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# **MMS California 1400 My12**

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**California 1400**

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# MMS California 1400 My12

## California 1400

### 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](http://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.

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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.

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# MMS California 1400 My12

## California 1400

**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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## Rules

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### Safety rules

#### Carbon monoxide

If you need to keep the engine running while working on the vehicle, please ensure that you do so in an open or very well ventilated area. Never run the engine in an enclosed area. If you do work in an enclosed area, make sure to use a fume extraction system.

#### CAUTION



**EXHAUST EMISSIONS CONTAIN CARBON MONOXIDE, A POISONOUS GAS WHICH CAN CAUSE LOSS OF CONSCIOUSNESS AND EVEN DEATH.**

#### Fuel

#### CAUTION



**THE FUEL USED TO POWER INTERNAL COMBUSTION ENGINES IS HIGHLY FLAMMABLE AND MAY BE EXPLOSIVE UNDER CERTAIN CONDITIONS. IT IS THEREFORE RECOMMENDED TO CARRY OUT REFUELLING AND MAINTENANCE PROCEDURES IN A VENTILATED AREA WITH THE ENGINE SWITCHED OFF. DO NOT SMOKE DURING REFUELLING OR NEAR FUEL VAPOUR. AVOID ANY CONTACT WITH NAKED FLAME, SPARKS OR OTHER HEAT SOURCES WHICH MAY CAUSE IGNITION OR EXPLOSION.**

**DO NOT ALLOW FUEL TO DISPERSE INTO THE ENVIRONMENT.  
KEEP OUT OF THE REACH OF CHILDREN.**

#### Hot components

The engine and the exhaust system components become very hot and remain hot for some time after the engine has been switched off. When handling these components, wear insulating gloves or wait until the engine and the exhaust system have cooled down.

#### Coolant

The coolant contains ethylene glycol which, under certain conditions, can become flammable.

When it burns, ethylene glycol produces an invisible flame which however can cause burns.

#### CAUTION



**TAKE CARE NOT TO SPILL COOLANT ONTO HOT ENGINE OR EXHAUST SYSTEM COMPONENTS; THE FLUID MAY IGNITE AND BURN WITH AN INVISIBLE FLAME. WHEN CARRYING OUT MAINTENANCE, IT IS ADVISABLE TO WEAR LATEX GLOVES. EVEN THOUGH IT IS TOXIC, COOLANT HAS A SWEET FLAVOUR WHICH MAKES IT VERY ATTRACTIVE TO ANIMALS. NEVER LEAVE THE COOLANT IN OPEN CONTAINERS IN AREAS ACCESSIBLE TO ANIMALS AS THEY MAY DRINK IT.**

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

**DO NOT REMOVE THE RADIATOR CAP WHEN THE ENGINE IS STILL HOT. THE COOLANT IS PRESSURISED AND MAY CAUSE SCALDING.**

**Used engine oil and transmission oil**

**CAUTION**



**IT IS ADVISABLE TO WEAR PROTECTIVE IMPERMEABLE GLOVES WHEN SERVICING THE VEHICLE.**

**THE ENGINE OR GEARBOX OIL MAY CAUSE SERIOUS INJURIES TO THE SKIN IF HANDLED FOR PROLONGED PERIODS OF TIME AND ON A REGULAR BASIS.**

**WASH YOUR HANDS CAREFULLY AFTER HANDLING OIL.**

**HAND THE OIL OVER TO OR HAVE IT COLLECTED BY THE NEAREST USED OIL RECYCLING COMPANY OR THE SUPPLIER.**

**DO NOT DISPOSE OF OIL IN THE ENVIRONMENT**

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



**THE BRAKE FLUID MAY DAMAGE PAINTED, PVC OR RUBBER SURFACES. WHEN SERVICING THE BRAKING SYSTEM, PROTECT THESE COMPONENTS WITH A CLEAN CLOTH. ALWAYS WEAR PROTECTIVE GOGGLES WHEN SERVICING THE BRAKING SYSTEM. THE BRAKE FLUID IS EXTREMELY DANGEROUS TO THE EYES. IN THE EVENT OF ACCIDENTAL CONTACT WITH THE EYES, RINSE THEM IMMEDIATELY WITH PLENTY OF COLD, CLEAN WATER AND SEEK MEDICAL ADVICE.**

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

**Battery electrolyte and hydrogen gas**

**CAUTION**



**THE BATTERY ELECTROLYTE IS TOXIC, CORROSIVE AND AS IT CONTAINS SULPHURIC ACID, IT CAN CAUSE BURNS WHEN IN CONTACT WITH THE SKIN. WHEN HANDLING BATTERY ELECTROLYTE, WEAR TIGHT-FITTING GLOVES AND PROTECTIVE APPAREL. IN THE EVENT OF SKIN CONTACT WITH THE ELECTROLYTIC FLUID, RINSE WELL WITH PLENTY OF CLEAN WATER. IT IS PARTICULARLY IMPORTANT TO PROTECT YOUR EYES BECAUSE EVEN TINY AMOUNTS OF BATTERY ACID MAY CAUSE BLINDNESS. IF THE FLUID GETS IN CONTACT WITH YOUR EYES, WASH WITH ABUNDANT WATER FOR FIFTEEN MINUTES AND CONSULT AN EYE SPECIALIST IMMEDIATELY. THE BATTERY RELEASES EXPLOSIVE GASES; KEEP IT AWAY FROM FLAMES, SPARKS, CIGARETTES OR ANY OTHER HEAT SOURCES. ENSURE ADEQUATE VENTILATION WHEN SERVICING OR RECHARGING THE BATTERY.**

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

**BATTERY LIQUID IS CORROSIVE. DO NOT POUR OR SPILL ON PLASTIC COMPONENTS IN PARTICULAR. ENSURE THAT THE ELECTROLYTIC ACID IS COMPATIBLE WITH THE BATTERY BEING ACTIVATED.**

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## Maintenance rules

### GENERAL PRECAUTIONS AND INFORMATION

When repairing, dismantling and reassembling the vehicle, follow the recommendations given below carefully.

### BEFORE DISASSEMBLING COMPONENTS

- Before dismantling components, remove dirt, mud, dust and foreign bodies from the vehicle. Use the special tools designed for this bike, as required.

### COMPONENTS REMOVAL

- Do not loosen and/or tighten screws and nuts using pliers or any other tools than the specific wrench.
- Mark positions on all connection joints (pipes, cables etc.) before separating them, and identify them with distinctive symbols.
- Each component needs to be clearly marked to enable identification during reassembly.
- Clean and wash the dismantled components carefully using a low-flammability detergent.
- Keep mated parts together since they have "adjusted" to each other due to normal wear.
- Some components must be used together or replaced completely.
- Keep away from heat sources.

### REASSEMBLING COMPONENTS

#### CAUTION

**BEARINGS MUST ROTATE FREELY, WITHOUT JAMMING AND/OR NOISE, OTHERWISE, THEY NEED TO BE REPLACED.**

- Only use ORIGINAL Aprilia SPARE PARTS.
- Comply with lubricant and consumables use guidelines.
- Lubricate parts (whenever possible) before reassembling them.
- When tightening nuts and screws, start either from the components with the largest diameter or from the innermost components, proceeding diagonally. Tighten nuts and screws in successive steps before applying the tightening torque.
- Always replace self-locking nuts, washers, sealing rings, circlips, O-rings (OR), cotter pins and screws with new parts if the thread is damaged.
- When assembling the bearings, make sure to lubricate them well.
- Check that each component is assembled correctly.
- After a repair or routine maintenance, carry out pre-ride checks and test the vehicle on private grounds or in an area with low traffic.
- Clean all mating surfaces, oil seal rims and gaskets before refitting. Smear a thin layer of lithium-based grease on the oil seal rims. Reassemble oil seals and bearings with the brand or batch number facing outward (visible side).

### ELECTRICAL CONNECTORS

Electric connectors must be disconnected as described below; failure to comply with this procedure causes irreparable damage to both the connector and the wiring harness:

Press the relative safety clips, if applicable.

- Grip the two connectors and disconnect them by pulling them in opposite directions.



- If any signs of dirt, rust, moisture, etc. are noted, clean the inside of the connector carefully with a jet of compressed air.
- Ensure that the cables are correctly fastened to the internal connector terminals.
- Then connect the two connectors, ensuring that they couple correctly (if fitted with clips, you will hear them "click" into place).

**CAUTION**

**DO NOT DISCONNECT CONNECTORS BY PULLING THE CABLES.**

**NOTE**

**THE TWO CONNECTORS CAN ONLY BE CONNECTED IN ONE DIRECTION: CONNECT THEM THE RIGHT WAY ROUND.**

**TIGHTENING TORQUES****CAUTION**

**REMEMBER THAT THE TIGHTENING TORQUES FOR ALL FASTENING ELEMENTS ON WHEELS, BRAKES, WHEEL AXLES AND ANY OTHER SUSPENSION COMPONENTS PLAY A KEY ROLE IN ENSURING VEHICLE SAFETY AND MUST COMPLY WITH SPECIFIED VALUES. CHECK THE TIGHTENING TORQUES OF FASTENING ELEMENTS ON A REGULAR BASIS AND ALWAYS USE A TORQUE WRENCH TO REASSEMBLE THESE COMPONENTS. FAILURE TO COMPLY WITH THESE RECOMMENDATIONS MAY CAUSE ONE OF THESE COMPONENTS TO LOOSEN OR EVEN DETACH, CAUSING A WHEEL TO LOCK OR COMPROMISING VEHICLE HANDLING. THIS MAY LEAD TO FALLS, WITH THE RISK OF SERIOUS INJURY OR DEATH.**

## Running-in

Running the engine in correctly is essential for ensuring engine longevity and functionality. Twisty roads and gradients are ideal for running in the engine, brakes and suspension effectively. Vary your riding speed during the running in period. This ensures that components operate in "loaded" conditions and then "unloaded" conditions, allowing the engine components to cool.

**CAUTION**

**THE CLUTCH MAY EMIT A SLIGHT BURNING SMELL WHEN FIRST USED. THIS PHENOMENON SHOULD BE CONSIDERED NORMAL AND WILL DISAPPEAR AS SOON AS THE CLUTCH PLATES GET ADAPTED.**

**IT IS IMPORTANT TO STRAIN ENGINE COMPONENTS DURING RUN-IN, HOWEVER, MAKE SURE NOT TO OVERDO THIS.**

**CAUTION**

**THE FULL PERFORMANCE OF THE VEHICLE IS ONLY AVAILABLE AFTER THE SERVICE AT THE END OF THE RUNNING IN PERIOD.**

**Follow the guidelines detailed below:**

- Do not fully open the throttle grip abruptly at low engine speeds, either during or after the running in period.
- During the first 100 Km (62 miles) use the brakes gently, avoiding sudden or prolonged braking. That is to permit the adequate adjustment of the pad friction material to the brake discs.



**AFTER THE SPECIFIED MILEAGE, TAKE THE VEHICLE TO AN OFFICIAL Moto Guzzi DEALER FOR THE CHECKS INDICATED IN THE "AFTER RUN-IN" TABLE IN THE SCHEDULED MAINTENANCE.**

**NANCE SECTION TO AVOID INJURING YOURSELF, OTHERS AND /OR DAMAGING THE VEHICLE.**

## Dimensions and mass

### WEIGHT AND DIMENSIONS

Specification	Desc./Quantity
Maximum length	2445 mm (96.26 in)
Maximum width to handlebar	915 mm (36.02 in)
Maximum width of the vehicle with accessories	1030 mm (40.55 in)
Maximum height	1460 mm (57.48 in)
Saddle height	740 mm (29.13 in)
Minimum ground clearance	165 mm (6.50 in)
Wheelbase	1685 mm (66.34 in)
Kerb weight	337 kg (742.96 lb)
Kerb weight of full house vehicle	337 kg (742.96 lb)

## Engine

### ENGINE

Specification	Desc./Quantity
Type	traverse-mounted twin-cylinder four-stroke V 90°
No. of cylinders	2
Cylinder arrangement	V of 90°
Bore / stroke	104 x 81.2 mm (4.09 x 3.20 in)
Engine capacity	1379.6 cm <sup>3</sup> (84.19 cu.in)
Compression ratio	10.5: 1
Start-up	starter
Engine idle speed	1200 +/- 100 rpm
Clutch	hydraulically controlled single-plate dry clutch with incorporated flexible coupling
Lubrication system	Pressure-fed, controlled by valves and trochoidal pump
Air filter	cartridge-type dry filter
Cooling	air and oil cooled with independent trochoidal pump and oil pressure control valve
Timing system diagram	single overhead camshaft with roller tappets and rocker-operated valves

## Transmission

### TRANSMISSION

Specification	Desc./Quantity
Primary drive	Helical gear, ratio 26/35 = 1:1.346
Gear	Mechanical, 6 speeds with foot lever on the left hand side of the engine
Gear ratios, 1st gear	17/38 = 1:2.235
Gear ratios, 2nd gear	20/34 = 1:1.7
Gear ratios, 3rd gear	23/31 = 1:1.347
Gear ratios, 4th gear	26/29 = 1:1.115
Gear ratios, 5th gear	31/30 = 1:0.967
Gear ratios, 6th gear	30/24 = 1:0.800
Final drive	cardan shaft and bevel gear set
Ratio	10/36 = 1:3.600

## Capacities

### CAPACITIES

Specification	Desc./Quantity
Engine oil	Oil change and oil filter replacement: 4010 cm <sup>3</sup> (244.70 cu.in)
Gearbox oil	430 cm <sup>3</sup> (26.24 cu.in)
Transmission oil	250 cc (15.26 cu in)
Fuel (reserve included)	20.5 +/- 0.5 l (4.51 +/- 0.11 UK gal) (5.41 +/- 0.13 gal US)
Fuel reserve	5 l (1.10 UK gal) (1.32 gal US)
Seats	2
Maximum weight limit	547 kg (1205.93 lb)

## Electrical system

### ELECTRICAL SYSTEM

Specification	Desc./Quantity
Spark plug	NGK LMAR8F
Electrode gap	0.6 - 0.7 mm (0.024 - 0.028 in)
Battery	12 V - 18 Ampere/hour
Alternator (permanent magnet type)	12 V - 550 W
Main fuses	40- 30- 10A
Auxiliary fuses	15 (4) - 7.5 (2) A
Front daylight running light	8 low intensity LEDs
(Halogen) low beam light	12V - 55W / H3
(Halogen) high beam light	12V - 55W / H7
Front turn indicators	12VRY10W
Rear turn indicators	9+9 low intensity LEDs
Tail lights /stop lights	6+6 low intensity LEDs
Supplementary headlamps (if fitted)	12V - 35W H8
Dashboard lighting	LED
License plate light	12V - 5 W
Cruise control warning light	LED
ABS warning light	LED
MGCT warning light	LED
Turn indicator warning light	LED
Low fuel warning light	LED
High beam warning light	LED
Neutral gear warning light	LED
General warning light	LED

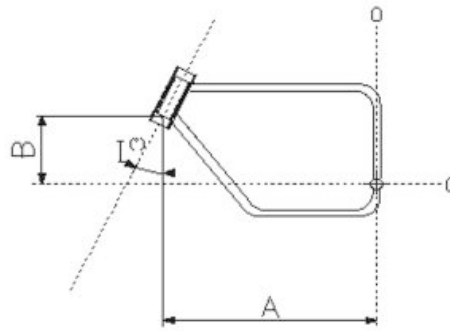
## Frame and suspensions

### CHASSIS

Specification	Desc./Quantity
Type	Tubular made of steel, closed double cradle, with elastokinematic engine mounting system for vibration isolation.
Trail	155 mm (6.10 in)
Headstock angle	32°
Front	46 mm (1.81 in) diameter hydraulic telescopic fork with radial brake calliper mounting bracket.
Front wheel travel	120 mm (4.72 in)
Rear	Swingarm with dual shock absorbers adjustable in the preload spring
Rear wheel travel	110 mm (4.33 in)

### SIZES A AND B

Specification	Desc./Quantity
Size A	760.0 mm (29.92 in)
Size B	332.0 mm (13.07 in)



## Brakes

### BRAKES

Specification	Desc./Quantity
Front	Ø 320-mm (12.6 in) stainless steel double floating disc, radial callipers with 4 opposed pistons.
Rear	Ø 282-mm (11.1 in) stainless steel disc, floating calliper with 2 different pins.

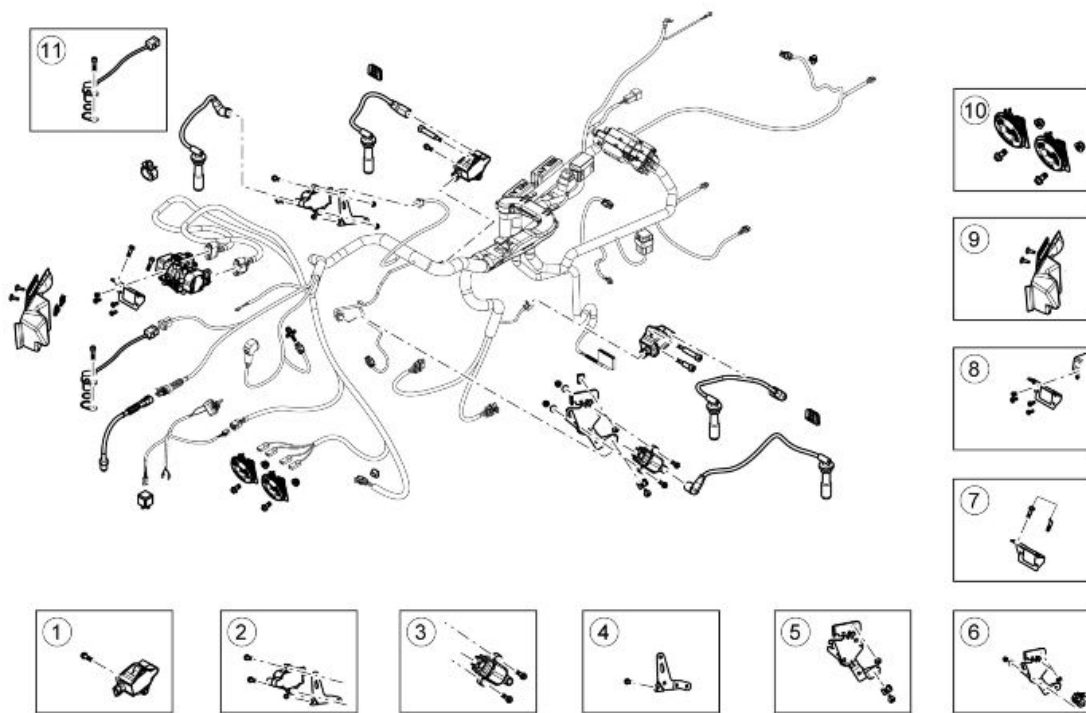
## Wheels and tyres

### WHEELS AND TYRES

Specification	Desc./Quantity
Type	Alloy wheels for tubeless tyres
Front wheel rim	3.50" x 18"
Rear wheel rim	6.00" x 16"
Tyres	Dunlop D 251
Front	130/70 R18 (63H)
Inflation pressure (front)	2.5 bar (250 kPa) (36.3 PSI)
Inflation pressure with passenger (front)	2.5 bar (250 kPa) (36.3 PSI)
Rear	200/60 R16 (79H)
Inflation pressure (rear)	2.7 bar (270 kPa) (39.2 PSI)
Inflation pressure with passenger (rear)	2.7 bar (270 kPa) (39.2 PSI)

## Tightening Torques

### ELECTRICAL SYSTEM



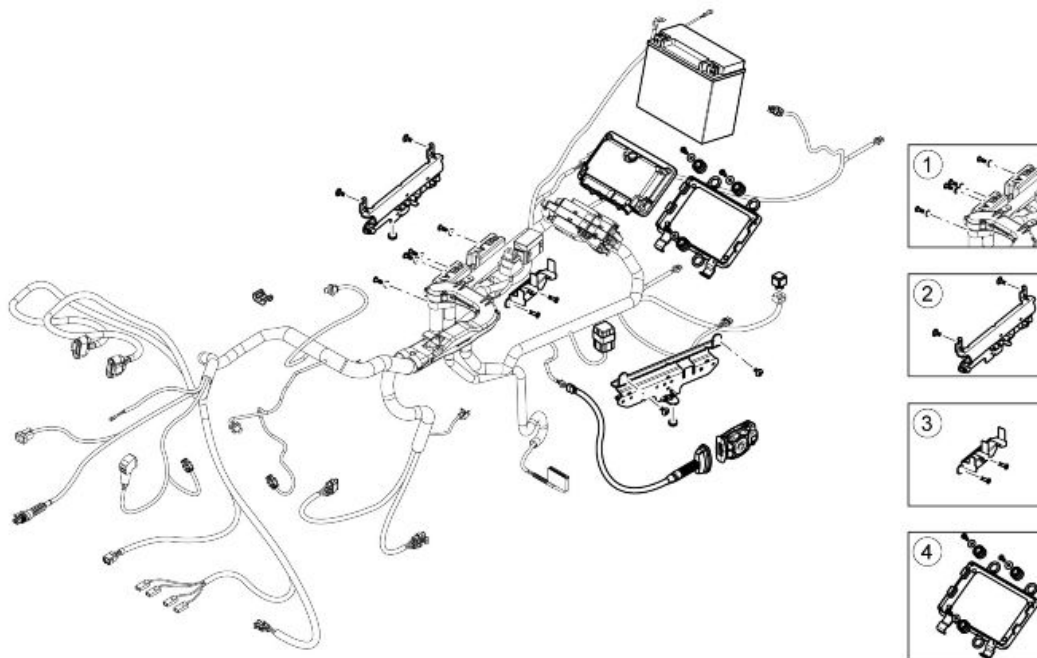
**FRONT PART ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Coil fixing screws	M6x25	2	10 Nm (7.37 lb ft)	-
2	Coil fixing screws	M6x30	2	10 Nm (7.37 lb ft)	-
3	Coil fixing screws	M6x16	2	10 Nm (7.37 lb ft)	-
4	Coil bracket fixing screws	M6x30	2	10 Nm (7.37 lb ft)	-
5	Coil bracket fixing screws	M5x12	2	6 Nm (4.42 lb ft)	-
6	Coil self-locking fixing nut	M6	2	10 Nm (7.37 lb ft)	-
7	Bracket plate fixing screws	M6x25	2	10 Nm (7.37 lb ft)	-
8	Bracket plate self threading fixing screws	M5x14	4	2.5 Nm (1.84 lb ft)	-
9	Box fixing screws	M5x12	2	6 Nm (4.42 lb ft)	-
10	Horn fixing screws	M6x16 stainless steel	2	10 Nm (7.37 lb ft)	-
11	Tone wheel sensor fixing screw	M6x16	1	10 Nm (7.37 lb ft)	-



**CENTRAL PART ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Duct cover self-threading fixing screws	3.9x14	6	3 Nm (2.21 lb ft)	-
2	Duct cover self-threading fixing screws	3.9x14	2	3 Nm (2.21 lb ft)	-



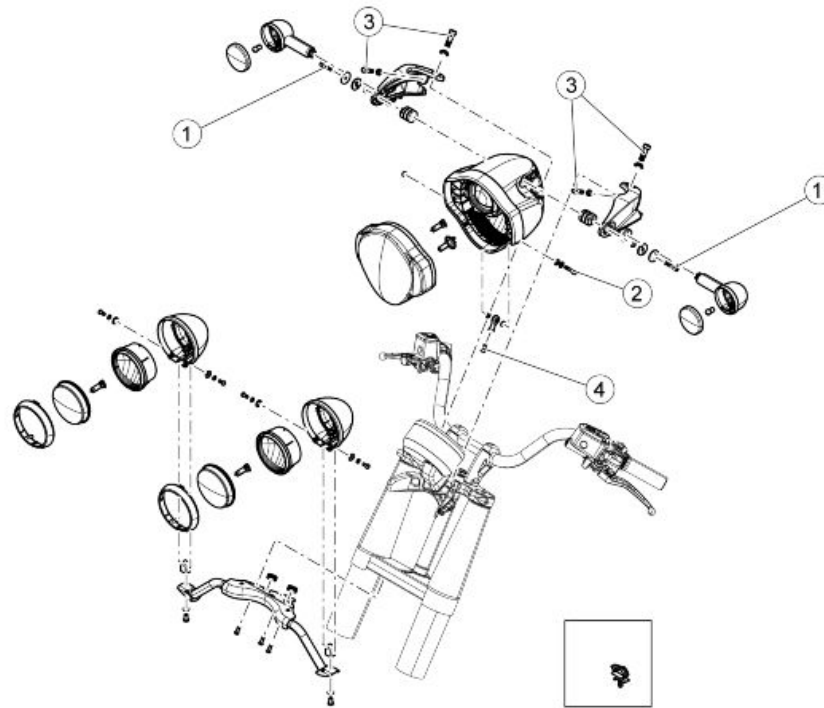
**REAR PART ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Relay bracket fixing screws	M5x12	4	6 Nm (4.42 lb ft)	-
2	Bracket self-threading fixing screws	M5x14	4	2.5 Nm (1.84 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
3	Fuse box bracket fixing screws	M5x20	2	3 Nm (2.21 lb ft)	-
4	ECU bracket self-threading fixing screws	M5x14	3	2.5 Nm (1.84 lb ft)	-

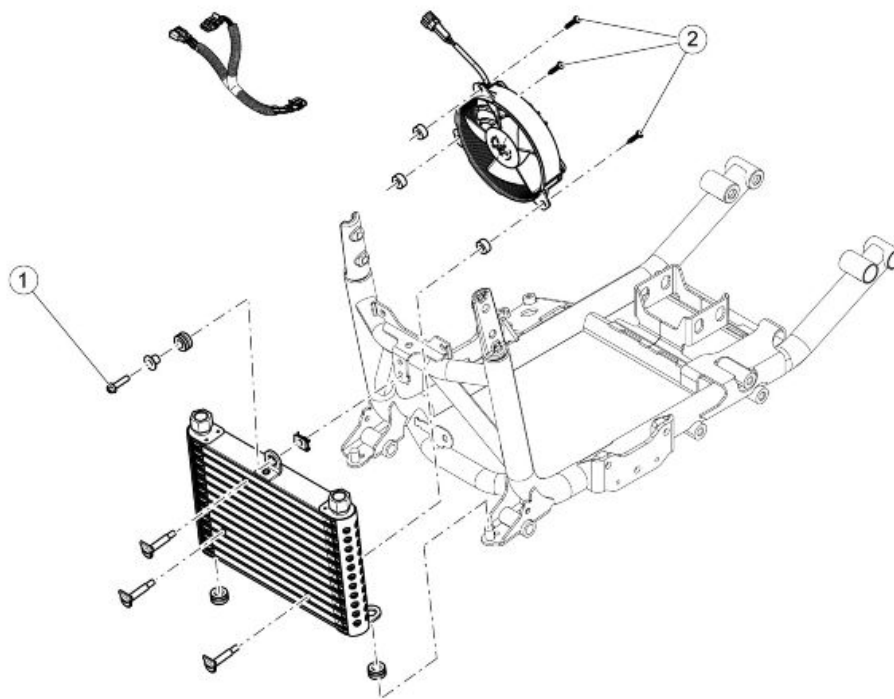
**Chassis**

**Front side**



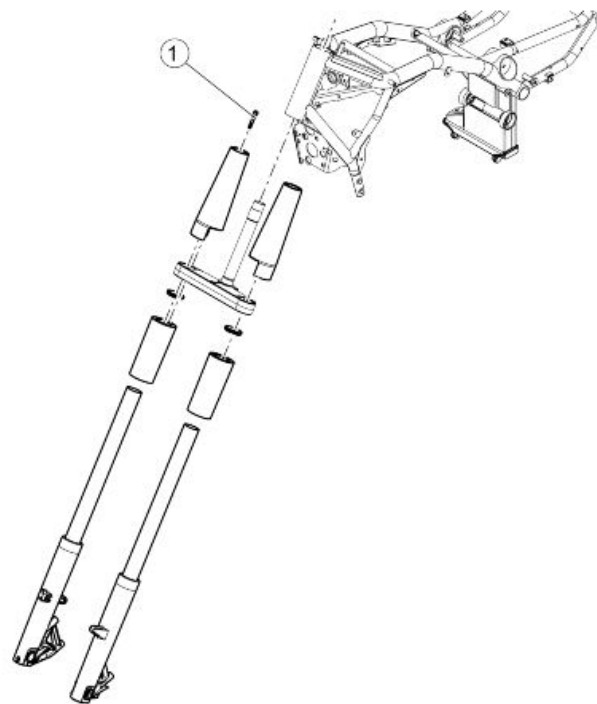
**HEADLAMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fixing headlamp to supports	M6x55	1	5 Nm (3.69 lb ft)	-
2	Screw fixing headlamp to joint	M6x30	1	10 Nm (7.37 lb ft)	-
3	Fixing screws sup. plate headlights sup. steering	M6x20	4	10 Nm (7.37 lb ft)	-
4	Steering lower plate joint head fixing screw	M6x35	1	10 Nm (7.37 lb ft)	-



**OIL RADIATOR**

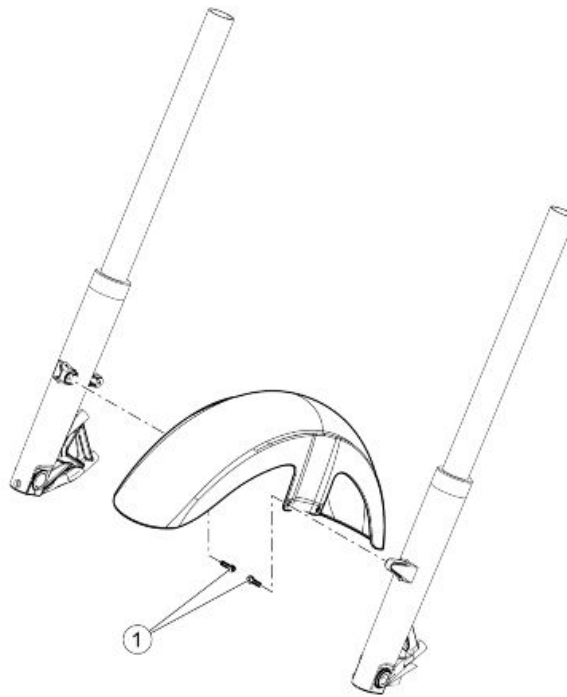
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing oil radiator to chassis	M6x25	3	10 Nm (7.37 lb ft)	-
2	Screws fixing electric fan to oil radiator	4,2x20	3	2.5 Nm (1.84 lb ft)	-



**FORK**

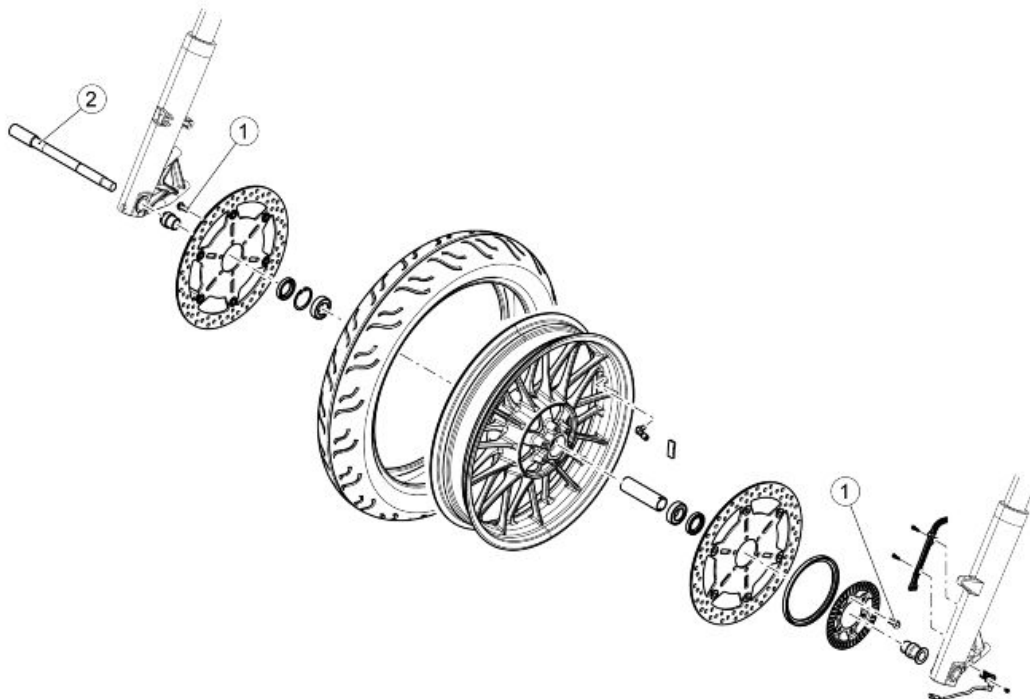
pos.	Description	Type	Quantity	Torque	Notes
1	Lower suspension bars fixing screws	M5x50	4	6 Nm (4.42 lb ft)	-





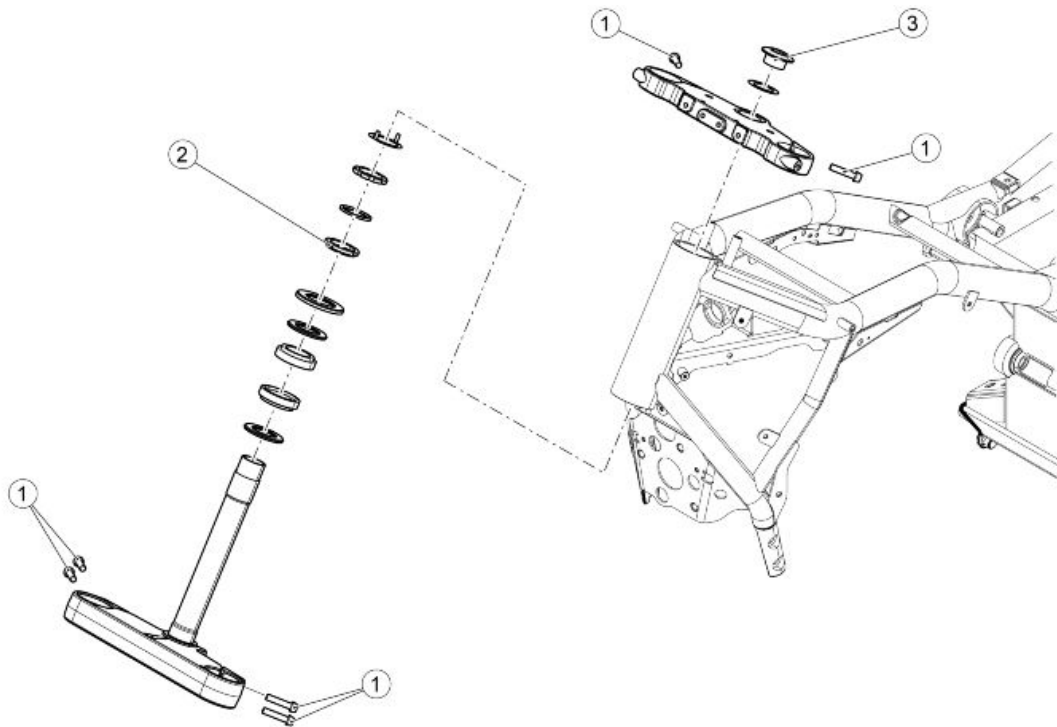
**FRONT MUDGUARD**

pos.	Description	Type	Quantity	Torque	Notes
1	Front mudguard fixing screws	M5x12	4	4 Nm (2.95 lb ft)	-



**FRONT WHEEL**

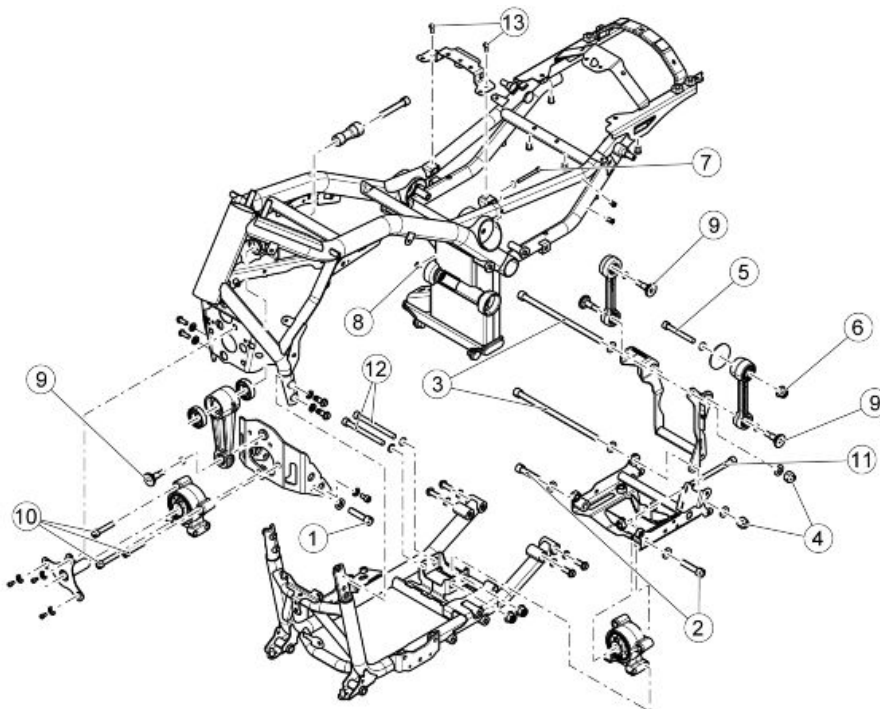
pos.	Description	Type	Quantity	Torque	Notes
1	Brake discs fixing screws	M8x22	12	25 Nm (18.44 lb ft)	-
2	Wheel axle	-	1	80 Nm (59.00 lb ft)	-



**STEERING**

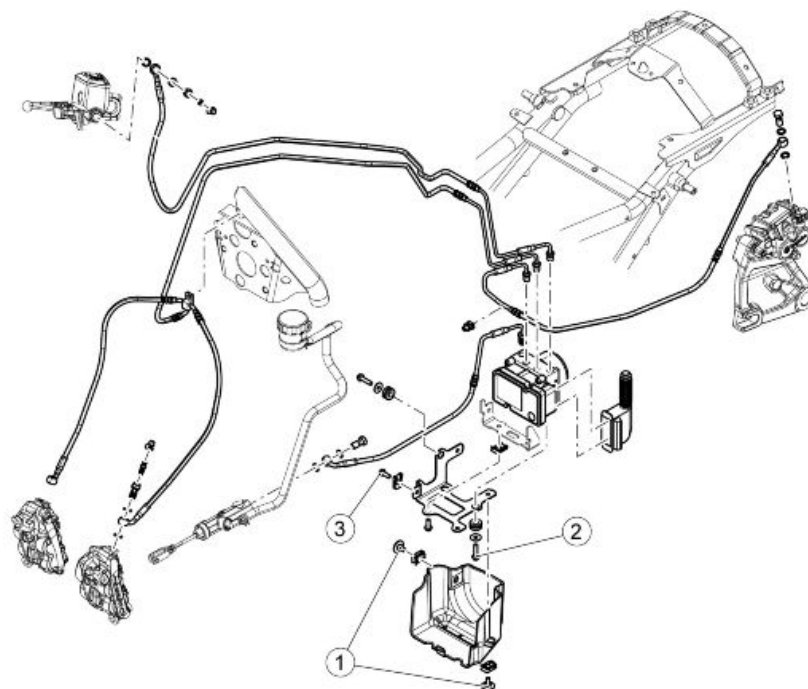
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing forks to plate	M8x35	6	25 Nm (18.44 lb ft)	-
2	Lower ring nut	-	1	50 Nm (36.87 lb ft)	Pretightening to 60 Nm (44.25 lb ft)
3	Upper cover	-	1	100 Nm (73.76 lb ft)	-

**Central part**



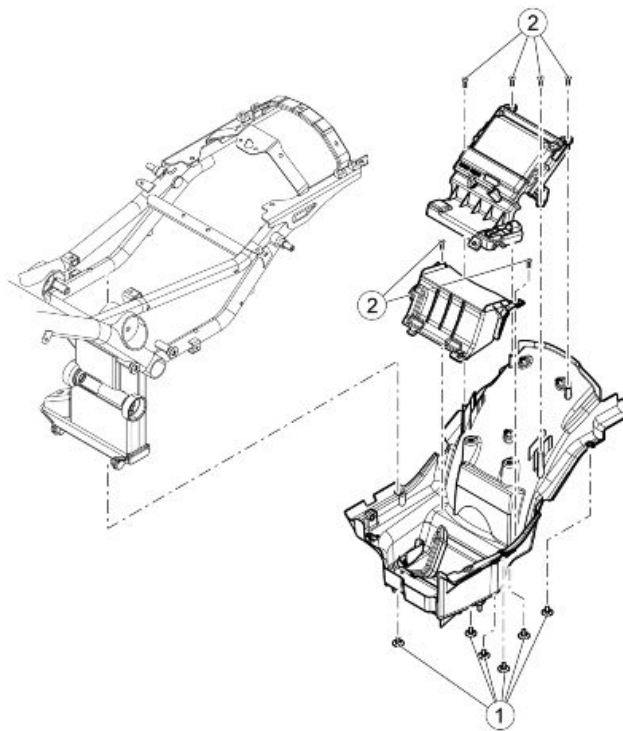
**FRAME**

pos.	Description	Type	Quantity	Torque	Notes
1	Front support fixing screw	M12x50	2	80 Nm (59.00 lb ft)	-
2	Rear support fixing screw	M12x50	2	50 Nm (36.88 lb ft)	-
3	Engine pin	-	2	50 Nm (36.88 lb ft)	-
4	Engine pin retainer nut	M12	2	80 Nm (59.00 lb ft)	-
5	Connecting rod fixing screw	M10x80	1	50 Nm (36.88 lb ft)	-
6	Connecting rod screw retainer nut	M10	1	50 Nm (36.88 lb ft)	-
7	Rear fixing screw	M6x60	1	5 Nm (3.68 lb ft)	-
8	Retainer nut	M6	1	10 Nm (7.37 lb ft)	-
9	Connecting rod fixing screws	-	3	50 Nm (36.88 lb ft)	-
10	Front silent block fixing screws	M10x50	3	50 Nm (36.88 lb ft)	-
11	Rear silent block fixing screw	M10x90	1	50 Nm (36.88 lb ft)	-
12	Screws fixing silent block to frame	M10x110	2	50 Nm (36.88 lb ft)	-
13	Upper frame fixing screw	M6x16	2	10 Nm (7.37 lb ft)	-



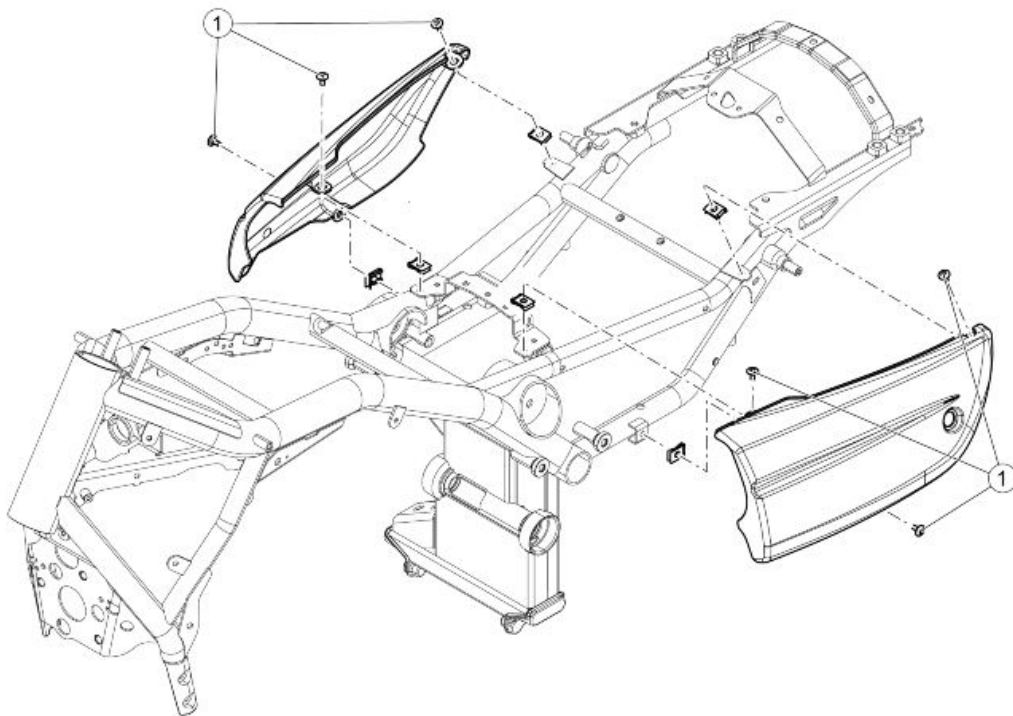
**ABS BRAKING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	ABS control unit lower cover fixing screws	-	2	6 Nm (4.42 lb ft)	-
2	ABS control unit support plate fixing screws	M6x25	3	10 Nm (7.37 lb ft)	-
3	ABS control unit support plate fixing screws	M6x16	3	10 Nm (7.37 lb ft)	-



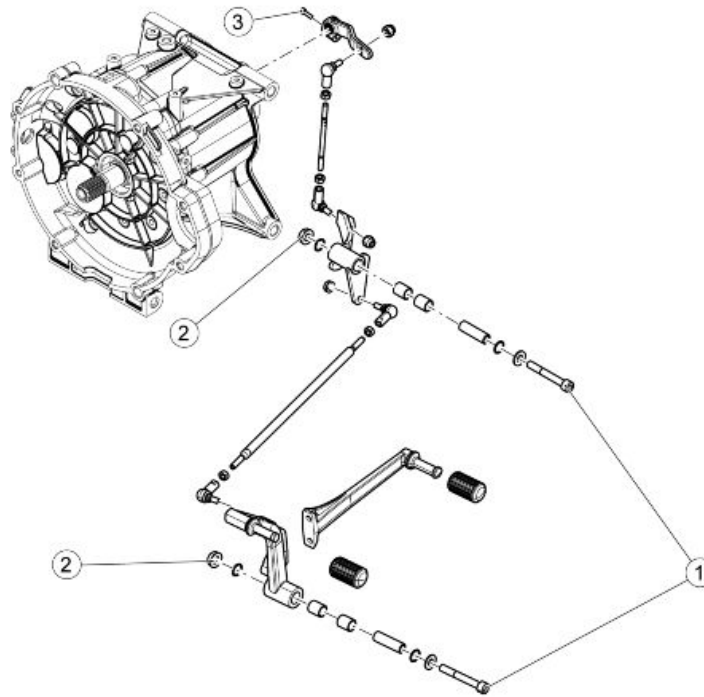
**UNDER SADDLE**

pos.	Description	Type	Quantity	Torque	Notes
1	Lower saddle compartment closing fixing screws	-	8	6 Nm (4.42 lb ft)	-
2	Fixing screw closing upper and lower saddle compartment	M5x20 stainless steel	6	3 Nm (2.21 lb ft)	-



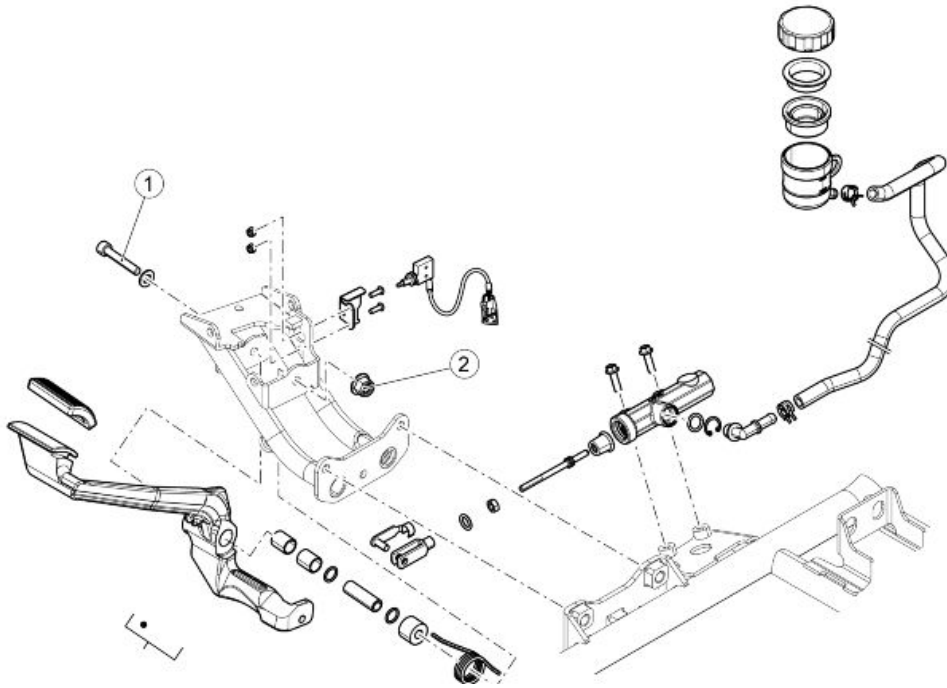
**CENTRAL BODYWORK**

pos.	Description	Type	Quantity	Torque	Notes
1	Side fairing fixing screws	M5x9	6	6 Nm (4.42 lb ft)	-



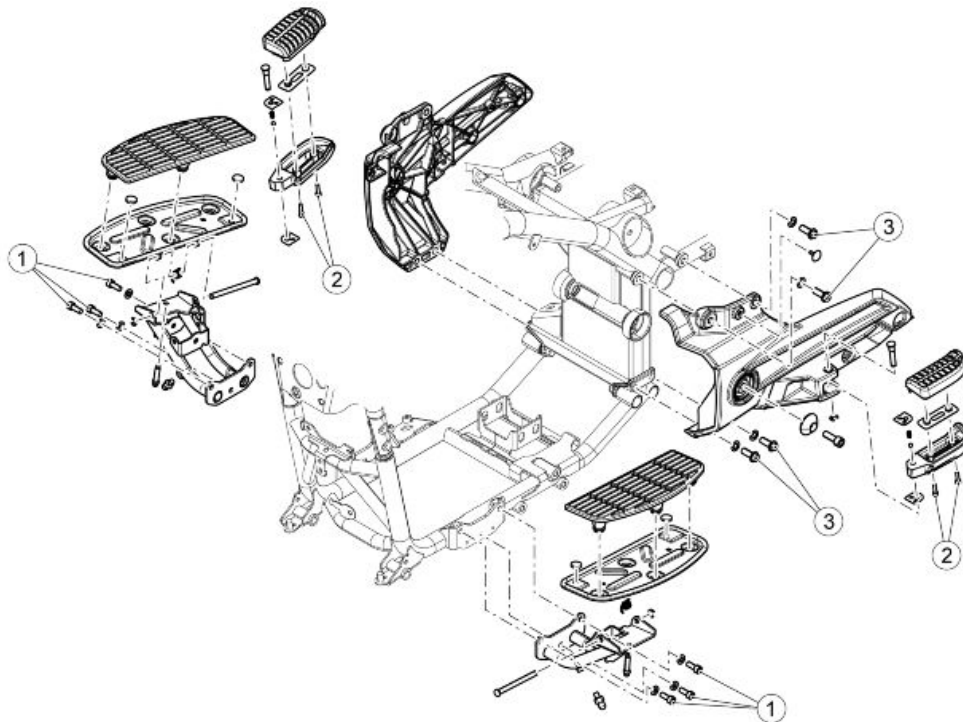
**GEAR LEVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screw	M8x60	2	25 Nm (18.44 lb ft)	-
2	Retainer nut	M8	2	25 Nm (18.44 lb ft)	-
3	Gearbox connecting rod fixing screw	M6x20	1	10 Nm (7.37 lb ft)	-



**REAR BRAKE PUMP**

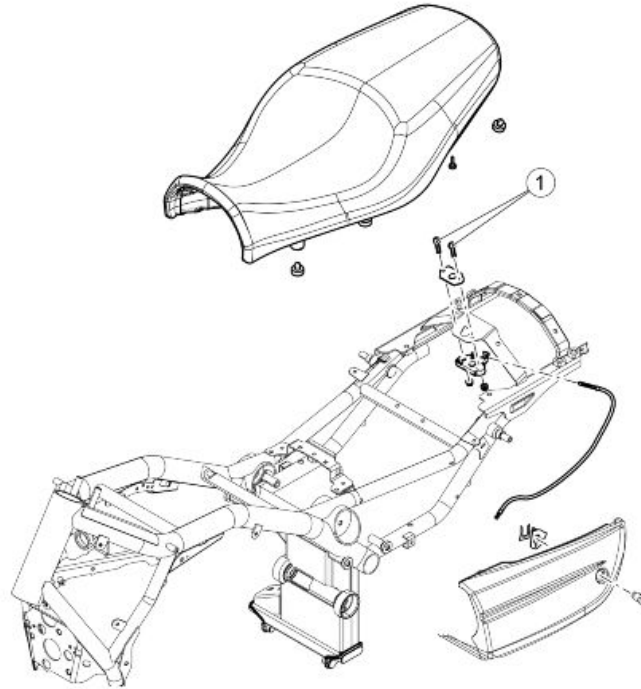
pos.	Description	Type	Quantity	Torque	Notes
1	Brake lever fixing screw	M8x75	1	25 Nm (18.43 lb ft)	-
2	Brake lever screw retainer nut	M8	1	25 Nm (18.43 lb ft)	-



**FOOTREST UNIT**

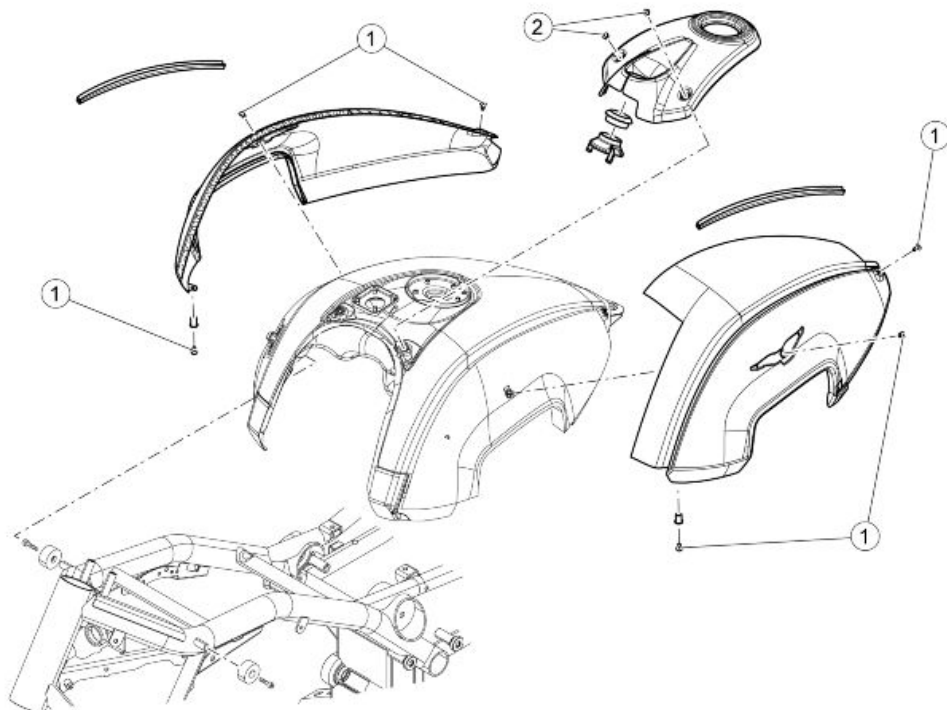
pos.	Description	Type	Quantity	Torque	Notes
1	Footrest to frame fixing screw	M8x20	6	25 Nm (18.43 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	Passenger footrest to rubber ring fixing screws	M5x20	4	6 Nm (4.42 lb ft)	-
3	Passenger footrest support fixing screw	M10x1.25	8	50 Nm (36.87 lb ft)	-



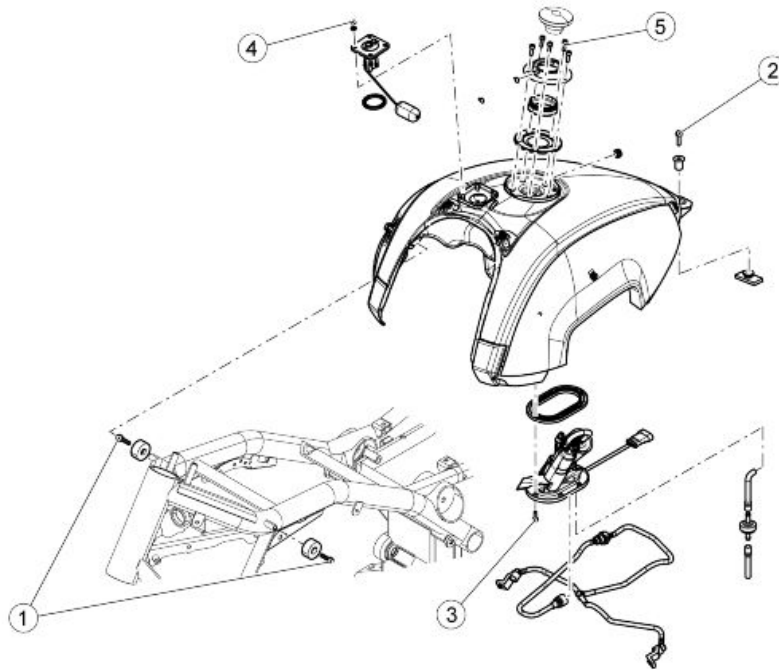
**SADDLE**

pos.	Description	Type	Quantity	Torque	Notes
1	Lock fixing screws	M6x25	2	10 Nm (7.37 lb ft)	-



**TANK COVER**

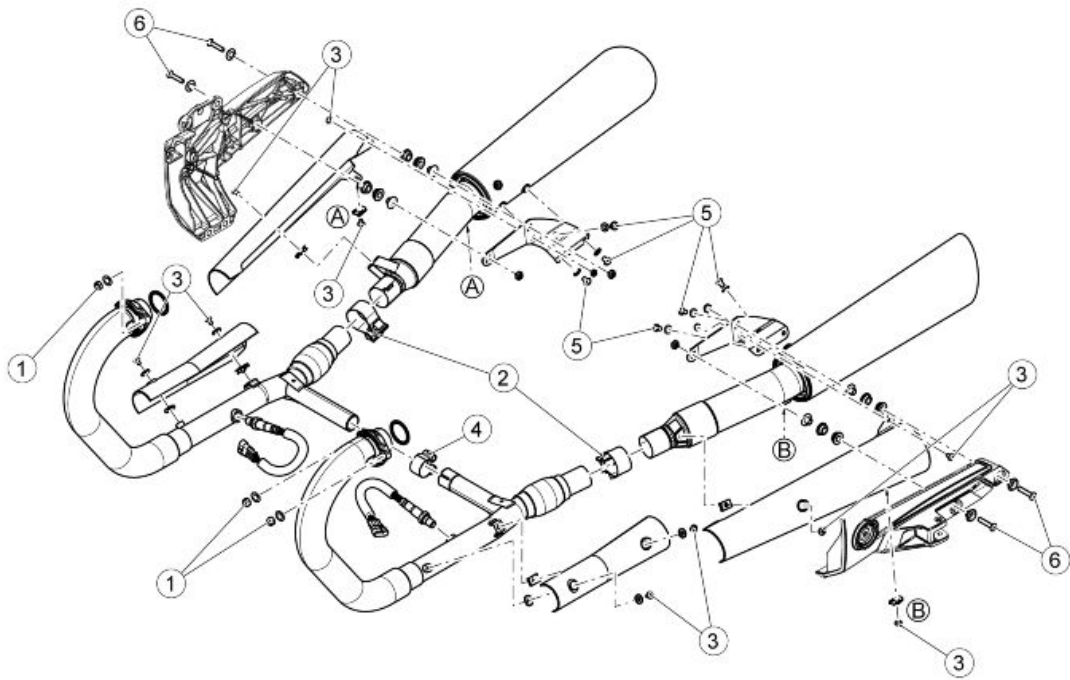
pos.	Description	Type	Quantity	Torque	Notes
1	Fairing fixing screws	M5x10	6	6 Nm (4.42 lb ft)	-
2	Dashboard fixing screw	M5x16	2	5 Nm (3.68 lb ft)	-



**FUEL TANK**

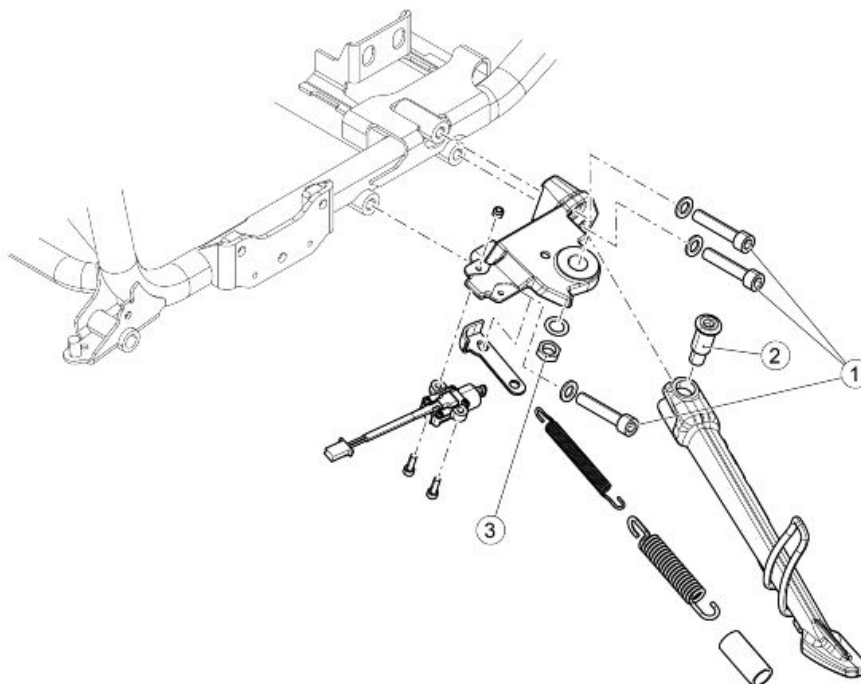
pos.	Description	Type	Quantity	Torque	Notes
1	Front fixing screw	M8x16	2	25 Nm (18.44 lb ft)	-
2	Rear fixing screw	M6x25	1	10 Nm (7.37 lb ft)	-
3	Fuel pump fixing screw	M5x20	6	6 Nm (4.42 lb ft)	-
4	Fuel level sensor fixing nuts	M5	4	5 Nm (3.69 lb ft)	-
5	Screw fastening cap flange to tank	M5x16	5	6 Nm (4.42 lb ft)	-





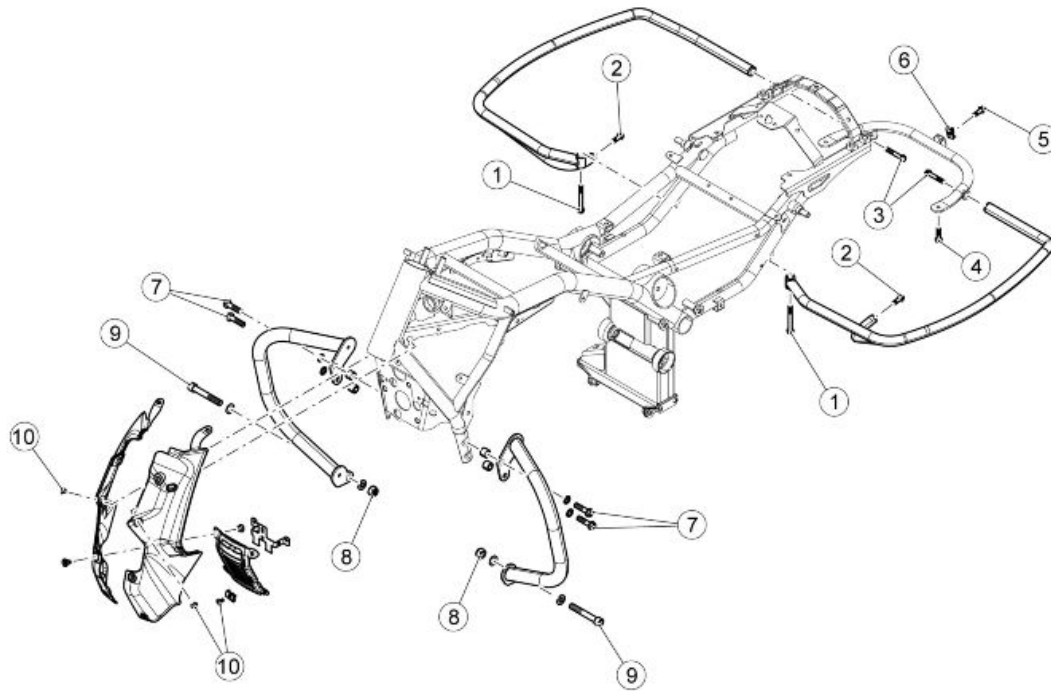
**EXHAUST**

pos.	Description	Type	Quantity	Torque	Notes
1	Exhaust - cylinder retainer nut	M8	4	25 Nm (18.44 lb ft)	-
2	Side clamps	-	2	50 Nm (36.88 lb ft)	-
3	Heat shield fixing screws	M6x10	10	10 Nm (7.37 lb ft)	-
4	Central manifold clamp	-	1	20 Nm (14.75 lb ft)	-
5	Screws fixing terminal support to terminal	M8x12	6	25 Nm (18.44 lb ft)	-
6	Terminal fixing screws	-	4	25 Nm (18.44 lb ft)	-



**STAND**

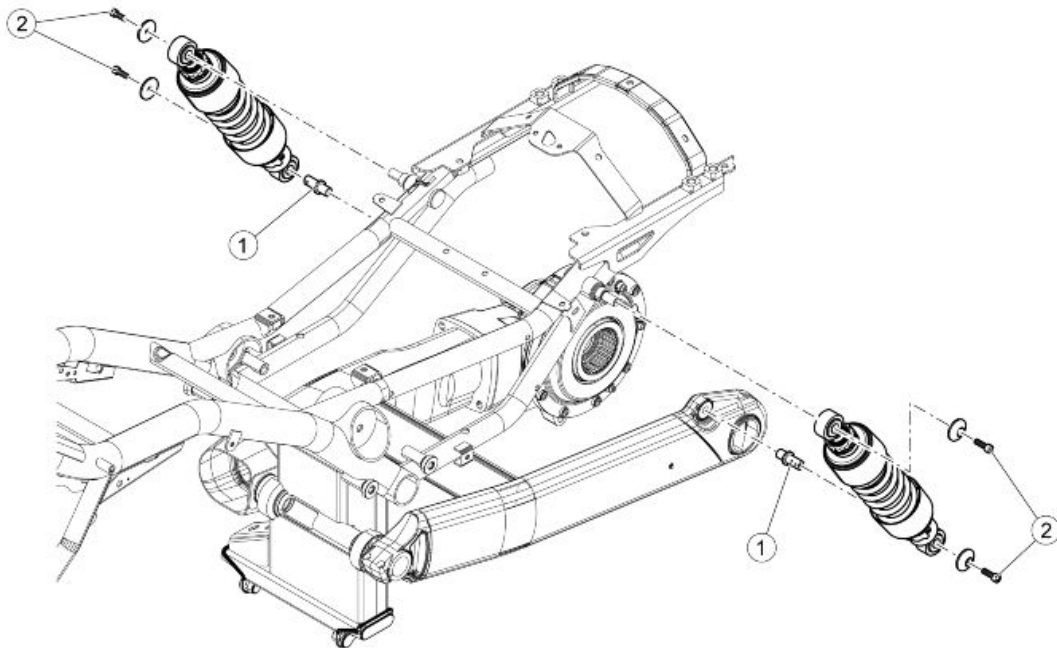
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing stand plate to chassis	M10x50	3	50 Nm (36.88 lb ft)	-
2	Stand bolt	-	1	25 Nm (51.61 lb ft)	-
3	Stand pin bolt	M12x1.25	1	70 Nm (51.61 lb ft)	-



**GUARDS KIT**

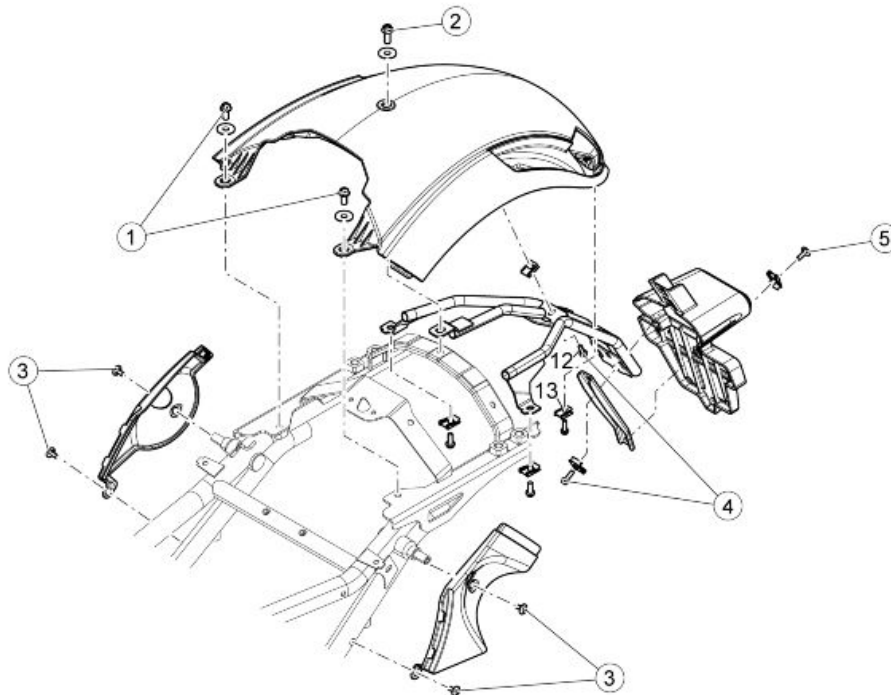
pos.	Description	Type	Quantity	Torque	Notes
1	Bumpers front fixing screw	M8x70	2	24 Nm (17.4 lb ft)	-
2	Bumpers central fixing screw	M8x25	2	24 Nm (17.4 lb ft)	-
3	Bumpers rear fixing screw	M8x50	2	24 Nm (17.4 lb ft)	-
4	Lower screw	M8x20	2	24 Nm (17.4 lb ft)	Small parts of the motorcycle
5	License plate fixing screw	M8x20	1	4 Nm (2.9 lb ft)	Small parts of the motorcycle
6	Fixing clip	M5	1	-	Small parts of the motorcycle
7	Engine guard upper fixing screws	M10	2	50 Nm (36.2 lb ft)	-
8	Engine guard lower fixing nuts	M12	2	50 Nm (36.2 lb ft)	-
9	Engine guard lower fixing screws	M12	2	50 Nm (36.2 lb ft)	-
10	Cover and grilles fixing screws	M5x9	7	6 Nm (4.42 lb ft)	-

Back side



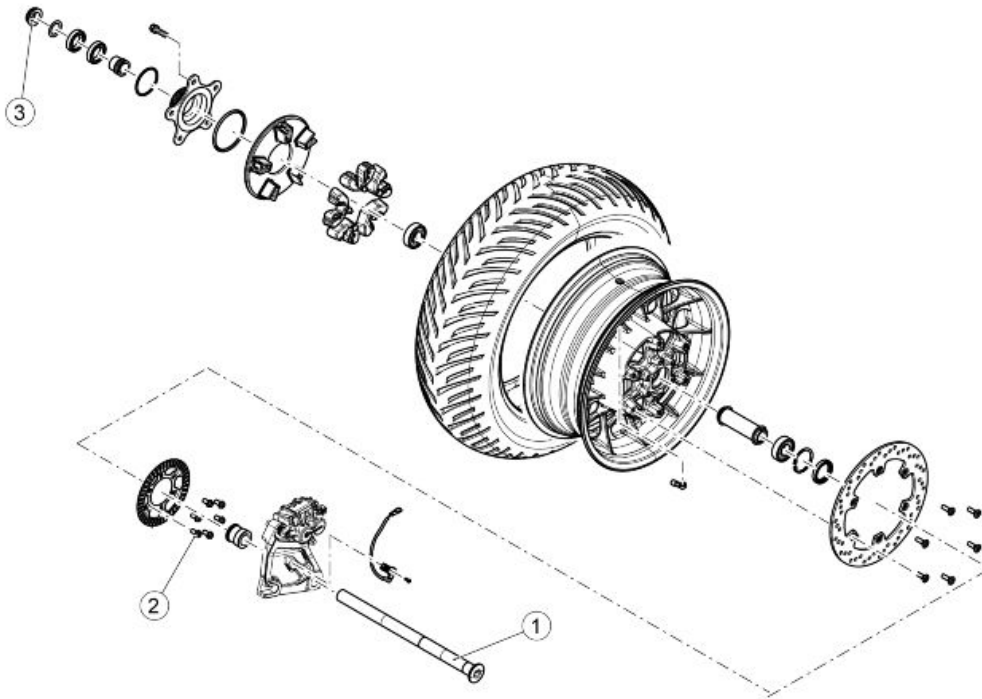
**REAR SHOCK ABSORBERS**

pos.	Description	Type	Quantity	Torque	Notes
1	Pins	-	2	40 Nm (29.50 lb ft)	-
2	Shock absorber fixing screws	M6x14	4	10 Nm (7.37 lb ft)	-



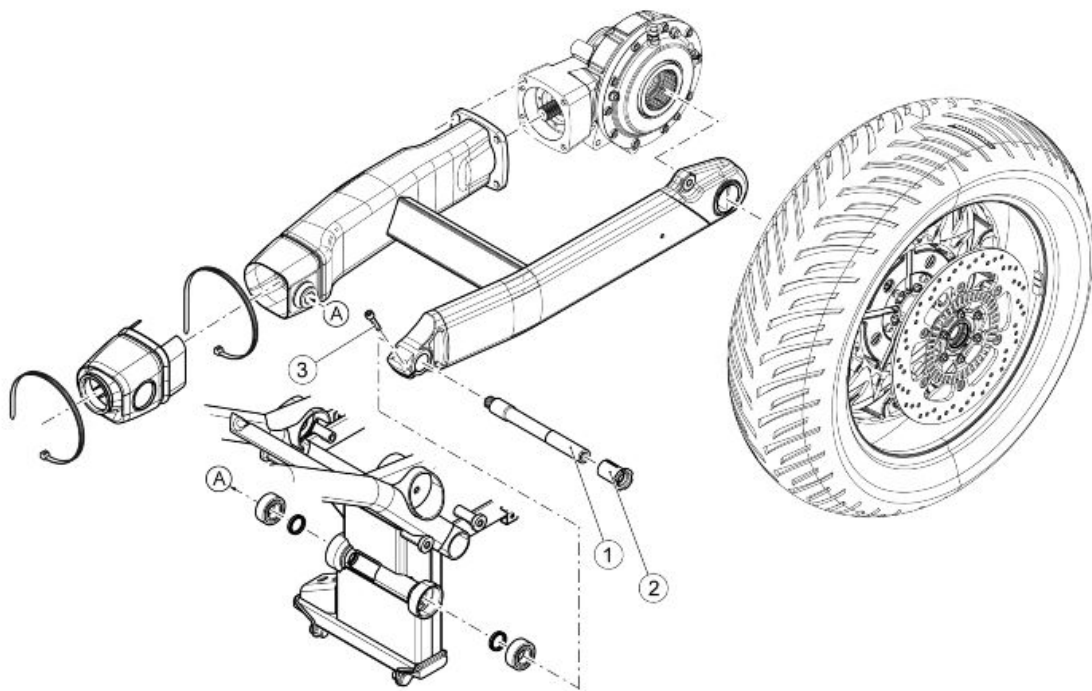
**REAR MUDGUARD**

pos.	Description	Type	Quantity	Torque	Notes
1	Front fixing screws	M8x20	2	25 Nm (18.44 lb ft)	-
2	Upper fixing screw	M8x16	1	25 Nm (18.44 lb ft)	-
3	Side cover fixing screws	M5x9	4	6 Nm (4.42 lb ft)	-



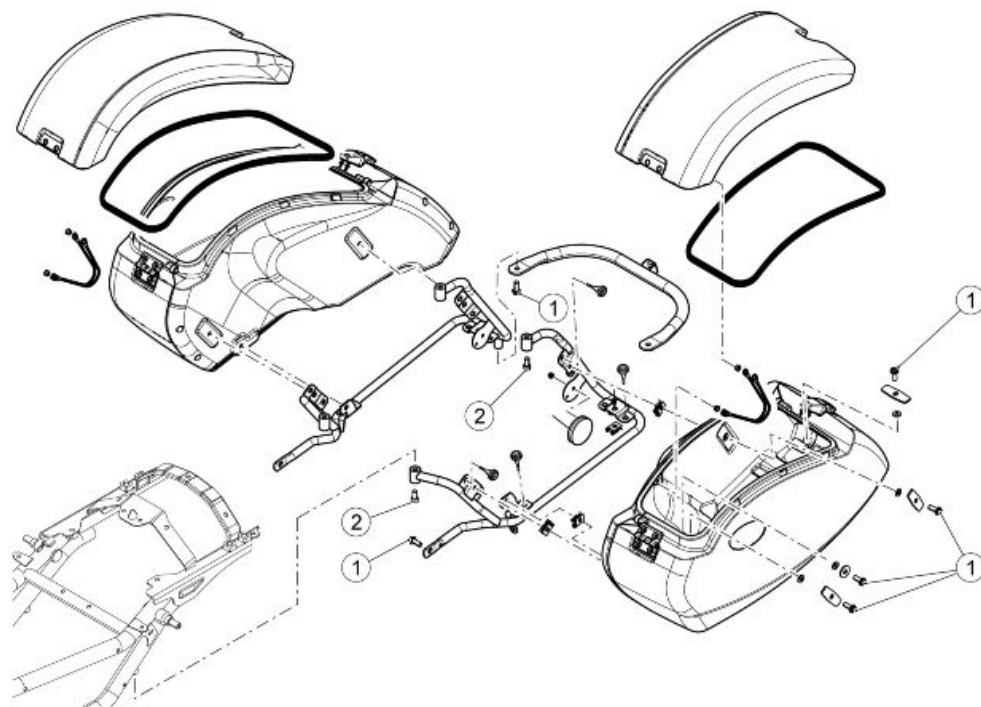
**REAR WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear wheel pin	-	1	100 Nm (73.76 lb ft)	-
2	Tone wheel flange screws	M8x20	6	25 Nm (18.44 lb ft)	-
3	Wheel axle nut	M25x1.5	1	100 Nm (73.76 lb ft)	-



**SWINGARM**

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm pin	-	1	60 Nm (44.25 lb ft)	-
2	Preloading bushing	-	1	10 Nm (7.37 lb ft)	-
3	Clamp screws	M6x25	2	10 Nm (7.37 lb ft)	-

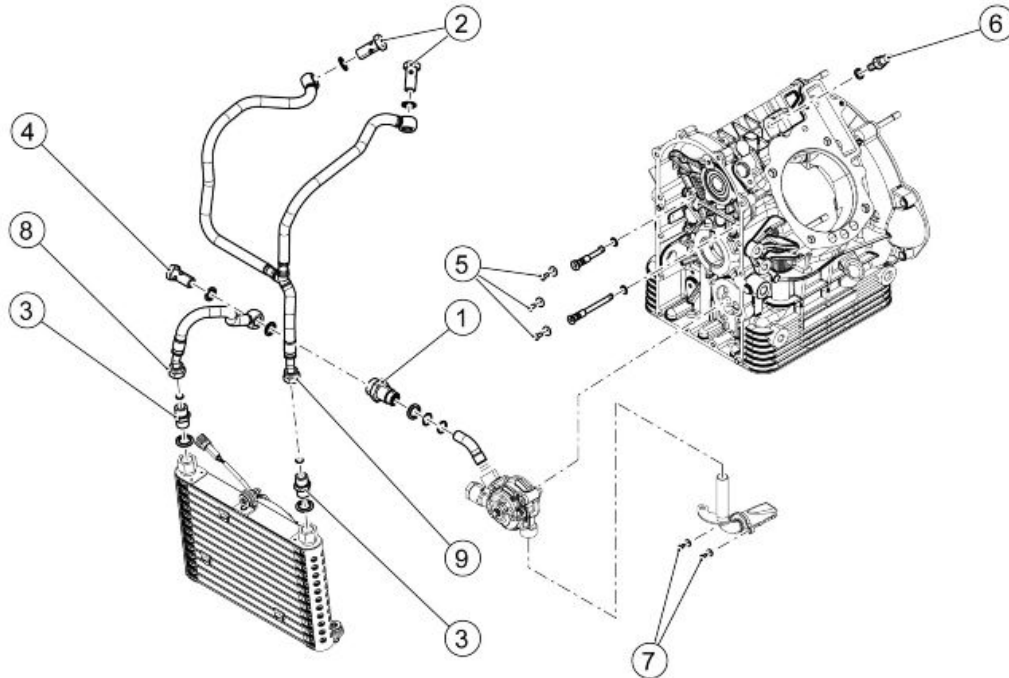


**PANNIERS KIT**

pos.	Description	Type	Quantity	Torque	Notes
1	Panniers supports fixing screws	M8x20	10	24 Nm (17.4 lb ft)	-

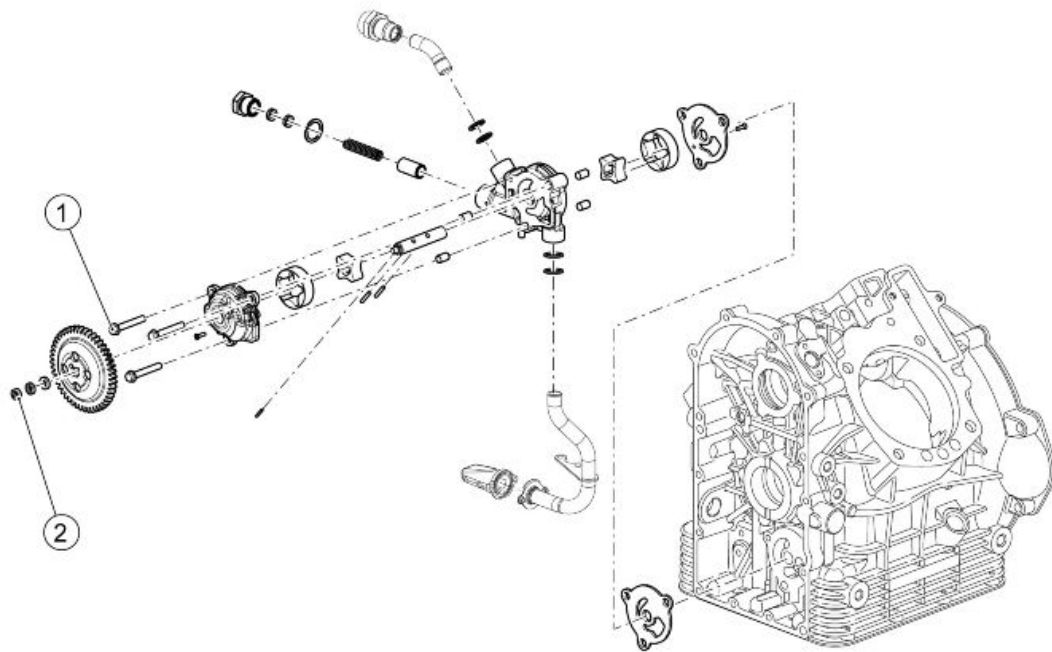
pos.	Description	Type	Quantity	Torque	Notes
2	Panniers supports fixing screws	M8x16	4	24 Nm (17.4 lb ft)	-

## Engine



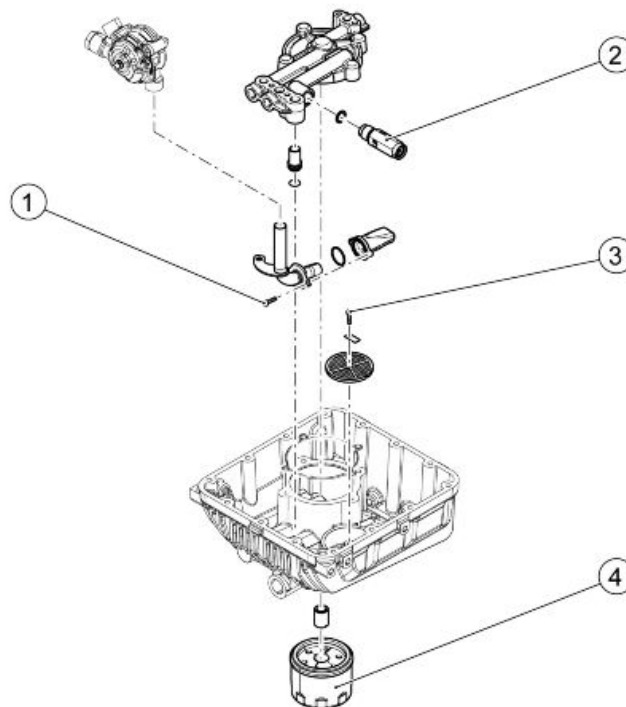
### LUBRICATION SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Pump outlet oil pipe nipple	M14x1.5	1	40 Nm (29.50 lb ft)	-
2	Slot screw for oil pipe on the cylinder head	M14x1.5	2	20 Nm (14.75 lb ft)	-
3	Nipple on the radiator and the oil pipe	M16x1.5	2	20 Nm (14.75 lb ft)	Apply Vaseline oil
4	Oil delivery pipe to radiator slot screw	M14x1.5	1	35 Nm (25.81 lb ft)	-
5	Oil jets fixing screw	-	3	By hand	Loctite 243
6	Minimum oil pressure sensor	M10	1	15 Nm (11.06 lb ft)	-
7	Intake oil filter fixing screw	M4x10	2	3 Nm (2.21 lb ft)	Loctite 243
8	Oil delivery pipe to radiator	-	1	20 Nm (14.75 lb ft)	-
9	Oil delivery pipe to heads	-	1	20 Nm (14.75 lb ft)	-



**OIL PUMP**

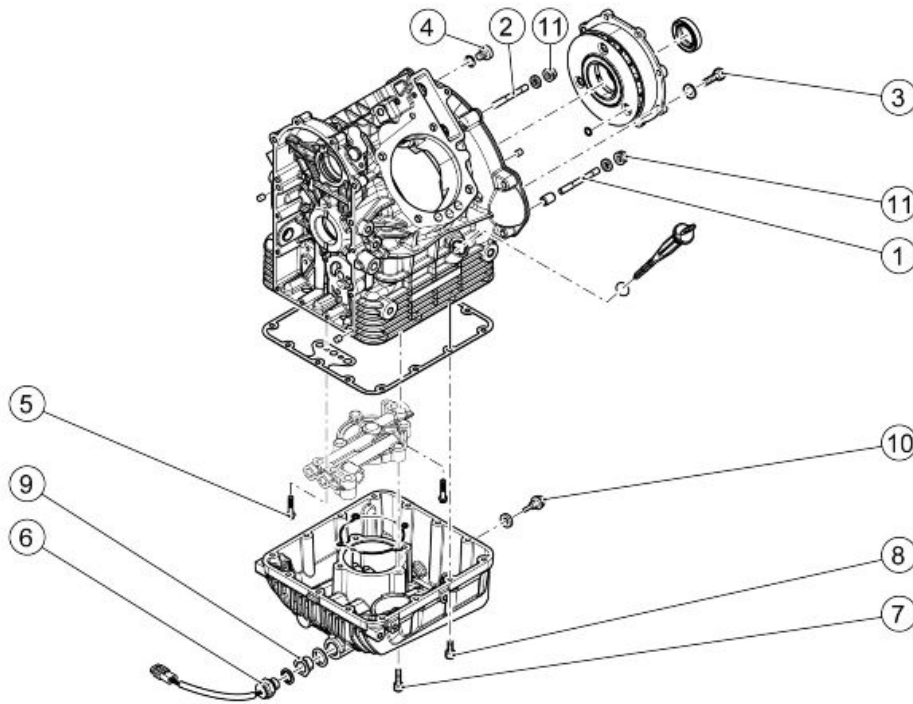
pos.	Description	Type	Quantity	Torque	Notes
1	Oil pump fixing screws	M6x45	3	9 11 Nm (6.64 8.11 lb ft)	Loctite 243
2	Low nut for oil pump	M6x0.75	1	8 Nm (5.90 lb ft)	Loctite 243



**OIL SUMP COMPONENTS**

pos.	Description	Type	Quantity	Torque	Notes
1	Cooling oil intake filter fixing screw	M4x10	2	By hand	-
2	Complete oil pressure control valve	-	1	20 Nm (14.75 lb ft)	Loctite 243

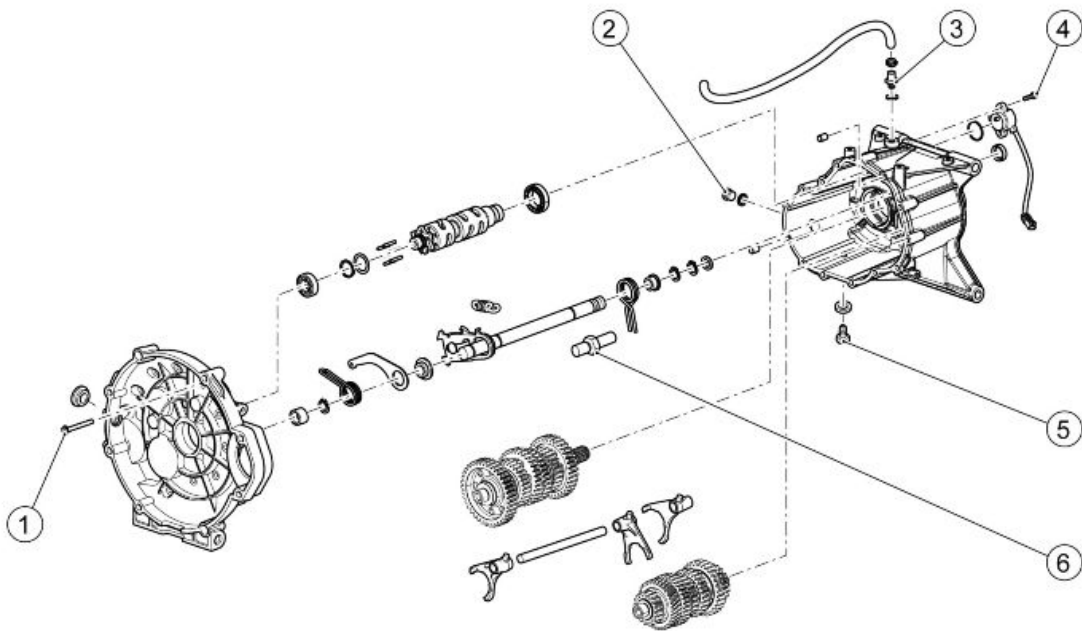
pos.	Description	Type	Quantity	Torque	Notes
3	Mesh type oil filter fixing screw	M6x14	1	6 Nm (4.42 lb ft)	-
4	Oil filter	-	1	15 Nm (11.06 lb ft)	Engine oil



**CRANKCASE AND OIL SUMP**

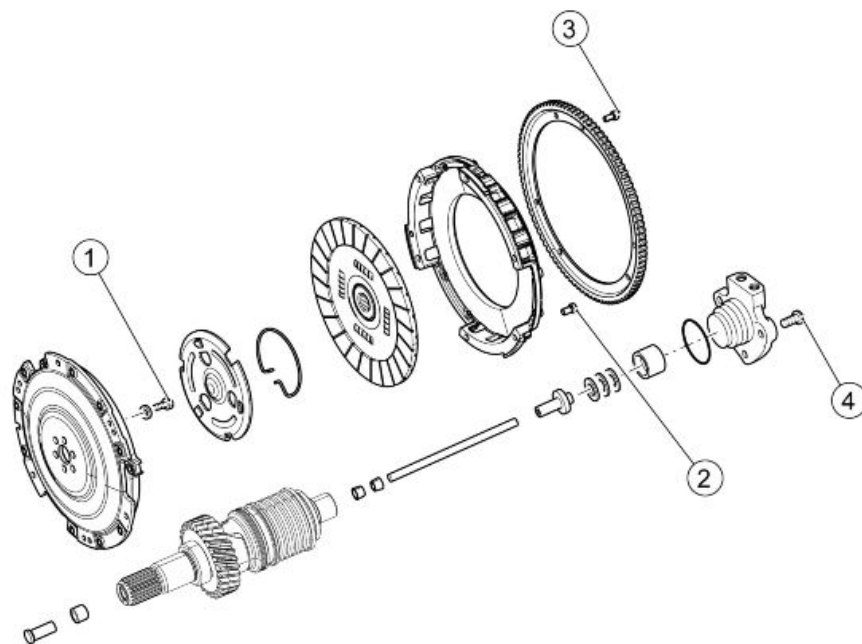
pos.	Description	Type	Quantity	Torque	Notes
1	Stud bolt	M8x75	2	10 Nm (7.37 lb ft)	-
2	Stud bolt	M8x66	3	10 Nm (7.37 lb ft)	-
3	Crankshaft rear support flange fixing screw	M8x25	8	26 Nm (19.18 lb ft)	-
4	Oil cap on the crankcase	-	2	25 Nm (18.44 lb ft)	-
5	Oil filter support flange fixing screw	M6x45	4	10 Nm (7.37 lb ft)	-
6	Thermal switch	M6x1.5	1	20 Nm (14.75 lb ft)	-
7	Sump to flange fixing screw	M6x35	4	10 Nm (7.37 lb ft)	-
8	Oil sump to crankcase fixing screw	M6x30	14	10 Nm (7.37 lb ft)	-
9	Thermal switch interface connection	-	1	20 Nm (14.75 lb ft)	Loctite 542
10	Magnetic oil drainage cap	-	1	20 Nm (14.75 lb ft)	-
11	Gear to engine fixing nut	M8	5	20 Nm (14.75 lb ft)	-





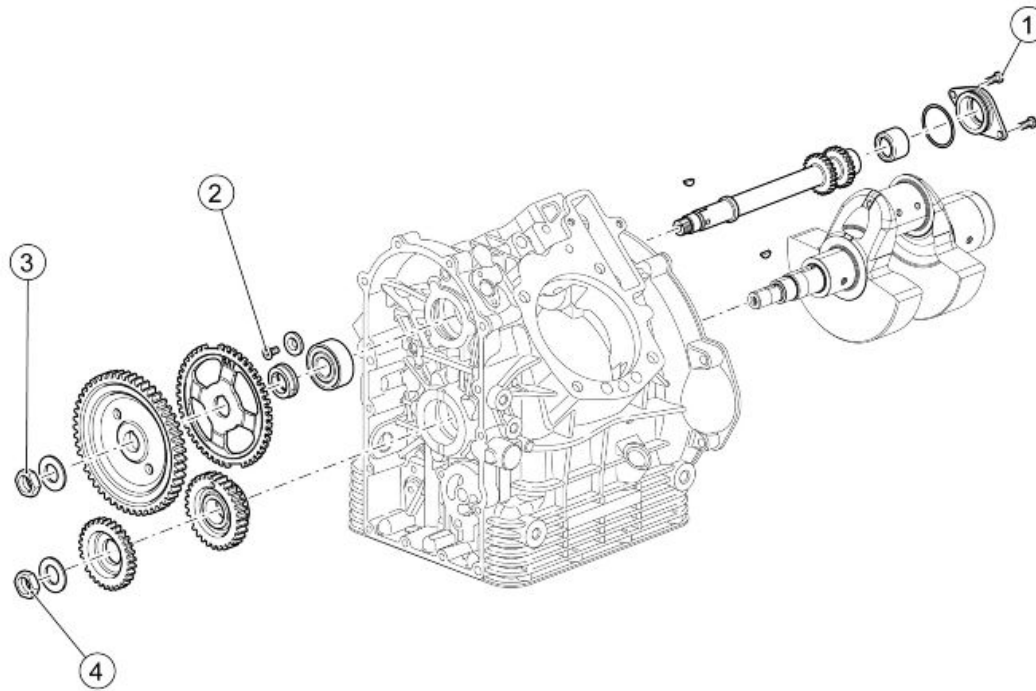
**GEARBOX**

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch housing to gearbox fixing screws	M6x55	14	13 Nm (9.59 lb ft)	-
2	Gearbox cap	M18x1.5	1	28 Nm (20.65 lb ft)	-
3	Breather stud bolt	M10x1.5	1	8 Nm (5.90 lb ft)	Loctite 243
4	Gear sensor fixing screw	M5x16	2	4.9 - 6 Nm (3.61 - 4.42 lb ft)	Loctite 243
5	Magnetic gearbox oil drainage cap	-	1	24 Nm (17.70 lb ft)	-
6	Spring guide pin	-	1	24 Nm (17.70 lb ft)	Loctite 243



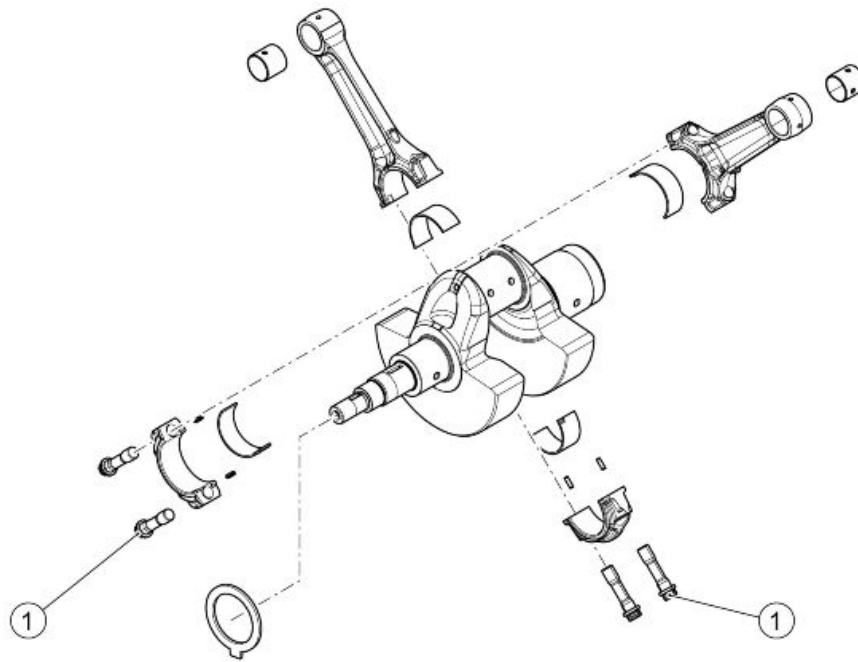
**CLUTCH**

pos.	Description	Type	Quantity	Torque	Notes
1	Flywheel on crankshaft fixing screw	M8x25	6	42 Nm (30.98 lb ft)	Loctite 243
2	Clutch external flange fixing screw on flywheel	M7x16	6	20 Nm (14.75 lb ft)	Loctite 243
3	Start-up crown fixing screw on flywheel	M6x12	6	10 Nm (7.37 lb ft)	-
4	Clutch control cylinder fixing screw	-	3	10 Nm (7.37 lb ft)	Loctite 243



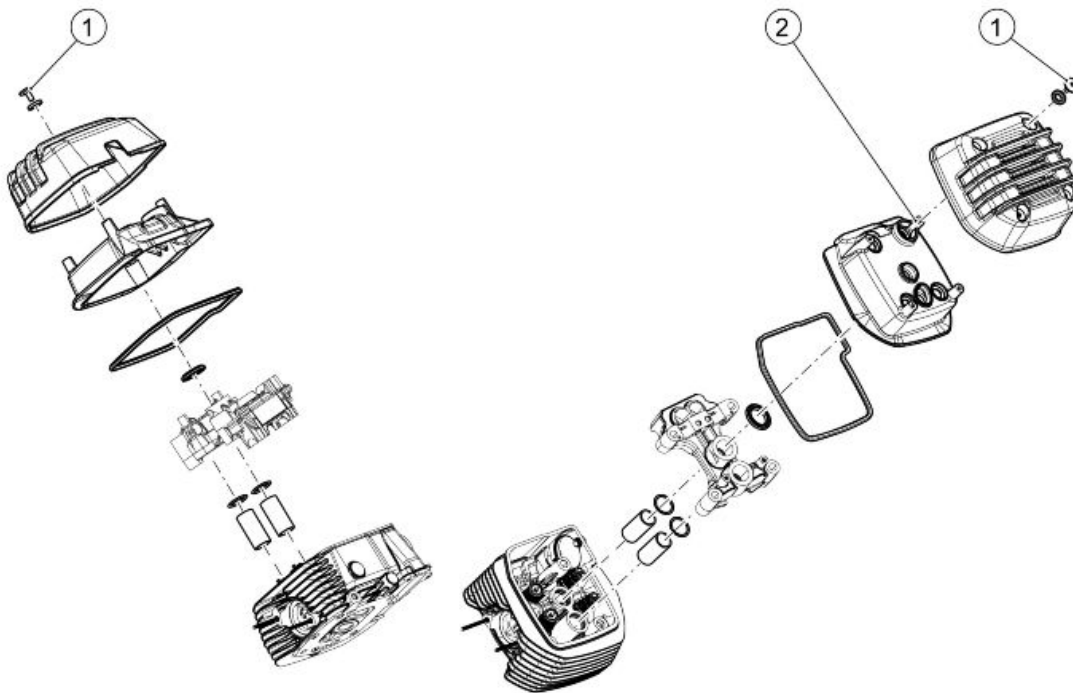
**TIMING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Idle shaft flange fixing screws	M6x14	2	7 - 8 Nm (5.16 - 5.90 lb ft)	Loctite 542 only on through hole
2	Bearing on idle shaft fixing screw	M6x16	1	8 - 10 Nm (5.90 - 7.37 lb ft)	Loctite 243
3	Idle shaft locking nut	M18x1.5	1	150 Nm (110.63 lb ft)	-
4	Crankshaft locking nut	M25x1.5	2	200 Nm (147.51 lb ft)	-



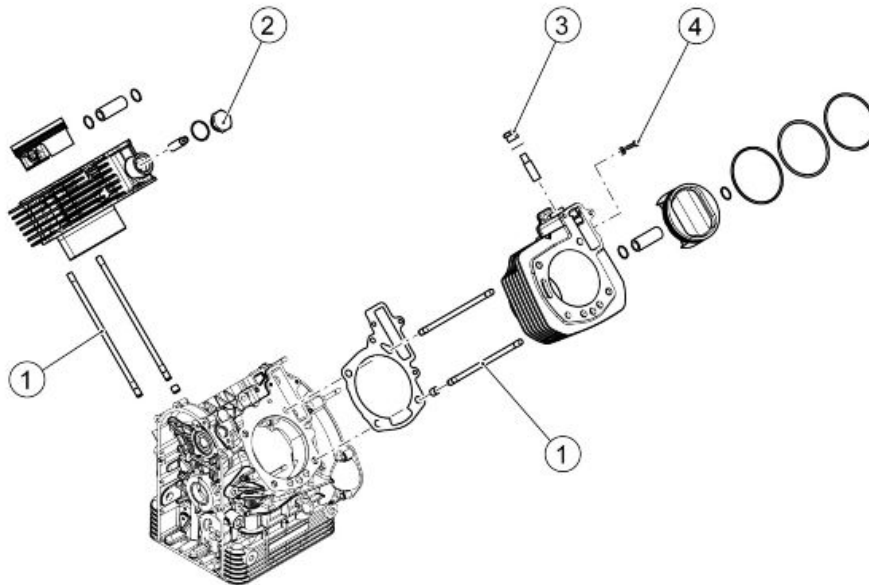
**CRANKSHAFT**

pos.	Description	Type	Quantity	Torque	Notes
1	Connecting rod screws	M10x1	4	Pre-torque 40 Nm (29.50 lb ft) Final torque 80 Nm (59.00 lb ft)	-



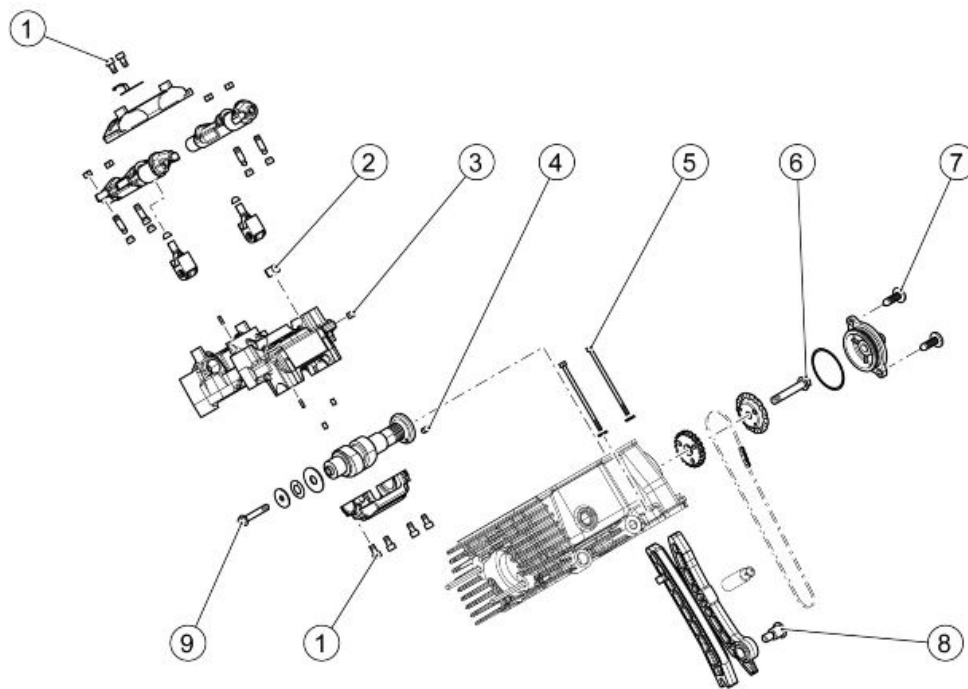
**CYLINDER HEAD COVERS**

pos.	Description	Type	Quantity	Torque	Notes
1	Special aesthetic head cover fixing screw	-	8	8 Nm (5.90 lb ft)	Locked with cross sequence
2	Special head cover screw	-	8	8 Nm (5.90 lb ft)	Locked with cross sequence



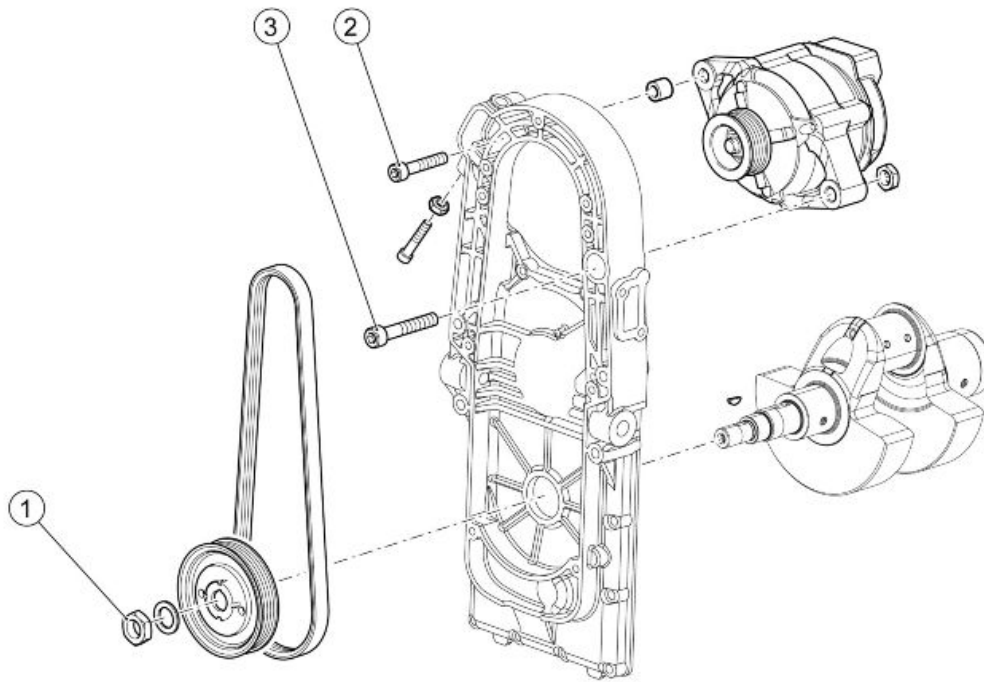
**PISTON CYLINDER**

pos.	Description	Type	Quantity	Torque	Notes
1	Tie rod on crankcase	M10x1.25	8	5 Nm (3.69 lb ft)	-
2	Right tensioner cover	M30x1.5	1	40 Nm (29.50 lb ft)	-
3	Left tensioner cover	M20x1.5	1	30 Nm (22.13 lb ft)	-
4	Left cylinder cover screw	M6x10	1	10 - 12 Nm (7.37 - 8.50 lb ft)	Loctite 542



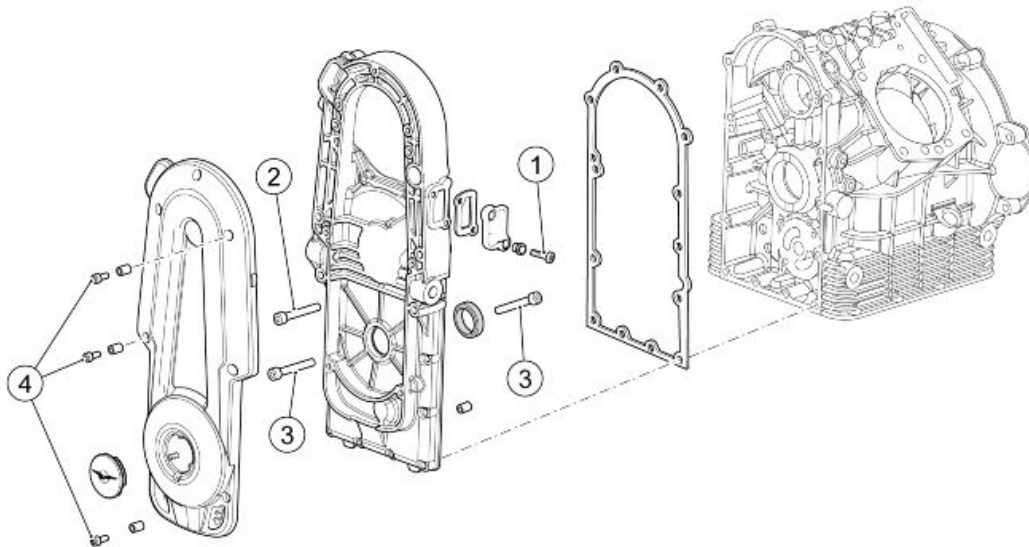
**CYLINDERS TIMING**

pos.	Description	Type	Quantity	Torque	Notes
1	Camshaft / rocker support fixing screws	M8x30	12	16 - 18 Nm (11.80 - 13.28 lb ft)	-
2	Nut for tie rod	M10x1.25	8	Pretorque 15 Nm (11.06 lb ft) Final torque 42 Nm (30.98 lb ft)	-
3	Cap	M6x10	2	10 - 12 Nm (7.37 - 8.50 lb ft)	Loctite 542
4	Reference dowel on camshaft	-	1	Interference insert	Loctite 542
5	Long screw for chain compartment on head	M6x120	4	10 Nm (7.37 lb ft)	-
6	Screws for sprocket timing on camshaft	M8x1	2	30 Nm (22.13 lb ft)	Loctite 243
7	Screws for blow-by cap on head	M5x16	4	6 - 8 Nm (4.42 - 5.90 lb ft)	-
8	Chain tensioner rod spacer screws	M8x24.5	2	20 Nm (14.75 lb ft)	-
9	Cup spring to camshaft fixing screws	M6x25	2	11 - 13 Nm (8.11 - 9.59 lb ft)	-



**ALTERNATOR**

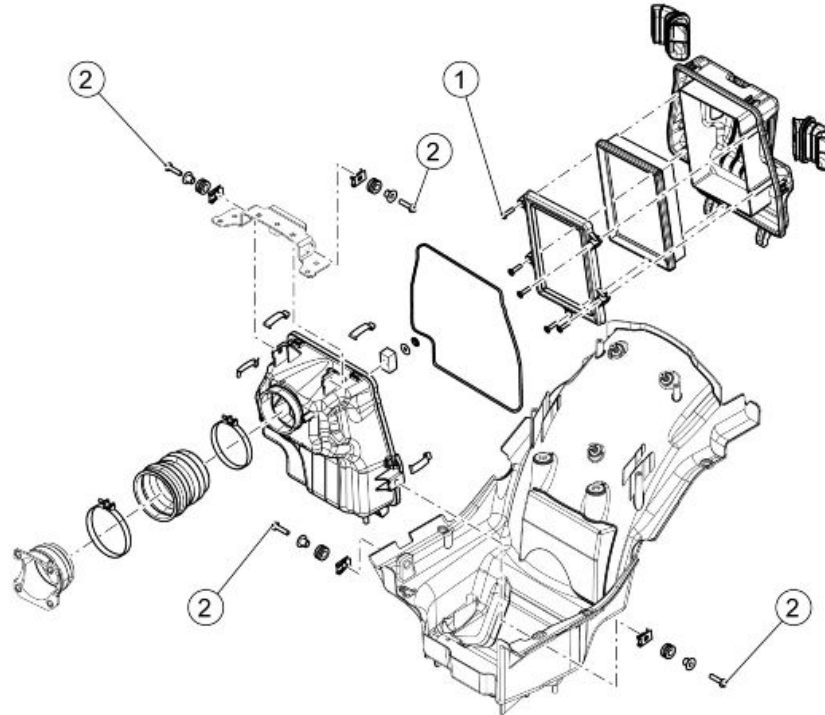
pos.	Description	Type	Quantity	Torque	Notes
1	Generator control pulley locking nut	M16	1	80 Nm (59.00 lb ft)	Loctite 243
2	Generator upper fixing screw	M8	1	22 Nm (16.23 lb ft)	-
3	Generator lower fixing screw	M10x60	1	30 Nm (22.13 lb ft)	-



**GENERATOR COVER**

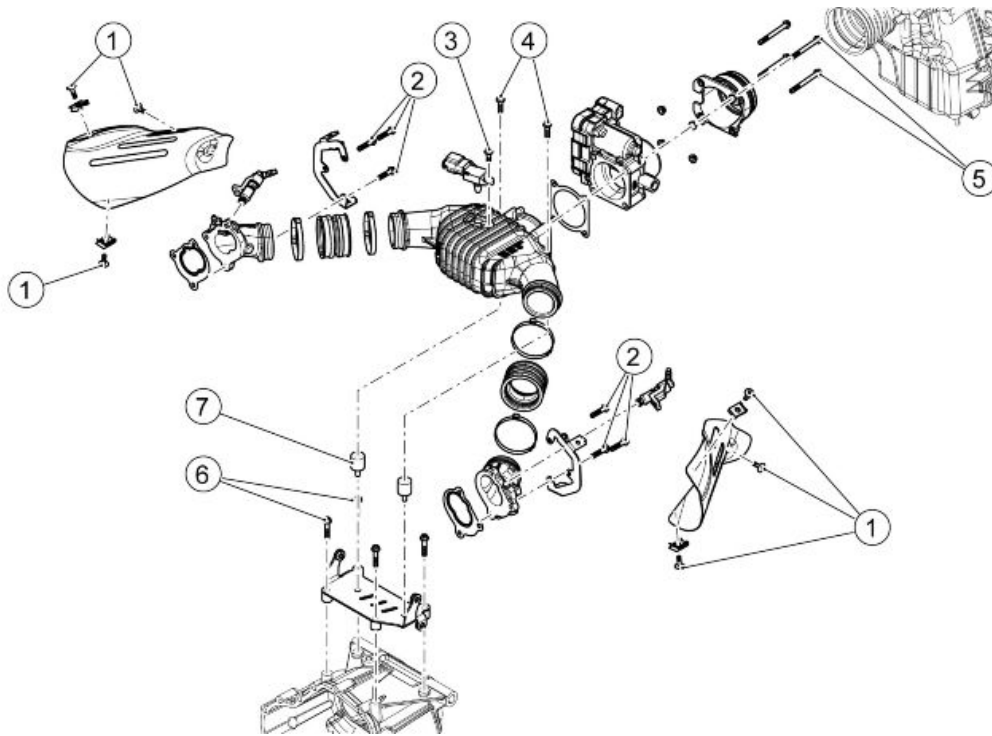
pos.	Description	Type	Quantity	Torque	Notes
1	Timing system cover cap fixing screw	M6x20	2	10 Nm (7.37 lb ft)	Loctite 243

pos.	Description	Type	Quantity	Torque	Notes
2	Timing system cover fixing screw	M8x55	4	25 Nm (18.44 lb ft)	-
3	Timing system cover fixing screw	M6x30	9	10 - 12 Nm (7.37 - 8.85 lb ft)	-
4	Generator cover fixing screw	M6x16	6	10 - 12 Nm (7.37 - 8.85 lb ft)	-



**AIR FILTER**

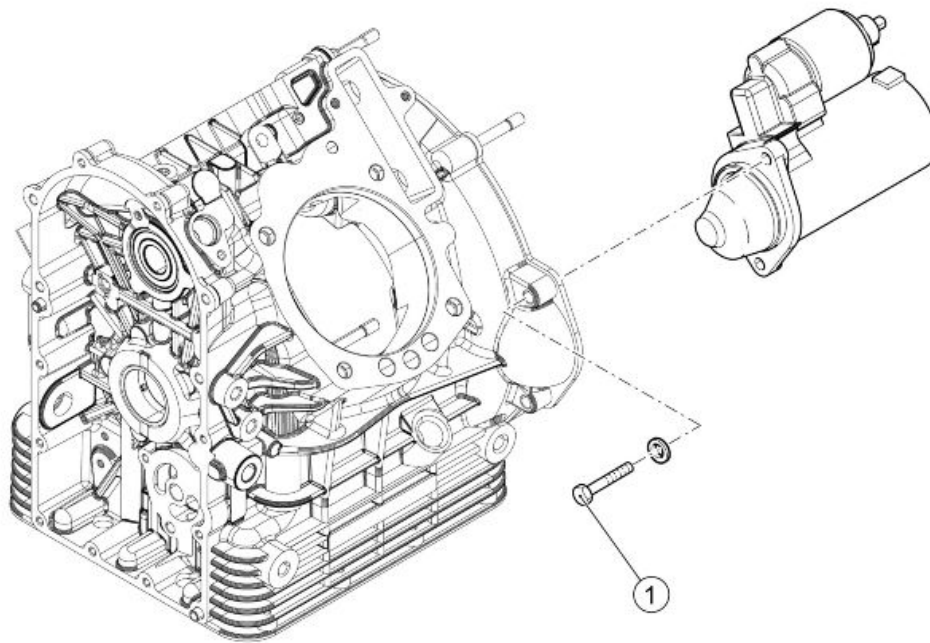
pos.	Description	Type	Quantity	Torque	Notes
1	Air filter box fastening screw to frame	-	2	10 Nm (7.38 lb ft)	-
2	Air filter box cover fastening screw	SWP 5x20	6	3 Nm (2.21 lb ft)	-



**THROTTLE BODY**

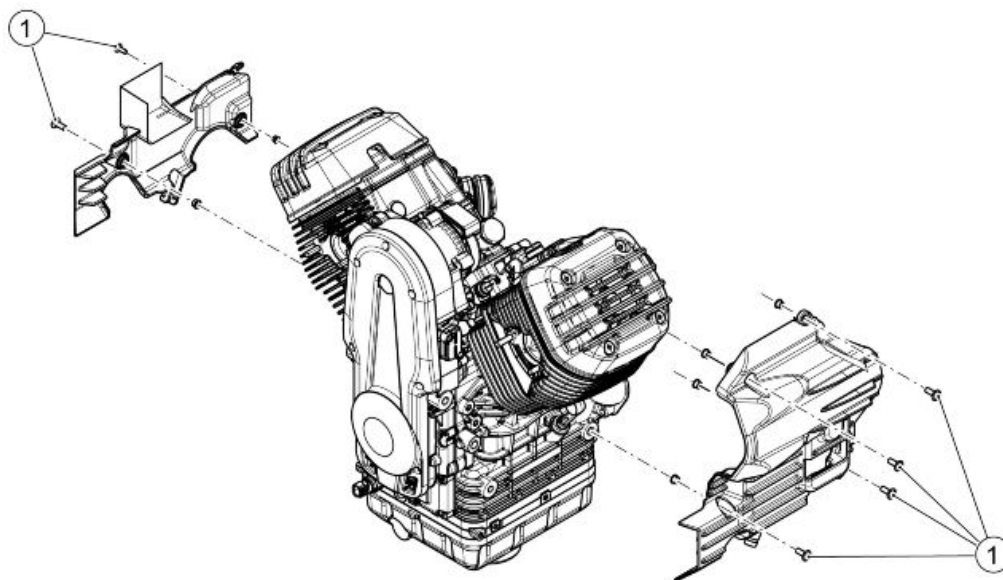
pos.	Description	Type	Quantity	Torque	Notes
1	Guards fixing screws	M5x15	6	6 Nm (4.42 lb ft)	-
2	Brackets fixing screws	M6x28	6	10 Nm (7.37 lb ft)	-
3	Air temperature sensor fixing screw	M6x16	1	10 Nm (7.37 lb ft)	-
4	Compensator volume fixing screw	M6x16	2	10 Nm (7.37 lb ft)	-
5	Throttle body manifold fixing screws	M6x60	4	10 Nm (7.37 lb ft)	-
6	Bracket fixing screws	M6x28	4	8.5 - 10 Nm (6.27 - 7.37 lb ft)	Loctite 243
7	Silent block	M6	2	Hand tighten	Loctite 243





**STARTER MOTOR**

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor fixing screws	M8x75	2	25 Nm (18.44 lb ft)	-



**ENGINE COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Engine cover fixing screws	M6x16 stainless steel	6	10 Nm (7.37 lb ft)	-

**Overhaul data**

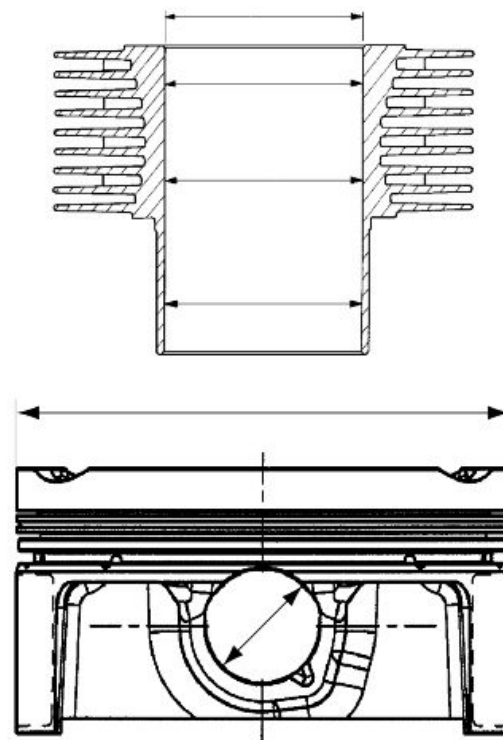
**Assembly clearances**

**Cylinder - piston assy.**

Measurement of the cylinder diameter must be done at three heights, turning the dial gauge 90°.  
 Check that cylinders and pistons are of the same selection types (D, E, F).  
 Check clearance between cylinders and pistons on the selected diameter; if it exceeds the value specified, it is necessary to replace cylinders and pistons.  
 The pistons of an engine must be balanced; a weight difference of up to 1.5 g (0.0033 lb) is allowed.

**CYLINDER COUPLING CLEARANCE -**

ABB REVI ATIO N	CYLINDER Ø	PISTON Ø	FITTING CLEARANCE
D	104.000-104.010 mm (4.0944-4.0948 in)	103.935-103.945 mm (4.0919-4.0923 in)	0.055-0.075 mm (0.00216-0.00295 in)
E	104.010-104.020 mm (4.0948-4.0952 in)	103.945-103.955 mm (4.0923-4.0927 in)	0.055-0.075 mm (0.00216-0.00295 in)
F	104.020-104.030 mm (4.0952-4.0956 in)	103.955-103.965 mm (4.0927-4.0930 in)	0.055-0.075 mm (0.00216-0.00295 in)



**PIN - PISTON COUPLING**

Specification	Desc./Quantity
Pin diameter	21.998 - 21.994 mm (0.86606 - 0.86590 in)

Specification	Desc./Quantity
Pin hole diameter on piston	22.020 - 22.015 mm (0.86693 - 0.86673 in)
Clearance between pin and holes on piston	0.017 - 0.026 mm (0.00067 - 0.00102 in)

## Piston rings

On each piston there are:

- 1 top piston ring;
- 1 middle piston ring;
- 1 oil scraper piston ring.

Turn the rings so that the coupling ends are 120 degrees from each other.

### CLEARANCE BETWEEN PISTON RINGS AND SEATS ON PISTON

Specification	Desc./Quantity
Top ring	0.030 - 0.070 mm (0.00118 - 0.00275 in)
Middle ring	0.020 - 0.060 mm (0.00079 - 0.00236 in)
Oil scraper ring	0.010 - 0.180 mm (0.00039 - 0.00709 in)

Gap between the end of the piston rings inserted in the cylinder:

- Upper piston ring 0.20 - 0.32 mm (0.0079 - 0.0126 in)
- Intermediate piston ring 0.35 - 0.50 mm (0.0138 - 0.0197 in)
- Oil scraper piston ring: 0.2 - 0.7 mm (0.0079 - 0.0275 in).

## Slot packing system

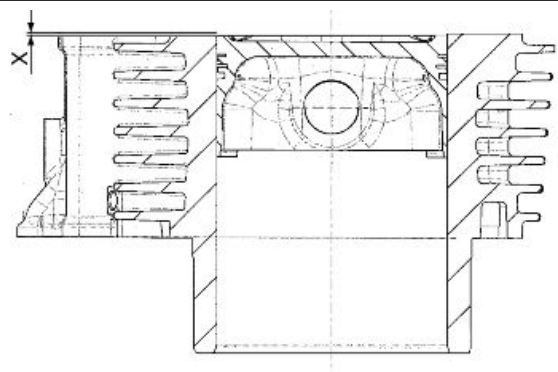
- Fit both pistons on the connecting rods.
- Working from both sides, fit the gasket between the crankcase and the cylinder on the crankcase.
- Fit both cylinders.
- Take the left cylinder piston to TDC and lock crankshaft rotation.



### Specific tooling

#### 020675Y Service shaft gear lock

- Thoroughly clean the upper surface of both cylinders.
- Position the tool on the left cylinder to determine the quota (X)
- Fasten the tool with the nuts of the stud bolts.



### Specific tooling

**020676Y Comparator support for piston position checking**



- Reset the micrometer on the cylinder rim.
- Move the tool so that the micrometer feeler reaches the top point of the piston crown.
- Take note of the measurement and, according to the values found, consult the chart at the bottom of the page to decide the thickness of the gasket to be fitted between cylinder and head.
- Unlock crankshaft rotation.
- Rotate the crankshaft by 90° until the right cylinder piston reaches the TDC.
- Lock crankshaft rotation.
- Position the tool on the right cylinder stud bolts to determine the quota (X)

**Specific tooling**

**020676Y Comparator support for piston position checking**

- Repeat the same operations to determine the thickness of the left cylinder gasket between cylinder and head also for the right cylinder.

**CYLINDER GASKET THICKNESS - HEAD**

Specification	Desc./Quantity
Value (X) -0.34 / -0.52 mm (-0.0134 / -0.0204 in)	gasket thickness 0.6 mm (0.0236 in).
Value (X) -0.14 / -0.34 mm (-0.0055 / -0.0133 in)	gasket thickness 0.8 mm (0.0314 in).
Value (X) -0.06 / -0.14 mm (-0.0023 / -0.0055 in)	gasket thickness 1 mm (0.0393 in).



**TO SELECT THE GASKET REFER TO THE CODE NUMBER WRITTEN ON IT.**



**IN CASE OF REPLACEMENT OF ONE OR MORE COMPONENTS IN THE THERMAL GROUP (PISTON, CYLINDER, PIN) OR OF AT LEAST ONE CRANKSHAFT CONNECTING ROD OR BUSHINGS, THE QUOTA (X) MUST BE REMEASURED IN ORDER TO SELECT THE APPROPRIATE GASKET.**

**Recommended products chart**

**RECOMMENDED PRODUCTS TABLE**

Product	Description	Specifications
ENI i-RIDE PG RACING 10W-60	Engine oil	SAE 10W - 60. As an alternative for recommended oils, top-branded oils that meet or exceed the requirements of

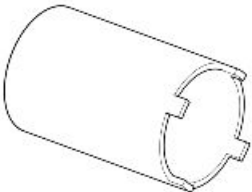




Product	Description	Specifications
		CCMC G-4 A.P.I. SG specifications can be used.
AGIP GEAR SAE 80 W 90	Transmission oil	API GL-4
AGIP GEAR MG/S SAE 85 W 90	Gearbox oil	API GL-5
FUCHS TITAN SAF 1091	Fork oil	-
AGIP GREASE SM2	Lithium grease with molybdenum for bearings and other points to lubricate	NLGI 2
Neutral grease or petroleum jelly.	Battery poles	
AGIP BRAKE 4	Brake / Clutch fluid	SAE J 1703 - FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid

## INDEX OF TOPICS

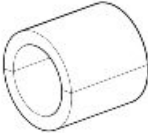
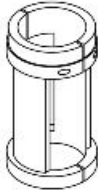

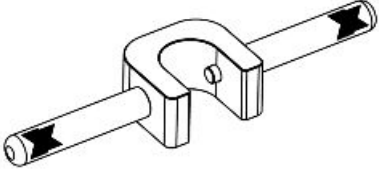
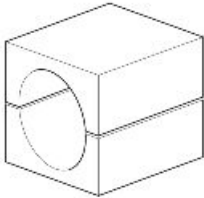
**S**SPECIAL TOOLS

**S-TOOLS**

**CHASSIS**

Stores code	Description	
AP8140190	Tool for steering tightening	
020376Y	Adapter handle	
020359Y	42 x 47-mm adaptor	
020360Y	Adaptor 52x54 mm	
001467Y001	Pliers to extract 25-mm diameter bearings	
001467Y035	Bell for 47-mm outside diameter bearings	

**FRONT FORK**

Stores code	Description	
AP8140146	Weight	
AP8145758	Tool for oil seals fitting	
020952Y	Pumping member ring nut locking spanner	
020888Y	Pliers for pre-fill pipe	
020951Y	Stanchion support	



# INDEX OF TOPICS

**MAINTENANCE**

**MAIN**

## Maintenance chart

### NOTE

**CARRY OUT MAINTENANCE OPERATIONS AT HALF THE INTERVALS SPECIFIED IF THE VEHICLE IS USED IN PARTICULAR RAINY OR DUSTY CONDITIONS, OFF ROAD OR FOR TRACK USE.**

### NOTE

**THE TIMES LISTED ON THE SCHEDULED MAINTENANCE TABLE INCLUDE TIME DEDICATED TO MANAGEMENT ACTIVITIES.**

### Routine maintenance table

I: INSPECT AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY

C: CLEAN, R: REPLACE, A: ADJUST, L: LUBRICATE

(1) Check and clean and adjust or replace, if necessary, before every journey.

(2) Replace every 2 years or 20000 Km (12427 mi).

(3) Replace every 4 years.

(4) Check at each engine start.

(5) Periodic lubrication of the stand with spray grease is recommended after particularly hard use (dirt from salt, dust, etc.) or after long periods of inactivity.

(6) Lubricate if you are riding in the rain, on wet roads or after the vehicle has been washed.

(7) Replace at whichever of the following occurs first: 40000 km (24854 mi) or 48 months

(8) Replace every 70000 km (43495 mi)

### ROUTINE MAINTENANCE TABLE

km x 1,000	1.5	10	20	30	40	50	60	70	80
Drive shaft (8)						I		R	
Exhaust pipe flange bolts	I		I		I		I		I
Spark plugs		I	R	I	R	I	R	I	R
Stand (5)		I	I	I	I	I	I	I	I
Control cables and controls (4)	I	I	I	I	I	I	I	I	I
Alternator belt						R			
Steering bearings and steering clearance	I	I	I	I	I	I	I	I	I
Wheel bearings		I	I	I	I	I	I	I	I
Brake discs	I	I	I	I	I	I	I	I	I
Air filter		R	R	R	R	R	R	R	R
Engine oil filter	R	R	R	R	R	R	R	R	R
Vehicle general operation	I	I	I	I	I	I	I	I	I
Braking systems	I	I	I	I	I	I	I	I	I
Light circuit	I	I	I	I	I	I	I	I	I
Safety switches	I		I		I		I		I
Brake fluid (2)	I	I	R	I	R	I	R	I	R
Clutch fluid (2)	I	I	I	I	I	I	I	I	I
Gearbox oil	R		R	R	R	R	R	R	R
Fork oil (7)					R				R
Engine oil	R	R	R	R	R	R	R	R	R
Final drive oil						R			
Clutch lever pin (6)	L	L	L	L	L	L	L	L	L
Tyres - pressure / wear (1)	I	I	I	I	I	I	I	I	I
Valve clearance adjustment	A	A	A	A	A	A	A	A	A
Wheels	I	I	I	I	I	I	I	I	I
Bolts and nuts tightening	I	I	I	I	I	I	I	I	I
Battery terminals tightening	I		I		I		I		I
Suspension	I		I		I		I		I
Filter box drainage tube		I	I	I	I	I	I	I	I

km x 1,000	1.5	10	20	30	40	50	60	70	80
Fuel lines (3)									
Brake lines (3)									
Brake pad wear (1)									
Labour time (minutes)	140	220	200	220	200	230	200	220	200

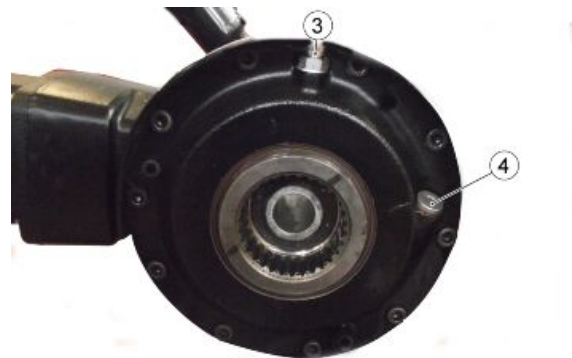
## Transmission fluid

### Check

- Remove the rear wheel.
- Undo and remove the three fixing screws (1) of the protection shield (2).
- Remove the protection shield (2).



- Keep the vehicle upright with both wheels on the ground.
- Unscrew and remove the cap/dipstick (4).
- The level is correct if the oil is close to the hole of the cap/dipstick (4).
- If the oil is lower than specified, top-up until it reaches the cap/dipstick hole (4).



#### CAUTION



DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

#### See also

[Removing the rear wheel](#)

## Replacement

#### CAUTION

THE UNIT MUST BE HOT WHEN THE OIL IS CHANGED AS UNDER SUCH CONDITIONS OIL IS FLUID AND THEREFORE EASY TO DRAIN.

#### NOTE

RIDE SOME km (miles) TO WARM UP ENGINE OIL

- Place a container with an over 400 cm<sup>3</sup> (25 cu.in) capacity under the drainage plug (5).
- Unscrew and remove the drainage plug (5).

- Unscrew and remove the breather cap (3).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Check and if necessary, replace the sealing washer of drainage plug (5).
- Remove any metal scrap attached to the drainage plug (5) magnet.
- Screw and tighten the drainage plug (5).
- Pour new oil through the fill opening (4) until it reaches the cap/dipstick hole (4).

**CAUTION**

**DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.**

- Screw and tighten the caps (3 - 4).



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## Engine oil

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### Check

**CAUTION**

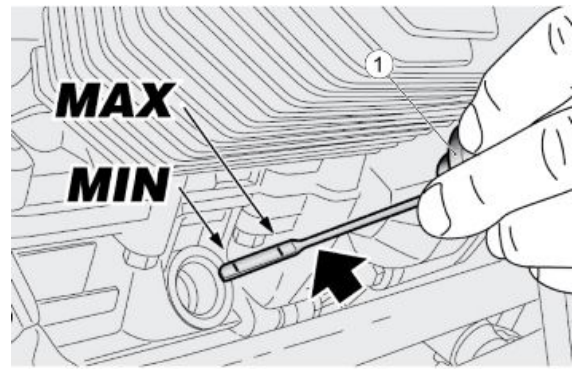
**ENGINE MUST BE WARM TO CHECK ENGINE OIL LEVEL.**

**NOTE**

**DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE OIL AND REACH THE OPERATING TEMPERATURE OF ENGINE OIL. OIL IS BEST CHECKED AFTER RUNNING FOR ABOUT 15 KM (10 miles).**

- Shut off the engine.
- Keep the vehicle upright with both wheels on the ground.

- Pull the filler plug / oil level dipstick (1) straight out.
- Wipe the oil level dipstick (1) clean and reinsert it.
- Pull it out again and check the oil level.
- The oil level is correct when it is close to the "MAX" mark. Otherwise, top-up with engine oil.

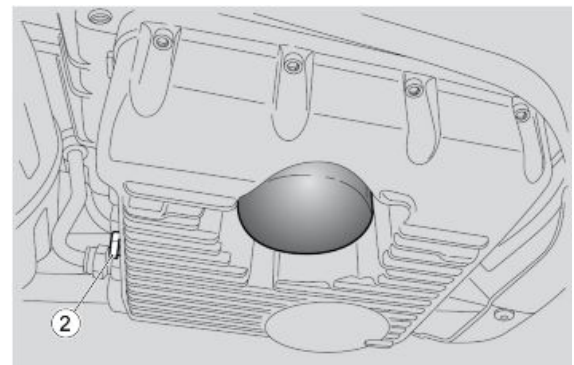
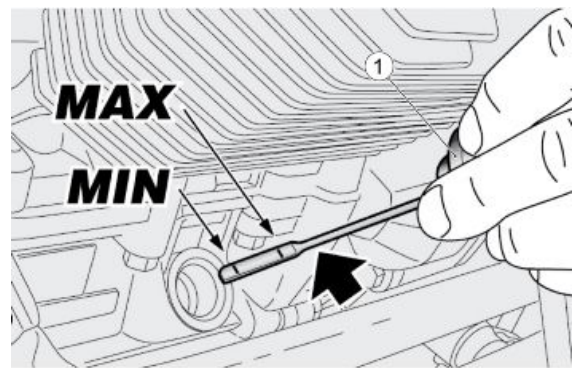
**CAUTION**

**DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.**

**Replacement****NOTE**

**HOT OIL IS MORE FLUID AND WILL DRAIN OUT MORE EASILY AND COMPLETELY.**

- Place a container with + 4000 cm<sup>3</sup> (244 cu.in) capacity under the drainage plug (2).
- Unscrew and remove the drainage plug (2).
- Pull out the oil filler plug / engine oil level dipstick (1).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Insert the oil filler plug / engine oil level dipstick (1).
- Check and if necessary, replace the sealing washers of drainage plug (2).
- Remove any metal scrap attached to the drainage plug (2) magnet.
- Screw and tighten the drainage plug (2).



**DO NOT DISPOSE OF OIL INTO THE ENVIRONMENT. DISPOSE OF ENGINE OIL IN A SEALED CONTAINER AND TAKE IT TO YOUR SUPPLIER OR TO THE NEAREST USED OIL COLLECTION CENTRE.**

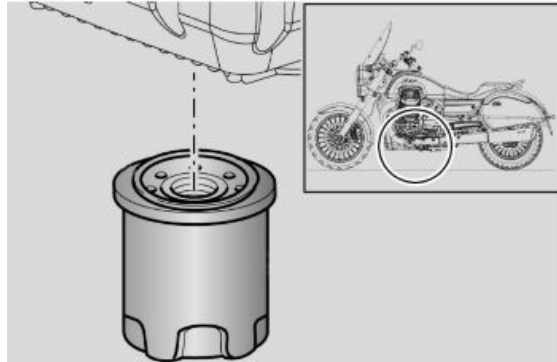
## Engine oil filter

Replace the engine oil filter each time you change the engine oil.

- Drain the engine oil completely.
- Unscrew and remove the engine oil filter from its seat.

### NOTE

NEVER REUSE AN OLD FILTER.



- Spread a thin layer of oil on the sealing ring of the new engine oil filter.
- Fit and screw the new oil filter in its seat.

## Gearbox Oil

### Inspection

#### CHECKING AND TOPPING UP

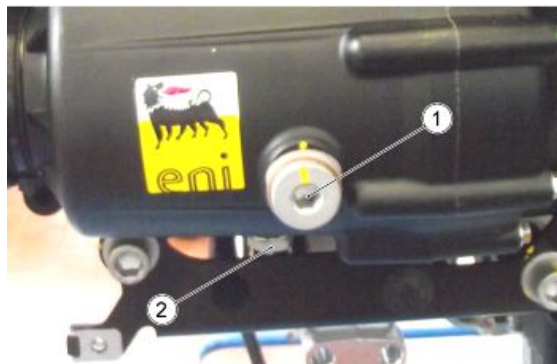
#### CAUTION

ENGINE MUST BE WARM TO CHECK GEARBOX OIL LEVEL.

#### NOTE

DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE OIL AND REACH THE OPERATING TEMPERATURE OF ENGINE OIL. OIL IS BEST CHECKED AFTER RUNNING FOR ABOUT 15 KM (10 miles).

- Shut off the engine.
- Keep the vehicle upright with both wheels on the ground.
- Undo and remove the dipstick opening (1) located on the right side of the gearbox.
- The level is correct if the oil is close to the hole of the dipstick (1).



If necessary:

- Top-up with oil until it reaches the dipstick opening (1).

#### CAUTION

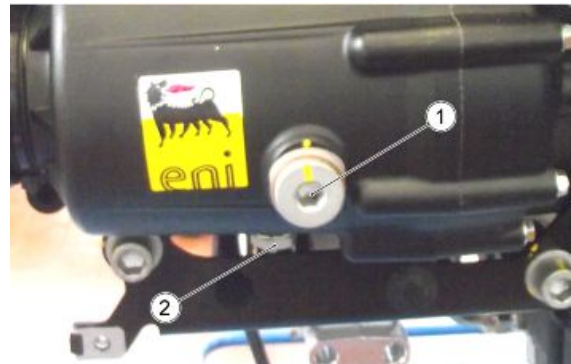
DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

## Replacement

**NOTE**

**HOT OIL IS MORE FLUID AND WILL DRAIN OUT MORE EASILY AND COMPLETELY.**

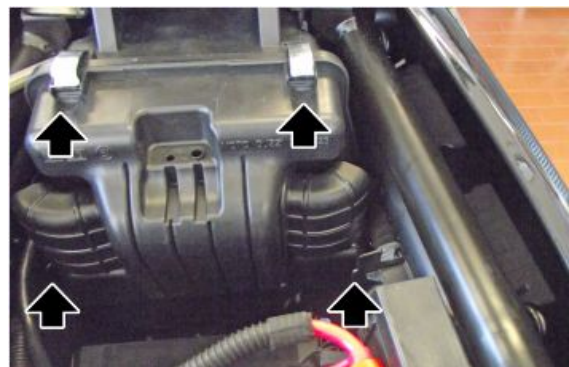
- Place a container with suitable capacity under the drainage plug (2).
- Unscrew and remove the drainage plug (2).
- Unscrew and remove the filler cap (1).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Check and replace, if necessary, the sealing washers of drainage plug (2).
- Remove any metal scrap attached to the drainage plug (2) magnet.
- Screw and tighten the drainage plug (2).
- Pour in new oil until it reaches the dipstick opening (1).
- Tighten the filler cap (1).

**CAUTION**

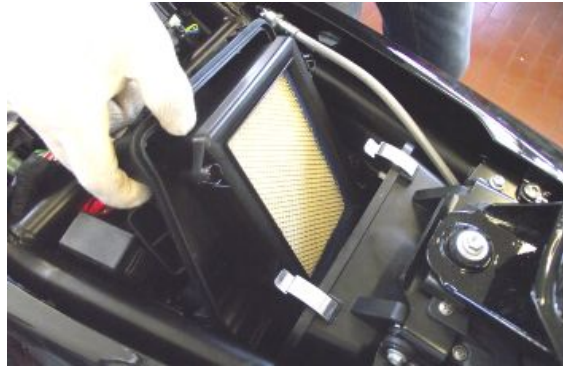
**DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.**

## Air filter

- Remove the saddle.
- Release the four fixing clips of the upper shell filter box.



- Lift the filter housing cover.



- Remove the air filter.
- Plug the intake duct with a clean cloth to prevent any foreign objects from entering the intake manifold.



**DO NOT START THE ENGINE WITHOUT THE AIR FILTER.  
TO CLEAN THE FILTERING ELEMENT, USE A PRESSURE AIR JET FROM THE INSIDE TO THE  
OUTSIDE.**

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## Braking system

---

### Level check

#### Brake fluid check

- Rest the vehicle on its stand.
- For the front brake, turn the handlebar fully to the right.
- For the rear brake, keep the vehicle upright so that the fluid in the reservoir is at the same level with the plug.
- Make sure that the fluid level in the reservoir is above the "MIN" reference mark:

**MIN** = minimum level

**MAX** = maximum level

If the fluid does not reach at least the "**MIN**" reference mark:

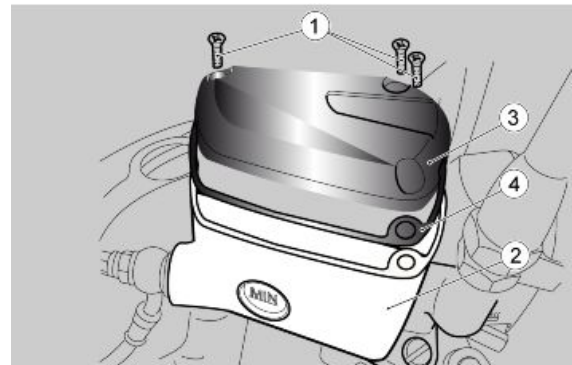
- Check brake pads and disc for wear.
  - If the pads and/or the disc do not need replacing, top-up the fluid.
-



## Top-up

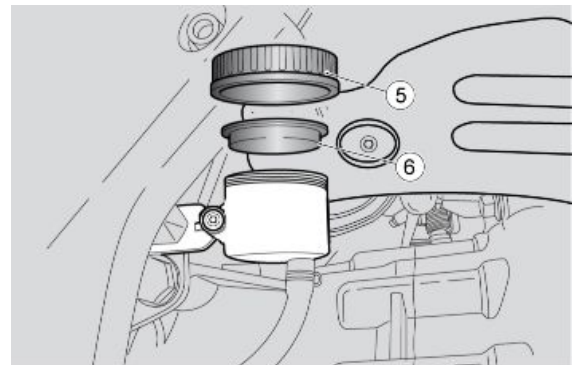
Front brake:

- Using a Phillips screwdriver, unscrew the three screws (1) of the brake fluid tank (2).
- Lift and remove the cover (3) and screws (1) as well.
- Remove the gasket (4).



Rear brake:

- Unscrew and remove the cap (5).
- Remove the gasket (6).
- Top-up the reservoir with brake fluid to the correct level, which is between the two "MIN" and "MAX" reference marks.



**RISK OF BRAKE FLUID SPILLS. DO NOT OPERATE THE BRAKE LEVER WITH BRAKE FLUID RESERVOIR CAP LOOSENED OR REMOVED.**

**CAUTION**



**AVOID PROLONGED AIR EXPOSURE OF THE BRAKE FLUID. BRAKE FLUID IS HYGROSCOPIC AND ABSORBS MOISTURE WHEN IN CONTACT WITH AIR. LEAVE THE BRAKE FLUID RESERVOIR OPEN ONLY FOR THE TIME NEEDED TO COMPLETE THE TOPPING UP PROCEDURE.**



**TO AVOID SPILLING FLUID WHILE TOPPING-UP, KEEP THE TANK PARALLEL TO THE RESERVOIR EDGE (IN HORIZONTAL POSITION).**

**DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID.**

**WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.**



**DO NOT EXCEED THE "MAX" LEVEL MARK WHEN TOPPING UP.**

**TOP-UP TO "MAX" LEVEL MARK ONLY WHEN BRAKE PADS ARE NEW. WHEN TOPPING UP DO NOT EXCEED THE "MAX" LEVEL MARK WHEN BRAKE PADS ARE WORN AS YOU RISK SPILLING FLUID WHEN CHANGING THE BRAKE PADS.**

**CHECK BRAKING EFFICIENCY. IN CASE OF EXCESSIVE TRAVEL OF THE BRAKE LEVER OR POOR PERFORMANCE OF THE BRAKING SYSTEM, TAKE YOUR VEHICLE TO AN Official Moto Guzzi Dealer, AS IT MAY BE NECESSARY TO PURGE THE AIR IN THE SYSTEM.**

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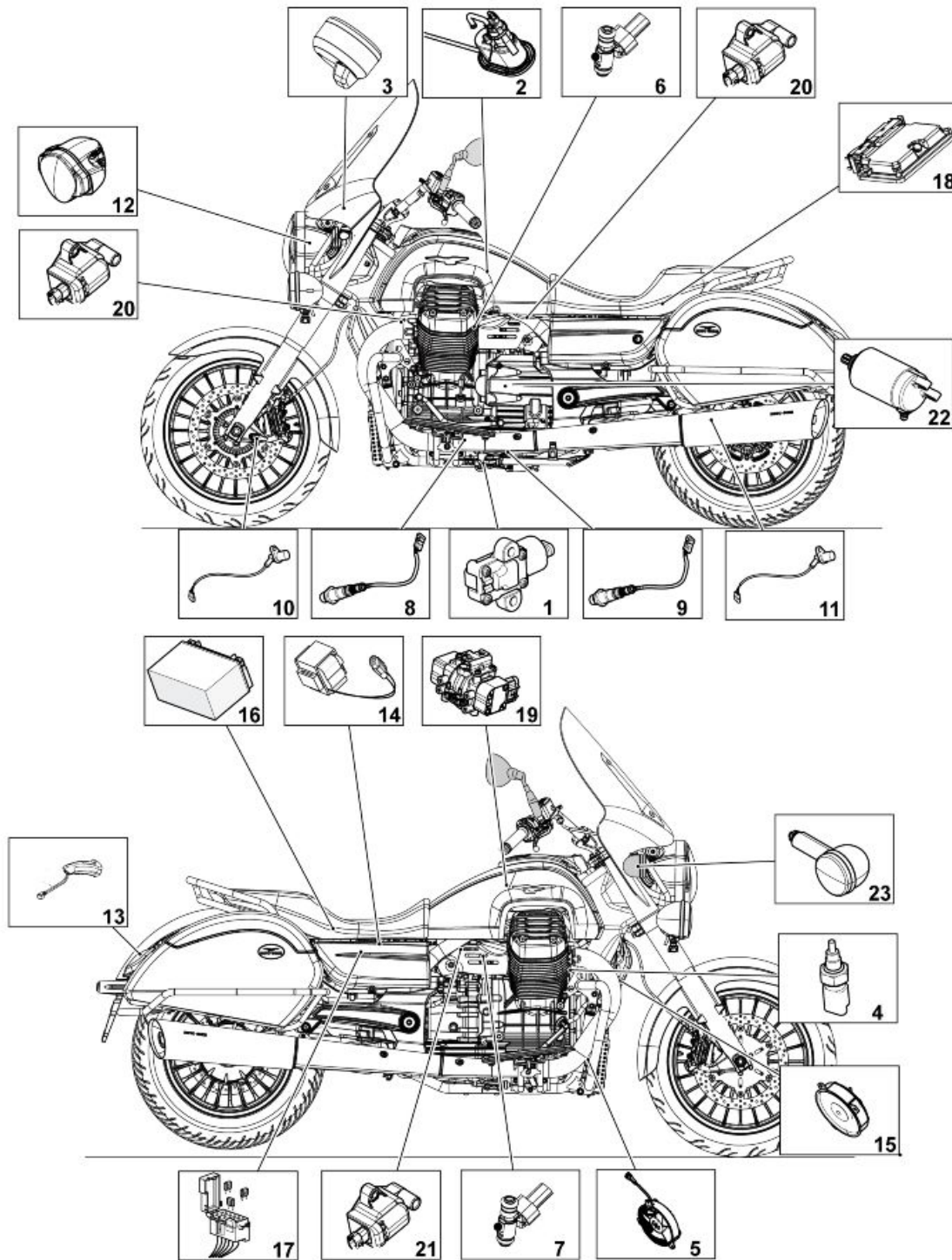
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## INDEX OF TOPICS

ELECTRICAL SYSTEM

ELE SYS

Components arrangement



KEY:

- 1. Side stand sensor:
- 2. Fuel pump.
- 3. Instrument panel.

4. Engine temperature sensor.
5. Cooling fan.
6. Left injector.
7. Right injector.
8. Lambda probe
9. Lambda probe
10. Front speed sensor.
11. Rear speed sensor.
12. Headlamp.
13. Turn indicators and taillight.
14. Fall sensor.
15. Horn.
16. Battery.
17. Fuses.
18. Control unit.
19. Demand Sensor.
20. Left coils.
21. Right coils.
22. Starter motor.
23. Front turn indicators.

---

## **Electrical system installation**

### **INTRODUCTION**

#### **Scope and applicability**

This document aims at defining the cable harness routing in order to achieve the vehicle reliability targets.

#### **Materials used and corresponding quantities**

The electrical system consists of the following cable harnesses and parts:

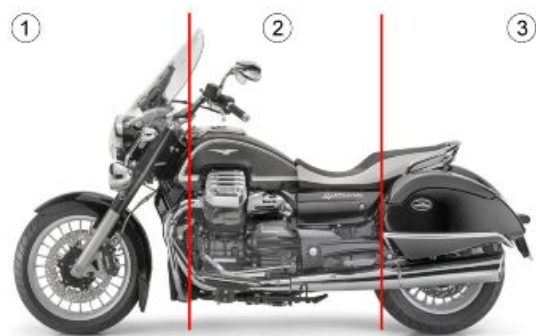
- 1 Main cable harness
- 1 Ground lead
- 1 Main injection relay
- 1 Relay Mounting Rubber Block
- 1 Fan cable harness
- 1 License plate light cable harness
- 1 Fog light switch with cable harness
- 1 12V 30A Relay
- 1 Relay Mounting Rubber Block

- 1 Complete antitheft kit
- 7 Large clamps
- 54 Medium clamps
- 6 Small clamps
- 5 Clamps with support
- 2 Plastic rivets
- 10 Retaining clips
- 3 Cable grommets
- 2 Cable guides

### Motorcycle division

The wiring timing is subdivided in three essential sections, as indicated in the figure.

1. Front section
2. Central section
3. Rear section



### Special checks for the correct connection and laying of cables

It is extremely important that any security-locks for the following connectors are properly connected and correctly tightened to ensure proper engine, and therefore proper vehicle, operation.

- Instrument panel connector
- Master and Slave Demand Connectors
- Pick Up connector and alternator
- Side Stand Switch Connector
- Coils connectors
- Control unit connectors
- Fuel pump connector
- Key Connector
- Right Light Switch Connectors
- Left Light Switch Connectors
- ABS connector and correct positioning of the cap
- Front and rear speed sensor connector
- Auxiliary Fuses (rubber housing correct positioning and closing)
- Fuel injector connectors
- Key and immobilizer aerial connector
- Throttle motor connector
- T-Map Sensor connector

- Check fixing of the grounds on the engine body (left side)
- Check correct running of the Battery-Starter Relay cable
- Check fixing of the positive cable on the starter motor and positioning of the hood

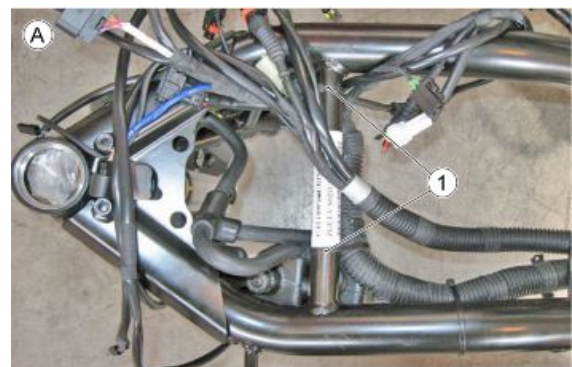
**The connectors in the list are circled in the different pictures. The listed connectors are considered more critical than the others because their disconnection could cause the vehicle to stop or malfunction. Obviously, the correct connection of the other connectors is also important and essential for proper vehicle operation.**

It is also important and essential that the instructions regarding the routing and fixing of the cable harness in the various areas are followed meticulously in order to guarantee functionality and reliability.

The operations for preassembly of the main cable harness on the frame are described in the tables below.

**TABLE A**

1. Large clamps.



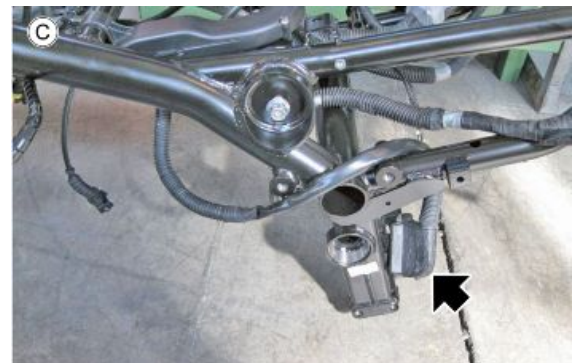
**TABLE B**

Pass the main cable harness as shown in figure.



**TABLE C**

Pass the main cable harness as shown in figure.



**TABLE D**

1. Large clamps.



**TABLE E**

Pass the main cable harness as shown in figure.



**TABLE F**

Pass the main cable harness as shown in figure.

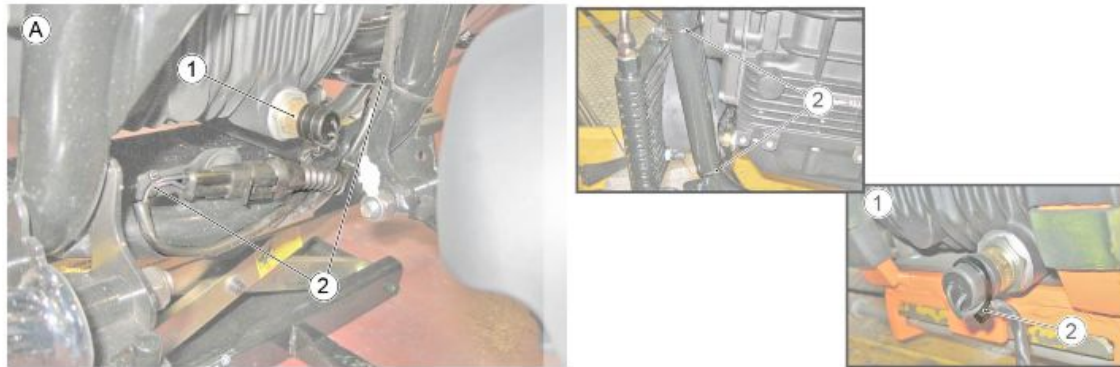


**Front side**

**TABLE A - FAN AND CONNECTED COMPONENTS**

- 1. Thermal switch.
- 2. Medium clamp





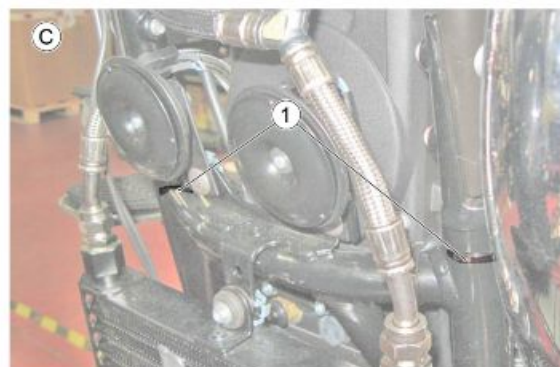
**TABLE B - FAN AND CONNECTED COMPONENTS**

- 1. Small clamp.



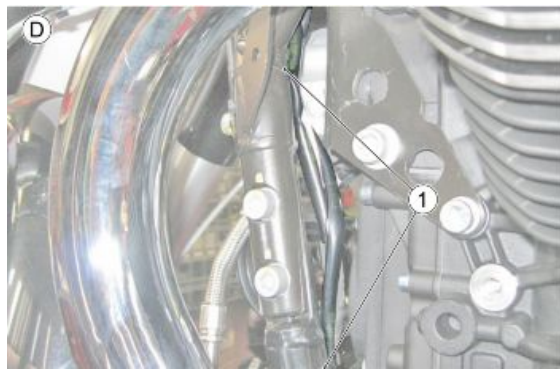
**TABLE C - FAN AND CONNECTED COMPONENTS**

- 1. Medium clamp



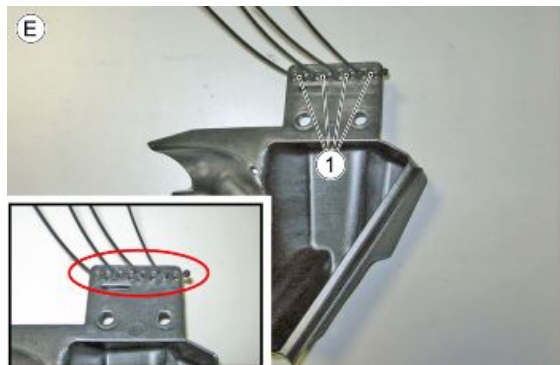
**TABLE D - FAN AND CONNECTED COMPONENTS**

- 1. Medium clamp



**TABLE E - RIGHT SIDE STEERING COLUMN AREA**

- 1. Medium clamp



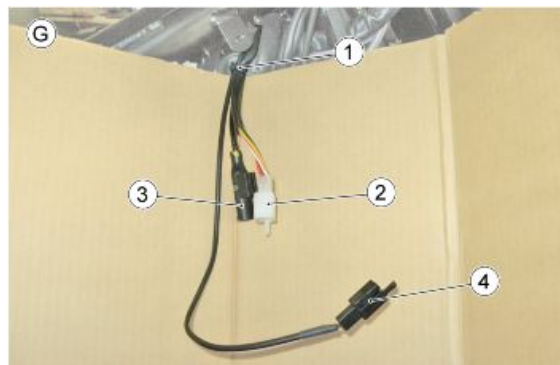
**TABLE F - RIGHT SIDE STEERING COLUMN AREA**

- 1. Medium clamp



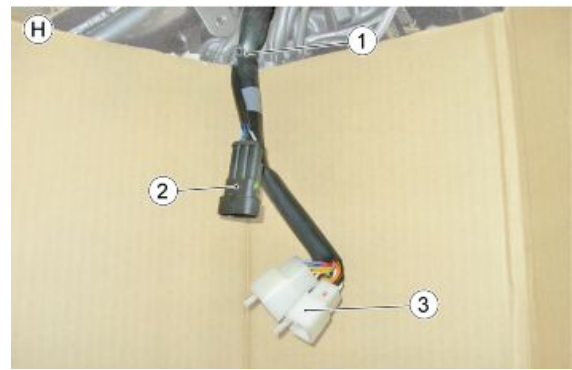
**TABLE G - RIGHT SIDE STEERING COLUMN AREA**

- 1. Medium clamp
- 2. Key connector.
- 3. Speed sensor.
- 4. Immobilizer aerial.



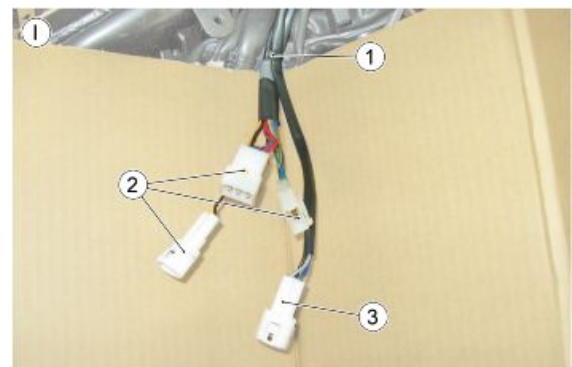
**TABLE H - RIGHT SIDE STEERING COLUMN AREA**

1. Medium clamp
2. Clutch switch.
3. Left light switch.



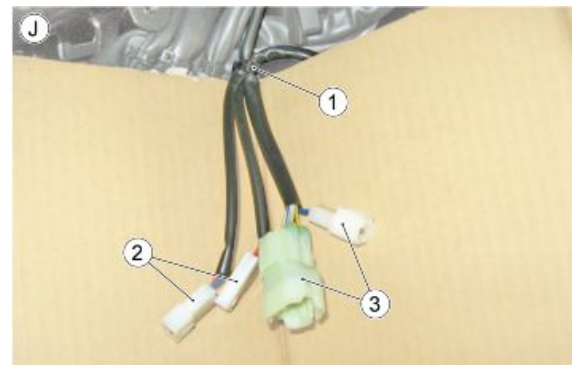
**TABLE I - RIGHT SIDE STEERING COLUMN AREA**

1. Medium clamp
2. Right light switch.
3. Front stop switch.



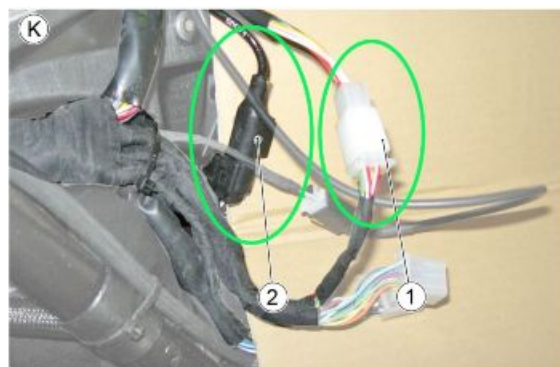
**TABLE J - RIGHT SIDE STEERING COLUMN AREA**

1. Medium clamp
2. Turn indicators.
3. Headlamp.



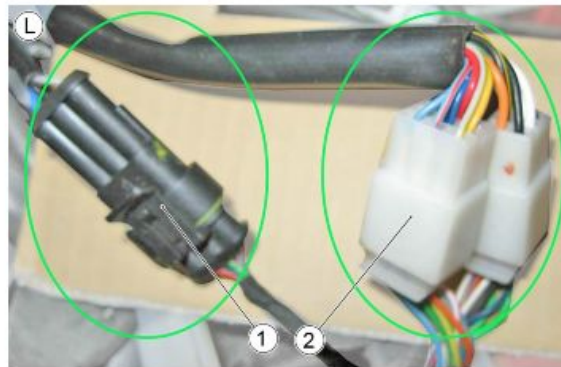
**TABLE K - RIGHT SIDE STEERING COLUMN AREA**

1. Key connector.
2. Immobilizer aerial.

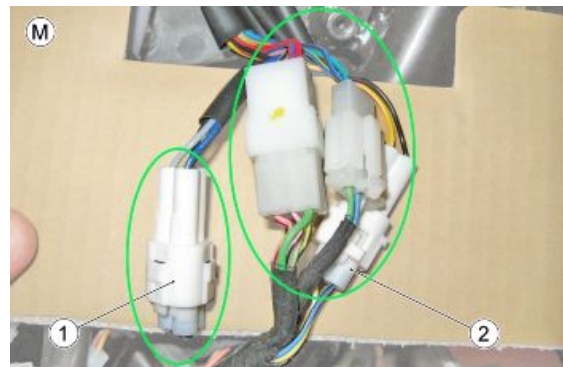


**TABLE L - RIGHT SIDE STEERING COLUMN AREA**

1. Clutch switch connectors.
2. Left light switch connectors.

**TABLE M - RIGHT SIDE STEERING COLUMN AREA**

1. Front stop switch connector.
2. Right light switch connector.

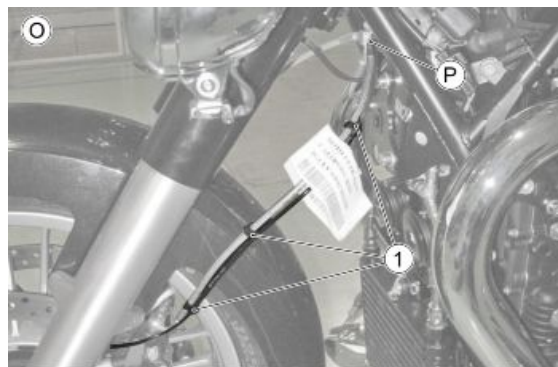
**TABLE N - LEFT SIDE STEERING COLUMN AREA**

1. Medium clamp
2. Left coil connector.



**TABLE O - LEFT SIDE FORK AREA**

- 1. Cable grommet.



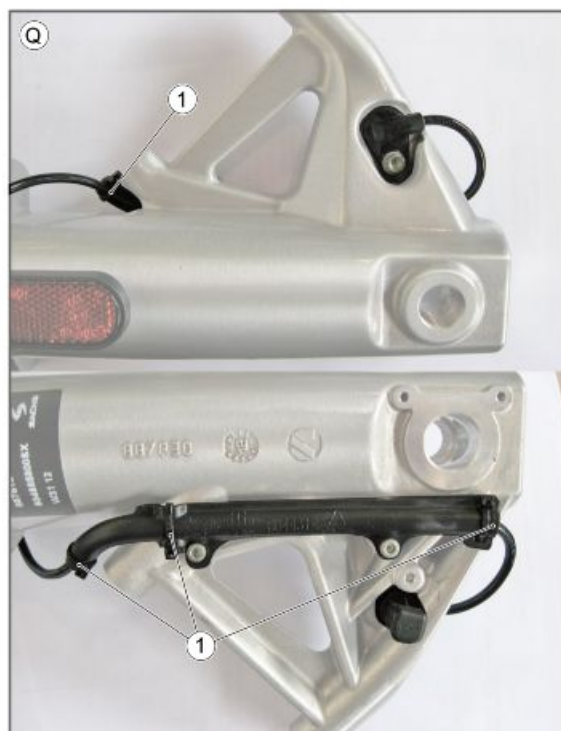
**TABLE P - LEFT SIDE FORK AREA**

- 1. Cable grommet.



**TABLE Q - LEFT SIDE FORK AREA**

- 1. Small clamp.



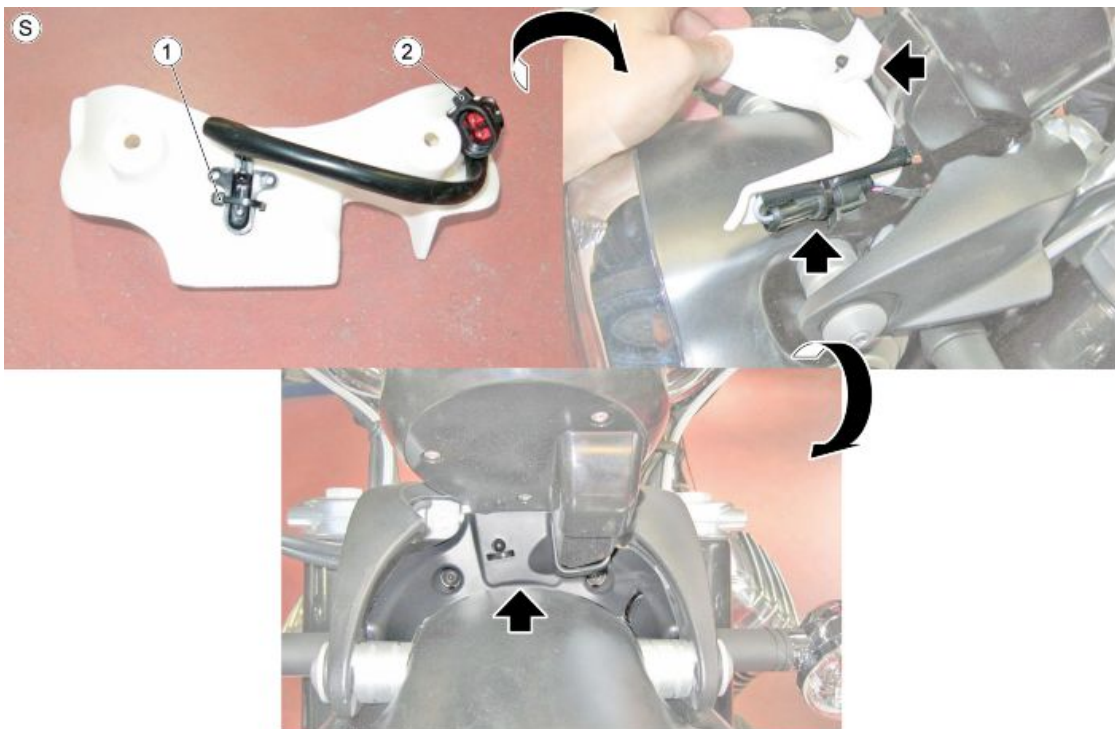
**TABLE R - INSTRUMENT PANEL FASTENING**

- 1. Medium clamp



**TABLE S - INSTALLATION AIR TEMPERATURE SENSOR**

- 1. Small clamp.
- 2. Medium clamp



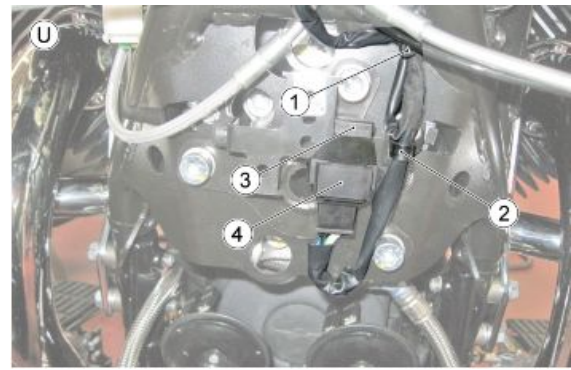
**TABLE T - FOG LIGHTS**

- 1. Fog lights kit connection.



**TABLE U - FOG LIGHTS**

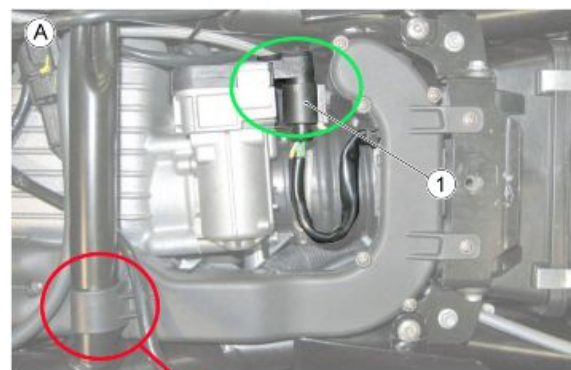
1. Medium clamp (to hold the branch that goes toward the headlights).
2. Clip.
3. 12V 30A relay.
4. Relay mounting rubber block.

**TABLE V - FOG LIGHTS**

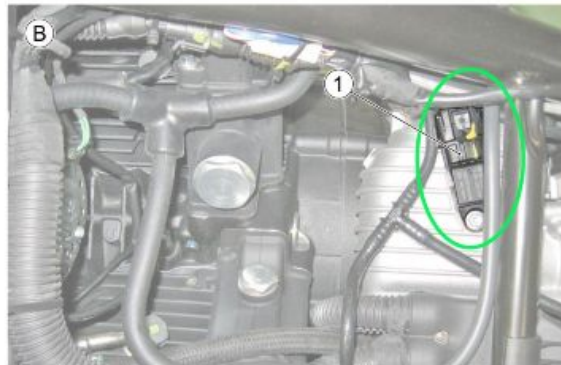
1. Cable guide.
2. Rubber ring.
3. Insert the light connections in the rubber rings and assemble them as shown in the figure.

**Central part****TABLE A - FRAME AREA  
(UNDER THE TANK)**

1. Throttle motor connector.
- Fit the duct to the frame as shown in the figure.

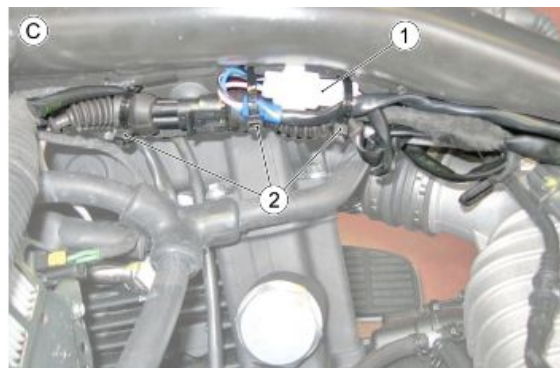
**TABLE B - FRAME AREA  
(UNDER THE TANK)**

1. T°Map connector.



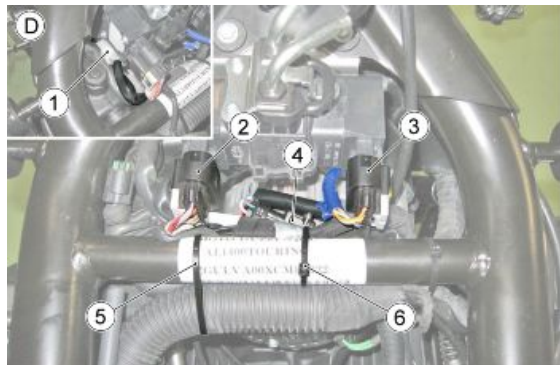
**TABLE C - FRAME AREA  
(FRAME RIGHT INTERNAL SIDE)**

- 1. Gear sensor connector.
- 2. Medium clamps.



**TABLE D - FRAME AREA  
(UNDER THE TANK)**

- 1. Fog light connector (optional).
- 2. Slave Demand Connector.
- 3. Master Demand Connector.
- 4. Pick-up connector
- 5. Big clamp.
- 6. Medium clamp



**TABLE E - FRAME AREA  
(UNDER THE TANK)**

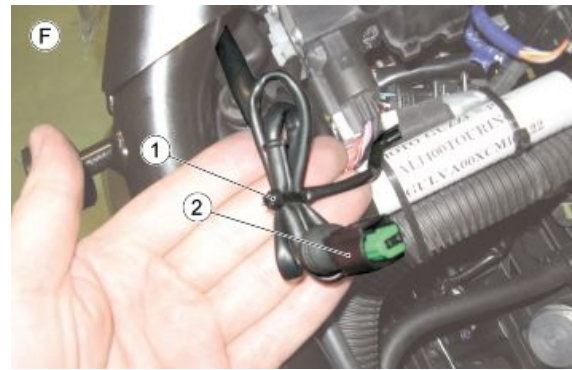
- 1. Big clamp.





**TABLE F - FRAME AREA  
(UNDER THE TANK)**

1. Medium clamp
2. Navigator pre-installation.



**TABLE G - DIRECT CONNECTIONS TO THE ENGINE**

- Alternator connections.



**TABLE H - DIRECT CONNECTIONS TO THE  
ENGINE**

Engine temperature.

1. Medium clamp



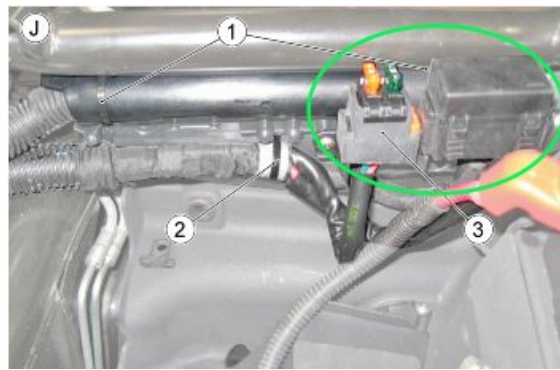
**TABLE I - BATTERY AREA**

1. Fall sensor.



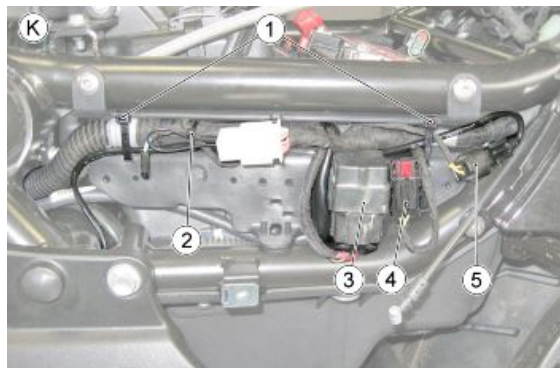
**TABLE J - BATTERY AREA  
(RIGHT SIDE FAIRING, INTERNAL VIEW)**

1. Medium clamp
2. Medium clamp
3. Fuses.



**TABLE K - BATTERY AREA  
(LEFT SIDE FAIRING, EXTERNAL VIEW)**

1. Medium clamp
2. Small clamp.
3. Relay.
4. Auxiliary fuse.
5. Rear speed sensor.

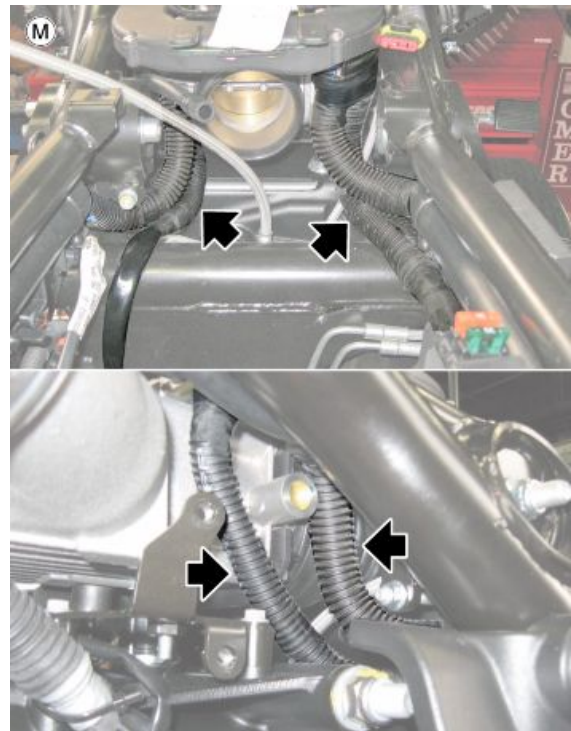


**TABLE K - BATTERY AREA**

1. Control unit connectors.

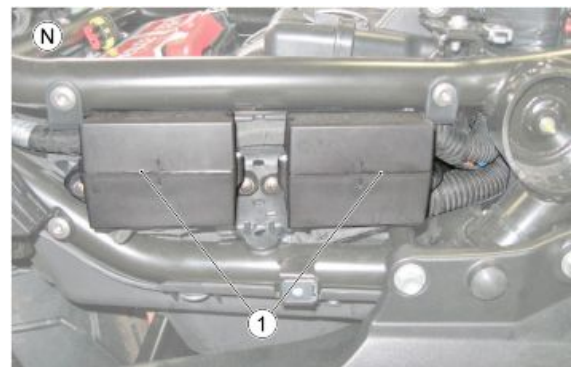


**TABLE M - CORRECT PASSING OF CORRUGATED PIPES**



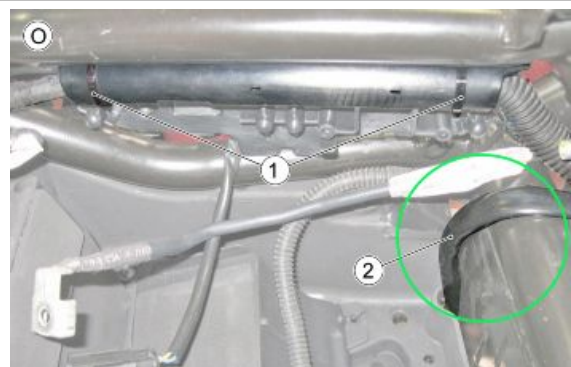
**TABLE N - BATTERY AREA  
(RIGHT SIDE FAIRING, EXTERNAL VIEW)**

1. Relay



**TABLE O - BATTERY AREA  
(LEFT SIDE FAIRING, INTERNAL VIEW)**

1. Medium clamp
2. ABS branch, must remain in its housing.

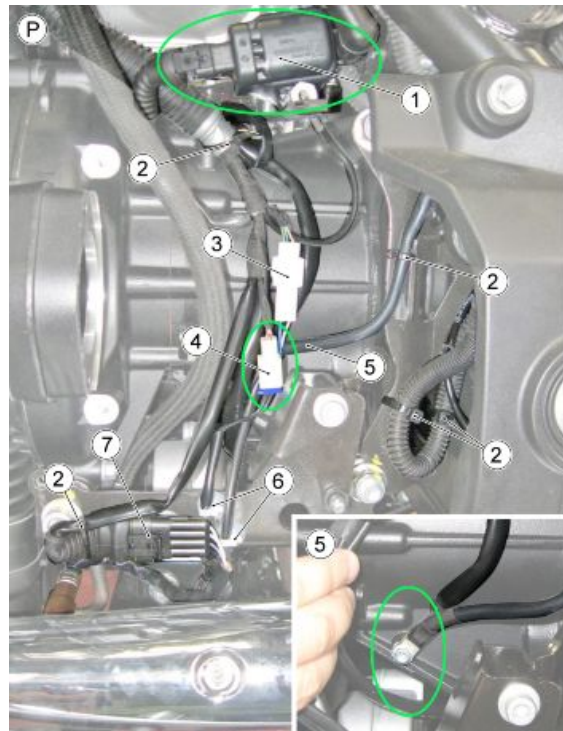


**TABLE P - STARTER MOTOR AREA**

1. Left coil.
2. Medium clamp
3. Rear stop connector.
4. Side stand connector.
5. Engine ground.
6. Clamp with support.
7. Lambda Probe Connector.

**In the engine ground cable, the two crimp connectors must be placed "back to back" as shown in the photo in order to favour the electrical contact of the surfaces.**

**Check correct fixing of the engine ground screw with the torque wrench.**

**TABLE Q - STARTER MOTOR AREA****Starter motor clamp**

1. Medium clamps.

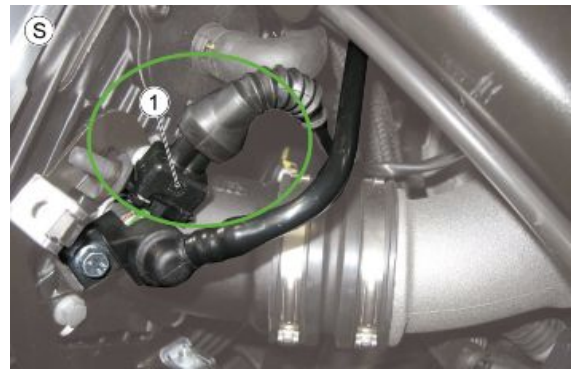
**TABLE R - STARTER MOTOR AREA**

1. Right coil connector.

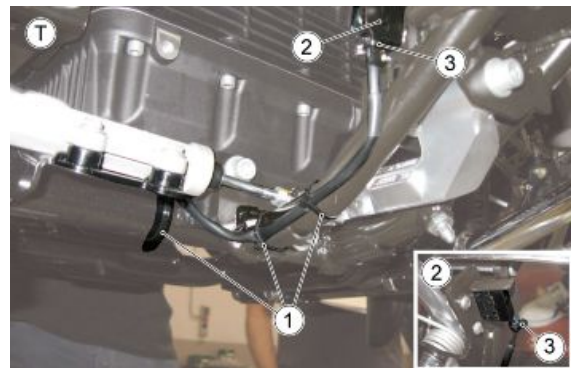


**TABLE S - STARTER MOTOR AREA**

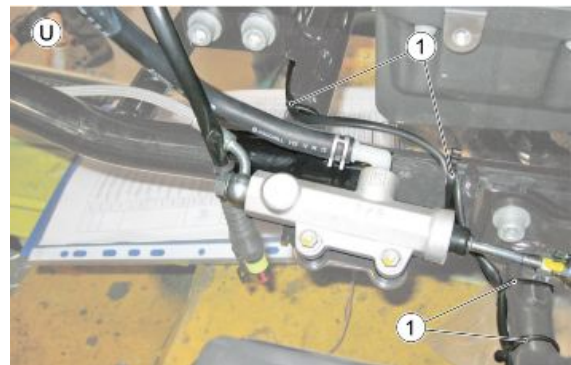
1. Left injector connector.

**TABLE T - REAR STOP SWITCH**

1. Medium clamps.
2. Rear stop switch.
3. Small clamp.

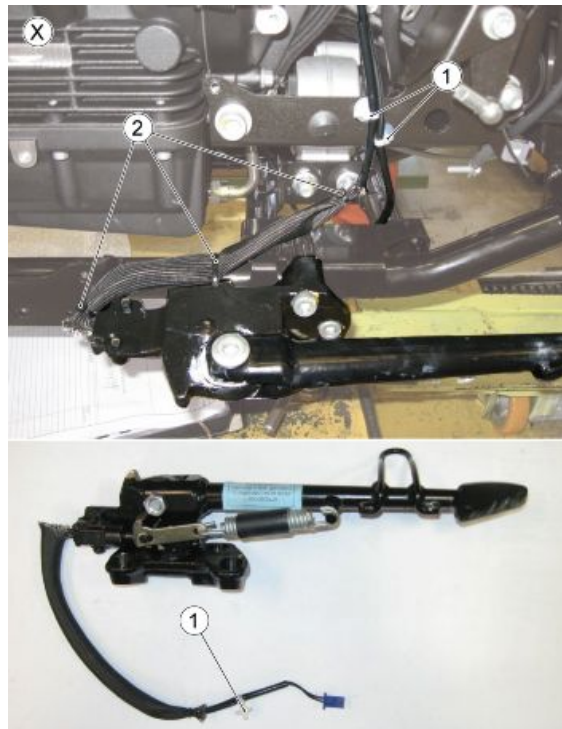
**TABLE U - REAR STOP SWITCH**

1. Medium clamps.



**TABLE X - SIDE STAND**

- 1. Clamp with support.
- 2. Medium clamp



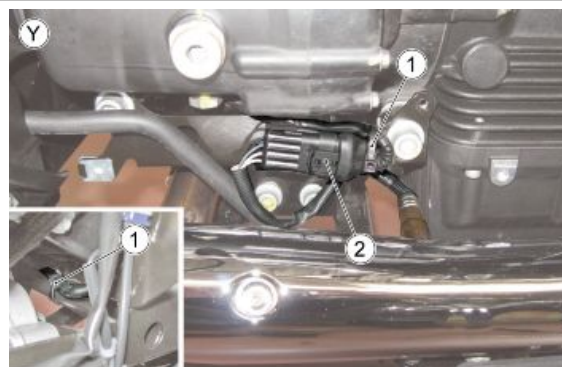
**TABLE W - REAR STOP SWITCH**

- 1. Clamp with support.



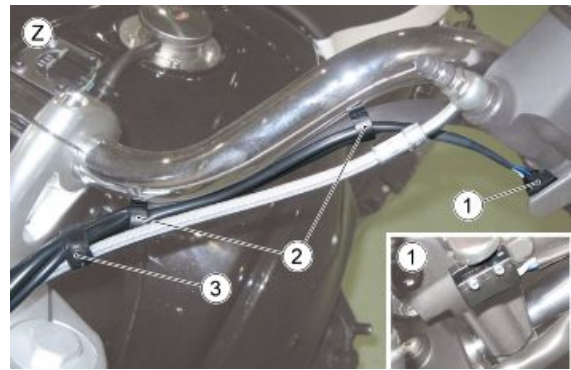
**TABLE Y - RIGHT LAMBDA FASTENING**

- 1. Medium clamp
- 2. Right lambda.



**TABLE Z - HANDLEBAR AREA**

1. Clutch switch.
2. Clip.
3. Cable guide.

**TABLE AA - HANDLEBAR AREA**

1. Front stop switch.
2. Clip.
3. Cable guide.

**TABLE BB - LEFT SIDE H.V. CABLES**

Left injector connector.

**TABLE CC - RIGHT SIDE H.V. CABLES**

Right injector and coil connector.



## Back side

### TABLE A - TAILLIGHT LICENSE PLATE LIGHT

1. Retaining clip.



### TABLE B - TAILLIGHT LICENSE PLATE LIGHT

1. Medium clamp



### TABLE C - TAILLIGHT LICENSE PLATE LIGHT

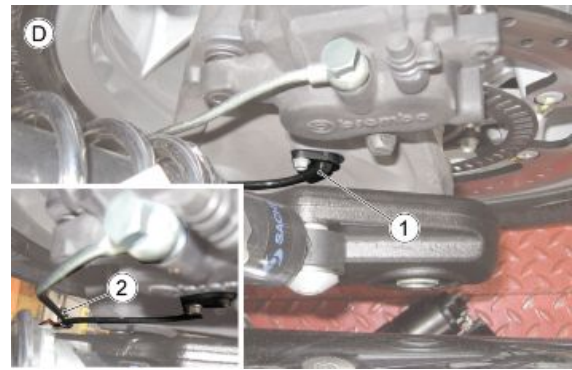
1. Hold the cable harness as shown in the figure.





**TABLE D - REAR WHEEL SPEED SENSOR**

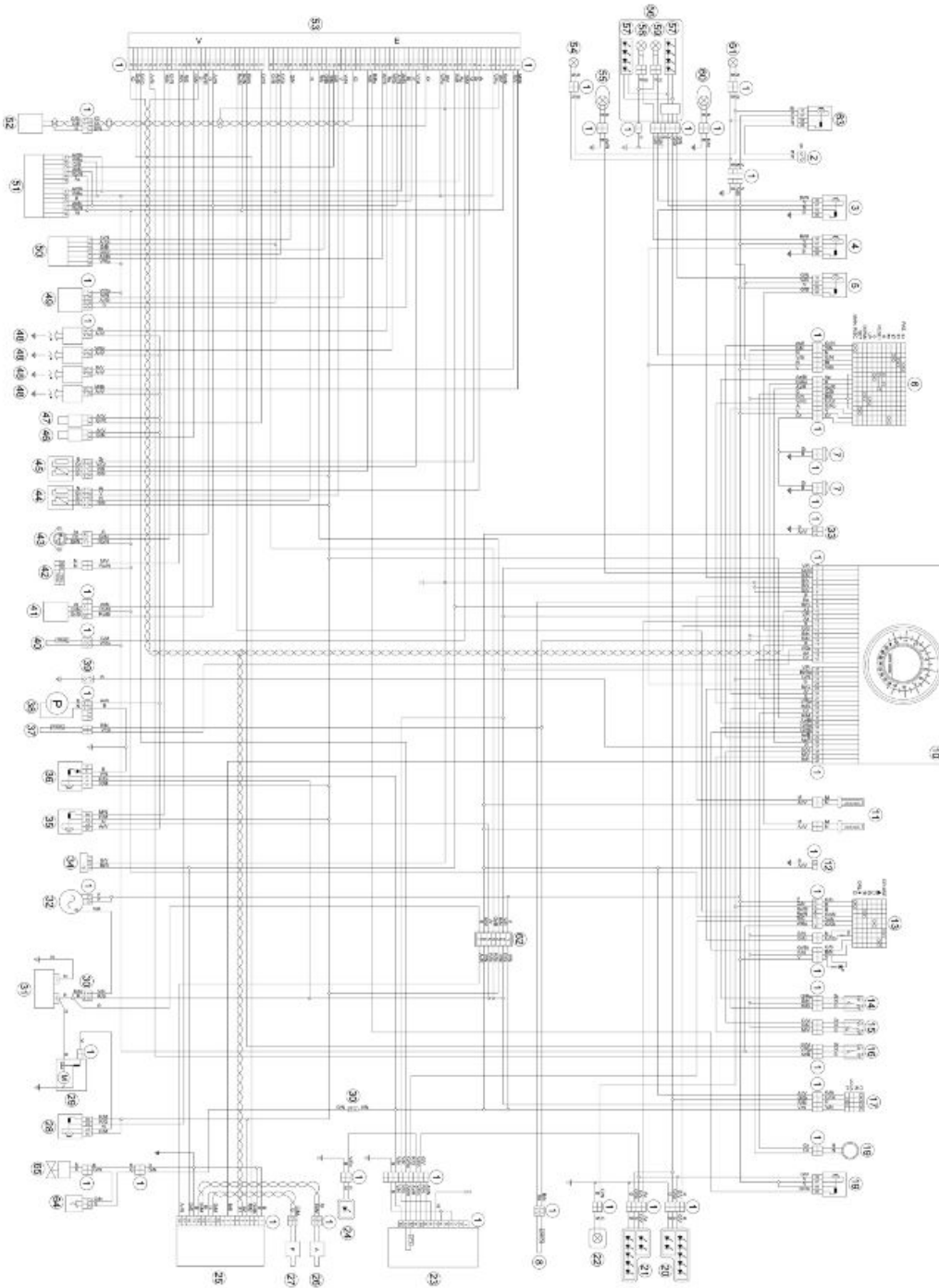
1. Rear speed sensor.
2. Medium clamp

**TABLE E - REAR WHEEL SPEED SENSOR**

1. Cable grommet.
2. Medium clamp
3. Rear speed sensor cable harness.



General wiring diagram



key:

- 1. Multiple connectors
- 2. Fog lamp switch (where provided)
- 3. Low beam light relay
- 4. High beam light relay

5. Light logic relay
6. Left light switch
7. Horn
8. Air temperature sensor
9. -
10. Instrument panel
11. Heated handgrips (where provided)
12. Power supply for GPS
13. Right light switch
14. Front stop switch
15. Rear stop switch
16. Clutch switch
17. Ignition switch
18. Immobilizer aerial
19. Recovery logic relay
20. Right fog lamp (optional)
21. Left fog lamp (optional)
22. License plate light bulb
23. Antitheft control unit (optional equipment)
24. Antitheft LED
25. ABS control unit
26. Front ABS sensor
27. Rear ABS sensor
28. Start-up relay
29. Starter motor
30. Main fuses
31. BATTERY
32. Alternator
33. Heated saddle socket
34. Diagnosis connector
35. Auxiliary injection relay
36. Main injection relay
37. Fuel reserve sensor
38. Fuel pump
39. Oil pressure sensor
40. Engine temperature sensor
41. Fall sensor (optional)
42. Side stand switch

- 43. Gear sensor
- 44. Lambda probe 2 (right)
- 45. Lambda probe 1 (left)
- 46. Right cylinder injector
- 47. Left cylinder injector
- 48. Coil
- 49. Map sensor
- 50. Motorised throttle
- 51. Handgrips position sensor
- 52. Engine speed sensor
- 53. Control unit 7sm
- 54. Left fog light (if applicable)
- 55. Front left turn indicator
- 56. Complete headlamp
- 57. Position lights and drl
- 58. High beam bulb
- 59. Low beam bulb
- 60. Front right turn indicator
- 61. Right fog light (if applicable)
- 62. AUXILIARY FUSES
- 63. Fog lamp light relay (where provided)
- 64. Thermal switch
- 65. Fan

---

## Checks and inspections

### GENERAL CONCEPTS OF ELECTRICAL TROUBLESHOOTING

THE CONNECTION DIAGRAMS ARE IN THE ELECTRICAL SYSTEM SECTIONS; PAY ATTENTION TO THESE DIAGRAMS AS THEY SHOW THE CONNECTOR/COMPONENT AS VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR/COMPONENT.

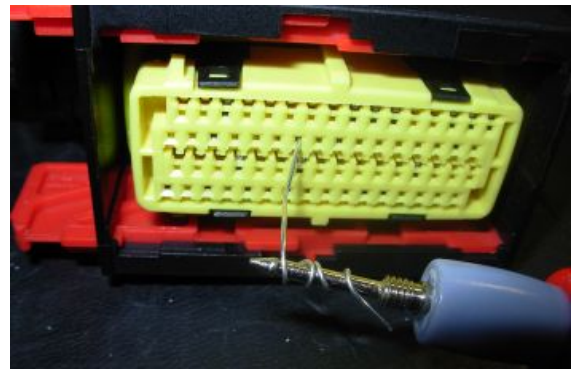
#### CAUTION

BEFORE CARRYING OUT ANY TROUBLESHOOTING PROCEDURE ON THE VEHICLE, CHECK THAT THE BATTERY VOLTAGE IS ABOVE 12V.

**CONNECTOR CHECK PROCEDURE**

The procedure includes the following checks:

1. Observation and check of the connector correct position on the component or on the coupling connector, making sure that the locking catch is released.
2. Observation of the terminals on the connector: no rust marks or dirt should be present and it is important to check terminal correct positioning on the connector (i.e., all terminals aligned at the same depth) and terminal integrity (i.e., that terminals are not loose, open/bent, etc.). For connectors whose terminals are not visible (e.g. Marelli control unit) use a metal cable of suitable diameter and introduce it carefully in the connector slot at the same depth as for the other terminals of the connector.

**CAUTION**

**IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.**

3. Pulling the cables slightly from the back of the connector in order to check the correct position of terminals on the connector and of the cable on the terminal.

**CONTINUITY check**

**Check goal:** this control is to check that there are not any circuit interruptions nor excessive resistance, for instance caused by rust, on the two terminals being inspected.

**Tester:** set the tester on the "continuity" symbol and place the tester probes on the two circuit ends: the tester emits a sound signal only if there is continuity; the tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

**CAUTION: THE CIRCUIT SHOULD NOT BE ENERGISED, OTHERWISE THE TEST IS IRRELEVANT.**

**GROUND CONNECTION check**

**Check goal:** this control is to check if a cable or a circuit is in contact with the vehicle ground (-) connection.

**Tester:** set the tester on the "continuity" symbol and place one tester probe on the vehicle ground connection (or on the battery - terminal) and the other probe on the cable being inspected: the tester sends out a sound signal only if there is continuity. The tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

---

**CAUTION! IF THERE IS A GROUND CONNECTION COMING FROM THE CONTROL UNIT, MAKE SURE THAT DURING THE TEST THE CONTROL UNIT IS GROUND CONNECTED TO THE CIRCUIT.**

#### **VOLTAGE check**

**Check goal:** this control is to check if a cable is energised, i.e. if it receives power supply from the battery or the control unit.

**Tester:** set the tester on the direct current symbol and place the tester red probe on the cable being inspected and the black probe on the vehicle ground connection (or on the battery - terminal).

#### **CAUTION**

**IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.**

---

### **GENERAL CONCEPTS OF ELECTRICAL TROUBLESHOOTING**

**THE CONNECTION DIAGRAMS ARE IN THE ELECTRICAL SYSTEM SECTIONS; PAY ATTENTION TO THESE DIAGRAMS AS THEY SHOW THE CONNECTOR/COMPONENT AS VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR/COMPONENT.**

#### **CAUTION**

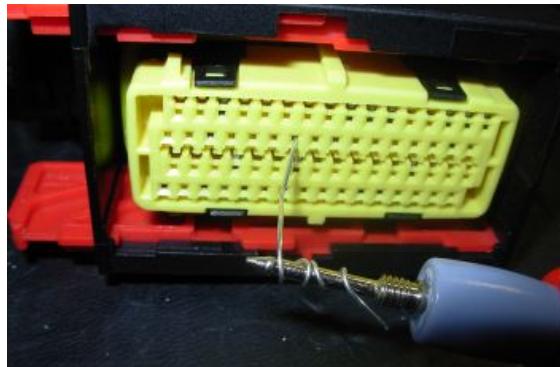
**BEFORE CARRYING OUT ANY TROUBLESHOOTING PROCEDURE ON THE VEHICLE, CHECK THAT THE BATTERY VOLTAGE IS ABOVE 12V.**

---

#### **CONNECTOR CHECK PROCEDURE**

The procedure includes the following checks:

1. Observation and check of the connector correct position on the component or on the coupling connector, making sure that the locking catch is released.
2. Observation of the terminals on the connector: no rust marks or dirt should be present and it is important to check terminal correct positioning on the connector (i.e., all terminals aligned at the same depth) and terminal integrity (i.e., that terminals are not loose, open/bent, etc.). For connectors whose terminals are not visible (e.g. Marelli control unit) use a metal cable of suitable diameter and introduce it carefully in the connector slot at the same depth as for the other terminals of the connector.



#### **CAUTION**

**IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.**

3. Pulling the cables slightly from the back of the connector in order to check the correct position of terminals on the connector and of the cable on the terminal.

#### **CONTINUITY check**

**Check goal:** this control is to check that there are not any circuit interruptions nor excessive resistance, for instance caused by rust, on the two terminals being inspected.

**Tester:** set the tester on the "continuity" symbol and place the tester probes on the two circuit ends: the tester emits a sound signal only if there is continuity; the tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

**CAUTION: THE CIRCUIT SHOULD NOT BE ENERGISED, OTHERWISE THE TEST IS IRRELEVANT.**

#### **GROUND CONNECTION check**

**Check goal:** this control is to check if a cable or a circuit is in contact with the vehicle ground (-) connection.

**Tester:** set the tester on the "continuity" symbol and place one tester probe on the vehicle ground connection (or on the battery - terminal) and the other probe on the cable being inspected: the tester sends out a sound signal only if there is continuity. The tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

**CAUTION! IF THERE IS A GROUND CONNECTION COMING FROM THE CONTROL UNIT, MAKE SURE THAT DURING THE TEST THE CONTROL UNIT IS GROUND CONNECTED TO THE CIRCUIT.**

#### **VOLTAGE check**

**Check goal:** this control is to check if a cable is energised, i.e. if it receives power supply from the battery or the control unit.

**Tester:** set the tester on the direct current symbol and place the tester red probe on the cable being inspected and the black probe on the vehicle ground connection (or on the battery - terminal).

#### **CAUTION**

**IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.**

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## **Immobiliser**

---

## System components

### Function

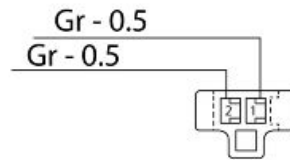
detects the transponder code in the key and sends it to the instrument panel

### Level in electrical circuit diagram:

Immobilizer

### Location:

- on the vehicle: in the instrument panel
- connector: grey two-way, under the right side steering column



### Electrical specifications

- 14 Ohm

### Pin out

not significant

### CAUTION

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

## INSTRUMENT PANEL: ERRORS

### DSB 01 Immobilizer fault

- key code read but not recognised

#### Error cause

- The read code is not stored in the instrument panel memory

#### Troubleshooting

- Carry out key data storage procedure

### DSB 02 Immobilizer fault

- read key code not read (key not present or transponder not working)

#### Error cause

- Key transponder does not communicate its own code

#### Troubleshooting

- Replace the key

### DSB 03 Immobilizer fault

- Immobilizer fault: aerial not working (open or short-circuited)

#### Error cause



- An electric interruption or a ground short circuit or voltage to the circuit have been detected

#### Troubleshooting

- Check the sensor connector on the cable harness and the instrument panel connector. If not OK, restore; if OK, check electrical characteristics and aerial circuit continuity from the instrument panel connector on PIN 24 and 34: if not OK, restore cable harness; if OK, check circuit ground insulation: if not ground insulated, restore cable harness; if insulated, with key ON, with instrument panel connector disconnected, check that there is not voltage at the circuit ends: if there is voltage, restore the cable harness

#### **DSB 04** Internal controller fault

#### Error cause

- There is a fault in the instrument panel

#### Troubleshooting

- Replace the instrument panel

---

## Dashboard

In case of doubts in operation of the engine revs indication, it is possible to connect the vehicle to the diagnostics instrument and activate the engine revs indication choosing the function "Rpm indicator" from the "Devices Activation" screen page (injector icon)

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## Start-up system check

### **Function**

Communicates to the control unit the will to start-up the engine.

### **Operation / Operating principle**

Press the start-up button to close the specific circuit taking the PIN 58 of the control unit to a voltage equal to zero (ground closing).

### **Level in electrical circuit diagram:**

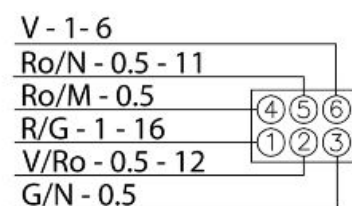
Start-up signal

### **Location:**

- on the vehicle: right light switch.
- connector: under right side steering column.

### **Electrical specifications:**

- key released: the circuit is open



- key pressed: the circuit is closed

**Pin out:**

4: voltage + 5V

5: ground connection

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Starter switch P0170

- shorted to positive / open circuit, shorted to negative.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 58; if the circuit is open, shorted to negative: voltage equal to zero has been detected.

**DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Starter switch P0169

- signal not valid.

**Error cause**

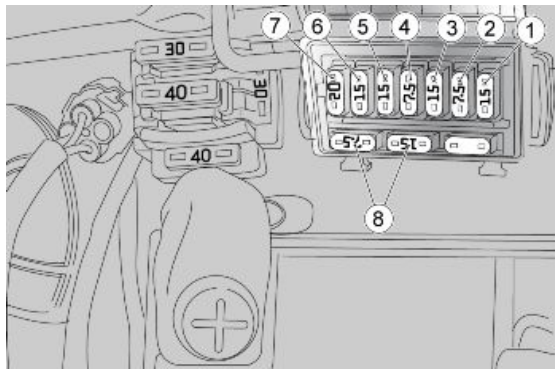
- Fault in the switch (lock) of the engine start-up. The instrument panel does not indicate the presence of this error even in the ATT status.

**Troubleshooting**

- Check the locking cause and restore.

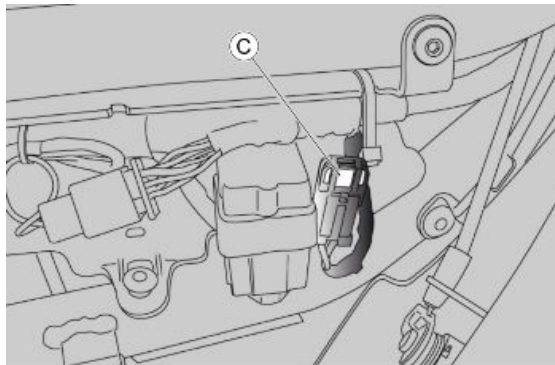
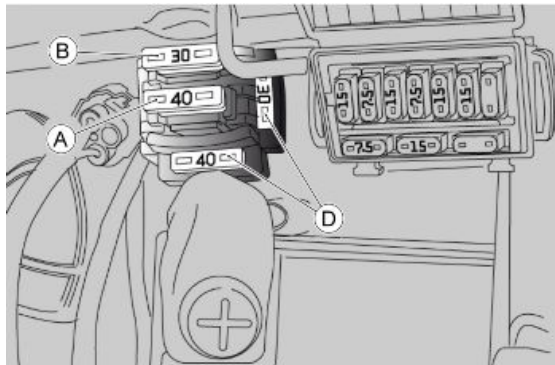
**Fuses****AUXILIARY FUSES DISTRIBUTION**

<b>Specification</b>	<b>Desc./Quantity</b>
1) 15A fuse	High beam/low beam, passing, stop light, fog light, daylight running lights, hazard button illumination, horn fuse
2) 7.5A fuse	Instrument panel power, antitheft power fuse
3) 15A fuse	ECU live positive fuse
4) 7.5A fuse	ECU permanent positive fuse
5) 15A fuse	Coils, injectors, fuel pump protection fuse
6) 15A fuse	Power socket, GPS socket, heated handgrips fuse
7) 20A fuse	ABS power fuse
8) Spare fuses	Spare fuses



**MAIN FUSES - DISTRIBUTION**

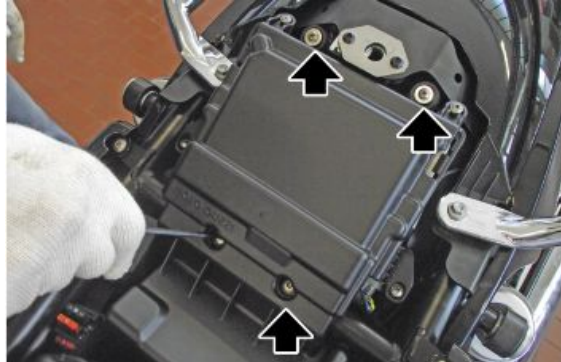
Specification	Desc./Quantity
A) 40A fuse	Battery recharge fuse
B) 30A fuse	Primary injection, key, parking lights fuse (auxiliary fuses 2, 4, 5 power)
D) spare fuses	Spare fuses
C) 10A fuse	Electric fan fuse



## Control unit

### Removal

- Remove the saddle.
- Undo and remove the four fixing screws of the battery cover.
- Remove the battery cover



- Disconnect both control unit connectors



- Undo and remove the three screws (1).
- Remove the control unit.



### NOTE

**WHEN REFITTING THE CONNECTORS, THE SLIDES MUST MOVE FREELY TO THE END OF STROKE, WHICH HELPS WITH THE INSERTION OF THE CONNECTOR: YOU MUST HEAR THE RELEASE OF THE RETAINING TANG AT THE END OF STROKE.**

### CONTROL UNIT - Diagnosis

#### Function

it controls the Ride by wire system, the injection/ignition, the system safety checks and the self-diagnosis function

#### Level in electrical circuit diagram:

Each level in which the main component involves the control unit

#### Location:

- on the vehicle: above the battery

- connector: on the ECU 52 PIN ENGINE connector (figure 1), 28 PIN VEHICLE connector (figure 2)

**Pin out:** See the CONNECTORS section

**DIAGNOSTICS INSTRUMENT: PARAMETERS ISO Screen page**

(screen/example value with key set to ON)

- Drawing number / -
- Marelli spare part code / IAW7SMHW430
- Hardware number / 00
- Mapping / -
- Software version number / 0000
- Type-approval Code / -
- ISO Code / -
- Marelli software code / -
- Control unit series number (NIP) / 7SMPRA119 - Identifies the single control unit
- Person in charge for last programming / - Indicates the series number of the DIAGNOSTICS INSTRUMENT that has carried out the last control unit remapping

**DIAGNOSTICS INSTRUMENT: PARAMETERS**

Nominal idle speed

- Example value with key ON: 1600 rpm

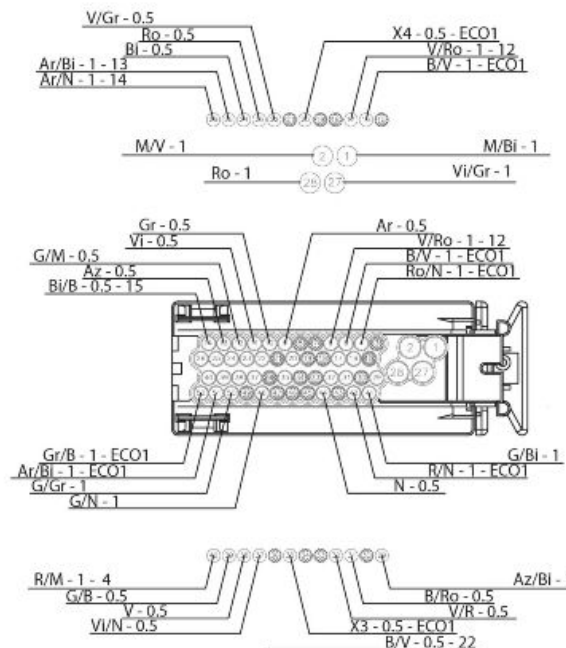
Adjustable fuel supply

Adjustable fuel correction

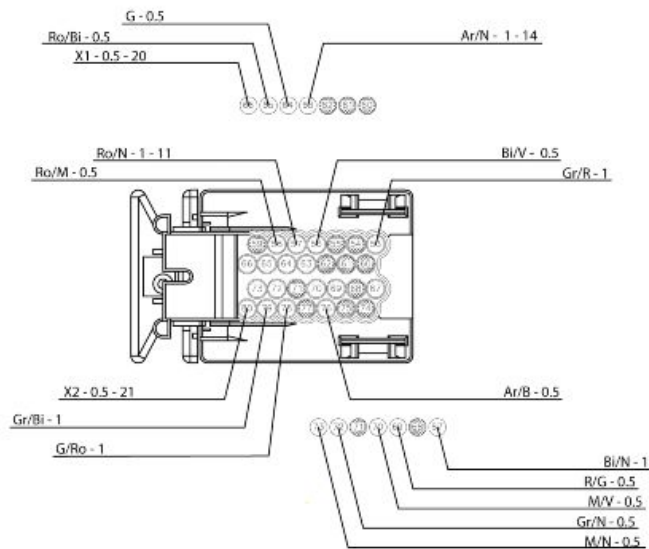
**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

①



②



## DIAGNOSTICS INSTRUMENT: STATUSES

### Engine status

- Indefinite\_Key ON\_Running engine\_Stopped\_Power latch\_Power latch 2\_Power latch finished

### Engine mode

- Indefinite\_Start-up\_Stable\_Idle\_Acceleration\_Deceleration\_Enters Cut Off\_Cut Off\_Exits Cut Off

### Immobilizer signal

- yes/no
- Indicates whether the control unit has received the consent by the instrument panel regarding the immobilizer: coded key or user code entered manually. Potential errors will be shown on the Instrument Panel Errors screen page, on the DIAGNOSIS section of the instrument panel

### Start-up enabling

- yes/no
- Indicates whether the control unit will enable start-up when requested: in case the safety measures are not respected (side stand, neutral sensor and clutch in correct position) or the fall sensor is inverted or if the immobilizer does not send the start-up consent to the control unit, the status is NO

## DIAGNOSTICS INSTRUMENT: ACTIVATION

### Stop light

- The stop light logic relay is energised (No. 19 on the electrical circuit diagram, position to the right of the battery, in any case VERIFY identification of the relay with the colour of the cables)

Error clearing

Ambient parameter reading

- Throttle position objective angle
- Rear throttle position
- Front throttle position
- Engine Temp. before Recovery
- Cylinders intake average pressure
- Engine rpm
- Indicated average torque
- Engine status - Indefinite\_Key ON\_Running engine\_Stopped\_Power latch\_Power latch 2\_Power latch finished
- Odometer
- Mapping selection - Indefinite/Track/Sport/Road

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

EEPROM Error P0601

- circuit not operational

##### **Error cause**

- Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

RAM Error P0604

- circuit not operational

##### **Error cause**

- Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

ROM Error P0605

- circuit not operational

##### **Error cause**

- Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

A/D converter P0607

- circuit not operational

##### **Error cause**

- Replace injection ECU

Stop lights relay error P0610

- short circuit to positive/ short circuit to negative / open circuit

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 31. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected

**Troubleshooting**

- If shorted to positive: check the relay electrical specifications are correct by disconnecting it from the cable harness. If they are not correct, replace the relay; if OK, restore the cable harness (Blue/Pink cable)
- If shorted to negative: check the relay electrical specifications are correct by disconnecting it from the cable harness. If they are not correct, replace the relay; if OK, restore the cable harness (Blue/Pink cable)
- If the circuit is open: check the relay electrical characteristics are correct by disconnecting it from the cable harness; if not OK, replace the relay, if OK, check relay connector, engine-vehicle cable harness connector and ENGINE connector of the Marelli control unit: if not OK, restore; if OK, check continuity of cable harness (Blue/Pink cable)

**DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Level 2 safety reset P0608

**Error cause**

- As the level 2 safety system (comparison between requested torque and calculated torque) has detected a fault, the control unit has reset engine (C gravity). The instrument panel does not indicate the presence of this error even in the ATT status.

**Troubleshooting**

- Continue fault search for the other errors detected

Safety Engine Stop P0609

**Error cause**

- Since the safety system has detected a serious fault, the control unit has shut off the engine

**Troubleshooting**

- Continue fault search for the other errors detected.

Saved data file (for safety) P0611

- Filled

**Error cause**

- This indication appears only if the Level 2 safety has reset the engine (C gravity). The instrument panel does not indicate the presence of this error even in the ATT status

**Troubleshooting**



- Continue fault search for the other errors detected.

**CAUTION**

**DELETING ALL THE SAVED DATA WHEN THE VEHICLE IS BEING MANUFACTURED (INCLUDING THE SELF-ADJUSTABLE PARAMETERS), THEN YOU MUST SELECT: HANDLE SELF-LEARNING AND CHECK THE TWO "AUTOMATIC FRONT HANDLE SELF-LEARNING" AND "AUTOMATIC REAR HANDLE SELF-LEARNING" STATUSES ARE "PERFORMED".**

**See also**

[Cylinders synchronisation](#)

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Saved data file download

**Error cause**

- The BUFERSVXX.BIN file is saved in the Navigator memory card or in your hard disk PC, if you are using Piaggio Group Diagnostic Software combined to Navigator: data regarding the control unit serial number and the serial number of the Navigator that has carried out the download is also included in that file

Saved data file deletion

**Error cause**

- Deletion enabled only if the file is downloaded after setting KEY ON

**NEW CONTROL UNIT ACTIVATION PROCEDURE and REPROGRAMMING**

After installing the control unit for the first time, or after REPROGRAMMING the control unit with a different or more updated mapping, turn the key to ON and wait 3 seconds; during this time the control unit carries out throttle position acquisition. Connect to diagnosis instrument and check that the statuses "Front throttle automatic self-learning" and "Rear throttle automatic self-learning" are "Carried out" and "Handle self-learning" is "Not carried out" (this last status entails Urgent service being displayed on the instrument panel). If front and rear throttle automatic self-acquisition indicate "Not carried out" go to phase 1, if indicate "Carried out" go to phase 2. Phase 1: current errors have probably been detected by the control unit: solve these malfunctions and check the two statuses. Throttle Self-learning can also be checked from the Parameter adjustment (screwdriver and hammer) screen page. Stage 2: Carry out the Handle Self-learning from the Parameter adjustment (screwdriver and hammer) screen page and check that Handle Self-learning status is Carried out. If not OK the voltage detected on the throttle is out of scale (check with diagnosis instrument) or current errors have been probably detected by the control unit: solve these malfunctions and repeat the procedure

---

## Engine rpm sensor

### Function

informs crankshaft position and speed to the Marelli control unit

### Operation / Operating principle

inductive sensor: sinusoidal-type generated voltage; two teeth are missing on the flywheel for the reference position

### Level in electrical circuit diagram:

Engine speed sensor

### Location:

- on the vehicle: front left part of the engine under the alternator
- connector: under fuel tank

### Electrical specifications:

0.79 kohm at ambient temperature

### Pin out:

1. negative signal
2. positive signal
3. shielding with ground connection

### DIAGNOSTICS INSTRUMENT: PARAMETERS

Engine rpm: rpm

#### CAUTION

BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

### DIAGNOSTICS INSTRUMENT: STATUSES

Synchronised panel

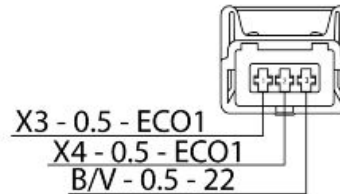
- No\_under analysis\_standby\_Yes

### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

#### CAUTION

IF THE ELECTRIC CIRCUIT IS INTERRUPTED OR SHORT-CIRCUITED, NO ERROR IS DISPLAYED. CHECK THE ENGINE SPEED SENSOR CONNECTOR AND THE MARELLI CONTROL UNIT CONNECTOR: IF NOT OK, RESTORE; IF OK, CHECK THE CORRECT ELECTRIC CHARACTERISTICS OF THE SENSOR: IF NOT OK, REPLACE THE SENSOR. IF OK, CHECK THAT THERE IS CONTINUITY ON BOTH CABLES, SUPPLY INSULATION AND GROUND INSULATION. CARRY OUT THE TESTS FROM THE SENSOR CONNECTOR TO THE SENSOR. IF NOT OK, RESTORE THE CABLE HARNESS/REPLACE THE SENSOR. IF OK, PERFORM THE TEST FROM PIN 20 AND 35 OF THE MARELLI CONTROL UNIT ENGINE CONNECTOR.

### DIAGNOSTICS INSTRUMENT: LOGIC ERRORS



Engine speed sensor P0336

- signal not valid

#### **Error cause**

- Probable bad contact in the electric circuit detected at PIN 20 - 35 of the ENGINE connector

#### **Troubleshooting**

- Check the electric circuit is in good conditions and the flywheel teeth cleaning and correct positioning of the sensor in its own housing: if it is not, replace it. If it is OK, replace the sensor

---

## **Twistgrip position sensor**

### **Removal**

- Remove the tank.
- Loosen the throttle cable nuts.
- Remove the cables pulling them out.



- Disconnect the two connections.
- Undo the two fixing screws of the hand-grip position sensor.



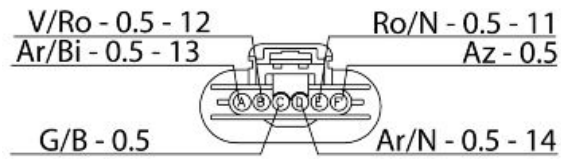
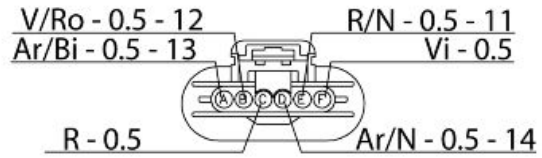
## THROTTLE GRIP POSITION SENSOR

### Function

The throttle grip is the part to which the throttle control cables arrive; its task is to translate the rider's power request (Demand) into an electrical signal to be sent to the electronic control unit.

### Operation / Operating principle

The two throttle cables (opening and closing) actuate on a scroll mounted on a shaft which is sent back to its home position by a return spring. On the shaft covers there are 2 double track potentiometers (4 control tracks) by means of which the torque demand is read (and checked). The 4 potentiometers are tinned and magnetically controlled (contactless); they cannot be overhauled nor replaced



**Level in electrical circuit diagram:** Throttle grip position sensor.

### Location:

- on the vehicle: under the fuel tank
- connector: on the sensor

### Electrical specifications:

- Not detected by a multimeter as they are contactless: read the voltage of the 4 tracks by the diagnostics instrument.

### MASTER connector (blue)

- A: Track A power (orange/white cable)
- B: Track A ground (green/pink cable)
- C: Track A signal (red cable)
- D: Track B power (orange/black cable)
- E: Track B ground (red/black cable)
- F: Track B signal (purple cable)

### SLAVE connector (white)

- A: Track C power (orange/white cable)
- B: Track C ground (green/pink cable)
- C: Track C signal (yellow/blue cable)
- D: Track D power (orange/black cable)
- E: Track D ground (red/black cable)

- F: Track D signal (light blue cable)

#### **DIAGNOSTICS INSTRUMENT: PARAMETERS**

Blue front connector throttle grip position sensor - track A

- Sample value with throttle released: 1044 mV

Voltage value of the front potentiometer - track A

Blue front connector throttle grip position sensor - track B

- Sample value with throttle released: 967 mV

Voltage value times 2 of the front potentiometer track B

White rear connector throttle grip position sensor - track C

- Sample value with throttle released: 3757 mV

Voltage value of the rear potentiometer track C

White rear connector throttle grip position sensor - track D

- Sample value with throttle released: 3796 mV
- Example value with engine on: -

Throttle grip opening percentage

- Example value with key ON: 0 mV
- Example value with engine on: -

The sum of the voltage between A and C must be about 5V

With a released throttle grip, the value read should be 0%, whereas 100 % should be read with throttle grip fully twisted.

#### **DIAGNOSTICS INSTRUMENT: STATUSES**

Throttle grip

- Slightly twisted\_choked\_fully twisted

Handle self-learning

- carried out/not carried out

#### **CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Blue front connector throttle grip position sensor - track A P0150

- short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 39 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 39 of the ENGINE connector.

#### **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the BLUE front connector Throttle Grip Position Sensor - track A: disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the key set to ON, check that there is power supply for the potentiometer PIN A and that PIN C is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

Blue front connector throttle grip position sensor - track B P0151

- short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 13 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 13 of the ENGINE connector

#### **Troubleshooting**

- short circuit to positive: check the value shown by the parameter of the BLUE front connector Throttle Grip position Sensor track B: disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the switch key set to ON, check that there is power supply for the potentiometer PIN D and that PIN F is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

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White rear connector throttle grip position sensor - track C P0152

- short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 23 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 23 of the ENGINE connector

#### **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the white rear connector Throttle Grip Position Sensor - track C: disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: with open circuit, short it to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the key set to ON, check that there is power supply for the potentiometer PIN A and that PIN C is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

White rear connector throttle grip position sensor - track D P0153

- short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 11 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 11 of the ENGINE connector

#### **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the white rear connector Throttle Grip Position Sensor - track D: disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the switch key set to ON, check that there is power supply for the potentiometer PIN D and that PIN F is connected to ground.

If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

#### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Blue front connector throttle grip position (tracks A-B) P0154

- inconsistent signal

##### **Error cause**

- Two illogical voltage signals have been detected at PIN 13 and 39 of the ENGINE connector (tracks A-B)

##### **Troubleshooting**

- Check the parameters of the blue front connector Throttle Grip Position Sensor - tracks A and B: if one of the two values clearly deviates from 600-1400 mV, it means that this potentiometer is defective. Check the throttle grip sensor connector and the control unit connector: if not OK, restore. If OK, check that cable resistance between the throttle grip sensor connector and the control unit is a few tenths of Ohm: if this is not the case, restore wiring. If the value is correct, replace the complete throttle grip sensor

White rear connector throttle grip position (tracks C-D) P0155

- inconsistent signal

##### **Error cause**

- Two illogical voltage signals have been detected at PIN 23 and 11 of the ENGINE connector (tracks A-B)

##### **Troubleshooting**

- Check the parameters of the white rear connector Throttle Grip Position Sensor - tracks C and D: if one of the two values clearly deviates from 600-1400 mV, it means that this potentiometer is defective. Check the throttle grip sensor connector and the control unit connector: if not OK, restore. If OK, check that cable resistance between the throttle grip sensor connector and the control unit is a few tenths of Ohm: if this is not the case, restore wiring. If the value is correct, replace the complete throttle grip sensor

Throttle grip position P0156

- inconsistent signal

##### **Error cause**

- The value of the front side sensor (tracks A-B) does not coincide with the value of the rear sensor (tracks C-D)

##### **Troubleshooting**

- Replace the throttle grip sensor

#### **DIAGNOSTICS INSTRUMENT: ADJUSTABLE PARAMETERS**

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Handle self-learning: -

#### RESET PROCEDURE

- If Marelli control unit or its mapping are replaced or if you carry out control unit EEPROM zero setting or if you replace the throttle grip sensor, it is necessary to carry out the Handle self-learning procedure with the diagnostics instrument: once the check is completed, make sure that the Handle self-learning status indicates: carried out

#### CAUTION

**THE TWO CONNECTORS WHICH GET TO THE THROTTLE GRIP SENSOR ARE ALIKE BUT THEY SHOULD NEVER BE INVERTED. MARK OR CHECK THE CONNECTOR MARKING BEFORE REMOVING THEM (BLUE STAMP + BLUE BAND). THE CONNECTOR AND THE BLUE BAND SHOULD BE PLACED AT THE FRONT. THE CONNECTOR AND THE WHITE BAND SHOULD BE PLACED AT THE BACK.**

## Intake pressure sensor

### Function

The pressure sensor is essential for calculating the torque produced, for calculating the ambient pressure and for correct ignition timing during start-up.

### Operation / Operating principle

Diaphragm sensor which translates the diaphragm position into electrical voltage when in contact with the intake air.

### Level in electrical circuit diagram:

Intake air pressure sensor

### Location:

- on the vehicle: under the fuel tank on the compensator.
- connector: on the sensor.

### Electrical specifications: -

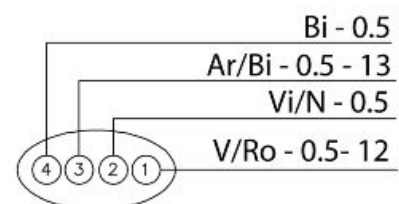
#### Pin out:

1. Ground connection
2. Temperature signal
3. Power supply 5V
4. Signal

### DIAGNOSTICS INSTRUMENT: PARAMETERS

Reference pressure Intake above sea level

- Example value with key ON: 1009 mbar
- Example value with engine on: 670 mbar



- NOTE: pressure estimated by the control unit according to the throttle position

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

P0105 cylinder air pressure sensor

- shorted to positive / open circuit, shorted to negative.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 24. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 24.

**Troubleshooting**

- If shorted to positive: verify that the parameter of the front cylinder air Pressure Sensor on the diagnostics instrument is approx. 1200 mbar; disconnect the sensor connector: if the value does not vary, it means that the cable is shorted between the control unit connector and the sensor connector: restore the cable harness; Replace the sensor if the value varies.
- If the circuit is open, shorted to negative: check the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, with key set to OFF, check if there is continuity between the PIN 24 of the Marelli control unit and the sensor connector PIN 4: if there is no continuity, restore the cable harness. If there is continuity, check the cable ground insulation: if there is continuity to ground, restore the cable harness; if not, with key set to ON check that the voltage on sensor connector PIN 3 is approx. 5 V: if not OK, set the key to OFF and check continuity between the ENGINE connector PIN 51 and the sensor connector PIN 3: if not OK, restore the cable harness; if OK, replace the control unit; if there is 5V voltage at PIN 3, and with key set to ON, check the continuity to ground of the sensor connector PIN 4: if not OK, restore the cable harness; if OK, replace the sensor.

**DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

P0107 air pressure sensor

- signal not valid.

**Error cause**

- According to the engine operation data (rpm, throttle, etc.) an average value for the intake pressure is estimated: if the value read deviates by a given percentage, this error is activated. The most frequent causes can be: abnormal resistance in the sensor circuit (for example, rusted terminals) or sensor with poor performance.

**Troubleshooting**

- Check the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, check that resistance between ENGINE connector PIN 24 and sensor

connector PIN 4 is a few tenths of an Ohm; If it is above that value, restore cable harness.  
Replace the sensor if it is correct.

Error due to unexpected air intake in the manifold P0210

- signal not valid.

**Error cause**

- A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is higher than the estimated one (intake manifold conditions).

**Troubleshooting**

- Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.

Estimation error for front cylinder intake manifold pressure P0215

- too high pressure/too low pressure.

**Error cause**

- A substantial difference between the estimated pressure and the measured pressure has been detected (for example, the hole for pressure reading is clogged or sensor screw is loose).

**Troubleshooting**

- Check the conditions of the intake manifold and cleanliness of the hole for reading the pressure: there is an evident defect in the intake and pressure reading systems.
- 

Manifold pressure too low error P0217

- signal not valid.

**Error cause**

- A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is below the estimated one (for example, smeared throttle body).

**Troubleshooting**

- Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

air temperature sensor P0110

- open circuit, shorted to positive / shorted to negative

**Error cause**

- If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 37 of the ENGINE connector. If shorted to negative: voltage equal to zero has been detected. The instrument panel does not indicate the presence of this error even in the ATT status.

### Troubleshooting

- If the circuit is open, shorted to positive: check the sensor connector and the Marelli control unit connector. If they are OK, check sensor continuity: replace the sensor if not OK; if OK, check continuity between the ENGINE connector PIN 37 and the sensor PIN 2: restore cable harness if there is not continuity; if it is OK, reconnect the control unit connector and, with key set to key ON, check the continuity between the sensor connector PIN 1 and the vehicle ground connection: if OK, it means that the error cause is that the cable is shorted to positive and it is necessary to restore the cable harness between ENGINE PIN 37 and sensor PIN 2; check the sensor connector and the Marelli control unit connector. If not OK, restore the cable harness. If OK, check continuity between the ENGINE connector PIN 6 or 17 and the sensor connector PIN 1: restore the cable harness if there is not continuity. If there is, it means that the control unit does not supply the ground connection and therefore should be replaced
- If shorted to negative, check sensor correct resistance: if resistance = 0, replace the sensor; if resistance is correct, it means that the Purple/Black cable has ground connection: restore the cable harness

## Lambda sensor

### Function

In charge of telling the control unit whether the mixture is lean or rich

### Operation / Operating principle

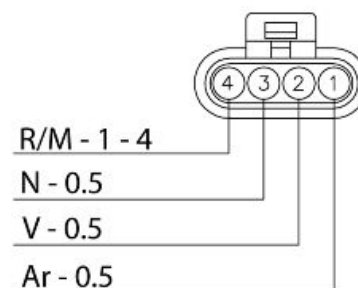
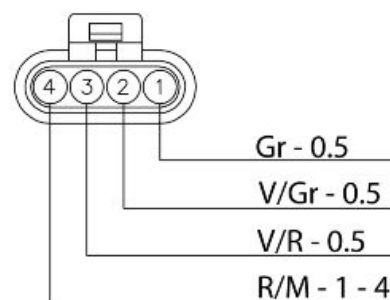
The Marelli injection control unit reads and interprets a voltage generated by the difference in oxygen content between the exhaust fumes and the ambient. It does not require an external supply source but, in order to work properly, it should reach a high operating temperature: that is why there is a heating circuit inside

### Level in electrical circuit diagram:

Lambda probe

### Left lambda position:

- on the vehicle: exhaust muffler under the rear head along the exhaust



- connector: left side above the footrest

**Right lambda position:**

- on the vehicle: exhaust muffler under the rear head along the exhaust
- connector: right side above the footrest

**Electrical specifications**

- Heater circuit: 7-9 $\Omega$  at Ambient temp.

**Pin out for both sensors:**

1. Sensor signal + (black wire)
2. Sensor signal - (grey wire)
3. Heater ground connection (white cable)
4. Heater power supply (white cable)

**DIAGNOSTICS INSTRUMENT: PARAMETERS**

## Oxygen sensor

- Example value with key ON: 0 mV
- Example value with engine on:  
100--900 mV

If there is a short circuit at + 5 V or above, the oxygen sensor parameter is not equal to the value read by the control unit; a recovery value is displayed instead

## Lambda sensor correction

- Example value with key ON: 1.00 mV
- Example value with engine on: 0.90 - 1.10mV

In closed loop, the value must be close to 1.00 (values not within the 0.90 - 1.10 interval indicate a fault): for example, value 0.75 corresponds to +25% with respect to the reference injection time; 1.25 corresponds to -25%. In an open circuit, the oxygen sensor signal is too low. Therefore, the control unit takes it as a lean combustion condition and will try to enrich it. The value read will be 0.75: once this correction has been tried, the value shifts to 1.00 fixed and the Oxygen sensor error is signalled

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: STATUSES**

Oxygen sensor: Start-up\_Lean\_Rich\_Fault due to rich value\_Fault due to lean value

- If the probe connector is removed (voltage almost equal to zero), the status is Fault due to lean value

Lambda check: Open loop/Closed loop/Rich in closed loop/Lean in closed loop/enriched

- Closed loop indicates that the control unit is using the oxygen sensor signal to keep the combustion as close as possible to the stoichiometric value.

**DIAGNOSTICS INSTRUMENT: ACTIVATION**

Oxygen sensor heating

- The auxiliary injection relay (No. 28 in the wiring diagram, right side, in the two relay box; CHECK, however, the identification of the relay with the colour of the cables) is energised and the heating circuit is closed to ground 5 times (pin 3 on the lambda probe connector). The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

'left cylinder lambda probe P0130

- shorted to positive

**Error cause**

- Excessive voltage (battery voltage) has been detected at PIN 10 and 22 of the ENGINE connector. Caution: the 'Oxygen sensor' parameter is not the real value that is read; a recovery value is displayed instead. The instrument panel does not indicate the presence of this error even in the ATT status.

**Troubleshooting**

- shorted to positive: with key set to ON, disconnect the sensor connector and measure PIN 1 voltage on the cable harness side (grey cable): if there is voltage (5 or 12 V), restore the cable harness; if there is not, replace the oxygen sensor

'Heating left cylinder lambda probe P0135

- short circuit to positive/ open circuit, short circuit to negative

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 32 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected

at PIN 32 of the ENGINE connector. The instrument panel does not indicate the presence of this error even in the ATT status.

### **Troubleshooting**

- If shorted to positive: disconnect the probe connector and check the sensor correct resistance: replace the sensor if not OK; if it is OK, restore the cable harness (Green/Red cable)
- If circuit is open, shorted to negative: check circuit continuity from probe connector (PIN 3 and 4) toward the probe: if it is not OK, replace the probe; if it is OK, check the sensor connector and the Marelli control unit connector: if it is not OK, restore; if it is OK, with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if it is not OK, check the Red/Brown cable continuity between the probe connector and the auxiliary injection relay (No. 28 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil, lower and upper injector and secondary air errors, check the relay and its excitation and power line; if there is voltage at PIN 4, check the Green/Red cable ground insulation (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the Green/Red cable (between the sensor connector PIN 3 and the ENGINE PIN 32) and restore the cable harness.

### **WARNING**

The control unit does not detect the following malfunctions of the oxygen sensor circuit according to the signal: interrupted circuit, shorted to ground or sensor malfunction (for example non variable voltage). In case of fault indication, carry out the following troubleshooting.

### **Troubleshooting**

- Check circuit continuity from probe connector (PIN 1 and PIN 2) toward the probe: replace the oxygen sensor if there is no continuity; if there is continuity, check the sensor connector and the Marelli control unit connector: If not OK, restore. If OK, check continuity between the ENGINE connector PIN 22 and PIN 10 and restore the cable harness.

'right cylinder lambda probe P0136

- shorted to positive

### **Error cause**

- Excessive voltage (battery voltage) has been detected at PIN 9 and 38 of the ENGINE connector. Caution: the 'Oxygen sensor' parameter is not the real value that is read; a recovery value is displayed instead. The instrument panel does not indicate the presence of this error even in the ATT status.

### **Troubleshooting**

- shorted to positive: with key set to ON, disconnect the sensor connector and measure PIN 1 voltage on the cable harness side (grey cable): if there is voltage (5 or 12 V), restore the cable harness; if there is not, replace the oxygen sensor

'Heating right cylinder lambda probe P0141

- short circuit to positive/ open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 38 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 38 of the ENGINE connector. The instrument panel does not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

- If shorted to positive: disconnect the probe connector and check the sensor correct resistance: replace the sensor if not OK; if it is OK, restore the cable harness (Black cable)
- If circuit is open, shorted to negative: check circuit continuity from probe connector (PIN 3 and 4) toward the probe: if it is not OK, replace the probe; if it is OK, check the sensor connector and the Marelli control unit connector: if it is not OK, restore; if it is OK, with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if it is not OK, check the Red/Brown cable continuity between the probe connector and the auxiliary injection relay (No. 28 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil, lower and upper injector and secondary air errors, check the relay and its excitation and power line; if there is voltage at PIN 4, check the Black cable ground insulation (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the Black cable (between the sensor connector PIN 3 and the ENGINE PIN 38) and restore the cable harness.

#### **WARNING**

The control unit does not detect the following malfunctions of the oxygen sensor circuit according to the signal: interrupted circuit, shorted to ground or sensor malfunction (for example non variable voltage). In case of fault indication, carry out the following troubleshooting.

#### **Troubleshooting**

- Check circuit continuity from probe connector (PIN 1 and PIN 2) toward the probe: replace the oxygen sensor if there is no continuity; if there is continuity, check the sensor connector and the Marelli control unit connector: If not OK, restore. If OK, check continuity between the ENGINE connector PIN 38 and PIN 9 and restore the cable harness.
-

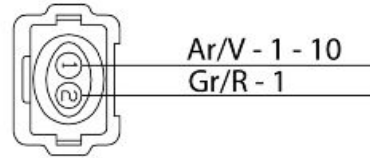


## Injector

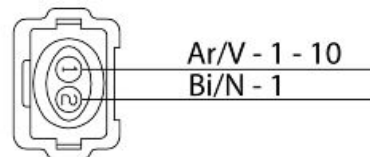
### Injectors key:

1. Front injector
2. Rear injector

①



②



## INJECTOR

### Function

To supply the correct amount of petrol at the right timing.

### Operation / Operating principle

Injector coil is energised for the petrol passage to open

### Level in electrical circuit diagram:

Coils and injectors

### Location:

- on the vehicle: intake manifold on the cylinder
- connector: on injectors

### Electrical specifications:

14.8Ω ± 5% (at ambient temp)

### Pin out left cylinder:

1. Power (orange/green cable)
2. Ground (grey/red cable)

### Pin out right cylinder:

1. Power (orange/green cable)
2. Ground (white/black cable)

### DIAGNOSTICS INSTRUMENT: PARAMETERS

Left cylinder injection time

- Example value with engine on: 1.9 ms

Right cylinder injection time

- Example value with engine on: 1.9 ms

#### CAUTION

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

#### DIAGNOSTICS INSTRUMENT: ACTIVATION

'Left cylinder injector

- The auxiliary injection relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

'Right cylinder injector

- The auxiliary injection relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

#### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

'Left cylinder injector: P0205

- short circuit to positive/ short circuit to negative / open circuit

#### Error cause

- If shorted to positive: excessive voltage has been detected at PIN 53. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected

#### Troubleshooting

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the DIAGNOSTICS INSTRUMENT and check the voltage on the Grey/Red cable on the injector connector (if there is voltage): if there is voltage, restore the filter box cable harness. If there is no voltage, replace the sensor
- If shorted to negative: disconnect the injector connector, set the key to ON and check if there is a ground connection on the Grey/Red cable: if there connection, restore the cable harness. If there is no connection, replace the injector.
- If the circuit is open: check the component correct electrical characteristic: if it is not the correct one, replace the component; if it is correct, check the connector on the component

and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between PIN 53 and component PIN 2 and restore the cable harness

'Right cylinder injector P0205

- short circuit to positive/ short circuit to negative / open circuit

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 67. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected

#### **Troubleshooting**

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnostics instrument and check the voltage on the White/Black cable on the injector connector (if there is voltage): if there is voltage, restore the filter box cable harness. If there is no voltage, replace the sensor
- If shorted to negative: disconnect the injector connector, set the key to ON and check if there is a ground connection on the White/Black cable: if there connection, restore the cable harness. If there is no connection, replace the injector.
- If the circuit is open: check the component correct electrical characteristic: if it is not the correct one, replace the component; if it is correct, check the connector on the component and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between the ENGINE PIN 67 and component PIN 2 and restore the cable harness

## Fuel pump

### **Function**

Fuel pump: keeps pressure of the injectors supply duct.

### **Level in electrical circuit diagram:**

Injection load relay

### **Location:**

- on the vehicle: under the tank.
- connector: near the fuel pump (2 ways, black).

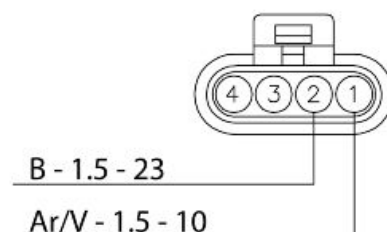
### **Electrical specifications:**

PIN 1-2: 0.5 - 1 ohm;

### **Pin out:**

1. + 12 V (orange/green cable)
2. Ground (blue cable)

**CAUTION**  
BEFORE CARRYING OUT ANY TROUBLESHOOTING,  
CAREFULLY READ THE GENERAL TROUBLESHOOTING



CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

### DIAGNOSTICS INSTRUMENT: ACTIVATION

Fuel pump

NOTE: The auxiliary injection relay (No. 35 on the electrical circuit diagram, in the two relay box, however VERIFY the identification of the relay with the colour of the cables) is energised for 30 seconds.

The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

fuel pump relay control P0230

- shorted to positive / open circuit, shorted to negative.

#### Error cause

- If shorted to positive: excessive voltage has been detected at PIN 73 of the VEHICLE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 73 of the VEHICLE connector.

#### Troubleshooting

- If shorted to positive: check whether the relay electrical specifications are correct by disconnecting it from the cable harness. If are not OK, replace the relay; if OK, restore the cable harness (Brown/Black cable).
  - If the circuit is open, shorted to negative: check the relay electrical characteristics are correct by disconnecting it from the cable harness; if it is not OK, replace the relay, if it is OK, check relay connector, engine-vehicle cable harness connector and VEHICLE connector of the Marelli control unit: if not OK, restore; if OK, check continuity of cable harness (Brown/Black cable)
-

## Coil

### Function

Spark generation

### Operation / Operating principle

Inductive discharge system

### Level in electrical circuit diagram:

coils and injectors

### Location:

- connector: on the sensor
  - on the vehicle:
1. LEFT CYLINDER SIDE COIL, left side, on the frame ABOVE THE STARTER MOTOR.
  2. RIGHT CYLINDER SIDE COIL, right side above the rear brake reservoir.
  3. LEFT CYLINDER CENTRAL COIL, left side in front of the cylinder under the steering column.
  4. RIGHT CYLINDER CENTRAL COIL, right side immediately behind the right cylinder.

### Electrical specifications:

0.7 - 0.9  $\Omega$  at ambient temperature

### Pin out:

1. Fuel system
2. Ground connection

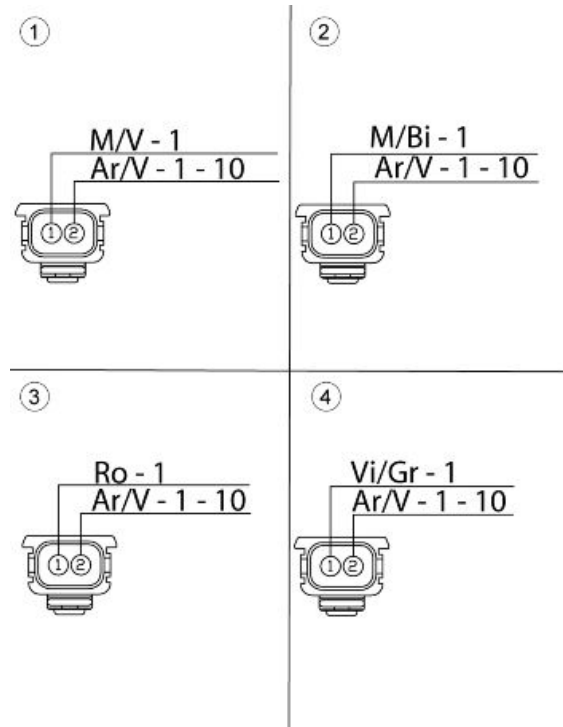
### DIAGNOSTICS INSTRUMENT: PARAMETERS

**Example value with key ON:** Current ignition advance

**Example value with engine on:** Indicates the cylinder advance where combustion will take place.

### CAUTION

BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.





## DIAGNOSTICS INSTRUMENT: ACTIVATION

### Left Cylinder Central Coil

The auxiliary relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Pink cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

### Right Cylinder Central Coil

The auxiliary relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Purple/Grey cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

### Left Cylinder Side Coil

The auxiliary injection relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Brown/Green cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

### Right Cylinder Side Coil

The auxiliary injection relay (No. 35 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the

coil Brown/White cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

**DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Left cylinder central coil P0351

- shorted to positive / shorted to negative, open circuit.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 28 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 28 of the ENGINE connector.

**Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 28: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

Right cylinder central coil P0352

- shorted to positive / shorted to negative, open circuit.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 27 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 27 of the ENGINE connector

**Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 27: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

Left cylinder side coil P0353

- shorted to positive / shorted to negative, open circuit.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 2 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 2 of the ENGINE connector.

**Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 2: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

## Right cylinder side coil P0354

- shorted to positive / shorted to negative, open circuit.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 1 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 1 of the ENGINE connector.

**Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 1: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
  - If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the cable ground insulation (from coil connector or control unit connector), if not OK, restore cable harness
-



## Throttle body

### Function

To send the throttle position to the injection control unit and to activate the throttle itself based on the request from the control unit

### Operation / Operating principle

All the unit internal components (potentiometer and electric motor) are contactless; therefore, no electrical diagnosis is possible for the throttle body, but for the circuits connected to it only.

### Level in electrical circuit diagram:

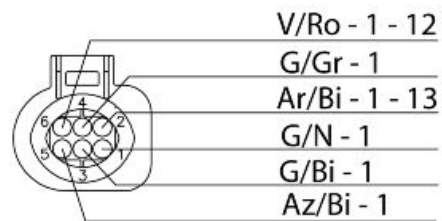
Throttle and handgrip sensor control (Demand)

### Location:

- on the vehicle: under the fuel tank
- connector: on the throttle body

### Pin out:

1. potentiometer signal 1 (yellow/black cable)
2. + 5 V voltage (Orange/white cable)
3. throttle drive command (+) (yellow/white cable)
4. potentiometer signal 2 (yellow/grey cable)
5. throttle drive command (+) (light blue/white cable)
6. ground (green/pink cable)



## DIAGNOSTICS INSTRUMENT: PARAMETERS

### Throttle correction

- Example value with key ON: 0.0°
- Example value with hot engine at idle: -0.5°

An acceptable value is between -1.5° and + 1.5°

### Throttle Potentiometer 1 (degrees)

- Example value with key ON: 6°7'
- Example value with engine at idle: engine hot 5.5°, engine cold 6,5°

### Throttle Potentiometer 1 (voltage)

- Example value with key ON: 800 mV
- Example value with engine on: engine hot 760 mV, engine cold 800 mV

### Throttle Potentiometer 2 (degrees)

- Example value with key ON: 5.5°
- Example value with engine on: engine hot 5.5°, engine cold 6.5°

#### Throttle Potentiometer 2 (voltage)

- Example value with key ON: 4200 mV
- Example value with engine on: engine hot 4240 mV, engine cold 4200 mV

#### Throttle Limp Home position

- Example value with key ON: 824 mV at 6.7°

Voltage stored in the control unit corresponding to the Limp home position

#### Throttle lower position

- Example value with key ON: 480-510 mV

#### CAUTION

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

### DIAGNOSTICS INSTRUMENT: STATUSES

Throttle automatic self-acquisition

- ice/ interrupted/carried out/limp home/closed throttle stop/springs check/limp home self-acquisition/initialise

Indicates if self-acquisition carried out by control unit has/has not been carried out: it is essential to know if the last self-acquisition with key ON has been successful

Throttle self-learning with diagnostics instrument

- carried out/not carried out

Indicates whether the self-acquisition process through the diagnostics instrument has/has not been carried out: if it has been carried out once, will always be carried out unless EEPROM control unit zero setting is carried out

### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

#### CAUTION

**IF ERRORS ARE DETECTED ON BOTH THROTTLE BODIES, CHECK ALSO THE CORRECT SUPPLY OF THE CONTROL UNIT TO PIN 42.**

'sensor potentiometer 1 throttle position P0120

- short circuit to positive / open circuit, short circuit to negative

#### Error cause

- If shorted to positive: excessive voltage has been detected at PIN 48. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 48.

#### Troubleshooting

- If shorted to positive: check the value indicated by the Throttle Potentiometer 1 parameter (voltage): disconnect the connector and read the value indicated by the diagnostics instru-

ment: if the voltage does not vary, there is a short circuit in the cable; replace the throttle body if the voltage drops to zero

- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

'sensor potentiometer 2 throttle position P0122

- short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 50. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 50.

#### **Troubleshooting**

- If shorted to positive: check the value indicated by the Throttle Potentiometer 2 parameter (voltage): disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable; replace the throttle body if the voltage drops to zero
- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

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### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

potentiometer 1 sensor, front throttle position P0121

- signal not valid

#### **Error cause**

- Signal not within the expected value drawn according to the values of the intake pressure

#### **Troubleshooting**

- Check the Throttle Potentiometer 1 parameter (voltage) to understand which signal the control unit receives. Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the control unit (PIN48) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

'sensor potentiometer 2 throttle position P0123

- signal not valid

**Error cause**

- Signal not within the expected value drawn according to the values of the intake pressure

**Troubleshooting**

- Check the Throttle Potentiometer 2 parameter (voltage) to understand which signal the control unit receives. Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 4) and the control unit (PIN 50) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

front throttle position potentiometer P0124

- inconsistent signal

**Error cause**

- Potentiometer 1 and potentiometer 2 do not show a logical value: the sum of the two voltages should be constant. The cause may be a malfunction in one of the two sensors or an abnormal resistance in one of the two circuits

**Troubleshooting**

- Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the control unit (PIN 48) is a few tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4) and the control unit (PIN 50) is a few tenths of an Ohm. If one of the two is different, restore the cable harness. If correct, replace the complete throttle body.

Front throttle Limp Home self-acquisition P0160

- failed test

**Error cause**

- Throttle position, kept by the springs, not within the expected range (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

**Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body

Throttle mechanical springs self-acquisition P0161

- failed test

**Error cause**

- Return time of the throttle, kept in position by the springs, not within the expected limits: the causes can be a deterioration of the performance of the springs or excessive throttle friction (at each key ON)

**Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body

Throttle mechanical idle position self-acquisition P0162

- failed test

#### **Error cause**

- Position of the throttle stop not within the expected field (at each key ON)

#### **Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body

'Detection of throttle Recovery conditions (Air temp, Water temp) P0163

- possible presence of ice

#### **Error cause**

- A correct throttle rotation cannot be detected given low ambient and engine temperatures: some ice may have formed in the duct (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

#### **Troubleshooting**

- Check that the throttle body is clean and that there is no ice or condensation in the intake duct. If OK, replace the throttle body

'Throttle power supply voltage during self-acquisition P0164

- low power supply voltage

#### **Error cause**

- The throttle power supply voltage is too low to carry out the self-acquisition test correctly (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

#### **Troubleshooting**

- Delete errors hindering throttle self-learning.

'Throttle position error P0167

- misalignment between control and activation

#### **Error cause**

- The throttle mechanical control may be damaged

#### **Troubleshooting**

- Replace the throttle body

---

### **DIAGNOSTICS INSTRUMENT: ADJUSTABLE PARAMETERS**

Throttle self-acquisition

#### **NOTE**

**THROTTLE BODY ACTIVATION TAKES PLACE EVERY TIME THE KEY IS SET TO ON: CORRECT ACTIVATION IS INDICATED WHEN THE STOP LIGHTS TURN ON: IF DURING ACTIVATION, THE**

**ENGINE IS STARTED, THE ACTIVATION IS NOT COMPLETED AND THE STOP LIGHTS DO NOT TURN ON. EVERY 150 KEY-ONS, HOWEVER, THE THROTTLE VALVES ARE FORCED TO ACTIVATION. IF START-UP IS ATTEMPTED DURING THIS ACTIVATION (WHICH REQUIRES 3 SECONDS), THE ENGINE WILL NOT START.**

**FITTING: MECHANICAL/ELECTRICAL REFIT**

#### **RESET PROCEDURE**

If the throttle body has been replaced, after key ON do not start the engine for the next 3 seconds, during which the control unit carries out throttle self-acquisition: then verify that the "Automatic throttle self-acquisition" status indicates: "carried out". If indication is not "Carried out", delete possible errors on the vehicle and then, with key set to ON, check that the statuses are "Carried out". If necessary carry out, from the adjustable parameters screen (screwdriver and hammer) "Throttle self-acquisition" and verify that the "Throttle self-acquisition with diagnostics instrument" status indicates: "Carried out" and that the "Automatic throttle self-acquisition" status indicates: "carried out"

---

## **Engine oil pressure sensor**

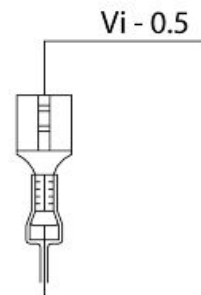
### **ENGINE OIL PRESSURE SENSOR**

**Function:** it indicates to the instrument panel if there is enough oil pressure ( $0.5 \pm 0.2$  bar ( $7.25 \pm 2.9$  PSI)) in the engine.

**Operation / Operating principle:** normally closed switch. With oil pressure above  $0.5 \pm 0.2$  bar ( $7.25 \pm 2.9$  PSI), open circuit.

**Location on the vehicle:** right side of the vehicle, under the oil sump

**Pin-out:** Voltage 5V



## Neutral sensor

### Function

It tells the gear position to the control unit, from the 1st gear to the 6th gear, and if the gear is neutral or riding.

### Operation / Operating principle

The sensor has 2 circuits: one to indicate the engaged gear, whose resistance varies according to the gear engaged: in this way, the injection ECU, according to detected electric voltage, identifies the engaged gear and sends the information via CAN to the instrument panel; the other indicates neutral gear, whose voltage is taken to zero if in neutral position.

### Level in electrical circuit diagram:

Start-up enabling switches

### Location:

- on the vehicle: rear part, above the gearbox.
- connector: near the sensor.

### Electrical specifications:

PIN 64: gear indication: closed circuit (continuity);  
 gear engaged: open circuit (infinite resistance).  
 Gear engaged circuit resistance: 1st gear: 0.8 kohm, 2nd gear 0.5 kohm, 3rd gear 15.0 kohm, 4th gear 6.9 kohm, 5th gear 2.8 kohm, 6th gear 1.5 kohm.

### Pin out:

White/Black: ground from ECU, Light Blue: + 12V from ECU (gear), Pink: + 5V from ECU (gears).

### CAUTION

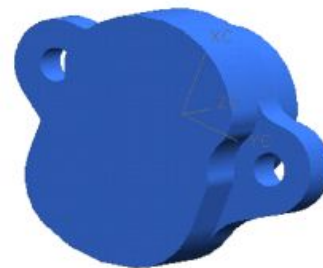
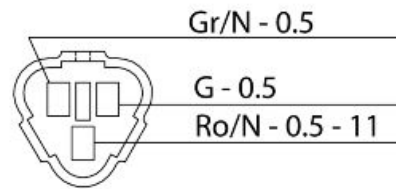
**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

### DIAGNOSTICS INSTRUMENT: STATUSES

Gearbox in neutral

- Yes/No

Gear engaged: 0 - 1 - 2- 3 - 4 - 5 - 6



**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS****Gear sensor P0461**

- shorted to positive or open circuit / shorted to negative.

**Error cause**

- If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 72. If shorted to negative: voltage equal to zero has been detected at PIN 72.

**Troubleshooting**

- If the circuit is open, shorted to positive: the error is detected with gear engaged only. Check the sensor connector and the VEHICLE connector of the control unit: if not OK, restore; if they are OK, check the continuity of the Grey/Black cable between the two connectors: if not OK, restore; if they are OK, with key set to ON and control unit connector disconnected, check from the control unit side if the cable is in voltage: if it is in voltage, disconnect the sensor connector and check if the cable is in voltage: if it is in voltage, restore the cable harness; if it is not in voltage, replace the sensor (there is an interruption or shorted to positive of the Pink/Black cable in the section from the sensor connector to the sensor or inside the sensor).
- If shorted to negative: disconnect the sensor connector and with key set to ON, check Grey/Black cable voltage: if equal to zero, restore the cable harness; if equal to approx. 5 V, replace the sensor (there is short circuit to ground of the Pink/Black cable in the section from the sensor connector to the sensor or inside the sensor).

**Clutch lever sensor****Function**

It tells the clutch lever position to the control unit.

**Operation / Operating principle**

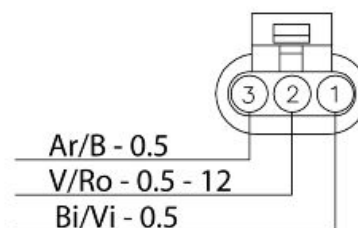
If there is gear engaged but the clutch is pulled, i.e. circuit closed to ground, vehicle start-up is not enabled.

**Level in electrical circuit diagram:**

Start-up enabling switches

**Location:**

- on the vehicle: under the clutch lever.
- connector: Under the steering column, right side.

**Electrical specifications:**



- Clutch pulled: closed circuit (continuity)
- Clutch released: open circuit (infinite resistance).

**Pin out:**

1. normally closed switch (white/purple cable)
2. ground (green/pink cable)
3. normally open switch (orange/blue cable)

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: STATUSES**

## Clutch

- Indefinite\_Released\_Pulled

**WARNING** The statuses regularly viewed are Released and Pulled.

- Indication on Navigator always released: check the sensor connector and the control unit connector (special attention to PIN56): if not OK, restore cable harness; if OK, disconnect both terminals from the sensor and check, with key set to ON, continuity to ground of PIN 2 (Green/Pink cable): if there is no continuity, restore the cable harness; if there is, replace the sensor.
- Indication on Navigator always pulled: check the sensor connector and the control unit connector (special attention to PIN76): if not OK, restore cable harness; if OK, disconnect both terminals from the sensor and check, with key set to ON, continuity to ground of PIN 2 (Green/Pink cable): if there is no continuity, restore the cable harness; if there is, replace the sensor.

**Side stand sensor****Function**

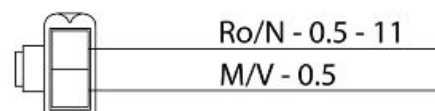
it tells the side stand position to the control unit

**Operation / Operating principle**

If the gear is engaged and the side stand is unfolded, and therefore the circuit is open, the control unit does not enable vehicle start-up or shuts off the engine if it is rotating

**Level in electrical circuit diagram:**

Start-up enabling switches



**Location:**

- on the vehicle: on the stand
- connector: behind the starter motor

**Pin out:**

1. ground (pink/black cable)
2. 12V Voltage (brown/green cable)

**Electrical specifications:**

- Side Stand Up: closed circuit (continuity)
- Side Stand Down: open circuit (infinite resistance)

**CAUTION**

BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

**DIAGNOSTICS INSTRUMENT: STATUSES**

Side stand sensor: up/down

- Indication on Navigator always down: check the connector: if not OK, restore; if it is OK, disconnect the two terminals from the sensor and check continuity to ground of PIN 1: if there is no continuity, restore the cable harness; if there is, replace the sensor
- Indication on Navigator always up: disconnect the terminals from the sensor and check if there is continuity between the two PINS, with stand down: if there is continuity, replace the sensor; if the circuit is open, it means that the brown/green cable from sensor PIN 2 to VEHICLE connector PIN 70 is short circuit to ground: restore the cable harness

**Bank angle sensor****Function**

It tells the vehicle position to the control unit

**Operation / Operating principle**

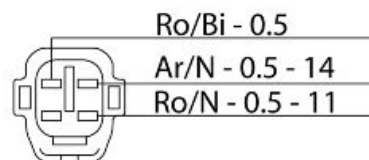
The sensor converts the vehicle position signal to electrical voltage.

**Level in electrical circuit diagram:**

Start-up enabling switches

**Location:**

- on the vehicle: under the saddle, above the battery.



- connector: near the sensor.

**Electrical specifications:****Pin out:**

1. 5V Power (orange/black cable)
2. Ground (pink/black cable)
3. Output signal (pink/white cable)

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**RUN/STOP switch****Function**

It tells the control unit if the rider wishes to enable engine start-up or to keep the engine running.

**Operation / Operating principle**

If the rider wants to shut off the engine or to disable engine start-up, the switch should be open, i.e.

VEHICLE connector PIN 58 of the Marelli control unit must not be connected to ground.

**Level in electrical circuit diagram:**

Start-up enabling switches

**Location:**

- on the vehicle: right light switch.
- connector: under right side steering column.

**Electrical specifications:**

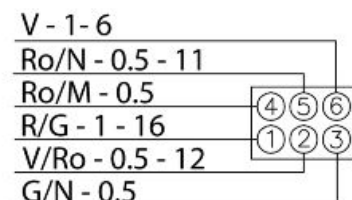
- STOP position: the circuit is open
- RUN position: closed circuit (continuity)

**Pin out:**

- 1 ground (pink/black cable)
- 2 power 5 V (pink/brown cable)

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: STATUSES**

RUN / STOP switch

- Run/Stop

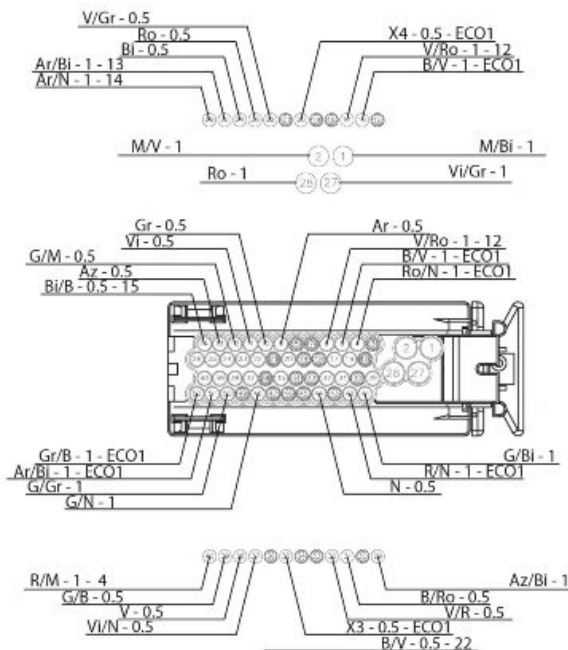
NOTES

- Indication on Navigator always STOP: disconnect the connector and verify with the RUN switch whether there is continuity toward the two Pink/Black and Pink/Brown cables switch: If there is not continuity, replace the sensor; if there is continuity, check the connector: of not OK restore the cabling, if OK verify the presence of voltage on the Pink/Brown cable with the key ON: if absent, restore cabling, if present verify insulation from ground of the Pink/ Brown cable: If there is continuity with ground connection, restore the cable harness; if OK, set the key to OFF and check the VEHICLE connector and the engine-vehicle cable harness connector: if it is not OK, restore; if it is OK, check the continuity of the Pink/Brown cable between the switch and the VEHICLE connector PIN 58: if not OK, restore the cable harness; if OK, replace the Marelli control unit.
- Indication on Navigator always RUN: disconnect the connector and, with the switch set to STOP, check if there is continuity between the two cables of the switch: if present replace the switch, if absent this means that, with the key ON, the Pink/Brown cable (between the switch and the control unit connector PIN 58) is short circuited to positive: restore the cable harness.

Connectors

ECU

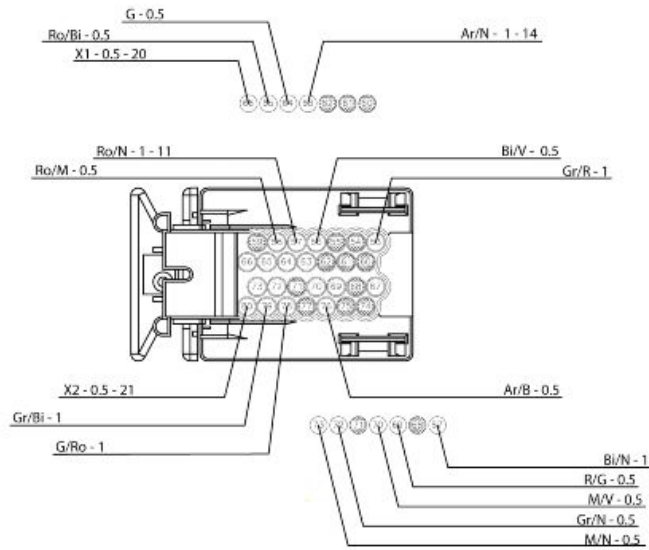
①



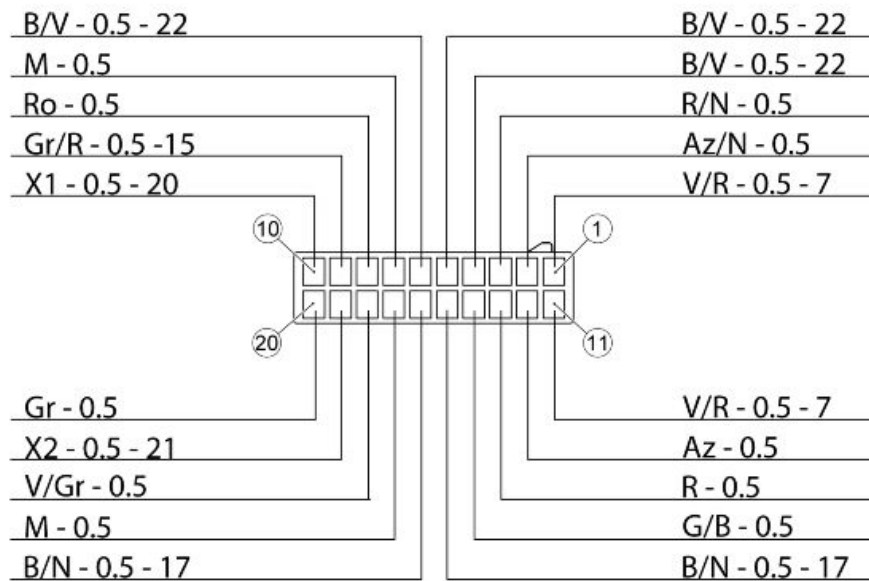
Engine pinout key:

Right cylinder side spark plug coil command output **PIN 1**  
Left cylinder side spark plug coil command output **PIN 2**  
Sensors ground 2 **PIN 4**  
Power ground **PIN 5**  
Sensors ground 1 **PIN 6**  
Right Lambda sensor input (+) **PIN 9**  
Left Lambda sensor input (+) **PIN 10**  
Track D handgrip input **PIN 11**  
Engine temperature **PIN 12**  
Track B handgrip input **PIN 13**  
Serial line K for diagnostics **PIN 14**  
PIN 16 Ground connection  
Sensors ground 1 **PIN 17**  
Engine rpm sensor input (-) **PIN 20**  
Left Lambda sensor input (+) **PIN 22**  
Track C handgrip input **PIN 23**  
Intake pressure sensor input **PIN 24**  
Reference voltage output + 5V: tracks A-C, throttle and pressure sensor (MAP) **PIN 25**  
Reference voltage output + 5V: tracks B-D, and fall sensor **PIN 26**  
Right cylinder central spark plug coil command output **PIN 27**  
Left cylinder central spark plug coil command output **PIN 28**  
Output for throttle motor drive (-) **PIN 29**  
Recovery logic relay command output (STOP light) **PIN 31**  
Left Lambda heater command output **PIN 32**  
Engine rpm sensor input (+) **PIN 35**  
Air temperature sensor input **PIN 37**  
Right Lambda sensor input (-) **PIN 38**  
Track A handgrip input **PIN 39**  
Key input **PIN 40**  
Output for throttle motor drive (+) **PIN 41**  
Key input **PIN 42**  
Right Lambda heater command output **PIN 44**  
Throttle potentiometer 1 signal input **PIN 48**  
Throttle potentiometer 2 signal input **PIN 50**  
Reference voltage output + 5V: tracks A-C, throttle and pressure sensor (MAP) **PIN 51**  
Direct power supply to control unit **PIN 52**

②

**Vehicle pinout key:**Left cylinder injector command output **PIN 53**Normally closed clutch switch input **PIN 56**Sensors ground 2 **PIN 57**Start engine button input **PIN 58**Reference voltage output + 5V: tracks B-D, and fall sensor **PIN 63**Neutral input **PIN 64**Fall sensor input **PIN 65**CAN L line (high speed) **PIN 66**Right cylinder injector command output **PIN 67**Starter relay command output **PIN 69**Side stand input **PIN 70**Gear sensor input **PIN 72**Injection auxiliary relay command output **PIN 73**Normally open clutch switch input **PIN 76**"Engine stop" input **PIN 78**Vehicle speed input **PIN 79**CAN H line (high speed) **PIN 80**

## Dashboard



### Grey-bodied instrument panel pinout key:

Battery positive **PIN 1**

Front left turn indicator output **PIN 2**

Front right turn indicator output **PIN 3**

**PIN 4** Ground connection

**PIN 5** Ground connection

**PIN 6** Ground connection

Left handgrip **PIN 7**

Air temperature **PIN 8**

Serial line K for diagnostics **PIN 9**

CAN L line (high speed) **PIN 10**

Battery positive **PIN 11**

Left rear turn indicator output **PIN 12**

Right rear turn indicator output **PIN 13**

Lights relay **PIN 14**

Sensors ground **PIN 15**

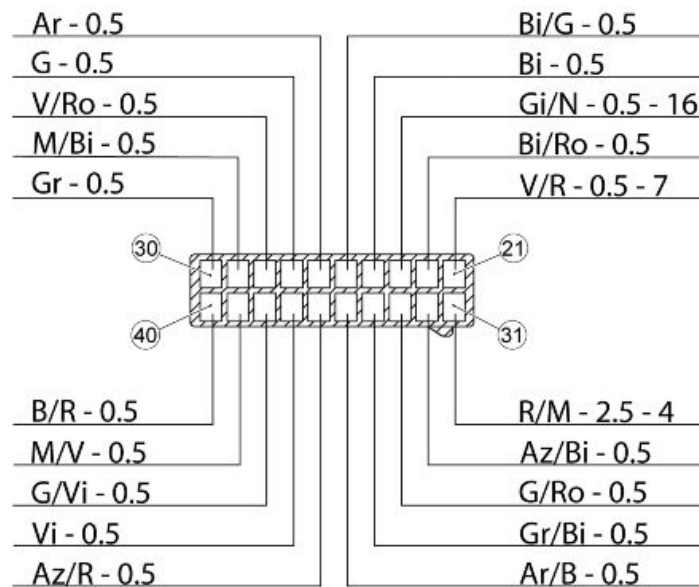
Sensors ground **PIN 16**

Right handgrip **PIN 17**

Fuel sensor **PIN 18**

CAN H line (high speed) **PIN 19**

A aerial **PIN 20**



**Black-bodied instrument panel pinout key:**

Battery positive **PIN 21**

Right turn indicator command **PIN 22**

DRL input **PIN 23**

High beam input **PIN 24**

Cruise Control button input **PIN 25**

Confirm command **PIN 26**

Down command **PIN 27**

Up command **PIN 28**

Normally closed front stop switch input **PIN 29**

B aerial **PIN 30**

Key positive **PIN 31**

Left turn indicator command **PIN 32**

Normally open front stop switch input **PIN 33**

Hazard input **PIN 34**

Handgrip command **PIN 35**

Turn indicator reset command **PIN 36**

Oil pressure **PIN 37**

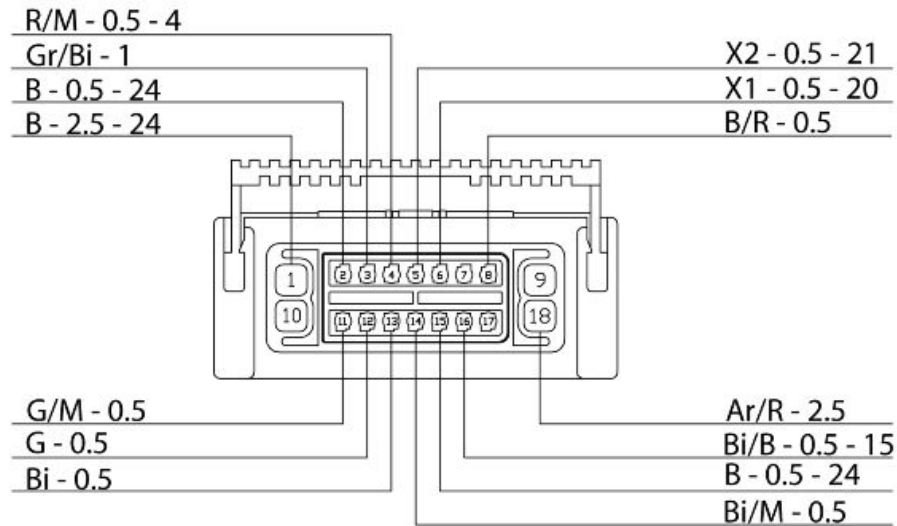
Normally open rear stop switch input **PIN 38**

Normally closed rear stop switch input **PIN 39**

ABS warning light **PIN 40**



## ABS Modulator



### ABS control unit pin out key:

**PIN 1** Ground connection

Vehicle identification (1) **PIN 2**

Vehicle speed output **PIN 3**

Key input **PIN 4**

CAN H line (high speed) **PIN 5**

CAN L line (low speed) **PIN 6**

ABS warning light **PIN 8**

Rear speed sensor signal **PIN 11**

Rear speed sensor ground **PIN 12**

Front speed sensor ground **PIN 13**

Front speed sensor signal **PIN 14**

Vehicle identification (2) **PIN 15**

Serial K line for diagnostics **PIN 16**

Battery power **PIN 18**

## Can line

### Function

It allows communication between the Marelli injection ECU and the instrument panel.

### Operation / operating principle

### CAN SYSTEM ADVANTAGES

A CAN (controller Area network) line is a connection among the vehicle several electronic devices, organised as a computer network (Internet). The CAN network has greatly simplified the electrical system layout and consequently, its complexity. With this communication line, needless duplication of several sensors present on the motorbike has been obviated. The sensor signals are shared by the two electronic elaboration units (instrument panel and control unit).

- Cable number reduction: The CAN line travels through a twisted cable to several nodes.
- These nodes can also isolate the errors without causing a system breakdown (FaultsConfination).
- Immunity to interference: the signal travels through two cables and the signal reading is differential (voltage difference between the two signals on both cables). If the two signals are disturbed by an external factor, their difference remains unaltered.
- Communication speed: messages travel at a speed of 250 kbps (data arrive at nodes every 20 ms, i.e. 50 times/second).

#### **CAN PROTOCOL (CONT. NETWORK AREA)**

The communication protocol is CSMA/CD (Carrier Sense Multiple Access w/ Collision Detection).

In order to transmit, every nod must first check that the BUS (the connection among all devices) is free before attempting to send a message with BUS (Carrier Sense).

If during this period there is no activity on BUS, every nod has the same chance to send a message (Multiple Access). If two nodes start transmitting simultaneously, the nodes recognise the "collision" (Collision Detection) and initiate an exchange action based on message priority (messages remain unaltered during exchange and there is no delay for high priority messages).

CAN protocol is based on messages and not on addresses. The message itself is divided into several parts (frames), each of which has a meaning: message priority, data contained, error detection, reception confirmation, etc.

Every network nod receives all the messages sent through the BUS (with reception confirmation or error messages) and each nod decides if the message is to be processed or rejected. Besides, every nod can request information from the other nodes (RTR = Remote Transmit Request).

---

#### **Level in electrical circuit diagram:**

CAN line

#### **Electrical specifications:**

- between PIN 66 and 80 of the control unit: approximately 130 Ohm
- between PIN 10 and 19 of the instrument panel: approximately 120 Ohm

#### **Pin out:**

- Line L: cable X1 between Marelli control unit PIN 66 and instrument panel black body connector PIN 10.

- Line H: cable X2 between Marelli control unit PIN 80 and instrument panel black body connector PIN 19.

**CAUTION**

**BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.**

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

CAN line "Mute Node" U1601

- Mute Node.

**Error cause**

- The injection ECU cannot send CAN signals; it receives signals from the instrument panel: the control unit may need replacing.

**Troubleshooting**

- Replace the Marelli control unit.

CAN line without signals U1602

- Bus Off.

**Error cause**

- No communication on CAN line (PIN 66 and/or PIN 80): problem on the whole network (for example, battery cut-off or short circuited or shorted to ground).

**Troubleshooting**

- check the Marelli control unit VEHICLE connector and the engine-vehicle cable harness connector: if not OK, restore; if OK, check the ground insulation of the two CAN lines from PIN 66 and PIN 80 of the VEHICLE connector: if not OK, restore cable harness; if OK, check the continuity of the two CAN lines from Marelli control unit VEHICLE connector to the instrument panel connector: if not OK restore cabling, if OK check that the two lines are not short circuited to positive testing from each of the 2 connectors (Marelli control unit, instrument panel connector) with 1 connector at a time disconnected and turning the key to the ON position: If not OK, restore; if OK, replace the Marelli control unit.

CAN line towards instrument panel U1701

- no signal.

**Error cause**

- No signal is received from the instrument panel.

**Troubleshooting**

- Check the connector of the instrument panel: if not OK, restore; if OK, check the continuity of the two lines from the instrument panel connector to the VEHICLE connector of the Marelli control unit: if not OK, restore the cable harness; if OK, replace the instrument panel.

CAN line towards instrument panel U1702.

- Intermittent signal or communication error.

**Error cause**

- Probable bad contact in the CAN line.

**Troubleshooting**

- Carry out the Vehicle connector check on pins 66 and 80, if NOT OK restore, if OK carry out the check procedure on pins 10 and 19 and the instrument panel connector, if NOT OK restore, if OK check general operation of the Marelli control unit and the instrument panel, in case of faults replace the component in question

CAN line to ABS control unit U1712

- Intermittent signal or communication error.

**Error cause**

- Probable bad contact in the CAN line.

**Troubleshooting**

- Carry out the Vehicle connector check on pins 66 and 80, if NOT OK restore, if OK carry out the check procedure on pins 5 and 6 and the ABS control unit connector, if NOT OK restore, if OK check general operation of the Marelli control unit and the ABS control unit, in case of faults replace the component in question

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**DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

CAN line to ABS control unit U1711

- No signal/Configuration error

**Error cause**

- If there is no signal, no signal is received from the ABS control unit. In case of configuration error, some devices are present (e.g. ABS) that were not foreseen in the vehicle configuration stored in the control unit.

**Troubleshooting**

- Signal absent - Carry out the check procedure on pins 5 and 6 of the ABS control unit, pins 66 and 80 of the Marelli control unit vehicle connector, if NOT OK restore, if OK with key off disconnect the ABS control unit connector, if NOT OK replace cabling, if OK check correct power supply pin 18 (12V) and ground at pin 1 of the ABS control unit, if NOT OK restore cabling, if OK replace the ABS control unit
- Configuration error - Open the Navigator devices status page to check if the control unit setting is actually consistent with the motorcycle setting. Example: if the bike has an ABS control unit the correct state that should be found in the Navigator device status screen will

be: MGTC (traction control) PRESENT. In the event of a bike with ABS control unit present and indication of the Navigator of: MGTC (traction control) NOT PRESENT, update the control unit.

Rear wheel radius acquisition P0510

- CAN error during acquisition/Invalid value.

**Error cause**

- In case of CAN error during acquisition, system warns that the procedure can not be completed due to a communication problem on the CAN line. In case of invalid value, it means that on key-ON an error of transcription occurred - from the non-volatile memory (EEPROM) to the volatile one (RAM) - of the value concerning the rear wheel radius. In this case the default value is used.
-

## INDEX OF TOPICS

ENGINE FROM VEHICLE

ENG VE

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## Vehicle preparation

Before removing the engine block, proceed as follows:

- From the back, secure the vehicle with belts attached to a hoist.
- From the front, secure the vehicle with belts attached to the handlebar and fixed to the work bench.
- Remove the exhaust system, the swingarm with cardan shaft, fuel tank and the rear shock absorber and the two footrest brackets.

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## Removing the engine from the vehicle

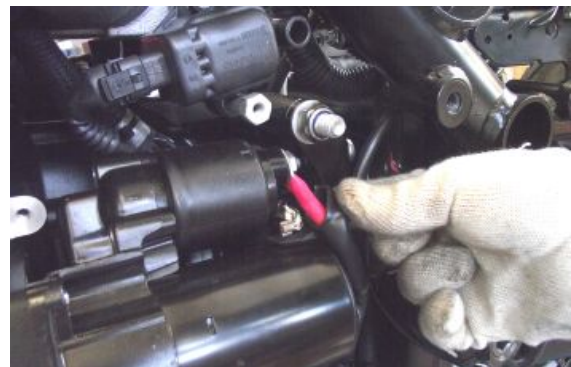
- Acting on the left side of the vehicle, remove the gear shift lever.



- Remove the protective cover of the starter motor by unscrewing the four fixing screws.



- Disconnect the positive cable and remove the starter motor by removing the two fixing screws.

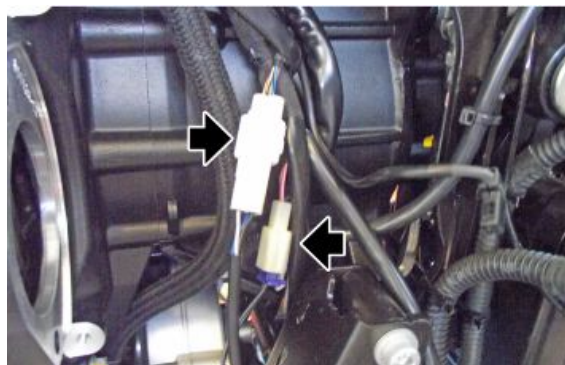




- Disconnect the cable located behind the starter motor.
- Disconnect the ground cable.



- Disconnect the stand sensor connector and rear stop switch.
- Release it from the clamps.





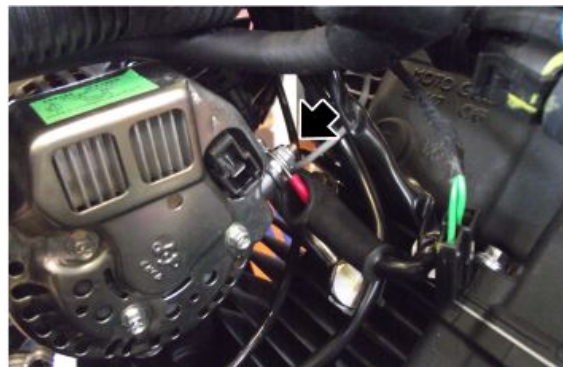
- 
- Working from both sides, disconnect the engine oil breather tube.



- 
- Working from both sides, disconnect the injector connectors.
  - Working from both sides, unscrew the retaining screw of the injector and remove it.



- Disconnect the alternator connectors.



- Disconnect the oil pressure sensor connector.



- Disconnect the engine temperature sensor connector.

- Disconnect the speed sensor connector.

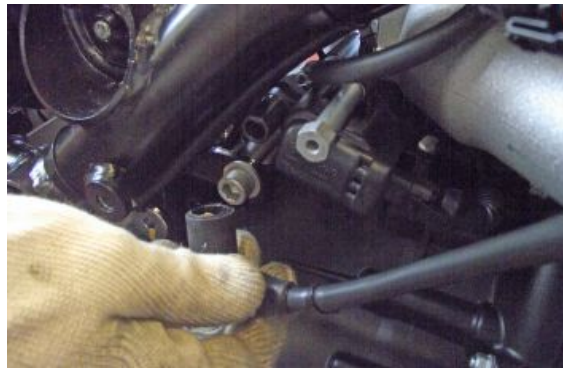


- Disconnect the ride by wire connectors.

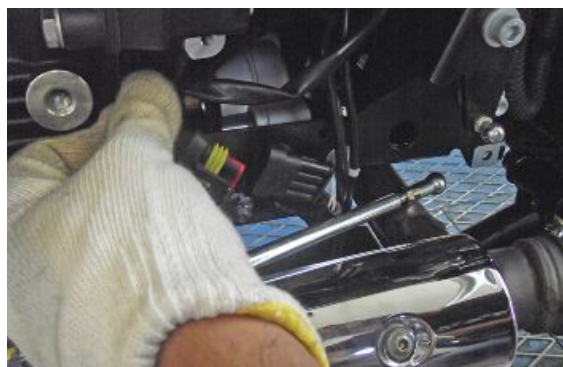


- Working from both sides, disconnect the connectors of the coils and cables of the plug caps.





- Working from both sides, disconnect the lambda probe connectors.



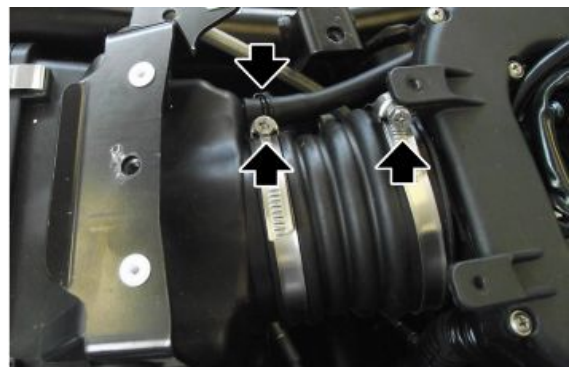
- Undo and remove the fixing screw of the oil radiator to the frame.

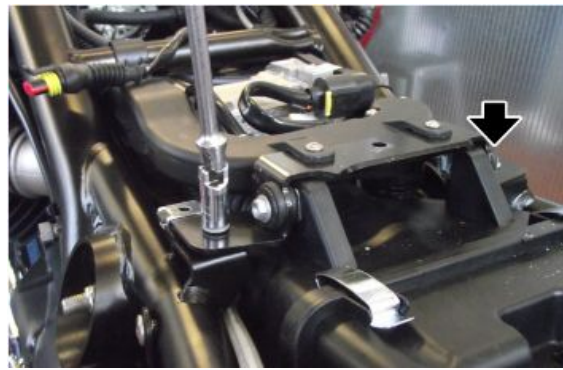


- Disconnect the two connectors located behind the oil radiator.



- Loosen the two fixing screws of the filter box and the tube shown in the figure.
- Undo the two fixing screws of the side bracket and the upper screws of the duct.
- Remove the rear of the air box and air filter.





- Remove the filter box.



- Remove the connector of the throttle body.

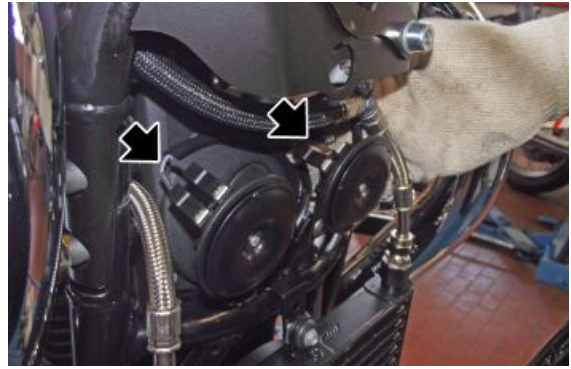


- Undo the four fixing screws and remove the throttle body.



- After disconnecting all the connectors, remove the various fixing clamps of the cables.

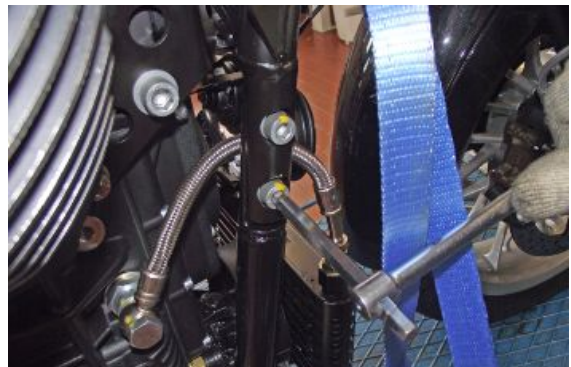
- Disconnect the horn connectors.



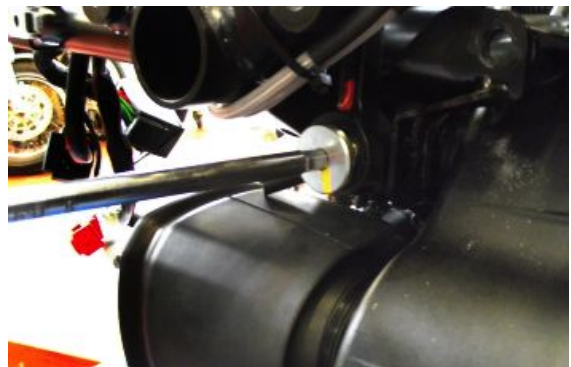
- Support the engine with suitable equipment.
- Working from both sides, remove the rear fixing screws of the cradle.

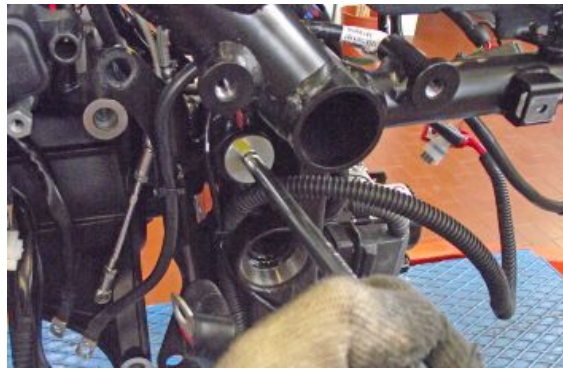


- Working from both sides, remove the front fixing screws of the cradle.

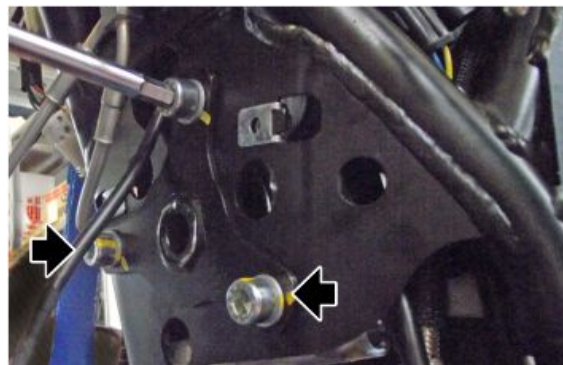


- Working from both sides undo the screws fixing the engine to the connecting rods.

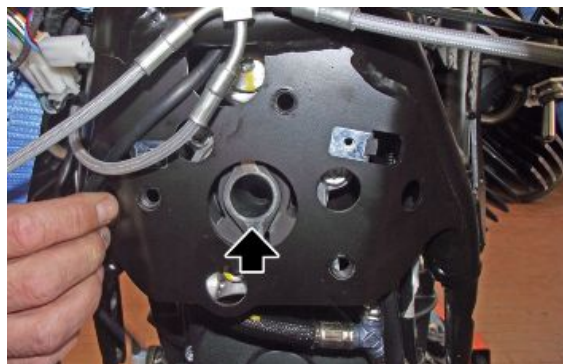




- Undo the three fixing screws of the silent block support.
- Remove the silent block.

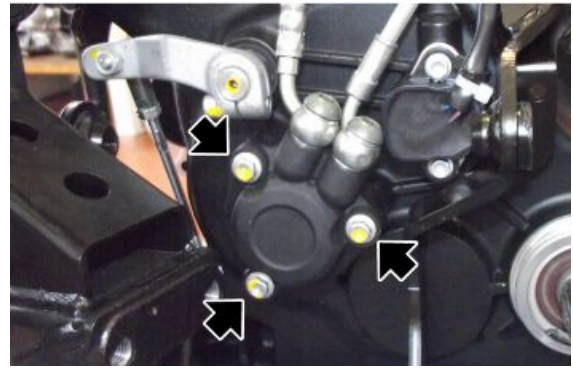


- Unscrew the front fixing screw that secures the engine to the silent block,





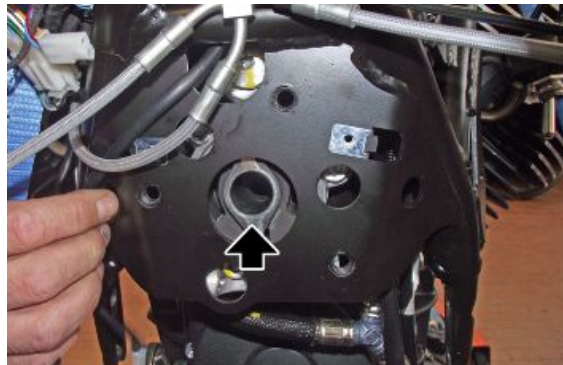
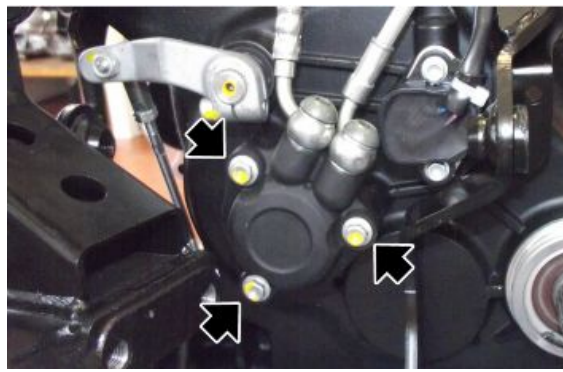
- Move the engine from the frame so as to be able to access the clutch control cylinder.
- Undo and remove the three fixing screws and move the clutch control cylinder.
- Lock the cylinder using a clamp in order to avoid the leakage of oil.
- Remove the engine from the frame.



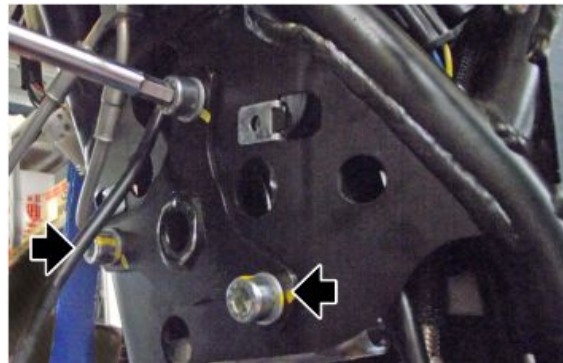
## Installing the engine to the vehicle

- Place the vehicle chassis over the engine with the gear.
- From the back, secure the chassis with belts attached to a hoist.
- From the front, secure the vehicle with belts attached to the handlebar and fixed to the work bench.
- Lift the engine placing it in position.
- Install the clutch control cylinder by tightening the three fixing screws.

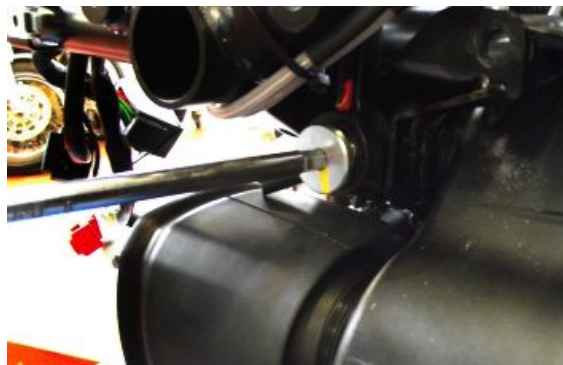
- Insert the front pin that secures the engine to the silent block.

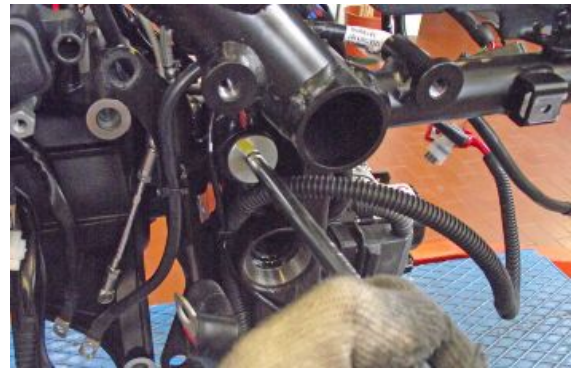


- Fix the silent block support by tightening the three fixing screws.



- Working from both sides, insert the engine/connecting rod fixing pins.

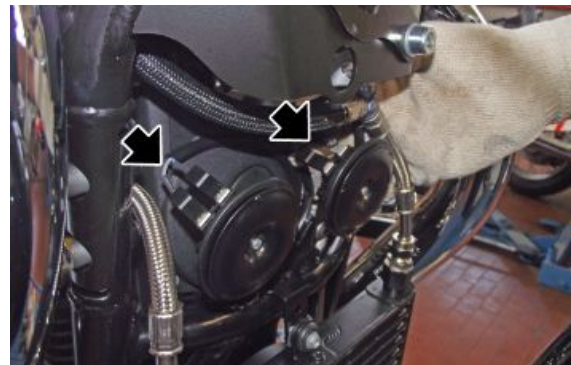




- Working from both sides, position the front and rear fixing screws of the cradle.



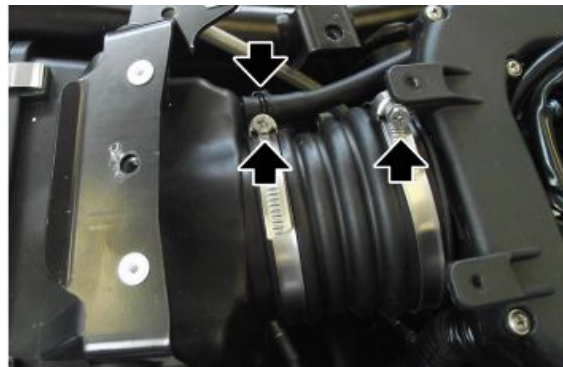
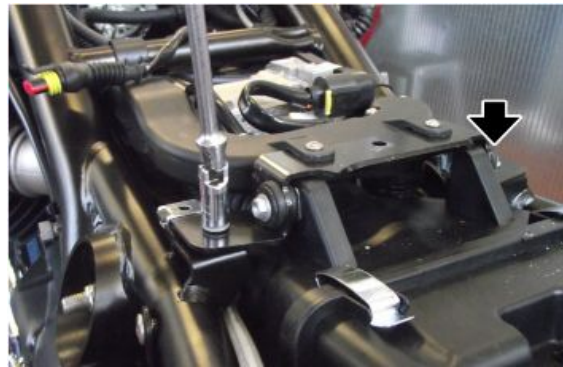
- Connect the horn connectors.



- Position throttle body and secure it using the four screws.
- Connect the connector.



- Install the air filter box.
- Secure it with the two fixing screws and the two clamps.



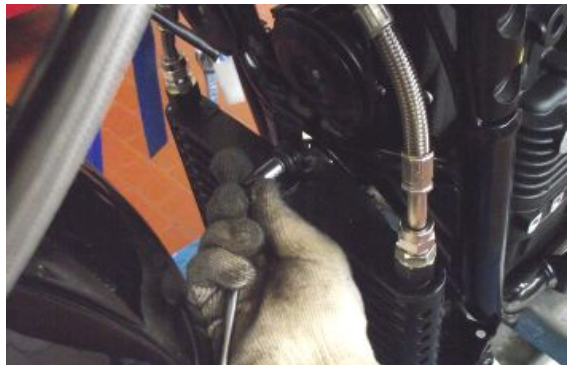
- Connect the tube as shown in the figure.



- Connect the connectors located inside the oil radiator.



- Install the oil radiator securing it with its lower joints and with the upper fixing screw.

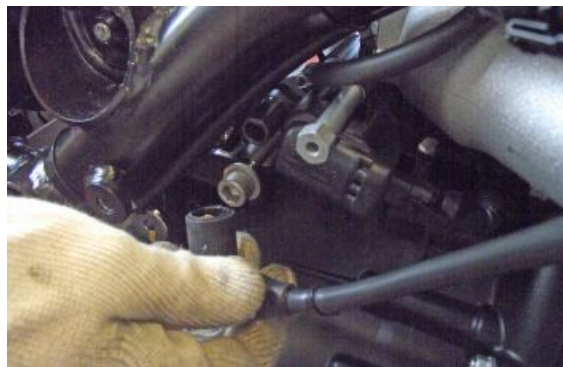


- Connect the connectors of the lambda probes.





- Connect the connectors of the coils and the cables of the plug caps.





- Connect the connectors of the ride by wire and that of the engine speed sensor.



- Connect the connectors of the engine temperature sensor and the oil pressure sensor.



- Connect the alternator.



- Operating from both sides, install the injectors, tightening the fixing screw.
- Connect the connectors.

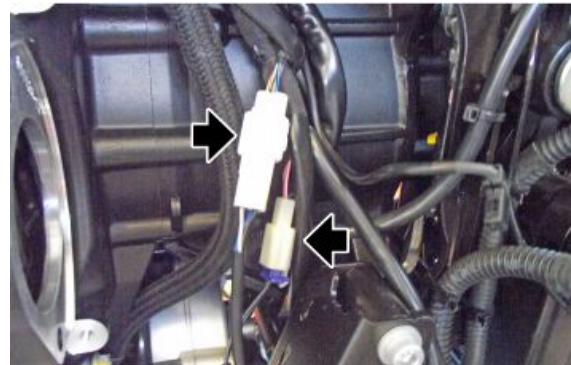




- Working from both sides, connect the engine breather tube.

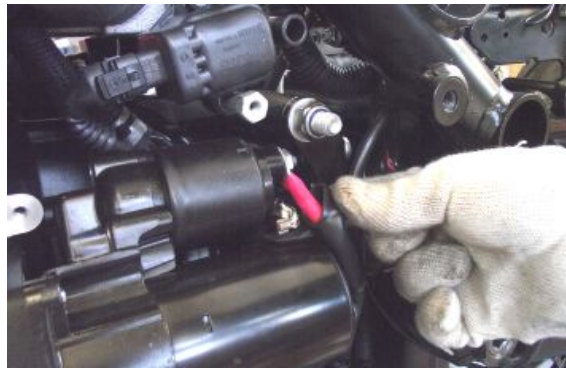


- Connect the stand sensor connector and rear stop switch.



- Connect the cable located behind the starter motor
- Install the starter motor fixing it with the two fixing screws.
- Connect the ground cable and the positive cable.



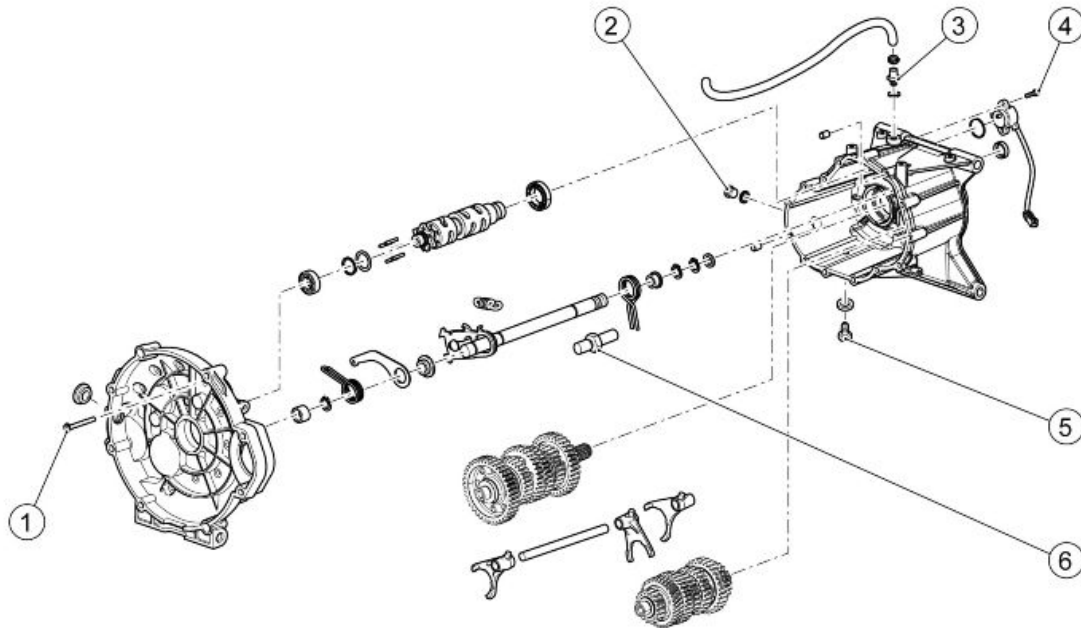


## INDEX OF TOPICS

ENGINE

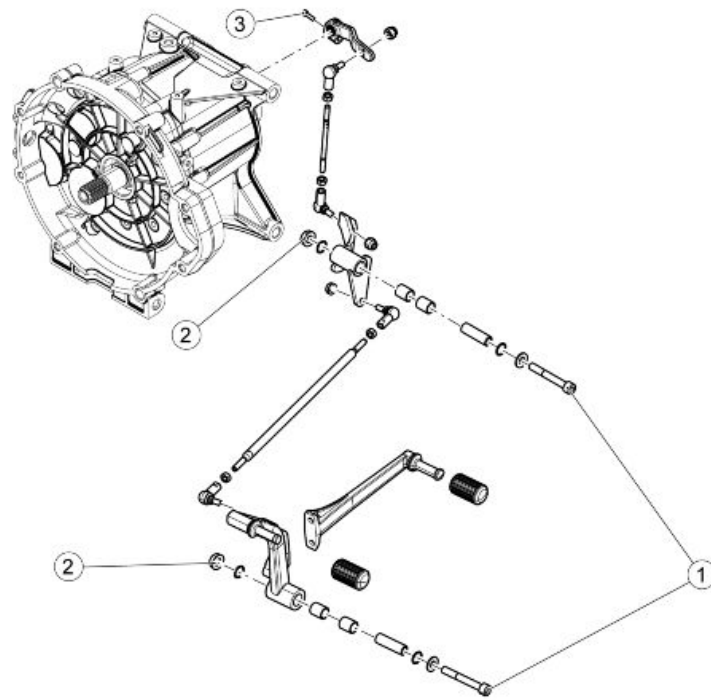
ENG

**Gearbox**



**GEARBOX**

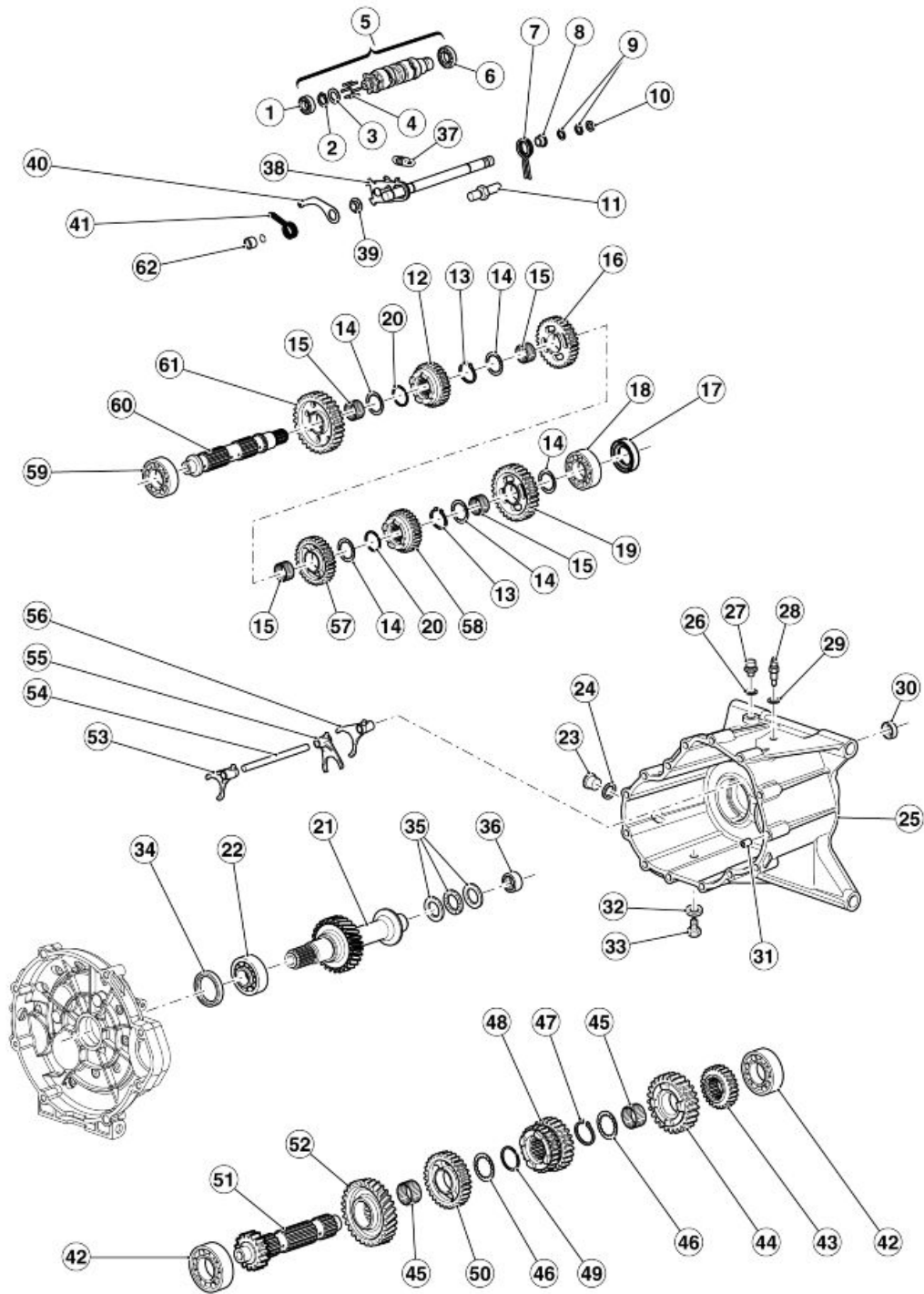
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch housing to gearbox fixing screws	M6x55	14	13 Nm (9.59 lb ft)	-
2	Gearbox cap	M18x1.5	1	28 Nm (20.65 lb ft)	-
3	Breather stud bolt	M10x1.5	1	8 Nm (5.90 lb ft)	Loctite 243
4	Gear sensor fixing screw	M5x16	2	4.9 - 6 Nm (3.61 - 4.42 lb ft)	Loctite 243
5	Magnetic gearbox oil drainage cap	-	1	24 Nm (17.70 lb ft)	-
6	Spring guide pin	-	1	24 Nm (17.70 lb ft)	Loctite 243



**GEAR LEVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screw	M8x60	2	25 Nm (18.44 lb ft)	-
2	Retainer nut	M8	2	25 Nm (18.44 lb ft)	-
3	Gearbox connecting rod fixing screw	M6x20	1	10 Nm (7.37 lb ft)	-

Diagram



key:

1. Ball bearing
2. Circlip
3. Thickness
4. Pin

5. Complete desmodromic
6. Ball bearing
7. Spring
8. Spacer
9. Circlip
10. Fifth wheel
11. Linking pin
12. Gear
13. Circlip
14. Thrust washer
15. Roller cage
16. Gear
17. Seal ring
18. Ball bearing
19. Gear
20. Circlip
21. Clutch shaft
22. Ball bearing
23. Oil plug
24. Washer
25. Gearbox
26. Aluminium washer
27. Breather cap
28. Neutral sensor
29. Gasket
30. Seal ring
31. Bushing
32. Gasket
33. Oil drainage plug
34. Seal ring
35. Thrust bearing
36. Roller bearing
37. Spring
38. Complete pre-selector
39. Bushing
40. Index lever
41. Spring
42. Ball bearing

- 43. Gear
- 44. Gear
- 45. Roller cage
- 46. Thrust washer
- 47. Circlip
- 48. Gear
- 49. Circlip
- 50. Gear
- 51. Primary shaft
- 52. Transmission gear
- 53. Fork (5th - 1st)
- 54. Fork shaft
- 55. Fork (3rd - 4th)
- 56. Fork (2nd - 4th)
- 57. Gear
- 58. Gear
- 59. Ball bearing
- 60. Transmission shaft
- 61. Gear
- 62. Spacer

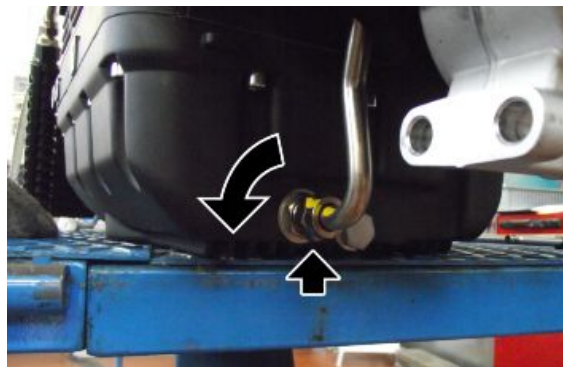
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## Gearbox

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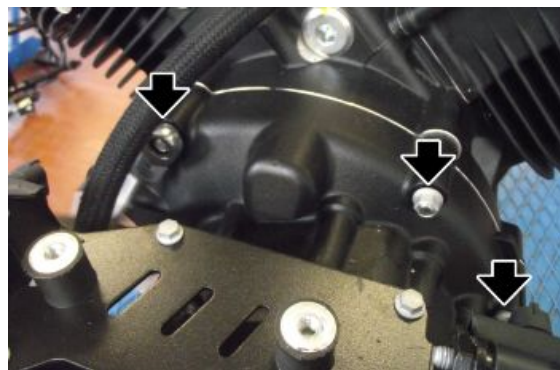
### Removing the gearbox

- Remove the starter motor in engine removal phase
- Make sure the transmission is in neutral gear
- Loosen and turn the oil pipe joint on the sump.





- Unscrew and remove the three screws



### See also

[Removing the starter motor](#)  
[Replacement](#)

- Unscrew and remove the two lower screws



- Unscrew and remove the screw



- Remove the gearbox.



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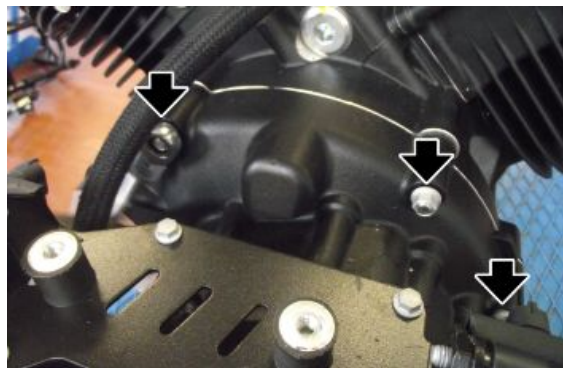
## Installing the gearbox

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- Position the gearbox



- Tighten the three upper nuts



- Tighten the two lower nuts



- Tighten the side nut



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## Gearbox shafts

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### Disassembling the gearbox

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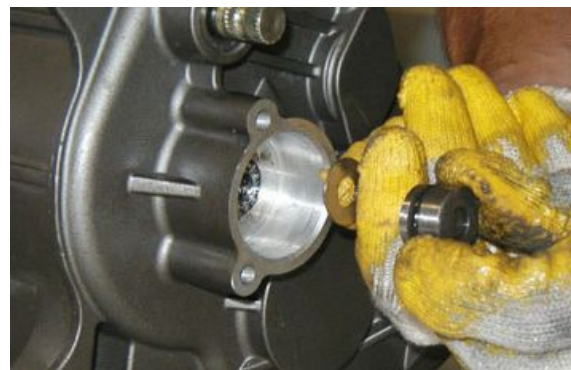
- Remove the gearbox.



- Undo the two screws and remove the gear sensor.



- From the outside, slide off the thrust cylinder and collect the O-Ring and the washer.



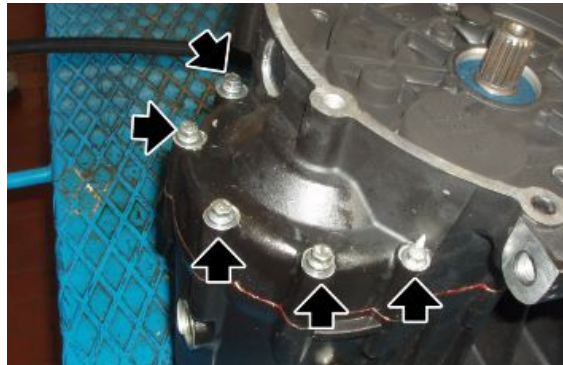
- Remove the thrust bearing and the washer.



- Slide off the rod with the two bushings.



- Undo and remove the five external screws.



- Place the gearbox on the specific gearbox support tool and on a vice.

### Specific tooling

#### 05.90.25.30 Gearbox support

- Undo and remove the nine internal screws.



- Open the gearbox using the specific tool.

### Specific tooling

#### 05.91.25.30 Gearbox opening





- Remove the bearings from the gearbox if necessary.



- Release the spring.



- Pressing the selector, slide off the whole transmission lever.
- Use rubber bands to tie down the transmission shaft unit and extract it.



- Once the transmission shaft unit is in on a bench, remove the rubber bands, being careful with the group.
- Detach the shafts and label the forks before removal.



- Remove the forks and collect the shaft.





- Replace bearings if necessary and remove the clutch shaft.



### See also

[Removing the gearbox](#)

## Removing the primary shaft

- Remove the main shaft.
- Operate on the main shaft from the second gear side.



- Remove the gear of the second gear and collect the ball bearing cage.



- Remove the gear of the sixth gear and collect the shoulder washer.



- Remove the circlip.



- Remove the gear of the third and fourth gears.



- Remove the circlip and collect the shoulder washer.





- Remove the gear of the fifth gear and collect the ball bearing cage.



- Heat the shaft with a specific heater and remove the helical transmission gear.



## Removing the secondary shaft

- Remove the transmission shaft.
- Operate on the shaft from the grooved side.



- Remove the shoulder washer.



- Remove the gear of the second gear and collect the ball bearing cage and the shoulder washer.



- Remove the circlip.



- Remove the gear of the sixth gear.



- Remove the circlip and collect the shoulder washer.



- Remove the gear of the fourth gear and collect the ball bearing cage.



- Remove the gear of the third gear and collect the ball bearing cage and the shoulder washer.



- Remove the circlip.



- Remove the gear of the fifth gear.



- Remove the circlip, the shoulder washer and remove the gear of the first gear, collect the ball bearing cage.
- Remove the bearing if necessary.



### See also

[Disassembling the gearbox](#)

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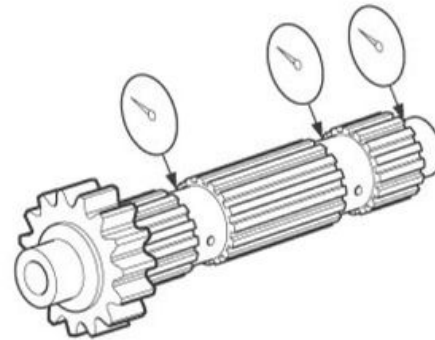
## Checking the primary shaft

Measure coaxiality of the main shaft with a dial gauge and a centring device and replace it if not complying with specifications.

### Characteristic

#### Shaft coaxiality limit

0.08 mm (0.0031 in)



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.

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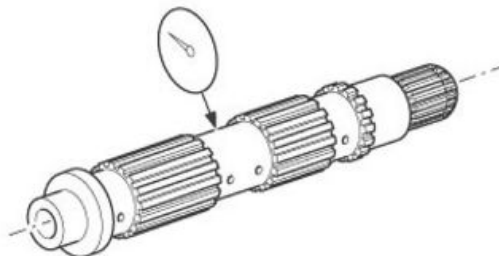
## Checking the secondary shaft

Measure the coaxiality of the transmission shaft with a dial gauge and a centring device and replace it if not complying with specifications.

### Characteristic

#### Shaft coaxiality limit

0.08 mm (0.0031 in)



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 gear drum for damage, scratches and wear and replace the desmodromic control rod if necessary.

Check the desmodromic segment «3» for damage and wear and replace it if necessary.

Check the desmodromic bearing «4» for damage and cracks and replace it if necessary.

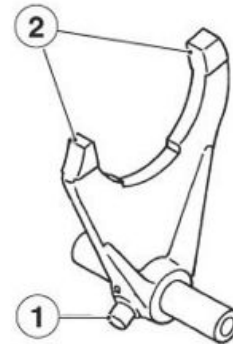


## Checking the forks

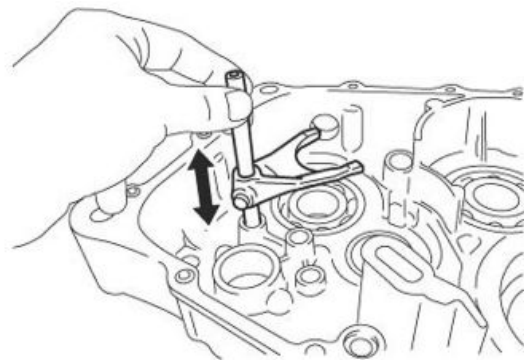
### NOTE

THE FOLLOWING PROCEDURE IS VALID FOR ALL GEARBOX FORKS.

- Check the transmission fork cam roller «1» and the transmission fork tooth «2» for damage, deformation and wear.
- Replace the transmission fork if necessary.



- Check the transmission fork movement and if it is not regular, replace the transmission forks.



### See also

[Disassembling the gearbox](#)

## Fitting the primary shaft

### NOTE

TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.

### See also

[Removing the](#)

primary shaft

## Fitting the secondary shaft

**NOTE**

**TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.**

**See also**

[Removing the secondary shaft](#)

## Assembling the gearbox

**NOTE**

**TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.**

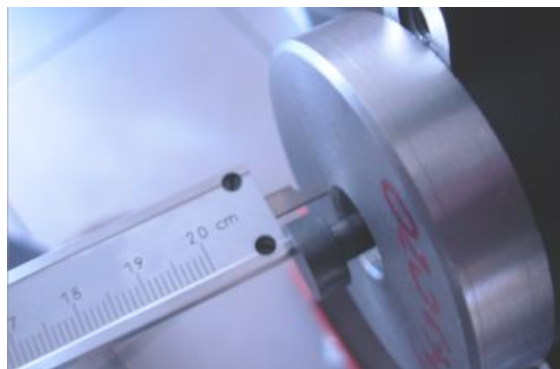
If the clutch is replaced, measure the length of the clutch control rod in order to use the correct rod.

Measure as follows:

- Fit the new clutch on the crankshaft.
- Fit the clutch control bowl in the gearbox.



- Fit the gearbox on the engine block.
- Fit the tool in the gearbox to determine the clutch control rod length.
- Measure rod protrusion using a depth gauge (see picture).
- According to the value found, select the correct rod based on the following table:



### Specific tooling

**020678Y Tool for clutch rod checking**

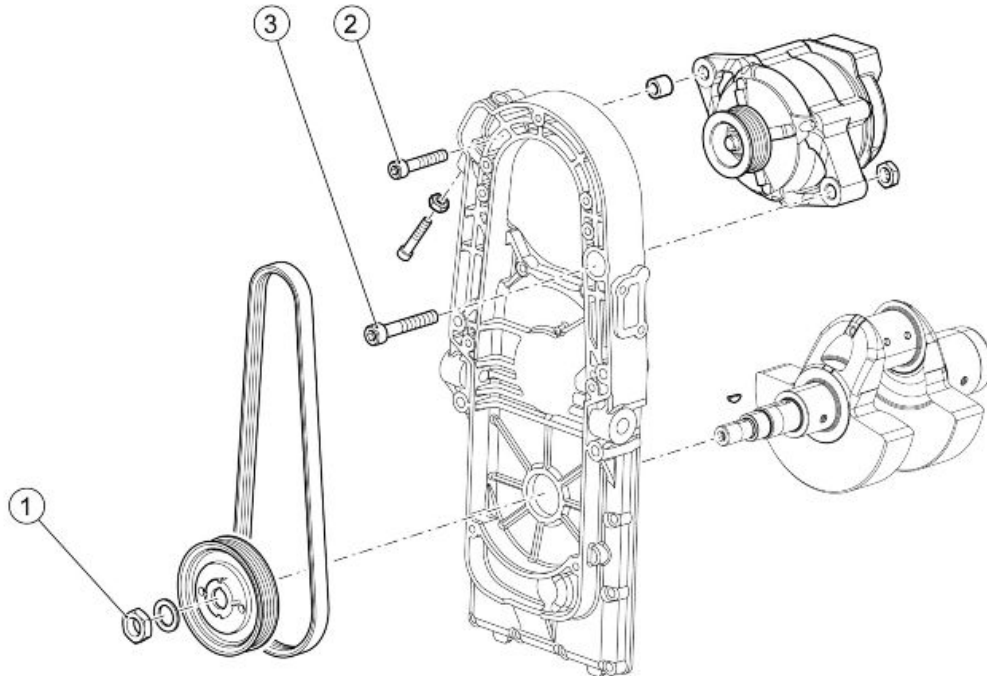
### **CLUTCH CONTROL ROD SELECTION**

<b>Specification</b>	<b>Desc./Quantity</b>
Protrusion: 9.8 - 11.2 mm (0.386 - 0.441 in)	Clutch control rod length = 183 mm (7.205 in)
Protrusion: 9 - 9.7 mm (0.354 - 0.382 in)	Clutch control rod length = 184.5 mm (7.264 in)
Protrusion: 8.25 - 8.95 mm (0.325 - 0.352 in)	Clutch control rod length = 185 mm (7.283 in)
Protrusion: 7.5 - 8.2 mm (0.295 - 0.323 in)	Clutch control rod length = 185.5 mm (7.303 in)
Protrusion: 6.75 - 7.45 mm (0.266 - 0.293 in)	Clutch control rod length = 186 mm (7.323 in)
Protrusion: 5.3 - 6.7 mm (0.209 - 0.264 in)	Clutch control rod length = 187.5 mm (7.382 in)

**See also**

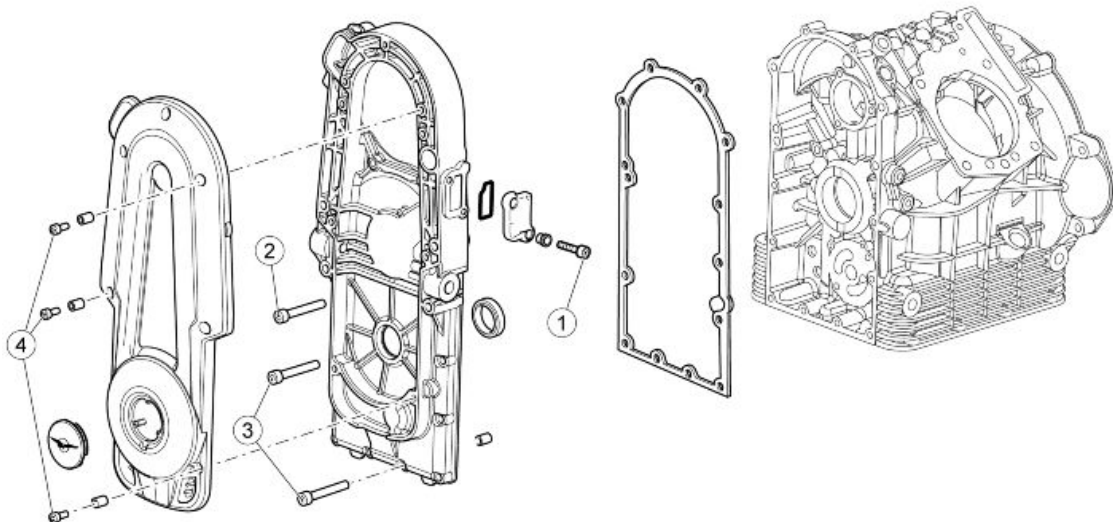
Disassembling the gearbox

**Generator**



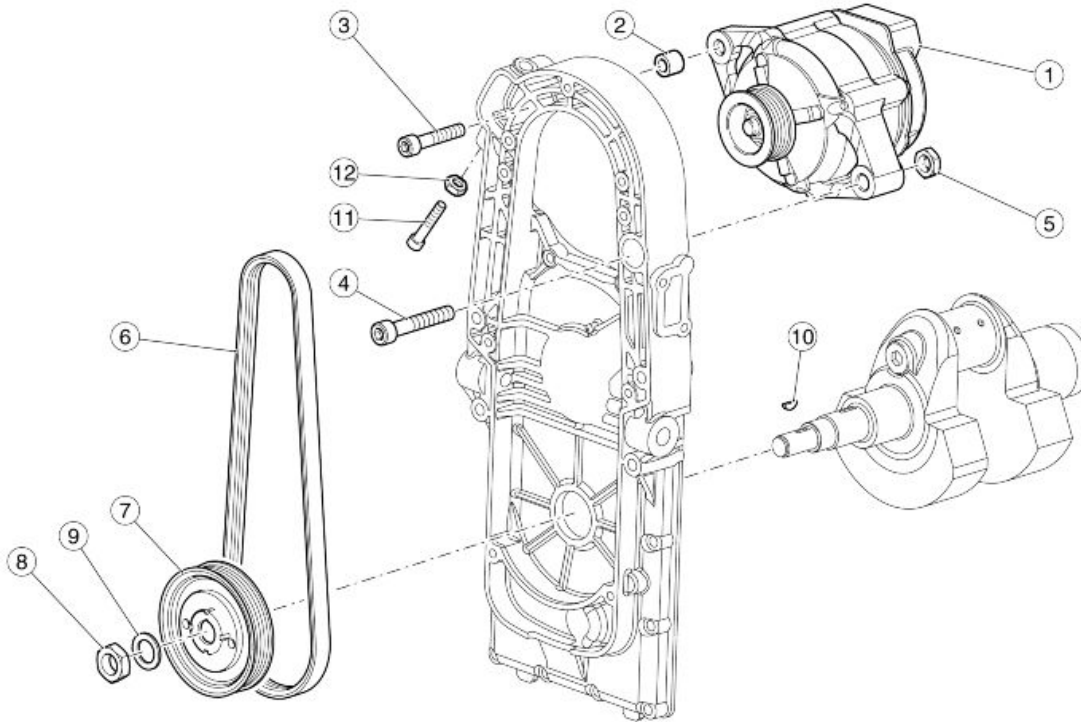
**ALTERNATOR**

pos.	Description	Type	Quantity	Torque	Notes
1	Generator control pulley locking nut	M16	1	80 Nm (59.00 lb ft)	Loctite 243
2	Generator upper fixing screw	M8	1	22 Nm (16.23 lb ft)	-
3	Generator lower fixing screw	M10x60	1	30 Nm (22.13 lb ft)	-



**GENERATOR COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Timing system cover cap fixing screw	M6x20	2	10 Nm (7.37 lb ft)	Loctite 243
2	Timing system cover fixing screw	M8x55	4	25 Nm (18.44 lb ft)	-
3	Timing system cover fixing screw	M6x30	9	10 - 12 Nm (7.37 - 8.85 lb ft)	-
4	Generator cover fixing screw	M6x16	6	10 - 12 Nm (7.37 - 8.85 lb ft)	-



**key:**

- 1. Alternator
- 2. Spacer
- 3. Screw
- 4. Screw
- 5. Nut
- 6. Belt
- 7. Generator control pulley
- 8. Nut
- 9. Washer
- 10. Magneto flywheel cotter
- 11. Screw
- 12. Nut

**Tensioning the belt**

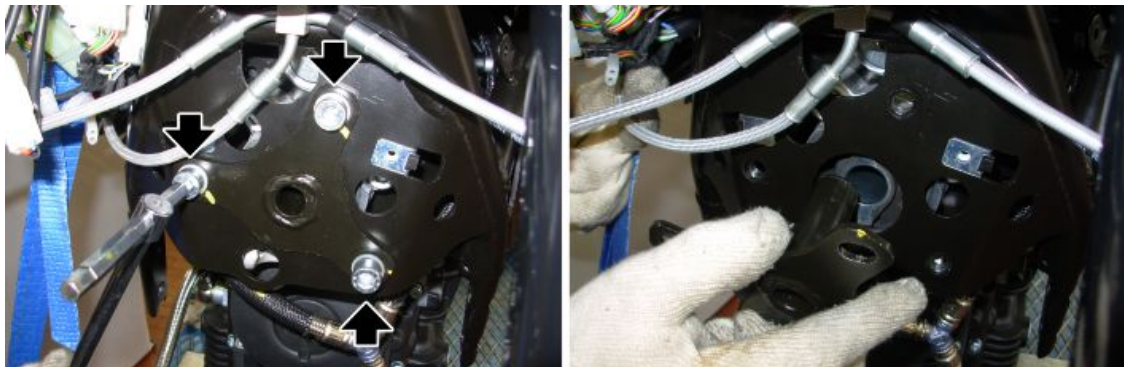
Before being able to start the belt tightening operation it is necessary to remove some components of the motorcycle, including the following in sequence:



- Saddle removal;
- Battery removal;
- Removal of steering column fairings;
- Removal of tank cap cover;
- Tank removal;
- Removal of side fairings;
- Removal of silencers;
- Removal of starter motor cover;
- Removal of exhaust pipe;
- Loosen the oil radiator to be able to remove the cradle;
- Remove the left coil;
- Remove the right side light switch connectors box;

Proceed with the following operations:

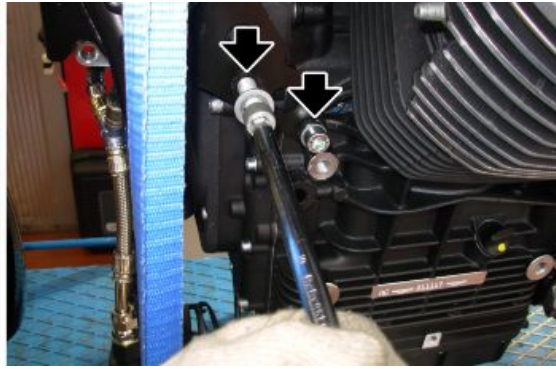
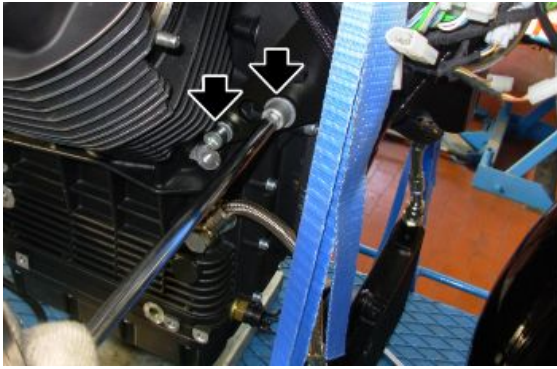
- Remove the fixing screws of the silent block support bracket and remove it;



- Remove the front bracket fixing screw from the engine support connecting rod.



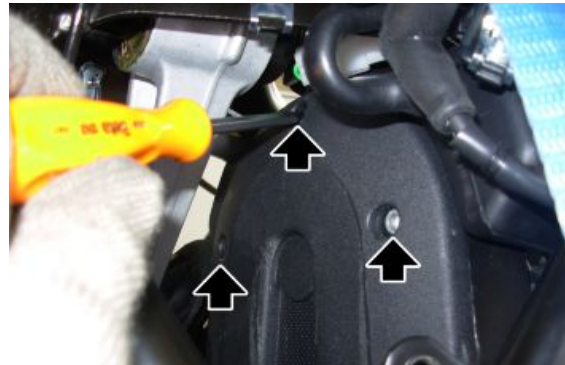
- Remove the four screws that fix the front bracket.



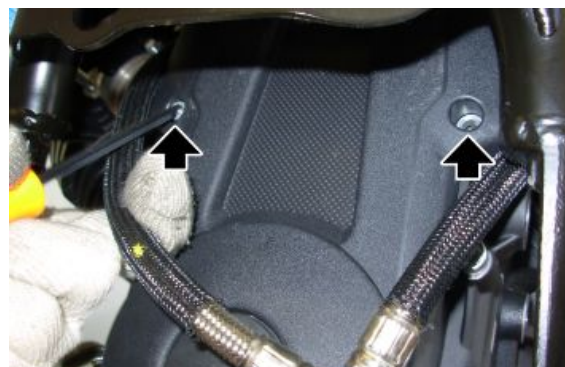
- Remove the front bracket with silent block from the lower part paying attention not to damage the alternator cover.



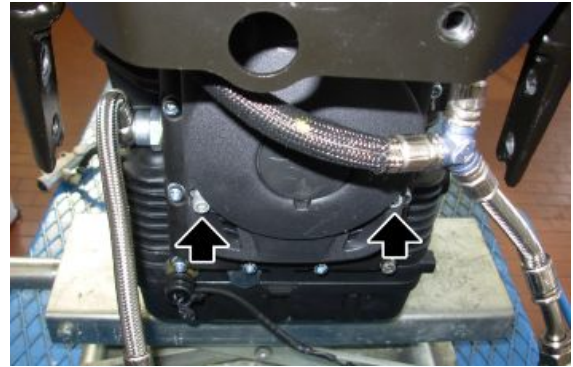
- Remove the three upper screws of the alternator cover.



- Remove the central screws of the alternator cover.



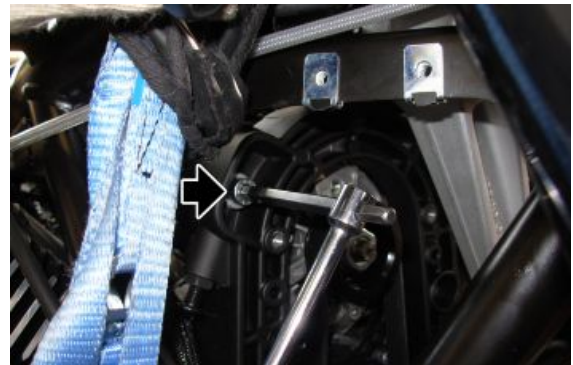
- Remove the lower screws of the alternator cover.



- Remove the alternator cover by pulling it off from the lower part, paying attention not to damage it.



- Loosen the screw.



- Loosen the nut and undo the set screw so that the alternator slides.



- Pre-position the wrench on the specific belt tensioning tool and then apply it entirely on the engine to properly tension the belt.

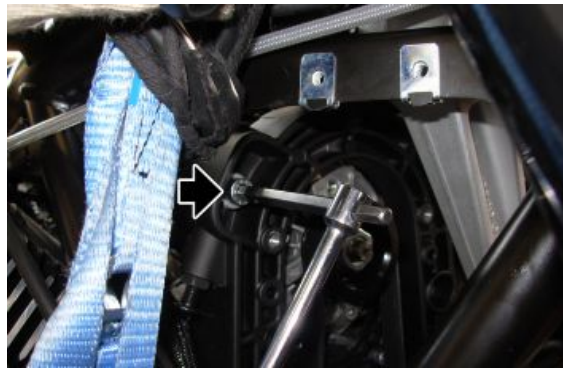
### Specific tooling

**020677Y Generator belt tensioner, lever for belt tensioning**

- Tighten the belt to a torque of 50 Nm (36.88 lb ft).
- Tighten the adjuster and tighten the locknut.

**Removing the generator**

- Remove the screw.



- Loosen the nut and undo the set screw so that the alternator slides.

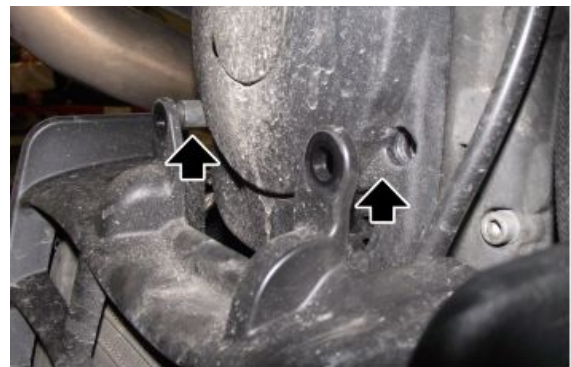


- Remove the belt and the alternator with pulley.



### Tensioning the belt

- Remove the left fairing lug.
- Undo and remove the two front fixing screws of the oil radiator.
- Collect the spacers.



- Undo and remove the five screws fixing the alternator belt cover.
- Remove the oil radiator lower support bracket and the alternator belt cover.



### Locking torques (N\*m)

**Alternator belt cover screw (radiator bracket retainer) TCEI M6x40 (2) 10 Nm (7.38 lb ft) Alternator belt cover screw - TCEI M6x16 (4) 10 Nm (7.38 lb ft)**

- Remove the generator belt cover by lightly loosening the oil radiator.



- Loosen the screw.



- Loosen the nut and undo the set screw so that the alternator slides down.



- Using the belt tensioning tool, tension the belt to the prescribed torque.
- Screw the set screw.
- Tighten the lock nut.



### Specific tooling

**020677Y Generator belt tensioner, lever for belt tensioning**

### Locking torques (N\*m)

**Belt tension 50 Nm (36.88 lb ft)**

### See also

Engine oil cooler

---

## Installing the generator

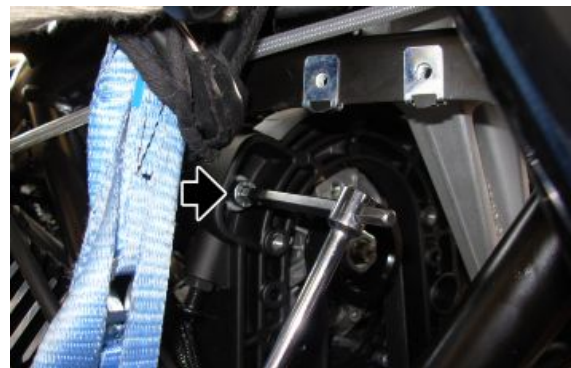
- Insert the alternator as shown in the figure



- After correctly inserting the belt, on the pulleys tighten the screw with the relative nut



- Position the screw and pre-tighten it.



- Using the belt tensioning tool, tension the belt to the prescribed torque and tighten the set screw.
- Remove the belt tensioning tool.
- Lock the set screw in position by screwing the lock nut.

### Specific tooling

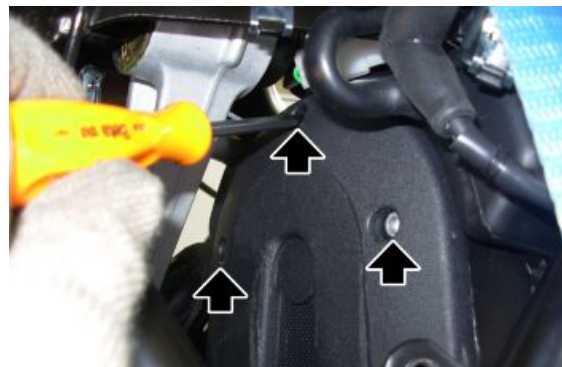
**020677Y Generator belt tensioner, lever for belt tensioning**



- Tighten the alternator fixing screws.
- Insert the alternator cover from below taking care not to scratch it as shown in the figure



- Insert the upper screws

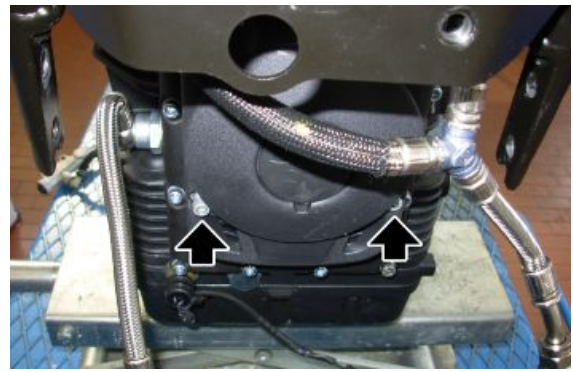


- Insert the central screws

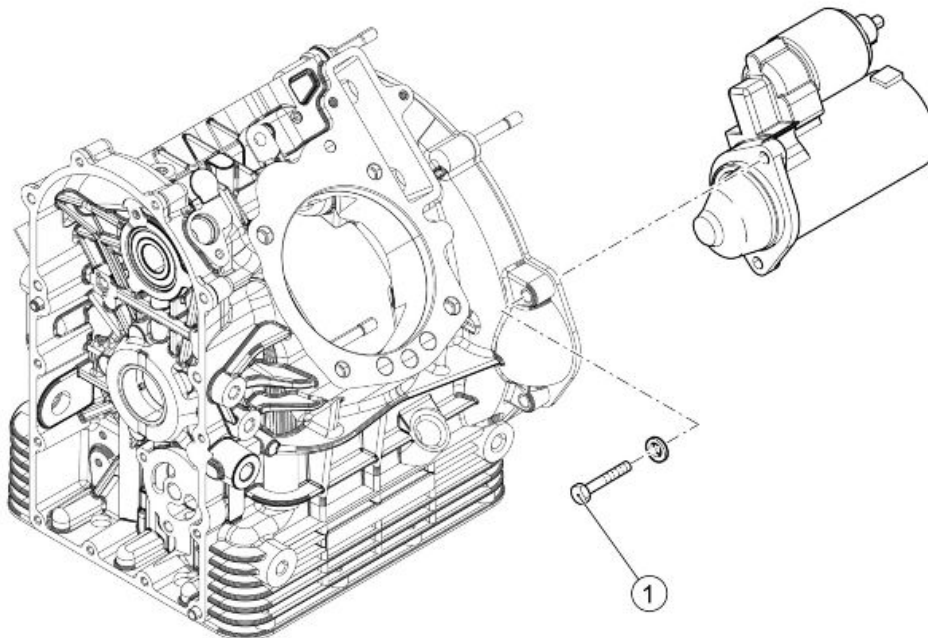




- Insert the lower screws
- Tighten all the screws of the cover



**Starter motor**



**STARTER MOTOR**

pos.	Description	Type	Quantity	Torque	Notes
1	Starter motor fixing screws	M8x75	2	25 Nm (18.44 lb ft)	-

## Removing the starter motor

- Undo and remove the two screws and collect the washers.

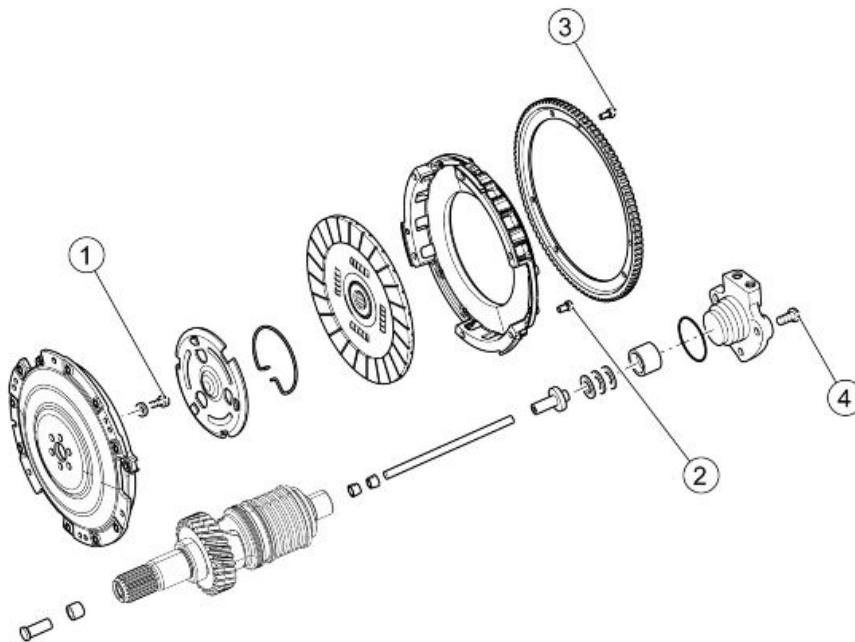


- Slide off the starter motor.



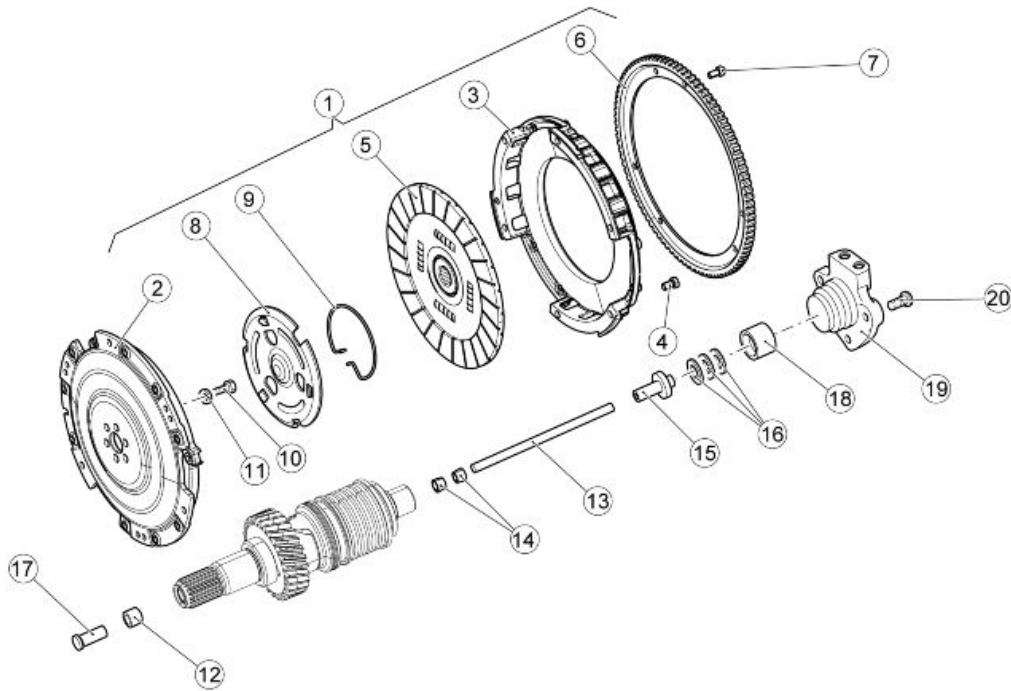
## Clutch side

### Disassembling the clutch



**CLUTCH**

pos.	Description	Type	Quantity	Torque	Notes
1	Flywheel on crankshaft fixing screw	M8x25	6	42 Nm (30.98 lb ft)	Loctite 243
2	Clutch external flange fixing screw on flywheel	M7x16	6	20 Nm (14.75 lb ft)	Loctite 243
3	Start-up crown fixing screw on flywheel	M6x12	6	10 Nm (7.37 lb ft)	-
4	Clutch control cylinder fixing screw	-	3	10 Nm (7.37 lb ft)	Loctite 243



**key:**

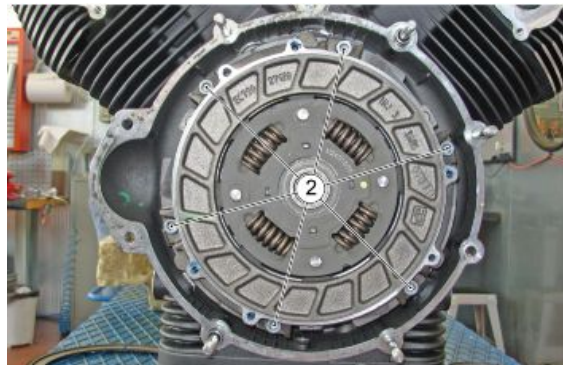
- 1. Complete clutch
- 2. Clutch
- 3. Clutch bell
- 4. TCEI screw
- 5. Clutch plate
- 6. Sprocket
- 7. TCEI screw
- 8. Clutch thrust plate
- 9. Ring
- 10. TE flanged screw
- 11. Conical washer
- 12. Bushing
- 13. Rod
- 14. Bushing
- 15. Intermediate body
- 16. Thrust bearing

- 17.Clutch control bowl
- 18.Thrust cylinder
- 19.Clutch control cylinder
- 20.TE flanged screw

- Remove the complete gearbox.
- Undo and remove the six screws (1).
- Remove the start-up crown gear.



- Remove the clutch bell and the friction disc by undoing the six screws (2).



- Remove the retainer ring.
- Remove the clutch pressure plate.



- Undo and remove the six screws and collect the belleville springs.
- Remove the clutch plate.

**See also**

[Removing the gearbox](#)

## Checking the clutch actuator

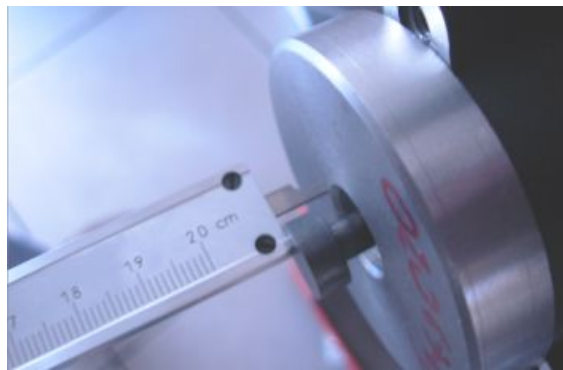
If the clutch is replaced, measure the length of the clutch control rod in order to use the correct rod.

Measure as follows:

- Fit the new clutch on the crankshaft.
- Fit the clutch control bowl in the gear-box.



- Fit the gearbox on the engine block.
- Fit the tool in the gearbox to determine the clutch control rod length.
- Measure rod protrusion using a depth gauge (see picture).
- According to the value found, select the correct rod based on the following table:



### Specific tooling

#### 020678Y Tool for clutch rod checking

#### **CLUTCH CONTROL ROD SELECTION**

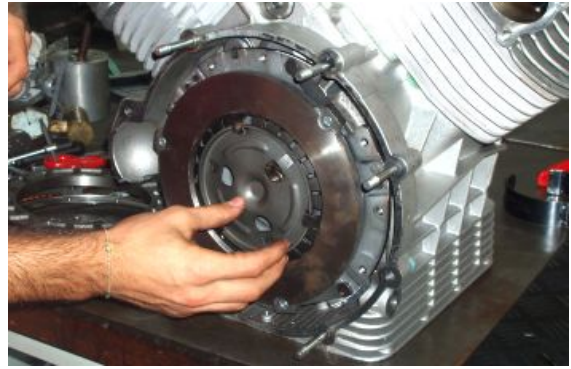
Specification	Desc./Quantity
Protrusion: 9.8 - 11.2 mm (0.386 - 0.441 in)	Clutch control rod length = 183 mm (7.205 in)
Protrusion: 9 - 9.7 mm (0.354 - 0.382 in)	Clutch control rod length = 184.5 mm (7.264 in)
Protrusion: 8.25 - 8.95 mm (0.325 - 0.352 in)	Clutch control rod length = 185 mm (7.283 in)
Protrusion: 7.5 - 8.2 mm (0.295 - 0.323 in)	Clutch control rod length = 185.5 mm (7.303 in)
Protrusion: 6.75 - 7.45 mm (0.266 - 0.293 in)	Clutch control rod length = 186 mm (7.323 in)
Protrusion: 5.3 - 6.7 mm (0.209 - 0.264 in)	Clutch control rod length = 187.5 mm (7.382 in)

## Assembling the clutch

- Lock crankshaft rotation with the crankpin facing upwards.
- Place the clutch plate with the reference facing upwards.
- Fasten the clutch plate on the crankshaft with the six screws, Loctite 243 and the Belleville springs.



- Place the clutch pressure plate.
- Fit the tool to centre and compress the plate.
- Fully tighten the two centring tool screws.

**Specific tooling****020672Y Clutch spring centre and pusher**

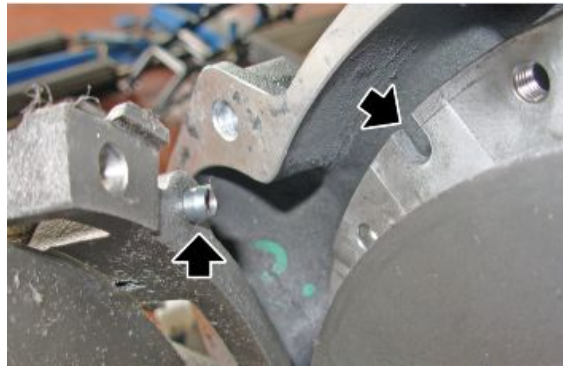
- Once the centring tool is fitted, lock the plate with the snap ring.
- Undo and remove the two screws fixing the tool.
- Remove the special tool.



- Place the friction disc; centre it.



- Insert the friction disc in the cap by matching the centring with the slot in the cap.



- Fit the clutch bell.

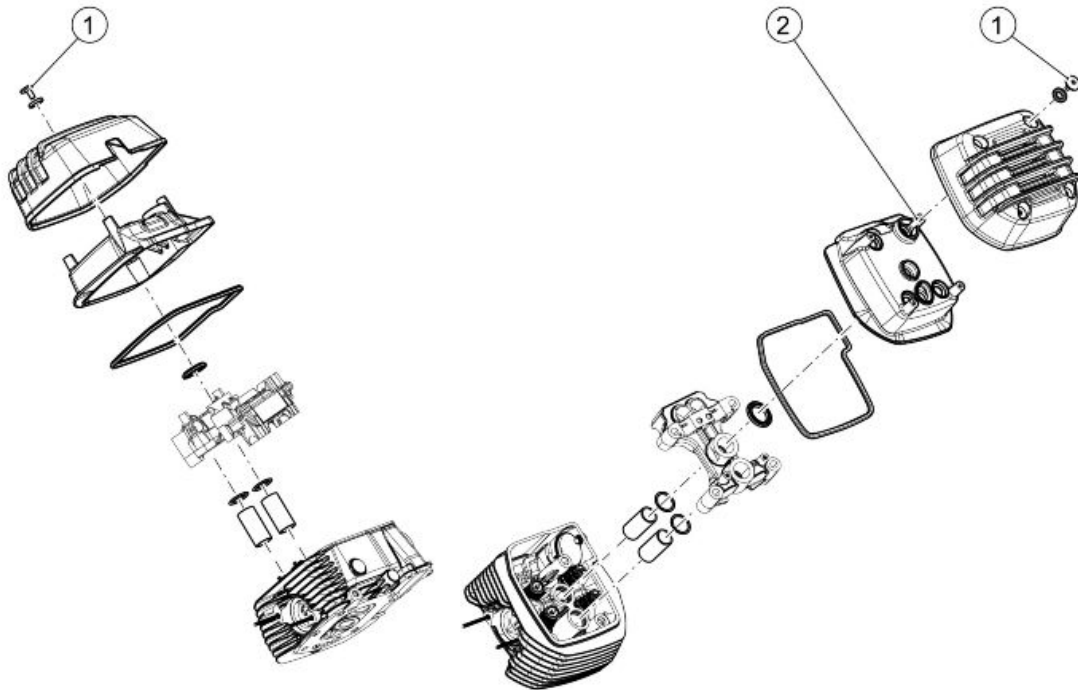


- Place the starter sprocket.
- Tighten the six screws to the prescribed torque operating diagonally and in stages.



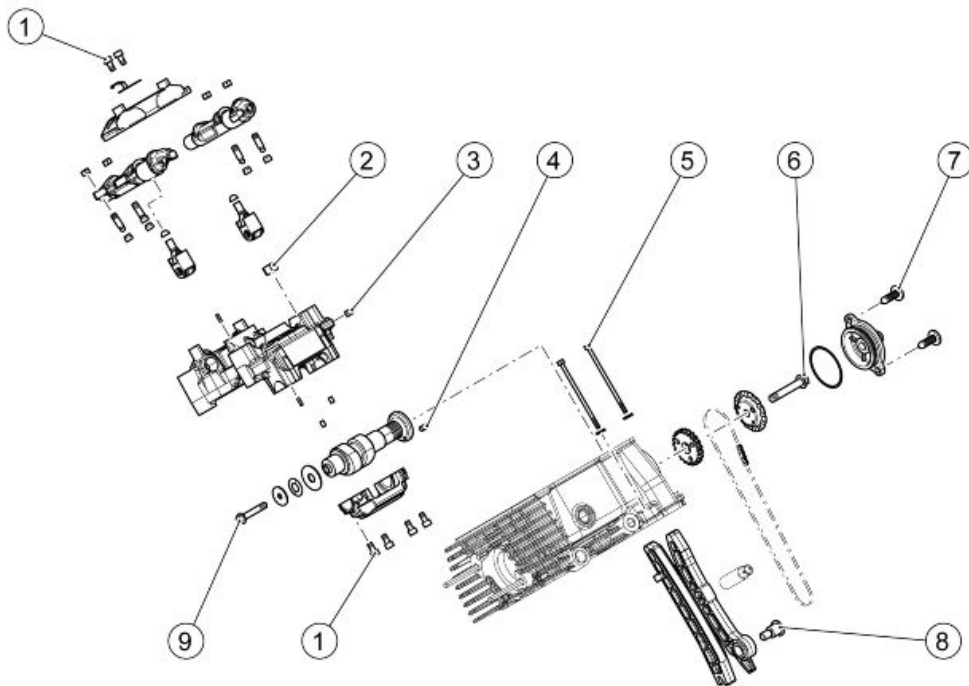


Heads



**CYLINDER HEAD COVERS**

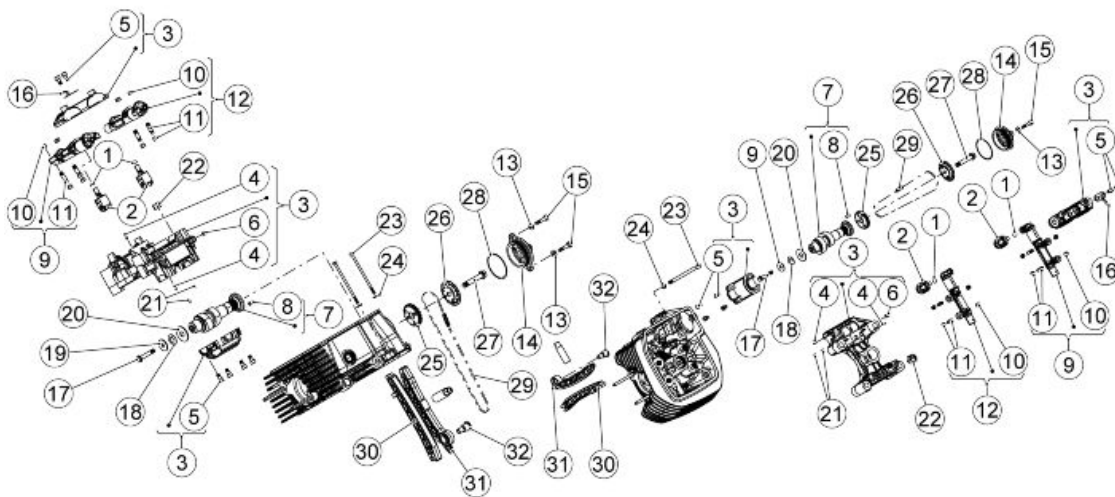
pos.	Description	Type	Quantity	Torque	Notes
1	Special aesthetic head cover fixing screw	-	8	8 Nm (5.90 lb ft)	Locked with cross sequence
2	Special head cover screw	-	8	8 Nm (5.90 lb ft)	Locked with cross sequence



**CYLINDERS TIMING**

pos.	Description	Type	Quantity	Torque	Notes
1	Camshaft / rocker support fixing screws	M8x30	12	16 - 18 Nm (11.80 - 13.28 lb ft)	-
2	Nut for tie rod	M10x1.25	8	Pretorque 15 Nm (11.06 lb ft) Final torque 42 Nm (30.98 lb ft)	-
3	Cap	M6x10	2	10 - 12 Nm (7.37 - 8.50 lb ft)	Loctite 542
4	Reference dowel on camshaft	-	1	Interference insert	Loctite 542
5	Long screw for chain compartment on head	M6x120	4	10 Nm (7.37 lb ft)	-
6	Screws for sprocket timing on camshaft	M8x1	2	30 Nm (22.13 lb ft)	Loctite 243
7	Screws for blow-by cap on head	M5x16	4	6 - 8 Nm (4.42 - 5.90 lb ft)	-
8	Chain tensioner rod spacer screws	M8x24.5	2	20 Nm (14.75 lb ft)	-
9	Cup spring to camshaft fixing screws	M6x25	2	11 - 13 Nm (8.11 - 9.59 lb ft)	-

**Head and timing**



**key:**

- 1. Pad
- 2. Hydraulic tappet
- 3. Right rocker axle support
- 4. Pin D. 2.5
- 5. Screw M8x30
- 6. Threaded cap M6x10
- 7. Camshaft
- 8. Pin

9. Intake and exhaust com. rockers
10. Rocker adjustment nut
11. Adjustment screw
12. Intake and exhaust com. rockers
13. 5.3x10x0.5 spring washer
14. Complete breather cover
15. Screw
16. Plate
17. TE flanged screw M6x25
18. Cup spring
19. Shim washer
20. Shim washer
21. Roller
22. Nut M10x1.25 6H
23. Flanged screw M6x120
24. Flat washer 12x6.1x2
25. Timing system gear
26. Breather plate
27. Flanged screw
28. Seal ring 2.62x46.52
29. Timing chain
30. Chain guide slider
31. Chain tensioner pad
32. Spacer screw M8

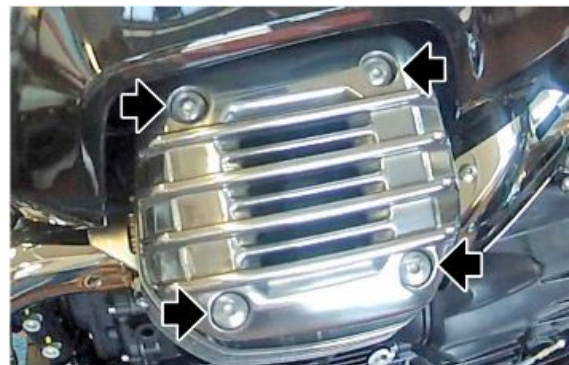
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## Removing the head cover

### NOTE

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

- Remove the cover of the head by undoing the four fixing screws.



- Disconnect the two spark plug caps.

### CAUTION

**BE CAREFUL NOT TO INVERT TWO SPARK PLUG CAPS.**

- Unscrew and remove the four head cover fixing screws and collect the sealing O-rings.



- Remove the head cover together with the gaskets.

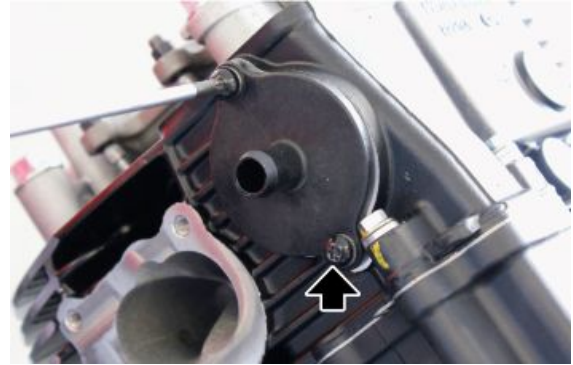


- Remove the two spark plugs.



## Removing the cylinder head

- Undo and remove the two fixing screws of the pliers of the blow-by.



- Remove the pliers of the blow-by paying attention not to damage the seal ring.



- Undo the external fixing screws of the head.

### CAUTION



PAY ATTENTION WHEN MOUNTING TO THE SCREW INDICATED ON THE RIGHT CYLINDER BECAUSE IT IS THE ONLY ONE WITH DUAL SPACERS.



- Undo the fixing screw of the separator plate/timing sprocket. Remove the plate.



- Discharge the left chain tensioner from the oil pressure undoing the screw shown.



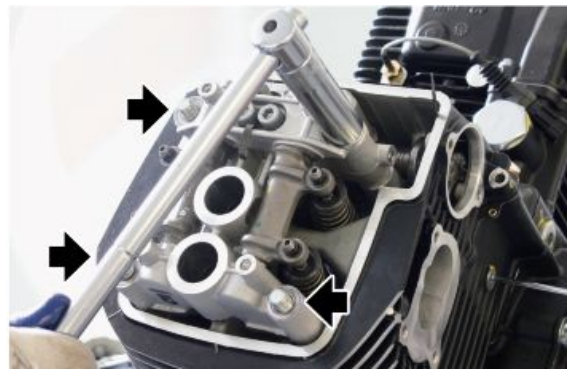
- With the help of a screwdriver act on the chain tensioner slider so as to discharge the thrust of the tensioner and simultaneously insert a pin in said hole so as to block the return.



- Remove the crown of the timing system thus releasing the camshaft.



- Undo the nuts securing the cam tower and the head unit.
- Remove the complete head of the cam tower timing system.



- Undo the fixing screws of the rocker bridge



- Remove the rocker bridge.



- Remove the rockers.



- Use the screws as shown in the figure to extract the cam tower.



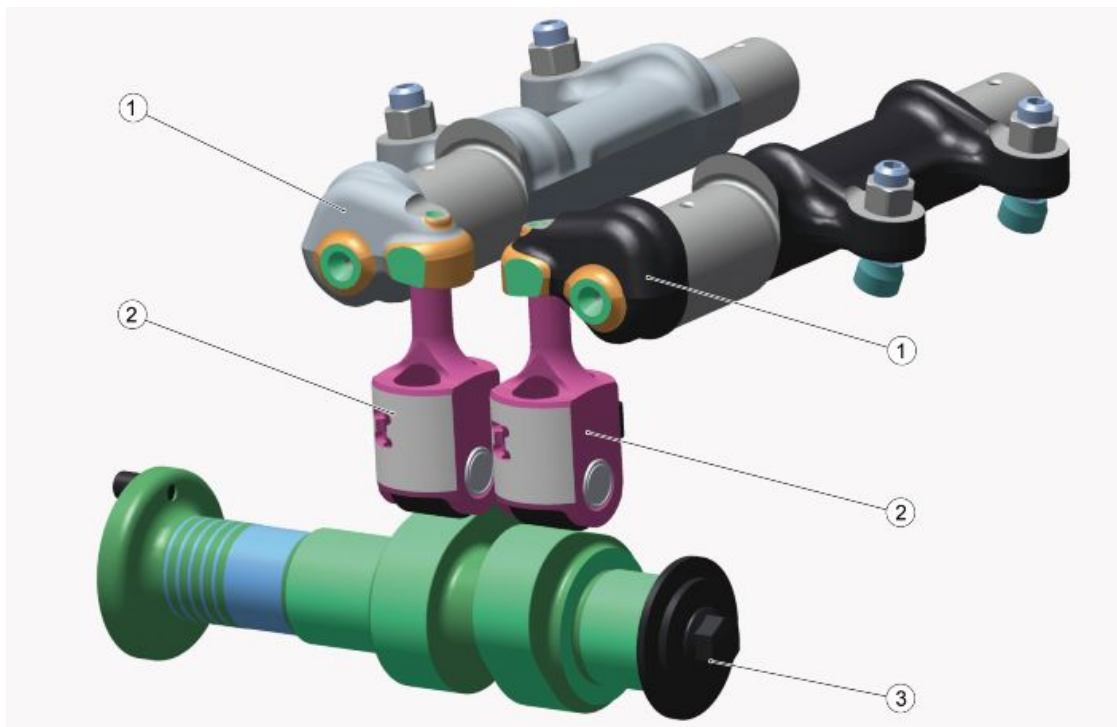
- Remove the timing system cam tower complete with the camshaft.



**See also**

[Removing the head cover](#)

**Cylinder head**



**key:**



1. Rockers.
2. Hydraulic tappets with rollers.
3. Camshaft.

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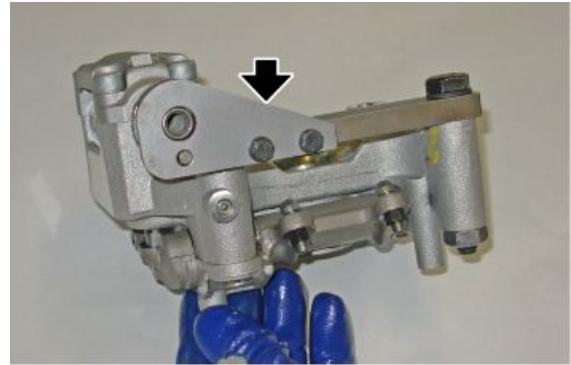
## Removing the overhead camshaft

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- Using the special tool hold the camshaft.

### Specific tooling

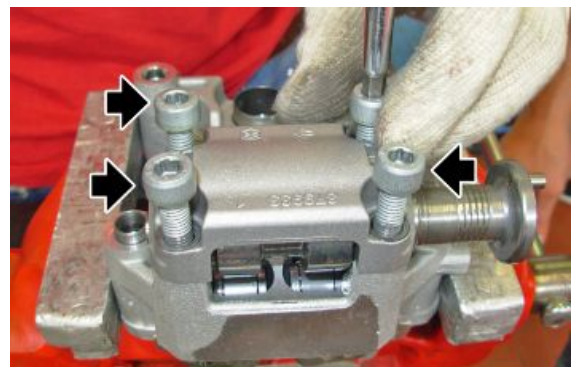
**020953Y Cam shaft lock for fixing**



- Unscrew and remove the camshaft fixing screw.



- Undo and remove the four fixing screws of the cover of the seat of the cam shaft.



- Remove the camshaft from its seat.



- Remove the hydraulic tappets with rollers from their seats.



### See also

[Removing the rocker arms](#)

## Removing the rocker arms

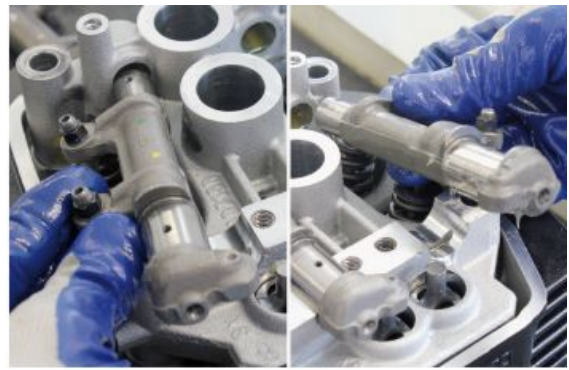
- Undo the fixing screws of the rocker bridge



- Remove the rocker bridge.



- Remove the rockers.



### See also

[Removing the cylinder head](#)

## Removing the valves

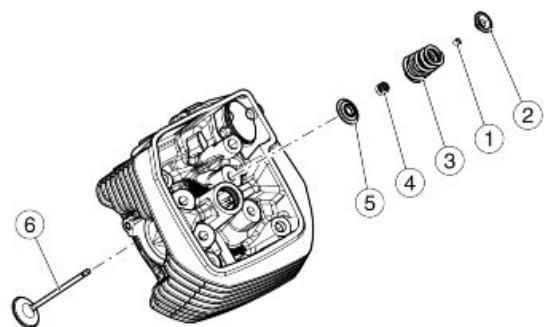
- Remove the head.
- Place the special tool on the upper cap and at the centre of the head of the valve to be removed.

### Specific tooling

**10.90.72.00 Tool for valve removal and refitting**  
**AP9100838 Tool for valve pressure plate**



- Tighten the tool screw until fitted, and then hit the tool head (where the upper cap works) with a mallet so that the two cotters (1) get detached from the upper cap (2).
- Once the two cotters (1) are detached, screw these cotters until they can be slid off the valve seats; unscrew the tool and remove it from the head.
- Slide off the upper cap (2).
- Remove the spring (3).
- Remove the lower cap (5) and the valve guide oil seal (4), if necessary.
- Remove the valve (6) from inside the head.



## Checking the valve guides

Use a punch to extract the valve guides from the heads.

The valve guides should be replaced only if the clearance between them and the stem cannot be eliminated by simply replacing the valves.

To refit the valve guides on the head, follow this procedure:

- Heat the head in an oven at approximately 60°C (140°F).
- Lubricate the valve guide.
- Fit the circlips.
- Press a punch with the valve guides.
- Use a reamer to bore the holes the valve stems slide through so that the inside diameter is at the prescribed value. The interference between the seat on the head and the valve guide must be 0.046 - 0.075 mm (0.0018 - 0.0030 in)

### VALVE GUIDE COUPLING - VALVES (INLET)

Specification	Desc./Quantity
Valve guide inside diameter	5.0 - 5.012 mm (0.19685 - 0.19732 in)
Valve stem diameter	4.972 - 4.987 mm (0.19574 - 0.19633 in)
Fitting clearance	0.013 - 0.040 mm (0.00051 - 0.00157 in)

### VALVE GUIDE COUPLING - VALVES (OUTLET)

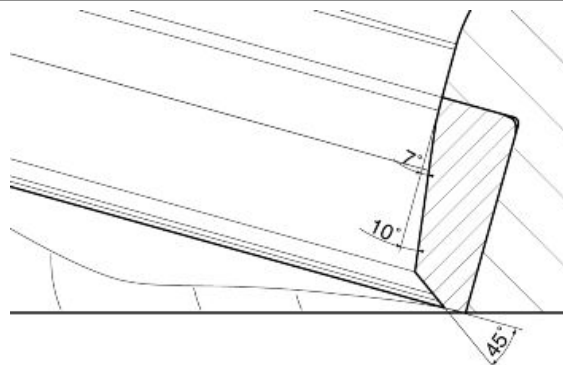
Specification	Desc./Quantity
Valve guide inside diameter	5.0 - 5.012 mm (0.19685 - 0.19732 in)
Valve stem diameter	4.960 - 4.975 mm (0.19527 - 0.19587 in)
Fitting clearance	0.025 - 0.052 mm (0.00098 - 0.00205 in)

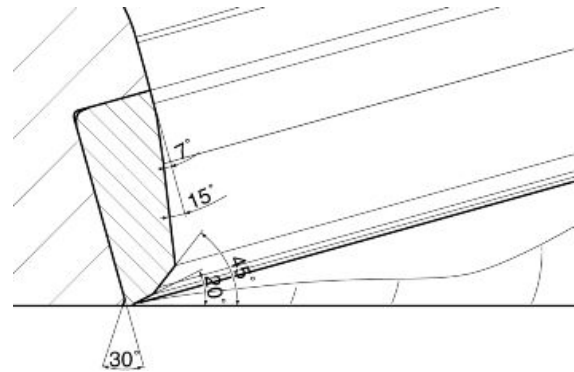
## Checking the cylinder head

Check that:

- The planes of contact with the cover and with the cylinder are not scored or damaged so as to compromise a perfect seal.
- Check that the clearance between the valve guide holes and valve stanchions is within the prescribed limits.
- Check the status of the valve seats.

### INLET VALVE SEAT DETAIL DRAWING



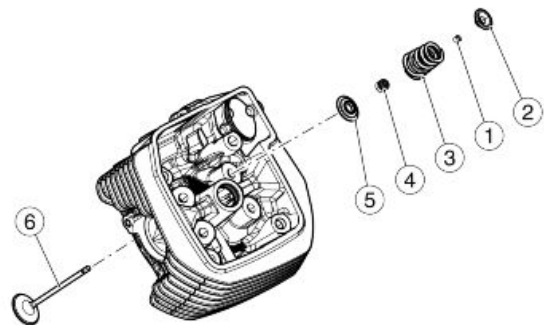
**OUTLET VALVE SEAT DETAIL DRAWING**

- If the width of the mark on the valve seat is larger than the prescribed limits, true the seats with a 45° milling cutter and then grind.
- Replace the head in case of excessive wear or damage.

**Installing the valves****NOTE**

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

- Place the valve guide oil seal (4) in the head.
- Place the lower cap (5).
- Place the valve (6) inside the head.
- Place the spring (3).
- Fit the upper cap (2).
- Place the two cotters (1) on the seats in the valves.
- By compressing the spring (3) with the special tool, fit the valve cotters.

**Specific tooling**

**10.90.72.00 Tool for valve removal and refitting**

**AP9100838 Tool for valve pressure plate**

- Remove the special tool



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## Installing the rocker arms

- Insert the roller hydraulic tappets.
- Fit the camshaft
- Place the half spheres (1) into the appropriate seats (2) of the rocker.



- Place the two rocking levers in the cam tower seats.



- Position the U-bolt on the rockers.
- Position the ground plate and tighten the two screws.



**See also**

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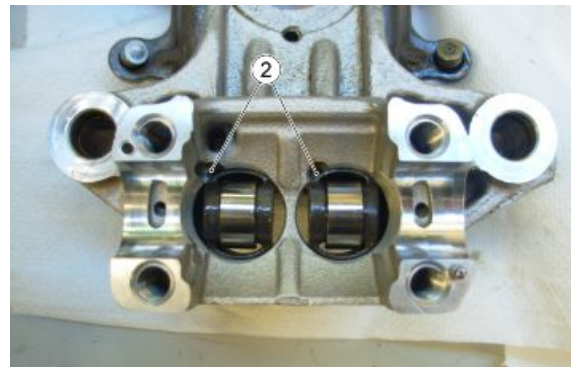
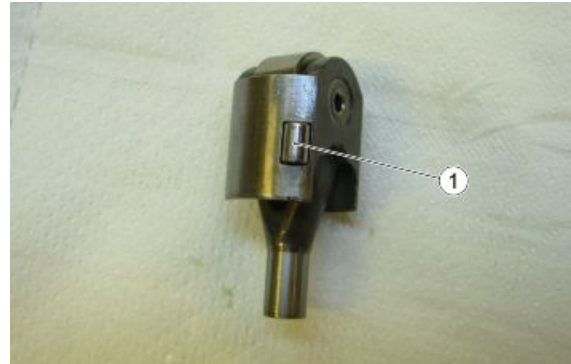
[Installing the overhead camshaft](#)

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**Installing the overhead camshaft**

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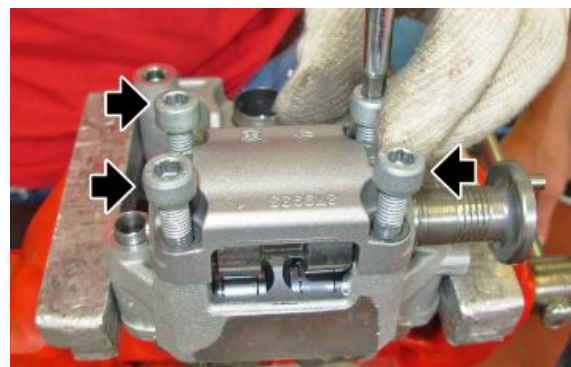
- Insert the roller hydraulic tappets making sure that the roller (1) in the appropriate milling (2) of the cam tower coincides.



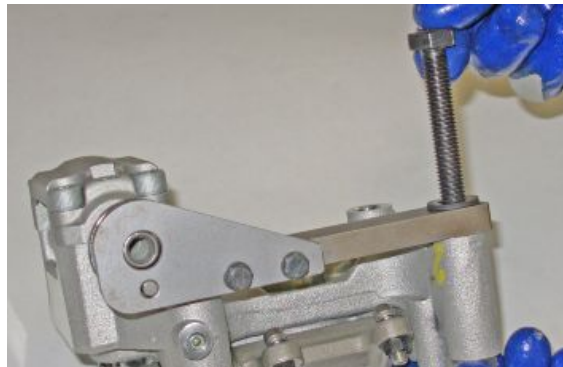
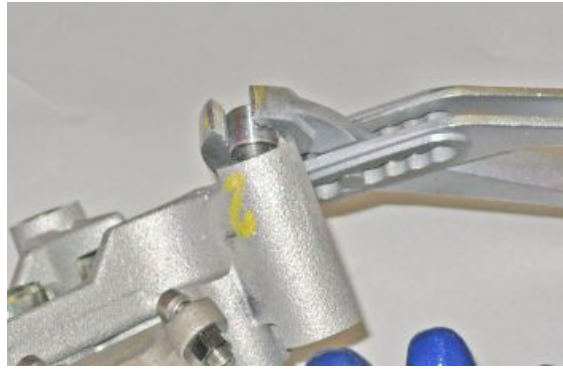
- Position the cam shaft paying attention to the direction.



- Position the U-bolt on the camshaft matching up the reference pins.
- Tighten the four fixing screws to the prescribed torque, proceeding diagonally.



- Remove the bushing so as to be able to fix the tool.
- Be careful when removing it not to damage it.

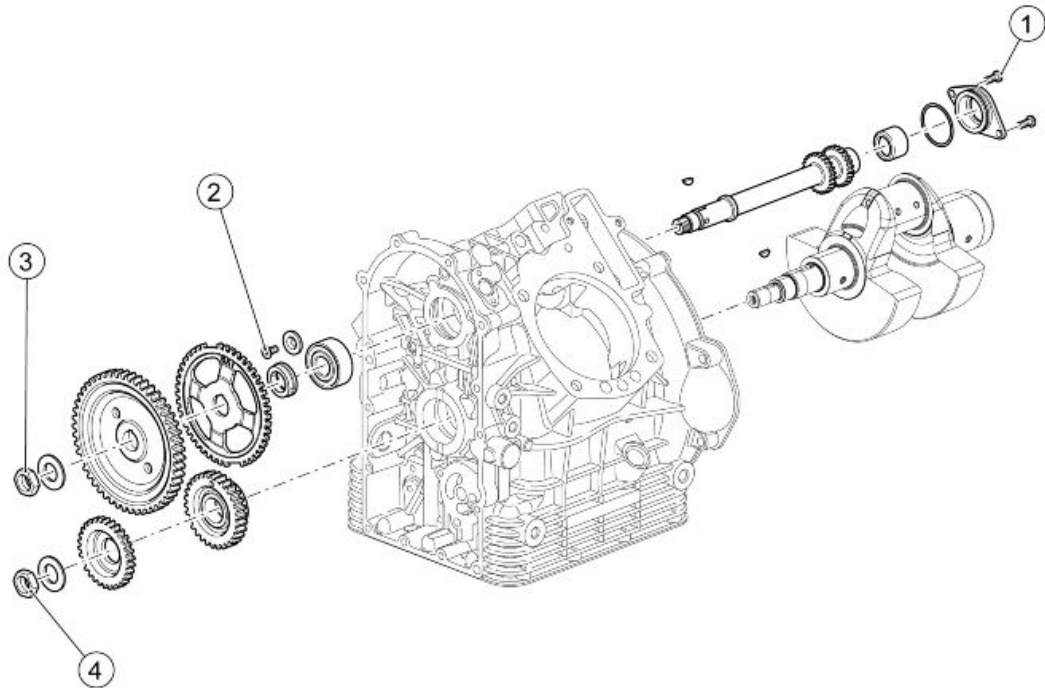
**Specific tooling****020953Y Cam shaft lock for fixing**

- Tighten the camshaft fixing screw.
- Between the two washers, there is a cup spring which recovers the axial clearance of the shaft. The spring must necessarily be centred using the appropriate tool.

**Specific tooling****020954Y Centring cam shaft cup spring**



Timing



**TIMING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Idle shaft flange fixing screws	M6x14	2	7 - 8 Nm (5.16 - 5.90 lb ft)	Loctite 542 only on through hole
2	Bearing on idle shaft fixing screw	M6x16	1	8 - 10 Nm (5.90 - 7.37 lb ft)	Loctite 243
3	Idle shaft locking nut	M18x1.5	1	150 Nm (110.63 lb ft)	-
4	Crankshaft locking nut	M25x1.5	2	200 Nm (147.51 lb ft)	-

**Removing the phonic wheel**

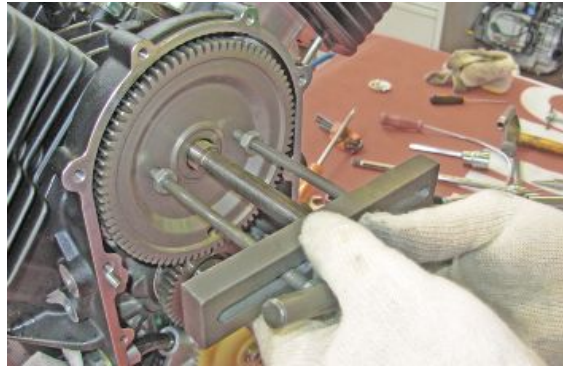
- First remove the generator and the timing system cover.
- Using the special tool, unscrew and remove the nut securing the timing system gear on the service shaft.

**Specific tooling**

**020675Y Service shaft gear lock**



- Using the special tool, remove the timing system gear.

**Specific tooling****12.91.36.00 Tool to remove the flywheel-side flange**

- Remove the tone wheel.
- Recover the cotter and the shim washer.



- Undo and remove the timing sensor fixing screw.
- Remove the timing sensor and its O-Ring

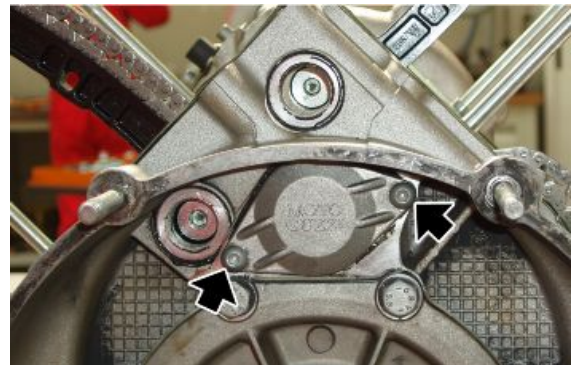


### See also

[Removing the generator](#)

## Service shaft removal

- Remove the tone wheel.
- Remove both cylinders.
- Undo and remove the two screws.
- Remove the service shaft closing cap.



- Mark the timing chains so as not to invert the direction of rotation upon fitting.
- Slide off the service shaft from the chains.
- Remove both chains.



### See also

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[Removing the phonic wheel](#)

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**Installing the service shaft**

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- Place the service shaft bearing (if previously removed) on the crankcase.
- Fix it to the seat with the lock washer and screw.



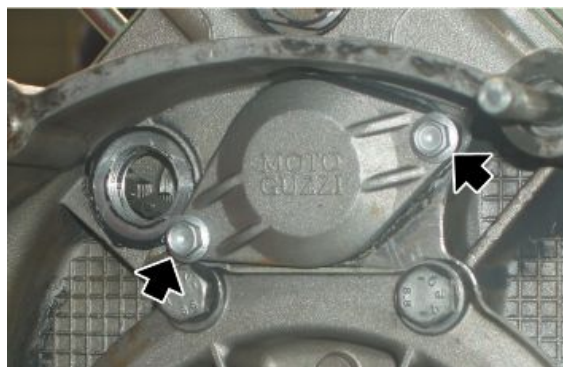
- Fit the timing chains according to the references marked at the removal phase.
- Lubricate the service shaft.
- Insert the service shaft in its crankcase seat by sliding it through the two chains.
- Fit each chain to the corresponding service shaft gear.



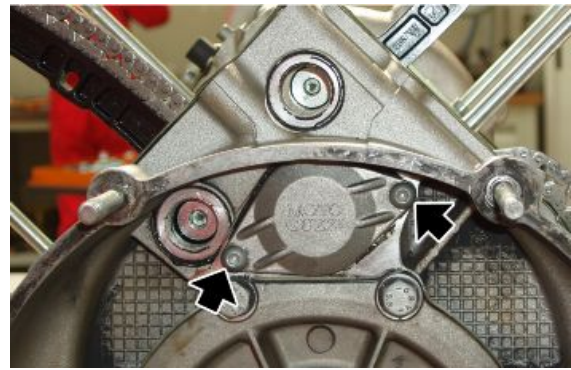
- Fit the roller cage and a new O-ring on the service shaft closing cap.



- Partially fit the service shaft closing cap.
- To screw the cap until it stops, use two M6 flanged screws larger than the original screws.
- Tighten the two M6 flanged screws operating in stages until the cap stops against the crankcase.



- Undo and remove the two M6 flanged screws.
- Tighten the cap with the two original TBEI screws.



## Installing sliders

- Fit the crankshaft and the service shaft on the crankcase.
- Fit the fixed chain sliders and tighten the fixing screws.



- Tighten the chain caps with O-rings.
- The operations related to the movable chain sliders are described in the cylinder fitting section.



### See also

[Installing the crankshaft](#)

[Installing the service shaft](#)

## Cam timing

- Fit the crankshaft and the service shaft on the crankcase.
- Fit the cylinders.
- Turn the crankshaft until the left cylinder piston reaches the top dead centre (TDC).
- Fit the cotter and the shim washer on the service shaft.
- Fit the tone wheel with the chamfered side facing the crankcase on the service shaft.



- Lock crankshaft rotation.
- Unscrew and remove the nut fixing the crankshaft gear.
- Remove the oil pump control gear.

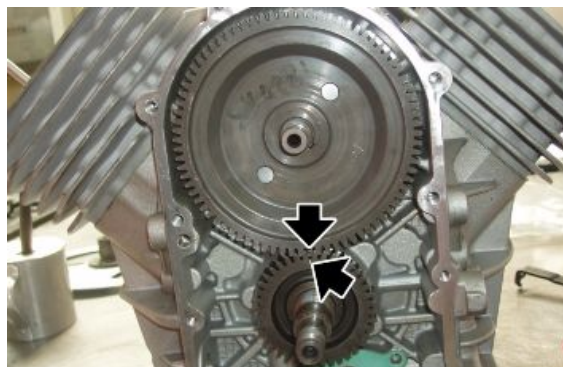


### Specific tooling

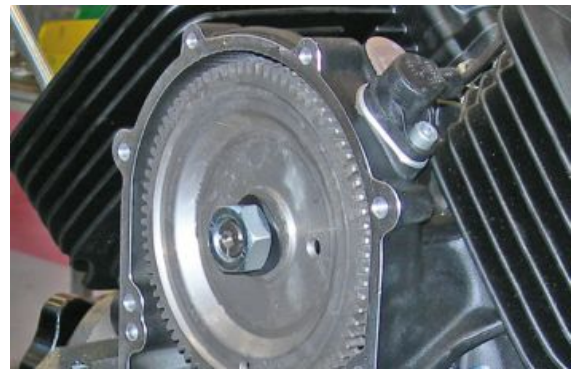
#### 12.91.18.01 Tool to lock the flywheel and the starting ring gear



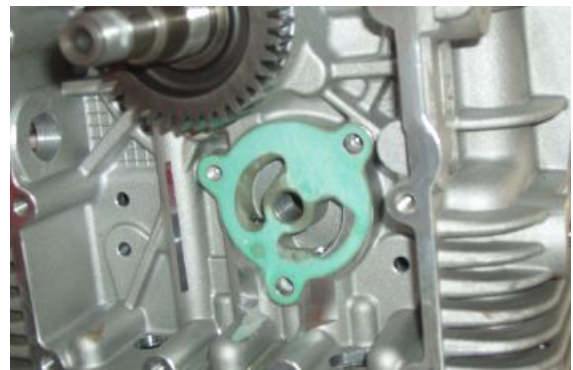
- Fit the timing system gear and align the reference with that on the crankshaft gear. Turn the crankshaft to align the two gears.



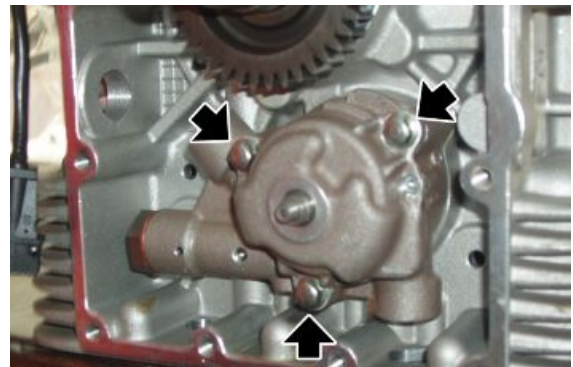
- After shimming the timing sensor properly, proceed to fit it.
- Fit the washer and tighten the timing system gear fixing nut of the service shaft.



- Place a new gasket between the crankcase and the oil pump.



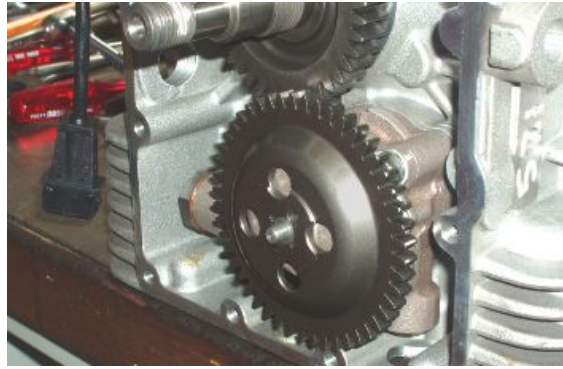
- Fit the oil pump.
- Tighten the three oil pump fixing screws.



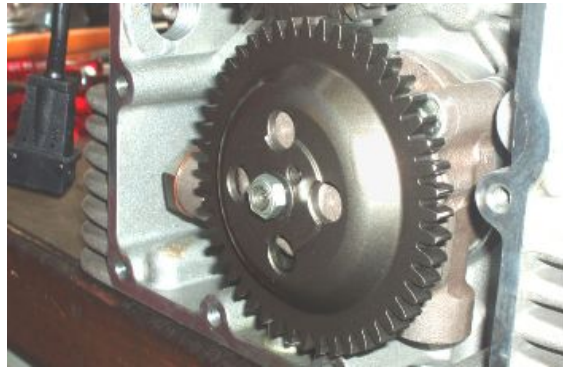
- Place the driving pin on the oil pump shaft.



- Place the gear on the oil pump shaft.



- Place the washer on the oil pump shaft.
- Tighten the nut to the specified torque.



- Place the oil pump control gear on the crankshaft and align its reference with that marked during the removal phase on the oil pump driven gear.
- Tighten the nut to the specified torque.



- Tighten the screw with the washer to the prescribed torque.



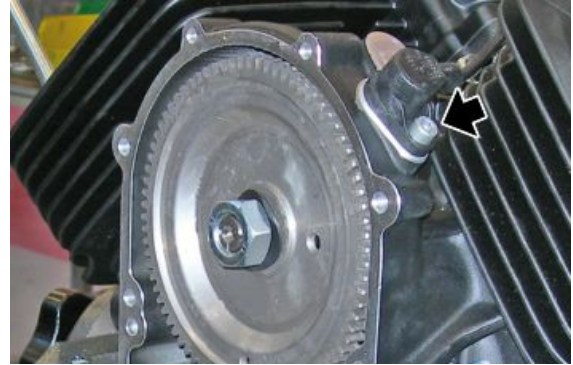
### See also

[Installing the crankshaft](#)  
[Installing the service shaft](#)  
[Measuring air gap](#)

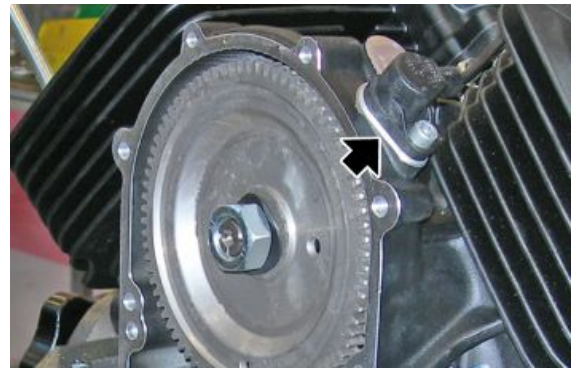


## Measuring air gap

- Undo the screw and remove the engine speed sensor.

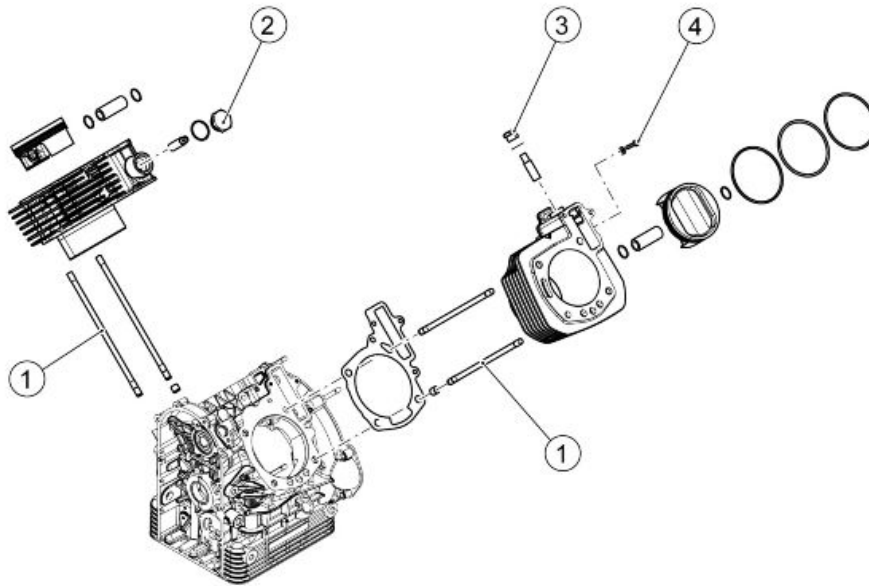


- Space the sensor with a 1 mm (0.0394 in) thick adjustment plate.



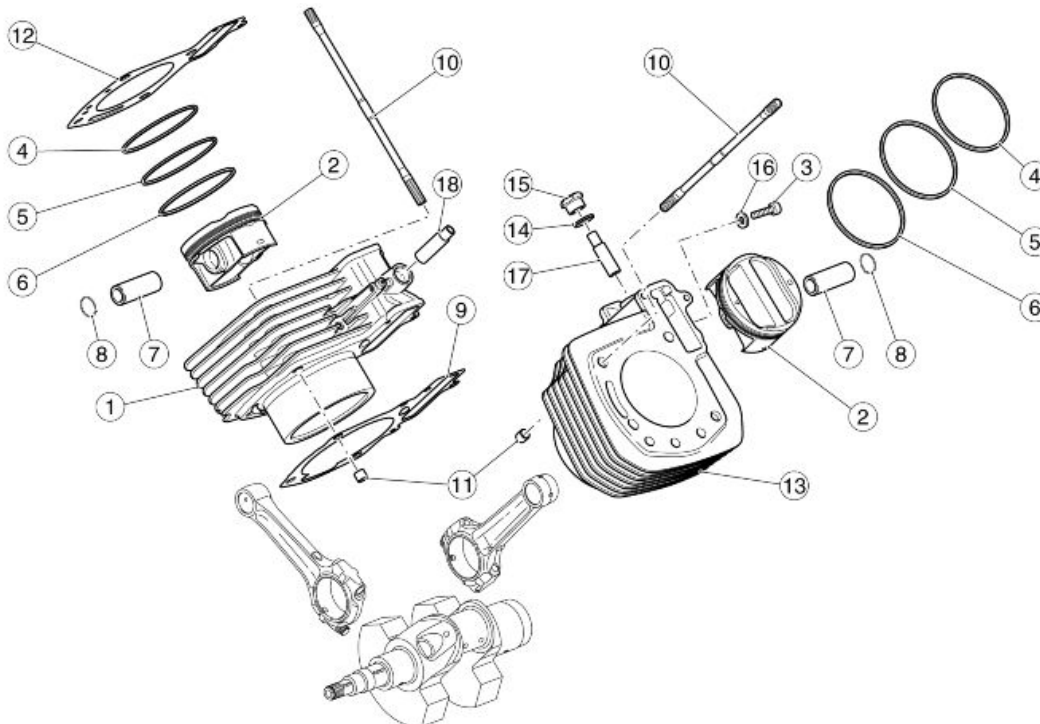
- Measure the distance between the engine speed sensor and the tone wheel. If the distance measured is:
    - 0.55 - 0.7 mm (0.0216 - 0.0275 in), the 1 mm (0.0394 in) adjustment plate must be replaced with a 1.2 mm (0.0472 in) thick plate;
    - 0.71 - 0.9 mm (0.0279 - 0.0354 in), the measurement is correct, therefore keep the 1 mm (0.0394 in) plate;
    - 0.91 - 1.05 mm (0.0358 - 0.0413 in), the 1 mm (0.0394 in) adjustment plate must be replaced with a 0.8 mm (0.0315 in) thick plate.
-

**Cylinder-piston assembly**



**PISTON CYLINDER**

pos.	Description	Type	Quantity	Torque	Notes
1	Tie rod on crankcase	M10x1.25	8	5 Nm (3.69 lb ft)	-
2	Right tensioner cover	M30x1.5	1	40 Nm (29.50 lb ft)	-
3	Left tensioner cover	M20x1.5	1	30 Nm (22.13 lb ft)	-
4	Left cylinder cover screw	M6x10	1	10 - 12 Nm (7.37 - 8.50 lb ft)	Loctite 542



**key:**

1. Right cylinder
2. Piston
3. Screw
4. Top piston ring
5. Middle piston ring
6. Oil scraper piston ring
7. Pin
8. Retainer ring
9. Cylinder base gasket
10. Stud bolt
11. Pin
12. Cylinder head gasket
13. Left cylinder
14. Washer
15. Chain tensioner cap
16. Washer
17. Left chain tensioner
18. Right chain tensioner

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## Removing the cylinder

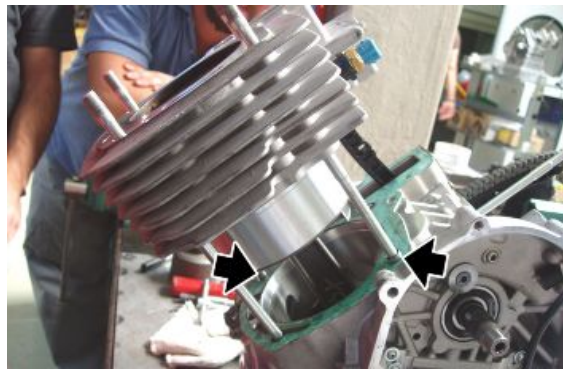
**NOTE**

**THE OPERATIONS DESCRIBED BELOW REFER TO ONE HEAD REMOVING ONLY BUT APPLY TO BOTH HEADS.**

- Remove the head, the gasket between the head and the cylinder and the two dowel pins.
- Slide off the movable chain slider.
- Remove the cylinder from the stud bolts.



- Remove the two dowel pins on the stud bolts.
- Remove the two gaskets between the crankcase and the cylinder.
- Cover the crankcase opening with a clean cloth.



### See also

[Removing the cylinder head](#)

## Disassembling the piston

### NOTE

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

- Remove the cylinder.
- Cover the crankcase opening with a clean cloth.
- Release the snap ring.



- Remove the pin.
- Mark the piston crown on the exhaust side so as to remember the refitting position.
- Remove the piston.



## Fitting the piston

### NOTE

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

- The reference on the piston ring must be facing the piston crown.
- Fit the piston rings on the piston: - the oil scraper in the lower slot; - the thicker smooth ring in the intermediate slot; - the less thick smooth ring in the upper slot.
- The piston rings must be offset at 120° one from the other.
- Fit one of the two pin snap rings on the piston.
- Lock crankshaft rotation.



### Specific tooling

#### 12.91.18.01 Tool to lock the flywheel and the starting ring gear

- Fit the piston.

#### NOTE

**CHECK THE ORIENTATION OF THE PISTON ACCORDING TO THE REFERENCES AT THE TOP. DO NOT ASSEMBLE PISTONS AND CYLINDERS OF DIFFERENT SELECTOR TYPES.**

- Insert the pin.



- Insert the snap ring.

### Specific tooling

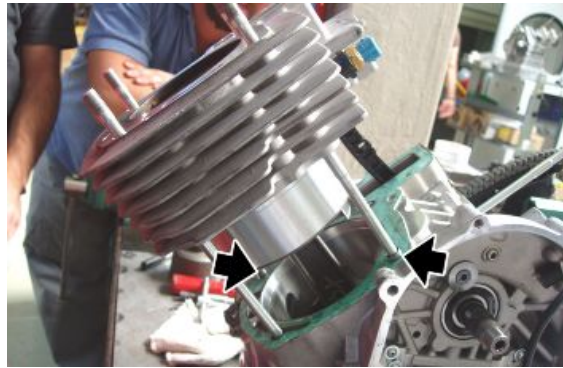
#### 020470Y Pin snap ring fitting tool



## Installing the cylinder

### RIGHT CYLINDER

- Fit the piston.
- Remove the cloth used to prevent foreign bodies from getting into the crankcase.
- Turn the rings so that the coupling ends are 120 degrees from each other.
- Place a new metal gasket between the crankcase and the cylinder. Place the two dowel pins on the stud bolts. Lubricate the piston and the cylinder. Lock connecting rod motion with the fork tool. Using the suitable piston ring clamp tool, place the cylinder and fit the chain in the timing system plate.



### CAUTION

DURING THIS OPERATION, PAY ATTENTION NOT TO DAMAGE THE PISTON.

### Specific tooling

020674Y Piston ring clamp

020716Y Connecting rod locking

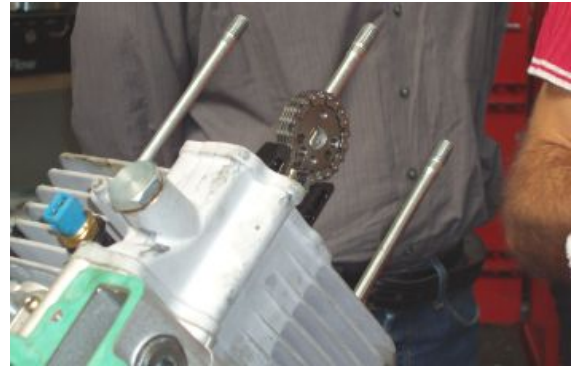
- Remove the piston ring clamp tool and finish positioning the cylinder.

### Specific tooling

020674Y Piston ring clamp



- Fit the movable chain slider.
- Fit the upper gear.
- Fit the chain tensioner and the chain tensioner cap temporarily and keep the chain taut on the service shaft.



### LEFT CYLINDER

- Fit the piston.
- Remove the cloth used to prevent foreign bodies from getting into the crankcase.
- Turn the rings so that the coupling ends are 120 degrees from each other.
- Place a new metal gasket between the crankcase and the cylinder.
- Place the two dowel pins on the stud bolts.
- Undo the screw which will be used to time the upper gear.



- Check that the oil in the left cylinder chain tensioner has been drained off by compressing it. If the operation is difficult, use a pin drive to push the central hole so that the oil is drained off from the circuit.



- Fit the chain tensioner in the cylinder.
- Lubricate the piston and the cylinder.
- Lock connecting rod motion with the fork tool.
- Using the suitable piston ring clamp tool, place the cylinder and fit the chain in the timing system plate.



**CAUTION**

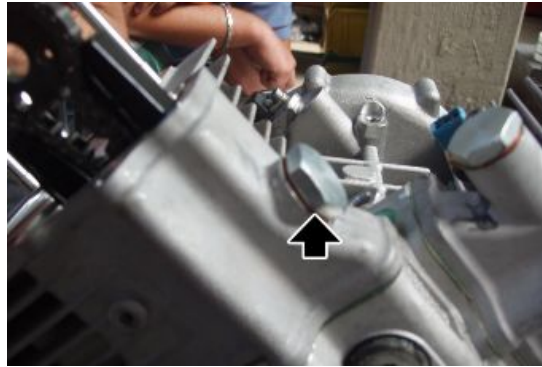
DURING THIS OPERATION, PAY ATTENTION NOT TO DAMAGE THE PISTON.

### Specific tooling

**020674Y Piston ring clamp**

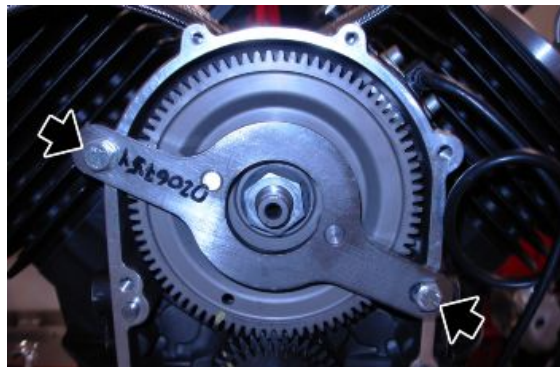
**020716Y Connecting rod locking**

- Fit the movable chain slider.
- Fit the upper gear.
- Fit the chain tensioner cap temporarily and keep the chain taut on the service shaft.



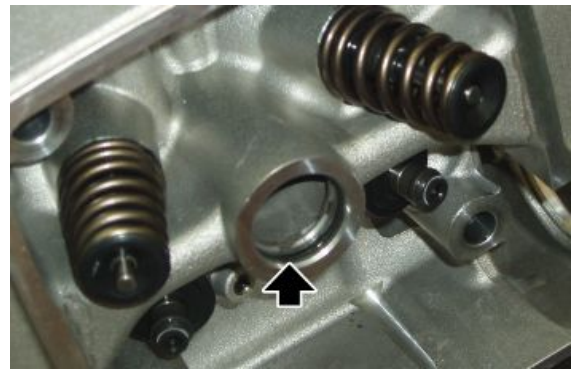
## Installing the cylinder head

- Fit the valves in the head, if previously removed.
- Take the left cylinder piston to TDC and lock crankshaft rotation.
- Determine the thickness of the gasket to be fitted between the head and the cylinder as described in the section: Shimming system.
- Place the two dowel pins.
- Fit the gasket with the correct thickness between the head and the cylinder.
- Fit the left cylinder head.

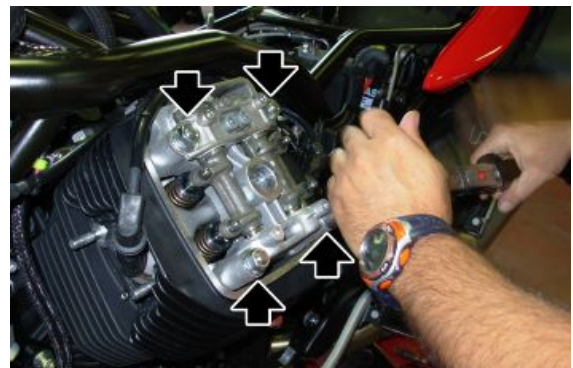




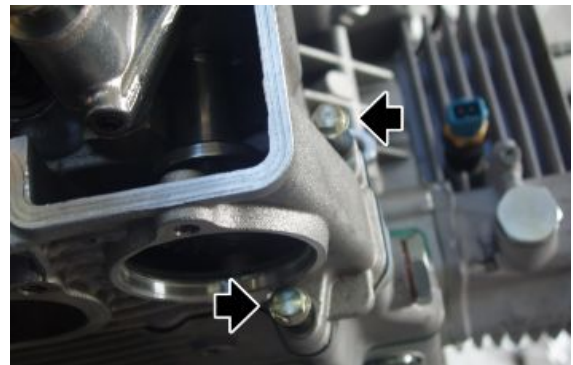
- Fit a new O-ring in the spark plug hole.
- Fit the complete cam cap.



- Fix the cam cap with the four nuts on the stud bolts.



- Fix the head with the two screws.
- Tighten nuts and screws to the prescribed torque operating diagonally and in stages.
- Loosen the valve set screws.



- Using a thin screwdriver relief oil pressure from the left cylinder chain tensioner.



- Screw two screws in the threaded holes of the timing system upper gear.
- Rotate the camshaft so that its pin is aimed towards the hole in the timing system chain.
- Place the gear in the chain.
- On the left camshaft pin, fit the hole marked with the letter "L" of the timing system gear.



- Block the left chain tensioner hole with screw and washer.
- Rotate the crankshaft by 90° so that the right cylinder piston reaches the TDC; lock crankshaft rotation.
- Also determine the thickness of the gasket for the right cylinder, to be fitted between the head and the cylinder as described in the section: Shimming system.
- Place the two dowel pins.
- Fit the gasket with the correct thickness between the head and the cylinder.
- Fit the right cylinder head.



- Unscrew and remove the right chain tensioner cap.



- Screw two screws in the threaded holes of the timing system upper gear.
- Rotate the camshaft so that its pin is aimed towards the hole in the timing system chain.
- Place the gear in the chain.
- On the right camshaft pin, fit the hole marked with the letter "R" of the timing system gear.



- Screw the cap of the right chain tensioner.
- Undo and remove the screws used to place the gear on the camshaft.
- Place the bulkhead and align the holes with the timing system gear.
- Fix the bulkhead on the timing system gear using a screw with Loctite on the thread.
- Tighten the screw to the prescribed torque.
- Also place the bulkhead of the other head.



- Place the cap.
- Tighten the two screws to the prescribed torque.
- Also place the cap of the other head.
- Adjust valve clearance.



### See also

[Checking the valve clearance](#)

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## Installing the head cover

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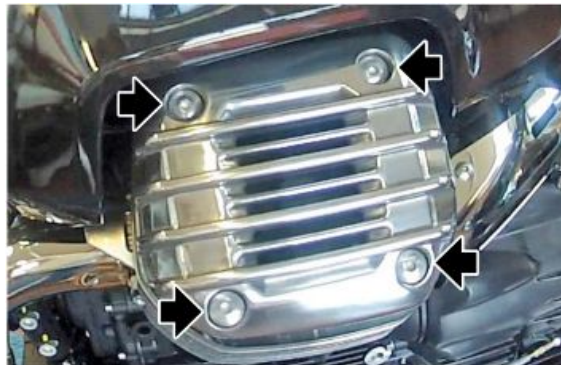
- Replace the gaskets and install the head cover.



- Replace the four rubber rings.
- Tighten the four screws to the prescribed torque.



- Position the two plug caps of the spark plug.
- Position the head cover and tighten the four screws to the prescribed torque.



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## Crankcase - crankshaft

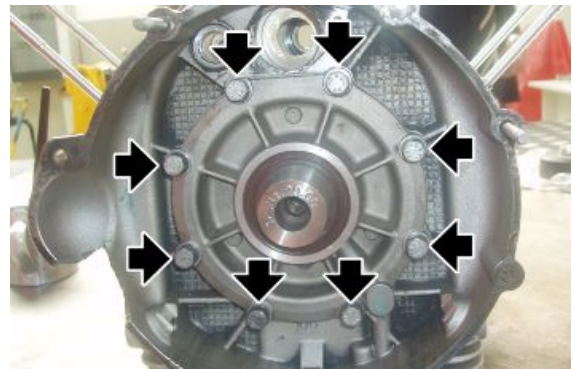
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## Removing the crankshaft

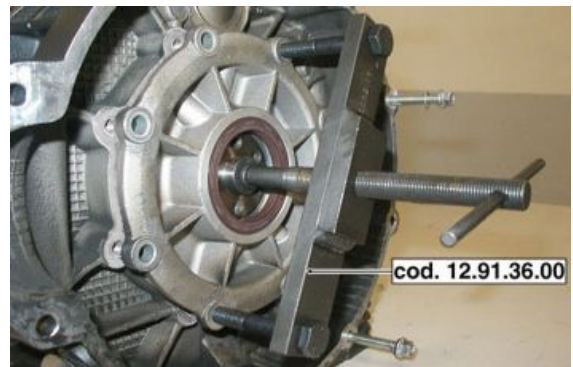
- Remove the clutch.
- Remove the tone wheel and the oil pump gear.
- Working from the generator side, unscrew and remove the nut.
- Remove both gears.



- Remove the connecting rods.
- Undo and remove the eight fixing screws and collect the washers.



- Hold the crankshaft during flange removal.
- Using the suitable special tool, remove the crankshaft flange.
- Remove the sealing ring from the flange, if necessary.



### Specific tooling

#### 12.91.36.00 Tool to remove the flywheel-side flange

- Remove the crankshaft afterwards.



- Collect the shim washer from inside the crankcase.

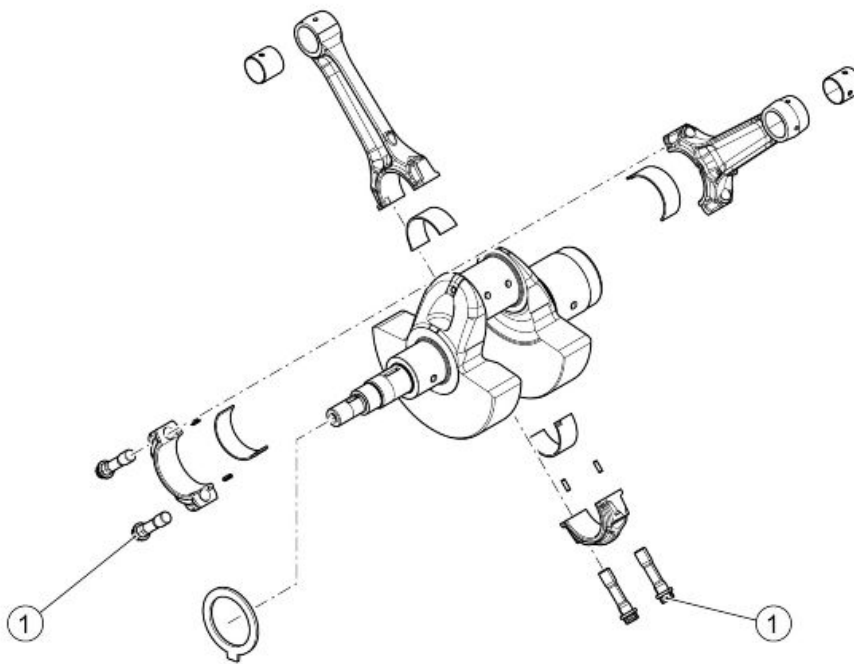


**See also**

[Disassembling the clutch](#)

[Removing the phonic wheel](#)

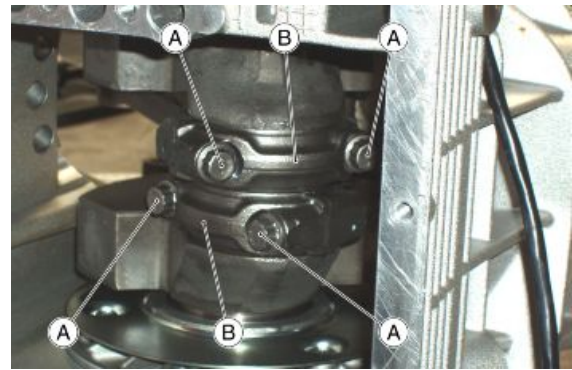
**Disassembling the connecting rod**



**CRANKSHAFT**

pos.	Description	Type	Quantity	Torque	Notes
1	Connecting rod screws	M10x1	4	Pre-torque 40 Nm (29.50 lb ft) Final torque 80 Nm (59.00 lb ft)	-

- Remove both heads.
- Remove the cylinders and the pistons.
- Remove the oil sump.
- Undo the coupling screws (A) inside the crankcase and remove the connecting rods (B).



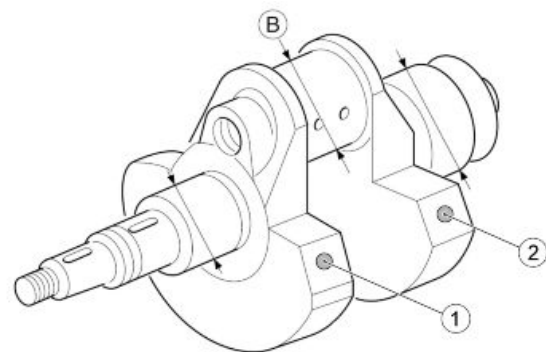
**See also**

- [Removing the flywheel](#)
- [Disassembling the piston](#)
- [Removing the cylinder](#)
- [Removing the cylinder head](#)

**Inspecting the crankshaft components**

Check the surfaces of the main journals; if they are scored or oval-shaped, reface them (observing the undersize charts), and replace the main bushings.

Reference (1) indicates the position where the coloured reference is applied to select diameter (B). Reference (2) indicates the position where the coloured reference is applied to select balancing.



**CRANKSHAFT SEAT (TIMING SYSTEM SIDE)**

Specification	Desc./Quantity
Diameter of crankshaft main journal, timing system side	37.975 - 37.959 mm (1.49507 - 1.49444 in)
Inside diameter of crankshaft bushing, timing system side	38.016 - 38.0 mm (1.49669 - 1.49606 in)
Clearance between bushing and main journal (timing system side)	0.025 - 0.057 mm (0.00098 - 0.00224 in)

**CRANKSHAFT SEAT ( CLUTCH SIDE)**

Specification	Desc./Quantity
Diameter of crankshaft main journal, clutch side	53.97 - 53.951 mm (2.12480 - 2.12405 in)
Inside diameter of crankshaft bushing on clutch-side flange	54.019 - 54.0 mm (2.12673 - 2.12598 in)
Clearance between bushing and main journal (clutch side)	0.030 - 0.068 mm (0.00118 - 0.00267 in)

**CRANKPIN DIAMETER (B)**

Specification	Desc./Quantity
'Blue' crankpin diameter	44.016 - 44.022 mm (1.73290 - 1.73314 in)
'Orange' crankpin diameter	44.022 - 44.028 mm (1.73314 - 1.73381 in)

**BALANCING SELECTION COLOURS (2)**

Specification	Desc./Quantity
Crankshaft selection colour (2) brown	Type 1 to be used with brown connecting rods.

Specification	Desc./Quantity
Crankshaft selection colour (2) green	Balance with a <b>1601 g (56.47 oz) +/- 0.25%</b> weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: <b>2 g (0.07 oz).</b> Type 2 to be used with green connecting rods.
Crankshaft selection colour (2) black	Balance with a <b>1618 g (57.07 oz) +/- 0.25%</b> weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: <b>2 g (0.07 oz).</b> Type 2 to be used with black connecting rods.
Crankshaft selection colour (2) black	Balance with a <b>1635 g (57.67 oz) +/- 0.25%</b> weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: <b>2 g (0.07 oz).</b>

## Checking the connecting rod

When examining the connecting rods, check that:

- Bushing conditions and bushings-pins clearance;
- Shaft parallelism;
- Connecting rod bearings.

These are thin shell bearings, anti-friction alloy that does not allow for any adaptation; replace them immediately if seizing or wear marks are found.

Upon replacing the bearings it may be necessary to ream the crankshaft pin.

Before reaming the crankpin, measure the pin diameter (B) comparing it with the maximum wear allowed, as indicated in the figure; this defines what kind of undersizing the bearing should have and to which diameter the pin (B) should be reamed.

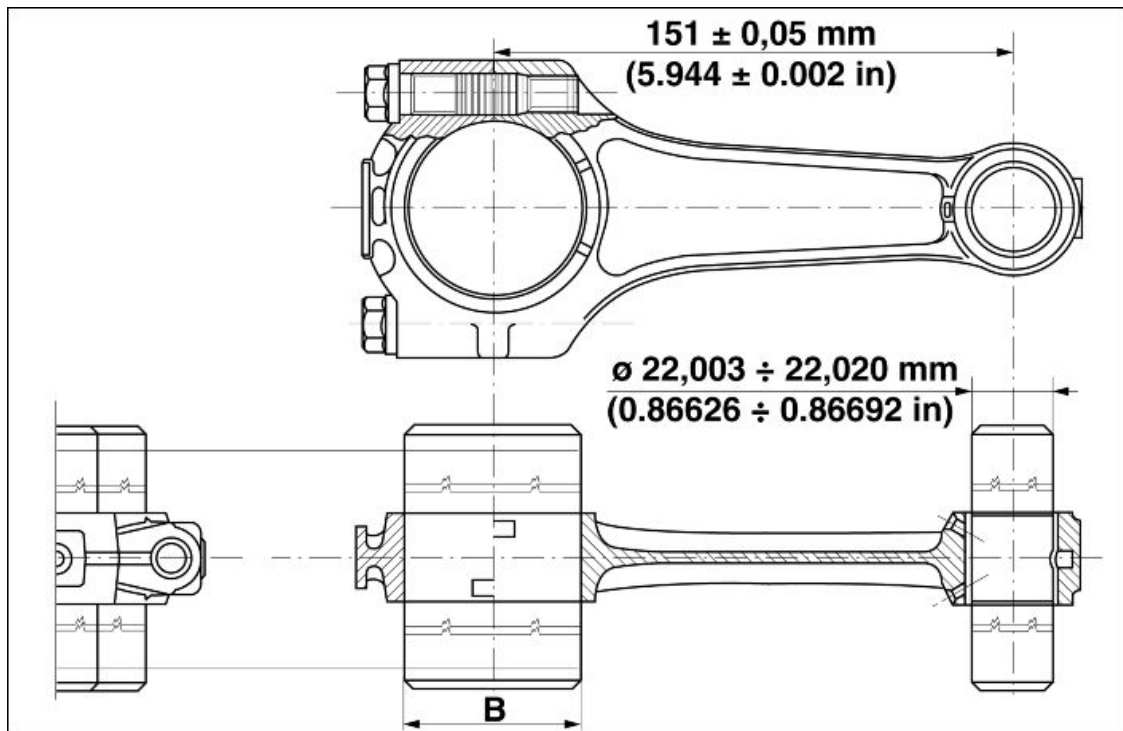
### Checking shaft parallelism

Check shafts for squaring before fitting them.

It is therefore necessary to check that the head holes and the rod small end are parallel and on the same plane.

The maximum parallelism and plane error of the two head shafts and connecting rod small end should be +/- 0.10 mm (0.00393 inch).





**CONNECTING ROD BUSHING THICKNESS**

Specification	Desc./Quantity
Regular 'Blue' connecting rod bearing (production)	1.539 - 1.544 mm (0.06059 - 0.06079 in)
Regular 'Red' connecting rod bearing (production)	1.535 - 1.540 mm (0.06043 - 0.06063 in)

**CRANKPIN DIAMETER (B)**

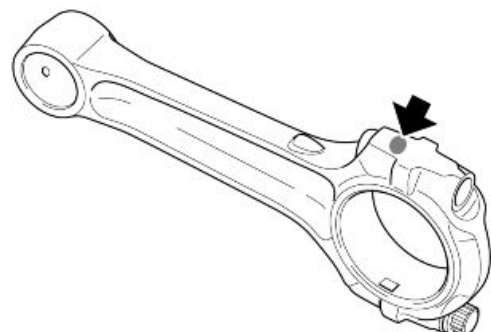
Specification	Desc./Quantity
'Blue' crankpin diameter	44.016 - 44.022 mm (1.73290 - 1.73314 in)
'Orange' crankpin diameter	44.022 - 44.028 mm (1.73314 - 1.73381 in)

**PIN-BUSHING COUPLING DATA**

Specification	Desc./Quantity
Fitted and machined bushing - inside Ø	22.003 - 22.020 mm (0.86626 - 0.86692 in)
Pin diameter	21.998 - 21.994 mm (0.86606 - 0.86590 in)
Clearance between pin and bushing	0.005 - 0.026 mm (0.000197 - 0.001024 in)

The connecting rods have a marked area for weight selection.

The weight indicated in the chart includes screws, dowels and the bushing.

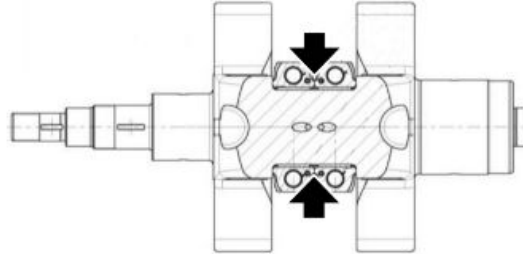


**CONNECTING ROD WEIGHT SELECTION**

Specification	Desc./Quantity
Connecting rod - brown	0.588 - 0.598 kg (0.02074 - 0.02109 oz)
Connecting rod - green	0.598 - 0.608 kg (0.02109 - 0.02145 oz)
Connecting rod - black	0.608 - 0.618 kg (0.02145 - 0.02180 oz)

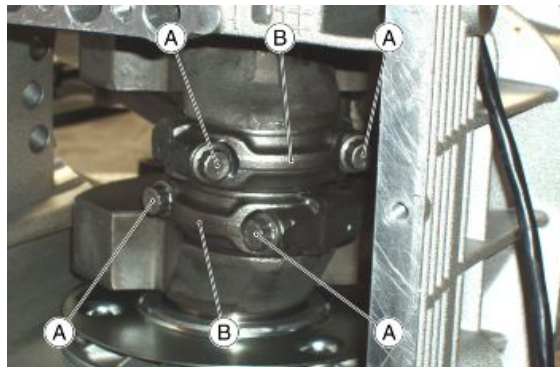
## Assembling the connecting rod

- Lubricate the crankpin on which the connecting rods are to be fixed.
- If the connecting rods are not replaced, be careful not to interchange the right connecting rod with the left one and vice versa.



The connecting rods must be mounted so that the faces of the big ends adjacent to the pair of pins are in contact.

- Place the connecting rods and the caps (B) on the crankshaft and fasten them with new screws (A).
- Remember these recommendations:



- The screws fixing the connecting rods to the crankshaft must be replaced with new ones at the following refitting as they are subject to high loads and stress;
- The fitting clearance between bearing and connecting rod pin is 0.020 mm (0.0078 inch) minimum and 0.044 mm (0.00173 inch) maximum;
- The clearance between the shim washers of the connecting rod and those of the crankshaft is comprised between 0.30 mm (0.01181 in) and 0.50 mm (0.01968 in);
- Lock the screws (A) on the caps (B) with a torque wrench at the prescribed torque.



**PAY ATTENTION TO CRANKSHAFT ROTATION WHEN ONLY THE CONNECTING RODS ARE FITTED BECAUSE IT COULD HIT THE TWO LUBRICATION JETS INSIDE THE CRANKCASE.**

## Installing the crankshaft

- Fit the shim washer inside the crankcase with the chamfered side facing the generator side.



- Lubricate the crankshaft bushing on the crankcase, generator side.



- Use the sealing ring fitting tool on the flywheel-side flange to fit the sealing ring on the flange.

### Specific tooling

#### 19.92.71.00 Tool to fit the seal ring on the flywheel-side flange

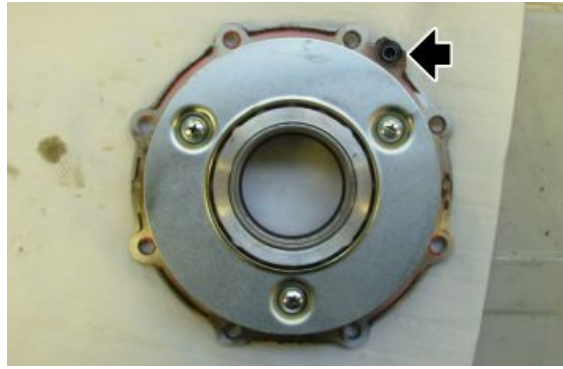
- Prepare loctite 510 between the crankcase and the crankshaft flange, on the flywheel side.
- Fit the crankshaft on the crankcase, flywheel side.
- Mark the crankshaft on the flywheel side with the crankpin facing upwards.
- Place the suitable sealing ring centring tool on the crankshaft.



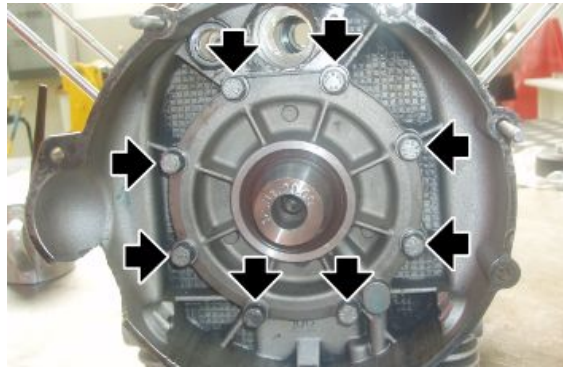
### Specific tooling

#### 12.91.20.00 Tool to fit the flywheel-side flange together with seal ring on the crankshaft

- Place the flywheel-side flange on the crankshaft and check if the dowel pin with the O-ring is correctly placed.



- Apply Teflon tape on the two lower fixing screws at the back in order to prevent oil leaks.
- Screw the eight flange screws on the flywheel side proceeding diagonally.



- Remove the sealing ring centring tool from the crankshaft.

### Specific tooling

#### 12.91.20.00 Tool to fit the flywheel-side flange together with seal ring on the crankshaft

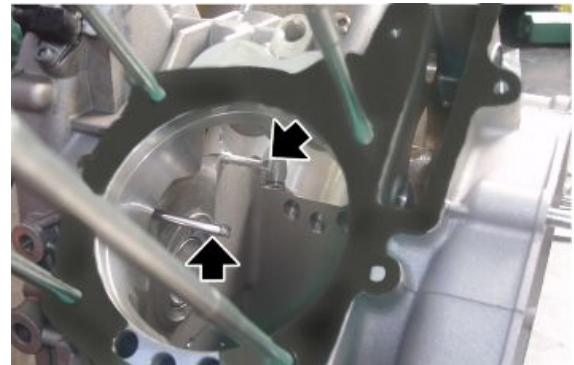
- To avoid that the shim washer inside the crankcase moves out of its seat, fit the two gears and the nut on the crankshaft on the generator side.



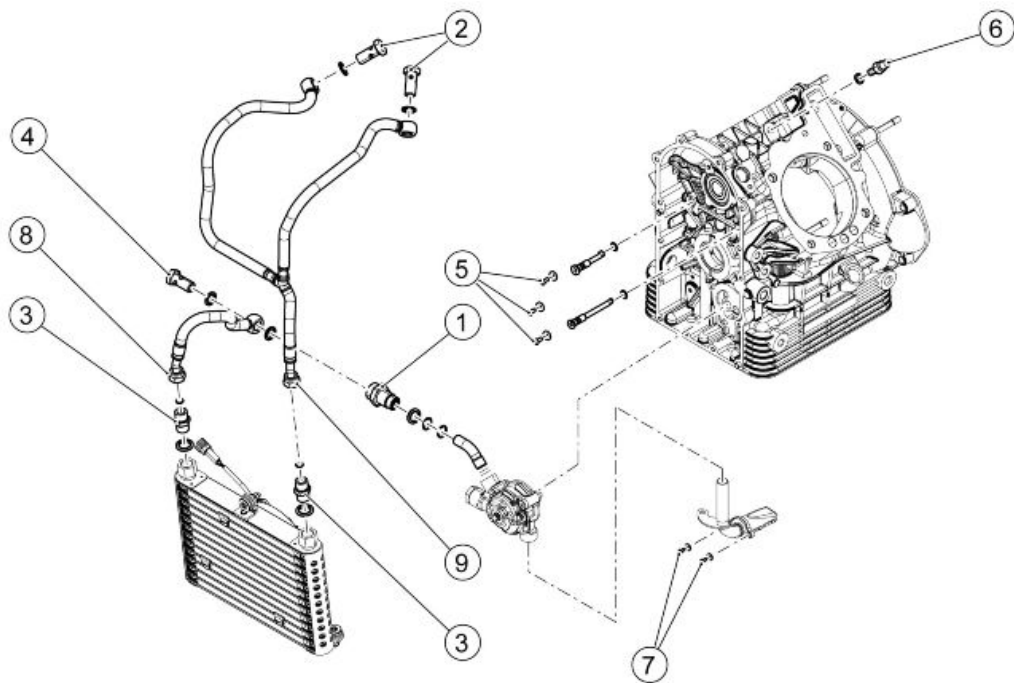
### Refitting the crankcase halves

In case the lubrication jets are removed, replace them with two new of the same type. Check that the O-ring is fitted on the jets.

Do not interchange them upon refitting because they have a different length.

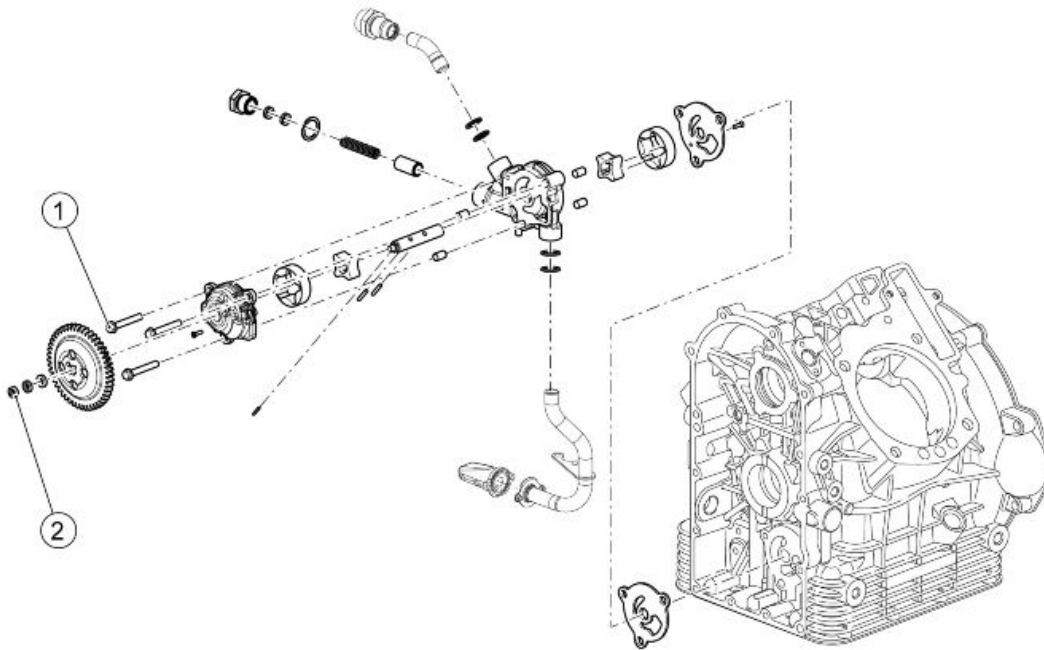


### Lubrication



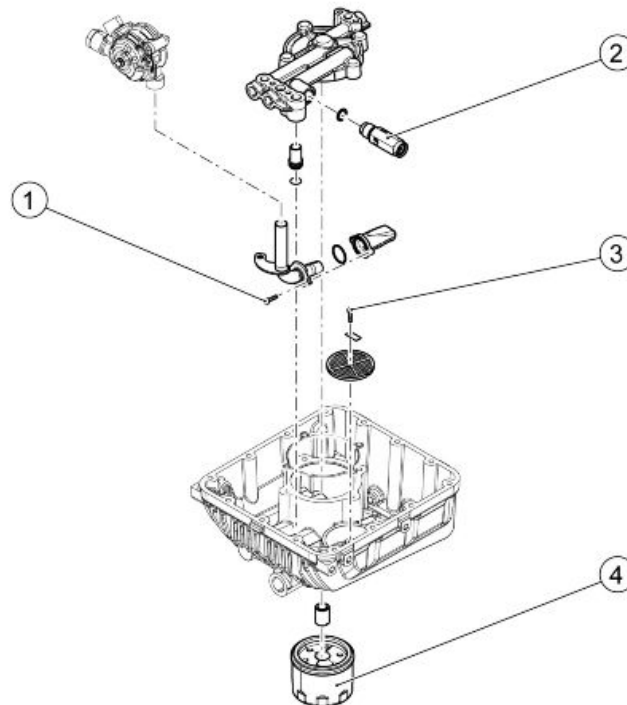
#### LUBRICATION SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Pump outlet oil pipe nipple	M14x1.5	1	40 Nm (29.50 lb ft)	-
2	Slot screw for oil pipe on the cylinder head	M14x1.5	2	20 Nm (14.75 lb ft)	-
3	Nipple on the radiator and the oil pipe	M16x1.5	2	20 Nm (14.75 lb ft)	Apply Vaseline oil
4	Oil delivery pipe to radiator slot screw	M14x1.5	1	35 Nm (25.81 lb ft)	-
5	Oil jets fixing screw	-	3	By hand	Loctite 243
6	Minimum oil pressure sensor	M10	1	15 Nm (11.06 lb ft)	-
7	Intake oil filter fixing screw	M4x10	2	3 Nm (2.21 lb ft)	Loctite 243
8	Oil delivery pipe to radiator	-	1	20 Nm (14.75 lb ft)	-
9	Oil delivery pipe to heads	-	1	20 Nm (14.75 lb ft)	-



**OIL PUMP**

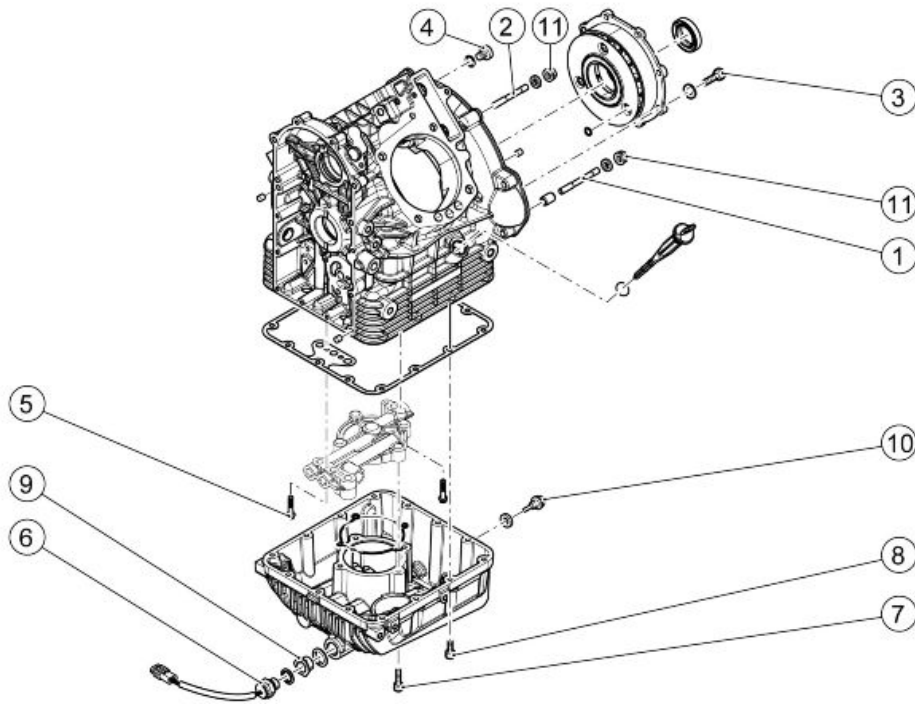
pos.	Description	Type	Quantity	Torque	Notes
1	Oil pump fixing screws	M6x45	3	9 11 Nm (6.64 8.11 lb ft)	Loctite 243
2	Low nut for oil pump	M6x0.75	1	8 Nm (5.90 lb ft)	Loctite 243



**OIL SUMP COMPONENTS**

pos.	Description	Type	Quantity	Torque	Notes
1	Cooling oil intake filter fixing screw	M4x10	2	By hand	-
2	Complete oil pressure control valve	-	1	20 Nm (14.75 lb ft)	Loctite 243

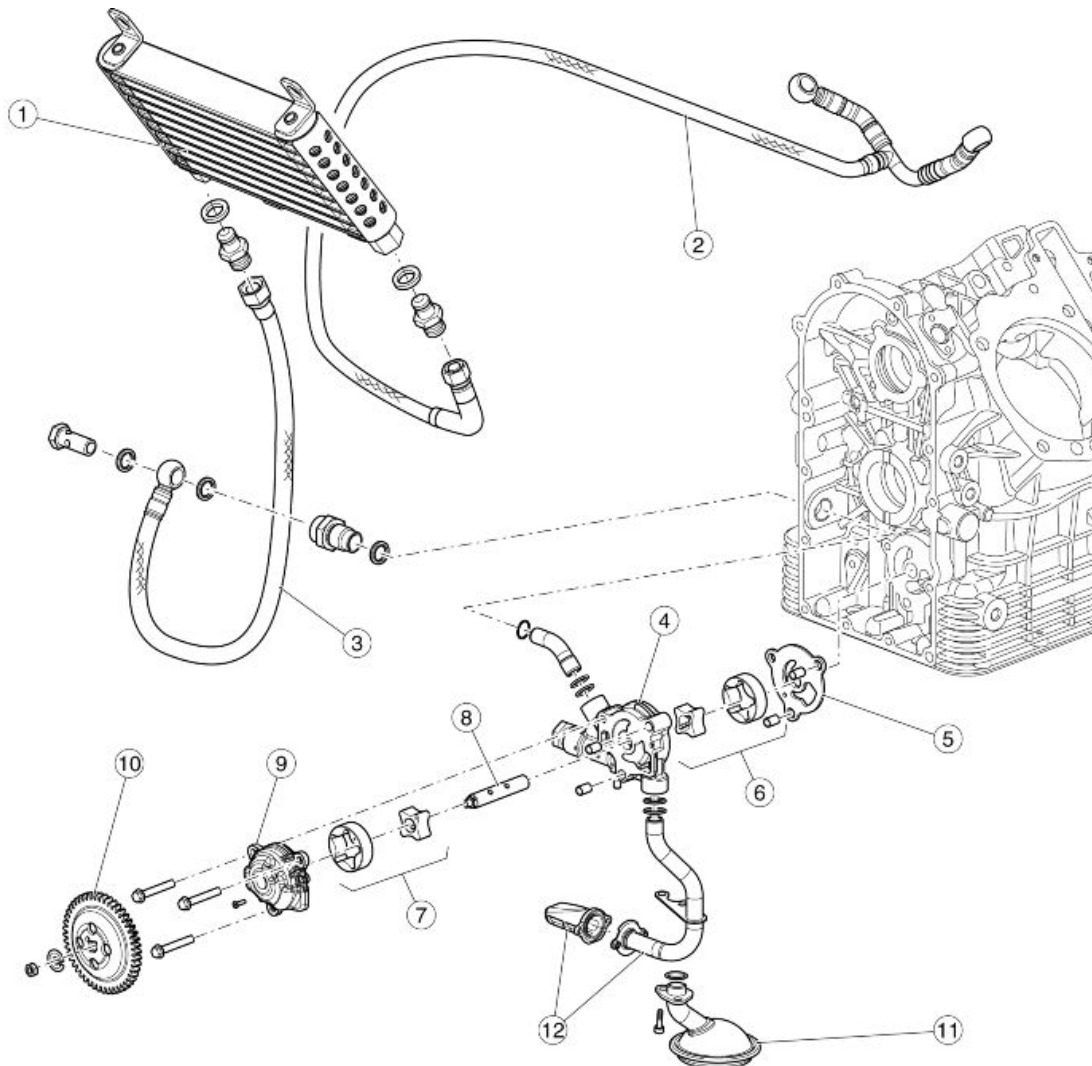
pos.	Description	Type	Quantity	Torque	Notes
3	Mesh type oil filter fixing screw	M6x14	1	6 Nm (4.42 lb ft)	-
4	Oil filter	-	1	15 Nm (11.06 lb ft)	Engine oil



**CRANKCASE AND OIL SUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Stud bolt	M8x75	2	10 Nm (7.37 lb ft)	-
2	Stud bolt	M8x66	3	10 Nm (7.37 lb ft)	-
3	Crankshaft rear support flange fixing screw	M8x25	8	26 Nm (19.18 lb ft)	-
4	Oil cap on the crankcase	-	2	25 Nm (18.44 lb ft)	-
5	Oil filter support flange fixing screw	M6x45	4	10 Nm (7.37 lb ft)	-
6	Thermal switch	M6x1.5	1	20 Nm (14.75 lb ft)	-
7	Sump to flange fixing screw	M6x35	4	10 Nm (7.37 lb ft)	-
8	Oil sump to crankcase fixing screw	M6x30	14	10 Nm (7.37 lb ft)	-
9	Thermal switch interface connection	-	1	20 Nm (14.75 lb ft)	Loctite 542
10	Magnetic oil drainage cap	-	1	20 Nm (14.75 lb ft)	-
11	Gear to engine fixing nut	M8	5	20 Nm (14.75 lb ft)	-

## Conceptual diagrams



The oil pump is operated by the gear (10) which receives the motion directly from the crankshaft. The gear (10) is mounted on the shaft (8), on which two rotors are fitted: one for engine cooling (7) and another for lubrication (6).

### Cooling:

The rotor (7) takes in oil from the sump through the filter (12); the oil is sent to the radiator (1) through the hoses (3). Oil passes through the radiator (1) dispersing part of the heat and reaches the heads through the hoses (2). Oil goes down to the sump again and joins the oil used for lubrication.

### Lubrication:

The rotor (6) takes in oil from the sump through the filter (11); the oil is sent through special ducts in the crankcase to all the parts to be lubricated. Oil goes down to the sump again and joins the oil used for cooling.

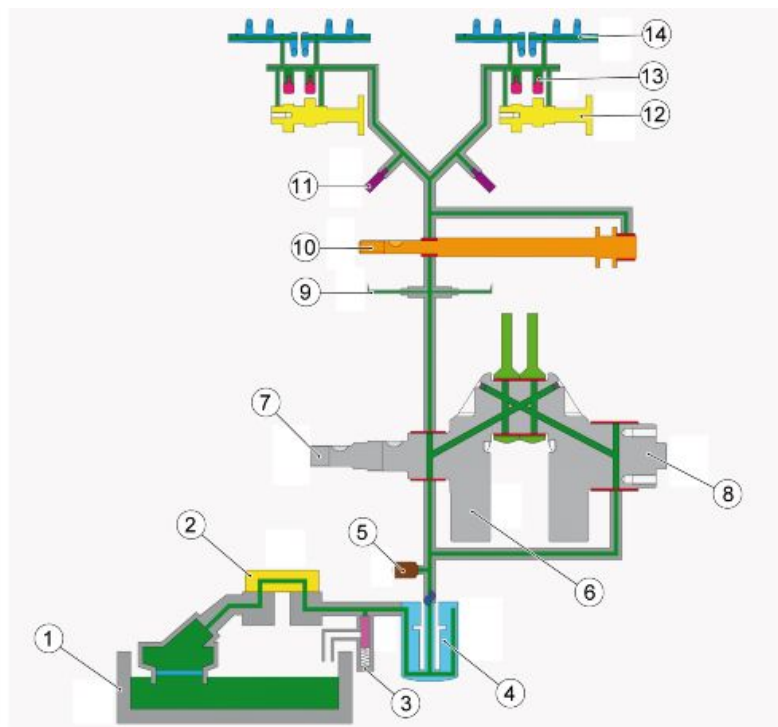
### key:

1. Oil radiator



2. Oil delivery pipe to heads
3. Oil delivery pipe to radiator
4. Oil pump body
5. Oil pump gasket
6. Rotor for lubrication
7. Rotor for cooling
8. Rotor control shaft- 9. Oil pump cover
- 10. Oil pump control gear
- 11. Lubrication oil intake filter
- 12. Cooling oil intake filter

### General characteristics



#### Lubrication circuit diagram key:

1. Oil sump
2. Lubrication pump
3. By-pass valve
4. Oil filter
5. Minimum oil pressure sensor
6. Crankshaft
7. Alternator side

8. Flywheel-side
9. Piston cooling jets
10. Auxiliary shaft
11. Chain tensioner
12. Camshaft
13. Hydraulic tappet with roller
14. Rocker axes

---

## Oil pump

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### Removing

- Bring the left cylinder piston to the TDC in combustion phase.
- Mark a reference on the oil pump control gear and another on the driven gear so as to place them correctly again upon refitting.
- Unscrew and remove the nut on the crankshaft.
- Remove the oil pump control gear.
- Screw the nut again so that the internal shim washer does not fall in the crankshaft crankcase.

- Unscrew and remove the driven gear nut.
- Collect the washer.
- Remove the oil pump driven gear.



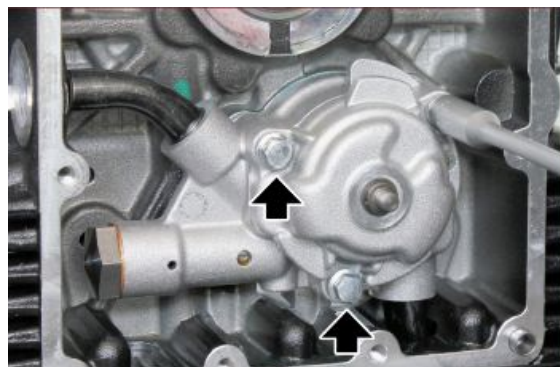
- Remove the driving pin.



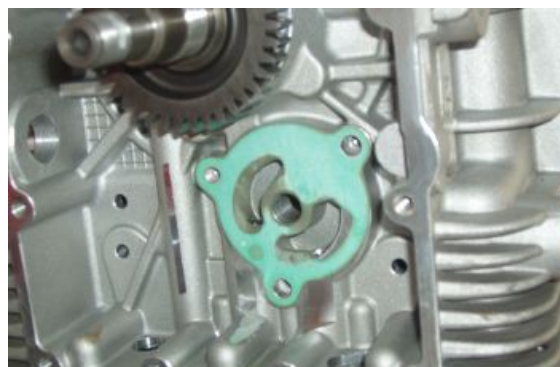
- Drain the engine oil.
- Remove the generator and the timing system cover.
- Unscrew and remove the nipple.
- Collect the gasket.



- Unscrew and remove the three screws.
- Remove the oil pump.



- Remove the gasket between the crankcase and the oil pump.



### See also

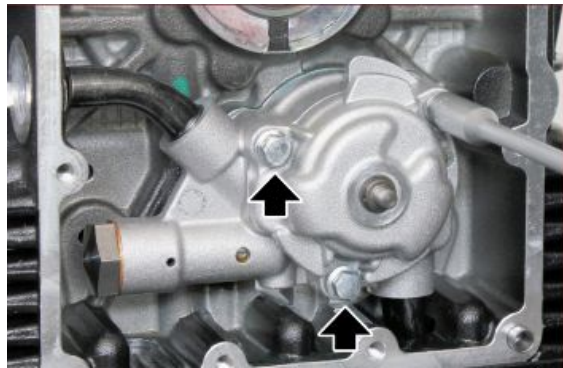
[Removing the generator](#)

## Installing

- Place a new gasket between the crankcase and the oil pump.



- Fit the oil pump.
- Tighten the three oil pump fixing screws.



- Place the driving pin on the oil pump shaft.



- Place the gear on the oil pump shaft.



- 
- Place the washer on the oil pump shaft.
  - Tighten the nut to the specified torque.

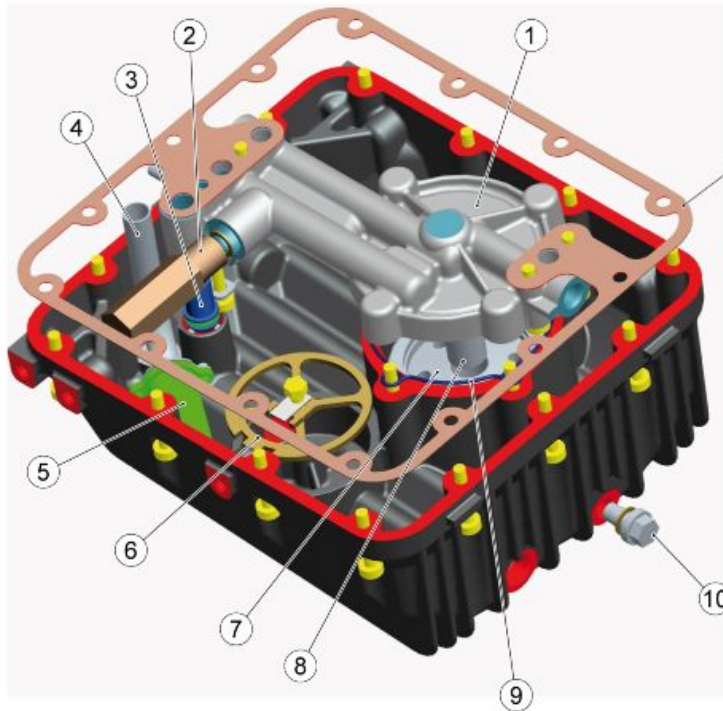


- Place the oil pump control gear on the crankshaft and align its reference with that marked during the removal phase on the oil pump driven gear.
- Tighten the nut to the specified torque.

- 
- Fit the nipple with the gasket on the crankcase.
  - Tighten the nipple to the prescribed torque.



## Removing the oil sump

**key:**

1. Flange
2. Pressure adjuster valve
3. Flange inlet pipe
4. Pump inlet pipe
5. Pump inlet filter
6. Oil filter
7. Cartridge-type oil filter
8. Joint
9. Special gasket
10. Exhaust cap
11. Oil sump gasket

**NOTE**

**TO REMOVE THE OIL SUMP, PLACE A SUITABLE CONTAINER UNDER IT TO COLLECT THE USED OIL AND DRAIN OUT ALL OIL.**

- If necessary, the filter can be removed with the suitable special tool.

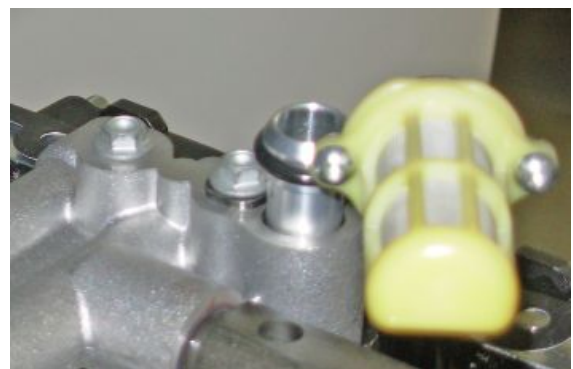
- Unscrew and remove the oil level plug and collect the O-Ring.



- Undo and remove the fourteen screws fixing the oil sump to the engine crankcase.



- Unscrew and remove the four screws.
- Remove the pump inlet filter.
- Remove the flange.





- Unscrew and remove the filter fixing screw.
- Remove the filter.



- Remove the overpressure valve.



## Refitting the oil sump

- Position the gasket of the overpressure valve.





- Apply threadlock on the overpressure valve.
- Tighten it to the prescribed torque.



- Make sure that the OR is in good condition, otherwise replace it.
- Position the joint.



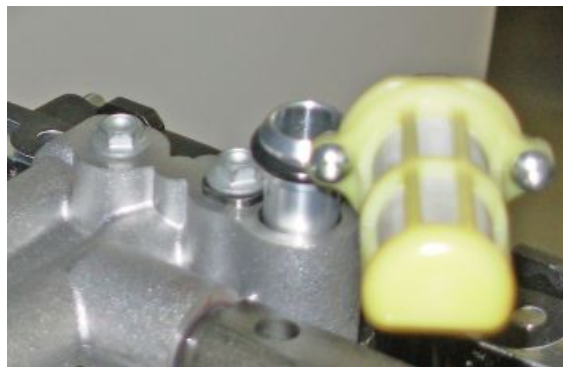
- Insert the joint in the oil sump, making sure the OR is in good condition.
- Replace the OR if necessary.



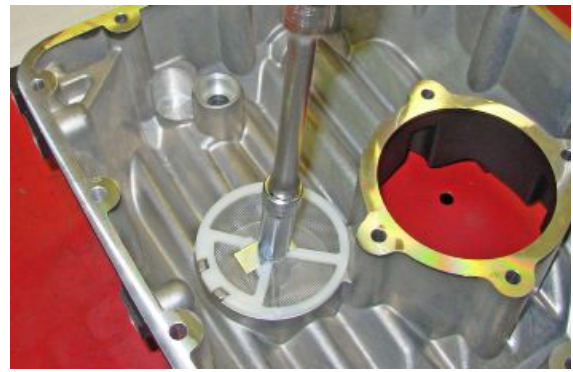
- Place a new gasket between the crankcase and the flange.



- Insert the flange, the intake filter.
- Secure the flange and the filter with the four screws.



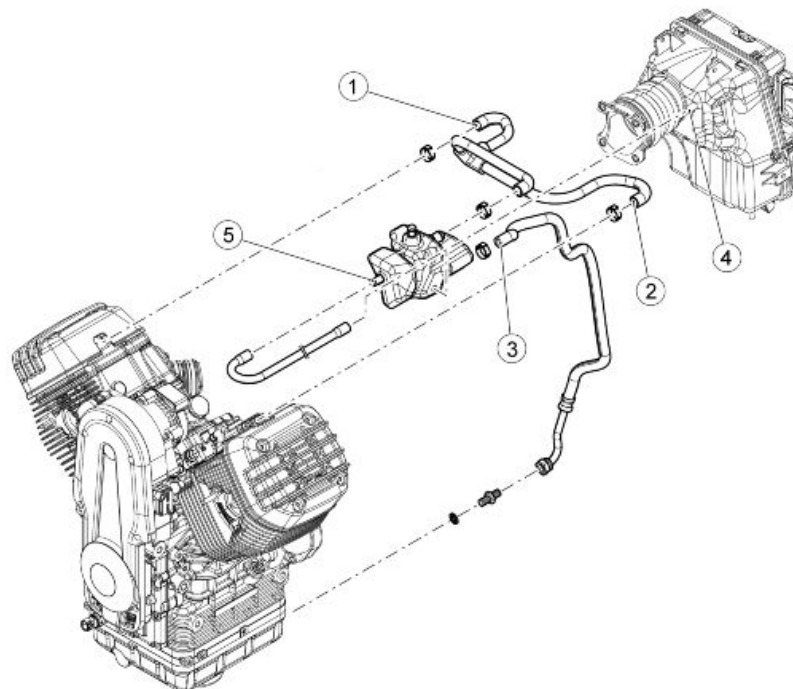
- Fit the filter and tighten it to the specified torque.



- Place the oil sump.
- Tighten the fourteen screws to the prescribed torque.
- Add engine oil up to the correct level.



## Blow-by

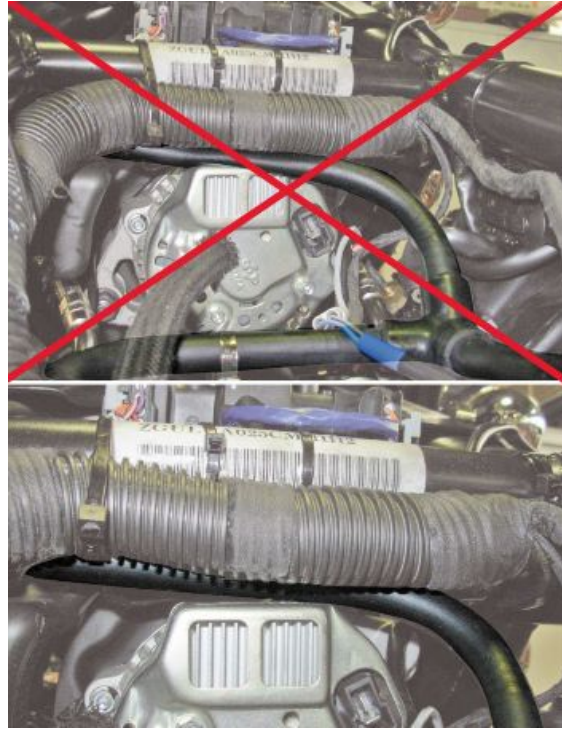


The Blow By system allows for oil vapours to be recycled. The law requires that these gas and oil vapours cannot be released into the atmosphere for environmental reasons. Therefore, there are systems for the recirculation of these gas-oil vapours inside the intake ducts to burn them in the subsequent active phases of the engine. This system separates the engine oil into oil vapour and the liquid part.

The oil vapours coming from the joints (1) and (2), are filtered and enter into the filter box through the joint (4)(5), while the liquid portion returns to the oil sump by means of the joint (3).



**IN ORDER TO PREVENT THE BLOW BY PIPE FROM BEING CRUSHED BETWEEN THE ALTERNATOR AND THE CORRUGATED PIPE, TAKE PARTICULAR CARE SO THAT IT IS POSITIONED AS ILLUSTRATED IN THE FIGURE.**



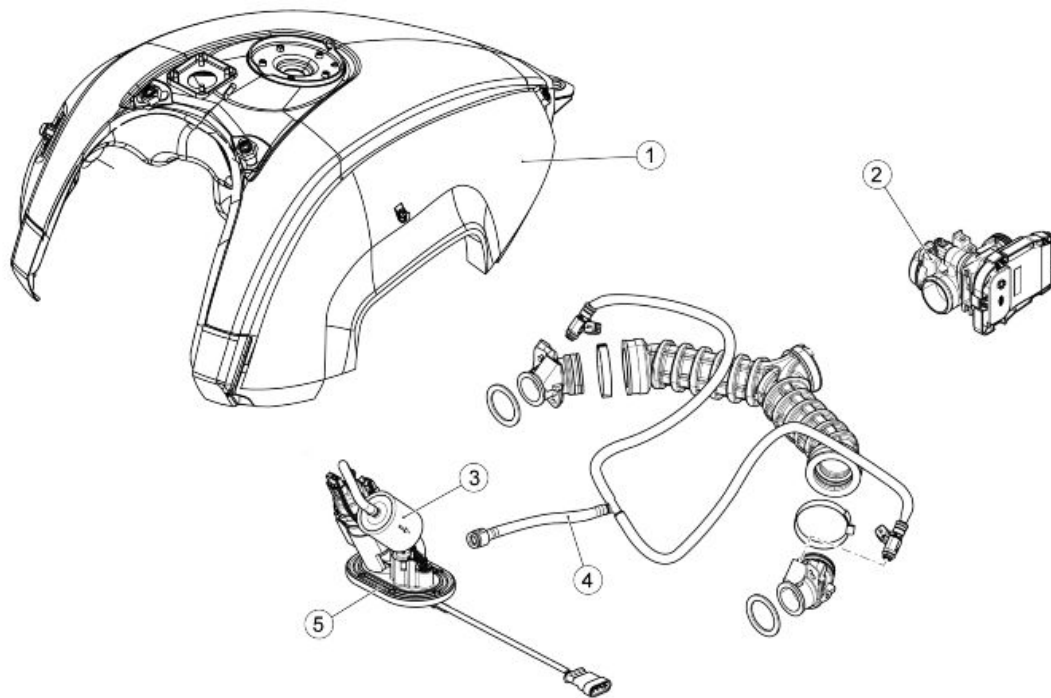
## INDEX OF TOPICS

POWER SUPPLY

P SUPP

---

## Circuit diagram

**key:**

1. Fuel tank
2. Throttle body
3. Fuel filter
4. Fuel delivery pipe
5. Fuel pump unit

---

## Injection

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### Diagram

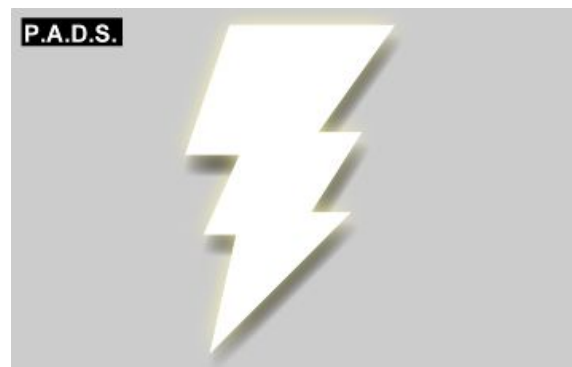
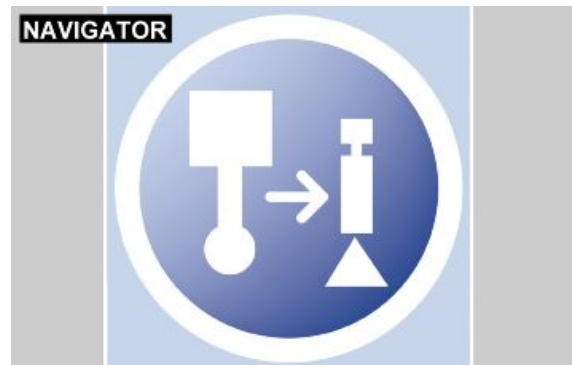
**key:**

1. Control unit position
2. Instrument panel
3. Ignition switch
4. Battery
5. Fuel pump
6. Throttle valve position sensor
7. Air pressure sensor and intake air
8. Injectors

- 9. Engine temperature sensor
- 10. Crankshaft position sensor
- 11. Gear sensor
- 12. Side stand
- 13. Lambda probe

### ACTIVATION screen page

This screen page is used to delete errors in the control unit memory and to activate some systems controlled by the control unit.



### DEVICES ACTIVATION

Navigator characteristic	P.A.D.S. characteristic	Description / Value
H.V. coil left cylinder	Coil 1	-
H.V. coil right cylinder	Coil 2	-
Rpm indicator	Rpm indicator	-
Left injector	Injector 1	-
Right injector	Injector 2	-
Idle motor	Stepper	-
Left lambda probe heater	Lambda probe heater 1	-
Right lambda probe heater	Lambda probe heater 2	-
Headlamp relay	Headlamp relay	-
Fuel pump relay	Fuel pump relay	-
Warning lamp control or EFI icon	General warning light	-
Error clearing	-	-
Reading errors of environmental parameters	-	-
Freezes and saves the parameter values of the states	-	-

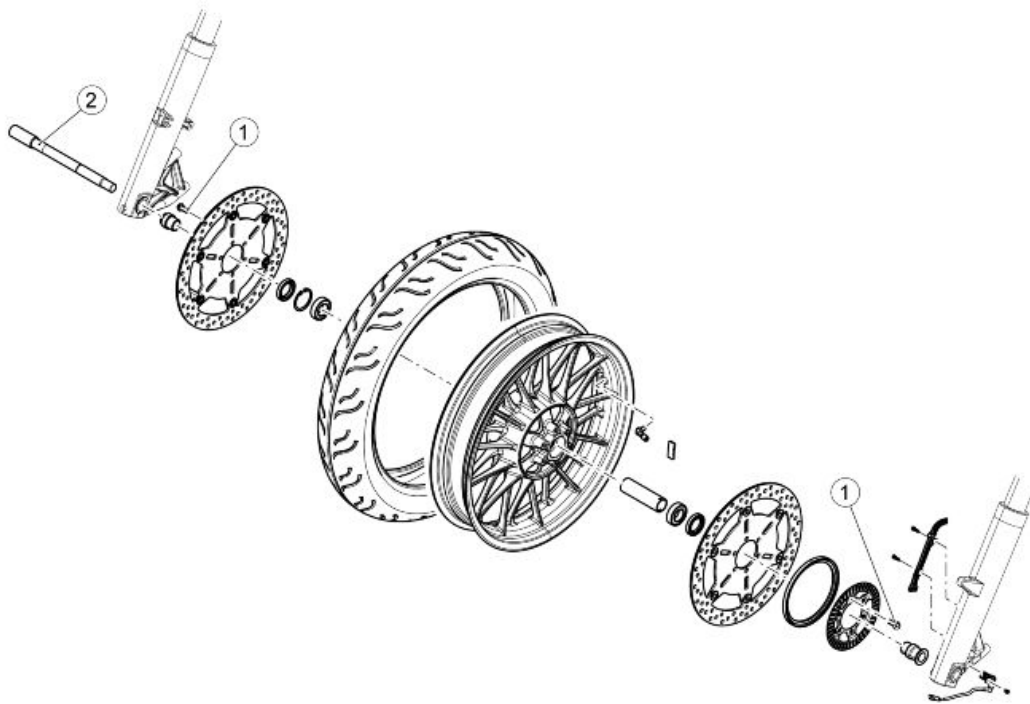
## INDEX OF TOPICS

**S**SUSPENSIONS

**SUSP**



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**Front**

**FRONT WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Brake discs fixing screws	M8x22	12	25 Nm (18.44 lb ft)	-
2	Wheel axle	-	1	80 Nm (59.00 lb ft)	-

**Removing the front wheel**

- Working from both sides, undo and remove the two fixing screws from the front brake callipers and remove them from their seats.



- Hold the motorcycle front section.
- Loosen the screw on the wheel axle clamp.



- Undo and remove the wheel axle.
- During the pin extraction operation, support the wheel and then remove it.



## Checking the front wheel

### FRONT WHEEL REMOVAL

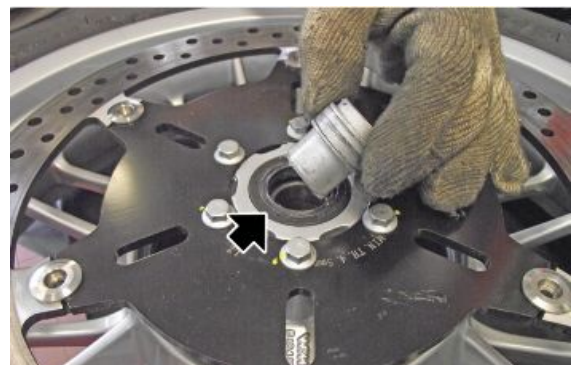
- Remove the spacer.

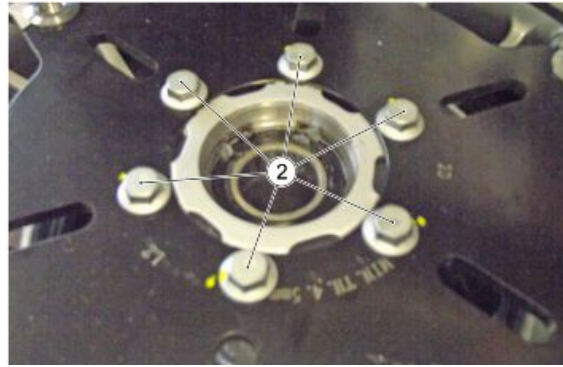


- Undo and remove the six fixing screws (1) of the tone wheel and the front disc.
- Remove the tone wheel and the front disc.



- Working on the opposite side remove the spacer.
- Remove the dust gaiter.
- Undo and remove the six fixing screws (2) of the front disc and remove it.



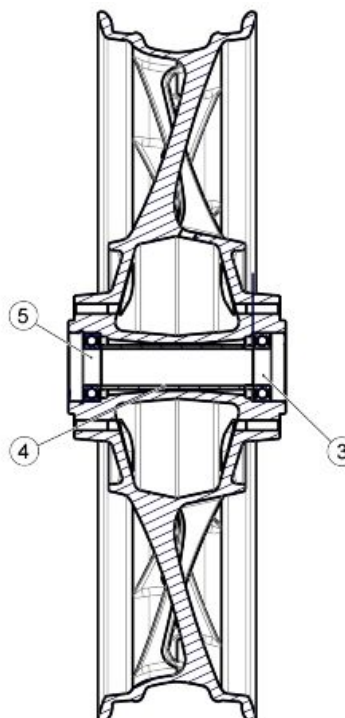


- Remove the Seeger ring.
- Using the special tool remove the bearing and the spacer.





- After removing the bearing (3) and the spacer (4), operate from the opposite side and remove the bearing (5).



## Handlebar

### REMOVAL OF COMMANDS TO HANDLEBAR

- Undo and remove the two fixing screws of the clutch pump bracelet.
- Remove the pump.



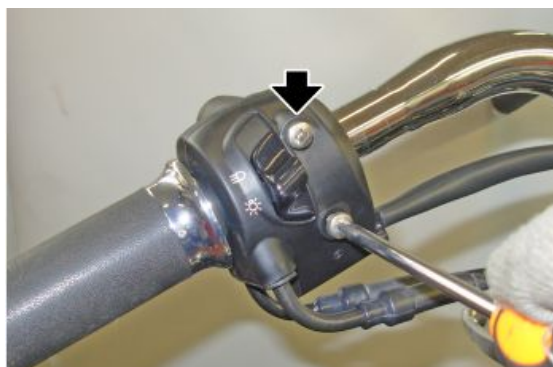
- Undo and remove the three fixing screws of the left switch.
- Remove the switch.



- Undo and remove the two fixing screws of the front brake pump bracelet.
- Remove the pump.



- Undo and remove the two fixing screws of the right switch.
- Remove the switch.



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## Removing

- Undo and remove the four fixing screws of the handlebar bracelet.

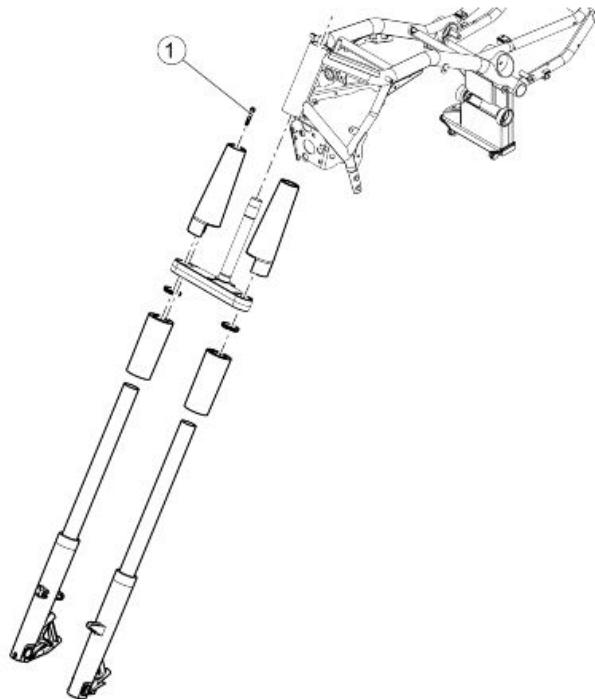


- Remove the handlebar.



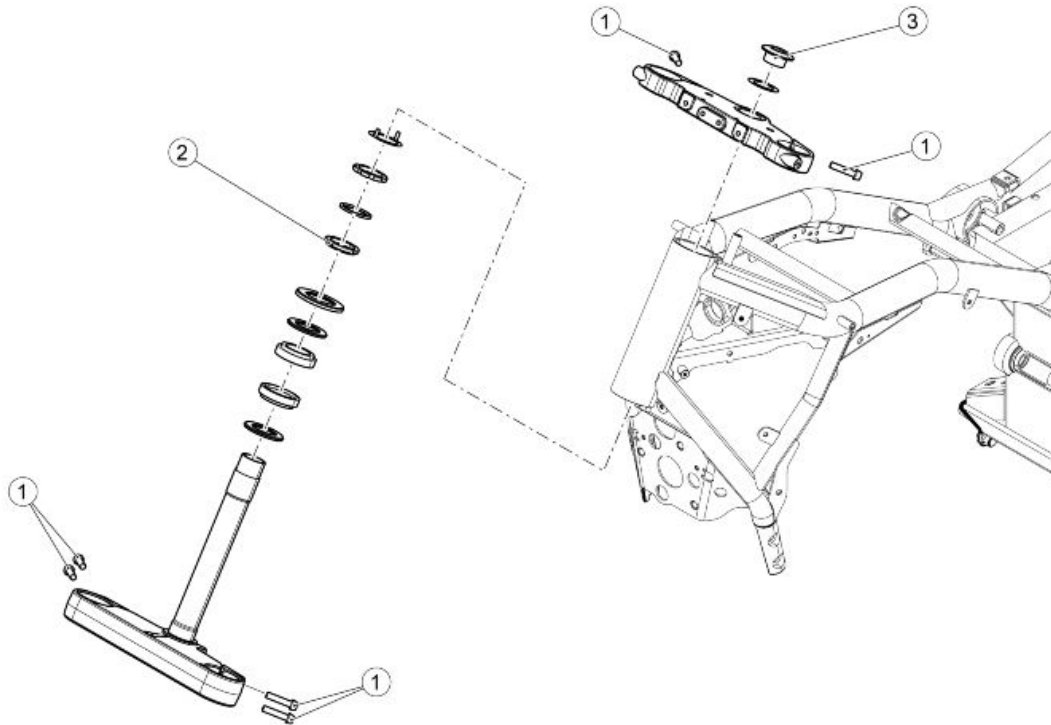
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## Front fork



**FORK**

pos.	Description	Type	Quantity	Torque	Notes
1	Lower suspension bars fixing screws	M5x50	4	6 Nm (4.42 lb ft)	-



**STEERING**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing forks to plate	M8x35	6	25 Nm (18.44 lb ft)	-
2	Lower ring nut	-	1	50 Nm (36.87 lb ft)	Pretightening to 60 Nm (44.25 lb ft)
3	Upper cover	-	1	100 Nm (73.76 lb ft)	-

**Removing the fork legs**

- Rest the vehicle on its centre stand.
- Secure the rear part of the vehicle through belts in order to lift the front wheel.
- Remove the mudguard.
- Remove the front wheel.
- Support the stanchion and loosen the screws on the upper and then the lower plate.







- Remove the ABS sensor.
- Remove the stanchion.

### See also

[Removing the front wheel](#)

---

## Draining oil

- Lock the stanchion in a vice with the specific tool.

### Specific tooling

**020951Y Stanchion support**



- Unscrew the upper cap of the stanchion.



- Using the special tool to hold the locked preloading pipe.
- Undo and remove the upper cap of the stanchion.



### Specific tooling

020888Y Pliers for pre-fill pipe

- Collect the washer.



- Remove the spring.
- Pour the oil inside a container of adequate capacity.



## Disassembling the fork

- Discharge all the oil from the sleeve.
- Tighten the wheel holder sleeve in a vice.
- Apply the specific wrench on the ring nut of the piston.
- Unscrew the fork bottom and remove it with the corresponding washer.



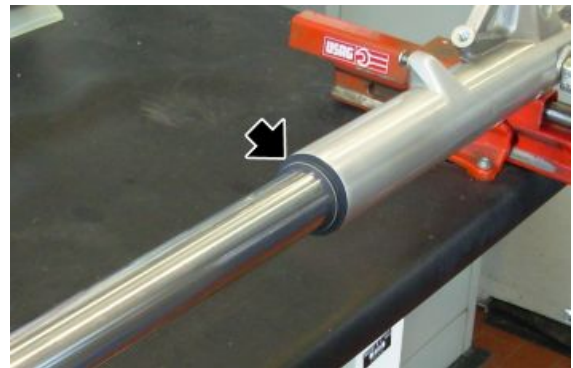
### Specific tooling

020952Y Pumping member ring nut locking spanner

- Remove the piston and its components.



- Slide off the dust scraper from the sleeve using a screwdriver as a lever.
- During this operation, pay attention not to damage the edge of the sleeve.



- Remove the retainer ring.



- Take out the sleeve from the stem using the stem as a hammer puller.



- Remove all components of the stanchion.

---

## Checking the components

### Stem

Check the sliding surface for scorings and/or scratches.

These scorings can be eliminated by rubbing them with wet sandpaper (grain 1).

If the scorings are deep, replace the stem.

Use a dial gauge to check that the stem bending is below the limit value.

If over the value, replace the stem.

**CAUTION**

**A BENT STEM SHOULD NEVER BE STRAIGHTENED BECAUSE ITS STRUCTURE WOULD BE WEAKENED AND USING THE VEHICLE MAY BECOME DANGEROUS.**

**Characteristic****Bending limit:**

0.2 mm (0.00787 in)

**Sleeve**

Check that there are no damages and/or cracks; otherwise, replace it.

**Spring**

Check the spring is in good conditions.

Check that the following components are in good conditions:

- upper bushing;



- lower bushing;



- piston.

If there are signs of excessive wear or damage, replace the affected component.

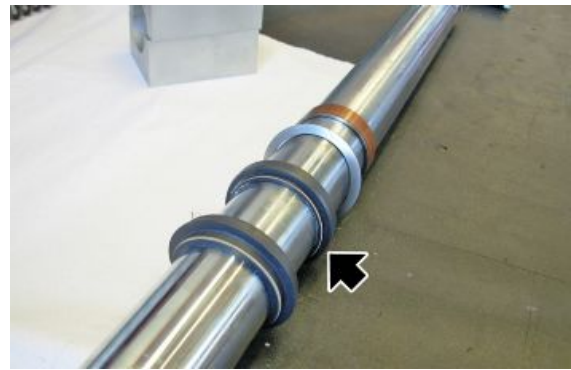
**CAUTION**

**REMOVE ANY IMPURITY IN THE BUSHINGS, TAKING CARE NOT TO SCRATCH THEIR SURFACE.**

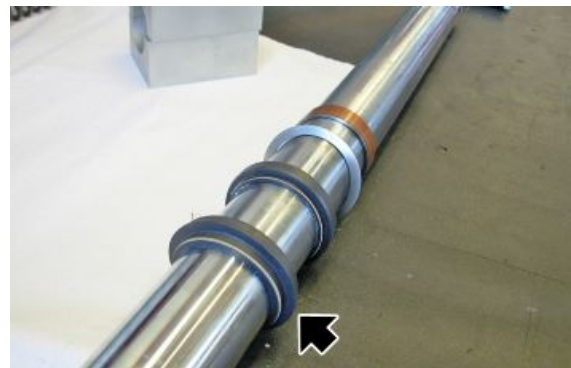
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Replace the following components with new ones:

- seal ring;



- dust gaiter;



- O-Ring on the cap.



---

## Reassembling the fork

- Lock the sleeve in the vice.
- Lubricate the stanchion sliding edges with fork oil or grease for seals.
- Install the lower and upper bushing on the stanchion, the dust scraper, the seal ring and the washer.

- Position the stanchion in the sleeve and with the prescribed tool put the oil seal in position.

**Specific tooling****AP8145758 Tool for oil seals fitting**

- Insert the retainer ring in its position.



- Fit the dust gaiter with the specific tool.

**Specific tooling****AP8140146 Weight**

- Insert the pumping member in the sleeve.
- Install the lock key of the piston.

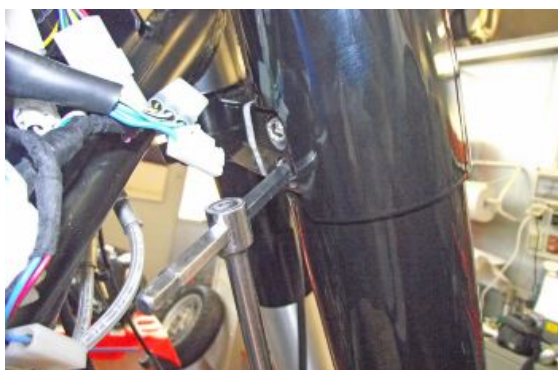
**Specific tooling****020952Y Pumping member ring nut locking spanner**

- Tighten the piston fixing screws in the fork end to the prescribed torque.

**Installing the fork legs**

- Insert the stanchion in position. Insert the wheel axle so that the stems are aligned.

- Tighten the screws on the fork plates to the prescribed torque.



- Mount the front wheel.
- Before tightening torque the clamp screw, turn the fork a few trips in order to perfectly align the sleeve.



## Removing

- First remove the handlebar, the front wheel.
- Working from both sides undo the screws fixing the upper plates to the forks.





- Unscrew and remove the bushing fixing the upper plate to washer.



- Remove the upper plate.
- Remove the OR from the forks and the upper cover.
- Undo and remove the screws fixing the lower plate to the fork.





- Retrieve the safety plate.



- Using the special tool loosen the upper ring nut (1) and the lower ring nut (2).
- Retrieve the rubber spacer (3) placed between the two ring nuts.
- Be careful to properly hold the lower plate.



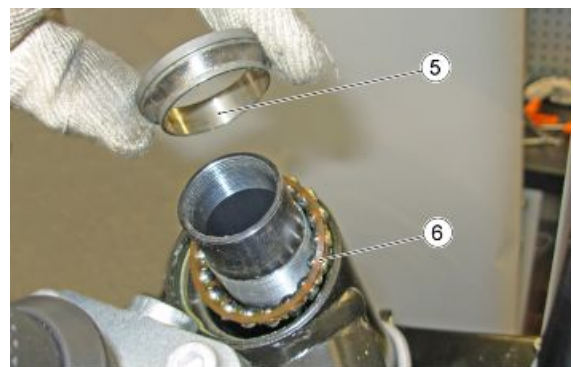
- Remove the two dust gaiter rings.



- Remove the spacer located in the lower plate.



- Remove the axial ball bearing (5)(6).
- Remove the lower plate.



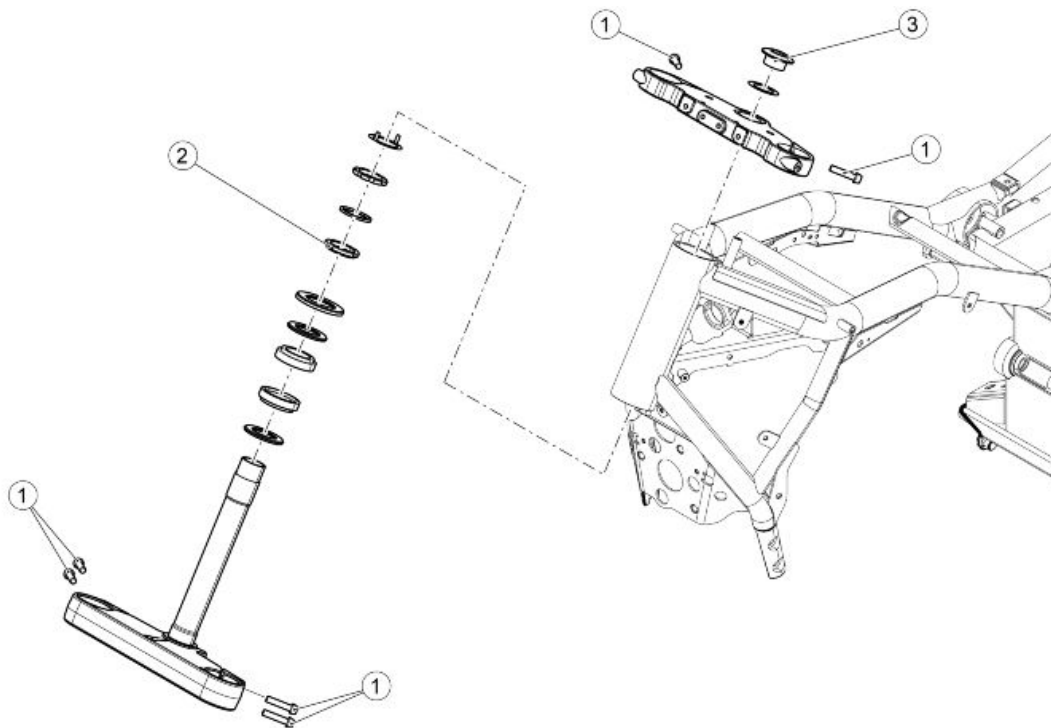
- Working from both sides, undo and remove the two fixing screws of the fork lower cover.
- Remove the fork by unscrewing the fixing screws to the lower plate.



**See also**

[Removing  
Removing the  
front wheel](#)

**Steering bearing**



**STEERING**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing forks to plate	M8x35	6	25 Nm (18.44 lb ft)	-
2	Lower ring nut	-	1	50 Nm (36.87 lb ft)	Pretightening to 60 Nm (44.25 lb ft)
3	Upper cover	-	1	100 Nm (73.76 lb ft)	-

## Adjusting play

- First remove the upper steering plate.
- remove the safety washer, unscrew and remove the counter-lock ring (1) then remove the rubber support (2) and finally loosen the lower ring nut (2) to proceed with the steering clearance adjustment.



- Adjust the preloading of the steering bearings by tightening the lower ring nut to the prescribed torque.
- Turn the steering 3-4 times completely from right to left and then check correct tightening torque of such ring nut.



- Fit the upper ring nut, tightening it manually, plus about 90 degrees so that the grooves are lined up.
- Position the safety washer, reiterating the tabs on the ring nuts.

- Rivet the tongues on the upper ring nut.

**See also**[Removing](#)

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**Disassembling**

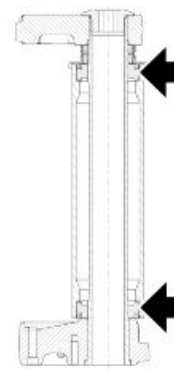
- Using the special tool remove the upper bearing.
- Subsequently, after removing the upper bearing hit it from bottom upwards, using the appropriate tool, to extract the lower one.

**Assembling**

- Using the special tool install the two bearings, first the lower then the upper one.

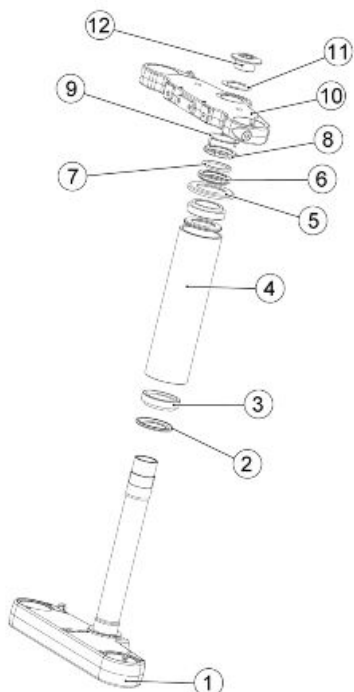


- Lubricate the two bearings with grease.

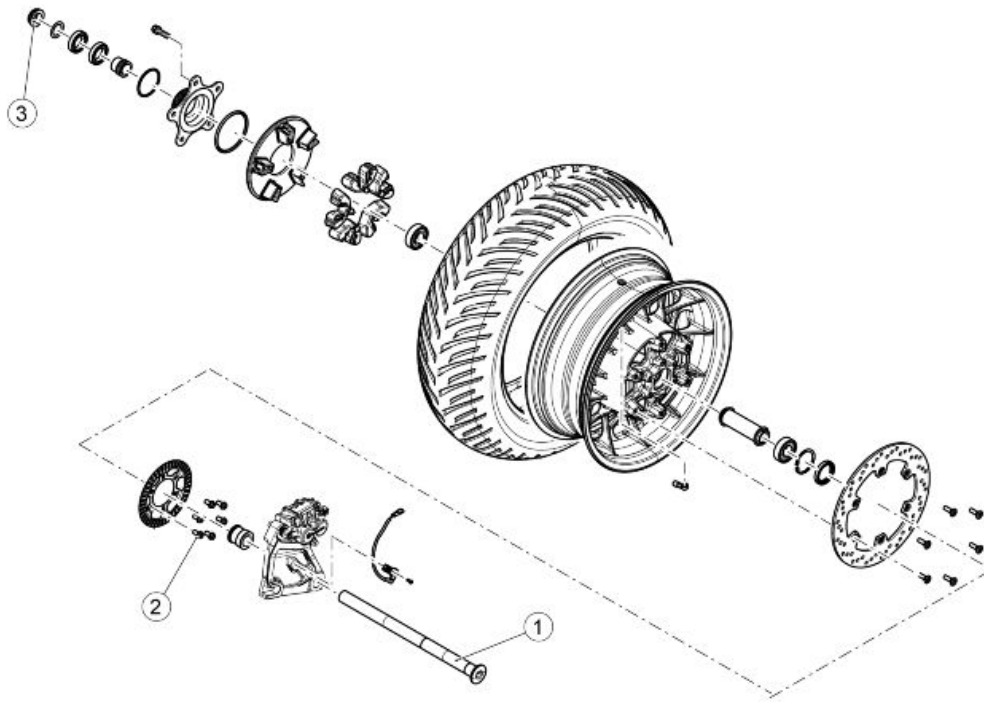


**ASSEMBLY PROCEDURE:**

- Assemble the components from (1) to (5).
- Insert the upper oil seal and make sure the straight section of the column (A) is secured.
- Tighten the ring nut (6) to the specified torque before the dust gaiter (5), then unscrew the abovementioned ring nut and retighten it.
- Fit the dust gaiter (5) from the back (B).
- Insert the rubber washer (7) and tighten the counter-lock ring (8) manually until making contact with the washer (7).
- Align the grooves of the tighten counter-lock ring (8) with the slots of the ring nut (6).
- Assemble the remaining components and tighten the cap (12) to the specified torque.



Rear



**REAR WHEEL**

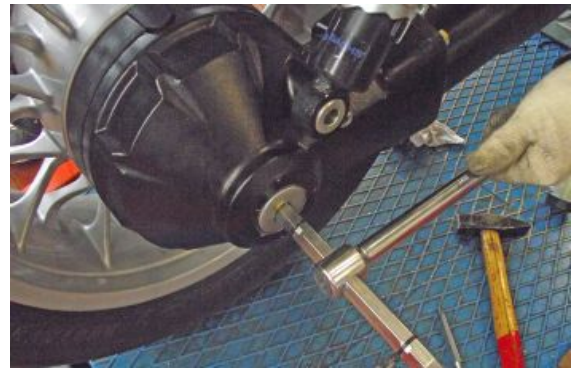
pos.	Description	Type	Quantity	Torque	Notes
1	Rear wheel pin	-	1	100 Nm (73.76 lb ft)	-
2	Wheel flange screws	M8x20	6	25 Nm (18.44 lb ft)	-
3	Wheel axle nut	M25x1.5	1	100 Nm (73.76 lb ft)	-

**Removing the rear wheel**

- Support the vehicle rear part using a suitable stand.
- Unscrew the fastening nut while holding the pin from the opposite side.







- Remove the pin and remove the rear wheel.



## Checking the rear wheel

### REMOVAL OF REAR WHEEL

- Remove the lock of the flexible coupling disc.



- Unscrew and remove the five screws (1).
- Remove the flange paying attention to the spacer.



- Remove the flexible coupling disc.



- Operating from the opposite side undo and remove the six fixing screws (2) of the tone wheel.
- Remove the tone wheel.





- Remove the dust gaiter and the seeger ring locking the bearings.



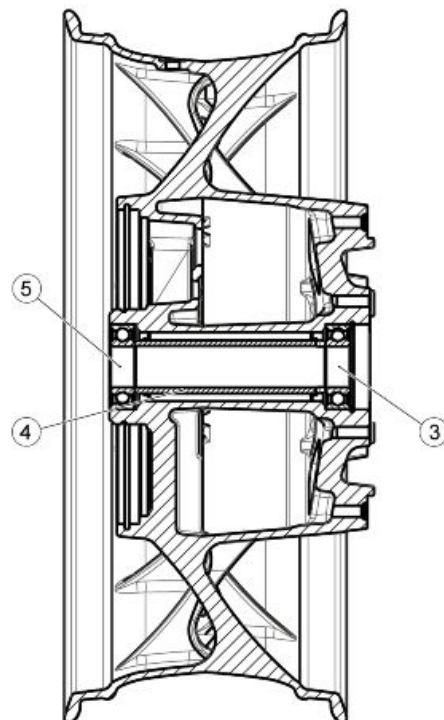
- Undo and remove the six fixing screws of the rear disc.
- Remove the rear disc.



- using the special tool, remove the bearings.



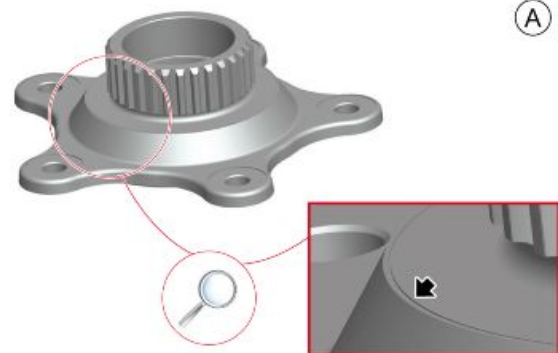
- After removing the bearing (3) and the spacer (4), operating from the opposite side and using the special tool, remove the bearing (5).



## Installing the rear wheel

- To install the rear wheel carry out the operations described for disassembly in reverse order, paying particular attention to the type of flange mounted. In fact, depending on this it may or may not be necessary to add a coupling spacer between the wheel and the cardan joint.

There are two types of flange which differ from one another by the presence or not of a step.



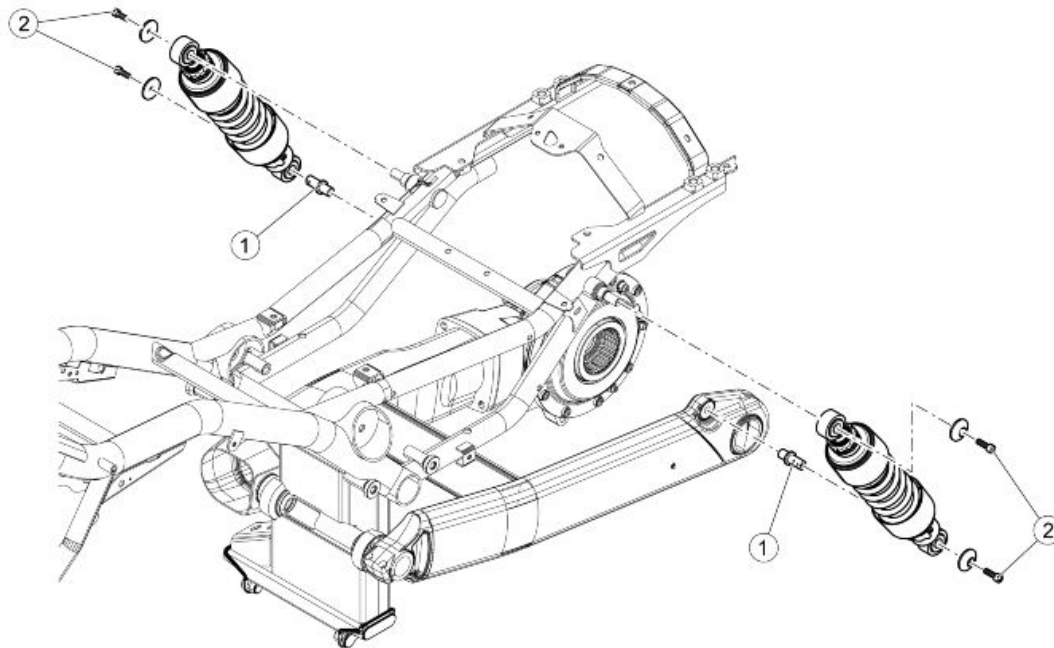
If there is a type **A** flange, no coupling spacer is needed between the wheel and the cardan joint.



If there is a type **B** flange, a coupling spacer is needed between the wheel and the cardan joint with a spacer washer.



**Shock absorbers**



**REAR SHOCK ABSORBERS**

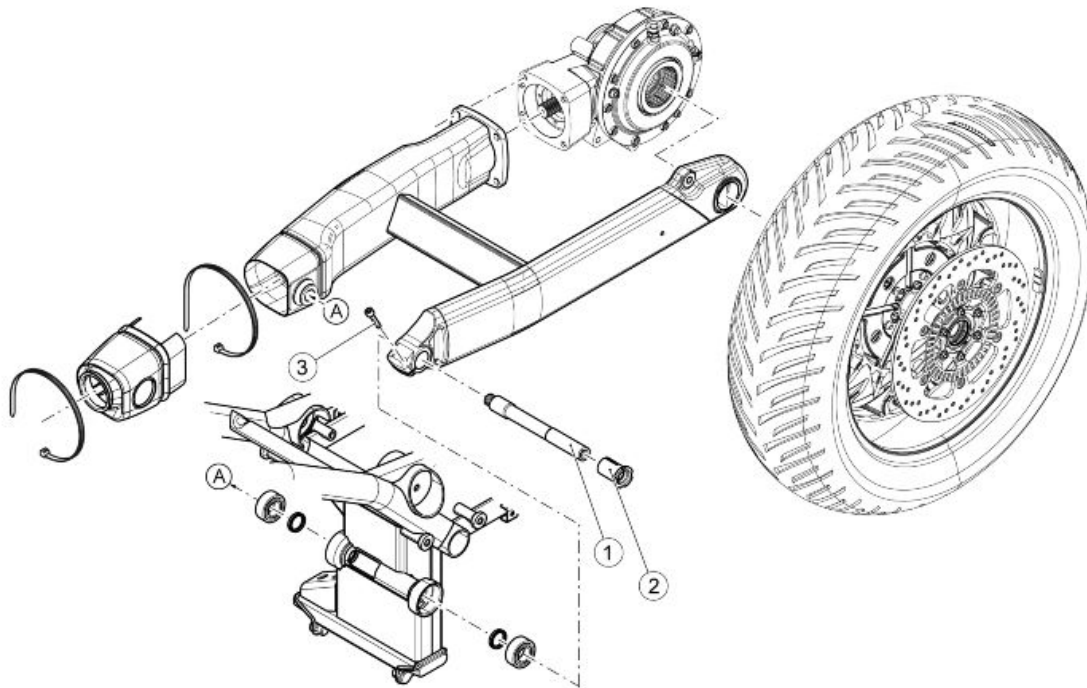
pos.	Description	Type	Quantity	Torque	Notes
1	Pins	-	2	40 Nm (29.50 lb ft)	-
2	Shock absorber fixing screws	M6x14	4	10 Nm (7.37 lb ft)	-

## INDEX OF TOPICS

**CHASSIS**

**CHAS**

## Swinging arm



### SWINGARM

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm pin	-	1	60 Nm (44.25 lb ft)	-
2	Preloading bushing	-	1	10 Nm (7.37 lb ft)	-
3	Clamp screws	M6x25	2	10 Nm (7.37 lb ft)	-

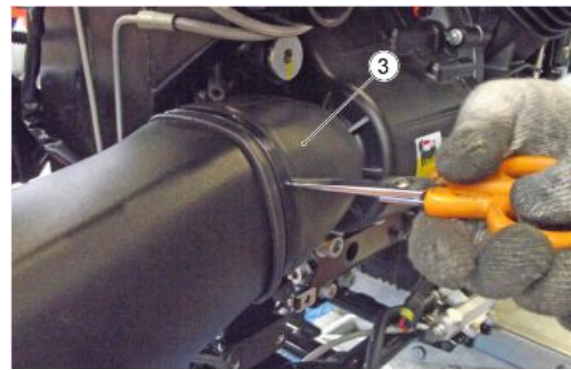
## Removing

- First remove the rear wheel.
- Working from both sides, undo the screw (1) of the rear shock absorber.
- Undo and remove the four fixing screws (2) of the bevel gear set.

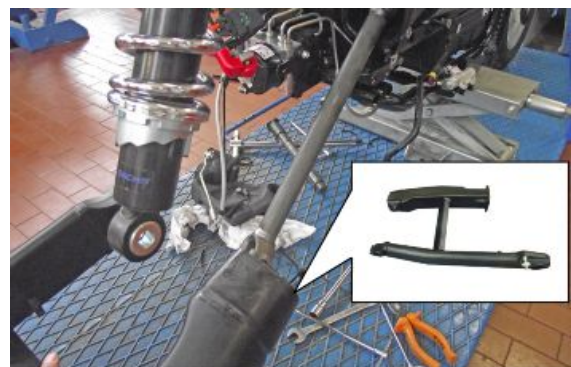




- Remove the clamp that fixes the dust gaiter (3) to the swingarm.



- Unscrew and remove the pin, making sure that the swingarm does not fall.



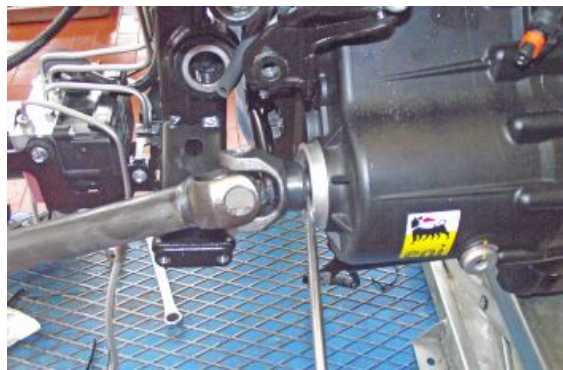
## Cardan shaft

## Removing

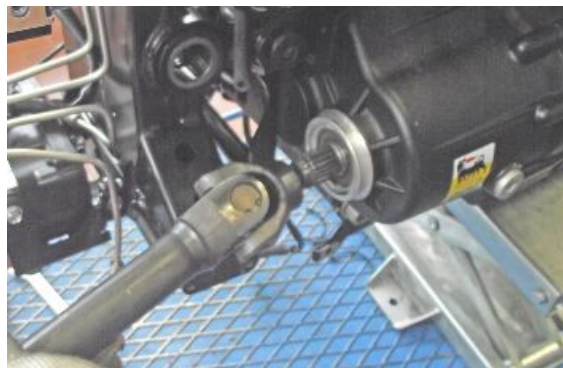
- First remove the swingarm.
- Remove the rubber protection.



- Using a screwdriver, remove the universal joint.



- Remove the cardan shaft.

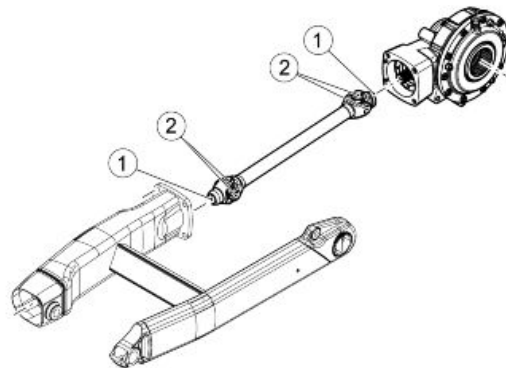


## Checking

### Carefully check:

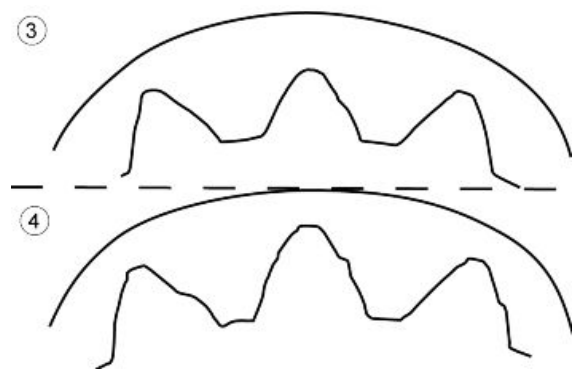
The splines on the cardan shaft (1) must be intact, free from grain or dents.

Check that the joints (2) are not hardened or excessively loose, otherwise replace it.

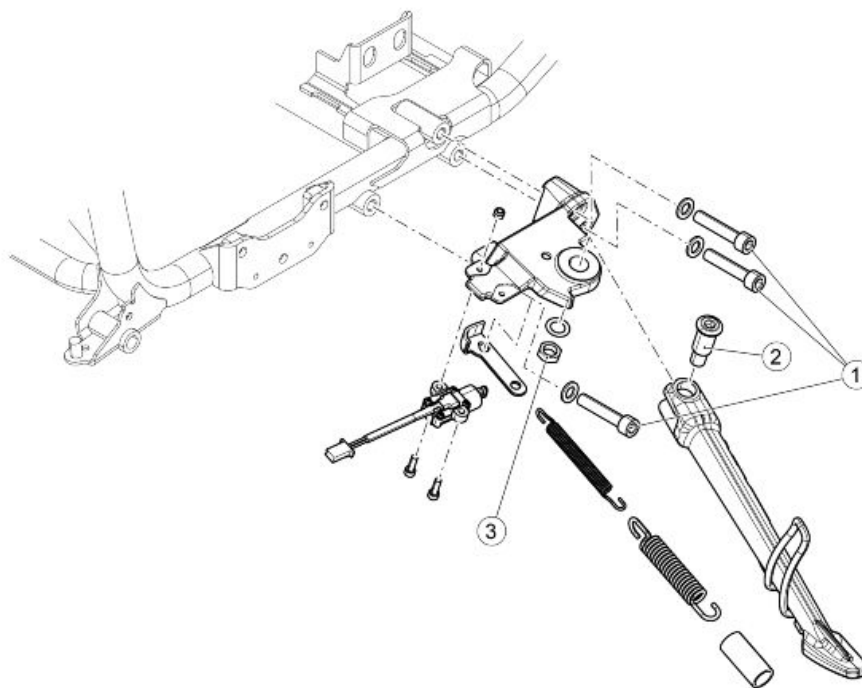


In the figure are shown two worn tothing profiles:

- Profile (3) shows acceptable wear, the cardan shaft should not be replaced.
- Profile (4) shows unacceptable wear, the cardan shaft must be replaced.



## Stand



### STAND

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing stand plate to chassis	M10x50	3	50 Nm (36.88 lb ft)	-
2	Stand bolt	-	1	25 Nm (51.61 lb ft)	-
3	Stand pin bolt	M12x1.25	1	70 Nm (51.61 lb ft)	-

## Side stand

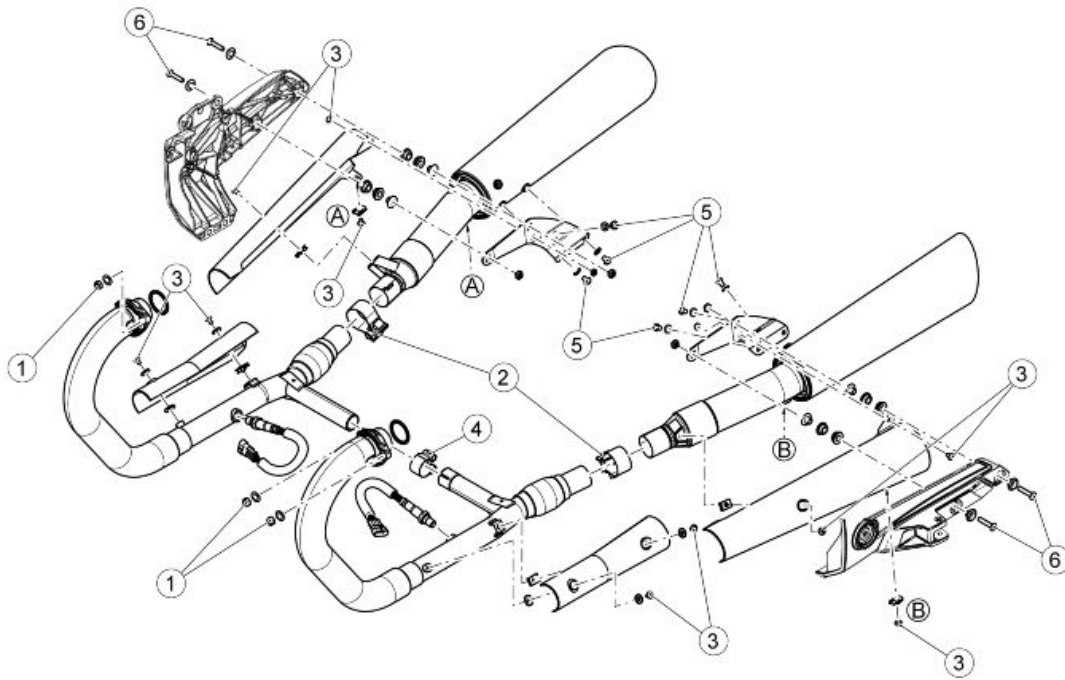
- Remove the clamp.
- Disconnect the stand connector.

- Unscrew and remove the three screws.



- Remove the side stand.

## Exhaust



### FUEL TANK

pos.	Description	Type	Quantity	Torque	Notes
1	Front fixing screw	M8x16	2	25 Nm (18.44 lb ft)	-
2	Rear fixing screw	M6x25	1	10 Nm (7.37 lb ft)	-
3	Fuel pump fixing screw	M5x20	6	6 Nm (4.42 lb ft)	-
4	Fuel level sensor fixing nuts	M5	4	5 Nm (3.69 lb ft)	-
5	Screw fastening cap flange to tank	M5x16	5	6 Nm (4.42 lb ft)	-

## Removing the manifold - tail pipe

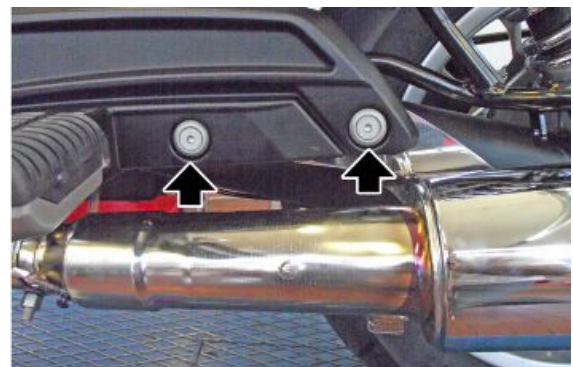
- The following procedure applies to both exhausts.
- Loosen and remove the three fixing screws of the heat shield.
- Remove the heat shield.



- Loosen the side clamp.
- Loosen the lower clamp.

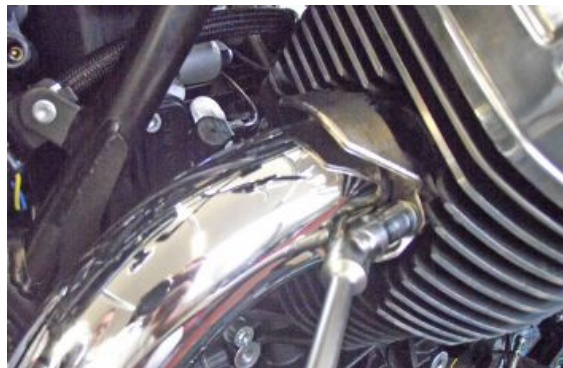


- Undo and remove the two fixing screws of the support bracket.
- Remove the exhaust end.

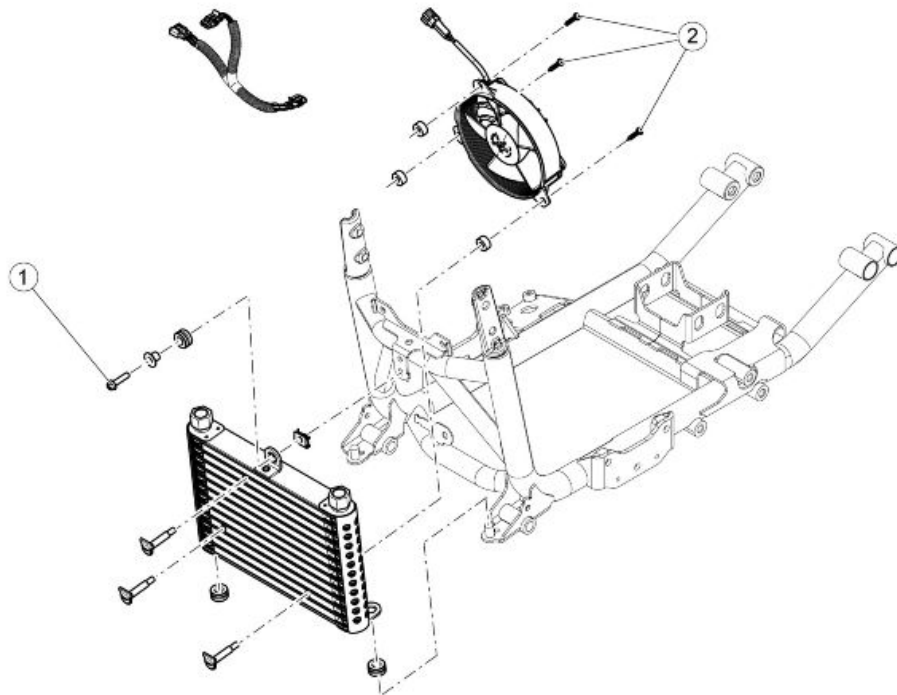




- Undo and remove the two nuts on the exhaust stud bolts of the head.
- Remove the exhaust manifold.



## Engine oil cooler

**OIL RADIATOR**

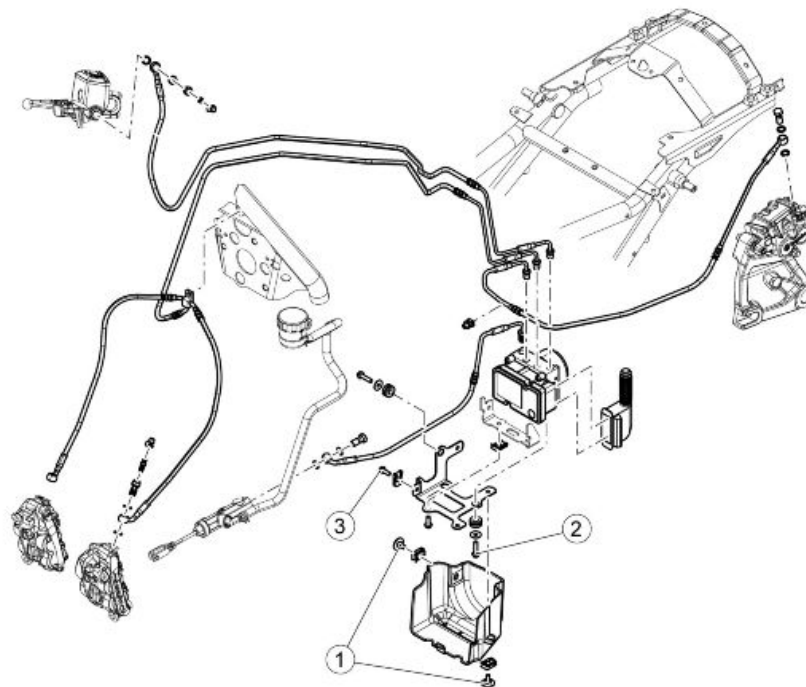
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fixing oil radiator to chassis	M6x25	3	10 Nm (7.37 lb ft)	-
2	Screws fixing electric fan to oil radiator	4,2x20	3	2.5 Nm (1.84 lb ft)	-

## INDEX OF TOPICS

**B**RAKING SYSTEM

**BRAK SYS**





### **ABS BRAKING SYSTEM**

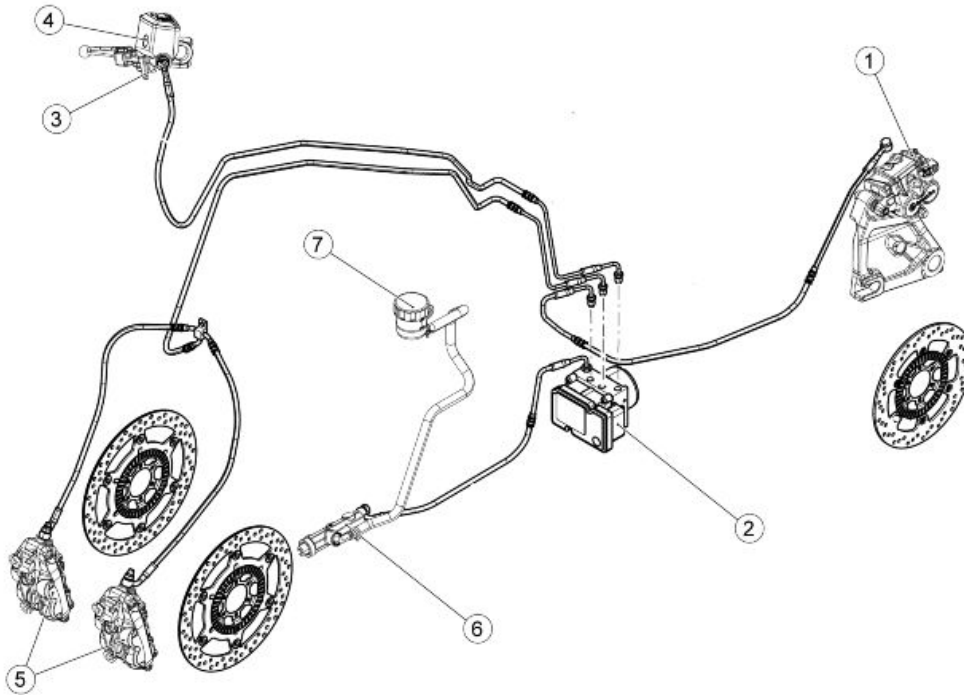
<b>pos.</b>	<b>Description</b>	<b>Type</b>	<b>Quantity</b>	<b>Torque</b>	<b>Notes</b>
1	ABS control unit lower cover fixing screws	-	2	6 Nm (4.42 lb ft)	-
2	ABS control unit support plate fixing screws	M6x25	3	10 Nm (7.37 lb ft)	-
3	ABS control unit support plate fixing screws	M6x16	3	10 Nm (7.37 lb ft)	-

## **Interventions rules**

### **CAUTION**

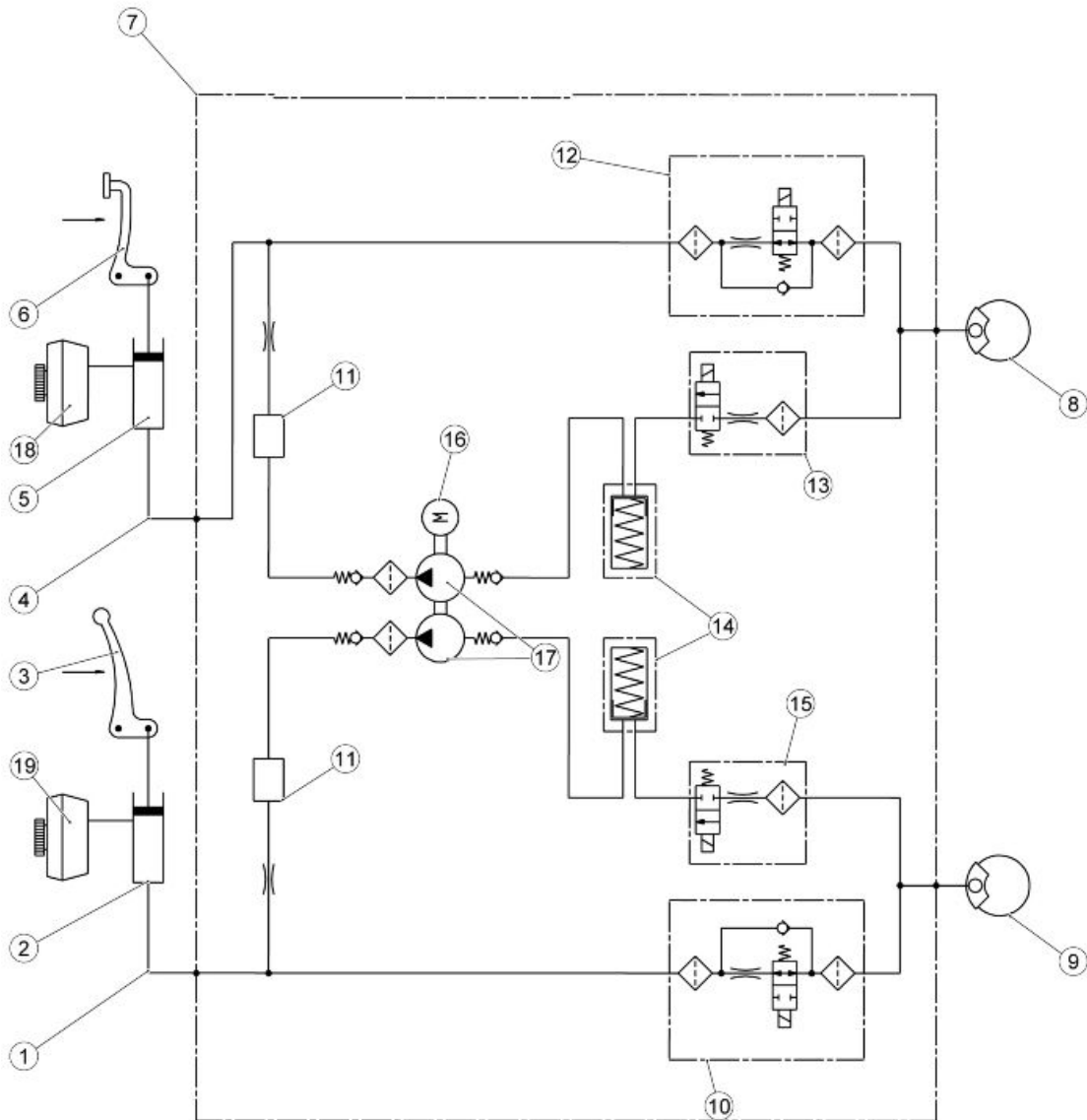
**THE FRONT BRAKE DISC SHAPE DOES NOT CHANGE THE OPERATING AND MAINTENANCE SPECIFICATIONS OF THE SYSTEM.**

## Foreword

**key:**

1. Rear brake calliper
2. Modulator
3. Front bleed valve
4. Front brake reservoir
5. Front brake callipers
6. Rear brake pump
7. Rear brake reservoir

Operating diagram



ABS functional diagram key

- 1. Front system circuit
- 2. Front brake pump
- 3. Front brake lever
- 4. Rear system circuit

5. Rear brake pump
6. Rear brake pedal control
7. ABS control unit
8. Rear brake calliper
9. Front calliper (2 callipers)
10. Front brake circuit intake solenoid valve (normally open)
11. Humidifier
12. Rear brake circuit intake solenoid valve (normally open)
13. Rear brake exhaust circuit solenoid valve (normally closed)
14. Rear/front brake circuit low pressure accumulator
15. Front brake exhaust circuit solenoid valve (normally closed)
16. DC electric motor
17. Double circuit hydraulic pump (ABS)
18. Rear brake reservoir
19. Front brake reservoir

## **ABS OPERATION**

### **General specifications:**

The front circuit is similar to the rear circuit.

- The ABS inlet valve (10 - 12) is normally open and it is closed only when the system intervenes to avoid wheel locking.
- The outlet valve (13 - 15) is normally closed and it is opened only when the system intervenes to avoid wheel locking.
- When the system is in standby, the ABS processor never stops monitoring the speed of the wheels in order to assess potential wheel slippage.
- When in standby, the system does not intervene at all when the rider brakes; the braking system is the same as the one without ABS.

**Stages in ABS cycle (the following operations refer to the front circuit but are also applicable to the rear one):**

**A - Brake activation: the rider starts braking** as he would usually do.

**B - Pressure reduction:** it coincides with danger recognition (wheel slippage above threshold): the system closes the inlet valve (10-12) and opens the outlet valve (13-15) temporarily.

At this stage the rider cannot increase the pressure on the callipers (8-9) and the system reduces the pressure on the callipers partially. The excess fluid temporarily fills the front reservoir (18-19) until the ABS pump (17) self-activates and delivers the fluid back to the brake pump (2-5).

**C - Pressure maintained:** the pressure in the callipers (8-9) remains low until total recovery of speed / wheel grip.

The system restores the fluid taken from the calliper (8-9) in the section of the system between the brake pump (2-5) and the ABS inlet valve (10-12).

**D - Pressure restored:** by opening the inlet valve (10-12) momentarily, the pressure of the callipers (8-9) is increased until maximum deceleration is reached. Then, the system gives the control over the braking back to the rider.

**E -** If the wheel does not reach complete grip, the system continues operating as before until complete grip is obtained or until the vehicle stops. An error can be detected if the duration of the pressure reduction phase exceeds the pre-set time limit.

### ABS SYSTEM DESCRIPTION

The ABS system is a device to avoid wheels locking in case of emergency braking, increasing vehicle braking stability when compared to a traditional braking system.

Sometimes when the brake is operated, the tyre locks with a consequent loss of grip, which makes it difficult to control the vehicle. A position sensor (3) on the tone wheel (2), forming an integral unit with the vehicle wheel, "reads" the status of the vehicle wheel spotting any possible lock.

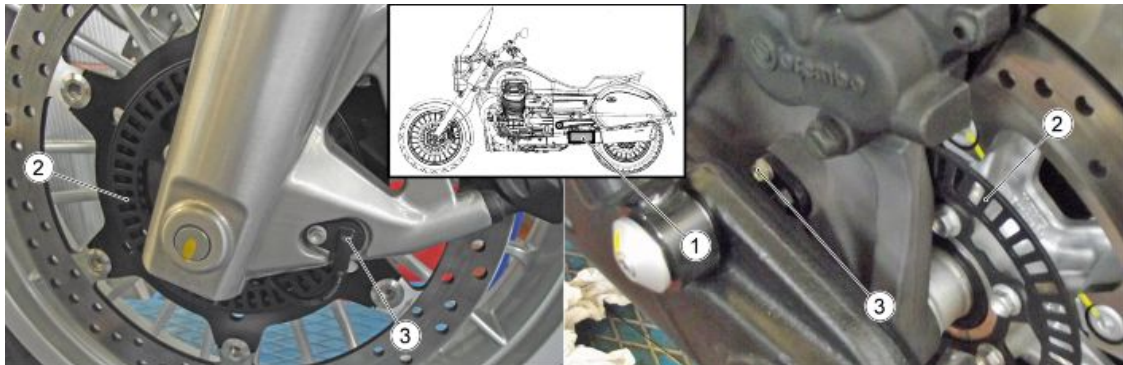
A control unit (1) signals this out and adjusts the pressure in the braking circuit accordingly.

#### NOTE

**WHEN THE ABS SYSTEM STARTS WORKING, A VIBRATION IS FELT ON THE BRAKE LEVER.**



**THE WHEEL ANTILOCK BRAKING SYSTEM DOES NOT PREVENT FALLS WHILE ON A BEND. AN EMERGENCY BRAKING WITH THE VEHICLE INCLINED, HANDLE BAR TURNED, ON UN-EVEN OR SLIPPERY ROADS, OR WITH POOR GRIP CREATES LACK OF STABILITY DIFFICULT TO HANDLE. THEREFORE, RIDE CAREFULLY AND SENSIBLY AND ALWAYS BRAKE GRADUALLY. BRAKING WHILE TURNING A CORNER IS SUBJECT TO LAWS OF PHYSICS WHICH NOT EVEN ABS CAN ELIMINATE.**



When the sensors (3) detect a significant speed difference between the rear and the front wheels (for example, when rearing up on the back wheel), the ABS system could take this as a dangerous situation. In this case, two things may occur:

- The ABS system intervenes by releasing pressure from the calliper until the wheel turns again at the same speed of the other wheel. It is not possible to brake for an instant.
- if the speed difference lasts long, the system may detect an error and deactivate the ABS system. As a consequence, the system works like any regular braking system.

### Riding with an active ABS system

- At engine starter, the ABS warning light (5) on the instrument panel (4) flashes until the vehicle exceeds 5 km/h (3.1 mph).

If the ABS warning light remains on when the vehicle is running, it means that a fault has been detected and the ABS system has been automatically deactivated.



### Riding with a deactivated ABS system

The warning light (5) turns on permanently, the system was deactivated.

## Guide to diagnosis

### PREMISE

Each time the key is ON, if, at least one current or stored\* error is detected, the ABS warning light turns on permanently.

### The ABS system is deactivated automatically

The system operates perfectly just as any other braking system without ABS

\* The diagnosis requires exceeding the 5 km/h (3.1 mph).



Each time the key is ON, if at least one current or stored\* error of the ABS system is not detected:

- the ABS warning light flashes.

### When the 5 km/h (3.1 mph) are exceeded:

- if errors are not detected: the ABS warning light turns off
- if at least one malfunction is detected: the ABS warning light turns on permanently.

### The ABS system is deactivated!

The system operates perfectly just as any other braking system without ABS.

The detection of malfunctions may require more or less time according to the type of failure.

Error detection logic foresees that for the errors to be diagnosed one or more conditions must persist within a given time.

If during this given time one of the conditions is missing but then it comes back, the timer is reset and the system is no longer able to diagnose the error.

The ABS system is still inactive.

### Example:

- error code **5D93** requires some minutes before it is diagnosed during the given time: the ABS warning light ABS keeps flashing.

## ECU INFO screen page

This screen page shows general data regarding the control unit, for example software type, mapping, control unit programming date



### INFO ECU SCREEN PAGE

Characteristic	Value/example	Unit of measurement	Notes
Vehicle manufacturing date			
Chassis number			
Software version			
Vehicle code			The vehicle code stored in the control unit is read.
Vehicle identification according to the status of Pin 2 and 15 of the ABS control unit connector			A different type of vehicle corresponds depending on the connection detected by the PIN 2 and PIN 15 of the ABS control unit connector.

## PARAMETERS screen page

This screen page shows the parameters measured by the several sensors (engine revs, engine temperature, etc.) or values set by the control unit (injection time, ignition advance, etc.)



### PARAMETERS

Characteristic	Value/example	Unit of measurement	Notes
Front wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed
Rear wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed
Battery voltage	11.9	V	

## ACTIVATION screen page

This screen page is used to delete errors in the control unit memory and to activate some systems controlled by the control unit.



### ACTIVATION

Characteristic	Value/example	Unit of measurement	Notes
Front brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
Rear brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
ABS warning light			During the test the warning light stays on
Ambient parameter error reading (1)			The ambient parameters are 4: Number of error detections, Operation cycles from the last detection, Battery voltage, Speed.
Ambient parameter error reading (2)			Number of error detections: number of times the error has been detected by the control unit;
Ambient parameter error reading (3)			for example, if it indicates 2, it means that the error has been detected (ATT), then it has not been detected for a while (sent to the MEM) and then it has been detected again.
Ambient parameter error reading (4)			Operation cycles from the last reading: a cycle is counted if the following occurs: key ON and speed over 20 km/h.
Ambient parameter error reading (5)			If for example 5 is shown, it means that the last time the error has been measured was 5 cycles ago.
Error clearing (1)			Press "enter" to transfer errors from the memory (MEM) to the historical record (STO).
Error clearing (2)			In the next connection between Navigator and the control unit, the historical errors (STO) are no longer shown.

## ERRORS screen page

This screen page shows potential errors detected in the vehicle (ATT) or stored in the control unit (MEM) and it allows to check error clearing (STO).





**ERRORS**

Characteristic	Value/example	Unit of measurement	Notes
Front speed sensor: 5D90 electric malfunction			Electrical fault in sensor or cable harness
Front speed sensor: 5D91 the signal works irregularly			Faulty sensor or signal interference
Front speed sensor: 5D92 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Front speed sensor: no signal or speed measured too low in relation to the rear wheel 5D93			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth
Front speed sensor: 5D94 no acceleration after pressure reduction			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel
Front speed sensor: 5D95 excessive measured speed			Faulty sensor/tone wheel, or tone wheel with wrong number of teeth or wrong tyre size
Rear speed sensor: 5DA0 electric malfunction			Electrical fault in sensor or cable harness
Rear speed sensor: 5DA1 the signal works irregularly			Faulty sensor or signal interference
Rear speed sensor: 5DA2 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Rear speed sensor: 5DA3 no signal or speed measured too low in relation to the front wheel			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth
Rear speed sensor: 5DA4 no acceleration after pressure reduction			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel
Rear speed sensor: excessive measured speed 5DA5			Faulty sensor or tone wheel with wrong number of teeth or wrong tyre size
Control unit: missing valve calibration 5DD2			Possible control unit fault
Control unit 5DD3			Possible control unit fault
Recirculation pump 5DF0			Possible control unit fault
Recirculation pump 5DF1			Possible control unit fault
Control unit 5DF2			Possible control unit fault
Low electric voltage - long period measurement 5DF3			Voltage too low measured for 30 seconds at PIN 18 of the ABS control unit:
Control unit 5DF5			Possible control unit fault
High electric voltage 5DF7			Excessive voltage measured at PIN 18 of the ABS control unit
Vehicle code 5E59			Inconsistency detected between memory coding (INFO ECU/Vehicle code) and what is measured at cable harness identification PIN (INFO ECU screen page, Vehicle identification line - Pins 2-15 of ABS control unit)
Control unit F000			Possible control unit fault
CAN line: D347 electric malfunction			Open circuit, short circuit in the ground lead or to battery of one or both wires of CAN line. Possible short circuit between the two cables.
CAN line: 5E11 electric malfunction			Open circuit, short circuit in the ground lead or to battery of one or both wires of CAN line. Possible short circuit between the two cables.
0xF01F control unit			Possible control unit fault
5E5A ABS switch			

## SETTINGS screen page

This screen page is used to adjust some control unit parameters.

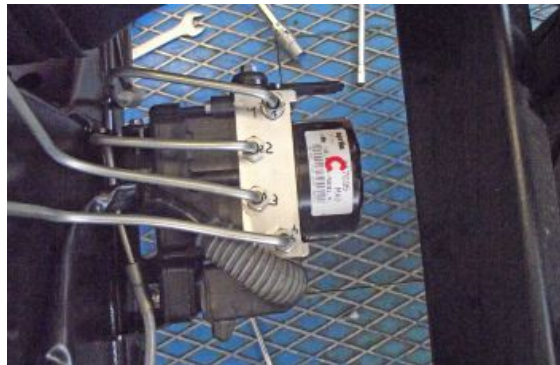


### ADJUSTMENTS

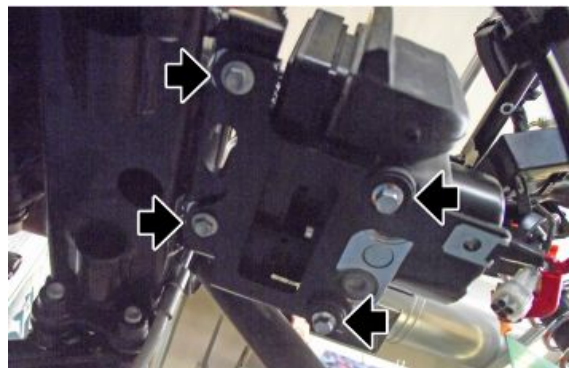
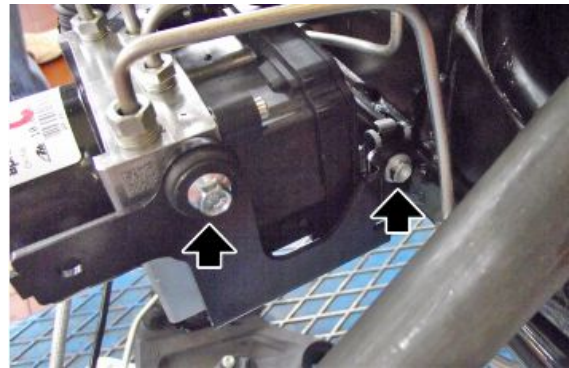
Characteristic	Value/example	Unit of measurement	Notes
Coding (1)			Used for re-coding the control unit or coding a new one.
Coding (2)			Vehicle identification is done according to the connection of PINS 2 and 15 of the ABS control unit connector and is stored in the control unit memory.
Coding (3)			The identification can be read in the INFO ECU screen page in the line: Vehicle code.

## Modulator

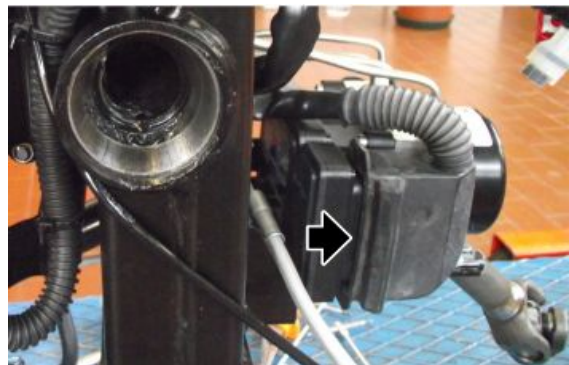
- Remove the plastic cover of the ABS system.
- Cut the clamp that fastens the wiring.
- With a felt-tip pen, mark a reference on the pipes and on the ABS control unit to avoid inverting them when refitting.
- Protect with a clean cloth the plastic materials near the ABS control unit.
- Loosen the nuts and remove the pipes.
- Cover the pipes to prevent brake fluid spilling.



- Undo and remove the two side fixing screws.
- Unscrew and remove the four lower fixing screws.

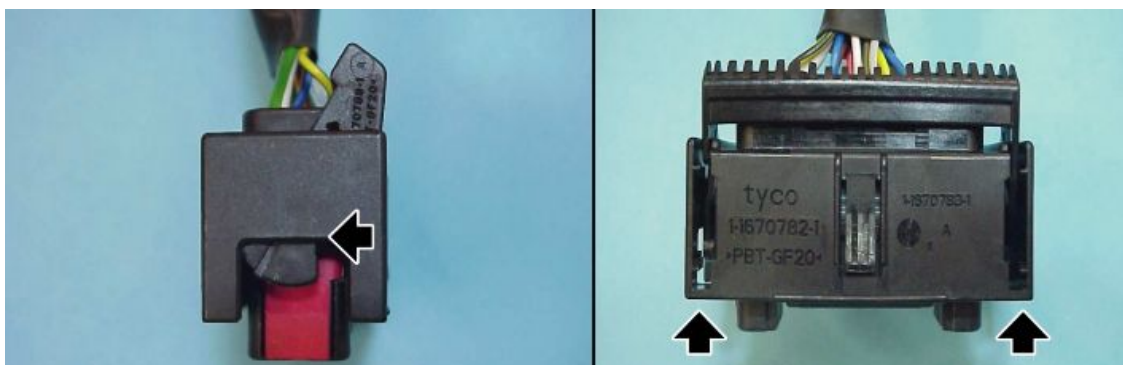


- Disconnect the ABS control unit connector.
- Remove the ABS control unit.

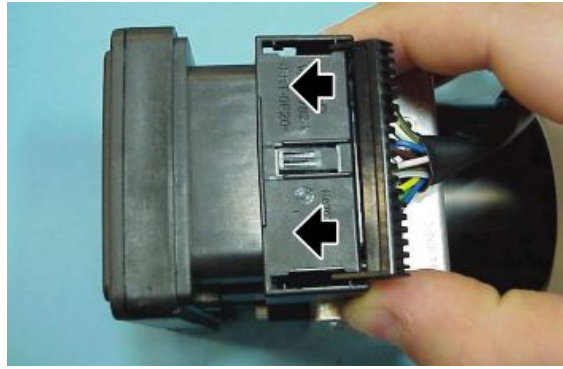


**INSERTION PROCEDURE OF ABS CONTROL UNIT CONNECTOR**

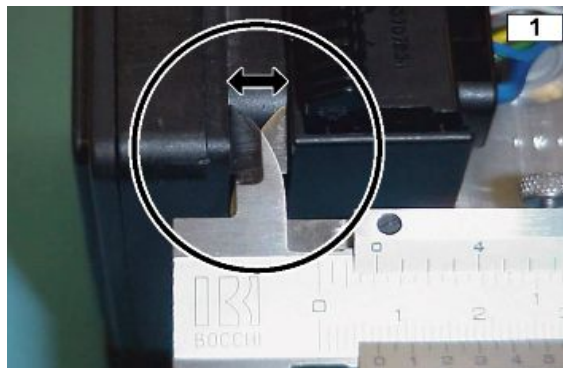
- Check the initial position of the lever that couples the connector.



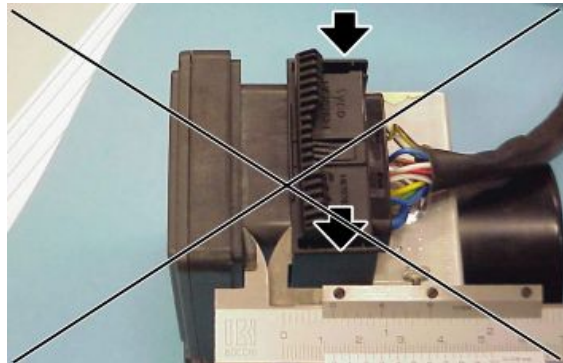
- When the connector is fully inserted, the distance between the connector and the ABS control unit must be 7.5 mm (0.29 in).



- If the initial position of the connector and the driving lever is not that shown in fig. 1, the connector will not be properly coupled and the distance measured will be greater (12 mm approx. (0.47 in)). In this case repeat the operation as described in the two previous points.



**IT IS ADVISABLE TO CREATE A TEMPLATE TO CHECK THE CORRECT CONNECTOR INSERTION.**

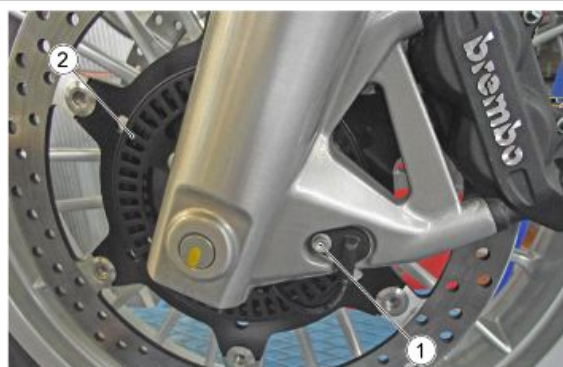


- Fit the protection casing.

## Component maintenance

The vehicle is fitted with a two-channel ABS system, i.e. it works on both the front and the rear wheel.

Check periodically and each time the wheels are refitted, the tone wheel (2) or the sensor (1) replaced, that the wheel distance is constant at each 360°. Use a thickness gauge to check the distance between sensor (1) and tone wheel (2) at three points at a 120° span. The values should be between:



0.3 - 2.00 mm (0.012 - 0.079 in) for the front one;

0.3 - 2.00 mm (0.012 - 0.079 in) for the rear one;

**CAUTION**

IF A VALUE BEYOND THE TOLERANCE RANGE IS MEASURED, REPLACE THE SENSOR (1) AND/OR THE TONE WHEEL (2) AND REPEAT THE CHECKS; MAKE SURE THAT THE VALUES ARE WITHIN THE TOLERANCE LIMITS.



### TONE WHEELS (2) CLEANING

It is important to check that all the tone wheels (2) are always clean. Otherwise, gently remove any possible dirt deposits with a cloth or metal brush. Avoid using solvents, abrasives and air or water jets directly on the tone wheel (2).

### TONE WHEEL SENSOR REPLACEMENT

Disconnect the tone wheel sensor connector (1) from the main wire. Unscrew and remove the screw and remove the tone wheel sensor (1).

**CAUTION**

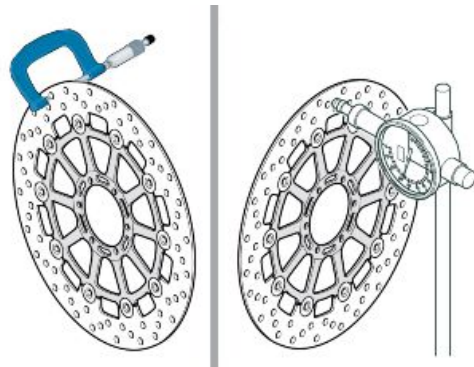
**BEFORE REFITTING, MAKE SURE THAT THE FAYING SURFACES BETWEEN THE SENSOR (1) AND THE SEAT ITSELF DO NOT SHOW SIGNS OF DAMAGE AND ARE COMPLETELY CLEAN. ALWAYS CHECK THE DISTANCE BETWEEN THE SENSOR (1) AND THE TONE WHEEL (2).**

## Disc Inspection

**CAUTION**

**THE FRONT BRAKE DISC SHAPE DOES NOT CHANGE THE OPERATING AND MAINTENANCE SPECIFICATIONS OF THE SYSTEM.**

- The following operations must be carried out with the brake discs fitted on the wheel; they refer to a single disc, but are valid for both.
- Check the disc for wear by measuring the minimum thickness with a micrometer in different points. If the minimum thickness, even in a single point of the disc, is less than the minimum value, replace the disc.



### Disc thickness minimum value: 4 mm (0.16 in)

- Using a dial gauge, check that the maximum oscillation of the disc does not exceed the tolerance; otherwise, replace it.

---

Disc oscillation tolerance: 0.15 mm (0.0059 in)

---

## Front brake pads

---

### Removal

- Undo and remove the two screws.
- Slide off the brake calliper from the disc.



- Turn the pins and remove both split pins.



- Remove both pins.



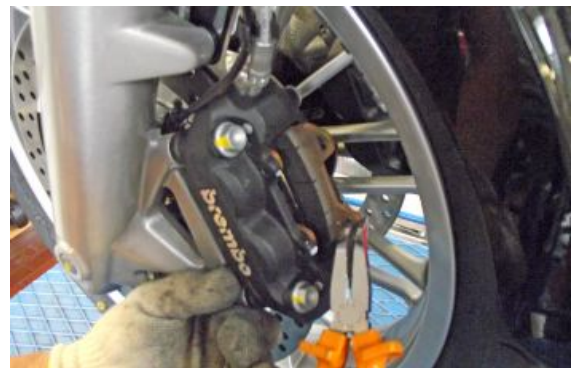
- Remove the vibration-damping plate.



- Extract one pad at a time.

#### CAUTION

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.



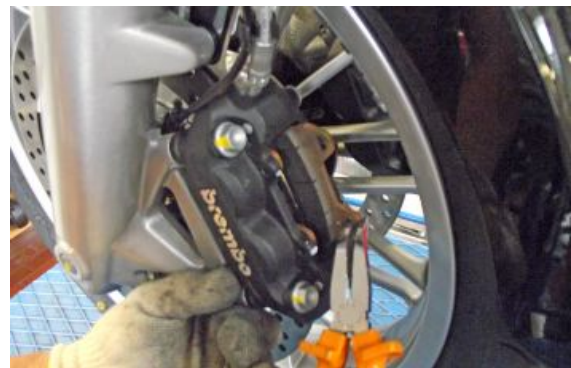
## Installing

- Insert two new pads, placing them so that the holes are aligned with the caliper holes.

#### CAUTION



ALWAYS REPLACE BOTH PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALLIPER.



- Position the anti-vibration plate.
- Insert both pins.
- Position both split pins.
- Abut the plungers against the pads, acting on the brake pump lever several times.
- Check the brake fluid level in the reservoir.





---

## Rear brake pads

---

### Removal

- Remove the lock and remove the pin.







- Extract one pad at a time.

**CAUTION**

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.

**Installing**

- Insert two new pads, placing them so that the holes are aligned with the caliper holes.

**CAUTION**

ALWAYS REPLACE BOTH PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALLIPER.



- Insert the pin.
- Position the lock.
- Abut the plungers against the pads, acting on the brake pump pedal several times.
- Check the brake fluid level in the reservoir.





---

## Bleeding the braking system

### VEHICLE PREPARATION

- It is important to check that there is always enough brake fluid in the reservoir.
- Using a bleed device facilitates these operations while, in the meantime, the "Brake fluid replacement" operations are performed.
- In this case, the bleed process must be accompanied by further pedal strokes and with the bleed device connected (about 5 for each wheel circuit).

### BRAKE PUMP REPLACEMENT

#### PRELIMINARY OPERATIONS

- Replace the damaged brake pump with a new one.
- Connect the brake pipe to the new brake pump.
- Fill the reservoir with new brake fluid.

#### CAUTION

**PERFORM THE REGULAR BRAKING SYSTEM BLEEDING, AS DESCRIBED AT THE END OF THE CHAPTER.**

- Always fill the reservoir up to the reference "MAX" and refit the cap.
- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in the braking system and if everything is ok, continue bleeding operations using Navigator as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.

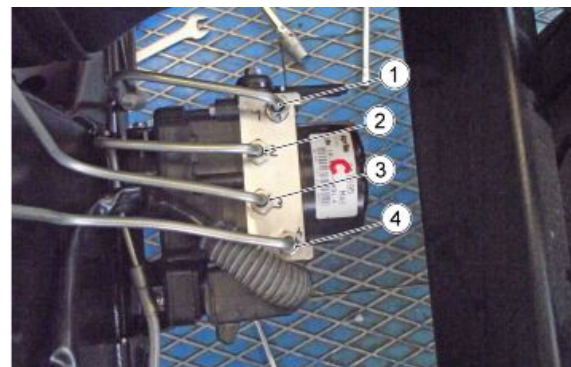
#### See also

[Front](#)  
[Rear](#)

---

**REPLACE THE ABS CONTROL UNIT****VEHICLE PREPARATION**

- Connect the bleed bottle to the bleed screws of the front and rear callipers and open it.
- Fully press down the lever and the brake pedal and fix them into position with the respective locking devices.
- Close the bleed screws of the front and rear callipers and remove the bleed bottle.
- Remove the damaged ABS control unit.



**Note:** First of all, detach the brake pipes that go from the ABS control unit to the brake pump (1-4) and immediately seal the opened unions of the ABS control unit with protective caps. Afterwards, remove pipes (2-3) that go from the ABS control unit to the brakes and also seal these unions with protective caps.

- Install the new ABS control unit, previously filled up.
- So that the brake fluid remains in the ABS control unit, first remove the protective caps of the braking circuit unions and connect the respective pipes.

**Once all the braking circuits have been connected, remove the protective caps from the braking pump unions and connect the braking pump pipes to the ABS control unit.**

- Unlock the lever and the brake pedal.
- Remove the reservoir cap and fill it with new brake fluid up to the reference "MAX".

**CAUTION**

**PERFORM THE REGULAR BRAKING SYSTEM BLEEDING, AS DESCRIBED AT THE END OF THE CHAPTER.**

- Always fill the reservoir up to the reference "MAX" and refit the cap.

- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in the braking system and if everything is ok, continue bleeding operations using Navigator as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.

**See also**

[Front](#)  
[Rear](#)

**CALLIPERS REPLACEMENT**

**VEHICLE PREPARATION - The operations are described for the front system, but they are also valid for both braking systems.**

- Connect the bleed bottles to the bleed screw of the front calliper and open it.
- Fully press down the brake lever and fasten it into position with a locking device so as to avoid fluid flowing out from the open system.
- Close the bleed screws of the front calliper and remove the bleed bottle.
- Replace the damaged calliper with a new one.
- Unlock the brake lever.
- Remove the reservoir cap and fill it with new brake fluid up to the reference "MAX".

**CAUTION**

**PERFORM THE REGULAR BRAKING SYSTEM BLEEDING, AS DESCRIBED AT THE END OF THE CHAPTER.**

- Always fill the reservoir up to the reference "MAX" and refit the cap.
- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in the braking system and if everything is ok, continue bleeding operations using Navigator as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.

**See also**

[Front](#)  
[Rear](#)

**BLEEDING SYSTEM WITH NAVIGATOR**

This type of bleeding has to be carried out if after all the checks the brake lever and the pedal are still spongy.

The operations described here are valid for both systems even though the description refers to the front system.

**FRONT**

- With Navigator properly connected, select the function "FRONT BRAKE BLEEDING PROCEDURE".
- The pump starts rotating.
- While the pump is performing a rotation cycle, operate and release the front brake lever until the message Navigator cycle completion is received.
- This procedure allows the air to turn and to accumulate.
- Once the procedure with Navigator is finished, perform the REGULAR BLEEDING to remove the air from the system completely.

**CAUTION**

**PERFORM THE REGULAR BRAKING SYSTEM BLEEDING, AS DESCRIBED AT THE END OF THE CHAPTER.**

**See also**

[Front](#)  
[Rear](#)

---

**Front**

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and by poor braking efficiency.

**CAUTION**

**CONSIDERING THE DANGER FOR VEHICLE AND RIDER, IT IS STRICTLY NECESSARY, AFTER REFITTING BRAKES AND RESTORING THE BRAKING SYSTEM TO THE REGULAR USE CONDITIONS, THAT THE HYDRAULIC CIRCUIT BE AIR PURGED.**

**NOTE**

**THE FOLLOWING OPERATIONS REFER TO ONLY ONE FRONT BRAKE CALLIPER BUT APPLY TO BOTH CALLIPERS. THE VEHICLE MUST BE ON LEVEL GROUND TO BE PURGED. WHILE PURGING THE HYDRAULIC SYSTEM, FILL THE RESERVOIR WITH THE NECESSARY QUANTITY OF BRAKE FLUID. CHECK THAT, DURING THE OPERATION, THERE IS ALWAYS BRAKE FLUID IN THE RESERVOIR.**

**REGULAR AIR BLEEDING SYSTEM**

- Remove the rubber protection cover from the bleed valve.
- Insert the transparent plastic pipe in the front brake calliper bleed valve and slide the other end of this pipe in a container to collect the fluid.
- Remove the front brake oil reservoir cap.
- Operate the brake lever and then open the bleed valve on the calliper 1/4 of a turn to let the air out.
- Close the bleed again before reaching the lever end of the stroke and repeat the operation until there is no air.
- Repeat the procedure for both callipers.
- Screw the bleeding valve and remove the pipe.
- Top-up the reservoir until the correct brake fluid level is obtained.
- Refit and block the front brake oil reservoir cap.
- Refit the rubber protection cover.



## Rear

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and by poor braking efficiency.

### CAUTION

**CONSIDERING THE DANGER FOR VEHICLE AND RIDER, IT IS STRICTLY NECESSARY, AFTER REFITTING BRAKES AND RESTORING THE BRAKING SYSTEM TO THE REGULAR USE CONDITIONS, THAT THE HYDRAULIC CIRCUIT BE AIR PURGED.**

### NOTE

**THE VEHICLE MUST BE ON LEVEL GROUND TO BE PURGED. WHILE PURGING THE HYDRAULIC SYSTEM, FILL THE RESERVOIR WITH THE NECESSARY QUANTITY OF BRAKE FLUID. CHECK THAT, DURING THE OPERATION, THERE IS ALWAYS BRAKE FLUID IN THE RESERVOIR.**

### REGULAR AIR BLEEDING SYSTEM

- Remove the rubber protection cover from the bleed valve.
- Insert the transparent plastic pipe in the rear brake calliper bleed valve and insert the other end of this pipe into a container to collect the fluid.
- Remove the rear brake oil reservoir cap.
- Operate the brake lever and then open the bleed valve on the calliper 1/4 of a turn to let the air out.
- Close the bleed again before reaching the lever end of the stroke and repeat the operation until there is no air.



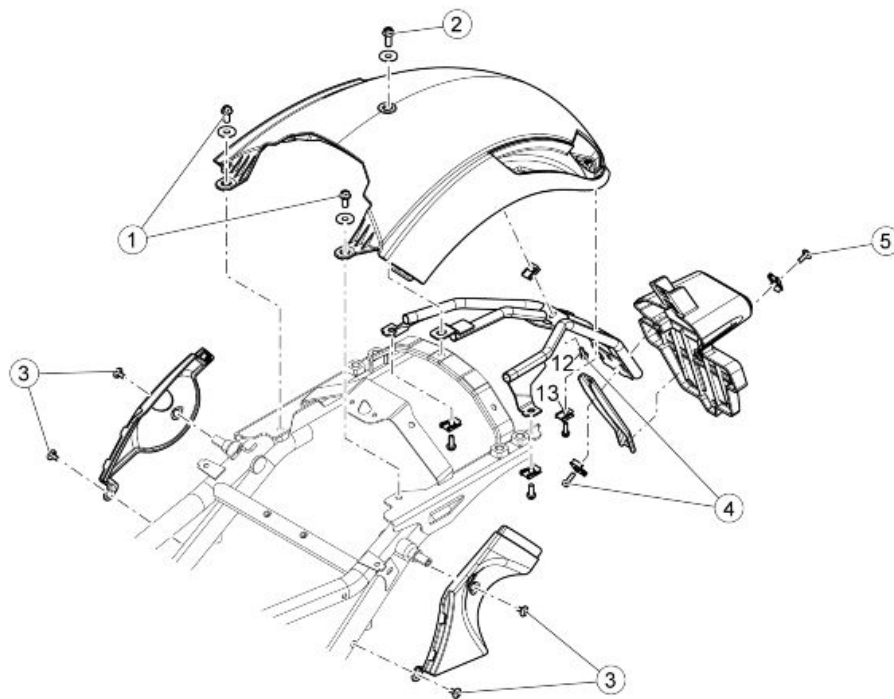
- Screw the bleed valve and remove the pipe.
  - Top-up the reservoir until the right brake fluid level is obtained.
  - Refit and lock the rear brake oil reservoir cap.
  - Refit the rubber protection cover.
-

## INDEX OF TOPICS

**BODYWORK**

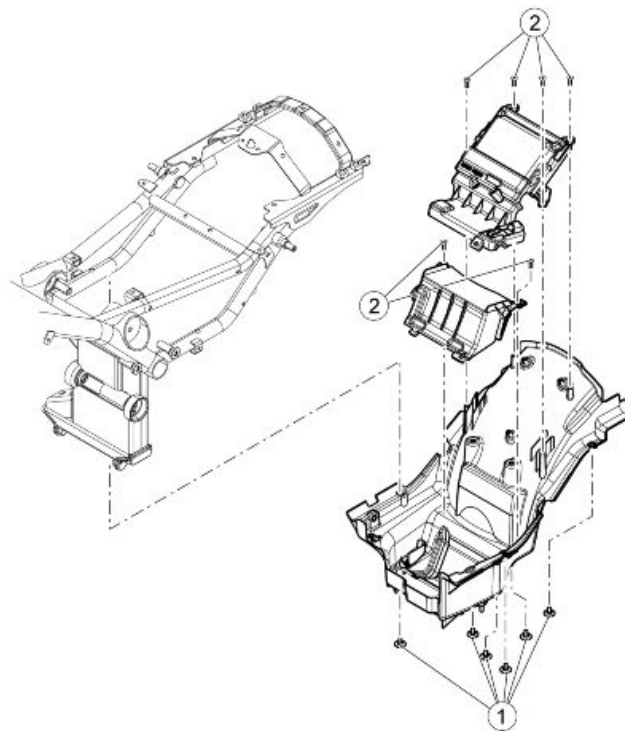
**BODYW**





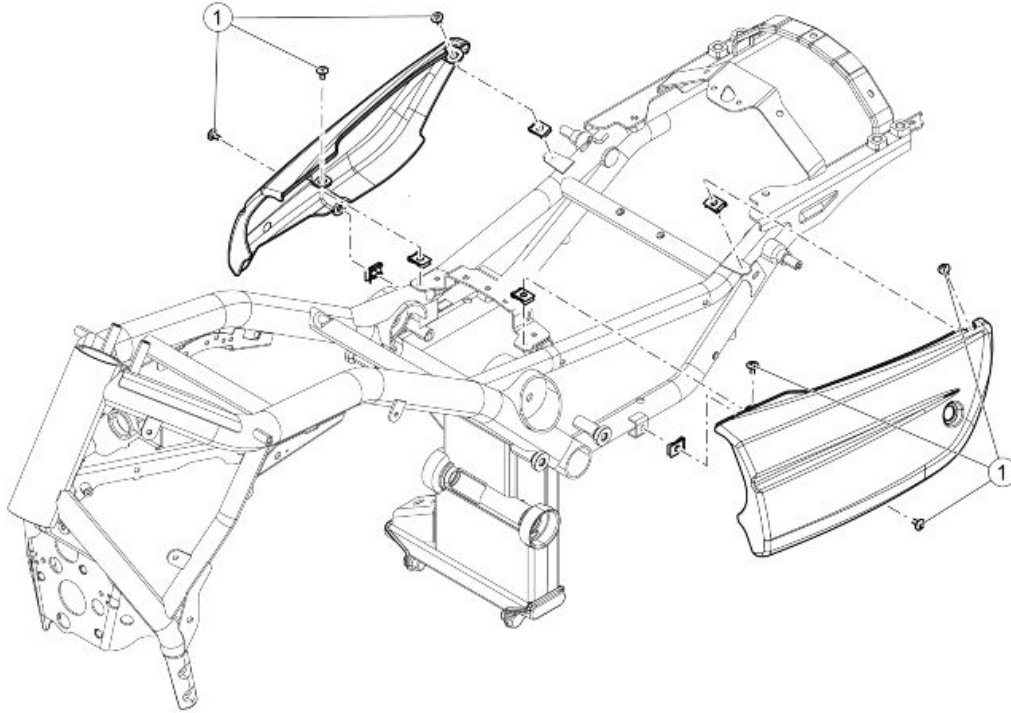
**REAR MUDGUARD**

pos.	Description	Type	Quantity	Torque	Notes
1	Front fixing screws	M8x20	2	25 Nm (18.44 lb ft)	-
2	Upper fixing screw	M8x16	1	25 Nm (18.44 lb ft)	-
3	Side cover fixing screws	M5x9	4	6 Nm (4.42 lb ft)	-



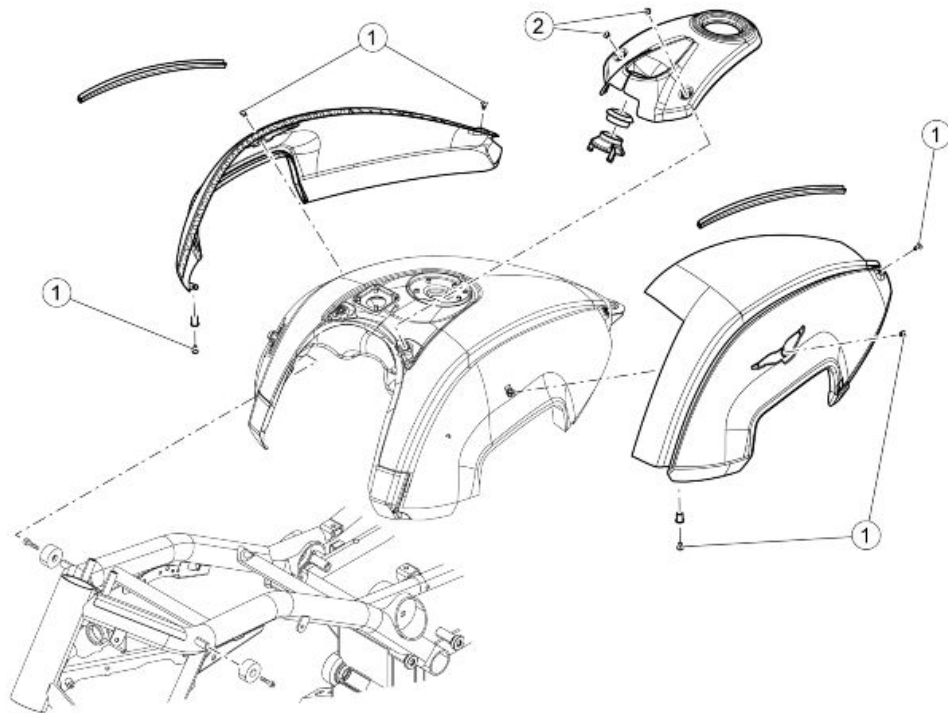
**UNDER SADDLE**

pos.	Description	Type	Quantity	Torque	Notes
1	Lower saddle compartment closing fixing screws	-	8	6 Nm (4.42 lb ft)	-
2	Fixing screw closing upper and lower saddle compartment	M5x20 stainless steel	6	3 Nm (2.21 lb ft)	-



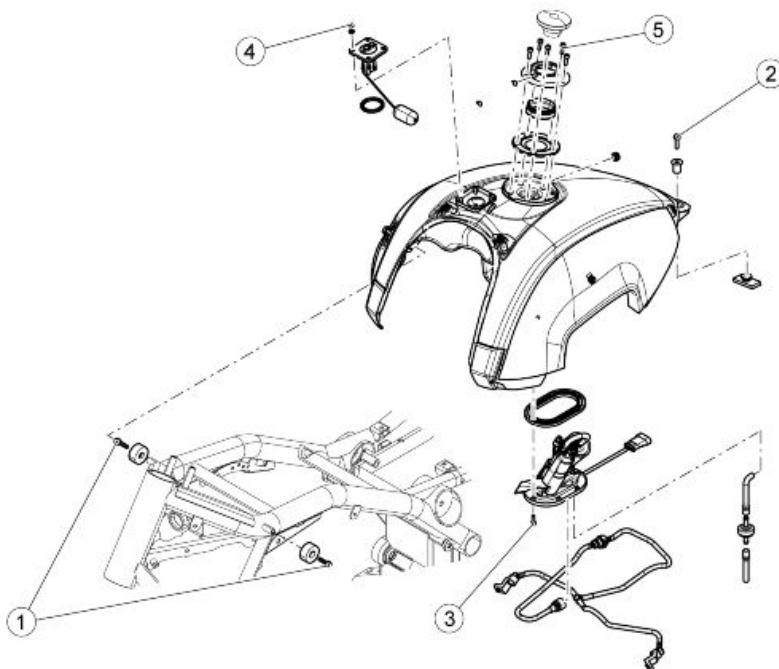
**CENTRAL BODYWORK**

pos.	Description	Type	Quantity	Torque	Notes
1	Side fairing fixing screws	M5x9	6	6 Nm (4.42 lb ft)	-



**TANK COVER**

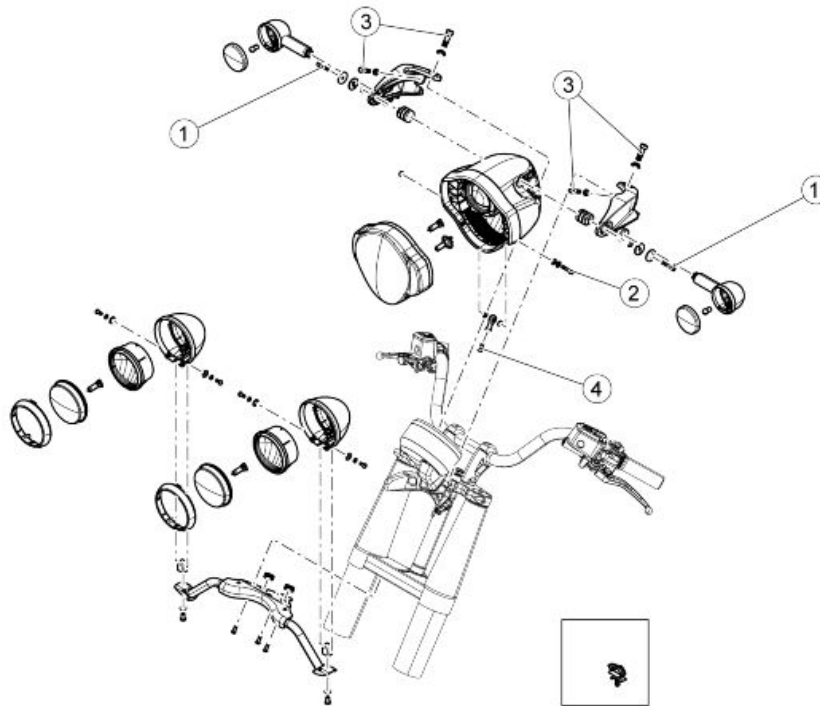
pos.	Description	Type	Quantity	Torque	Notes
1	Fairing fixing screws	M5x10	6	6 Nm (4.42 lb ft)	-
2	Dashboard fixing screw	M5x16	2	5 Nm (3.68 lb ft)	-



**FUEL TANK**

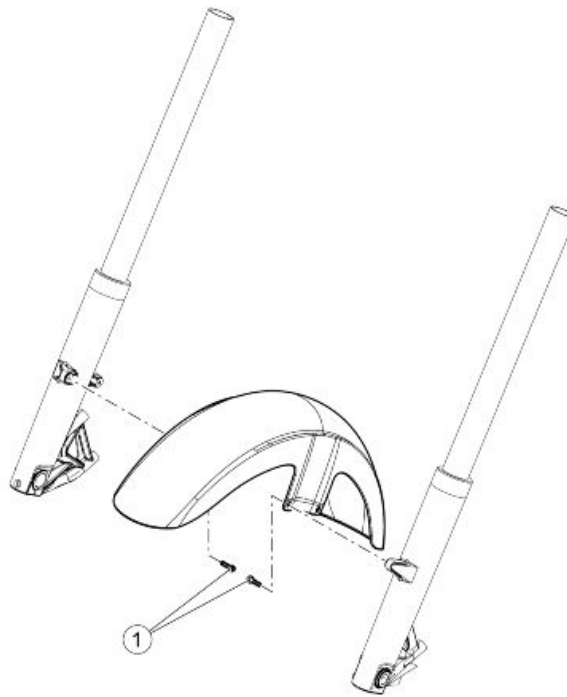
pos.	Description	Type	Quantity	Torque	Notes
1	Front fixing screw	M8x16	2	25 Nm (18.44 lb ft)	-
2	Rear fixing screw	M6x25	1	10 Nm (7.37 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
3	Fuel pump fixing screw	M5x20	6	6 Nm (4.42 lb ft)	-
4	Fuel level sensor fixing nuts	M5	4	5 Nm (3.69 lb ft)	-
5	Screw fastening cap flange to tank	M5x16	5	6 Nm (4.42 lb ft)	-



**HEADLAMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fixing headlamp to supports	M6x55	1	5 Nm (3.69 lb ft)	-
2	Screw fixing headlamp to joint	M6x30	1	10 Nm (7.37 lb ft)	-
3	Fixing screws sup. plate headlights sup. steering	M6x20	4	10 Nm (7.37 lb ft)	-
4	Steering lower plate joint head fixing screw	M6x35	1	10 Nm (7.37 lb ft)	-



**FRONT MUDGUARD**

pos.	Description	Type	Quantity	Torque	Notes
1	Front mudguard fixing screws	M5x12	4	4 Nm (2.95 lb ft)	-

**Instrument panel**

- Undo and remove the two front fixing screws of the instrument panel; during operation, take care to support it adequately.



- Undo and remove the three fixing screws (1).
- Remove the rear cover.



- Disconnect the connector.
- Remove the instrument panel.



## Headlight assy.

- Cut the clamp that fastens the wiring.



- Disconnect the front headlamp connectors.



- Unscrew and remove the fixing screw behind the headlight assembly.



- Undo and remove the two side fixing screws.
- Be careful to adequately support the headlight assembly before removing the screws.



### HEADLAMP SUPPORTS

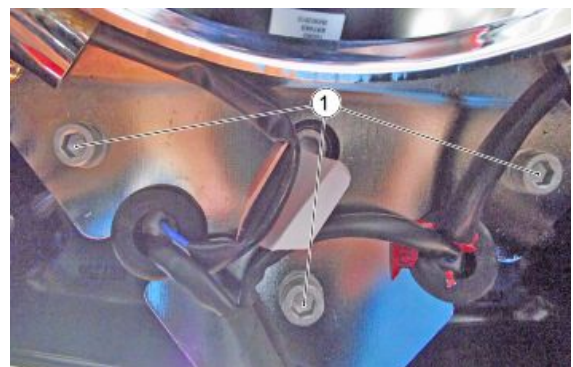
The following procedure is described for one single support, but is valid for both.

- Unscrew and remove the rear screw.
- Unscrew and remove the front screw, remove the support.

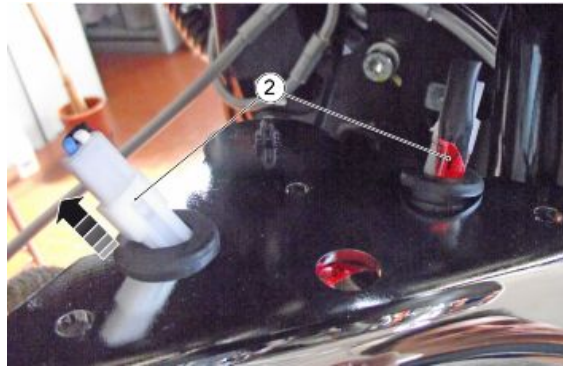


### Additional lights

- Undo and remove the three lower fixing screws (1) taking care to properly support the additional headlamps.



- Remove the two connectors (2) from the bulkhead, pulling slightly.
- Disconnect the additional light connectors.



- Remove the additional headlamps assembly.

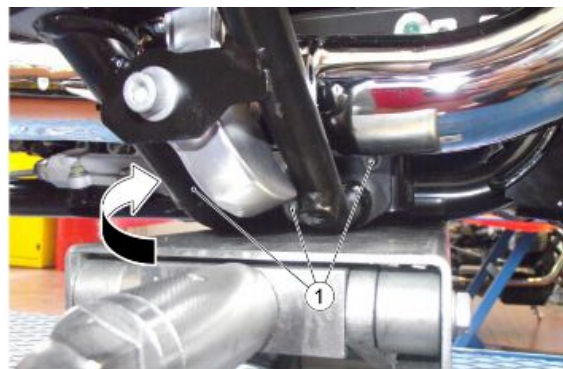


## Footrest

- The following procedure is described for one single footrest, but is valid for both.
- Disconnect the stop light connector.
- Undo and remove the three fixing screws (1).

### NOTE

**BEFORE PROCEEDING WITH THE LEFT FOOTREST REMOVAL, DISCONNECT THE GEAR TIE ROD. ON THIS FOOTREST THE MICRO IS NOT PRESENT AS IN THE RIGHT FOOTREST.**

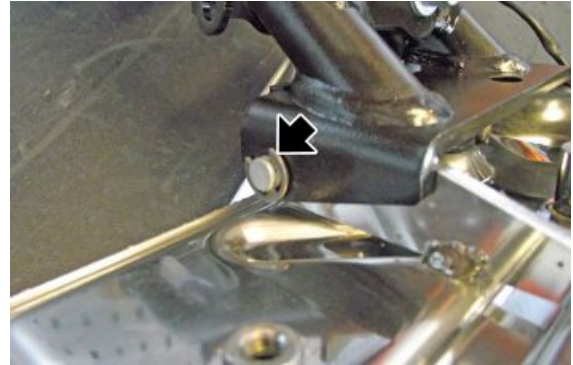


- Remove the footrest.





- Remove the locking seeger of the pin of the footrest.



- Remove the fixing pin of the footrest.
- Remove the footrest.



- Remove the fixing clamp of the stop light micro (3).
- Undo and remove the two fixing screws (2).
- Remove the micro.



- Unscrew and remove the fixing screw of the brake lever.
- Remove the brake lever.



#### GEAR LEVER REMOVAL

- To remove the gear lever, unscrew the screw shown in the figure.



#### PASSENGER FOOTREST

- Unscrew and remove the four screws (1).



- Unscrew and remove the rear screw.
- Remove the passenger footrest.



## Side body panels

- Operating from both sides, unscrew and remove the fixing screw.



- Remove the side fairing.



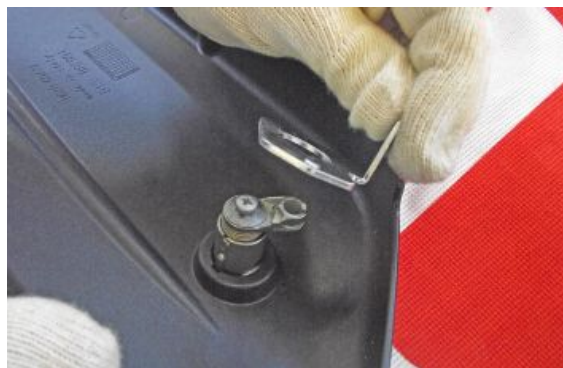
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**SADDLE RELEASE CONTROL REMOVAL**

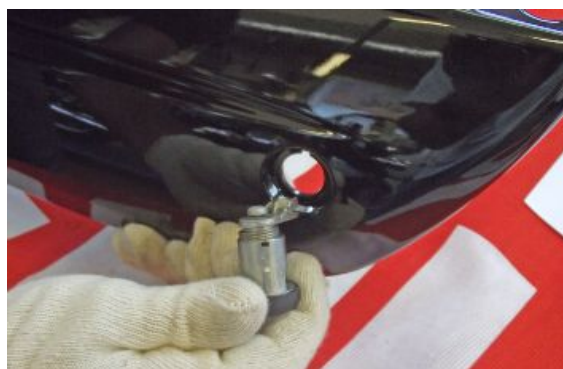
- Remove the fork spring.



- Disconnect the saddle release cable.
- Remove the cable support plate.



- Remove the ignition switch assembly.



---

## License plate holder

- Disconnect the light connector located under the rear mudguard.



- Undo and remove the two fixing screws of the license plate support.
- Remove the license plate support.



---

## Rear mudguard

- First remove the rear handle.
- Disconnect the connector of the license plate light.



- Unscrew and remove the lower fixing screw.



**See also**

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### Rear grab rail

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- Working from both sides, release the two side locks.

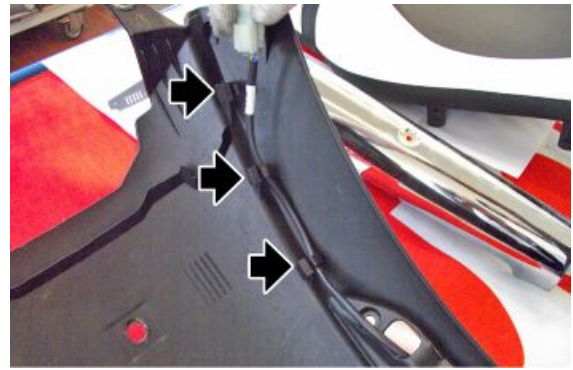


- Disconnect the two connectors of the rear turn indicators.
- Remove the rear mudguard.



- Undo and remove the turn indicator fixing screws.
- Remove the wiring by its fasteners.
- Remove the turn indicator.





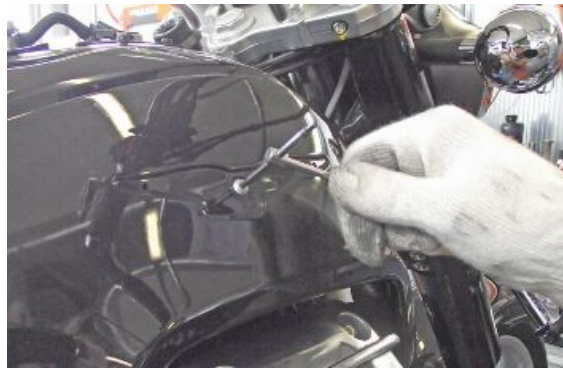
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## Fuel tank

- Undo and remove the two fixing screws of the tank cap cover.
- Remove the cover.
- Disconnect the two connectors of the fuel level sensor.



- Working from both sides, undo and remove the two side screws.



- Unscrew and remove the rear screw.



- Slightly lift the tank so as to be able to reach the connector.
- Disconnect the connector of the fuel pump.



- Disconnect the fuel pipe.

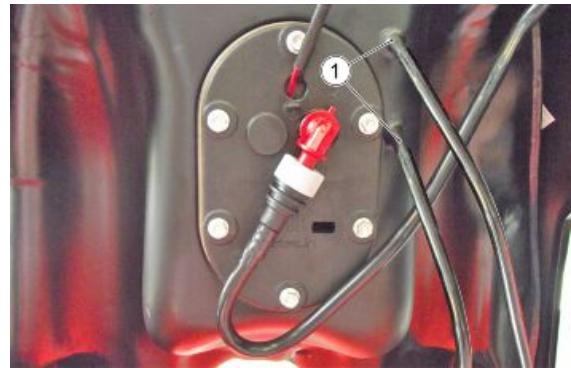
**CAUTION**

**PAY ATTENTION TO THE LEAKAGE OF FUEL EVEN IF IN A MINIMUM QUANTITY.**



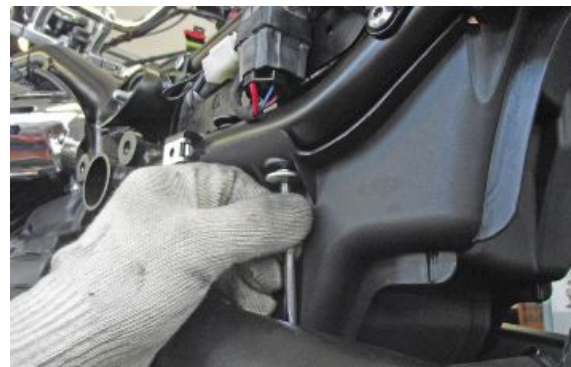


- Disconnect the two breather pipes (1) located under the tank.
- Remove the tank.

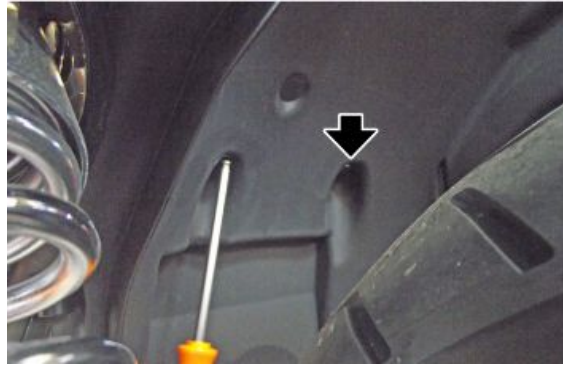


## Rear wheelhouse

- First remove the control unit, license plate support and side panniers support.
- Working from both sides, undo and remove the two side fixing screws.



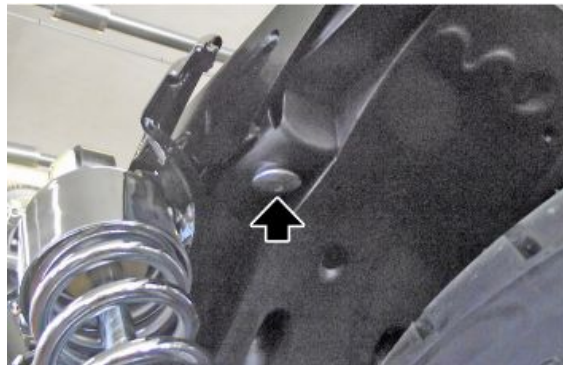
- Unscrew and remove the two rear screws.



### See also

License plate holder  
[Pannier mounting](#)

- Working from both sides, undo and remove the two screws on the side of the rear shock absorber.



- Undo and remove the fixing screws in the lower protection part of the ABS control unit.
- Remove the rear wheel housing by pulling it off from the rear.





---

## Front mudguard

- Working from both sides, undo and remove the two fixing screws (1).



- Remove the front mudguard.



---

## Pannier mounting

The following steps are described for only one side of the frame but apply to both.

- Undo and remove the screw fixing the passenger footrest to the pannier holder frame.



- Unscrew and remove the two screws in the figure.
- Remove the bag holder frame.

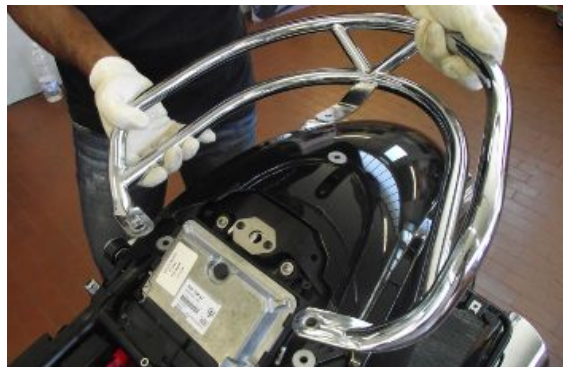


## Rear grab rail

- First remove the saddle.
- Undo and remove the three fixing screws (1) of the rear handle.



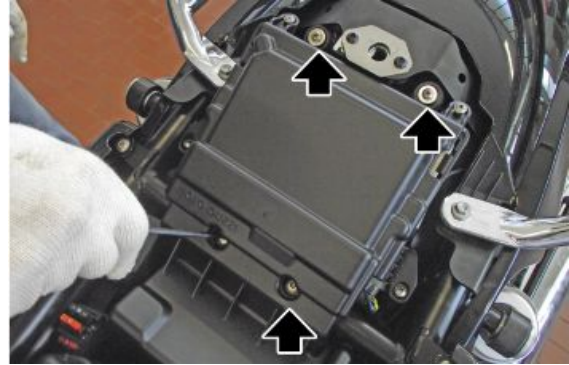
- Remove the rear handle.



---

## Battery

- Unscrew and remove the four screws in the figure.
- Remove the battery cover.



- Disconnect the two battery cables starting from the negative and then move to the positive.



- Remove the battery.



# INDEX OF TOPICS

**P**RE-DELIVERY

**P**RE DE

Carry out the listed checks before delivering the motorcycle.

**WARNING**

**HANDLE FUEL WITH CARE.**

---

**Aesthetic inspection**

- Paintwork
  - Fitting of Plastic Parts
  - Scratches
  - Dirt
- 

**Tightening torques inspection**

- Safety fasteners:
    - front and rear suspension unit
    - front and rear brake calliper retainer unit
    - front and rear wheel unit
    - engine - chassis retainers
    - steering assembly
  - Plastic parts fixing screws
- 

**Electrical system**

- Main switch
  - Headlamps: high beam lights, low beam lights, tail lights (front and rear) and their warning lights
  - Headlight adjustment according to regulations in force
  - Front and rear stop light switches and their bulbs
  - Turn indicators and their warning lights
  - Instrument panel lights
  - Instrument panel: fuel and temperature indicator (if present)
  - Instrument panel warning lights
  - Horn
  - Electric starter
  - Engine stop via emergency stop switch and side stand
  - Helmet compartment electrical opening switch (if present)
-

- Through the diagnosis tool, check that the last mapping version is present in the control unit/s and, if required, program the control unit/s again: consult the technical service website to know about available upgrades and details regarding the operation.

**CAUTION**

**TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS BATTERY LIFE.**

**CAUTION**

**UPON INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE, AND PERFORM THE REVERSE OPERATION UPON REMOVAL.**

**WARNING**

**THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING. IN CASE OF CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK MEDICAL ATTENTION IMMEDIATELY. IF ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK MEDICAL ATTENTION IMMEDIATELY. BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES. KEEP OUT OF THE REACH OF CHILDREN.**

**CAUTION**

**NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.**

---

## Levels check

- Hydraulic braking system fluid level
- Clutch system fluid level (if present)
- Gearbox oil level (if present)
- Transmission oil level (if present)
- Engine coolant level (if present)
- Engine oil level
- Mixer oil level (if present)

---

## Road test

- Cold start
- Instrument panel operation



- Response to throttle control
  - Stability when accelerating and braking
  - Front and rear brake efficiency
  - Front and rear suspension efficiency
  - Abnormal noise
- 

## **Static test**

### **Static check after test drive:**

- Restarting when warmed up
  - Starter operation (if present)
  - Minimum holding (turning the handlebar)
  - Uniform turning of the steering
  - Possible leaks
  - Radiator electric fan operation (if present)
- 

## **Functional inspection**

- Hydraulic braking system
- Stroke of brake and clutch levers (if present)
- Clutch - Check for correct operation
- Engine - Check for correct general operation and absence of abnormal noise
- Other
- Documentation check:
- Chassis and engine numbers check
- Supplied tools check
- License plate fitting
- Locks checking
- Tyre pressure check
- Installation of mirrors and any possible accessories



**NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES AS TYRES MAY BURST.**  
**CAUTION**



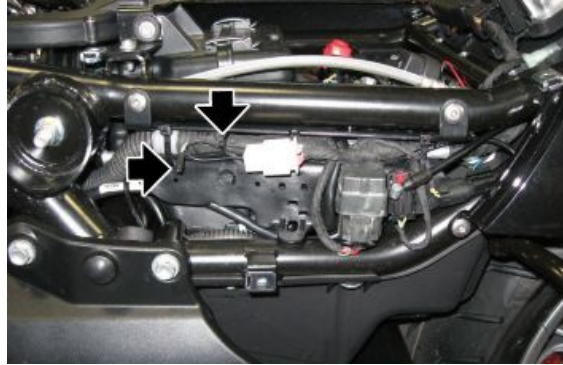
**CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.**

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## Specific operations for the vehicle

### ANTITHEFT DEVICE

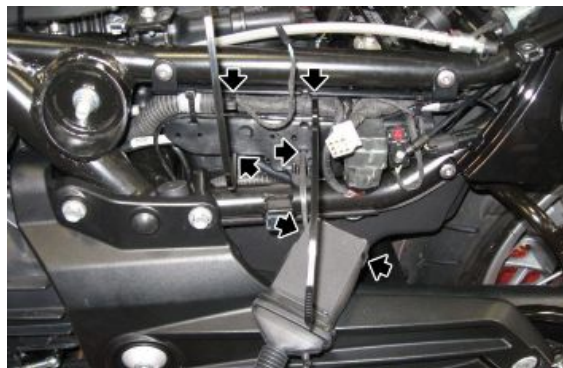
- Remove the left fairing.
- Cut the indicated clamp and free the LED connector.



- Take half of the adhesive backed foam in the antitheft device kit and stick it to the bottom of the antitheft control unit.



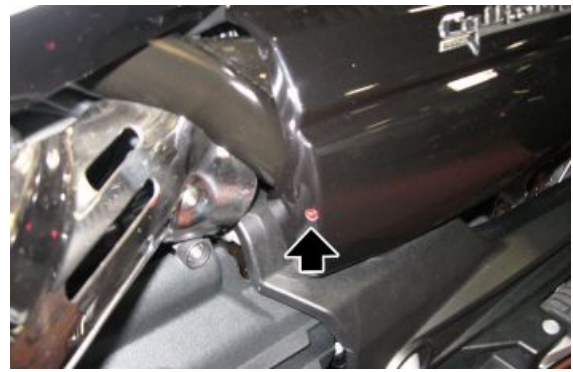
- Position the clamps in the specific seats prepared on the mounting plastic.
- Pass the right clamp through the two slots on the antitheft device control unit.



- Pull the clamps, securing the control unit to the bracket.
- Connect the control unit and LED connectors to the specific cable harness on the bike and attach the adhesive LED on the internal side of the left side fairing.



- Install the left side fairing on the bike.



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