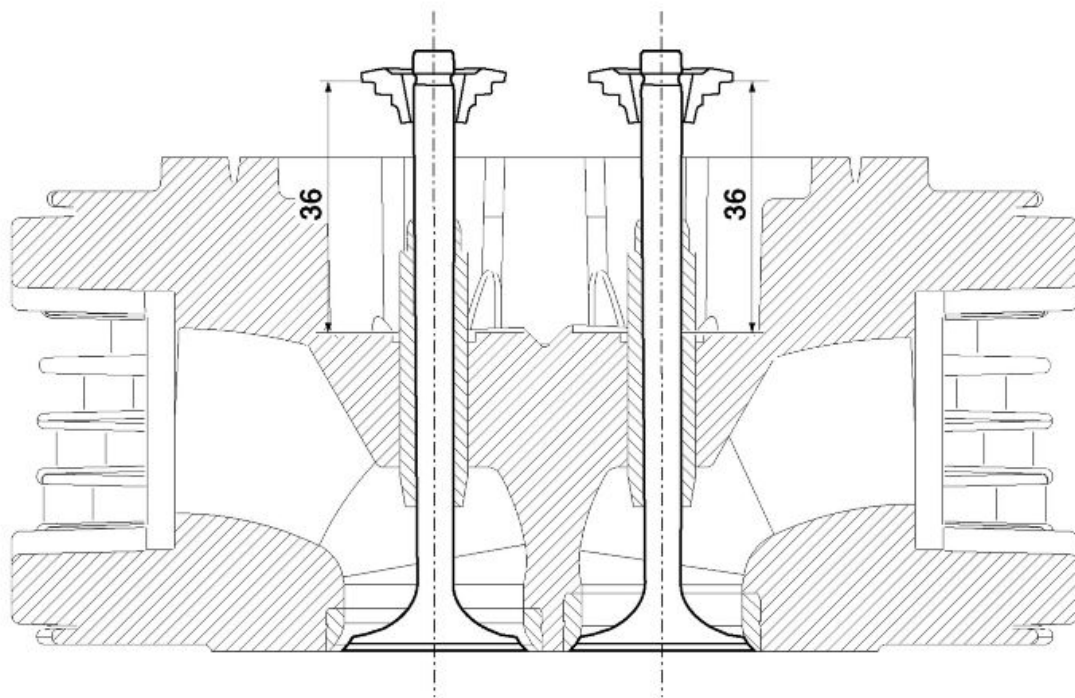
Checking the rocker arms

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

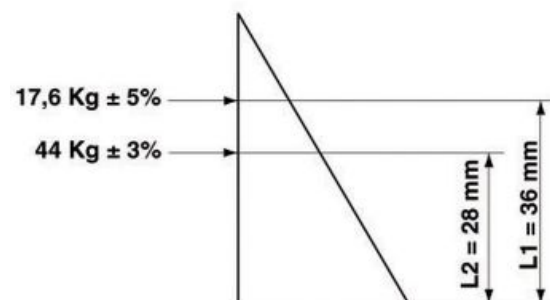
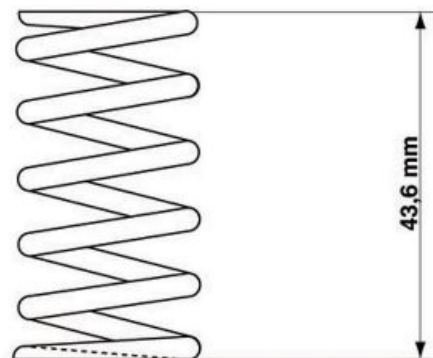


Inspecting the springs and half-cones

With the assembly installed (retainers, springs, valves and cotters in the heads), the compressed external springs should measure 36 mm (1.4173 in). Please note that the valves should have a remaining lift of 1 mm (0.039 in) when fully open before the internal spring becomes fully compressed. If not so, remove or add shims until achieving this condition.



Unloaded length



SPRING SPECIFICATIONS

Specification	Desc./Quantity
Inside diameter	17.8 ± 0.2 mm (0.7007 ± 0.0079 in)
Wire diameter	3.4 ± 0.03 mm (0.1338 ± 0.0012 in)
Unloaded length	43.6 mm (1.7165 in)
Compressed length	27.5 mm (1.0827 in)
Test length L1	36 mm (1.4173 in)
Test length L2	28 mm (1.1024 in)

Specification	Desc./Quantity
Detected test load P1	17.6 ± 5% Kg (38.8013 ± 5% lb)
Detected test load P2	44 ± 3% Kg (97.0033 ± 3% lb)
Hand	right
Spring class according to UNI 7900/4	CC

Checking the cylinder head

CAUTION

VALVE SEAT GRINDING AFTER VALVE GUIDE REPLACEMENT OR WHEN THE VALVES LEAK.

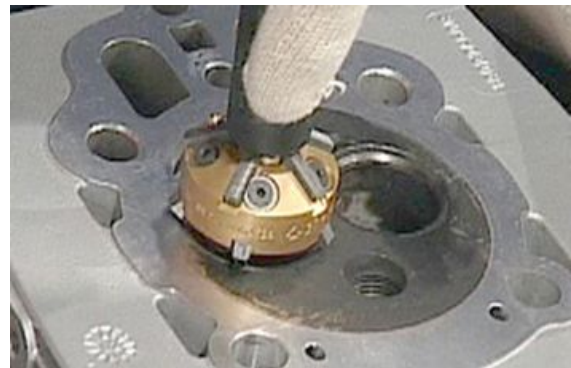
- Once you have chosen the pilot tool, insert it into the valve guide seat and lock it in place.



- Choose the proper cutter to suit valve seat diameter and angle.
- Insert the cutter into the pilot tool and push it down gently until it contacts the valve seat.



- Insert the T handle into the cutter and turn clockwise while pressing lightly achieving an even valve contact surface.



- Repeat the procedure using the suitable cutter to achieve the correct valve seat sealing surface.



- Remove any tools you have used to complete the procedure.
- Insert the lower spring seats and fit the seal rings onto the valve guide using the specified tool.



Installing the valves

- Press the valve guides into the heads from the outside towards the inside using punch and mallet; it is advisable to heat the head to approximately 60 °C (140 °F) before proceeding.



Specific tooling

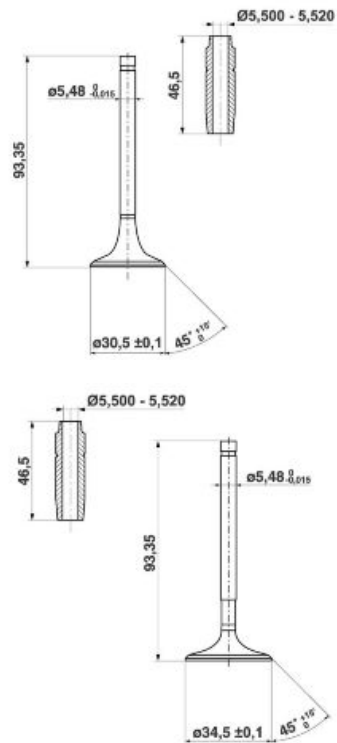
19.92.60.20 Punch for cap installation on valve guide.

- Insert the valve guides into their seats and bore them out to the size indicated in the table with a reamer.



VALVE AND GUIDE COUPLING DATA

	VALVE GUIDE INSIDE Ø mm (in)	VALVE STEM Ø mm (in)	FITTING CLEARANCE mm (in)
Intake	5.500-5.520 (0.2165-0.2173)	5.480-5.465 (0.2157-0.2151)	0.020-0.055
Exhaust	5.500-5.520 (0.2165-0.2173)	5.480-5.465 (0.2157-0.2151)	0.020-0.055

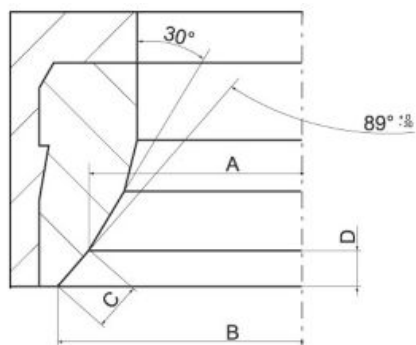


INTAKE

A Ø mm (in)	B (nominal) Ø mm (in)	C (nominal) Ø mm (in)	D mm (in)
32.0-32.25 (1.2598-1.2697)	34 (1.3386)	1.42 (0.0559)	1 (0.0394)

EXHAUST

A Ø mm (in)	B (nominal) Ø mm (in)	C (nominal) Ø mm (in)	D mm (in)
27.72-27.97 (1.0913-1.1012)	30 (1.1811)	1.6 (0.0630)	1.14 (0.0448)



Installing the rocker arms

- Make sure that the longitudinal slot is pointing to the oil delivery passage.

WHEN REFITTING, PAY SPECIAL ATTENTION TO THE MOUNTING POSITION OF THE WASHERS.



- Insert the oil delivery fitting and the rockers on the shaft and lock them in place with the circlips.





- Check that the rocker rods are straight and that the contact surfaces at the ends show no signs of seizing; otherwise, replace it.
- To check the pressed ends on the rods (pads) for looseness, simply drop the rods from a small height on a flat surface; on impact, you should hear a sharp clank: this means the pads have no clearance.



Adjusting valve clearance

- 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.



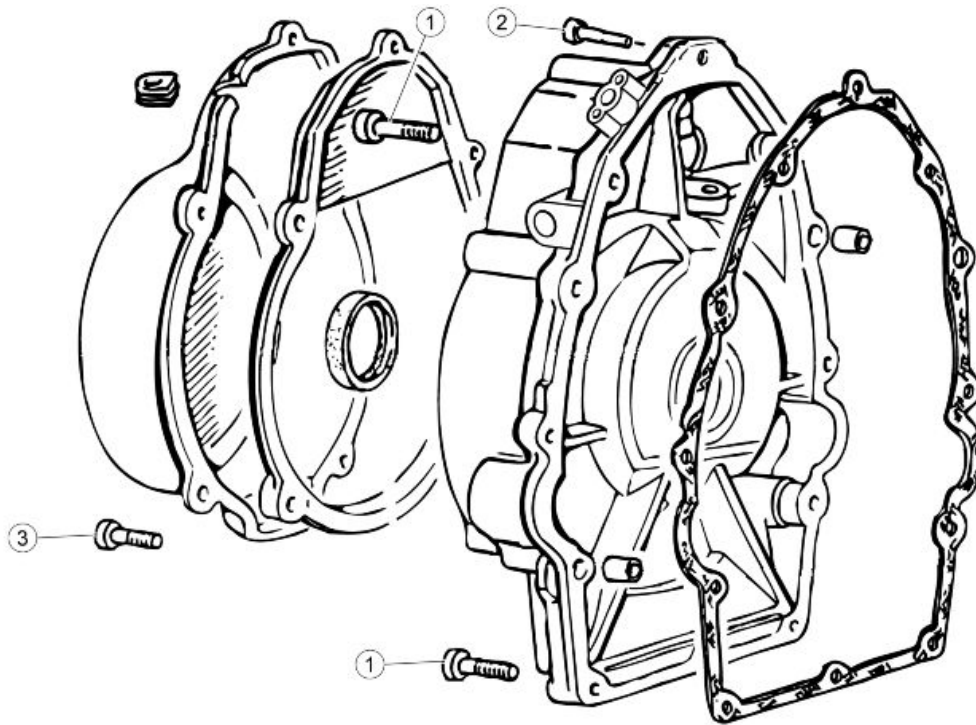
- Place the camshaft with the reference pin of the gear pointing downwards.



- Use a feeler gauge to check that the clearance between the valve and the set screw corresponds with the indicated values. When the valve clearance values, intake and exhaust respectively, are different from the ones indicated below, adjust them by loosening the lock nut and operate on the set screw with a screwdriver.
- Intake: 0.15 mm (0.0059 in) (when cold)
- Outlet: 0.20 mm (0.0079 in) (when cold)

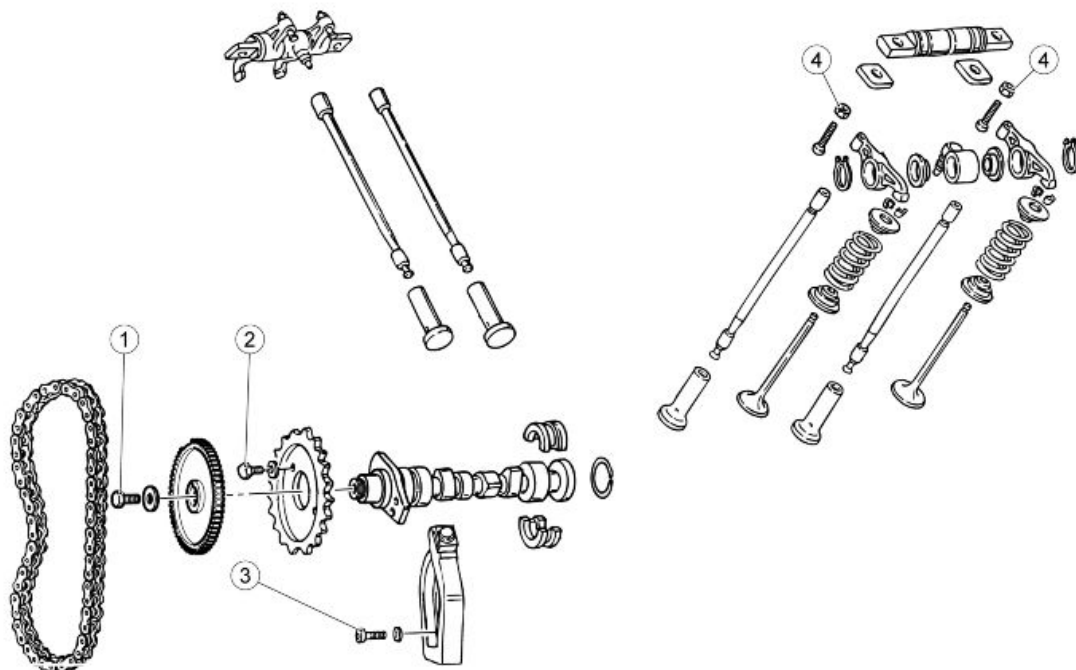


Timing



TIMING SYSTEM COVER

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M6x25	10	10 Nm (7.37 lb ft)	-
2	TCEI screw	M6x30	2	10 Nm (7.37 lb ft)	-
3	Alternator cover screws	M6x35	5	10 Nm (7.37 lb ft)	Loctite 243

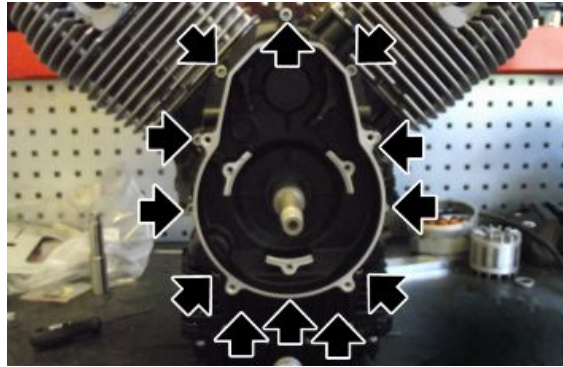


TIMING SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Tone wheel screw	M8x22	1	25 Nm (18.44 lb ft)	-
2	Timing system gear screws	-	2	25 Nm (18.44 lb ft)	Loctite 243
3	Chain tensioner screw	M6x16	1	10 Nm (7.38 lb ft)	-
4	Valve clearance adjuster screw	M6x1	4	10 Nm (7.38 lb ft)	-

TIMING SYSTEM COVER REMOVAL

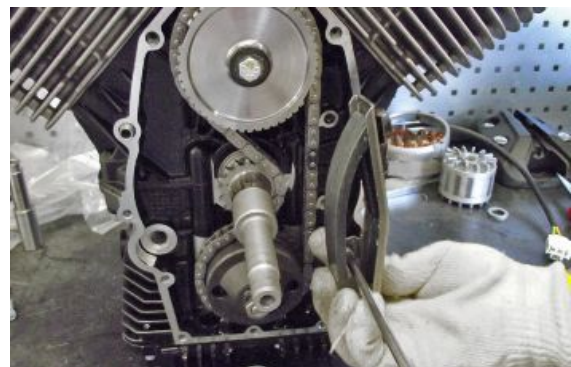
- Remove alternator and cover to get access to the timing system.
- Undo the fixing screws and remove the timing system cover with its gasket.

**REFITTING THE TIMING SYSTEM COVER**

- Insert the gasket, position the timing system cover and tighten to the prescribed torque using a torque wrench.

Removing the chain tensioner

- Remove the timing system cover.
- Remove the chain tensioner.
- Collect the washer.

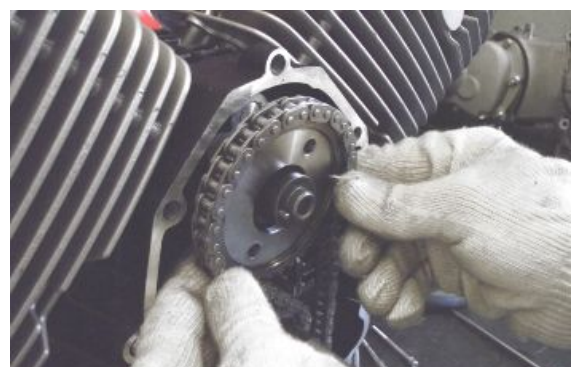
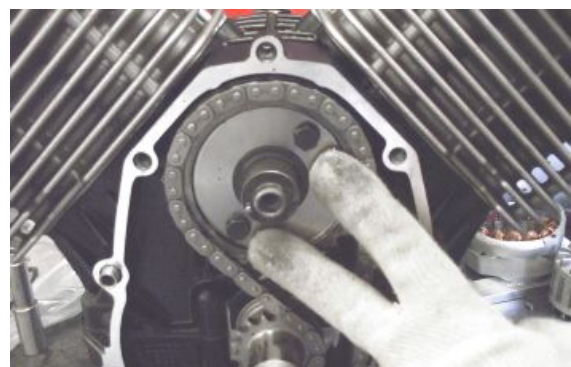


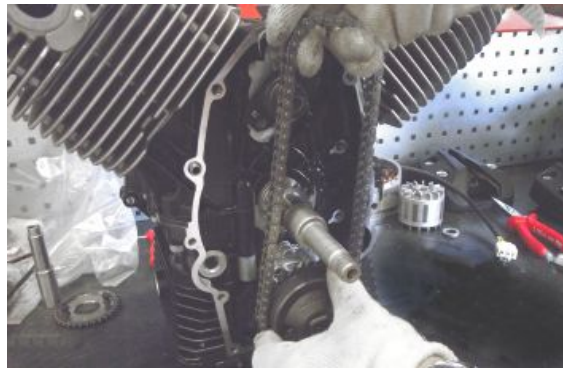
See also

[Timing](#)

Chain removal

- Remove the tone wheel.
- Remove the two screws, slide the timing gear off the shaft, remove chain and oil pump gear.
- Collect the washer.



**See also**

[Removing the phonic wheel](#)

Removing the phonic wheel

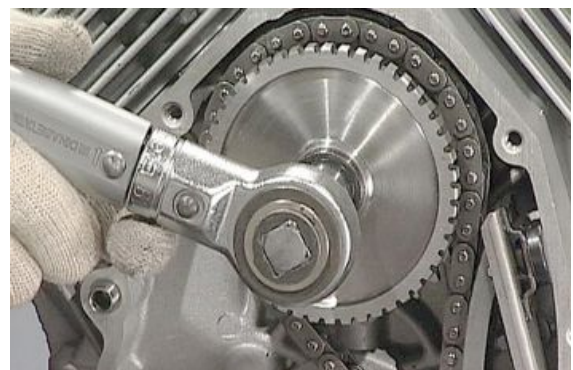
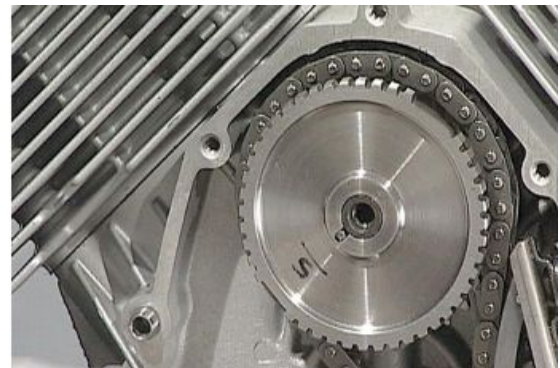
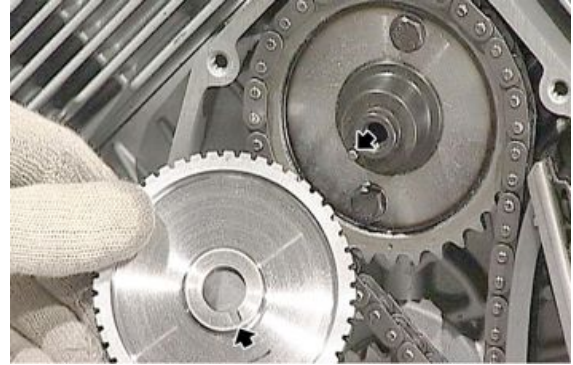
- Remove the engine unit from the chassis.
- Remove the timing system cover.
- Remove the chain tensioner.
- Unscrew and remove the tone wheel fixing screw and collect the washer.

**See also**

[Removing the chain tensioner](#)
[Timing](#)

Installing the phonic wheel

- Tone wheel position is dictated by the pin on the camshaft.
- Position the tone wheel making sure it locates correctly on the camshaft (see slot) and tighten to the prescribed torque using a torque wrench.



Cam 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.



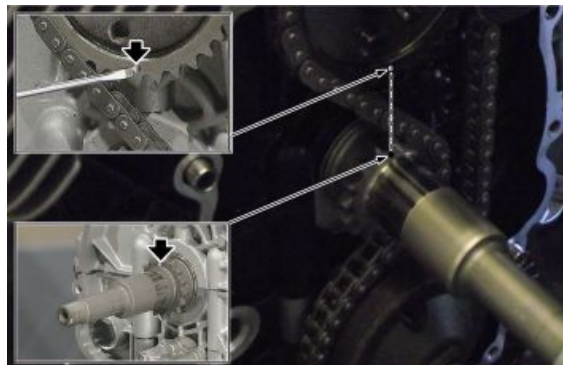
- Place the camshaft with the reference pin of the gear pointing downwards.

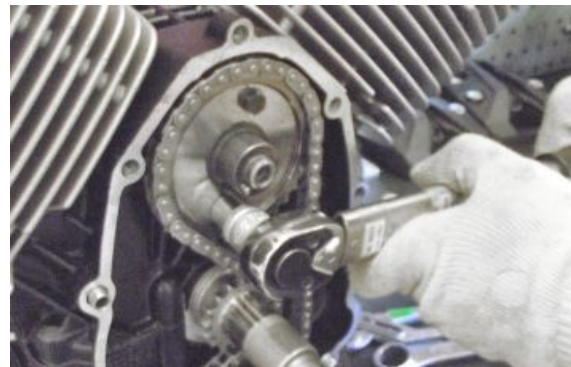
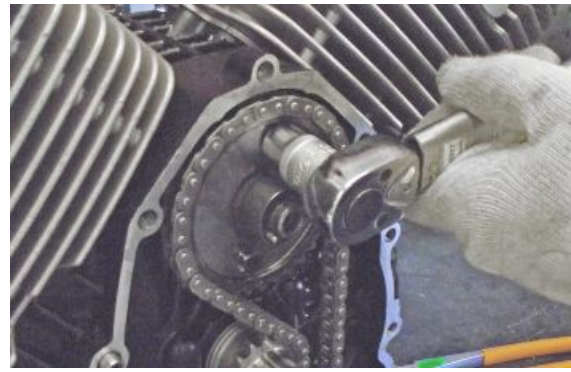


- Insert the oil pump shaft (pin) key.



- Fit the two gears with the timing chain; after installation, check the position of the reference notches and tighten the screws to the prescribed torque with a torque wrench.



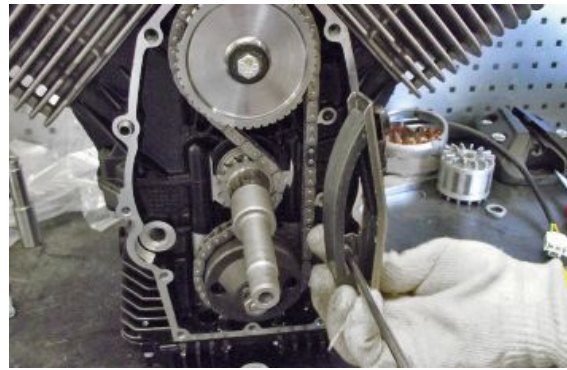


- Tighten the oil pump nut while holding the oil pump shaft steady.

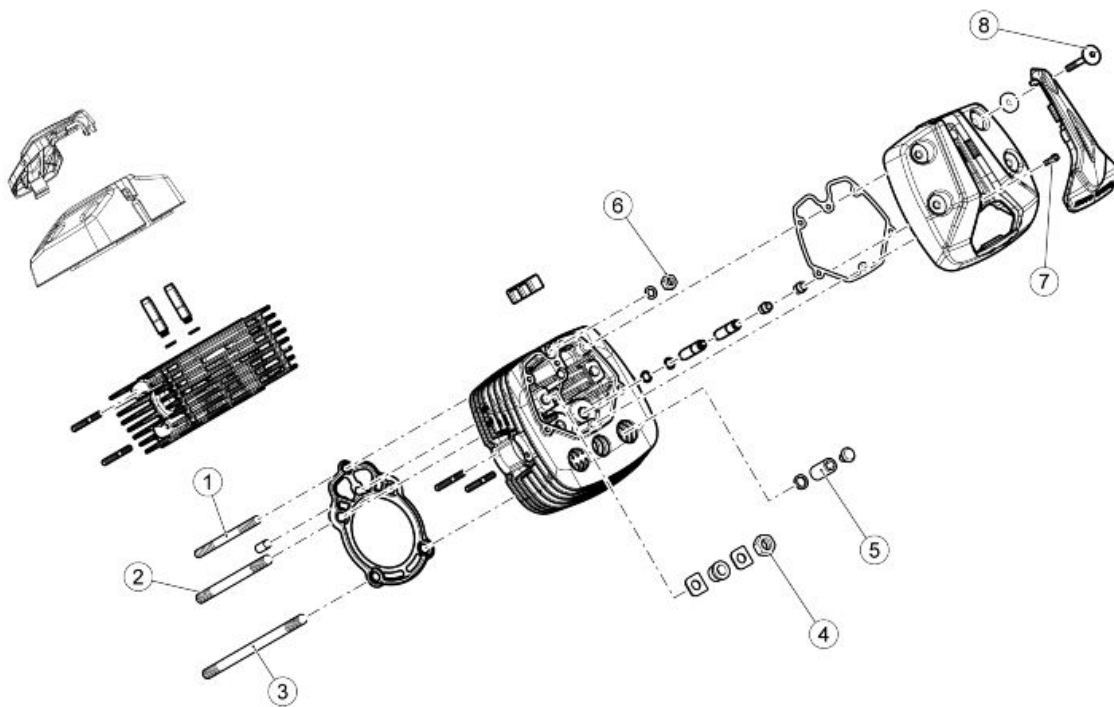


- Fit the chain tensioner and tighten to the prescribed torque using a torque wrench.





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	-	4	25 Nm (18.44 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



See also

[Removing the cylinder head](#)

- Remove the O-ring of the lubrication duct of the thermal unit

CAUTION

PAY PARTICULAR ATTENTION TO ENSURE THAT THE O-RING DOES NOT FALL INSIDE THE CRANKCASE



Disassembling the piston

- After protecting the cylinder seat, remove the two snap rings that retain the piston pin



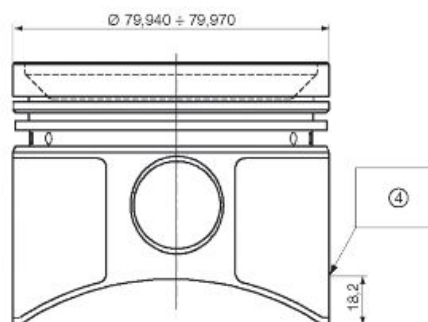
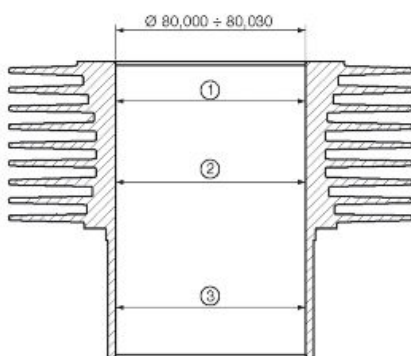
- Slide off the pin using the specified tool (turn the tool screw) and remove the piston.

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.



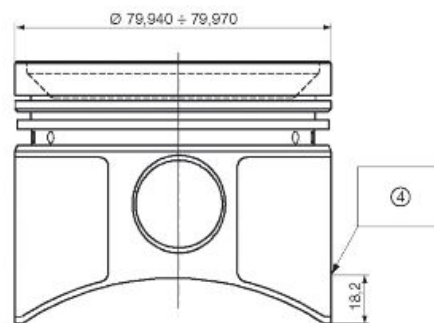
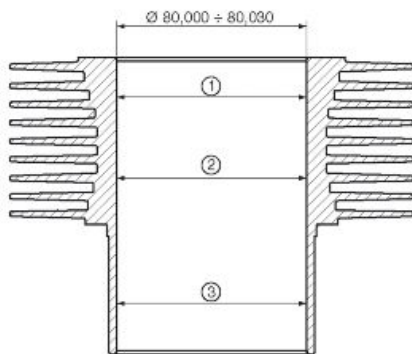
Key:

1. 1st measurement

2. 2nd measurement
3. 3rd measurement
4. measurement for classification

Checking the piston

- After checking for scoring, check cylinder surface wear using a dial gauge graduated in hundredths of a millimetre.
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Key:

1. 1st measurement
2. 2nd measurement
3. 3rd measurement
4. measurement for classification

Inspecting the piston rings

PISTON RINGS AND OIL SCRAPER REMOVAL

- Remove piston rings and oil scraper.

CAUTION

PUSH THE PISTON RING END GAPS APART JUST ENOUGH TO EASE THE PISTON RINGS OFF THE PISTON TO AVOID BREAKING THEM



- Insert the piston rings into the cylinder and check clearance at end gaps using a feeler gauge.

Top piston ring: mm 0.20 - 0.35 (in 0.0079 - 0.0138);

Intermediate piston ring: mm 0.35 - 0.55 (in 0.0138 - 0.0216);

oil scraper ring: mm 0.20 - 0.70 (in 0.0079 - 0.0275).



PISTON RINGS AND OIL SCRAPER REFITTING

- 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

- To refit the piston into the connecting rod small end, heat up the piston in an oil bath up to approximately 60°C (140° F); this will cause the piston to expand slightly and facilitate pin insertion.
- Insert the retaining clip into the piston and fit the specified pin insertion tool to the piston.
- Position the piston with the tool attached on the connecting rod in order to install the pin.



- When finished, remove the tool and insert the second snap ring that closes the piston pin seat, after protecting the cylinder seat.

CAUTION

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





Installing the cylinder

- Check that the piston ring end gaps are approximately 120 degrees from each other.
- Position the O-ring on the lubrication duct of the thermal unit



-
- Fit a new gasket



-
- Place a commercially available appropriate ring clamp on the piston.



- As soon as past the piston ring area, remove the piston ring compressor clamp from the piston and insert the cylinder into its seat.
- Install the head.



See also

[Installing the cylinder head](#)

Selecting the cylinder

CYLINDER SELECTION Ø

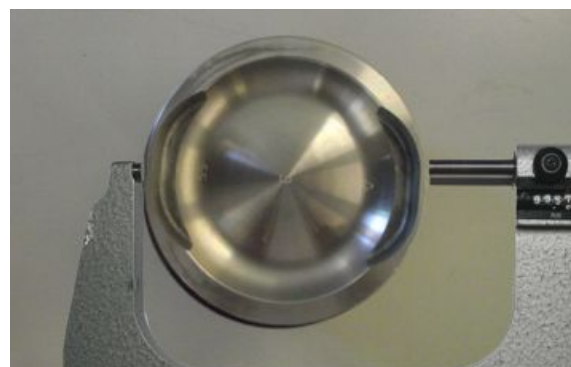
GRADE "D" mm (in)	GRADE "E" mm (in)	GRADE "F" mm (in)
80.000 - 80.010 (3.1496 - 3.1500)	80.010 - 80.020 (3.1500 - 3.1504)	80.020 - 80.030 (3.1504 - 3.1508)

When fitting new units, grade "D-E-F" cylinders must be matched with corresponding grade "D-E-F" pistons.

Fitting clearances between piston and cylinders: 0.050 - 0.070 mm (0.0020 - 0.0027 in).

Selecting the piston

- Check the diameter of the piston at the specified height, perpendicular to the pin axis.
- Selection values refer to the bare piston (without graphite coating).



- Check that the piston bears the selection mark and the arrow that denotes mounting position.



PISTON Ø SELECTION

GRADE "D" mm (in)	GRADE "E" mm (in)	GRADE "F" mm (in)
79.940 - 79.950 (3.1472 - 3.1476)	79.950 - 79.960 (3.1476 - 3.1480)	79.960 - 79.970 (3.1480 - 3.1484)

CAUTION

THICKNESS OF THE NEW PAINTED ANTI-FRICTION COATING: 0,015 ± 0,020 mm (0.00059 ± 0.00079 in)

PIN AND PISTON EYE COUPLING DATA

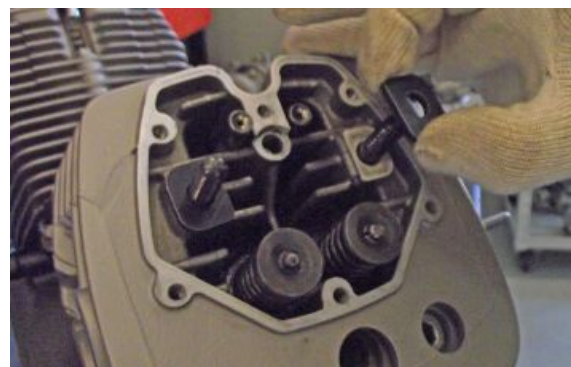
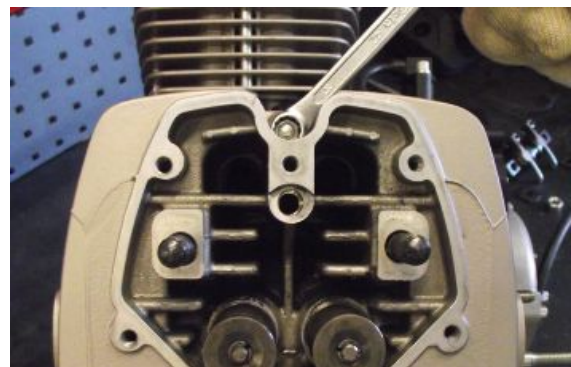
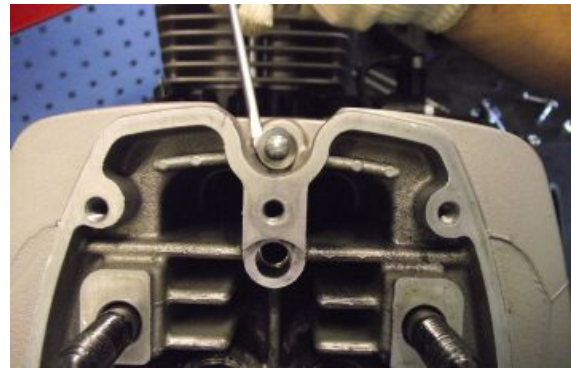
PIN OUTER Ø mm (in)	PISTON EYE Ø mm (in)	FITTING CLEARANCE and INTERFERENCE FIT mm (in)
21.994 - 21.998 (0.8659 - 0.8661)	22.000 - 22.006 (0.8661 - 0.8664)	From 0.006 mm (0.00024 in) clearance to 0.002 mm (0.0008 in) interference fit

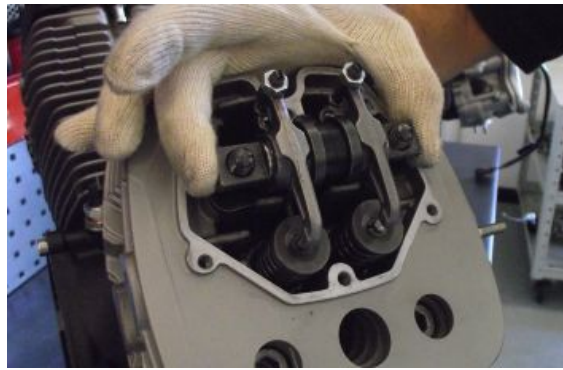
Installing the cylinder head

- Insert the new gasket and fit the cylinder head into place.



- Fit the rocker lower spacers, the rocker control rods, the rockers and the upper spacers with their nuts.



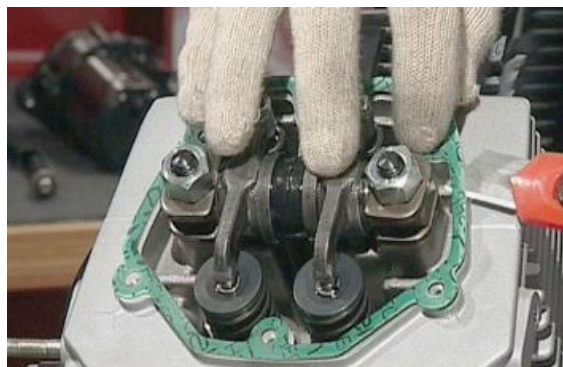


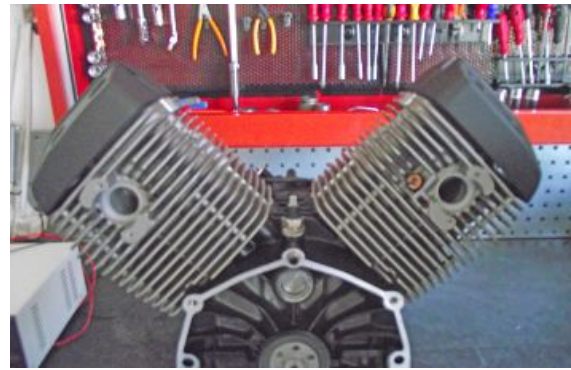
- Tighten the nuts to the prescribed torque following a crisscross pattern.



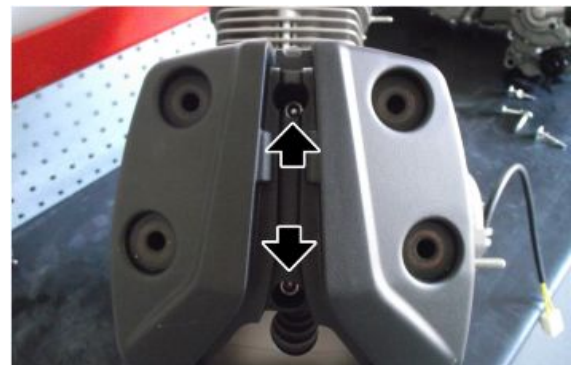
Installing the head cover

- Replace the head cover gaskets and refit the covers to the heads.

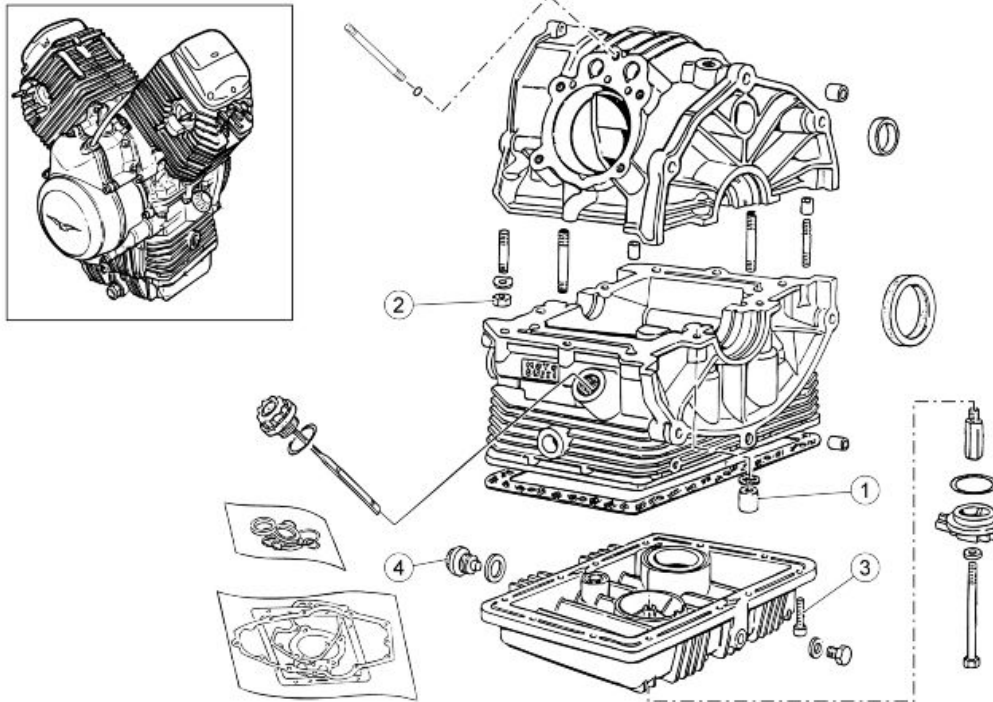




- Tighten the screws following a criss-cross pattern with a torque wrench set to the prescribed torque.

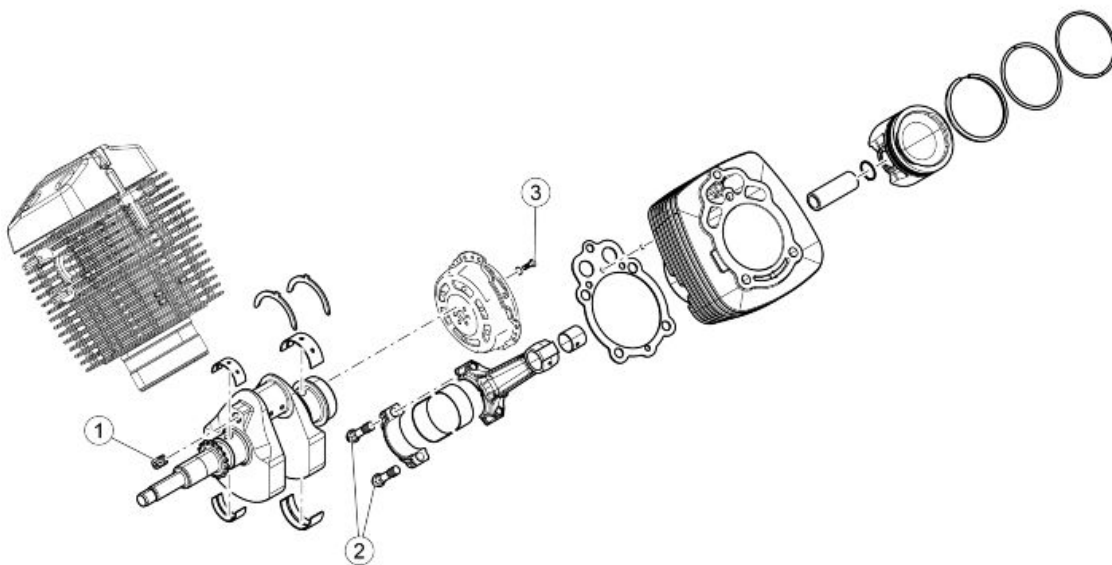


Crankcase - crankshaft



CRANKCASE

pos.	Description	Type	Quantity	Torque	Notes
1	Column nuts	-	4	42 Nm (30.98 lbf ft)	-
2	Nut	M8x1.25	6	22 Nm (16.22 lbf ft)	-
3	TCEI screw	M6x25	12	10 Nm (7.37 lbf ft)	-
4	Oil drainage plug	M10x1	1	40 Nm (29.5 lbf ft)	-
-	Spark plugs	-	2	30 Nm (22.13 lbf ft)	-

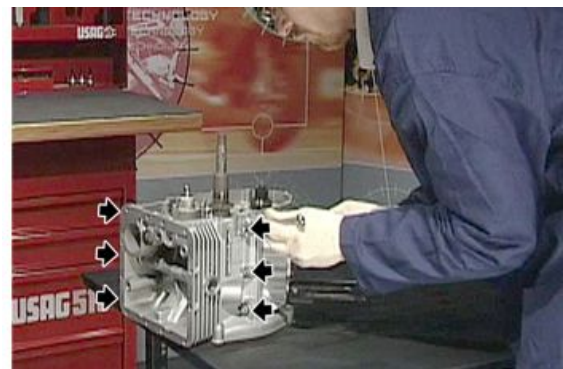
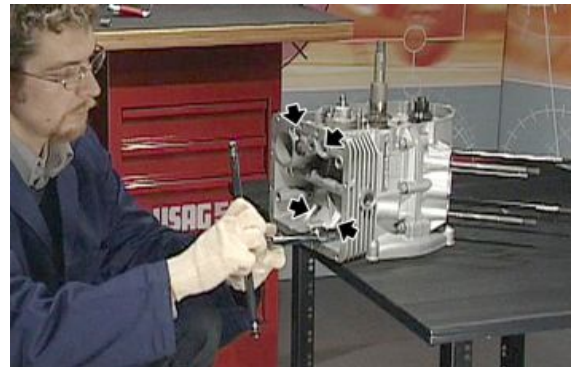


CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Oil plug	-	1	15 Nm (11.06 lbf ft)	Loctite 601
2	Connecting rod screws	-	4	33 Nm (24.34 lbf ft)	-
3	Flywheel screws	-	6	42 Nm (30.98 lbf ft)	Loctite 243

Splitting the crankcase halves

- Unscrew the four long nuts from inside the crankcase and the six external nuts.



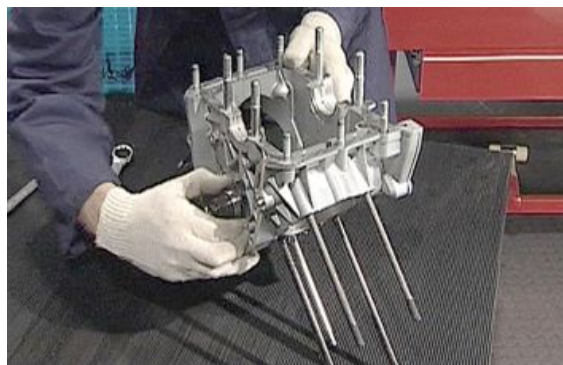
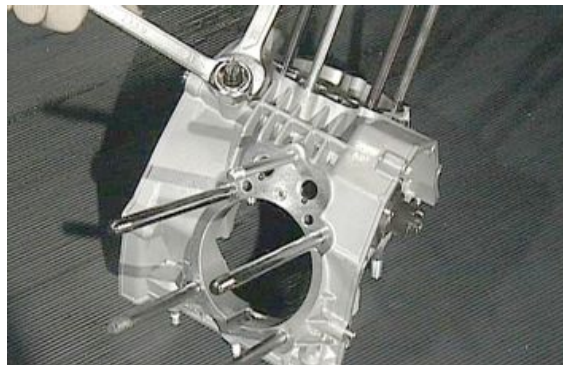
- Insert a rod into the seat of the linkage joining engine and chassis, then tap the rod lightly with a plastic mallet until separating the two crankcase halves.



- Remove the upper crankcase being careful not to damage its mating face.
- Remove the crankshaft together with connecting rods and half-bearings.



Unscrew the oil pressure sensor from the upper crankcase and remove the retaining bushing of the camshaft; remove the shaft and the tappets, noting their positions.

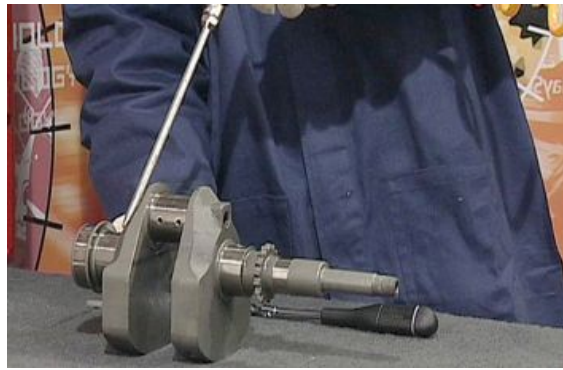




Removing the crankshaft

- 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

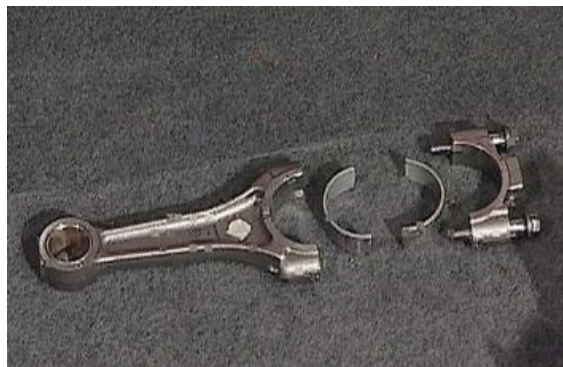
After removing the crankshaft together with the connecting rods from the upper crankcase, loosen the screws and separate connecting rod from small end noting the reference marks and mounting direction.



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

CAUTION

REPEAT THE PROCEDURE FOR THE OTHER CONNECTING ROD



Inspecting the crankcase halves

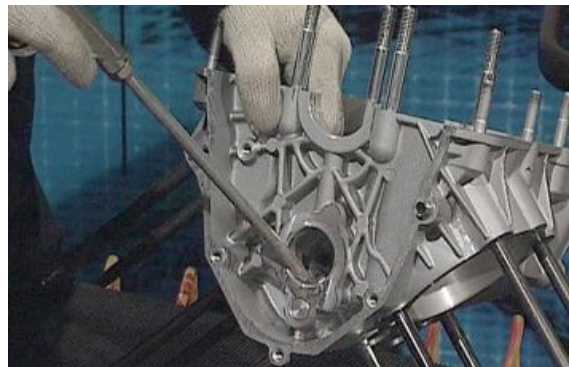
- Check that the mating faces are not damaged, dented or scored. Remove any liquid gasket residues with trichlorethylene.



- 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

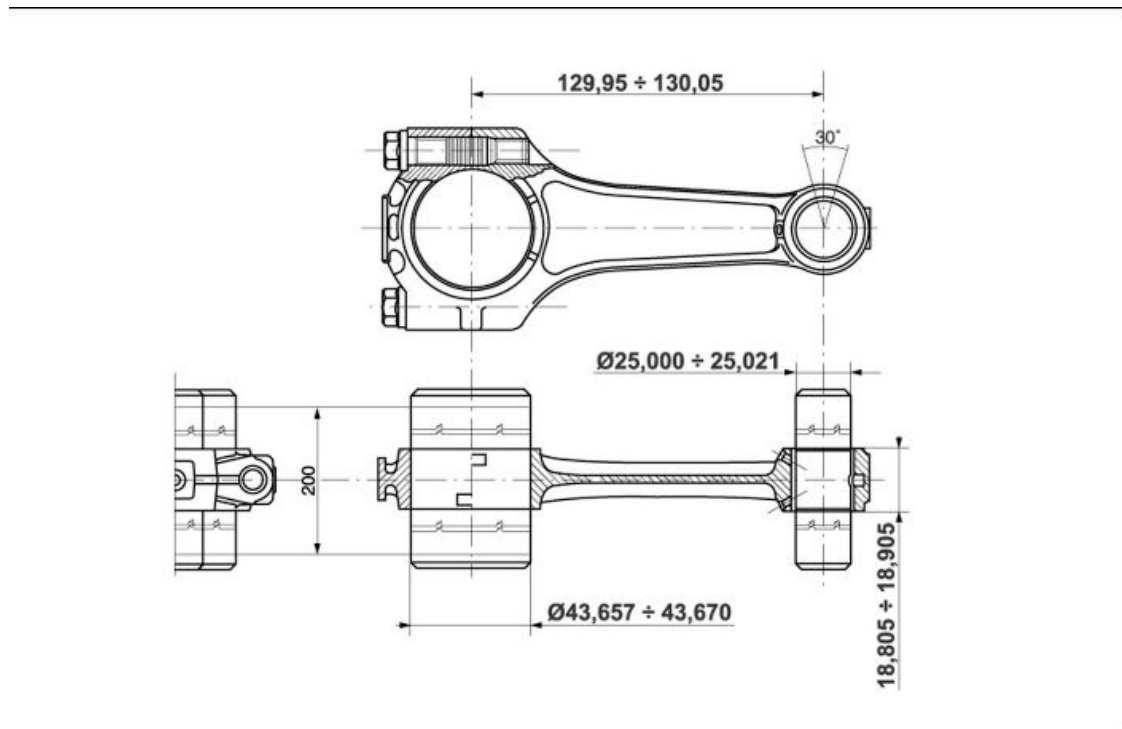
Specification	Desc./Quantity
Main journal diameter on timing system side	40.02 - 40.004 mm (1.5756 - 1.5750 in)
Timing system side main bearing seat diameter	43.67 - 43.657 mm (1.7193 - 1.7188 in)
Total thickness for timing system side main bearings	1.807 - 1.817 mm (0.0711 - 0.0715 in)
Clearance between shaft and timing system side bearing	0.007 - 0.048 mm (0.0002 - 0.0019 in)
Clutch side main journal diameter	43.023 - 40.007 mm (1.5757 - 1.6932 in)
Clutch side main bearing seat diameter	47.142 - 47.13 mm (1.8560 - 1.8555 in)
Total thickness for clutch side main bearings	2.042 - 2.052 mm (0.0804 - 0.0808 in)
Clearance between shaft and clutch side bearing	0.007 - 0.047 mm (0.0002 - 0.0018 in)
Crankshaft shoulder quota	24.77 - 24.803 mm (0.9752 - 0.9765 in)
Crankcase shoulder quota	24 - 19.95 mm (0.9449 - 0.7854 in)
Thickness of thrust half ring on clutch side main bearing	2.31 - 2.36 mm (0.0909 - 0.0929 in)
Thrust clearance of crankshaft in crankcase	0.05 - 0.233 mm (0.0020 - 0.0092 in)
Crank pin diameter	39.995 - 40.011 mm (1.5746 - 1.5752 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

- Measure connecting rod pin diameter across the pin and again at 90° degrees away. Measure bearing seats on both timing system and flywheel side at the half-bearing locations.
- Assemble the connecting rod without half-bearings and tighten the connecting rod screws to the prescribed torque. Measure the outer diameter of half-bearing locations with a dial gauge graduated in hundredths of a millimetre and the thickness of both half-bearings 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.



Seat diameter 43.657-43.670 mm (1.7188 - 1.7193 in).

Shaft diameter 39.995-40.001 mm (1.5746 - 1.5748 in).

Clearance between shaft and connecting rod bearing at 90° away from mating faces: min 0.020 (0.0008 in), max 0.061 (0.0024 in).

CONNECTING ROD BEARING THICKNESSES

STANDARD (stock production) A mm (in)	STANDARD (stock production) B mm (in)
1.537-1.543 (0.0605 - 0.0607)	1.527-1.533 (0.0601 - 0.0603)

DIAMETER OF PRESSED SMALL END BUSHING AND PISTON PIN

INNER \varnothing FOR PRESSED SMALL END BUSHING mm (in)	PISTON PIN \varnothing	MOUNTING CLEARANCE BETWEEN SMALL END BUSHING AND PISTON PIN mm (in)
18.010-18.020 (0.7090 - 0.7094)	21.994-21.998 (0.8659 - 0.8661)	0.005-0.021 (0.0002 - 0.0008)

CONNECTING ROD CHECK

Specification	Desc./Quantity
Diameter of the connecting rod head	43.657 - 43.67 mm (1.7188 - 1.7193 in)
Total thickness for the connecting rod bearing	1.805 - 1.815 mm (0.0710 - 0.0714 in)
Diameter of the small end with pressed and bored bushing	22.005 - 22.015 mm (0.8663 - 0.8667 in)
Rough bushing thickness	1.7 - 1.8 mm (0.0669 - 0.0709 in)

Assembling the connecting rod

- 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.



CONNECTING ROD SHIMS CHECK

Check that the mounting clearance between connecting rod shims and crankshaft shoulders is within the specified values: 0.265 - 0.515 mm (0.0104 - 0.0203 in).



Refitting the crankcase halves

- Insert the tappets after lubricating them properly.

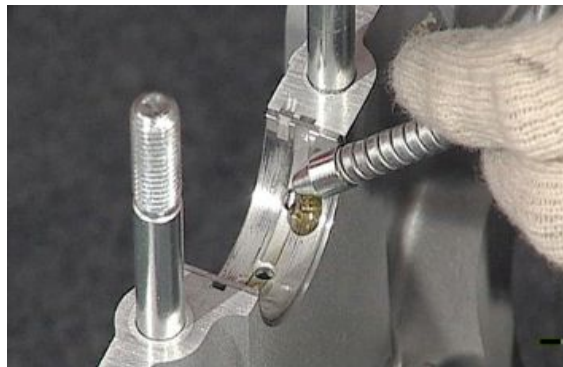


- Insert the camshaft into the seat in the upper crankcase, lubricate and insert locking the camshaft locking fitting.

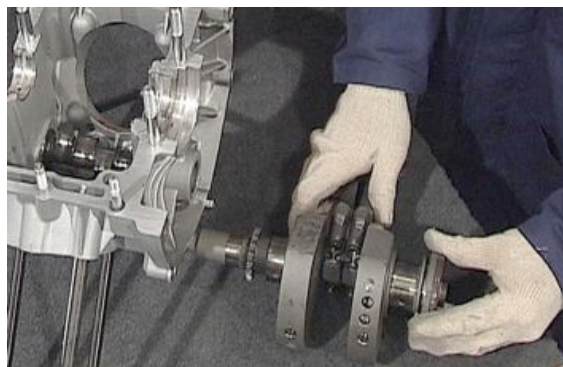


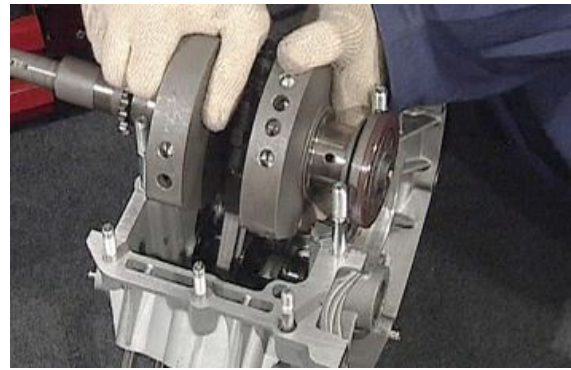
- Insert the timing system side and fly-wheel side half-bearings with their thrust washers into the seats in the upper crankcase.



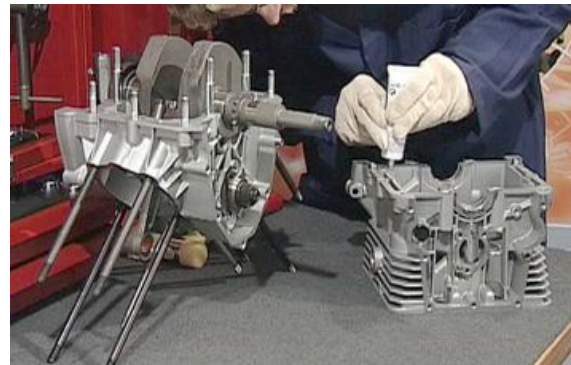


- Insert the seal ring (after lubricating it) on the crankshaft and the assembly onto the engine crankcase making sure that the connecting rods locate correctly into their seats.

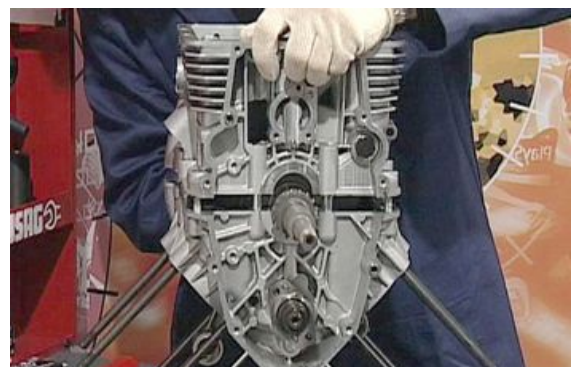


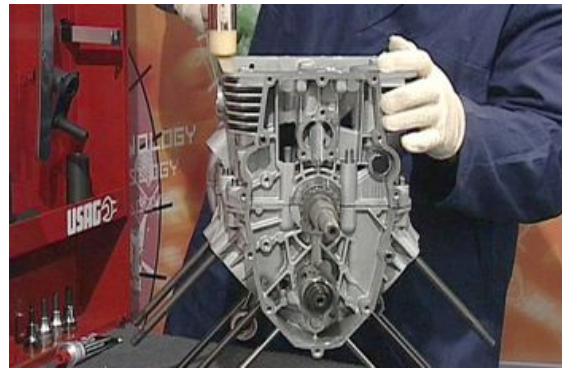


- Fit the half-bearings (lubricate them first) into the lower crankcase; apply the specified liquid gasket to the crankcase mating faces

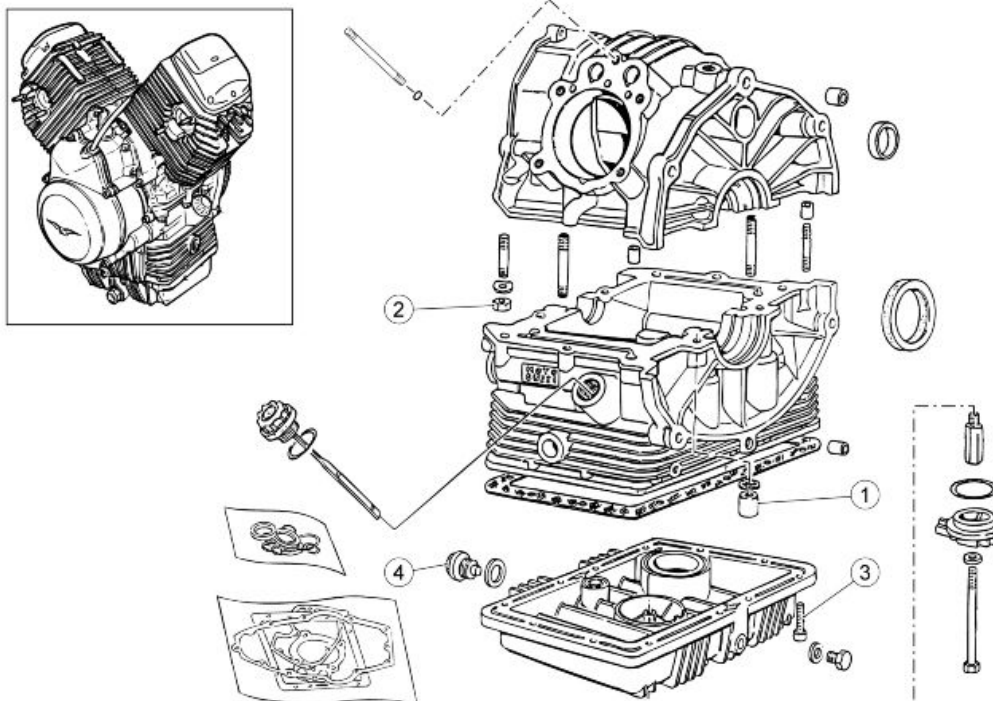


- Join the two crankcase halves and tap lightly with a mallet to ensure that the two mating faces adhere together firmly; tighten the four central stud bolts and the external nuts following a criss-cross pattern.





Lubrication

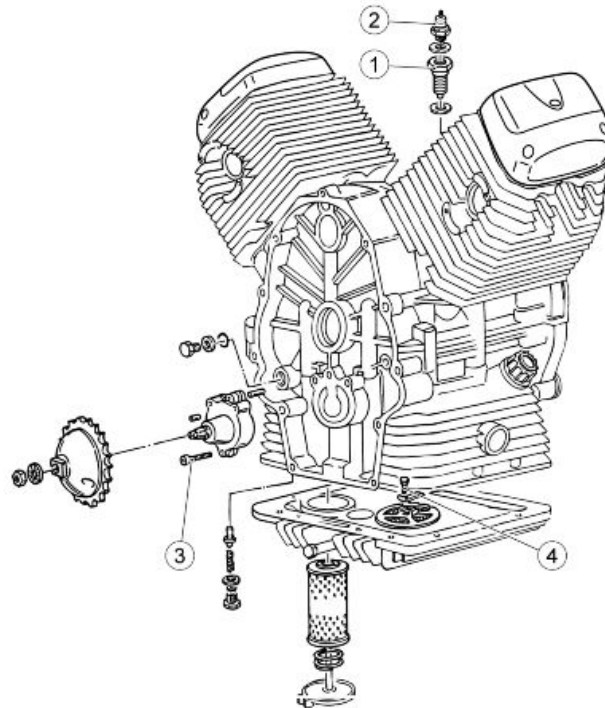
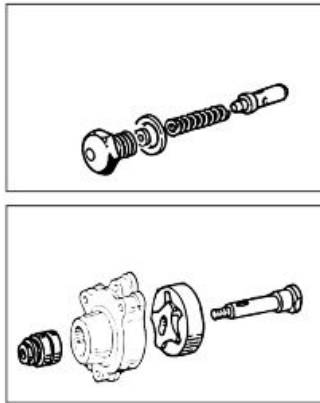


CRANKCASE

pos.	Description	Type	Quantity	Torque	Notes
1	Column nuts	-	4	42 Nm (30.98 lbf ft)	-
2	Nut	M8x1.25	6	22 Nm (16.22 lbf ft)	-
3	TCEI screw	M6x25	12	10 Nm (7.37 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
4	Oil drainage plug	M10x1	1	40 Nm (29.5 lbf ft)	-
-	Spark plugs	-	2	30 Nm (22.13 lbf ft)	-

Oil pump

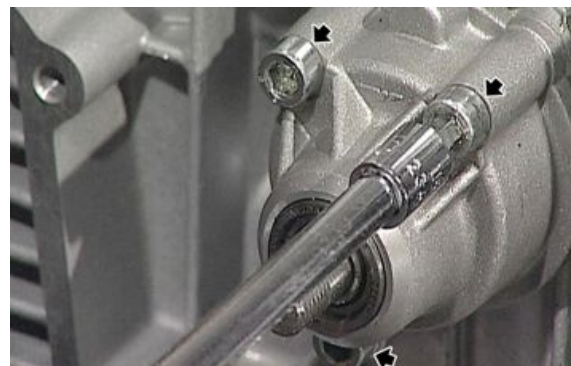


OIL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Transmitter joint	-	1	25 Nm (18.44 lbf ft)	-
2	Oil pressure sensor	-	1	30 Nm (22.13 lbf ft)	-
3	Oil pump screws	M6x35	3	10 Nm (7.38 lbf ft)	Loctite 648
4	Oil filter screw	-	1	6 Nm (4.43 lbf ft)	-

Removing

- After removing the timing system, remove the oil pump from the crankcase unscrewing the Allen screws. Removal procedure is as follows.



- Remove the retaining key.
- Slide off the pump drive shaft with the internal rotor attached.
- Slide off the external rotor.

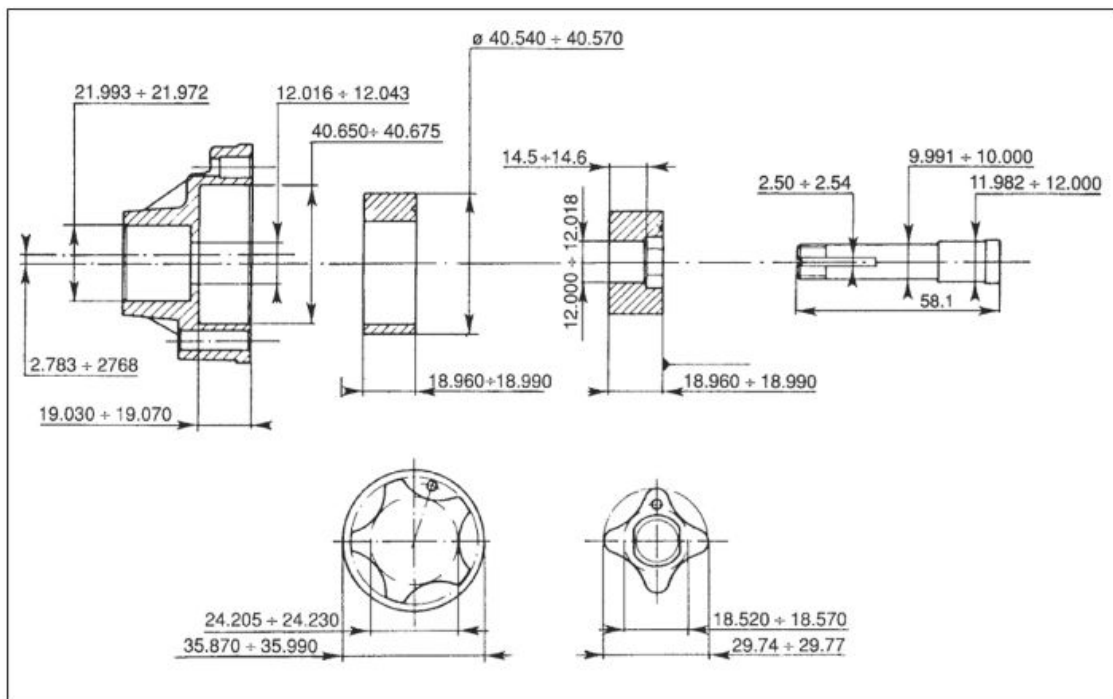


- Slide off the bearings and their inner housing from pump body.





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

- External rotor seat $\varnothing 40.650 - 40.675$ mm (1.6004 - 1.6014 in);
- Pump drive shaft bore $\varnothing 12.016 - 12.043$ mm (0.4730 - 0.4741 in);
- Needle bearing seat $\varnothing 21.972 - 21.993$ mm (0.8650 - 0.8659 in);



- External rotor seat thickness 15.030 - 15.070 mm (0.5917 - 0.5933 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:

- outer \varnothing 40.540 - 40.570 mm (1.5960 - 1.5972 in);
- inner \varnothing 24.205 - 24.230 mm (0.9529 - 0.9539 in);
- thickness 14.960 - 14.990 mm (0.5890 - 0.5902 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.

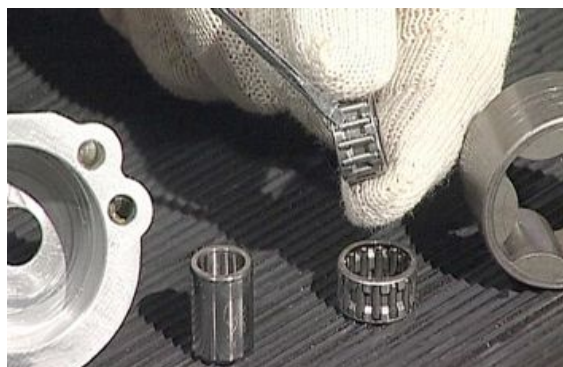
Internal rotor specifications:

- outer \varnothing 29.745 - 29.770 mm (1.1711 - 1.1720 in);
- inner \varnothing 12.000 - 12.018 mm (0.4724 - 0.4731 in);
- thickness 14.960 - 14.990 mm (0.5890 - 0.5902 in).



NEEDLE BEARINGS

Make sure the needle rollers of the bearings are not damaged; if they are, replace the bearings.



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:

- \varnothing for pump body seat 11.982 - 12.000 mm (0.4717 - 0.4724 in);
- \varnothing for needle bearings 9.991 - 10.000 mm (0.3933 - 0.3937 in);



FITTING CLEARANCES

- between pump body and external rotor 0.080 - 0.135 mm (0.0031 - 0.0053 in);
- between internal rotor bore and drive shaft 0.016 - 0.061 mm (0.0006 - 0.0024 in);
- between internal body bore and drive shaft 0.016 - 0.061 mm (0.0006 - 0.0024 in);



Installing

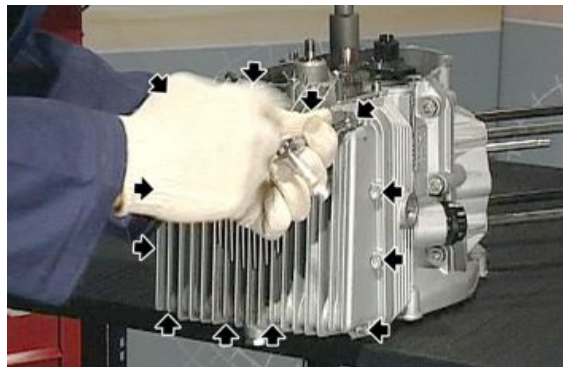
- Assemble the oil pump and refit it to the crankcase, paying attention to the two alignment dowels.
- Tighten the Allen screws to the prescribed torque and make sure the driving shaft turns freely.



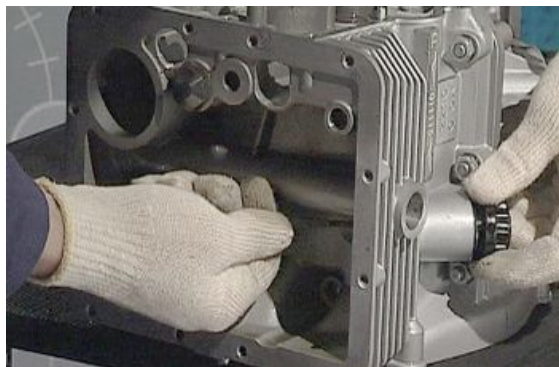


Removing the oil sump

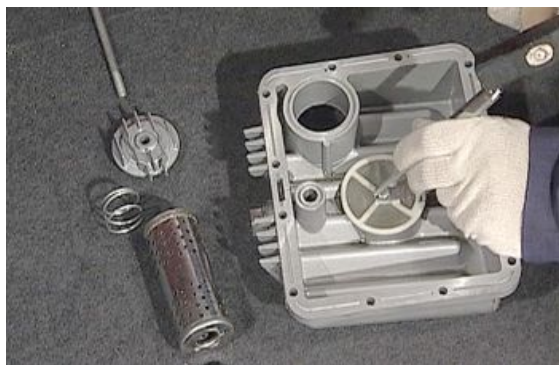
- Remove the engine oil filter.
- Unscrew the screws fixing the oil sump to the engine crankcase, remove the oil sump and the gasket.



- Remove the oil level indicator.



- Straighten the safety plate, remove the mesh filter retaining screw from the oil sump and remove the mesh filter.



- Check that the mesh filter is not dirty, wash and blow with compressed air if needed.

Refitting the oil sump

- Insert filter, safety plate and fixing screw, then tighten the screw.



-
- Bend the safety plate.



-
- Position the gasket between the sump and crankcase (always change the gasket). Pay attention during the procedure; if wrongly installed, the gasket will prevent proper oil circulation.



- Tighten the sump screws following a crisscross pattern to the prescribed torque using a torque wrench.



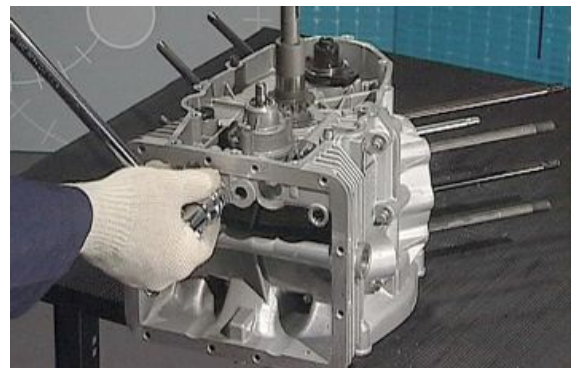
- Insert the filter cartridge and tighten the screw to the prescribed torque.



Pressure reducer valve

REMOVAL

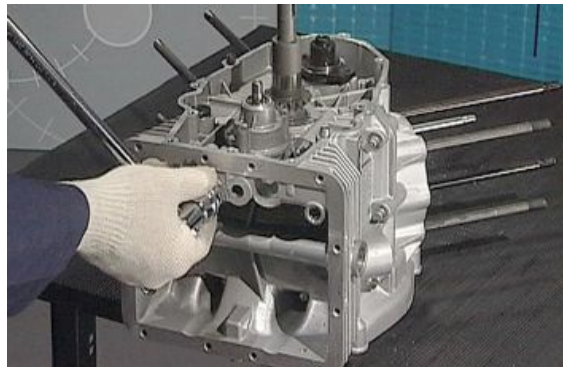
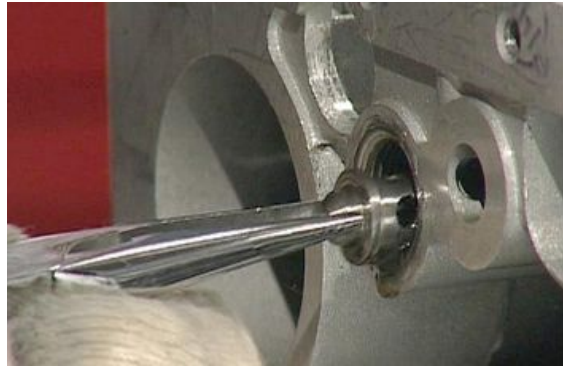
- Unscrew the regulating valve mounted on the threaded hole in the crankcase using a suitable wrench.





FITTING

- Insert the valve first and then the spring, apply threadlocker to the screw and tighten to the prescribed torque.



A

Alternator:

C

Chain: *113, 114*

Chain tensioner: *113, 114*

Clutch: *62, 65, 66, 86, 87, 89–92*

Crankcase: *130, 131, 135, 139*

Crankshaft: *130, 133, 136*

Cylinder: *96, 98, 104, 119, 120, 124–126*

D

Desmodromic drum: *65*

E

Exhaust:

F

Forks: *66*

H

Head cover: *95, 97, 99, 128*

O

Oil sump: *148, 150*

P

Primary shaft: *44*

S

Secondary shaft: *51*

Starter motor: *85, 86*

T

Throttle body: