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# SERVICE STATION MANUAL

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**RSV4 Factory**

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# SERVICE STATION MANUAL

## RSV4 Factory

### THE VALUE OF SERVICE

Due to the continuous technical updates and specific mechanic training programs for Aprilia products, only **Aprilia Official Network** mechanics know this vehicle fully and have the special tools necessary to carry out maintenance and repair operations correctly.

The reliability of the vehicle also depends on its mechanical state. Checking the vehicle before riding, its regular maintenance and using only **Original Aprilia Spare Parts** are essential!

For information about the nearest **Official Dealer and/or Service Centre**, consult the Yellow Pages or search directly from the map on our Official Website:

**[www.aprilia.com](http://www.aprilia.com)**

Only by requesting Aprilia Original Spare Parts can you be sure of purchasing products that were developed and tested together with the actual vehicle itself. All Aprilia Original Spare Parts undergo quality control procedures to guarantee reliability and durability.

The descriptions and illustrations given in this publication are not binding; While the basic characteristics as described and illustrated in this booklet remain unchanged, Aprilia reserves the right, at any time and without being required to update this publication beforehand, to make any changes to components, parts or accessories, which it considers necessary to improve the product or which are required for manufacturing or construction reasons.

Not all versions/models shown in this publication are available in all Countries. The availability of individual versions/models should be confirmed with the official Aprilia sales network.

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# SERVICE STATION MANUAL

## RSV4 Factory

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

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

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

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



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



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



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

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## 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 let the engine run 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



**FUEL USED TO POWER INTERNAL COMBUSTION ENGINES IS HIGHLY FLAMMABLE AND CAN BECOME EXPLOSIVE UNDER SPECIFIC 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 AND NEAR FUEL VAPOURS, AVOID ANY CONTACT WITH NAKED FLAMES, SPARKS OR OTHER SOURCES WHICH MAY CAUSE THEM TO IGNITE OR EXPLODE. DO NOT DISPERSE FUEL IN 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. Before handling these components, make sure that you are wearing 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 LATEX 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 REACH OF CHILDREN**

**Battery electrolyte and hydrogen gas**

**CAUTION**



**THE BATTERY ELECTROLYTE IS TOXIC, CORROSIVE AND, AS IT CONTAINS SULPHURIC ACID, MAY CAUSE BURNING IF IT COMES INTO 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. IN THE EVENT OF CONTACT WITH THE EYES, RINSE WITH PLENTY OF WATER FOR FIFTEEN MINUTES AND CONSULT AN EYE SPECIALIST IMMEDIATELY. IF THE FLUID IS ACCIDENTALLY SWALLOWED, DRINK LARGE QUANTITIES OF WATER OR MILK, FOLLOWED BY MILK OF MAGNESIA OR VEGETABLE OIL AND SEEK MEDICAL ADVICE 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 IT OR SPILL IT, PARTICULARLY ON PLASTIC COMPONENTS. ENSURE THAT THE ELECTROLYTIC ACID IS COMPATIBLE WITH THE BATTERY BEING ACTIVATED.**

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## Maintenance rules

**GENERAL PRECAUTIONS AND INFORMATION**



When repairing, disassembling and reassembling the vehicle, strictly follow the recommendations reported below.

### **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 the positions on all connection joints (pipes, cables, etc.) before separating them, and identify them with different 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 altogether.
- 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).

### **ELECTRIC 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

Engine run-in is essential to ensure engine long life and correct operation. Twisty roads and gradients are ideal to run-in engine, brakes and suspensions effectively. Vary your riding speed during the running in period. In this way, you allow for the work of components to be "loaded" and then "unloaded", thus cooling engine parts.

**CAUTION**

**ONLY AFTER THE SERVICE AT THE END OF THE RUN-IN PERIOD CAN THE BEST PERFORMANCE OF YOUR VEHICLE BE OBTAINED.**

**Follow the guidelines detailed below:**

- Do not twist the throttle grip abruptly and completely when the engine is working at a low revs, either during or after run-in.
- 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.
- It is recommended, during the first 1000 km (621 mi), not to exceed 7500 rpm and 9500 rpm up 2000 km (1243 mi).



**AFTER THE SPECIFIED MILEAGE, TAKE YOUR VEHICLE TO AN Official Aprilia Dealer FOR THE CHECKS INDICATED IN THE "PERIODICAL MAINTENANCE" TABLE IN THE SCHEDULED MAIN-**

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

## Vehicle identification

### SERIAL NUMBER LOCATION

These numbers are necessary for vehicle registration.

#### NOTE

**ALTERING IDENTIFICATION NUMBERS MAY BE SERIOUSLY PUNISHABLE BY LAW. IN PARTICULAR, MODIFYING THE CHASSIS NUMBER IMMEDIATELY VOIDS THE WARRANTY.**

This number consists of numbers and letters, as in the example shown below.

**ZD4RKB000YSXXXXXX**

#### KEY:

**ZD4:** WMI (World manufacturer identifier) code;

**RK:** model;

**B00:** version variation;

**0:** free digit

**Y** year of manufacture

**S:** production plant (S= Scorzè);

**XXXXXX:** serial number (6 digits);

### CHASSIS NUMBER

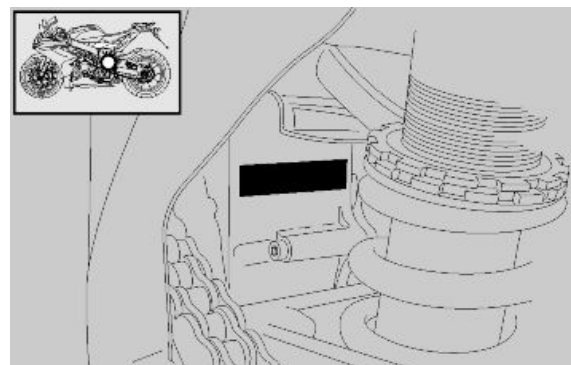
The chassis number is stamped on the right hand side of the headstock.



### ENGINE NUMBER

The engine number is printed on the base of the engine crankcase, left hand side.

Engine No. ....



## Dimensions and mass

### DIMENSIONS

Specification	Desc./Quantity
Max. length	2040 mm (80.31 in)
Max width (at handlebar)	735 mm (28.94 in)
Max. height (to windshield)	1120 mm (44.09 in)
Saddle height	847 mm (33.35 in)
Wheelbase	1420 mm (55.90 in)
Minimum ground clearance	130 mm (5.12 in)

Specification	Desc./Quantity
Dry weight	189 kg (417 lb)
Kerb weight	200 kg (441 lb)
Full loaded weight (rider only)	275 kg (441 lb)

## Engine

### ENGINE

Specification	Desc./Quantity
Model	V4
Type	65° longitudinal V-4, 4-stroke, 4 valves per cylinder, double overhead camshafts.
Engine capacity	999 cm <sup>3</sup> (60.96 cu.in)
Bore / stroke	78 mm / 52.26 mm (3.07 in / 2.06 in)
Compression ratio	13 : 1
Idle speed	1400 ± 100 rpm
Engine revs at maximum speed	14000 ± 100 rpm
Clutch	Multiplate wet clutch with mechanical control lever on left side of the handlebar Anti-juddering and slipper clutch systems
Ignition	starter
TIMING SYSTEM	Morse chain on intake camshaft, cam to cam gear, bucket tappets and valve clearance adjustments with calibrated pads
Values valid with control clearance between rocker and valve	intake: 0.10 - 0.15 mm (0.0039 - 0.0059 in) exhaust: 0.20 - 0.25 mm (0.0079 - 0.0098 in)
Lubrication system	Wet sump with oil radiator
Oil pump	Dual trochoidal pump (lubrication + cooling)
Oil filter	With external cartridge filter
Cooling	Fluid
Cooling system	3-way thermostatic valve, cooling radiator with electric fan and expansion tank
Coolant pump	Centrifugal bearingless aspirating pump with integrated ceramic gasket
Air filter	In cotton
Alternatively:	
Air filter	Paper

## Transmission

### GEAR RATIOS

Specification	Desc./Quantity
Primary drive ratio	44 / 73 (with gears)
1st gear ratio	16 / 38 (secondary)
2nd gear ratio	18 / 35 (secondary)
3rd gear ratio	17 / 28 (secondary)
4th gear ratio	22 / 32 (secondary)
5th gear ratio	26 / 34 (secondary)
6th gear ratio	27 / 33 (secondary)
Final drive gear ratio	16 / 42

### TRACTION CONTROL

Specification	Desc./Quantity
a-PRC system	(Aprilia Performance Ride Control), which includes traction control, wheelie control, launch control and clutchless gear shift functions.

## Capacities

### CAPACITY

Specification	Desc./Quantity
Fuel capacity (reserve included)	17 l (3.74 UK gal)
Fuel tank reserve	3.6 l (0.79 UK gal)
Engine oil	oil and filter change 4 l (0.88 UK gal)
Coolant	2.4 l (0.53 UK gal)
Seats	1 + 1 Two seat configuration: if vehicle is fitted with footpegs and saddle for passenger
Maximum weight capacity	201 kg (443 lb)

## Drive chain

### DRIVE CHAIN

Specification	Desc./Quantity
Type	525 With sealed master link
Model	Regina 110 links

## Electrical system

### ELECTRICAL SYSTEM

Specification	Desc./Quantity
Spark plugs	NGK-R CR10E
Electrode gap	0.7 - 0.8 mm (0.027 - 0.031 in)
Battery	YUASA YT12A-BS, 12 V 9.5 Ah or YUASA YTZ10S, 12 V 8.6 Ah
Coils	Stick coil
Recharging system	Flywheel with rare earth magnets
Alternator	450 W
Main fuses	30 A
Auxiliary fuses	5A - 7.5A - 15A

### BULBS

Specification	Desc./Quantity
Low-/ high beam light	12V - 55W H11
Front daylight running light	12V - 5W
Turn indicators	12V - 10W (White light)
Rear daylight running light / stop light	LED
License plate light	12V - 5W

### WARNING LIGHTS

Specification	Desc./Quantity
High beam light	LED
Right turn indicator	LED
Left turn indicator	LED
General warning	LED
Gear in neutral	LED
Side stand down	LED
Fuel reserve	LED
ABS	NOT ENABLED

## Frame and suspensions

### CHASSIS

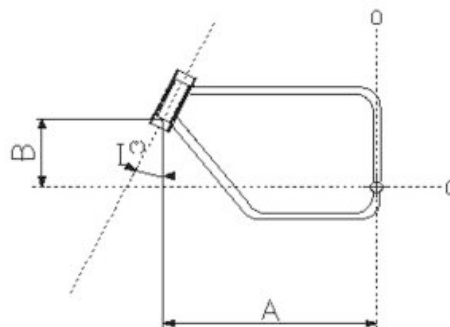
Specification	Desc./Quantity
Type	Twin-spar adjustable aluminium, with castings and pressings.
Steering rake	26.5° (measurements with reference to bare frame). Rake value for the Factory version fitted with standard bushings is 26.8°
Trail	110 mm (4.33 in) (with adjustable headstock inserts as standard)

### SUSPENSION

Specification	Desc./Quantity
Front fork	Öhlins upside down units with adjustable hydraulic damping and 43 mm (1.69 in) diam. stanchions with Tin surface coating
Front wheel travel	120 mm (4.72 in)
Rear shock absorber	Lateral, with progressive linkage and APS system. ÖHLINS piggy-back shock absorber with adjustable spring preloading, wheelbase and hydraulic compression and rebound damping.
Rear wheel travel	130 mm (5.12 in)

### SIZES A AND B

Specification	Desc./Quantity
Size "A"	639.5 mm (25.18 in) (measurements refer to the bare chassis)
Size "B"	329.5 mm (12.97 in) (measurements refer to the bare chassis)



## Brakes

### BRAKES

Specification	Desc./Quantity
Front	320 mm (12.59 in) diam. dual floating discs, radial monoblock callipers with four 34 mm (1.34 in) diam. pistons and four pads - radial pump and metal braid brake pipe.
Rear	Single 220 mm (8.66 in) diam. disc, calliper with two 32 mm (1.25 in) diam. pistons - pump with integrated reservoir and metal braid pipe.

## Wheels and tyres

### WHEEL RIMS

Specification	Desc./Quantity
Front wheel rim	3.50 x 17" Forged
Rear wheel rim	6.00 x 17" Forged

**TYRES**

Specification	Desc./Quantity
Tyre model	Pirelli DIABLO Super Corsa SP Metzeler RACETEC K3 Michelin Power One Dunlop SPORTMAX GP Racer (Mixture "M" Front) Dunlop SPORTMAX GP Racer (Mixture "E" Rear)
Front tyre	120/70 ZR17 (58W)
Inflation pressure	1 passenger: 2.3 bar (230 kPa) (33.36 PSI) 2 passengers: 2.5 bar (250 kPa) (36.26 PSI)
Rear tyre	200/55 ZR17 (78W) (*) 190/55 ZR17 (75W) 190/50 ZR17 (73W)
	<b>(*) With these dimensions use only Pirelli Diablo Super-corsa SP tyres.</b>
Inflation pressure	1 passenger: 2.5 bar (250 kPa) (36.26 PSI) 2 passengers: 2.8 bar (280 kPa) (40.61 PSI)

**Supply****FUEL SYSTEM**

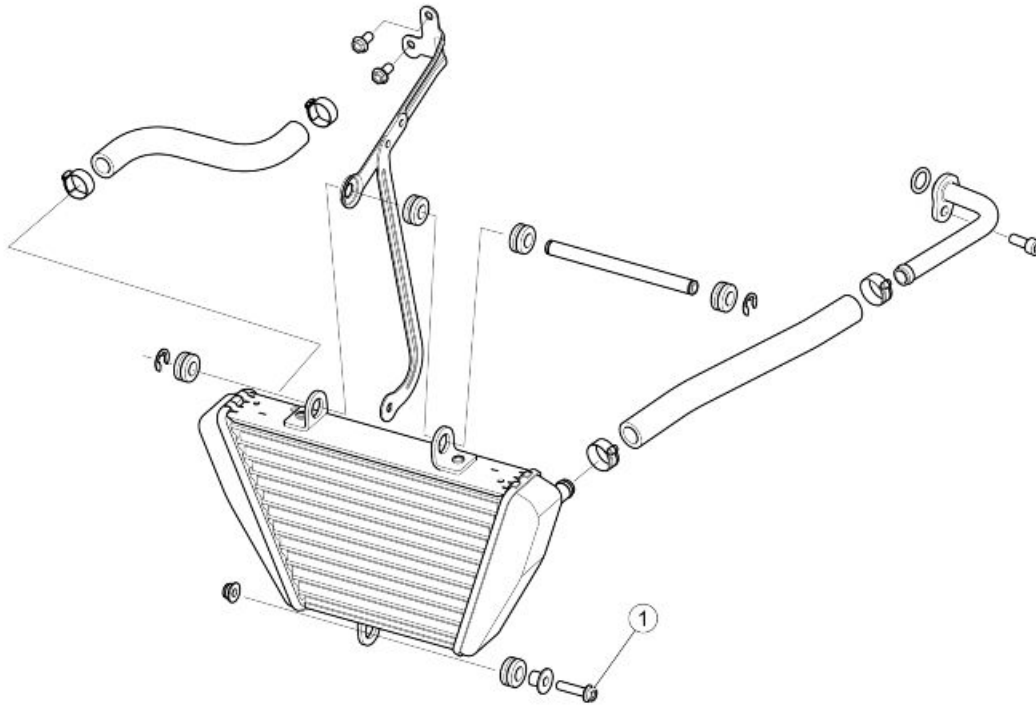
Specification	Desc./Quantity
Fuel	Premium unleaded petrol, minimum octane rating of 95 (NORM) and 85 (NOMM)

**FUEL SYSTEM**

Specification	Desc./Quantity
Throttle body diameter	48 mm (1.89 in)
Type	Electronic injection with 2 injectors per cylinder, 4 motorised throttle bodies (Ride by Wire). Variable length intake ducts. 2 dynamic air intakes. Multiple selectable maps.

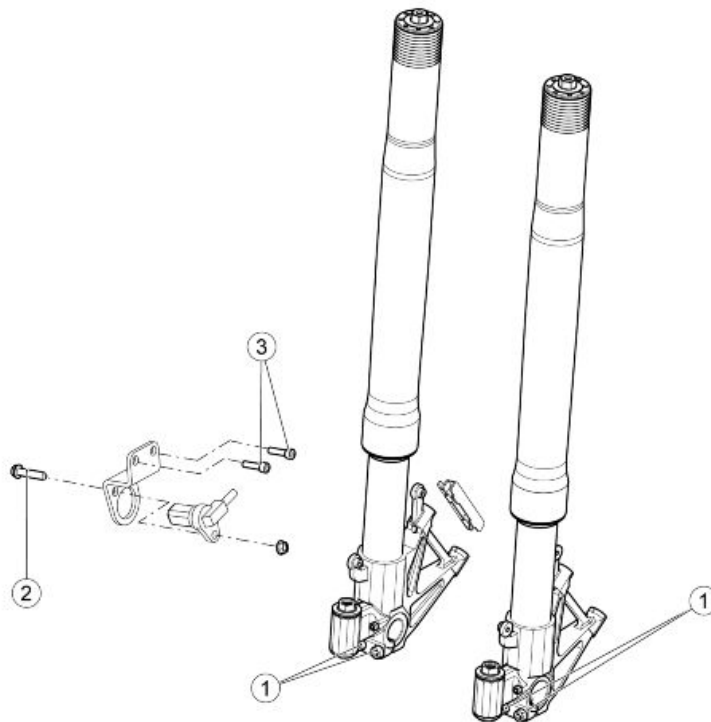
**Tightening Torques****Chassis**

Front side



**OIL RADIATOR**

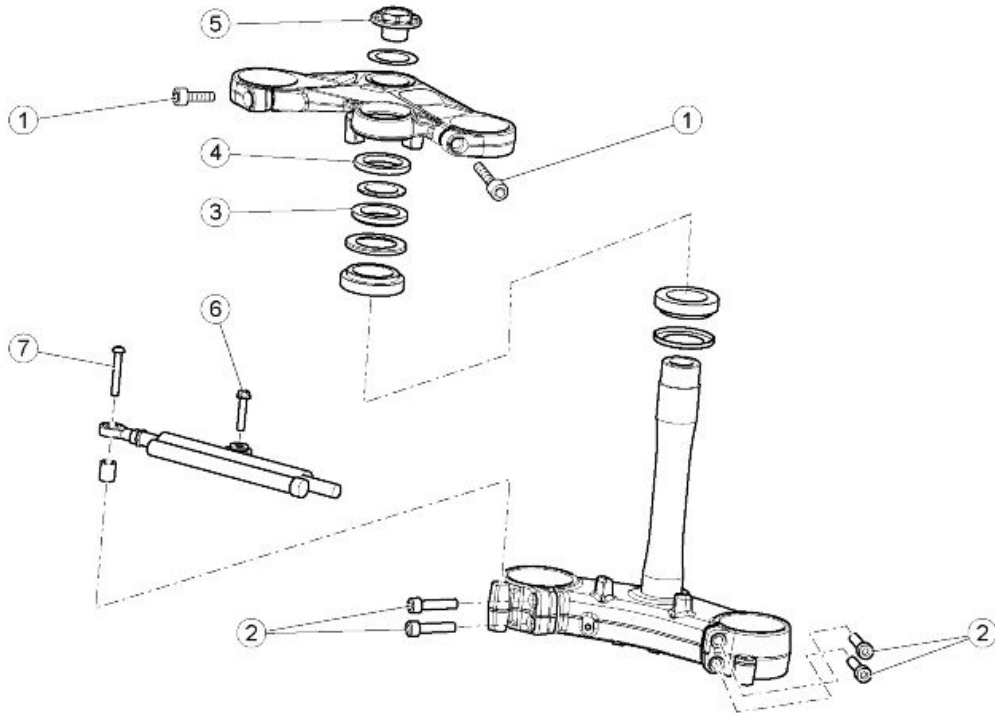
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening oil radiator to mounting bracket	M6	1	7 Nm (5.16 lbf ft)	-





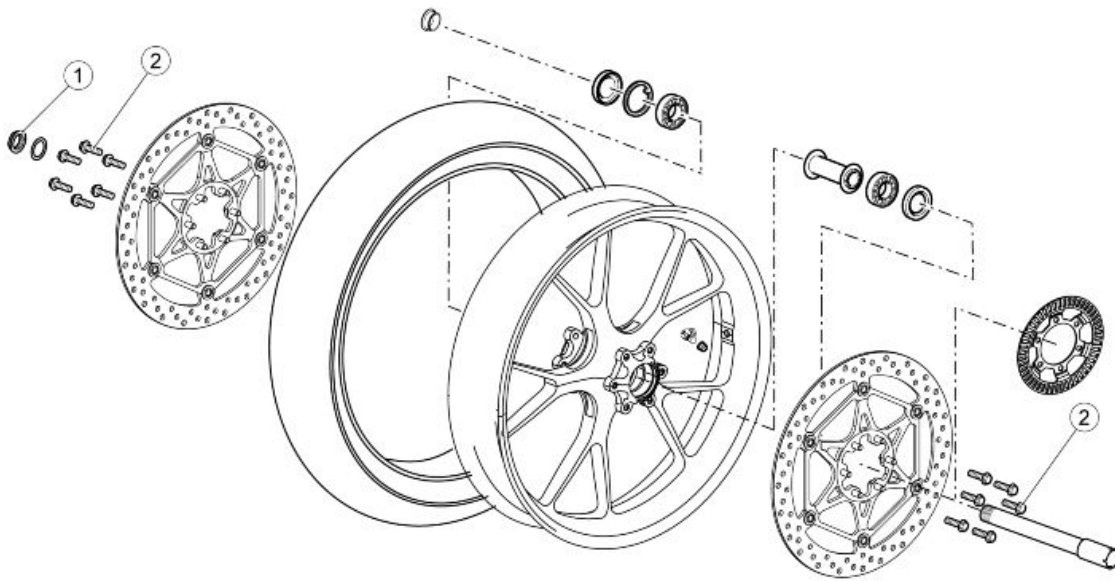
**FRONT FORK**

pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screws for calliper mounting bracket (Öhlins)	M6	2 + 2	12 Nm (8.85 lbf ft)	-
2	Odometer sensor fixing screw	M6	1	10 Nm (7.38 lbf ft)	-
-	Speed sensor bracket screws	-	2	-	-



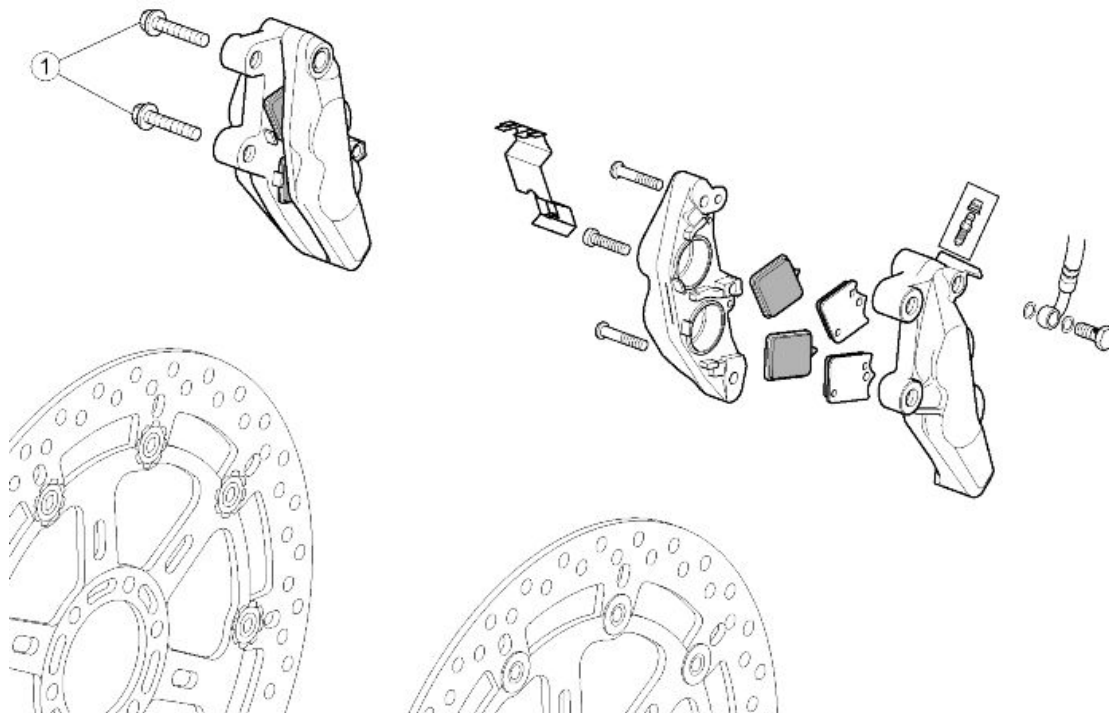
**STEERING**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening upper yoke to stanchions	M8	2	25 Nm (18.44 lbf ft)	-
2	Screws fastening lower yoke to stanchions	M8	4	25 Nm (18.44 lbf ft)	-
3	Headstock lock ring	M35x1	1	60 Nm (44.25 lbf ft)	-
4	Headstock counter-lock ring	M35x1	1	Manual +35° or -10°	Bend the tabs into the notches in the lock ring
5	Upper yoke fixing cap	-	1	100 Nm (73.76 lbf ft)	-
6	Screw fastening shock absorber to frame	M6	1	10 Nm (7.37 lbf ft)	-
7	Screw fastening shock absorber to lower yoke	M6	1	10 Nm (7.37 lbf ft)	-



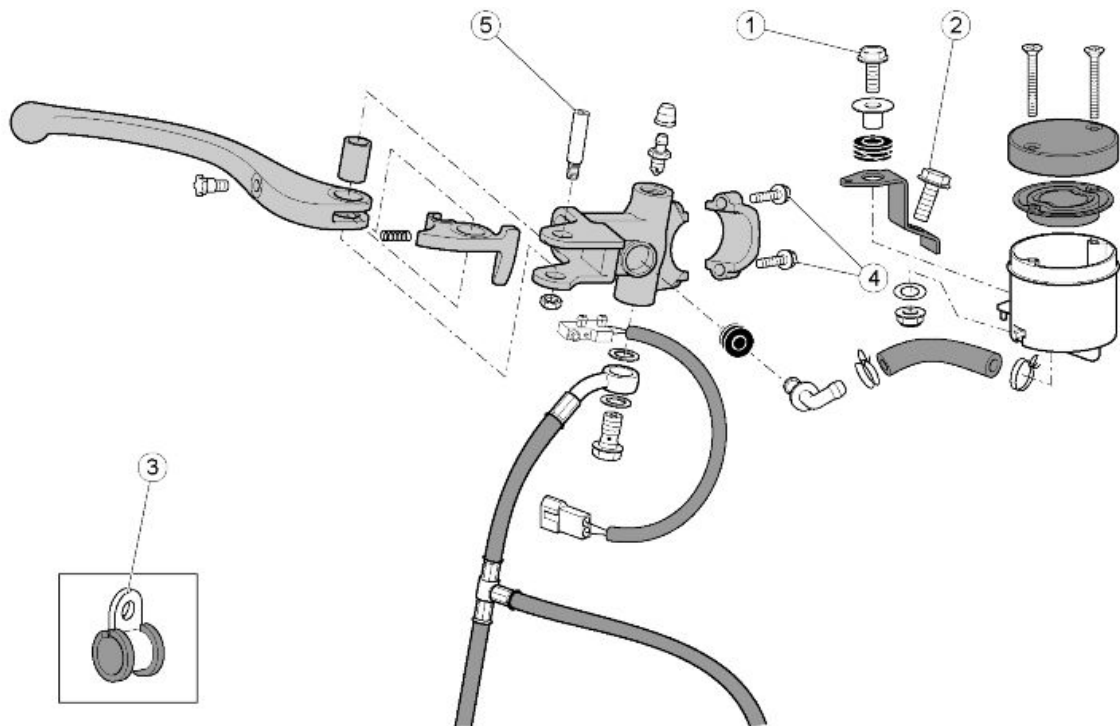
**FRONT WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Front wheel spindle nut	M25x1.5	1	80 Nm (59 lbf ft)	-
2	Front brake disc fixing screws	M8	6 + 6	30 Nm (22.13 lbf ft)	Loct. 243



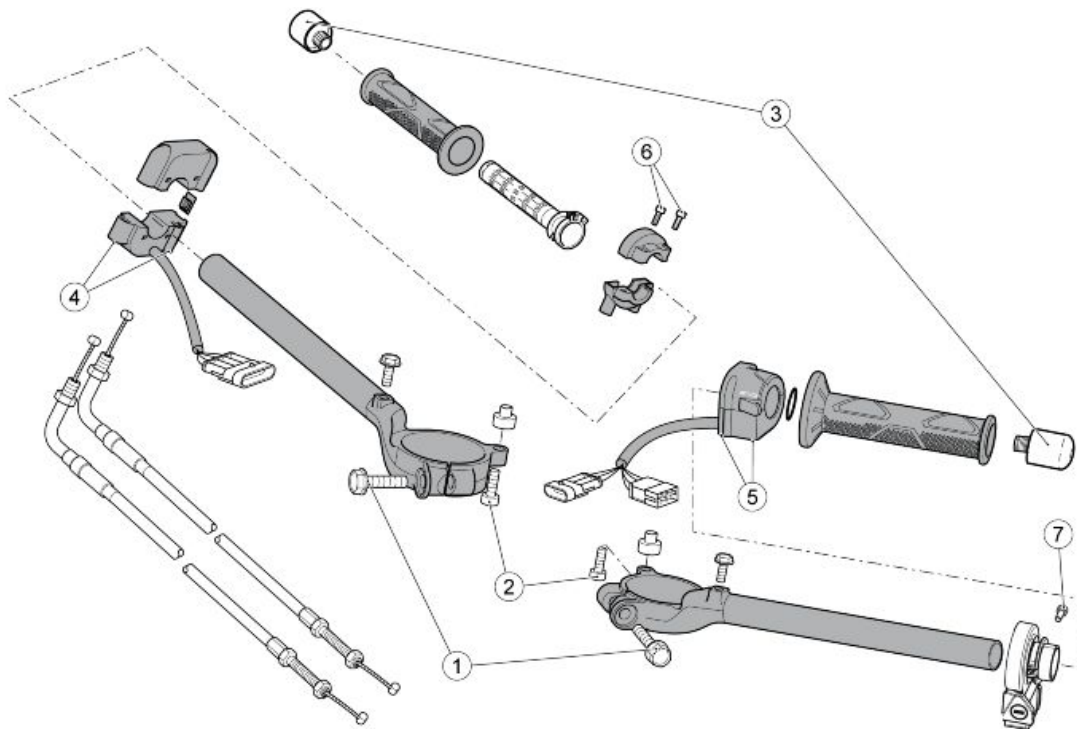
**FRONT BRAKE CALLIPER**

pos.	Description	Type	Quantity	Torque	Notes
1	Front brake calliper fixing screws	M10x1.25	2 + 2	50 Nm (36.88 lbf ft)	-



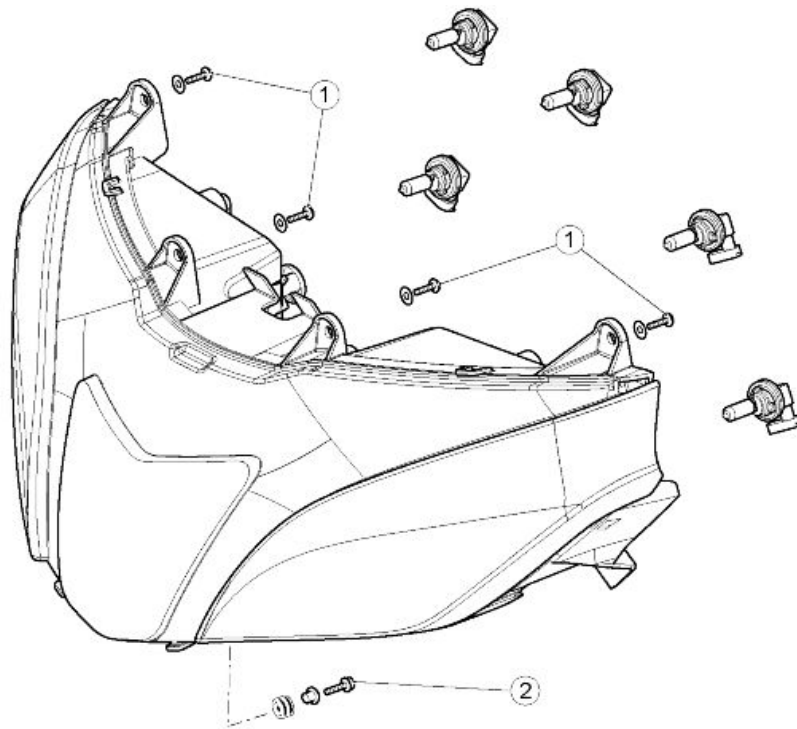
**FRONT BRAKE PUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening front brake fluid reservoir to bracket	M6	1	7 Nm (5.16 lbf ft)	-
2	Screw fastening brake fluid reservoir mounting bracket to handlebar	M6	1	7 Nm (5.16 lbf ft)	-
3	Screw fastening brake pipe grommet to the lower yoke	M5	1	8 Nm (5.9 lbf ft)	-
4	Front brake pump U bolt clamp	M6	2	10 Nm (7.37 lbf ft)	-
5	Front brake lever pin fixing screw	M6	1	10 Nm (7.37 lbf ft)	-



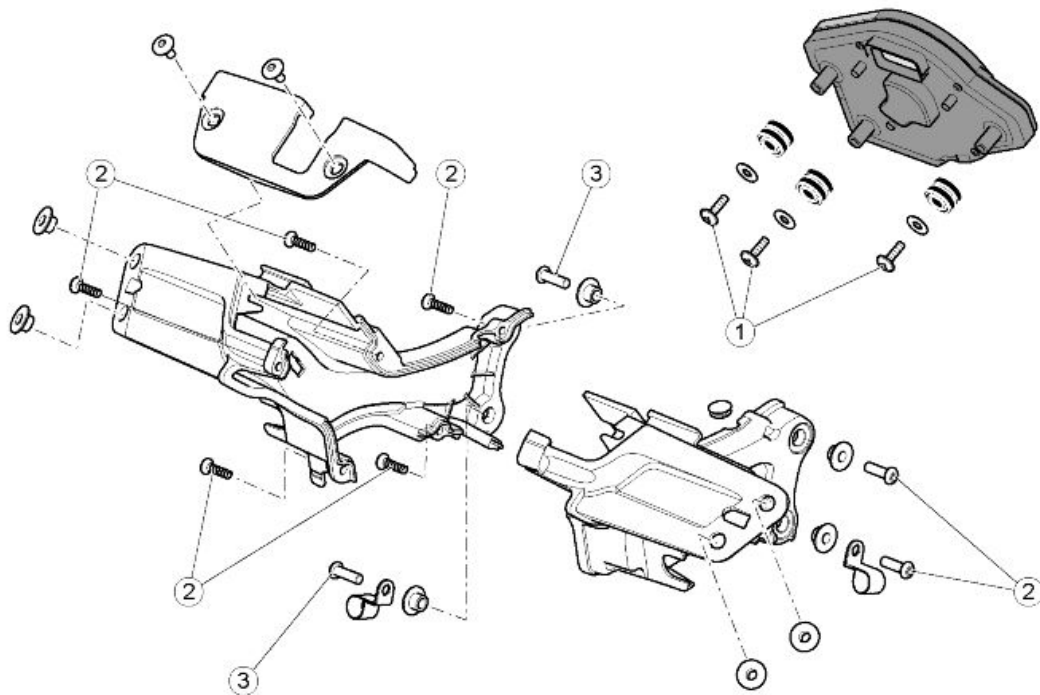
**HANDLEBAR AND CONTROLS**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening the semi-handlebar collar to the fork sleeves	M8	1 + 1	25 Nm (18.44 lbf ft)	-
2	Semi-handlebar safety screw	M6	1+1	10 Nm (7.37 lbf ft)	-
3	Anti-vibration counterweight fastener	M18x1.5	1+1	20 Nm (14.75 lbf ft)	-
4	Right light switch	M4	2	1.5 Nm (1.11 lbf ft)	-
5	Left light switch	M5	2	1.5 Nm (1.11 lbf ft)	-
6	Throttle control fixing screws	M5	2	2 Nm (1.47 lbf ft)	-
7	Traction control control unit fixing screw	M4	1	2 Nm (1.47 lbf ft)	-



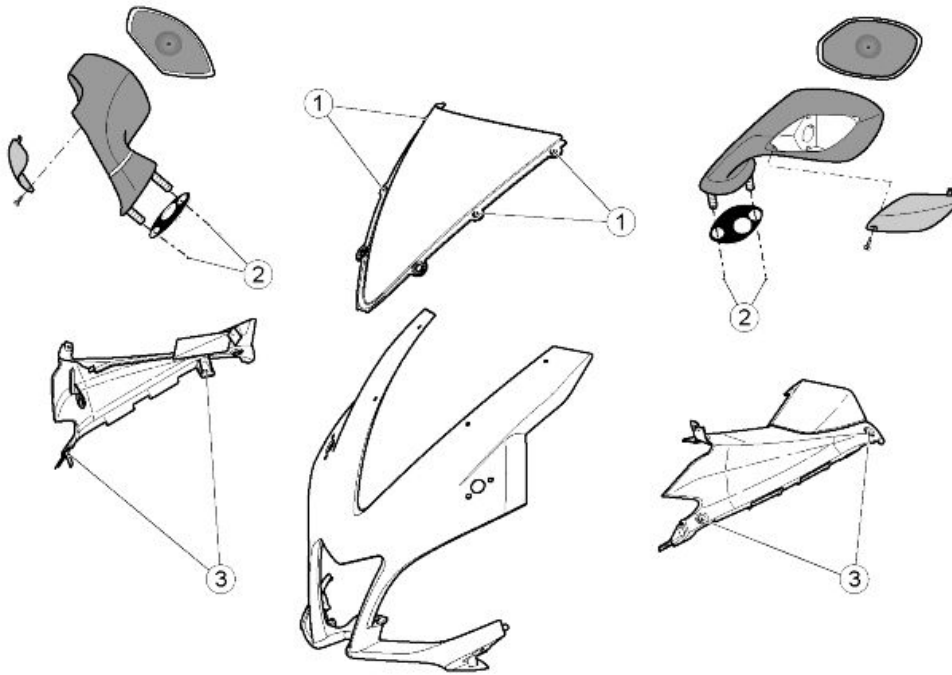
**HEADLAMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening headlamp to front fairing	SWP 4.9	4	2 Nm (1.47 lbf ft)	-
2	Headlamp fixing screw	M5	2 + 1	2 Nm (1.47 lbf ft)	-



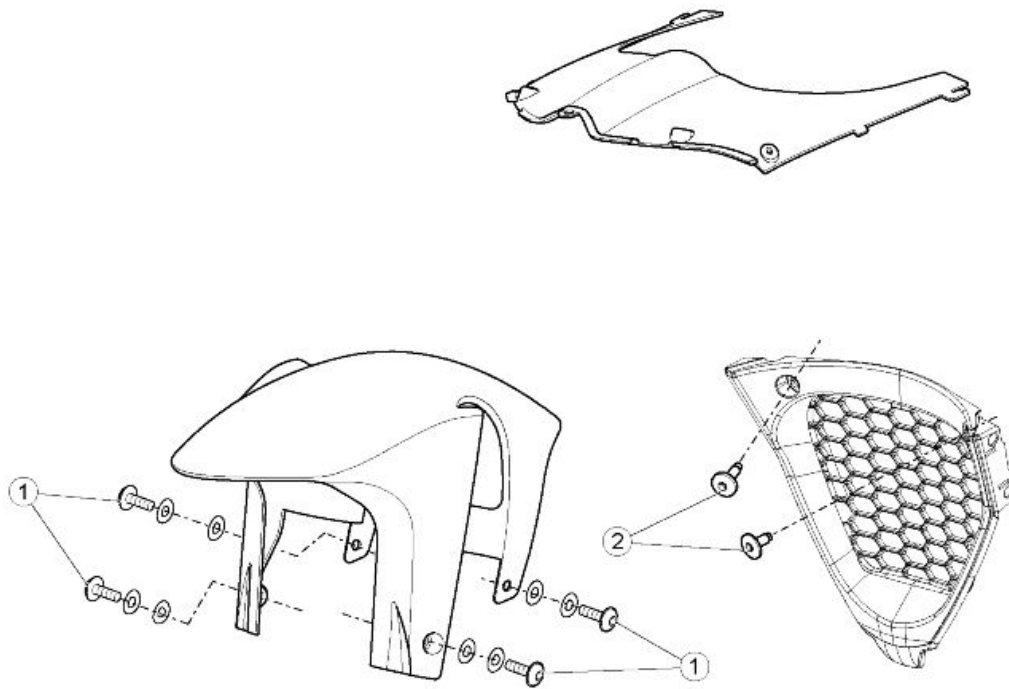
**INSTRUMENT PANEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the rubber rings to the instrument panel	SWP 4.9	3	3 Nm (2.21 lbf ft)	-
2	Instrument panel mounting shell fixing screws	SWP 4.9	5	2 Nm (1.47 lbf ft)	-
3	Screws fastening instrument panel mounting to chassis	M6	4	8 Nm (5.9 lbf ft)	-



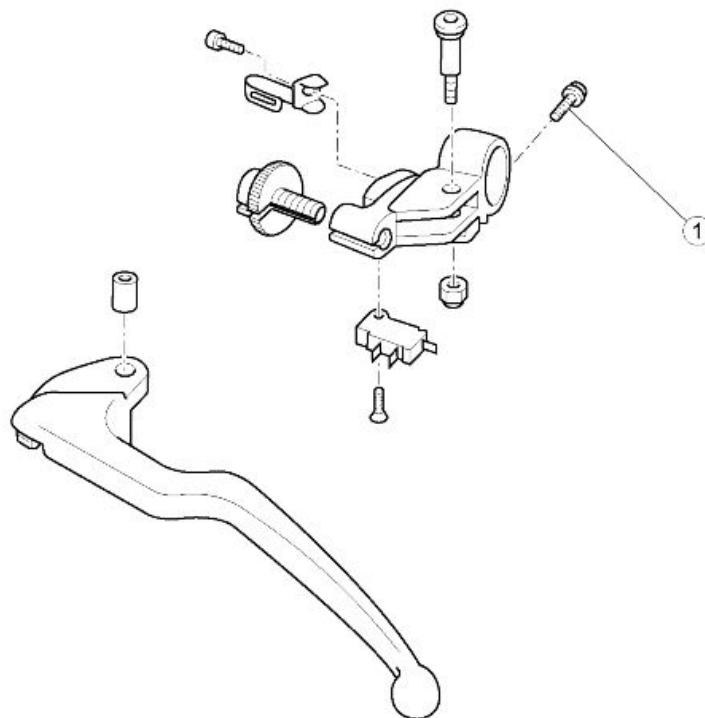
**WINDSHIELD**

pos.	Description	Type	Quantity	Torque	Notes
1	Windshield fixing screws	M4	4	0.5 Nm (0.37 lbf ft)	-
2	Rear-view mirror fixing nuts	M6	2 + 2	10 Nm (7.37 lbf ft)	-
3	- Screws fastening the side fairings to front fairing	M5	4	1 Nm (0.74 lbf ft)	-



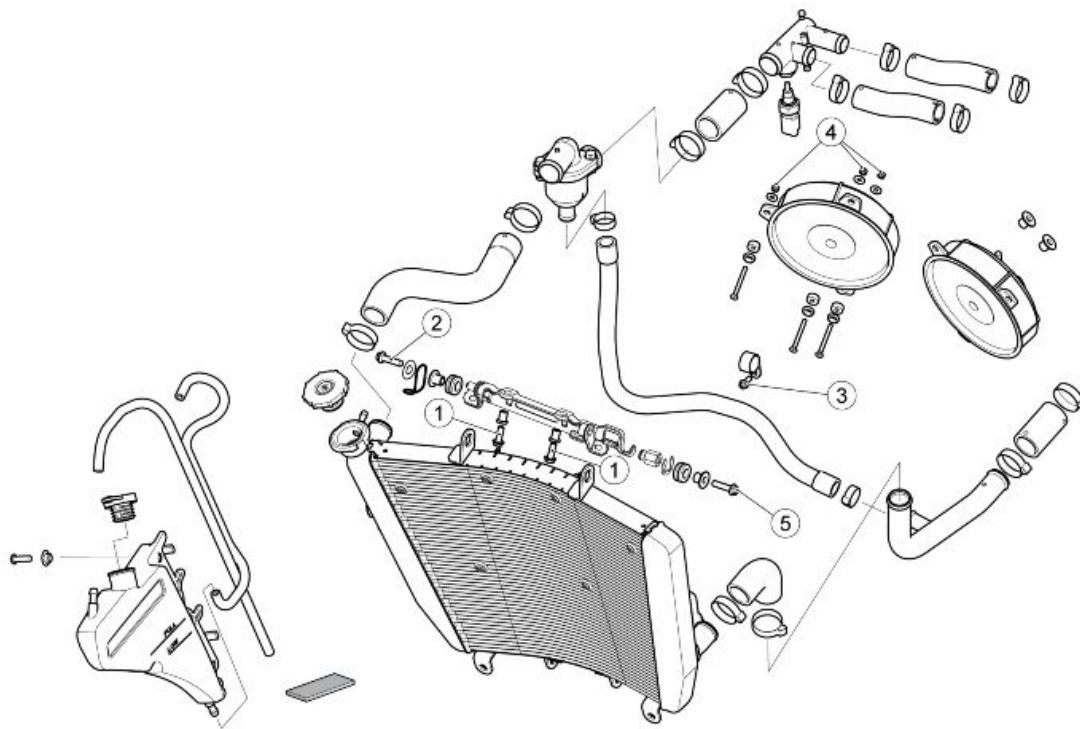
**FRONT MUDGUARD**

pos.	Description	Type	Quantity	Torque	Notes
1	Front mudguard fixing screws	M5	4	3 Nm (2.21 lbf ft)	-
2	Lug fixing screws	M5	2	4 Nm (2.95 lbf ft)	-



**CLUTCH LEVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch lever collar fixing screws	M6	1	10 Nm (7.37 lbf ft)	-

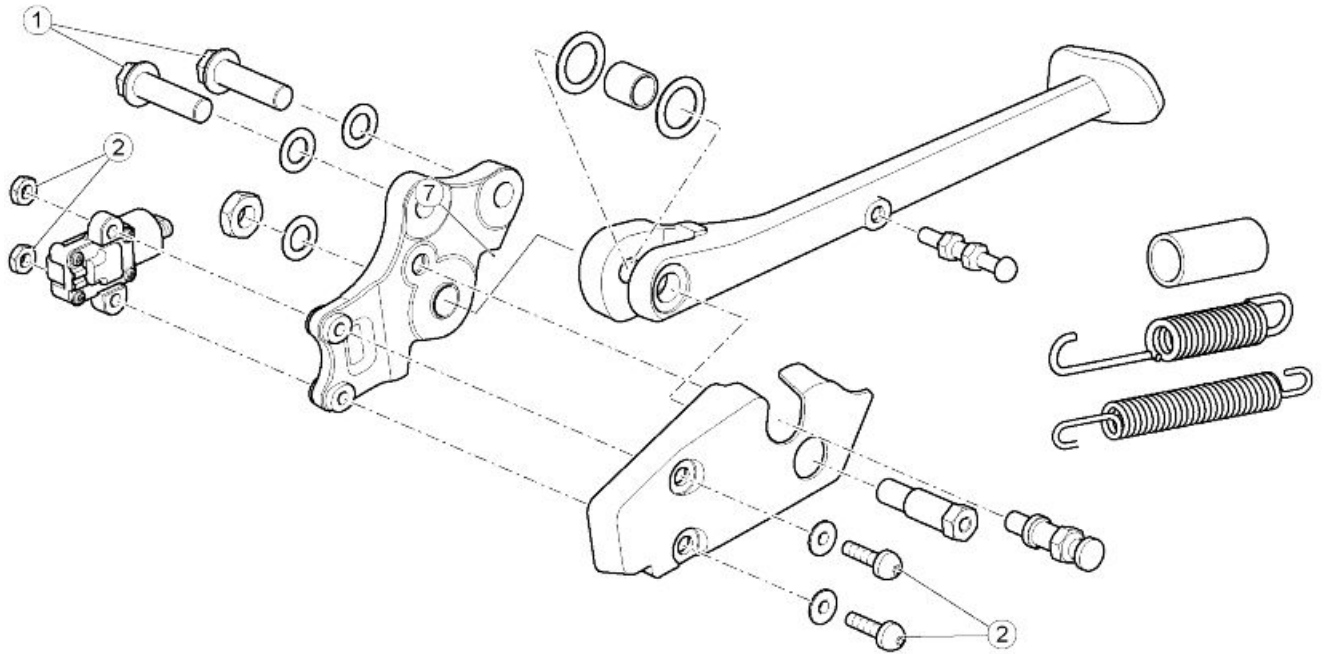


**COOLING**

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screws for fastening the water radiator mounting bracket to frame	M6x20	2	10 Nm (7.37 lbf ft)	-
2	Self-tapping screw for fastening the water radiator to the mounting bracket	-	1	2 Nm (1.47 lbf ft)	-
3	Screw fastening pipe grommet for By-pass water hose	M5	1	6 Nm (4.42 lbf ft)	-
4	Screws fastening electric fan to water radiator	M4	6	2 Nm (1.47 lbf ft)	-
5	Flanged TE screw for fastening the water radiator to the mounting bracket	M6x20	1	7 Nm (5.16 lbf ft)	-

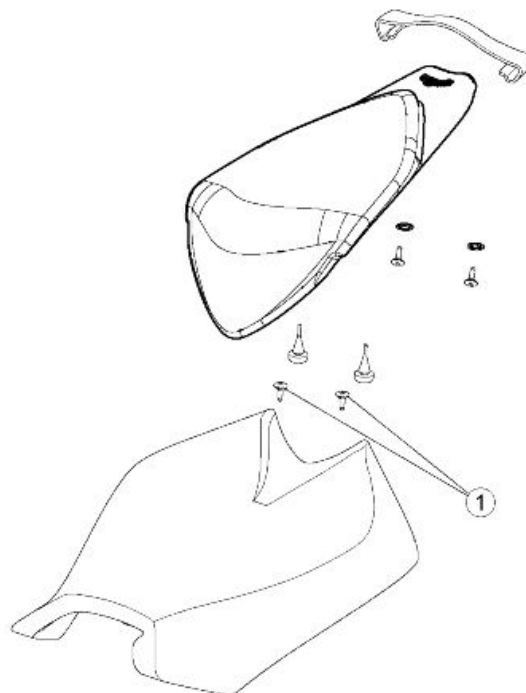


Central part



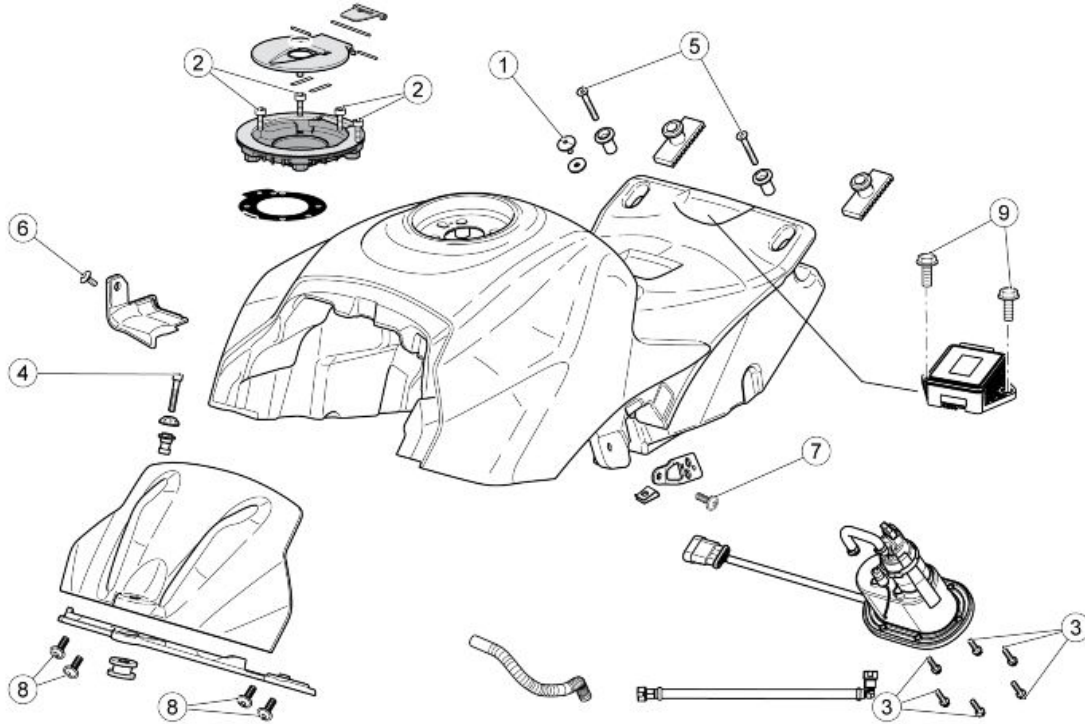
**SIDE STAND**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the stand to the chassis	M10	2	45 Nm (33.19 lbf ft)	Loct. 243
2	Linear switch retainer	M5	2	4 Nm (2.95 lbf ft)	-
-	Rear stand bushing fastening screws	M6	2	7 Nm (5.16 lbf ft)	-



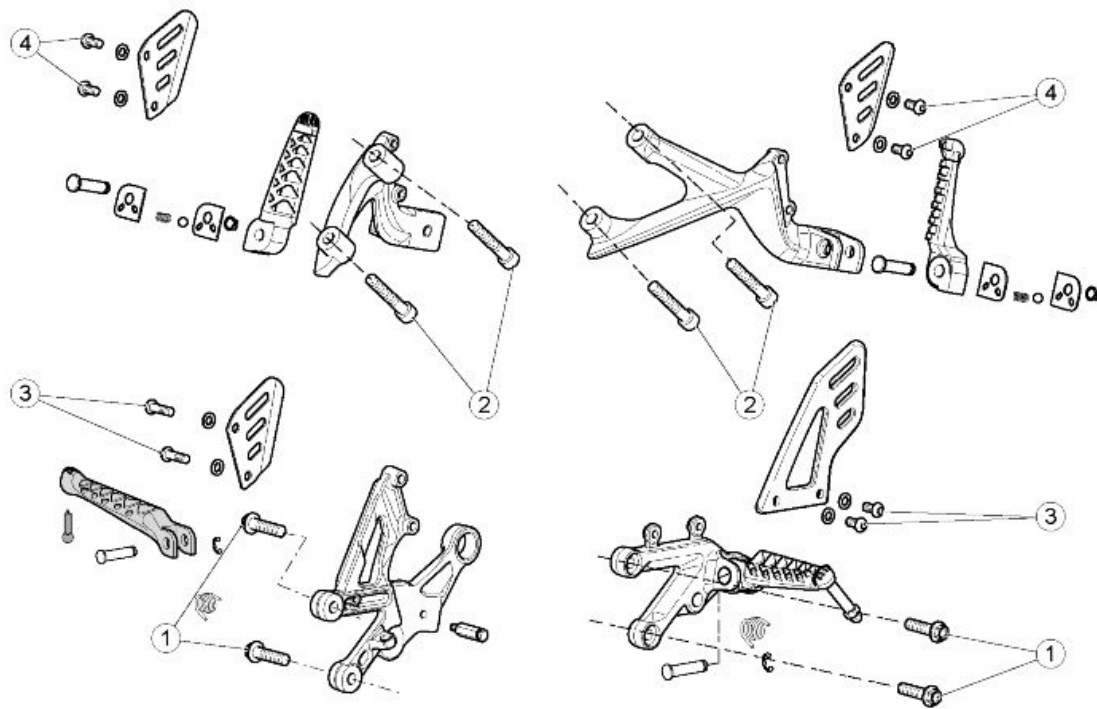
**SADDLE**

pos.	Description	Type	Quantity	Torque	Notes
1	Rider saddle fixing screw	M5	2	6 Nm (4.42 lbf ft)	-



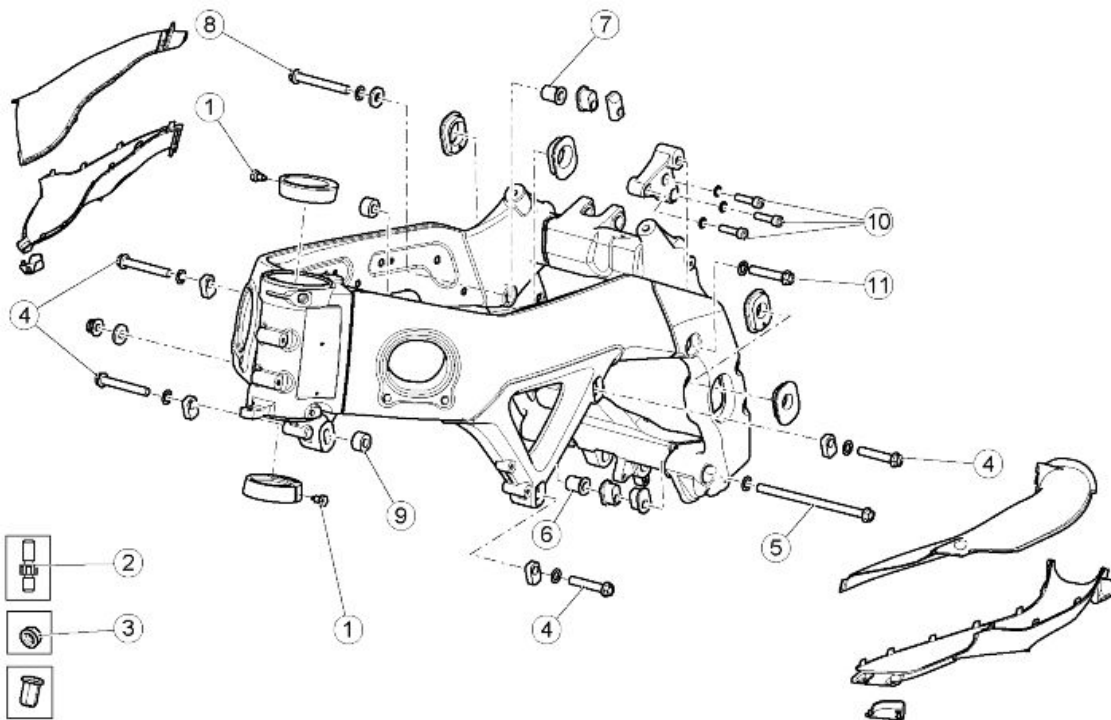
**FUEL TANK**

pos.	Description	Type	Quantity	Torque	Notes
1	Special screw fastening rider saddle to the tank	M6	1	4 Nm (2.95 lbf ft)	-
2	Screws fixing the filler to the tank	M5	4	4 Nm (2.95 lbf ft)	-
3	Screws fixing the fuel pump flange to the tank	M5	8	3 Nm (2.21 lbf ft)	-
4	Front screws fastening the tank to the chassis	M6	1	8 Nm (5.9 lbf ft)	-
5	Rear screws fastening the tank to the rear chassis	M6	2	7 Nm (5.16 lbf ft)	-
6	Screws fastening plastic fuel pipe mounting	M5	1	2.5 Nm (1.84 lbf ft)	-
7	Left fairing mounting bracket fixing screws	M5	1	3 Nm (2.21 lbf ft)	-
8	Screws fastening structural tank mounting to tank	M6	4	3 Nm (2.21 lbf ft)	-
9	Flanged TBEI screw fixing the sensor box	M6x16 stainless steel	2	6 Nm (4.42 lbf ft)	-
-	Central screw fastening the cover to the tank	M4	1	0.5 Nm (0.37 lbf ft)	-
-	Fuel tank breather pipe unions	M7	2	3 Nm (2.21 lbf ft)	-



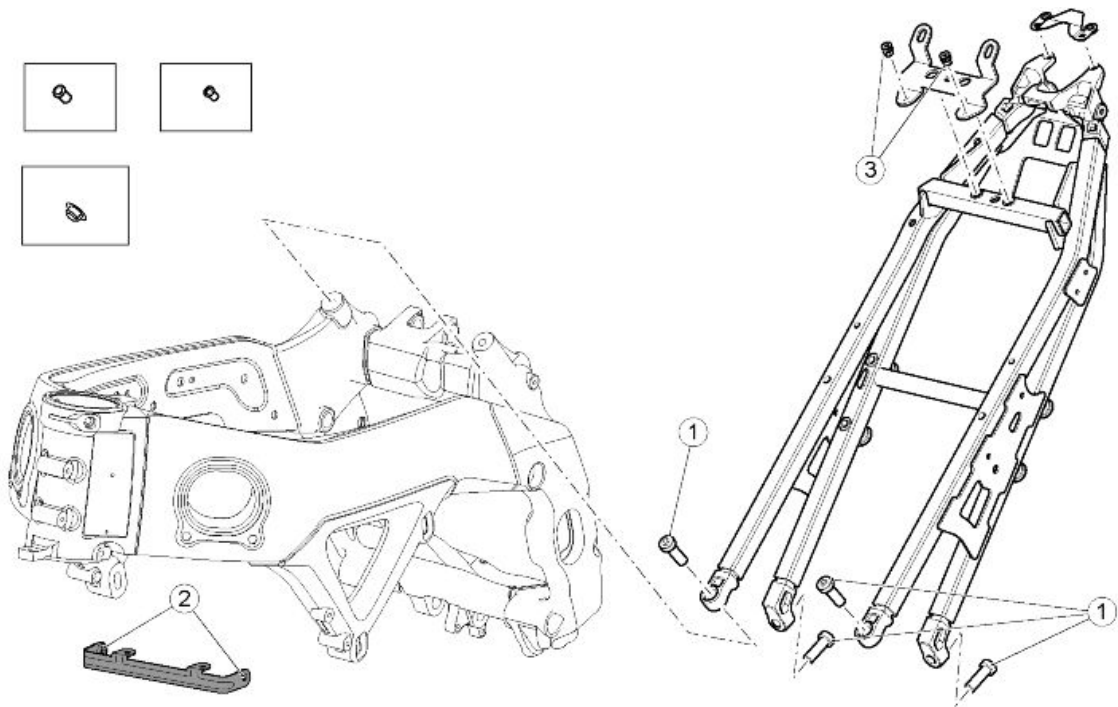
**FOOTRESTS**

pos.	Description	Type	Quantity	Torques	Notes
1	Screws fastening rider footpegs to chassis	M8	2 + 2	25 Nm (18.44 lbf ft)	-
2	Screws fastening passenger footpegs to chassis	M8	2 + 2	18 Nm (13.28 lbf ft)	For countries in which passenger footpegs are mandatory or for two seat configuration
3	Rider heelrest fixing screws	M6	2 + 2	8 Nm (5.9 lbf ft)	-
4	Passenger heelrest fixing screws	M6	2 + 2	8 Nm (5.9 lbf ft)	-
-	Anti-slip pin	M6	1	8 Nm (5.9 lbf ft)	-



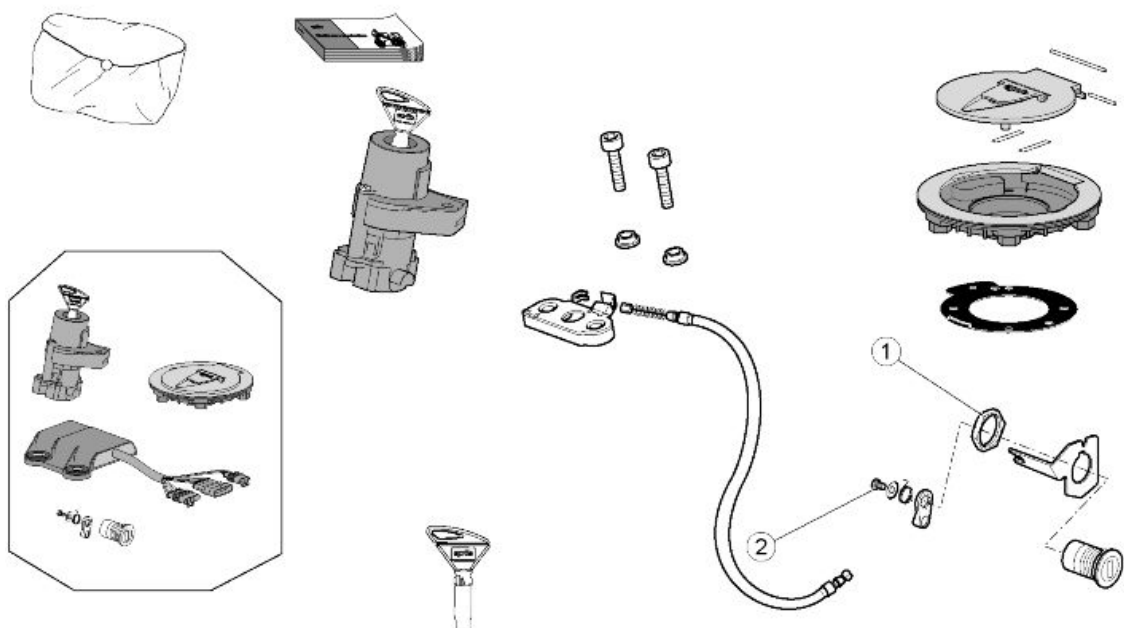
**FRONT CHASSIS**

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock locator dowel	M8x1	2	10 Nm (7.37 lbf ft)	-
2	Threaded intake duct fastener pins	M6	2 + 2	4 Nm (2.95 lbf ft)	Loct. 243
3	Intake duct fixing nuts	M6	2 + 2	Manual	-
4	Front mounts	M10	2 + 2	50 Nm (36.88 lbf ft)	-
5	Lower rear mount	M10	1	50 Nm (36.88 lbf ft)	-
6	Lower rear right hand adjuster screw bushing	M18x1.5	1	12 Nm (8.85 lbf ft)	-
7	Upper rear right hand adjuster screw bushing	M18x1.5	1	12 Nm (8.85 lbf ft)	-
8	Upper rear right hand mount	M10	1	50 Nm (36.88 lbf ft)	-
9	Right fairing spacer	M6	1	10 Nm (7.37 lbf ft)	Loct. 243
10	Upper rear left hand engine mount fastener screws	M8	3	25 Nm (18.44 lbf ft)	-
11	Upper rear mount	M10	1	50 Nm (36.88 lbf ft)	-
-	Screw fastening the ground cable to the left side chassis	M6	1	6 Nm (4.42 lbf ft)	-



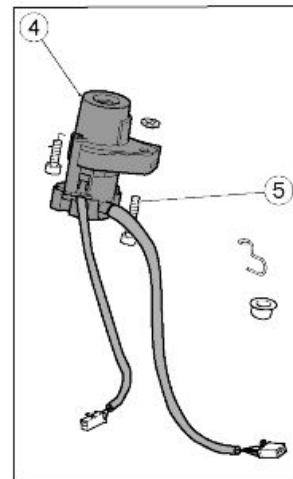
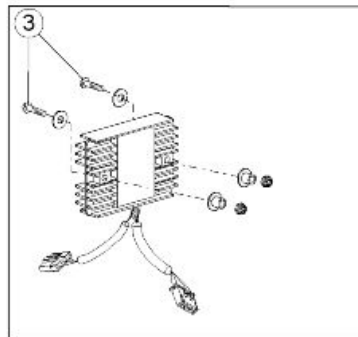
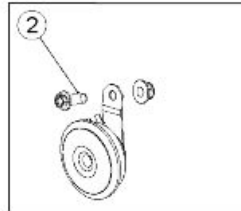
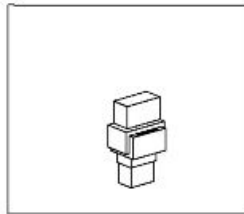
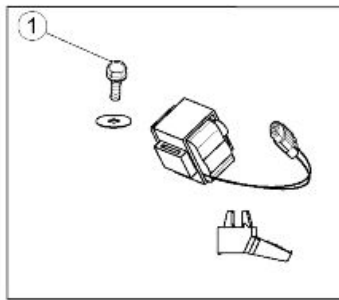
**REAR CHASSIS**

pos.	Description	Type	Quantity	Torque	Notes
1	Saddle mounting fixing screws	M10	4	50 Nm (36.88 lbf ft)	-
2	Screws fastening oil radiator mounting bracket to engine	M6	2	8 Nm (5.9 lbf ft)	-
3	Passenger saddle and saddle cover catch plate fixing screws	M6	2	8 Nm (5.9 lbf ft)	-



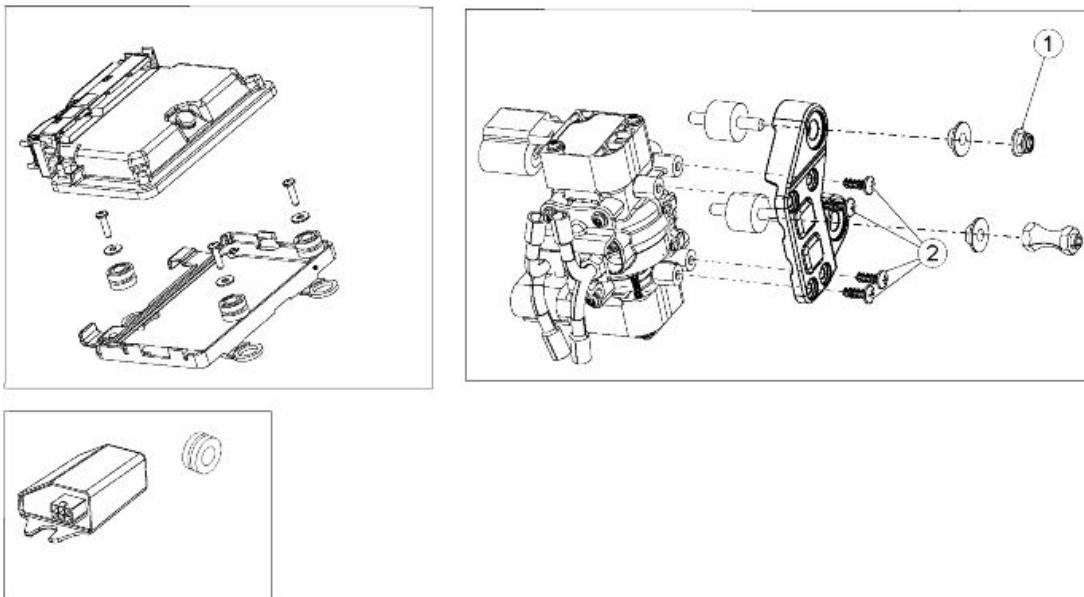
**LOCKS**

pos.	Description	Type	Quantity	Torque	Notes
1	Nut fastening saddle lock to tail fairing	M22x1.5	1	5 Nm (3.69 lbf ft)	-
2	Lock lever self-tapping screw	M4	1	2 Nm (1.47 lbf ft)	-



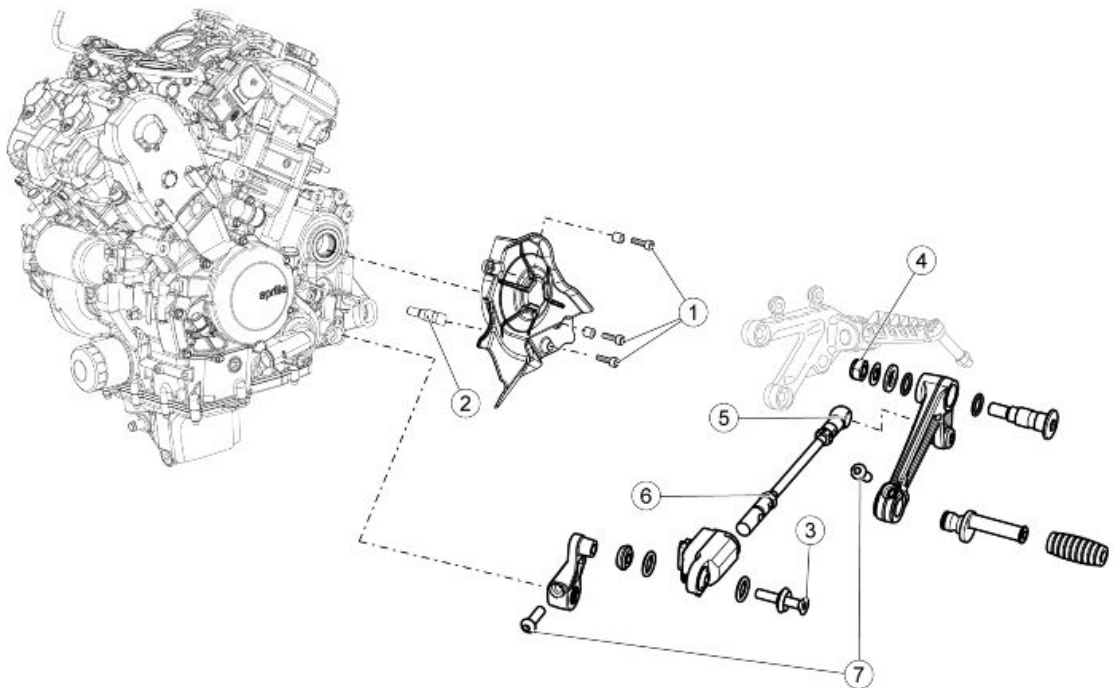
**FRONT ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Fall sensor mounting fixing screw	M6	1	8 Nm (5.9 lbf ft)	-
2	Horn fixing screw	M8	1	15 Nm (11.06 lbf ft)	-
3	Screw fastening the voltage regulator to the inner fairing	M6	2	6 Nm (4.42 lbf ft)	-
4	Shear head screw (to the left of the ignition lock)	M8	1	Manual	Tighten until the head shears off
5	Right hand ignition lock screw	M8	1	20 Nm (14.75 lbf ft)	-



**CENTRAL ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Upper Silentblock nut, demand sensor mounting bracket	M6	1	5 Nm (3.69 lbf ft)	-
2	Demand sensor fixing screw to mounting plate	SWP 4.9	4	1.2 Nm (0.88 lbf ft)	-



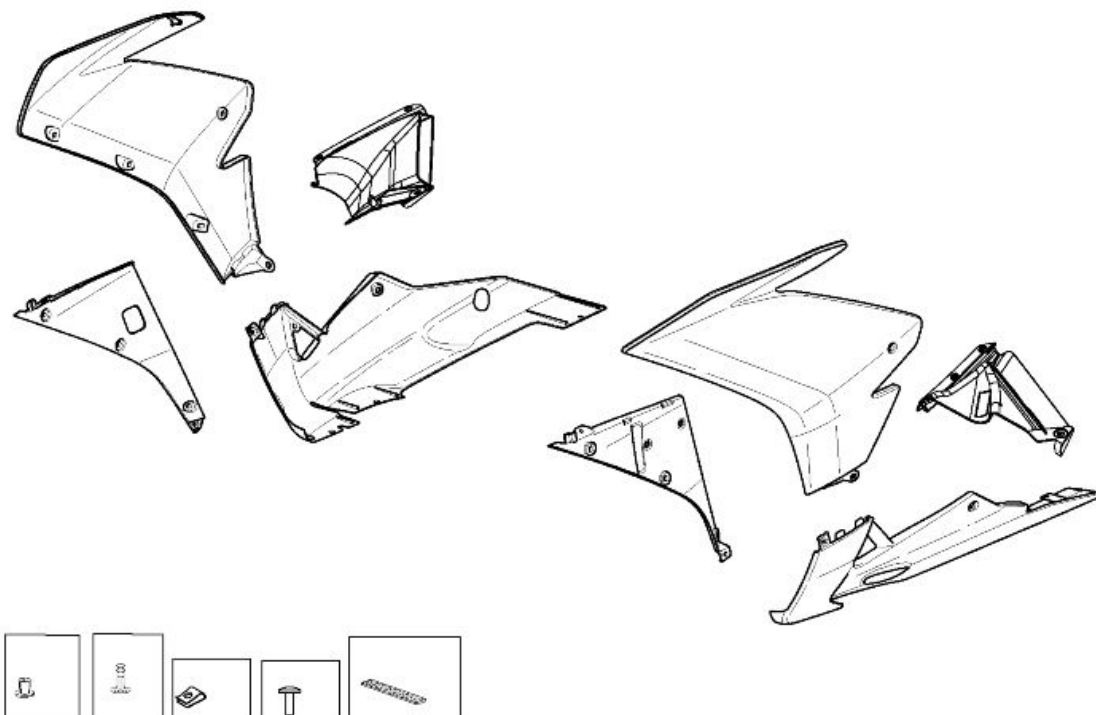
**ENGINE**

pos.	Description	Type	Quantity	Torques	Notes
1	Pinion protector casing fixing screws	M6	3	8 Nm (5.9 lbf ft)	-
2	Threaded spacer	-	1	8 Nm (5.9 lbf ft)	-
3	TSPEI screw	M6x35	1	10 Nm (7.38 lbf ft)	Loct.
4	Self-locking nut	M8	1	25 Nm (18.44 lbf ft)	-
5	Gearbox linkage joint to gearbox lever fastener	-	1	8 Nm (5.90 lbf ft)	Loct.
6	Gearbox linkage nut to quick shift fastener	-	1	8 Nm (5.90 lbf ft)	-
7	TBEI screws	M6x20	2	8 Nm (5.90 lbf ft)	-

- Smear waterproof grease between the O-rings and the Quick Shift uniball.

**NOTE**

**ONCE REASSEMBLY IS COMPLETED, CENTRE TO CENTRE DISTANCE BETWEEN UNIBALL AND JOINT MUST BE APPROX. 180mm (7.09in).**



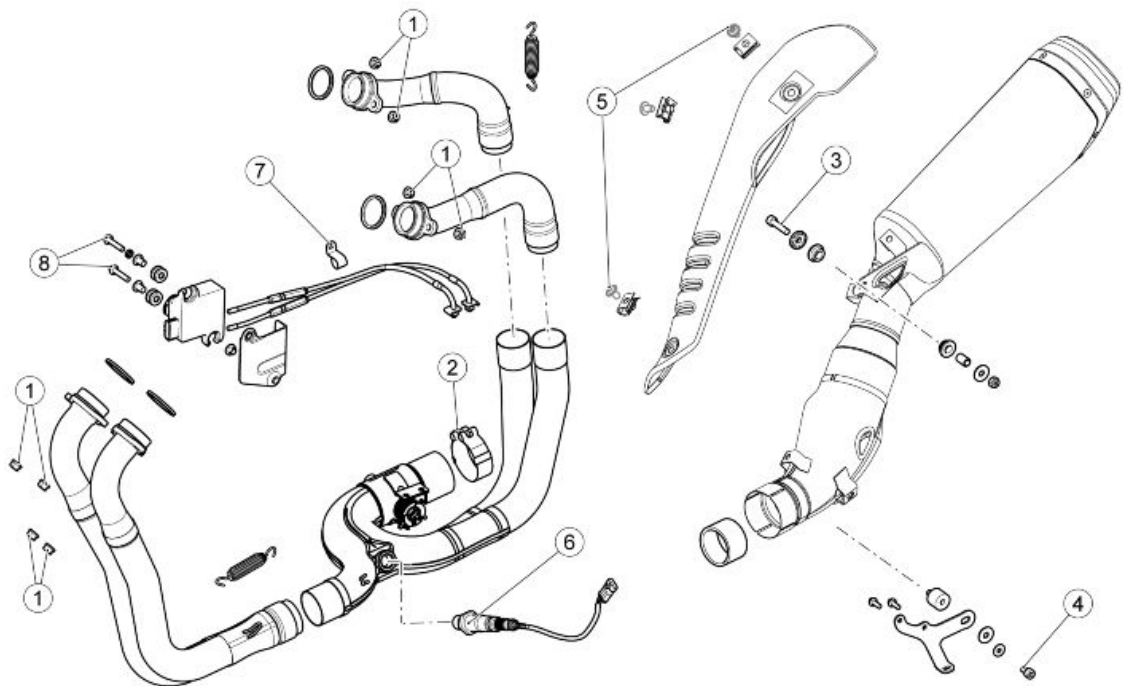
**FAIRING**

pos.	Description	Type	Quantity	Torque	Notes
-	Centre screws fastening lower fairing	M6	2	10 Nm (7.37 lbf ft)	-
-	Right hand lower fairing mounting bracket	M6	2	10 Nm (7.37 lbf ft)	-
-	Left hand lower fairing mounting bracket	M6	2	10 Nm (7.37 lbf ft)	-
-	Screws fixing the side fairings to the side spacers	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to intake duct	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to front fairing	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to intake duct	self-tapping	2	1 Nm (0.74 lbf ft)	-
-	Screws fixing upper fairing fastener to headlamp	self-tapping	2	1 Nm (0.74 lbf ft)	-
-	Screws fastening the lower fairing to the bracket	M5	2 + 2	1 Nm (0.74 lbf ft)	-



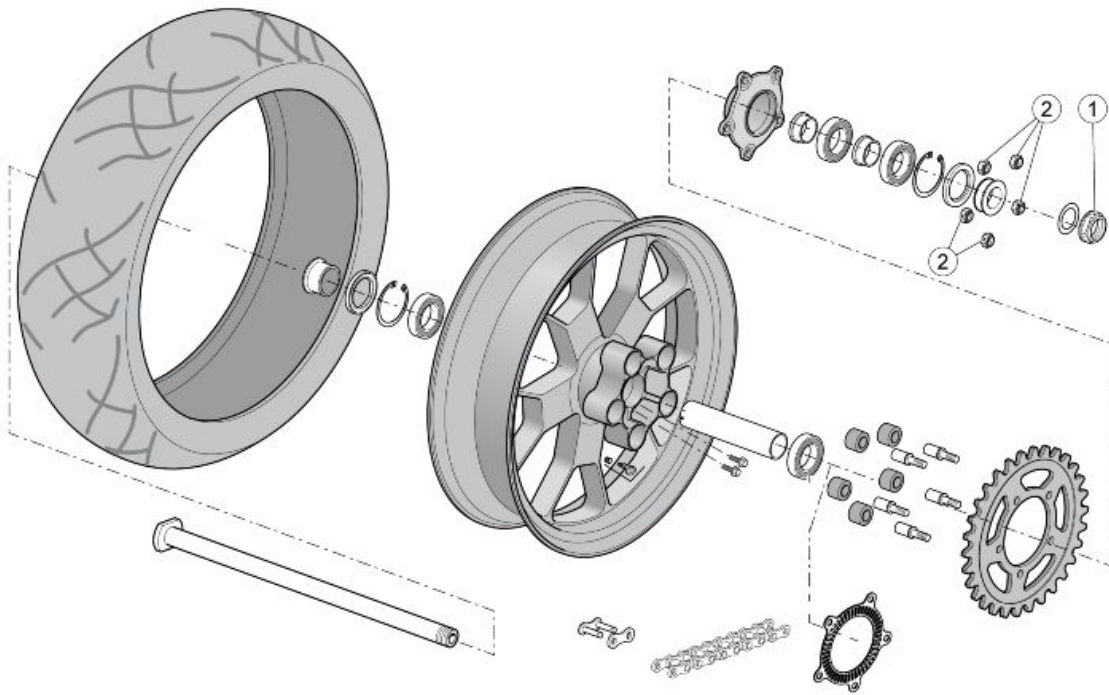
pos.	Description	Type	Quantity	Torque	Notes
-	Screws fastening the lower fairing to the lug	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower fairing lower fastening screws	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower fork fastener fixing screws	M6	2	8 Nm (5.90 lbf ft)	-
-	Screws fixing lower front fairing fastener to intake ducts	SWP 3.9	2	1 Nm (0.74 lbf ft)	-
-	Inner screws fixing fairing to the lower front fairing fastener	M4	2	0.5 Nm (0.37 lbf ft)	-
-	Inner screws fastening the fairing to the lug	M5	2	2 Nm (1.47 lbf ft)	-

**Back side**



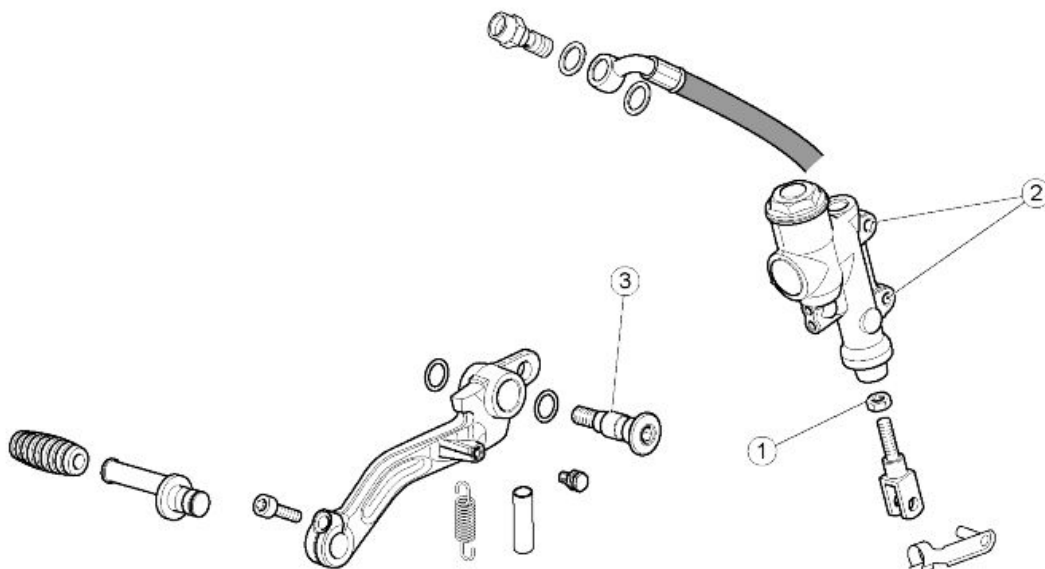
**EXHAUST**

pos.	Description	Type	Quantity	Torque	Notes
1	Exhaust manifold flange fixing nuts	M7	8	13 Nm (9.59 lbf ft)	-
2	Silencer clamp fixing screw	M6	1	10 Nm (7.37 lbf ft)	-
3	Screw fastening silencer to right hand footpeg mounting	M8	1	25 Nm (18.44 lbf ft)	-
4	Screw fastening silencer to central lower fairing bracket	M8	1	20 Nm (14.75 lbf ft)	-
5	Cosmetic silencer shield fixing screw	M5	2	5 Nm (3.69 lbf ft)	-
6	Oxygen sensor fastener	M18x1.5	1	38 Nm (28.03 lbf ft)	-
7	Fastener screw for cable grommet for exhaust butterfly valve cables	M6	1	10 Nm (7.37 lbf ft)	-
8	Exhaust butterfly valve actuator fixing screws	M6	2	10 Nm (7.37 lbf ft)	-



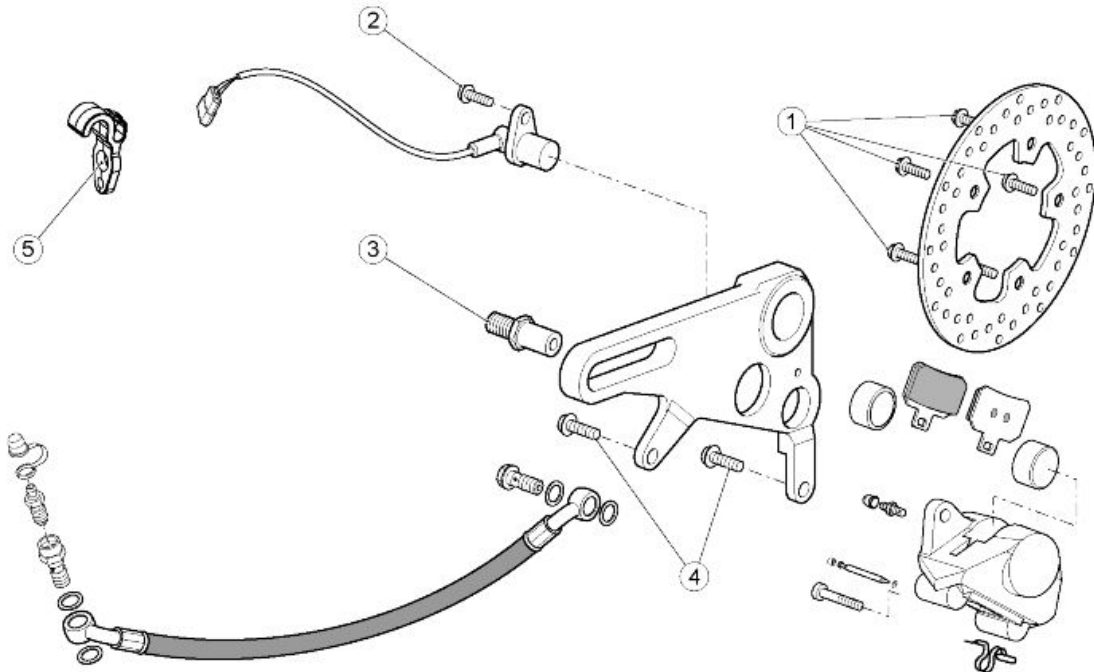
**REAR WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear wheel spindle nut	M25x1.5	1	120 Nm (88.5 lbf ft)	-
2	Screws fastening sprocket on sprocket mount	M10	5	50 Nm (36.88 lbf ft)	-



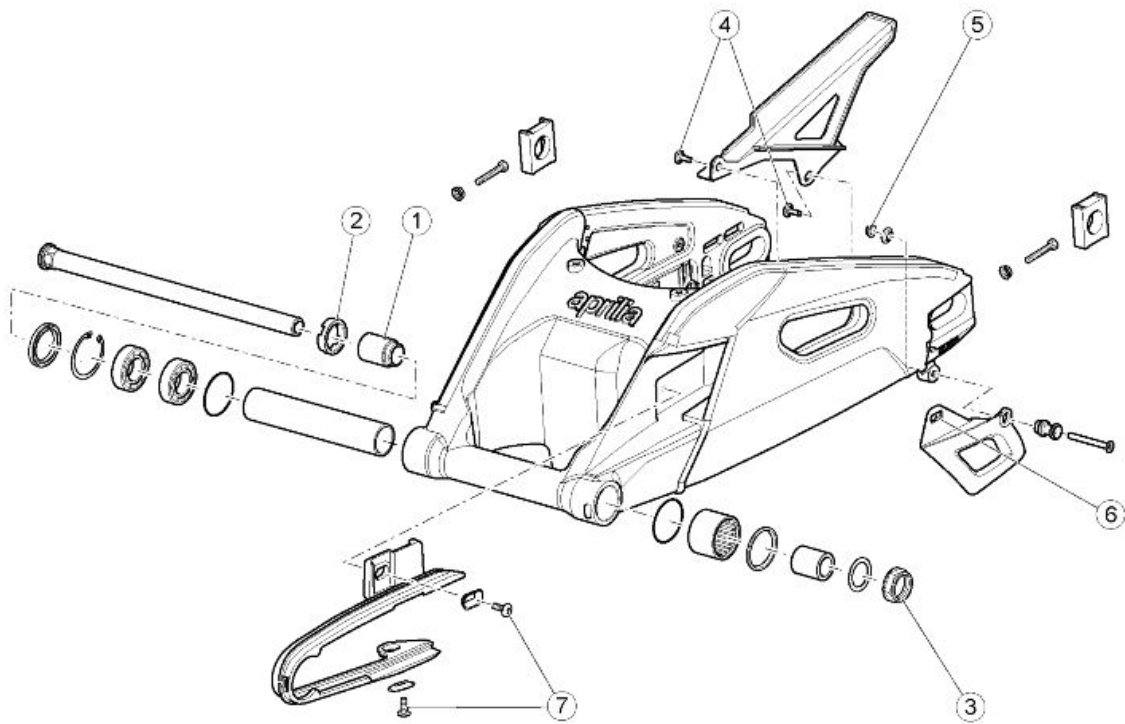
**REAR BRAKE PUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake rod lock nut	M6	1	12 Nm (8.85 lbf ft)	-
2	Rear brake pump fixing screws	M6	2	8 Nm (5.9 lbf ft)	-
3	Rear brake lever fixing screw	M8	1	25 Nm (18.44 lbf ft)	-



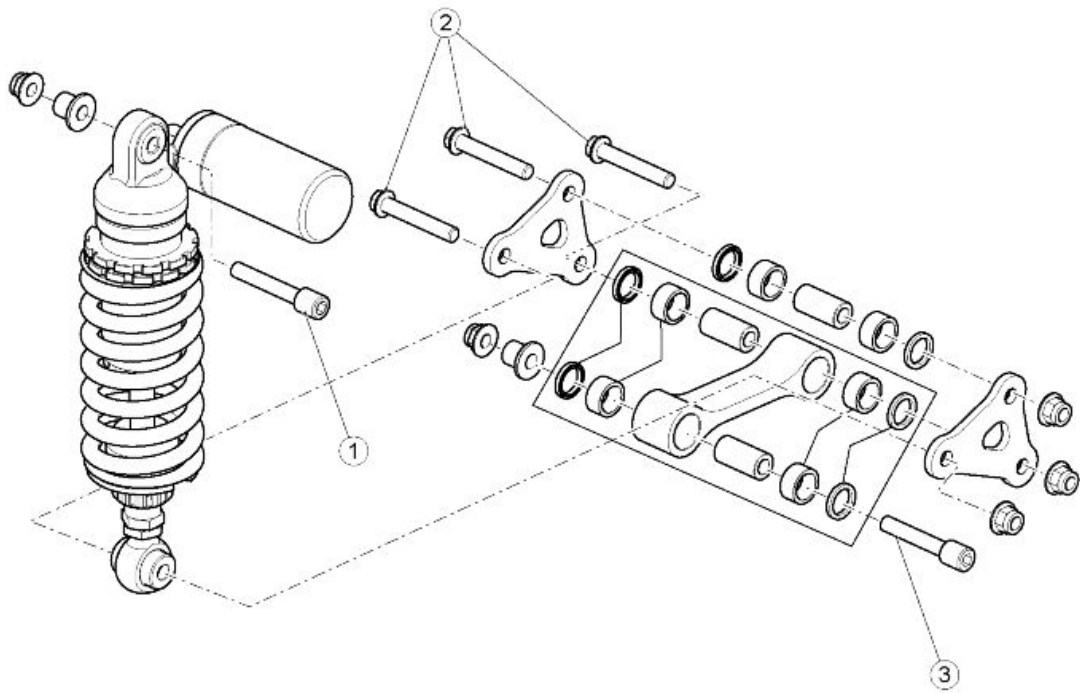
**REAR BRAKE CALLIPER**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake disc fixing screws	M8	5	30 Nm (22.13 lbf ft)	Loct. 243
2	Odometer sensor fixing screw	M6	1	10 Nm (7.38 lbf ft)	-
3	Rear brake calliper mounting plate lock pin	M12	1	50 Nm (36.88 lbf ft)	Loct. 243
4	Rear calliper fixing screw	M5	2	25 Nm (18.44 lbf ft)	-
5	Brake pipe clamp fixing screw	M5	2	4 Nm (2.95 lbf ft)	-
-	Brake pipe bracket fixing screw	M5	2	4 Nm (2.95 lbf ft)	-



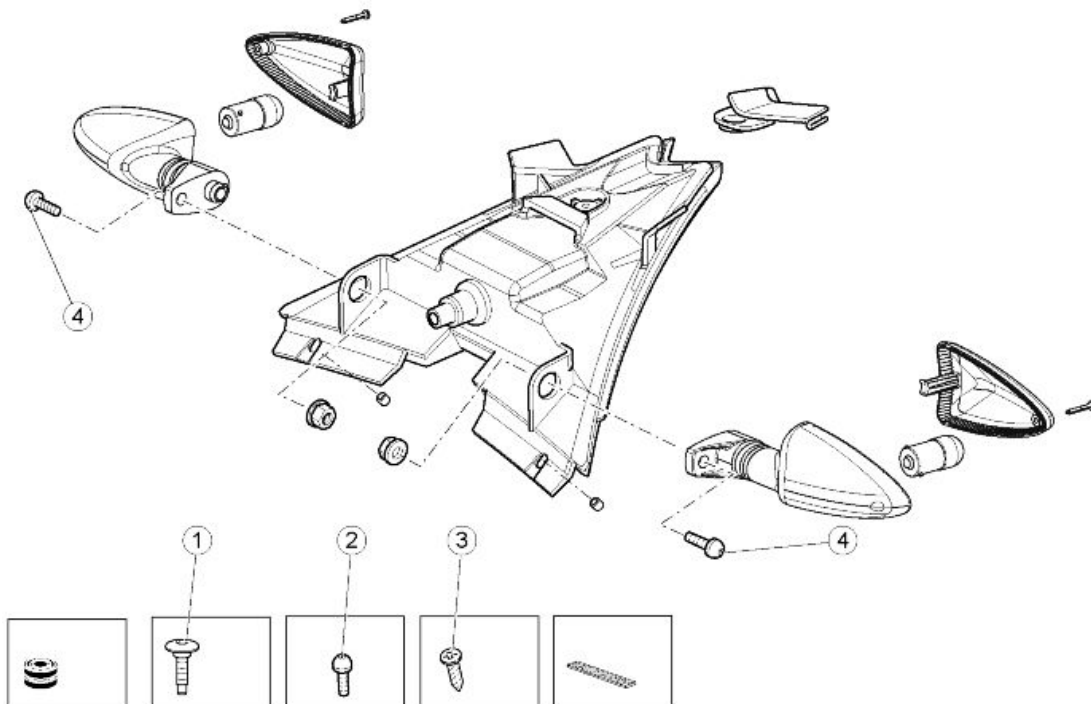
**REAR SWINGARM**

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm adjuster screw bushing	M30x1.5	1	12 Nm (8.85 lbf ft)	-
2	Swingarm ring nut	M30x1.5	1	60 Nm (44.25 lbf ft)	-
3	Swingarm pin nut	M20x1.5	1	65 Nm (47.94 lbf ft)	AGIP GREASE SM2
4	Chain casing fixing screws	M5	2	4 Nm (2.95 lbf ft)	-
5	Front chain guide fixing screw	M5	1	4 Nm (2.95 lbf ft)	-
6	Rear chain guide fixing nut	M6	1	7 Nm (5.16 lbf ft)	-
7	Chain skid fixing screws	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower chain slider fixing screws	M6	2	10 Nm (7.37 lbf ft)	-
-	Chain guide fixing screw	M6	1	8 Nm (5.90 lbf ft)	-



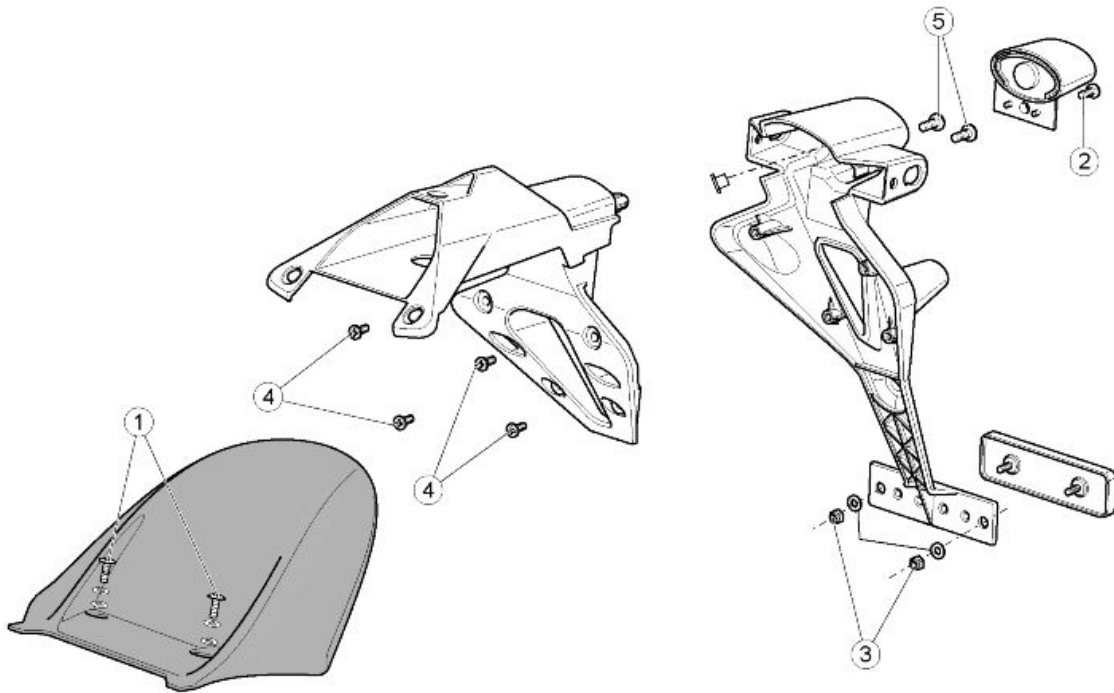
**REAR SHOCK ABSORBER**

pos.	Description	Type	Quantity	Torque	Notes
1	Upper shock absorber fixing screw	M10	1	50 Nm (36.88 lbf ft)	-
2	Dual connecting rod fixing screw	M10	3	50 Nm (36.88 lbf ft)	-
3	Screw fastening single connecting rod to chassis	M10	1	50 Nm (36.88 lbf ft)	-



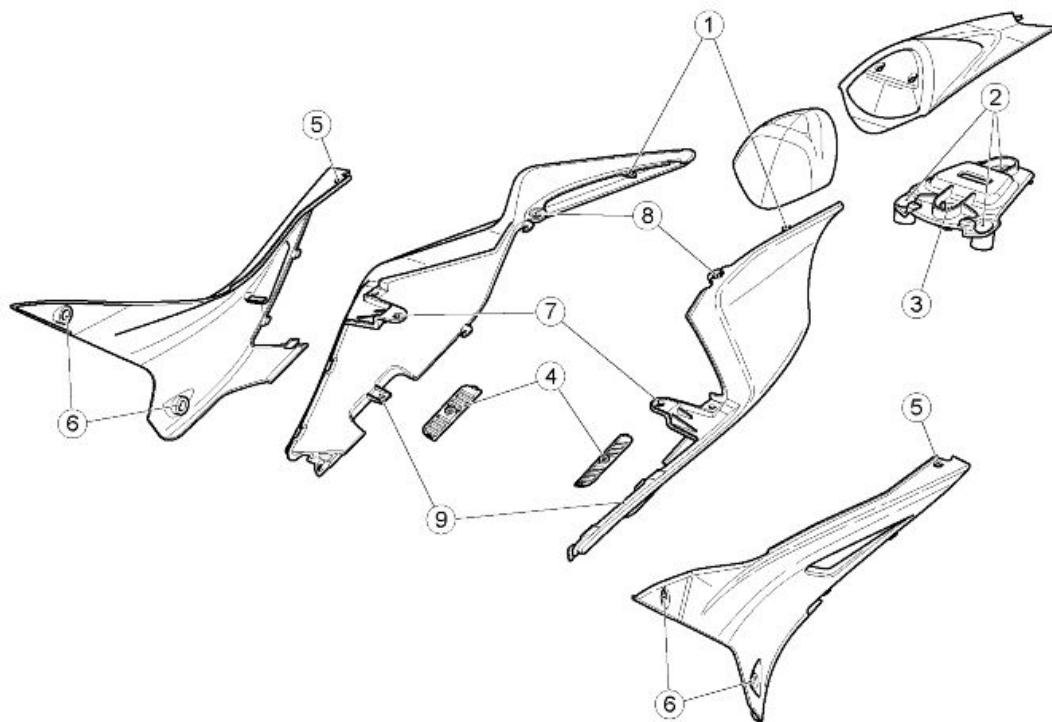
**TAILLIGHT**

pos.	Description	Type	Quantity	Torque	Notes
1	Taillight fixing screws	M5	2	3 Nm (2.21 lbf ft)	-
2	Taillight mounting bracket fixing screws	M5	2	4 Nm (2.95 lbf ft)	-
3	Rear turn indicator fixing screws	M6	2	2.5 Nm (1.84 lbf ft)	-
4	Taillight cover fixing screws	SWP 2.9	1	0.5 Nm (0.37 lbf ft)	-



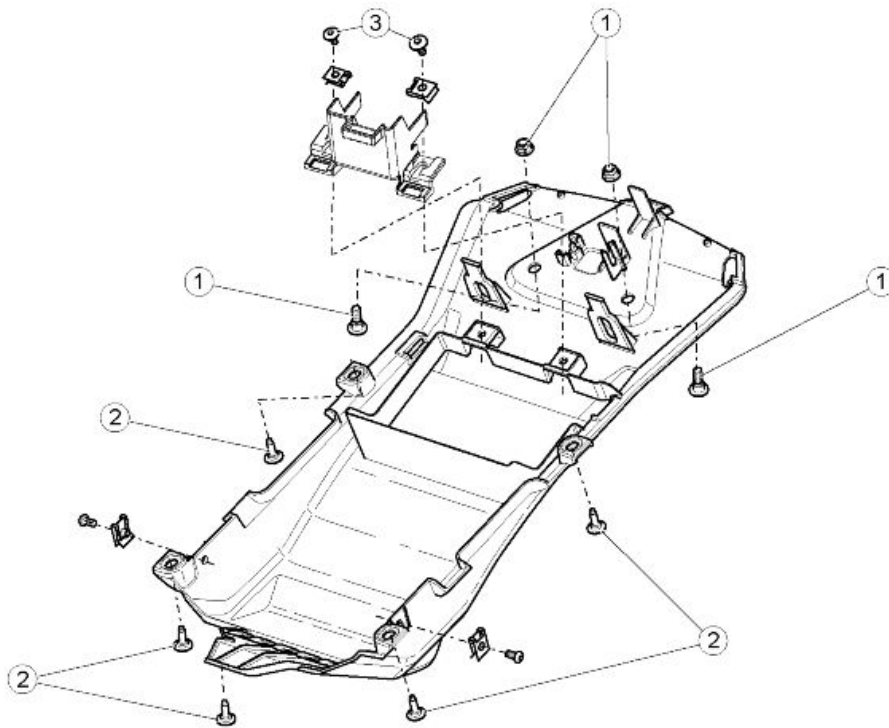
**LICENSE PLATE HOLDER**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear mudguard fixing screws	M6	2	3 Nm (2.21 lbf ft)	-
2	License plate light fixing screws	M4	1	1 Nm (0.74 lbf ft)	-
3	Reflector fixing nuts	M4	2	1 Nm (0.74 lbf ft)	-
4	Screws fastening rear license plate holder to front license plate holder	SWP 3.9	4	1 Nm (0.74 lbf ft)	-
5	Self-tapping screws fastening rear license plate holder to front license plate holder	5x20	2	2 Nm (1.47 lbf ft)	-
-	Screws fastening license plate mounting to saddle mounting casting	M6	3	4 Nm (2.95 lbf ft)	-



**TAIL FAIRING**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear screws fastening tail fairing to taillight bracket	M5	2	3 Nm (2.21 lbf ft)	-
2	Screws fastening the saddle cover base to the saddle cover	SWP 2.9	3	1 Nm (0.74 lbf ft)	-
3	Saddle cover pin fixing screws	M4	1	1.5 Nm (1.11 lbf ft)	-
4	Screws fastening grilles to tail fairing	M5	2	0.5 Nm (0.37 lbf ft)	-
5	Screws fastening side fairings to tail fairing	M5	2	1 Nm (0.74 lbf ft)	-
6	Screws fixing side fairings to tank	M5	2 + 2	2 Nm (1.47 lbf ft)	-
7	Screws fastening tail fairing to saddle mounting	M5	2	3 Nm (2.21 lbf ft)	-
8	Screws fastening tail fairing to saddle mounting bracket	M5	2	2 Nm (1.47 lbf ft)	-
9	Screws fixing tail fairing to lower saddle mounting fastener	M5	2	3 Nm (2.21 lbf ft)	-

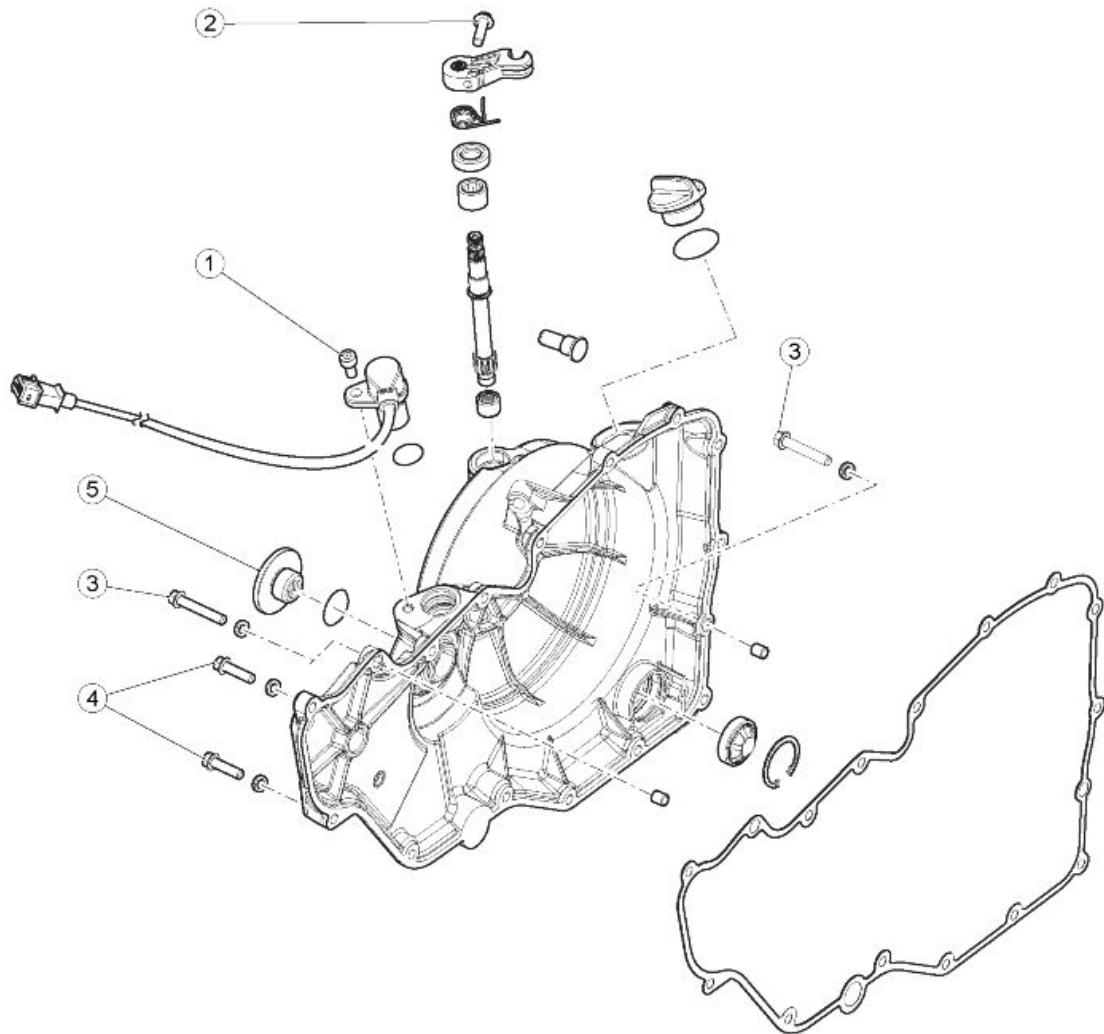


**HELMET COMPARTMENT**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws and nuts for fastening license plate holder to saddle mounting plate	M6	2	4 Nm (2.95 lbf ft)	-
2	Lower saddle mounting fastener fixing screws	M5	5	3 Nm (2.21 lbf ft)	-
3	Battery bracket fixing screws	M5	2	2 Nm (1.47 lbf ft)	-

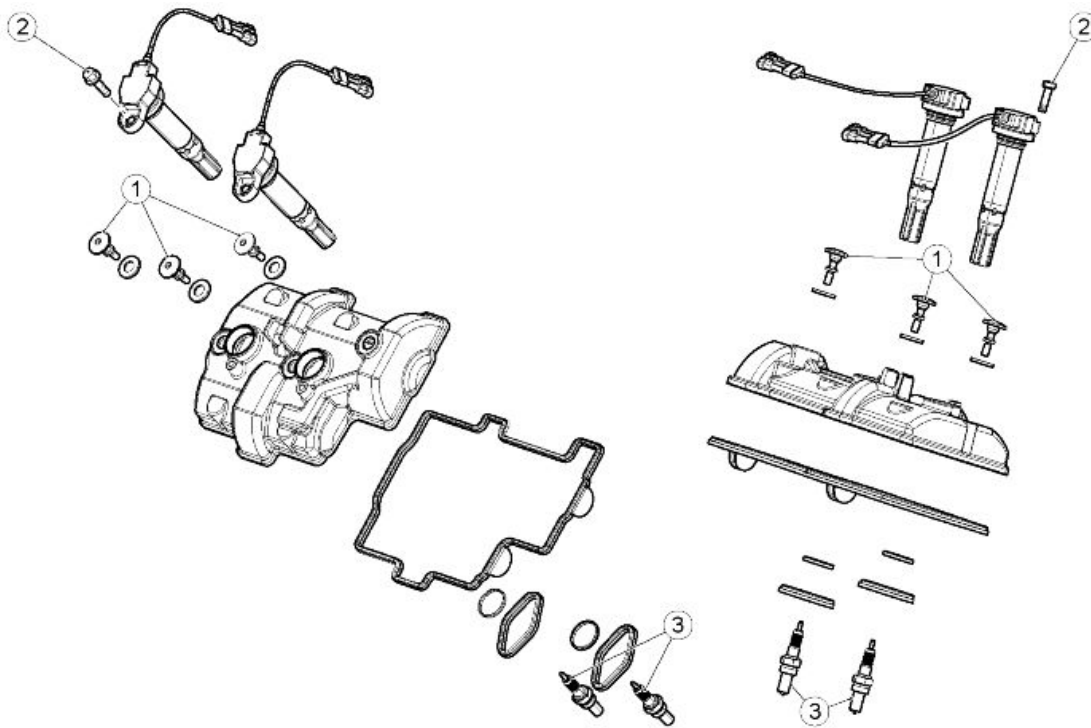


Engine



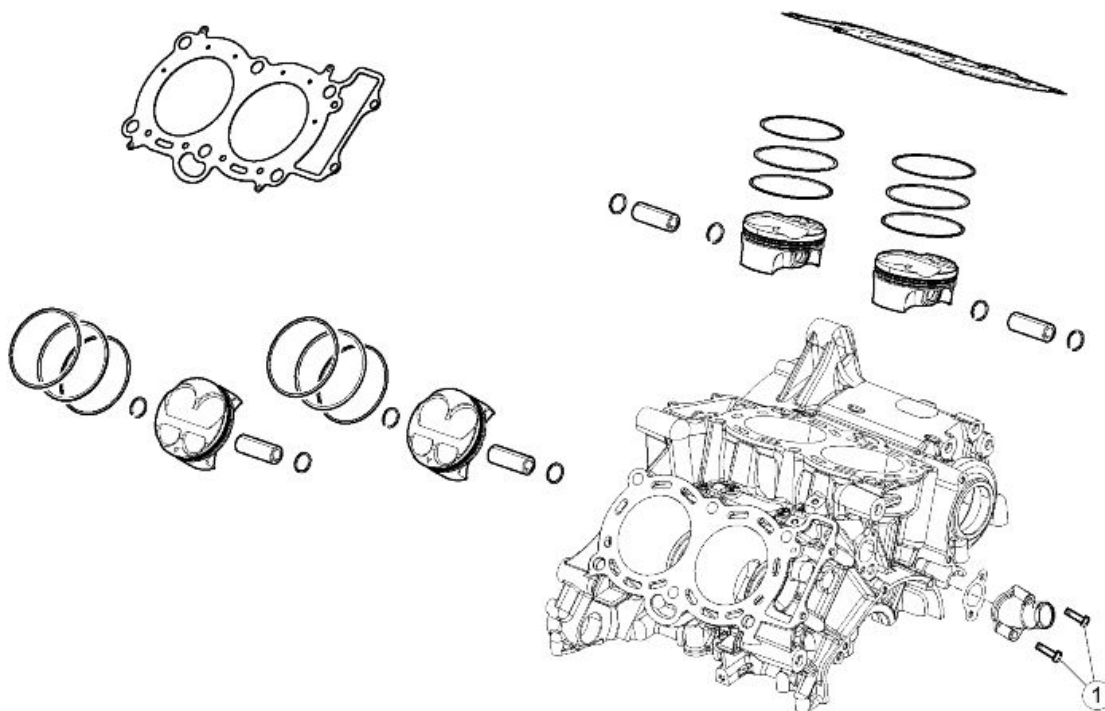
**CLUTCH COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Engine speed sensor fixing screw	-	1	8 Nm (5.9 lbf ft)	-
2	TE flanged screw	M6x20	1	12 Nm (8.85 lbf ft)	-
3	Flanged TE screws	M6x35	2	12 Nm (8.85 lbf ft)	-
4	Flanged TE screws	M6x22	16	12 Nm (8.85 lbf ft)	-
5	Engine timing inspection cap	-	1	25 Nm (18.44 lbf ft)	-



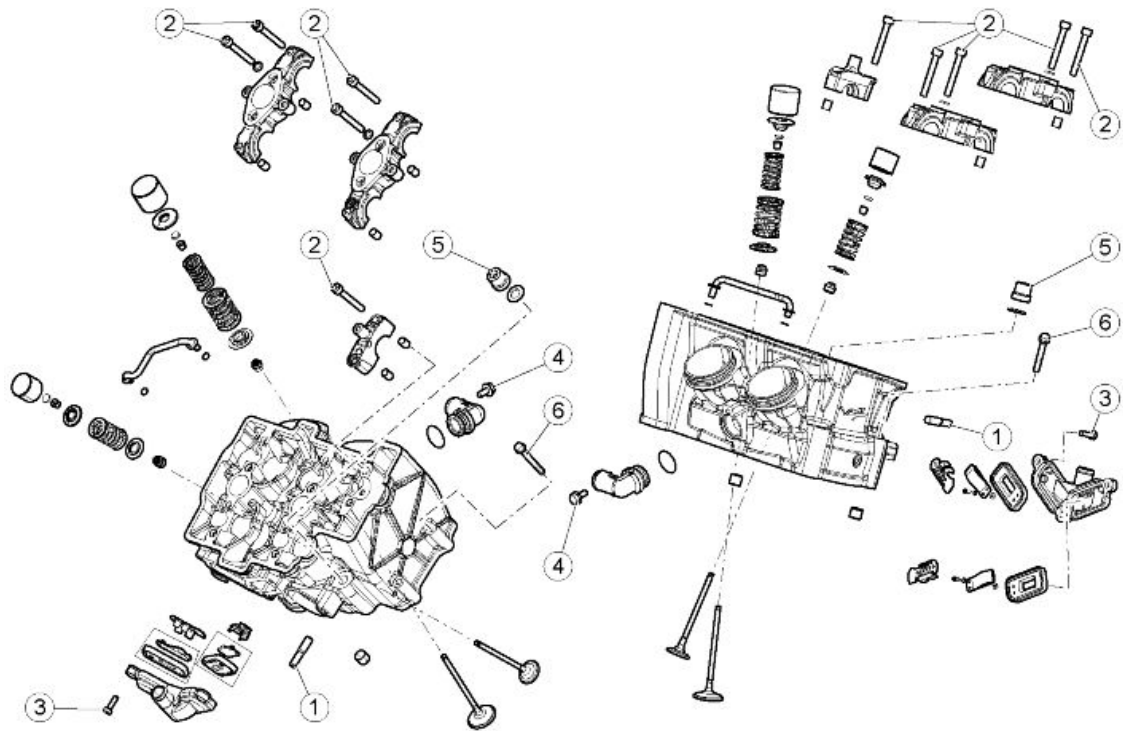
**VALVE COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Head cover fixing screws	-	6	10 Nm (7.37 lbf ft)	-
2	Coil fixing screws	-	4	8 Nm (5.9 lbf ft)	Loct. 243
3	Spark plugs	-	4	12 Nm (8.85 lbf ft)	-



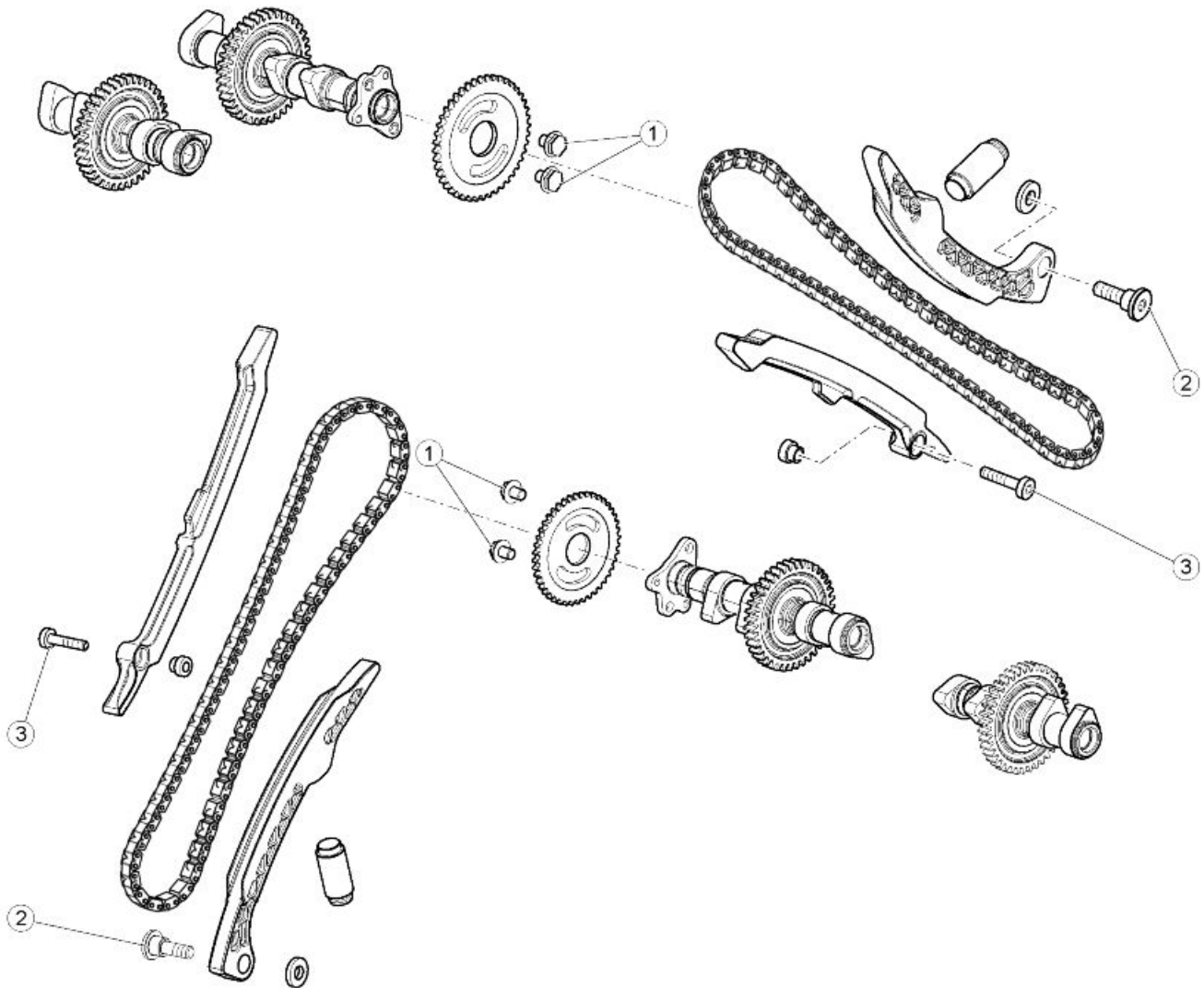
**CYLINDERS - PISTON**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening water union onto crankcase	M6x40	2	10 Nm (7.37 lbf ft)	-



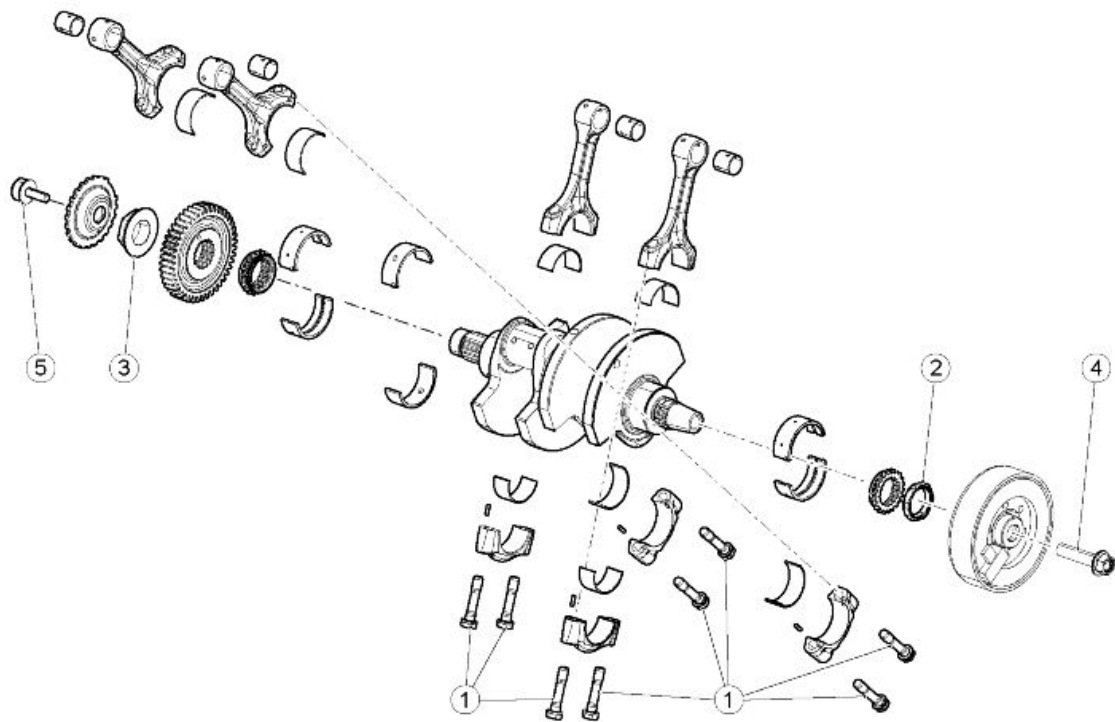
**HEADS**

pos.	Description	Type	Quantity	Torque	Notes
1	Exhaust stud bolts	-	8	10 Nm (7.37 lbf ft)	-
2	Camshaft cam tower fixing screws	M6x45	20	12 Nm (8.85 lbf ft)	-
3	Reed valve cover fixing screws	-	6	6 Nm (4.42 lbf ft)	-
4	Water outlet union fixing screw	-	2	12 Nm (8.85 lbf ft)	Loct. 243
5	Flanged head nut	-	12	30 + 55 Nm (22.13 + 40.56 lbf ft)	Molykote spray on thread and under head
6	Head fastener screw, chain side	M6x55	4	12 Nm (8.85 lbf ft)	-



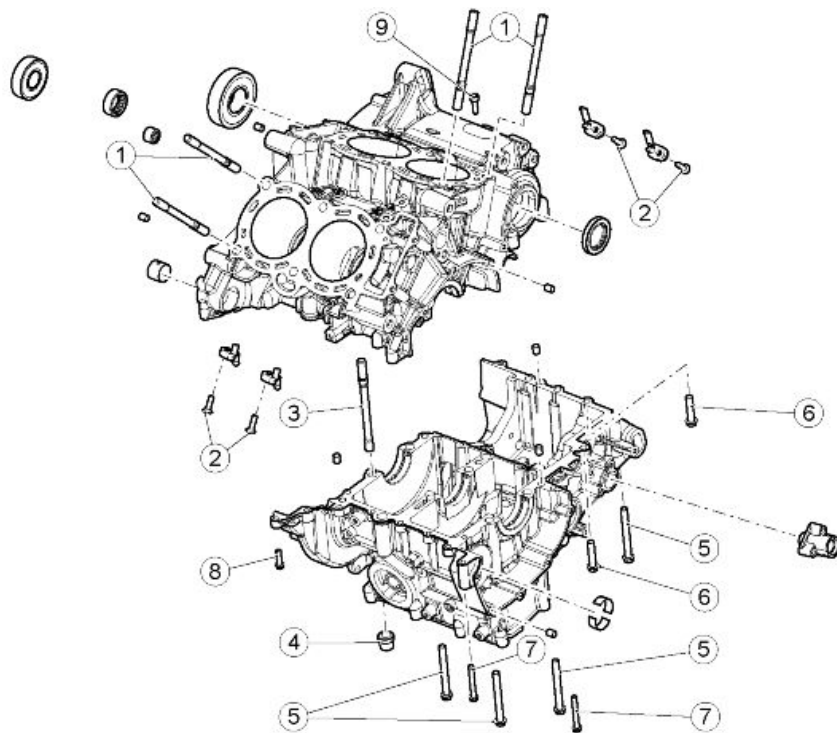
**TIMING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the timing system gear on the intake shaft	M8	4	30 Nm (22.13 lbf ft)	Loct. 243
2	Skid fastener screws	M8	2	20 Nm (14.75 lbf ft)	Loct. 243
3	Skid fastener screws	M6x18	2	10 Nm (7.37 lbf ft)	Loct. 243



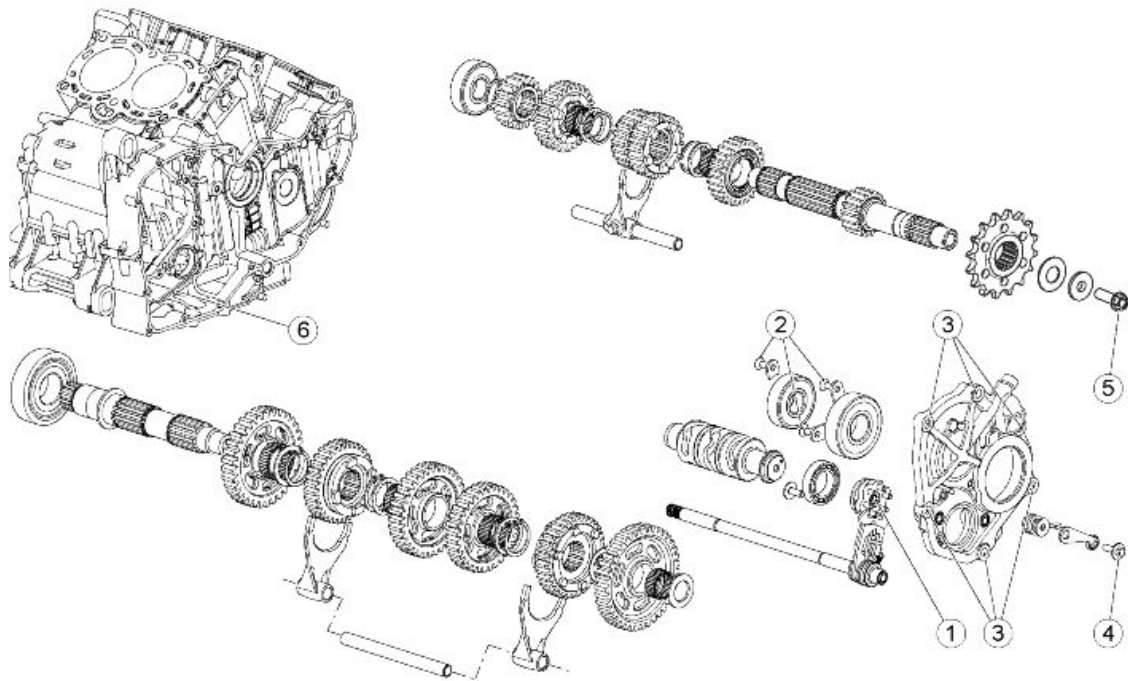
**CRANKSHAFT**

pos.	Description	Type	Quantity	Torque	Notes
1	Connecting rod screws	-	8	15 Nm (11.06 lbf ft) + 40° + 60°	Lubricate the thread and under the head with Molykote
2	Fastener ring nut for alternator side timing sprocket	-	1	100 Nm (73.76 lbf ft)	Loct. 243
3	Primary sprocket fixing ring nut	-	1	200 Nm (147.51 lbf ft)	Loct. 243
4	Alternator fixing screw	M12x1.25	1	120 Nm (88.51 lbf ft)	-
5	Tone wheel fixing screw	M8x1.25	1	30 Nm (22.13 lbf ft)	Loct. 3M or 270



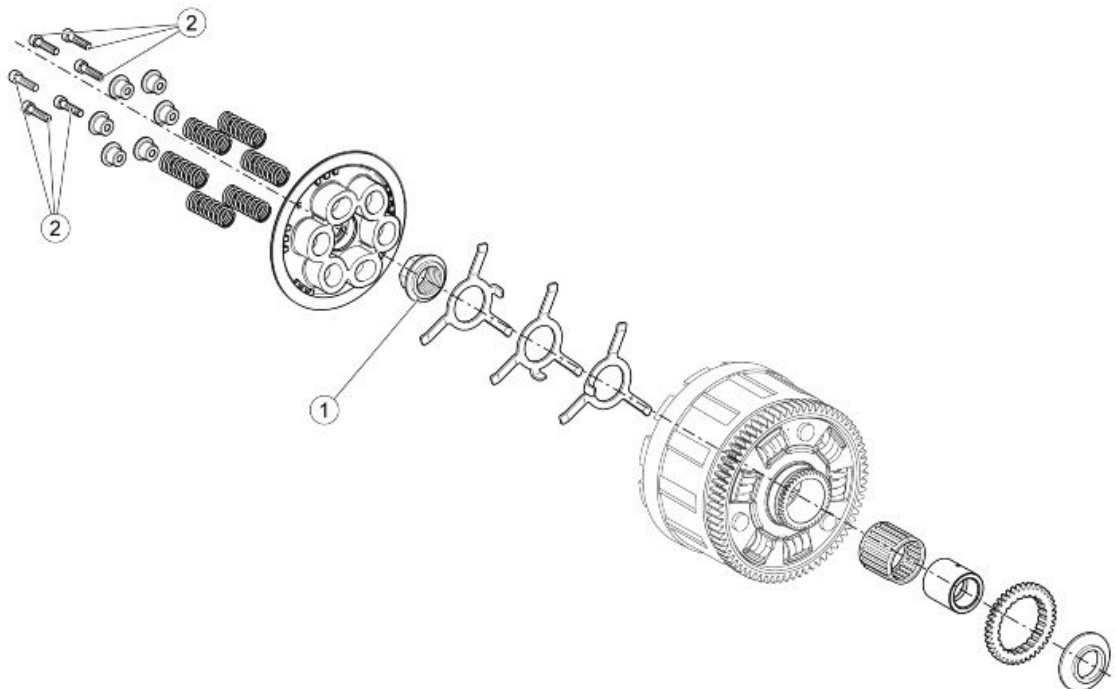
**CRANKCASES**

pos.	Description	Type	Quantity	Torque	Notes
1	Head stud bolts	-	12	20 Nm (14.75 lbf ft)	Loct. 648 or 270
2	Special screw for piston cooling oil jet	-	4	6 Nm (4.42 lbf ft)	Loct. 2045
3	Crankcase stud bolts	-	6	20 Nm (14.75 lbf ft)	Loct. 648 or 270
4	Main crank flanged nut	-	6	30 + 55 Nm (22.13 + 40.57 lbf ft)	Molykote - lubricate the thread and under the head
5	Crankcase fixing screw	M8x70	4	25 Nm (18.44 lbf ft)	Lubricate the thread and under the head
6	Crankcase fixing screw	M8x35	3	25 Nm (18.44 lbf ft)	Lubricate the thread and under the head
7	Crankcase fixing screw	M6x45	2	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head
8	Crankcase fixing screw	M6x20	5	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head
9	Crankcase fixing screw	M6x20	5	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head



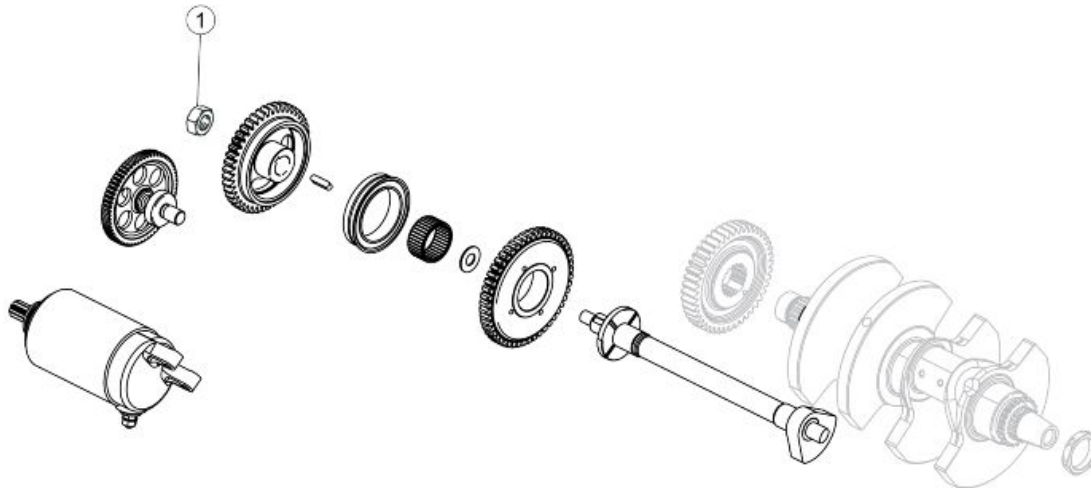
**GEAR**

pos.	Description	Type	Quantity	Torque	Notes
1	Connector drum fastener screw	M6x20	1	10 Nm (7.37 lbf ft)	Loct. 243
2	Bearing retainer plate fixing screw	M6x16	3	10 Nm (7.37 lbf ft)	Loct. 243
3	Flange fixing screws	M8x25	6	25 Nm (18.44 lbf ft)	-
4	Index lever fixing screw	M6	1	10 Nm (7.37 lbf ft)	Loct. 243
5	Pinion retainer	-	1	50 Nm (36.88 lbf ft)	Loct. 243
6	Screw retaining pre-selector on crankcase	-	1	25 Nm (18.44 lbf ft)	Loct. 270
-	Gear indicator fixing screw	M5x15	2	6 Nm (4.42 lbf ft)	-



**CLUTCH**

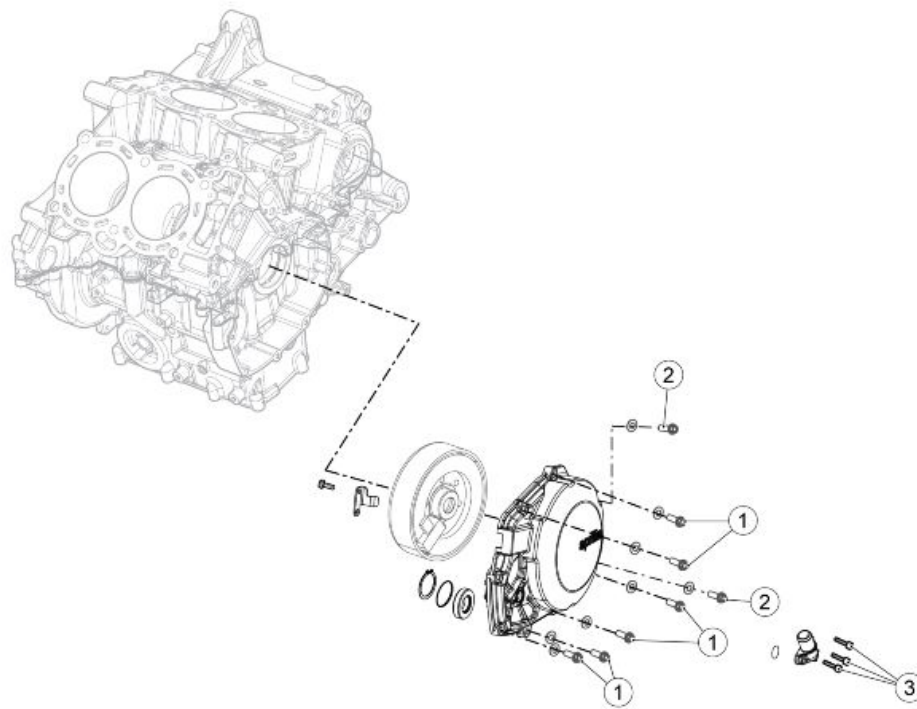
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch nut	-	1	150 Nm (110.63 lbf ft)	Loct. 243
2	Clutch spring fastener screw	M6	6	10 - 12 Nm (7.38 - 8.85 lbf ft)	-



**IGNITION UNIT**

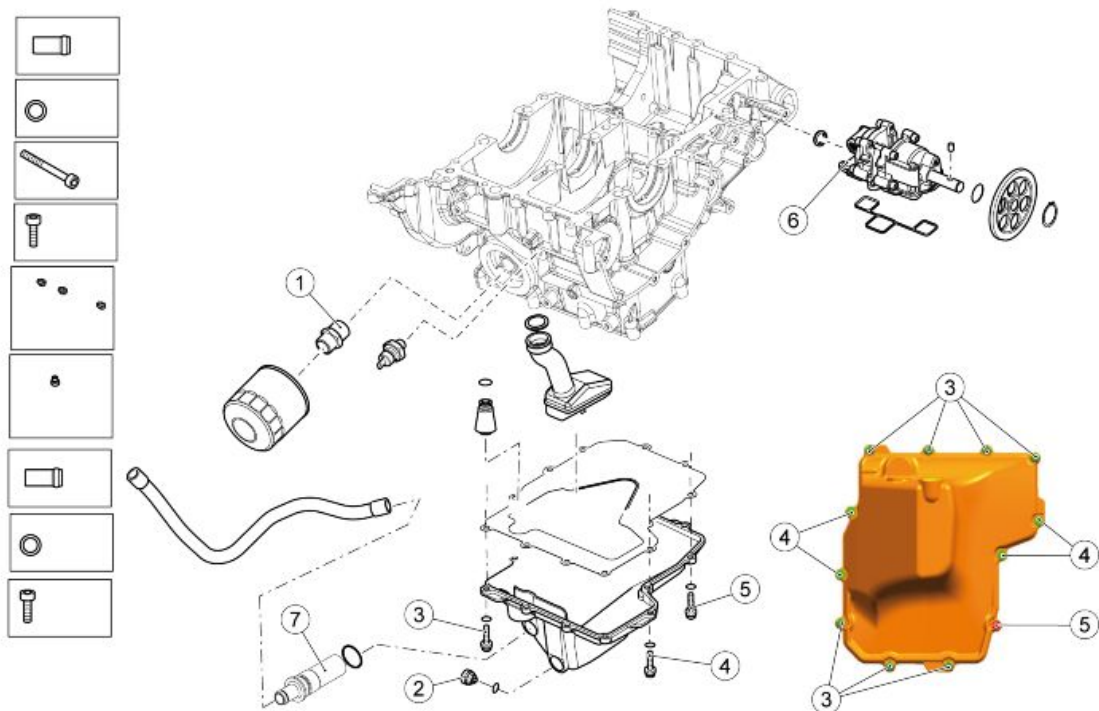
pos.	Description	Type	Quantity	Torque	Notes
1	Hex headed nut, cl.10 type 2 ISO 8674	M10x1	1	50 Nm (36.88 lbf ft)	Loct. 243





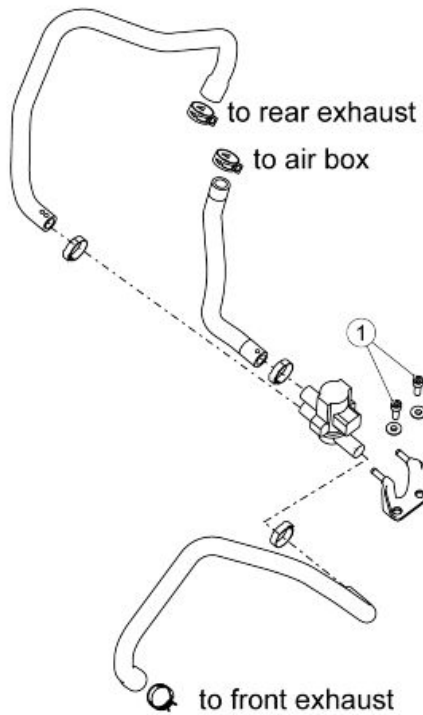
**ALTERNATOR COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening cover onto centre pins	M6x25	6	12 Nm (8.85 lbf ft)	-
2	Cover fastener screws, alternator side	M6x40	2	12 Nm (8.85 lbf ft)	-
3	Blow-by union fastener screws	M5x16	3	7 Nm (5.16 lbf ft)	-
-	Stator fixing screw UNI 5931 CL8.8	M6x25	3	10 Nm (7.37 lbf ft)	Loct. 243
-	Flanged screw	M5x12	1	6 Nm (4.42 lbf ft)	Loct. 243



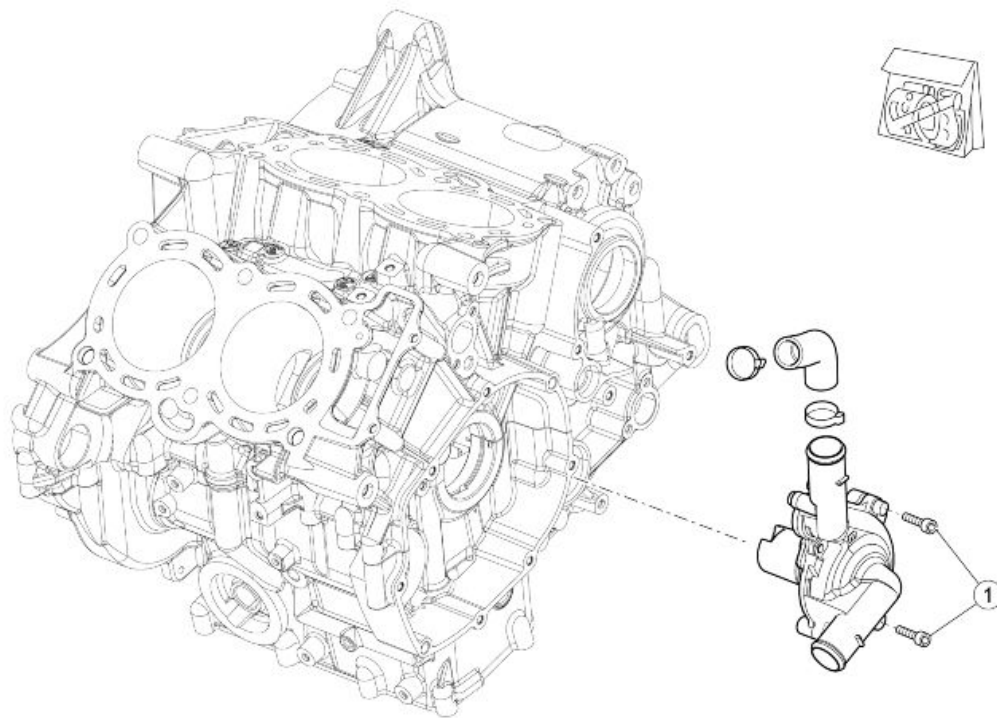
**LUBRICATION**

pos.	Description	Type	Quantity	Torque	Notes
1	Oil filter union fixing screw	-	1	30 Nm (22.13 lbf ft)	-
2	Oil drainage plug	-	1	30 Nm (22.12 lbf ft)	-
3	Oil sump fixing screws	M6x30	7	12 Nm (8.85 lbf ft)	-
4	Oil sump fixing screws	M6x22	4	12 Nm (8.85 lbf ft)	-
5	Oil sump fixing screws	M6x25	1	12 Nm (8.85 lbf ft)	-
6	Screws fastening the pump to the crankcase	M6	5+1	10 Nm (7.37 lbf ft)	-
7	Oil pipe union fixing screw	M6	1	8 Nm (5.90 lbf ft)	Loct. 243
-	Screw fastening the diffuser in the oil sump	-	1	10 Nm (7.37 lbf ft)	-



**SECONDARY AIR SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Secondary air system solenoid screws	-	2	10 Nm (7.37 lbf ft)	-



**WATER PUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the pump to the crankcase	M6x25	2	10 Nm (7.37 lbf ft)	-

**Recommended products chart**

**RECOMMENDED PRODUCTS TABLE**

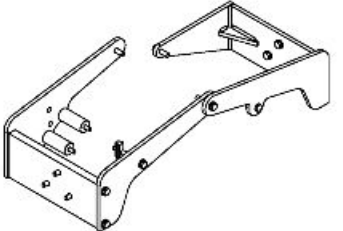
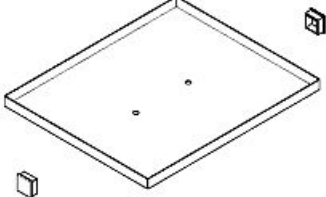

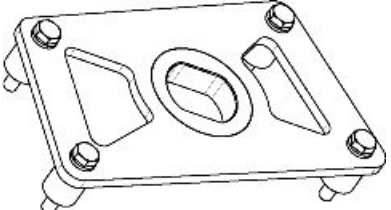
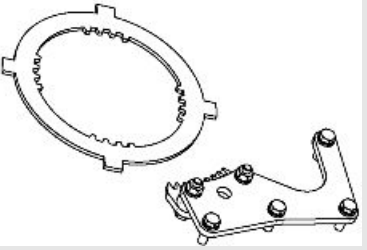
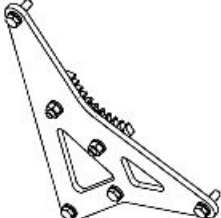
Product	Description	Specifications
AGIP RACING 4T, SAE 5W-40	Engine oil	Use branded oils with performance equivalent to or exceeding JASO MA, MA2 - API SJ (5W-40) specifications; API SG - ACEA A3 (5W-40)
AGIP MP GREASE	Grease for bearings, joints, couplings and linkages	As an alternative to the recommended product, use top brand grease for roller bearings with an operating temperature range of -30°C to +140°C (-22°F to +284°F), a drop point between 150°C and 230°C (302°F and 446°F), high corrosion protection qualities and good water and rust resistance.
AGIP PERMANENT SPEZIAL	Coolant	Ready for use mixed biodegradable coolant with "long life" technology and characteristics (red). Freezing protection up to -40°C. Compliant with CUNA 956-16 standard.
AGIP BRAKE 4	Brake fluid	As an alternative to the recommended fluid, other fluids that meet or exceed the required specifications may be used. SAE J1703, NHTSA 116 DOT 4, ISO 4925 Synthetic fluid
ÖHLINS 5W	Fork oil (Factory)	-

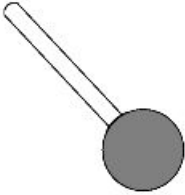
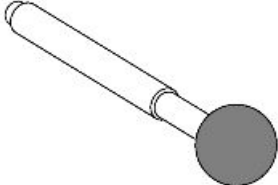
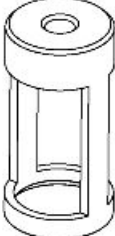
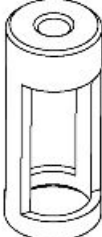
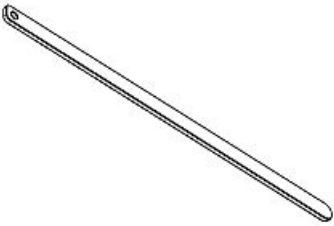
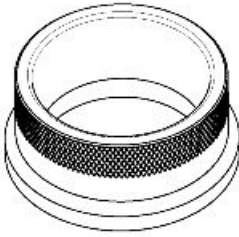
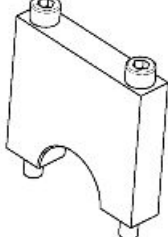
## INDEX OF TOPICS

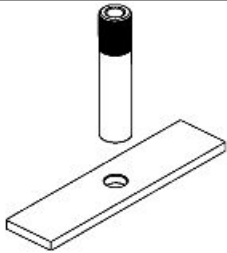


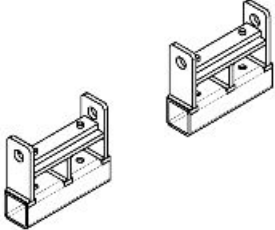


**S**SPECIAL TOOLS

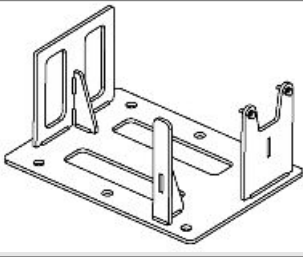
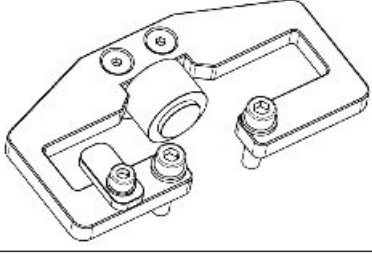
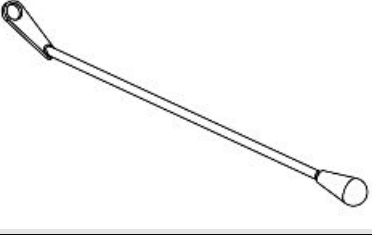
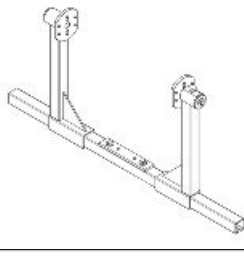
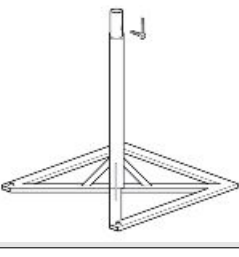


**S-TOOLS**

**SPECIAL TOOLS**




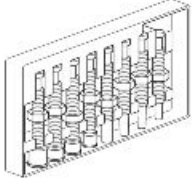
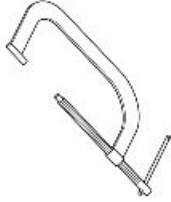

Stores code	Description	
020845Y	Engine support	
020846Y	Retaining tray + plastic caps	
020847Y	Flywheel extractor	
020848Y	Flywheel retainer	
020849Y	Clutch retainer	
020850Y	Primary gear lock	

Stores code	Description	
020851Y	Camshaft timing pin	
020852Y	Crankshaft timing pin	
020853Y	Intake valve spring compressor	
020854Y	Exhaust valve spring compressor	
020855Y	Lever for engaging the chain tensioner	
020856Y	Piston installation ring	
020857Y	Crankshaft bearing U bolt	

Stores code	Description	
020858Y	Device for holding the pistons in the cylinders	
AP8140199	Tool panel	
020859Y	Panel graphics	
8140426	Hooks for panel	
020860Y	Engine support extension	
020862Y	Gearbox control rod roller cage fitting punch	
020863Y	Desmodromic drum roller cage fitting punch	

Stores code	Description	
020864Y	Engine mounting plate	
020865Y	Support for camshaft gear on head	
020883Y	Tool for fitting/removing the timing chain tensioner	
020709Y	Engine support	
AP8140187	Engine support stand	
020376Y	Adapter handle	
020363Y	20-mm Oil seal guide	

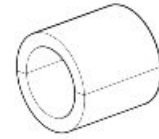


Stores code	Description	
020364Y	25-mm Guide	
020359Y	42 x 47 mm punch	
020431Y	Valve oil seal extractor	
AP8140180	Extractor for bushings	
AP8140179	Valve spring compressor	
0277308	Guide bushing for secondary gearbox shaft	

Stores code	Description
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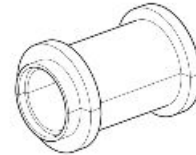
AP8140146

Weight



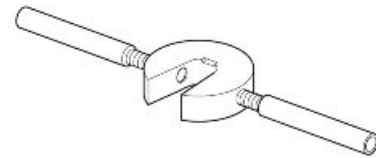
AP8140145

fitting tool for Ø 41 mm seal rings



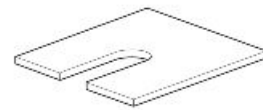
AP8140147

Spacer tool



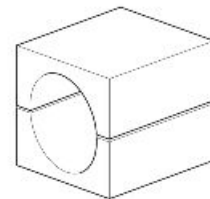
AP8140148

Spacer-piston separating plate



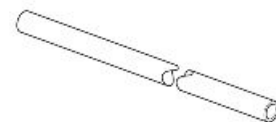
AP8140149

Protection for fitting operations



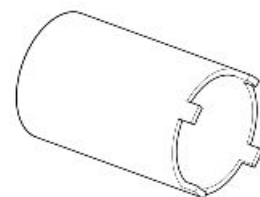
AP8140150



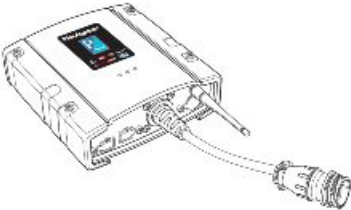
Perforated rod for piston air bleed



AP8140190

Tool for steering tightening



Stores code	Description	
AP8140181	Fuel pressure checking tool	 A fuel pressure checking tool consisting of a gauge connected to a hose and several adapters.
020481Y	Control unit interface wiring	 A control unit interface wiring harness, which is a black plastic housing with multiple electrical terminals and a bundle of wires.
020680Y	TXB Navigator	 A TXB Navigator device, a rectangular electronic unit with a small screen and a cable attached to its side.

# INDEX OF TOPICS

**MAINTENANCE**

**MAIN**

## Maintenance chart

Adequate maintenance is fundamental to ensure long-lasting, optimum operation and performance of your vehicle.

To this end, Aprilia offers a set of checks and maintenance services (at the owner's expense), that are summarised in the table shown on the following page. Any minor faults must be reported without delay to an **Authorised Aprilia Dealer or Sub-Dealer** without waiting until the next scheduled service to solve it.

All scheduled maintenance services must be carried out at the specified intervals and mileage, as soon as the predetermined mileage is reached. Carrying out scheduled services on time is essential for your warranty validity. For further information regarding Warranty procedures and "Scheduled Maintenance", please refer to the "Warranty Booklet".

### 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.**

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

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

(1) Check at each engine start

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

(3) Check and clean and adjust or replace, if necessary, every 1000 Km (621 mi)

(4) Replace every 2 years

(5) Replace every 4 years

(6) Every 5000 Km (3107 mi) if the vehicle is used for racing

(7) Every 10000 Km (6213 mi) if the vehicle is used for racing

**ROUTINE MAINTENANCE TABLE**

Km x 1000	1	10	20	30	40
Rear shock absorber (6)			I		I
Set up (6)	I	I	I	I	I
Cylinder equalisation		I	I	I	I
Spark plug (6)		I	R	I	R
Drive chain (3)	I - L	I - L	I - L	I - L	I - L
Clutch cable	L	L	L	L	L
Control cables and controls (6)	I	I	I	I	I
Sprocket - pinion (6)		I	I	I	I
Rear suspension bearings - linkages			I		I
Steering bearings and steering clearance (6)		I	I	I	I
Wheel bearings (6)		I	I	I	I
Control unit diagnosis		I	I	I	I
Brake discs (6)	I	I	I	I	I
Air filter (6)		I	R	I	R
Engine oil filter (6)	R	R	R	R	R
Engine oil filter (on pickup screen)					C
Fork			I		I
General vehicle operation (6)	I	I	I	I	I
Valve clearance (7)			A		A
Cooling system (6)		I	I	I	I

Km x 1000	1	10	20	30	40
Brake systems (6)					
Light circuit					
Stand switch					
Safety switches					
Stop switches					
Brake fluid (4)					
Coolant (4)					
Fork oil (7)			R		R
Engine oil (6)	R	R	R	R	R
Light aiming					
Fork oil seals (6)			R		R
Flexible coupling					
Tyres - pressure/wear (2)					
Wheels (6)					
Tightening torques (6)					
Tightening the clutch cover, flywheel and oil sump screws					
Fault warning light on instrument panel (1)					
Fuel lines (5)					
Clutch wear (7)					
Brake pad wear (2)					

## Spark plug

### FRONT SPARK PLUGS

- Remove the base of the air filter box.
- Undo and remove the screw.



- Slide off the front coil.



- Unscrew and remove the front spark plug.

### REAR SPARK PLUGS

- Remove the fuel tank.
- Unscrew and remove the rear coil fastener screw.

- Slide off the rear coil.
- Unscrew and slide off the rear spark plug.



## Engine oil

### Check

#### NOTE

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

- Shut off the engine and wait for a few seconds.
  - Keep the vehicle upright with both wheels on the ground.
  - Ensure that the vehicle is on a level surface.
  - Check via the inspection glass in the crankcase, that the oil level is near the upper marking.
- Upper marking = Max. level  
- Lower marking = Min. level
- If this is not the case, top-up the oil immediately through the filler plug.



#### CAUTION

**NEVER ALLOW THE OIL LEVEL TO DROP BELOW THE MINIMUM LEVEL OR FILL ABOVE THE MAXIMUM LEVEL; IF YOU DO NOT COMPLY WITH THE MINIMUM AND MAXIMUM OIL LEVELS THE ENGINE COULD BE SERIOUSLY DAMAGED**

#### NOTE

**ON ENGINES PRODUCED BEFORE SERIAL NUMBER 1635 THERE ARE NO ENGINE OIL LEVEL MARKINGS. THE OIL LEVEL MUST NEVER DROP BELOW THE MINIMUM (JUST ABOVE THE MIDDLE OF THE SIGHT GLASS), NOR EXCEED THE MAXIMUM (SIGHT GLASS ALMOST COMPLETELY FULL) LEVELS.**

ALLOWING THE LEVEL TO DROP BELOW THE MINIMUM LEVEL OR OVERFILLING BEYOND THE MAXIMUM LEVEL MAY CAUSE SEVERE ENGINE DAMAGE.

## Replacement

### NOTE

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

- Place a container with suitable capacity under the drainage plug.
- Unscrew and remove the drainage plug.



- Unscrew and remove the filler cap.
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Check and, if necessary, replace the drainage plug sealing washers.
- Screw and tighten the drainage plug.
- Add 4 l (0.88 UK gal) of new engine oil of the specified type.
- Screw on the filler cap.



- Warm up the engine up by running it for a few minutes, then switch it off. After thirty seconds, check the level in the sight glass. Top up if necessary.



### CAUTION

**NEVER ALLOW THE OIL LEVEL TO DROP BELOW THE MINIMUM LEVEL OR FILL ABOVE THE MAXIMUM LEVEL; IF YOU DO NOT COMPLY WITH THE MINIMUM AND MAXIMUM OIL LEVELS THE ENGINE COULD BE SERIOUSLY DAMAGED**

### NOTE

**ON ENGINES PRODUCED BEFORE SERIAL NUMBER 1635 THERE ARE NO ENGINE OIL LEVEL MARKINGS.**

THE OIL LEVEL MUST NEVER DROP BELOW THE MINIMUM (JUST ABOVE THE MIDDLE OF THE SIGHT GLASS), NOR EXCEED THE MAXIMUM (SIGHT GLASS ALMOST COMPLETELY FULL) LEVELS.

ALLOWING THE LEVEL TO DROP BELOW THE MINIMUM LEVEL OR OVERFILLING BEYOND THE MAXIMUM LEVEL MAY CAUSE SEVERE ENGINE DAMAGE.



## Engine oil filter

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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.
- Insert and screw the new engine oil filter in the seat, filling the filter to 1/3 of its capacity with engine oil before fitting.

**See also**

[Replacement](#)

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## Air filter

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- Remove the fuel tank.
- Unscrew and remove the eight air filter box cover screws



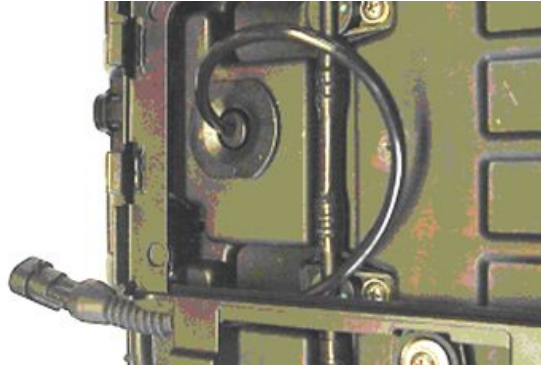
- Disconnect the upper injector fuel delivery union.

**See also**

[Fuel tank](#)

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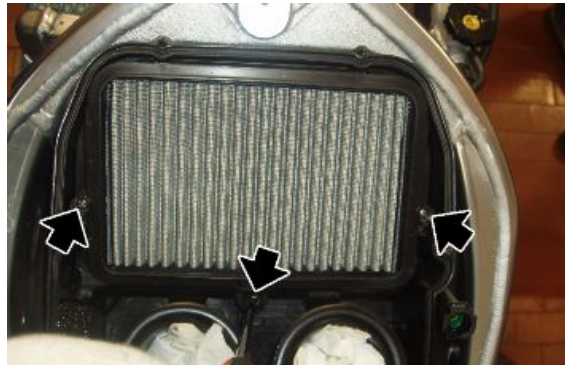
- Disconnect the variable geometry intake system connector.



- Fit a suitably sized shim behind the filter box cover.
- Lift the filter box cover on which the control unit is installed.
- Do not rotate the cover excessively to avoid straining the pipes and cables.
- Plug the intake duct opening with clean paper



- Unscrew and remove the three air filter screws.
- Remove the filter and replace it with a new component of the same type.



- Remove the air filter.



## Checking the valve clearance

### FRONT HEAD

- Remove both throttle bodies and the coils.
- Remove the front head cover and the spark plugs.
- Remove the cap on the clutch cover in order to turn the crankshaft, taking care not to lose the O-ring.



### See also

[Removing the throttle body](#)

Spark plug

Head cover removal

- Use a feeler gauge to check the clearance between the cam of the shaft and the relative tappet for both front head shafts.

### Characteristic

#### Values valid with control clearance between rocker and valve

intake: 0.10 - 0.15 mm (0.0039 - 0.0059 in) ex-

haust: 0.20 - 0.25 mm (0.0079 - 0.0098 in)



### REAR HEAD

- Remove both throttle bodies and the spark plugs.
- Remove the rear head cover.

### See also

[Removing the throttle body](#)

Spark plug

---

## Head cover removal

---

- Use a feeler gauge to check the clearance between the cam on the shaft and the relative tappet for both rear head shafts.

### Characteristic

#### Values valid with control clearance between rocker and valve

intake: 0.10 - 0.15 mm (0.0039 - 0.0059 in)

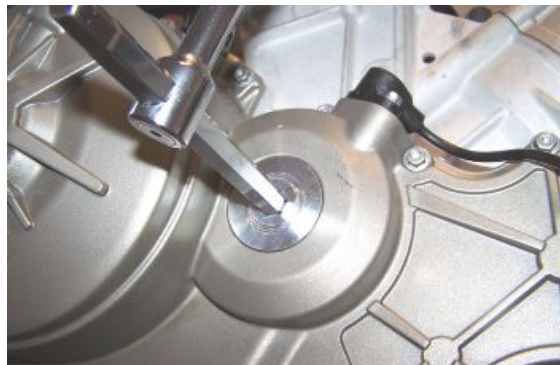
exhaust: 0.20 - 0.25 mm (0.0079 - 0.0098 in)



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## Front cylinder head valves

- Check the front valve head clearance and restore the correct clearance values if necessary, proceeding as described below.
- Remove both head covers, the alternator side cover and remove the cap on the clutch cover in order to rotate the crankshaft.
- Remove the O ring.



### See also

Head cover removal

[Removing the flywheel cover](#)

---

- Turn the crankshaft from the hole on the clutch cover.
- Move cylinder piston 1 (left rear piston) to the TDC overlap;
- Turn the crankshaft 150° in the direction of engine rotation (direction of travel).



- Insert the pin from the flywheel side, in the hole in the crankshaft.

**NOTE**

THE SPECIAL TOOL IS ONLY USED FOR IDENTIFYING THE CORRECT CRANKSHAFT POSITION. DO NOT USE IT FOR TIGHTENING OPERATIONS.

**Specific tooling**

**020852Y Crankshaft timing pin**



- Fit the pin for aligning the intake camshaft with the hole on U-bolt.
- If it was not possible before adjusting the valve clearance, check the engine timing.

**Specific tooling**

**020851Y Camshaft timing pin**



- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the camshaft gear screw.
- Remove the crankshaft locking tool.



### Specific tooling

**020850Y Primary gear lock**

**020848Y Flywheel retainer**

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft 150° in the direction of engine rotation (direction of travel) in order to align the hole on the intake camshaft with the specific hole on the U bolt; this ensures that all the front cylinder bank valve springs are decompressed.
- Refit the camshaft timing setting pin in the hole in the U bolt on the front head, and refit the crankshaft timing pin from the flywheel side, to check that the timing setting was not altered while the engine was turned with only one camshaft drive gear fastener screw in place.
- Remove the camshaft timing pin.
- Unscrew and remove the two U bolt screws (1).
- Remove the U bolt and the oil pipe.



### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Leave the gear on the camshaft.

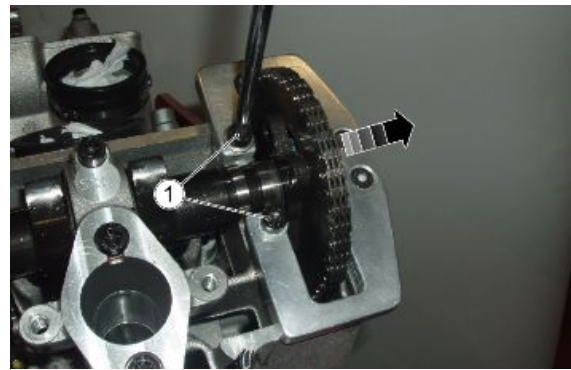


### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

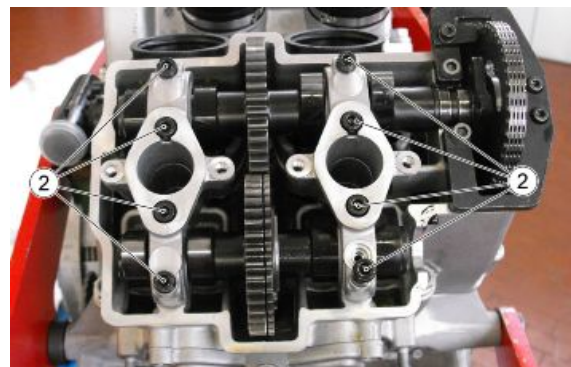
- Install the specific camshaft gear support tool.
- Fix it to the head using the two screws (1).
- Move the gear from the camshaft to the tool.



### Specific tooling

#### 020865Y Support for camshaft gear on head

- Unscrew and remove the eight screws (2), proceeding in stages and diagonally.
- Retrieve the washers from the screws near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.



- Remove the intake and exhaust camshafts.

If the two camshafts are timed correctly, the exhaust camshaft gear tooth (indicated with a dot) is meshed with the trough of the intake camshaft gear (indicated with two dots).



- Use a magnet to remove the tappet.

#### CAUTION

**REMOVE THE TAPPET CAREFULLY AS THE PAD MAY FALL INTO THE ENGINE.**

- Retrieve the pad and replace with a suitable component to achieve the correct valve clearance.

Refer to the table: "Calibrated pad thicknesses" to identify the suitable thickness.

- Fit the tappet.



### See also

### Calibrated pad thickness

- Install the intake and exhaust camshafts on the front head, bearing in mind that:

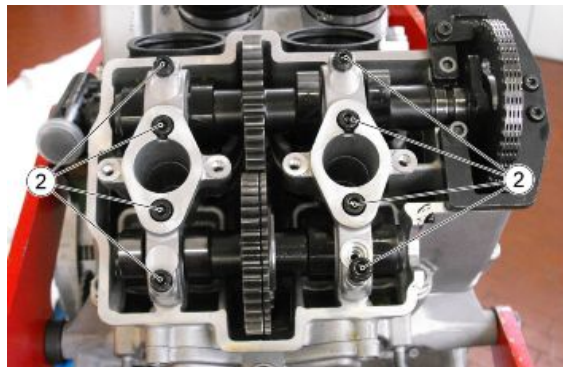
the exhaust camshaft gear tooth (indicated with a dot) is meshed with the trough of the intake camshaft gear (indicated with two dots).



**CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.**



- Fit the U bolts with the nine O rings and locator pins.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the seven screws (2) operating in stages and diagonally.
- Do not fit the eighth screw (2 - fastening the oil pipe) yet.



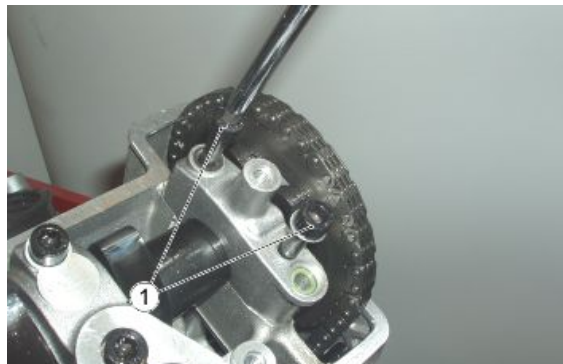
- Move the gear from the mounting tool to the camshaft.
- Unscrew and remove the two screws (1).
- Remove the tool.

### Specific tooling

**020865Y Support for camshaft gear on head**



- Fit the U bolt and the oil pipe.
- Tighten the two U bolt screws (1) and the screw (2) that was not fitted previously.





- Align the intake camshaft with the specific hole on the U bolt.
- Insert the specified pin.

### Specific tooling

#### 020851Y Camshaft timing pin



- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

#### 020848Y Flywheel retainer

#### 020850Y Primary gear lock

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener screw. This screw must be replaced at each reassembly.



- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.

### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; insert the reference pin while checking with the crankshaft reference pin, that the flywheel side hole and the hole on the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Check if the clearance between the cam on the shaft and the tappet is correct.
- If not, repeat the valve clearance adjustment procedure.

---

## Rear cylinder head valves

- Check the rear valve head clearance and restore the correct clearance values if necessary, proceeding as described below.
- Remove the rear head cover and the clutch cover.
- Move cylinder piston 1 (left rear piston) to the TDC;
- Turn the crankshaft 450° (one complete turn + 90°) in the direction of motor rotation (direction of travel).
- Insert the pin from the clutch side into the hole in the crankshaft.

### NOTE

**THE SPECIAL TOOL IS ONLY USED FOR IDENTIFYING THE CORRECT CRANKSHAFT POSITION. DO NOT USE IT FOR TIGHTENING OPERATIONS.**

### Specific tooling

**020852Y Crankshaft timing pin**



### See also

Head cover removal

### Removing the clutch cover

- Fit the pin for aligning the intake camshaft with the hole on U-bolt.
- If it was not possible before adjusting the valve clearance, check the engine timing.

#### Specific tooling

##### 020851Y Camshaft timing pin



- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the camshaft gear screw.
- Remove the crankshaft locking tool.



#### Specific tooling

##### 020850Y Primary gear lock

##### 020848Y Flywheel retainer

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft by 450° (one complete turn + 90°) in the direction of engine rotation (direction of travel) to align the hole on the intake camshaft with the specific hole on the U bolt. This ensures that all the rear cylinder bank valve springs are decompressed.
- Refit the camshaft timing setting pin in the hole in the U bolt on the rear head,



and refit the crankshaft timing pin from the clutch side, to check that the timing setting was not altered while the engine was turned with only one camshaft drive gear fastener screw in place.

- Remove the camshaft timing pin.
- Unscrew and remove the two U bolt screws (1).
- Remove the U bolt and the oil pipe.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Leave the gear on the camshaft.

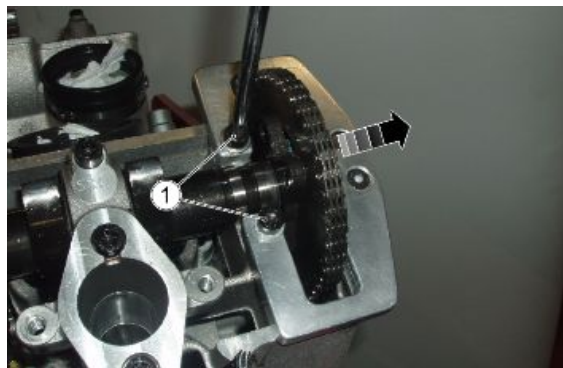


### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

- Install the specific camshaft gear support tool.
- Fix it to the head using the two screws (1).
- Move the gear from the camshaft to the tool.



### Specific tooling

**020865Y Support for camshaft gear on head**

- Unscrew and remove the eight screws (2), proceeding in stages and diagonally.
- Retrieve the washers from the screws near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.



- Remove the intake and exhaust camshafts.

If the two camshafts are timed correctly, the intake camshaft gear tooth (indicated with one dot) is meshed with the trough of the exhaust camshaft gear (indicated with two dots).



- Use a magnet to remove the tappet.

#### CAUTION

**REMOVE THE TAPPET CAREFULLY AS THE PAD MAY FALL INTO THE ENGINE.**

- Retrieve the pad and replace with a suitable component to achieve the correct valve clearance.

**Refer to the table: "Calibrated pad thicknesses" to identify the suitable thickness.**

- Fit the tappet.



#### See also

[Calibrated pad thickness](#)

- Install the intake and exhaust camshafts on the rear head, remembering that:

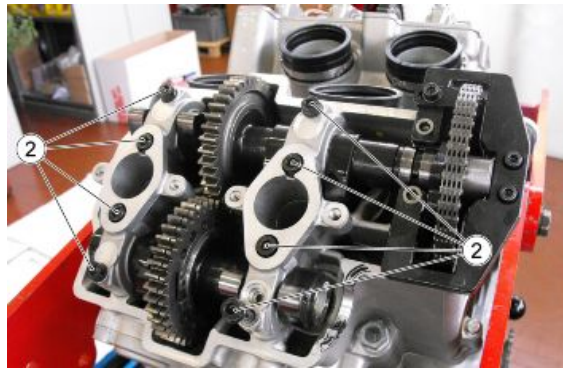
the intake camshaft gear tooth (indicated with a dot) is inserted in the groove of the exhaust camshaft gear (indicated with two dots).



**CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.**



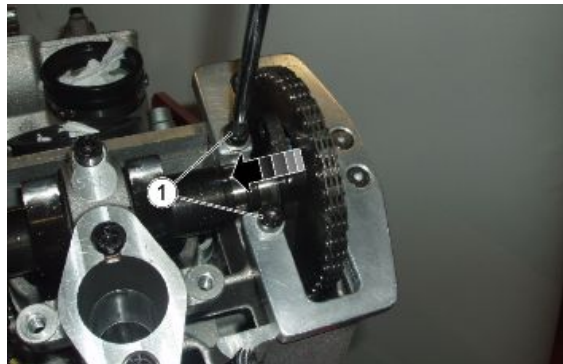
- Fit the U bolts with the nine O rings and locator pins.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the seven screws (2) operating in stages and diagonally.
- Do not fit the eighth screw (2 - fastening the oil pipe) yet.



- Move the gear from the mounting tool to the camshaft.
- Unscrew and remove the two screws (1).
- Remove the tool.

### Specific tooling

**020865Y Support for camshaft gear on head**



- Fit the U bolt and the oil pipe.
- Tighten the two U bolt screws (1) and the screw (2) that was not fitted previously.



- Align the intake camshaft with the specific hole on the U bolt.
- Insert the specified pin.

### Specific tooling

#### 020851Y Camshaft timing pin



- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

#### 020848Y Flywheel retainer

#### 020850Y Primary gear lock

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener



screw. This screw must be replaced at each reassembly.

- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.

### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; Refit the reference pin while checking, using the crankshaft reference pin, that the clutch side hole and the hole in the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

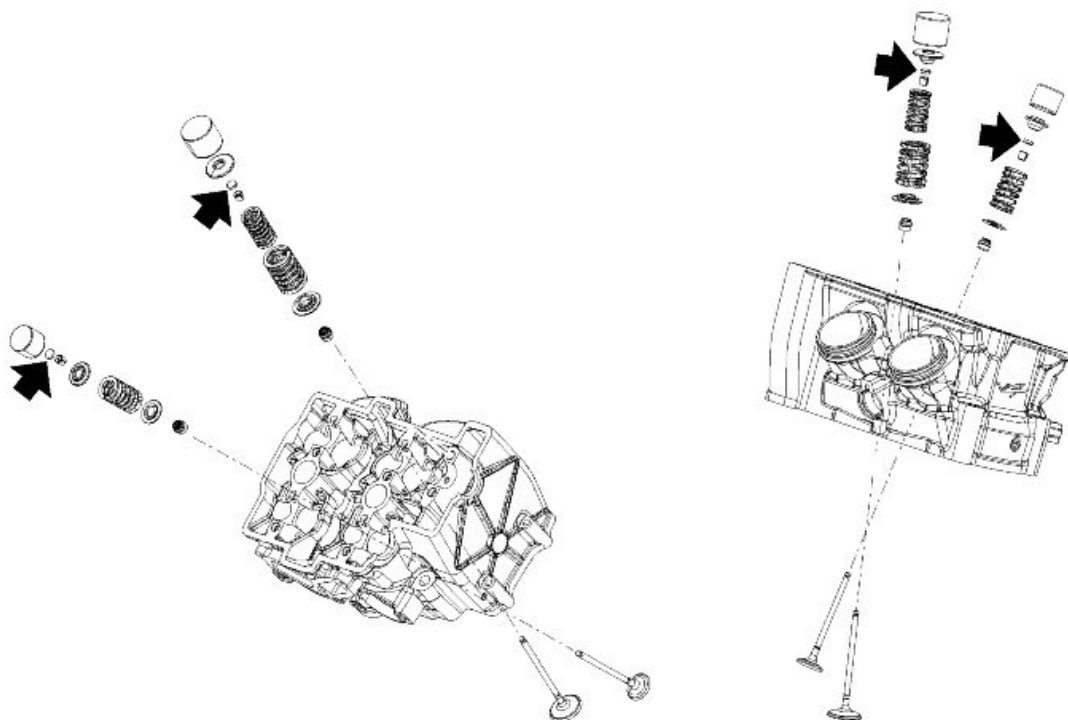
### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Check if the clearance between the cam on the shaft and the tappet is correct.
- If not, repeat the valve clearance adjustment procedure.

## Calibrated pad thickness





Pad thicknesses for adjusting valve clearance correctly:

1.75 mm (0.0689 in)  
1.80 mm (0.0709 in)  
1.85 mm (0.0728 in)  
1.90 mm (0.0748 in)  
1.95 mm (0.0768 in)  
2 mm (0.0787 in)  
2.05 mm (0.0807 in)  
2.1 mm (0.0827 in)  
2.15 mm (0.0846 in)  
2.2 mm (0.0866 in)  
2.25 mm (0.0886 in)  
2.3 mm (0.0905 in)  
2.35 mm (0.0925 in)  
2.4 mm (0.0945 in)  
2.45 mm (0.0964 in)  
2.50 mm (0.0984 in)  
2.55 mm (0.1004 in)  
2.6 mm (0.1024 in)  
2.65 mm (0.1043 in)  
2.7 mm (0.1063 in)  
2.75 mm (0.1083 in)  
2.8 mm (0.1102 in)  
2.85 mm (0.1122 in)  
2.9 mm (0.1142 in)  
2.95 mm (0.1161 in)  
3 mm (0.1181 in)  
3.05 mm (0.1201 in)  
3.10 mm (0.1220 in)  
3.15 mm (0.1240 in)

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## INDEX OF TOPICS

TROUBLESHOOTING

TROUBL

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**TROUBLESHOOTING PROCEDURE IF THE EFI WARNING LIGHT ON THE INSTRUMENT PANEL TURNS ON OR IF THERE IS ABNORMAL ENGINE PERFORMANCE****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 - THE "EFI" WARNING LIGHT IS ON AND THE WORD "SERVICE" IS SHOWN or THE "EFI" WARNING LIGHT IS FLASHING AND THE WORDS "URGENT SERVICE" ARE SHOWN or ONE OF THE TWO SITUATIONS TAKES PLACE AND IS SUDDENLY OUT or THERE IS ABNORMAL ENGINE PERFORMANCE
- 2 - CONNECT TO THE DIAGNOSIS INSTRUMENT THROUGH CONTROL UNIT BY SELECTING "SELF-ACQUISITION, APRILIA, RSV4"
- 3 - ARE CURRENT- "ATT"- or STORED- "MEM"- ERRORS SHOWN IN THE "ERRORS DISPLAY" SCREEN PAGE?

**YES, go to 4; NO, go to 11.**

- 4 - IF THE ERROR IN THE CENTRAL WINDOW IS SELECTED AND "?" IS DISPLAYED, PRESS THE KEY "?" TO OBTAIN FURTHER INFORMATION ABOUT THE ERROR. THEN GO TO THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS" CHAPTER AND READ THE INFORMATION CONCERNING THE DEFECTIVE COMPONENT
- 5 - ACCORDING TO WHAT IS INDICATED ABOUT THE ERROR/S, PROCEED AS SUGGESTED AND SOLVE THE PROBLEM
- 6 - WAS THE PROBLEM SOLVED BY REPLACING THE MARELLI CONTROL UNIT?

**YES, go to 7; NO, go to 8.**

- 7 - READ THE ACTIVATION PROCEDURE FOR A NEW CONTROL UNIT ON THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/ECU/MARELLI CONTROL UNIT" CHAPTER - END
- 8 - SELECT "ERROR CLEARING" FROM THE "DEVICES ACTIVATION (INJECTOR ICON)" SCREEN PAGE
- 9 - WAS THE PROBLEM SOLVED BY REPLACING THE THROTTLE GRIP SENSOR (DEMAND) OR THE THROTTLE BODY?

**NO, END; YES, go to 10**

- 10 - READ THE RESET PROCEDURE ON THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/THROTTLE GRIP POSITION SENSOR OR THROTTLE BODY" CHAPTER - END
- 11 - CHECK IF THERE ARE CURRENT OR STORED ERRORS DETECTED BY THE INSTRUMENT PANEL REFERRING TO THE "DIAGNOSIS" CHAPTER, "INSTRUMENT

PANEL ERRORS" SECTION. IF THERE ARE ERRORS PRESENT, SOLVE THE FAULT AND SELECT "CLEAR ERRORS"; IF THERE ARE NO ERRORS PRESENT, go to 12

- 12 - IN THE "ENGINE PARAMETER READING" SCREEN PAGE, DOES THE "AIR TEMPERATURE" PARAMETER INDICATE A VALUE EQUIVALENT TO ROOM TEMPERATURE?

**YES, go to 13; NO, note A**

- 13 - IN THE "ENGINE PARAMETER READING" SCREEN PAGE, DOES THE ENGINE TEMPERATURE PARAMETER WITH COLD ENGINE INDICATE A VALUE SIMILAR TO THAT OF THE AIR TEMPERATURE PARAMETER? AFTER STARTING THE ENGINE, DOES THE PARAMETER INCREASE GRADUALLY INDICATING A CORRECT VALUE?

**YES, go to 14; NO, note B**

- 14 - IN THE "ENGINE PARAMETER READING" AND THE "LAMBDA CORRECTION" SCREEN PAGES, WITH ENGINE AT IDLE AND ENGINE TEMPERATURE AT  $> 65^{\circ}\text{C}$ , DOES THE VALUE VARY WITHIN THE 0.85 - 1.15 RANGE?

**YES, go to 15; NO, note C**

- 15 - IN THE "ENGINE PARAMETER READING" WITH ENGINE AT IDLE AND ENGINE TEMPERATURE  $>65^{\circ}\text{c}$ , "FRONT THROTTLE CORRECTION" OR "REAR THROTTLE CORRECTION", WITH ENGINE AT IDLE, ARE THE PARAMETERS INCLUDED WITHIN  $(-0.8^{\circ} - +0.8^{\circ})$  INTERVAL? AND IN THE SAME SCREEN PAGE, ARE THE "FRONT THROT., POT. 1 (DEGREES)" AND " "REAR THROT., POT. 1 (DEGREES)", WITH ENGINE AT IDLE,  $> \text{OR} = \text{A } 0.5^{\circ}$ ? CAUTION: THE DIFFERENCE OF THE THROTTLE CORRECTION VALUES BETWEEN THE REAR AND FRONT CYLINDER MUST NOT BE  $>1^{\circ}$

**YES, go to 16; NO, note D**

- 16 - CHECK: ENGINE SPEED SENSOR, FUEL PRESSURE, INJECTORS (MECHANICAL OPERATION), COILS (SPARK), ENGINE MECHANICS - END

**Note A: SEE THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/AIR TEMPERATURE SENSOR" CHAPTER.**

**Note B: SEE THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/ENGINE TEMPERATURE SENSOR" CHAPTER.**

**Note C: SEE THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/LAMBDA PROBE" CHAPTER.**

**Note D: SEE THE "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/THROTTLE BODY" CHAPTER.**

**See also**

[Checks and inspections](#)

## The engine does not start

**THE ENGINE DOES NOT START, THE INSTRUMENT PANEL TURNS ON.**

**CAUTION**

**AXONE SHOULD BE WORKING PROPERLY AND UPGRADED AT LEAST TO THE 7.0.0 VERSION OR THE PGDS UPDATED AT LEAST TO THE 3.0.0 VERSION**

**CAUTION**

**BEFORE ANY TROUBLESHOOTING, MAKE SURE THAT:**

- 1) BATTERY VOLTAGE IS ABOVE 12V;**
- 2) THE MAIN 30A FUSE IS NOT DAMAGED AND IS ADEQUATELY FITTED;**
- 3) AUXILIARY FUSES ARE NOT DAMAGED AND ARE ADEQUATELY FITTED.**

**NOTE**

**THE RELAY NUMBER SPECIFIED REFERS TO THE WIRING DIAGRAM. THE POSITION OF THE RELAY ON THE VEHICLE IS INDICATED IN THE "ELECTRICAL SYSTEM/COMPONENT LAYOUT/RELAY LAYOUT" CHAPTER.**

- 1- WITH THE KEY TURNED TO "ON", THE INSTRUMENT PANEL LIGHTS UP BUT NO FAULT INDICATION IS SHOWN WITH INDICATION "SERVICE" OR "URGENT SERVICE" BUT THE WORD ECU IS READ BELOW and THE PLUG SOCKET DISCONNECTED?

**YES, go to CONTROL UNIT SUPPLY CHECK; NO, go to 2**

- 2. IS THE FUEL PUMP ACTIVATED?

**YES, go to 3; NO, go to FUEL PUMP CHECK**

- 3. THE DIAGNOSIS INSTRUMENT COMMUNICATES WITH THE CONTROL UNIT? THAT IS, AFTER SELECTING FUEL INJECTION, AND FOLLOWING THE INSTRUCTION, WITH KEY SET TO "ON", THE PARAMETERS, STATUSES, ETC ARE READ?

**YES, go to 4; NO, go to DIAGNOSIS INSTRUMENT CONNECTION CHECK**

- 4. WITH DIAGNOSIS INSTRUMENT ("DEVICES ACTIVATION" SCREEN PAGE, INJECTOR ICON) CARRY OUT ACTIVATION OF A LOWER INJECTOR (IT IS ADVISED TO DISCONNECT THE BLACK FUEL PUMP CONNECTOR AT PIN 4, ON THE RIGHT): IS THE INJECTOR ACTIVATED?

**YES, go to 5, NO, go to INJECTION RELAY 33 CHECK**

- 5. DOES THE MOTOR TURN WHEN THE STARTER SWITCH IS PRESSED?

**YES, SEE CHAPTER "ELECTRICAL SYSTEM/CHECK AND CONTROLS/ENGINE SPEED SENSOR and if engine speed sensor works correctly, go to 16; NO, go to 6**

- 6. WHAT DOES THE "START-UP ENABLING SWITCH" STATUS IN THE DIAGNOSIS INSTRUMENT, DEVICES STATUS SCREEN PAGE, ICON 0/1 MEAN?

**YES, go to STARTER SWITCH CHECK; NO, go to 7**

- 7. WHAT DOES THE "FALL SENSOR" STATUS IN THE DIAGNOSIS INSTRUMENT, DEVICES STATUS SCREEN PAGE, ICON 0/1 MEAN?

**If NORMAL is shown, go to 8; if TIP OVER is shown, go to 12**

- 8. WITH THE SWITCH SET TO "RUN", WHAT DOES THE "RUN-STOP SWITCH" STATUS ON THE DIAGNOSIS INSTRUMENT, DEVICES STATUS SCREEN PAGE, ICON 0/1 MEAN?

**If "RUN" is shown, go to 9; if "STOP" is shown, go to 15**

- 9. CHECK THROUGH THE DIAGNOSIS INSTRUMENT THE CORRECT OPERATION OF THE SIDE STAND, THE NEUTRAL SENSOR, THE CLUTCH SENSOR: OPERATE ANY DEVICE AND CHECK THE SUITABLE INDICATION ON THE DEVICE STATUS, ICON 0/1 SCREEN PAGE.

**If there is a fault, go to 10; if everything works correctly, go to 11**

- 10. ACCORDING TO THE FAULT, SEE CHAPTER "ELECTRICAL SYSTEM/CHECK AND CONTROLS/NEUTRAL GEAR SENSOR" or "ELECTRICAL SYSTEM/CHECK AND CONTROLS/GEAR SENSOR" or "ELECTRICAL SYSTEM/CHECK AND CONTROLS/SIDE STAND SENSOR" - END
- 11. REPLACE THE CONTROL UNIT - END
- 12. IS THE SENSOR, IN THE FRAME INTERNAL FRONT NICHE, IN VERTICAL POSITION?

**YES, go to 13; NO, go to 14**

- 13. REFER TO THE CHAPTER "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/FALL SENSOR"; INDICATION ON DIAGNOSIS INSTRUMENT ALWAYS "TIP OVER" - END
- 14. SET THE SENSOR TO THE CORRECT POSITION - END
- 15. REFER TO THE CHAPTER "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/RUN - STOP SWITCH"; INDICATION ON DIAGNOSIS INSTRUMENT ALWAYS "TIP OVER" - END
- 16. CHECK OPERATION OF FUEL CIRCUIT PRESSURE AND ENGINE MECHANICAL OPERATION - END

### See also

[Engine rpm sensor](#)

[Neutral sensor](#)

Side stand sensor

RUN/STOP switch

---

### CHECK CONTROL UNIT POWER SUPPLY

- 1. WITH THE KEY TURNED TO "OFF" CHECK IF THERE IS BATTERY VOLTAGE AT PIN 52 OF THE CONTROL UNIT, CABLE HARNESS SIDE

**YES, go to 2; NO, go to 5**

- 2. WITH THE KEY TURNED TO "ON" THERE IS BATTERY VOLTAGE AT PIN 40 OF THE CONTROL UNIT, CABLE HARNESS SIDE (IN CASE OF LACK OF POWER SUPPLY ON

PIN 42, "URGENT SERVICE" TURNS ON IN THE INSTRUMENT PANEL AND THE CONTROL UNIT INDICATES ERRORS RELATED TO THE FRONT AND REAR THROTTLE BODY)

**YES, go to 3; NO, go to 6**

- 3. CHECK CONTINUITY WITH GROUND CONNECTION AT PIN 5 and 16

**If there is continuity, go to 4; if there is not continuity, restore ground connection on the engine front part or restore cable harness**

- 4. REPLACE CONTROL UNIT, SEE "ELECTRICAL SYSTEM/CHECK AND CONTROLS/CONTROL UNIT " THE PART RELATED TO NEW CONTROL UNIT ACTIVATION PROCEDURE - END
- 5. CHECK CONTINUITY red/blue CABLE up to secondary fuse D and red/white cable from secondary fuse to 30 A main fuse CHECKING ALSO THE ENGINE - VEHICLE CABLE HARNESS CONNECTOR - END
- 6. CHECK CONTINUITY OF RED/BROWN CABLE FROM PIN 40 TO PROTECTION RELAY 19 CHECKING ENGINE - VEHICLE ELECTRICAL SYSTEM CONNECTOR

**If there is continuity, go to PROTECTION RELAY 19 CHECK; if there is not continuity, restore cable harness - END**

### See also

[Control unit](#)

---

### CHECK FUEL PUMP

- 1. WITH KEY SET TO "ON", DISCONNECT THE CONNECTOR AND CHECK THAT THERE IS BATTERY VOLTAGE ON PIN 1

**YES, go to 2; NO, go to 4**

- 2. CHECK FUEL PUMP CONNECTOR AND CHECK THAT AT PIN 2 THERE IS GROUND CONTINUITY

**YES, go to 3; NO, go to 5**

- 3. CHECK ON CONNECTOR ON THE PUMP SIDE, THE ELECTRICAL CHARACTERISTICS: between PIN 1 and PIN 2 there should be a resistance of 0.5 - 1 ohm - END
  - 4. CHECK CONTINUITY OF ORANGE/GREEN CABLE FROM PUMP CONNECTOR TO INJECTION RELAY 33 AND RESTORE CABLE HARNESS - END
  - 5. RESTORE GROUND CONNECTION - END
- 

### DIAGNOSIS INSTRUMENT CONNECTION CHECK

---

- 1. CHECK CONTINUITY OF WHITE/BLUE CABLE FROM PIN 14 OF THE CONTROL UNIT ON CABLE HARNESS SIDE TO PIN 3 OF THE BLACK CONNECTOR OF THE DIAGNOSIS

**YES, go to 2; NO, go to 4**

- 2. CHECK THE CONTROL UNIT CONNECTOR AS WELL AS THE DIAGNOSIS BLACK CONNECTOR

**YES, go to 3; NO, restore faulty connector - END**

- 3. CHECK CORRECT OPERATION OF THE DIAGNOSIS INSTRUMENT CONNECTION CABLE AND THE CORRECT INSTALLATION OF THE PLIERS ON THE BATTERY - END
- 4. CHECK ENGINE CABLE HARNESS - VEHICLE CABLE HARNESS CONNECTOR - END

#### **INJECTION RELAY 33 CHECK**

- 1. CHECK CONTINUITY OF THE ORANGE/GREEN CABLE FROM THE LOWER INJECTOR AT PIN 3 OF THE INJECTION RELAY 33, ALSO CHECKING THE ENGINE CABLE HARNESS - VEHICLE CABLE HARNESS CONNECTOR AND THE INJECTION RELAY CONNECTOR

**If there is continuity, go to 2; if there is not continuity, restore cable harness - END**

- 2. WITH KEY SET TO "ON" IS THERE VOLTAGE ON RED/BROWN CABLE OF THE INJECTION RELAY CONNECTOR, ON THE CABLE HARNESS SIDE?

**YES, go to 3; NO, go to 6**

- 3. WITH KEY SET TO "ON" IS THERE VOLTAGE ON ORANGE CABLE OF THE INJECTION RELAY CONNECTOR, ON THE CABLE HARNESS SIDE?

**YES, go to 4; NO, go to 7**

- 4. CHECK CORRECT OPERATION OF THE RELAY, THAT IS, PROVIDING VOLTAGE ON THE CORRESPONDING PIN TO THE RED/BROWN CABLE AND GROUND ON SPECIFIC PIN TO THE BROWN/BLACK CABLE IS THERE CONTINUITY BETWEEN THE OTHER TWO RELAY PINS?

**YES, go to 5; NO, replace the relay - END**

- 5. REPLACE THE CONTROL UNIT - END
- 6. CHECK CONTINUITY OF RED/BROWN CABLE FROM THE INJECTION RELAY 33 TO THE PROTECTION RELAY 19

**If there is continuity, go to PROTECTION RELAY 19 CHECK; if there is not continuity, restore cable harness - END**



- 7. CHECK CONTINUITY OF THE CABLE FROM THE INJECTION RELAY 33 TO THE PROTECTION RELAY 19: ORANGE (BETWEEN RELAY 33 AND FUSE F) and RED/BROWN (BETWEEN FUSE RELAY F AND RELAY 19)

**If there is continuity, go to PROTECTION RELAY 19 CHECK; if there is not continuity, restore cable harness - END**

---

#### **PROTECTION RELAY 19 CHECK**

- 1. WITH KEY SET TO OFF, DISCONNECT THE RELAY CONNECTOR AND CHECK CONTINUITY OF BLUE CABLE WITH GROUND

**If there is continuity, go to 2; if there is not continuity, restore cable harness - END**

- 2. WITH KEY SET TO OFF, DISCONNECT THE RELAY CONNECTOR AND CHECK IF THERE IS VOLTAGE ON RED/WHITE CABLE

**YES, go to 3; NO, restore the cable harness - END**

- 3. CHECK CORRECT OPERATION OF THE RELAY, THAT IS, PROVIDING VOLTAGE ON CORRESPONDING PIN TO THE GREEN/BLUE CABLE AND GROUND ON SPECIFIC PIN TO THE BLUE CABLE IS THERE CONTINUITY BETWEEN THE OTHER TWO RELAY PINS?

**YES, go to 4; NO, replace the relay - END**

- 4. CHECK CONTINUITY OF THE GREEN/BLUE CABLE FROM THE KEY CONNECTOR AT PIN 3 OF THE RELAY CHECKING ALSO THE KEY SWITCH CONNECTOR AND RELAY CONNECTOR

**If there is continuity, go to 5; if there is not continuity, restore cable harness - END**

- 5. WITH KEY SET TO OFF, CHECK IF THERE IS VOLTAGE ON RED/WHITE CABLE ON THE KEY SWITCH CONNECTOR

**YES, go to 6; NO, restore the cable harness - END**

- 6. WITH KEY SET TO ON AND CONNECTOR DISCONNECTED, CHECK ON THE SWITCH SIDE IF THERE IS LACK OF CONTINUITY BETWEEN THE TWO PINS CORRESPONDING TO THE RED/WHITE CABLE AND GREEN BLUE AND REPLACE THE KEY SWITCH- END
- 

#### **STARTER BUTTON CHECK**

- 1. WITH KEY SET TO "ON" DISCONNECT THE SWITCH CONNECTOR (4-ways black, inside the bow) AND CHECK IF THERE IS VOLTAGE + 5V ON PIN 2 ON THE CABLE HARNESS SIDE

**YES, go to 2; NO, go to 5**

---

- 2. WITH CONNECTOR DISCONNECTED (4-ways black, inside the bow) CHECK IF THERE IS GROUND CONNECTION ON PIN 3, ON THE CABLE HARNESS SIDE

**YES, go to 3; NO, go to 6**

- 3. CHECK WITH CONNECTOR DISCONNECTED (4-ways black, inside the bow) ON THE SWITCH SIDE, PUSHING THE SWITCH, IF THERE IS CONTINUITY BETWEEN PIN 2 AND PIN 3

**YES, go to 4; NO, go to 7**

- 4. REPLACE THE CONTROL UNIT - END
- 5. CHECK CONTINUITY OF PINK CABLE BETWEEN SWITCH CONNECTOR AND PIN 58 OF THE CONTROL UNIT, CHECKING ALSO THE ENGINE - VEHICLE CABLE HARNESS CONNECTOR

**YES, go to 4; NO, restore the cable harness - END**

- 6. CHECK CONTINUITY OF PINK/BLACK CABLE BETWEEN SWITCH CONNECTOR AND PIN 4 OF THE CONTROL UNIT, CHECKING ALSO THE ENGINE - VEHICLE CABLE HARNESS CONNECTOR

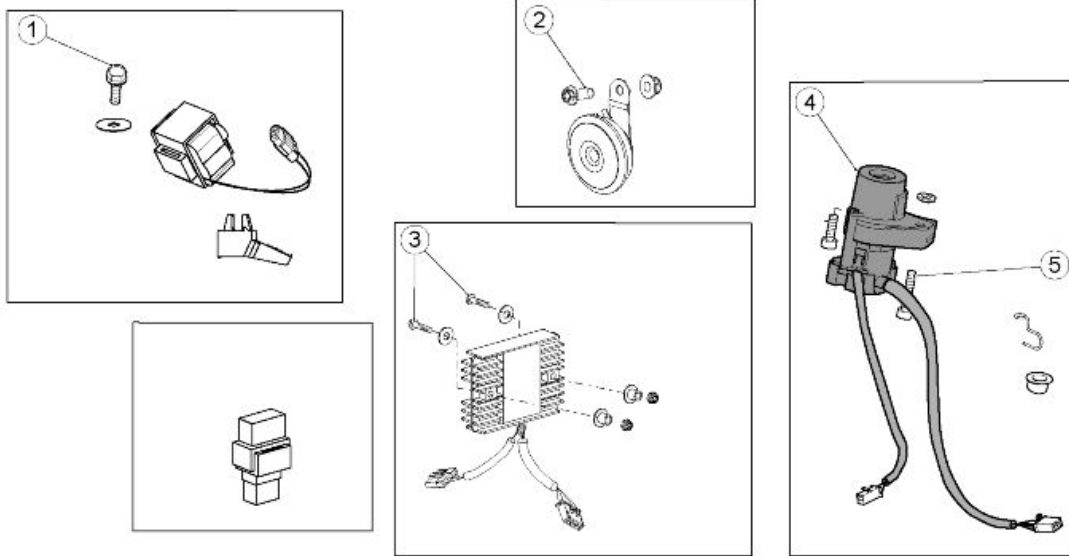
**YES, go to 4; NO, restore the cable harness - END**

- 7. REPLACE THE STARTER BUTTON COMPONENT - END
-

## INDEX OF TOPICS

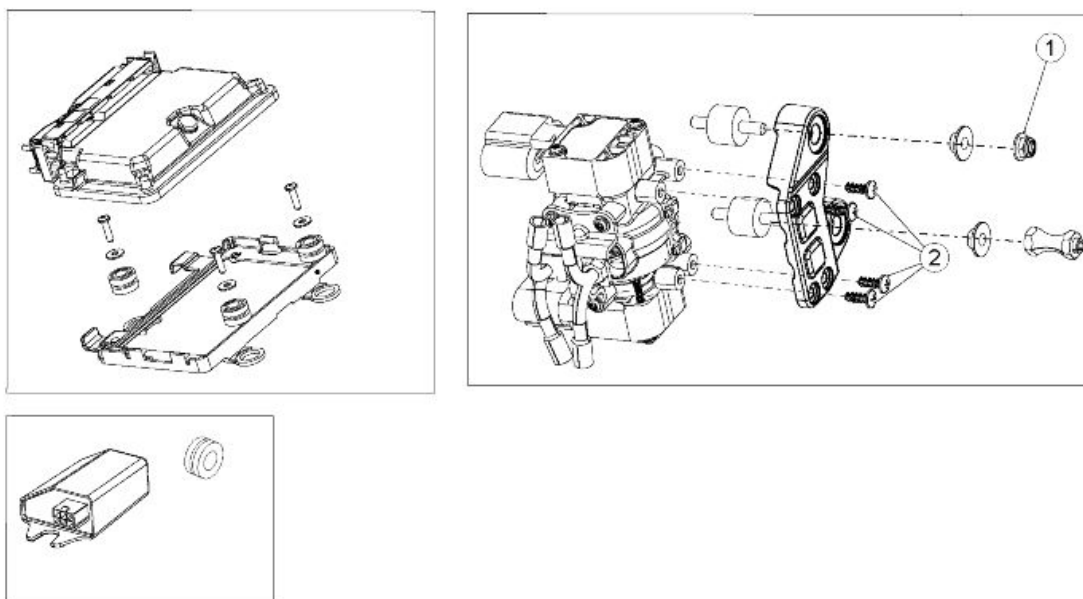
ELECTRICAL SYSTEM

ELE SYS



**FRONT ELECTRICAL SYSTEM**

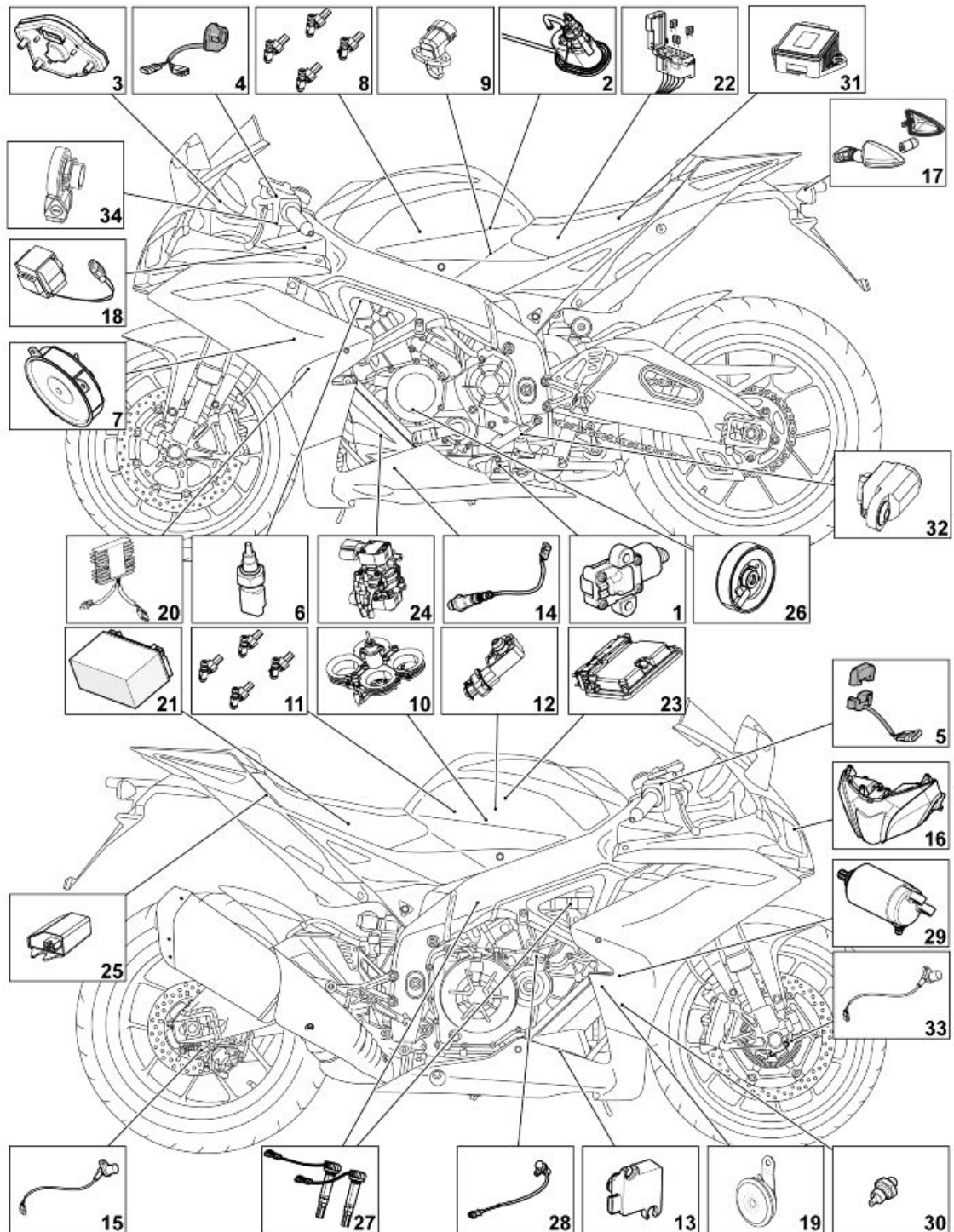
pos.	Description	Type	Quantity	Torque	Notes
1	Fall sensor mounting fixing screw	M6	1	8 Nm (5.9 lbf ft)	-
2	Horn fixing screw	M8	1	15 Nm (11.06 lbf ft)	-
3	Screw fastening the voltage regulator to the inner fairing	M6	2	6 Nm (4.42 lbf ft)	-
4	Shear head screw (to the left of the ignition lock)	M8	1	Manual	Tighten until the head shears off
5	Right hand ignition lock screw	M8	1	20 Nm (14.75 lbf ft)	-



**CENTRAL ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Upper Silentblock nut, demand sensor mounting bracket	M6	1	5 Nm (3.69 lbf ft)	-
2	Demand sensor fixing screw to mounting plate	SWP 4.9	4	1.2 Nm (0.88 lbf ft)	-

**Components arrangement**



Key:

1. Side stand sensor
2. Fuel pump
3. Instrument panel
4. Left hand switch
5. Right hand switch
6. Water Temperature Sensor
7. Cooling fans
8. Upper injectors
9. Air temperature sensor
10. Intake connectors
11. Lower injectors
12. Air pressure sensor
13. Exhaust valve
14. Lambda probe
15. Speed sensor
16. Headlamp
17. Rear turn indicators
18. Fall sensor
19. Horn
20. Voltage regulator
21. Battery
22. Auxiliary fuses
23. Control unit
24. Hand grip position sensor
25. Intake ducts connector control unit
26. Alternator
27. Coils
28. Timing sensor
29. Starter motor
30. Oil pressure sensor
31. Inertia sensor platform
32. Quick Shift
33. Front tone wheel sensor
34. a-PRC controls



**A RELAY CANNOT BE IDENTIFIED BASED ON THE FOLLOWING INDICATIONS ONLY: THIS HAS TO BE DONE ALSO IDENTIFYING THE COLOUR OF THE RELAY CABLES.**

**RELAY LAYOUT**

Component position in the electrical circuit diagram	Component name	Location on the vehicle
10	Low beam light relay	Windshield front part
9	High beam light relay	Windshield front part
31	Start-up relay	Rear undertail section
19	Protection relay	Under the saddle next to the battery, left side
33	Injection relay	Under the saddle next to the battery, right side
36	Fan control relay	In the niche of the headstock, on the left
25	Recovery logic relay (urgent service)	In the niche of the headstock, on the right

**Electrical system installation****INTRODUCTION****Scope and applicability**

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

**CHASSIS****Materials used and corresponding quantities**

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

- 1 Vehicle cable harness
- 1 Headlamp cable harness
- 1 License plate frame cable harness
- 1 Positive battery cable
- 1 Battery - engine ground cable
- 1 Ignition switch
- 1 ABS speed sensor
- 1 Start-up relay
- 5 Relays
- 1 Protection relay
- 1 Horn
- 1 Fall sensor
- 1 Headlamp
- 1 Taillight
- 1 Instrument panel
- 1 Right rear view mirror with turn indicator
- 1 Left rear view mirror with turn indicator
- 1 Rear right turn indicator
- 1 Rear left turn indicator
- 1 Fuel pump unit
- 1 Stand switch

- 1 Exhaust valve actuator
- 1 Oxygen sensor
- 2 Fans
- 1 Right handlebar control
- 1 Left handlebar control
- 1 Shift control
- 1 Regulator
- 1 Demand sensor
- 1 Variable geometry control unit
- 1 Battery
- 1 Tone wheel reading control unit
- 1 SensorBox
- 1 QuickShift

**Small parts and mountings**

- 6 Large black 290x4 clamps
- 14 Small black 160x2.5 clamps
- 5 Rubber clamps
- 2 TBEI M6x30 screws
- 2 TE M6x20
- 1 flanged TE 6x16 screw
- 2 M5x8 screws
- 2 TBEI M5x16 screws
- 1 TE M6x30 screw
- 3 Self-tapping 5x14 screws
- 2 flanged TBEI M5x9 screws
- 1 M6 nut
- 2 Flanged self-locking M6 nuts
- 10 Cable grommet (there are various types of cable grommets)
- 3 Cable guides
- 5 Relay socket rubber rings
- 11 Rubber block (there are various types of rubber blocks)
- 1 Rubber ring for the protection relay
- 1 Rubber ring for the fall sensor
- 1 AMP Superseal connector mounting
- 1 Relay/fall sensor mounting
- 1 Battery mounting bracket
- 2 T-shaped bushing (there are various types of T-shaped bushings)



- 2 6.6x18x1.6 washers
- 2 Washer
- 1 Spring washer
- 3 5x20x1.5 washer
- 1 Spacer
- 1 Spacer
- 1 Exhaust valve opening cable
- 1 Exhaust valve closing cable
- 1 Instrument panel mounting cover
- 1 Heat-protecting cover
- 2 Adhesive sponge

## **ENGINE**

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

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

- 1 Engine cable harness
- 1 Engine speed sensor
- 1 Control unit 7SM
- 1 Air temperature sensor
- 1 H2O temperature sensor
- 2 Coil with short cable (Cylinder 1 and Cylinder 4)
- 2 Coil with long cable (Cylinder 2 and Cylinder 3)
- 1 Gear sensor
- 1 Secondary air solenoid
- 1 Front motorised throttle body
- 1 Rear motorised throttle body
- 2 MAP sensor
- 1 Alternator
- 1 Starter motor
- 4 Upper injectors
- 4 Lower injectors

### **Small parts and mountings**

- 1 Control unit mounting
- 4 Large black 178x4 clamps
- 4 Self-tapping 5x20 screws
- 3 Self-tapping screws
- 3 Washers
- 3 Silentblocks

- 2 Self-tapping screws
- 4 AMP Superseal connector mountings
- 1 Mounting for the Framatome connector
- 2 Small black clamps
- 1 Rubber clamp
- 1 Flanged M6x16 screw
- 1 Secondary air solenoid mounting
- 3 Secondary air pipe (there are various types of pipes)
- 4 Rubber manifolds
- 4 Clip-on clamps

---

### Motorcycle division

The wiring distribution 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.

#### CHASSIS

- Instrument panel connector
- Demand sensor connectors
- Start-up relay connector
- Front speed sensor connector
- Rear speed sensor connector
- Fall sensor connector
- Safety relay connector
- Protection relay connector
- Injection relay connector
- Taillight connector
- Fuel pump connector
- Exhaust valve actuator connector
- Engine-vehicle interface connector
- Flywheel connector

- Regulator connector
- Fan connectors
- Starter motor eyelet
- Stand switch connector
- Right handlebar control connector
- Left handlebar control connector
- Clutch connector
- Relay connectors
- Ignition switch connector
- Immobilizer aerial connector
- Oxygen sensor connector
- CLF control unit connector
- SensorBox connector

#### **ENGINE**

- Engine revolution sensor connector - Output "30"
- 7SM control unit connector - Outputs "25" and "26"
- Coil connectors - Outputs "29", "8", "7" and "28"
- Gear sensor connector - Output "15"
- Secondary air solenoid connector - Output "11"
- Front motorised throttle body connector - Output "13"
- Rear motorised throttle body connector - Output "14"
- MAP sensor connector - Outputs "11" and "27"
- Upper injector connectors - Outputs "20", "21", "22" and "23"
- Lower injector connectors - Outputs "5", "6", "16" and "17"

**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.

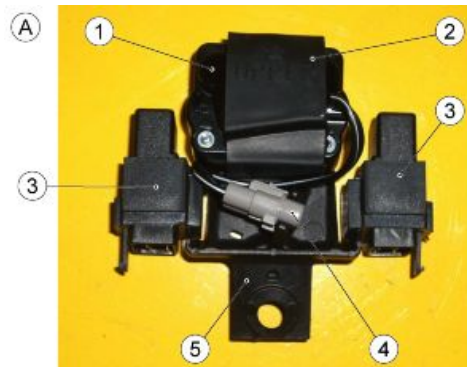
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## Front side

### TABLE A - RELAY AND FALL SENSOR MOUNTING PRE-FITTING

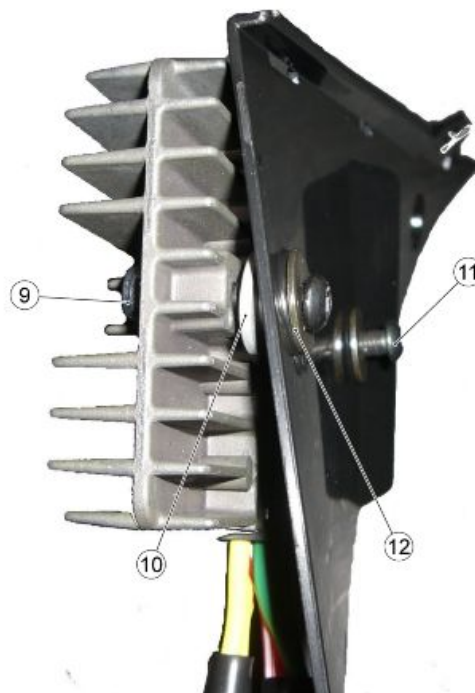
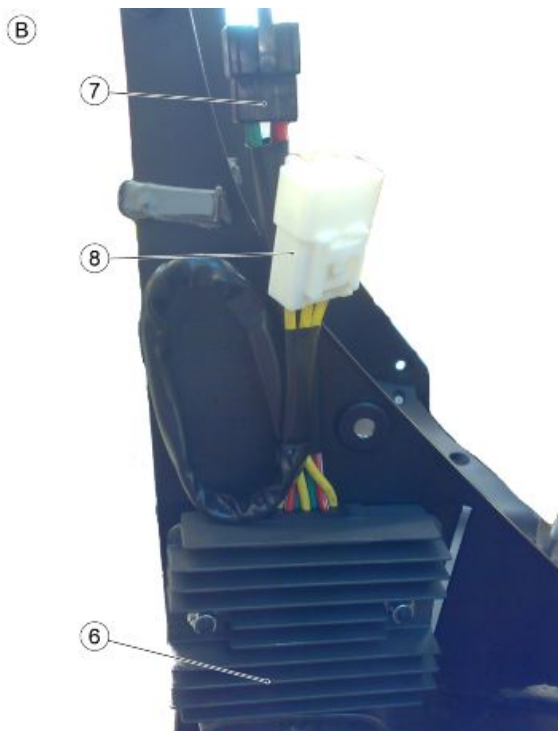
Check that the fall sensor has been positioned correctly, with the arrow above the indication UPPER facing upward.

1. fall sensor
2. Fall sensor rubber ring
3. Relay
4. Fall sensor connector
5. Mounting



### TABLE B - REGULATOR PRE-FITTING

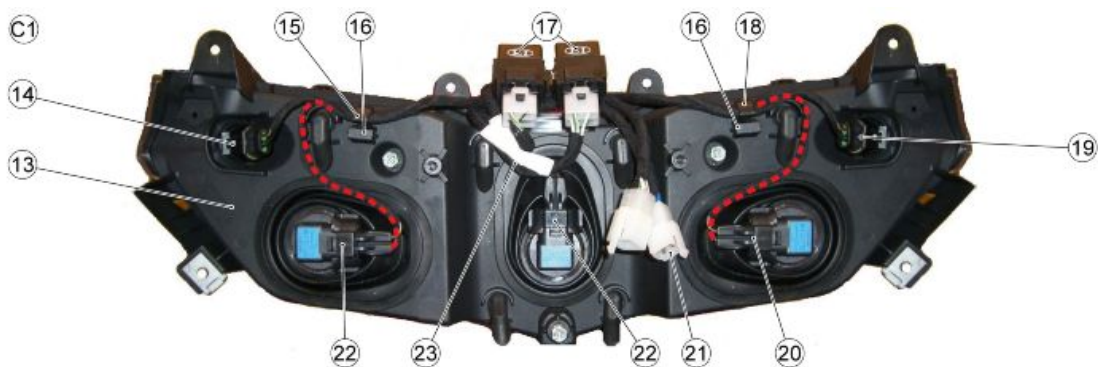
6. Regulator
7. Regulator connector
8. Flywheel connector
9. Self-locking nut (x2)
10. T-shaped bushing (x2)
11. TBEI M6x30 screw (x2)
12. Washer (x2)



### TABLE C1 - HEADLAMP PRE-FITTING

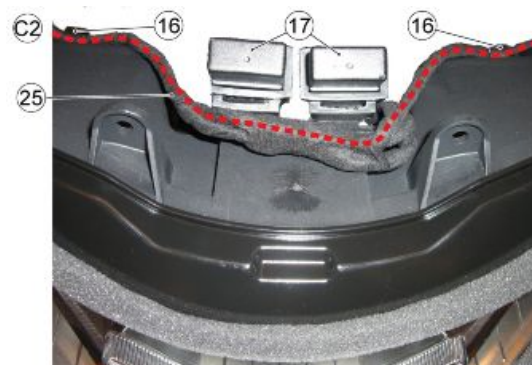
The headlamp cable harness (23) and the two relays with a relay socket rubber ring (17) must be fit on the headlamp (13) as shown in the photos below.

- 13. Headlamp
- 14. Left position light connector
- 15. Cable harness routing in the cable grommet
- 16. Cable grommet
- 17. Relay with relay socket rubber ring
- 18. Cable harness routing in the cable grommet
- 19. Right position light connector
- 20. Right low beam light connector
- 21. Vehicle cable harness interface connectors
- 22. High beam light connector
- 23. Headlamp cable harness
- 24. Left low beam light connector



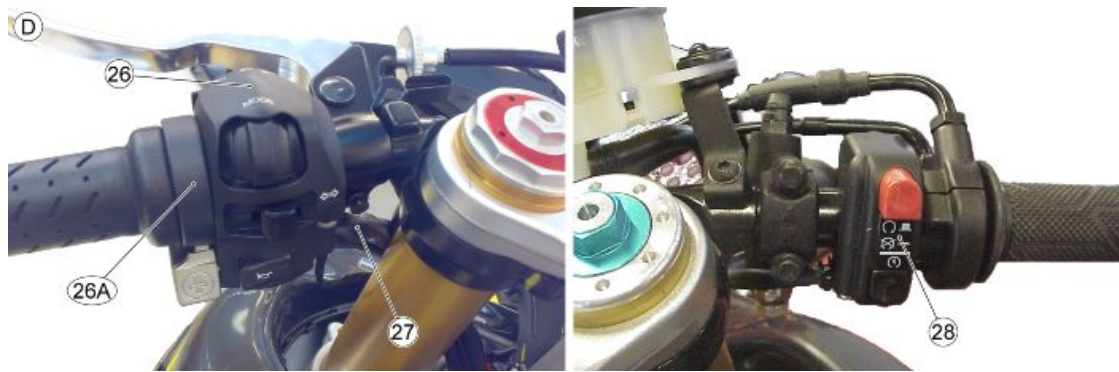
**TABLE C2 - HEADLAMP PRE-FITTING**

- 16. Cable grommet
- 17. Relay with relay socket rubber ring
- 25. Cable harness routing behind the relay



**TABLE D - HANDLEBAR CONTROLS**

- 26. Left handlebar control
- 26A. Quick Shift control on handlebar
- 27. Clutch connector
- 28. Right handlebar control



#### TABLE E - INSTRUMENT HOLDER SUPPORT AND FRONT PART

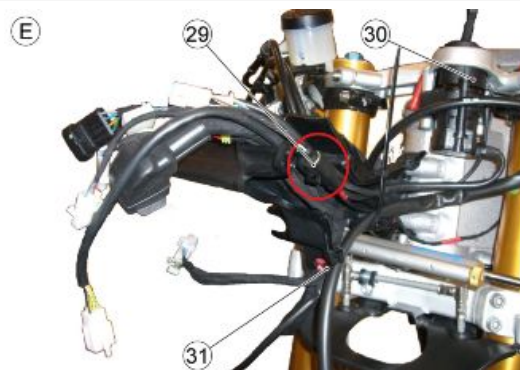
Use a clamp (31) to fasten the vehicle cable harness, in correspondence of the grey taping, on the specific seat located on the instrument holder support.

Connect the Immobilizer antenna connector (30) to the corresponding cable harness connector.

29. Antenna connector

30. Ignition switch

31. Clamp

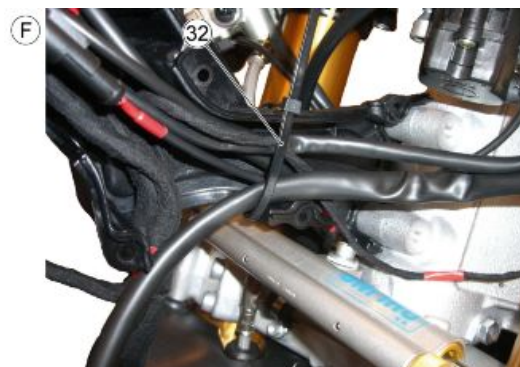


#### TABLE F - INSTRUMENT HOLDER ARCH BRACE AND FRONT PART

Pass all the cable harnesses arriving from the right semi-handlebar (right handlebar control + front stop switch) and from the left semi-handlebar (left handlebar control + key switch) inside of the right arch brace, as shown in the figure; also pass the cable with the clutch connector on the vehicle cable harness together with the left switch cable harness.

Use a clamp (32), as shown in figure, to hold the various cable harnesses inside the arch brace.

32. Clamp



### TABLE G - INSTRUMENT HOLDER ARCH BRACE AND FRONT PART

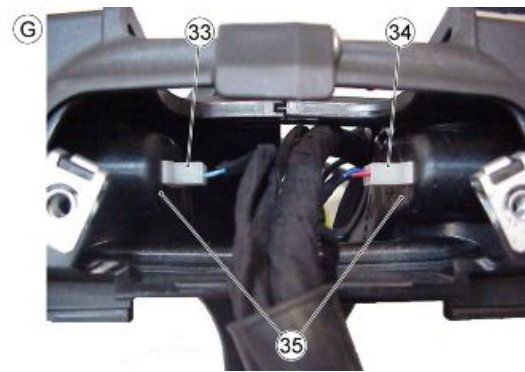
The left arch brace can now be fit.

After fitting the left arch brace, the clamp used for holding the cable harnesses inside the arch brace itself must be cut and removed.

33. Left turn indicator connector (cable colours: light blue and blue)

34. Right turn indicator connector (cable colours: red and blue)

35. Insert the connectors into their seats on the arch brace



### TABLE H - INSTRUMENT HOLDER SUPPORT AND FRONT PART

36. Ignition switch connector (cable harness with red taping)

36A. Quick Shift control connector

37. Left handlebar control connectors

38. Antenna connector

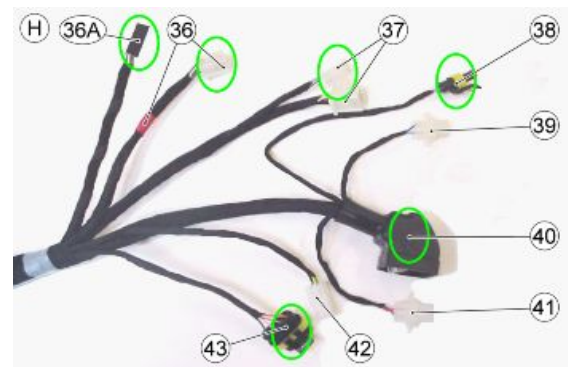
39. Left turn indicator connector (cable colours: light blue and blue)

40. Instrument panel connector

41. Right turn indicator connector (cable colours: red and blue)

42. Front stop switch connector

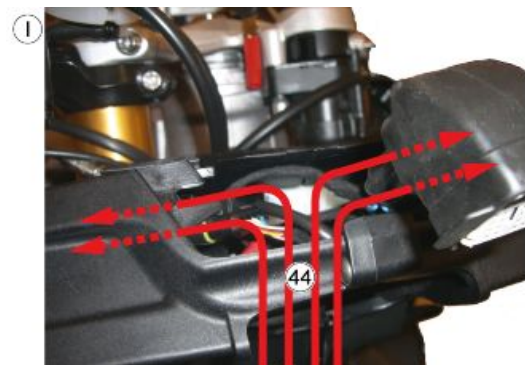
43. Right handlebar control connector



### TABLE I - INSTRUMENT HOLDER SUPPORT AND FRONT PART

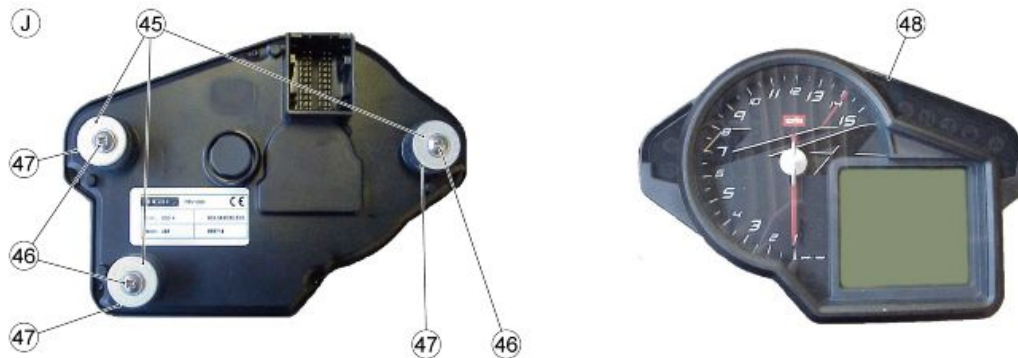
Make the connections for all connectors. The key switch connector has a longer cable harness in comparison to the 6 pin connectors for the left light switch. The cable harness side ignition switch connector is distinguished with red taping on its branch.

44. Insert the connectors inside the two support compartments (left and right)



**TABLE J - INSTRUMENT HOLDER ARCH BRACE AND FRONT PART**

- 45. Rubber ring (x3)
- 46. Screw (x3)
- 47. Washer (x3)
- 48. Instrument panel

**TABLE K - INSTRUMENT HOLDER ARCH BRACE AND FRONT PART**

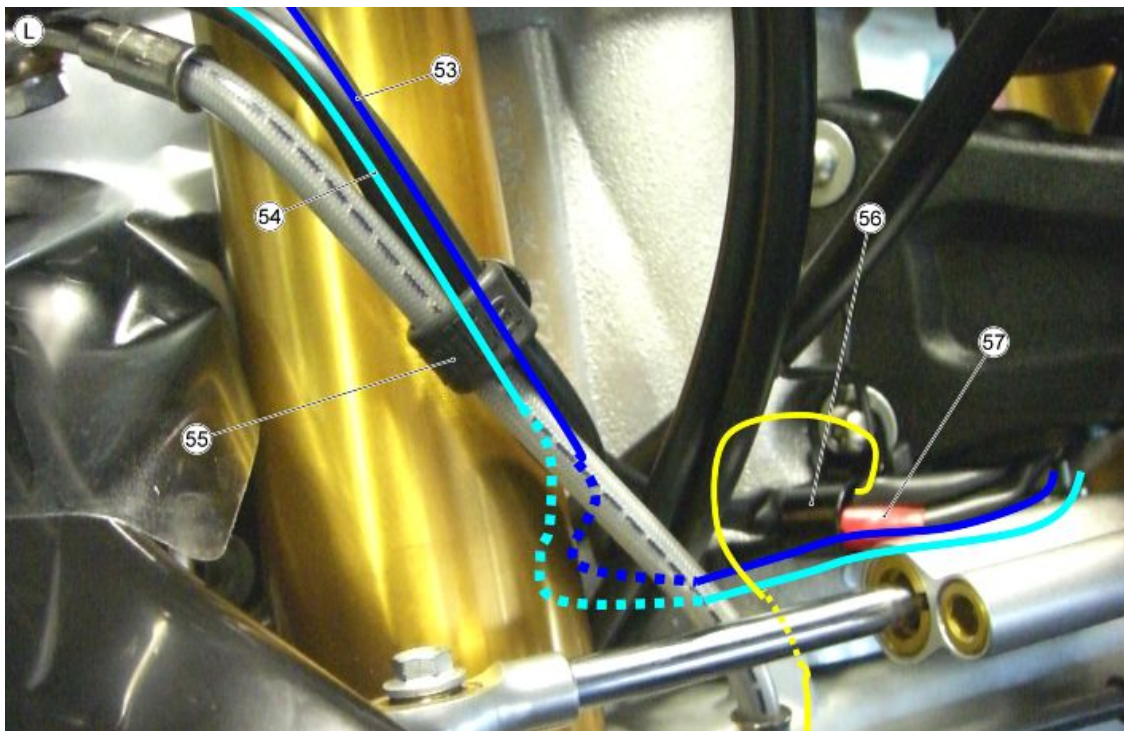
- 49. Insert the instrument panel rubber rings in their seats on the arch brace.
- 50. Instrument panel connector
- 51. Instrument panel mounting cover
- 52. Screw

**TABLE L - INSTRUMENT HOLDER SUPPORT AND FRONT PART****Right side**

**Check that the cable grommets are not tensioned on the right and left cable grommet during steering rotation.**

- 53. Cable harness routing to right handlebar control
- 54. Front stop switch cable harness routing
- 55. Rubber clamp
- 56. Cable grommet
- 57. Red reference tape on the right handlebar control cable harness in correspondence of the cable grommet.





**TABLE M - INSTRUMENT HOLDER SUPPORT AND FRONT PART**

**Left side**

**Check that the cable grommets are not tensioned on the right and left cable grommet during steering rotation.**

58. Antenna cable harness routing

59. Ignition switch cable harness routing

60. Rubber clamp

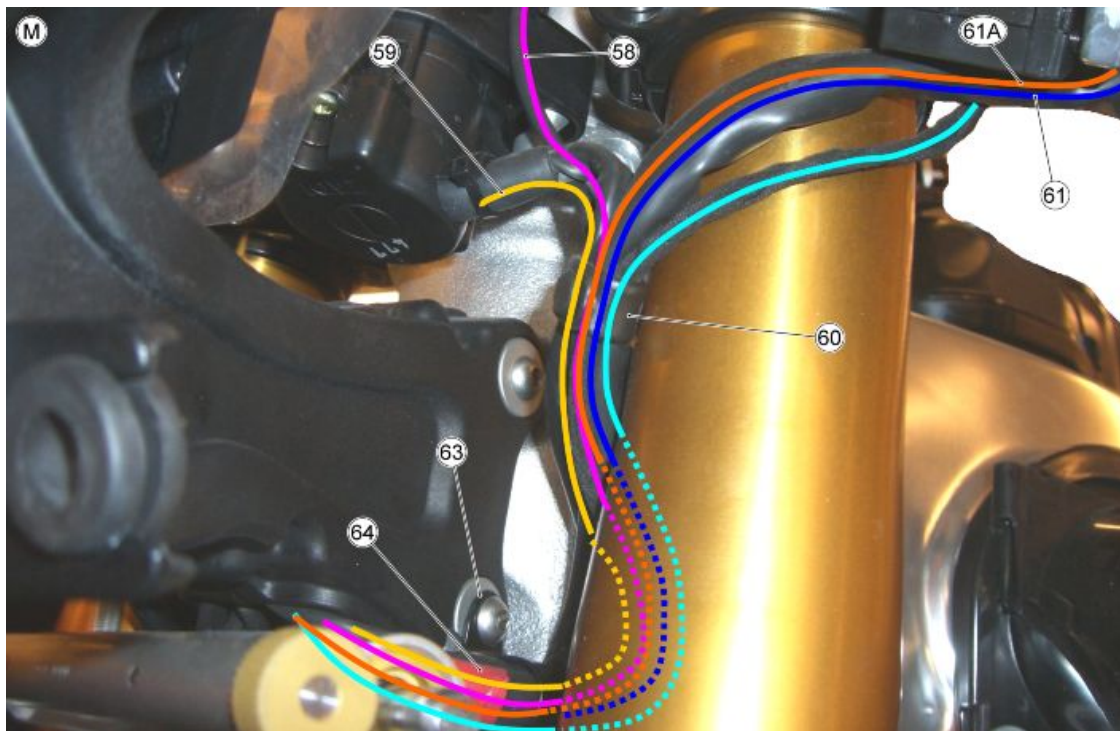
61. Cable harness routing to left handlebar control

61A. Quick Shift control cable harness routing

62. Clutch cable harness routing

63. Cable grommet

64. Red tape on the clutch and left handlebar control cable harness in correspondence of the cable grommet.



#### TABLE N - COMPLETION OF THE FRONT

65. Headlamp connectors

66. Headlamp connector positioning (as shown in the figure)

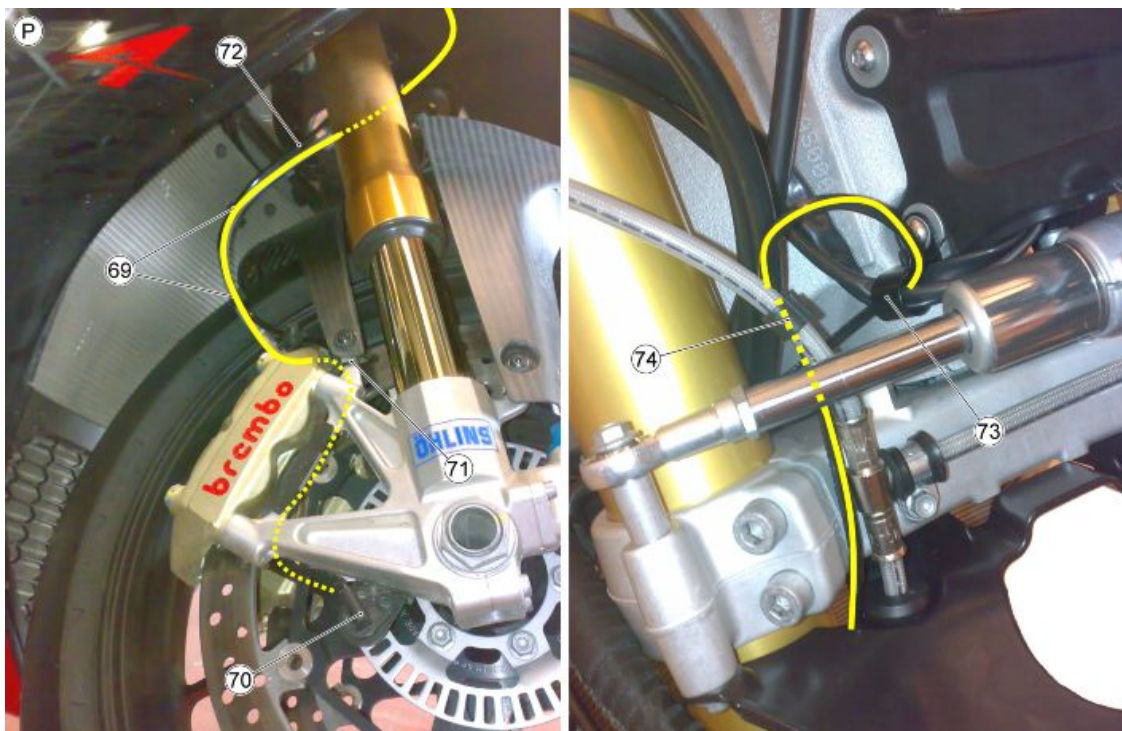
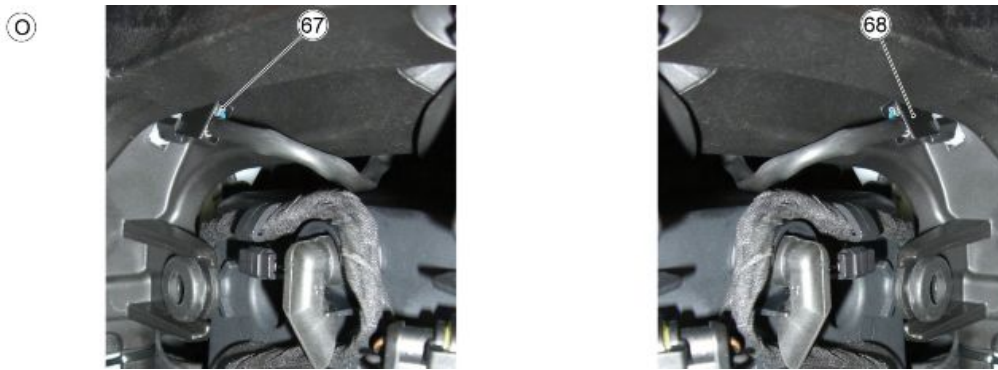


#### TABLE O - COMPLETION OF THE FRONT

**Check that the turn indicator connectors are inserted correctly and do not return inside the instrument holder arch brace.**

67. Front right turn indicator connectors

68. Front left turn indicator connector



#### TABLE P - FRONT SPEED SENSOR

69. Cable grommet

70. Front speed sensor

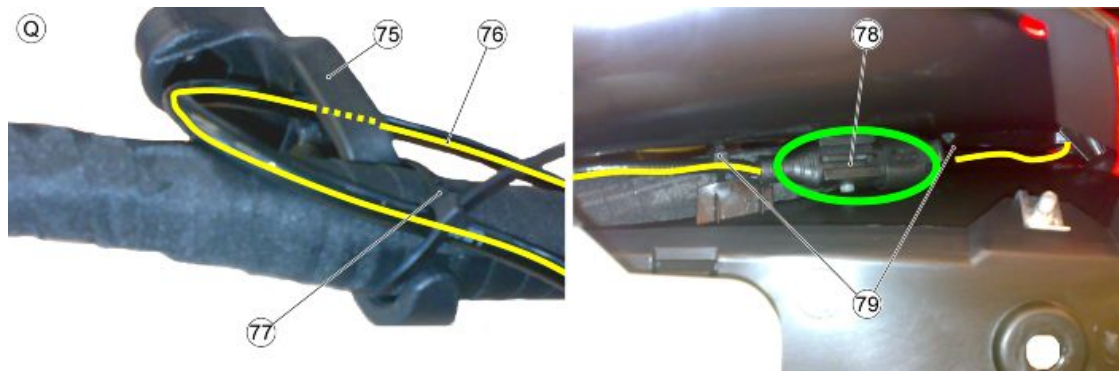
71. Clamp

72. Front speed sensor cable harness routing

73. Speed sensor cable harness routing inside the cable grommet, between throttle cables and frame

74. Cable grommet

**Ensure that the cable grommet (74) is not interfering with the steering damper during its movement**

**TABLE Q - FRONT SPEED SENSOR CONNECTOR POSITION**

75. Radiator support

76. Front speed sensor cable harness

77. Clamp

**Route cable harness on clutch cable grommet and tie it together with the front speed sensor**

78. Front speed sensor connector

79 Clamps

## Central part

**TABLE A - RADIATOR AREA**

**Right side**

1. Cable grommet

2. Vehicle cable harness

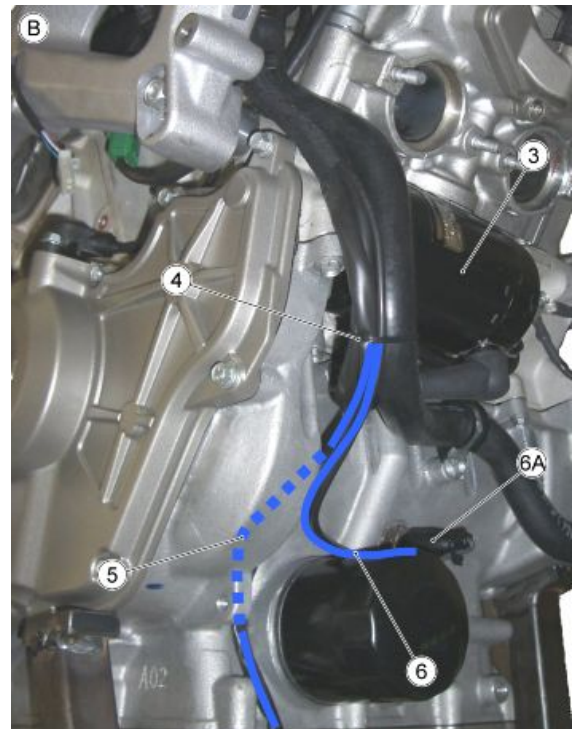


**TABLE B - RADIATOR AREA**

- 3. Starter motor
- 4. Clamp
- 5. Exhaust valve actuator cable harness routing
- 6. Oil pressure sensor cable harness routing
- 6A. Oil pressure sensor.

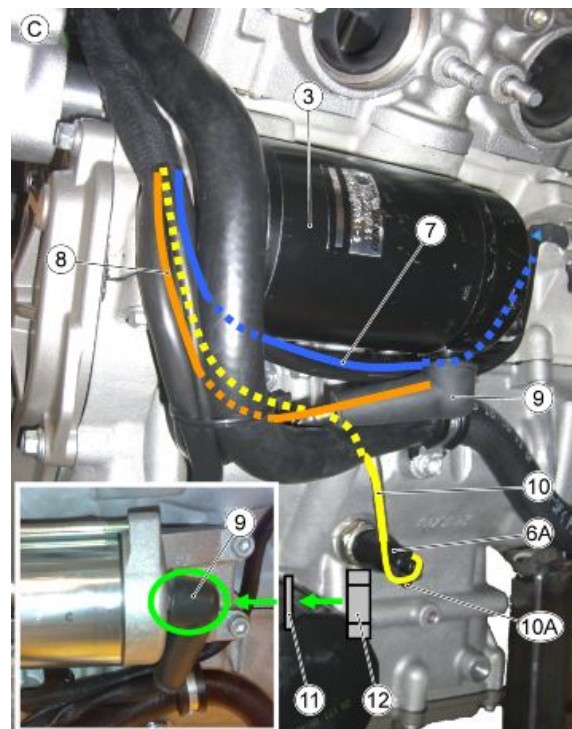
**CAUTION**

THE FEMALE FASTON OF OIL PRESSURE SENSOR FEATURES A RETAINING TANG. USE A SMALL SCREWDRIVER TO RELEASE TANG AND DISCONNECT THE FASTON



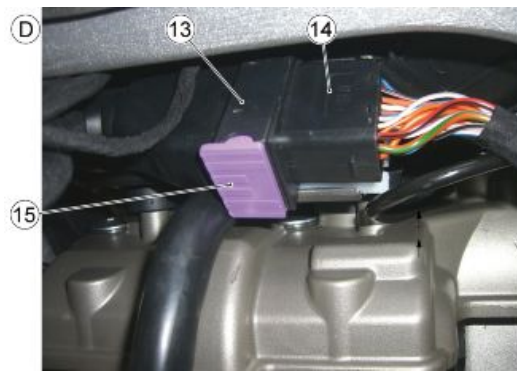
**TABLE C - RADIATOR AREA**

- 7. Ground cable harness routing (behind water pipe and behind the starter motor)
- 8. Starter motor cable harness routing (behind water pipe)
- 9. Starter motor eyelet
- Cover motor nut and square terminal with waterproof dielectric grease. Quantity: 0.5 g (0.18 oz)**
- 10. Oil pressure sensor cable harness routing (behind water pipe)
- 10A. Clamp
- 11. Washer
- 12. M6 Nut



**TABLE D - RADIATOR AREA**

- 13. Vehicle connector
- 14. Engine connector
- 15. Check that the connectors are inserted correctly and that the purple slide is at the end of stroke (as shown in the figure).

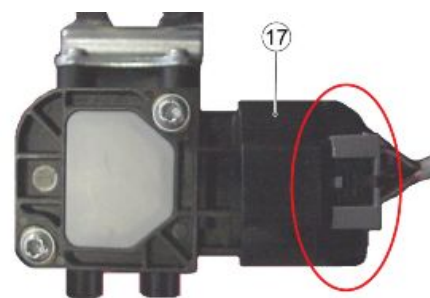


**TABLE E - RADIATOR AREA**

Left side

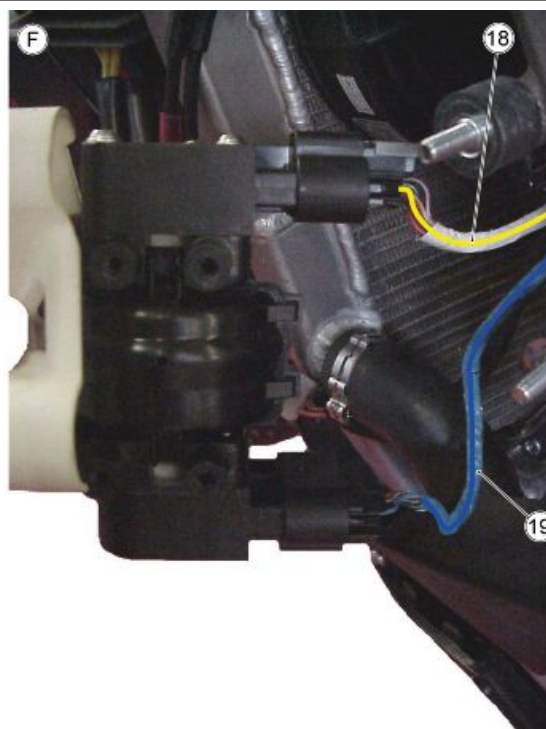
Check that the connectors are inserted correctly and that the security locks are in the locked position.

- 16. Master Demand connector (blue).
- 17. Slave Demand connector (white)



**TABLE F - DEMAND SENSOR FITTING**

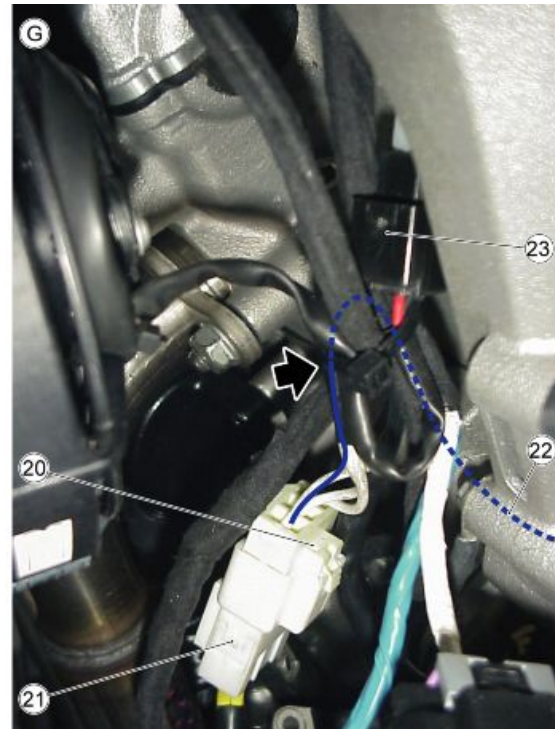
- 18. Slave Demand cable harness routing (creating a "U-bend" in the cable harness)
- 19. Master Demand cable harness routing (creating a "U-bend" in the cable harness)



**TABLE G - DEMAND SENSOR FITTING**

**Clamp where indicated.**

- 20. Flywheel connector
- 21. Flywheel connector to the regulator
- 22. Flywheel cable harness routing
- 23. Fan connector

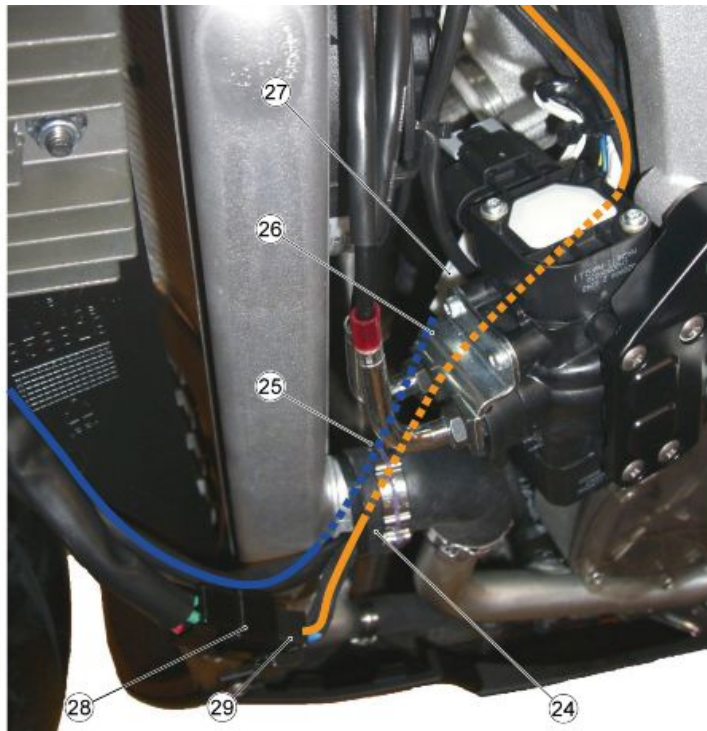
**TABLE H - DEMAND SENSOR FITTING**

- 24. Clamp (flywheel cable harness and regulator cable harness routing)
- 25. Flywheel cable harness routing

**The flywheel connectors must be positioned between the two demand connectors, so that they remain away from the exhaust pipes.**

- 26. Flywheel connector to the regulator
- 27. Flywheel connector
- 28. Regulator connector
- 29. Regulator connector on the vehicle cable harness

(H)



**TABLE I**

**Right side**

- 30. Instrument panel branch vehicle cable harness
- 31. Fan connector 32. Clamp



**TABLE J**

- 32A. Tie
- 32B. Fan connector
- 32C. Instrument panel branch vehicle cable harness



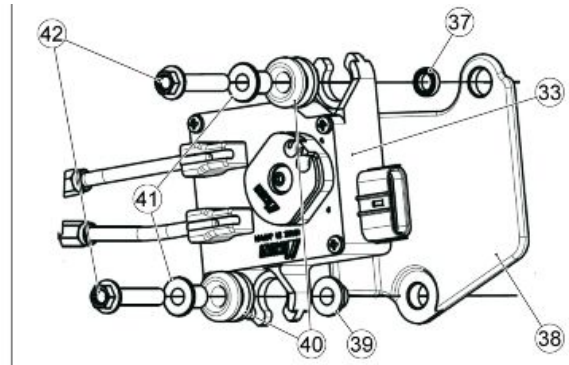
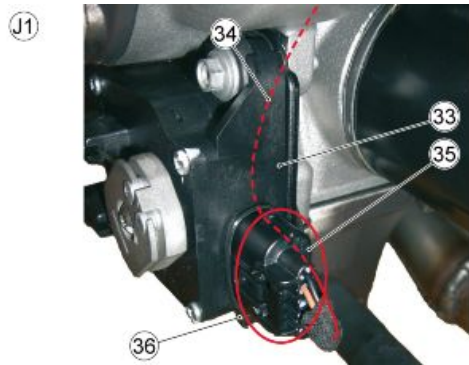
**TABLE J1 - EXHAUST VALVE ACTUATOR**

**Positioning and calibration**

- 33. Exhaust valve actuator
- 34. Exhaust valve actuator cable harness routing
- 35. Exhaust valve actuator connector

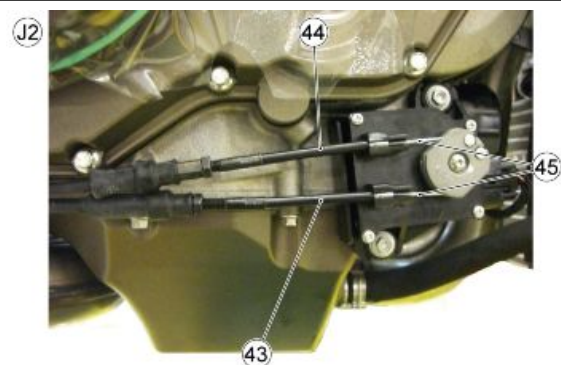


- 36. Clamp
- 37. Spacer
- 38. Heat-protecting cover
- 39. Spacer
- 40. Rubber ring
- 41. T-shaped bushing
- 42. TE M6x30 screw



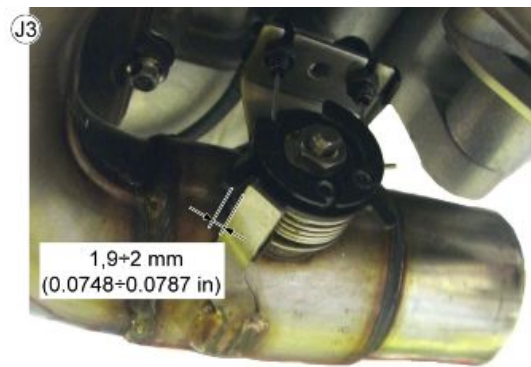
**TABLE J2 - EXHAUST VALVE ACTUATOR**  
**Positioning and calibration Actuator - valve**  
**Bowden cable (45) fitting procedure**

- Insert the cables with the set screws closed in the following sequence:
  1. Valve side closing cable (44) (univocal fitting)
  2. Actuator side closing cable (44)
  3. Valve side opening cable (45) (univocal fitting)
  4. Actuator side opening cable (45)
    - Turn the closing cable set screw until there is a distance of 1.9-2 mm (0.0748-0.0787 in) between the mechanical endstop and the pulley.
    - Finally tighten the lock nut on the set screw.

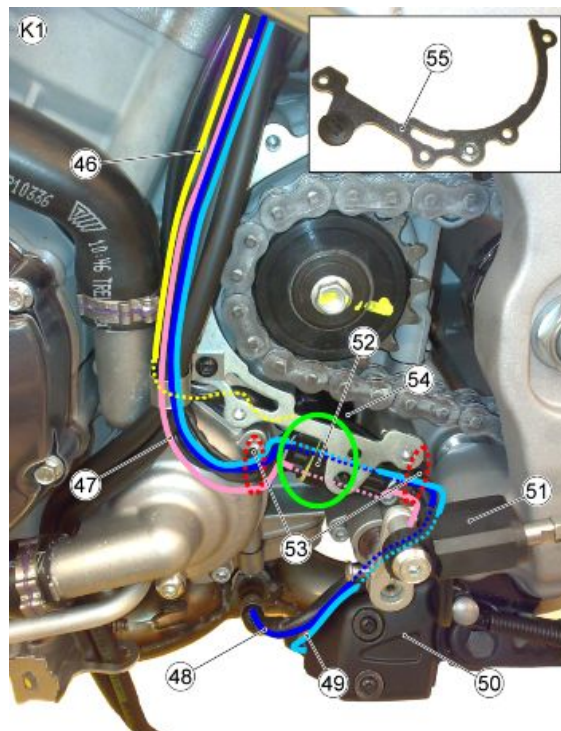


**TABLE J3 - EXHAUST VALVE ACTUATOR****Positioning and calibration Actuator - valve  
Bowden cable (45) fitting procedure**

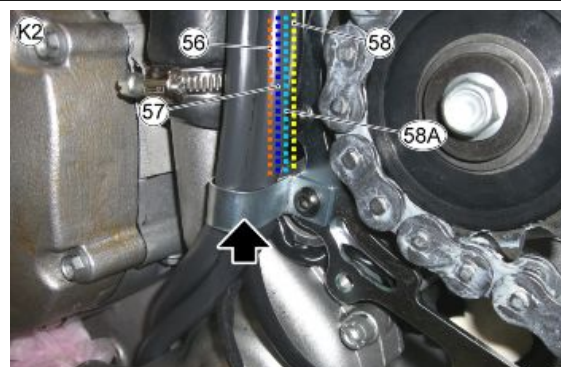
- Turn the opening cable (43) set screw until the cable tension is identical to the closing cable (44).
- Finally tighten the lock nut on the set screw.

**TABLE K1 - PINION CASING AREA**

- 46. Gear sensor cable harness routing
- 47. Oxygen sensor connector on the vehicle cable harness
- 48. Gear sensor
- 49. Oxygen sensor connector
- 50. Stand switch cable harness routing
- 51. Oxygen sensor cable harness routing
- 52. Clamp
- 53. Stand switch
- 54. Lambda probe
- 55. Mounting

**TABLE K2****Pass the cable harnesses behind the cable grommet that closes the two fuel breather pipes.**

- 56. Quick shift cable harness routing
- 57. Oxygen sensor cable harness routing
- 58. Gear sensor cable harness routing
- 58A. Stand switch cable harness routing



**TABLE K3 - QUICK SHIFT**

56. Quick shift cable harness routing

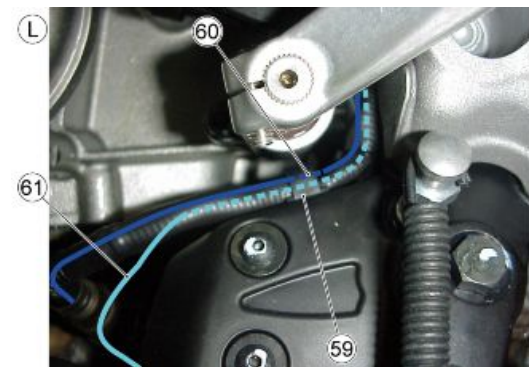


**TABLE L**

59. Cable guide

60. Oxygen sensor cable harness routing

61. Stand switch cable harness routing



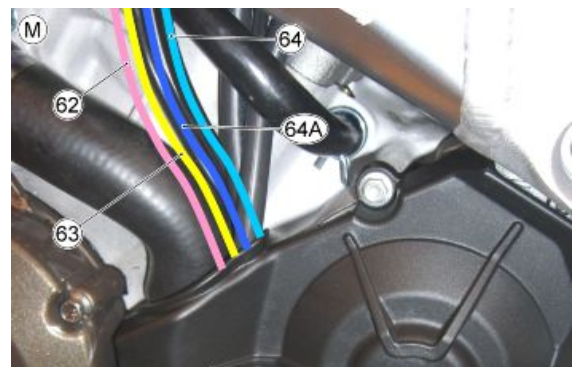
**TABLE M**

62. Quick Shift cable harness routing

63. Gear sensor cable harness routing

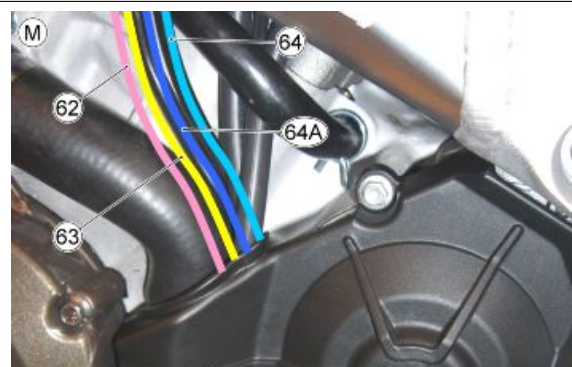
64. Stand switch cable harness routing

64A. Oxygen sensor cable harness routing



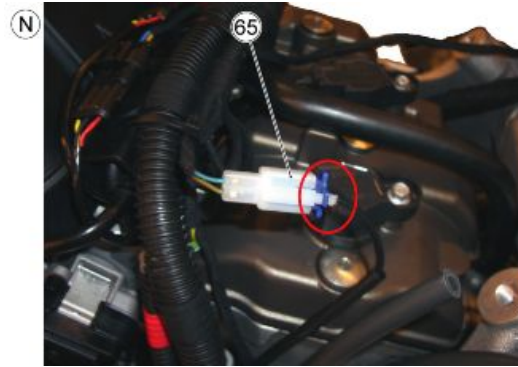
**TABLE M1**

64B. Quick Shift connector



**TABLE N**

65. Stand switch connector

**TABLE O**

66. Set the connectors for stand switch, Quick Shift and gear sensor under the two corrugated pipes.

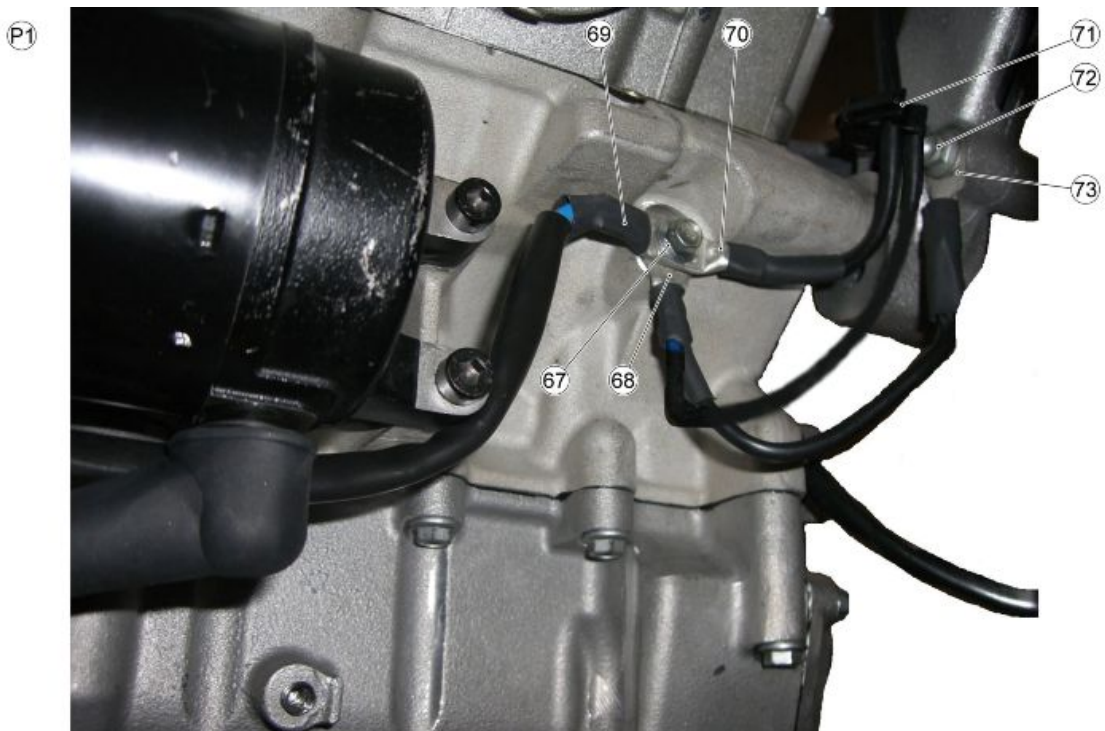
**TABLE P1 - NOTES FOR FITTING THE GROUND CABLES**

- 67. Flanged M6x15 screw
- 68. Engine GND lug terminal from the engine cable harness
- 69. Engine GND lug terminal from the vehicle cable harness
- 70. Engine - battery ground cable engine Gnd lug terminal
- 71. Cable grommet
- 72. Flanged M6x16 screw
- 73. Chassis GND lug terminal from the engine cable harness

To avoid inverting the ground connections, unscrew the screw (67) from the engine; to connect the other ground connections, the chassis ground cable (73) can be connected with the screw (72), as shown in the figure.

**CAUTION**

**BE CAREFUL NOT TO INVERT THE TWO GROUND LUG TERMINALS (68) AND (73).**

**TABLE P2 - ENGINE - BATTERY GROUND CABLE ROUTING**

Clamp the engine- battery ground cable harness to the Demand sensor cable harness as far up as possible.

74. Clamp

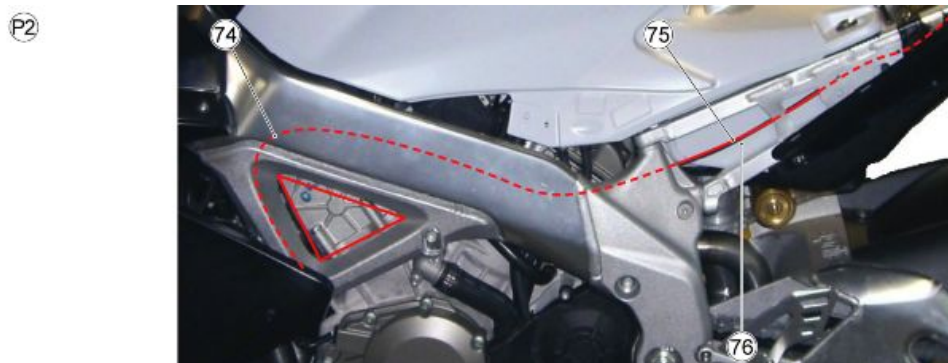
75. Battery - engine ground lead

76. Engine - battery ground cable harness routing

The engine - battery ground cable harness must not be visible within the area indicated with a red triangle.

**CAUTION**

**BE CAREFUL NOT TO INVERT THE TWO GROUND LUG TERMINALS (68) AND (73).**

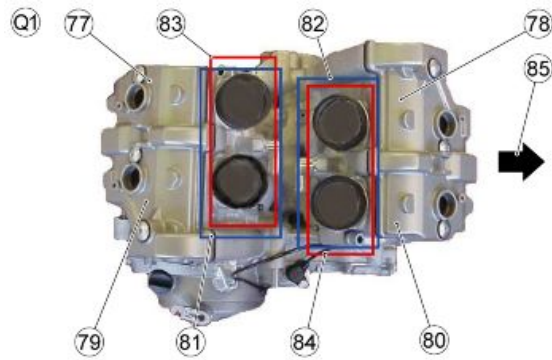


**CENTRAL Q1 - NOTES FOR ENGINE CABLE HARNESS FITTING**

Definition of component numbering:

**Upper view**

- 77. Cylinder 1
- 78. Cylinder 2
- 79. Cylinder 3
- 80. Cylinder 4
- 81. Cylinder bank 1
- 82. Cylinder bank 2
- 83. Throttle body 1 (FARF 1)
- 84. Throttle body 2 (FARF 2)



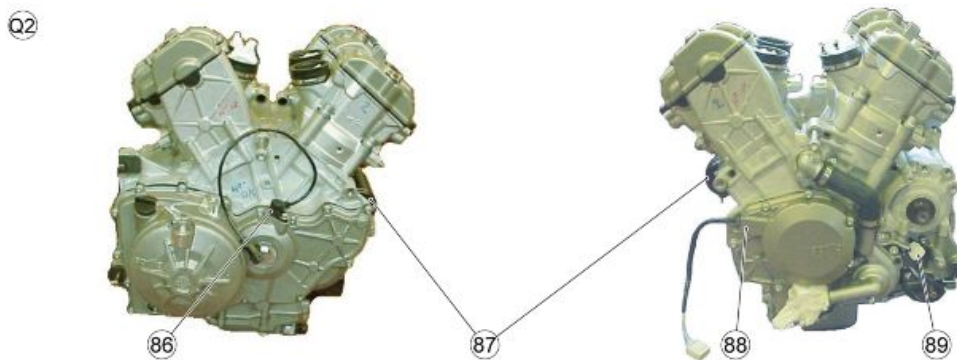
**CENTRAL Q2**

**Right side view**

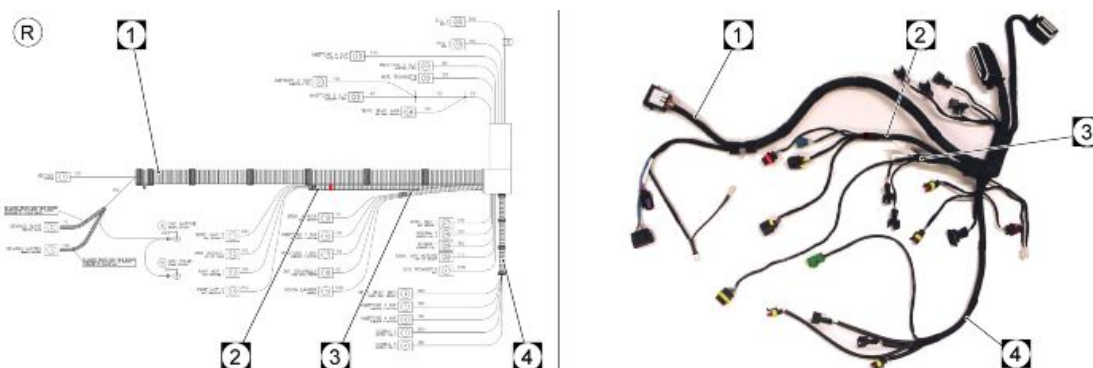
- 86. Engine speed sensor
- 87. Starter motor

**Left side view**

- 87. Starter motor
- 88. Alternator
- 89. Gear sensor



**TABLE R - ENGINE CABLE HARNESS LAYOUT**

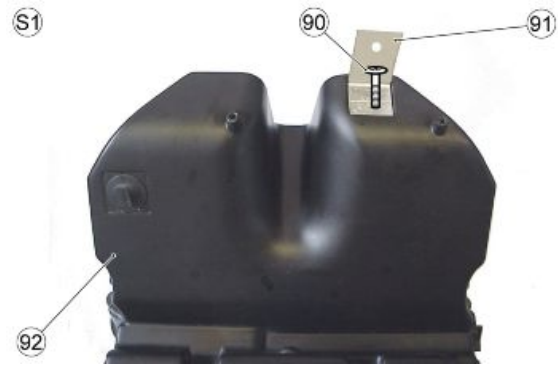


**TABLE S1 - FILTER BOX COVER AND LOWER FILTER BOX PREPARATION**

Fit four mountings for the "coil" connectors and the mounting for the "vehicle" connector as shown in figures S1, S2 and S3.

**Lower filter box**

- 90. Self-tapping 5x20 screw
- 91. Connector mounting
- 92. Connector mounting



**TABLE S2**

**Lower filter box**

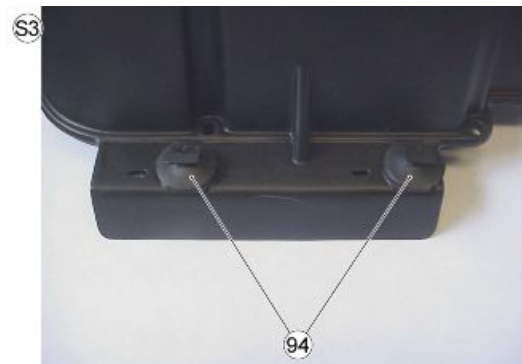
- 93. Connector mounting



**TABLE S3**

**Filter box cover**

- 94. Connector mounting



**TABLE T - CONTROL UNIT MOUNTING PREPARATION**

Fit the three silent blocks (96) onto the seats on the mounting; then, fit the 7SM control unit (95) using the specific links.

- 95. 7SM control unit
- 96. Silent block
- 97. Control unit mounting



**TABLE U - MOTORISED THROTTLE BODY CONNECTION PREPARATION AND SECONDARY AIR SOLENOID FITTING**

Before fitting the motorised throttle bodies (98 and 99), the respective engine cable harness connectors must be connected: on branch "2" of the cable harness (corrugated pipe marked with RED tape), there are outputs 13 and 14, which are respectively motorised throttle body 1 (98 - rear) (shorter branch) and motorised throttle body 2 (99 - front) (longer branch).

- 98. Rear motorised throttle body
- 99. Front motorised throttle body



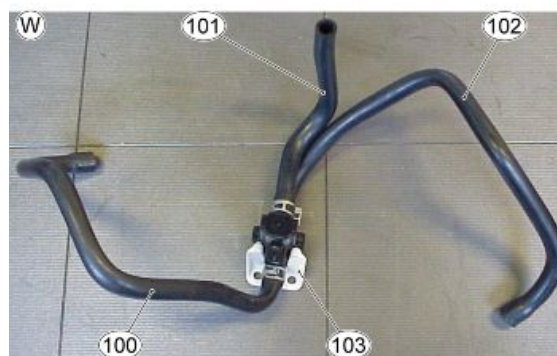
**TABLE V**

Check that the connectors are inserted correctly and that the security locks are in the locked position.



**CENTRAL W - FITTING THE PIPES ON THE SECONDARY AIR SOLENOID**

- 100. Pipe
- 101. Pipe
- 102. Pipe
- 103. Secondary air solenoid mounting



**TABLE X - FITTING AND CONNECTING THE SECONDARY AIR SOLENOID AND FITTING THE RUBBER MANIFOLD WITH THE CLIP-ON CLAMP**

- 104. Rubber manifold
- 105. Clip-on clamp





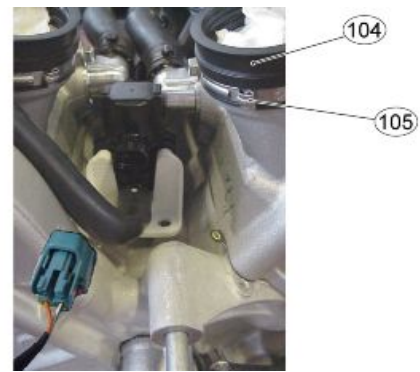
**TABLE Y - MOTORISED THROTTLE BODY FITTING**

First fasten the "Motorised Throttle Body 2 (front)" to the rubber manifolds with the specific clip-on clamps.

Then fasten the "motorised throttle body 1 (rear)" to the rubber manifolds with the clip-on clamps using the specific tool.

106. Cable harness routing (branch "4") under the fuel pipe

(X)



**Specific tooling**

**020877Y Pliers for clamps**

**TABLE Z**

First fasten the "Motorised Throttle Body 2 (front)" to the rubber manifolds with the specific clip-on clamps.

Then fasten the "motorised throttle body 1 (rear)" to the rubber manifolds with the clip-on clamps using the specific tool.

106. Cable harness routing (branch "4") under the fuel pipe

(Z)



Pay attention when positioning the Map Sensor 2 connector.

**Specific tooling**

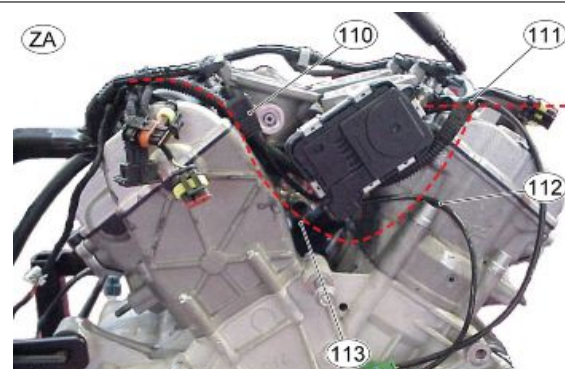
**020877Y Pliers for clamps**

**TABLE ZA - H2O TEMPERATURE SENSOR AND LOWER INJECTORS CONNECTION**

Cable harness routing on the right side of the engine: branch "4" of the cable harness must pass behind the Front Motorised Throttle Body; the output with the branchings must be positioned in correspondence of the upper part of the head cover.

- 110. Engine speed sensor connector
- 111. Output with branchings
- 112. Engine speed sensor cable routing
- 113. Cable harness routing (branch "4") under the water pipe fitting.

(ZA)



**TABLE ZB - H2O TEMPERATURE SENSOR**

114. Cable harness routing (branch "4") under the 3-way fitting

115. Engine speed sensor cable routing between the front motorised throttle body and the 3-way fitting

116. Rubber clamp

**TABLE ZC**

At this point, the injectors 2 (output "5") and 4 (output "6") can be connected: the connector (117) for injector 4 is GREY (or there is a spot with grey tape on the cable harness) whereas the connector (119) for injector 2 is BROWN.

Move the connector for coil 2 (output "7"), marked with red tape, to the far left, routing with the respective wiring together with the injector cable harnesses.

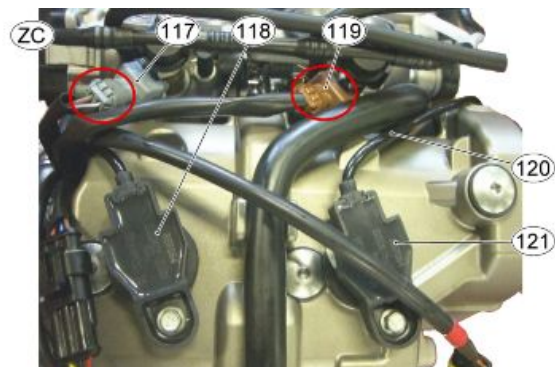
117. Lower injector 4 cable harness connector (output "6") - grey connector

118. Coil 4 - short cable harness

119. Lower injector 2 cable harness connector (output "5") - brown connector

120. Coil 2 cable harness routing (output "7")

121. Coil 2 - long cable harness

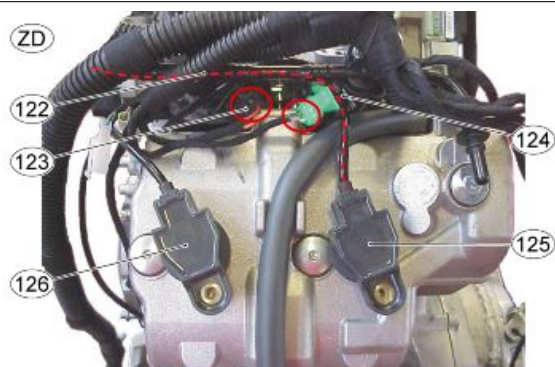
**TABLE ZD**

Connect the injectors 1 (output "16") and 3 (output "17"), which are on branch "3": the connector (123) for injector 1 is BLACK whereas the connector (124) for injector 3 is GREEN (or there is a spot with blue tape on the cable harness).

Move the cable for coil 3 to the far left, routing it as shown in the following figure (122).

122. Coil 3 cable routing

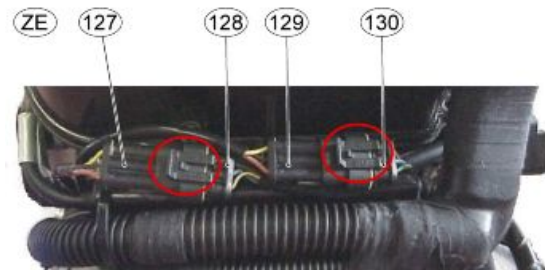
123. Lower injector 1 cable harness connector (output "16") - black connector



- 124. Lower injector 3 cable harness connector (output "17") - green connector
- 125. Coil 3 - long cable harness
- 126. Coil 1 - short cable harness

**TABLE ZE - COIL AND MAP SENSOR CONNECTION**

Once the filter box is assembled, the coil and map sensor connections must be made. The connectors for the 4 coils (AMP Superseal male plug terminals) must be placed on the mountings that were previously fit on the filter box: to do this, insert the slide positioned under the connector in the plastic tooth of the mounting.



**Passage of coil 3 and coil 1 cables between the Fuel Rail and the filter box**

- 127. Coil 1 connector
- 128. Coil 1 cable harness connector (output "29")
- 129. Coil 3 connector
- 130. Coil 3 cable harness connector (output "28")

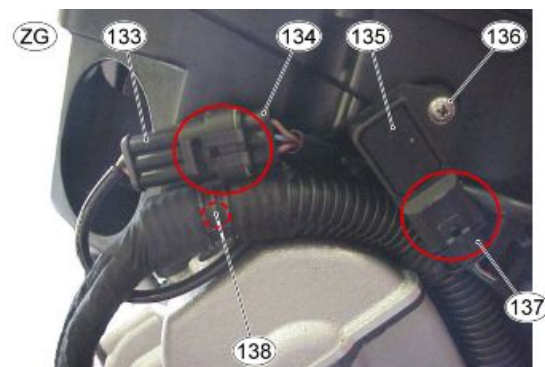
**TABLE ZF**

- 131. Coil 4 cable harness connector (output "8")
- 132. Coil 4 connector



**TABLE ZG**

- 133. Coil 2 connector
- 134. Coil 2 cable harness connector (output "7")
- 135. Map sensor 2
- 136. Self-tapping 5x20 screw
- 137. Map sensor 2 cable harness connector (output "11")
- 138. Insert the tape clamp on the cable harness in the free hole on the filter box



**TABLE ZH**

Once the Engine Speed Sensor (output "30") connector (142) has been connected to its counterpart, it must be clamped, using the indicated clamp (143), to the Blow-by pipe in the position shown in the figure.

139. Map sensor 1

140. Self-tapping 5x20 screw

141. Map sensor 1 cable harness connector (output "27")

142. Engine speed sensor cable harness connector (output "30")

143. Clamp



**CENTRAL ZI - GEAR SENSOR CONNECTION AND OXYGEN SENSOR CABLE HARNESS ROUTING**

Once the "Gear Sensor" (output "15") connector (144) has been connected to its counterpart, it must be moved behind the corrugated pipes to the position shown in the figure (145).

144. Gear sensor cable harness connector

145. Cable harness routing and connector position behind the corrugated pipes

**CENTRAL ZJ**

The "Oxygen sensor" (output "19") cable harness (147) must go down along the left side of the engine together with the Gear Sensor cable harness.

146. Oxygen sensor cable harness routing

147. Oxygen sensor cable harness connector (output "19")

**TABLE ZK - AIR TEMPERATURE SENSOR AND UPPER INJECTORS CONNECTION**

148. Upper injectors

149. Upper injector 2 cable harness connector (output "20") - brown connector

150. Upper injectors

151. Upper injector 4 cable harness connector (output "21") - grey connector

152. Upper injector 3 cable harness connector (output "22") - green connector

153. Air temperature sensor cable harness connector (output "24")

154. Air temperature sensor

155. Upper injector 1 cable harness connector (output "23") - black connector

156. Self-tapping screw

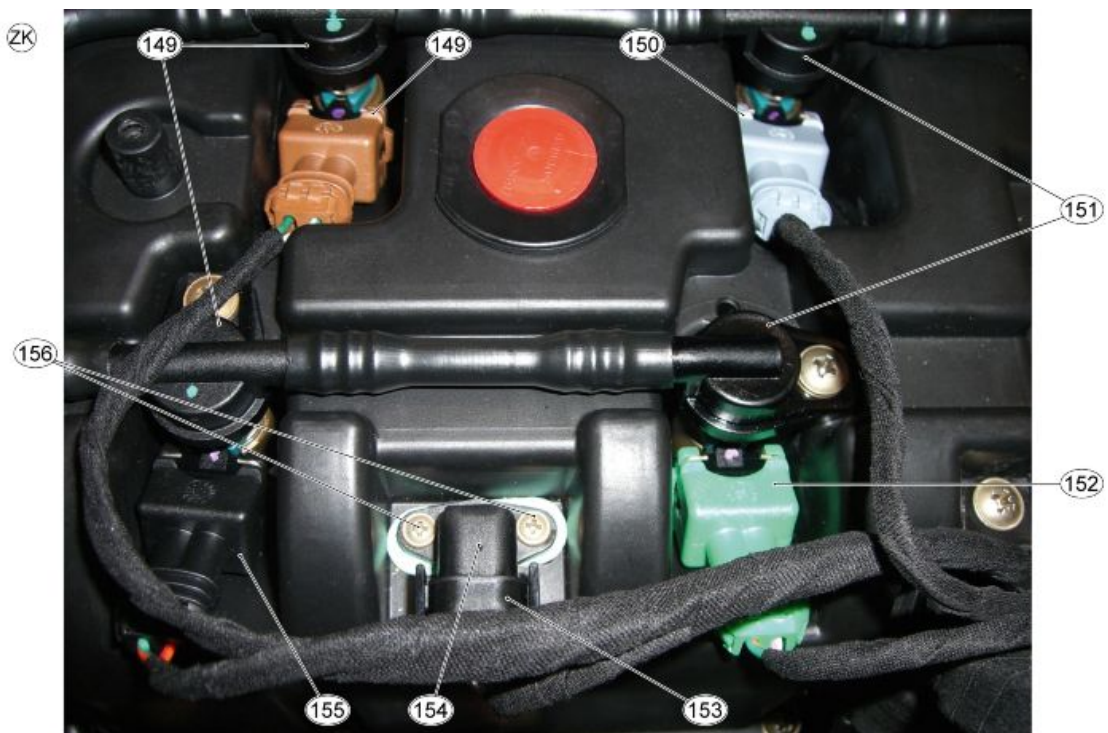
Connect the upper injectors as shown in the figure and according to the following sequence:

Injector 1 (output "23"): **BLACK** connector

Injector 2 (output "20"): **BROWN** connector

Injector 3 (output "22"): **GREEN** connector

Injector 4 (output "21"): **GREY** connector



**TABLE ZL - 7SM CONTROL UNIT FITTING AND CONNECTION**

After connecting the upper injector connections and the air temperature sensor connector, the 7SM control unit can be fastened, which was previously fastened to its relative mounting.

157 Washer

158. Self-tapping screw



**TABLE ZM**

159. Clamp

160. Self-tapping 5x20 screw

**TABLE ZN**

The connectors (161) "ECU 1" (output "26") and (162) "ECU 2" (output "25") must be connected to their respective connectors on the 7SM control unit, being very careful when inserting them. The slides must move freely until the end of the stroke, which helps with connector insertion: you must hear the release of the retaining tang at the end of the stroke.

161. "ECU 1" cable harness connector (output "26")

162. "ECU 2" cable harness connector (output "25")

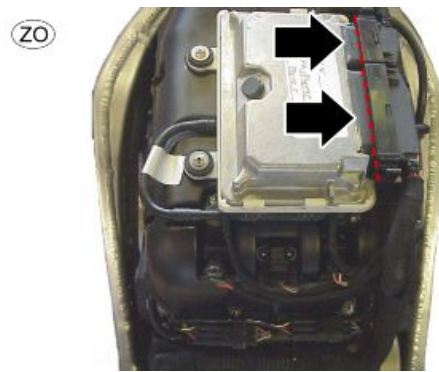
163. Cable harness routing (output "25") under the mounting

164. Cable harness routing (output "25") above the mounting



**TABLE ZO**

It is advisable to create a jig in order to check the correct insertion of both connectors.



**TABLE ZP - VEHICLE CONNECTOR FASTENING**

The "VEHICLE" (output "1") connector (165) must be fastened to the mounting with the white slide pre-fit on the connector itself, in the position indicated in the figure.

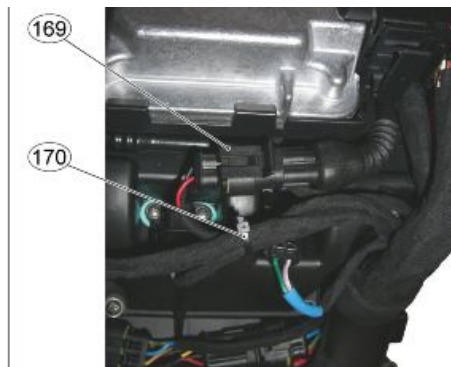
- 165. Vehicle cable harness connector (output "1")
- 166. Connector mounting



**TABLE ZQ - CONNECTORS FOR INTAKE DUCT CONTROL UNIT AND INTAKE DUCT MOTOR**

The "Intake duct mot." (output "32") connector (167) must be fastened with a small black clamp (170) as shown in the figure.

- 167. Intake duct motor connector (output "32")
- 168. Cable harness routing
- 169. Intake duct motor cable harness connection (output "32")
- 170. Clamp

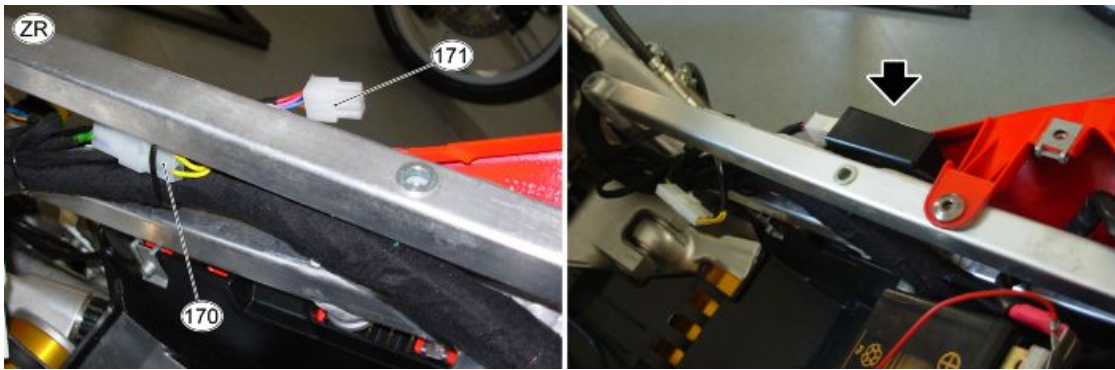


**TABLE ZR**

Clamp (170) the connector (171) together with the main cable harness and rear brake switch connected as indicated in the figure.

Connect the connector (171) to the control unit.

- 170. Clamp
- 171. Intake duct "ECU" cable harness connector (output "31")



#### TABLE ZS - NOTES FOR FITTING THE GROUND CABLE

There are two ground lug terminals on the cable harness: the "ENGINE GND" (output "9") and the "CHASSIS GND" (output "10").

The lug terminal "ENGINE GND" (172) (output "9") must be connected to the M6 hole on the upper engine crankcase with a flanged M6x16 screw (173). The other lug terminal "CHASSIS GND" (174) (output "10") must be left free.

#### CAUTION

TAKE CARE NOT TO SWAP THE TWO GROUND LUG TERMINALS



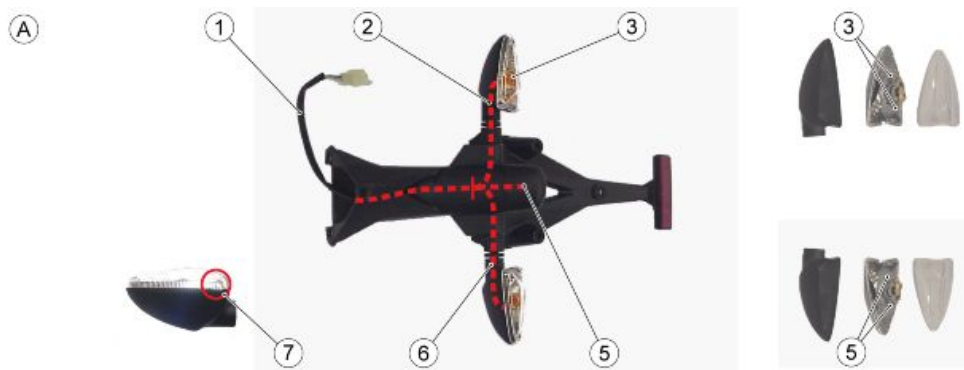
## Back side

#### TABLE A - LICENSE PLATE FRAME PRE-FITTING

Check that the drainage hole (7) for the water of both turn indicators is positioned downward.

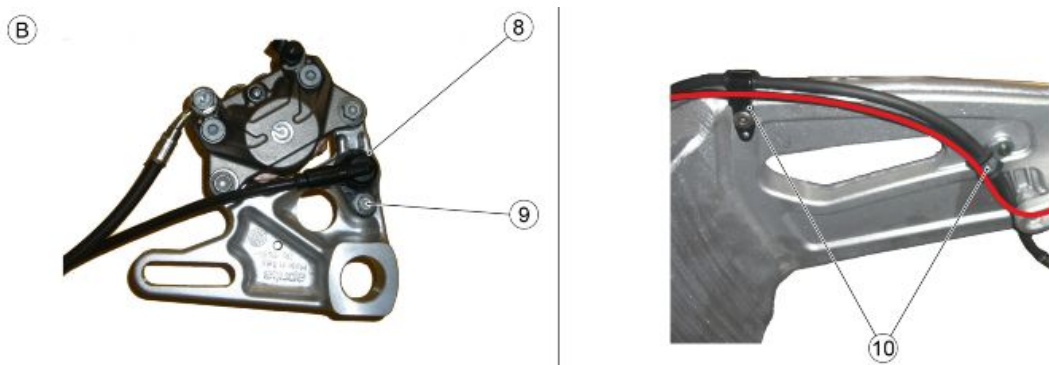
1. License plate frame cable harness
2. Right rear turn indicator cable harness routing
3. 2.8 mm (0.11 in) Faston - cable colours: red and blue
4. License plate light grey rubber ring
5. 2.8 mm (0.11 in) Faston - cable colours: light blue and blue
6. Left rear turn indicator cable harness routing
7. Breather





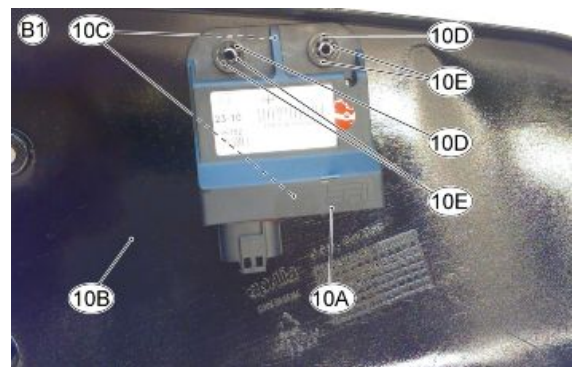
**TABLE B - SPEED SENSOR PRE-FITTING**

- 8. Speed sensor
- 9. TE M6x20 screw
- 10. Sensor cable harness routing in the cable grommet



**TABLE B1 - CLF CONTROL UNIT PRE-FITTING**

- 10A. CLF control unit
- 10B. Left fairing
- 10C. Sponge
- 10D. Washer
- 10E. Rubber ring



**TABLE C - START-UP RELAY PRE-FITTING**

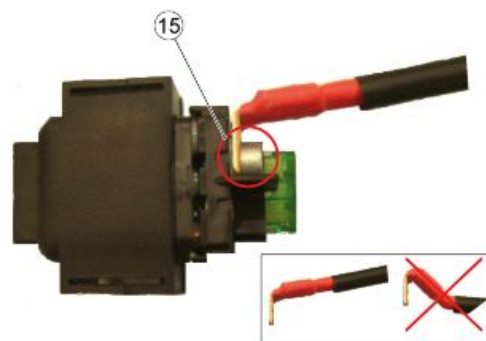
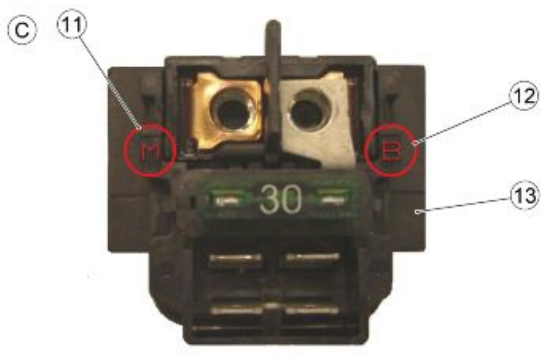
- 11. Starter motor cable on the vehicle cable harness
- 12. Positive battery cable
- 13. Start-up relay
- 14. Positive battery cable
- 15. M5x8 screw

The positive battery cable (14) must be connected with a screw (15) on the hole marked with the letter B (battery).

**M=starter motor**

**B=battery**

**Be careful not to bend the positive battery cable (14).**



### TABLES D1 and D2 - VEHICLE CABLE HAR- NESSES

The Vehicle Cable Harness (16) and the "Relay and Fall Sensor" mounting (18) must be fit on the chassis before fitting the engine.

Check that the fan relay (20), safety relay (23) and fall sensor (19) are connected correctly (fit on the relative mounting).

16. Vehicle cable harness

17. Insert two tape clamps on the rigid section of the cable harness in the two holes on the right chassis beam

18. Fall sensor and relay mounting

19. Fall sensor connector

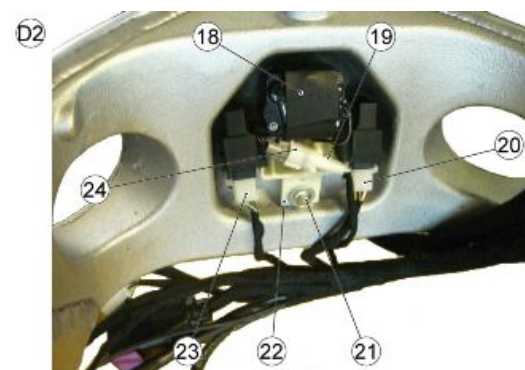
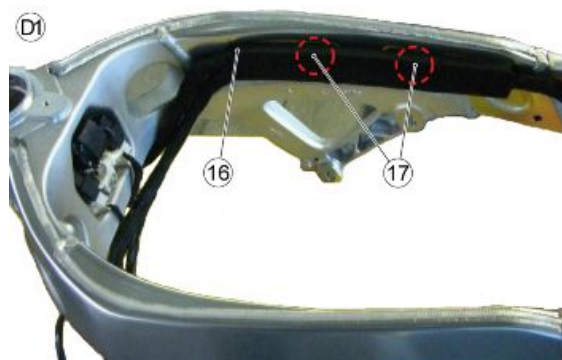
20. Fan relay connector

21. TE M6x20 screw

22. T-shaped bushing

23. Safety relay connector

24. Fasten the fall sensor connector on the mounting link



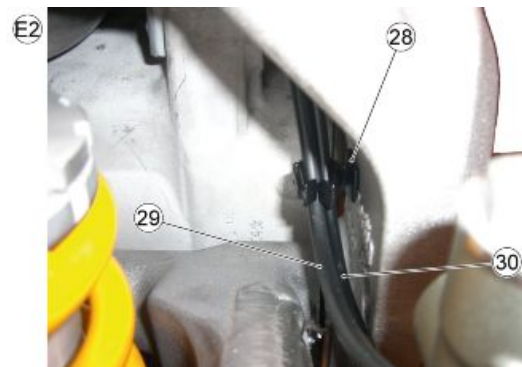
**TABLE E1 - REAR SWINGARM AREA**

- 25. Rubber clamp
- 26. Rear brake switch cable harness
- 27. Speed sensor cable harness



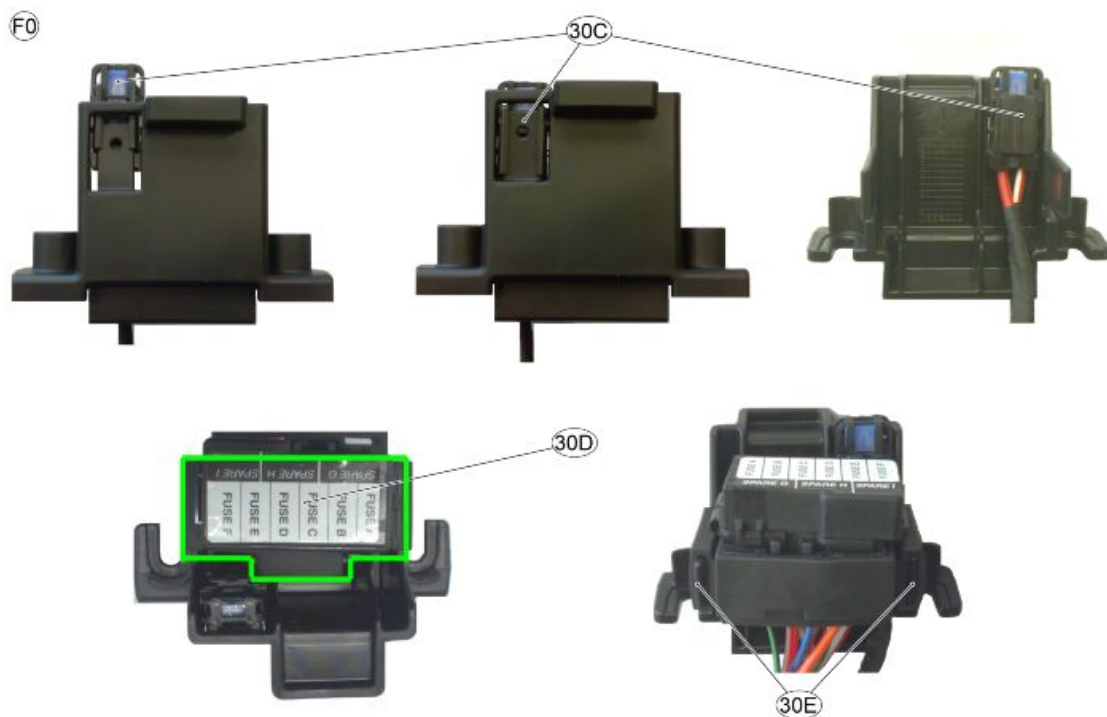
**TABLE E2 - REAR STOP SWITCH AND SPEED SENSOR CABLE HARNESS ROUTING ON THE RIGHT SIDE**

- 28. Cable grommet
- 29. Speed sensor cable harness
- 30. Rear brake switch cable harness



**TABLE F0 - REAR SADDLE MOUNTING AREA**

- 30C. Fit the (individual) fan fuse on battery mounting bracket tongue
- 30D. Fuse-box positioning on battery mounting bracket
- 30E. Insert the fuse-box in the two tongues on the battery mounting bracket

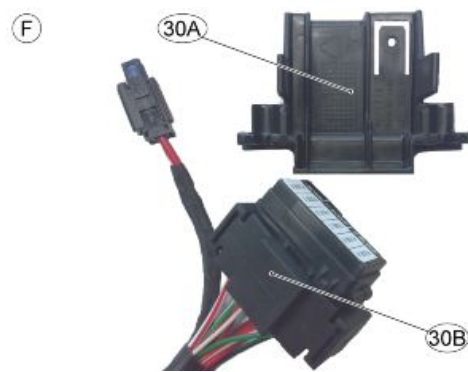


**TABLE F - REAR SADDLE MOUNTING AREA**

Preparing the battery mounting bracket with fuses.

30A. Battery mounting bracket

30B. Vehicle cable harness



**TABLE F1 - REAR SADDLE MOUNTING AREA**

31. License plate frame cable harness connector

32. License plate frame cable harness routing

33. Taillight connector

34. Taillight



**TABLE F2**

35. Insert the fuse-box in the two tongues on the battery mounting bracket

36. Protection relay and relay socket rubber ring

37. Insert the relay in the plastic tongue on the left

38. TBEI M5x16 screw

39. Battery mounting bracket

40. TBEI M5x16 screw

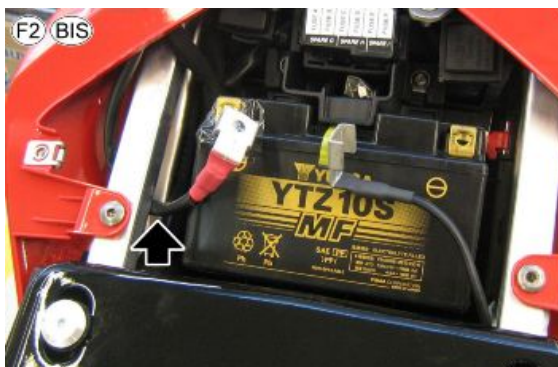
41. Insert the relay in the plastic tongue on the right

42. Relay and relay socket rubber ring



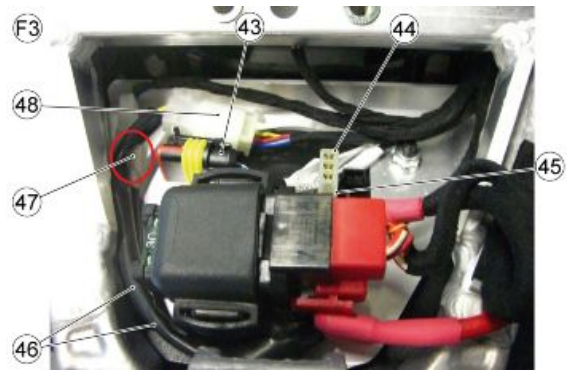
**TABLE F2 BIS**

- Pass the positive battery cable under the top of the frame.



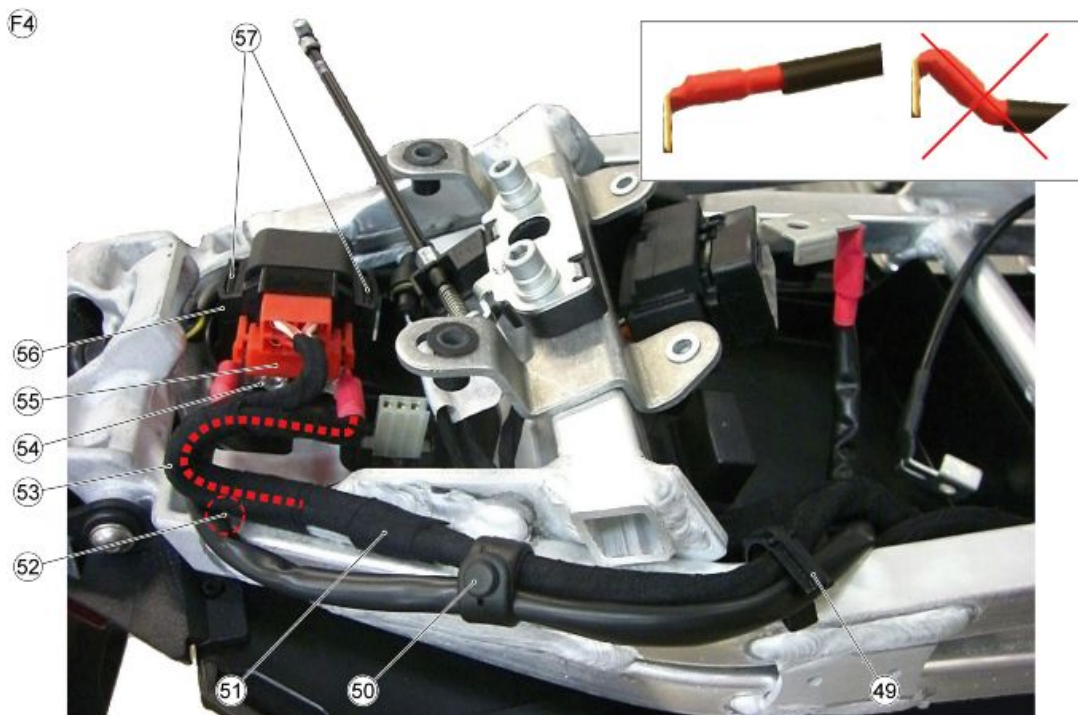
**TABLE F3**

- 43. ECU diagnosis connector
- 44. Instrument panel diagnosis connector
- 45. Insert the instrument panel diagnosis and the ECU diagnosis connectors in their specific seats
- 46. License plate frame and taillight cable harness routing
- 47. Taillight connector
- 48. License plate frame cable harness connector



**TABLE F4**

- 49. Cable grommet
  - 50. Rubber clamp
  - 51. Vehicle cable harness
  - 52. Insert the tape clamp on the cable harness in the hole on the right side of the saddle mounting
  - 53. Starter motor cable
  - 54. M5x8 screw
  - 55. Start-up relay connector
  - 56. Start-up relay
  - 57. Insert the start-up relay in the two plastic tongues
- Pay attention not to bend the starter motor cable



**TABLE F5 - RIGHT SIDE SADDLE MOUNTING**

**Outer**

58. Fuel pump connector

59. Insert the tape clamp on the cable harness in the hole on the right side of the saddle mounting

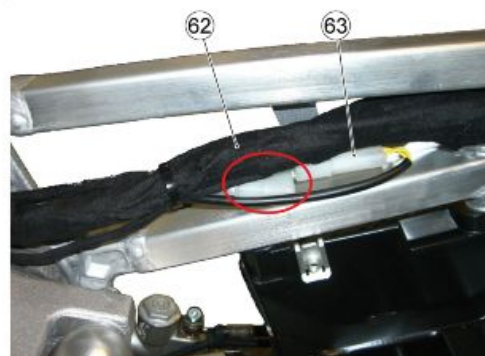
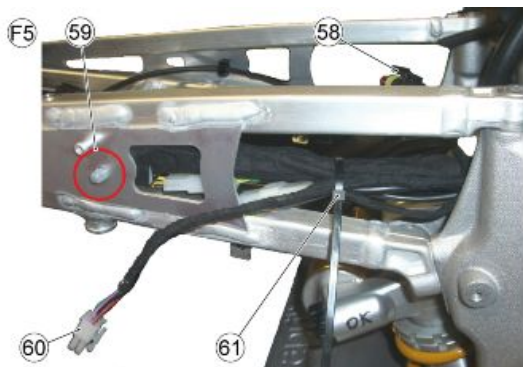
60. variable length intake duct control unit connector

61. Clamp

**Inner**

62. Speed sensor connector

63. Rear brake switch connector

**TABLE F6 - LEFT SIDE SADDLE MOUNTING**

64. Battery - engine ground lead

65. Cable grommet

**TABLE G - INTAKE DUCT CONTROL UNIT AND TANK**

After fitting the tank and connecting the fuel line push fitting, the fuel pump connector (66) can be connected and positioned as shown in the figure.

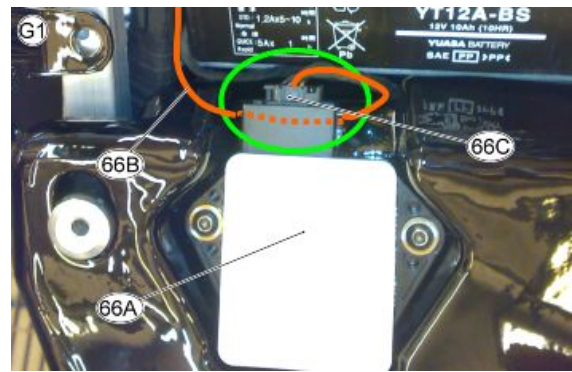
No clamps are necessary.

66. Fuel pump connector



**TABLE G1 - SENSOR BOX**

- 66A. Sensor Box
- 66B. Sensor Box cable harness routing
- 66C. Sensor Box connector



**TABLE H1**

- 67. Intake duct control unit
- 68. Intake duct control unit connector
- 69. Rubber ring

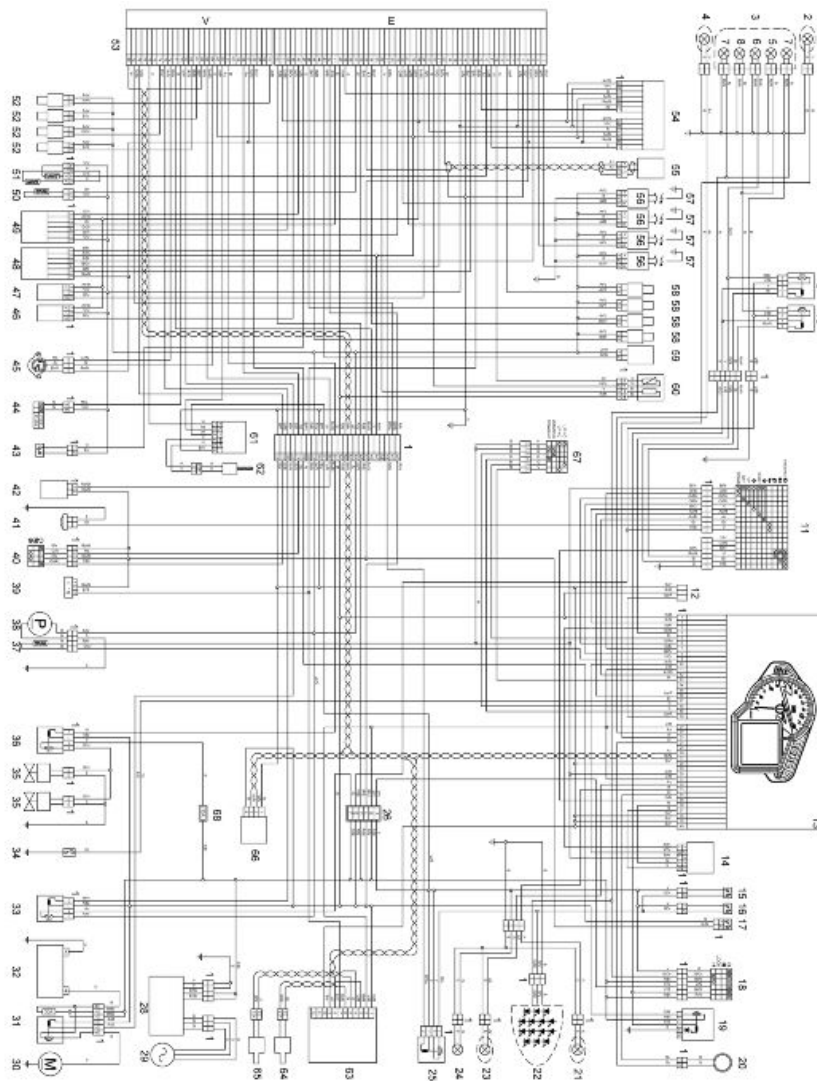


**TABLE H2**

- 70. Clamp
- 71. Intake duct control unit cable harness routing



## General wiring diagram



### key:

1. MULTIPLE CONNECTORS
2. FRONT RIGHT TURN INDICATOR
3. COMPLETE HEADLAMP
4. FRONT LEFT TURN INDICATOR
5. RIGHT LOW BEAM LIGHT BULB
6. HIGH BEAM BULB
7. TAIL LIGHT BULB
8. LEFT LOW BEAM LIGHT BULB
9. HIGH BEAM LIGHT RELAY
10. LOW BEAM LIGHT RELAY
11. Left light switch
12. INSTRUMENT PANEL DIAGNOSIS



13. INSTRUMENT PANEL
14. EXHAUST VALVE MOTOR
15. FRONT STOP SWITCH
16. REAR STOP SWITCH
17. CLUTCH SWITCH
18. IGNITION SWITCH
19. PROTECTION RELAY
20. IMMOBILIZER AERIAL
21. Rear right turn indicator
22. TAILLIGHT ASSEMBLY
23. LICENSE PLATE LIGHT BULB
24. REAR LEFT TURN INDICATOR
25. RECOVERY LOGIC RELAY
26. MAIN FUSES
27. -
28. Voltage regulator
29. ALTERNATOR
30. STARTER MOTOR
31. START-UP RELAY
32. BATTERY
33. INJECTION LOAD RELAY
34. OIL PRESSURE SENSOR
35. FAN
36. FAN CONTROL RELAY
37. FUEL RESERVE SENSOR
38. FUEL PUMP
39. ECU DIAGNOSIS
40. Right light switch
41. HORN
42. FALL SENSOR
43. ELECTRONIC TRANSMISSION
44. SIDE STAND SWITCH
45. GEAR SENSOR
46. FRONT CYLINDER PRESSURE SENSOR
47. REAR CYLINDER PRESSURE SENSOR
48. FRONT CYLINDER THROTTLES
49. REAR CYLINDER THROTTLES
50. AIR TEMPERATURE SENSOR

- 51. Water Temperature Sensor
- 52. UPPER INJECTORS
- 53. 7SM CONTROL UNIT
- 54. HAND GRIP POSITION SENSOR
- 55. ENGINE SPEED SENSOR
- 56. COIL
- 57. SPARK PLUG
- 58. LOWER INJECTORS
- 59. SECONDARY AIR SYSTEM
- 60. LAMBDA PROBE
- 61. VARIABLE GEOMETRY CONTROL UNIT
- 62. VARIABLE GEOMETRY ENGINE
- 63. TONE WHEEL READING CONTROL UNIT
- 64. FRONT WHEEL SPEED SENSOR
- 65. REAR WHEEL SPEED SENSOR
- 66. INERTIA SENSOR PLATFORM
- 67. aPRC CONTROLS
- 68. FAN FUSE

---

## 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.

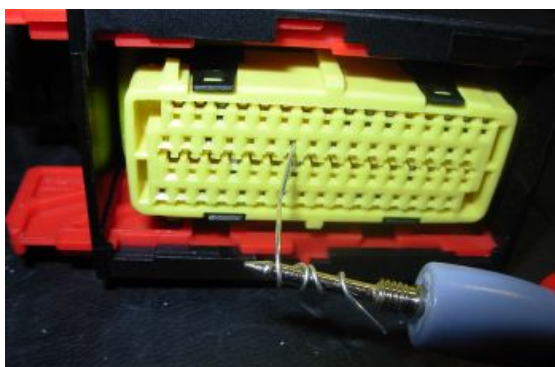
#### CAUTION

**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 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 termi-



nals 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 the 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.**

---

---

## 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 ignition switch assembly
- connector: two-way, black, inside the bow

#### 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)

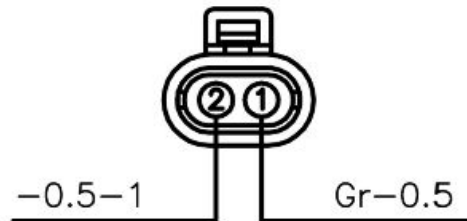
#### Error cause

- Key transponder does not communicate its own code

#### Troubleshooting

- Replace the key

##### DSB 03 Immobilizer fault



- Immobilizer failure: 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 diagnosis instrument and activate the engine revs indication choosing the function "Rpm indicator" from the "Devices Activation" screen page (injector icon)

---

## **Installing a new instrument panel**

In case the instrument panel is replaced by a new one, follow the procedure shown below so that the immobilizer system (key storage) and the exhaust butterfly valve (controlled by the ECU through the instrument panel) operate correctly.

1. Request all the keys of the vehicle in the customer possession.

Once the instrument panel is electrically connected to the vehicle and a key is set to ON, the key is stored and the instrument panel waits for 20 seconds for a possible second key. If there is a second key, remove the first key and wait for the storage of the second key. When the second key storage is complete, the instrument panel waits for another key up to a maximum of 4 total keys or the procedure will be interrupted after 20 seconds.

At this stage, the instrument panel turns on as usual.

2. Deleting the errors stored by the instrument panel: select Menu and then Diagnosis. An access code is required to enter this menu:

**12412**

Then, select the option: "Delete errors"

---

**NOTE****DELETE THE ERROR CAUSED BY THE LACK OF MEMORY OF KEY CODES.**

3. Connect to the vehicle with the diagnosis tool and select the adjustable Parameters in the screen page:

"Exhaust butterfly valve self-acquisition"

**NOTE****SEARCH FOR MINIMUM AND MAXIMUM MECHANICAL STOPS STORED IN THE INSTRUMENT PANEL.**

In case of a correct self-acquisition, the procedure is finished.

If the self-acquisition is not performed correctly, follow the procedure "Exhaust butterfly valve calibration" as shown in the section: Electrical system, Checks and controls, Exhaust butterfly valve.

**See also**

[Butterfly valve in exhaust](#)

**Diagnosis**

An access code is required to enter this menu which controls the diagnosis function:

- ENTER SERVICE CODE

This is a 5-digit code, fixed for each vehicle. For these vehicles, the code is:

12412

If the code is incorrect, the following message is displayed:

- INCORRECT CODE

and the instrument panel goes back to the main menu. Otherwise, the following menu is displayed:

- Exit
- INSTRUMENT PANEL ERRORS
- Error Clearing
- VEHICLE SERVICING RESET
- Update
- CHANGE KEYS
- KM / MILES

**INSTRUMENT PANEL ERRORS**

In this mode, a chart is displayed showing potential errors in the immobilizer and the sensors connected to it.

ERRORI CRUSCOTTO		
	ACTIVE	MEMO
DSB 01	0	0
DSB 02	0	X
DSB 03	X	X
DSB 04	0	X
DSB 05	0	0
DSB 06	0	X

Instrument panel errors

In this mode, a chart is displayed showing potential errors in the immobilizer and the sensors connected to it.

**DSB 01** - Immobilizer fault: key code read but not recognised.

**DSB 02** - Immobilizer fault: key code not read (key not present or transponder not working)

**DSB 03** - Immobilizer fault: aerial not working (open or short-circuited)

**DSB 04** - Internal controller fault

**DSB 05** - -

**DSB 06** - -

Error cause

- An oil sensor fault is signalled when it is detected that the sensor circuit is open or shorted to positive.

**DSB 07** - Oil pressure sensor

Error cause

An oil sensor fault is signalled when, with engine off, it is detected that the sensor circuit is open.

Troubleshooting

The test is performed only once when the key is set to ON. This error is signalled by the bulb icon, and the general warning light turns on as well.

**DSB 08** - Oil pressure sensor

Error cause

An oil sensor fault is signalled when, with engine running, it is detected that the sensor circuit is closed. There is an error when the general warning light turns on.

Troubleshooting

This error is signalled by the bulb icon, and the general warning light turns on as well.

---

The instrument panel must keep all previous errors stored in its memory.

### **DELETE ERRORS**

This option deletes all instrument panel errors; a further confirmation is requested. Use Navigator to reset ECU errors.

### **VEHICLE SERVICING RESET**

This function is used to reset vehicle servicing. Using this function, the odometer can be reset only once within the first 200 km (124 mi) of the vehicle, provided this has not been done by the Quality Check.

### **UPDATE**

This function is used to program the instrument panel again. This screen page shows the software version currently loaded; the LCD reads:

- INSTRUMENT PANEL DISCONNECTED. NOW CONNECT THE DIAGNOSIS INSTRUMENT.

The instrument panel will restart to work normally after the key is inserted-extracted.

---

**Modify Keys**

With this function the instrument panel can update the keys. Up to 4 keys can be stored.

The user code is first requested to be entered:

- ENTER THE CODE

After entering the correct code, the following message should be shown on the display:

- INSERT THE X KEY
- INSERT THE X+1 KEY

At least one key must be programmed for the next start-ups. If no other key is inserted within 20 seconds or if there is no power or after the fourth key is programmed, the procedure finishes and all the functions of the vehicle and the instrument panel must be enabled (even if only one key has been programmed).

**Km / miles**

This menu selects the unit of measurement, either for the speed or the total or partial odometers.

- KM
- MILES

**LANGUAGES**

Select the user interface language from this menu.

- ITALIANO
- ENGLISH
- FRANCAIS
- DEUTSCH
- ESPAÑOL

---

**Service warning light reset****VEHICLE SERVICING RESET**

This function is used to reset vehicle servicing. Using this function, the odometer can be reset only once within the first 200 km (124 mi) of the vehicle, provided this has not been done by the Quality Check.

In order to activate this function follow the instructions in the DIAGNOSIS section.

**See also**

[Diagnosis](#)

---



## 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 wiring diagram:

Start-up signal

### Location:

- on the vehicle: right light switch.
- connector: inside the bow (4-ways black).

### Electrical characteristics:

- key released: the circuit is open
- key pressed: the circuit is closed

### Pin out:

2: voltage + 5V

3. ground

### 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.**

### DIAGNOSIS 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.

### DIAGNOSIS INSTRUMENT: LOGIC ERRORS

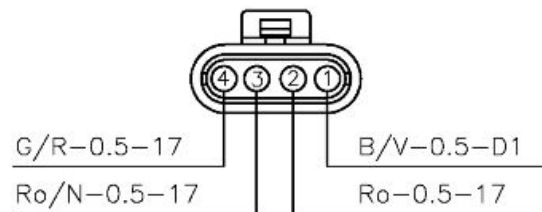
Starter switch P0169

- 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.

## level indicators

### See also

Fuel pump

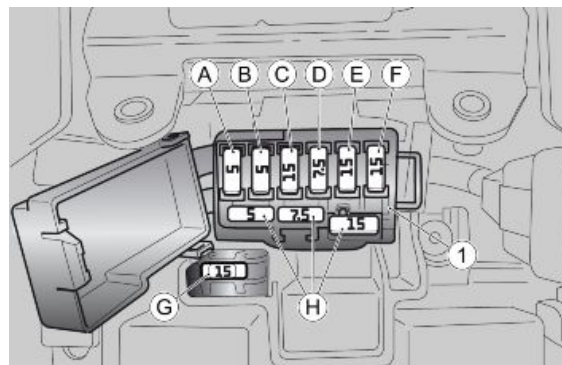
## Fuses

### AUXILIARY FUSES DISTRIBUTION

Specification	Desc./Quantity
A) 5A fuse	Lights relay, stop light, daylight running lights, variable geometry intake ducts (factory)
B) 5A fuse	Instrument panel, turn indicators, speed, instrument panel diagnosis, tone wheel ECU (a-PRC)
C) 15A fuse	Control unit
D) 7.5A fuse	Control unit
E) 15A fuse	High beam/low beam, horn.
F) 15A fuse	Coils, injectors, fuel pump, oxygen sensor and secondary air valve
G) 15A fuse	Fans.

#### CAUTION

THREE OF THE FUSES ARE SPARES (H).

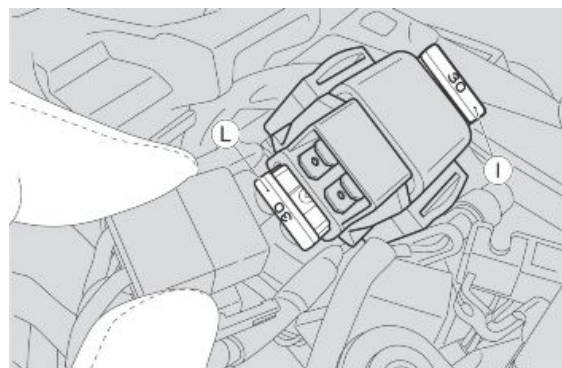


### MAIN FUSES DISTRIBUTION

Specification	Desc./Quantity
L) 30A fuse	Battery recharge and vehicle current consumers, injection current consumers (red and red/white cables).

#### CAUTION

THERE IS ONE SPARE FUSE (I).



## Control unit

### Removal

- Remove the fuel tank.
- Disconnect both control unit connectors



- Unscrew and remove the three screws.
- 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 filter box
- connector: on connector control unit of ENGINE PIN 52 (figure A), connector of ENGINE PIN 28 (figure B)

**Pin out:** See the CONNECTORS section

**DIAGNOSIS 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 diagnosis instrument that has carried out the last control unit remapping

**DIAGNOSIS INSTRUMENT: PARAMETERS**

Nominal idle speed

- Example value with key ON: 1600 rpm

Adjustable fuel supply

Adjustable fuel correction

**CAUTION**

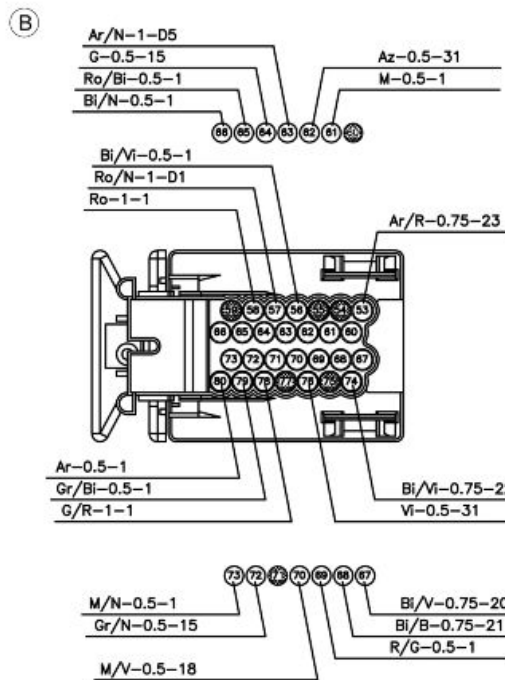
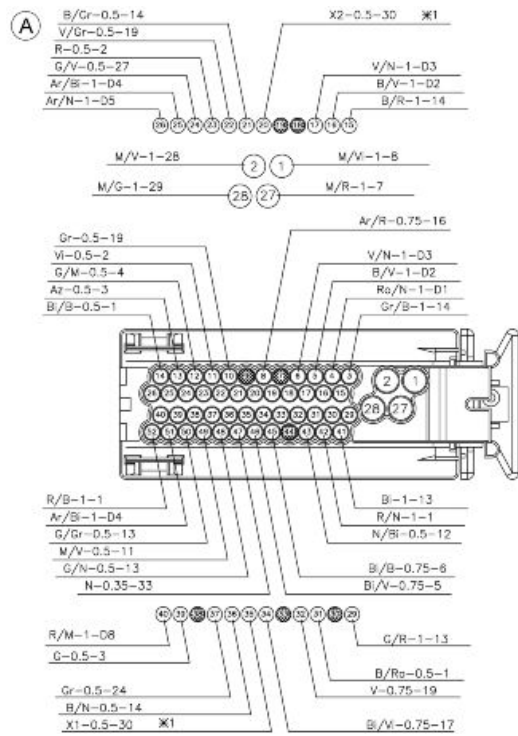
BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

**DIAGNOSIS 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

### **DIAGNOSIS INSTRUMENT: ACTIVATION**

#### Stop light

- The stop light logic relay (No 25 in the wiring diagram, position in the front niche of the frame, right side, CHECK, however, the identification of the relay with the colour of the cables) is energised

#### Error clearing

#### Ambient parameter reading

- Rear throttle target position angle
- Front throttle target position angle
- Rear throttle position
- Front throttle position
- Engine Temp. before Recovery
- Rear cylinder mean intake pressure (1 and 3)
- Front cylinder mean intake pressure (2 and 4)
- 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

### **DIAGNOSIS 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)

**DIAGNOSIS 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.

Reached wheelie time-out P0730

**Error cause**

- If this error is displayed, it means that the wheelie control software has detected a faulty motorcycle behaviour.

**Troubleshooting**

- -

**DIAGNOSIS INSTRUMENT: ADJUSTABLE PARAMETERS**

Cylinders pressure balance

- It allows balancing the cylinders 1-3 and then the cylinders 2-4 by the by-pass screws

Control unit EEPROM zero setting

**CAUTION**

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

**See also**

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## Cylinders synchronisation

---

Saved data file download

### Error cause

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

---

## Battery

### **Function**

Electrically supply the vehicle: battery YTZ 10 S MF is already activated, loaded and sealed; or, alternatively, battery YT 12A - BS, which must be activated and loaded.

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

Battery recharge

### **Location:**

- on the vehicle: under the saddle
- connector: on the battery





**Electrical characteristics:**8.6 Ah

**Pin out:**

1. Positive pole (red): approx. 12.6 V
2. negative pole (black): ground connection

### **DIAGNOSIS INSTRUMENT: PARAMETERS**

#### **Battery voltage**

- Example value with key ON: 12.0 V
- Example value with engine on: 14.2 V

In case of recovery, this value is set by the control unit

#### **Battery voltage pre Recovery**

- Example value with key ON: 12.0 V
- Example value with engine on: 14.2 V

Value drawn from the signal read without taking into account any recovery

#### **CAUTION**

**BE CAREFUL WITH THE POSITIVE BATTERY CABLE - IT HAS TO GO UNDER THE TOP OF THE FRAME.**

#### **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.**

### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

Battery voltage P0560

- too high/too low

#### **Error cause**

- If too high: too high a voltage has been detected at PIN 42. If too low: too low a voltage has been detected at PIN 42. The instrument panel does not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

- If too high: check correct operation of the voltage regulator.
- If too low: check voltage regulator connectors, engine - vehicle cable harness connector and the control unit connector (paying special attention to possible oxidation): if not OK, restore; if OK, check that red/white cable resistance from the voltage regulator connector to the control unit connector is a few tenths of Ohm: if not OK, restore cable harness; if OK, check correct operation of the electrical alternator: if not OK, restore; if OK, check operation of the voltage regulator

## Speed sensor

### VEHICLE FRONT SPEED SENSOR

#### Function:

To generate a signal that the CLF control unit will convert into wheel speed.

#### Operation / Operating principle:

Magnetoresistive sensor: a square-wave pulse is generated with width of approximately 1V across PIN3 and PIN6.

#### Electrical circuit diagram - Level in wiring diagram:

Traction control.

#### Location on the vehicle:

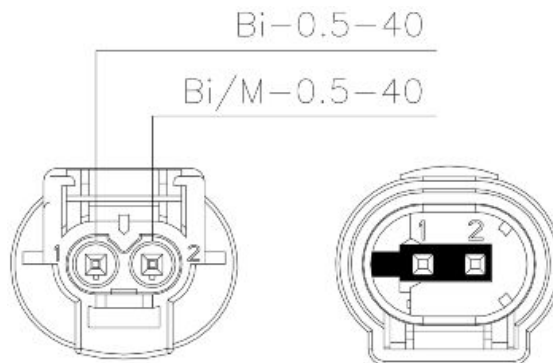
On the fork, right stanchion, next to the brake caliper support.

#### Connector location (if available):

Under the right dynamic air intake.

#### Pin-out:

- PIN 1 - Power negative/Signal negative (white)
- PIN 2 - Power positive/Signal positive (white/brown)



### DIAGNOSIS INSTRUMENT

#### Parameters:

Speed (km/h) - Front wheel speed.

### DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

#### C1002 Front speed sensor: short circuit.

It activates when the two wires are shorted one with the other or if the negative wire is shorted to positive (e.g. 12V)

#### Troubleshooting:

Check insulation of white cable and white/brown cable: if NOT OK, restore cable harness; if OK, check positive insulation (12V) of the white cable. If NOT OK, restore; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, change the sensor; if NOT OK, change the CLF control unit

#### C1003 Front speed sensor: electric malfunction.

Missing sensor or interrupted wire or short circuit to negative of one of the two wires.

#### Troubleshooting:

Check the sensor connector and the CLF control unit connector. If it is not OK, restore the connectors; if it is OK, check continuity of the white/brown cable across wiring-side sensor PIN 2 and PIN 3. If NOT OK, restore cable harness; if OK, check the continuity of the white cable across wiring-side sensor PIN 1 and CLF control unit connector PIN 6. If NOT OK, restore cable harness; if OK, check the white/brown cable ground insulation. If NOT OK restore cable harness; if OK, check the white cable ground insulation. If NOT OK restore cable harness; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, replace the sensor; if NOT OK, replace the CLF control unit

**C1008 Front speed sensor: electric malfunction.**

It activates when the positive wire is shorted to ground.

**Troubleshooting:**

Check continuity of white/brown cable across wiring-side sensor PIN 2 and CLF connector PIN 3: if NOT OK, restore cable harness; if OK, check ground insulation of the white/brown cable. If NOT OK, restore cable harness; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, replace the sensor; if NOT OK, replace the CLF control unit.

**P0501 Front wheel speed signal/sensor.**

Connect to CLF control unit diagnosis (Tone Wheel Reading control unit)

**DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

**C1100 Front speed sensor: missing signal or speed measured too low in relation to the rear wheel.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1102 Front speed sensor: missing signal or speed measured too low in relation to the rear wheel.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1104 Front speed sensor: missing signal or different speed measured at the two wheels.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1106 Front speed sensor: missing signal or different speed measured at the two wheels.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1108 Front speed sensor: the signal works irregularly.**

Faulty sensor or signal interference

**C1110 Front speed sensor: 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.

## VEHICLE REAR SPEED SENSOR

### Function:

To generate a signal that the CLF control unit will convert into wheel speed.

### Operation / Operating principle:

Magneto-resistive sensor: a square-wave pulse is generated with width of approximately 1V across PIN3 and PIN6.

### Electrical circuit diagram - Level in wiring diagram:

Traction control.

### Location on the vehicle:

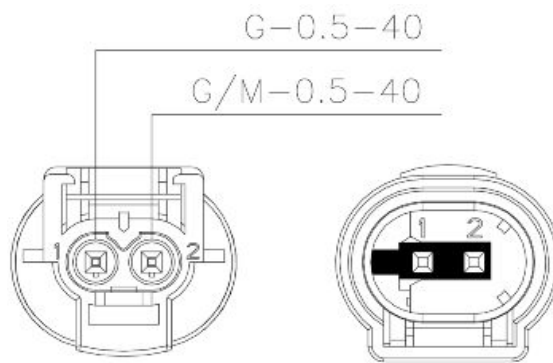
Swingarm, right side, on the brake calliper support plate.

### Connector location (if available):

Under the right side fairing.

### Pin-out:

- PIN 1 - Power negative/Signal negative (yellow)
- PIN 2 - Power positive/Signal positive (yellow/brown)



## DIAGNOSIS INSTRUMENT

### Parameters:

Speed (km/h) - Rear wheel speed

## DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

### C1004 Rear speed sensor: short circuit.

It activates when the two wires are shorted one with the other or if the negative wire is shorted to positive (e.g. 12V).

### Troubleshooting:

Check insulation of yellow cable and yellow/brown cable: if NOT OK, restore cable harness; if OK, check positive insulation (12V) of the yellow cable. If NOT OK, restore; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, replace the sensor; if NOT OK, replace the CLF control unit.

### C1005 Rear speed sensor: electric malfunction.

Missing sensor or interrupted wire or short circuit to negative of one of the two wires.

### Troubleshooting:

Check the sensor connector and the CLF control unit connector. If it is not OK, restore the connectors; if it is OK, check continuity of the yellow/brown cable across wiring-side sensor PIN 2 and PIN 4. If NOT OK, restore cable harness; if OK, check the continuity of the yellow cable across wiring-side sensor PIN 1 and CLF control unit connector PIN 5. If NOT OK, restore cable harness; if OK, check the yellow/brown cable ground insulation. If NOT OK restore cable harness; if OK, check the yellow cable ground insulation. If NOT OK restore cable harness; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, replace the sensor; if NOT OK, replace the control unit

**CLF C1009 Rear speed sensor: electric malfunction.**

It activates when the positive wire is shorted to ground.

**Troubleshooting:**

Check continuity of yellow/brown cable across wiring-side sensor PIN 2 and CLF connector PIN 3: if NOT OK, restore cable harness; if OK, check ground insulation of the yellow/brown cable. If NOT OK, restore cable harness; if OK, check with sensor disconnected and key ON that power voltage is slightly below battery voltage. If OK, replace the sensor; if NOT OK, replace the CLF control unit.

**DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

**C1101 Rear speed sensor: missing signal or speed measured too low in relation to the front wheel.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1103 Rear speed sensor: missing signal or speed measured too low in relation to the front wheel.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1105 Rear speed sensor: missing signal or different speed measured at the two wheels.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1107 Rear speed sensor: missing signal or different speed measured at the two wheels.**

Faulty sensor or missing tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

**C1109 Rear speed sensor: the signal works irregularly.**

Faulty sensor or signal interference.

**C1111 Rear speed sensor: 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

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## Variable geometry intake

### Function

Extend or shorten the engine intake ducts to increase the intake air quantity according to the engine revs.

### Operation / Operating principle

The system consists of:

- two intake ducts for each manifold, which may be joined (long ducts) or separated (short ducts);
- a motor that, by means of an endless screw, activates the upper part of the intake ducts;
- a variable geometry control unit for managing the system, interfaced with the engine injection control unit.

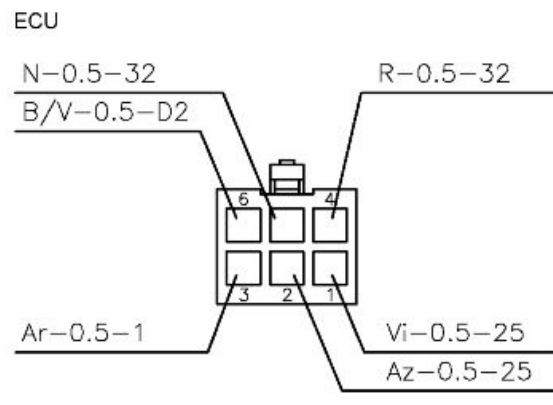
At key-ON, the variable geometry control unit lowers the ducts (if still in the raised position). Subsequently, depending on the control voltage on PIN 2 from the injection ECU (0V down, 5V up), the ECU drives the electric motor with the relative polarity for raising or lowering the ducts. The drive voltage delivered to the motor is determined in relation to battery voltage and the motor is stopped once a given current limit is reached or if the time-out period of 500 ms has elapsed.

### Level in electrical circuit diagram:

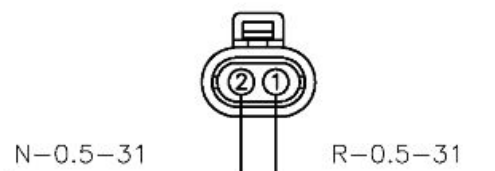
Variable geometry

### Location:

- on the vehicle: ducts and motor inside the filter box, variable geometry control unit on rear frame under the saddle, right side.
- variable geometry control unit connector: on the control unit.
- connector of the electrical motor cable to the engine cable harness: outside



### ENGINE



the filter box next to the rear upper injectors.

**Electrical characteristics:**

Electrical motor resistance. 4.5 +/- 0.5  $\Omega$ ; PIN 1: 0V normal, Vbatt fault PIN 2: 0V ducts control down, 5V ducts control up.

**Pin out:**

1. Control unit fault
2. Control from the injection ECU
3. Key ON (Vbatt)
4. Engine +
5. Engine -
6. 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.**

**DIAGNOSIS INSTRUMENT: STATUSES**

Variable geometry intake

- not active/active

**NOTE:** It indicates whether the control unit has sent the command to the variable geometry control unit to lift the ducts.

**DIAGNOSIS INSTRUMENT: ACTIVATION**

Variable geometry intake control

**NOTE:** The injection ECU sends the command to the variable geometry control unit to lift the ducts. In the version PGDS 3.0.0 for Navigator, the command works once only, then it is used to take the key to OFF and wait if communication with the control unit is lost.

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**DIAGNOSIS INSTRUMENT: ERRORS**

Variable geometry intake P0447

- shorted to positive / shorted to negative / open circuit / signal not valid.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 62. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected. If signal is not valid: PIN 76 detects a battery voltage set by the variable geometry control unit to indicate error detection. The instrument panel does not indicate the presence of this error even in the ATT status.

**Troubleshooting**

- If shorted to positive: if a voltage higher than 5V is detected, disconnect the variable geometry control unit connector and check with key ON the voltage to PIN 2: if it is higher than 5 V, restore cable harness; if equal to zero, replace the variable geometry control unit.
- If shorted to negative: disconnect the variable geometry control unit connector and the injection ECU connector and check continuity to ground of the light blue cable: if there is continuity with the ground, restore cable harness; if insulated from ground, replace the variable geometry control unit.
- If the circuit is open: check the connector of the variable geometry control unit and the injection control unit: if they are not OK, restore; if they are OK, check continuity on the light blue cable: if not OK, restore; if OK, replace the variable geometry control unit.
- If signal is not valid: check the connector of the variable geometry control unit, the motor cable connector and the motor connector (check the PINS of the connector, installed directly on the motor): if not OK, restore; if OK, check electrical characteristics of the motor: if not OK, replace; if OK, check, with connector of the variable geometry control unit and connector of the motor disconnected and intermediate connector connected, if the red and black cables are in continuity, insulated from ground and without voltage and insulated one from the other: if not OK, restore; if OK, check if the electrical motor pin is correctly inserted in the cavity of the endless screw (however it must turn a bit): if not OK, place it correctly; if OK, replace the variable geometry control unit.

## 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

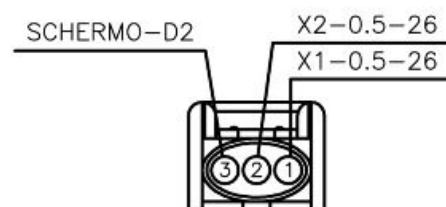
### Location:

- on the vehicle: on the clutch cover
- connector: under the tank on the right (3-ways black connector)

### Electrical characteristics:

0.79 kohm at ambient temperature

### Pin out:





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

#### **DIAGNOSIS 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.**

#### **DIAGNOSIS INSTRUMENT: STATUSES**

Synchronised panel

- No\_under analysis\_standby\_Yes

#### **DIAGNOSIS 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 9 AND 23 OF THE MARELLI CONTROL UNIT ENGINE CONNECTOR.**

#### **DIAGNOSIS 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

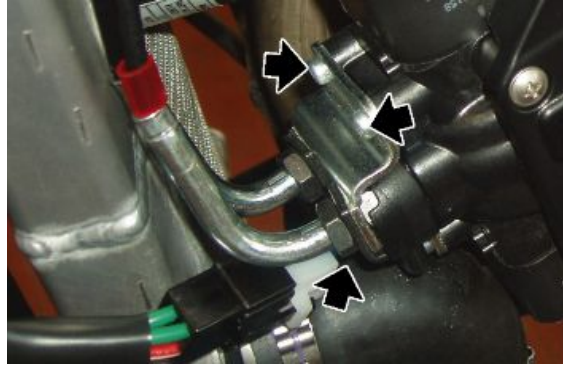
##### **Troubleshooting**

- 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
-

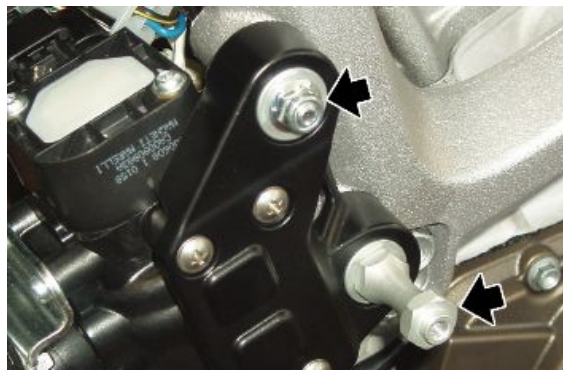
## Twistgrip position sensor

### Removal

- Remove the left fairing.
- Loosen the two throttle cable nuts.
- Unscrew and remove the three plate fixing screws.
- Remove the throttle cables.



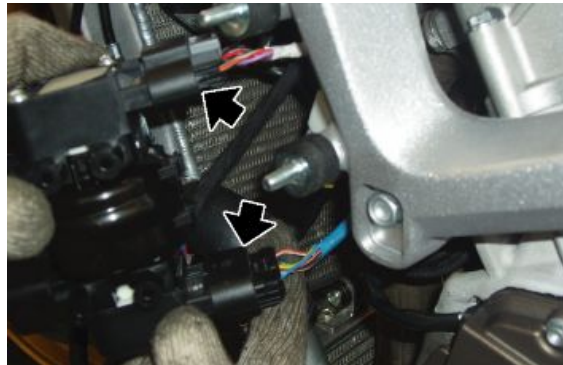
- Unscrew and remove the nut and the stud bolt.
- Retrieve the washers.



- Move the hand grip position sensor, disconnect the two connectors.
- Remove the hand grip position sensor.

### NOTE

WHEN REFITTING, REMEMBER NOT TO INVERT THE CONNECTORS.  
THE LIGHT BLUE CONNECTOR HAS THE BLUE CABLE  
AND THE WHITE CONNECTOR HAS THE WHITE CABLE.



### 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 and 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 wiring diagram:

Hand grip position sensor

### Location:

- on the vehicle: front left part, next to the cooling liquid radiator
- connector: on the sensor

### Electrical specifications

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

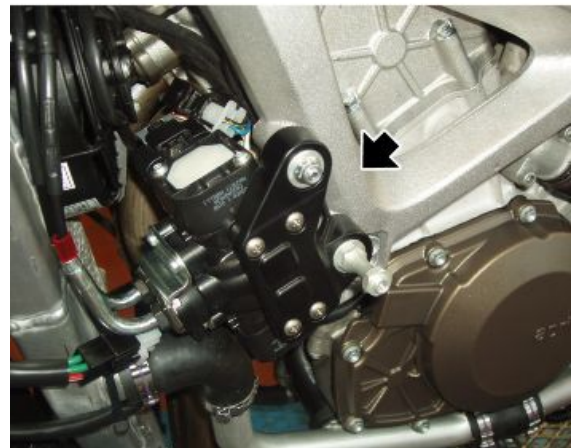
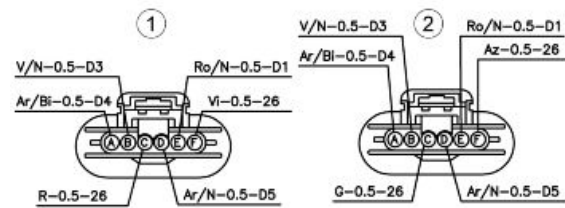
### Pin out:

BLUE connector

- A: Track A supply
- B: Track A ground
- C: Track A signal
- D: Track B supply
- E: Track B ground
- F: Track B signal

WHITE connector

- A: Track C supply
- B: Track C ground



- C: Track C signal
- D: Track D supply
- E: Track D ground
- F: Track D signal

**DIAGNOSIS INSTRUMENT: PARAMETERS**

Blue lower connector throttle grip position sensor - track A

- Example value with key ON: 1107 mV
- Example value with engine on: -

Voltage value of the lower potentiometer - track A

Blue lower connector throttle grip position sensor - track B

- Example value with key ON: 1070 mV
- Example value with engine on: -

Voltage value times 2 of the lower potentiometer track B

White upper connector throttle grip position sensor - track C

- Example value with key ON: 3560 mV
- Example value with engine on: -

Voltage value of the upper potentiometer track C

White upper connector throttle grip position sensor - track D

- Example value with key ON: 3555 mV
- Example value with engine on: -

Voltage value times 2 of the upper potentiometer track D

Throttle grip position sensor

- Example value with key ON: 1107 mV
- Example value with engine on: -

Voltage corresponding to the potentiometer track A

Throttle grip opening percentage

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

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

**DIAGNOSIS INSTRUMENT: STATUSES**

Throttle grip

- Slightly twisted\_choked\_fully twisted

Throttle grip self-acquisition

- 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.**

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### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

Blue lower 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 VEHICLE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 39 of the VEHICLE connector

#### **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the BLUE lower connector Throttle Grip Position Sensor - track A: disconnect the connector and read the value indicated by the diagnosis 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 lower 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 VEHICLE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 13 of the VEHICLE connector

#### **Troubleshooting**

- short circuit to positive: check the value shown by the parameter of the BLUE lower connector Throttle Grip position Sensor track B: disconnect the connector and read the value indicated by the diagnosis 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

### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

White upper 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 upper connector Throttle Grip Position Sensor - track C: disconnect the connector and read the value indicated by the diagnosis 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: carry out the open circuit, 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

White upper 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 upper connector Throttle Grip Position Sensor - track D: disconnect the connector and read the value indi-

cated by the diagnosis 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

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

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

- incongruent 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 lower 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 upper connector throttle grip position (tracks C-D) P0155

- incongruent 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 upper 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

- incongruent signal

#### **Error cause**

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

#### **Troubleshooting**

- Replace the throttle grip sensor

#### **DIAGNOSIS INSTRUMENT: ADJUSTABLE PARAMETERS**

Throttle grip self-acquisition: -

#### **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 grip self-acquisition procedure with the diagnosis instrument: once the check is completed, make sure that the throttle grip Self-acquisition 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 BLUE CONNECTOR AND COLLAR ARE PLACED DOWNWARDS AND THE WHITE CONNECTOR AND COLLAR ARE PLACED UPWARDS.**

## **Intake pressure sensor**

#### **Function**

The pressure sensors (one per bank), are fundamental for calculation of generated torque, for calculation of ambient pressure and for correct ignition timing during start-up.

#### **Operation / operating principle**

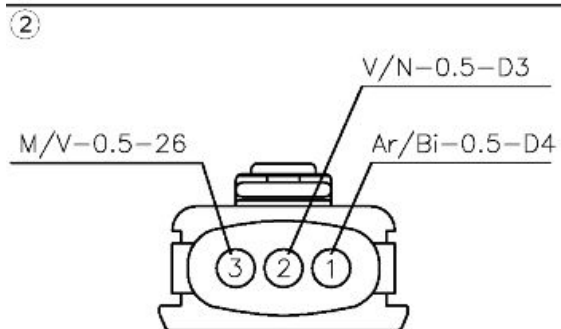
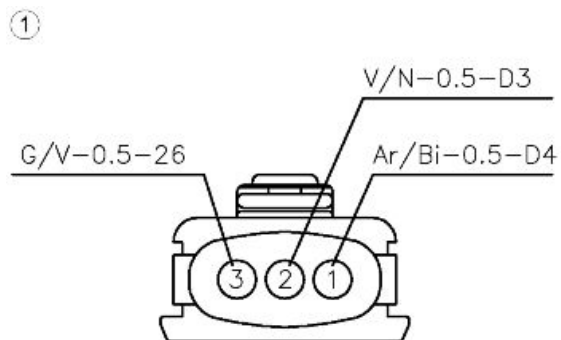
Diaphragm sensor which translates the diaphragm position into electrical voltage when in contact with the intake air.

#### **Level in wiring diagram:**

Intake air temperature sensor

#### **Location:**

- on the vehicle: sensor for rear cylinders (1 and 3) on the right of the filter box, sensor for front cylinders (2 and 4) on the left of the filter box.
- connector: on the sensor.





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

1. Power supply 5V
2. Ground connection
3. Output signal

**DIAGNOSIS INSTRUMENT: PARAMETERS**

## Front Cylinder Intake Pressure (2 and 4)

- Example value with key ON: 1003 mbar
- Example value with engine on: 720 mbar
- NOTE: pressure read by the front sensor

## Rear Cylinder Intake Pressure (1 and 3)

- Example value with key ON: 1004 mbar
- Example value with engine on: 715 mbar
- NOTE: pressure read by the rear sensor

## Front Cylinder estimated Intake Pressure (2 and 4)

- Example value with key ON: 1003 mbar
- Example value with engine on: 721 mbar
- NOTE: pressure estimated by the control unit according to the throttle position

## Rear Cylinder estimated Intake Pressure (1 and 3)

- Example value with key ON: 1004 mbar
- Example value with engine on: 735 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.**

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**DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

## rear cylinder air pressure sensor P0105

- 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: see that the parameter of the rear cylinders air Pressure Sensor on the diagnosis instrument reads 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 3: 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 1 is approx. 5 V: if not OK, set the key to OFF and check continuity between the ENGINE connector PIN 25 and the sensor connector PIN 1: if not OK, restore the cable harness; if OK, replace the control unit; if there is 5V voltage at PIN 1, and with key set to ON, check the continuity to ground of the sensor connector PIN 3: if not OK, restore the cable harness; if OK, replace the sensor.

front cylinder air pressure sensor P0106

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 49. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 49.

#### **Troubleshooting**

- If shorted to positive: see that the parameter of the front cylinders air Pressure Sensor on the diagnosis instrument reads 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 49 of the Marelli control unit and the sensor connector PIN 3: 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 1 is approx. 5 V: if not OK, set the key to OFF and check continuity between the ENGINE connector PIN 25 and the sensor connector PIN 1: if not OK, restore the cable harness; if OK, replace the control unit; if there is 5V voltage at PIN 1, and with key set to ON, check the continuity to ground of the sensor connector PIN 3: if not OK, restore the cable harness; if OK, replace the sensor.

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

rear cylinder air pressure sensor P0107

- 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 VEHICLE connector PIN 24 and sensor connector PIN 3 is a few tenths of an Ohm; If it is above that value, restore cable harness. Replace the sensor if it is correct.

rear cylinder air pressure sensor P0108

- 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 filter box large connector, the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, check that resistance between VEHICLE connector PIN 49 and sensor connector PIN 3 is a few tenths of an Ohm; If it is above that value, restore cable harness. Replace the sensor if it is correct.

Error for unexpected air intake in the rear cylinder 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 (for example, the pipe between sensor and throttle body is squashed or there is a hole in the intake manifold).

**Troubleshooting**

- Check the pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean.

Error for unexpected air intake in the front cylinder manifold P0211

- 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 (for example, the pipe between sensor and throttle body is squashed or there is a hole in the intake manifold).

**Troubleshooting**

- Check the pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean.

Estimation error for rear 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 pipe between sensor and throttle body is fully detached/ clogged or squashed).

**Troubleshooting**

- Check the pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean: there is an evident defect in the intake and pressure reading systems.

Estimation error for front cylinder intake manifold pressure P0216

- 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 pipe between sensor and throttle body is fully detached/ clogged or squashed).

**Troubleshooting**

- Check the pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean: there is an evident defect in the intake and pressure reading systems.

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Pressure too low at rear cylinder manifold 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 pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean.

Pressure too low at front cylinder manifold error P0218

- 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 pneumatic system between the pressure sensor and the socket to read pressure on the throttle body; check that the intake manifold is in good conditions and the pressure reading hole is clean.

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## Engine temperature sensor

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### **Function**

It tells the engine temperature to the control unit to improve its performance and to calculate the engine friction for a better estimation of the generated torque.

### **Operation / operating principle**

NTC type sensor (resistance sensor, inversely variable with temperature).

### **Level in wiring diagram:**

Temperature sensors

### **Location:**

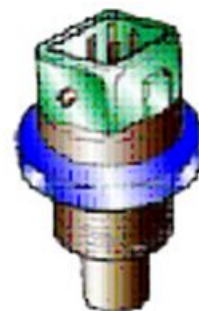
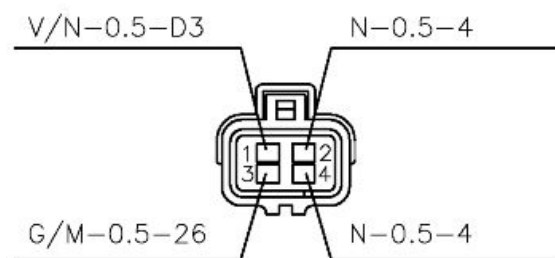
- on the vehicle: right side next to the two heads.
- connector: on the sensor.

### **Electrical characteristics:**

- Resistance at 25°: 2.05 k $\Omega$   $\pm$  100  $\Omega$
- Resistance at 60°: 575 k $\Omega$   $\pm$  15  $\Omega$
- Resistance at 90°: 230 k $\Omega$   $\pm$  5  $\Omega$

### **Pin out:**

1. B1 yellow/brown : 0-5 V signal



2. B2 green/black: Ground connection

### DIAGNOSIS INSTRUMENT: PARAMETERS

Engine temperature:

- Example value with key ON: 25° C
- Example value with engine on: 75° C
- In case of recovery, this value is set by the control unit: if there is a malfunction after engine start-up, temperature decreases up to approximately 75°.

Engine temperature pre Recovery:

- Example value with key ON: -40° C
- Example value with engine on: -40° C
- Value drawn from the signal read without taking into account any recovery: the value in the example refers to an open circuit.

Engine temperature at start-up:

- Example value with key ON: -40° C
- Example value with engine on: 25° C
- The temperature value is stored during engine start-up. With key ON, value -40°C is read.

#### 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.**

### DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

engine temperature sensor P0115

- 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 12 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 12 and the sensor PIN 1: 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 2 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 12 and sensor PIN 1; if there is no continuity with the ground connection, 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 2: 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 is null, replace the sensor; if resistance is correct, it means that the Yellow/Brown cable has ground connection: restore the cable harness

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

engine temperature sensor P0116

- signal not valid.

#### **Error cause**

- An excessive temperature variation has been detected: for example, the cause may be a contact resistance between the terminals. The instrument panel does not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

- Check the sensor connector and the ENGINE connector of the Marelli control unit.

#### **NOTES**

No error is detected if the sensor does not work correctly or the control unit connector or sensor terminals are rusty: then check through Axone if the temperature indicated is plausible in relation to the engine temperature. Check also that the sensor electrical characteristics are observed: replace the sensor if not OK; if it is OK, check the sensor connector and the Marelli control unit connector.

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## Air temperature sensor

### Function

it tells the control unit the intake air temperature in order to calculate oxygen presence so as to optimise the petrol quantity necessary for correct combustion

### Operation / operating principle

NTC type sensor (resistance sensor, inversely variable with temperature)

### Level in wiring diagram:

Temperature sensors

### Location:

- sensor: on rear side of the filter box
- connector: on the sensor

### Electrical characteristics: Resistance

- at 0 °C (32 °F): 32.5 kΩ ± 5%
- at 25 °C (77 °F): 10.0 kΩ ± 5%

### Pin out:

1. 0-5 V signal
2. Ground connection

### DIAGNOSIS INSTRUMENT: PARAMETERS

#### Air temperature

Example value with key ON: 26 °C (78.8 °F)

In case of recovery, this value is set by the control unit

#### Air temperature pre Recovery

Example value with key ON: -40 °C (-40.0 °F)

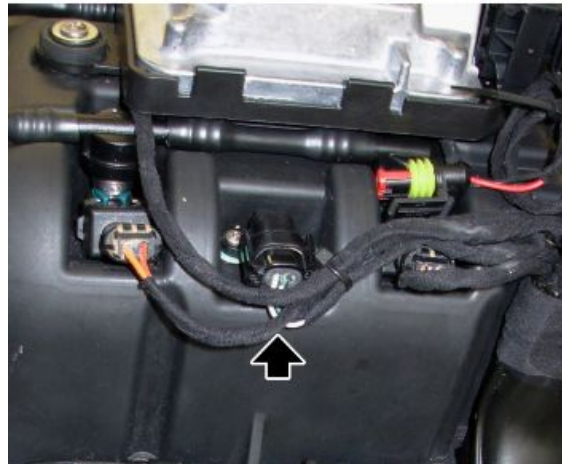
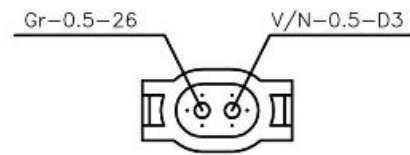
Value drawn from the signal read without taking into account any recovery: the value in the example refers to an open circuit

### 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.

### DIAGNOSIS 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 1: 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 2 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 1; 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 2: 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 grey 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 wiring diagram:

Lambda Probe

### Location:

- on the vehicle: left side of the vehicle
- connector: on the right of the pinion cover (4-ways black connector)

### Electrical specifications

- Heater circuit: 7-9Ω at Ambient temp.

### Pin out:

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

### DIAGNOSIS INSTRUMENT: PARAMETERS

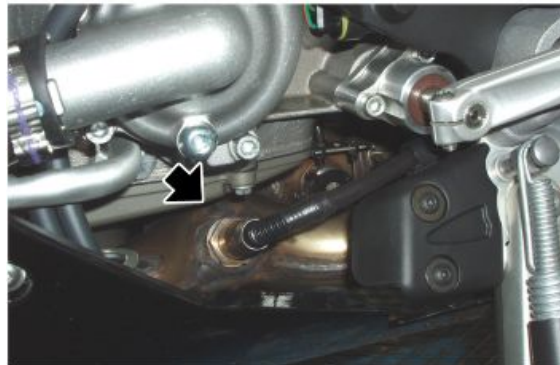
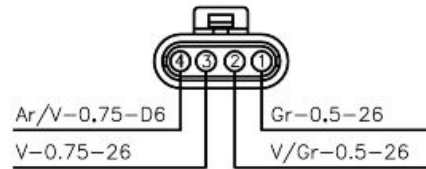
Lambda probe

- 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 lambda probe parameter is not equal to the value read by the control unit; a recovery value is displayed instead

Lambda 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 lambda probe 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 Lambda probe 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.**

**DIAGNOSIS INSTRUMENT: STATUSES**

Lambda probe: 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 lambda probe signal to keep the combustion as close as possible to the stoichiometric value.

**DIAGNOSIS INSTRUMENT: ACTIVATION**

Lambda probe heating

- The injection relay (No. 33 in the wiring diagram, placed under the saddle next to the battery, right side; 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 of 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

**DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

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 'lambda probe' parameter is not the real value that is read; a re-

covery 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 lambda probe

Lambda probe heating 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 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 orange/green cable continuity between the probe connector and the injection relay (No. 33 in the wiring diagram, placed under the saddle next to the battery, right 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 ground insulation of the green cable (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the green cable (between the sensor connector PIN 3 and the ENGINE PIN 32) and restore the cable harness.
- 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 orange/green cable continuity between the probe connector and the injection relay (No. 33 in the wiring diagram, placed under the saddle next to the battery, right 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 ground insulation of the green

cable (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the green 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 lambda probe 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.

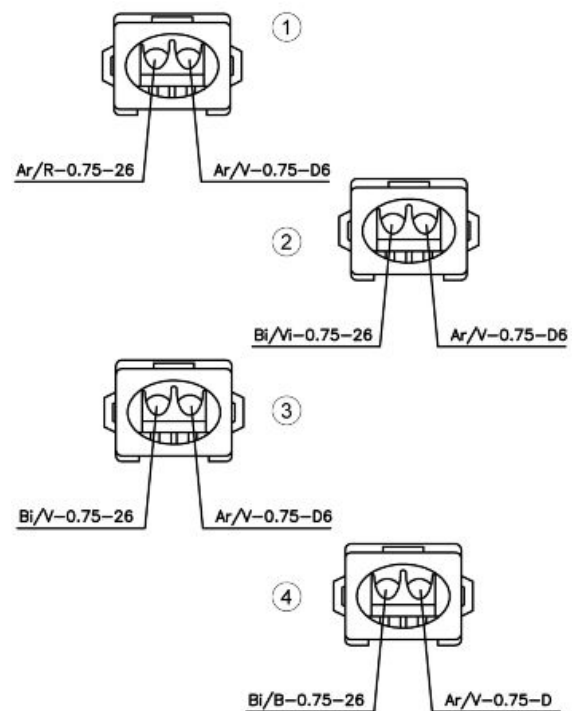
### Troubleshooting

- Check circuit continuity from probe connector (PIN 1 and PIN 2) toward the probe: replace the lambda probe 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.

## Injector

### Lower injectors key:

- 1. Lower injector 1
- 2. Lower injector 3
- 3. Lower injector 2
- 4. Lower injector 4



## LOWER INJECTOR

### Function

To supply the correct amount of petrol at the right timing. The lower injectors work in the field of low engine revs, the upper injectors in the field of high engine revs.

### Operation / Operating principle

Injector coil is excited for the petrol passage to open

### Level in electrical circuit diagram:

Coils and injectors

### Location:

- on the vehicle: on the throttle body
- connector: on injectors

### Electrical characteristics:

14.8Ω ± 5% (at ambient temp)

### Pin out:

- "+": supply
- " ": ground

### DIAGNOSIS INSTRUMENT: PARAMETERS

Cylinder injection time 1

- Example value with engine on: 1.9 ms

Cylinder injection time 2

- Example value with engine on: 1.9 ms

Cylinder injection time 3

- Example value with engine on: 1.9 ms

Cylinder injection time 4

- Example value with engine on: 1.9 ms

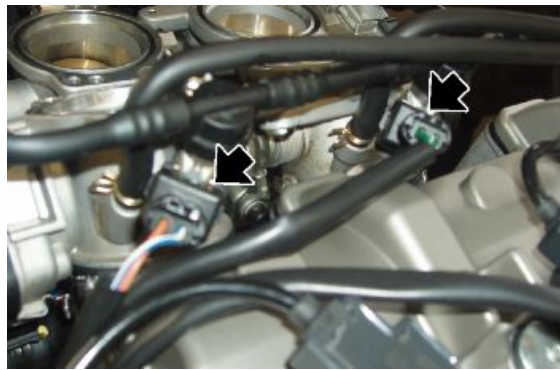
### CAUTION

**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.**

### DIAGNOSIS INSTRUMENT: ACTIVATION

Lower injector cylinder 1

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 sec-



onds 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

#### Lower injector cylinder 2

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

#### Lower injector cylinder 3

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

#### Lower injector cylinder 4

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

#### Lower injector cylinder 1 P0201

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 8. 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 diagnosis instrument and check the voltage on the orange/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 orange/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 the ENGINE PIN 8 and component PIN - and restore the cable harness

#### Lower injector cylinder 2 P0202

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 46. 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 diagnosis instrument and check the voltage on the white/green cable on the injector connector: 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/green 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 46 and component PIN - and restore the cable harness

#### Lower injector cylinder 3 P0203

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 34. 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 diagnosis instrument and check the voltage on the white/purple 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/purple 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 34 and component PIN - and restore the cable harness

Lower injector cylinder 4 P0204

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

#### **Error cause**

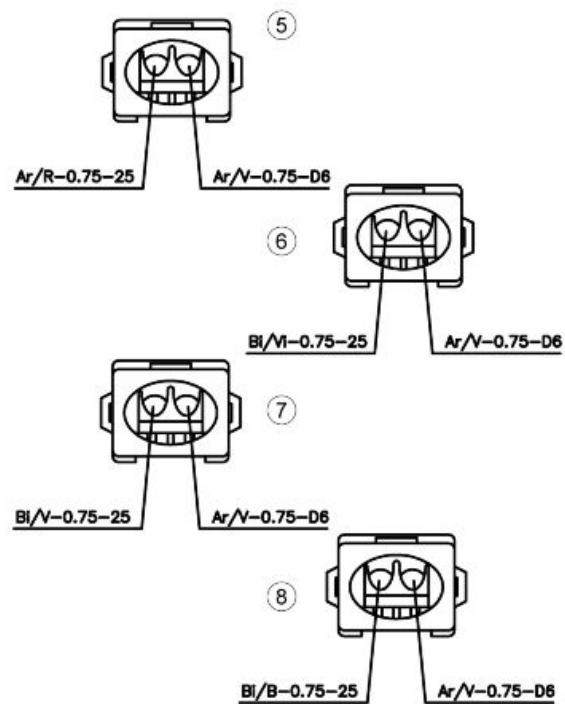
- If shorted to positive: excessive voltage has been detected at PIN 45. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected

#### **Troubleshooting**

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnosis instrument and check the voltage on the white/blue 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/blue 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 45 and component PIN - and restore the cable harness

**Upper injectors key:**

- 5. Upper injector 1
- 6. Upper injector 3
- 7. Upper injector 2
- 8. Upper injector 4

**UPPER INJECTOR Function**

To supply the correct amount of petrol at the right timing. The lower injectors work in the field of low engine revs, the upper injectors in the field of high engine revs.

**Operation / Operating principle**

Injector coil is excited for the petrol passage to open

**Level in electrical circuit diagram:**

Coils and injectors

**Location:**

- on the vehicle: on filter box cover
- connector: on injectors

**Electrical characteristics:**

14.8Ω ± 5% (at ambient temp)

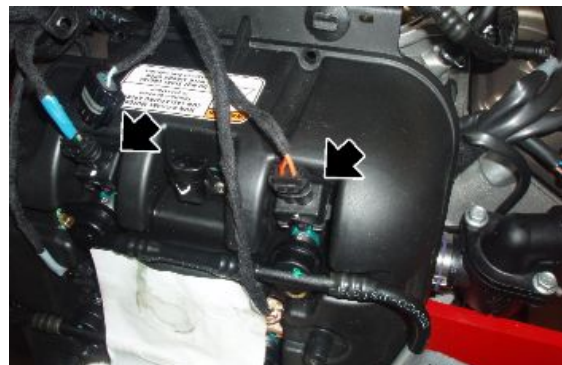
**Pin out:**

- "+": supply
- " ": ground

**DIAGNOSIS INSTRUMENT: PARAMETERS**

Cylinder injection time 1

- Example value with engine on: 1.9 ms



Cylinder injection time 2

- Example value with engine on: 1.9 ms

Cylinder injection time 3

- Example value with engine on: 1.9 ms

Cylinder injection time 4

- Example value with engine on: 1.9 ms

**CAUTION**

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**DIAGNOSIS INSTRUMENT: ACTIVATION**

Lower injector cylinder 1

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

Upper injector cylinder 2

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

Upper injector cylinder 3

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

Upper injector cylinder 4

- The injection relay (No. 33 in the wiring diagram, placed under saddle, right 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

### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

Upper injector cylinder 1 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 diagnosis instrument and check the voltage on the orange/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 orange/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 - and restore the cable harness

Upper injector cylinder 2 P0206

- 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 diagnosis instrument and check the voltage on the white/green cable on the injector connector: 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/green 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 67 and component PIN - and restore the cable harness

Upper injector cylinder 3 P0207

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 74. 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 diagnosis instrument and check the voltage on the white/purple 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/purple 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 74 and component PIN - and restore the cable harness

Upper injector cylinder 4 P0208

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 68. 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 diagnosis instrument and check the voltage on the white/blue 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/blue 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 68 and component PIN - and restore the cable harness

## Fuel pump

### Function

Fuel pump: keeps pressure of the injectors supply duct.

Low fuel: tells to the instrument panel about low fuel

### Operation / Operating principle

Low fuel: it is a resistance that if correctly supplied varies its electrical resistance if it is damped or not by petrol.

### Level in electrical circuit diagram:

Injection load relay

### Location:

- on the vehicle: on the tank.
- connector: on right rear frame (4-ways black).

### Electrical characteristics:

PIN 1-2: 0.5 - 1 ohm; PIN 3-4: you do not need to measure the component electrical resistance since it works correctly with suitable supply from the instrument panel only. Check correct operation as follows: connect in series a bulb of approximately 2 W: it should turn on if the tank is in reserve, otherwise, it remains off.

### Pin out:

1. + 12 V
2. ground connection
3. ground connection
4. + 12 V (signal)

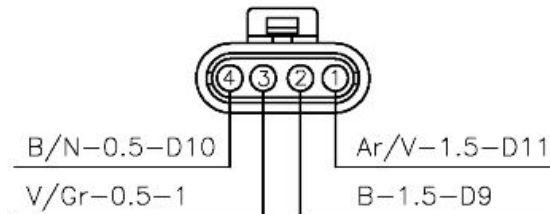
### CAUTION

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### DIAGNOSIS INSTRUMENT: ACTIVATION

Fuel pump

NOTE: The injection relay (No 33 in the wiring diagram, position under the saddle, right side, CHECK, however, 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

**DIAGNOSIS 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**

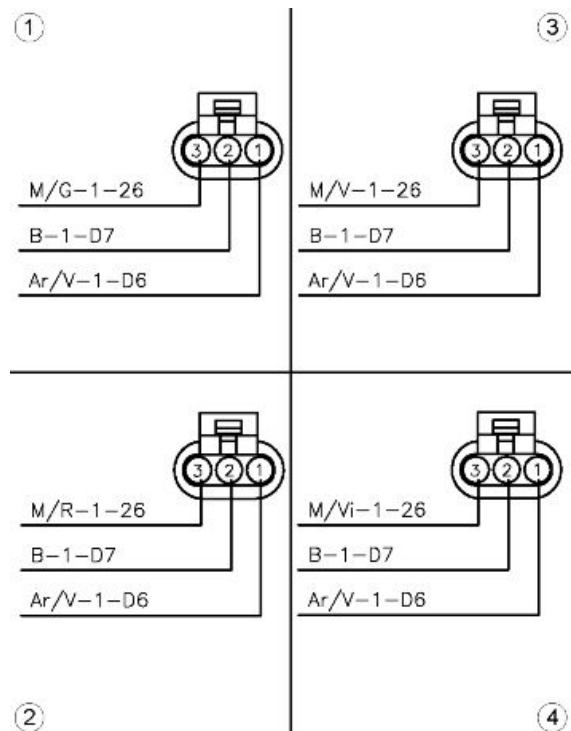
Inductive discharge system

**Level in electrical circuit diagram:**

coils and injectors

**Location:**

- on the vehicle: on the head covers.
- connector: For each 3-ways black coil connector. Coil 1 with short cable: on the left on the filter box, rear side; coil 2 with long cable: on the left of the front side of the filter box (connector with red strap on engine cable harness), coil 3 with long cable: on the left on the rear side of the filter box (connector with red



strap on engine cable harness); coil 4 with short cable: on the right of the front side of the filter box.



**Electrical characteristics:**

0.7 - 0.9  $\Omega$  at ambient temperature

**Pin out:**

1. Power supply + Vbatt
2. Secondary circuit to ground
3. Activation from control unit

**DIAGNOSIS 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**

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**DIAGNOSIS INSTRUMENT: ACTIVATION**

**Coil 1:**

The injection relay (No. 33 in the wiring diagram, placed under the right side of the saddle; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the brown/yellow cable of the coil 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.

**Coil 2:**

The injection relay (No. 33 in the wiring diagram, placed under the right side of the saddle; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the brown/red cable of the coil 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.

**Coil 3:**

The injection relay (No. 33 in the wiring diagram, placed under the right side of the saddle; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the brown/green cable of the coil 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.

**Coil 4:**



The injection relay (No. 33 in the wiring diagram, placed under the right side of the saddle; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the brown/purple cable of the coil 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.

**DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

Coil 1 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 Axone 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.

Coil 2 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 Axone 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.

#### Coil 3 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 Axone 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.

#### Coil 4 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 Axone 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

Sends to the injection control unit the throttle position and activates the throttle according to 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 check and handle grip sensor (Demand)

### Location:

- on the vehicle: inside the filter box
- connector: on the throttle body, in lower position, near the throttle motors

### Pin out:

1. potentiometer signal 1
2. supply voltage + 5V
3. throttle valve control (+)
4. potentiometer signal 2
5. throttle valve control (+)
6. ground connection

## DIAGNOSIS INSTRUMENT: PARAMETERS

### Front cylinder throttle correction

- Example value with key ON: 0.0°
- Example value with engine on: 0.4°

The system, reading the intake pressure, tries to balance the intake pressures between the cylinders of the rear bank (1-3) and of the front bank (2-4) working on the throttle position: an acceptable value should be between -0.5 and + 0.5

### Rear cylinder throttle correction

- Example value with key ON: 0.0°
- Example value with engine on: -0.2°

The system, reading the intake pressure, tries to balance the intake pressures between the cylinders of the rear bank (1-3) and of the front bank (2-4) working on the throttle position: an acceptable value should be between -0.5 and + 0.5

### Front throttle Potentiometer 1 (degrees)

- Example value with key ON: 7.8°
- Example value with engine on: 1.4°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear

is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

**Rear throttle Potentiometer 1 (degrees)**

- Example value with key ON: 8°
- Example value with engine on: 1.5°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

**Front throttle Potentiometer 1 (voltage)**

- Example value with key ON: 873 mV
- Example value with engine on: 561 mV

**Rear throttle Potentiometer 1 (voltage)**

- Example value with key ON: 883 mV
- Example value with engine on: 536 mV

**Front throttle Potentiometer 2 (voltage)**

- Example value with key ON: 4123 mV
- Example value with engine on: 4426 mV

**Rear throttle Potentiometer 2 (voltage)**

- Example value with key ON: 4113 mV
- Example value with engine on: 4455 mV

**Front throttle Potentiometer 2 (degrees)**

- Example value with key ON: 8.0°
- Example value with engine on: 1.5°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

**Rear throttle Potentiometer 2 (degrees)**

- Example value with key ON: 8.2°
- Example value with engine on: 1.6°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

**Front cylinders throttle Limp Home position**

- Example value with key ON: 878 mV

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

**Rear cylinders throttle Limp Home position**

- Example value with key ON: 888 mV

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

**Front throttle lower position**

- Example value with key ON: 502 mV

Voltage stored in the control unit corresponding to the throttle mechanical minimum position

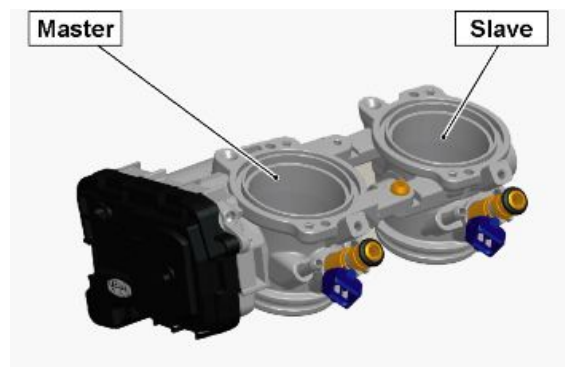
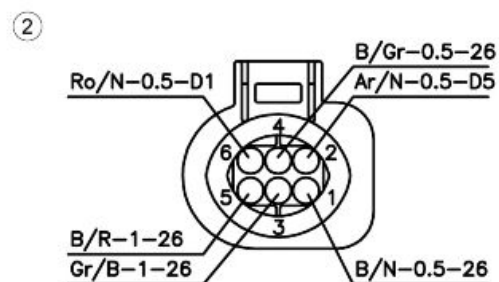
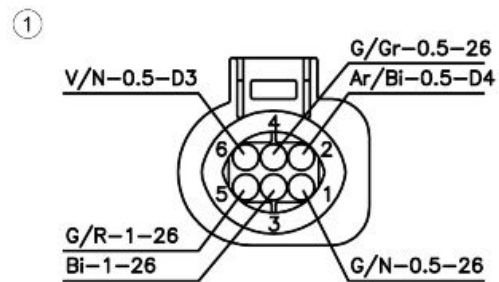
**Rear throttle lower position**

- Example value with key ON: 492 mV

Voltage stored in the control unit corresponding to the throttle mechanical minimum 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.**



**DIAGNOSIS INSTRUMENT: STATUSES**

Front throttle automatic self-learning

- 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

Rear throttle automatic self-learning

- 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 diagnosis 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

## DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

### CAUTION

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

potentiometer 1 sensor, rear 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 shown by the parameter of the Rear throttle Potentiometer 1 (voltage): disconnect the connector and see the value displayed by Axone: 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

potentiometer 2 sensor, rear 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 shown by the parameter of the Front throttle Potentiometer 2 (voltage): disconnect the connector and see the value displayed by Axone: 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

potentiometer 1 sensor, front throttle position P0125

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 36. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 36

#### **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the Rear throttle Potentiometer 1 (voltage): disconnect the left connector and see the value displayed by Axone: if the voltage does not vary, there is a short circuit in the cable wiring; 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

potentiometer 2 sensor, front throttle position P0127

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

#### **Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 21. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 21.

#### **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the rear Throttle Potentiometer 2 (voltage): disconnect the left connector and see the value displayed by Axone: if the voltage does not vary, there is a short circuit in the cable wiring; 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

Rear throttle control circuit P0166

- short circuit to positive / short circuit to negative / open circuit, overvoltage, excessive internal temperature.

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 29 - 41. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption or excessive ampere input or control unit overheating has been detected

**Troubleshooting**

- If shorted to positive: disconnect the throttle body connector, set key to ON and check voltage at PIN 3: if the voltage read is higher or equal to 5V, there is a short circuit on the cable harness; replace the throttle body if the voltage is null
- If shorted to negative: disconnect the throttle body connector, set the key to ON and check if PIN 3 is in continuity with the vehicle ground connection: if there is continuity, restore the cable harness; if there is not continuity, replace the throttle body
- If the circuit is open, there is overvoltage or excessive internal temperature: check the throttle body connector and the control unit connector: if not OK, restore; if OK, disconnect the throttle body connector and control unit connector and check if there is cables continuity; if there is no continuity, restore the cable harness. If there is continuity, with the throttle body connector connected, check that the resistance, from the throttle control unit connector, between PIN 29 and 41 is within 1 and 2.5 Ohm; if it is not, replace the throttle body; if it is, check that the throttle body is not mechanically blocked: if blocked, solve the problem and replace the body; if it is not, replace the control unit

## Front throttle control circuit P0186

- short circuit to positive / short circuit to negative / open circuit, overvoltage, excessive internal temperature circuit open

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 3 - 15. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption or excessive ampere input or control unit overheating has been detected

**Troubleshooting**

- If shorted to positive: disconnect the throttle body connector, set key to ON and check voltage at PIN 3: if the voltage read is higher or equal to 5V, there is a short circuit on the cable harness; replace the throttle body if the voltage is null
- If shorted to negative: disconnect the throttle body connector, set the key to ON and check if PIN 3 is in continuity with the vehicle ground connection: if there is continuity, restore the cable harness; if there is not continuity, replace the throttle body
- If the circuit is open, there is overvoltage or excessive internal temperature: check the throttle body connector and the control unit connector: if not OK, restore; if OK, disconnect the



throttle body connector and control unit connector and check if there is cables continuity; if there is no continuity, restore the cable harness. If there is continuity, with the throttle body connector connected, check that the resistance, from the throttle control unit connector, between PIN 3 and 15 is within 1 and 2.5 Ohm; if it is not, replace the throttle body; if it is, check that the throttle body is not mechanically blocked: if blocked, solve the problem and replace the body; if it is not, replace the control unit

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**DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

potentiometer 1 sensor, rear 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 parameter of the Potentiometer 1 front Throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 1 rear Throttle (voltage). 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

potentiometer 2 sensor, rear 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 parameter of the Potentiometer 2 front Throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 2 rear Throttle (voltage). 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

rear throttle position potentiometer P0124

- incongruent 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.

potentiometer 1 sensor, front throttle position P0126

- signal not valid

**Error cause**

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

**Troubleshooting**

- Check the parameter of the Potentiometer 1 rear throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 1 front throttle (voltage). 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 36) 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

potentiometer 2 sensor, front throttle position P0128

- signal not valid

**Error cause**

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

**Troubleshooting**

- Check the parameter of the Potentiometer 2 rear throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 2 front throttle (voltage). 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 throttle control unit (PIN 21) 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 P0129

- incongruent 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 36) is a few tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 21) 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.

Rear 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

Rear 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

Rear throttle minimum mechanical 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 the rear 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

Rear throttle power supply voltage during self-learning P0164

- low 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.

Rear throttle position error P0167

- misalignment between control and activation

**Error cause**

- The throttle mechanical control may be damaged

**Troubleshooting**

- Replace the throttle body

Front throttle Limp Home self-acquisition P0180

- 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

Front throttle mechanical springs self-acquisition P0181

- 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

Front throttle minimum mechanical position self-acquisition P0182

- 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 the front throttle Recovery conditions (air temp., water temp.) P0183

- 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

Front throttle power supply voltage during self-learning P0184

- low 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.

Front throttle position error P0187

- misalignment between control and activation

#### **Error cause**

- The throttle mechanical control may be damaged

#### **Troubleshooting**

- Replace the throttle body

---

### **DIAGNOSIS INSTRUMENT: ADJUSTABLE PARAMETERS**

Throttle Self-learning

#### **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 a throttle body is replaced, after key is set to ON, do not start the engine within the 3 seconds; during this time the control unit carries out the throttle self-acquisition process: according to the throttle body replaced check that the status "Front throttle automatic self-learning" or "Rear throttle automatic self-learning" 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 "Throttle self-learning" process on the adjustable parameters screen page (screwdriver and hammer), and check again that the "Throttle self-learning with diagnostics instrument" status indicates: "Carried out" and that the "Front throttle automatic self-learning" or "Rear throttle automatic self-learning" indicate: "carried out"

## Engine oil pressure sensor

### Function

Indicates the instrument panel if there is enough oil pressure (0.5 +/-0.2 bar) in the engine.

### Operation / operating principle

Normally closed switch (grounds the control unit signal); with pressure values above  $0.5 \pm 0.2$  bar, the switch is tripped.

### Level in wiring diagram:

Low fuel and oil pressure

### Location:

- on the vehicle: front side of the engine, next to the oil filter.
- connector: on the sensor.

### Electrical specifications: -

#### Pin out:

1. Voltage: 5 V

#### 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

DSB 07: Oil pressure sensor



**Error cause**

- An oil sensor fault is signalled when, with engine off, it is detected that the sensor circuit is open. The test is performed only once when the key is set to ON. There is an error when the general warning light turns on.

**Troubleshooting**

- Check the sensor connector and the instrument panel connector (PIN 17): if they are not OK, restore. If OK, check continuity of the purple cable between the sensor connector and the instrument panel connector PIN 17: if not OK, restore the cable harness; if OK, replace the sensor.

DSB 08: Oil pressure

**Error cause**

- An oil sensor fault is signalled when, with engine running, it is detected that the sensor circuit is closed. There is an error when the general warning light turns on.

**Troubleshooting**

- Check if oil pressure is low with the specific gauge.

**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**

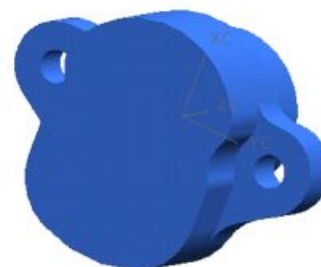
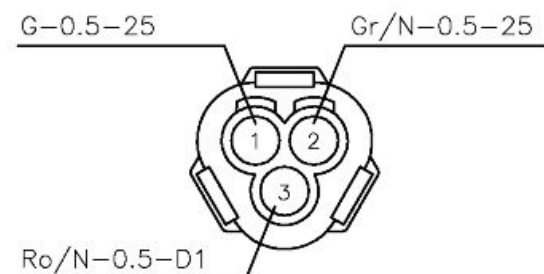
The sensor has 2 circuits: one to indicate the engaged gear, whose resistance varies according to the engaged gear: in this way, the injection ECU, according to detected electric voltage, identifies the engaged gear and sends the information via CAN to the instrument panel; the other indicates neutral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

**Level in electrical circuit diagram:**

Start-up enabling switches

**Location:**

- on the vehicle: under chain pinion, behind the pinion cover.



- connector: between head cover and filter box on left side (3-ways white connector).

### Electrical characteristics:

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.**

### DIAGNOSIS INSTRUMENT: STATUSES

Gear in neutral

- Yes/No

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

### DIAGNOSIS 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 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 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 wiring diagram:

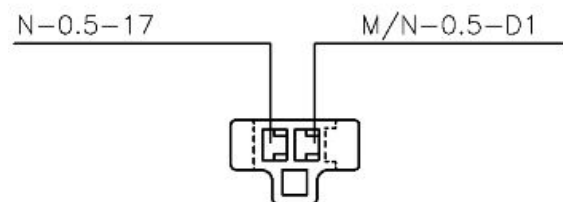
Start-up enabling switches

### Location:

- on the vehicle: on the handlebar.
- connector: on the sensor.

### Electrical characteristics:

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



### Pin out:

1. voltage 5V
2. 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.**

### DIAGNOSIS INSTRUMENT: STATUSES

Clutch

- Indefinite\_Released\_Pulled

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

- Indication on Axone always Released: check the sensor connector, the engine-vehicle cable harness connector (special attention to PIN C3) 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: if there is no continuity, restore the cable harness; if there is, replace the sensor.

- Indication on Axone always Pulled: disconnect the terminals from the sensor and check if there is continuity between the two PINS, with clutch released: if there is continuity, replace sensor; if the circuit is open, it means that there is short circuit to ground of black cable from sensor PIN 1 to engine-vehicle cable harness connector PIN C3 or of the white/purple cable from PIN C3 to VEHICLE connector PIN 56: restore the cable harness.

## 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: between head cover and filter box on left side (2-ways white connector)

### Pin out:

1. Ground connection
2. Voltage 12V

### Electrical characteristics:

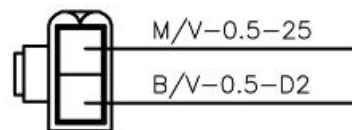
- Side Stand Up: closed circuit (continuity)
- Side Stand Down: open circuit (infinite resistance)

### 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.

### DIAGNOSIS INSTRUMENT: STATUSES

Side stand sensor: up/down



- Indication on Axone 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 Axone 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

When the sensor is inverted, the circuit is closed to ground: When the Marelli control unit detects this ground connection, it does not enable start-up or shuts off the engine.

### Level in wiring diagram:

Start-up enabling switches

### Location:

- on the vehicle: sensor placed in the frame front niche.
- connector: next to the sensor (2-ways grey connector).

### Electrical characteristics:

- Sensor in vertical position: open circuit (resistance: 62 kOhm)
- Sensor inverted: closed circuit (continuity)

### Pin out:

1. Ground connection
2. Voltage 5V

### 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.

### DIAGNOSIS INSTRUMENT: STATUSES

**Fall sensor:** Normal / Tip over



- Indication on Axone always Normal, even when the sensor is inverted: disconnect the connector and, with sensor inverted, check if there is continuity between the two PINS of the sensor: If there is not continuity, replace the sensor; if there is continuity, check the connector: if not OK, restore cable harness; if OK, check the ground continuity of PIN 1: if there is not continuity, restore cable harness; if there is continuity, check, with key ON, if there is voltage of 5 V at PIN 2; if there is not voltage, check Marelli control unit connector (with special attention to PIN 65) and check the vehicle-engine cable harness connector (with special attention to PIN B6).
- Indication on Axone always Tip over: disconnect the connector and check if there is continuity between the two PINS when the sensor is in vertical position: if there is continuity, replace the sensor; if there is not, it means that, with key set to ON, there is no 5V voltage at PIN 2: restore the cable harness whose pink/white cable will be shorted to ground

**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.**

## Electric fan circuit

**Function**

Radiator fan and coolant - Operation

**Operation / Operating principle**

When the control unit detects a temperature of approx. 101 °C, it closes the fan control relay pickup circuit to ground

**Level in electrical circuit diagram:**

electric fan

**Location:**

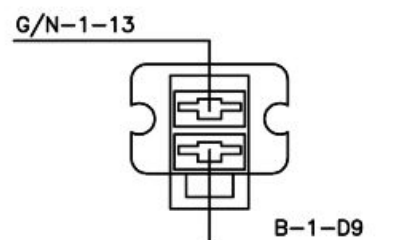
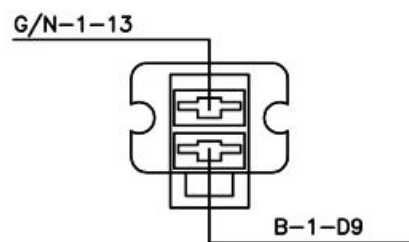
- sensor: relay placed in the frame front niche, on the left
- connector: on the relay

**Electrical characteristics:**

- relay normally open;
- drive coil resistance 110 Ohm (+/- 10 %)

**DIAGNOSIS INSTRUMENT: STATUSES****Fan relay**

- on/off



**DIAGNOSIS INSTRUMENT: ACTIVATIONS**

## Fan

- The fan relay (No. 36 in the wiring diagram, placed in the headstock niche, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 10 seconds. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

**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.**

**DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

## Cooling fan relay P0480

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

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 61 of the VEHICLE connector. If shorted to negative: no voltage has been detected. If the circuit is open: 5V voltage has been detected. Error recognition carries out only when the fan relay is activated.

**Troubleshooting**

- If shorted to positive: check the relay electrical specifications are correct by disconnecting it from the cable harness. If not OK, replace the relay; if OK, restore the cable harness (brown cable)
- If shorted to negative: check the relay electrical specifications are correct by disconnecting it from the cable harness. If not OK, replace the relay; if OK, restore the cable harness (brown cable)
- If the circuit is open: 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 cable)

## SAS valve actuator

### Function

Quickly warms up the catalytic converter and keeps the combustion rich in some critical conditions

### Operation / Operating principle

The valve coil is excited to open the air passage of the filter box to the exhaust manifold

### Level in electrical circuit diagram:

Secondary air valve and lambda probe

### Location:

- on the vehicle: under throttle bodies, in the V between the two front and rear cylinders banks
- connector: on the valve

### Electrical characteristics:

Resistance at ambient temperature:  $21 \pm 3 / - 1 \Omega$

### Pin out:

1. Power supply V batt
2. Ground connection

### DIAGNOSIS INSTRUMENT: PARAMETERS

#### Secondary air valve duty cycle

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

Used only at 0 or 100%

#### CAUTION

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### DIAGNOSIS INSTRUMENT: LOGIC ERRORS

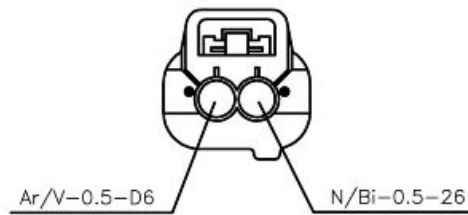
Secondary air valve control P0446

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

### Error cause

- If shorted to positive: excessive voltage has been detected at PIN 43. If shorted to negative/ open circuit: no voltage has been detected. The instrument panel does not indicate the presence of this error even in the ATT status.

### Troubleshooting



- If shorted to positive: disconnect the component, set the key to ON, start the vehicle and check if the error symptom is still "shorted to positive": it means that short circuit is between black/white cable and a cable in voltage, therefore restore cable harness; if the error symptom is short circuit to ground, it means that short circuit is inside the valve and therefore, you must replace the component.
- If shorted to negative or open circuit: check the component connector and control unit connector: if not OK, restore; if OK, check the continuity of the black/white cable between the two connectors: if not OK, restore cable harness; if OK, with key ON, check if there is voltage at PIN 1: if there is not voltage, check orange/green cable; if there is voltage, check component electrical characteristics and replace the component

## RUN/STOP switch

### Function

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

### Operation / Operating principle

If the driver wants to shut off the engine or to disable engine start-up, the switch should be open, i.e. VEHICLE connector PIN 78 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: inside the bow (4-ways black).

### Electrical characteristics:

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

### Pin out:

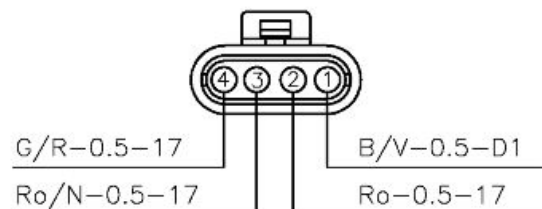
1 blue/green cable: ground connection

4 yellow/red cable: 5 V

### CAUTION

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### DIAGNOSIS INSTRUMENT: STATUSES



## RUN / STOP switch

- Run/Stop

## NOTES

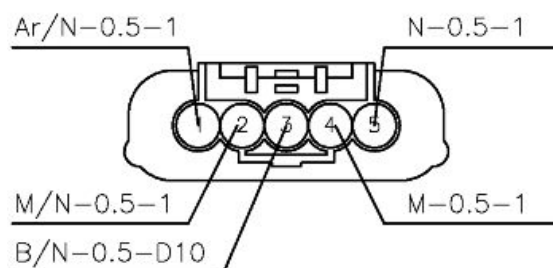
- Indication on Axone always STOP: disconnect the connector and, with the switch set to RUN, check if there is continuity towards the two cables switch - blue/green and yellow/red: If there is not continuity, replace the sensor; if there is continuity, check the connector: if not OK, restore the cable harness; if OK, check, with key set to ON, if there is voltage on Yellow/Red cable: if there is no voltage, restore the cable harness; if there is, check the yellow/red cable ground insulation: 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 not OK, restore; if OK, check continuity of the Yellow/Red cable between switch connector and PIN C7 of the engine-vehicle cable harness connector and between the PIN C7 and the VEHICLE connector PIN 78: if not OK, restore the cable harness; if OK, replace the Marelli control unit.
- Indication on Axone 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 there is continuity, replace the switch; if there is not continuity, it means that, with key set to ON, the yellow/red cable (between switch and the PIN C7 of the engine-vehicle cable harness connector or from the latter to the PIN 78 of the control unit connector) is shorted to positive: restore the cable harness.

## Butterfly valve in exhaust

### Function

It is used to reduce exhaust noise. The exhaust butterfly valve is managed as follows:

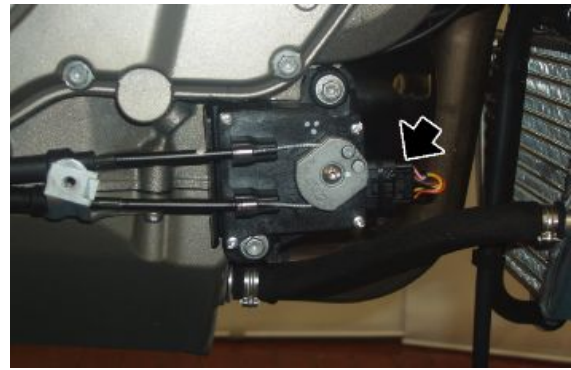
- With engine off: open by 75%
- With engine running: regardless of the gear engaged, below 5,500 rpm and below 14° of throttle opening it is fully closed; over 6,500 rpm or 16° of throttle opening it is fully open; under any other condition it is in an intermediate position. With bike stopped and in neutral the valve stays closed, regardless of rpm.



### Operation / Operating principle



The system consists of a throttle valve with a return spring placed on the exhaust pipe. The valve is closed via two cables actuated by an electric motor, which, in turn, is connected electrically to the instrument panel. The operating logic and motor control are, however, resident in the Marelli injection control unit, which dialogues with the instrument panel via the CAN.

**Level in electrical circuit diagram:**

Exhaust butterfly valve

**Location:**

- on the vehicle: The motor is placed in the front lower part of the engine. The valve in the exhaust duct.
- connector: on the motor.

**Electrical characteristics:**

- Electrical motor resistance (PIN 4-5):  
2--4 Ohm
- Potentiometer resistance (PIN 1-3):  
10.1 kOhm +/- 10%

**Pin out:**

1. Power supply voltage 5V
2. Output signal (0- 5V)
3. Ground connection
4. Motor A supply
5. Motor B supply

**DIAGNOSIS INSTRUMENT: PARAMETERS**

**Exhaust butterfly valve target position:** 7 - 93 %

NOTE: Value that control unit sends to the instrument panel to activate the valve: 7% (closed valve), 93 % (open valve).

**CAUTION**

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**DIAGNOSIS INSTRUMENT: STATUSES**

## Exhaust butterfly valve

- Indefinite/in research/activation with key ON/ in operation/stopped for detected malfunction/ research of zero position.

NOTE: If there is no problem, it appears: in operation

**DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

## Exhaust butterfly valve stop research P0191

- potentiometer signal above maximum threshold/potentiometer signal below minimum threshold/excessive time/research not carried out or wrong stroke.

**Error cause**

- If potentiometer signal is above maximum threshold: voltage of the maximum end of stroke position (open valve) outside the foreseen field has been detected. If potentiometer signal is below maximum threshold: voltage of the minimum end of stroke position (closed valve) outside the foreseen field has been detected. If time is excessive: excessive time for stop search has been detected (possible mechanical problem of the valve, of the motor or cables not connected). If research has not been carried out or wrong stroke: this symptom may be caused when a new instrument panel is installed and the stop self-acquisition procedure is not carried out or if the stop between minimum and maximum is too short or too long.

**Troubleshooting**

- If potentiometer signal is above maximum threshold: during adjustment "Exhaust butterfly valve self-acquisition", voltage of maximum opening end of stroke outside the foreseen field is detected. Check correct tensioning of the two valve cables.
- If potentiometer signal is below maximum threshold: during adjustment "Exhaust butterfly valve self-acquisition", voltage of minimum opening end of stroke outside the foreseen field is detected. Check correct tensioning of the two valve cables.
- If time is excessive: check that the valve cables are in voltage: if they are not in voltage, fix them; if they are OK, check that mechanical rotation of the exhaust butterfly valve is without friction or deceleration: if they are not OK, restore normal valve rotation; if they are OK, check motor electrical characteristics: if they are not OK, replace the motor; if they are OK, check valve connector and instrument panel connector (with special attention to possible oxidation): if they are not OK, restore; if they are OK, replace the electrical motor. Or also free cables.
- If research has not been carried out or wrong stroke: adjust "Exhaust butterfly valve self-acquisition" if the stop self-acquisition procedure has not been carried out after installation of new instrument panel. If the instrument panel is not new, check correct calibration of the cables and if correct, check that there is not an obstacle for correct rotation of the valve.

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Exhaust valve engine P0192

- open circuit, thermal overload protection, shorted to negative, shorted to positive or short circuit between both cables.

**Error cause**

- If the circuit is open: too low current has been detected at PIN 36 - 37 of the instrument panel connector. If thermal overload protection: instrument panel fault. If shorted to negative: voltage equal to zero has been detected. If shorted to positive or short circuit between both cables: excessive voltage has been detected.

**Troubleshooting**

- If the circuit is open: may occur due to loosen cables, therefore, make sure that cables are tight: if not tight, fix them; if cables are OK, check valve connector and instrument panel connector: if not OK, restore; if OK, check continuity of brown and black cables: if not OK, restore cable harness; if OK, check motor electrical characteristics and replace it.
- If thermal overload protection: replace the instrument panel.
- If shorted to negative: disconnect the valve connector and check, with key set to ON, if there is continuity with ground at PIN 4 of the connector: if there is ground connection, disconnect also the instrument panels connector and if it is still present, restore the brown cable; if there is not ground connection, replace the instrument panel; if there is not ground connection, check, with key set to ON, if there is continuity with ground connection at PIN 5 of the connector: if there is ground connection, disconnect also the instrument panel connector and if it is still present, restore the black cable; if there is not ground connection, replace the instrument panel; if there is not ground connection, check if PIN 4 or PIN 5 on the motor are in continuity with ground connection: if it is in continuity, replace the motor.
- If shorted to positive or short circuit between both cables: disconnect the instrument panel connector and check, with key set to ON if there is voltage on PIN 4 and PIN 5 of the connector: if there is, restore cable harness; if there is not, check, with key set to OFF and disconnecting also the valve connector, if both cables are insulated between them: if they are not insulated, restore cable harness; if insulated between them, it is possible that there is a shorted to positive inside the motor or instrument panel: it is necessary to replace one of the two components to identify which of them is faulty.

Exhaust valve potentiometer P0193

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

**Error cause**

- If shorted to positive: excessive voltage has been detected at PIN 10 of the instrument panel. If shorted to negative, the circuit is open: low voltage has been detected.

**Troubleshooting**

- If shorted to positive: disconnect the valve connector and check, with key set to ON, if there is voltage at PIN 2 of the connector: if there is voltage, disconnect also the instrument panel

connector and if there is voltage, restore cable harness; if there is not voltage, replace instrument panel, if there is not voltage, replace motor.

- If shorted to negative, the circuit is open: check the valve connector and instrument panel connector: if not OK, restore; if OK, check continuity on the brown/black cable: if not OK, restore; if OK, always with two connectors disconnected, check ground insulation: if there is ground continuity, disconnect also the instrument panel and if it is still present, restore the cable harness; if there is not ground continuity, replace the instrument panel; if there is not ground continuity, replace the motor.

### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

Exhaust valve position P0190

- position error.

#### **Error cause**

- Position indicated by potentiometer does not correspond with position set by control unit.

#### **Troubleshooting**

- Mechanically check the valve, its normal rotation (with cables disconnected from motor, manually activate the cables and see movement regularity and check valve complete stroke with correct operation of the return spring) and absence of foreign bodies which do not allow its rotation: if not OK, restore; if OK, check valve and instrument panel connectors (special attention to oxidation) and check cables resistance: if not OK, restore; if OK, always with cables disconnected and key set to ON, check normal rotation of the electric motor and replace motor (potentiometer does not work correctly).

### **DIAGNOSIS INSTRUMENT: ADJUSTABLE PARAMETERS**

- Acquire exhaust valve zero position.

NOTE: Motor is placed in a reference position to correctly search mechanical stop later.

- Exhaust valve self-acquisition

NOTE: Search minimum and maximum mechanical stop.

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The system consists of a throttle valve (1) with a return spring placed in the exhaust pipe. The valve is closed via two cables actuated by an electric motor (2) which, in turn, is connected electrically to the instrument panel. The operating logic and motor control are, however, resident in the Marelli injection control unit, which dialogues with the instrument panel via the CAN.

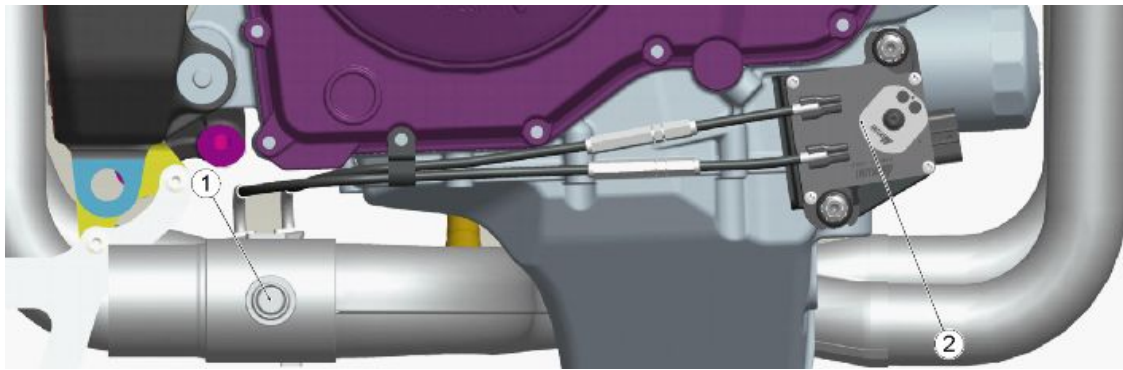
The motor unit (2) consists of a potentiometer for position detection and a DC electric motor (2).

At key-ON, a valve (1) self-cleaning cycle is performed.

In the event of malfunction (electric or mechanical), the valve (1) may remain stuck in the closed position.

In the event of a CAN line malfunction, the valve (1) is returned to the open position.

In the event of removal or replacement of one or more system components (cables, valve or motor), a calibration procedure is required.

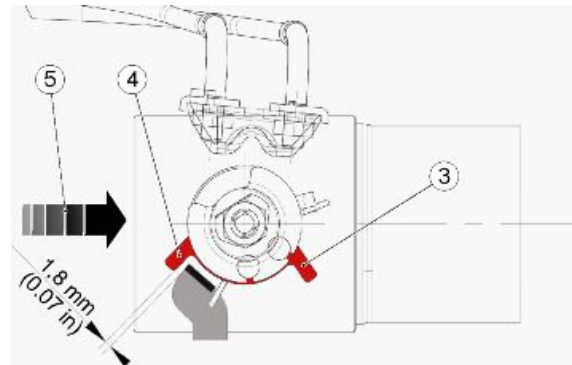


### EXHAUST THROTTLE VALVE CALIBRATION

- Slacken the exhaust throttle valve cable tension.



- From the Adjustable parameters screen, use the diagnostic instrument to select: Acquire exhaust valve zero position
- After pressing the send button for zero research, stop the vehicle and leave the key in OFF.
- Using the specific adjuster screw, tension the upper cable, leaving approx. 1.8 mm (0.07 in) between the retainer and opening travel limit (4) of the valve (1). Using the specific adjuster screw, tension the lower cable so it has the same tension as the upper cable.
- Tightening the lower cable will probably have caused the travel limit to shift: repeat the procedure until the correct position is obtained.
- Turn the key to ON.



**CAUTION**  
THE ZEROING PROCEDURE OF THE EXHAUST BUTTERFLY VALVE ENTAILS RESETTING THE EXISTING ME-

**MECHANICAL STOPS. AN ERROR FOR STOP SEARCH NOT CARRIED OUT IS THEN INDICATED. DO NOT CARRY OUT THIS OPERATION WHEN USING A NON-ORIGINAL EXHAUST SYSTEM WHERE ANY CABLES CONSIDERED NOT NECESSARY HAVE BEEN DISCONNECTED.**

- Using the diagnostic tool, from the Adjustable parameters screen, select:

Exhaust valve self-acquisition, which acquires the opening travel limit (4) (valve open) and the closing travel limit (3) (valve closed).

During both normal operation and the self-cleaning cycle, the valve will only move within this range and without reaching the mechanical end stops, to prevent strain to the electric motor.

5 - exhaust fumes flow direction.

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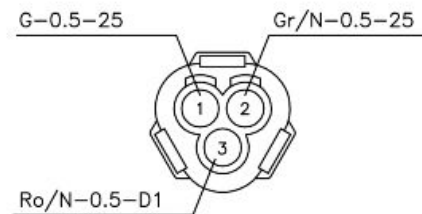
## Quick shift

### Function:

To signal to the control unit the request for power-assisted gear shifting.

### Operation / Operating principle:

Normally open switch that is closed to ground when the gearbox lever is activated (only when shifting up).



### Electrical circuit diagram - Level in wiring diagram:

Electronic transmission.

### Location on the vehicle:

On the gearbox lever transmission.

### Connector location (if available):

Under the fuel tank, left side, next to the rear head.

### Electrical characteristics:

Normally open.

### Pin-out:

- PIN1 - Signal
- PIN2 - Ground

## DIAGNOSIS INSTRUMENT: STATUSES

### Quick shift (electronic transmission) control status:

Activated released.

### Aprilia Quick Shift:

Present/Not present

## DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

Quick Shift sensor (electronic transmission) P0462.

- Shorted to negative (upon key-ON)/Signal not valid.

**Error cause:**

If shorted to negative: on key-ON a voltage equal to zero has been detected at PIN 47. If signal is not valid it means that the control unit has detected activation of the lever but not its release within the set time limit.

**Troubleshooting:**

Indication on Navigator always ACTIVATED: disconnect the sensor connector and, with the switch RELEASED, check if there is continuity between the two cables (PIN 1) and (PIN 2) (sensor side): if present, replace the sensor; if not present, replace the cable harness. Disconnect the Engine connector from the Marelli control unit and check the ground insulation of the black cable (sensor PIN 1 - Marelli ECU PIN 47): if OK, check pink cable and black cable insulation; if NOT OK, restore cable harness; if pink/black cable insulation is OK, replace the Marelli control unit; if NOT OK, restore cable harness.

NOTE: The control unit can not detect faults due to failed cable continuity.

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## a-PRC setting buttons

**Function:**

To signal to the control unit the request for modification of the a-PRC system settings.

**Operation / Operating principle:**

Either control (+) or (-) is made up of a deviator with both outputs electrically connected to the instrument panel: at the same time, the instrument panel sends the requested command to the Marelli ECU, via CAN line.

**Electrical circuit diagram - Level in wiring diagram:**

Traction control.

**Location on the vehicle:**

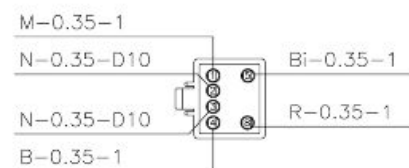
On the left side semi-handlebar.

**Connector location (if available):**

Inside the top fairing and instrument panel mounting support.

**Electrical characteristics:**

+ button: - 0 Ohm across PIN 2 and PIN 1 - Infinite resistance across PIN 2 and PIN 5; - button: 0 Ohm across PIN 3 and PIN 8 - infinite resistance across PIN 3 and PIN 4.



**Pin-out:**

- PIN 1: + 12 V power supply (green-brown)
- PIN 2: ground (black-black)
- PIN 3: ground (brown-black)
- PIN 4: + 12 V power supply (blue-blue)
- PIN 5: + 12 V power supply (yellow-white)
- PIN 8: + 12 V power supply (red-red)

**DIAGNOSIS INSTRUMENT: STATUSES****"+" button:**

Pressed/Released/Invalid data due to open circuit error/Invalid data due to short circuit error.

**"-" button:**

Pressed/Released/Invalid data due to open circuit error/Invalid data due to short circuit error

**DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

"+" button sensor P0720:

- Open contacts/Closed contacts.

**Error cause:**

With open contacts, a voltage over zero is detected at the same time at PIN 5 and PIN 13 of the instrument panel. With closed contacts, zero voltage is detected at the same time at PIN 5 and PIN 13 of the instrument panel.

**Troubleshooting:**

The instrument panel expects to find, at either of the two PINs, a voltage over approx. 1 V and at the same time a voltage below 1 V at the other PIN; if this does not occur, the instrument panel outputs the information to the control unit that shows this error. Indication on Navigator "Invalid data due to short circuit error"; CASE 1): if this status is displayed with control not activated only, it means that a voltage below 1V, instead of battery, is detected at PIN 5 of the instrument panel; disconnect the "+" button connector and read voltage at PIN 5 of the instrument panel: if voltage is below 1 V, it means that on the white cable there is a short circuit to ground; if voltage is above 1 V (approximately battery voltage), replace the "+" button sensor. CASE 2): if this status is displayed only with control activated, it means that at that moment a voltage below 1V, instead of battery, is being detected at PIN 13 of the instrument panel; disconnect the gearshift control connector and read voltage at PIN 13 of the instrument panel: if voltage is below 1 V, it means that on the brown cable there is a short circuit to ground; if voltage is above 1 V (approximately battery voltage), replace the "+" button sensor. Indication on Navigator "Invalid data due to open circuit error"; CASE 1): if this status is displayed only with control not activated, it means that circuit from PIN 13 to PIN 30 of the instrument panel is interrupted or that PIN 30 is not grounded: check the instrument panel connector and the "+" button connector: if they are not OK,



restore; if they are OK, check continuity on the brown cable: if it is not OK, restore; if it is OK, check continuity on the black cable from the "+" button connector to PIN 30 of the instrument panel: if it is not OK, restore; if it is OK, check continuity of the "+" button from the "+" button connector (between black cable and green cable): if it is not OK, change the control; if it is OK, check, with key to ON, that the black cable is not grounded and then change the instrument panel. CASE 2): if this status is displayed with control activated only, it means that circuit from PIN 5 to PIN 30 of the instrument panel is interrupted: check the instrument panel connector and the "+" button connector: if they are not OK, restore; if they are OK, check continuity on the white cable: if it is not OK, restore; if it is OK, check, with control activated, that there is not continuity of the "+" button from the "+" button connector (between black cable and yellow cable) and then replace the control.

"-" button sensor P0721

- Open contacts/Closed contacts

**Error cause:**

With open contacts, a voltage over zero is detected at the same time at PIN 18 and PIN 19 of the instrument panel. With closed contacts, zero voltage is detected at the same time at PIN 18 and PIN 19 of the instrument panel.

**Troubleshooting:**

The instrument panel expects to find, at either of the two PINs, a voltage over approx. 1 V and at the same time a voltage below 1 V at the other PIN; if this does not occur, the instrument panel outputs the information to the control unit that shows this error. Indication on Navigator "Invalid data due to short circuit error"; CASE 1): if this status is displayed with control not activated only, it means that a voltage below 1V, instead of battery, is detected at PIN 18 of the instrument panel; disconnect the "-" button connector and read voltage at PIN 18 of the instrument panel: if voltage is below 1 V, it means that on the red cable there is a short circuit to ground; if voltage is above 1 V (approximately battery voltage), replace the "-" button sensor. CASE 2): if this status is displayed only with control activated, it means that at that moment a voltage below 1V, instead of battery, is being detected at PIN 19 of the instrument panel; disconnect the gearshift control connector and read voltage at PIN 19 of the instrument panel: if voltage is below 1 V, it means that on the blue cable there is a short circuit to ground; if voltage is above 1 V (approximately battery voltage), replace the "-" button sensor. Indication on Navigator "Invalid data due to open circuit error"; CASE 1): if this status is displayed only with control not activated, it means that circuit from PIN 19 to PIN 30 of the instrument panel is interrupted or that PIN 30 is not grounded: check the instrument panel connector and the "-" button connector: if they are not OK, restore; if they are OK, check continuity on the blue cable: if it is not OK, restore; if it is OK, check continuity on the black cable from the "-" button connector to PIN 30 of the instrument panel: if it is not OK, restore; if it is OK, check continuity of the "-" button from the "-" button connector (between brown cable and blue cable): if it is not OK, change the control; if it is OK, check, with key to ON, that the black cable is not grounded and then change the instrument panel. CASE 2): if this status is displayed only with control activated, it means that circuit from PIN 18 to PIN 30 of the instrument panel is interrupted: check the

instrument panel connector and the "-" button connector: if they are not OK, restore; if they are OK, check continuity on the red cable: if it is not OK, restore; if it is OK, check, with control activated, that there is not continuity of the "-" button from the "-" button connector (between brown cable and red cable) and then replace the control.

NOTE: The control unit can not detect faults due to failed cable continuity

## Tone wheel reading ECU

### Function:

Receives the signals coming from the wheel speed sensors and calculates the wheel speed accordingly.

### Electrical circuit diagram - Level in wiring diagram:

Traction control.

### Location on the vehicle:

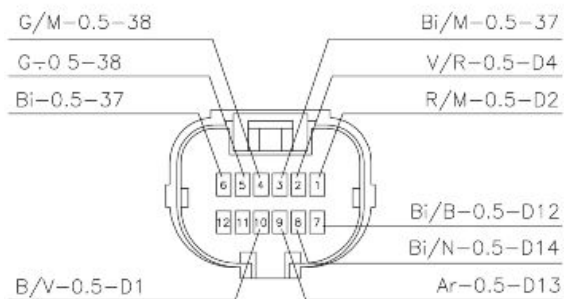
Inside the left fairing.

### Connector location (if available):

-

### Pin-out:

- Pin 1: live power supply (red/brown)
- Pin 2: battery power (green/red)
- Pin 3: front wheel speed sensor positive (white/brown)
- Pin 4: rear wheel speed sensor positive (yellow/brown)
- Pin 5: rear wheel speed sensor negative (yellow)
- Pin 6: front wheel speed sensor negative (white)
- Pin 7: diagnosis line (white/blue)
- Pin 8: CAN "L" Line (white/black)
- Pin 9: CAN "H" line (orange)
- Pin 10: ground (blue/green)



## DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS

Control unit voltage too low C1001

- It activates if voltage detected at PIN2 is below the minimum threshold.

### Troubleshooting:

Check battery charge: if NOT OK, recharge the battery or replace it; if OK, check CLF control unit pin 2. If NOT OK, restore; if OK check the continuity of the green/red cable across pin 2 and secondary fuse (B). If NOT OK, restore; if OK, check the continuity of the red/white cable across secondary fuse (B) and pin 1 of the starter relay connector.

Control unit internal error C1200

- Possible control unit fault.

#### **Troubleshooting:**

Replace the control unit.

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

-

## **Inertial sensor platform (sensor box)**

#### **Function:**

To transmit information about the motorcycle dynamics to the Marelli control unit (e.g.: yaw rate).

#### **Electrical circuit diagram - Level in wiring diagram:**

Traction control.

#### **Location on the vehicle:**

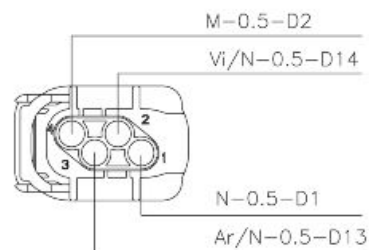
Fastened to the fuel tank, under the seat.

#### **Connector location (if available):**

-

#### **Pin-out:**

- Pin 1: ground lead (black)
- Pin 2: CAN "L" Line (purple/black)
- Pin 3: CAN "H" Line (orange/black)
- Pin 4: supply (brown)



#### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

-

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

Sensor box error (inertia sensor platform) P0710

- Faulty sensor/Signal not valid

#### **Troubleshooting:**

With faulty sensor, the component inside the control unit is damaged and replacement of the control unit is recommended. With signal not valid, the sensor has generated a signal out of range that is still sent to the injection control unit together with the relevant error.

Sensor box error (inertia sensor platform) P0711

- Faulty sensor/Signal not valid

**Troubleshooting:**

With faulty sensor, the component inside the control unit is damaged and replacement of the control unit is recommended. With signal not valid, the sensor has generated a signal out of range that is still sent to the injection control unit together with the relevant error.

Sensor box error (inertia sensor platform) P0712

- Faulty sensor/Signal not valid

**Troubleshooting:**

With faulty sensor, the component inside the control unit is damaged and replacement of the control unit is recommended. With signal not valid, the sensor has generated a signal out of range that is still sent to the injection control unit together with the relevant error.

Sensor box error (inertia sensor platform) P0713

- Faulty sensor/Signal not valid

**Troubleshooting:**

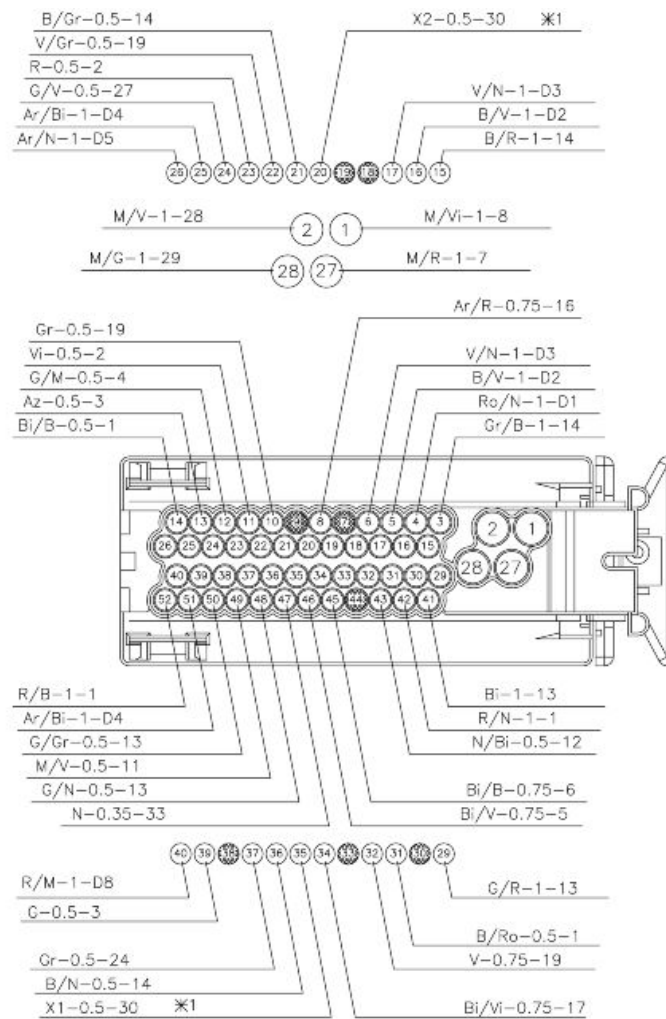
With faulty sensor, the component inside the control unit is damaged and replacement of the control unit is recommended. With signal not valid, the sensor has generated a signal out of range that is still sent to the injection control unit together with the relevant error.

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## Connectors

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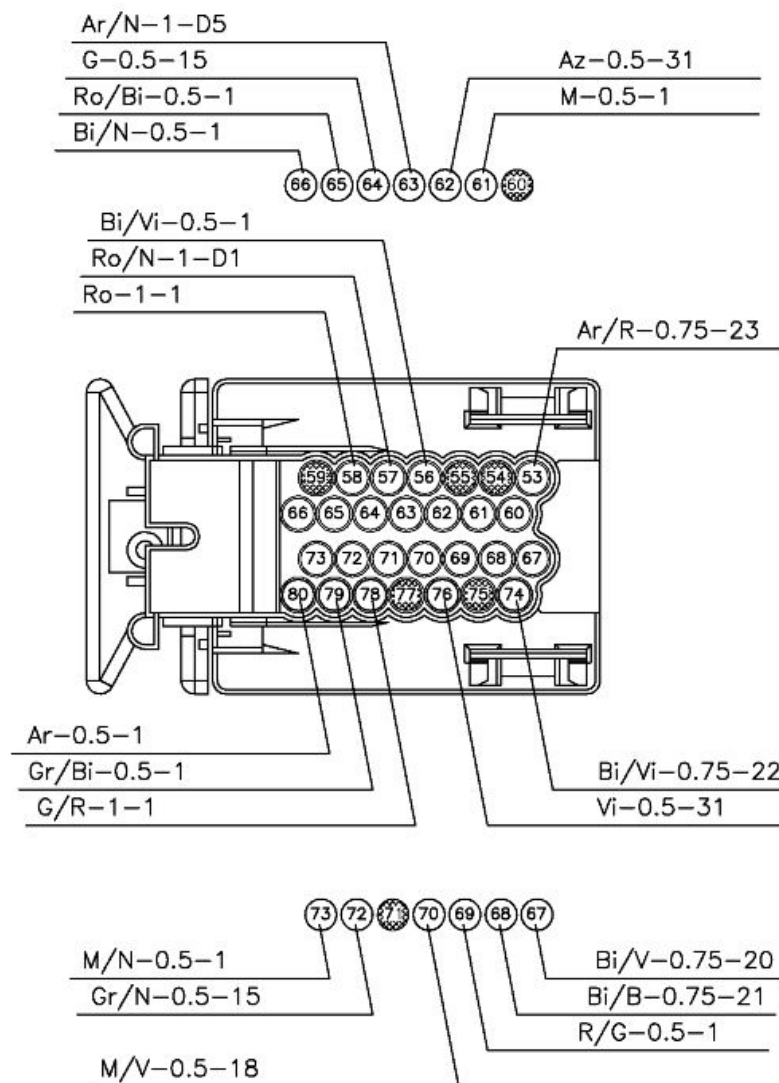
ECU



**Engine pinout key:**

- Cylinder 4 coil control output **PIN 1**
- Cylinder 3 coil control output **PIN 2**
- Front throttle motor output (+) **PIN 3**
- Analogue ground connection 2 **PIN 4**
- Power ground connection 1 **PIN 5**
- Analogue ground connection 1 **PIN 6/17**
- Lower cylinder 1 injector control output **PIN 8**
- Lambda sensor input (+) **PIN 10**
- Track D hand grip input **PIN 11**
- Water temp. sensor input **PIN 12**
- Track B hand grip input **PIN 13**
- Serial line K for diagnosis **PIN 14**
- Front throttle motor output (-) **PIN 15**
- Power ground connection 2 **PIN 16**

Engine speed sensor input (-) **PIN 20**  
Input for front throttle potentiometer 2 signal **PIN 21**  
Lambda sensor input (-) **PIN 22**  
Track C hand grip input **PIN 23**  
Rear cylinder intake pressure sensor input **PIN 24**  
Reference voltage output + 5 V: tracks A-C, rear throttle and pressure sensor **PIN 25/51**  
Reference voltage output + 5V: tracks B-D and front throttle **PIN 26**  
Cylinder 2 coil control output **PIN 27**  
Cylinder 1 coil control output **PIN 28**  
Rear throttle motor output (-) **PIN 29**  
STOP lights relay control output **PIN 31**  
Lambda heating control output **PIN 32**  
Lower cylinder 3 injector control output **PIN 34**  
Engine speed sensor input (+) **PIN 35**  
Input for front throttle potentiometer 1 signal **PIN 36**  
Air temperature sensor input **PIN 37**  
Track A hand grip input **PIN 39**  
Key input **PIN 40/42**  
Rear throttle motor output (+) **PIN 41**  
Secondary air valve control output **PIN 43**  
Lower cylinder 4 injector control output **PIN 45**  
Lower cylinder 2 injector control output **PIN 46**  
Quick shift input **PIN 47**  
Input for rear throttle potentiometer 1 signal **PIN 48**  
Front cylinder intake pressure sensor input **PIN 49**  
Input for rear throttle potentiometer 2 signal **PIN 50**  
Direct power supply to control unit **PIN 52**



**Vehicle pinout key:**

- Upper cylinder 1 injector control output **PIN 53**
- Clutch sensor input **PIN 56**
- Analogue ground connection 2 **PIN 57**
- "Start engine" switch input **PIN 58**
- Electric fan relay control output **PIN 61**
- Variable geometry control unit control output **PIN 62**
- Reference voltage output + 5V: tracks B-D and front throttle **PIN 63**
- Neutral input **PIN 64**
- Fall sensor input **PIN 65**
- CAN L line (high speed) **PIN 66**
- Upper cylinder 2 injector control output **PIN 67**
- Upper cylinder 4 injector control output **PIN 68**
- Start-up control output **PIN 69**

Side stand input **PIN 70**

Gear input **PIN 72**

Injection relay control output **PIN 73**

Upper cylinder 3 injector control output **PIN 74**

Variable geometry control unit fault input **PIN 76**

"engine stop" input **PIN 78**

Vehicle speed input **PIN 79**

CAN H line (high speed) **PIN 80**

---

**Engine - vehicle connector pinout key:**

Key **PIN 1A**

Vehicle speed **PIN 2A**

STOP lights relay control output **PIN 3A**

- **PIN 4A**

- **PIN 5A**

- **PIN 6A**

Analogue ground connection 2 **PIN 7A**

Direct power supply to control unit **PIN 8A**

Injection supply **PIN 1B**

CAN H **PIN 2B**

CAN L **PIN 3B**

Key **PIN 4A**

Electric fan relay control **PIN 5B**

Fall sensor **PIN 6B**

Variable geometry power supply **PIN 7B**

Power ground connection 2 **PIN 8B**

Injection power supply **PIN 1C**

Serial line K for diagnosis **PIN 2C**

Clutch sensor **PIN 3C**

"Start engine" switch **PIN 4C**

Start-up control **PIN 5C**

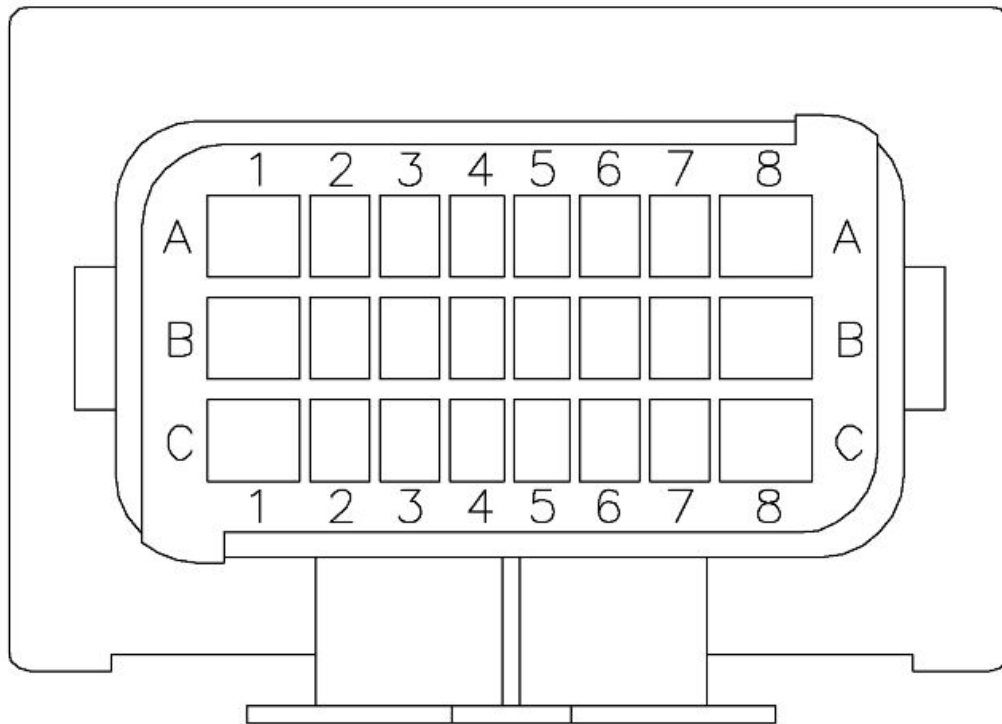
Injection relay **PIN 6C**

Engine stop **PIN 7C**

Power ground connection 2 **PIN 8C**

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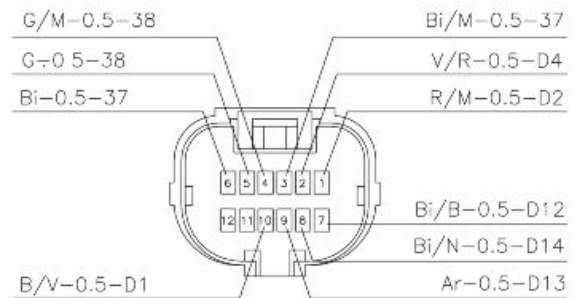




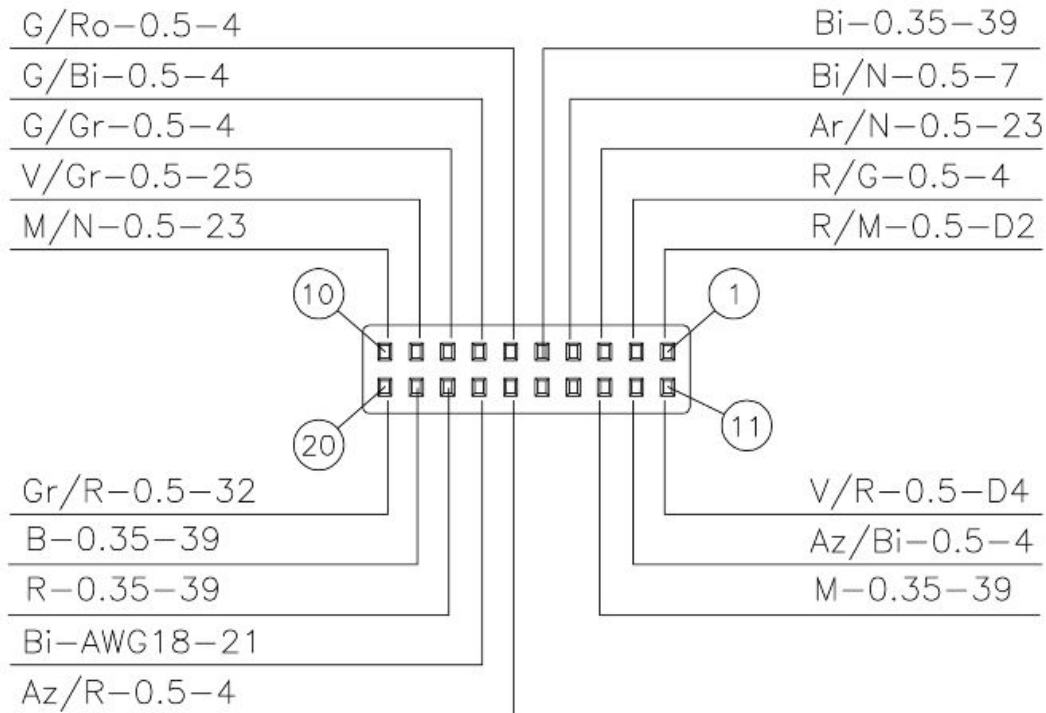
**Tone wheels ecu reading**

**key:**

- 1. 12 V Key-on power supply
- 2. 12V power from battery
- 3. Front tone wheel signal (+)
- 4. Rear tone wheel signal (+)
- 5. Rear tone wheel signal (-)
- 6. Front tone wheel signal (-)
- 7. Diagnosis
- 8. CAN L line
- 9. CAN H line
- 10. Ground connection
- 11. Not used
- 12. Not used

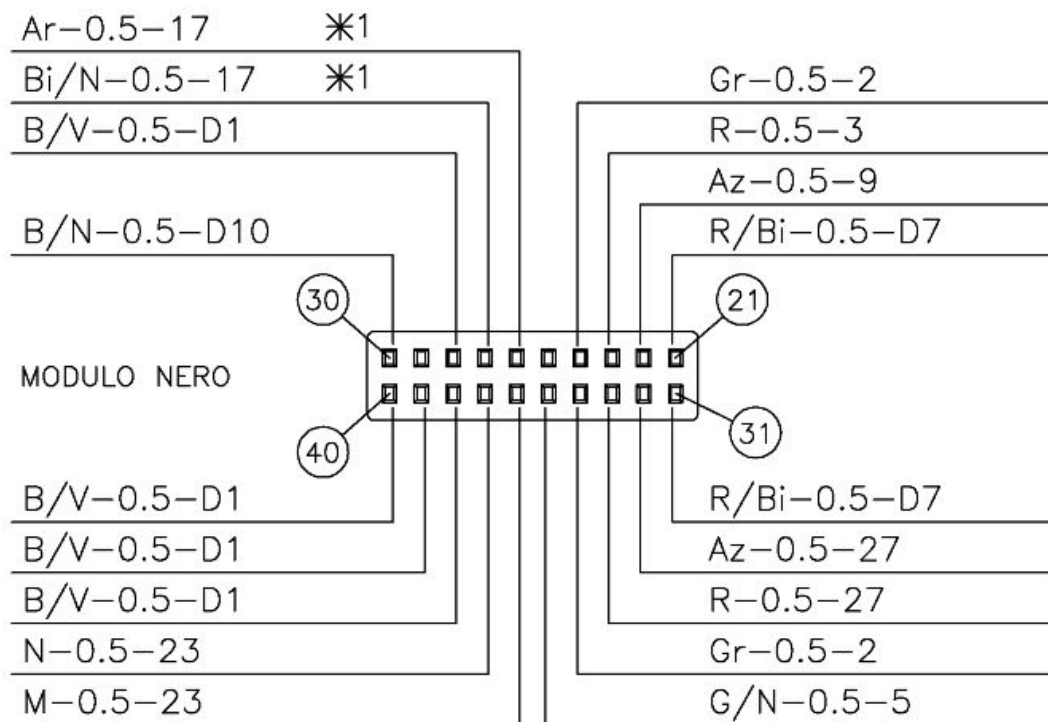


## Dashboard



### Grey-bodied instrument panel pinout key:

- 1 +Key
- 2 Right turn indicator control
- 3 Exhaust valve potentiometer power supply
- 4 High beam lights input
- 5 Normally open button "1"
- 6 Select 3 (Set)
- 7 Select 2 (Down)
- 8 Select 1 (Up)
- 9 Low fuel sensor
- 10 Exhaust valve potentiometer signal input
- 11+ Battery
- 12 Left turn indicator control
- 13 Normally closed button "+"
- 14 \*
- 15 \*
- 16 Indicator reset
- 17 Oil sensor input
- 18 Normally open button "-"
- 19 Normally closed button "-"
- 20 K line



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

- 21 +Battery
- 22 Front left turn indicator activation
- 23 Front right turn indicator activation
- 24 Aerial 2
- 25 \*
- 26 CAN H
- 27 CAN L
- 28 ABS warning light input (if present)
- 29 \*
- 30 Sensors ground connection
- 31 +Battery
- 32 Rear left turn indicator activation
- 33 Rear right turn indicator activation
- 34 Aerial 1
- 35 Low beam light relay activation
- 36 Exhaust valve A control output
- 37 Exhaust valve B control output
- 38 Ground connection
- 39 Ground connection
- 40 Ground connection

## 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 (FaultsConfirmation).
- 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 wiring diagram:

CAN line

#### Electrical characteristics:

- between PIN 66 and 80 of the control unit: approximately 130 Ohm

- between PIN 26 and 27 of the instrument panel: approximately 120 Ohm

**Pin out:**

- Line L: white/black cable between Marelli control unit PIN 66 and the black-bodied connector PIN 27 of the instrument panel.
- Line H: orange cable between Marelli control unit PIN 80 and the black-bodied connector PIN 26 of the instrument panel.

**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.**

**DIAGNOSIS 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 the cable harness; if OK, check that the two lines are not shorted to positive testing each of the 3 connectors (Marelli control unit, engine-vehicle cable harness connector and instrument panel connector) with 1 connector disconnected at a time and by setting the key to ON: 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**

- Check the Vehicle connector pins 66 and 80 and the vehicle-engine cable harness pins B2 and B3. If not OK, restore. If OK, check pins 26 and 27 and the instrument panel connector. If not OK, restore. If OK, check overall operation of the Marelli control unit and instrument panel: replace the affected component if you find any fault

CAN line toward CLF control unit U1712

- Intermittent signal or communication error.

**Error cause**

- Probable bad contact in the CAN line.

**Troubleshooting**

- Check the Vehicle connector pins 66 and 80 and the vehicle-engine cable harness pins B2 and B3. If not OK, restore. If OK, check pins 8 and 9 and the CLF control unit connector. If not OK, restore. If OK, check overall operation of the Marelli control unit and CLF control unit: replace the affected component if any fault is detected.

CAN line toward Sensor Box U1722

- Intermittent signal or communication error

**Error cause**

- Probable bad contact in the CAN line.

**Troubleshooting**

- Check the Vehicle connector pins 66 and 80 and the vehicle-engine cable harness pins B2 and B3. If not OK, restore. If OK, check pins 2 and 3 and the inertia sensor platform (Sensor box) connector. If not OK, restore. If OK, check overall operation of the Marelli control unit and inertia sensor platform (Sensor box): replace the affected component if any fault is detected.

Failed CAN reception from injection ECU C1300

**Error cause**

- No signal is received from the injection ECU.

**Troubleshooting**

- Check the pins 66 and 80 of the Vehicle connector of the Marelli control unit, vehicle-engine connector pins B2 and B3 and CLF control unit connector pins 8 and 9. If not OK, restore. If OK, with key OFF disconnect the following: a) CLF control unit connector, b) vehicle-engine connector and check the continuity across vehicle-engine connector pin B2 and CLF control unit connector pin 9. If NOT OK, replace the vehicle cable harness; if OK, check the continuity across vehicle-engine connector pin B3 and CLF control unit connector pin 8. If NOT OK, change the cable harness; if OK, attach CLF control unit connector and disconnect the Vehicle connector of the Marelli ECU. Check the continuity across vehicle-engine connector pin B2 and pin 80 of the Vehicle connector of the Marelli ECU. If NOT OK, replace engine cable harness; if OK, check the continuity across vehicle-engine connector pin B3 and Marelli ECU connector pin 66. If NOT OK, change cable harness; if OK, check for the correct power supply (12V) at pins 42 and 52, and ground at pin 5 of the Engine connector of the Marelli ECU. If NOT OK, restore the cable harness; if OK, replace the Marelli ECU.
- 

Failed CAN reception from instrument panel C1301

**Error cause**

- No signal is received from the instrument panel.

**Troubleshooting**

- Check the pins 26 and 27 of the instrument panel connector, and CLF control unit connector pins 8 and 9. If not OK, restore. If OK, with key OFF disconnect the following: a) CLF control unit connector, b) instrument panel connector and check the continuity across instrument panel connector pin 26 and CLF control unit connector pin 9. If NOT OK, replace the vehicle cable harness; if OK, check the continuity across instrument panel pin 27 and CLF control unit connector pin 8. If NOT OK, replace the cable harness; if OK, check for the correct power supply (12V) at pins 1 and 11 and ground at pins 38, 39 3 40 of the instrument panel connector. If NOT OK, restore the cable harness; if OK, replace the instrument panel.

CAN line mute mode C1302

**Error cause**

- No signal is received from the CAN line, possible line break.

**Troubleshooting**

- Check the pins 2 and 3 of the inertia sensor platform (Sensor box) connector, and CLF control unit connector pins 8 and 9. If not OK, restore. If OK, with key OFF disconnect the following: a) CLF control unit connector, b) inertia sensor platform (Sensor box) connector and check the continuity across inertia sensor platform (Sensor box) connector pin 2 and
-

CLF control unit connector pin 9. If NOT OK, change the vehicle cable harness; if OK, check the continuity across inertia sensor platform (Sensor box) connector pin 3 and CLF control unit connector pin 8. If NOT OK, change the cable harness; if OK, check for the correct power supply (12V) at pins 1 and 2 and ground at pin 10 of the CLF control unit connector. If NOT OK, restore the cable harness; if OK, change the instrument panel.

### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

CAN line toward CLF control unit U1711

- No signal/Configuration error

#### **Error cause**

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

#### **Troubleshooting**

- No signal - Check the pins 8 and 9 of the CLF control unit connector, vehicle-engine connector pins B2 and B3 and Marelli control unit vehicle connector pins 66 and 80. If NOT OK, restore. If OK, with key OFF disconnect the following: a) CLF control unit connector, b) inertia sensor platform (Sensor box) connector and check the continuity across inertia sensor platform (Sensor box) pin 3 and CLF control unit pin 9. If NOT OK, replace the vehicle cable harness; if OK, check the continuity across inertia sensor platform (Sensor box) pin 2 and CLF control unit pin 8. If NOT OK, replace the cable harness; if OK, check for the correct power supply (12V) at pins 1 and 2 and ground at pin 10 of the CLF control unit. If NOT OK, restore the cable harness; if OK, replace the CLF 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 is equipped with CLF control unit, the correct status we should find on the Navigator devices status page will be: Aprilia Traction Control PRESENT. While on a bike equipped with CLF control unit and Navigator indication: Aprilia Traction Control NOT PRESENT update the control unit.

CAN line toward Sensor box U1721

- No signal/Configuration error

#### **Error cause**

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

#### **Troubleshooting**

- No signal - Check the pins 2 and 3 of the inertia sensor platform (Sensor Box) connector, vehicle-engine connector pins B2 and B3 and Marelli control unit vehicle connector pins 66 and 80. If NOT OK, restore. If OK, with key OFF disconnect the following: a) CLF control



unit connector, b) inertia sensor platform (Sensor box) connector and check the continuity across inertia sensor platform (Sensor box) pin 3 and CLF control unit pin 9. If NOT OK, change the vehicle cable harness; if OK, check the continuity across inertia sensor platform (Sensor box) pin 2 and CLF control unit pin 8. If NOT OK, change the cable harness; if OK, check for the correct power supply (12V) at pin 4 and ground at pin 1 of the CLF control unit. If NOT OK, restore the cable harness; if OK, change the inertia sensor platform (sensor box).

- 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 is equipped with inertia sensor platform (Sensor box), the correct status we should find on the Navigator devices status page will be: Aprilia Traction Control Performance (in a bend) PRESENT. While on a bike equipped with inertia sensor platform (Sensor box) and Navigator indication: Aprilia Traction Control Performance (in a bend) NOT PRESENT update the control unit.

Rear wheel radius acquisition P0510

- CAN error during acquisition/Invalid value.

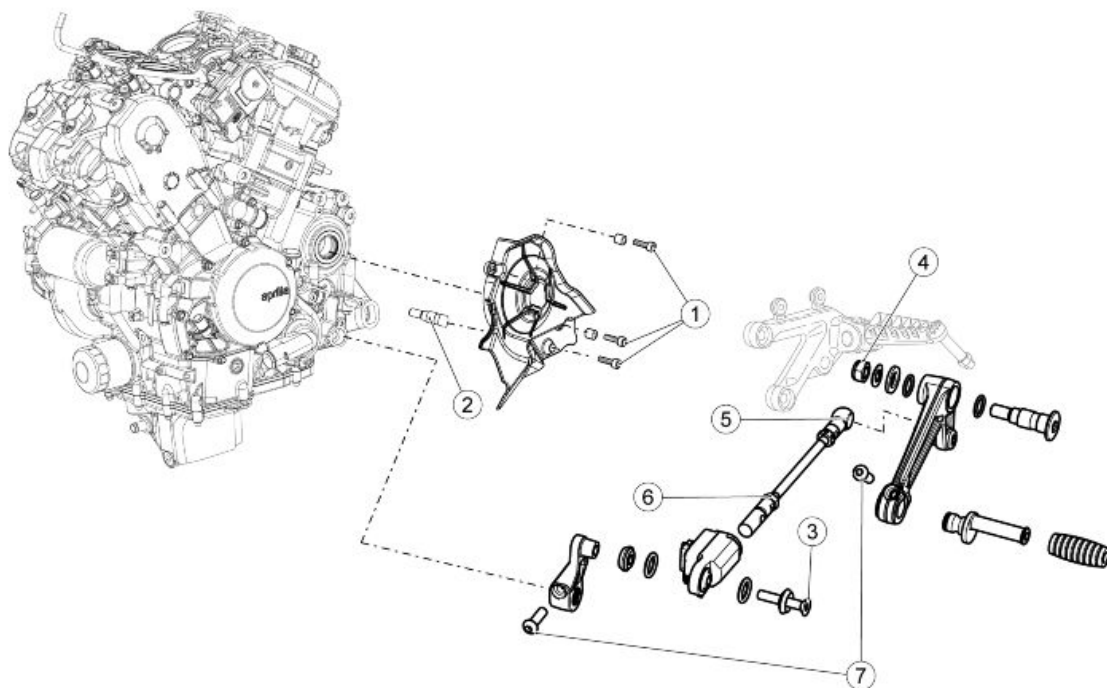
**Error cause**

- 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



**ENGINE**

pos.	Description	Type	Quantity	Torques	Notes
1	Pinion protector casing fixing screws	M6	3	8 Nm (5.9 lbf ft)	-
2	Threaded spacer	-	1	8 Nm (5.9 lbf ft)	-
3	TSPEI screw	M6x35	1	10 Nm (7.38 lbf ft)	Loct.
4	Self-locking nut	M8	1	25 Nm (18.44 lbf ft)	-
5	Gearbox linkage joint to gearbox lever fastener	-	1	8 Nm (5.90 lbf ft)	Loct.
6	Gearbox linkage nut to quick shift fastener	-	1	8 Nm (5.90 lbf ft)	-
7	TBEI screws	M6x20	2	8 Nm (5.90 lbf ft)	-

- Smear waterproof grease between the O-rings and the Quick Shift uniball.

**NOTE**

**ONCE REASSEMBLY IS COMPLETED, CENTRE TO CENTRE DISTANCE BETWEEN UNIBALL AND JOINT MUST BE APPROX. 180mm (7.09in).**

**Vehicle preparation**

Proceed as follows to remove from the chassis:

- Remove the underfairings, the fairing lug and the radiator cowl.
- Remove the fuel tank and the battery.
- Disconnect and remove the hand grip position sensor.
- Remove the throttle body and the filter box.
- Remove the complete exhaust.
- Remove the lubrication and cooling system radiators.
- Remove the side stand.
- Remove the left hand rider footpeg.

Position the vehicle as described:

- Fasten an appropriately sized belt for the weight of the vehicle to the semi-handlebars and to a hoist.
- Fit the rear and front stands.
- Fit the specific under-ump engine support plate.

### Specific tooling

020864Y Engine mounting plate

### See also

[Fairing mounting panels](#)

[Lower cowl](#)

Radiator cover

Fuel tank

Exhaust

[Twistgrip position sensor](#)

[Air box](#)

[Removing the](#)

radiator

[Removing](#)

Side stand

---

## Removing the engine from the vehicle

- Detach the clutch cable.



- Remove the timing sensor.



- Remove the engine oil pressure sensor.



- Remove the rubber cap.
- Unscrew and remove the nut, retrieve the washer and disconnect the starter motor.



- Unscrew and remove the screw, remove the cable grommet and detach the three ground cables.



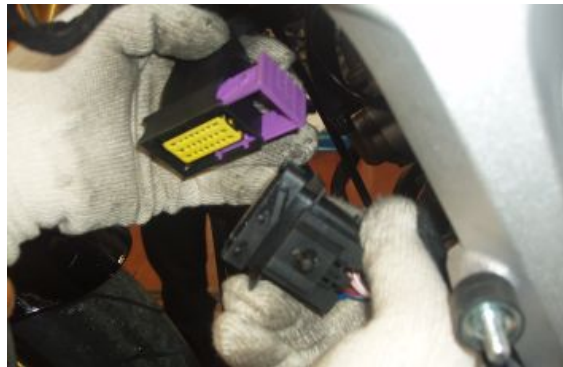
- Unscrew and remove the nut and retrieve the washer.
- Detach the ground from the chassis.



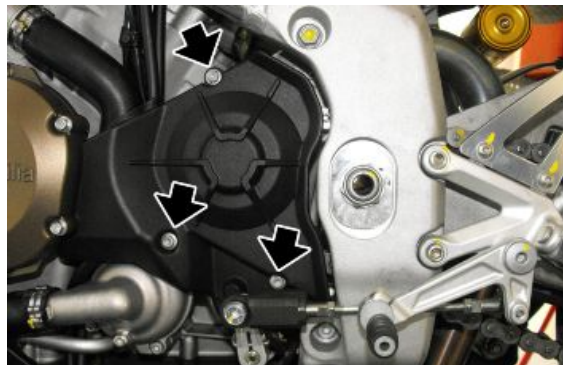
- Working on the right hand side of the vehicle, detach the exhaust valve control unit connector.



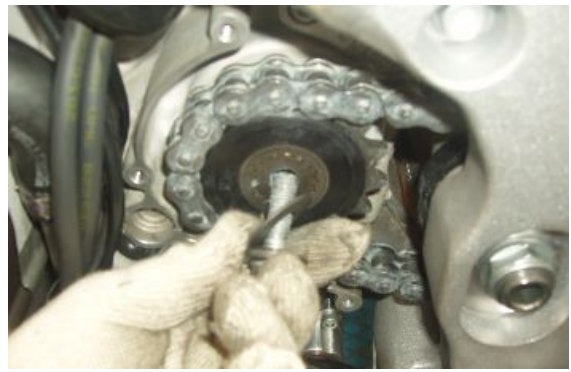
- Disconnect the vehicle cable harness/ engine cable harness connector



- Unscrew and remove the three screws and remove the pinion cover.



- Unscrew and remove the pinion fixing screw and retrieve the two washers.



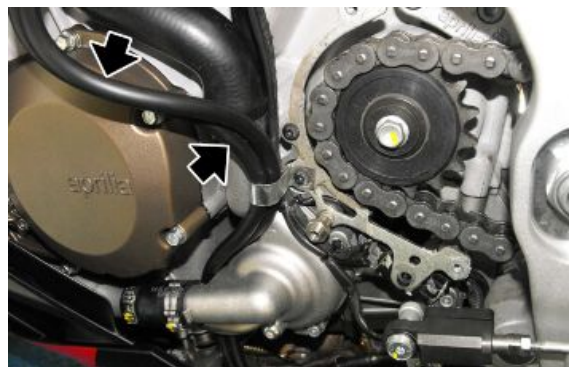
- Loosen the drive chain adjuster screws.



- Loosen the rear wheel fixing nut.
- Remove the pinion, releasing it from the drive chain.



- Remove the side stand.
- Remove the two fuel breather pipes



- Detach the neutral sensor.



### See also

Side stand

- Remove the hand grip position sensor from the chassis.



- Disconnect the voltage regulator connector.

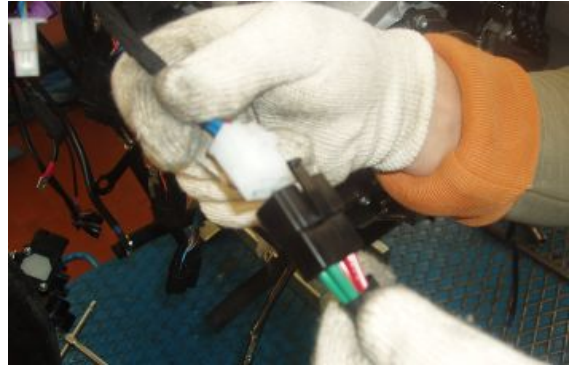


### See also

[Twistgrip position sensor](#)



- Disconnect the alternator connector.



- Working from the left hand side of the vehicle, unscrew and remove the screw and retrieve the washer.



- Unscrew and remove the three plate fixing screws and remove the plate.



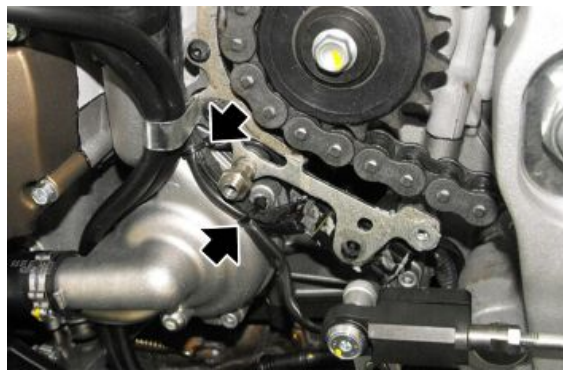
- Unscrew and remove the subframe fixing screw and retrieve the washer, remove the radiator subframe.



- Disconnect the quick-shift connector.



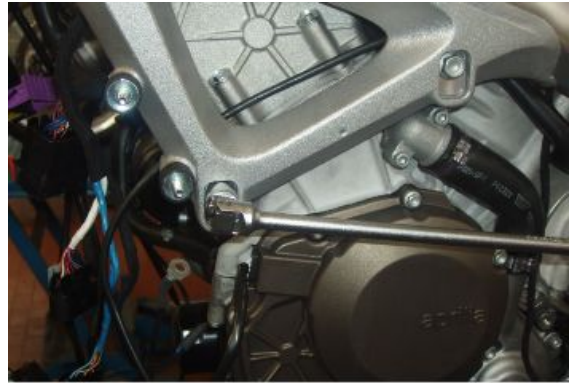
- Cut the ties fastening the cable harness to the engine.



- Loosen the screw and slide off the gear shift lever and cable harness from the engine.



- Working on the left hand side of the vehicle, unscrew and remove the two screws and retrieve the respective plates.



- Working on the right hand side of the vehicle, unscrew and remove the two screws and retrieve the respective plates and washers.
- Also retrieve the shims on the inner side of the frame.



- Unscrew and remove the screw and retrieve the nut.



- Unscrew the upper adjuster screw bushing until it turns no more.



- Working on the right side of the vehicle, unscrew and remove the nut and retrieve the washer.
- Ease off the pin from the left hand side of the vehicle.



- Unscrew the lower adjuster screw bushing.



- Remove the clamps on the saddle mounting.

**CAUTION**

**PERFORM THE OPERATIONS BELOW AIDED BY A SECOND OPERATOR.**

- Lower the engine
- Lift the front part of the vehicle.
- Remove the front stand.
- Release the belts from the hoist, supporting the front part of the vehicle.
- Remove the rear stand.
- Remove the chassis from the engine.

## Installing the engine to the vehicle

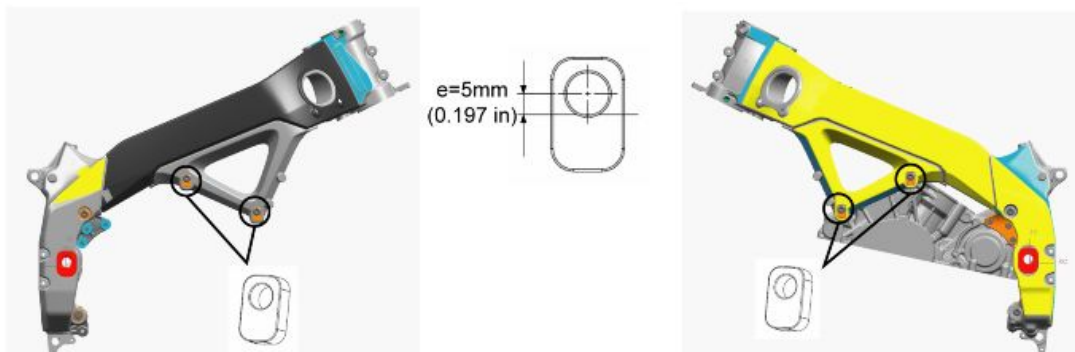
- Before aligning the engine retainers, place on the frame the internal and external right and left inserts, with the precautions described below.

Adjustment of engine height relative to the chassis is assured by properly inserts placed on the chassis (front position) and on the engine, matching the fixing points of the engine to the chassis.

The hole position relative to the centreline of the insert is  $e=+5$  mm ( $e= +0.197$  in), therefore, the engine is fixed at maximum height possible.

**CAUTION**

**THE LEFT AND RIGHT FRONT INSERTS ARE EQUAL AND MUST NOT BE PLACED IN THE INVERTED POSITION.**



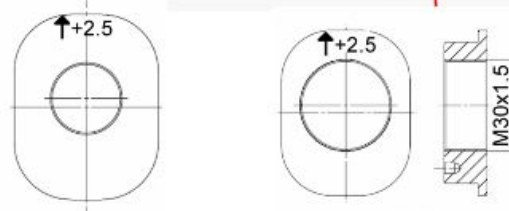
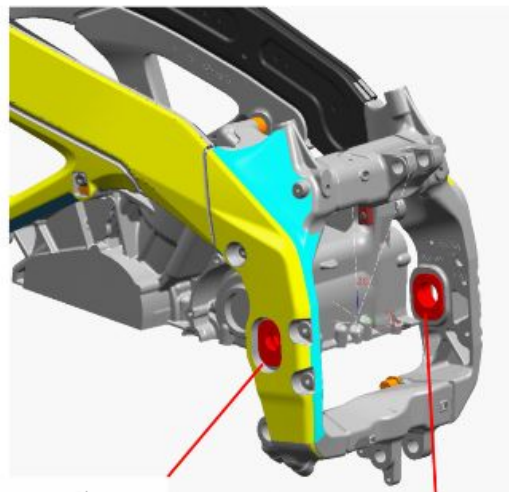
The height of the swingarm pin relative to the chassis is adjusted with special inserts installed in the respective seats in the chassis. The hole is offset by +2.5 mm (0.098 in) relative to the centre-line of the insert, as a result the swingarm is in the high position.

There are 4 inserts, subdivided as follows:

- Inner/outer
- Right/Left

The two right side swingarm pin inserts are different.

The two left side swingarm pin inserts are the same.



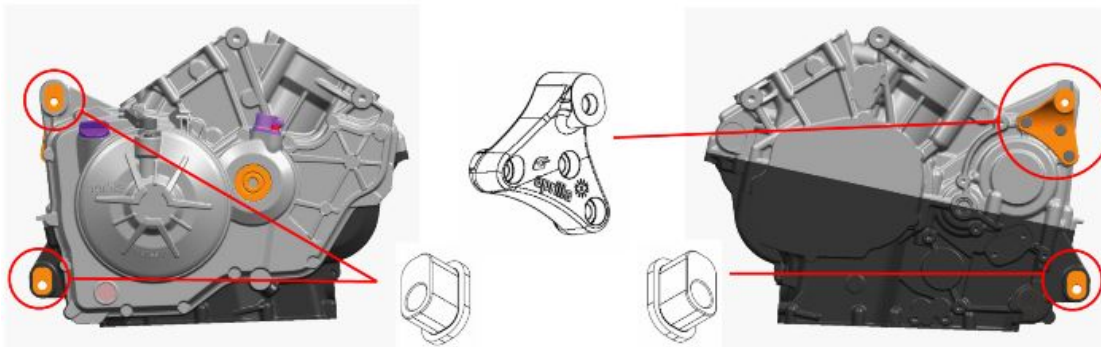
**CAUTION**



**THE FOUR INSERTS MUST BE FITTED WITH THE ARROW FACING UPWARDS, OTHERWISE THE VEHICLE WILL BE DAMAGED!**

**CAUTION**

**THE RIGHT REAR INSERTS (+5mm (+0.19 in)) AND THE LOWER LEFT REAR INSERT (+5mm (+0.19 in)), ARE EQUAL.**



- Working from the vehicle left side, install the left upper engine attachment, tightening the three screws.



- With the help of a second operator, secure the vehicle chassis with a hoist and onto a front and rear stand and lift the engine to place it in position.

### Specific tooling

#### 020864Y Engine mounting plate

#### Centring the engine on the chassis

##### CAUTION

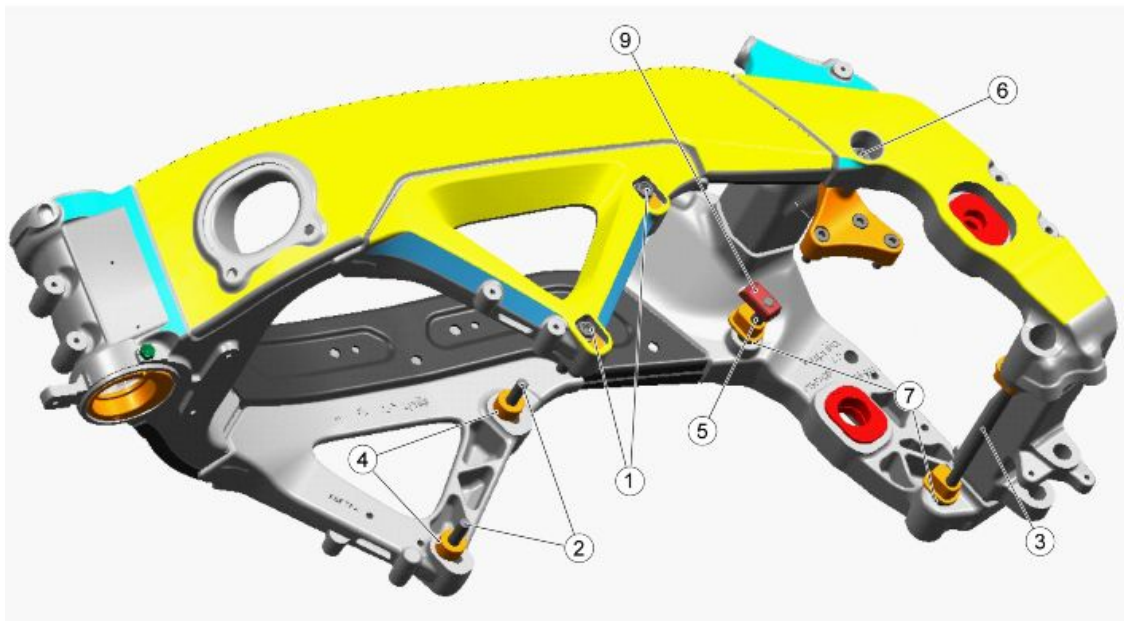
**PAY SPECIAL ATTENTION DURING CENTRING PHASE OF THE ENGINE ON THE CHASSIS. OPERATE WITH CAUTION SO AS NOT TO DAMAGE THE SCREWS AND THE CHASSIS INTERNAL AND EXTERNAL SPACERS.**

Working on the left side, place and screw without tighten:

- the two front fixing screws (1);
- the engine attachment upper fixing screw (6);
- the lower rear fixing pin (3), so as to centre the engine position.

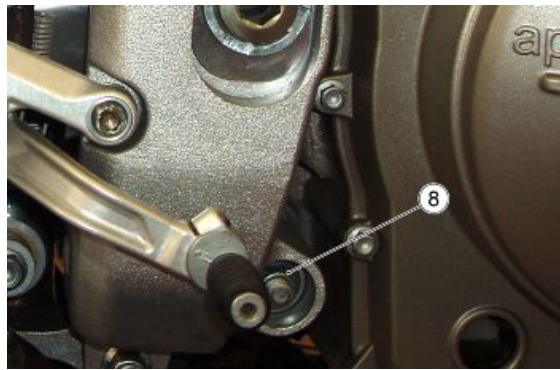
Working on the right side, place and screw without tighten:

- the two front fixing screws (2) and, from the chassis internal side, the specific spacers (4);
- the upper rear fixing screws (5).



**Engine retainer****CAUTION**

AFTER ENGINE ALIGNMENT AND CENTRING ON THE CHASSIS, ASSURE THE CORRECT POSITION BEFORE TIGHTENING TO THE PRESCRIBED TORQUE ALL THE SCREWS IN THE ABOVE MENTIONED ORDER.



Working on the left side:

- tighten the two front screws (1) to the prescribed torque.
- Tighten the engine attachment upper fixing screw (6) to the prescribed torque, after placing the corresponding washer.
- Slide the lower rear fixing pin (3);

Working on the right side:

- slide the upper rear fixing screw (5).
- Place and tighten internally the two set pack bushings (7) to the prescribed torque.
- Place again on the left side, the lower rear fixing pin (3).
- Tighten the rear pin fastening nut (8).
- Place again the upper rear fixing screw (5) and tighten the lock nut (9) on the internal side of the chassis to the prescribed torque.
- Tighten the two engine screws (2) to the prescribed torque.

- Refit the clamps on the saddle mounting.





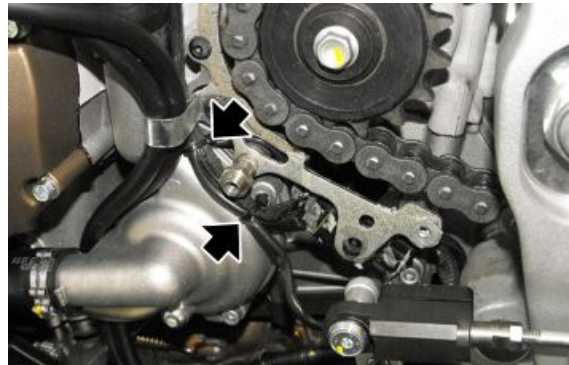
- Place the radiator frame, the washer and tighten the screw, fastening the frame to the engine.



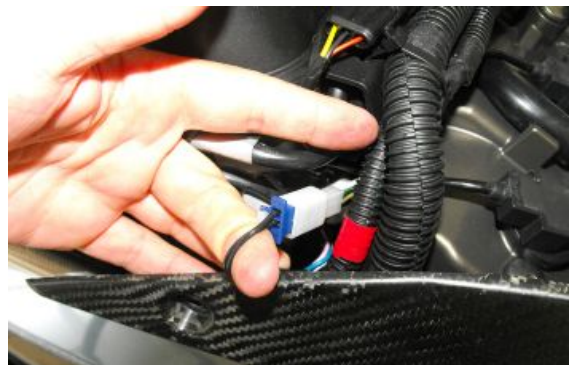
- Place the gear lever and tighten the screw.



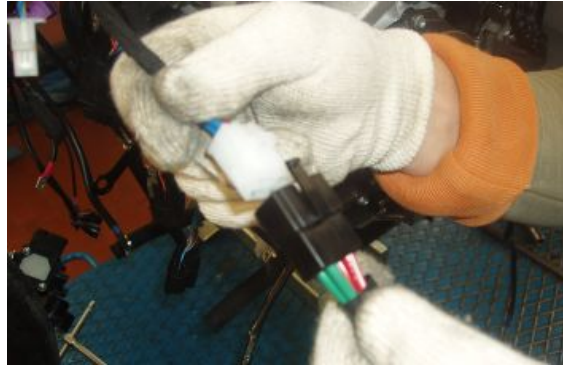
- Position the quick-shift cable harness and fasten using ties.



- Connect the quick-shift connector.



- Connect the alternator connector.



- Connect the voltage regulator connector.



- Position and fix the hand grip position sensor to the chassis.

**WARNING**

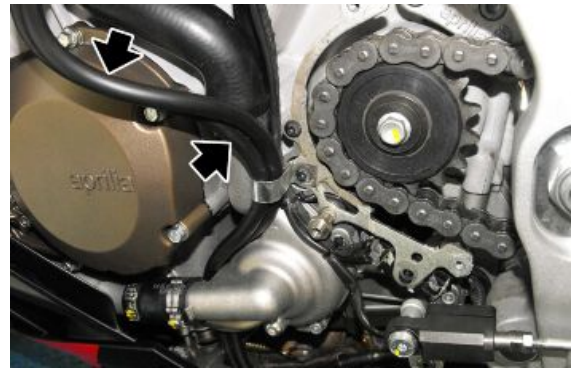
**BEFORE POSITIONING THE DEMAND SENSOR APPLY SOME LOCTITE 243 ON THE SILENT BLOCKS.**



- Connect the neutral sensor.



- Place the two fuel breather pipes.
- Install the side stand.



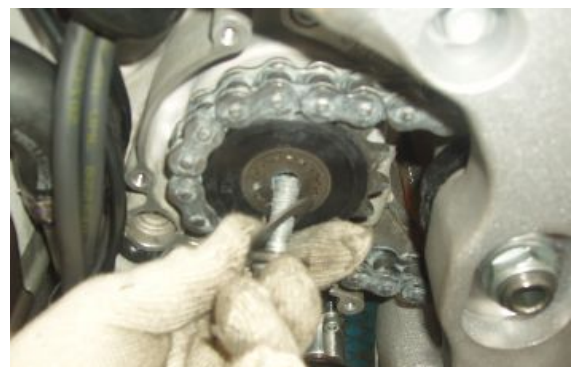
- Place the pinion and insert the transmission chain in the seat.
- Tighten the rear wheel fixing nut.



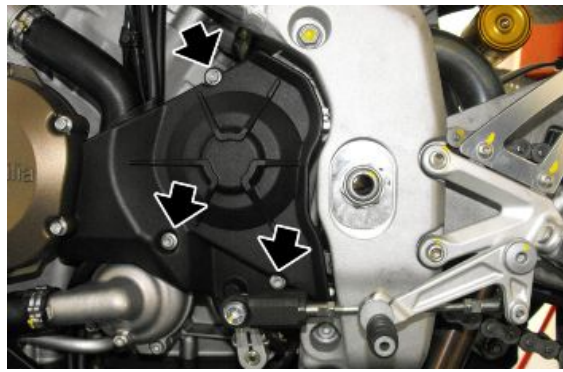
- Adjust the drive chain adjuster screws.



- Place the two washers and tighten the pinion fixing screw.



- Place the pinion cover and tighten the three screws.



- Connect the vehicle cable harness / engine cable harness connector.



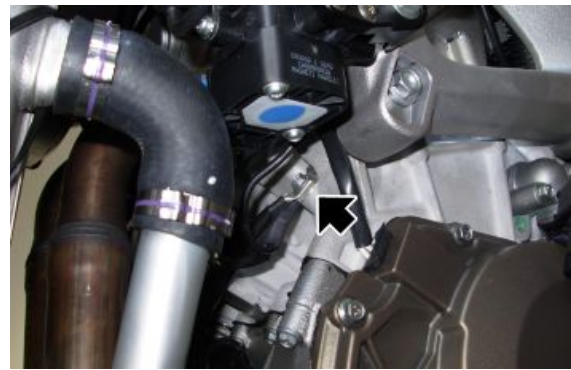
- Working on the right side of the vehicle, connect the exhaust valve control unit connector.



- Place the ground on the frame.
- Fit the washer and tighten the nut.



- Place the cable grommet and the three cable leads as shown.
- Tighten the cable grommet fixing screw.



- Connect the starter motor, place the washer and tighten the nut.
- Place the rubber cap.



- Tighten the engine oil pressure sensor.



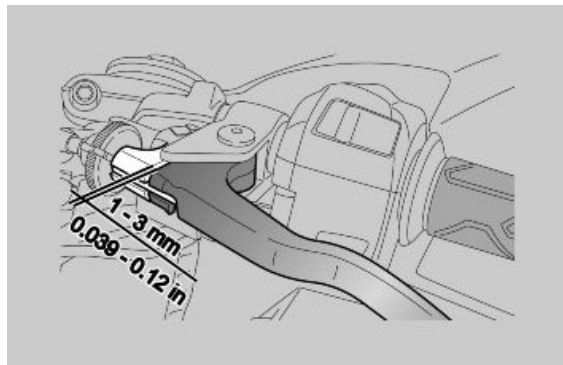
- Connect the timing sensor.



- Connect the clutch cable.



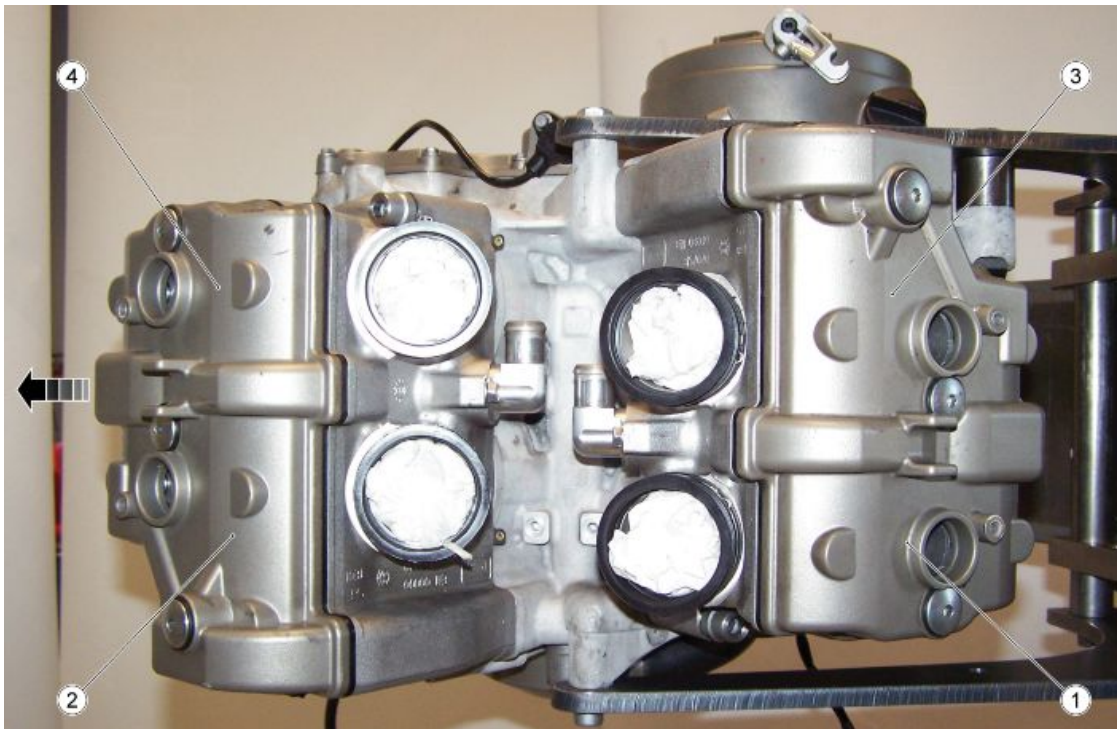
- Check and adjust the clutch lever clearance with the adjuster screw.
- The clutch lever clearance should be between 1-3 mm (0.039 - 0.12 in).



# INDEX OF TOPICS

ENGINE

ENG



**key:**

- 1. rear left cylinder;
- 2. front left cylinder;
- 3. rear right cylinder;
- 4. front right cylinder.



**Combustion sequence:**

1 - 3 - 2 - 4

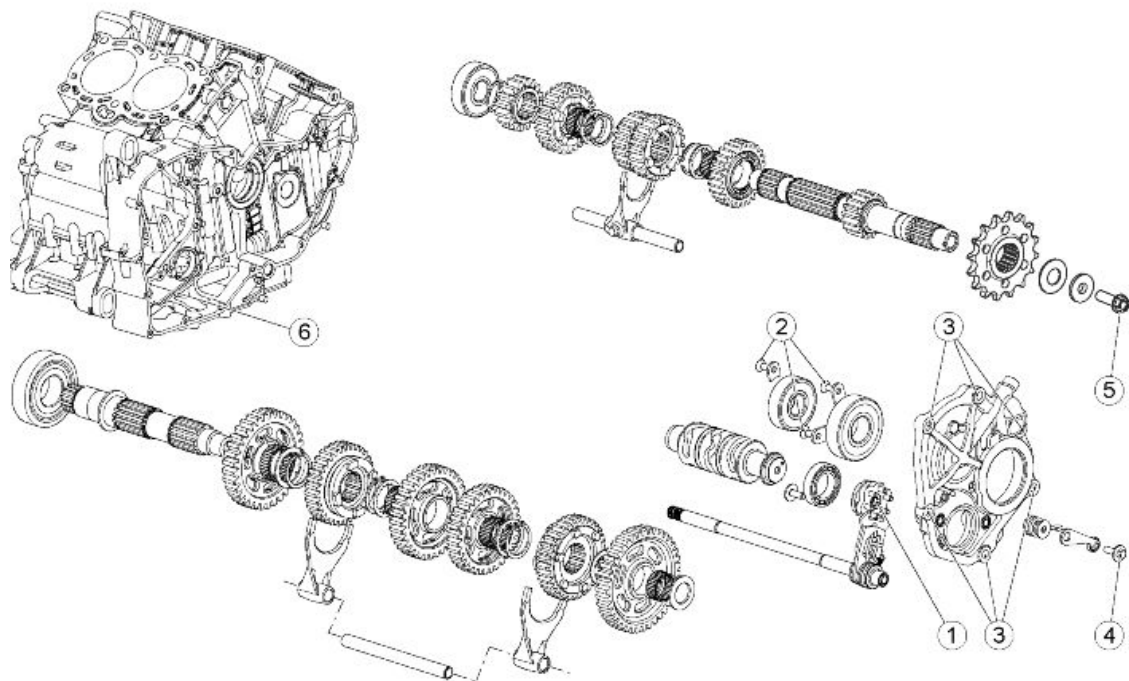
**Combustion angle:**

- cyl 1: 0°
- cyl 2: 180°
- cyl 3: 425°
- cyl 4: 605°



**Gearbox**

**Diagram**



**GEAR**

pos.	Description	Type	Quantity	Torque	Notes
1	Connector drum fastener screw	M6x20	1	10 Nm (7.37 lbf ft)	Loct. 243
2	Bearing retainer plate fixing screw	M6x16	3	10 Nm (7.37 lbf ft)	Loct. 243
3	Flange fixing screws	M8x25	6	25 Nm (18.44 lbf ft)	-
4	Index lever fixing screw	M6	1	10 Nm (7.37 lbf ft)	Loct. 243
5	Pinion retainer	-	1	50 Nm (36.88 lbf ft)	Loct. 243
6	Screw retaining pre-selector on crankcase	-	1	25 Nm (18.44 lbf ft)	Loct. 270
-	Gear indicator fixing screw	M5x15	2	6 Nm (4.42 lbf ft)	-

**Removing the gearbox**

- Remove the gearbox selector.
- Remove the clutch housing.
- Remove the gear sensor from the flywheel side.

- Remove the Seeger ring.
- Remove the water/oil pump control gear.

**See also**

[Removing the gear selector](#)  
[Disassembling the clutch](#)

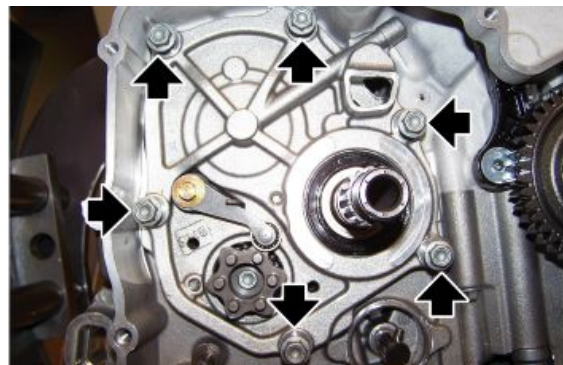
- Remove the water/oil pump control gear driving pin



- Loosen the screw.



- Unscrew and remove the six screws.



- Screw a M10x120 screw in the secondary shaft hole, from the alternator side, to make it easier to extract the gearbox unit.
- Use a rubber mallet to tap on the secondary shaft from the alternator side to detach the gearbox cover from the crankcase.
- Remove the complete gearbox unit.



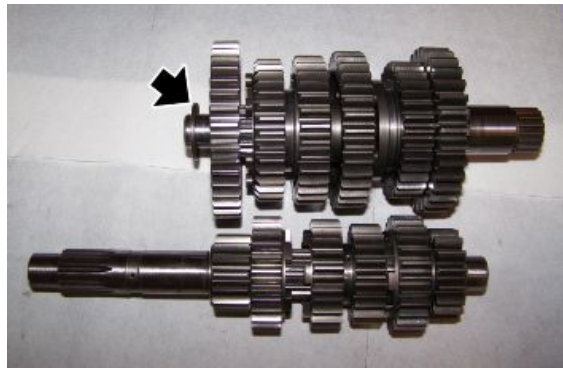
## Gearbox shafts

### Disassembling the gearbox

- Position the gear in neutral, checking that when the primary shaft rotates the secondary shaft does not move.
- Remove the gearbox unit.
- Slide off the gearbox primary shaft control rod together with the fork.
- Slide off the gearbox secondary shaft control rod together with the forks.



- Remove both gearbox shafts from the cover.
- Collect the shim washer that is located on the secondary shaft between the shaft and the cover.

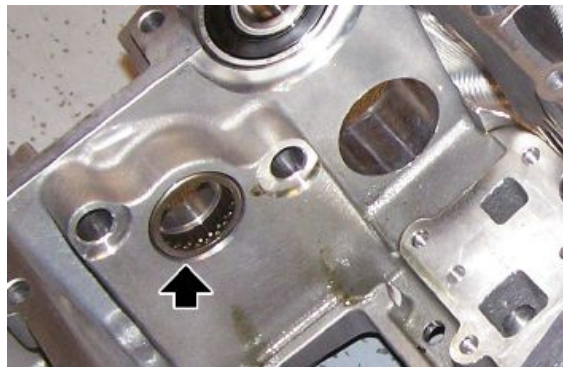


- Unscrew and remove the screw.
- Remove the selector drum.



**DESMODROMIC GEARBOX CONTROL ROD DRUM ROLLER CAGE, ALTERNATOR SIDE**

- Remove the lower crankcase.
- A suitable extractor must be used to remove the desmodromic gearbox control rod drum roller cage from the alternator side.



- A specific punch is required to install the desmodromic gearbox control rod drum roller cage.
- Lubricate the seat and insert the new roller cage.



---

## Checking the primary shaft

### Characteristic

#### Maximum wear limit for the selection gear grooves

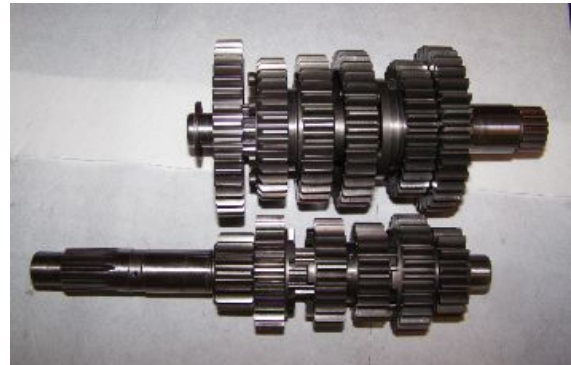
5.3 mm (0.21 in)

#### Minimum wear limit of the pinion side primary shaft seat

24.97 mm (0.98 in)

#### Minimum wear limit of the clutch side primary and secondary shaft seat

19.97 mm (0.79 in)



---

## Checking the secondary shaft

### Characteristic

#### Maximum wear limit for the selection gear grooves

5.3 mm (0.21 in)

#### Minimum wear limit of the pinion side secondary shaft seat

29.97 mm (1.18 in)

#### Minimum wear limit of the clutch side primary and secondary shaft seat

19.97 mm (0.79 in)



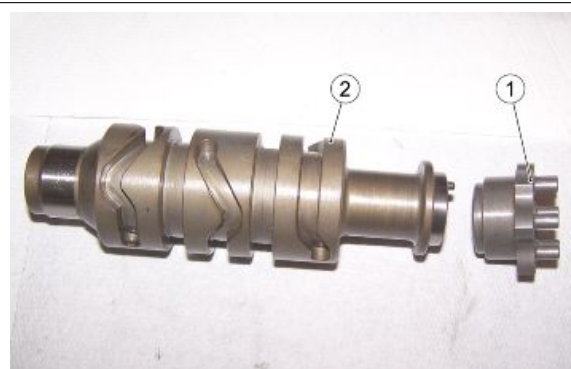
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## Checking the desmodromic drum

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

Check the desmodromic segment (1) for damage and wear and replace it if necessary.

Check the desmodromic bearing (2) for damage and pitting and replace it if necessary.



### Characteristic

#### Maximum selector shaft eccentricity

0.2 mm (0.0079 in)

## Checking the forks

The purpose of the springs at the end of the gearbox control rods is to reduce vibration and make it easier to engage the gears.

### Characteristic

#### Maximum selection fork axial clearance

0.5 mm (0.020 in)

#### Minimum wear limit of the selection fork guide pins

6.8 mm (0.27 in)

#### Maximum eccentricity of the two fork guide shafts

0.05 mm (0.0020 in)

### 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.



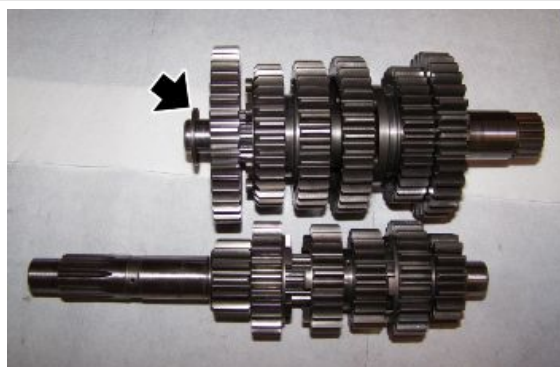
- Check the transmission fork movement and if it is not regular, replace the transmission forks.

## Assembling the gearbox

- Move the gearbox primary and secondary shafts together and fit them into the cover.

### NOTE

**SECURE THE SHIM WASHER TO THE SECONDARY SHAFT WITH GREASE.**



### NOTE

**MAKE SURE THE SLIDING BUSHING IS PRESENT ON EVERY GEAR CONTROL FORK.**

- Grease the bushings.



- Introduce the forks in their respective seats.
- Insert the desmodromic gearbox control rod on the cover.
- Position the selector drum.
- Turn the screw without tightening it.
- Position the fork bushings into the grooves on the desmodromic control rod.



- Insert the fork shafts, making sure the springs are present.





- Position the special tool from the alternator side in order to not ruin the edges of the oil seal.
- Insert the gearbox unit in the crankcase.

#### Specific tooling

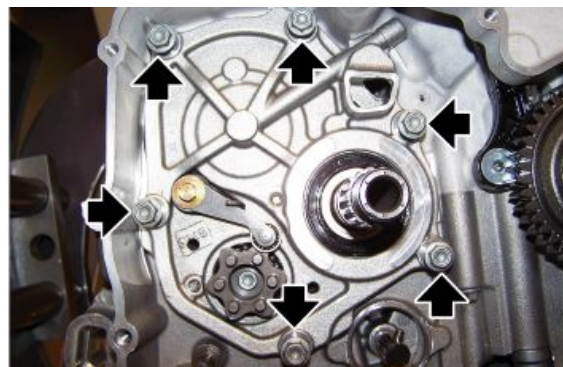
**0277308 Guide bushing for secondary gearbox shaft**



- Remove the special tool from the alternator side.
- Tighten the six screws that fasten the gearbox unit to the crankcase.

#### Specific tooling

**0277308 Guide bushing for secondary gearbox shaft**





- Tighten the selector drum screw.



- Insert the driving pin on the oil pump shaft.
- Install the water/oil pump control gear.
- Insert the Seeger ring.
- Install the gear sensor, making the pin coincide with the slot on the desmotic control rod.



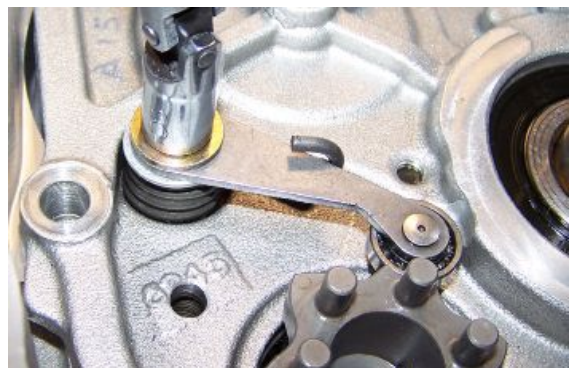
## Gear selector

### Removing the gear selector

- Drain the engine oil.
- Remove the clutch cover.
- Working from the clutch side, remove the selector control shaft.



- Remove the gear locking pawl and retrieve the washer and the spring.



### GEARBOX CONTROL ROD ROLLER CAGE, CLUTCH SIDE

- Remove the lower crankcase.
- The specific tool without an adaptor must be used to remove the gearbox control rod roller cage from the clutch side.



#### Specific tooling

#### 020862Y Gearbox control rod roller cage fitting punch

- Fit the adaptor on the specific tool to insert the roller cage at the controlled depth.
- Lubricate the seat and insert the new roller cage from the clutch side.



#### Specific tooling

#### 020862Y Gearbox control rod roller cage fitting punch

### GEARBOX CONTROL ROD OIL SEAL AND ROLLER CAGE, SPACER

- Remove the gearbox control rod spacer.
- Remove the oil seal and the roller cage.
- Install a new gearbox control rod roller cage on the spacer, using the specific tool without an adaptor.

#### Specific tooling

#### 020862Y Gearbox control rod roller cage fitting punch

- Position a new oil seal on the spacer with the writing on the edge of the oil seal facing outward.
- Install the oil seal on the spacer using the specific tool without an adaptor.



#### Specific tooling

#### 020862Y Gearbox control rod roller cage fitting punch

---

## Checking the gear selector

Check the stop lever for damage and wear and make sure the ball rotates freely.

If necessary, replace the parts.

Check the gear selector spring for damage and wear.

If necessary, replace the part.



Check the selector shaft and its teeth for damage and wear.

If necessary, replace the part.

Check the lever spring for damage and wear.

If necessary, replace the part.



---

## Reassembling the gear selector

- To refit, lubricate and carry out the removal operations but in reverse order.

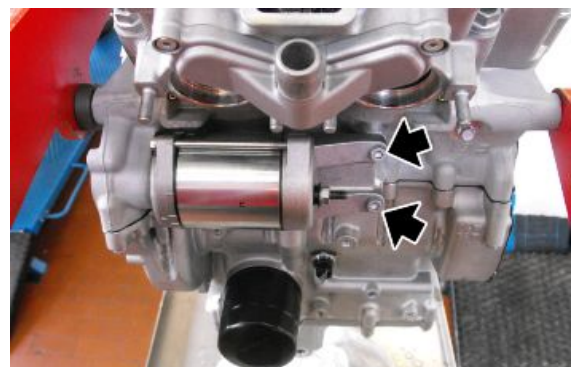
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## Starter motor

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### Removing the starter motor

- Unscrew the starter motor fixing screws and pull it out of its housing.



## Removing the idle gear

- Remove the clutch cover.
- Remove the intermediate gear.

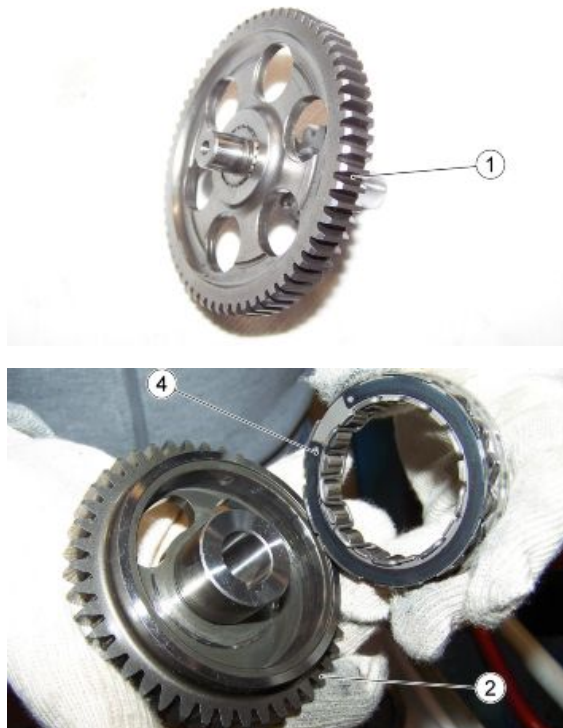


## Start-up system check

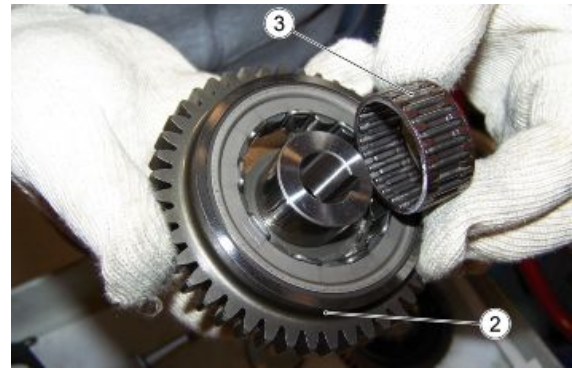


IF THE DUAL STARTER GEAR TOOTHING IS DEFORMED AFTER STARTING, THE STARTER MOTOR TOOTHING MUST BE CHECKED AS WELL.

Check the dual starter gear tothing (1) and the freewheel gear (2) to see if the material is damaged or deformed.

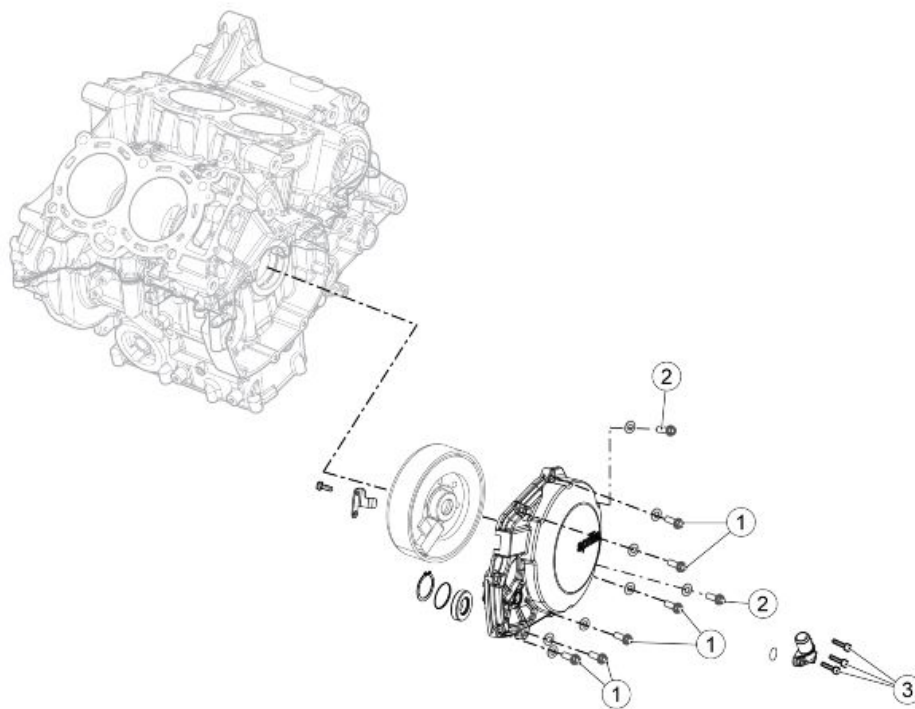


If deformations or broken material are found on the sliding surface, replace the freewheel gear (2).  
 Check the freewheel sliding surface (2) for wear.  
 Make sure that the woodruff key slot is in perfect condition.



Remove the needle cage (3) and the roller cage (4) from their housings on the freewheel (2) and check the rollers/needles for wear.  
 Check for wear on the freewheel sliding surface (2).

### Generator side



#### ALTERNATOR COVER

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening cover onto centre pins	M6x25	6	12 Nm (8.85 lbf ft)	-
2	Cover fastener screws, alternator side	M6x40	2	12 Nm (8.85 lbf ft)	-
3	Blow-by union fastener screws	M5x16	3	7 Nm (5.16 lbf ft)	-
-	Stator fixing screw UNI 5931 CL8.8	M6x25	3	10 Nm (7.37 lbf ft)	Loct. 243
-	Flanged screw	M5x12	1	6 Nm (4.42 lbf ft)	Loct. 243

## Removing the flywheel cover

- Release the clamp and detach the Blow-by pipe.
- Unscrew and remove the five screws (1).
- Unscrew and remove the two screws (2).
- Mark the screws (1 - 2) that have different lengths.
- Remove the cover together with the stator and retrieve the two centring dowels.



## Magneto flywheel removal

- Remove the flywheel cover.
- Block flywheel rotation using the specific tool.
- Unscrew and remove the screw.

### Specific tooling

020848Y Flywheel retainer



- Remove the tool for blocking flywheel rotation.
- Insert a TCEI M10x20 screw into the crankshaft hole, which will act as a mounting base for flywheel extraction.
- Remove the flywheel using the specific extractor.
- Collect the TCEI M10x20 screw.



### Specific tooling

020847Y Flywheel extractor

### See also

[Removing the flywheel cover](#)

---

## Inspecting the cover components

---

- Unscrew and remove the three Blow-by system fitting screws.
- Remove the Blow-by system fitting.
- Replace the O-ring with a new one of the same type



- 
- Remove the flywheel cover.
  - Remove the Seeger ring.



- 
- Remove the shim washer.



- 
- Remove the oil seal.

**CAUTION**

DURING REFITTING REPLACE THE OIL SEAL WITH A NEW ONE OF THE SAME TYPE.  
SET THE NEW OIL SEAL WITH THE MARKING ON THE EDGE FACING OUTWARD.

**See also**

[Removing the flywheel cover](#)

---

## Installing the flywheel

- Position the flywheel on the crankshaft.
- Block flywheel rotation using the specific tool.
- Tighten the screw.



### Specific tooling

020848Y Flywheel retainer

## Flywheel cover installation

- Insert the centring dowels in the cover.
- Apply a layer of sealing paste along the external edge of the cover.
- Insert the cover together with the stator.

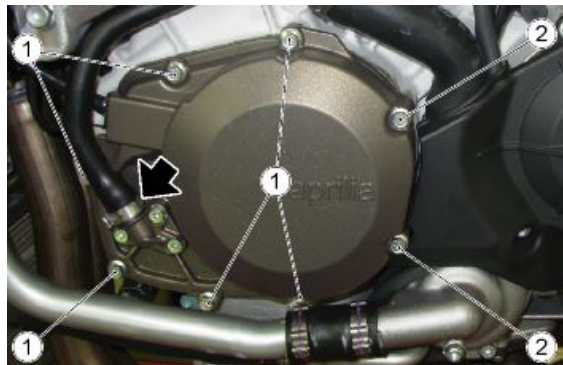


### Recommended products

Three bond Sealing paste

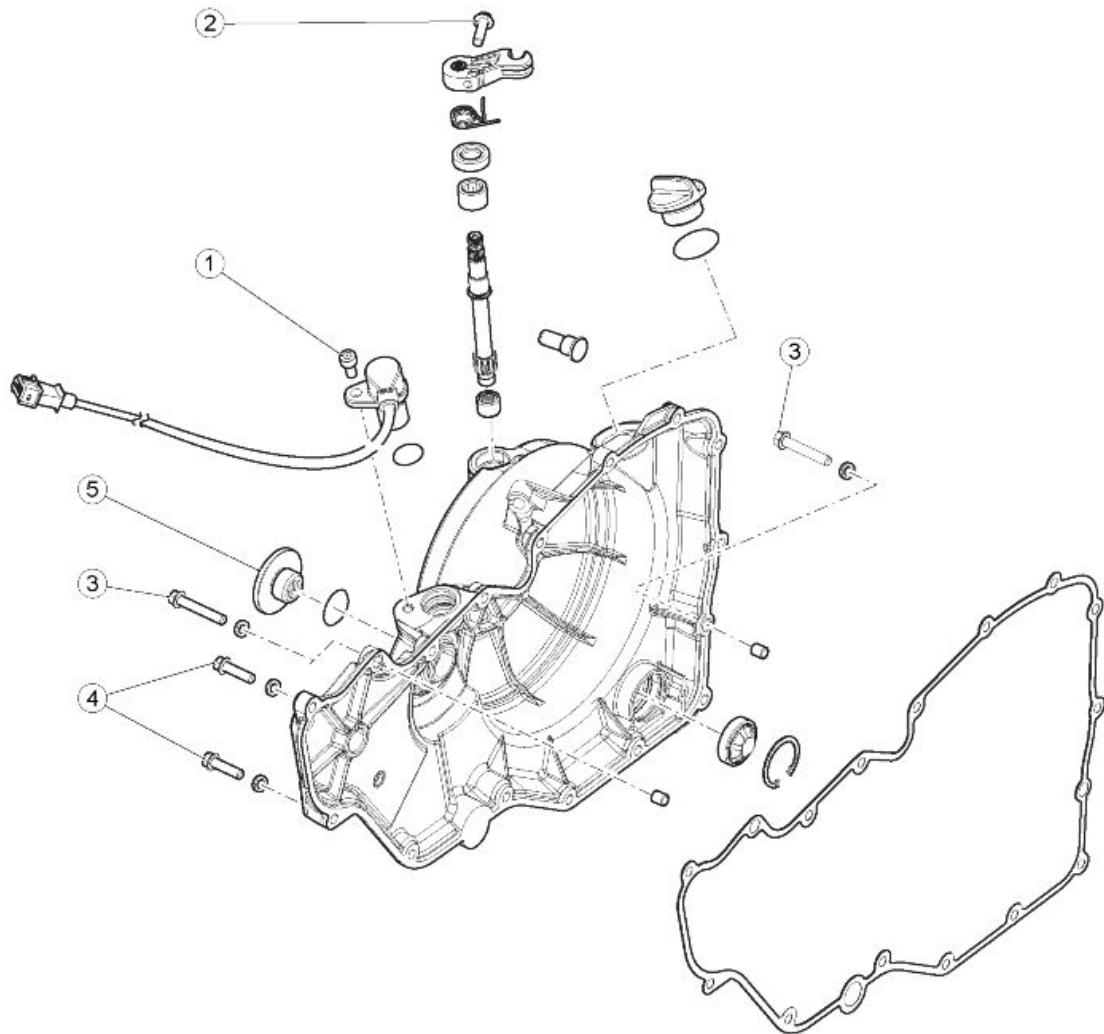
-

- Turn the five screws (1) and the two screws (2).
- Tighten the screws working in stages and diagonally.
- Insert the Blow-by system pipe and fasten it with a new clamp.





Clutch side



**CLUTCH COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Engine speed sensor fixing screw	-	1	8 Nm (5.9 lbf ft)	-
2	TE flanged screw	M6x20	1	12 Nm (8.85 lbf ft)	-
3	Flanged TE screws	M6x35	2	12 Nm (8.85 lbf ft)	-
4	Flanged TE screws	M6x22	16	12 Nm (8.85 lbf ft)	-
5	Engine timing inspection cap	-	1	25 Nm (18.44 lbf ft)	-

## Removing the clutch cover

- Drain the engine oil.
- Unscrew and remove the sixteen perimeter fixing screws and retrieve the washers

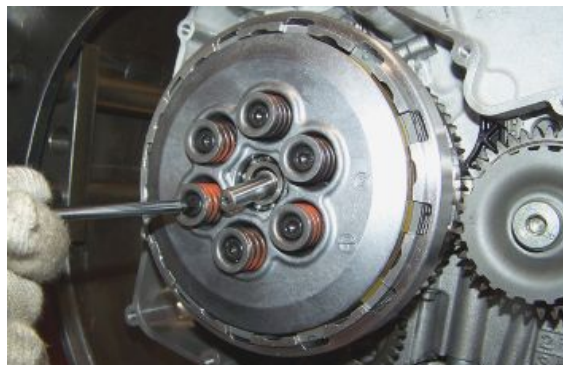


- Remove the clutch casing, retrieving the gasket, the two locator pins and the starter motor transmission gear.

## Disassembling the clutch

- Unscrew and remove the tone wheel fixing screw.
- Remove the tone wheel.

- Remove the clutch cover.
- Unscrew and remove the six screws by loosening them 1/4 of a turn at a time; operate in stages and diagonally, and retrieve the washers and the clutch springs.



- Remove the thrust plate and the complete control rod.



- Remove the discs.

### See also

[Removing the clutch cover](#)

- Block clutch bell rotation using the specific tools.
- Unscrew and remove the clutch bell fixing nut.

**Specific tooling****020849Y Clutch retainer**

- Remove the slipper unit.



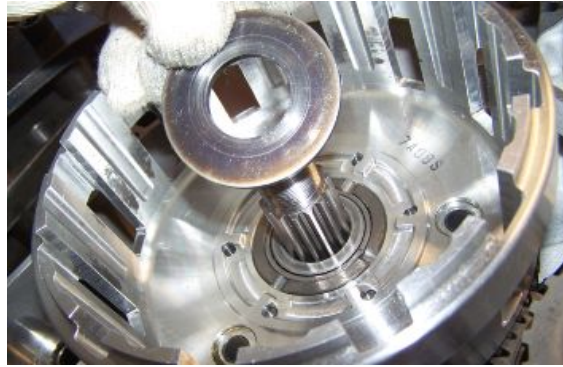
- Remove the clutch hub.



- Remove the clutch hub cam tower.



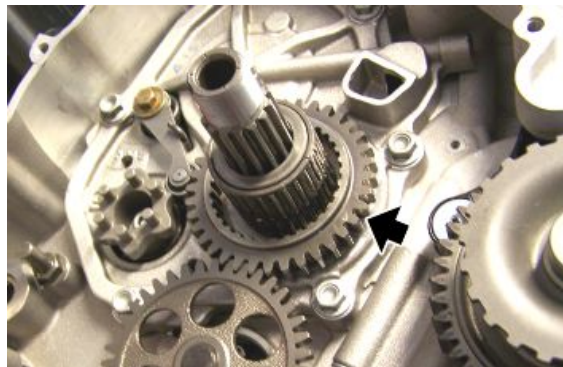
- Collect the shim washer.



- Collect the clutch housing.



- Remove the clutch gear that controls the oil/water pumps



- Remove the needle cage.



- Remove the spacer.



- Remove the thrust bearing.



## Checking the clutch plates

### Characteristic

**Maximum clutch plate deformation (in comparison to a flat surface)**

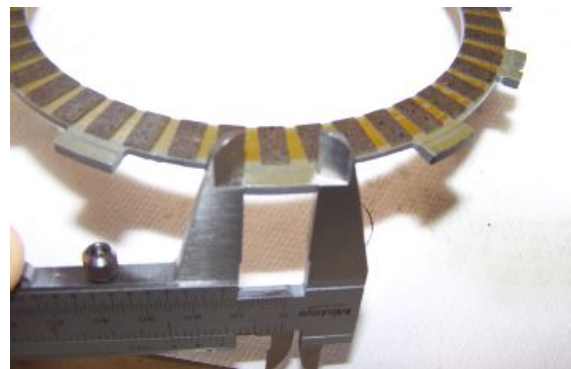
0.15 mm (0.0059 in)

**Minimum wear limit of the clutch plate sliding teeth**

13.5 mm (0.53 in)

**Minimum wear limit of the complete clutch pack thickness (friction discs + steel discs)**

47.6 mm (1.87 in)



---

## Checking the clutch housing

Check the clutch bell for damage and wear that may result in clutch irregular operation. If necessary, replace the bell.

Check the riveted joint between the clutch housing and the primary drive sprocket for correct sealing and evenness.

---

Check the primary driven gear for damage and wear and, if necessary, replace the primary driven gear and the clutch bell all together.

Make sure there is not excessive noise during operation; if necessary, replace the primary drive gear and the clutch bell all together.



---

## Checking the pusher plate

Check the thrust plate and the bearing for damage and wear. If necessary, replace the parts.

### Characteristic

#### Maximum deformation permitted on the thrust plate compression surface

0.15 mm (0.0059 in)

#### Maximum depth of the thrust plate

27.3 mm (1.07 in)



---

## Checking the clutch hub

Check the clutch hub for damage and wear that may result in clutch irregular operation. If necessary, replace the hub.



## Checking the springs

**NOTE**

**THE FOLLOWING PROCEDURE IS VALID FOR ALL CLUTCH SPRINGS.**

- Check the springs for damage and, if necessary, replace the them all together.
- Measure the clutch spring length when unloaded; if necessary, replace the springs all together.

**Characteristic**

**Minimum wear limit in the release position of the individual clutch springs**

46.8 mm (1.84 in)

## Assembling the clutch

- Insert the thrust bearing with the collar facing the gearbox



- Insert the spacer.



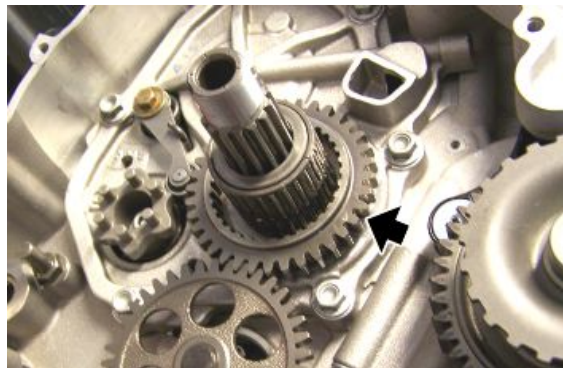
- Fit the needle cage.



- Install the clutch gear, making it mesh with the oil/water pump control gear



**TURN THE CLUTCH GEAR COLLAR TOWARD THE CLUTCH BELL.**



- Insert the clutch bell, making it engage with the engine pinion



- Fit the shim washer.





- Install the clutch hub cam tower.



- Position the clutch hub.



**HOUSE THE THREE CLUTCH HUB CAMS IN THE SPECIFIC CLUTCH HUB CAM TOWER INCLINES.**



- Fit the three slipper unit clips, offsetting them by 120°.
- Install the slipper unit correctly.



- Block clutch bell rotation using the specific tool.
- Tighten the clutch bell fixing nut.

### **Specific tooling**

**020849Y Clutch retainer**



- Insert the disc with friction material and the black tooth into the bell.



- Insert one of the metal discs into the bell.



- Insert the flat washer.
- Insert the belleville spring with the concave side facing outward.



- 
- Insert the disc covered with the friction material into the bell.



- 
- Continue inserting, alternating a metal disc with one with friction material, finishing with a friction material disc with a black tooth.



- 
- Place the control rod together with the thrust bearing and the shim washer.

- Place the thrust plate.

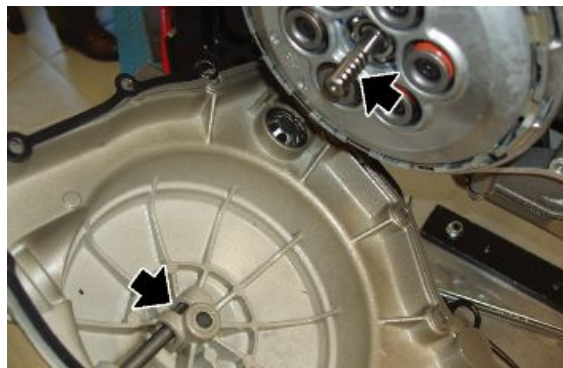


- Fit the clutch springs.
- Fit the screw washers.
- Tighten the six screws operating in stages and diagonally.

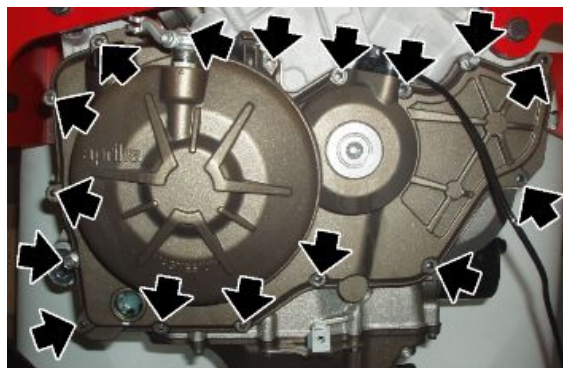


### Installing the clutch cover

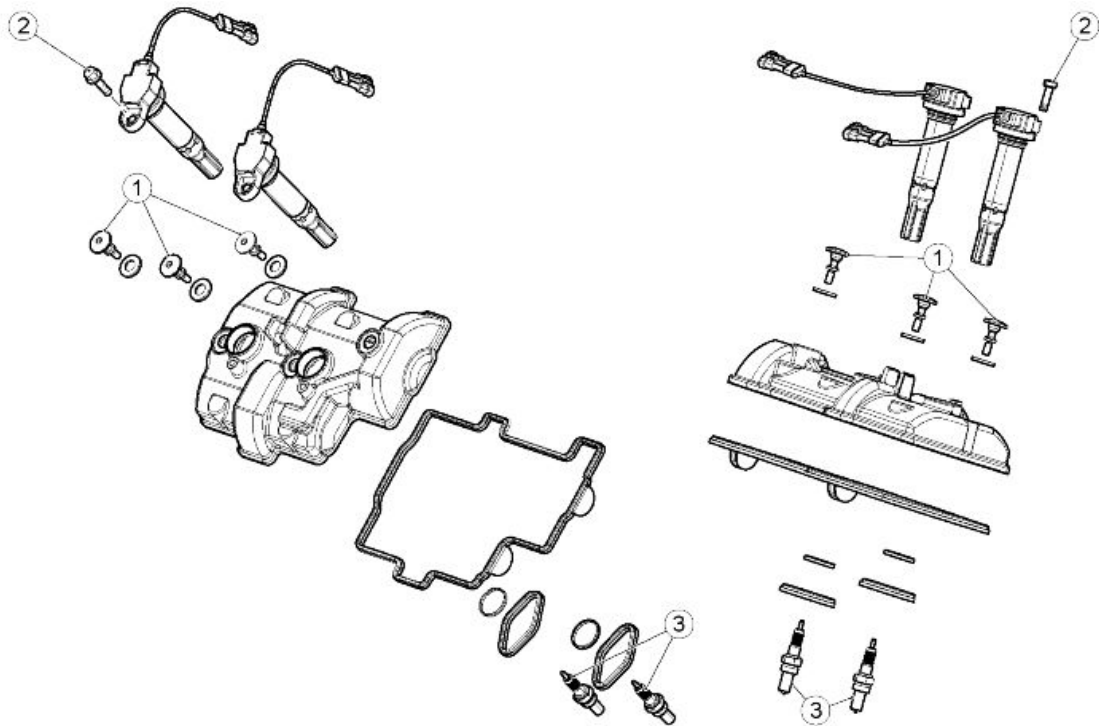
- Position the starting transmission gear on the crankcase.
- Position the gasket and the two dowel pins in the clutch cover.
- Insert the clutch cover, making sure to have correctly engaged the clutch control lever and the rack shaft.



- Screw the sixteen perimetric fixing screws with the washers.
- Tighten the screws working in stages and diagonally.
- Add engine oil up to the correct level.

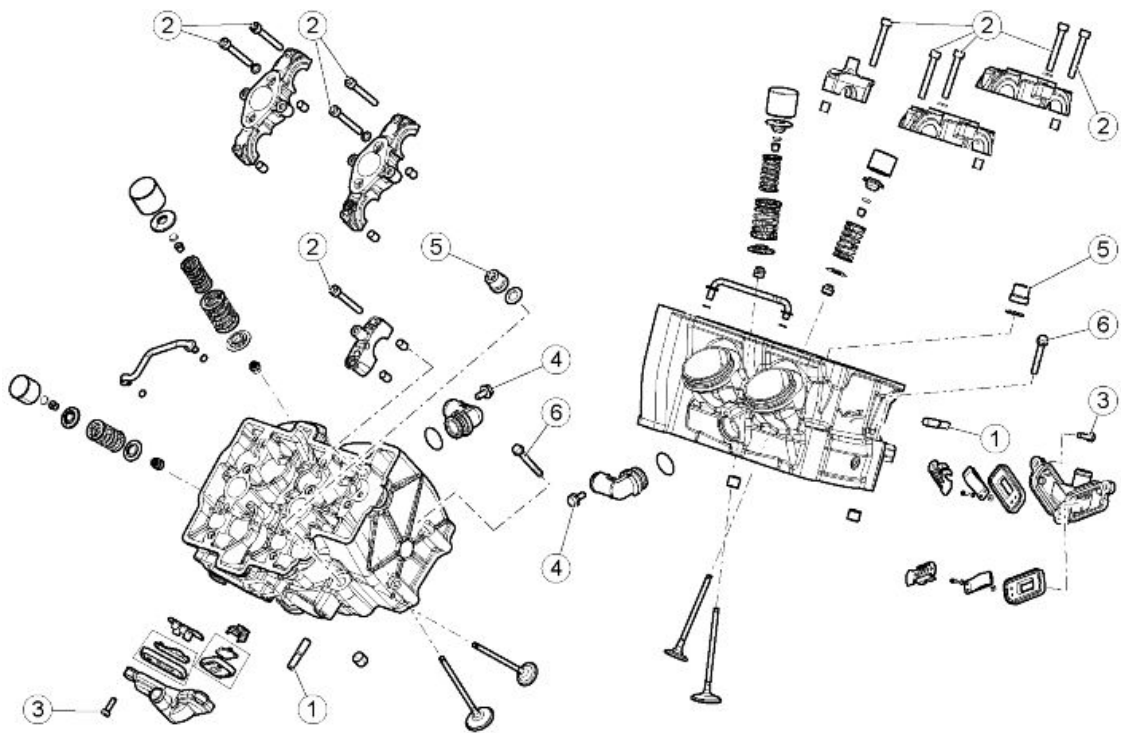


Heads



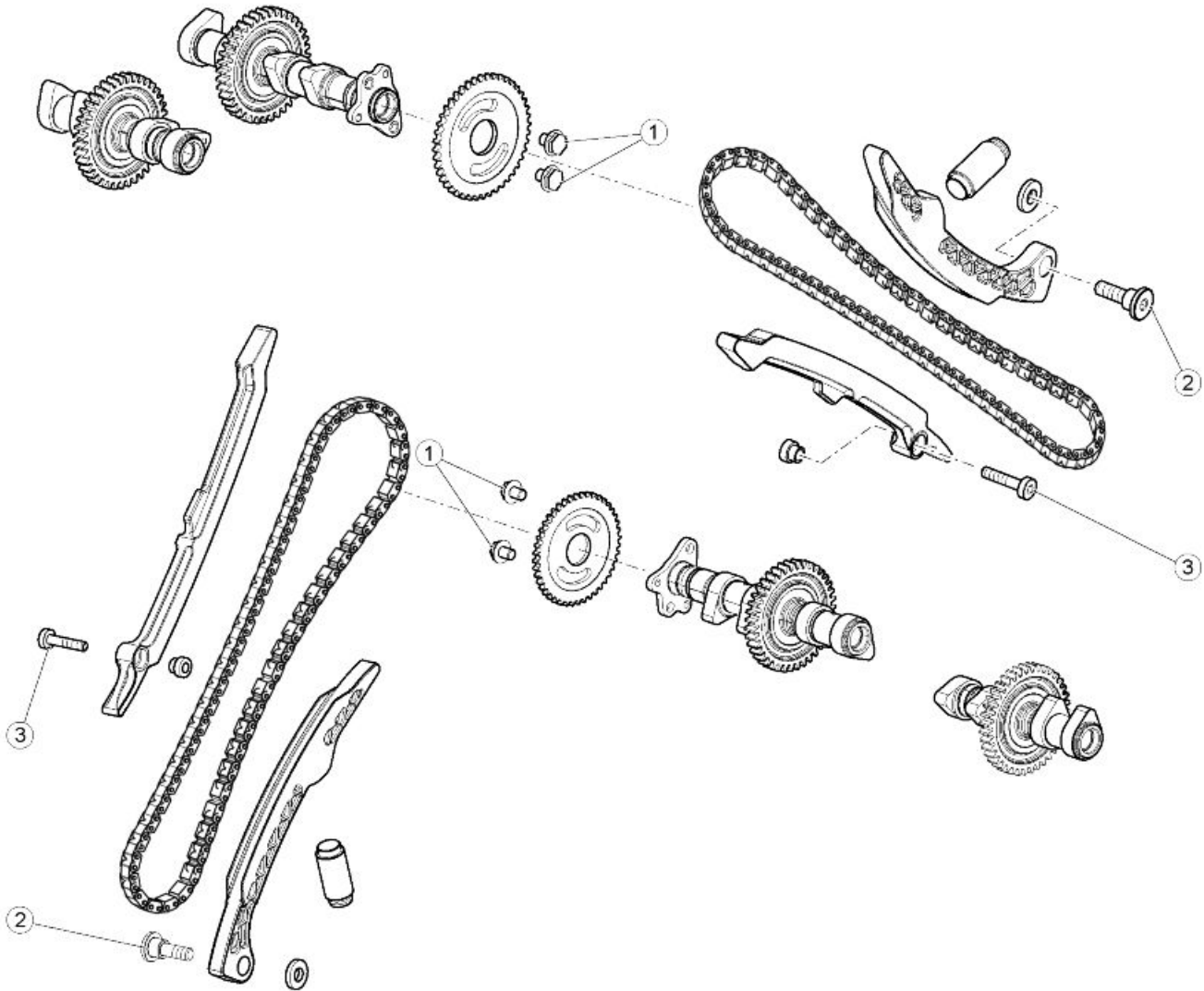
**VALVE COVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Head cover fixing screws	-	6	10 Nm (7.37 lbf ft)	-
2	Coil fixing screws	-	4	8 Nm (5.9 lbf ft)	Loct. 243
3	Spark plugs	-	4	12 Nm (8.85 lbf ft)	-



**HEADS**

pos.	Description	Type	Quantity	Torque	Notes
1	Exhaust stud bolts	-	8	10 Nm (7.37 lbf ft)	-
2	Camshaft cam tower fixing screws	M6x45	20	12 Nm (8.85 lbf ft)	-
3	Reed valve cover fixing screws	-	6	6 Nm (4.42 lbf ft)	-
4	Water outlet union fixing screw	-	2	12 Nm (8.85 lbf ft)	Loct. 243
5	Flanged head nut	-	12	30 + 55 Nm (22.13 + 40.56 lbf ft)	Molykote spray on thread and under head
6	Head fastener screw, chain side	M6x55	4	12 Nm (8.85 lbf ft)	-



**TIMING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the timing system gear on the intake shaft	M8	4	30 Nm (22.13 lbf ft)	Loct. 243
2	Skid fastener screws	M8	2	20 Nm (14.75 lbf ft)	Loct. 243
3	Skid fastener screws	M6x18	2	10 Nm (7.37 lbf ft)	Loct. 243

## Head cover removal

- Unscrew and remove the three screws with rubber washers.
- Remove the head cover together with the sealing gasket.



### INSTALLATION

- Install a new gasket in the head cover.
- Smear the gasket with suitable sealant, in the area indicated in the figure.

#### Recommended products

Three bond Sealing paste

-



- Smear the head surface with suitable sealant, in the area indicated in the figure.

#### Recommended products

Three bond Sealing paste

-



- Fit the head cover.
- Tighten the three screws with rubber washers to the prescribed tightening torque.

## Front head

---

## Removing camshafts

- Remove both head covers, the alternator side cover and remove the cap on the clutch cover in order to rotate the crankshaft.
- Remove the O ring.



### See also

Head cover removal

[Removing the flywheel cover](#)

- 
- Turn the crankshaft from the hole on the clutch cover.
  - Move cylinder piston 1 (left rear piston) to the TDC overlap;
  - Turn the crankshaft 150° in the direction of engine rotation (direction of travel).



- Insert the pin from the flywheel side, in the hole in the crankshaft.

#### NOTE

THE SPECIAL TOOL IS ONLY USED FOR IDENTIFYING THE CORRECT CRANKSHAFT POSITION. DO NOT USE IT FOR TIGHTENING OPERATIONS.

#### Specific tooling

020852Y Crankshaft timing pin





- Fit the pin for aligning the intake camshaft with the hole on U-bolt.
- If it was not possible before adjusting the valve clearance, check the engine timing.

### Specific tooling

#### 020851Y Camshaft timing pin



- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the camshaft gear screw.
- Remove the crankshaft locking tool.



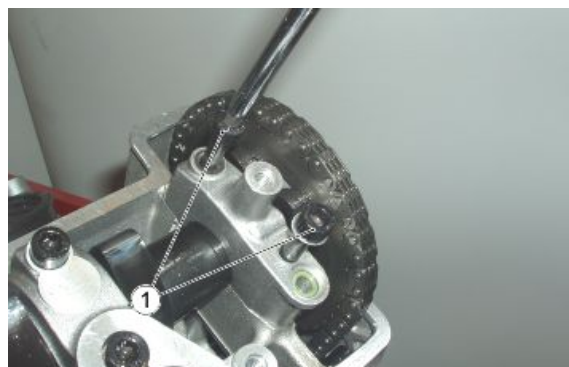
### Specific tooling

#### 020850Y Primary gear lock

#### 020848Y Flywheel retainer

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft 150° in the direction of engine rotation (direction of travel) in order to align the hole on the intake camshaft with the specific hole on the U bolt; this ensures that all the front cylinder bank valve springs are decompressed.
- Refit the camshaft timing setting pin in the hole in the U bolt on the front head, and refit the crankshaft timing pin from the flywheel side, to check that the tim-



ing setting was not altered while the engine was turned with only one camshaft drive gear fastener screw in place.

- Remove the camshaft timing pin.
- Unscrew and remove the two U bolt screws (1).
- Remove the U bolt and the oil pipe.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Leave the gear on the camshaft.

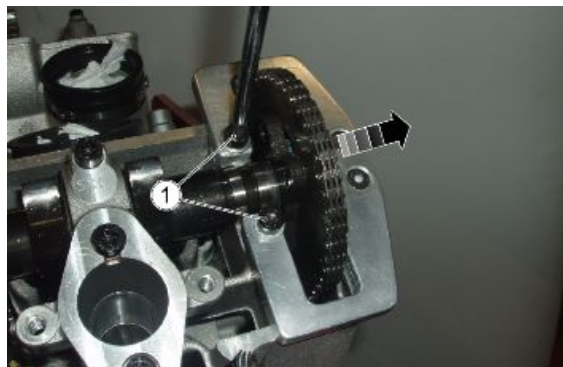


### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

- Install the specific camshaft gear support tool.
- Fix it to the head using the two screws (1).
- Move the gear from the camshaft to the tool.



### Specific tooling

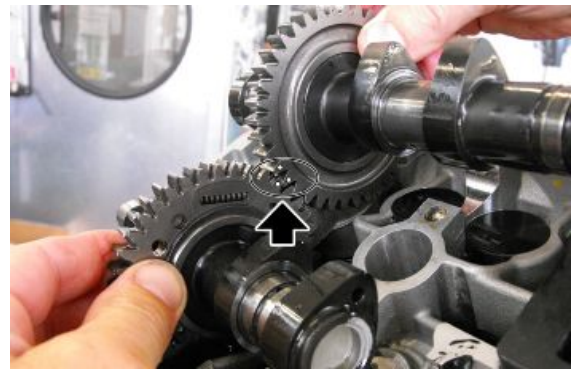
**020865Y Support for camshaft gear on head**

- Unscrew and remove the eight screws (2), proceeding in stages and diagonally.
- Retrieve the washers from the screws near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.



- Remove the intake and exhaust camshafts.

If the two camshafts are timed correctly, the exhaust camshaft gear tooth (indicated with a dot) is meshed with the trough of the intake camshaft gear (indicated with two dots).



## Inspecting camshafts

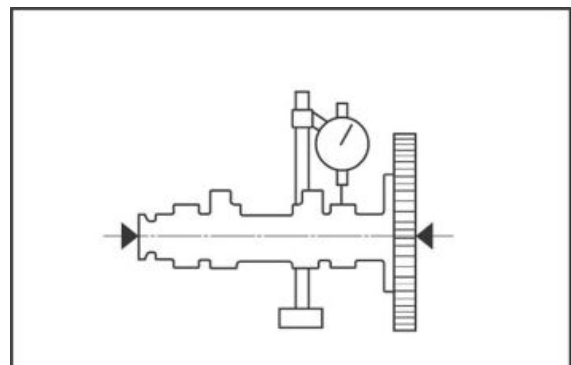
### CAMSHAFT TOOTHED WHEEL CHECK

- Check that the camshaft gear works properly: if it is damaged or does not move smoothly, replace the timing chain and the camshaft gear.

### CAMSHAFT LOBES

- Check that they do not show blue colouring, cracks or scratches; otherwise, replace the camshaft, gear and chain.

- Fasten the camshaft in horizontal position, as shown in the figure, and make it spin to check the eccentricity with a dial gauge; if necessary, replace the part.



### Characteristic

#### Maximum camshaft axial clearance (intake/exhaust)

0.4 mm (0.0016 in)

#### WARNING

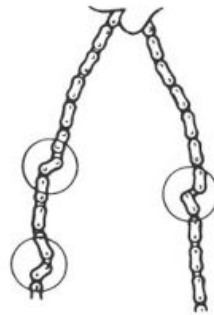
**THE EXHAUST CAMSHAFTS OF THE FRONT AND REAR CYLINDER BANKS MUST BOTH BE OF THE SAME TYPE - EITHER WITH A CONVENTIONAL GEAR OR WITH A SELF-ADJUSTING CAMSHAFT GEAR. THE TWO TYPES OF CAMSHAFT ARE INTERCHANGEABLE ON ALL ENGINES IRRESPECTIVE OF THE CAMSHAFT TYPE ORIGINALLY INSTALLED.**

Check the timing chain for damage or stiffness while moving.

If necessary, replace the timing chain together with the camshaft gears.

Check the timing chain guide sliders for damage.

If necessary, replace the parts.



## Installing camshafts

- Install the intake and exhaust camshafts on the front head, bearing in mind that:

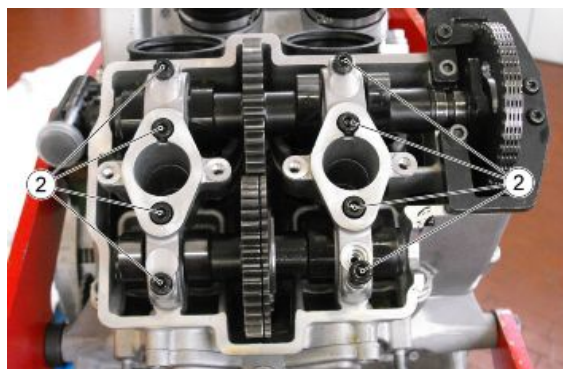
the exhaust camshaft gear tooth (indicated with a dot) is meshed with the trough of the intake camshaft gear (indicated with two dots).



**CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.**



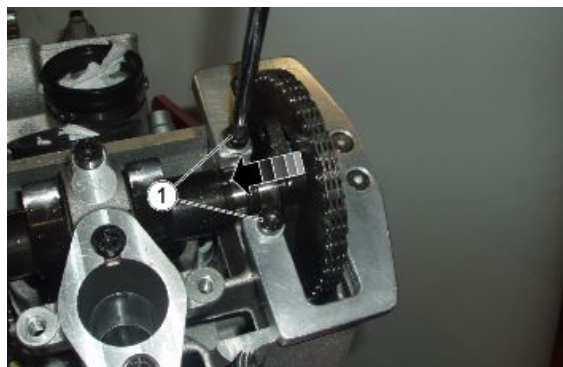
- Fit the U bolts with the nine O rings and locator pins.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the seven screws (2) operating in stages and diagonally.
- Do not fit the eighth screw (2 - fastening the oil pipe) yet.



- Move the gear from the mounting tool to the camshaft.
- Unscrew and remove the two screws (1).
- Remove the tool.

### Specific tooling

**020865Y Support for camshaft gear on head**



- Fit the U bolt and the oil pipe.
- Tighten the two U bolt screws (1) and the screw (2) that was not fitted previously.



- Align the intake camshaft with the specific hole on the U bolt.
- Insert the specified pin.

### Specific tooling

020851Y Camshaft timing pin



- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

020848Y Flywheel retainer

020850Y Primary gear lock

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener screw. This screw must be replaced at each reassembly.
- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; insert the reference pin while checking with the crankshaft reference pin, that the flywheel side hole and the hole on the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

---

## Front head removal

- Remove both head covers, the alternator side cover and remove the cap on the clutch cover in order to rotate the crankshaft.
- Remove the O ring.



### See also

Head cover removal  
[Removing the flywheel cover](#)

- 
- Turn the crankshaft from the hole on the clutch cover.
  - Move cylinder piston 1 (left rear piston) to the overlap TDC;
  - Turn the crankshaft 150° in the engine rotation direction (direction of travel), in order to align the hole on the intake camshaft with the specific hole on the U bolt; this ensures that all the front cylinder bank valve springs are decompressed.



- 
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
  - Block crankshaft rotation using one of the specific tools.
  - Unscrew and remove the camshaft gear screw.
  - Remove the crankshaft locking tool.



### Specific tooling

020850Y Primary gear lock

020848Y Flywheel retainer

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft 150° in the engine rotation direction (direction of travel), in order to align the hole on the intake camshaft with the specific hole on the U bolt; this ensures that all the front cylinder bank valve springs are decompressed.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Remove the crankshaft locking tool.



### Specific tooling

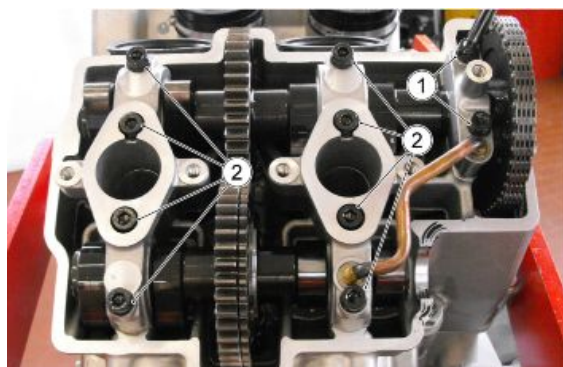
**020850Y Primary gear lock**

**020848Y Flywheel retainer**

- Slide the gear off the intake camshaft.
- Block the gear to the timing chain with a clamp.



- Unscrew and remove the ten screws (1-2), proceeding in stages and in a crossed pattern.
- Retrieve the washers from the screws (2) near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.



#### NOTE

**MARK THE COMPONENTS TO PREVENT INCORRECT RE-FITTING.**



- Remove the intake and exhaust camshafts from the front head.
- Unscrew and remove the fixed chain slider screw.
- Remove the fixed chain slider.



- Unscrew and remove the mobile chain slider screw.
- Remove the mobile chain slider.



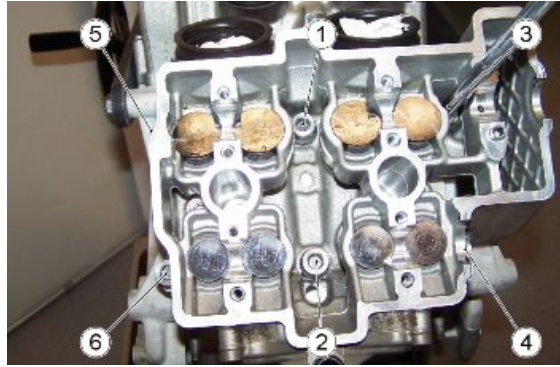
- Remove the camshaft control gear connected with a clamp to the timing chain.



- Unscrew and remove the two head fixing screws (a - b) from the flywheel side.



- Loosen the six nuts on the stud bolts, proceeding in the following order 6 - 5 - 4 - 3 - 2 - 1.
- After loosening all nuts, remove them in order indicated above.



- Remove the front head, slipping it off the stud bolts.
- Collect the gasket and the two dowel pins.



- Remove the chain tensioner complete with O-ring using the specific tool.
- If the O-ring is not on the chain tensioner, make sure it was not left in the crankcase seat.



REPLACE THE O RING UPON EACH REMOVAL.

**Specific tooling**

**020883Y Tool for fitting/removing the timing chain tensioner**



**Front head check**

Check that:

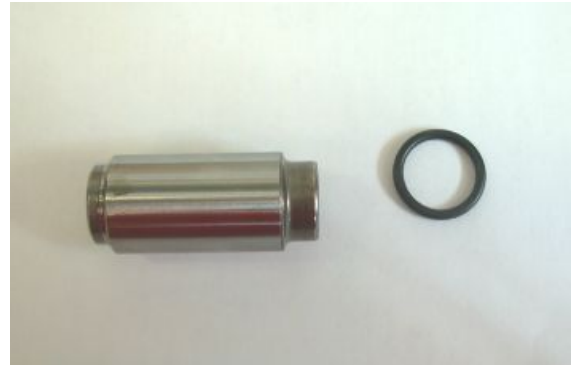
- The contact surfaces with the cover and the crankcase are not scored or damaged so they jeopardise a perfect seal.
- Check the status of the valve seats.
- Check that the routing of the oil pipes is free and if required, clean them by blowing a jet of compressed air.

## Front head fitting

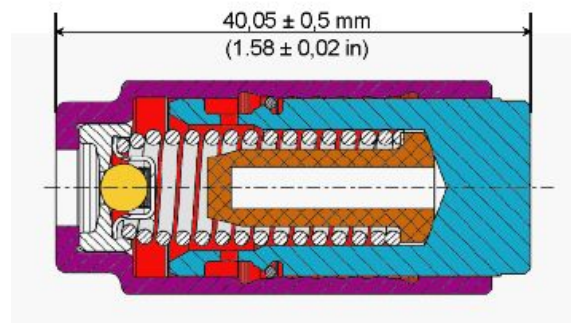
- Install a new O ring on the chain tensioner



REPLACE THE O RING UPON EACH REMOVAL.



- Compress the chain tensioner completely, making sure that the total length is  $40.05 \pm 0.5$  mm ( $1.58 \pm 0.02$  in).



- Insert the chain tensioner into the crankcase, being careful to position it correctly.



- Place a new gasket between the crankcase and the head.
- Place the two dowel pins.



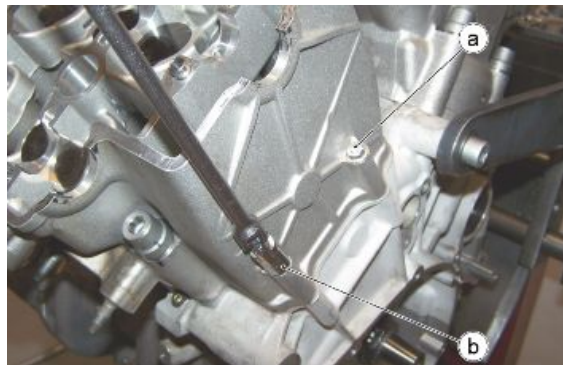
- Install the head.



- Pretighten the six nuts on the stud bolts proceeding in the following order: 1 - 2 - 3 - 4 - 5 - 6.
- Then tighten them fully following the same order.



- Tighten the two screws according to the sequence (a - b)



- Install the camshaft control gear connected with a clamp to the timing chain.
- Keep the gear in position with the chain tightened.



THE SIDE WITH THE BEVELLED HOLE IN THE TIMING SYSTEM GEAR MUST ALWAYS FACE THE EXTERIOR OF THE HEAD.



- Install both chain sliders and fasten them with the specific screws.



- Turn the crankshaft from the hole on the clutch cover.
- Move cylinder piston 1 (left rear piston) to the TDC overlap;
- Turn the crankshaft 150° in the direction of engine rotation (direction of travel).



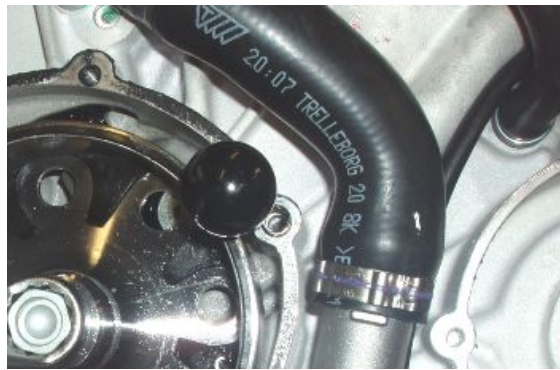
- Insert the pin from the flywheel side, in the hole in the crankshaft.

**NOTE**

THE SPECIAL TOOL IS ONLY USED FOR IDENTIFYING THE CORRECT CRANKSHAFT POSITION. DO NOT USE IT FOR TIGHTENING OPERATIONS.

**Specific tooling**

**020852Y Crankshaft timing pin**



- Install the intake and exhaust camshafts on the front head, bearing in mind that:

the exhaust camshaft gear tooth (indicated with a dot) is meshed with the trough of the intake camshaft gear (indicated with two dots).



CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.



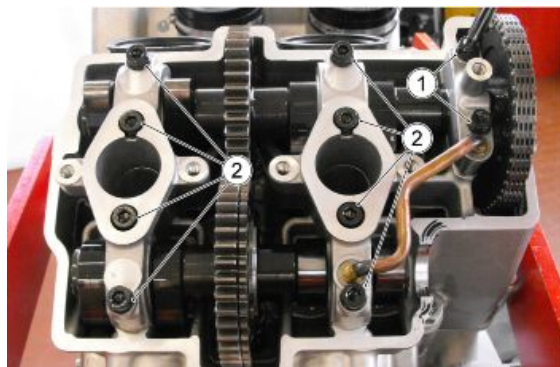
- Check the number engraved on the U bolts, which must correspond with the one engraved on the head.
- If the U bolts between the two heads are inverted, camshaft seizure may occur



IT IS NOT POSSIBLE TO REPLACE ONLY ONE U BOLT, IF NECESSARY: REPLACE THE ENTIRE HEAD.



- Fit the U bolts with the nine O rings and locator pins.
- Install the oil pipe.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the ten screws (1 - 2) working in stages and diagonally.



- Cut the clamp that binds the chain to the gear.
- Position the gear on the camshaft so that the timing hole and the gear fixing screw hole are centred with the gear slot.
- Insert the specific timing pin.



### Specific tooling

#### 020851Y Camshaft timing pin



- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Protect the edge of the head with rubber.
- Load the chain tensioner with special tool.

### Specific tooling

#### 020855Y Lever for engaging the chain tensioner

- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener screw. This screw must be replaced at each reassembly.
- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; insert the reference pin while checking with the crankshaft reference pin, that the flywheel side hole and the hole on the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

### Specific tooling

**020851Y Camshaft timing pin**



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**020852Y Crankshaft timing pin**

---

**Rear head**

---

**Removing camshafts**

- Remove the rear head cover and the clutch cover.
  - Move cylinder piston 1 (left rear piston) to the TDC;
  - Turn the crankshaft 450° (one complete turn + 90°) in the direction of motor rotation (direction of travel).
- 
- Insert the pin from the clutch side into the hole in the crankshaft.

**NOTE**

THE SPECIAL TOOL IS ONLY USED FOR IDENTIFYING THE CORRECT CRANKSHAFT POSITION. DO NOT USE IT FOR TIGHTENING OPERATIONS.

**Specific tooling****020852Y Crankshaft timing pin****See also**

Head cover removal

[Removing the clutch cover](#)

- 
- Fit the pin for aligning the intake camshaft with the hole on U-bolt.
  - If it was not possible before adjusting the valve clearance, check the engine timing.

**Specific tooling****020851Y Camshaft timing pin**

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the camshaft gear screw.
- Remove the crankshaft locking tool.



### Specific tooling

**020850Y Primary gear lock**

**020848Y Flywheel retainer**

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft by 450° (one complete turn + 90°) in the direction of engine rotation (direction of travel) to align the hole on the intake camshaft with the specific hole on the U bolt. This ensures that all the rear cylinder bank valve springs are decompressed.
- Refit the camshaft timing setting pin in the hole in the U bolt on the rear head, and refit the crankshaft timing pin from the clutch side, to check that the timing setting was not altered while the engine was turned with only one camshaft drive gear fastener screw in place.
- Remove the camshaft timing pin.
- Unscrew and remove the two U bolt screws (1).
- Remove the U bolt and the oil pipe.



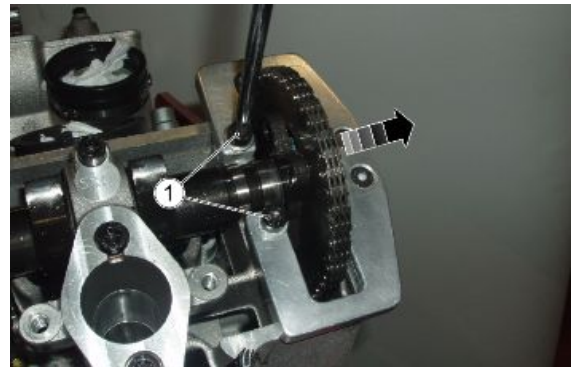
### Specific tooling

**020851Y Camshaft timing pin****020852Y Crankshaft timing pin**

- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Leave the gear on the camshaft.

**Specific tooling****020848Y Flywheel retainer****020850Y Primary gear lock**

- Install the specific camshaft gear support tool.
- Fix it to the head using the two screws (1).
- Move the gear from the camshaft to the tool.

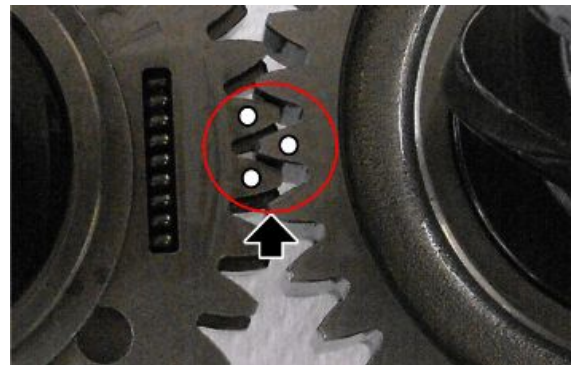
**Specific tooling****020865Y Support for camshaft gear on head**

- Unscrew and remove the eight screws (2), proceeding in stages and diagonally.
- Retrieve the washers from the screws near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.



- Remove the intake and exhaust camshafts.

If the two camshafts are timed correctly, the intake camshaft gear tooth (indicated with one dot) is meshed with the trough of the exhaust camshaft gear (indicated with two dots).



## Inspecting camshafts

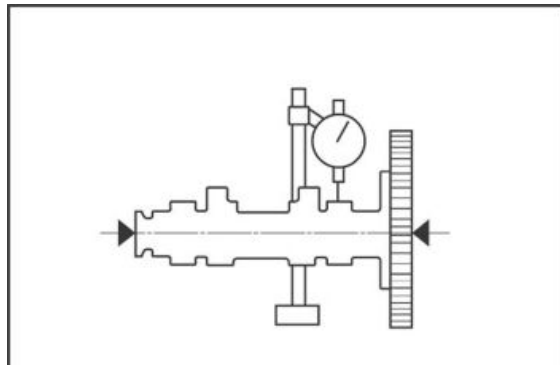
### CAMSHAFT TOOTHED WHEEL CHECK

- Check that the camshaft gear works properly: if it is damaged or does not move smoothly, replace the timing chain and the camshaft gear.

### CAMSHAFT LOBES

- Check that they do not show blue colouring, cracks or scratches; otherwise, replace the camshaft, gear and chain.

- Fasten the camshaft in horizontal position, as shown in the figure, and make it spin to check the eccentricity with a dial gauge; if necessary, replace the part.



### Characteristic

#### Maximum camshaft axial clearance (intake/exhaust)

0.4 mm (0.0016 in)

### WARNING

**THE EXHAUST CAMSHAFTS OF THE FRONT AND REAR CYLINDER BANKS MUST BOTH BE OF THE SAME TYPE - EITHER WITH A CONVENTIONAL GEAR OR WITH A SELF-ADJUSTING CAMSHAFT GEAR. THE TWO TYPES OF CAMSHAFT ARE INTERCHANGEABLE ON ALL ENGINES IRRESPECTIVE OF THE CAMSHAFT TYPE ORIGINALLY INSTALLED.**

Check the timing chain for damage or stiffness while moving.

If necessary, replace the timing chain together with the camshaft gears.

Check the timing chain guide sliders for damage.

If necessary, replace the parts.



## Installing camshafts

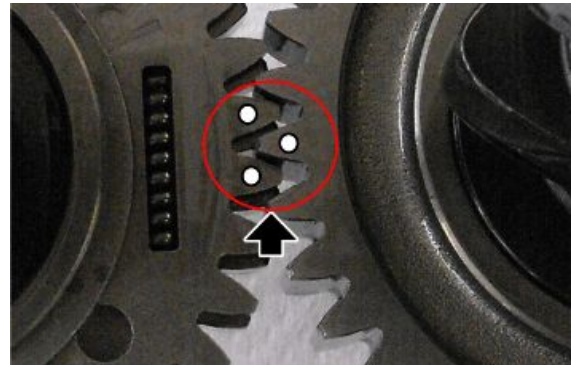
- Install the intake and exhaust camshafts on the rear head, remembering that:

the intake camshaft gear tooth (indicated with a dot) is inserted in the groove of the exhaust camshaft gear (indicated with two dots).



**CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.**

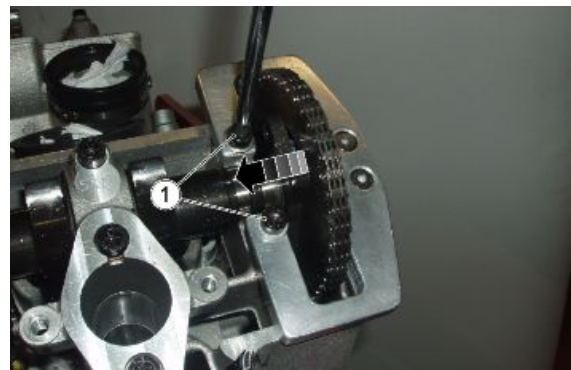
- Fit the U bolts with the nine O rings and locator pins.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the seven screws (2) operating in stages and diagonally.
- Do not fit the eighth screw (2 - fastening the oil pipe) yet.



- Move the gear from the mounting tool to the camshaft.
- Unscrew and remove the two screws (1).
- Remove the tool.

### Specific tooling

**020865Y Support for camshaft gear on head**



- Fit the U bolt and the oil pipe.
- Tighten the two U bolt screws (1) and the screw (2) that was not fitted previously.



- Align the intake camshaft with the specific hole on the U bolt.
- Insert the specified pin.

### Specific tooling

#### 020851Y Camshaft timing pin



- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

#### 020848Y Flywheel retainer

#### 020850Y Primary gear lock

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener



screw. This screw must be replaced at each reassembly.

- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.

### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; Refit the reference pin while checking, using the crankshaft reference pin, that the clutch side hole and the hole in the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

---

## Rear head removal

- Remove the rear head cover and the clutch cover.
- Move cylinder piston 1 (left rear piston) to the TDC;
- Turn the crankshaft 450° (one complete turn + 90°) in the direction of motor rotation (direction of travel) in order to align the hole on the intake camshaft gear with the hole on the U-bolt. This ensures that all the rear cylinder bank valve springs are decompressed.

- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the camshaft gear screw.
- Remove the crankshaft locking tool.



### Specific tooling

**020850Y Primary gear lock**

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**020848Y Flywheel retainer****See also**

Head cover removal

[Removing the clutch cover](#)

Repeat the following operations:

- move cylinder piston 1 (left rear piston) to TDC;
- turn the crankshaft by 450° (one complete turn + 90°) in the direction of engine rotation (direction of travel) to align the hole on the intake camshaft with the specific hole on the U bolt. This ensures that all the rear cylinder bank valve springs are decompressed.
- Block crankshaft rotation using one of the specific tools.
- Unscrew and remove the second intake camshaft gear screw.
- Remove the crankshaft locking tool.

**Specific tooling**

**020850Y Primary gear lock**

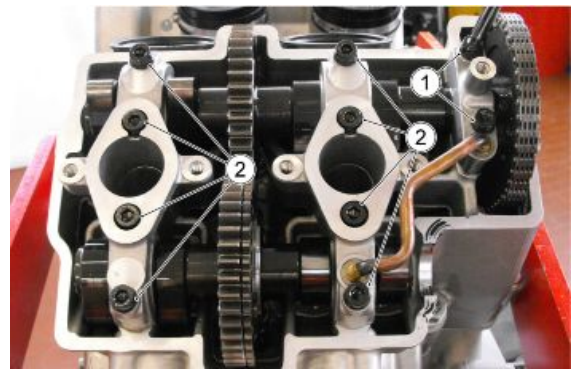
**020848Y Flywheel retainer**

- Slide the gear off the intake camshaft.
- Block the gear to the timing chain with a clamp.





- Unscrew and remove the ten screws (1-2), proceeding in stages and in a crossed pattern.
- Retrieve the washers from the screws (2) near the spark plug holes.
- Remove the U bolts with the O rings and locator pins.

**NOTE**

MARK THE COMPONENTS TO PREVENT INCORRECT RE-FITTING.

- Remove the intake and exhaust camshafts from the rear head.
- Unscrew and remove the mobile chain slider screw.
- Remove the mobile chain slider.



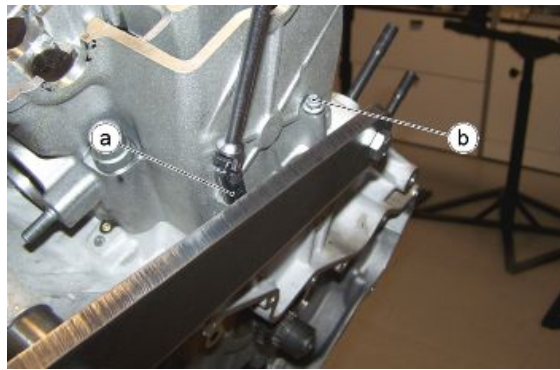
- Unscrew and remove the fixed chain slider screw.
- Remove the fixed chain slider.



- Remove the camshaft control gear connected with a clamp to the timing chain.



- Unscrew and remove the two head fastener screws (a - b) from the clutch side.



- Loosen the six nuts on the stud bolts, proceeding in the following order 6 - 5 - 4 - 3 - 2 - 1.
- After loosening all nuts, remove them in order indicated above.



- Remove the rear head, slipping it off the stud bolts.
- Collect the gasket and the two dowel pins.



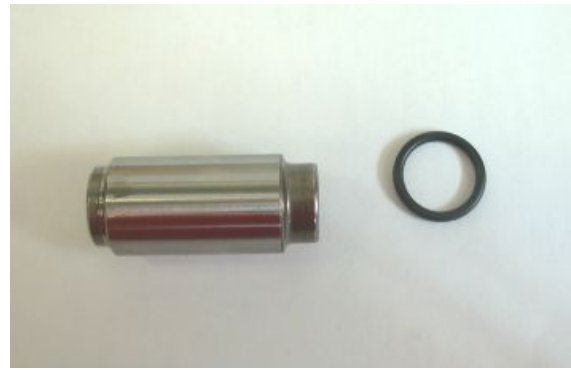
- Remove the chain tensioner complete with O-ring using the specific tool.
- If the O-ring is not on the chain tensioner, make sure it was not left in the crankcase seat.



REPLACE THE O RING UPON EACH REMOVAL.

**Specific tooling**

**020883Y Tool for fitting/removing the timing chain tensioner**



## Rear head check

Check that:

- The contact surfaces with the cover and the crankcase are not scored or damaged so they jeopardise a perfect seal.
- Check the status of the valve seats.
- Check that the routing of the oil pipes is free and if required, clean them by blowing a jet of compressed air.

## Rear head fitting

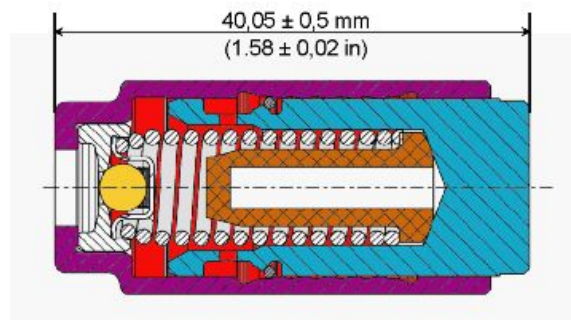
- Install a new O ring on the chain tensioner



**REPLACE THE O RING UPON EACH REMOVAL.**



- Compress the chain tensioner completely, making sure that the total length is  $40.05 \pm 0.5$  mm ( $1.58 \pm 0.02$  in).



- Insert the chain tensioner into the crankcase, being careful to position it correctly.



- Place a new gasket between the crankcase and the head.
- Place the two dowel pins.



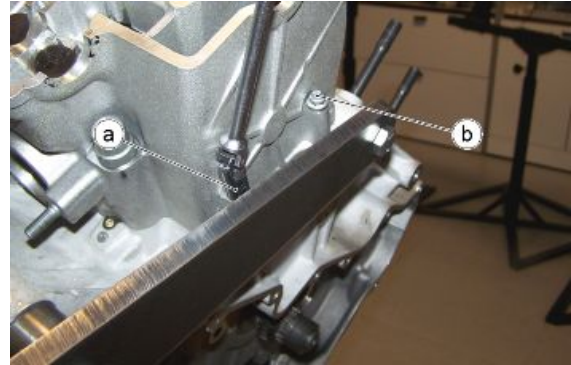
- Install the head.



- Pretighten the six nuts on the stud bolts proceeding in the following order: 1 - 2 - 3 - 4 - 5 - 6.
- Then tighten them fully following the same order.



- Tighten the two screws according to the sequence (a - b)



- Install the camshaft control gear connected with a clamp to the timing chain.
- Keep the gear in position with the chain tightened.



**THE SIDE WITH THE BEVELLED HOLE IN THE TIMING SYSTEM GEAR MUST ALWAYS FACE THE EXTERIOR OF THE HEAD.**

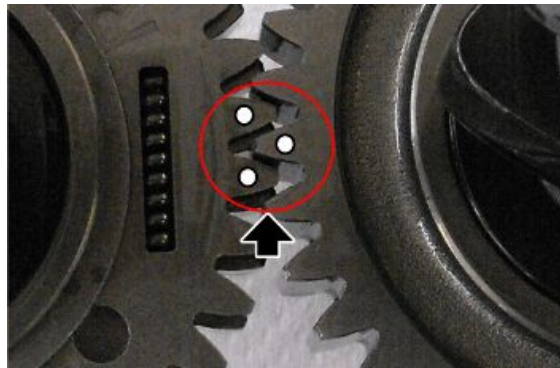


- Install both chain sliders and fasten them with the specific screws.



- Install the intake and exhaust camshafts on the rear head, remembering that:

the intake camshaft gear tooth (indicated with a dot) is inserted in the groove of the exhaust camshaft gear (indicated with two dots).



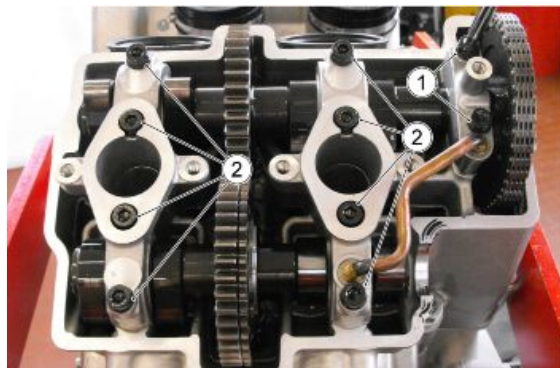
**CLEAN THOROUGHLY THE SEATS OF THE GEAR RETAINER SCREWS, ON THE INTAKE CAMSHAFT.**

- Check the number engraved on the U bolts, which must correspond with the one engraved on the head.
- If the U bolts between the two heads are inverted, camshaft seizure may occur



**IT IS NOT POSSIBLE TO REPLACE ONLY ONE U BOLT, IF NECESSARY: REPLACE THE ENTIRE HEAD.**

- Fit the U bolts with the nine O rings and locator pins.
- Install the oil pipe.
- Fit the new washers under the screws (2) near the spark plug holes only.
- Tighten the ten screws (1 - 2) working in stages and diagonally.



- Cut the clamp that binds the chain to the gear.
- Position the gear on the camshaft so that the timing hole and the gear fixing screw hole are centred with the gear slot.
- Insert the specific timing pin.



**Specific tooling**

**020851Y Camshaft timing pin**

- Apply Loctite 243 thread lock on the thread of the timing gear fastener screw. This screw must be replaced at each reassembly.
- Apply and loosely tighten the gear fixing screw on the camshaft.



- Protect the edge of the head with rubber.
- Load the chain tensioner with special tool.

### Specific tooling

#### 020855Y Lever for engaging the chain tensioner

- Block crankshaft rotation using one of the specific tools.
- Tighten the gear fixing screw on the camshaft to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

#### 020848Y Flywheel retainer

#### 020850Y Primary gear lock

- Remove the two crankshaft and camshaft reference pins.
- Turn the crankshaft until the gear screw covered by the head when the hole on the camshaft gear is aligned with the hole on the U bolt, is visible.
- Block crankshaft rotation using one of the specific tools.
- Apply Loctite 243 thread lock on the thread of the second gear fastener screw. This screw must be replaced at each reassembly.
- Tighten the second camshaft gear fixing screw to exactly the torque specified.
- Remove the crankshaft locking tool.



### Specific tooling

**020848Y Flywheel retainer**

**020850Y Primary gear lock**

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

- Turn the crankshaft back to the previous position in which the camshaft and U bolt holes were aligned; Refit the reference pin while checking, using the crankshaft reference pin, that the clutch side hole and the hole in the crankshaft are perfectly aligned.
- If this is not the case, repeat the timing operations.

### Specific tooling

**020851Y Camshaft timing pin**

**020852Y Crankshaft timing pin**

## Valves

### Valve removal

- Remove the head.
- Place the head on supporting surface.
- Number the valves and their bucket tappets in order to position them correctly upon refitting.



- Remove the bucket tappets and the adjustment shims using a magnet.



- Compress the valve springs with the specific wrench and with the spring compressing tool.

### Specific tooling

**AP8140179 Valve spring compressor**

**020853Y Intake valve spring compressor**

**020854Y Exhaust valve spring compressor**



### See also

Front head removal

Rear head removal

- Remove the cotters using a magnet.



- Release the valve springs.
- Remove the upper cap and the springs.

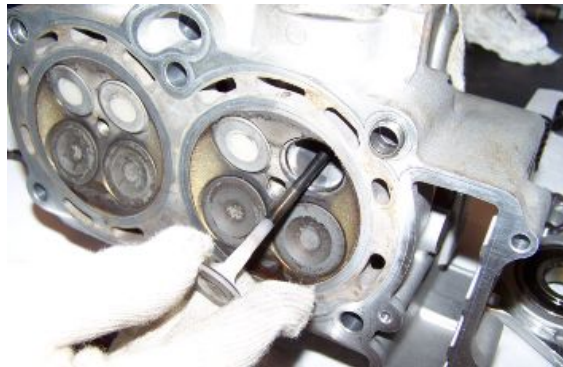
### CAUTION

**THE INTAKE VALVES HAVE A DOUBLE SPRING WHEREAS THE EXHAUST VALVES HAVE A SINGLE SPRING.**





- Remove the valves.



## Valve check

### CAUTION

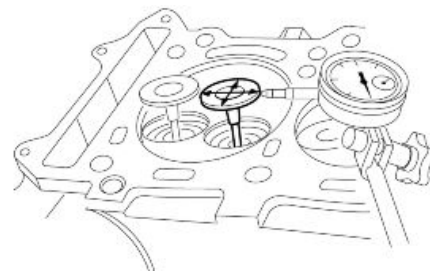
**REPLACE THE VALVES ONE AT A TIME. DO NOT MIX THE COMPONENTS. EACH VALVE MUST BE INSERTED INTO ITS SEAT, WHICH IS MARKED PRIOR TO REMOVAL.**

### VALVE STEM DEVIATION

Lift up the valve approx. 10 mm (0.39 in) from its seat.

Measure the valve stem deviation in two perpendicular directions and position the dial gauge as shown in the figure.

If the measured deviation exceeds the specified limit, determine if the valve or the guide must be replaced.



### Characteristic

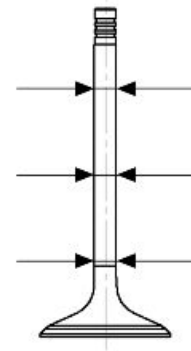
#### Valve stem distortion

0.25 mm (0.0098 in)

If the valve stem, when measured with a micrometer, is worn to its limit and the clearance exceeds the specified limit, replace the valve.

If the valve stem lies within the specific limit, replace the valve guide.

Recheck the clearance after replacing the valve or the guide.



**Characteristic**

**Intake valve stem diameter**

4.985 - 4.965 mm (0.1963 - 0.1954 in)

**Exhaust valve stem diameter**

4.975 - 4.955 mm (0.1959 - 0.1951 in)

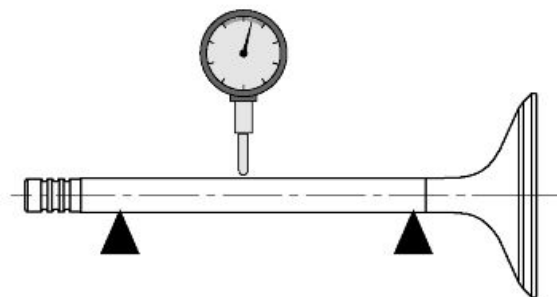
Support the valve with two "V" blocks as shown and check the run-out with a dial gauge.

If the run-out exceeds the specified limit, replace the valve.

**Characteristic**

**Valve stem run-out**

0.05 mm (0.0020 in)



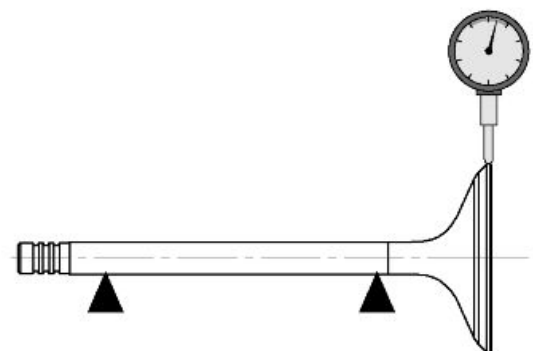
Position the dial gauge at a right angle to the valve head face and measure the eccentricity.

If the eccentricity exceeds the specified limit, replace the valve.

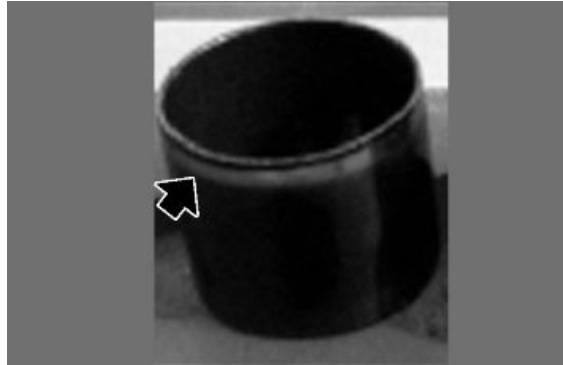
**Characteristic**

**Valve head eccentricity**

0.03 mm (0.0012 in)

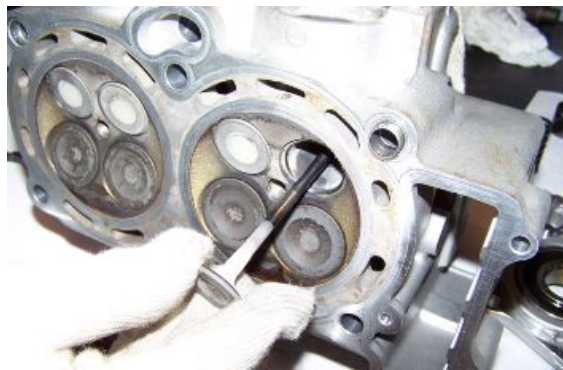


Coating may get slightly damaged in the indicated area.



## Valve installation

- Lubricate the valve stem and insert the valves on the valve guide.



- Position the springs with the closest turns facing the head of the valve

### CAUTION

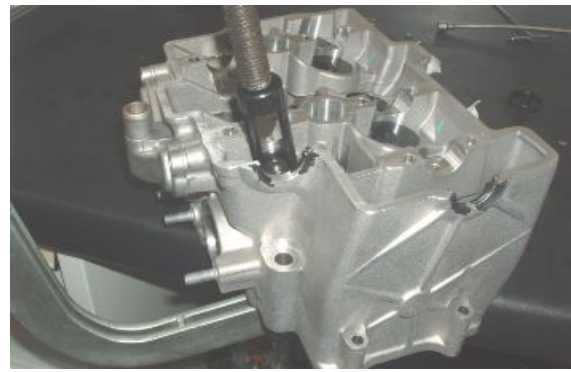
THE INTAKE VALVES HAVE A DOUBLE SPRING WHEREAS THE EXHAUST VALVES HAVE A SINGLE SPRING.



- Fit the caps.



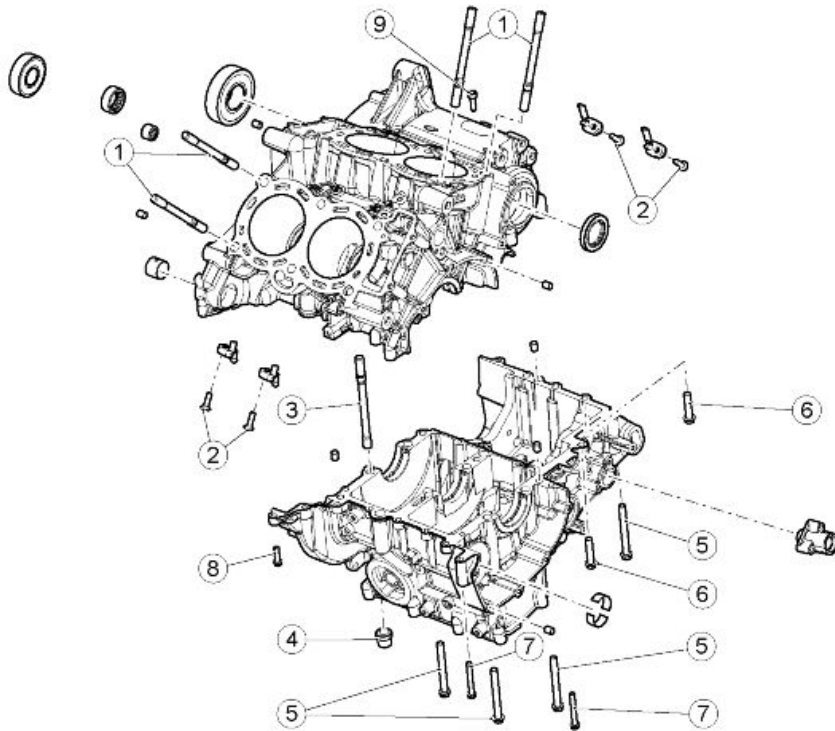
- Compress the valve springs with the specific wrench and with the spring compressing tool.
- Insert the cotters into the seat

**Specific tooling****AP8140179 Valve spring compressor****020853Y Intake valve spring compressor****020854Y Exhaust valve spring compressor**

- Release the wrench, checking that the cotters are positioned correctly in the valve grooves.
- Position the adjustment shims and then the bucket tappets.

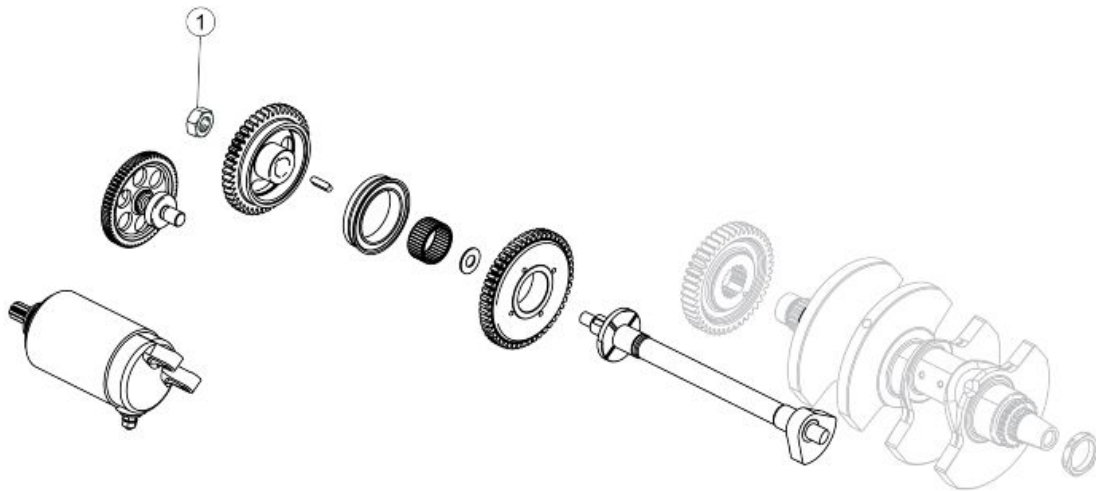


**Crankcase**



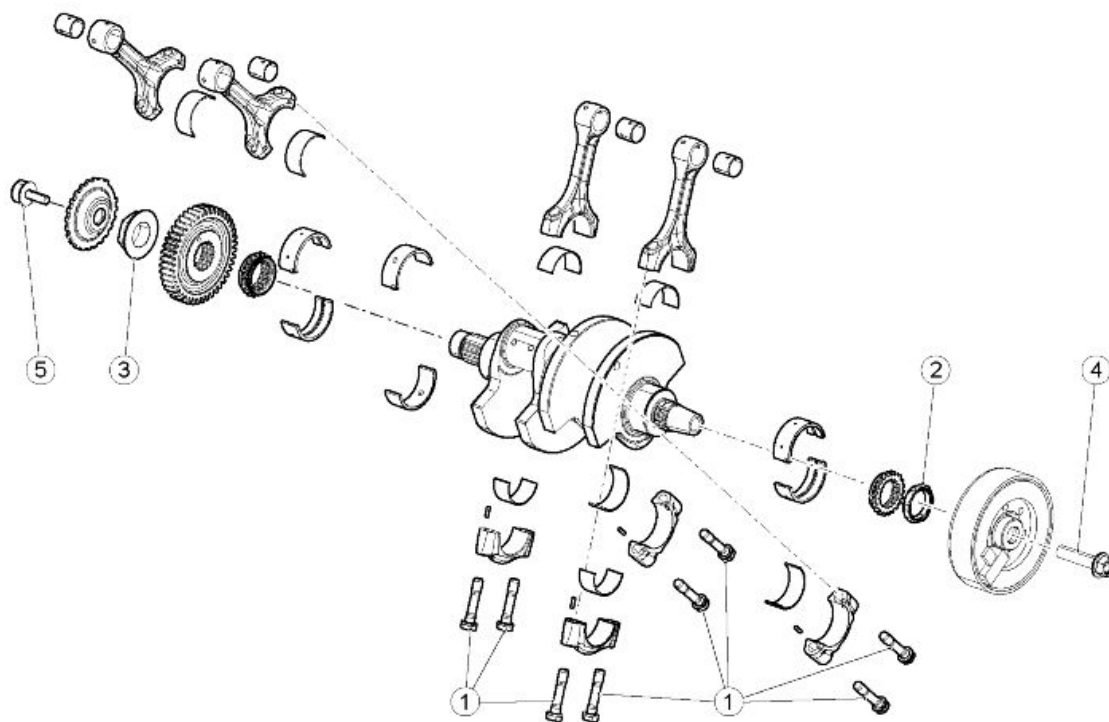
**CRANKCASES**

pos.	Description	Type	Quantity	Torque	Notes
1	Head stud bolts	-	12	20 Nm (14.75 lbf ft)	Loct. 648 or 270
2	Special screw for piston cooling oil jet	-	4	6 Nm (4.42 lbf ft)	Loct. 2045
3	Crankcase stud bolts	-	6	20 Nm (14.75 lbf ft)	Loct. 648 or 270
4	Main crank flanged nut	-	6	30 + 55 Nm (22.13 + 40.57 lbf ft)	Molykote - lubricate the thread and under the head
5	Crankcase fixing screw	M8x70	4	25 Nm (18.44 lbf ft)	Lubricate the thread and under the head
6	Crankcase fixing screw	M8x35	3	25 Nm (18.44 lbf ft)	Lubricate the thread and under the head
7	Crankcase fixing screw	M6x45	2	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head
8	Crankcase fixing screw	M6x20	5	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head
9	Crankcase fixing screw	M6x20	5	10 Nm (7.37 lbf ft)	Lubricate the thread and under the head



**IGNITION UNIT**

pos.	Description	Type	Quantity	Torque	Notes
1	Hex headed nut, cl.10 type 2 ISO 8674	M10x1	1	50 Nm (36.88 lbf ft)	Loct. 243

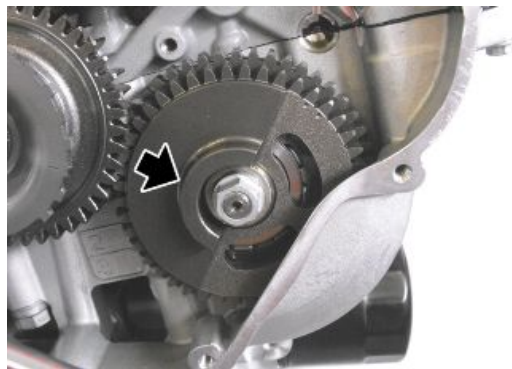


**CRANKSHAFT**

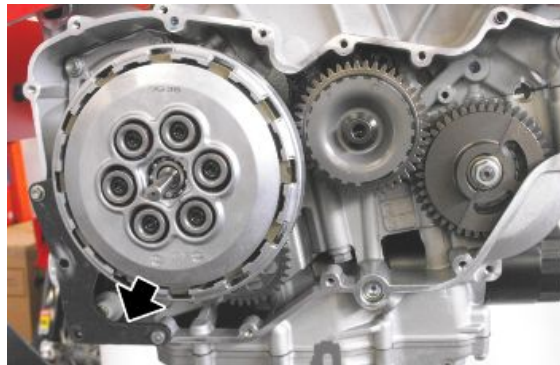
pos.	Description	Type	Quantity	Torque	Notes
1	Connecting rod screws	-	8	15 Nm (11.06 lbf ft) + 40° + 60°	Lubricate the thread and under the head with Molykote
2	Fastener ring nut for alternator side timing sprocket	-	1	100 Nm (73.76 lbf ft)	Loct. 243
3	Primary sprocket fixing ring nut	-	1	200 Nm (147.51 lbf ft)	Loct. 243
4	Alternator fixing screw	M12x1.25	1	120 Nm (88.51 lbf ft)	-
5	Tone wheel fixing screw	M8x1.25	1	30 Nm (22.13 lbf ft)	Loct. 3M or 270

**Balancing countershaft removal**

- To extract the balancing countershaft, first remove: the clutch cover and the alternator cover.
- Turn the crankshaft so as to position the thicker side of countershaft gear on the side opposite to crankcase bulk-head.



- Block crankshaft rotation using the specific tool.



**Specific tooling**

**020850Y Primary gear lock**

**See also**

[Removing the clutch cover](#)

[Removing the flywheel cover](#)

- Unscrew and remove the nut and collect the washer







- Remove the countershaft from the alternator side.



- Remove the countershaft gear.



- Remove the key on countershaft



- Remove the spacer.



- Remove the countershaft on the opposite side.



### Balancing countershaft fitting

- Install the spacer.



**THE SPACER CHAMFERED SIDE MUST BE FACING THE CRANKCASE.**



- Install the countershaft gear aligning the references on the countershaft gear and the primary shaft gear.

**NOTE**

**THE BURIN ON THE PRIMARY SHAFT GEAR TOOTH MUST BE INSERTED INTO THE SLOT IDENTIFIED WITH TWO BURINS ON THE COUNTERSHAFT GEAR.**



- Insert the countershaft from the alternator side.
- Turn the countershaft until aligning the key seat on the countershaft and on the gear.
- Insert the drive key.



- Place the washer.



- Turn the nut on the countershaft.
- Block crankshaft rotation using the specific tool.
- Tighten the nut on the countershaft.

### Specific tooling

020849Y Clutch retainer

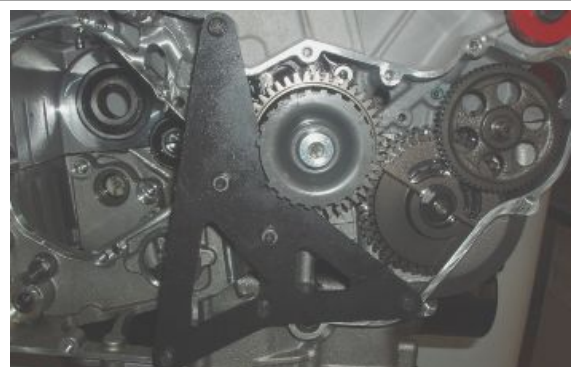


## Main transmission gear removal

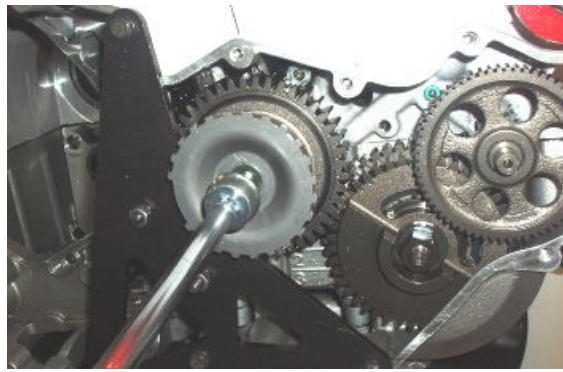
- Remove the clutch.
- Turn the crankshaft and align the references on the countershaft gear and the primary shaft gear.
- Block crankshaft rotation using the specific tool.

### Specific tooling

020850Y Primary gear lock



- Unscrew and remove the tone wheel fixing screw.
- Remove the tone wheel.



### See also

[Disassembling the clutch](#)

- Unscrew and remove the primary shaft fixing nut.
- Remove the crankshaft blocking tool.

### Specific tooling

**020850Y Primary gear lock**

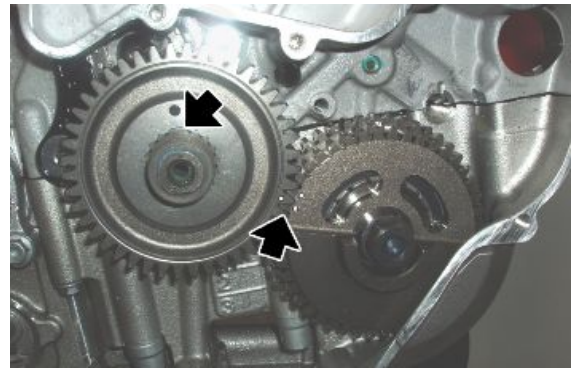


- Remove the primary shaft gear.



## Installing the primary drive gear

- Install the primary shaft gear correctly in its seat on the crankshaft from the clutch side.
- Make the references on the gears of the primary shaft and the countershaft coincide.



### NOTE

THE BURIN ON THE PRIMARY SHAFT GEAR TOOTH MUST BE INSERTED INTO THE SLOT IDENTIFIED WITH TWO BURINS ON THE COUNTERSHAFT GEAR.

- Install the crankshaft blocking tool.
- Tighten the primary shaft fixing nut.



### Specific tooling

020850Y Primary gear lock

- Insert the tone wheel on the crankshaft.

The crankshaft and the tone wheel have a bevel that identifies the fitting direction



- Tighten the tone wheel fixing screw.
- Remove the special tool.



### Specific tooling

020850Y Primary gear lock

## Preparation

To open the crankcase, first remove the following components:

- alternator;
- water pump;
- gearbox unit;
- primary drive shaft gear
- both timing chains;
- the chain sliders;
- oil sump;
- the gear selector pin spacer;
- starter motor and intermediate gear;
- countershaft.

### See also

Magneto flywheel removal

Water pump

[Disassembling the gearbox](#)

[Main](#)

transmission gear removal

Front head removal

Rear head removal

[Removing the](#)

oil sump

[Removing the](#)

starter motor

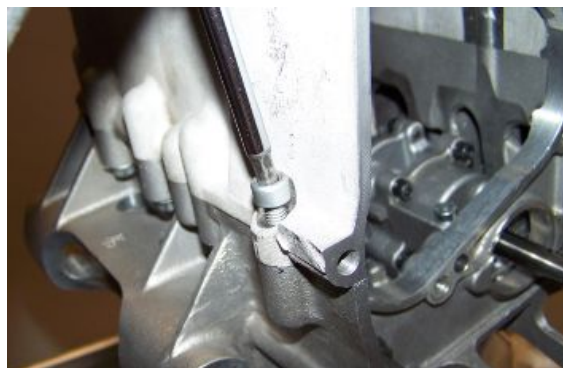
[Balancing](#)

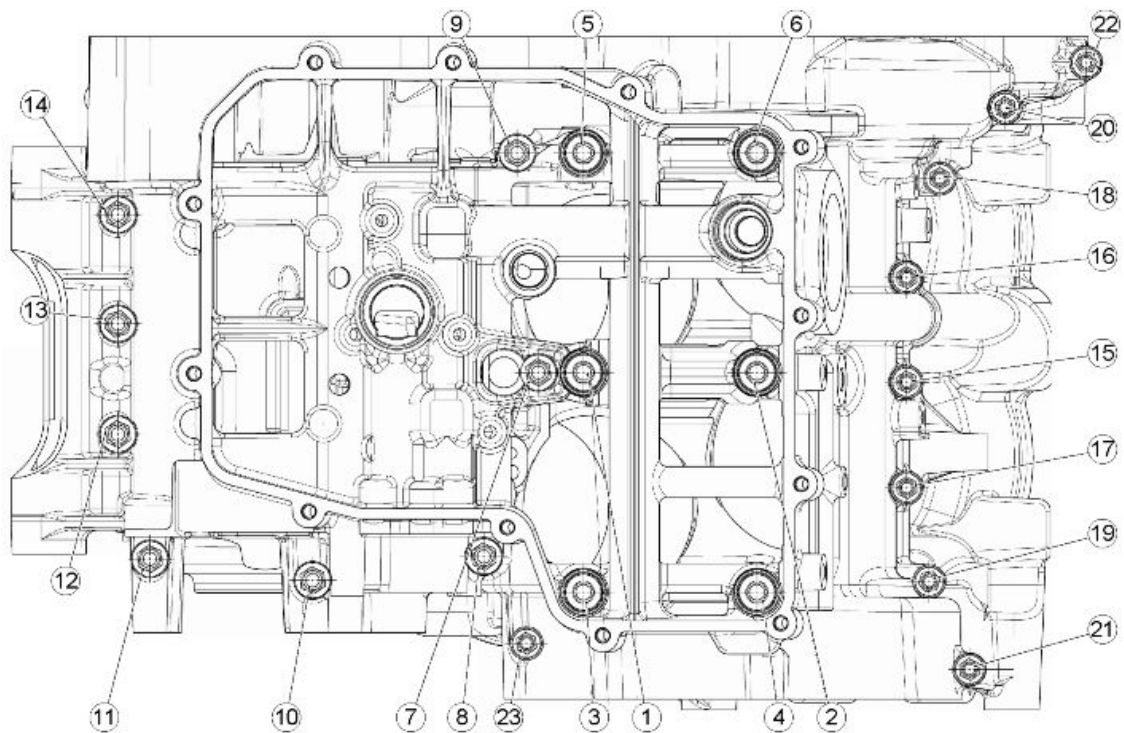
countershaft removal

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## Crankcase opening

- Position the engine with the heads facing upward, unscrew and remove the screw (24).





- Turn the engine with the heads facing downward and loosen the screws in the following order: 23 - 22 - 21 - 20 - 19 - 18 - 17 - 16 - 15 - 14 - 13 - 12 - 11 - 10 - 9 - 8 - 7.
- After loosening all screws, remove them in order indicated above.
- Loosen the six nuts on the stud bolts, proceeding in the following order 6 - 5 - 4 - 3 - 2 - 1.
- After loosening all nuts, remove them in order indicated above.

- Separate the crankcases, removing the lower part
- Collect the three dowel pins.
- The crankshaft, the pistons and the connecting rods remain in the upper crankcase.



---

## Removing connecting rods - pistons

- Remove both heads.
- Open the crankcases.
- Install the tool that keeps the crankshaft in position.

### Specific tooling

020857Y Crankshaft bearing U bolt



### See also

Front head removal

Rear head removal

- 
- Unscrew and remove the two connecting rod screws.
  - Remove the connecting rod cap.

### NOTE

MARK THE COMPONENTS TO PREVENT INCORRECT RE-FITTING.



- 
- Remove the piston connected to the connecting rod from the cylinder side.
  - Extract the snap ring, slide off the pin





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



## Crankshaft removal

- Separate the crankcases, removing the lower part
- If the heads were removed, position the specific special tool to keep the pistons from coming out.



### Specific tooling

#### 020858Y Device for holding the pistons in the cylinders

- Unscrew and remove the eight connecting rod screws.
- Remove the four connecting rod caps.



#### NOTE

MARK THE COMPONENTS TO PREVENT INCORRECT RE-FITTING.

- Take out the crankshaft.



## Bearing removal

### BALANCING COUNTERSHAFT BEARING REMOVAL

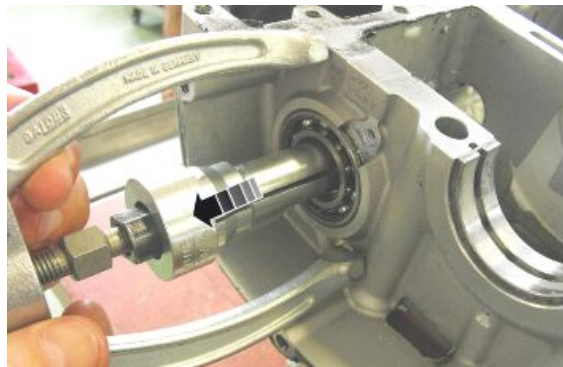
- Remove the lower crankcase.
- Remove the countershaft.

### FLYWHEEL-SIDE

- Unscrew and remove the bearing retainer screw.
- Remove the lock.



- Heat up the crankcase to 150°C (302° F)
- Position the general tool to pull out bearings.
- Remove the bearing.



### See also

Crankcase opening

### CLUTCH-SIDE

- Unscrew and remove the bearing retainer screw.
- Remove the lock.



- Heat up the crankcase to 150°C (302° F)
- Position the general tool to pull out bearings.
- Remove the bearing.



---

## Crankshaft check

**Characteristic****Maximum crankshaft axial clearance after closing the crankcase**

0.5 mm (0.0197 in)

**Maximum radial clearance between the main bearings and the crankshaft pins**

0.05 mm (0.00197 in)



---

## Balancing countershaft check

**Characteristic****Maximum countershaft axial clearance after closing the crankcase**

0.1 mm (0.0039 in)

---

## Connecting rod check

**Characteristic****Maximum wear limit of the rod small end**

17.05 mm (0.671 in)

**Maximum rod small end radial clearance**

0.055 mm (0.0022 in)

**Maximum axial clearance between the connecting rod and the crank pin**

0.55 mm (0.022 in)

**Maximum connection rod pin clearance**

0.08 mm (0.0031 in)



---

## Inspecting pistons

### Characteristic

#### Minimum piston diameter

77.914 mm (3.067 in)

#### Maximum clearance between the cylinder and piston

0.1 mm (0.0039 in)

#### Maximum wear limit of the pin hole on the piston

0.055 mm (0.0022 in)

#### Maximum permitted clearance between piston ring 1 (starting from the bottom) and the corresponding slot on the piston

0.1 mm (0.0039 in)

#### Maximum permitted clearance between piston ring 2 (starting from the bottom) and the corresponding slot on the piston

0.1 mm (0.0039 in)

#### Maximum opening of the piston ring fit on the piston

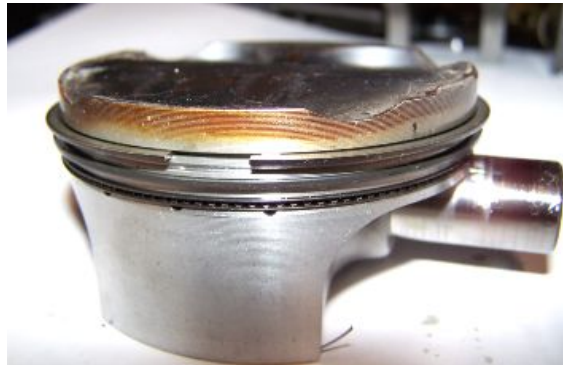
0.3 mm (0.0118 in)

#### Minimum wear limit of the thickness of piston ring 1 (starting from the bottom)

0.077 mm (0.0030 in)

#### Minimum wear limit of the thickness of piston ring 2 (starting from the bottom)

0.070 mm (0.0027 in)



---

## Selecting connecting rods

**If a selection class of connecting rods is fit on the crankshaft that is not class D - D, it is not a problem.**

It is essential, for proper crankshaft balance, that if one connecting rod is replaced the other one fit on the same crank pin must also be replaced:

- if the piston 1 connecting rod is replaced, the one relative to piston 2 must also be replaced and vice versa;

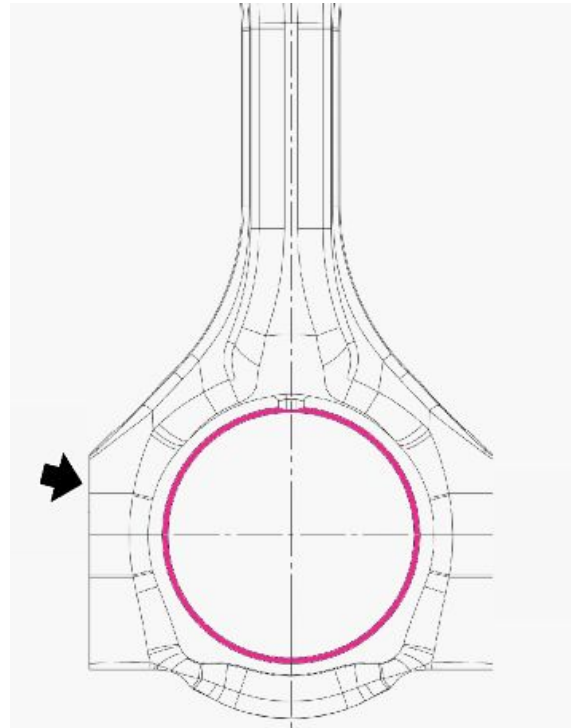


- if the piston 3 connecting rod is replaced, the one relative to piston 4 must also be replaced and vice versa;

The connecting rod class is stamped on its left side, viewed from the front, from the side with the bevelling on the big end hole.



**ONLY ONE CONNECTING ROD SELECTION CLASS IS SPECIFIED FOR REPLACEMENT PARTS, INDICATED WITH THE LETTERS D-D.**



## Bushing selection

### CRANKSHAFT BUSHINGS

#### CRANKCASE CATEGORY

Three crankcase classes are available (A - B- C) which differentiate in the diameter of the hole in the bearings.

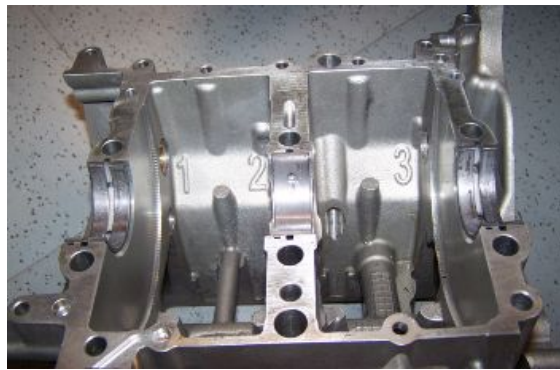
The category is marked on the crankcase, on the right side, in the area below the crankshaft.

Different classes of bearings can be used (e.g.: A - B - C or B - B - C or A - B - A ...).



A number that indicates the position of the main journal is stamped on the crankcase:

1. flywheel side;
2. central;
3. clutch side



**CRANKCASE CATEGORY**

Specification	Desc./Quantity
Class A	Bushing seat diameter 52.023 - 52.018 mm (2.0481 - 2.0479 in)
Class B	Bushing seat diameter 52.018 - 52.013 mm (2.0479 - 2.0477 in)
Class C	Bushing seat diameter 52.013 - 52.008 mm (2.0477 - 2.0475 in)

**SHAFT CATEGORY**

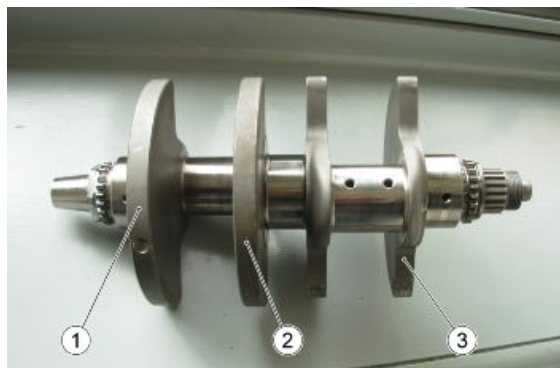
The three crankshaft main journals

1. flywheel side;
2. central;
3. clutch side

each are available in two classes, A or B.

The class is stamped on the flat face of the counterweight, as shown in the image.

The three different classes of main journals may be used (e.g. A - B - A or B - B - A....)



**CRANKSHAFT CATEGORIES WITH REMOVABLE REELS**

Specification	Desc./Quantity
Class A	Main journals - diameter: 46.005 - 46.000 mm (1.8112 - 1.8110 in)
Class B	Main journals - diameter: 46.000 - 45.995 mm (1.8110 - 1.8108 in)

**CRANKSHAFT CATEGORIES WITH NON REMOVABLE REELS**

Specification	Desc./Quantity
Class C	Main journals - diameter: 46.008 - 46.003 mm (1.8113 - 1.8111 in)
Class D	Main journals - diameter: 46.003 - 45.998 mm (1.8111 - 1.8109 in)
Class E	Main journals - diameter: 45.998 - 45.993 mm (1.8109 - 1.8107 in)

Once the categories below are checked:

1. crankcase;

2. flywheel side main journal;
3. centre main journal;
4. clutch side main journal.

Choose the bushings used for assembly from the following table

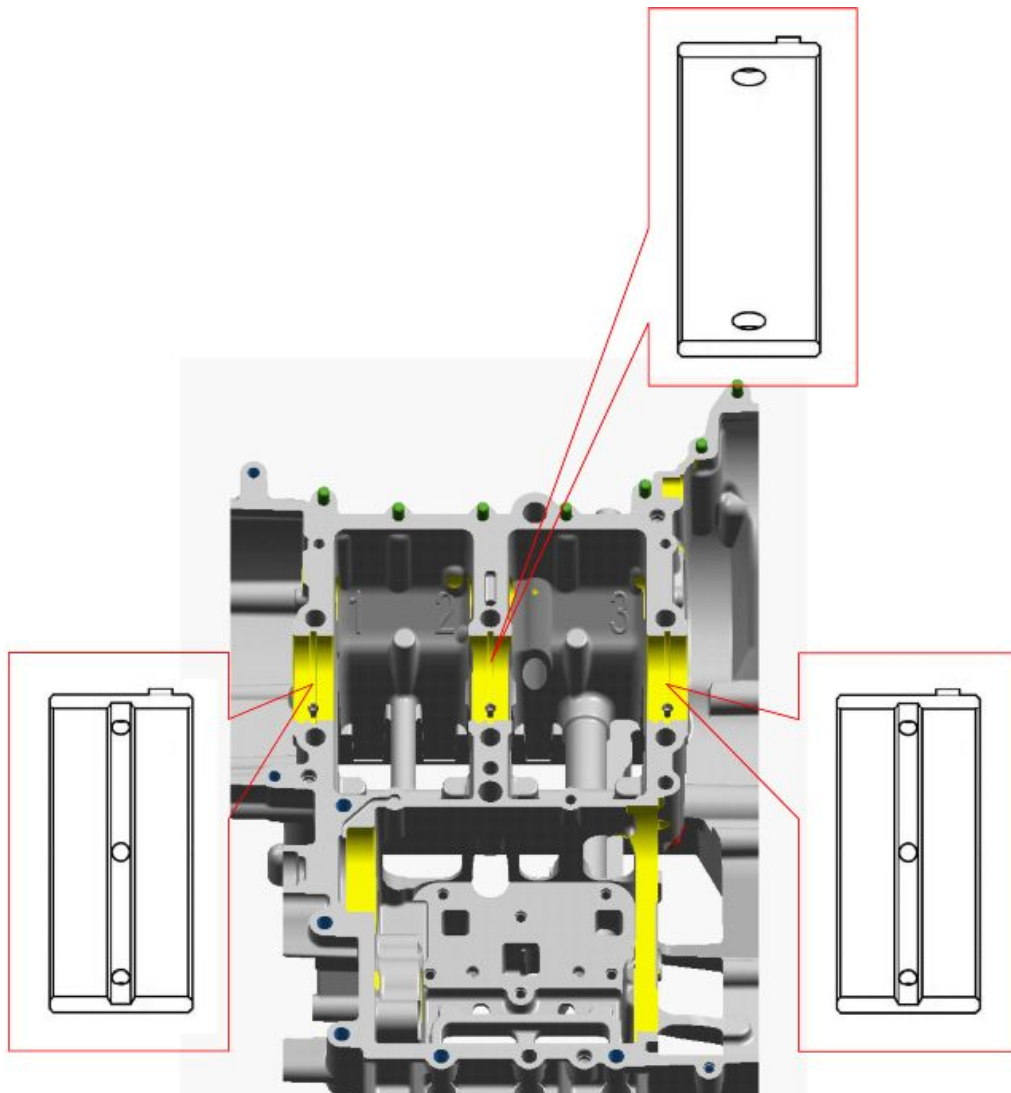
**CRANKSHAFT BUSHINGS WITH REMOVABLE REELS**

Crankshaft main journal	Class A crankcase	Class B crankcase	Class C crankcase
Class A main journal	Bushing (blue)	Bushing (blue)	Bushing (red)
Class B main journal	Bushing (yellow)	Bushing (blue)	Bushing (blue)

**CRANKSHAFT BUSHINGS WITH NON REMOVABLE REELS**

Crankshaft main journal	Class A crankcase	Class B crankcase	Class C crankcase
Class C main journal	Bushing (blue)	Bushing (red)	Bushing (red)
Class D main journal	Bushing (blue)	Bushing (blue)	Bushing (red)
Class E main journal	Bushing (yellow)	Bushing (blue)	Bushing (blue)

The flywheel side and clutch side main bearings are different from the central ones and therefore, so are the respective replacement part numbers.



**CRANKSHAFT BUSHINGS - CONNECTING RODS**

Three types of semi-bushing are available:

- Blue
- Red
- Yellow

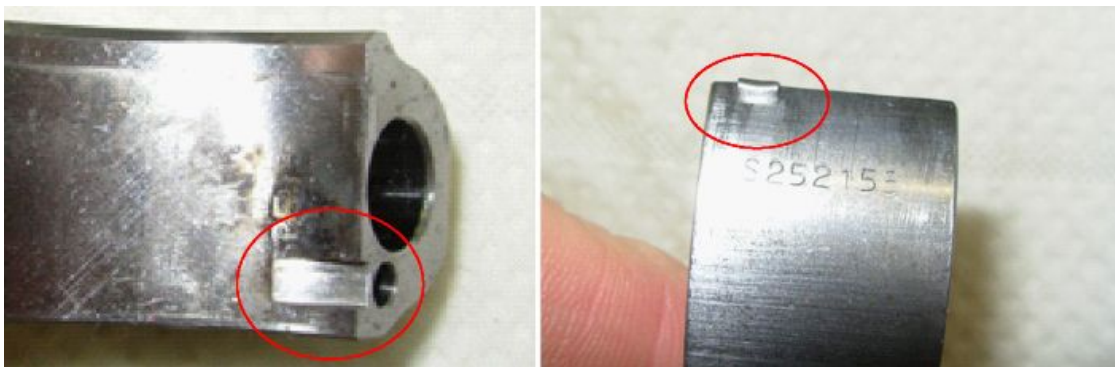
There are no dimension classes for the crank pins or the connecting rods. As a result, only the two semi-bushing combinations are possible:

1. BLUE - BLUE (recommended solution)
2. YELLOW - RED (if combination 1 is not possible)

In combination 2, the YELLOW semi-bushing must be installed on the connecting rod shank and the RED semi-bushing must be installed on the cap.

### **CRANKSHAFT BUSHING REPLACEMENT PROCEDURE**

When replacing the big end bushings, make sure that the tang of the semi-bushing is correctly housed in the corresponding notch in the connecting rod shank or cap



---

## **Bearing fitting**

### **BALANCING COUNTERSHAFT BEARING INSTALLATION**

#### **FLYWHEEL-SIDE**

- Heat up the crankcase to 150°C (302°F).
- Prepare the following tools:

#### **Specific tooling**

**020364Y 25 mm Adaptor**

**020359Y 42 x 47 mm punch**

**020376Y Adapter handle**



- Position the new bearing with its groove on the outside diameter facing outward with respect to the crankcase. In this way it will be possible to install the bearing retainer in the groove.



- Using the suitable tools, fit the bearing in the crankcase until tool stops



- Fit the retainer in the bearing groove.
- Tighten the bearing retainer screw.



### CLUTCH-SIDE

- Heat up the crankcase to 150°C (302°F).
- Prepare the following tools:

#### Specific tooling

020363Y Crankshaft oil seal punch D 20 mm

020359Y 42 x 47 mm punch

020376Y Adapter handle

- Position the new bearings with their groove on the outside diameter facing outward with respect to the crankcase. In this way it will be possible to install the bearing retainer in the groove.



- Using the suitable tools, fit the bearing in the crankcase until tool stops.



- Fit the retainer in the bearing groove.
- Tighten the bearing retainer screw.
- Install the balancing countershaft.



## Crankshaft fitting

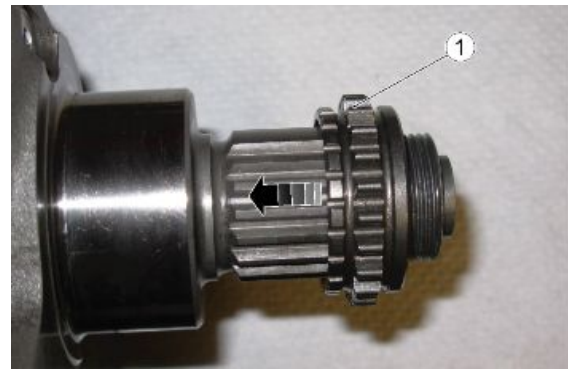
If the two timing chain control sprockets (1 - 2) on the crankshaft were removed, check their exact positioning carefully because the two components cannot be interchanged.

Remember that the thicker sprocket (1) must be positioned from the clutch side of the crankshaft.



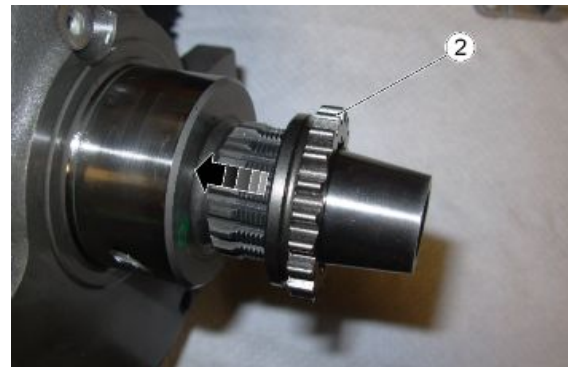
Position the sprocket (1) with the smooth side facing outward of the crankshaft.

Move the sprocket (1) up against the crankshaft shoulder.



Position the sprocket (2) with the smooth side facing the inside of the crankshaft.

Move the sprocket (2) up against the crankshaft shoulder.



- Lubricate the crankshaft pins and insert them into their positions.



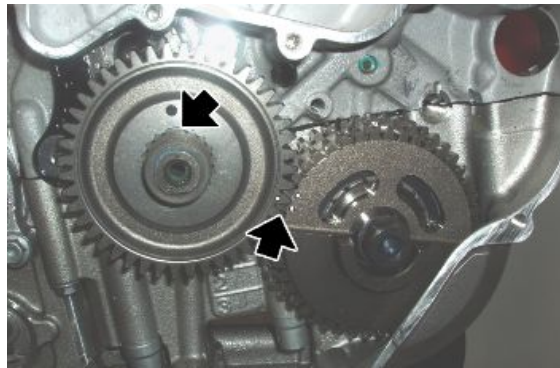
- Install the connecting rod shank piston assembly in the relative cylinders.
- Join the crankcases.
- If the special tool was used, remove it to keep the pistons from coming out.



### Specific tooling

**020858Y Device for holding the pistons in the cylinders**

- Install the primary shaft gear correctly in its seat on the crankshaft from the clutch side.
- Make the references on the gears of the primary shaft and the countershaft coincide.



**NOTE**

THE BURIN ON THE PRIMARY SHAFT GEAR TOOTH MUST BE INSERTED INTO THE SLOT IDENTIFIED WITH TWO BURINS ON THE COUNTERSHAFT GEAR.

- Install the crankshaft blocking tool.
- Tighten the primary shaft fixing nut.



**Specific tooling**

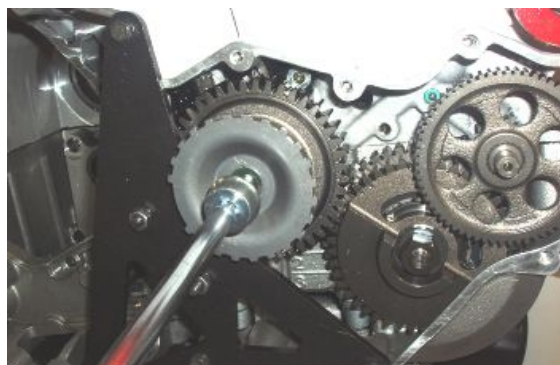
020850Y Primary gear lock

- Insert the tone wheel on the crankshaft.

The crankshaft and the tone wheel have a bevel that identifies the fitting direction



- Tighten the tone wheel fixing screw.
- Remove the special tool.



**Specific tooling**

020850Y Primary gear lock

## Installing connecting rods - pistons

The piston rings are different and must be fit with the markings "R" and "RN" facing upward.

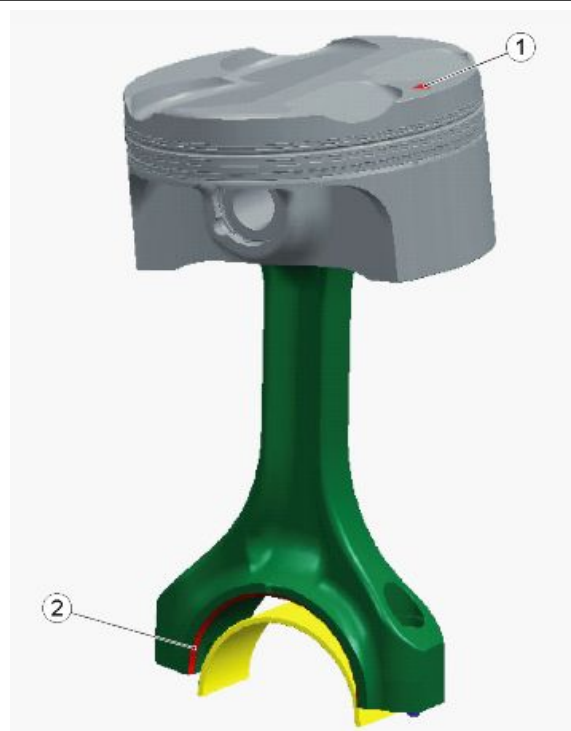
The five ring gaps (two piston rings, two oil scraper rings, one oil scraper spring) are fitted displaced 90° to each other, starting from the exhaust-side stud bolt opposite the chain and continuing clockwise.



There are no dimension classes for the pistons. Preassemble the pistons on the workbench with the connecting rod shank and the relative semi-bushing.

The pre-assembly procedure is identical for all four pistons and must be done as follows:

- with the piston crown parallel to the workbench and the arrow (1) positioned from the side opposite of the operator, fit the connecting rod shank with the bevelling (2), on the hole of the rod head, on the right side.



- Position the special tool on the crankcase.
- Partially insert the connecting rod shank - piston assembly in the corresponding cylinder with the arrow (on the piston) twisted 45° towards the exhaust.
- When the connecting rod head is low, and has exceeded its lubricating jet, rotate the connecting rod shank - piston assembly with the arrow on the piston crown towards the exhaust; the beveling on the connecting rod head must face outward of its crank pin.



### Specific tooling

#### 020856Y Piston installation ring

- Remember to couple the connecting rod shank and cap correctly, combining the respective numerical references.
- Use new connecting rod screws, lubricating the thread and under the head..



- Proceed with tightening according to the procedure described in the tightening torque table using the torque wrench and angular tightening with a goniometer.



## Crankcase closing

- Insert the crankshaft together with connecting rods and pistons in the upper crankcase.
- Position the three centring dowels in the crankcase.
- Insert a new oil seal O ring in the specific seat.



- Apply a layer of sealing paste along the external edge of the crankcase.
- Join the two crankcases.



### Recommended products

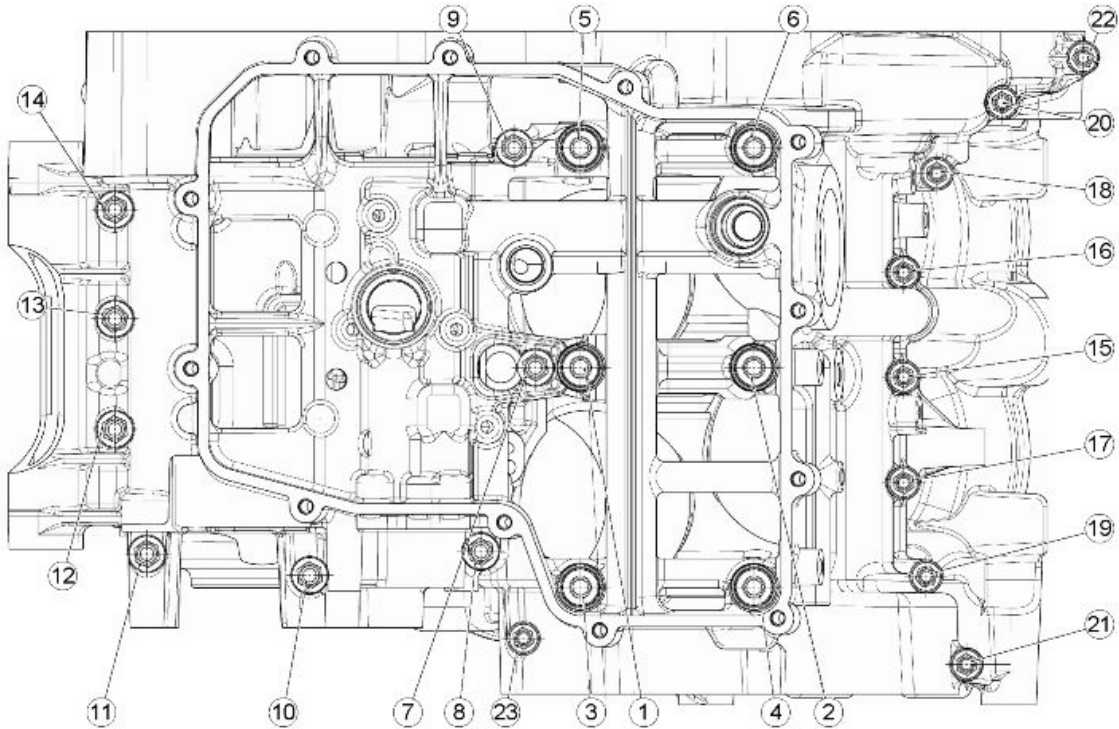
#### Three bond Sealing paste

-

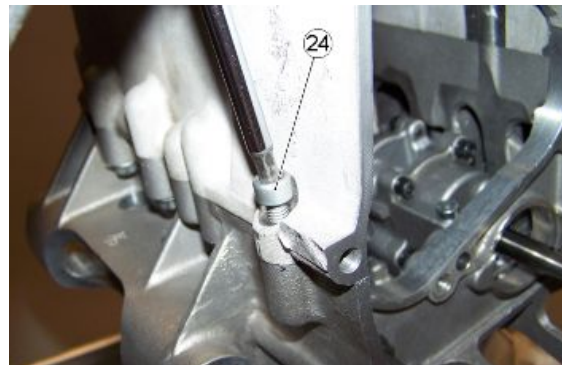


- Pretighten the six nuts on the stud bolts proceeding in the following order: 1 - 2 - 3 - 4 - 5 - 6.

- Then tighten them fully following the same order.
- Pre-tighten the screws in the following order: 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 - 16 - 17 - 18 - 19 - 20 - 21 - 22 - 23.
- Then tighten them fully following the same order.

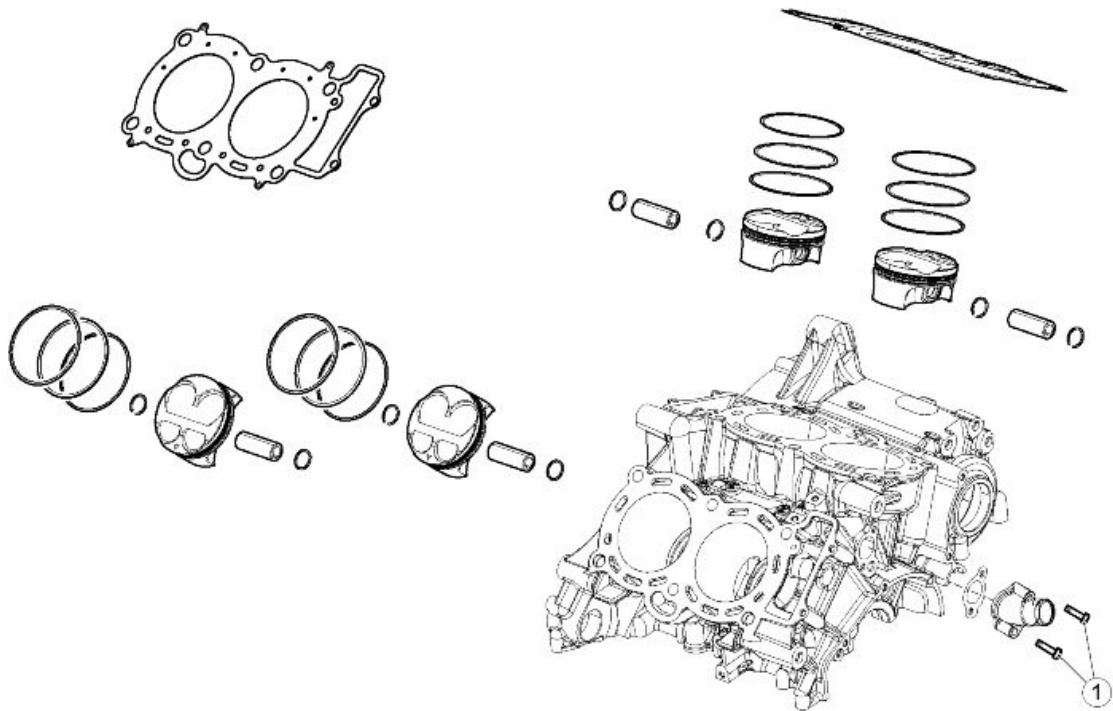


- Turn the engine with the heads facing upward.
- Tighten the screw (24).





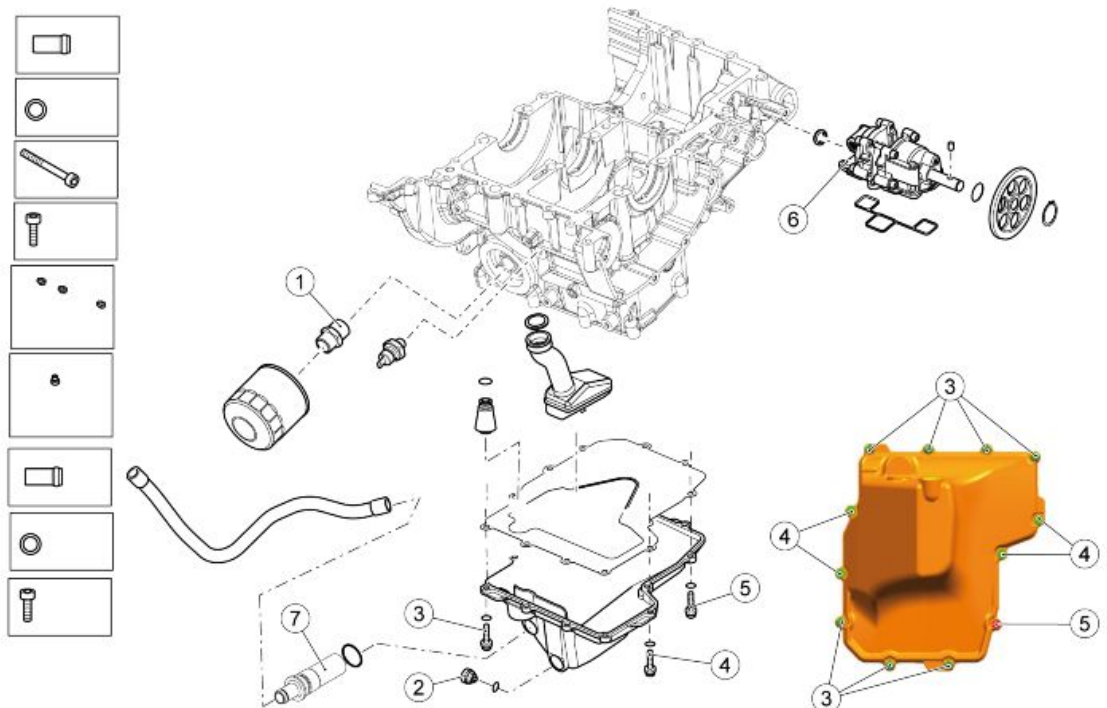
Thermal group



**CYLINDERS - PISTON**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening water union onto crankcase	M6x40	2	10 Nm (7.37 lbf ft)	-

Lubrication

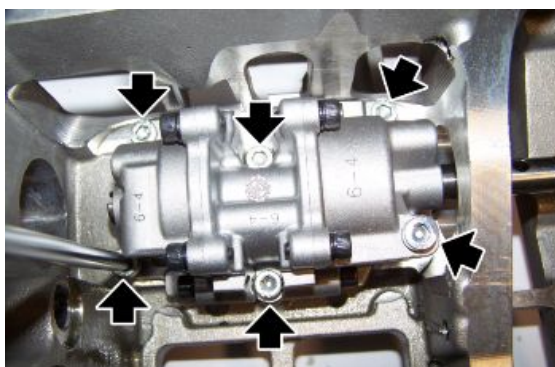


**LUBRICATION**

pos.	Description	Type	Quantity	Torque	Notes
1	Oil filter union fixing screw	-	1	30 Nm (22.13 lbf ft)	-
2	Oil drainage plug	-	1	30 Nm (22.12 lbf ft)	-
3	Oil sump fixing screws	M6x30	7	12 Nm (8.85 lbf ft)	-
4	Oil sump fixing screws	M6x22	4	12 Nm (8.85 lbf ft)	-
5	Oil sump fixing screws	M6x25	1	12 Nm (8.85 lbf ft)	-
6	Screws fastening the pump to the crankcase	M6	5+1	10 Nm (7.37 lbf ft)	-
7	Oil pipe union fixing screw	M6	1	8 Nm (5.90 lbf ft)	Loct. 243
-	Screw fastening the diffuser in the oil sump	-	1	10 Nm (7.37 lbf ft)	-

**Oil pump****Removing**

- Remove the gearbox.
- Remove the water pump.
- Unscrew and remove the six screws fastening the oil pump to the crankcase.
- Remove the oil pumps.

**OIL PUMP REMOVAL**

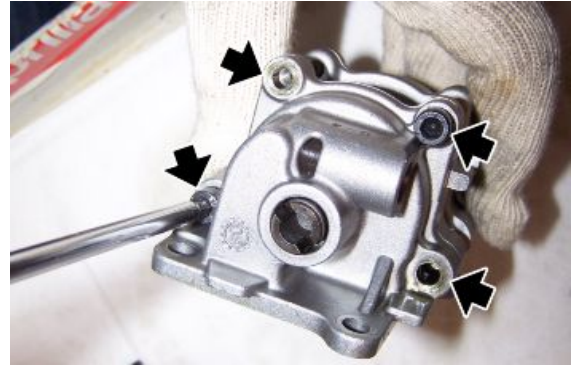
- Place the oil pumps on a work table.
- Remove the gasket.

**See also**

[Removing the gearbox](#)

Water pump

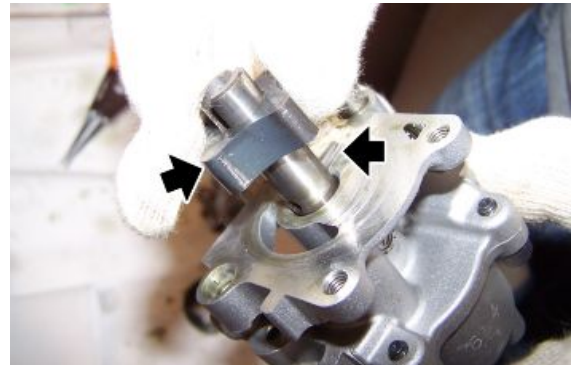
- Unscrew and remove the four cooling oil pump cover screws



- Remove the cooling oil pump cover.
- Collect the two dowel pins.
- Remove the external rotor from the cover.



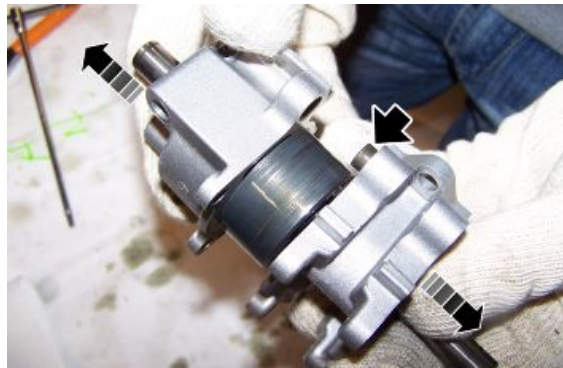
- Remove the internal oil cooling rotor.
- Collect the hitch pin.



- Unscrew and remove the four lubrication oil pump cover screws.



- Remove the lubrication oil pump cover and the intermediate pump casing from the shaft.
- Collect the two dowel pins.



- Remove the external lubrication rotor.



- Remove the internal oil lubrication rotor
- Collect the drive spindle.



## Installing

- Position the lubrication pump internal rotor on the oil pump control shaft

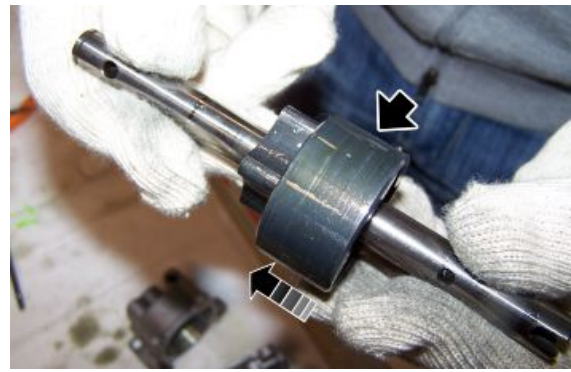
The lubrication pump components are larger than the cooling pump components.

The lubrication pump must be fit onto the shaft from the side with the Seeger ring seat for fastening the gear.

- Install the drive spindle on the shaft.



- Position the external rotor on the lubrication pump's internal rotor.



- Position the dowel pins.
- Position the pump cover and the intermediate pump casing on the lubrication pump's external rotor.

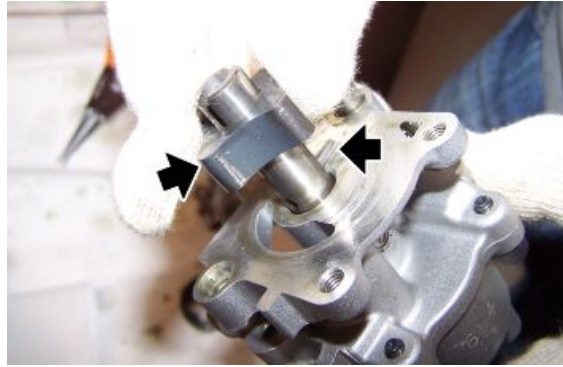
To check that the intermediate casing is oriented correctly, check the gasket seat.



- Tighten the four lubrication oil pump cover screws.



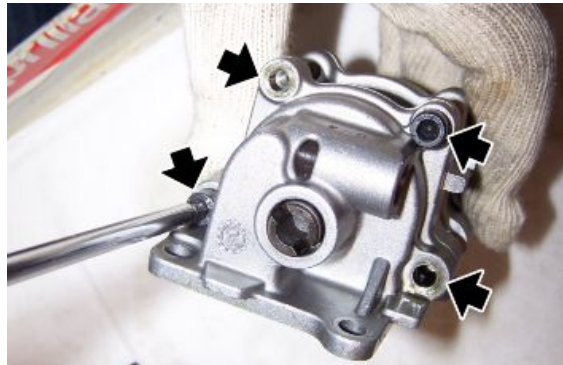
- Position the hitch pin on the oil pump control shaft.
- Position the oil cooling pump's internal rotor.



- Position the dowel pins and the external rotor on the cooling oil pump cover.
- Fit the pump cover on the internal rotor.

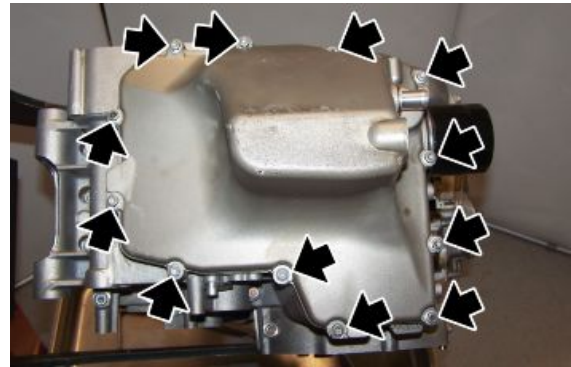


- Tighten the four cooling oil pump cover screws.
- Fit a new gasket.



### Removing the oil sump

- Drain the engine oil.
- Unscrew and remove the twelve oil sump screws.



- Remove the oil sump.
- Remove the metal gasket.

- Remove the rose pipe together with the gasket.



**DURING REFITTING REPLACE THE GASKET WITH A NEW ONE OF THE SAME TYPE.**



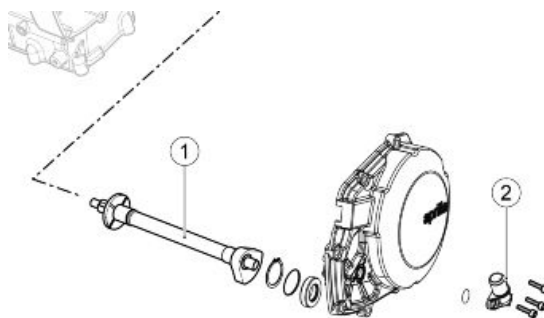
- Remove the pressure relief valve together with gasket



**DURING REFITTING REPLACE THE GASKET WITH A NEW ONE OF THE SAME TYPE.**



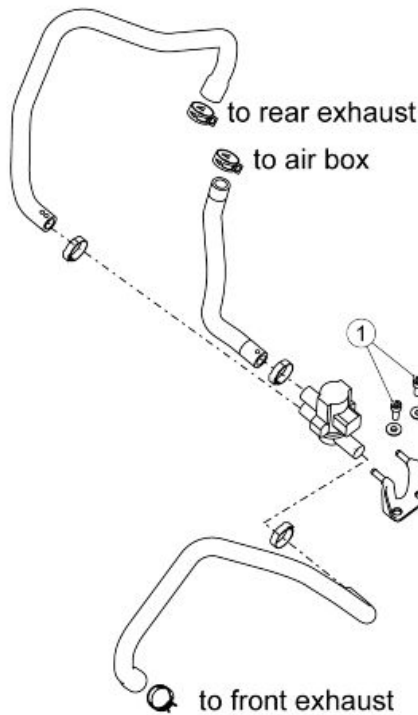
### Blow-by



The Blow-by system uses the rotation of the countershaft (1) to separate the engine oil into oil vapour and liquid.

The oil vapours exit from the fitting (2) on the alternator cover and enter the air filter box whereas the liquid returns to the oil sump.

### SAS valve



#### SECONDARY AIR SYSTEM

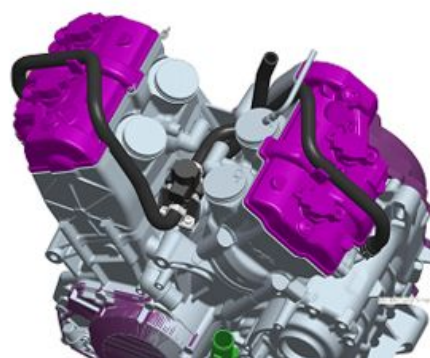
pos.	Description	Type	Quantity	Torque	Notes
1	Secondary air system solenoid screws	-	2	10 Nm (7.37 lbf ft)	-

### Diagram

Valve controlled by control unit which delivers aspirated air from the filter box to the exhaust manifolds.

The advantages of this function are twofold:

- the catalytic converter reaches the operating temperature more quickly;
- it permits the use of richer mixtures in some critical conditions (e.g. at idle or low engine speeds).





## Inspecting the one-way valve

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- Unscrew and remove the three screws.



- Remove the cover together with the two secondary air system valves.



## INDEX OF TOPICS

**P**OWER SUPPLY

**P** SUPP

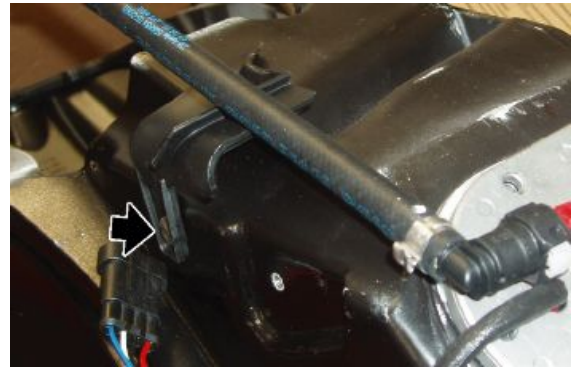
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## Fuel pump

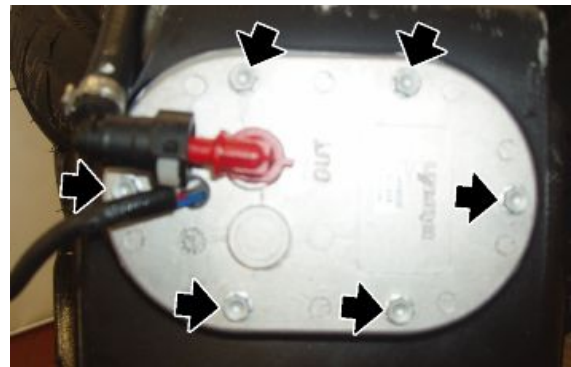
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### Removing

- Remove and empty the fuel tank.
- Loosen the pipe grommet screw.
- Detach the fuel pipe.



- Unscrew and remove the screws.
- Remove the fuel pump.

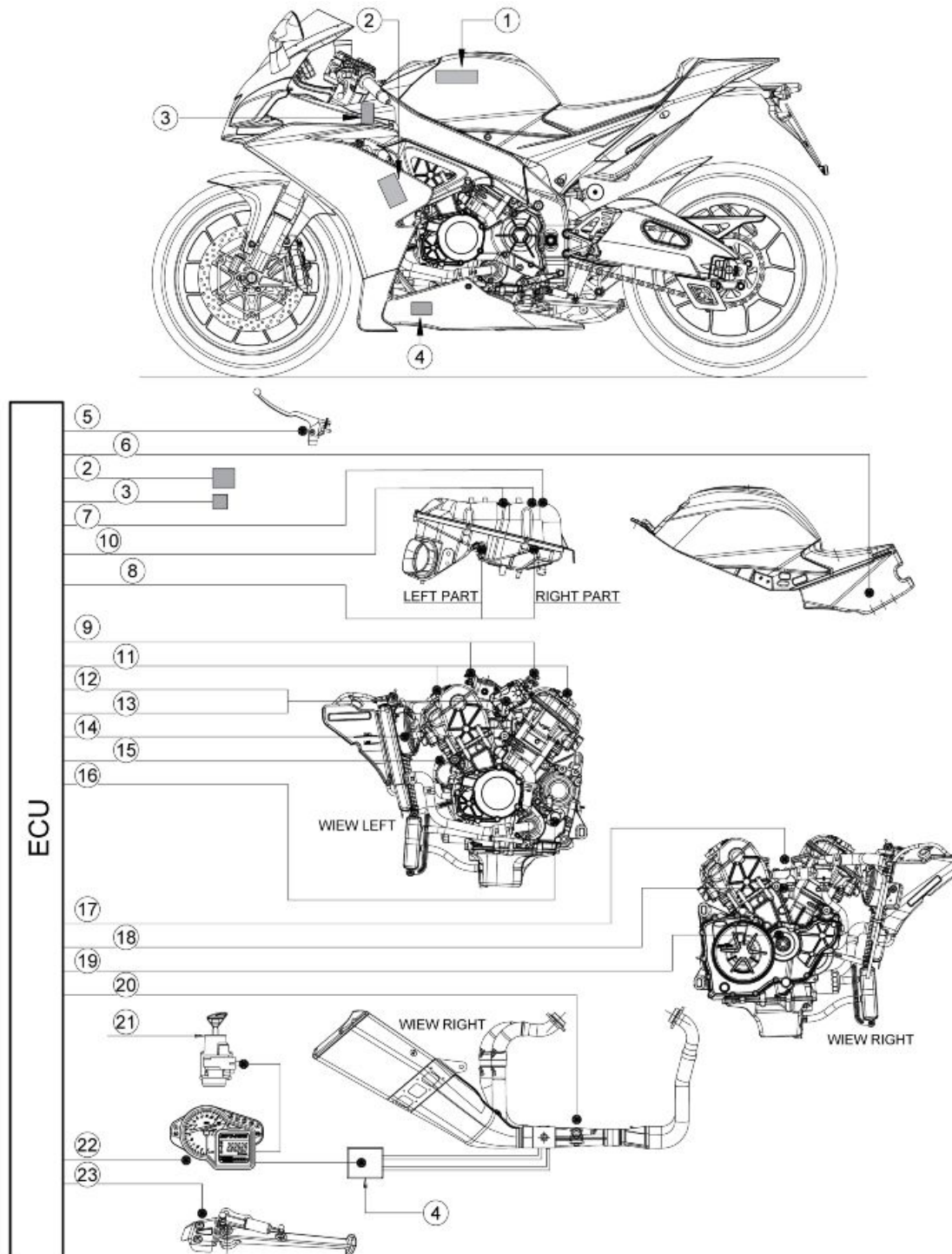


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## Injection

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Diagram



key:

- 1. Control unit position
- 2. Hand grip position sensor
- 3. Fall sensor
- 4. Outlet valve

5. Clutch position sensor
  6. Fuel pump (inside the tank)
  7. Air temperature sensor
  8. Air pressure sensor (MAP)
  9. Lower injectors
  10. Upper injectors
  11. Coils (spark plug cover)
  12. Engine throttle valves
  13. Throttle valve position sensor
  14. Electric fan
  15. Starter motor
  16. Gear position sensor
  17. Secondary air injection valve
  18. Coolant temperature sensor
  19. Crankshaft position sensor
  20. Oxygen sensor
  21. Ignition switch
  22. Instrument panel
  23. Side stand sensor
- 

## Ride by Wire

### Operating logic

Those riding motorbikes do not require a specific throttle valve opening from their engines but actually a specific torque. The Ride by Wire system has been so designed that the throttles of the throttle bodies are mechanically isolated from the throttle control; their actuation depends exclusively on 2 electrical motors controlled by the control unit. The control unit refers to specific handle maps to determine by how much and how quickly the throttle valves are opened. The parameters influencing the handle map are as follows:

- Handle aperture
- Engine rpm
- Handle aperture rate

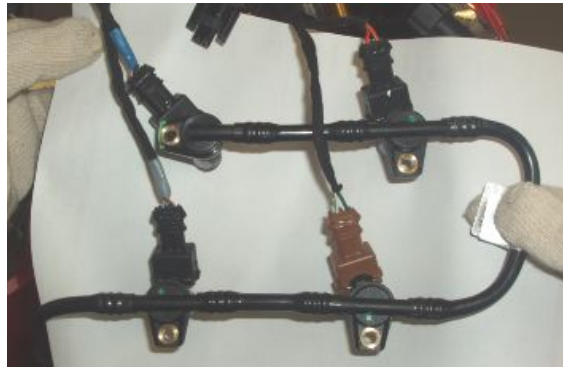
The Marelli control unit performs the following functions:

1. Implements the necessary strategies for calculating torque demand
  2. Operates the sensors and actuators necessary for system function
  3. Safety checks for the Ride by Wire system
-

## Removing the injector

To optimise engine performance, there are four lower injectors on the throttle bodies and four upper injectors on the filter box. Except during transition stages, only the lower or the upper injectors are working at any given time.

- The lower injectors optimise tractability and reduce emissions and fuel consumption
- The upper injectors are designed for maximum power output and, as a result, have a high fuel flow rate

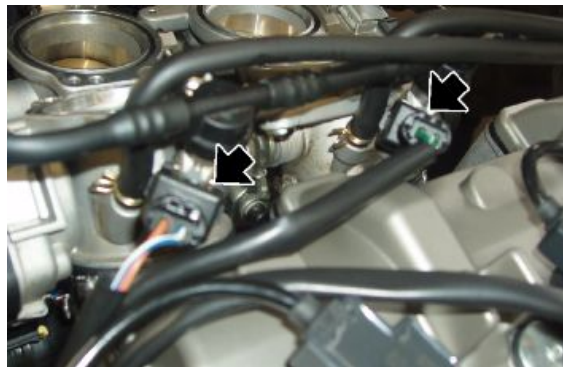


The electrical connectors are colour coded as follows to prevent accidentally swapping the injector connectors:

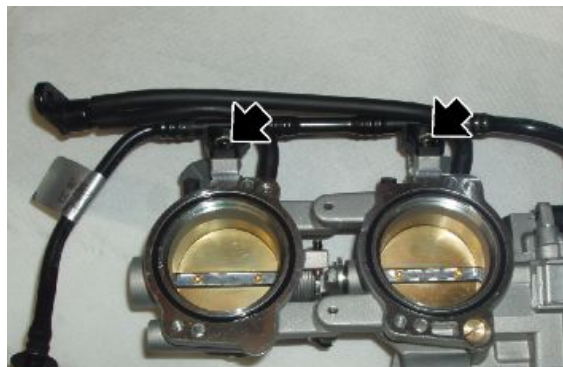
- Cylinder 1: Black
- Cylinder 2: Brown
- Cylinder 3: Green
- Cylinder 4: Grey

### LOWER INJECTORS

- Remove the air filter box.
- Disconnect the injector connectors.



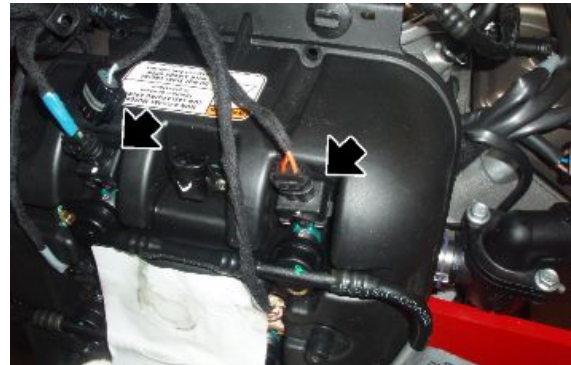
- Unscrew and remove the injector fixing screws.
- Remove the lower injectors, identified by grey collars.



### See also

[Air box](#)**UPPER INJECTORS**

- Remove the control unit.
- Disconnect the injector connectors.



- Unscrew and remove the injector fixing screws.
- Remove the upper injectors, identified by green collars.

**See also**[Control unit](#)**Removing the throttle body**

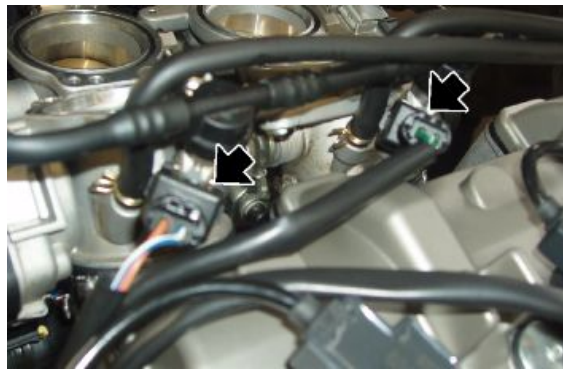
- Completely remove the air filter box.
- Disconnect the injector fuel pipe.
- Release the snap fit clamp on the collars from the engine.

**NOTE**

DO NOT RELEASE THE CLAMPS COMPLETELY. LEAVE IN AN INTERMEDIATE POSITION TO FACILITATE REFITTING.



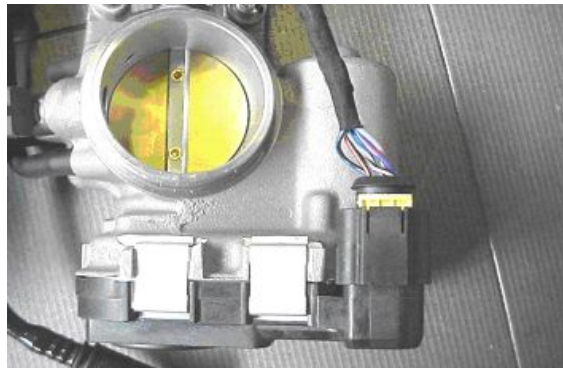
- Disconnect the lower injector connectors.



### See also

[Air box](#)

- Disconnect the connector.
- Remove the complete throttle body.



## Checking the throttle body

The throttle bodies are maintenance free and are not serviceable. Replace the entire assembly in the event of malfunction.

As all the internal components of the throttle body assembly (potentiometers and electrical motor) are contactless, no electrical diagnosis is possible. Functional tests are performed on the throttle body assembly by the control unit during vehicle operation, with the results visible on the diagnostic instrument.

The only action possible before replacing the component is checking the connectors and cable harnesses.

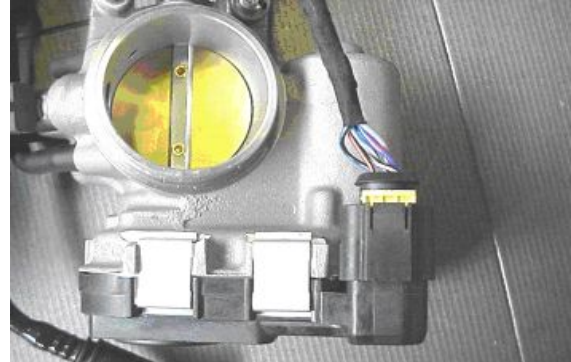




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## Installing the throttle body

- When installing the throttle body, refer to the electrical system section for the correct cable routing.
- Ensure that the injector connectors are correctly fastened.
- Connect the control unit connector, ensuring that the security lock is in the locked position.



---

## Stepper motor

The control unit regulates the idle speed by controlling the throttle body motors directly. As a result, idle speed adjustment and maintenance of the components involved in idle speed regulation (stepper motors, thermoactuators, etc.) are not necessary.

---

## Variable geometry intake

To access the variable geometry intake system, remove the air filter box cover.

The system consists of: two intake ducts for each manifold, which may be joined (long ducts) or separated (short ducts)

### CAUTION

TAKE PARTICULAR CARE DURING REASSEMBLY: THE SCREW SEAT WITH THE CHAMFER IS ASSEMBLED IN THE FRONT PART



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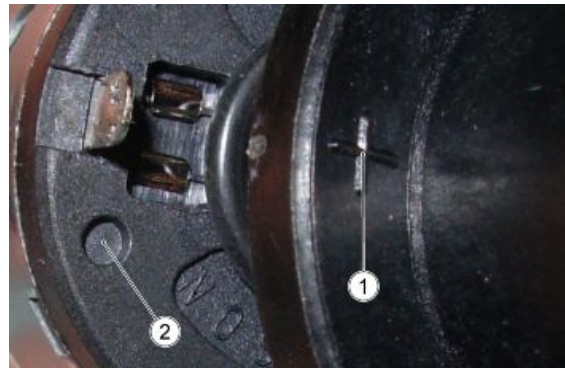
## Electric motor

This is a DC motor actuating the upper portion of the intake ducts through an endless circuit.

### CAUTION

TAKE PARTICULAR CARE DURING REASSEMBLY. THE POSITIVE SIDE (1) OF THE CONNECTOR MUST MATCH WITH THE SIDE WHERE A NOTCH (2) IS INDICATED.





a variable geometry control unit for managing the system, interfaced with the engine injection control unit



### Operation

At key-ON, the variable geometry control unit lowers the ducts (if still in the raised position).

Subsequently, depending on the control voltage on PIN 2 from the injection ECU (0V down, 5V up), the ECU drives the electric motor with the relative polarity for raising or lowering the ducts.

The drive voltage delivered to the motor is determined in relation to battery voltage and the motor is stopped once a given current limit is reached or if the time-out period of 500 ms has elapsed.

There is no feedback relative to duct position! If in doubt, use the diagnostic instrument to actuate the ducts.

In the case of a defect in the variable geometry control unit, an error message is sent immediately to the engine injection ECU.

The variable geometry control unit does store errors



### See also

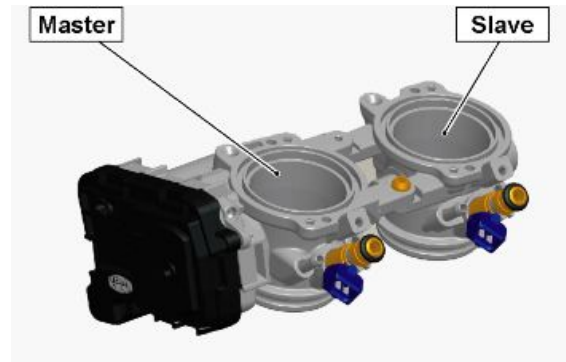
Variable geometry intake

Variable geometry intake

## Cylinders synchronisation

The control unit receives information on the intake pressure in the four ducts from the two pressure sensors: as the control unit knows the timing phase of the cylinders, it can calculate the individual pressure of the four cylinders.

The control unit can equalise the depression between the front and rear cylinder banks by controlling two motors that are independent of the throttle bodies, but cannot equalise the pressure between the master cylinder (the cylinder closest to the motor) and the slave cylinder.



If irregular idling is noted, the By-pass screws can be checked and adjusted if necessary to ensure correct equalisation between cylinders 1-3 and 2-4.

On the diagnostic instrument, select Cylinder pressure equalisation from the Adjustable parameters screen.

In order for the procedure to start:

- the engine must have a water temperature above 80 °C (176 °F);
- be at the idling speed;
- there may not be any control unit errors.

As soon as the fans are activated (approx. 101°C - 214°F), the procedure is aborted and cannot be carried out.

During the procedure, the position of the hand grip position sensor is not considered. If Aux 2 is pressed on Axone (safety button) the procedure is not concluded correctly and the engine must be turned off.

A screen is displayed indicating the By-pass screws for cylinders 1 and 3 and whether the screw setting is correct, or whether it must be opened/closed by a small (1/8 turn) or large (1/4 turn) amount.

If the operation concerns slave screws, no removal of components is necessary.

If the operation concerns master screws, the air filter box must be removed.



After making any adjustment, wait for confirmation that the position of the adjusted screw position is now correct.



The procedure then continues with screws 2 and 4.

To ensure correct engine operation, one of the two screws of each throttle body must **always** be closed. Motorcycles are factory set with screws 1 and 2 turned by half a turn and screws 3 and 4 closed.

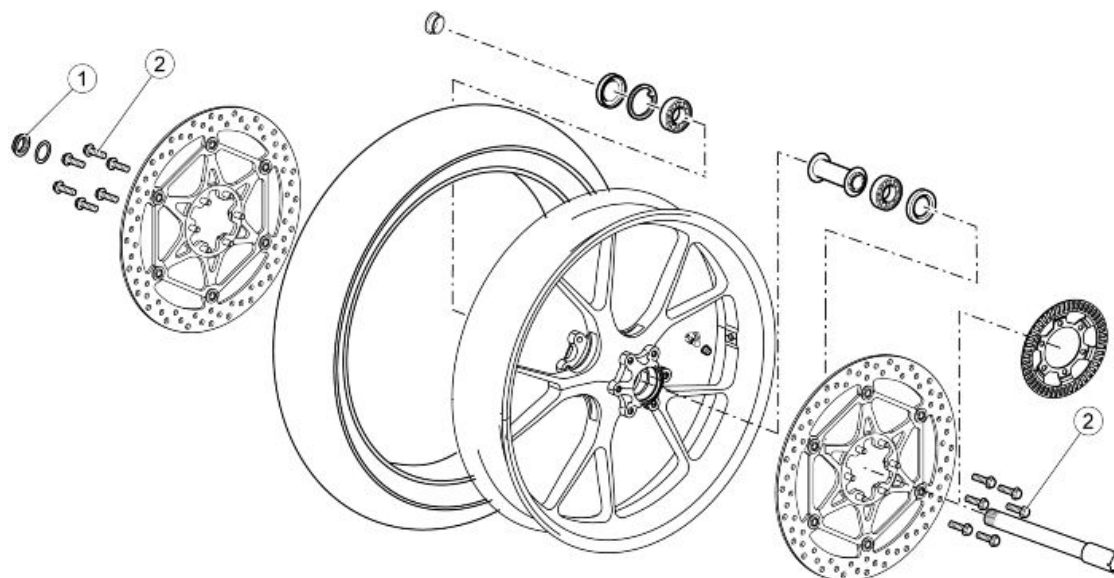
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## INDEX OF TOPICS

**SUSPENSIONS**

**SUSP**

**Front**



**FRONT WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Front wheel spindle nut	M25x1.5	1	80 Nm (59 lbf ft)	-
2	Front brake disc fixing screws	M8	6 + 6	30 Nm (22.13 lbf ft)	Loct. 243

**Removing the front wheel**

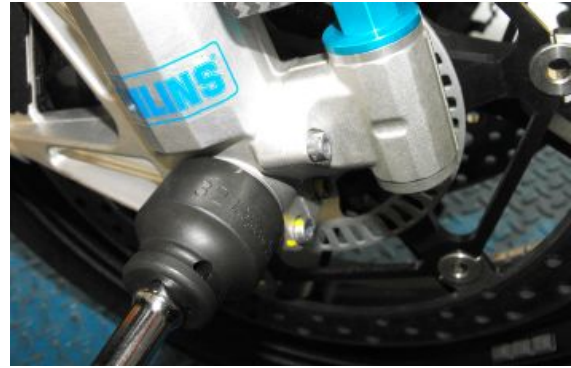
- Hold the vehicle front part.
- Remove the front mudguard.
- Unscrew the screws fixing the front pliers and slide them off the disc.



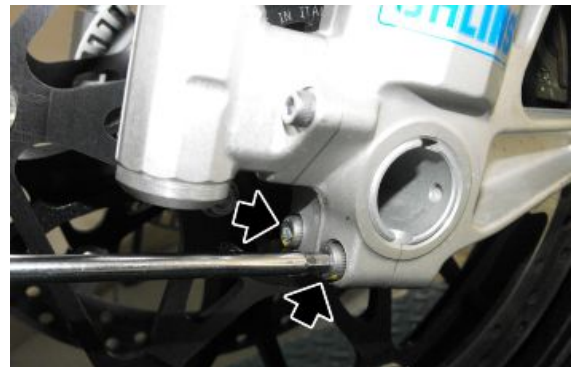
**See also**

[Front mudguard](#)

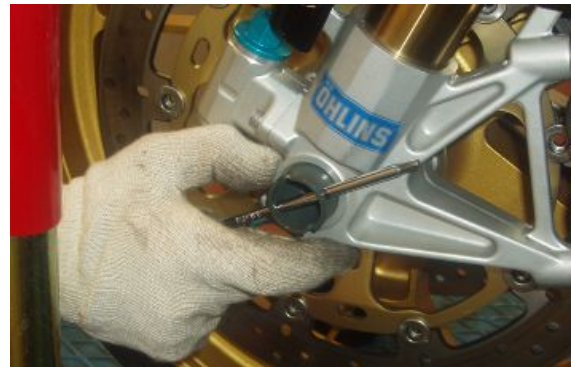
- Remove the wheel axle fixing nut.
- Retrieve the sealing washer.



- Loosen the screws on the wheel axle clamps.



- Tap the wheel axle slightly with a rubber mallet so that the hole on the opposite side is exposed.
- Remove the wheel axle by inserting a screwdriver in the holes on the pin.



- During extraction, support the wheel and then remove it.

## Checking the front wheel

### FRONT WHEEL BEARINGS

Carry out the check with the bearings fitted on the wheel.



**CHECK THAT ALL PARTS ARE IN GOOD CONDITION, ESPECIALLY THOSE LISTED AS FOLLOWS.**

### ROTATION CHECK

- Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

- Replace both wheel bearings.

#### RADIAL AND AXIAL CLEARANCE CHECK

- Check the radial and axial clearance.

**Axial clearance: a minimum axial clearance is allowed.**

**Radial clearance: none.**

If one or both bearings do not fall within the control parameters:

- Replace both wheel bearings.



**ALWAYS REPLACE BOTH BEARINGS.**

**ALWAYS REPLACE THE BEARINGS WITH OTHERS OF THE SAME TYPE.**

#### GASKETS

- Check that the gaskets are in good conditions; replace them if they show signs of damage or excessive wear.

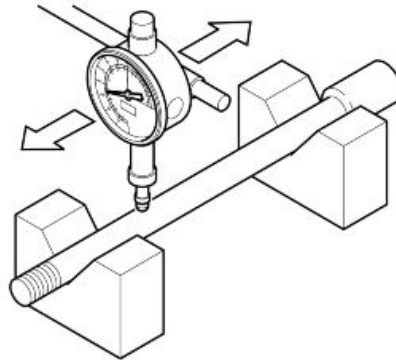


**ALWAYS REPLACE BOTH GASKETS.**

**ALWAYS REPLACE THE GASKETS WITH OTHERS OF THE SAME TYPE.**

#### WHEEL AXLE

- Use a dial gauge to check the wheel axle eccentricity. Replace the wheel axle if the eccentricity exceeds the limit value.

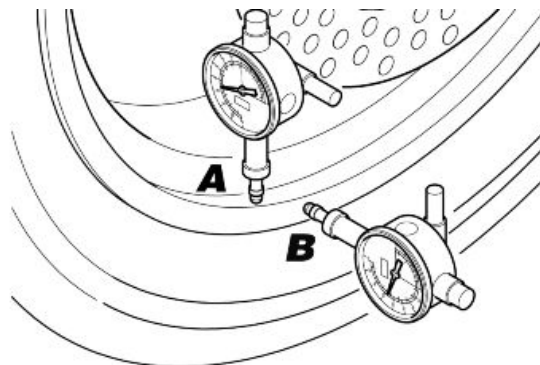


#### Characteristic

##### Maximum eccentricity:

0.25 mm (0.0098 in)

- Using a dial gauge, check that the radial (A) and the axial (B) eccentricities of the rim do not exceed the limit value. An excessive eccentricity is usually caused by worn or damaged bearings. Replace the rim if, after replacing the bearings, the value is not within the specified limit.



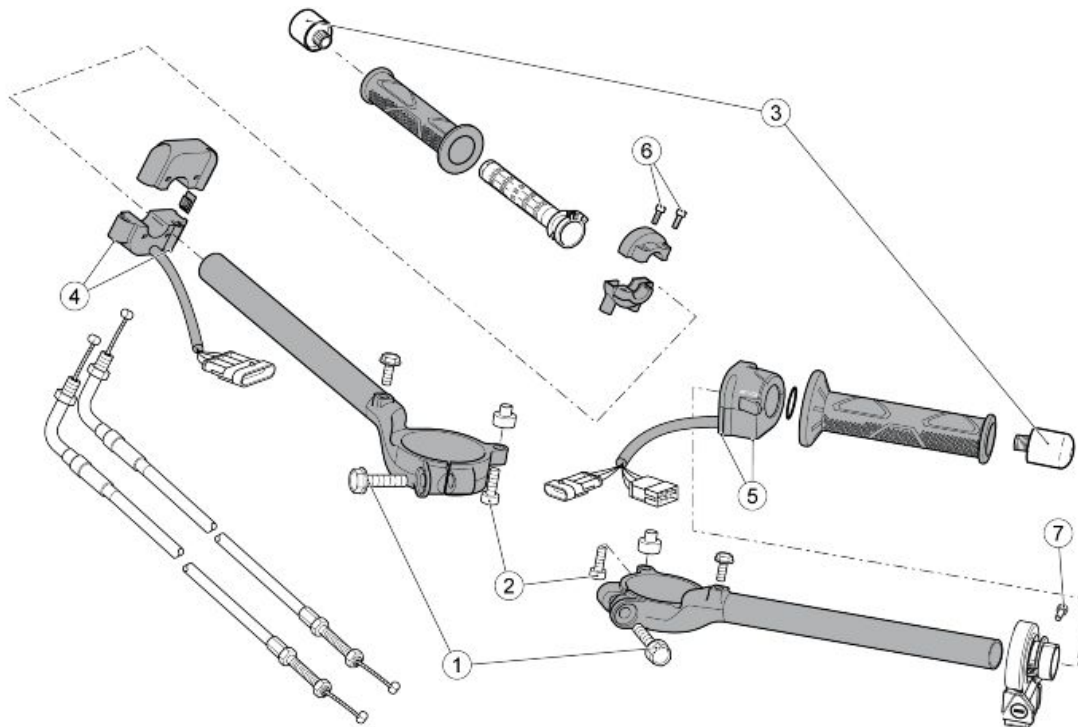
#### Characteristic

##### Maximum radial and axial eccentricity:

0.8 mm (0.031 in)

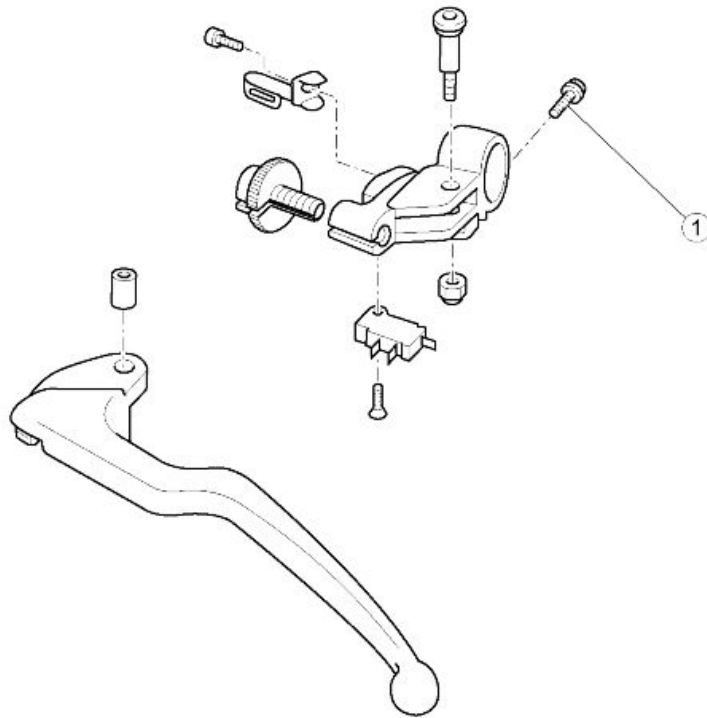


Handlebar



**HANDLEBAR AND CONTROLS**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening the semi-handlebar collar to the fork sleeves	M8	1 + 1	25 Nm (18.44 lbf ft)	-
2	Semi-handlebar safety screw	M6	1+1	10 Nm (7.37 lbf ft)	-
3	Anti-vibration counterweight fastener	M18x1.5	1+1	20 Nm (14.75 lbf ft)	-
4	Right light switch	M4	2	1.5 Nm (1.11 lbf ft)	-
5	Left light switch	M5	2	1.5 Nm (1.11 lbf ft)	-
6	Throttle control fixing screws	M5	2	2 Nm (1.47 lbf ft)	-
7	Traction control control unit fixing screw	M4	1	2 Nm (1.47 lbf ft)	-

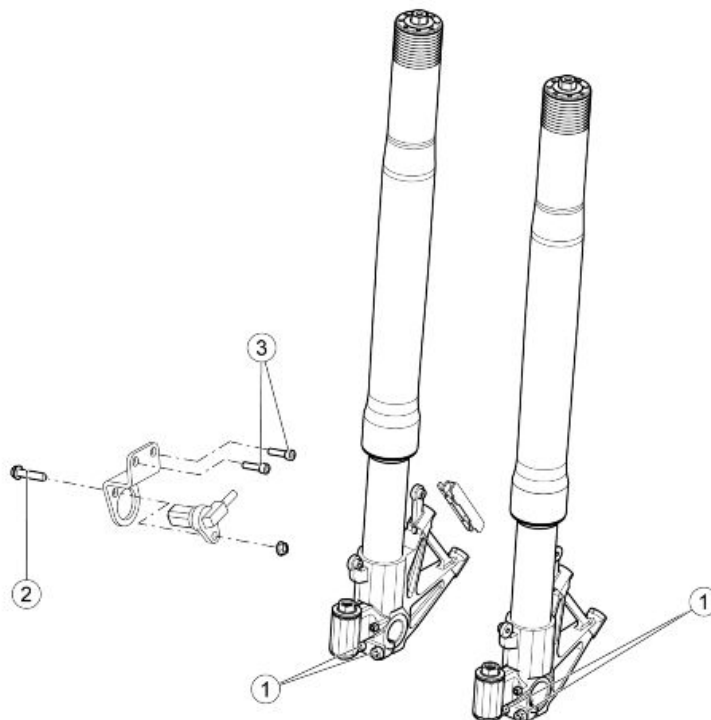


**CLUTCH LEVER**

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch lever collar fixing screws	M6	1	10 Nm (7.37 lbf ft)	-

**Front fork**

**Diagram**



**FRONT FORK**

pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screws for calliper mounting bracket (Öhlins)	M6	2 + 2	12 Nm (8.85 lbf ft)	-
2	Odometer sensor fixing screw	M6	1	10 Nm (7.38 lbf ft)	-
-	Speed sensor bracket screws	-	2	-	-

**Adjustment**

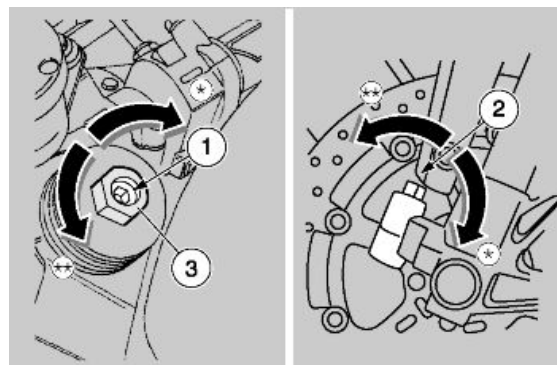
Standard front fork setting is adjusted to suit most high and low speed riding conditions, whether the vehicle is partially or fully loaded.

However, the setting can be modified for specific needs according to vehicle use.

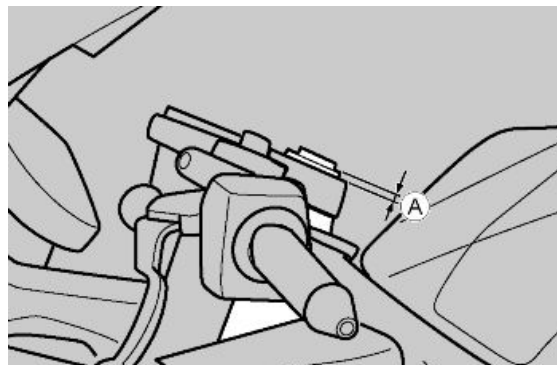


**RACING TRACK SETTINGS MUST BE DONE ONLY FOR OFFICIAL COMPETITIONS OR SPORTS EVENTS WHICH ARE, IN ALL CASES, AWAY FROM NORMAL ROAD TRAFFIC AND WITH THE AUTHORISATION OF THE RELEVANT AUTHORITIES.**

**IT IS STRICTLY FORBIDDEN TO RIDE A VEHICLE SET FOR RACING ON ROADS AND MOTORWAYS.**



**WHEN COUNTING THE NUMBER OF CLICKS AND/OR TURNS OF ADJUSTMENT SCREWS (1 - 2), ALWAYS START FROM THE STIFFEST SETTING (ADJUSTER SCREW TURNED FULLY CLOCKWISE). WHEN COUNTING THE NUMBER OF CLICKS AND/OR TURNS OF ADJUSTMENT SCREW (3), ALWAYS START FROM THE SOFTEST SETTING (ADJUSTER SCREW TURNED FULLY ANTI-CLOCKWISE).**



**FRONT FORK - STANDARD SETTING (FOR ROAD USE ONLY)**

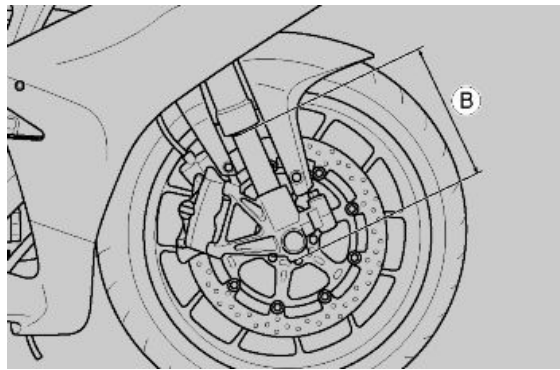
Specification	Desc./Quantity
Rebound damping adjustment, screw (1)	Unscrew (**) 12 clicks from fully closed (*)
Compression damping adjustment, screw (2)	Unscrew (**) 14 clicks from fully closed (*)
Spring preloading, nut (3)	screw (*) 8 turns from fully open (**)
Stems (A) (***) protrusion from top plate (excluding cover)	2 notches / 8 mm (2 notches / 0.31 in)
Theoretical fork failure (motorcycle + rider 70kg - 154lb) (B)	35 +/- 1 mm (1.38 +/- 0.039 in)

**FRONT FORK - RACING ADJUSTMENT RANGE (TRACK USE ONLY)**

Specification	Desc./Quantity
Rebound damping adjustment, screw (1)	Unscrew (**) 8 - 10 clicks from fully closed (*)
Compression damping adjustment, screw (2)	Unscrew (**) 6 - 8 clicks from fully closed (*)
Spring preloading, nut (3)	Screw (*) 7 - 8 turns from fully open (**)
Stems (A) (***) protrusion from top plate (excluding cover)	2 notches / 8 mm (2 notches / 0.31 in) - 3 notches / 12 mm (3 notches / 0.47 in)
Theoretical fork failure (motorcycle + rider 70kg - 154lb) (B)	35-37 +/- 1 mm (1.38-1.46 +/- 0.039 in)

**NOTE**

TO CHECK FOR FRONT FORK FAILURE, MEASURE THE DIFFERENCE BETWEEN THE BEGINNING OF THE WHEEL HUB AND THE END OF THE FORK SLEEVE

**Removing the fork legs**

- Remove the front wheel.
- Support the fork stanchion and loosen the screws on the upper yoke.



- Loosen the screws on the semi-handlebars.



- Loosen the lower yoke screws.
- Remove the fork stem.

**See also**

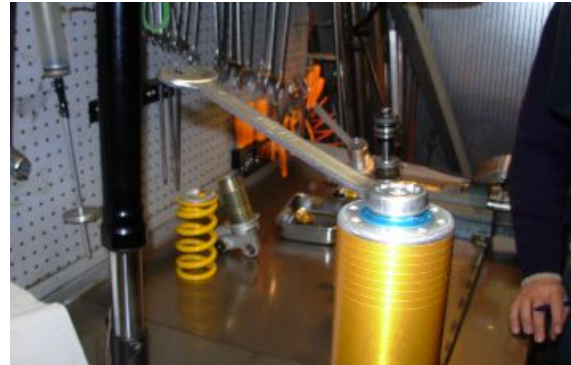
[Removing the front wheel](#)

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## Draining oil

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- Fix the fork in a vice, taking care not to damage the fork.
- Set the minimum spring preloading.



- Unscrew the upper cap from the sleeve using a specific Ohlins tool.



- Loosen the cap, holding the upper spring ring nut still with a wrench.
- Unscrew the upper adjustment cap.



- Remove the whole cap.



- Loosen and remove the nut, keeping the preload spring slightly compressed.



- Remove the lock nut for the preload spring



- Remove the preload spring



- Drain the fork oil into a specific container, taking care not to allow the preload pipe and the hydraulic rebound damping brake adjustment pipe to escape.



## Disassembling the fork

- Fix the fork again in a vice, taking care not to damage the fork.
- Remove the preload pipe.



- Remove the sleeve (2) from the wheel holder stanchion (1).



- Use a plain slot screwdriver to lift up the dust gaiter (3) in multiple points and remove from the sleeve (2).



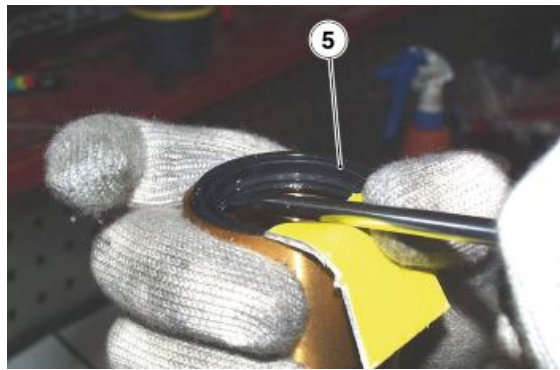
- Use a plain slot screwdriver to remove the snap ring (4).



- Use a plain slot screwdriver to remove the oil seal (5).

**CAUTION**

PLACE A STRIP OF RUBBER ON THE EDGE OF THE SLEEVE TO PROTECT IT FROM DAMAGE WHEN REMOVING THE OIL SEAL (5).



Replace the following components with new ones:

- oil seal (5)
- dust gaiter (3)

**CAUTION**

**BE EXTREMELY CAREFUL IN ORDER THAT NO FOREIGN BODIES GET INTO THE SLEEVE OR THE WHEEL HOLDER STEM. NEVER REUSE OIL.**

- Use the Öhlins tool to unscrew the pumping member pin fixing ring nut.
- Remove the pumping member pin unit.

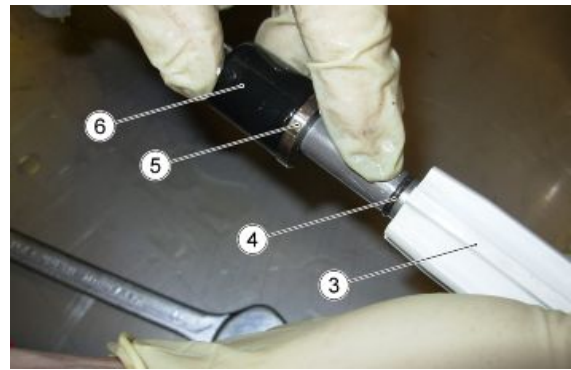


- Remove the spring guide snap ring (1)
- Remove the spring guide support ring (2)





- Remove the spring guide (3), noting its direction of installation to ensure correct reassembly.
- Remove the other spring guide snap ring (4).
- Remove the ring (5) and extract the rubber buffer (6)



- Remove the ring nut, on which the threaded pipe is attached, from the pumping member pin.



- Remove the rubber O ring.



- Remove the guide bushing and the counterspring.



## 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.

##### Springs

Check that the springs are in good condition. Check that the length of the springs is within the specified tolerance range.

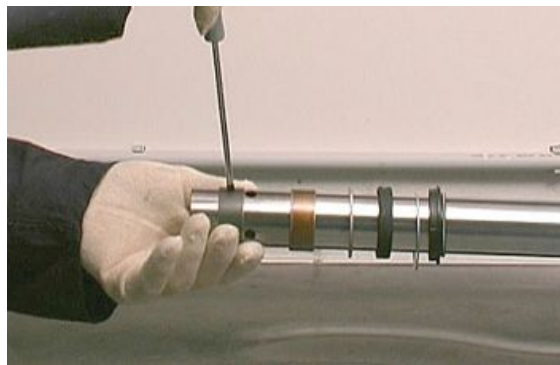
Replace the springs if the length is not within the specified tolerance range.

**SPRING MINIMUM LENGTH WHEN UNLOADED: 254 mm (9.99 in)**

**MINIMUM COUNTERSPRING LENGTH 35 mm (1.38 in)**

Check that the following components are in good conditions:

- sliding bushing;
- guide bushing;
  
- piston.



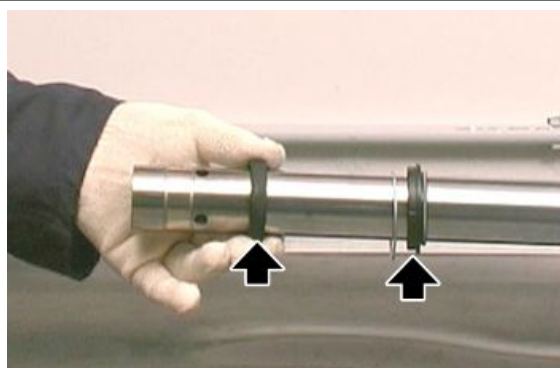
If there are signs of excessive wear or damage, replace the affected component.

#### CAUTION

**REMOVE ANY IMPURITY IN THE BUSHINGS, TAKING CARE NOT TO SCRATCH THEIR SURFACE.**

Replace the following components with new ones:

- seal;
- dust gaiter
- the two OR on the regulator.





**Oil level: 110 mm (4.33 in) (from the sleeve edge, without a spring and with preload pipe).**

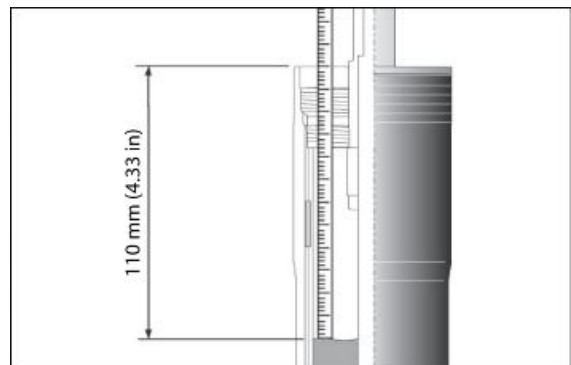


**THE SLEEVE MUST BE PERFECTLY UPRIGHT IN ORDER TO MEASURE THE CORRECT OIL LEVEL. THE OIL LEVEL MUST BE THE SAME IN BOTH STEMS.**

#### **Characteristic**

##### **Fork oil**

530 cc (0.12 Uk gal) (for each stanchion)



## **Reassembling the fork**

- Insert the guide bushing and the counterspring.



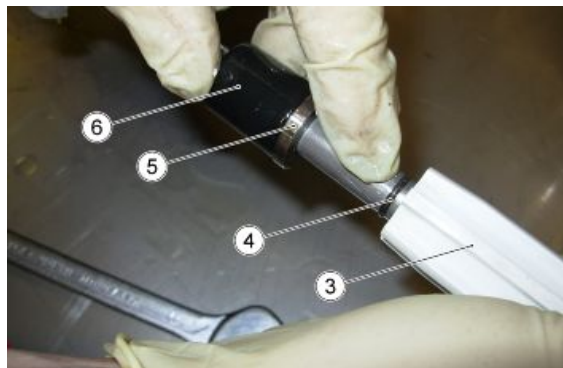
- Insert the rubber O ring.



- Insert the ring nut, on which the threaded pipe is attached, on the pumping member pin.



- Insert the rubber buffer (6).
- Insert the spring guide support ring (5), noting the internal milling allowing the spring guide retainer ring to be installed against the support ring.
- Insert the spring guide retainer ring (4)
- Insert the spring guide (3).



- Insert the spring guide retainer ring (1)
- Insert the spring guide support ring (2), noting the internal milling allowing the spring guide retainer ring to be installed against the support ring.



- Insert the pumping member pin unit.
- Use the Ölins tool to tighten the pumping member pin fixing ring nut to 40 Nm (29.50 lbf ft).



- Install the following components on the wheel holder stanchion (1) in the order given: dust gaiter (3), retainer ring (4) and oil seal (5).



- Fix the sleeve in a vice, taking care not to damage the sleeve.
- Insert the stanchion (1) into the sleeve (2).



- Fit the two half-shells of the special tool on the wheel holder stanchion (1), behind the oil seal (5).
- Grip the special tool and push the oil seal (5) into its seat on the sleeve (2).
- Remove the tool.



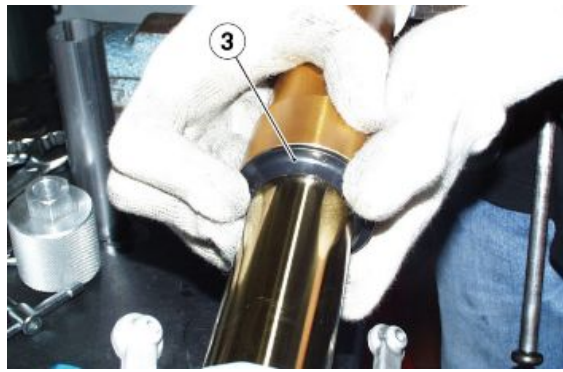
- Fit the retainer ring (4) into its seat on the sleeve (2).



- Push the dust gaiter (3) into its seat on the sleeve (2), ensuring that it is located correctly.
- Grip the stanchion and move it repeatedly and slowly in opposite directions.

**CAUTION**

THE STANCHION MUST SLIDE FREELY IN THE SLEEVE WITHOUT RESISTANCE.



- Insert the pumping member pin unit.

**CAUTION**

THE STANCHION MUST SLIDE FREELY IN THE SLEEVE WITHOUT RESISTANCE.



## Filling oil

- Place the sleeve in a vertical position.
- Insert the pumping member pin unit and tighten to the specified torque with the Öhlins tool.



- Insert the preload pipe.



- Fill the fork so that any air bubbles trapped within are expelled.

- Holding up the pin, insert the preload spring.



- Fit the lock nut for the preload spring (1).
- Fit the nut (2).
- Keeping the spring compressed, tighten the nut completely.



- Screw the complete cap onto the pumping member pin.



- Tighten the cap using a wrench to block the lower spring ring nut.
- Tighten the upper adjustment cap to bring it into contact with the lower nut on the cap.



- Use the specific Öhlins tool to tighten the upper cap on the sleeve to 20 Nm (14.75 lbf ft).

## Steering damper

## Adjusting

The steering damper may be adjusted by turning the knob (1).

- Turn the knob (1) clockwise to stiffen the steering.
- Turn the knob anticlockwise to loosen the steering.



**SPORT SETTINGS MAY BE USED ONLY FOR OFFICIAL COMPETITIONS TO BE CARRIED OUT ON TRACKS, AWAY FROM NORMAL ROAD TRAFFIC AND WITH THE AUTHORISATION OF THE RELEVANT AUTHORITIES.**



**ADJUSTMENTS MAY ONLY BE MADE WITH THE VEHICLE STATIONARY. AFTER ALTERING THE SETTINGS, ALWAYS CHECK THAT THE HANDLEBAR TURNS FREELY IN BOTH DIRECTIONS.**

### **STEERING DAMPER - STANDARD SETTING (FOR ROAD USE)**

Specification	Desc./Quantity
Hydraulic setting	From all open (**) tighten (*) 5 - 8 clicks

### **STEERING DAMPER- RACING SETTING RANGE (FOR TRACK ONLY)**

Specification	Desc./Quantity
Hydraulic setting	From all open (**) tighten (*) 10 - 13 clicks

(\*) = clockwise

(\*\*) = anticlockwise

## Removing

The steering damper steering more precise and stable, improving motorcycle handling in all conditions. The damper is fastened at the front of the motorcycle between the base of the headstock and the frame

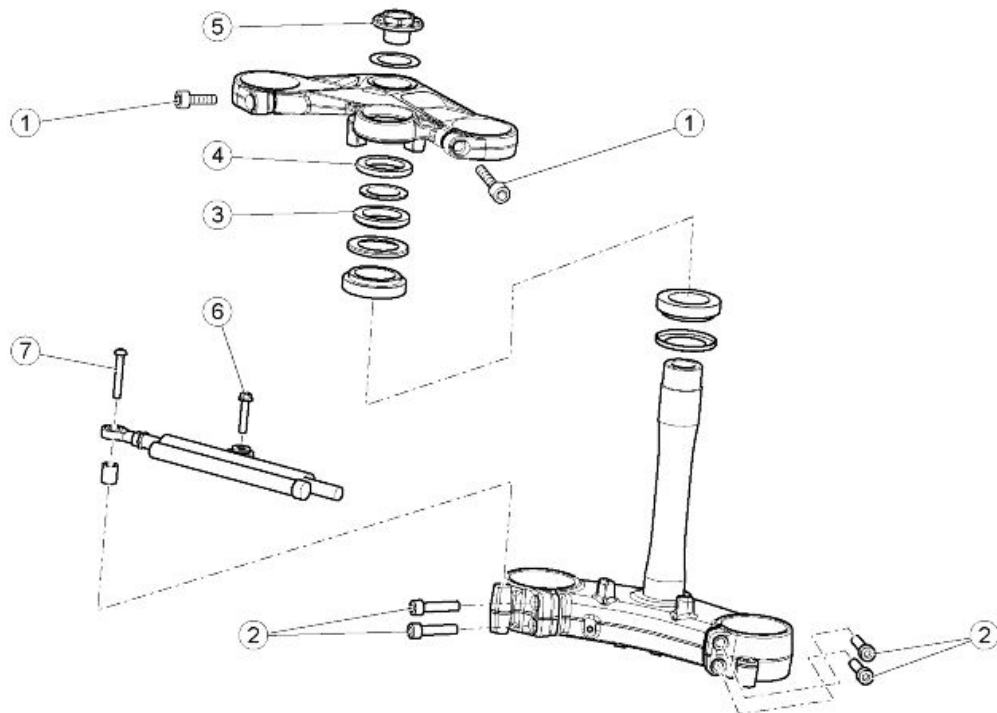
Removal:

- Unscrew the chassis fixing screw.
- Unscrew the fixing screw at the base of the headstock.
- Remove the steering damper.





### Steering bearing



#### STEERING

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening upper yoke to stanchions	M8	2	25 Nm (18.44 lbf ft)	-
2	Screws fastening lower yoke to stanchions	M8	4	25 Nm (18.44 lbf ft)	-
3	Headstock lock ring	M35x1	1	60 Nm (44.25 lbf ft)	-
4	Headstock counter-lock ring	M35x1	1	Manual +35° or -10°	Bend the tabs into the notches in the lock ring
5	Upper yoke fixing cap	-	1	100 Nm (73.76 lbf ft)	-
6	Screw fastening shock absorber to frame	M6	1	10 Nm (7.37 lbf ft)	-
7	Screw fastening shock absorber to lower yoke	M6	1	10 Nm (7.37 lbf ft)	-

### Adjusting play

- Unscrew and remove the top bolt on the headstock and retrieve the washer.



- Loosen the screws fixing the fork stanchions to the upper yoke.



- Working from both sides, unscrew and remove the semi-handlebar screws.



- Remove the upper yoke



- Rivet the safety washer on the headstock.



- Undo the counter-lock ring, remove the safety washer then unscrew the lower lock ring in order to adjust the steering free play correctly.



- Tighten the lower lock ring to a torque of 70 Nm (51.63 lbf ft).
- Steer repeatedly completely left and completely right to allow the bearings to settle.
- Loosen the ring nut.
- Retighten the lock ring to the prescribed torque of 60 Nm (44.25 lbf ft).
- Steer completely left and completely right and check that the steering rotates smoothly and without excessive resistance.
- If any problems are noted, repeat the procedures described above.

**NOTE**

**DISCONNECT THE STEERING DAMPER WHEN ADJUSTING THE STEERING FREE PLAY.**

**Specific tooling**

**AP8140190 Tool for steering tightening**

- Fit the safety washer and bend the two opposing tabs into the notches on the lock ring.



- Fit the counter-lock ring, hand tightening only.
- To allow the tabs to be bent into the notches of the counter-lock ring in order to lock the ring, the counter-lock ring may be tightened further by up to 35° or loosened by up to 10°.
- When tightening the counter-lock ring, hold the lock ring still with an appropriate hook spanner.
- Lock the counter-lock ring by bending the tabs of the retainer washer into the notches in the counter-lock ring itself.
- Reconnect the steering damper.

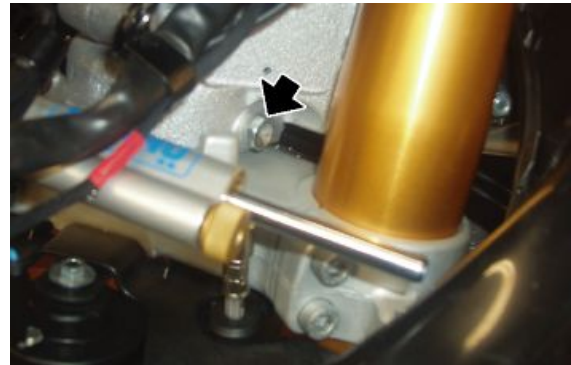


- Fit the upper fork plate.



## Disassembling

- Remove the steering assembly completely.
- Unscrew and remove the lower dowel fastening the collar.
- Remove the lower collar.



- Unscrew and remove the upper dowel fastening the collar.
- Remove the upper collar.



### CAUTION



ALWAYS CHANGE BOTH COLLARS (UPPER AND LOWER).

Upper and lower collars are not interchangeable.

To identify them, check the number printed on them:

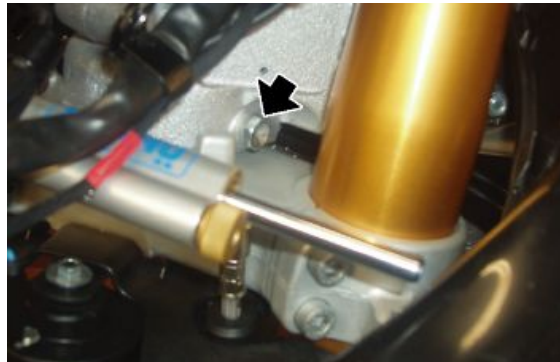
- lower collar 0.3+5.5
- upper collar 0.3+4.5

## Assembling

- Fit the upper collar.
- Partially tighten the dowel in the relative threaded hole, so that it protrudes by no more than 2 or 3 mm into the conical surface.
- Fit the bushing in its seat, ensuring that the seal (in the groove in the bushing) remains in place.
- Press the bushing into place with a rubber mallet.
- Tighten the dowel to the specified torque.



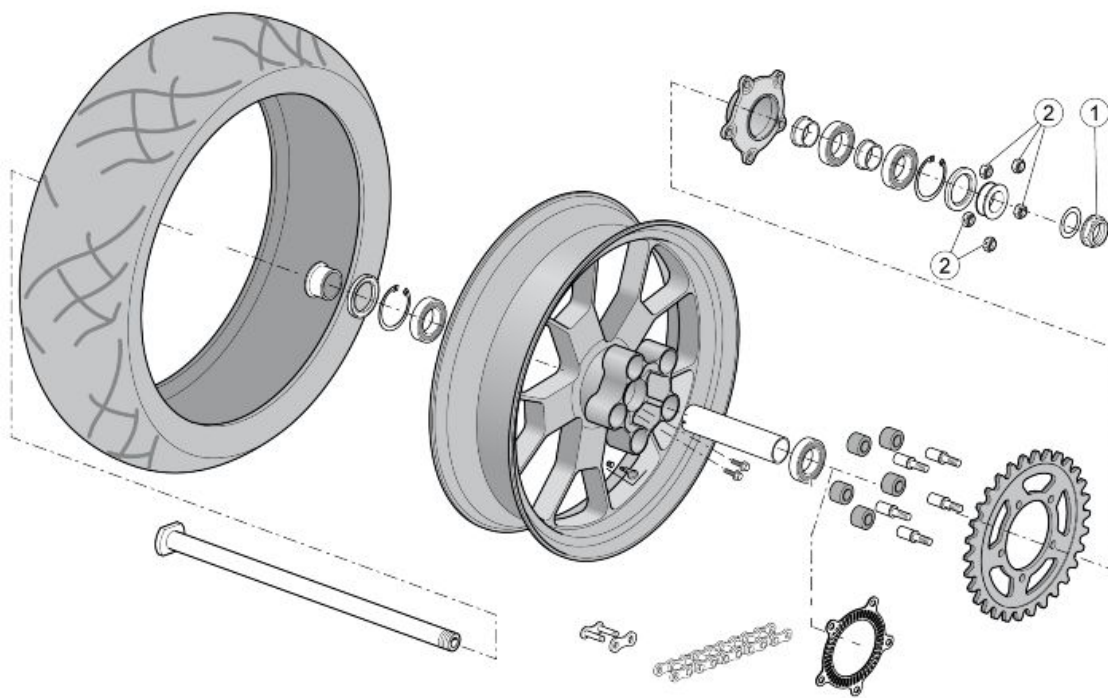
- Repeat the procedure for the lower bushing.
- Fit the steering assembly and restore the correct steering bearing free play.



**See also**

[Adjusting play](#)

**Rear**



**REAR WHEEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear wheel spindle nut	M25x1.5	1	120 Nm (88.5 lbf ft)	-
2	Screws fastening sprocket on sprocket mount	M10	5	50 Nm (36.88 lbf ft)	-

## Removing the rear wheel

- Place the vehicle on its rear service stand.
- Loosen and remove the nut on the wheel axle.
- Retrieve the thrust washer and the left hand chain tensioner slider.



- Tap the wheel axle slightly to extract the head from its seat.
- Make the wheel move forward and release the gearing chain from the sprocket.



- Remove the wheel spindle together with the right hand chain tensioner skid.
- Remove the wheel by freeing the disc from the brake calliper.



- Holding the outer rim of the sprocket with both hands, slide off the final transmission unit by pulling it parallel to the wheel axis.



**OPERATE WITH CAUTION. IF THE FINAL TRANSMISSION UNIT IS INSTALLED ON THE ANTI-VIBRATION BUFFER HOLDER, DO NOT TURN OVER OR ROTATE THE REAR WHEEL SPROCKET SIDE HORIZONTALLY, OR THE FINAL TRANSMISSION UNIT COULD SLIDE OUT AND FALL, AND THE SPROCKET MAY GET DAMAGED.**

**CAUTION**

**DO NOT UNSCREW THE FIVE NUTS. THE FINAL TRANSMISSION UNIT CAN BE SLID OFF COMPLETELY FROM THE ANTI-VIBRATION BUFFER HOLDER.**

- Remove the final transmission unit.

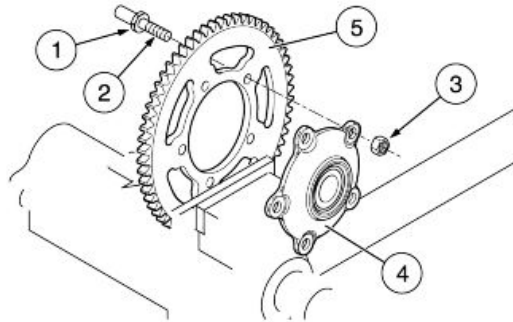
**CAUTION**

**THE FLEXIBLE COUPLINGS REMAIN FITTED ON THEIR HOLDER.**



- Remove all the flexible couplings.

- Using an Allen spanner on the related seat (1), lock the rotation of the threaded pin (2), unscrew and remove the self-locking nut (3) and the threaded pin (2).

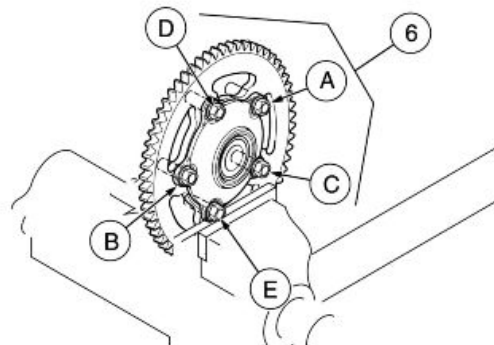


**THE SELF-LOCKING NUTS (3) MUST BE REPLACED EVERY THREE SPROCKET REMOVALS. REPLACE THE SELF-LOCKING NUTS (3) WITH NUTS OF THE SAME TYPE.**

- Remove the sprocket mounting (4).
- Clean the sprocket (5) and the sprocket mounting (4) with fresh detergent.

**Reassembly:**

- Fit the five threaded pins (2) on the sprocket (5).
- Install the sprocket mounting on the sprocket mounting - threaded pin assembly.
- Hand-tighten the five self-locking nuts (3).



**NEVER INSTALL THE FINAL TRANSMISSION UNIT (6) ON THE WHEEL TO TIGHTEN THE SELF-LOCKING NUTS.**





TO PROTECT THE SPROCKET, INSTALL (WOODEN OR ALUMINIUM) PROTECTIONS ON THE VICE JAWS. LOCK THE SPROCKET ONLY IN A VICE. DO NOT LOCK ANY OTHER COMPONENT OF THE FINAL TRANSMISSION UNIT.

- Lock sprocket in a vice.

**CAUTION**

**TO AVOID POTENTIAL DISTORTIONS AND/OR INCORRECT COUPLING, TIGHTEN AS FOLLOWS:**

- Using an Allen key on the specific seat (1), lock the rotation of the threaded pin (2), and applying half the specified torque, tighten the diametrically opposed elements in this sequence: (A) (B) (C) (D) (E).
- Repeat the previous operation, applying the specified tightening torque.

**CAUTION**

**IN THIS WAY THE PRESSURE EXERTED BY THE FIXING ELEMENTS WILL BE EVENLY DISTRIBUTED ON THE COUPLING SURFACE.**

---

## Checking the rear wheel



**CHECK THAT ALL PARTS ARE IN GOOD CONDITION, ESPECIALLY THOSE LISTED AS FOLLOWS.**

### REAR WHEEL BEARINGS

Carry out the check with the bearings fitted on the wheel.

#### ROTATION CHECK

- Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

- Replace both wheel bearings.



**ALWAYS REPLACE BOTH BEARINGS.**

**ALWAYS REPLACE THE BEARINGS WITH OTHERS OF THE SAME TYPE.**

- Check the radial and axial clearance.

**Axial clearance: a minimum axial clearance is allowed.**

**Radial clearance: none.**

If one or both bearings do not fall within the control parameters:

- Replace both wheel bearings.

### REAR WHEEL GASKETS

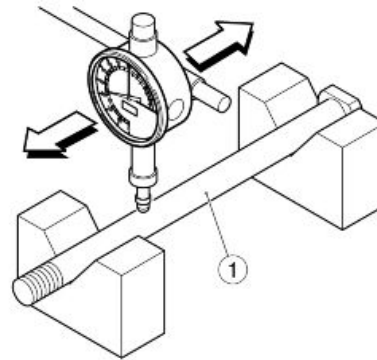
- Check that the gaskets are in good conditions; replace them if they show signs of damage or excessive wear.



**ALWAYS REPLACE BOTH GASKETS.  
ALWAYS REPLACE THE GASKETS WITH OTHERS OF THE SAME TYPE.**

#### REAR wheel axle

- Use a dial gauge to check the wheel axle eccentricity (1). Replace the wheel axle if the eccentricity exceeds the limit value (1).



#### Characteristic

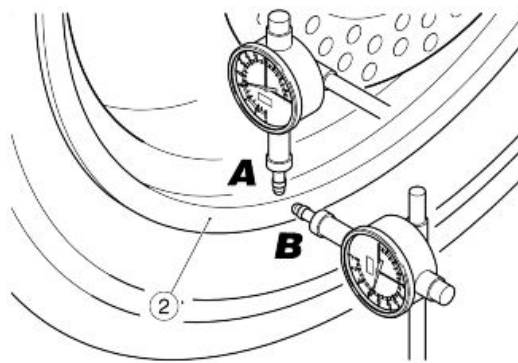
##### Maximum eccentricity:

0.25 mm (0.0098 in)

#### REAR WHEEL RIM

- Using a dial gauge, check that the radial (A) and the axial eccentricity (B) of the rim (2) do not exceed the limit value.

An excessive eccentricity is usually caused by worn or damaged bearings. Replace the rim (2) if after replacing the bearings, the value is not within the specified limit.



#### Characteristic

##### Maximum radial and axial eccentricity:

0.8 mm (0.031 in)

### FINAL DRIVE UNIT BEARINGS

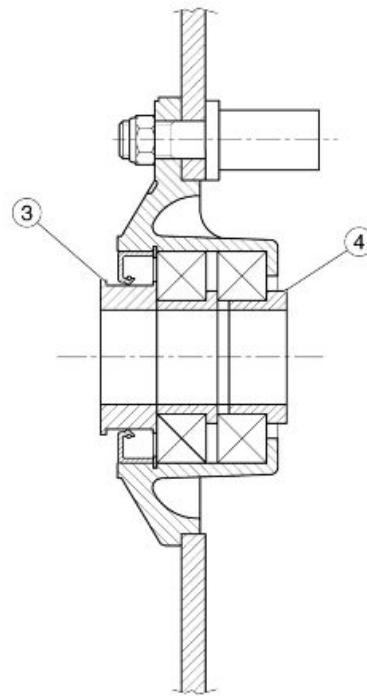
Carry out the check with the bearings fitted on the final drive unit.

#### ROTATION CHECK

- Remove the left spacer (3).
- Remove the right spacer (4).
- Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

- Replace both bearings of the final drive unit.



#### RADIAL AND AXIAL CLEARANCE CHECK

- Check the radial and axial clearance. Axial clearance: a minimum axial clearance is allowed. Radial clearance: none.

If one or both bearings do not fall within the control parameters:

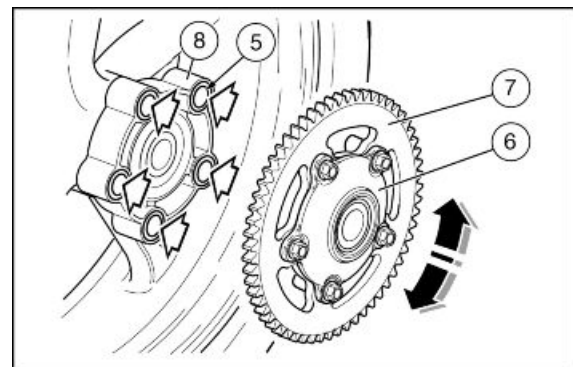
- Replace both bearings of the final drive unit.

### FLEXIBLE COUPLING

Check that the flexible couplings (5) are not damaged or excessively worn.

#### To check:

- Fit the entire final drive unit (6) to the wheel.
- Manually rotate the sprocket (7) to right and left, and check the clearance between the flexible couplings (5) and their holder (8).



#### If there is excessive clearance:

- Replace all the flexible couplings (5).



**ALWAYS REPLACE ALL THE FLEXIBLE COUPLINGS WITH OTHERS OF THE SAME TYPE.**

### SPROCKET

- Check the sprocket (7) tooting for proper conditions.

If there is excessive wear:

- Replace the sprocket.



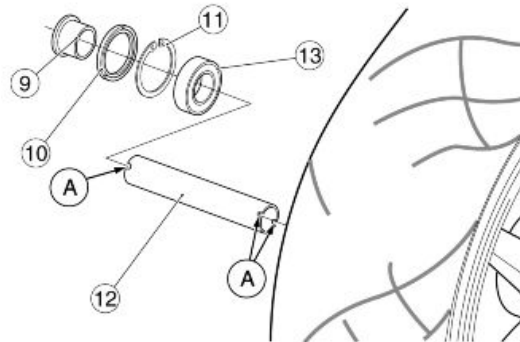
**TO PREVENT EARLY WEAR OF NEW COMPONENTS, REPLACE THE SPROCKET, PINION AND TRANSMISSION CHAIN AT THE SAME TIME.**

### REAR WHEEL BEARINGS

- Remove the rear wheel.
- Clean the two sides of the hub with a cloth.

#### Working from the wheel right side:

- Remove the right spacer (9).
- Remove the sealing gasket (10).
- Remove the circlip (11).



#### CAUTION

THE CIRCLIP (11) IS FITTED ONLY ON THE WHEEL RIGHT SIDE.

The spacer end (12) is fitted with slots (A) for the extractor teeth to pass through.

- Take out the right bearing (13) with the specific extractor.

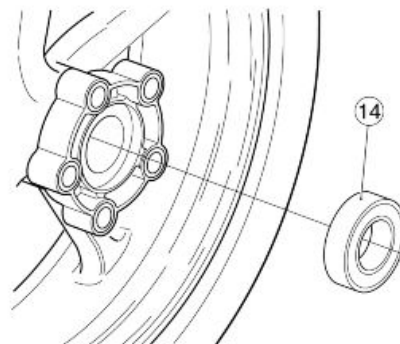
### Specific tooling

#### AP8140180 Extractor for bushings

- Collect the inside spacer (12).

#### Working from the wheel left side:

- Take out the left bearing (16) with the specific extractor.



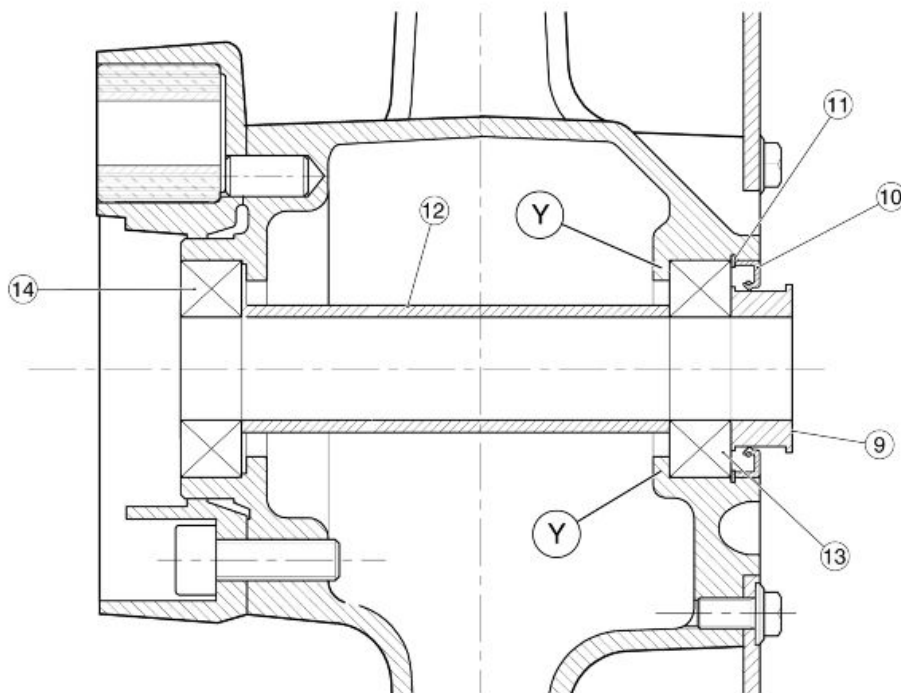
### Specific tooling

#### AP8140180 Extractor for bushings

- Clean the inside of the hub thoroughly.

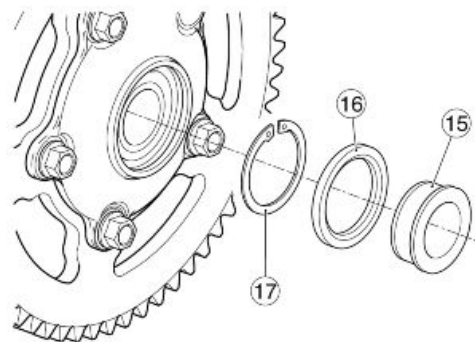
#### CAUTION

**WASH ALL THE PARTS WITH CLEAN DETERGENT.**



#### FINAL DRIVE UNIT - BEARING REMOVAL

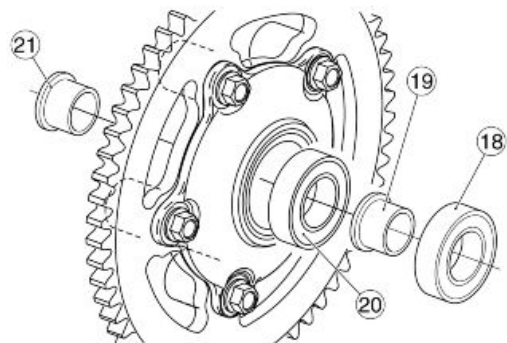
- Remove the final drive unit.
- Clean the two sides of the hub with a cloth.
- Remove the left spacer (15).
- Remove the sealing gasket (16).
- Remove the circlip (17).



#### CAUTION

THE CIRCLIP (17) IS FITTED ONLY ON THE FINAL DRIVE UNIT, LEFT SIDE.

- Remove the left bearing (18) with the specific extractor.
- Collect the inside spacer (19).
- Remove the right bearing (20) with the specific extractor.
- Retrieve the right hand spacer (21).
- Clean the inside of the hub thoroughly.

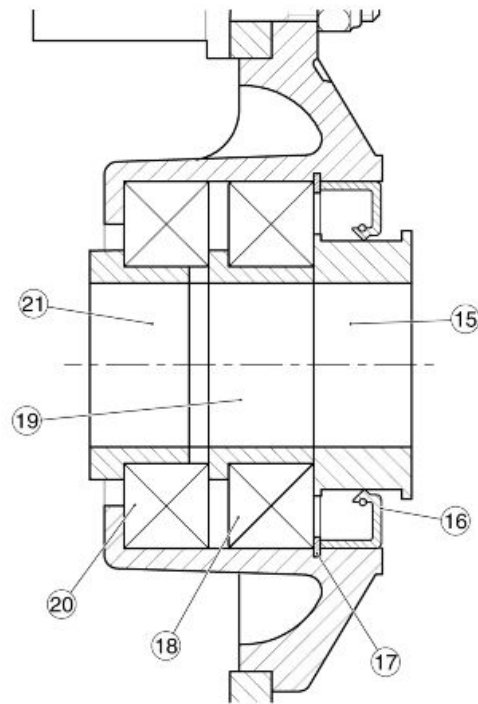


#### CAUTION

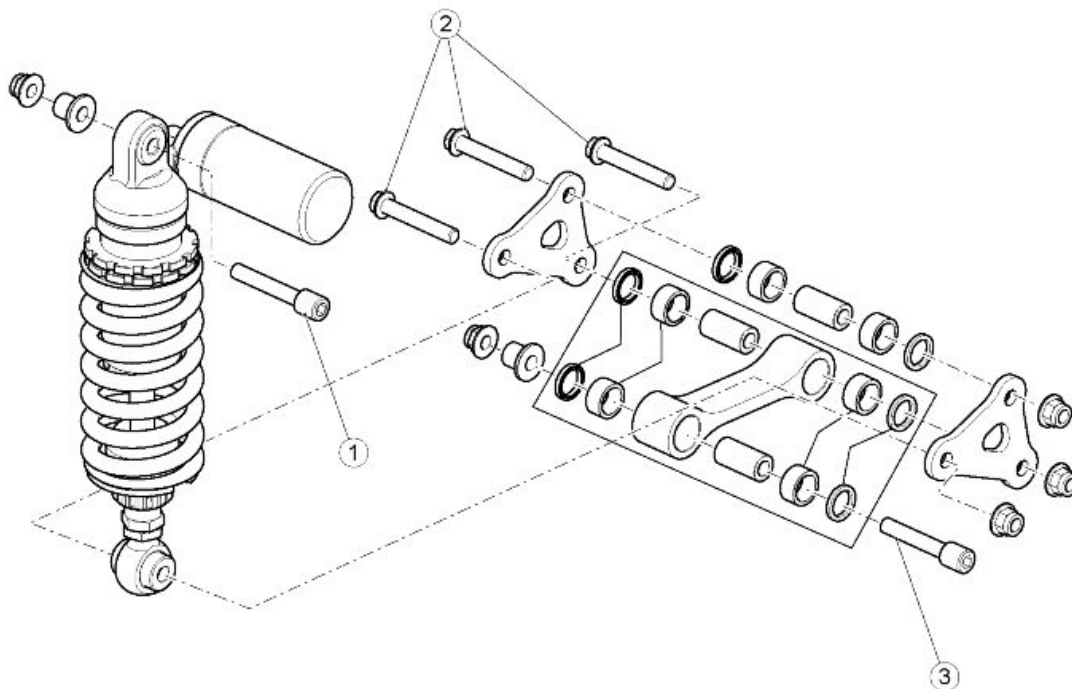
WASH ALL THE PARTS WITH CLEAN DETERGENT.

#### Specific tooling

AP8140180 Extractor for bushings



**Shock absorbers**



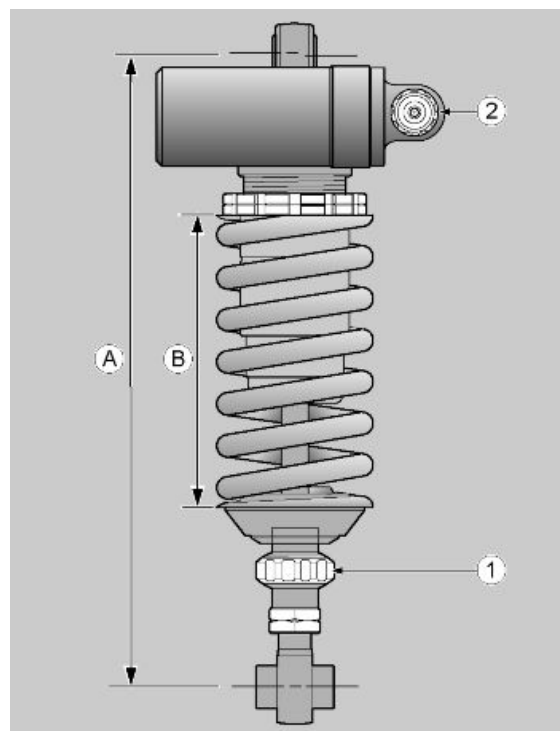
**REAR SHOCK ABSORBER**

pos.	Description	Type	Quantity	Torque	Notes
1	Upper shock absorber fixing screw	M10	1	50 Nm (36.88 lbf ft)	-
2	Dual connecting rod fixing screw	M10	3	50 Nm (36.88 lbf ft)	-
3	Screw fastening single connecting rod to chassis	M10	1	50 Nm (36.88 lbf ft)	-

## Adjusting



**SPORT SETTINGS MAY BE USED ONLY FOR OFFICIAL COMPETITIONS TO BE CARRIED OUT ON TRACKS, AWAY FROM NORMAL ROAD TRAFFIC AND WITH THE AUTHORISATION OF THE RELEVANT AUTHORITIES.**



### **REAR SHOCK ABSORBER - STANDARD ADJUSTMENT (FOR ROAD USE ONLY)**

Specification	Desc./Quantity
Shock absorber centre-to-centre distance (A)	310 +/- 1.5 mm (12.20 +/- 0.059 in)
(preloaded) Spring (B) length	148.5 +/- 1.5 mm (5.85 +/- 0.059 in)
Rebound adjustment, ring nut (1)	open (**) 20 ± 1 clicks from fully closed (*)
Compression adjustment, knob (2)	open (**) 15 +/- 2 clicks from fully closed (*)
Theoretical shock absorber failure (motorcycle + rider 70kg - 154lb) (C)	25 +/- 1 mm (0.98 +/- 0.039 in)

### **REAR SHOCK ABSORBER - RACING ADJUSTMENT RANGE (TRACK USE ONLY)**

Specification	Desc./Quantity
Shock absorber centre-to-centre distance (A)	311 +/- 1 mm (12.24 +/- 0.039 in)
(preloaded) Spring (B) length	145.5 mm +/- 1.5 mm (5.73 +/- 0.059 in)
Rebound adjustment, ring nut (1)	open (**) 16 - 18 clicks from fully closed (*)
Compression adjustment, knob (2)	open (**) 8 - 10 clicks from fully closed (*)
Theoretical shock absorber failure (motorcycle + rider 70kg - 154lb) (C)	19 +/- 1 mm (0.75 +/- 0.039 in)

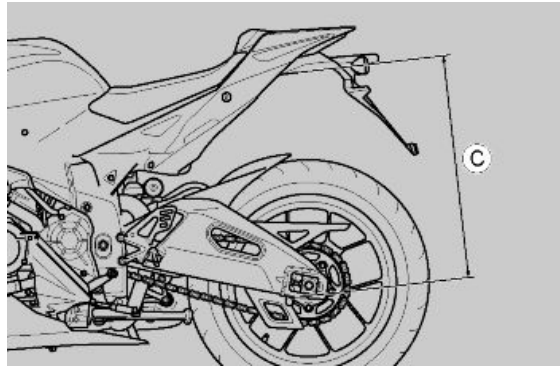
(\*) = clockwise

(\*\*) = anticlockwise

**NOTE**

**TO CHECK FOR REAR FAILURE, MEASURE THE DIFFERENCE BETWEEN THE FOLLOWING TWO FIXED POINTS:**

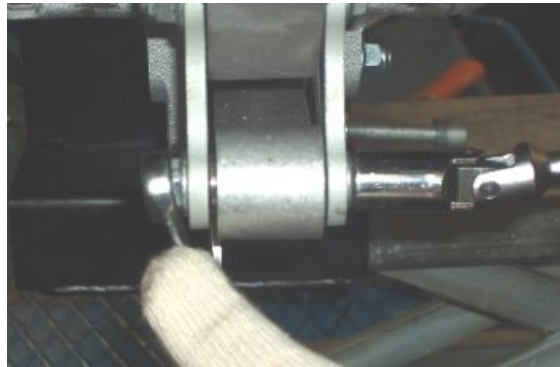
- CENTRE OF THE FRONT SCREW FASTENING THE LICENSE PLATE HOLDER TO UNDERTAIL SECTION AND
- UPPER CORNER OF THE SCREW FASTENING THE REAR STAND PIN ON THE SWING-ARM

**Removing**

- Secure the vehicle using a belt and hoist.
- Remove the silencer and the right hand rider footpeg.
- Unscrew and remove the lower screw and retrieve the nut.



- Unscrew and remove the screw fixing the dual linkage rod to the single linkage.
- Retrieve the nut.



- Unscrew and remove the upper screw and retrieve the nut.
- Remove the shock absorber from the right side.

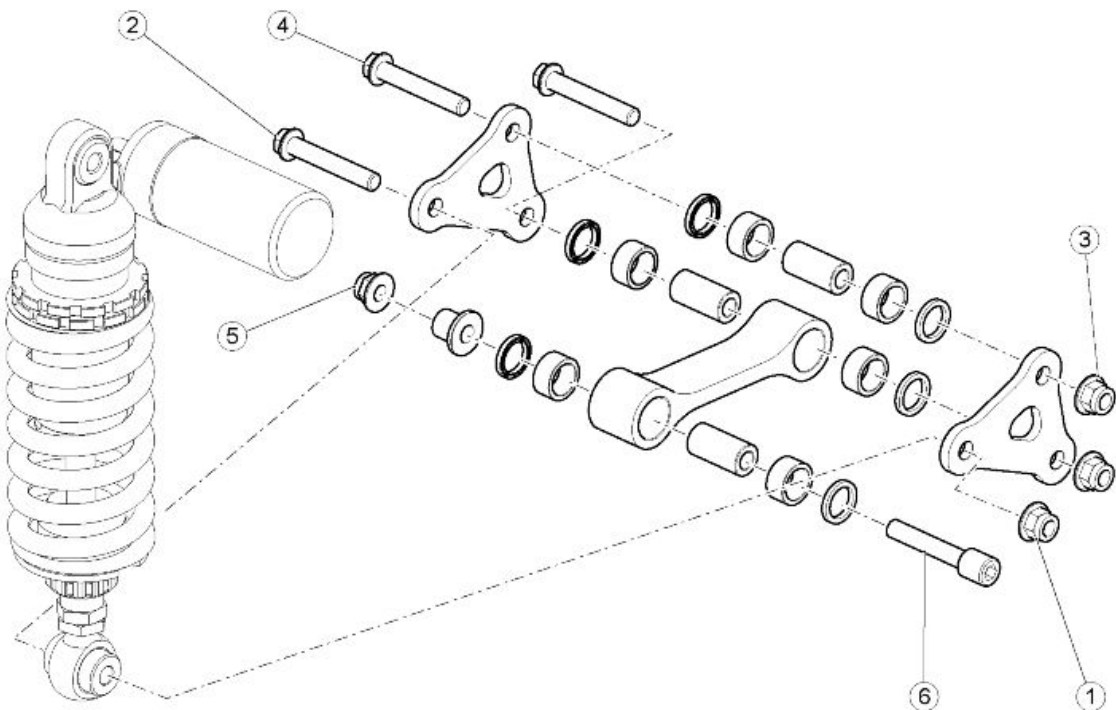






## Linkages

### Removing



- Working from the left side of the vehicle, loosen and remove the nut (1).
- Slide off the screw (2) from the opposite side.
- Loosen and remove the nut (3).
- Slide off the screw (4) from the opposite side.
- Loosen and remove the nut (5).
- Slide off the screw (6) from the opposite side.
- Remove the complete suspension connecting rod assembly unit.

**CAUTION**

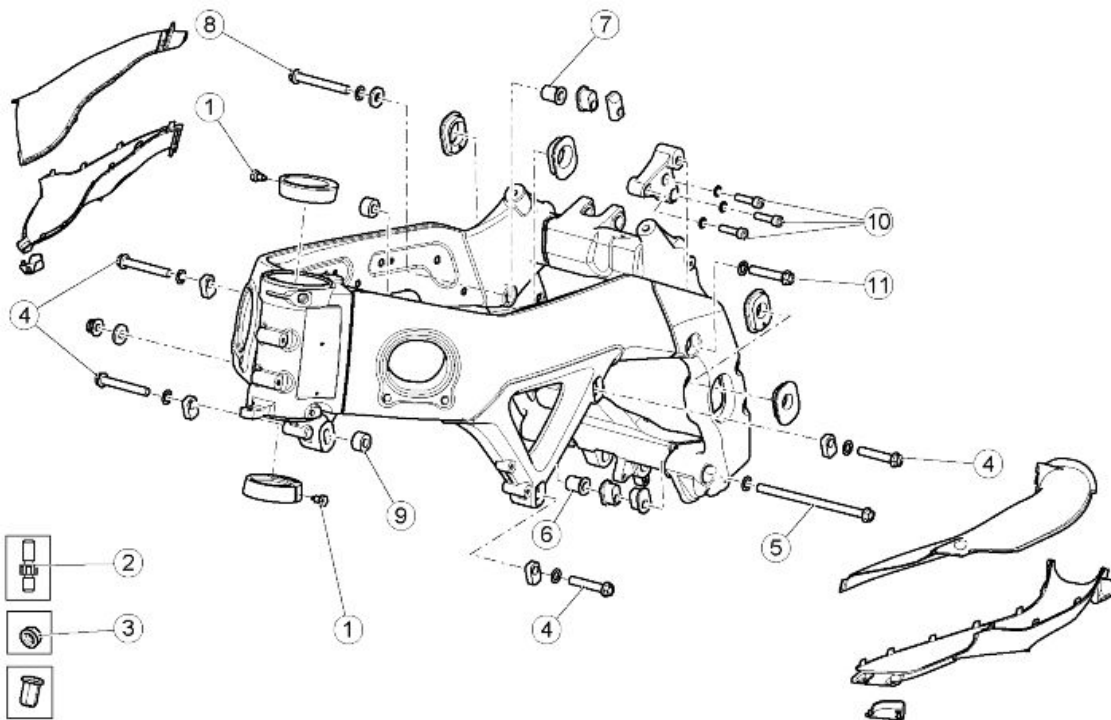
**UPON REFITTING, GREASE THE FULCRUM POINTS ON THE CONNECTING ROD ASSEMBLY. PAY SPECIAL ATTENTION TO THE CORRECT POSITIONING OF THE PARTS AND CHECK SEVERAL TIMES THAT JOINTS MOVE SMOOTHLY.**

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# INDEX OF TOPICS

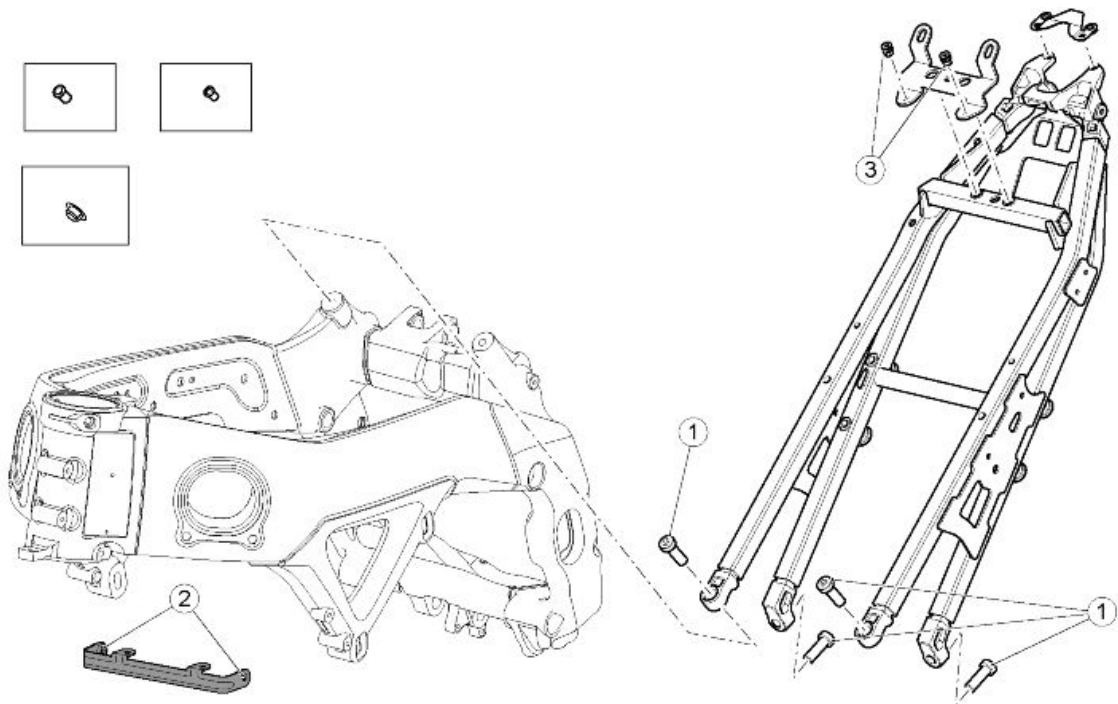
**CHASSIS**

**CHAS**



**FRONT CHASSIS**

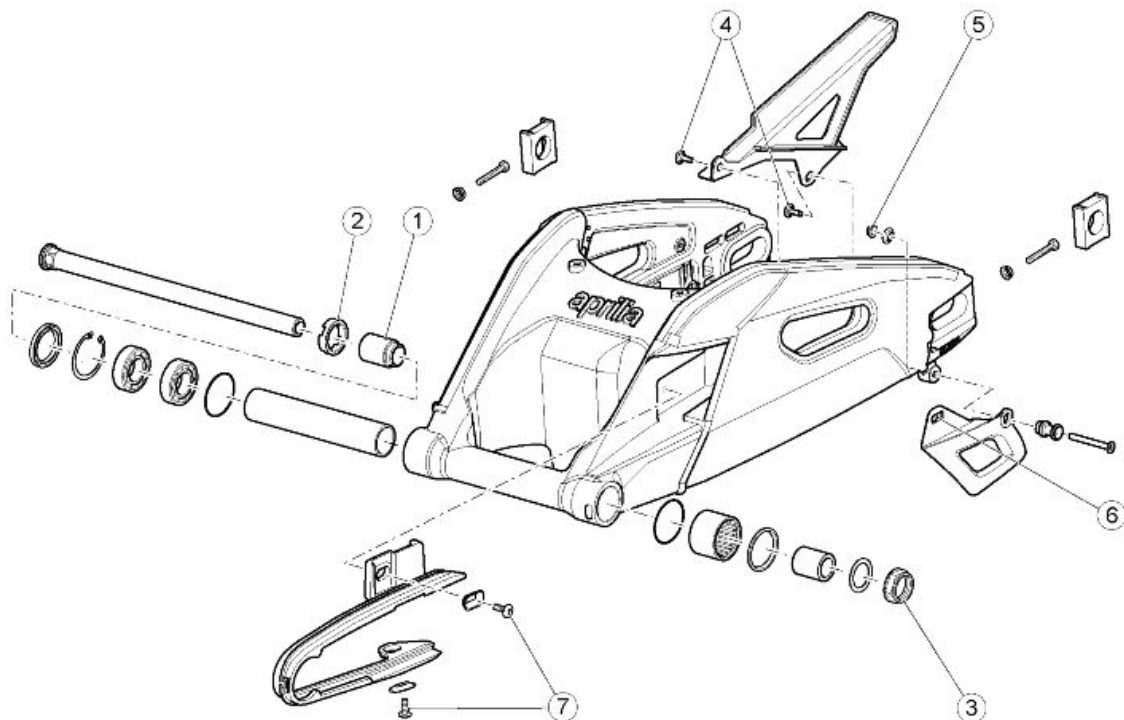
pos.	Description	Type	Quantity	Torque	Notes
1	Headstock locator dowel	M8x1	2	10 Nm (7.37 lbf ft)	-
2	Threaded intake duct fastener pins	M6	2 + 2	4 Nm (2.95 lbf ft)	Loct. 243
3	Intake duct fixing nuts	M6	2 + 2	Manual	-
4	Front mounts	M10	2 + 2	50 Nm (36.88 lbf ft)	-
5	Lower rear mount	M10	1	50 Nm (36.88 lbf ft)	-
6	Lower rear right hand adjuster screw bushing	M18x1.5	1	12 Nm (8.85 lbf ft)	-
7	Upper rear right hand adjuster screw bushing	M18x1.5	1	12 Nm (8.85 lbf ft)	-
8	Upper rear right hand mount	M10	1	50 Nm (36.88 lbf ft)	-
9	Right fairing spacer	M6	1	10 Nm (7.37 lbf ft)	Loct. 243
10	Upper rear left hand engine mount fastener screws	M8	3	25 Nm (18.44 lbf ft)	-
11	Upper rear mount	M10	1	50 Nm (36.88 lbf ft)	-
-	Screw fastening the ground cable to the left side chassis	M6	1	6 Nm (4.42 lbf ft)	-



**REAR CHASSIS**

pos.	Description	Type	Quantity	Torque	Notes
1	Saddle mounting fixing screws	M10	4	50 Nm (36.88 lbf ft)	-
2	Screws fastening oil radiator mounting bracket to engine	M6	2	8 Nm (5.9 lbf ft)	-
3	Passenger saddle and saddle cover catch plate fixing screws	M6	2	8 Nm (5.9 lbf ft)	-

**Swinging arm**

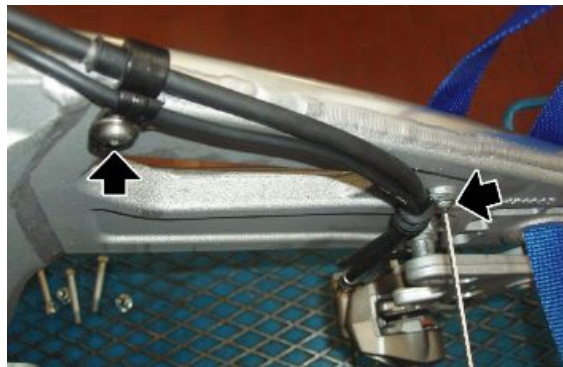


**REAR SWINGARM**

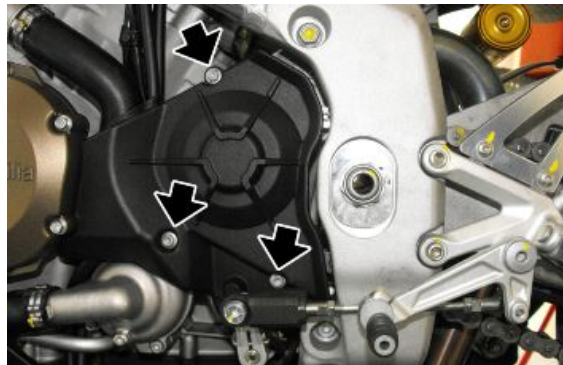
pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm adjuster screw bushing	M30x1.5	1	12 Nm (8.85 lbf ft)	-
2	Swingarm ring nut	M30x1.5	1	60 Nm (44.25 lbf ft)	-
3	Swingarm pin nut	M20x1.5	1	65 Nm (47.94 lbf ft)	AGIP GREASE SM2
4	Chain casing fixing screws	M5	2	4 Nm (2.95 lbf ft)	-
5	Front chain guide fixing screw	M5	1	4 Nm (2.95 lbf ft)	-
6	Rear chain guide fixing nut	M6	1	7 Nm (5.16 lbf ft)	-
7	Chain skid fixing screws	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower chain slider fixing screws	M6	2	10 Nm (7.37 lbf ft)	-
-	Chain guide fixing screw	M6	1	8 Nm (5.90 lbf ft)	-

**Removing**

- Remove the exhaust system.
- Remove the rear mudguard.
- Remove the rear shock absorber.
- Remove the rear wheel.
- Secure the rear part of the vehicle with a belt and a hoist.
- Unscrew and remove the two pipe grommet screws.
- Remove the rear brake calliper off the swingarm.



- Unscrew and remove the three screws and remove the pinion cover.



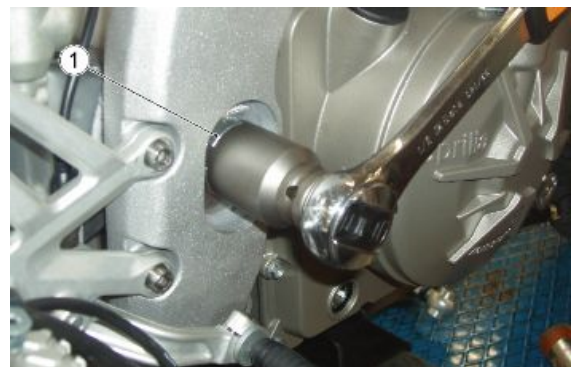
- Unscrew and remove the screw and retrieve the washer.
- Slide off the pinion from the chain and remove.



- Unscrew and remove the nut and retrieve the washer.



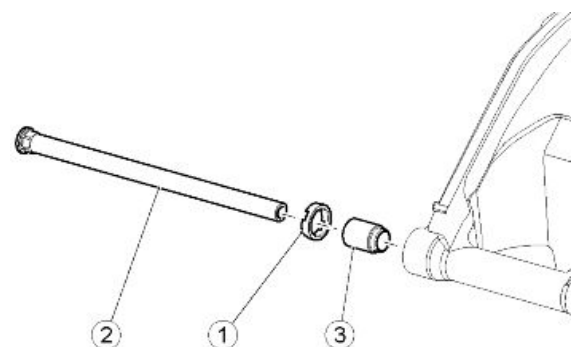
- Working from the right side, loosen and remove the locking ring nut.



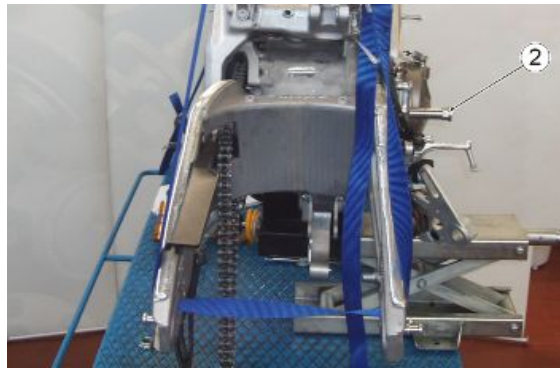
- Turn the swingarm pin (2) anticlockwise, which turns and loosens the adjustment bushing (3) completely.



**REMOVAL SHOULD BE CARRIED OUT WITH UTMOST CAUTION. SUPPORT THE SWINGARM FROM THE FRONT TO AVOID ACCIDENTAL FALLS. PLACE A WOODEN SUPPORT UNDER THE FRONT PART OF THE REAR SWINGARM TO PREVENT IT FROM LOWERING AND TO KEEP IT UPRIGHT.**



- Place a mounting under the front part of the swingarm.
- Support the swingarm from the front.
- Remove the swingarm pin (2) from the right hand side.
- Support the front part of the swingarm and be ready to accompany it.
- Using the rear mounting stand, remove the swingarm completely from the vehicle from the rear.
- Remove the adjustment bushing from the swingarm pin (2).



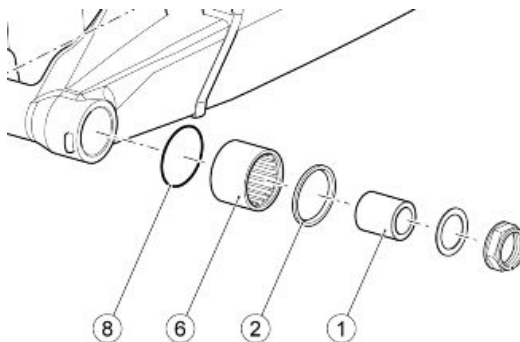
**UPON REMOVING THE REAR SWINGARM PAY ATTENTION NOT TO JAM THE GEARING CHAIN.**

- If necessary, use a specific tool to remove a pin from the drive chain.
- Open and remove the chain.



## Checking

- Remove the swingarm.
- Clean the two sides of the bearing seats with a cloth.
- Slide off the bushing (1).
- Remove the sealing gasket (2).
- Remove the sealing gasket (3).
- Remove the circlip (4).
- Use the specific special tool to extract the two bearings (5) and the roller bearing (6).

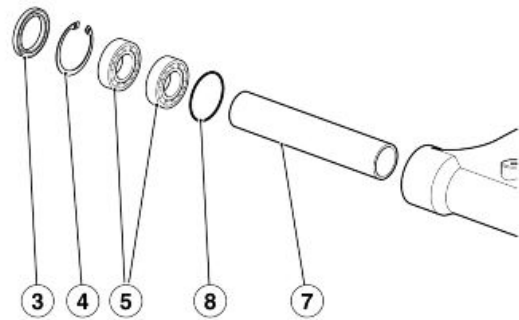




CHECK AND, IF REQUIRED, REPLACE THE BEARINGS AFTER EVERY BEARING REMOVAL.

### Specific tooling

AP8140180 Extractor for bushings



- Remove the inner spacer (7) and collect the two OR seals (8).
- Carefully clean inside the bearing seat.

#### CAUTION

WASH ALL THE PARTS WITH CLEAN DETERGENT.



UPON REFITTING, USE A BUFFER WITH A DIAMETER EQUAL TO THE EXTERNAL RING OF THE BEARINGS TO INSERT THE BEARINGS. DO NOT HIT THE BALLS AND/OR THE INTERNAL RING.



CHECK THAT ALL PARTS ARE IN GOOD CONDITION, ESPECIALLY THOSE LISTED AS FOLLOWS.

### SWINGARM BEARINGS

Carry out the check with the bearings fitted on the swingarm.

#### ROTATION CHECK

- Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

- Replace both swingarm bearings.

#### RADIAL AND AXIAL CLEARANCE CHECK

- Check the radial and axial clearance.

**Axial clearance: a minimum axial clearance is allowed.**

**Radial clearance: none.**

If one or both bearings do not fall within the control parameters:

- Replace both swingarm bearings.



**ALWAYS REPLACE BOTH BEARINGS.  
ALWAYS REPLACE THE BEARINGS WITH OTHERS OF THE SAME TYPE.**

### SWINGARM SEALS

- Check that the gaskets are in good conditions; replace them if they show signs of damage or excessive wear.

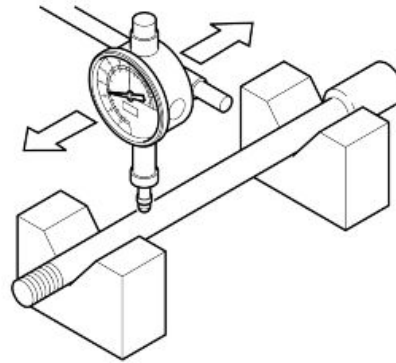


**ALWAYS REPLACE BOTH GASKETS.  
ALWAYS REPLACE THE GASKETS WITH OTHERS OF THE SAME TYPE.**

#### SWINGARM PIN

- Use a dial gauge to check the swingarm pin eccentricity. If the eccentricity exceeds the limit value, replace the swingarm pin.

**Maximum eccentricity: 0.3 mm (0.012 in)**



## Installing

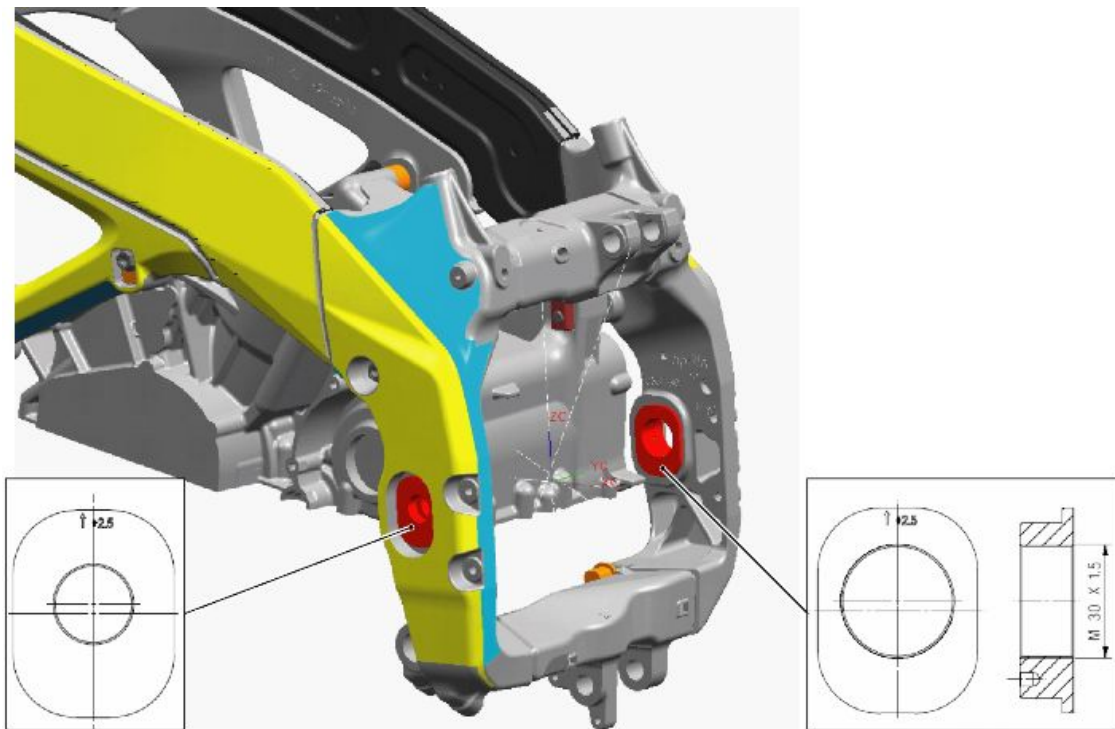
The height of the swingarm pin relative to the chassis is adjusted with special inserts installed in the respective seats in the chassis. The hole is offset by +2.5 mm (+0.098 in) relative to the centreline of the insert, as a result the swingarm is in the high position.

There are four inserts, subdivided as follows:

- Inner/outer
- Right/left



**THE TWO LEFT SIDE SWINGARM PIN INSERTS ARE THE SAME.  
THE TWO RIGHT SIDE SWINGARM PIN INSERTS ARE DIFFERENT.**



- Refit the swingarm height adjustment inserts if removed, bearing in mind that the arrow must face upward.

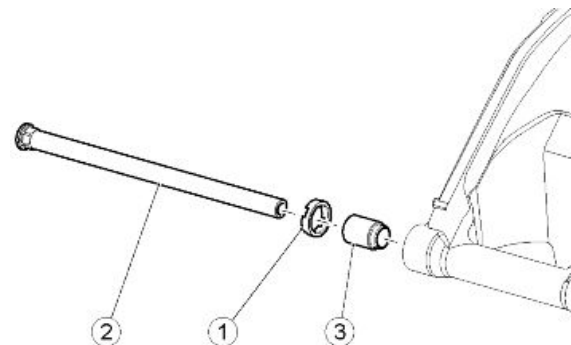
**WARNING**

**PAY PARTICULAR ATTENTION TO THE DIRECTION OF THE INSERTS WHEN REFITTING. INCORRECT ASSEMBLY MAY CAUSE SEVERE DAMAGE TO THE VEHICLE. THE ARROW MUST FACE UPWARD.**

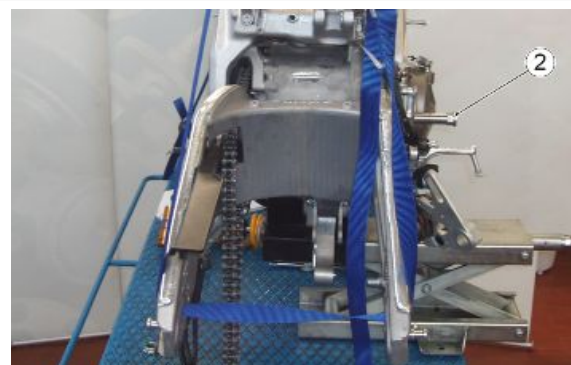
- Spread a thin layer of lubricating grease all along the swingarm pin.
- Fit the adjustment bushing (3) to its seat and tighten it manually.

**CAUTION**

**THE ADJUSTMENT BUSHING (3) MUST NOT PROTRUDE BEYOND THE CHASSIS INTERNAL EDGE.**



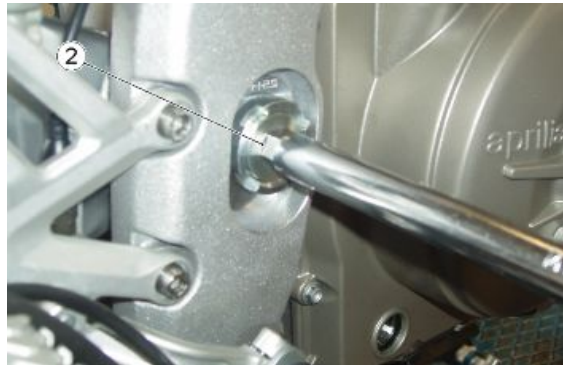
- Place a wooden support under the front of the swingarm to prevent it from dropping and hold in position.
- Support the swingarm from the front; move it into position so that the holes are aligned and simultaneously insert the pin (2) fully.



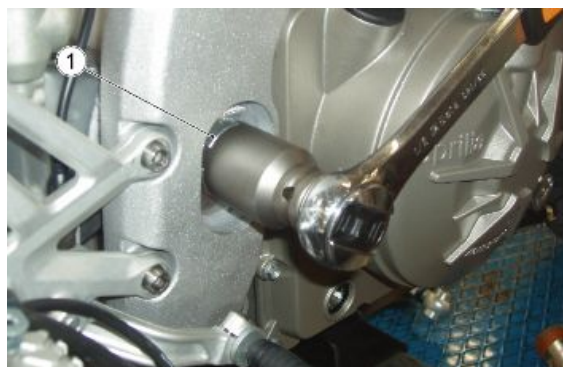
- Ensure that the hexagonal area on the pin head (2) is inserted correctly in the hexagonal seat inside the adjustment bushing (3).
  - Fit and hand-tighten the counter-lock ring nut by a few turns (1).
- 
- Put some grease on the swingarm pin nut as indicated



- Fit the washer and the swingarm pin fixing nut on the pin and hand-tighten the nut.
- Working from the right hand side of the vehicle, turn the swingarm pin (2) clockwise. This turns the adjustment bushing (3), driving the swingarm in until fully seated.



- Tighten the locking ring nut (1).



- Screw the nut.



- Refit the chain on the drive pinion

**CAUTION**

**APPLY LOCTITE ANTI-SEIZE ON THE INTERNAL TOOTHING OF THE TRANSMISSION PINION.**



- Fit the pinion and the chain on the shaft.

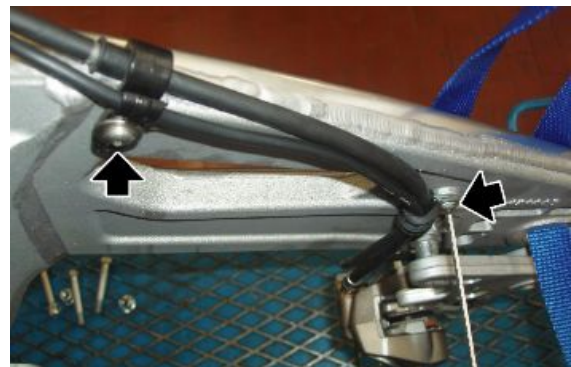
**CAUTION**

**APPLY LOCTITE 243 ON THE SCREW THREAD.**

- Fit the washer on the screw
- Tighten the screw.



- Install the rear shock absorber and the linkages.
- Fit the rear brake calliper plate.
- Fasten the two pipe grommets on the swingarm



- Install the rear wheel and the exhaust system.
- Fit the pinion casing.
- Adjust the chain tension

## Drive chain

### Adjusting

The vehicle is fitted with an endless chain, without master link.

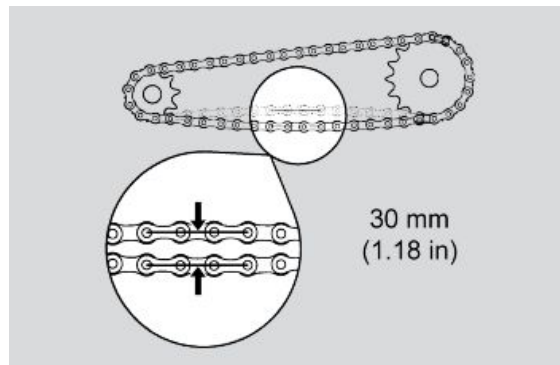
#### NOTE

**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.**

#### CLEARANCE CHECK

##### To check clearance:

- Shut off the engine.
- Rest the vehicle on its stand.
- Engage neutral gear.
- Check that the vertical oscillation at a point between the pinion and the sprocket on the lower branch of the chain is around 30 mm (1,18 in).
- Move the vehicle forward so as to check vertical oscillation in other positions too. clearance should remain constant at all wheel rotation phases.



#### ADJUSTMENT

#### CAUTION

**GET A SPECIFIC REAR SERVICE STAND (OPT) TO ADJUST THE CHAIN.**

If you need to adjust chain tension after the check:

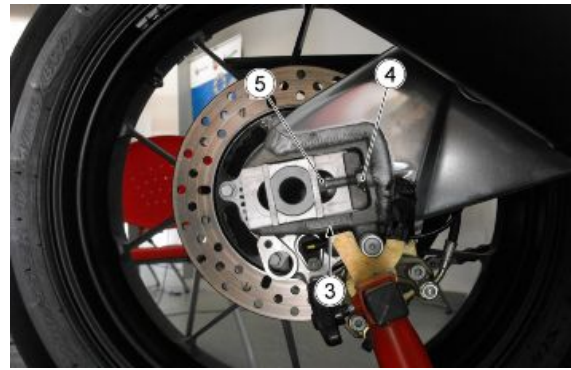
- Place the vehicle on its rear service stand (OPT).
- Loosen the nut (1) completely.
- Loosen both lock nuts (4).
- Actuate on the adjuster screws (5) and adjust the chain clearance checking that the references (2-3) match on both sides of the vehicle.



- Tighten both lock nuts (4).
- Tighten the nut (1).
- Check chain clearance.

**CAUTION**

TO ENSURE THAT THE WHEEL IS CORRECTLY CENTRED, THERE ARE FIXED REFERENCE MARKINGS (2-3) INSIDE THE CHAIN TENSIONER SLIDER SEATS ON THE SWINGARMS, IN FRONT OF THE WHEEL AXLE.

**CHECKING THE CHAIN, THE PINION AND THE SPROCKET FOR WEAR**

Furthermore, check the following parts and make sure the chain, the pinion and the sprocket do not show:

- damaged rollers;
- loosened pins;
- dry, rusty, flattened or jammed chain links;
- excessive wear;
- missing sealing rings;
- excessively worn or damaged pinion or sprocket teeth.



**IF THE CHAIN ROLLERS ARE DAMAGED, THE PINS ARE LOOSE AND/OR THE SEAL RINGS ARE MISSING OR DAMAGED, THE WHOLE CHAIN UNIT (PINION, SPROCKET AND CHAIN) SHOULD BE REPLACED.**

**LUBRICATE THE CHAIN ON A REGULAR BASIS, PARTICULARLY IF YOU DETECT DRY OR RUSTY PARTS.**

**FLATTENED OR JAMMED CHAIN LINKS SHOULD BE LUBRICATED AND GOOD OPERATING CONDITIONS RESTORED.**



**THE GEARING CHAIN HAS SEALING RINGS AMONG THE LINKS THAT KEEP THE GREASE INSIDE.**

**ADJUST, LUBRICATE, WASH AND REPLACE THE CHAIN WITH UTMOST CAUTION.**

**CLEANING AND LUBRICATION**

Do not wash the chain with water jets, steam jets, high-pressure water jets and highly flammable solvents.

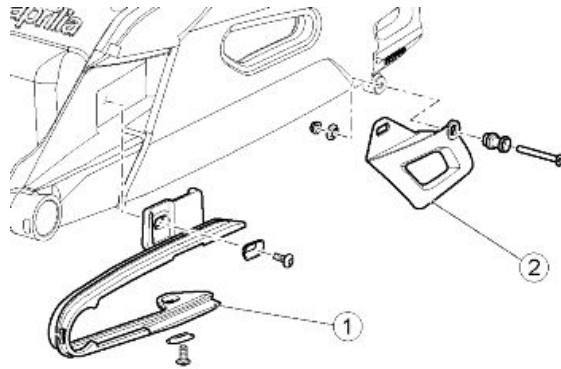
- Wash the chain with fuel oil or kerosene. Maintenance operations should be more frequent if there are signs of quick rust.

Lubricate the chain at the intervals specified on the routine maintenance table and whenever necessary.

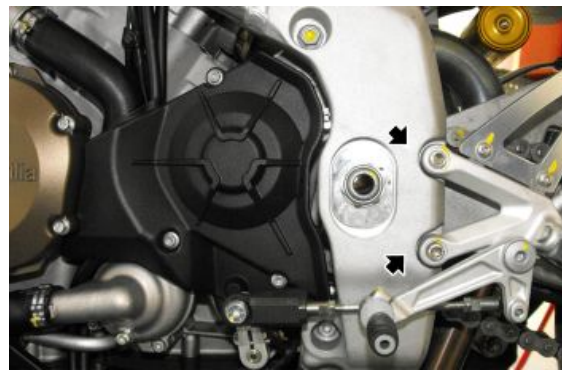
- Wash the chain, allow to dry and lubricate with spray grease for sealed chains.

## Chain sliders

- Place the vehicle on its OPTIONAL rear service stand.
- Check that the pad (1) is not worn or damaged. Replace it with a new one if it is.
- Check the chain guide (2) for wear.



- Unscrew and remove the two screws from the left rider footpeg protection.



- Remove the rear wheel.
- Unscrew and remove the upper screw fixing the chain slider and retrieve the washer.



### See also

[Removing the rear wheel](#)

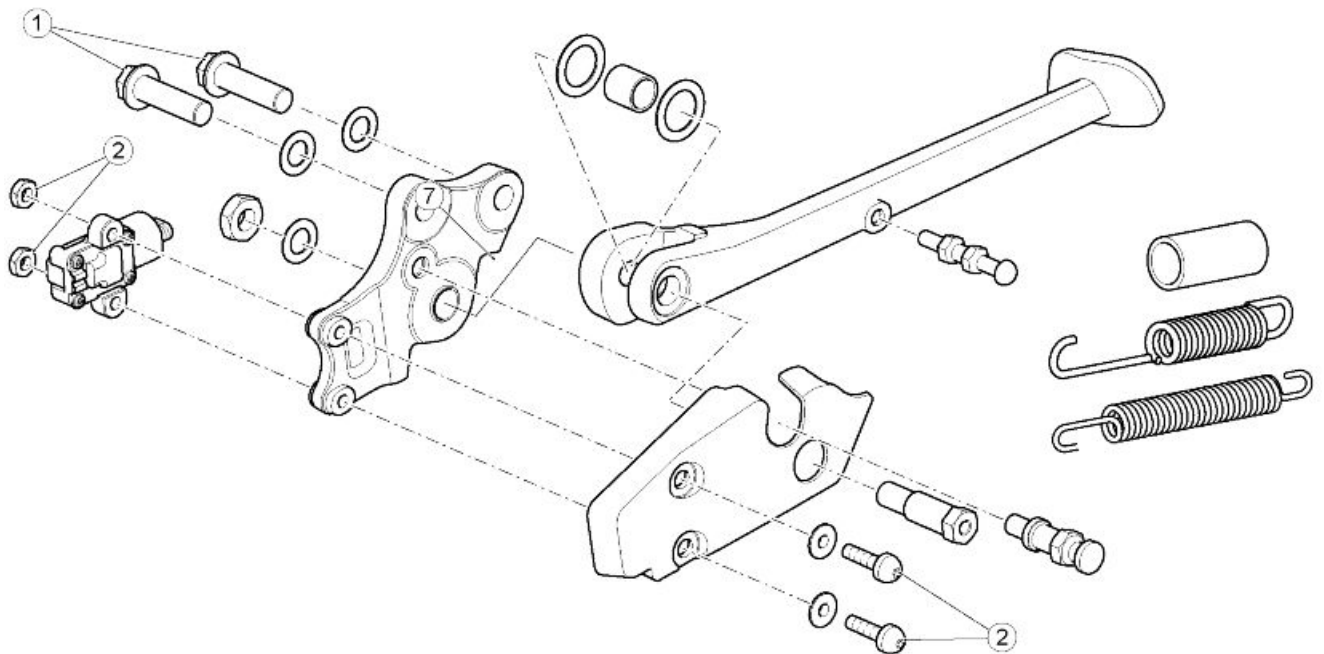


- Unscrew and remove the lower screw fixing the chain pad and retrieve the washers.



- Remove the chain skid (1).

**Stand**



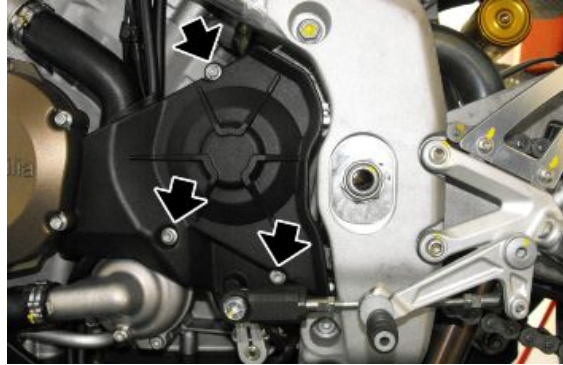
**SIDE STAND**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the stand to the chassis	M10	2	45 Nm (33.19 lbf ft)	Loct. 243
2	Linear switch retainer	M5	2	4 Nm (2.95 lbf ft)	-
-	Rear stand bushing fastening screws	M6	2	7 Nm (5.16 lbf ft)	-

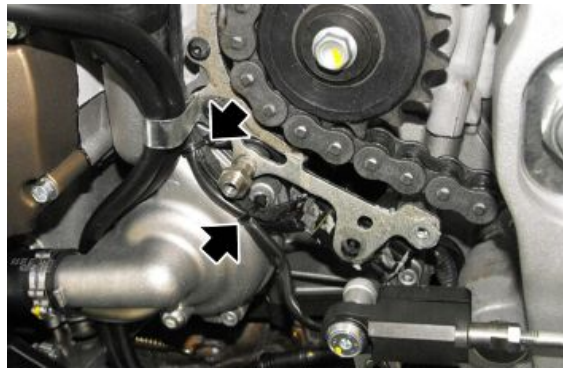
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## Side stand

- Remove the fuel tank.
- Remove the pinion cover.



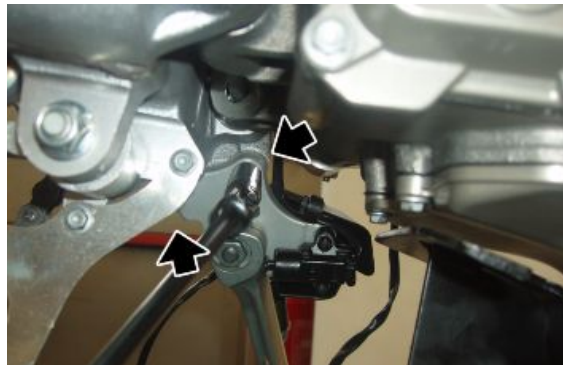
- Remove the clamps.



- Disconnect the stand connector.

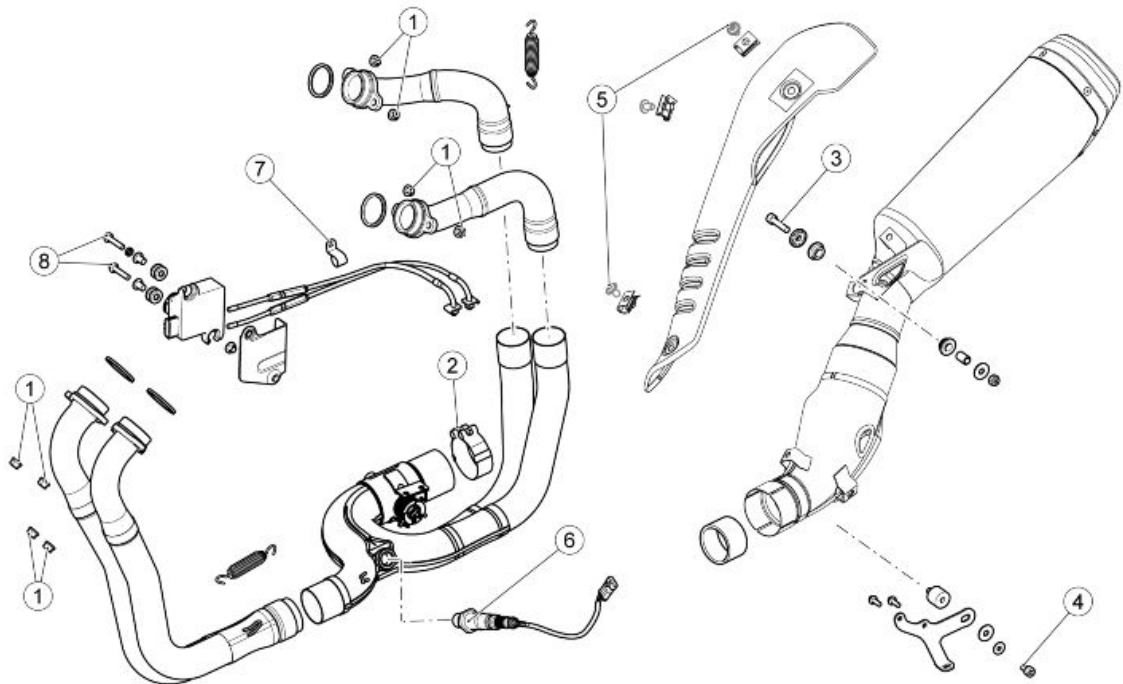


- 
- Unscrew and remove the two screws.



- Remove the side stand.
-

Exhaust

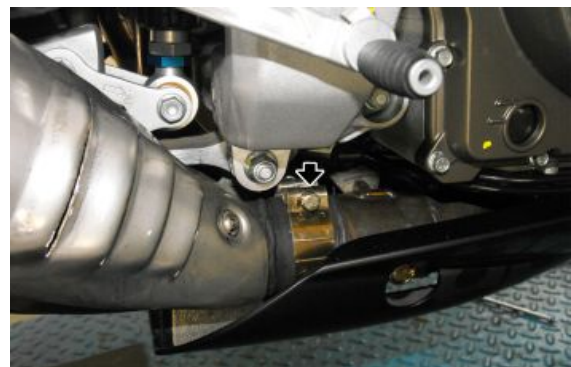


**EXHAUST**

pos.	Description	Type	Quantity	Torque	Notes
1	Exhaust manifold flange fixing nuts	M7	8	13 Nm (9.59 lbf ft)	-
2	Silencer clamp fixing screw	M6	1	10 Nm (7.37 lbf ft)	-
3	Screw fastening silencer to right hand footpeg mounting	M8	1	25 Nm (18.44 lbf ft)	-
4	Screw fastening silencer to central lower fairing bracket	M8	1	20 Nm (14.75 lbf ft)	-
5	Cosmetic silencer shield fixing screw	M5	2	5 Nm (3.69 lbf ft)	-
6	Oxygen sensor fastener	M18x1.5	1	38 Nm (28.03 lbf ft)	-
7	Fastener screw for cable grommet for exhaust butterfly valve cables	M6	1	10 Nm (7.37 lbf ft)	-
8	Exhaust butterfly valve actuator fixing screws	M6	2	10 Nm (7.37 lbf ft)	-

Removing the tail pipe

- Loosen the sealing clamp between the exhaust and the central manifold.



- Unscrew and remove the front screw fastening the exhaust to the chassis.



- Unscrew and remove the upper attachment screw fixing the exhaust pipe to the chassis; retrieve the collar, the washer and the nut.



**DURING THIS OPERATION SUPPORT THE EXHAUST PIPE SO THAT IT DOES NOT FALL.**



- Remove the exhaust end.

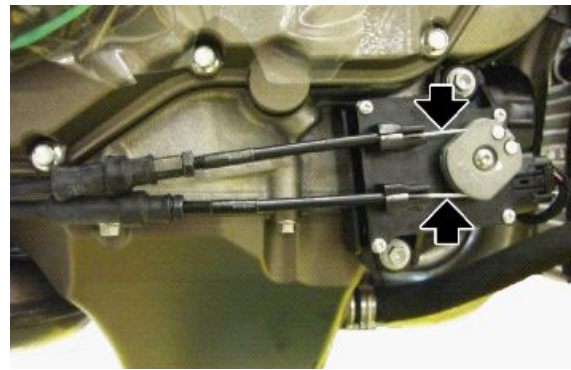


## Removing the catalytic converter

- Remove the exhaust end.
- Remove the front exhaust manifold.
- Remove the pinion crankcase
- Disconnect the lambda sensor connector.
- Release the oxygen sensor cable harness from the clamps.



- Disconnect the two exhaust butterfly valve control cables



- Unscrew and remove the screw from the cable grommet for the two exhaust butterfly valve control cables.

**CAUTION**

**ON REASSEMBLY, POSITION AND TIGHTEN THE SCREW BUT NOT THE CABLE GROMMET.**



- Release the springs between the rear exhaust manifolds and the catalytic converter
- Remove the catalytic converter.

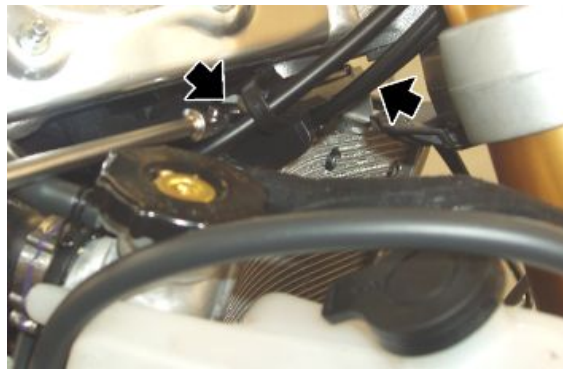


## Removing the exhaust manifold

### 2 IN 1 FRONT EXHAUST MANIFOLD

- Remove the front underfairings.
- Remove the hand grip position sensor control unit.

- Unscrew and remove both radiator upper fixing screws.



### See also

[Fairing mounting panels](#)  
[Twistgrip position sensor](#)

- Release the springs between the front exhaust manifolds and the catalytic converter



- Move the radiator forward.
- Unscrew and remove the four nuts fastening the front exhaust manifold and retrieve the washers.



- Remove the front exhaust manifold.



---

**REAR EXHAUST MANIFOLDS**

- Remove the catalytic converter.
- Remove the left rider footpeg.
- Unscrew and remove the four nuts fastening the rear exhaust manifolds and retrieve the washers.
- Remove both rear exhaust manifolds.



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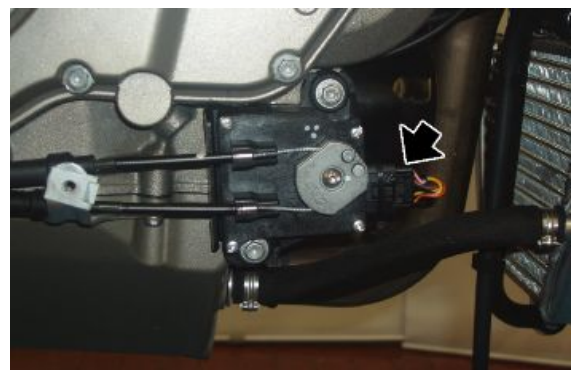
**Butterfly valve in exhaust**

To check correct operation and calibration of the exhaust valve, see electrical system section.

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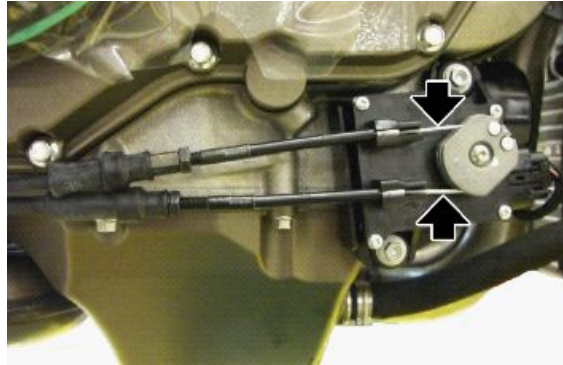
**REMOVING THE EXHAUST THROTTLE VALVE**

- Remove the fairing lug.
- Disconnect the connector from the valve actuator motor.

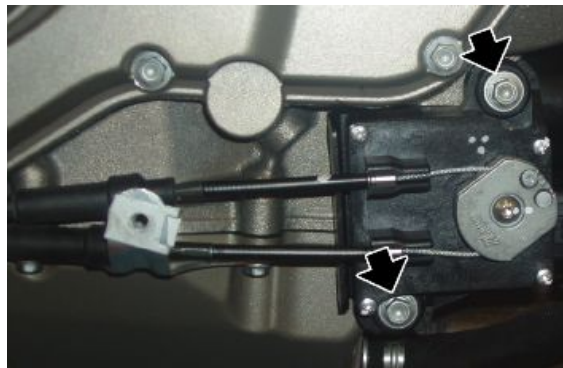
**See also**

[Butterfly valve in exhaust](#)  
[Lower cowl](#)

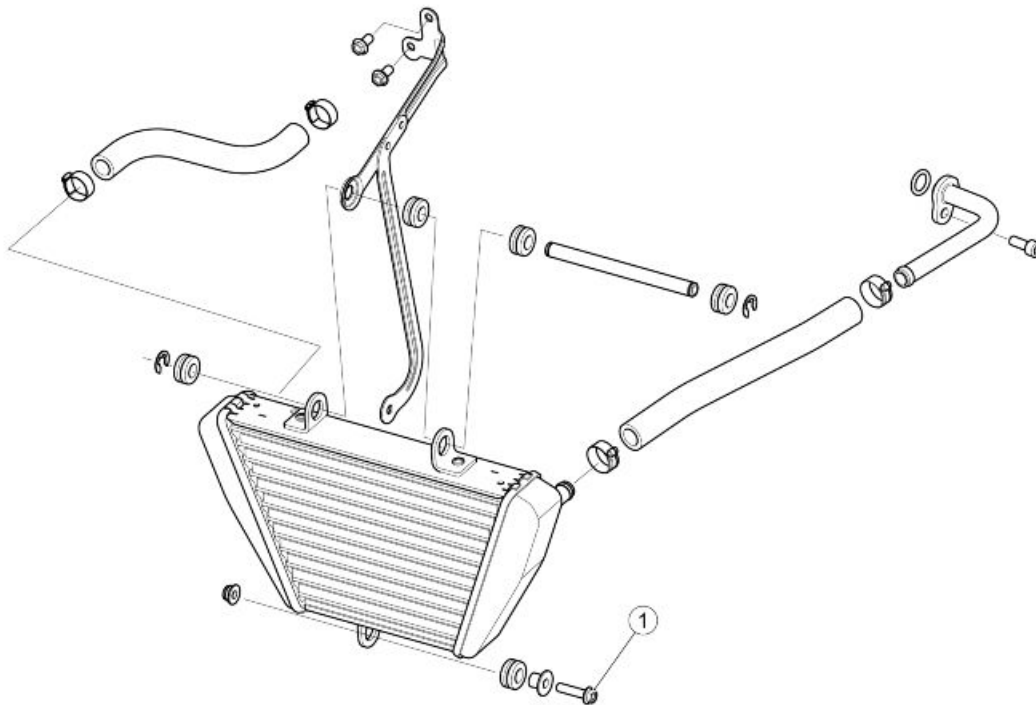
- Disconnect the two exhaust butterfly valve control cables



- Unscrew and remove the two valve actuator motor screws
- Remove the valve actuator motor together with the heat shield.



## Engine oil cooler



### RADIATORE OLIO

Pos.	Descrizione	Tipo	Quantità	Coppia	Note
1	Screws fastening oil radiator to mounting bracket	M6	1	7 Nm (5.16 lbf ft)	-



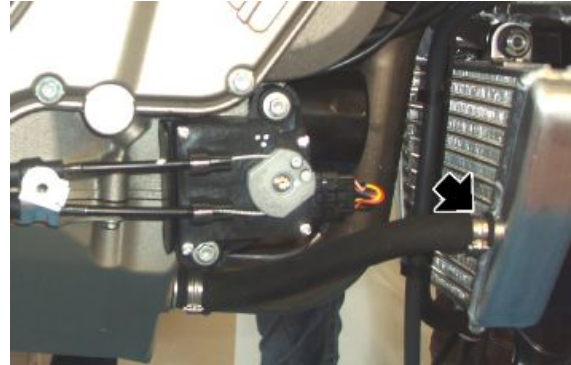
---

Pos.	Descrizione	Tipo	Quantità	Coppia	Note
2	Viti TE fl. per fissaggio staffa a telaio	M6x20	2	10 Nm (7.38 lbf ft)	-

---

## Removing

- Drain the engine oil.
- Remove both fairings and the radiator cowl.
- Release the clamp and disconnect the right hand radiator pipe.



- Release the clamp and disconnect the left hand radiator pipe.



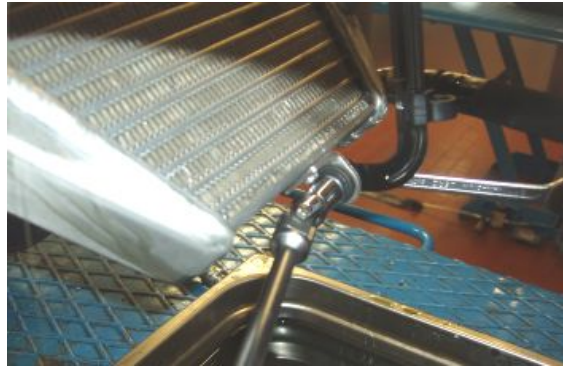
## See also

### [Replacement](#)

- Remove the split pin.
- From the opposite site, remove the coolant radiator-oil radiator connector pin.



- Unscrew and remove the lower radiator retainer.
- Remove the radiator, draining completely of oil.

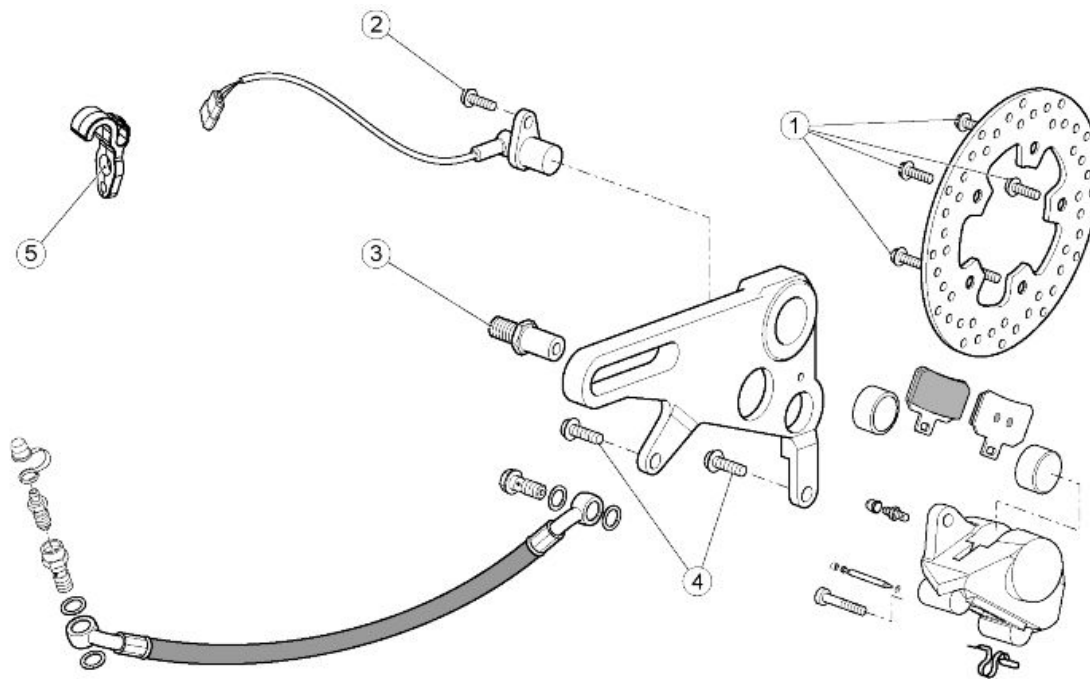


## INDEX OF TOPICS

**B**RAKING SYSTEM

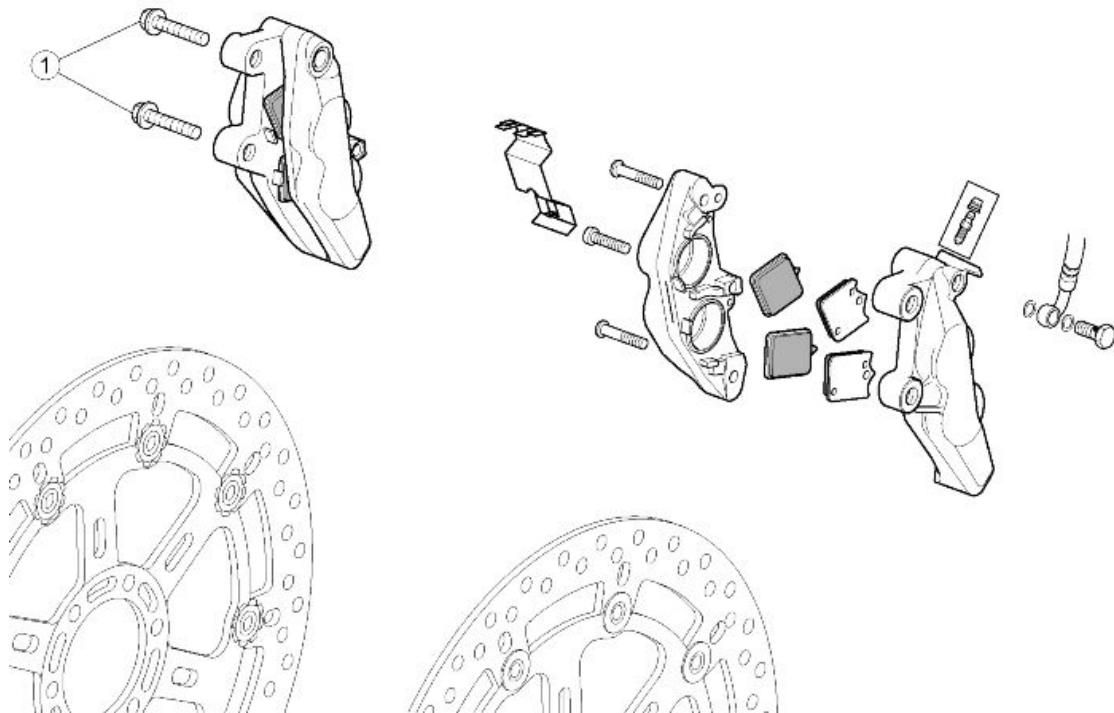
**BRAK SYS**

## Rear brake calliper

**REAR BRAKE CALLIPER**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake disc fixing screws	M8	5	30 Nm (22.13 lbf ft)	Loct. 243
2	Odometer sensor fixing screw	M6	1	10 Nm (7.38 lbf ft)	-
3	Rear brake calliper mounting plate lock pin	M12	1	50 Nm (36.88 lbf ft)	Loct. 243
4	Rear calliper fixing screw	M5	2	25 Nm (18.44 lbf ft)	-
5	Brake pipe clamp fixing screw	M5	2	4 Nm (2.95 lbf ft)	-
-	Brake pipe bracket fixing screw	M5	2	4 Nm (2.95 lbf ft)	-

Front brake calliper



**FRONT BRAKE CALLIPER**

pos.	Description	Type	Quantity	Torque	Notes
1	Front brake calliper fixing screws	M10x1.25	2 + 2	50 Nm (36.88 lbf ft)	-

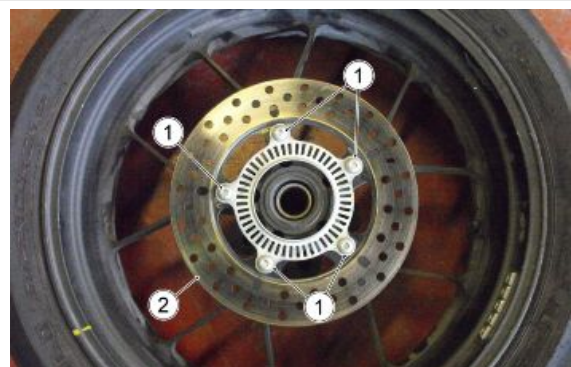
Rear brake disc

Removal

- Remove the rear wheel.

**CAUTION**

TO UNSCREW THE SCREWS (1), USE AN AIR SCREWER GUN TO GIVE A CLEAN BLOW, WHICH WILL DETACH THE SCREWS STUCK WITH LOCTITE 243.



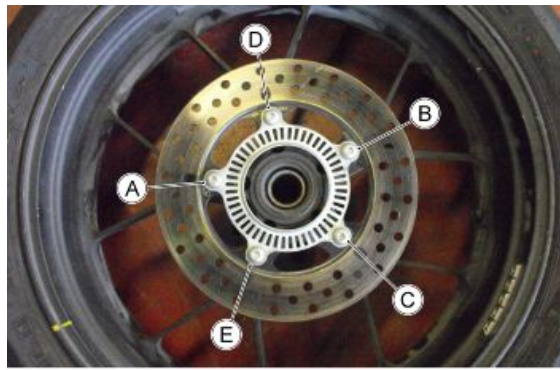
- Unscrew and remove the five brake disc screws (1).
- Remove the brake disc (2).



UPON REFITTING, APPLY LOCTITE 243 ON THE THREAD OF THE BRAKE DISC SCREWS (1).

**CAUTION**

UPON REFITTING, SCREW ALL THE SCREWS (1) MANUALLY AND TIGHTEN THEM OPERATING DIAGONALLY FOLLOWING THIS SEQUENCE: A-B-C-D-E.



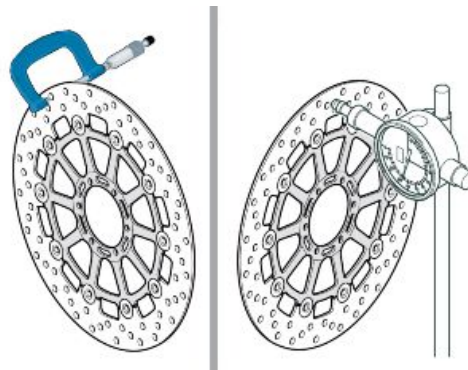
**See also**

[Removing the rear wheel](#)

## Disc Inspection

The operations must be carried out with the brake disc fitted on the wheel.

- 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: 4.5 mm (0.18 in)**

- Using a dial gauge, check that the maximum oscillation of the disc does not exceed the tolerance; otherwise, replace it.

**Disc oscillation tolerance: 0.1 mm (0.0039 in)**

## Front brake disc

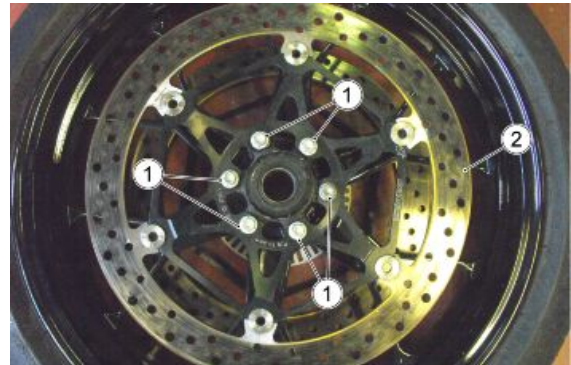
## Removal

- Remove the front wheel

The following operations refers to a single disc but apply to both.

### CAUTION

TO UNSCREW THE SCREWS (1), USE AN AIR SCREWER GUN TO GIVE A CLEAN BLOW, WHICH WILL DETACH THE SCREWS STUCK WITH LOCTITE 243.



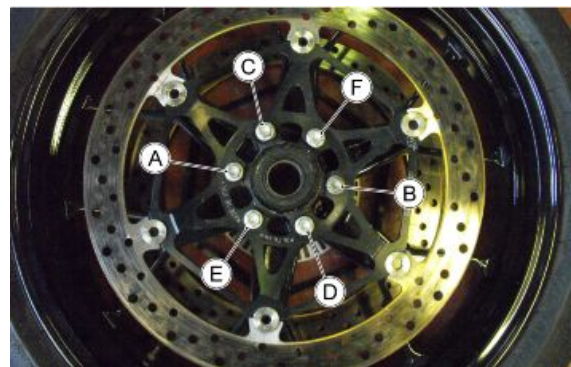
- Unscrew and remove the six brake disc screws (1).
- Remove the brake disc (2).



UPON REFITTING, APPLY LOCTITE 243 ON THE THREAD OF THE BRAKE DISC SCREWS (1).

### CAUTION

UPON REFITTING, SCREW ALL THE SCREWS (1) MANUALLY AND TIGHTEN THEM OPERATING DIAGONALLY FOLLOWING THIS SEQUENCE: A-B-C-D-E-F.

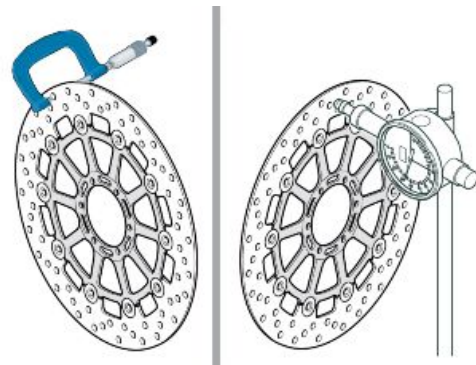


### See also

[Removing the front wheel](#)

## Disc Inspection

- 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



**THIS VEHICLE IS FITTED WITH A DOUBLE DISC FRONT BRAKING SYSTEM (RIGHT AND LEFT SIDE).**

**ALWAYS REPLACE ALL THE PADS FROM BOTH FRONT BRAKE CALLIPERS.**

**REPLACING THE PADS OF ONLY ONE FRONT CALLIPER MAY JEOPARDISE THE VEHICLE STABILITY AND SAFETY, POSING SERIOUS DANGER FOR PEOPLE, OBJECTS AND THE VEHICLE ITSELF.**

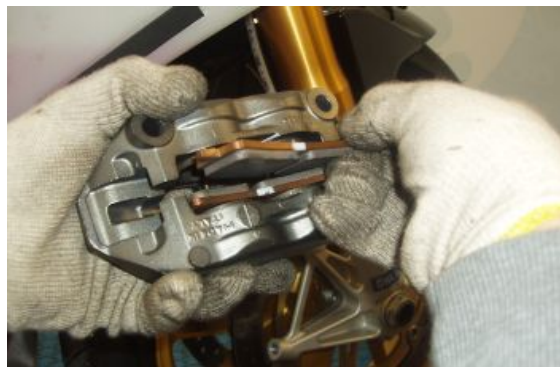
#### CAUTION

**THE FOLLOWING OPERATIONS REFER TO A SINGLE CALLIPER, BUT APPLY TO BOTH.**

- Unscrew and remove the two screws (1).
- Slide off the disc from the front brake calliper.



- Separate the brake calliper pistons.
- Remove the pads from the brake calliper.
- Retrieve the clip.



**AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE CONTROL LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKAGE.**

### Installing

- An arrow is stamped on the brake calliper and on the clip, which must always point in the direction of rotation of the front wheel.
- Fit the clip in the brake calliper.



- Fit the two new pads in the correct position.



**ALWAYS REPLACE THE FOUR PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALIPER.**



- Fit the front brake calliper on the disc.
- Hand-tighten the two screws (1) fully.
- Pull the front brake lever to seat the brake calliper correctly.
- Tighten the two screws (1).
- Check the front brake fluid level.



## Rear brake pads

### Removal

- Rest the vehicle on its stand.
- Remove the rear brake calliper.

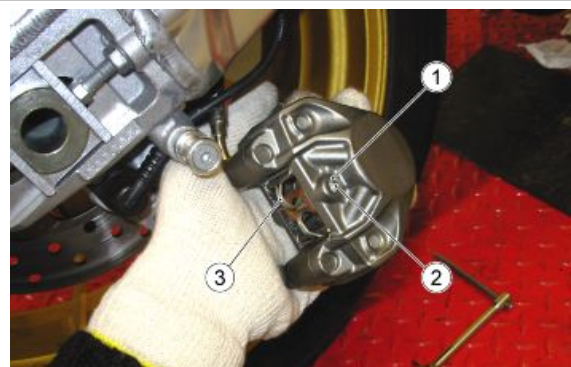
#### CAUTION

**DO NOT ACTUATE ON THE REAR BRAKE LEVER AFTER REMOVING THE WHEEL, OTHERWISE THE CALLIPER PLUNGER COULD GO OUT OF ITS SEAT, RESULTING IN BRAKE FLUID LEAKAGE.**

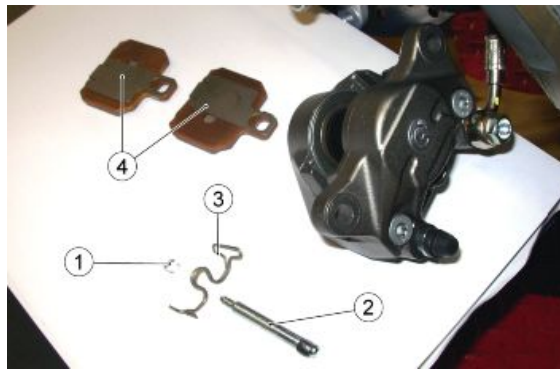
- Remove the snap ring (1).



**BEFORE REMOVING THE PIN (2), CHECK THAT THE SAFETY SPRING (3) IS CORRECTLY POSITIONED; WHEN REFITTED, IT MUST BE POSITIONED IN THE SAME WAY.**



- Remove the pin (2) and retrieve the safety spring (3).
- Extract the two pads (4) and retrieve the noise damping plates.
- If worn, replace the vibration damping plates.



**AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE CONTROL LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKAGE.**

## Installing

- Insert two new pads and the vibration-damping plates, placing them so that the holes are aligned with the calliper holes.



**UPON REFITTING, MAKE SURE THE ARROWS ON THE VIBRATION-DAMPING PLATES FACE THE DIRECTION OF ROTATION OF THE WHEEL.**

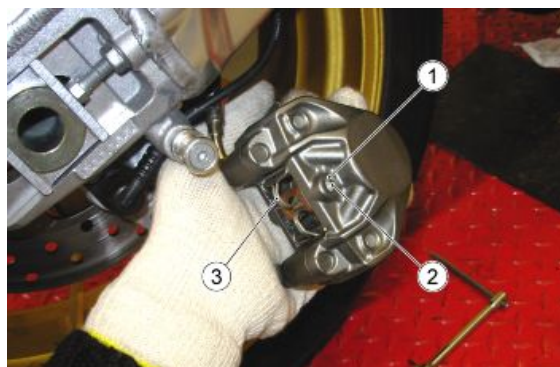
### CAUTION



**ALWAYS REPLACE BOTH PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALLIPER.**



- Place the safety spring (3).
- Hold the centre of the safety spring (3) depressed and insert the pin (2) so it passes above the spring.
- Fit the retainer ring (1).
- Check the brake fluid.



---

## Bleeding the braking system

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### Front

If there is air in the hydraulic system, it acts as a bearing, absorbing a large part of the pressure from the brake pump and minimising calliper efficiency during braking.

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.**

- 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 fluid 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 bleed valve and remove the pipe.
  - Top-up the reservoir until the right brake fluid level is obtained.
  - Refit and block the front brake fluid reservoir cap.
  - Refit the rubber protection cover.



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## 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.**

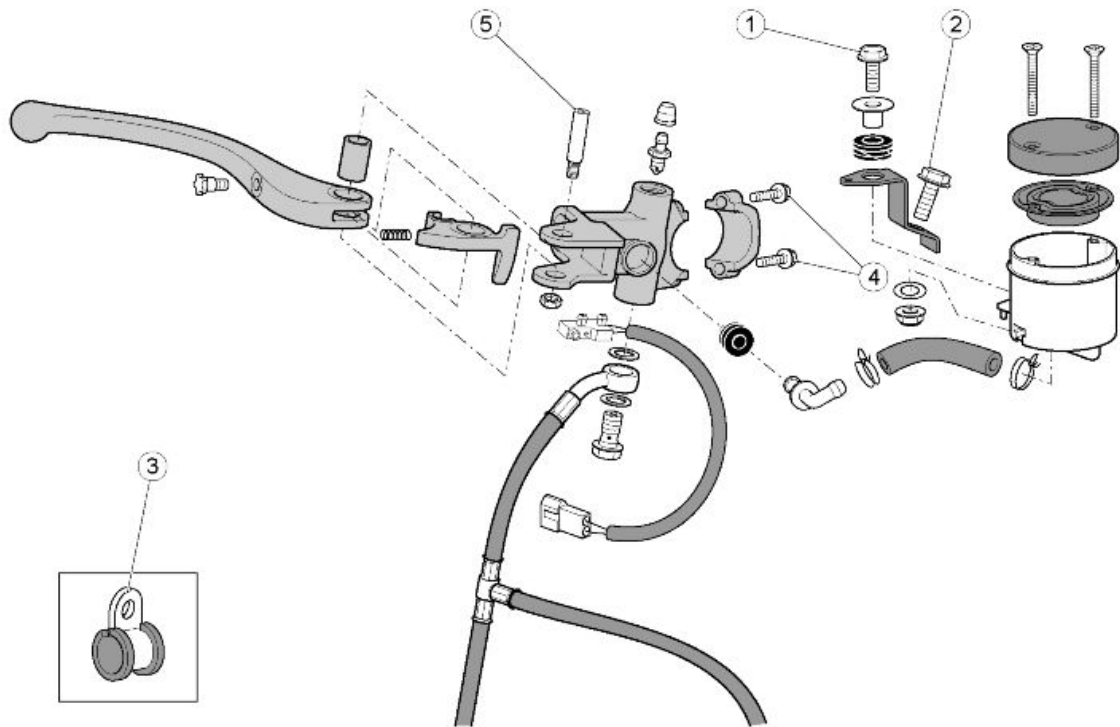
### NOTE

**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.**

- 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 fluid reservoir cap.
- Operate the brake lever and then open the bleed valve on the calliper by a 1/4 turn to let the air escape.
- Close the bleed valve before reaching the end of travel of the brake lever, then repeat the operation until air no longer escapes.
- 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 fluid reservoir cap.
- Refit the protective rubber cap.



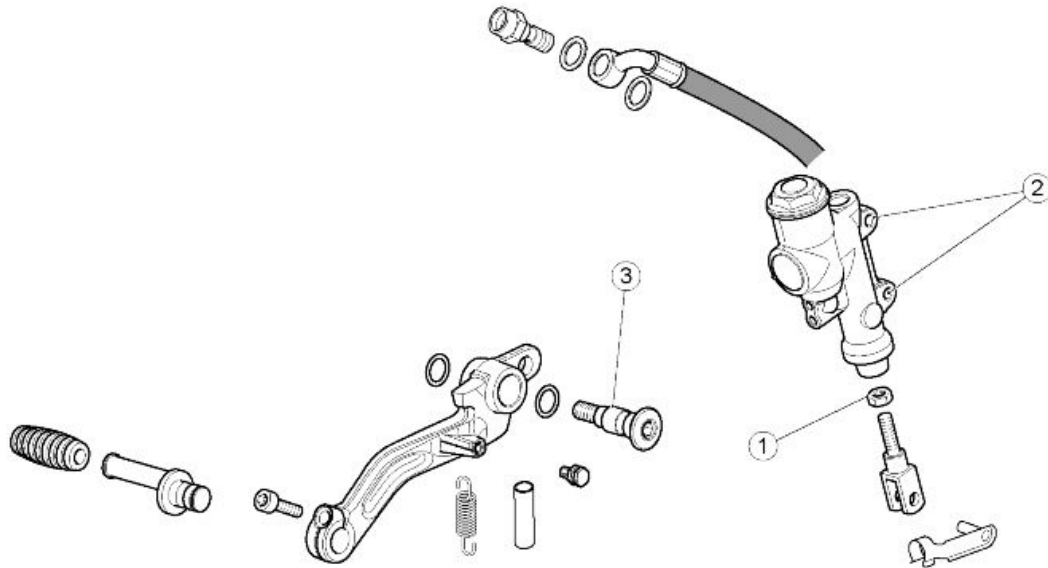
Front brake pump



**FRONT BRAKE PUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening front brake fluid reservoir to bracket	M6	1	7 Nm (5.16 lbf ft)	-
2	Screw fastening brake fluid reservoir mounting bracket to handlebar	M6	1	7 Nm (5.16 lbf ft)	-
3	Screw fastening brake pipe grommet to the lower yoke	M5	1	8 Nm (5.9 lbf ft)	-
4	Front brake pump U bolt clamp	M6	2	10 Nm (7.37 lbf ft)	-
5	Front brake lever pin fixing screw	M6	1	10 Nm (7.37 lbf ft)	-

## Rear brake pump

**REAR BRAKE PUMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake rod lock nut	M6	1	12 Nm (8.85 lbf ft)	-
2	Rear brake pump fixing screws	M6	2	8 Nm (5.9 lbf ft)	-
3	Rear brake lever fixing screw	M8	1	25 Nm (18.44 lbf ft)	-

## INDEX OF TOPICS

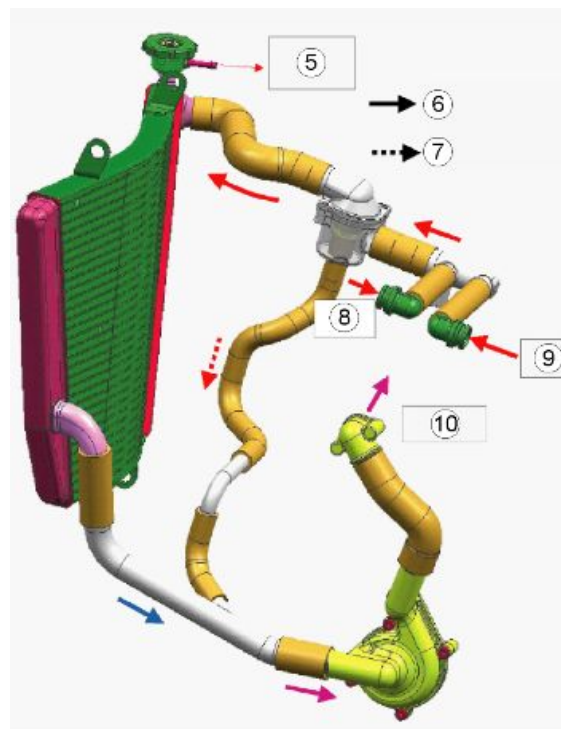
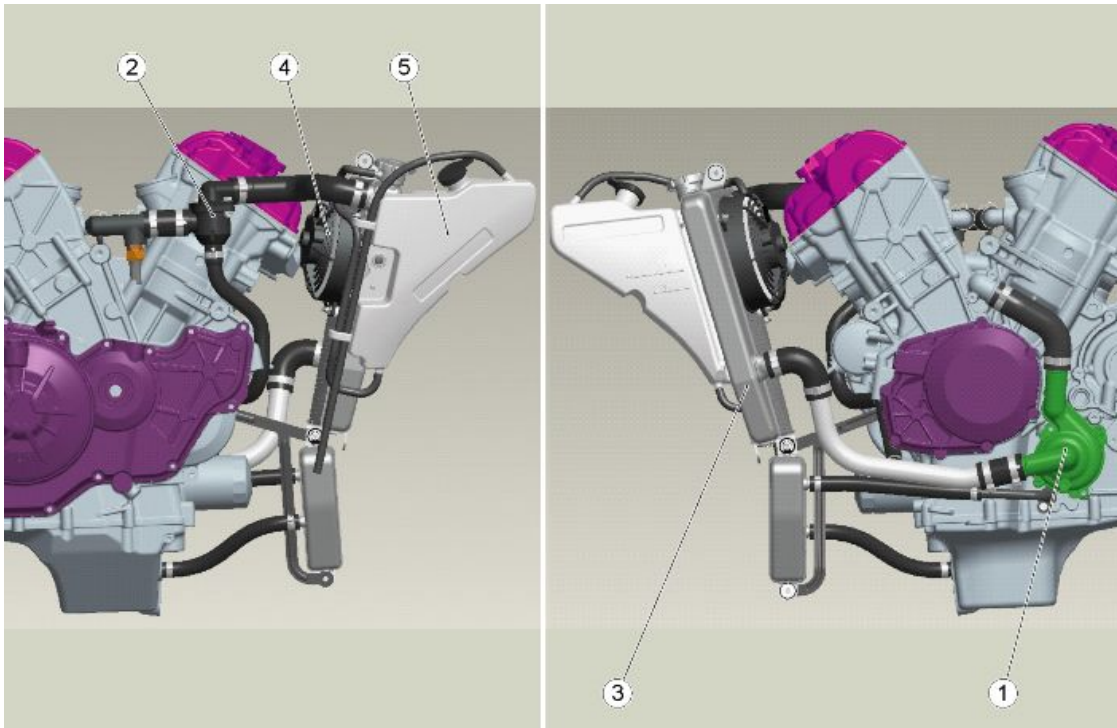
COOLING SYSTEM

COOL SYS

## Circuit diagram

### SYSTEM TYPE

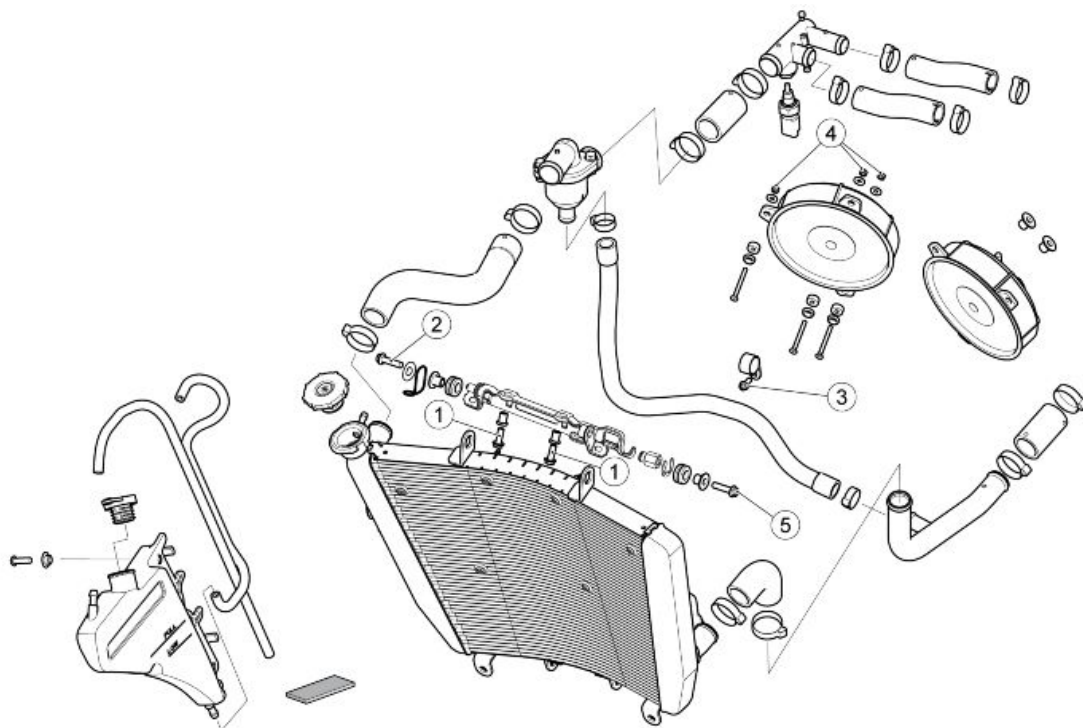
Self bleeding cooling circuit with aspirating centrifugal pump (1), three-way thermostat valve (2), cooling radiator (3) with electric fans (4) and expansion tank (5).



key:

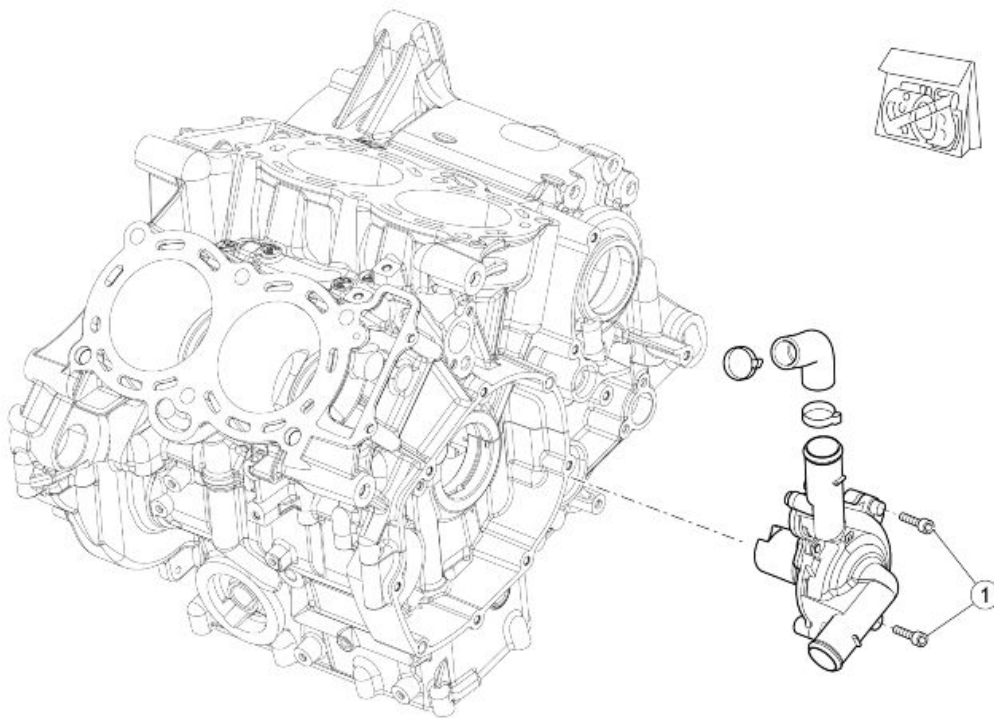


1. Centrifugal pump
2. Thermostatic valve
3. Radiator
4. Electric fans
5. Expansion tank
6. With the thermostat open
7. With the thermostat closed
8. From front head
9. From rear head
10. To upper crankcase



**COOLING**

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screws for fastening the water radiator mounting bracket to frame	M6x20	2	10 Nm (7.37 lbf ft)	-
2	Self-tapping screw for fastening the water radiator to the mounting bracket	-	1	2 Nm (1.47 lbf ft)	-
3	Screw fastening pipe grommet for By-pass water hose	M5	1	6 Nm (4.42 lbf ft)	-
4	Screws fastening electric fan to water radiator	M4	6	2 Nm (1.47 lbf ft)	-
5	Flanged TE screw for fastening the water radiator to the mounting bracket	M6x20	1	7 Nm (5.16 lbf ft)	-

**WATER PUMP**

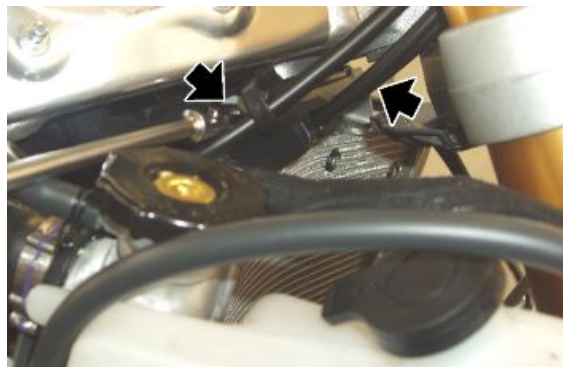
pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the pump to the crankcase	M6x25	2	10 Nm (7.37 lbf ft)	-

**Electric fan**

- Remove the front underfairings and the hand grip position sensor
- Disconnect the cooling fan connector to be replaced.



- Unscrew and remove both radiator upper fixing screws.

**See also**

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Fairing mounting panels  
Twistgrip position sensor

---

- Move the radiator forward.
- Unscrew and remove the three fan retainers and retrieve the washers.



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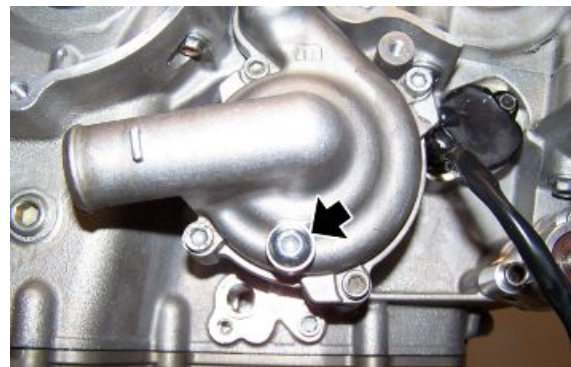
## Coolant replacement

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- Remove both fairings.
- Place a container with a suitable capacity under the coolant pump.
- Remove the radiator cap/valve to help the fluid drain out.



- Unscrew and remove the system drain screw and retrieve the seal washer.
- Wait for the entire circuit to drain (engine+pipes+radiator)
- Refit the system drain screw complete with a new washer.



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## FILLING

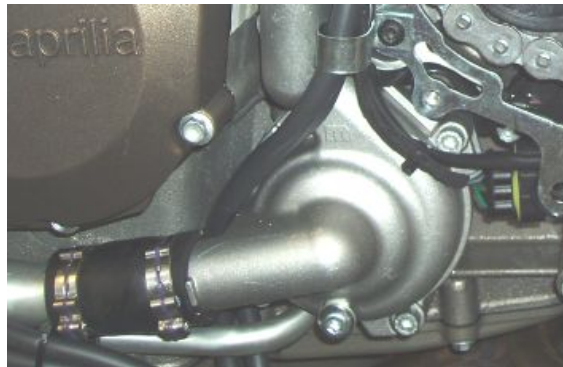
- Via the filler orifice on the radiator, fill with the quantity of coolant (approx. 2.2 l - 0.48 UK gal) necessary to reach the edge.
- Fit the cap / valve.

- Via the filler orifice on the expansion tank, fill with the quantity of coolant necessary to reach the FULL marking, then refit the cap.
- Start the engine, run at idle speed and wait for the electric fans to activate (approx. 101 °C - 213 °F) then turn off the engine and wait for it to cool.
- With the vehicle standing vertically, check the liquid level both in the radiator and in the expansion tank and top up if necessary.

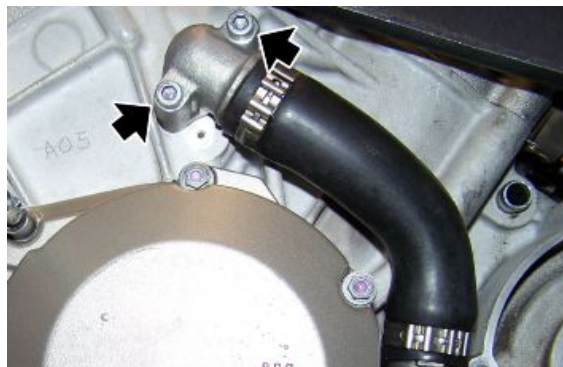


## Water pump

- Drain the coolant.
- Remove the pipe from the radiator.



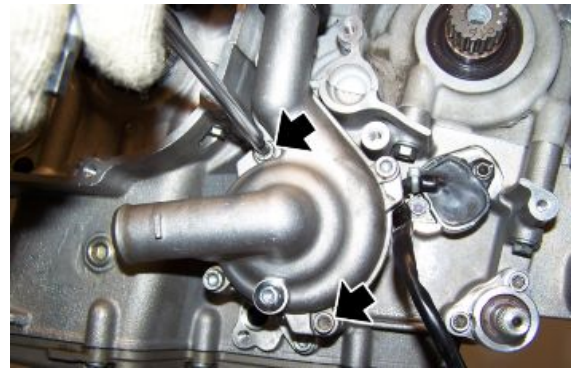
- Unscrew and remove the two screws fastening the pipe to the engine.
- Retrieve the gasket and replace with a new component when refitting.



## See also

Coolant replacement

- Unscrew and remove the two screws fastening the pump to the engine.
- Remove the coolant pump.



- Unscrew and remove the two external pump cover fixing screws.



- Unscrew and remove the inner screw.
- Remove the pump cover.



**TO PREVENT IRREPARABLE DAMAGE TO THE PUMP, UNSCREW AND REMOVE THE INNER SCREW BEFORE REMOVING THE COVER.**



- At each removal, replace the inner gasket between the pump casing and the cover and the O ring on the pump casing.



ENSURE THAT THE LIQUID PASSAGE ORIFICES ARE NOT OBSTRUCTED.



## Removing the radiator

- Drain off the cooling system.
  - Remove the front underfairings and the hand grip position sensor
  - Disconnect both cooling fan connectors.
- 
- Disconnect the expansion tank breather pipe from the pipe grommet.

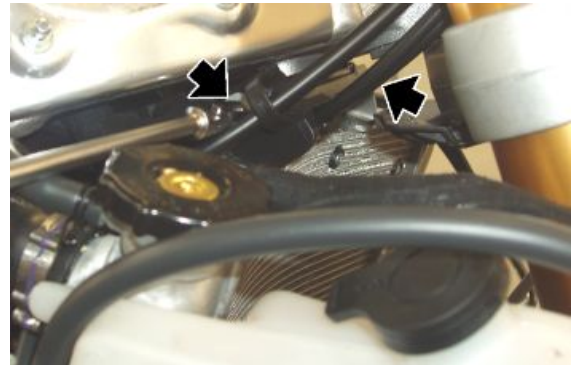


### See also

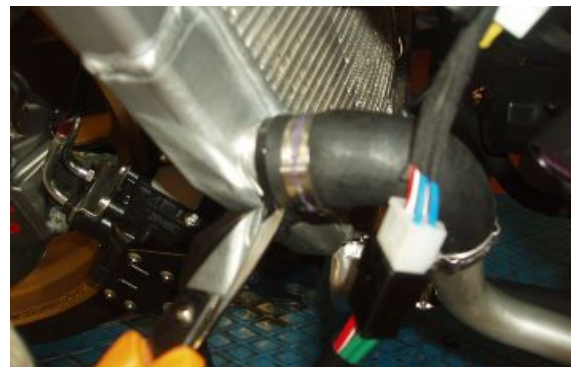
Coolant replacement  
[Fairing mounting panels](#)

## Twistgrip position sensor

- Unscrew and remove both radiator upper fixing screws.



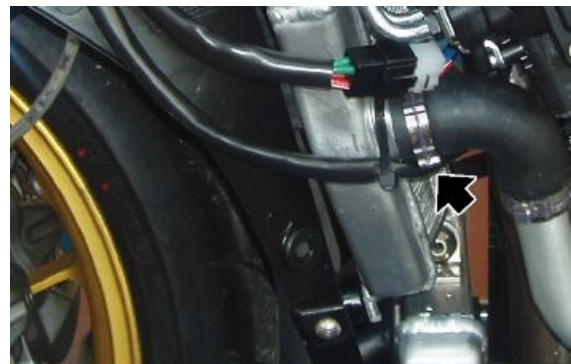
- Cut the clamp fastening the cable harness to the radiator return pipe on the left hand side.



- Release the clamp fastening the return pipe to the radiator pipe



**UPON REFITTING, REPLACE CLIC CLAMP REMOVED WITH A NEW ONE OF EQUAL SIZE. DO NOT REFIT THE CLIP-ON CLAMP REMOVED PREVIOUSLY AS IT IS NO LONGER USABLE. DO NOT REPLACE THE CLIP-ON CLAMP REMOVED PREVIOUSLY WITH A SCREW CLAMP OR ANY OTHER TYPE OF CLAMP.**



- Release the clamp fastening the delivery pipe to the radiator pipe



**UPON REFITTING, REPLACE CLIC CLAMP REMOVED WITH A NEW ONE OF EQUAL SIZE. DO NOT REFIT THE CLIP-ON CLAMP REMOVED PREVIOUSLY AS IT IS NO LONGER USABLE. DO NOT REPLACE THE CLIP-ON CLAMP REMOVED PREVIOUSLY WITH A SCREW CLAMP OR ANY OTHER TYPE OF CLAMP.**



- Remove the split pin.
- From the opposite site, remove the coolant radiator-oil radiator connector pin.



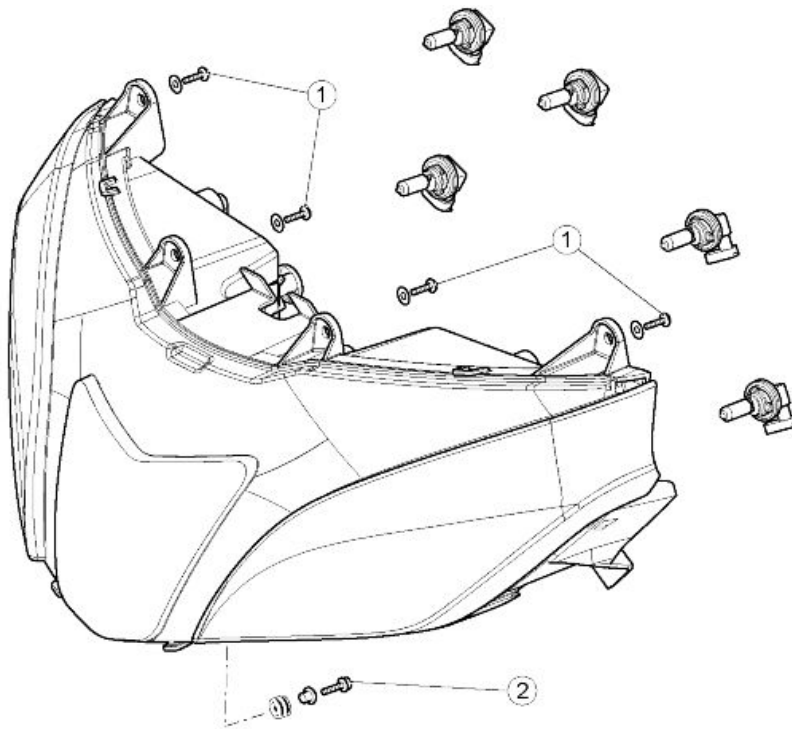
- Remove the radiator.
-



## INDEX OF TOPICS

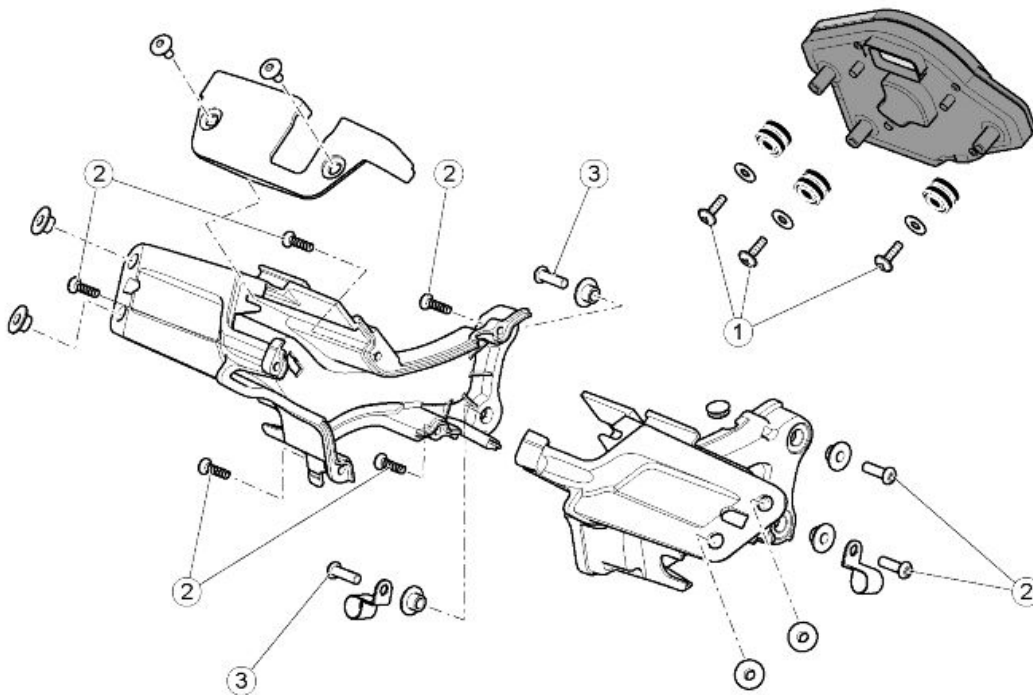
**BODYWORK**

**BODYW**



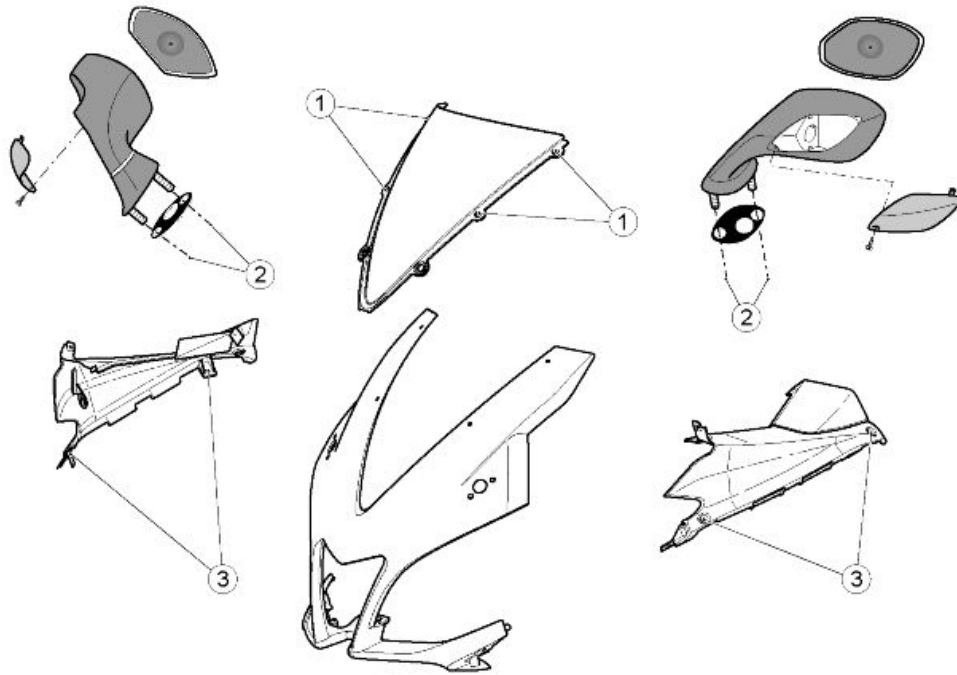
**HEADLAMP**

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening headlamp to front fairing	SWP 4.9	4	2 Nm (1.47 lbf ft)	-
2	Headlamp fixing screw	M5	2 + 1	2 Nm (1.47 lbf ft)	-



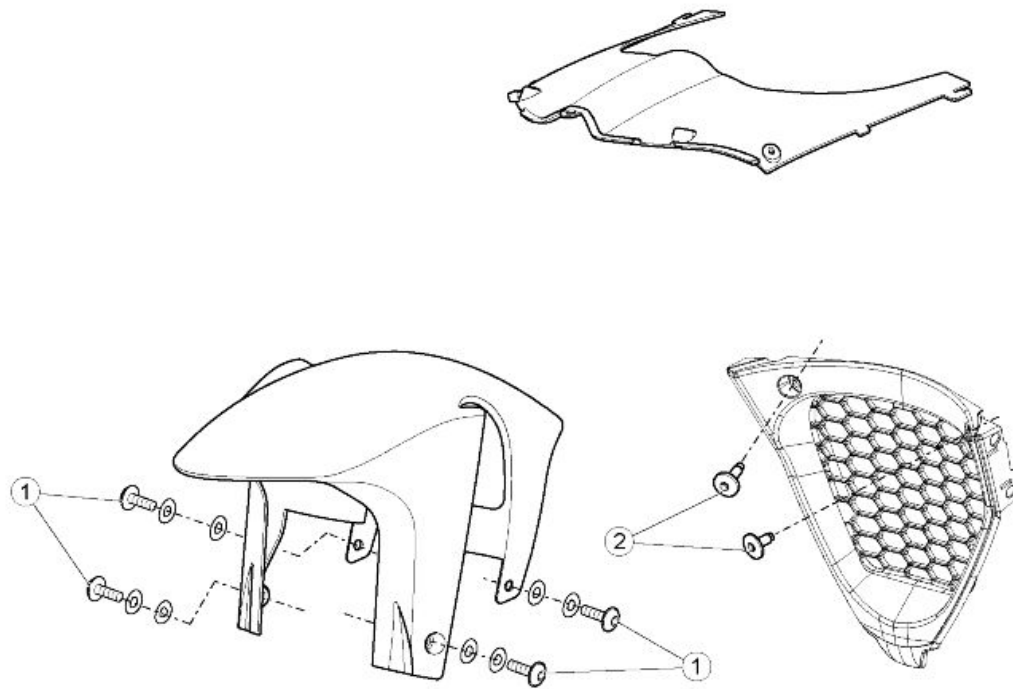
**INSTRUMENT PANEL**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening the rubber rings to the instrument panel	SWP 4.9	3	3 Nm (2.21 lbf ft)	-
2	Instrument panel mounting shell fixing screws	SWP 4.9	5	2 Nm (1.47 lbf ft)	-
3	Screws fastening instrument panel mounting to chassis	M6	4	8 Nm (5.9 lbf ft)	-



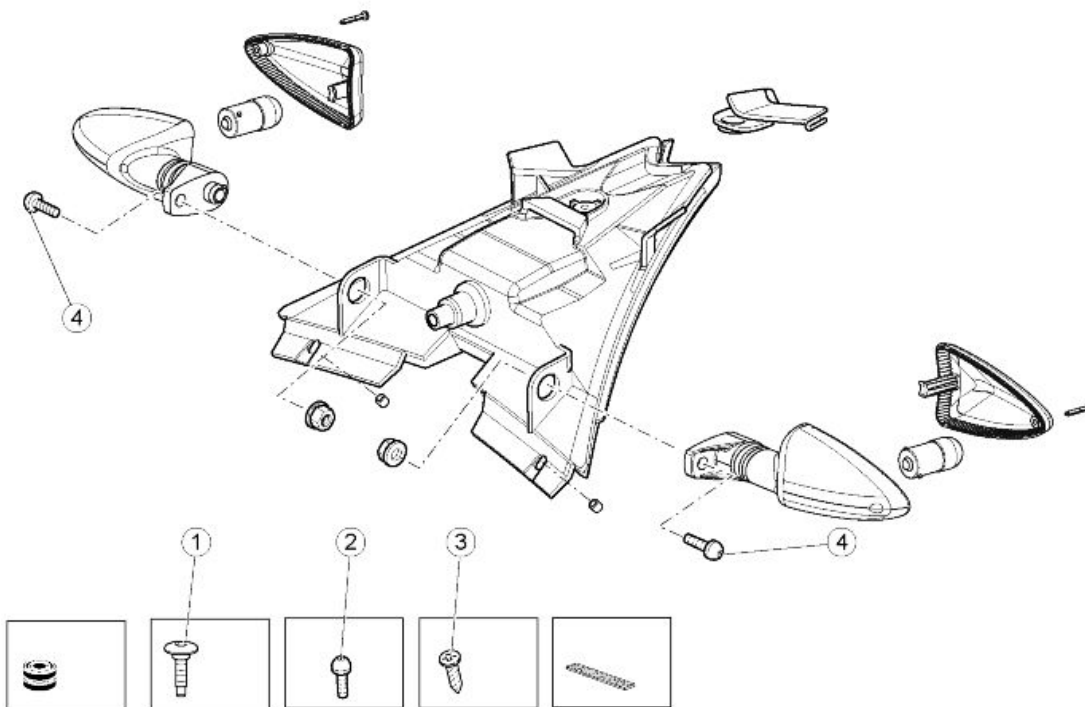
**WINDSHIELD**

pos.	Description	Type	Quantity	Torque	Notes
1	Windshield fixing screws	M4	4	0.5 Nm (0.37 lbf ft)	-
2	Rear-view mirror fixing nuts	M6	2 + 2	10 Nm (7.37 lbf ft)	-
3	- Screws fastening the side fairings to front fairing	M5	4	1 Nm (0.74 lbf ft)	-



**FRONT MUDGUARD**

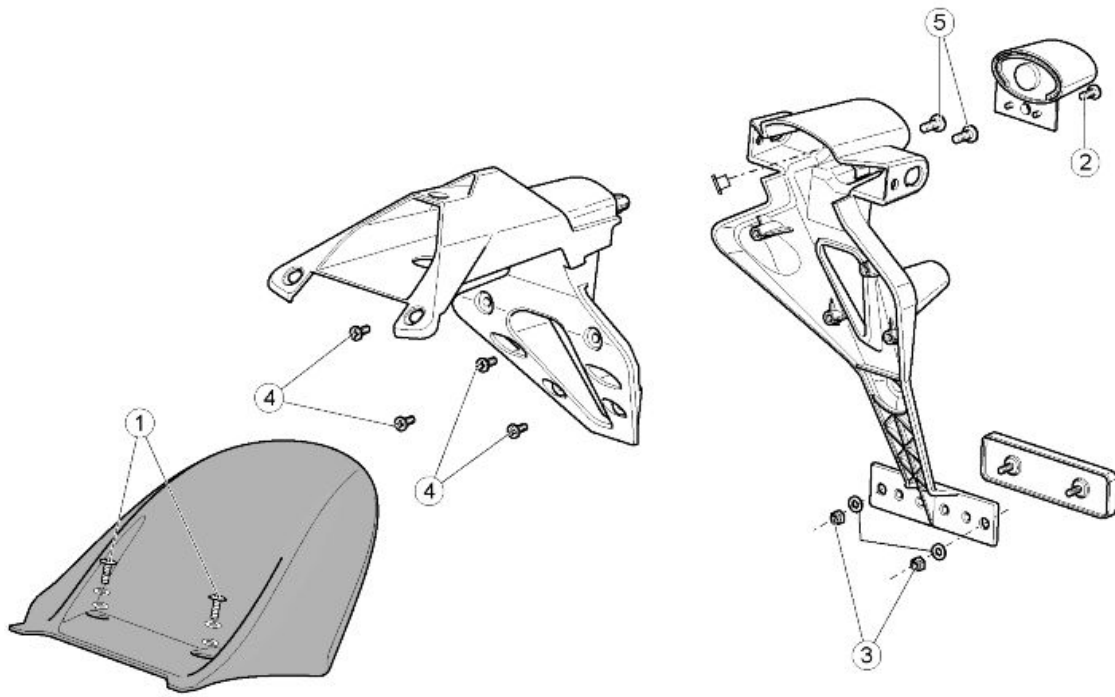
pos.	Description	Type	Quantity	Torque	Notes
1	Front mudguard fixing screws	M5	4	3 Nm (2.21 lbf ft)	-
2	Lug fixing screws	M5	2	4 Nm (2.95 lbf ft)	-



**TAILLIGHT**

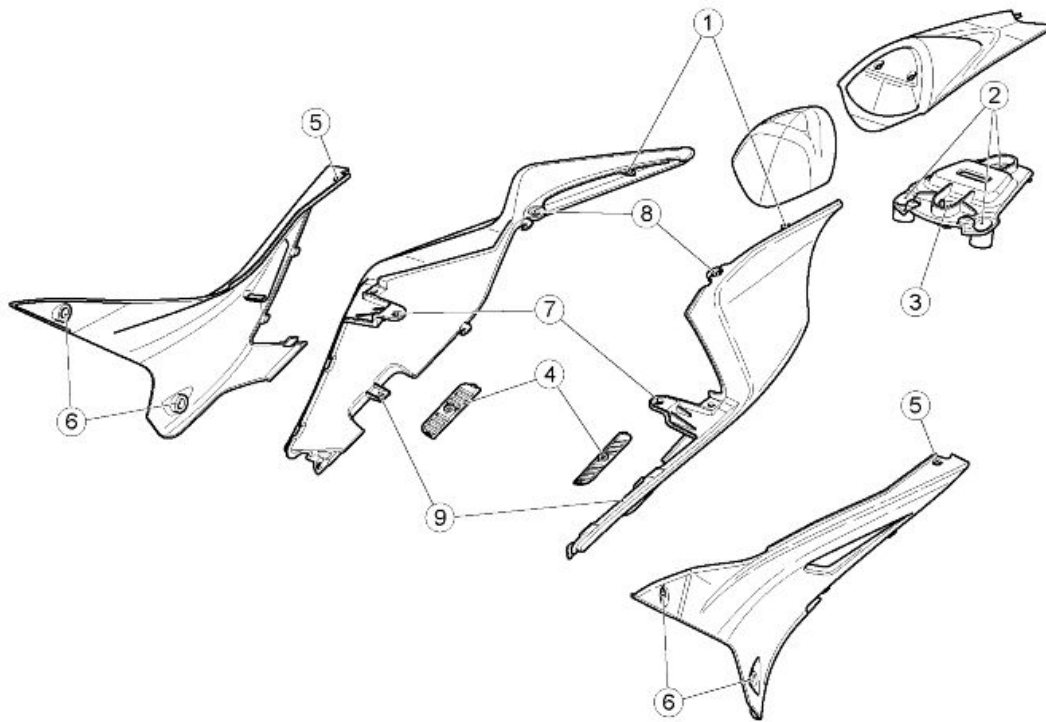
pos.	Description	Type	Quantity	Torque	Notes
1	Taillight fixing screws	M5	2	3 Nm (2.21 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	Taillight mounting bracket fixing screws	M5	2	4 Nm (2.95 lbf ft)	-
3	Rear turn indicator fixing screws	M6	2	2.5 Nm (1.84 lbf ft)	-
4	Taillight cover fixing screws	SWP 2.9	1	0.5 Nm (0.37 lbf ft)	-



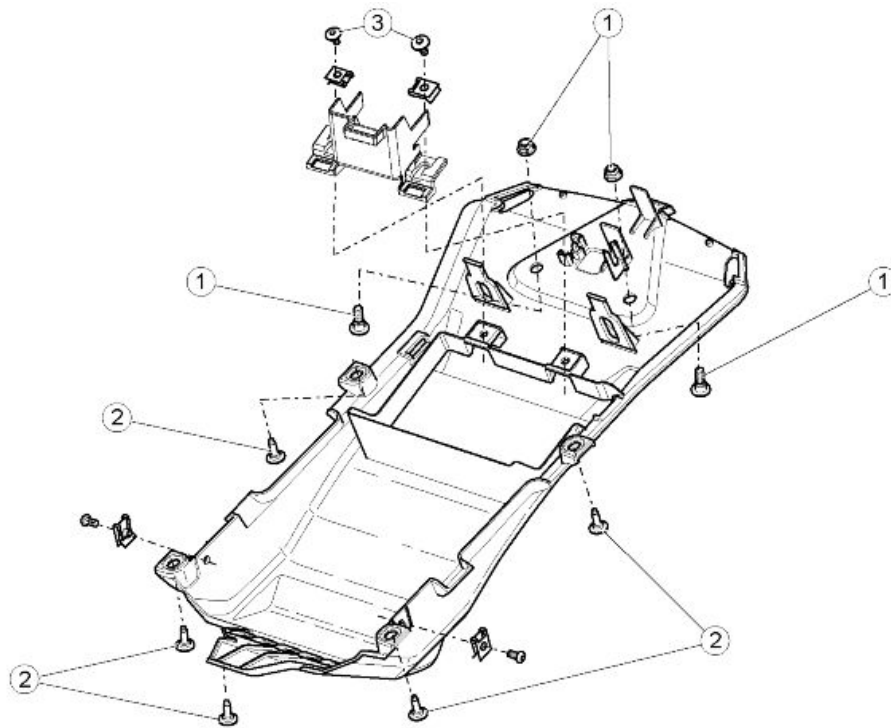
**LICENSE PLATE HOLDER**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear mudguard fixing screws	M6	2	3 Nm (2.21 lbf ft)	-
2	License plate light fixing screws	M4	1	1 Nm (0.74 lbf ft)	-
3	Reflector fixing nuts	M4	2	1 Nm (0.74 lbf ft)	-
4	Screws fastening rear license plate holder to front license plate holder	SWP 3.9	4	1 Nm (0.74 lbf ft)	-
5	Self-tapping screws fastening rear license plate holder to front license plate holder	5x20	2	2 Nm (1.47 lbf ft)	-
-	Screws fastening license plate mounting to saddle mounting casting	M6	3	4 Nm (2.95 lbf ft)	-



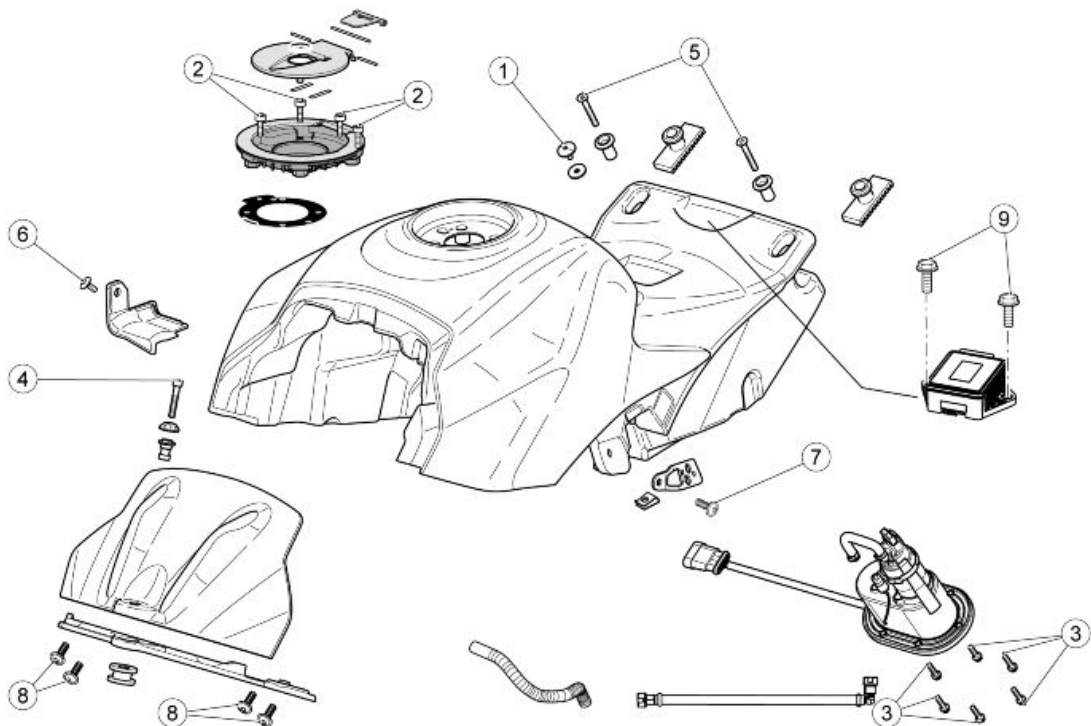
**TAIL FAIRING**

pos.	Description	Type	Quantity	Torque	Notes
1	Rear screws fastening tail fairing to taillight bracket	M5	2	3 Nm (2.21 lbf ft)	-
2	Screws fastening the saddle cover base to the saddle cover	SWP 2.9	3	1 Nm (0.74 lbf ft)	-
3	Saddle cover pin fixing screws	M4	1	1.5 Nm (1.11 lbf ft)	-
4	Screws fastening grilles to tail fairing	M5	2	0.5 Nm (0.37 lbf ft)	-
5	Screws fastening side fairings to tail fairing	M5	2	1 Nm (0.74 lbf ft)	-
6	Screws fixing side fairings to tank	M5	2 + 2	2 Nm (1.47 lbf ft)	-
7	Screws fastening tail fairing to saddle mounting	M5	2	3 Nm (2.21 lbf ft)	-
8	Screws fastening tail fairing to saddle mounting bracket	M5	2	2 Nm (1.47 lbf ft)	-
9	Screws fixing tail fairing to lower saddle mounting fastener	M5	2	3 Nm (2.21 lbf ft)	-



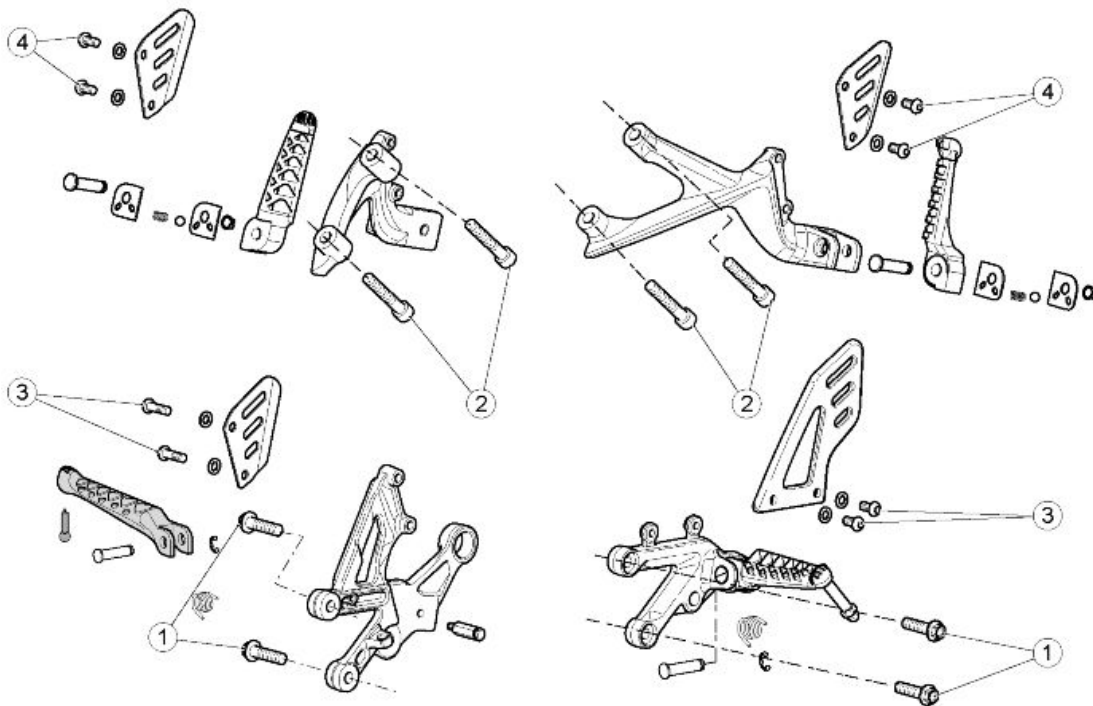
**HELMET COMPARTMENT**

pos.	Description	Type	Quantity	Torque	Notes
1	Screws and nuts for fastening license plate holder to saddle mounting plate	M6	2	4 Nm (2.95 lbf ft)	-
2	Lower saddle mounting fastener fixing screws	M5	5	3 Nm (2.21 lbf ft)	-
3	Battery bracket fixing screws	M5	2	2 Nm (1.47 lbf ft)	-



**FUEL TANK**

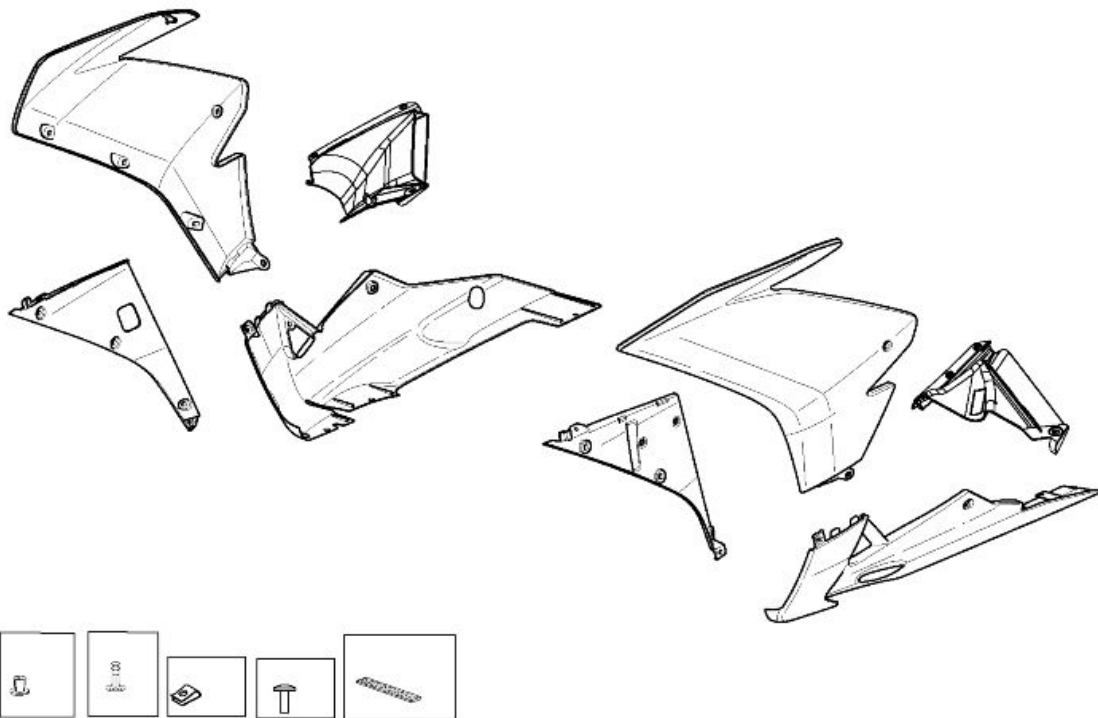
pos.	Description	Type	Quantity	Torque	Notes
1	Special screw fastening rider saddle to the tank	M6	1	4 Nm (2.95 lbf ft)	-
2	Screws fixing the filler to the tank	M5	4	4 Nm (2.95 lbf ft)	-
3	Screws fixing the fuel pump flange to the tank	M5	8	3 Nm (2.21 lbf ft)	-
4	Front screws fastening the tank to the chassis	M6	1	8 Nm (5.9 lbf ft)	-
5	Rear screws fastening the tank to the rear chassis	M6	2	7 Nm (5.16 lbf ft)	-
6	Screws fastening plastic fuel pipe mounting	M5	1	2.5 Nm (1.84 lbf ft)	-
7	Left fairing mounting bracket fixing screws	M5	1	3 Nm (2.21 lbf ft)	-
8	Screws fastening structural tank mounting to tank	M6	4	3 Nm (2.21 lbf ft)	-
9	Flanged TBEI screw fixing the sensor box	M6x16 stainless steel	2	6 Nm (4.42 lbf ft)	-
-	Central screw fastening the cover to the tank	M4	1	0.5 Nm (0.37 lbf ft)	-
-	Fuel tank breather pipe unions	M7	2	3 Nm (2.21 lbf ft)	-



**FOOTRESTS**

pos.	Description	Type	Quantity	Torques	Notes
1	Screws fastening rider footpegs to chassis	M8	2 + 2	25 Nm (18.44 lbf ft)	-
2	Screws fastening passenger footpegs to chassis	M8	2 + 2	18 Nm (13.28 lbf ft)	For countries in which passenger footpegs are mandatory or for two seat configuration
3	Rider heelrest fixing screws	M6	2 + 2	8 Nm (5.9 lbf ft)	-
4	Passenger heelrest fixing screws	M6	2 + 2	8 Nm (5.9 lbf ft)	-
-	Anti-slip pin	M6	1	8 Nm (5.9 lbf ft)	-





**FAIRING**

pos.	Description	Type	Quantity	Torque	Notes
-	Centre screws fastening lower fairing	M6	2	10 Nm (7.37 lbf ft)	-
-	Right hand lower fairing mounting bracket	M6	2	10 Nm (7.37 lbf ft)	-
-	Left hand lower fairing mounting bracket	M6	2	10 Nm (7.37 lbf ft)	-
-	Screws fixing the side fairings to the side spacers	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to intake duct	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to front fairing	M5	2	1.5 Nm (1.11 lbf ft)	-
-	Screws fixing upper fairing fastener to intake duct	self-tapping	2	1 Nm (0.74 lbf ft)	-
-	Screws fixing upper fairing fastener to headlamp	self-tapping	2	1 Nm (0.74 lbf ft)	-
-	Screws fastening the lower fairing to the bracket	M5	2 + 2	1 Nm (0.74 lbf ft)	-
-	Screws fastening the lower fairing to the lug	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower fairing lower fastening screws	M5	2	2 Nm (1.47 lbf ft)	-
-	Lower fork fastener fixing screws	M6	2	8 Nm (5.90 lbf ft)	-
-	Screws fixing lower front fairing fastener to intake ducts	SWP 3.9	2	1 Nm (0.74 lbf ft)	-
-	Inner screws fixing fairing to the lower front fairing fastener	M4	2	0.5 Nm (0.37 lbf ft)	-
-	Inner screws fastening the fairing to the lug	M5	2	2 Nm (1.47 lbf ft)	-

---

## Driving mirrors

- The following procedure is for a single rear view mirror, but is applicable to both mirrors.
- Unscrew and remove the two nuts, supporting the rear view mirror.



- 
- Disconnect the turn indicator connector from the relative fixed connector on the instrument panel.



- Guiding the turn indicator cable through the relative hole on the windshield, remove the rear view mirror.
-

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## Instrument panel

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- Remove the windshield.
- Unscrew and remove the two screws.



- Remove the instrument panel mounting cover.
- Move the instrument panel, removing the rubber rings from the seats on the support.



- Rotate the instrument panel connector retainer lever.
- Remove the connector.
- Remove the instrument panel.



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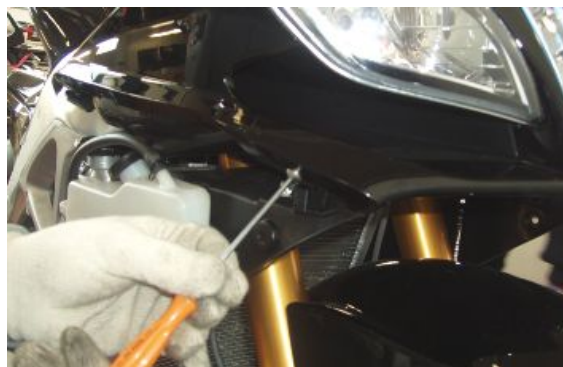
### NOTE

**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.**

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## Headlight fairing

- Working from both sides, unscrew and remove the four screws.



- Remove the side fairings.
- Disconnect the turn indicator connectors from the fixed connector on the instrument panel mounting.
- Remove the two rear view mirrors if necessary.
- Remove the three lower inserts.



### See also

#### Side fairings

- Supporting the windshield, move it forward to create the minimum space necessary to work on the front bulb connectors.
- Disconnect the front bulb connectors.



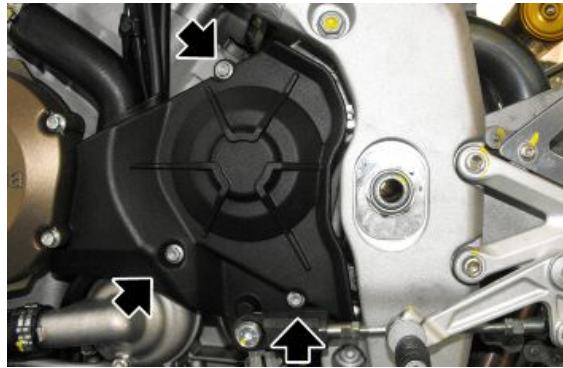
- Remove the windshield in a forward motion.



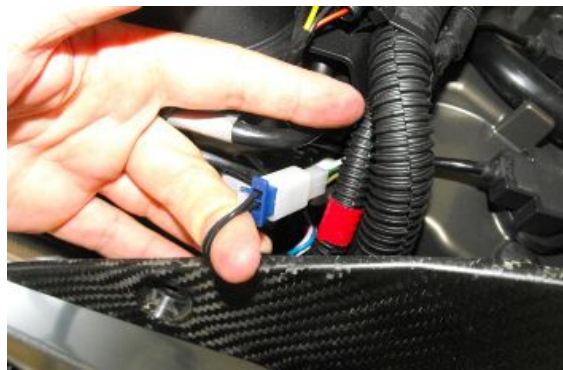
## Rider footrest plate

### LEFT RIDER FOOTREST REMOVAL - GEAR-BOX LEVER

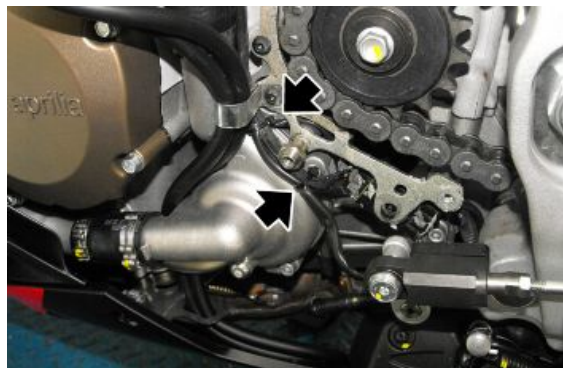
- Remove the fuel tank.
- Unscrew and remove the three screws and remove the pinion cover.



- Disconnect the quick-shift connector.



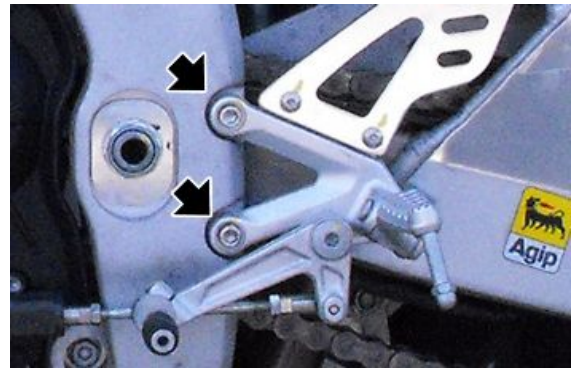
- Cut the ties fastening the cable harness to the engine



- Loosen the screw and slide off the gear shift lever and cable harness from the engine.



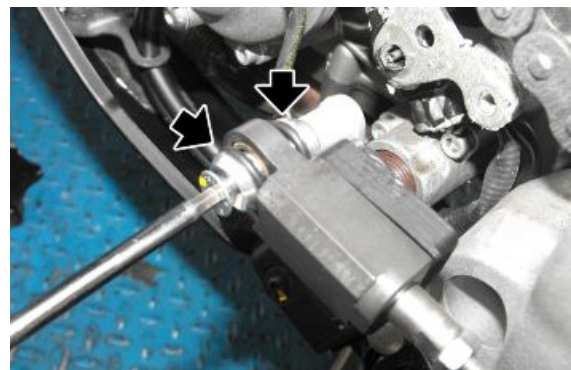
- Unscrew and remove the two screws fixing the left rider footrest plate to the chassis.



- If necessary, you can loosen and remove the quick-shift fixing screw to change the O-rings.

**NOTE**

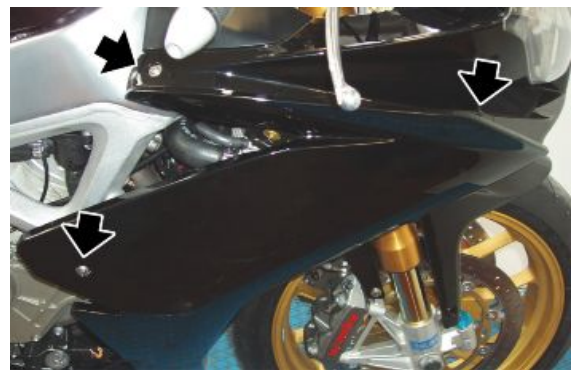
**NOTE THE CABLE HARNESS DOES NOT NEED TO BE DISCONNECTED FOR THIS OPERATION**



## Side fairings

The following procedure is relative to a single fairing, but is applicable to both.

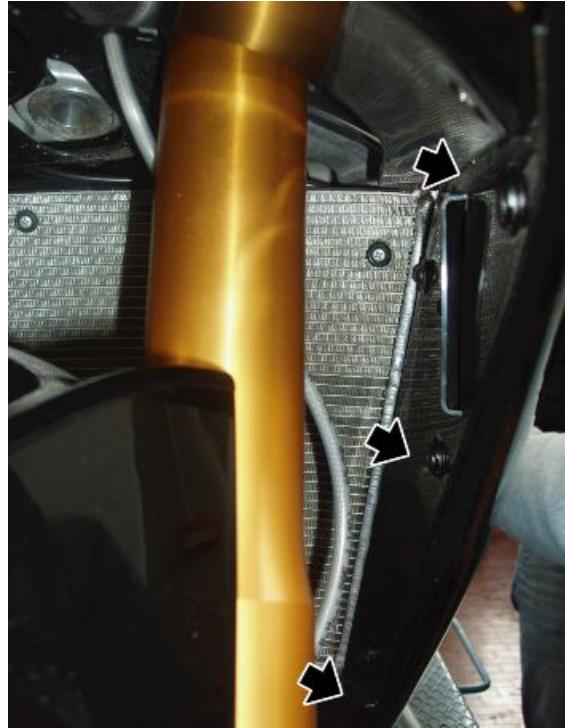
- Remove the lower side fairing.
- Unscrew and remove the three screws.



- Release the insert on the retainer with the duct.



- Release the three inserts on the inner fairing.

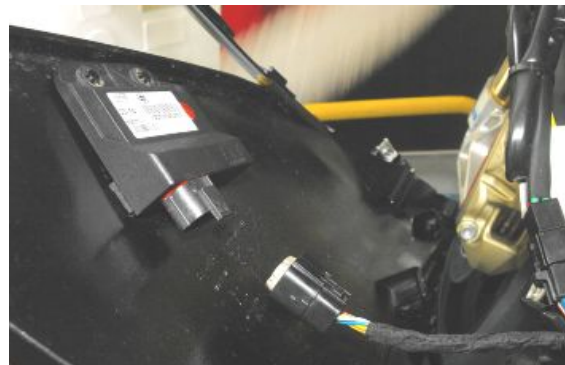


- Ease off the side fairing, taking particular care not to damage the fitting with the lower side fairing and the tabs fastening the side fairing to the lug.



#### FOR LEFT FAIRING ONLY

- Disconnect the connector from the tone wheel reading control unit (CLF).
- The control unit remains installed on the fairing.



- Remove the fairing
- To refit, repeat the above procedure in reverse order, taking particular care not to damage the components involved.

#### NOTE



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**HANDLE PAINTED AND PLASTIC COMPONENTS WITH CARE; BE CAREFUL NOT TO SCRATCH OR DAMAGE THEM.**

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### LOWER SIDE FAIRINGS

- The operations described below are valid for both lower side fairings.
- Remove the side fairing.
- Unscrew and remove the screw and remove the lower side fairing.

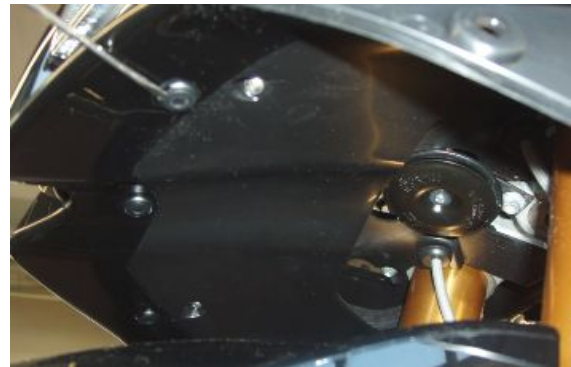


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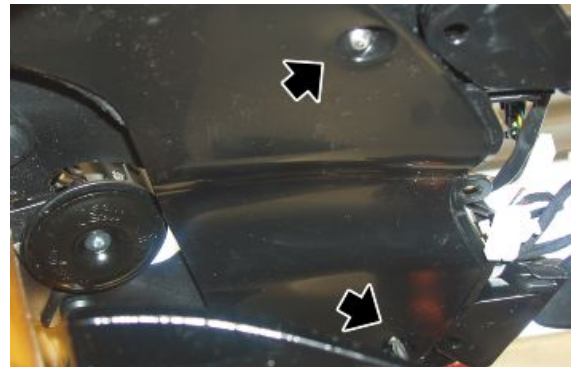
### Fairing mounting panels

#### CENTRAL UNDERFAIRING

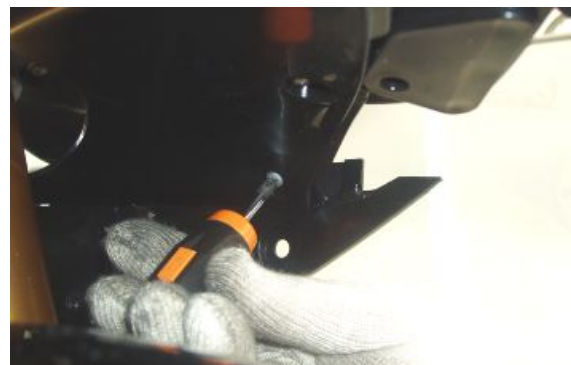
- Remove the three windshield fixing inserts.



- Unscrew and remove the two screws.
- Ease off the central underfairing, taking care not to damage the fittings with the lateral underfairings and the windshield.



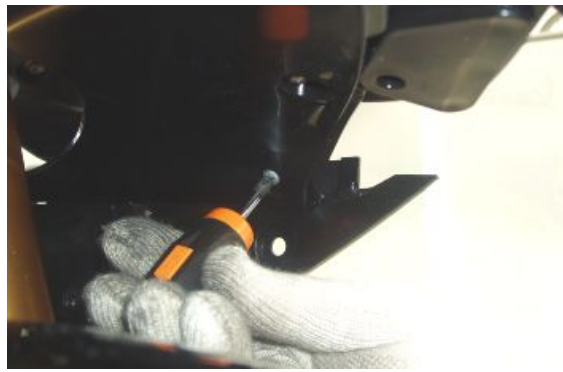
- Working from both sides, unscrew and remove the lower screw.



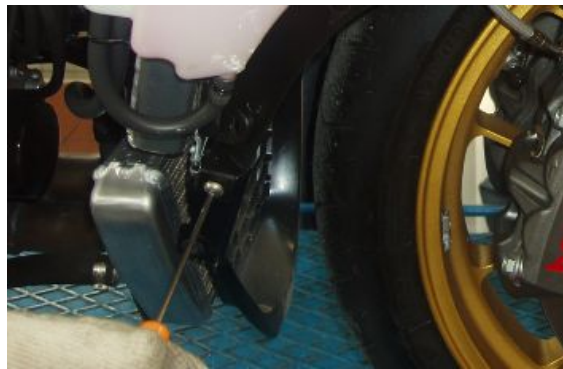
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**LATERAL UNDERFAIRINGS**

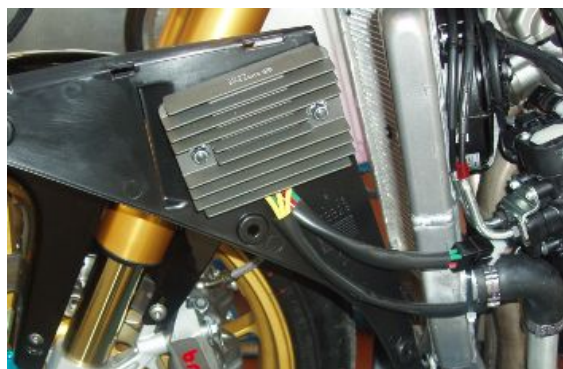
- The following procedure is relative to a single lateral underfairing, but is applicable to both, except where specified otherwise.
- Unscrew and remove the central underfairing fixing screw.



- 
- Remove the respective side fairing.
  - Unscrew and remove the lower screw.



- 
- When working on the left hand side of the vehicle, remove the underfairing taking particular care not to damage the fittings with the central underfairing.
  - When working on the left hand side of the vehicle, support the left hand underfairing, unscrew and remove the two nuts, retrieve the screws and lower the regulator.
  - Remove the underfairing.



---

## Air box

---

### FILTER BOX COVER REMOVAL

- Remove the control unit.
- Disconnect the air temperature sensor connector.



- 
- Move the two rear coil connectors



### See also

[Control unit](#)

- 
- Unscrew and remove the four upper injector screws.
  - Move the upper injector mounting.



- 
- Disconnect the variable geometry intake system connector.



- Unscrew and remove the eight air filter box cover screws.
- Remove the air filter box cover.



#### FILTER BOX BASE

- Open the air filter box cover.
- Unscrew and remove the air intake duct fixing screws.



- Disconnect the variable geometry intake system connector.

- Working from both sides, unscrew and remove the air pressure sensor fixing screw.



- Disconnect both front coil connectors (cylinders 2 and 4).



- Working from both sides, disconnect the Blow-by system intake pipes.



- Release the cable harness from the cable grommet on the filter box.
- Remove the air filter box base.



## Rear mudguard

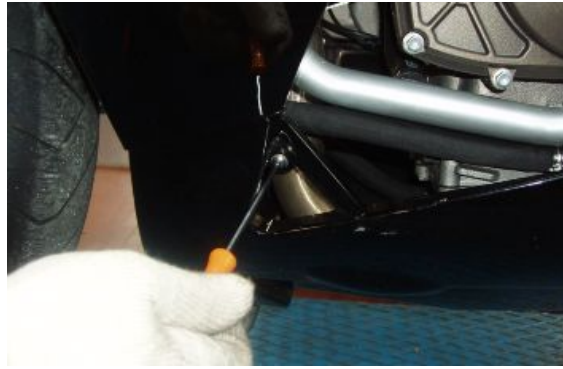
- Unscrew and remove the two screws.
- Remove the rear mudguard.



## Lower cowl

- The following procedure is applicable to both parts of the fairing lug.
- Remove the lower side fairing.

- Unscrew and remove the front screw.



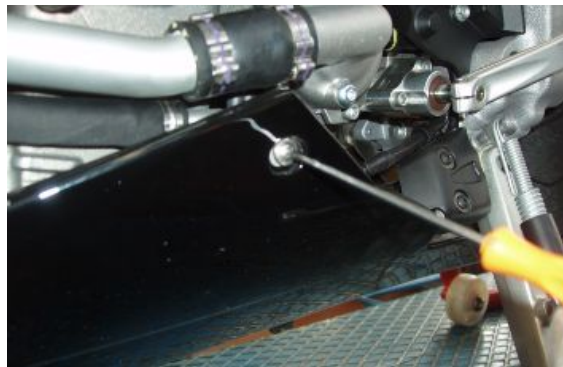
### See also

#### Side fairings

- Unscrew and remove the lower screw.



- Supporting the right fairing lug, unscrew and remove the right lug fixing screw and remove the lug.
- Remove the left fairing lug in the same manner.



---

## Fuel tank

- Unscrew and remove the front screw fixing the tank.



- 
- Remove the rider saddle.
  - Unscrew and remove the two rear screws.



- 
- Release the clamps.
  - Remove the two tank breather pipes.



- 
- Disconnect the fuel pipe.



- Disconnect the fuel pump connector.
- Remove the tank.



## Front mudguard

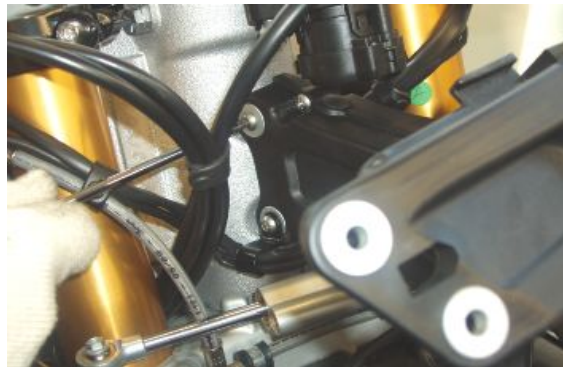
- Working from both sides, unscrew and remove the two screws.
- Remove the front mudguard.



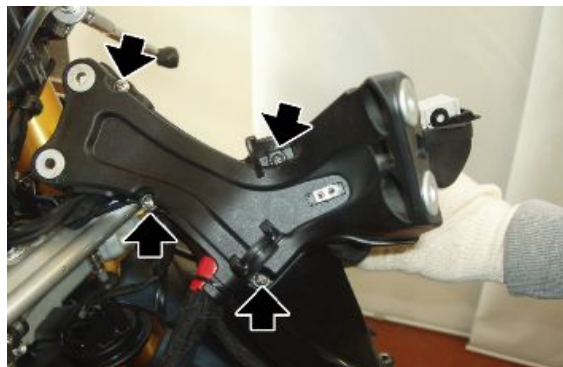
## Instrument cluster support

### REMOVAL

- Remove the instrument panel.
- Working on both sides, unscrew and remove the two screws fastening the arch brace to the headstock.
- Retrieve the cable grommet.



- Unscrew and remove the five semi-arch brace fixing screws.



### See also



---

**Instrument panel**

---

- Separate and remove the two semi-arch braces



---

**FITTING**

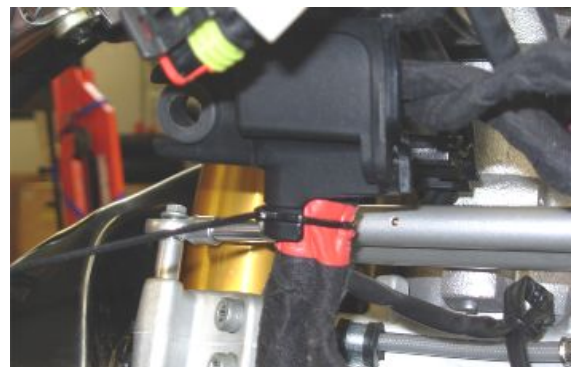
- Fit the right semi-arch brace, fixing it to the headstock with two screws.



- 
- Connect the Immobilizer aerial cables.



- Fasten the main cable harness to the semi-arch brace with a clamp.



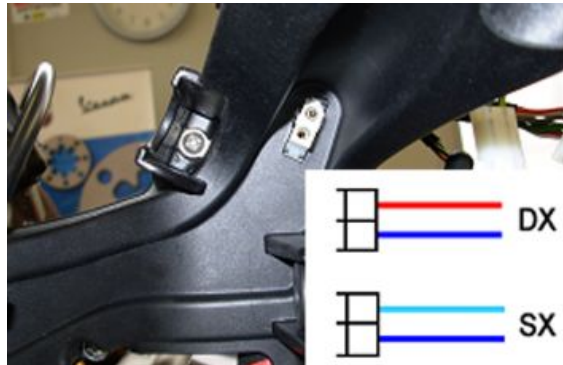
- Gather the cables on the right semi-arch brace and fasten them provisionally with a clamp.
- Fit the left semi-arch brace, applying the five coupling screws. Do not strain the connection between the two semi-arch braces, as this would prevent the removal of the clamp.



- Cut and remove the provisional clamp.
- Fit the cable grommet from the left hand side of the arch brace, tighten the two screws on the headstock.
- Tighten the five coupling screws.



- Fit the turn indicator connectors in the relative housings, noting the colours of the wires identifying the correct side.



- Join the remaining connectors and arrange the cable carefully in the space available within the arch brace. Note that there are two pairs of connectors which may be connected incorrectly.

The male connector on the cable with the red strip must be connected to the female connector on the longer cable.



- Reconnect the instrument panel connector

**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.

**Radiator cover**

- Remove the side fairings.
- Remove the fairing lug.
- Working from both sides, unscrew and remove the screw.



- Supporting the radiator cover and working from the right side of the vehicle, unscrew and remove the screw and retrieve the washer and the nut.

**See also**

[Lower cowl](#)

Side fairings

## Side air deflectors

The following procedure is for a single lateral duct but is applicable to both.

- Remove the windshield.
- Unscrew and remove the two fixing nuts.



- Remove the duct from its seat on the frame.

### CAUTION

**DURING REASSEMBLY, THE DUCT MUST BE SEATED CORRECTLY ON THE FRAME TO ENSURE THAT IT IS FLUSH WITH THE ADJACENT PARTS.**

### See also

Headlight fairing

---

## 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 IMMEDIATE MEDICAL ATTENTION. 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

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### LICENSE PLATE HOLDER

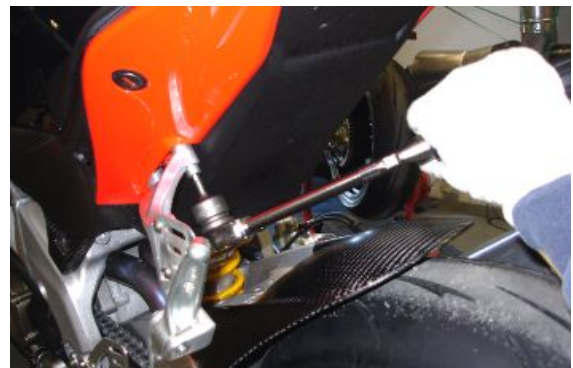
- Set three washers of suitable diameter between license plate and its holder to avoid damaging the license plate.



- 
- Remove the screw (2).
  - Remove the plastic cover (1).



- 
- Fit the rear pedal in its seat.
  - Fit the two TCEI M8X45 screws and tighten with a torque wrench to a torque of 18 Nm (13.27 lbf ft)



---

#### NOTE

REPEAT THE STEPS TO FIT THE PASSENGER FOOTPEG ON THE OPPOSITE SIDE.

---

#### WARNING

OPERATIONS REQUIRED TO RENDER VEHICLE COMPLIANT WITH TWO SEATER TYPE APPROVAL.

---

#### Saddle replacement

---

- Insert the key in the lock and turn it clockwise.
- Remove the tail fairing.



- Fit the two-seater saddle.



#### Adjusting the rear-view window joint.

- With the mirror closed (base turned 90° in relation to the mirror) check that the nut is closed properly, as indicated by the arrow, (you should be able to see about 0.5 mm - 1mm (0.02 in - 0.04 in) of the threaded pin projecting from the nut and the Loctite 270).



If the nut is not closed correctly, proceed as follows:

- Close the mirror (base turned 90° in relation to the mirror).
- Remove the glass from the indicator light.



- Cut the cable harness clamp (if there is one), disconnect the cable harness connector and pull the cable harness away from the mirror.



- Loosen the nut so its upper surface is about 0.5 mm (0.02 in) above the end of the threaded pin.
- Put some Loctite 270 inside the nut.



- Screw the nut back down until its upper surface is about 0.5 mm - 1 mm (0.02 in - 0.04 in) away from the end of the pin.
- Wait 24 hours for the Loctite to dry well before moving the mirror.

- Assemble the rear-view mirror.
- Pass the cable harness through the specific hole and place the rear-view mirror in its seat.



- Tighten the two fixing nuts of the rear-view mirror.



- Connect the connector.



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