aprilia

SERVICE STATION MANUAL

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DORSODURO FACTORY ABS

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THE VALUE OF SERVICE

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

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

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

www.aprilia.com

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

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

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

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SERVICE STATION MANUAL
DORSODURO FACTORY ABS

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, **Piaggio & C. S.p.a.** commits itself to continually improve its products and the relative documentation. The main technical modifications and changes in repair procedures are communicated to all **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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CHARACTERISTICS	CHAR

Rules

Safety rules

Carbon monoxide

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

CAUTION

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

Fuel

CAUTION

THE FUEL USED TO POWER INTERNAL COMBUSTION ENGINES IS HIGHLY FLAMMABLE AND MAY BE EXPLOSIVE UNDER CERTAIN CONDITIONS. IT IS THEREFORE RECOMMENDED TO CARRY OUT REFUELLING AND MAINTENANCE PROCEDURES IN A VENTILATED AREA WITH THE ENGINE SWITCHED OFF. DO NOT SMOKE DURING REFUELLING AND NEAR FUEL VAPOURS, AVOIDING 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. When handling these components, wear insulating gloves or wait until the engine and the exhaust system have cooled down.

Coolant

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

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

CAUTION

TAKE CARE NOT TO POUR COOLANT ONTO HOT ENGINE OR EXHAUST SYSTEM COMPONENTS; THE FLUID MAY CATCH FIRE AND BURN WITH INVISIBLE FLAMES. WHEN CARRYING OUT MAINTENANCE OPERATIONS, 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 UNDER PRESSURE AND MAY CAUSE BURNS.

Used engine oil and transmission oil

CAUTION

IT IS ADVISABLE TO WEAR PROTECTIVE IMPERMEABLE GLOVES WHEN SERVICING THE VEHICLE.
THE ENGINE OR GEARBOX OIL MAY CAUSE SERIOUS INJURIES TO THE SKIN IF HANDLED FOR PROLONGED PERIODS OF TIME AND ON A REGULAR BASIS.
WASH YOUR HANDS CAREFULLY AFTER HANDLING OIL.
HAND THE OIL OVER TO OR HAVE IT COLLECTED BY THE NEAREST USED OIL RECYCLING COMPANY OR THE SUPPLIER.
DO NOT DISPOSE OF OIL IN THE ENVIRONMENT
KEEP OUT OF THE REACH OF CHILDREN

Brake and clutch fluid

BRAKE AND CLUTCH FLUIDS CAN DAMAGE THE PLASTIC OR RUBBER PAINTED SURFACES. WHEN SERVICING THE BRAKING SYSTEM OR THE CLUTCH SYSTEM, PROTECT THESE COMPONENTS WITH A CLEAN CLOTH. ALWAYS WEAR PROTECTIVE GOGGLES WHEN SERVICING THESE SYSTEMS. BRAKE AND CLUTCH FLUIDS ARE EXTREMELY HARMFUL FOR YOUR EYES. IN THE EVENT OF ACCIDENTAL CONTACT WITH THE EYES, RINSE THEM IMMEDIATELY WITH ABUNDANT COLD, CLEAN WATER AND SEEK MEDICAL ADVICE.
KEEP OUT OF THE REACH OF CHILDREN

Battery electrolyte and hydrogen gas

CAUTION

THE BATTERY ELECTROLYTE IS TOXIC, CORROSIVE AND AS IT CONTAINS SULPHURIC ACID, IT CAN CAUSE BURNS WHEN IN CONTACT WITH THE SKIN. WHEN HANDLING BATTERY ELECTROLYTE, WEAR TIGHT-FITTING GLOVES AND PROTECTIVE APPAREL. IN THE EVENT OF SKIN CONTACT WITH THE ELECTROLYTIC FLUID, RINSE WELL WITH PLENTY OF CLEAN WATER. IT IS PARTICULARLY IMPORTANT TO PROTECT YOUR EYES BECAUSE EVEN TINY AMOUNTS OF BATTERY ACID MAY CAUSE BLINDNESS. IF THE FLUID GETS IN CONTACT WITH YOUR EYES, WASH WITH ABUNDANT WATER FOR FIFTEEN MINUTES AND CONSULT AN EYE SPECIALIST IMMEDIATELY. THE BATTERY RELEASES EXPLOSIVE GASES; KEEP IT AWAY FROM FLAMES, SPARKS, CIGARETTES OR ANY OTHER HEAT SOURCES. ENSURE ADEQUATE VENTILATION WHEN SERVICING OR RECHARGING THE BATTERY.
KEEP OUT OF THE REACH OF CHILDREN
BATTERY LIQUID IS CORROSIVE. DO NOT POUR IT OR SPILL IT, PARTICULARLY ON PLASTIC COMPONENTS. ENSURE THAT THE ELECTROLYTIC ACID IS COMPATIBLE WITH THE BATTERY TO BE ACTIVATED.

Maintenance rules

GENERAL PRECAUTIONS AND INFORMATION

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

BEFORE DISASSEMBLING COMPONENTS

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

COMPONENTS REMOVAL

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

REASSEMBLING COMPONENTS

CAUTION

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

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

ELECTRICAL CONNECTORS

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

Press the relative safety clips, if applicable.

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

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

CAUTION

DO NOT DISCONNECT CONNECTORS BY PULLING THE CABLES.

NOTE

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

TIGHTENING TORQUES

CAUTION

IN THE EVENT THAT A SELFBRAKING NUT IS UNSCREWED, IT IS NECESSARY TO REPLACE IT WITH A NEW ONE.

CAUTION

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

Running-in

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

CAUTION

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

Follow these guidelines:

- 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.

AFTER THE SPECIFIED MILEAGE, TAKE YOUR VEHICLE TO AN Official Aprilia Dealer FOR THE CHECKS INDICATED IN THE "AFTER-RUN-IN" TABLE IN THE SCHEDULED MAINTENANCE SECTION TO AVOID INJURING YOURSELF, OTHERS AND /OR DAMAGING THE VEHICLE.

Vehicle identification

Write down the chassis and engine number in the specific space in this booklet. The chassis number is handy when purchasing spare parts.

CAUTION

THE MODIFICATION OF THE IDENTIFICATION CODES IS A SERIOUS PUNISHABLE CRIME. HOWEVER, THE LIMITED WARRANTY FOR NEW VEHICLES WILL BE VOID IF THE VEHICLE IDENTIFICATION NUMBER (VIN) HAS BEEN MODIFIED OR NOT PROMPTLY DETERMINED.

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

ZD4SMB000YSXXXXXX

KEY:

ZD4: WMI (World manufacturer identifier) code;

SM: model;

B00: version variation;

0: free digit

Y year of manufacture

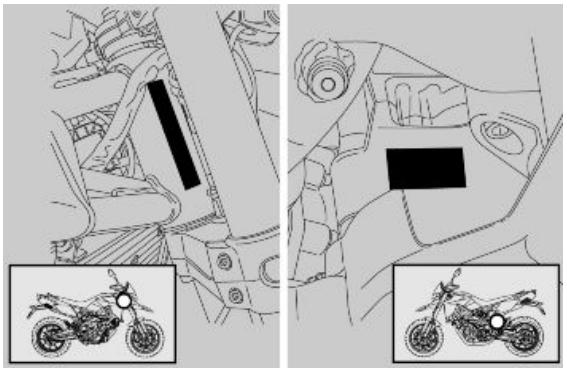
S: production plant (S= Scorzè);

XXXXXX: serial number (6 digits);

ENGINE NUMBER

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

Engine No. .....



CHASSIS NUMBER

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

Chassis No. .....

Dimensions and mass

DIMENSIONS

Specification	Desc./Quantity
Max. length	2210 mm (87.01 in)
Max. width (at hand guards)	905 mm (35.63 in)
Max. height	1185 mm (46.65 in)
Saddle height	900 mm (35.43 in)
Wheelbase	1505 mm (59.25 in)
Kerb weight	206 kg (454 lb)
Dry weight (unfuelled)	196 kg (432 lb)

Engine

ENGINE

Specification	Desc./Quantity
Model	M551M
Type	90° longitudinal V-twin, 4-stroke, 4 valves per cylinder, 2 overhead camshafts.
No. of cylinders	2
Total engine capacity	749.9 cm³ (45.76 cu.in)
Bore / stroke	92 x 56.4 mm (3.62 x 2.22 cu.in)
Intake valve clearance	0.11 - 0.18 mm (0.0043 - 0.0071 in)
Exhaust valve clearance	0.16 - 0.23 mm (0.0063 - 0.0091 in)
Compression ratio	11.0: 1
Electric	Electric starter
Engine idle speed	1400 ± 100 rpm
Clutch	Multiple-disk, oil-bathed clutch with control on the left side of the handlebar
Lubrication system	Wet crankcase. Pressure system regulated by a trochoidal pump
Air filter	With dry cartridge filter
Cooling	Fluid

GEARBOX

Specification	Desc./Quantity
Type	Mechanical, 6 speeds with foot lever on the left hand side of the engine

Transmission

GEAR RATIOS

Specification	Desc./Quantity
Gear ratio	Gear primary drive 38/71
1st gear ratio	14/36 (secondary)
2nd gear ratio	17/32 (secondary)
3rd gear ratio	20/30 (secondary)
4th gear ratio	22/28 (secondary)
5th gear ratio	23/26 (secondary)
6th gear ratio	24/25 (secondary)
Final drive gear ratio	16/46

Capacities

CAPACITY

Specification	Desc./Quantity
Fuel capacity (reserve included)	12 l (2.64 UKgal; 3.17 US gal)
Fuel reserve	2.8 l (0.62 UKgal; 0.74 US gal)
Engine oil	3.0 l (without oil filter change) (0.66 UKgal; 0.79 USgal) 3.2 l (with oil filter change) (0.70 UKgal; 0.85 USgal)
Fork oil (check also the correct air level in the stem)	441 cm³ (26.91 cu.in) (for each stanchion)
Coolant	1.8 l (0.40 UKgal; 0.48 USgal)
Seats	2
Maximum weight limit	400 kg (882 lb)

Drive chain

DRIVE CHAIN

Specification	Desc./Quantity
Type	Endless (without master link) and with sealed links. No. of links 108
Model	525 ZRPK

Electrical system

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Battery	12 V - 10 Ah YTX 12 - BS
Main fuses	30A
Secondary fuses	3A, 10A, 15A, 20A
Alternator (permanent magnet type)	13.5 V - 450 W at 6000 rpm

SPARK PLUGS

Specification	Desc./Quantity
Standard spark plugs	NGK CR7EKB
Spark plug electrode gap	0.6 - 0.7 mm (0.024 - 0.028 in)
Resistance	5 kOhm

BULBS

Specification	Desc./Quantity
High beam light	12 V - 60 W H4
Low beam light	12 V - 50 W H4
Front daylight running light	12V - 6W H6
Turn indicator light	12V - 10W
Rear daylight running light / stop light	LED
License plate light	12V - 5W
Rpm indicator lighting	LED
Multifunction display lighting	LED

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	LED

Frame and suspensions

CHASSIS

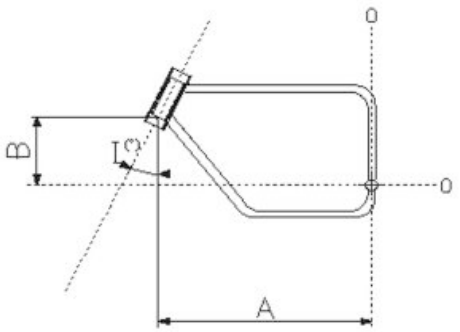
Specification	Desc./Quantity
Type	Component chassis (bolted). Die-cast aluminium plates and high-strength steel tubular chassis.
Steering inclination angle	25.8°
Trail	108 mm (4.25 in)

SUSPENSION

Specification	Desc./Quantity
Front	Sachs upside-down stanchions with adjustable hydraulic damping and 43mm (1.69 in) diameter stanchions
Travel	160 mm (6.3 in)
Rear	Oscillating swingarm with Sachs piggy-back single shock absorber and adjustable spring preloading, wheelbase and hydraulic compression and rebound damping.
Wheel travel	155 mm (6.1 in)

SIZES A AND B

Specification	Desc./Quantity
Size A	693.1 mm (27.29 in)
Size B	369.8 mm (14.56 in)



Brakes

BRAKES

Specification	Desc./Quantity
Front	Double floating disc, Ø 320 mm (12.60 in), radially-mounted calliper with four Ø 32 mm (1.26 in) pistons and two calliper pads
Rear	240 mm (9.45 in) disc brake with 34 mm (1.34 in) single piston calliper

Wheels and tyres

WHEEL RIMS

Specification	Desc./Quantity
Type	Light alloy rims with extractable bolt
Front	3.50 x 17"
Rear	6.00 x 17"

TYRES

Specification	Desc./Quantity
Tyre type (standard)	PIRELLI CORSA III DUNLOP SPORTMAX QUALIFIER
Front tyre	120/70 ZR17"
Front tyre pressure	rider only: 2.3 bar (230 kPa) (33.36 PSI) rider + passenger: 2.4 bar (240 kPa) (34.81 PSI)
Rear tyre	180/55 ZR17"
Rear tyre pressure	rider only: 2.5 bar (250 kPa) (36.26 PSI) rider + passenger: 2.7 bar (270 kPa) (39.16 PSI)

Supply

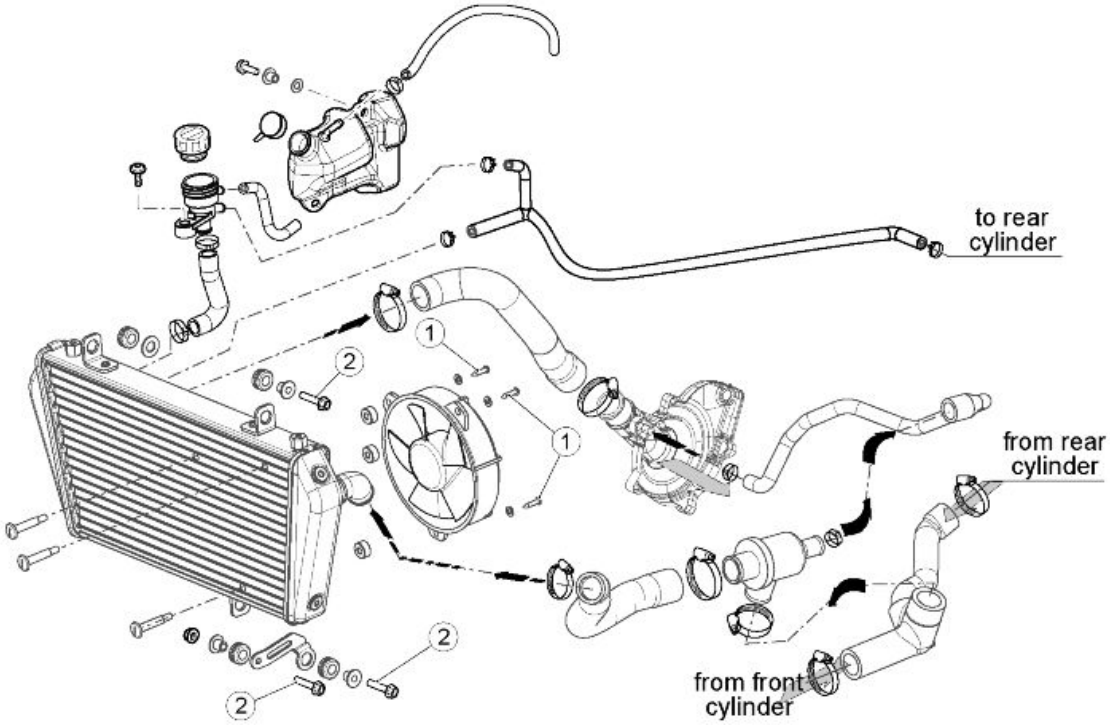
FUEL SYSTEM

Specification	Desc./Quantity
Type	Electronic injection (Multipoint)
Throttle valve diameter	Ø 52 mm (2.05 in)
Fuel	Premium unleaded petrol, minimum octane rating 95 (NORM) and 85 (NOMM)

Tightening Torques

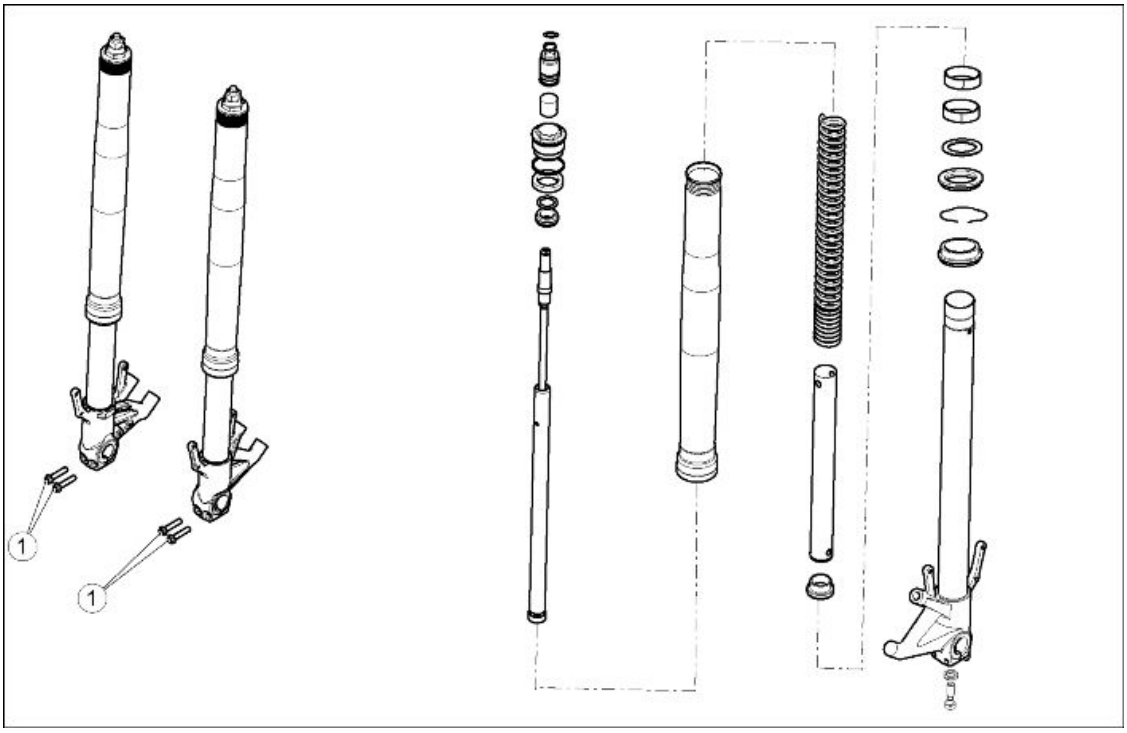
Chassis

Front side



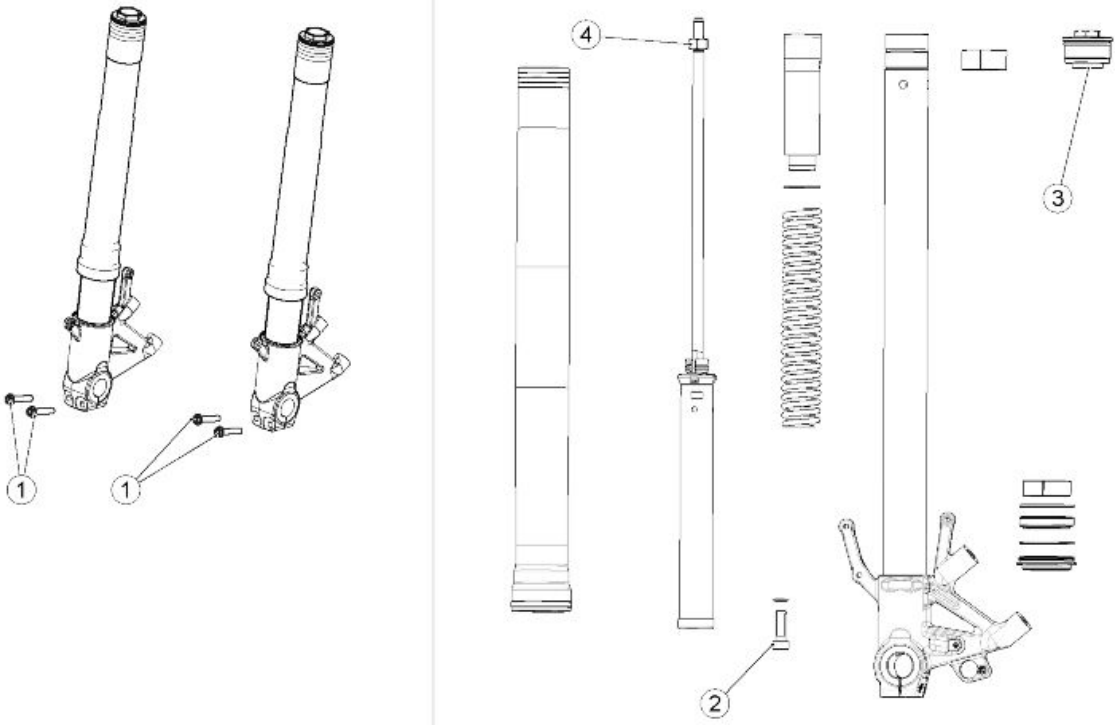
COOLING SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Fan fastener screw	-	3	3 Nm (2.21 lbf ft)	-
2	Flanged TE screw fixing LH side radiator to trellis frame and radiator bracket to engine	M6x25	2	10 Nm (7.37 lbf ft)	-



FRONT FORK - SHOWA

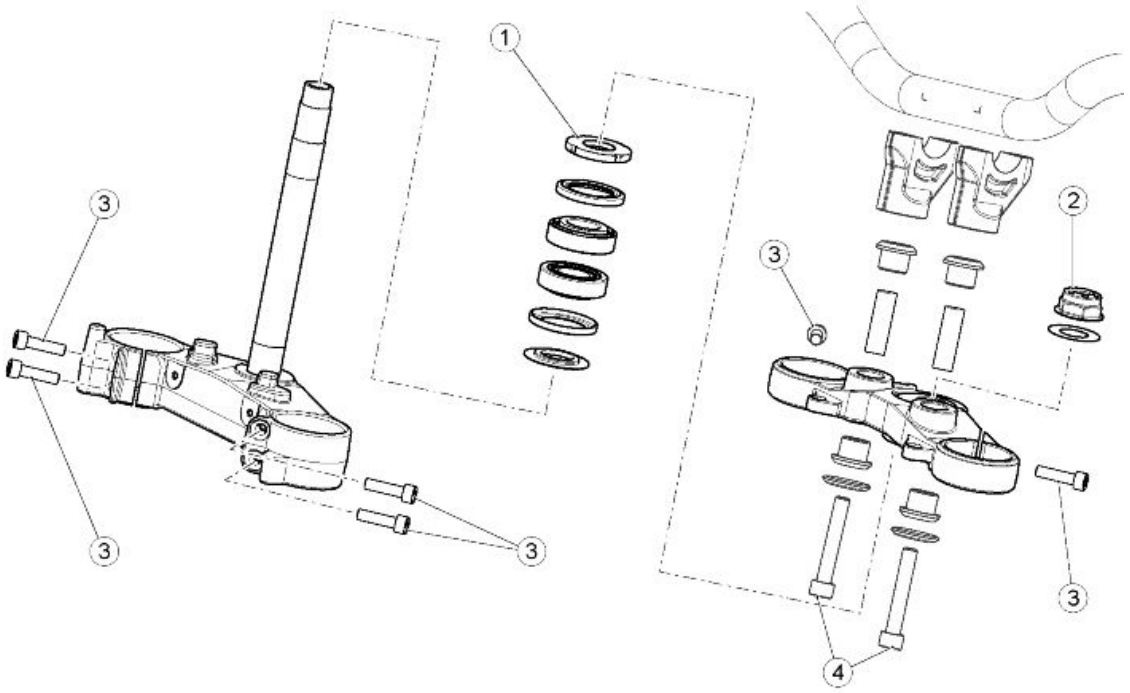
pos.	Description	Type	Quantity	Torque	Notes
1	Screws (fasten onto fork hubs)	M8x40	4	25 Nm (18.44 lb ft)	-



FRONT FORK - SACHS

pos.	Description	Type	Quantity	Torque	Notes
1	Screws (fasten onto fork hubs)	M8x40	4	25 Nm (18.44 lb ft)	-
2	Bottom screw	-	2	30 Nm (22.13 lb ft)	Loctite 242
3	Cap		2	20 Nm (14.75 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
4	Nut on pumping member pin		2	20 Nm (14.75 lb ft)	-

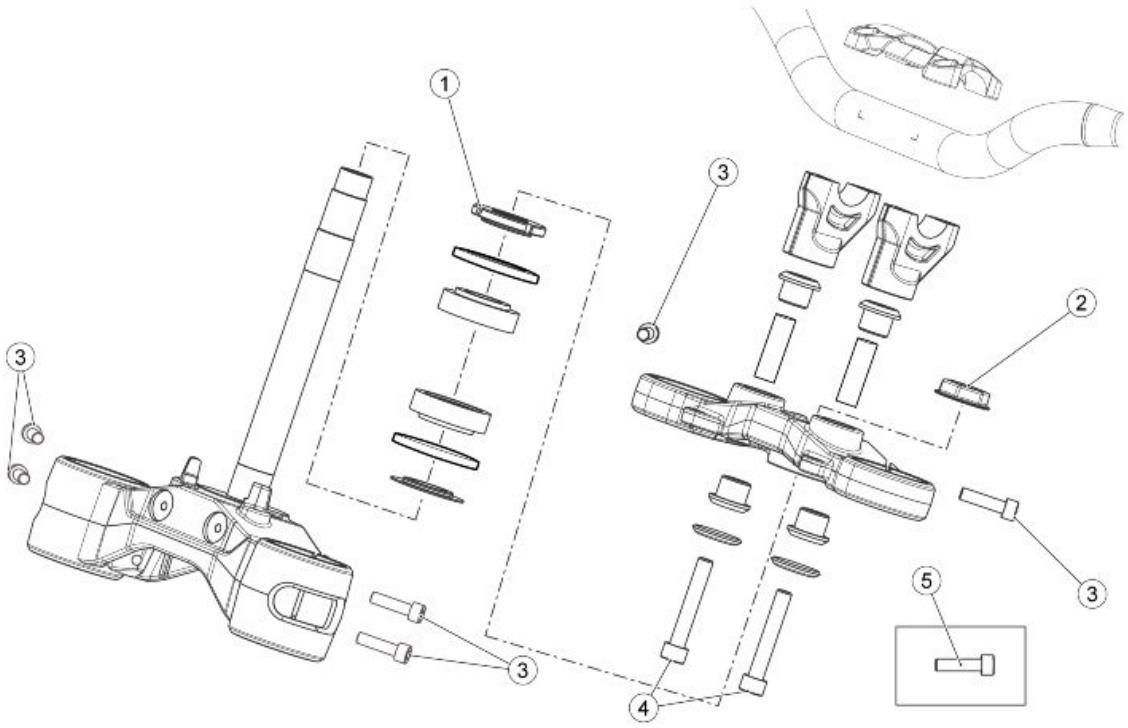


OPTION 01- Steering upper plate **without** a headstock cut.

STEERING - OPTION 1

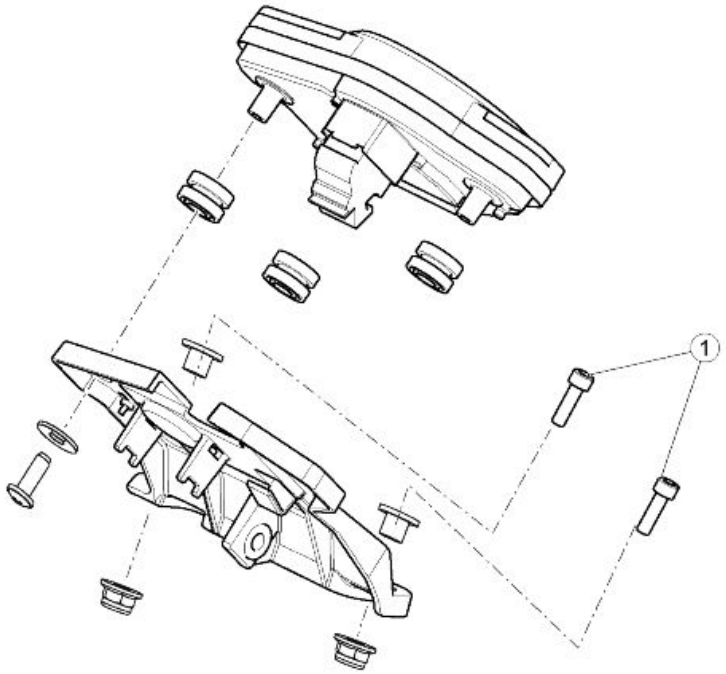
pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-

OPTION 02- Steering upper plate **with** a headstock cut.



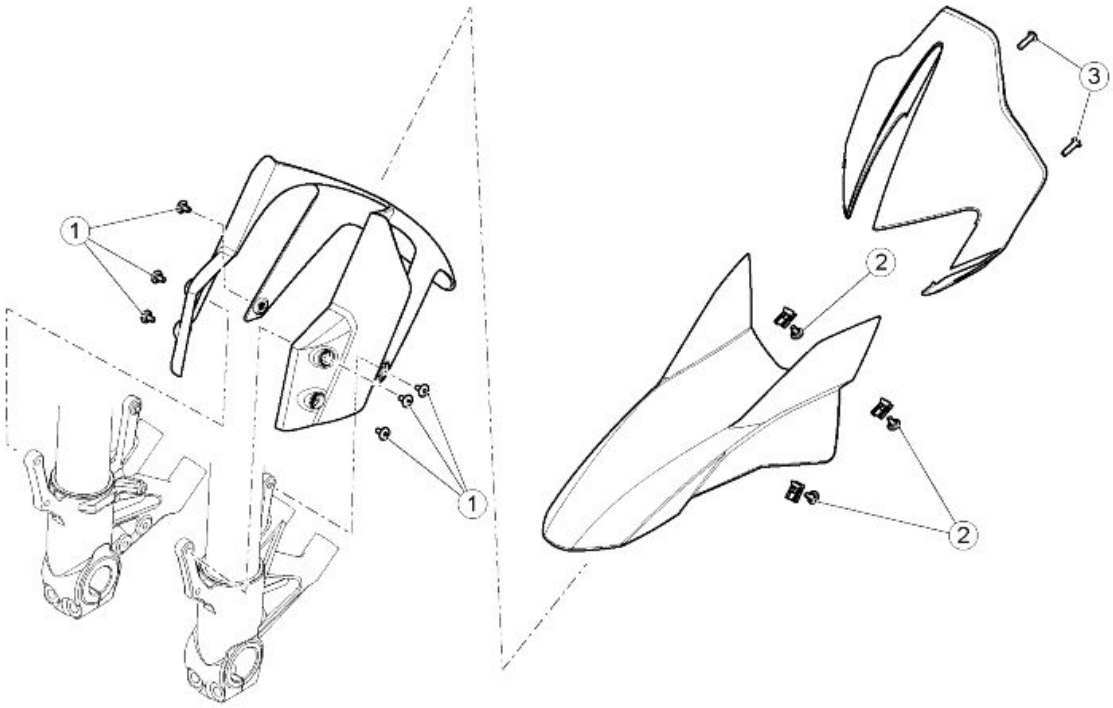
STEERING

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock nut - pre-tightening	M22x1	1	10 Nm (7.37 lb ft)	Loctite 243
2	Headstock nut	M22x1	1	25 Nm (18.44 lb ft)	Loctite 243
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-
5	Steering upper plate clamp closing screw	M8x30	1	25 Nm (18.44 lb ft)	Loctite 243



INSTRUMENT PANEL

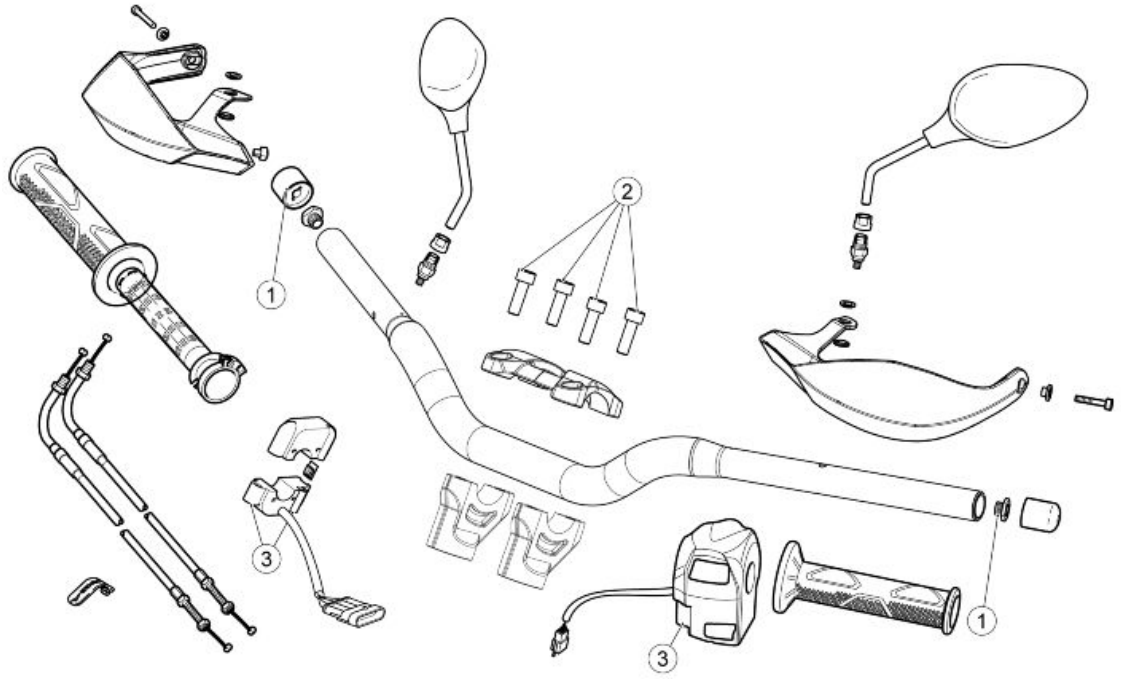
pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening instrument panel mounting to fork yoke	M6x20	2	10 Nm (7.37 lbf ft)	-



FRONT MUDGUARD

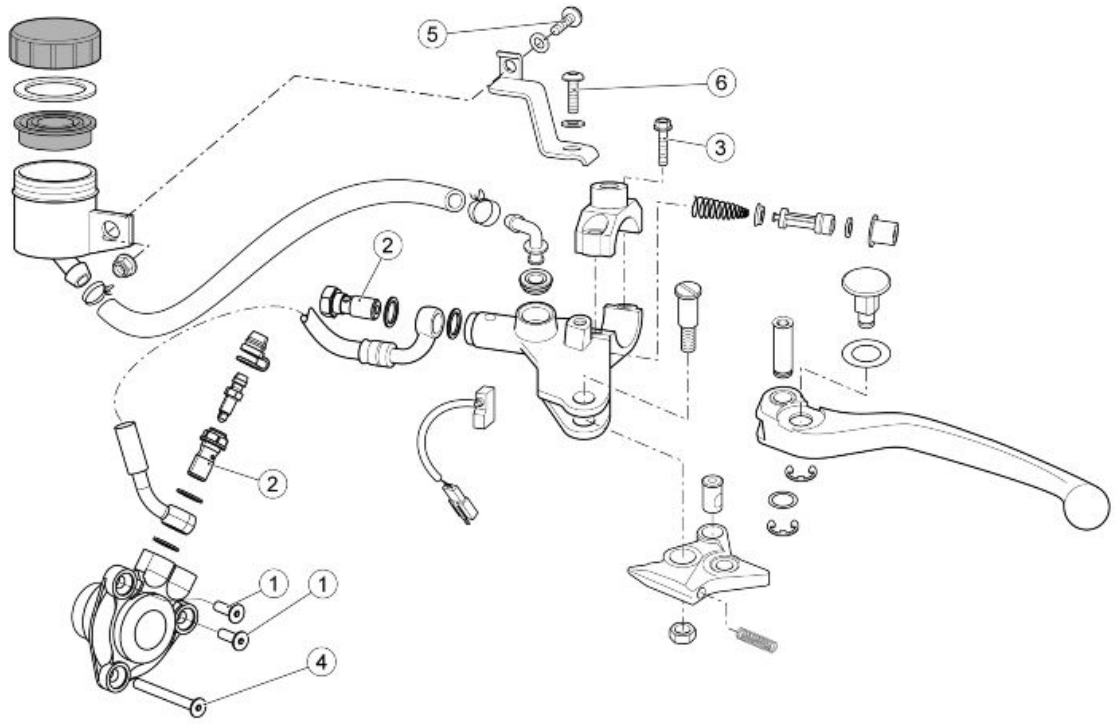
pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening fork guard to calliper mounting bracket	M5x9	6	6 Nm (4.42 lbf ft)	Loct. 243

pos.	Description	Type	Quantity	Torque	Notes
2	TBEI screw fastening mudguard to stanchions	M5x9	4	4 Nm (2.95 lbf ft)	-
3	Screw fastening number panel to headlamp	-	4	1 Nm (0.74 lbf ft)	-



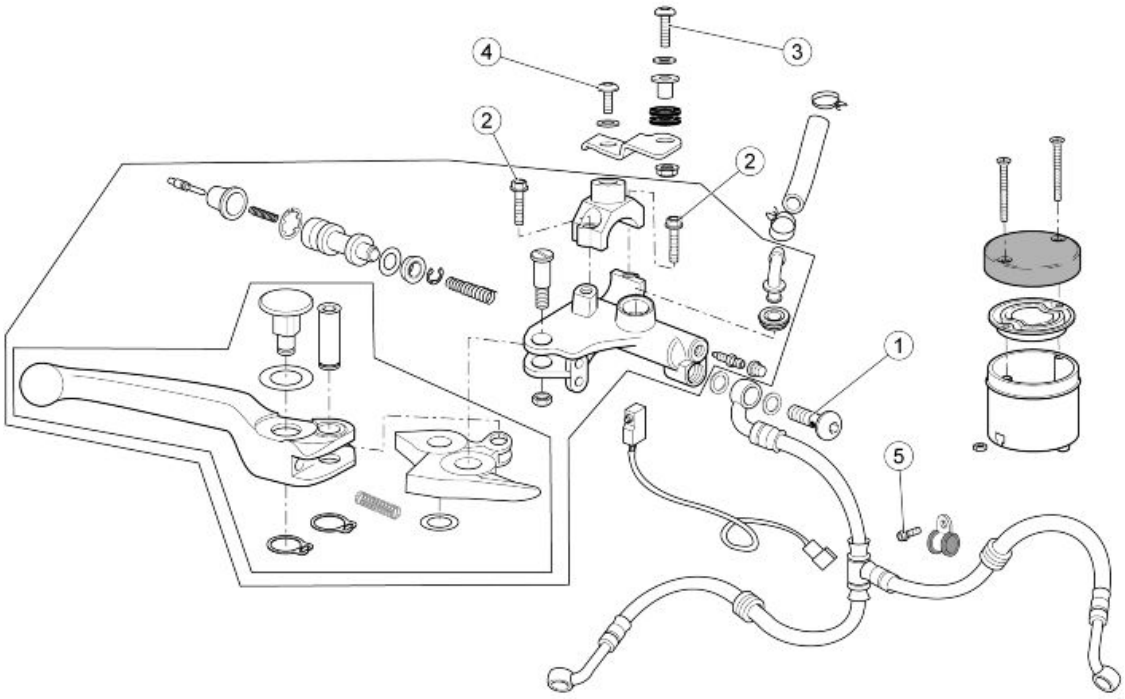
HANDLEBAR

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening counterweight to handlebar end	M6x50	2	10 Nm (7.37 lbf ft)	-
2	Stainless steel TCC screw fastening upper U-bolt to lower clamp	M8x25	4	25 Nm (18.44 lbf ft)	-
3	Screws fastening light switch assembly	M4	2	1.5 Nm (1.11 lbf ft)	-



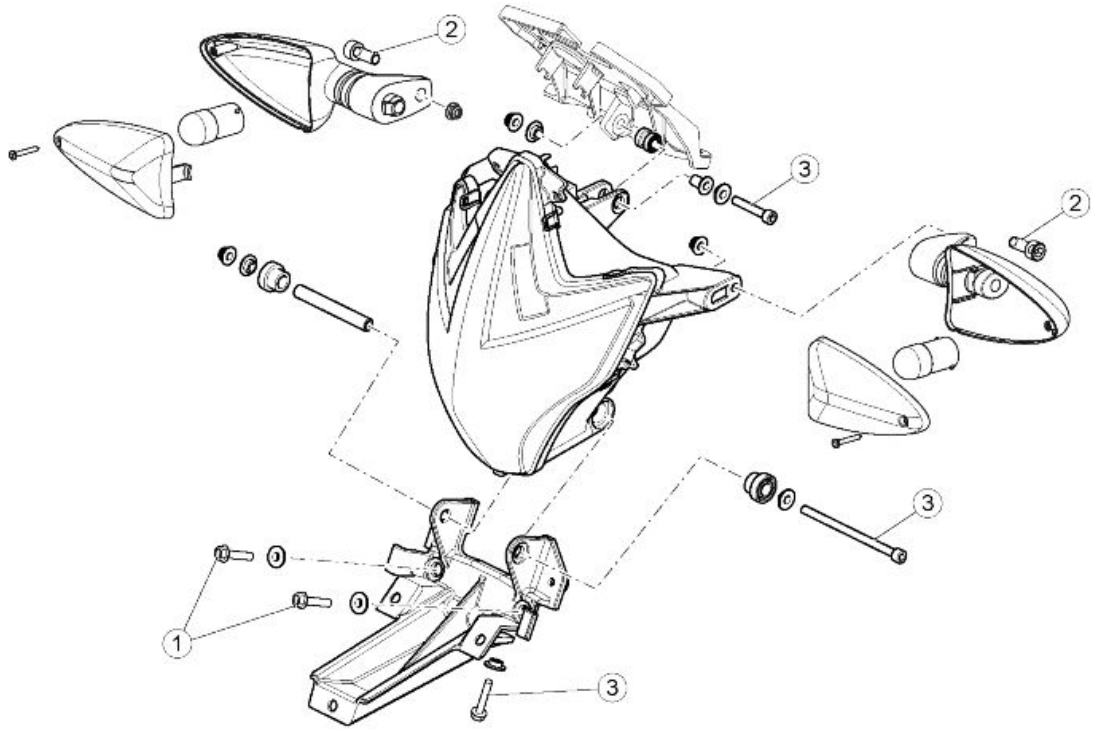
CLUTCH PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch cylinder fastener	M6	2	10 Nm (7.37 lbf ft)	-
2	Union with breather and fixing pipe	M10x1	1+1	25 Nm (18.44 lbf ft)	-
3	Fastener for clutch pump on handle-bar	-	2	10 Nm (7.37 lbf ft)	-
4	Screw fastening clutch control mounting on flywheel side crankcase half	M6	1	10 Nm (7.37 lbf ft)	-
5	TBEI tank fixing screw	M5x10	1	6 Nm (4.42 lbf ft)	-
6	TBEI plate fixing screw	M6x12	1	10 Nm (7.37 lbf ft)	-



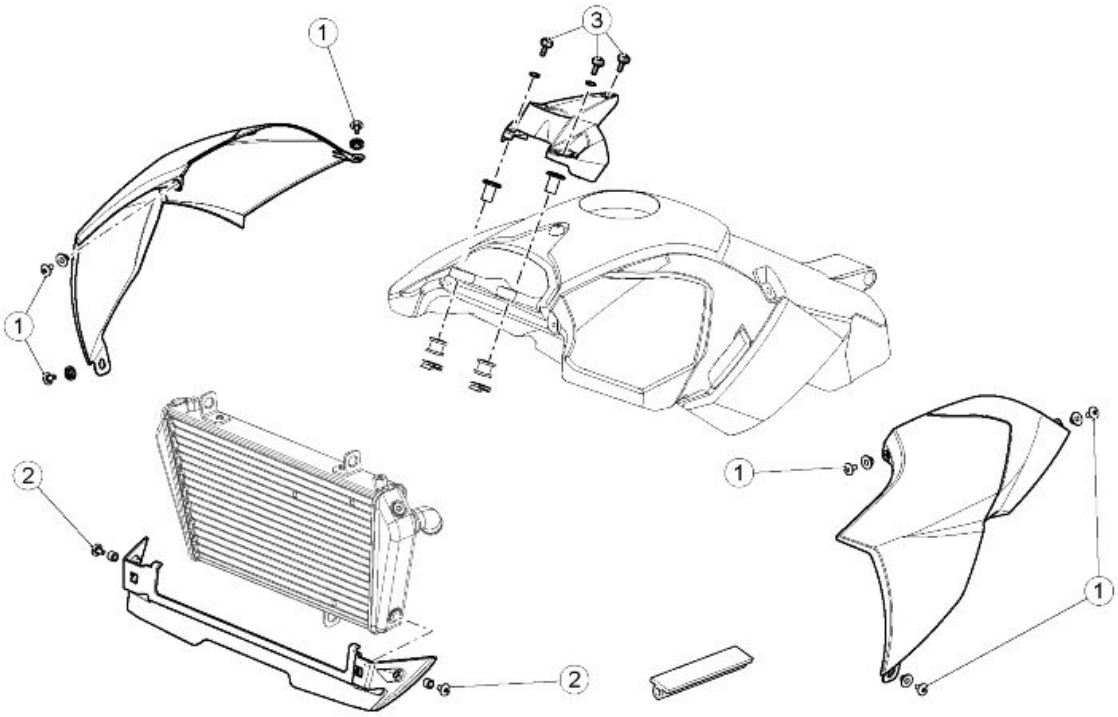
FRONT BRAKE PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Pipe union fastening brake pipe to pump	M10x1	1	25 Nm (18.44 lbf ft)	-
2	Fastener for front brake pump on handlebar	-	2	10 Nm (7.37 lbf ft)	-
3	TBEI screw fastening the brake tank to the plate	M6x20	1	10 Nm (7.37 lbf ft)	-
4	Plate fixing screw	M6x12	1	10 Nm (7.37 lbf ft)	-
5	Screw fastening the brake pipe to steering base	M6x25	1	10 Nm (7.37 lbf ft)	-



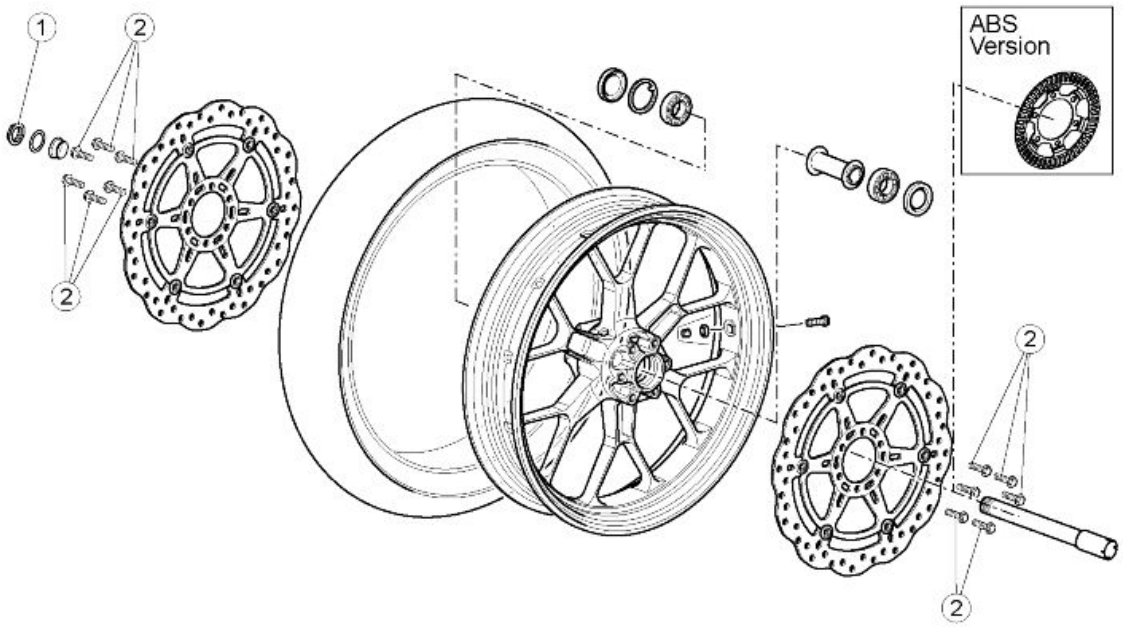
HEADLAMP

pos.	Description	Type	Quantity	Torque	Notes
1	TE screw fastening headlamp to headlamp mounting and mudguard to steering base	M6x16	2	10 Nm (7.37 lbf ft)	-
2	Fastener for front turn indicators	M5	2	3 Nm (2.21 lbf ft)	-
3	TCEI screw fastening headlamp mounting to fork yoke	M6	3	10 Nm (7.37 lbf ft)	-



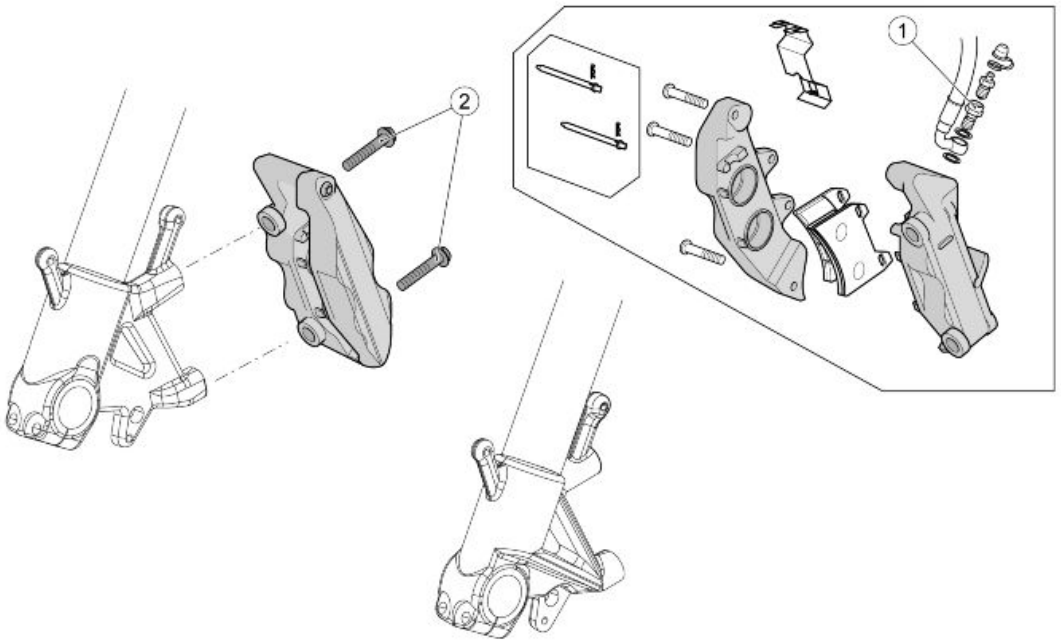
FRONT BODYWORK

pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening front side panels to tank	M5x9	6	4 Nm (2.95 lbf ft)	-
2	TBEI screw fastening front side panels and duct to radiator	M6x16	4	6 Nm (4.42 lbf ft)	-
3	TBEI screw fastening ignition block cover to spacer	M5x9	3	4 Nm (2.95 lbf ft)	-
-	Front tank fastener spacer	M6	2	10 Nm (7.37 lbf ft)	-



FRONT WHEEL

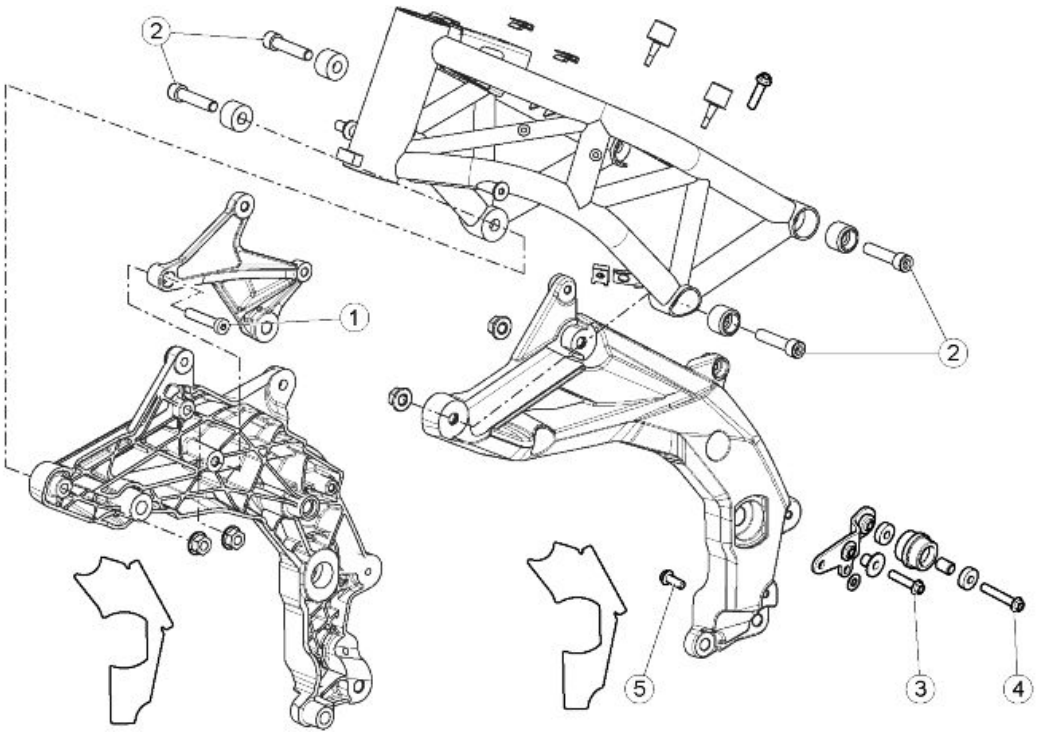
pos.	Description	Type	Quantity	Torque	Notes
1	Wheel axle nut	-	1	80 Nm (59 lbf ft)	-
2	TE flanged screw fastening front disc	M8x20	12	30 Nm (22.13 lbf ft)	Loctite 243



FRONT BRAKE

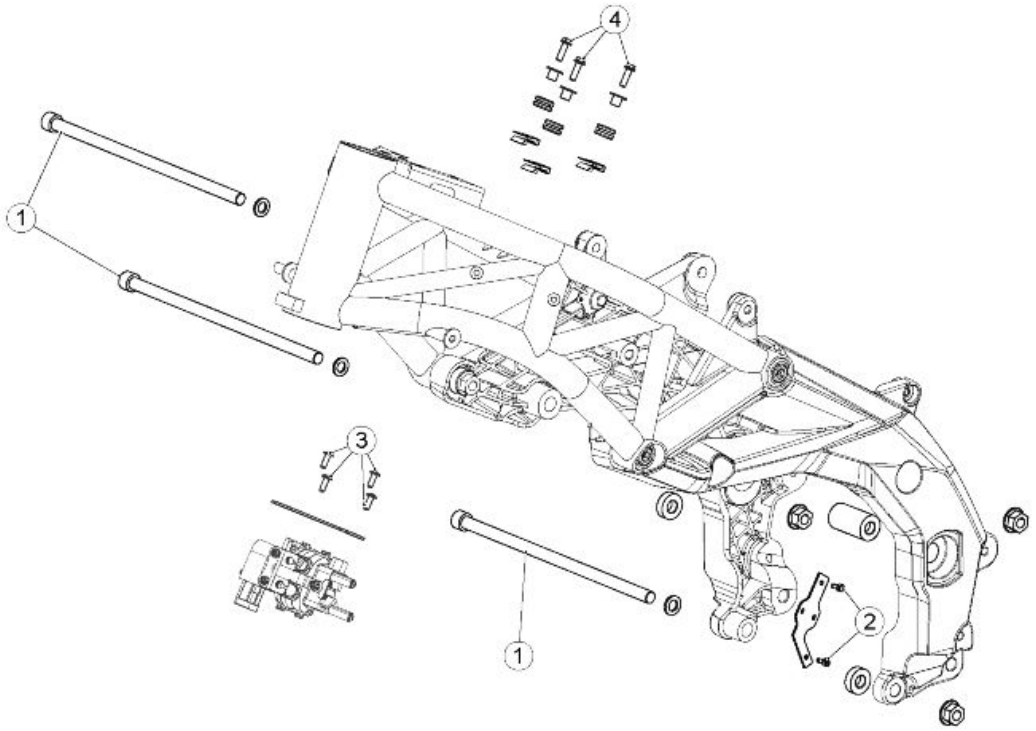
pos.	Description	Type	Quantity	Torque	Notes
1	Union with breather (fixing pipe to callipers)	M10x1	2	25 Nm (18.44 lbf ft)	-
2	TEFL screw (Fixing calliper to fork stems)	M10x1.25	4	50 Nm (36.88 lbf ft)	-
-	Fastener for brake pipe on steering base	M6x25	1	10 Nm (7.37 lbf ft)	-

Central part



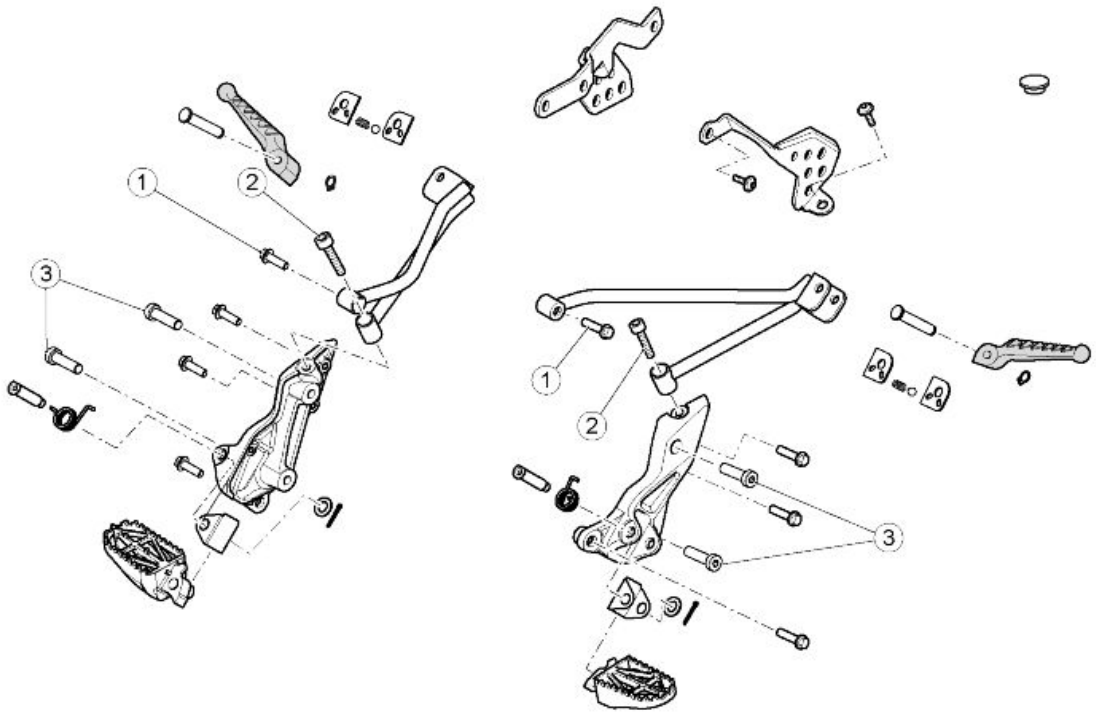
FRONT CHASSIS

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening shock absorber counterplate to RH frame bracket	M10x30	1	50 Nm (36.88 lbf ft)	-
2	TC TORX screw fastening trellis frame to frame side panels	M12x53	4	80 Nm (59 lbf ft)	-
3	Screw fastening chain roller bracket to LH plate	M8x35	1	25 Nm (18.44 lbf ft)	Loctite 243
4	Screw fastening chain roller to chain roller bracket	M8x45	1	25 Nm (18.44 lbf ft)	Loctite 243
5	Screw fastening chain roller bracket to LH plate	M8x20	1	25 Nm (18.44 lbf ft)	Loctite 243



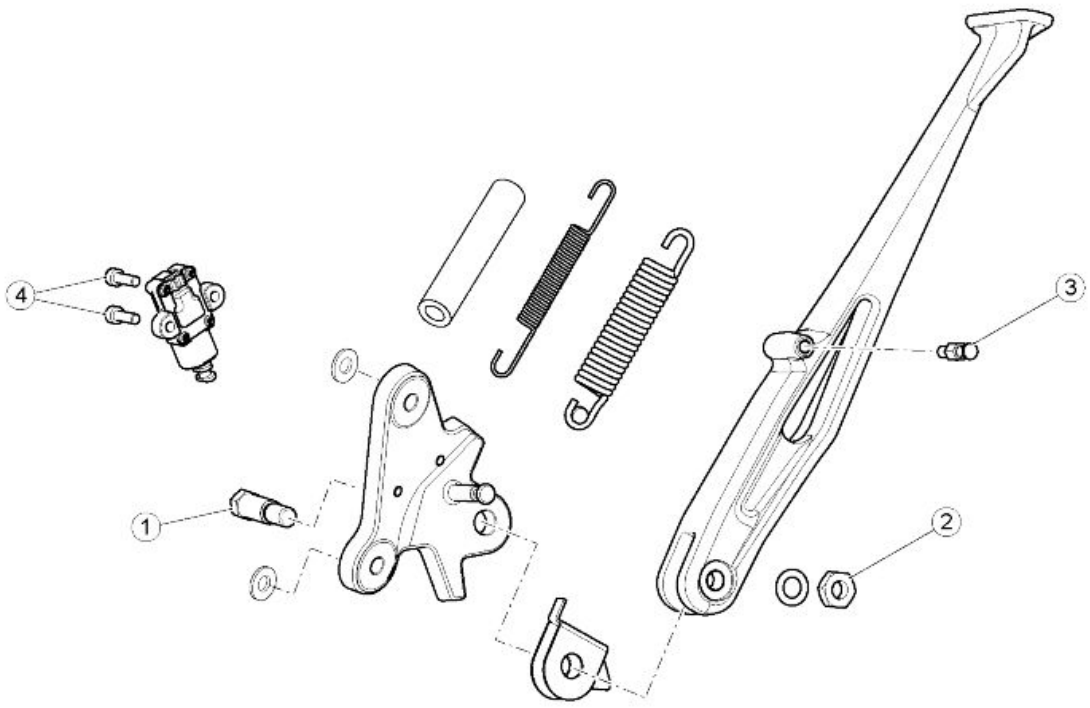
CENTRE FRAME

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screws fastening side panels to engine	M12x282	3	80 Nm (59 lbf ft)	-
2	TCEI screw fastening lambda probe plate to RH frame (pre-fit on RH side panel	M4x10	2	3 Nm (2.3 lbf ft)	-
3	SWP self-tapping screw fastening demand sensor mounting to demand sensor	M5x14	4	2.6 Nm (1.92 lbf ft)	-
4	Flanged TE screw fastening demand sensor to frame	M6x20	3	10 Nm (7.37 lbf ft)	-



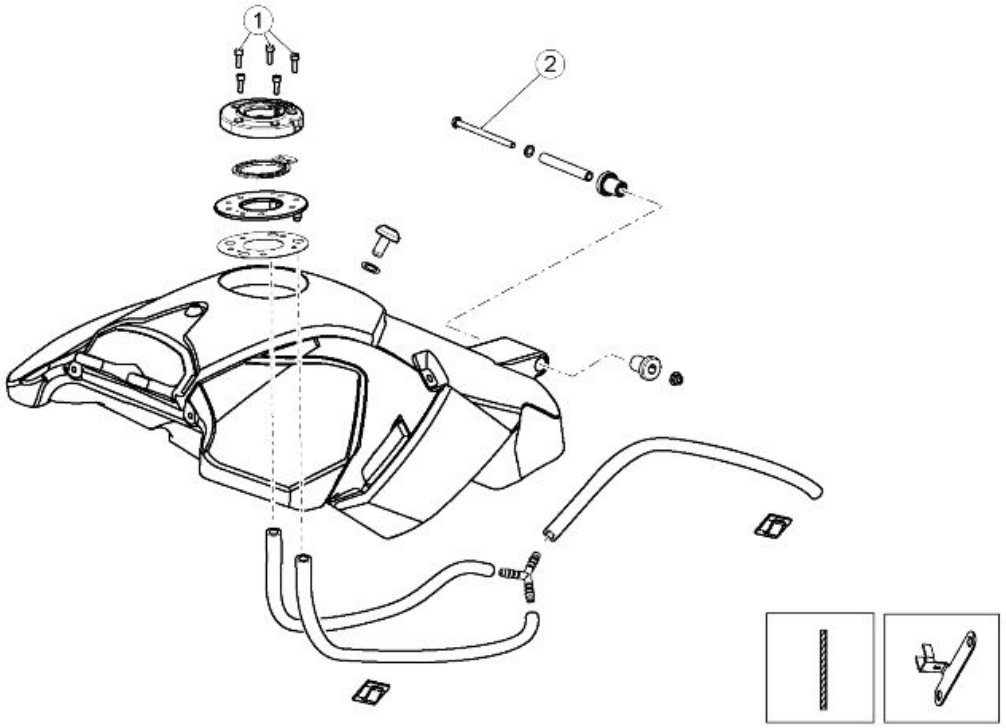
FOOTPEGS

pos.	Description	Type	Quantity	Torque	Notes
1	Upper screw fastening passenger footrests to frame side panels	M8x35	2	25 Nm (18.44 lbf ft)	Loct. 243
2	Lower TCEI screw fastening passenger footrests to rider footrest mounting	M8x35	2	25 Nm (18.44 lbf ft)	Loct. 243
3	TCEI screw fastening rider footrest mounting to frame	M8x35	4	28 Nm (20.65 lbf ft)	Loctite 243



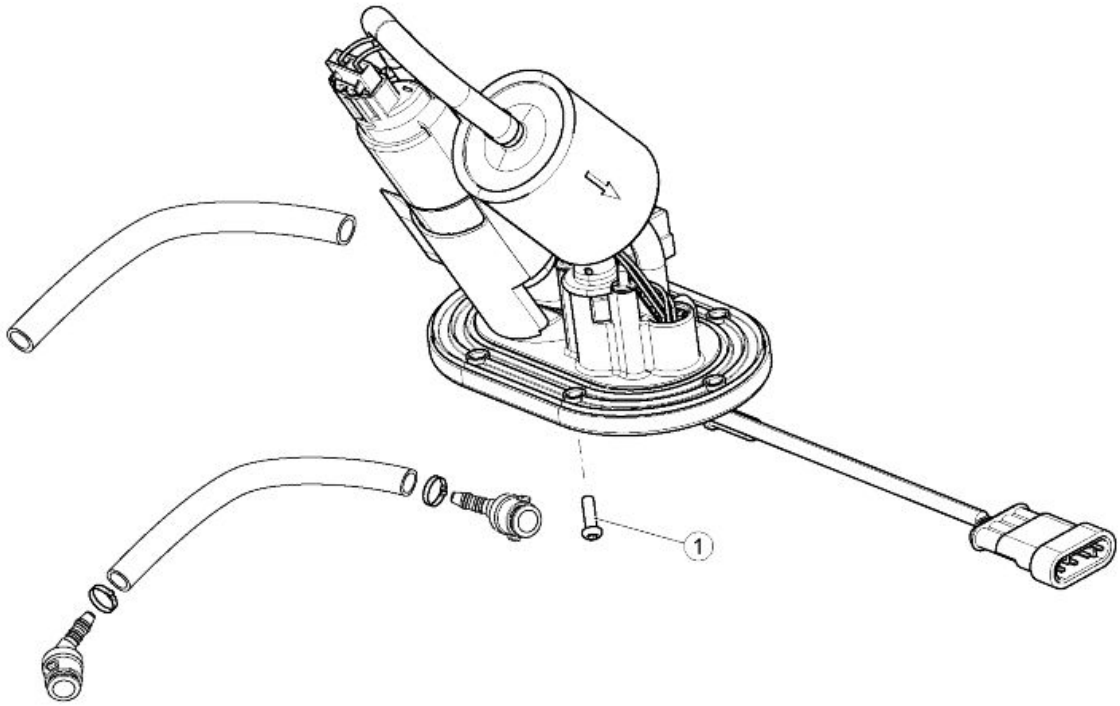
STAND ASSEMBLY

pos.	Description	Type	Quantity	Torque	Notes
1	Stand screw	M10x1.25	1	10 Nm (7.37 lbf ft)	Loctite 243
2	Thin nut	M10x1.25	1	30 Nm (22.13 lbf ft)	Loctite 243
3	Spring fixing pin	-	1	7.5 Nm (5.53 lbf ft)	-
4	TCEI screw fastening stand switch	M5x16	2	7 Nm (5.16 lbf ft)	-



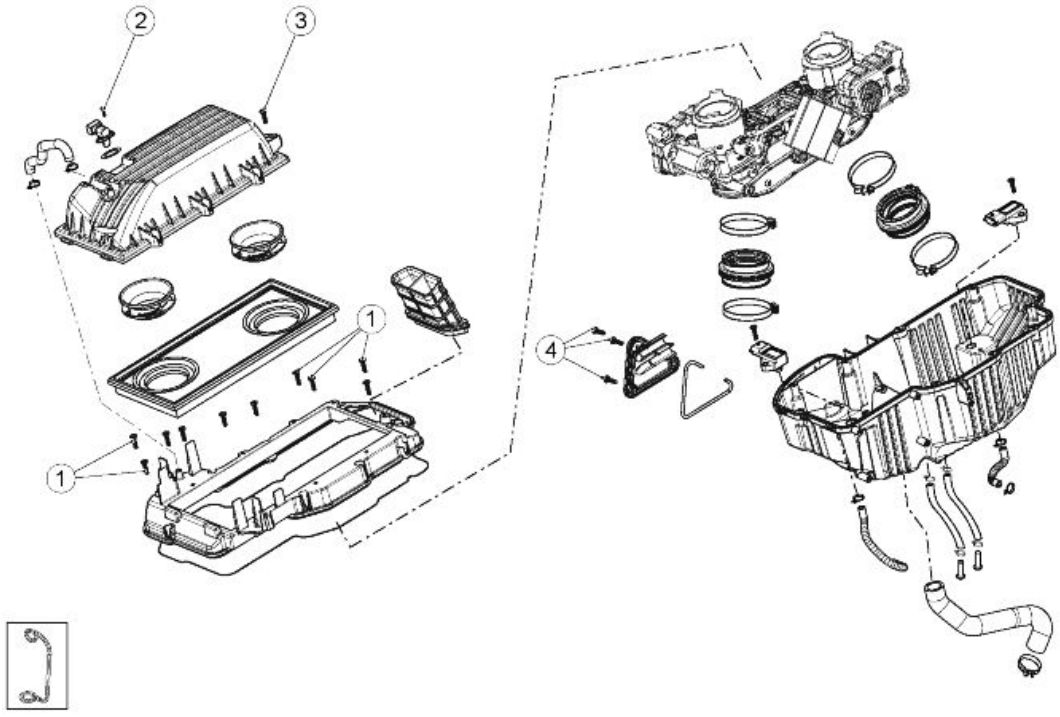
FUEL TANK

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening filler cap flange	M5x16	5	3 Nm (2.21 lbf ft)	-
2	Rear TE screw fastening tank	M6x90	1	10 Nm (7.37 lbf ft)	-



FUEL PUMP

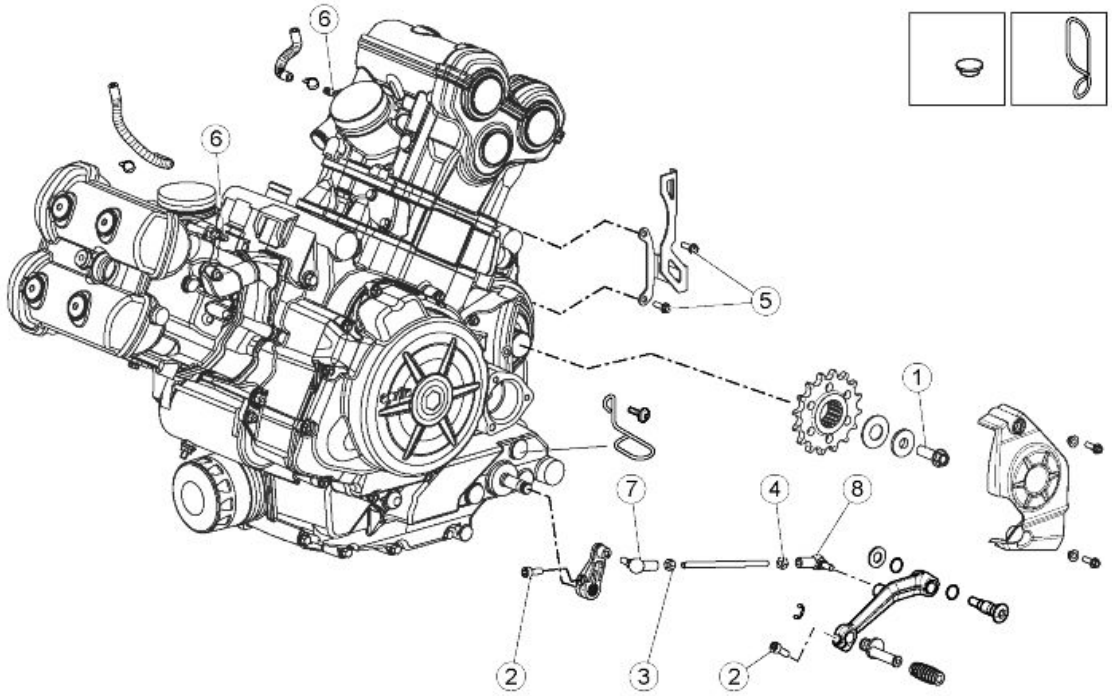
pos.	Description	Type	Quantity	Torque	Notes
1	TEFL screw fastening fuel pump	M5x16	6	6 Nm (4.42 lbf ft)	-



AIR FILTER BOX

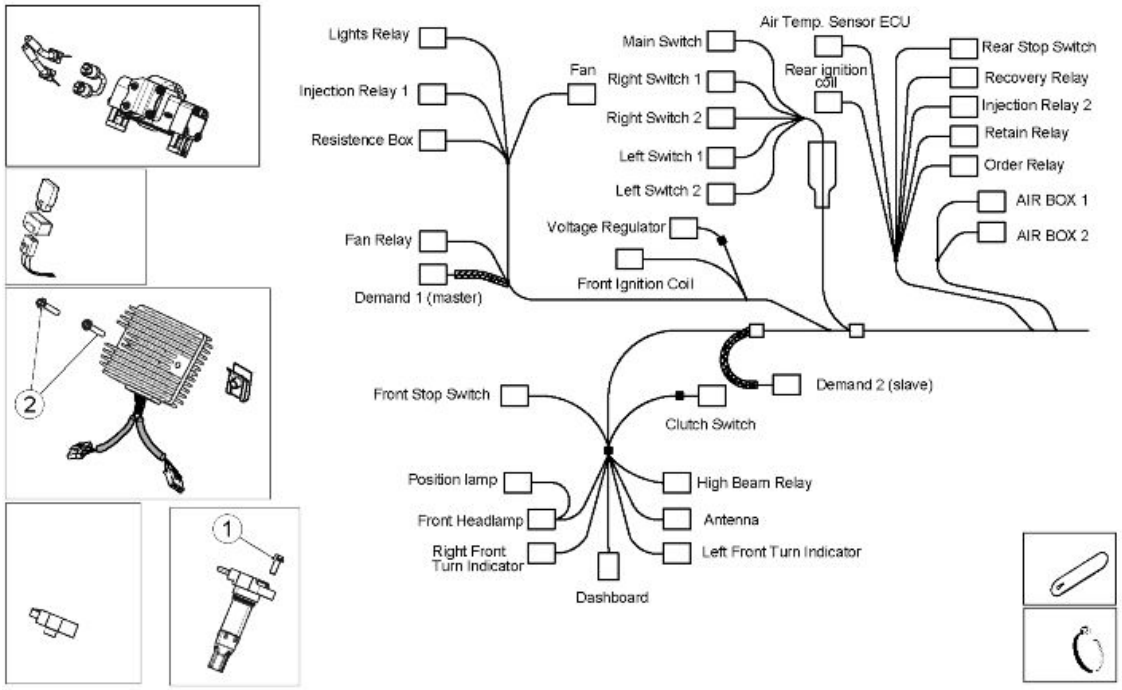
pos.	Description	Type	Quantity	Torque	Notes
1	Cross head self-tapping screw fastening separator / filter box	M5x20	10	3 Nm (2.21 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	SWP self-tapping screw	M2.9x12 TCCR	2	3 Nm (2.21 lbf ft)	-
3	Cross head self-tapping screw fastening cover / filter box	M5x20	8	3 Nm (2.21 lbf ft)	-
4	Cross head self-tapping screw fastening lateral cap / filter box	M5x20	3	3 Nm (2.21 lbf ft)	-
-	Cross head self-tapping screw	M5x10	2	3 Nm (2.21 lbf ft)	-



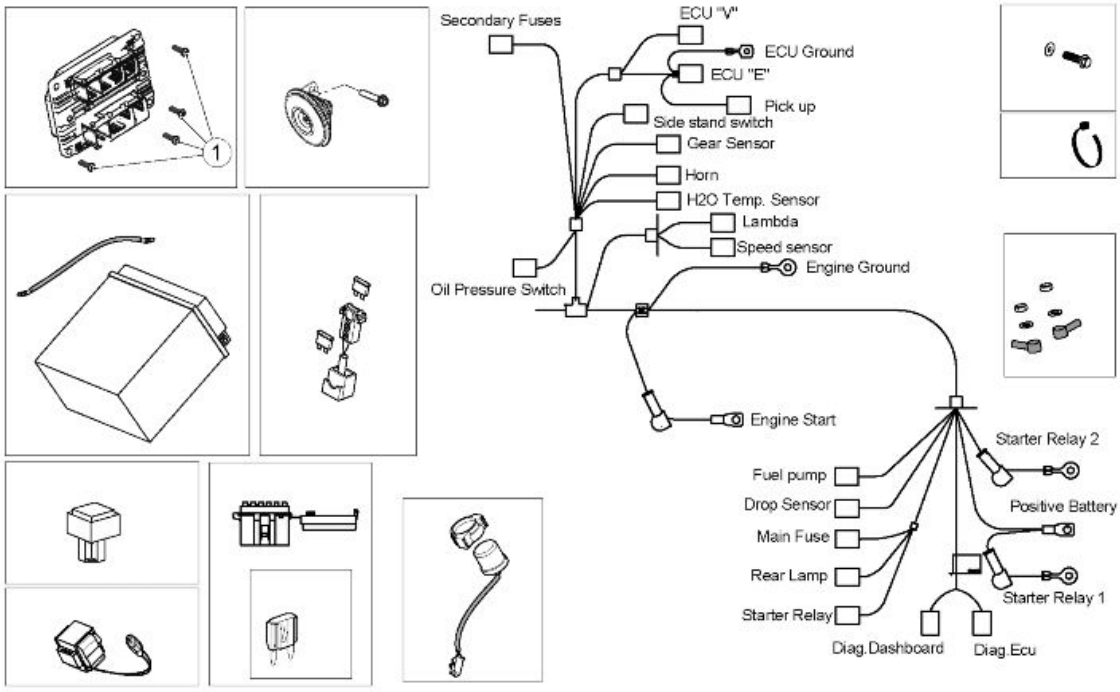
ENGINE

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screw fastening pinion	M10x1.25x25	1	50 Nm (36.88 lbf ft)	Loctite 270
2	TCEI screw fastening Pin to gearbox lever and Gearbox Lever to knurled shaft	M6x16	2	10 Nm (7.37 lbf ft)	-
3	LH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
4	RH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
5	Screw fastening engine bracket / clutch side crankcase half	M6	2	12 Nm (8.85 lbf ft)	-
6	Map sensor union (brass)	-	2	2 Nm (1.48 lbf ft)	Loctite 243
6	Map sensor union (steel)	-	2	3.50 Nm (2.58 lbf ft)	Loctite 243
7	LH ball joint on gearbox control lever	-	1	10 Nm (7.37 lbf ft)	Loctite 243
8	RH ball joint on gearbox control lever	-	1	10 Nm (7.37 lbf ft)	Loctite 243
-	Fastener for positive cable on engine	-	1	10 Nm (7.37 lbf ft)	-
-	TE screw fastening negative cable to engine	M6x12	1	10 Nm (7.37 lbf ft)	-



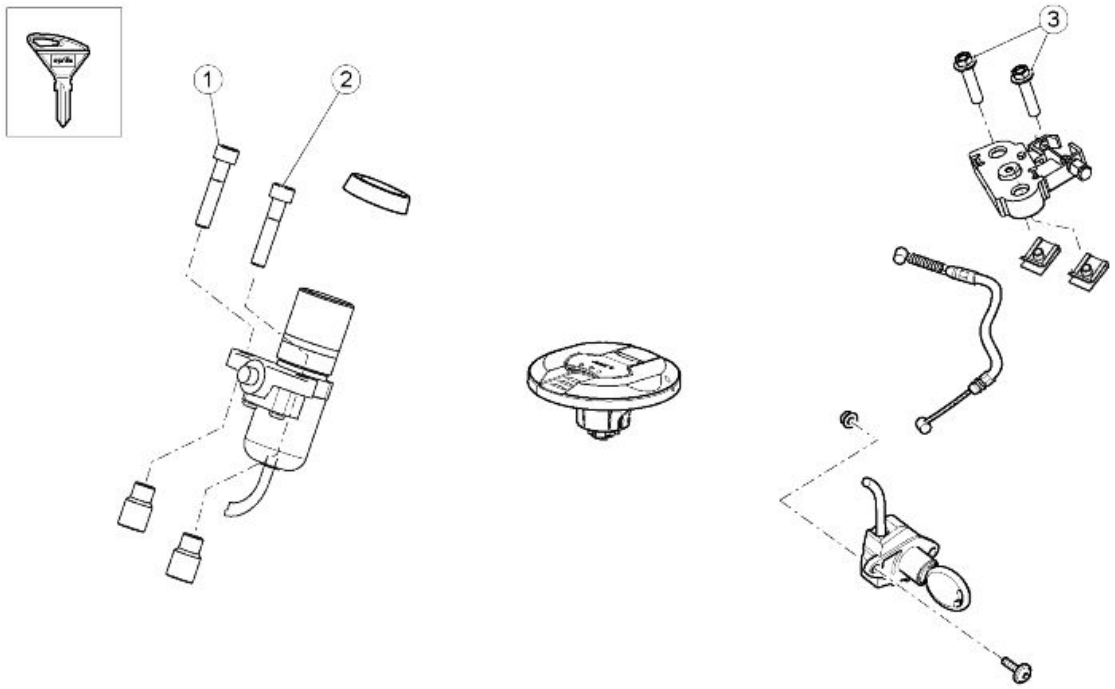
ELECTRICAL SYSTEM 1

pos.	Description	Type	Quantity	Torque	Notes
1	Coil fixing screw	M6	2	13 Nm (9.59 lbf ft)	-
2	TE screw fastening regulator to frame	M6x30	2	10 Nm (7.37 lbf ft)	-



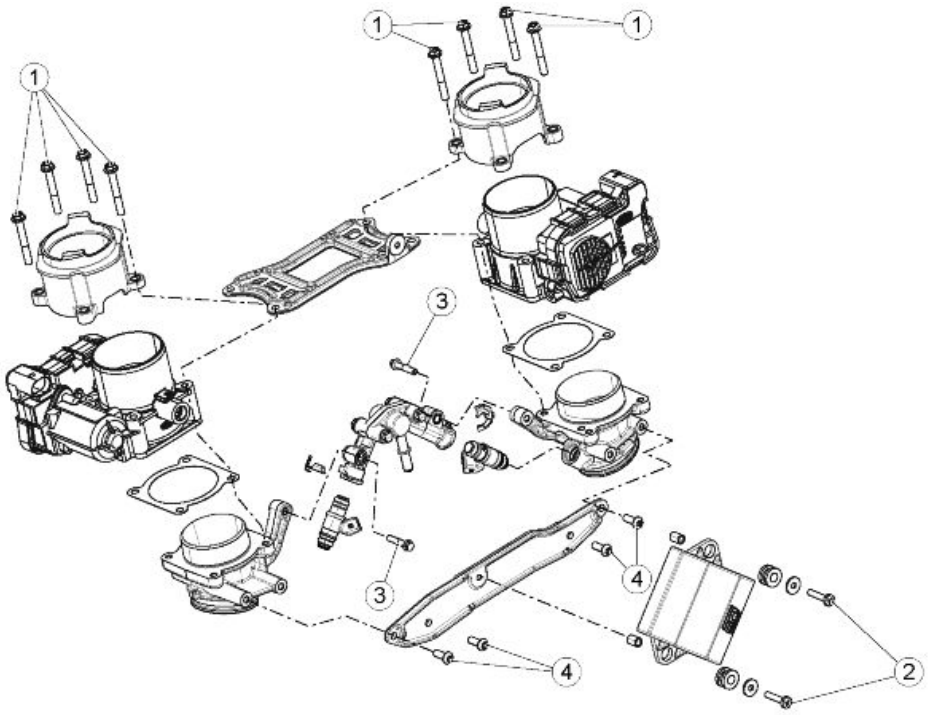
ELECTRICAL SYSTEM 2

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening ECU to filter box base	-	4	2.5 Nm (1.47 lbf ft)	-
-	Starter relay fastener	-	2	3 - 4.2 Nm (2.21 - 3.1 lbf ft)	-



LOCKS

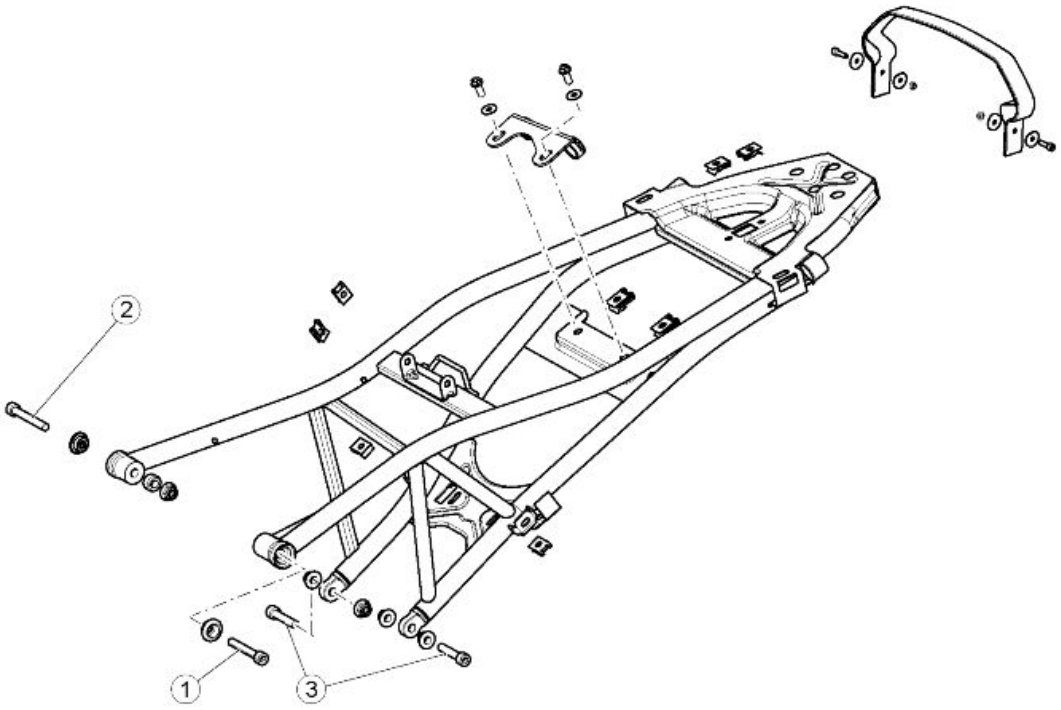
pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw	M8x40	1	25 Nm (18.44 lbf ft)	-
2	Switch fastener	shear head screw	1	Manual	-
3	TE screw fastening saddle lock / battery compartment to saddle mounting	M6x25	2	10 Nm (7.37 lbf ft)	-



THROTTLE BODY

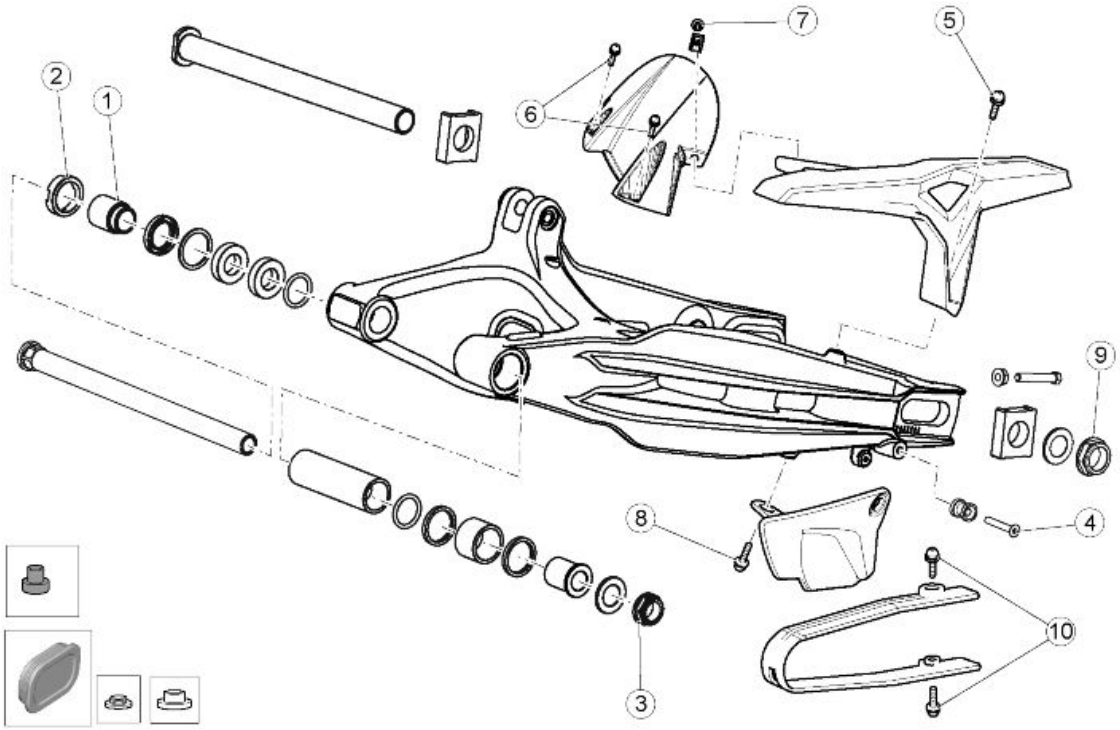
pos.	Description	Type	Quantity	Torque	Notes
1	Intake union fastener screw	M6	8	12 Nm (8.85 lb ft)	Loctite 242
2	RBW control unit fastener screw	M5	2	3.50 Nm (2.58 lbf ft)	Loctite 242
3	Injector fastener screw	M6	2	12 Nm (8.85 lb ft)	Loctite 242
4	Injection Throttle Body fastener screw	M6	8	12 Nm (8.85 lb ft)	Loctite 242

Back side



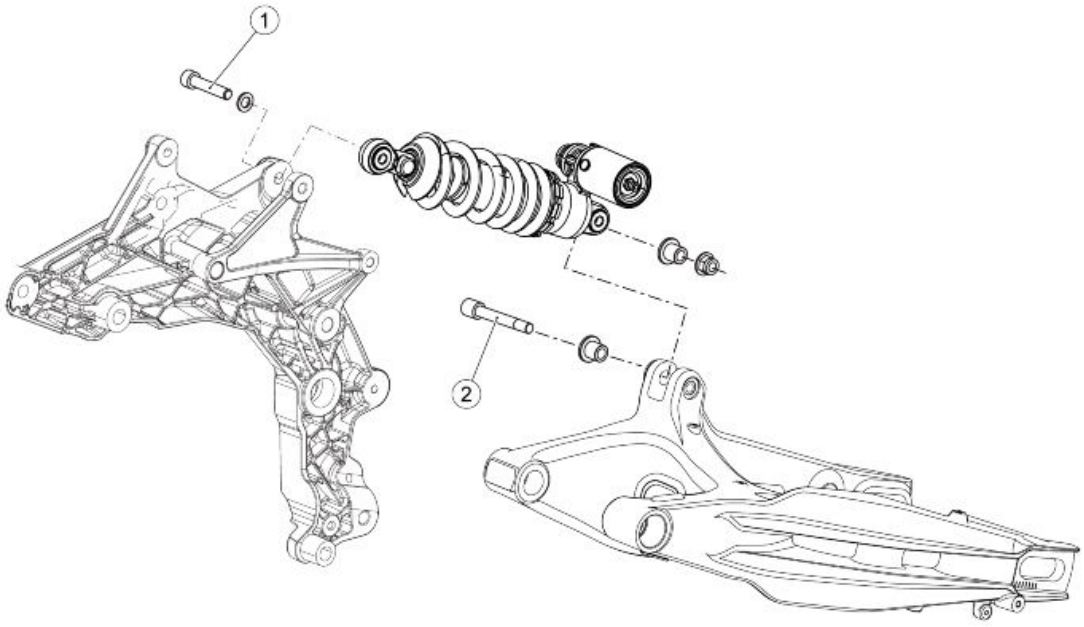
SADDLE MOUNTING

pos.	Description	Type	Quantity	Torque	Notes
1	Upper LH TCEI screw fastening saddle mounting to frame	M8x55	1	25 Nm (18.44 lbf ft)	-
2	Upper RH TCEI screw fastening saddle mounting to frame	M8x60	1	25 Nm (18.44 lbf ft)	-
3	Lower TCEI screw fastening Saddle mounting to frame	M8x40	2	25 Nm (18.44 lbf ft)	-
-	TCEI screw fastening passenger grab handles to frame	M8x80	4	30 Nm (22.13 lbf ft)	-



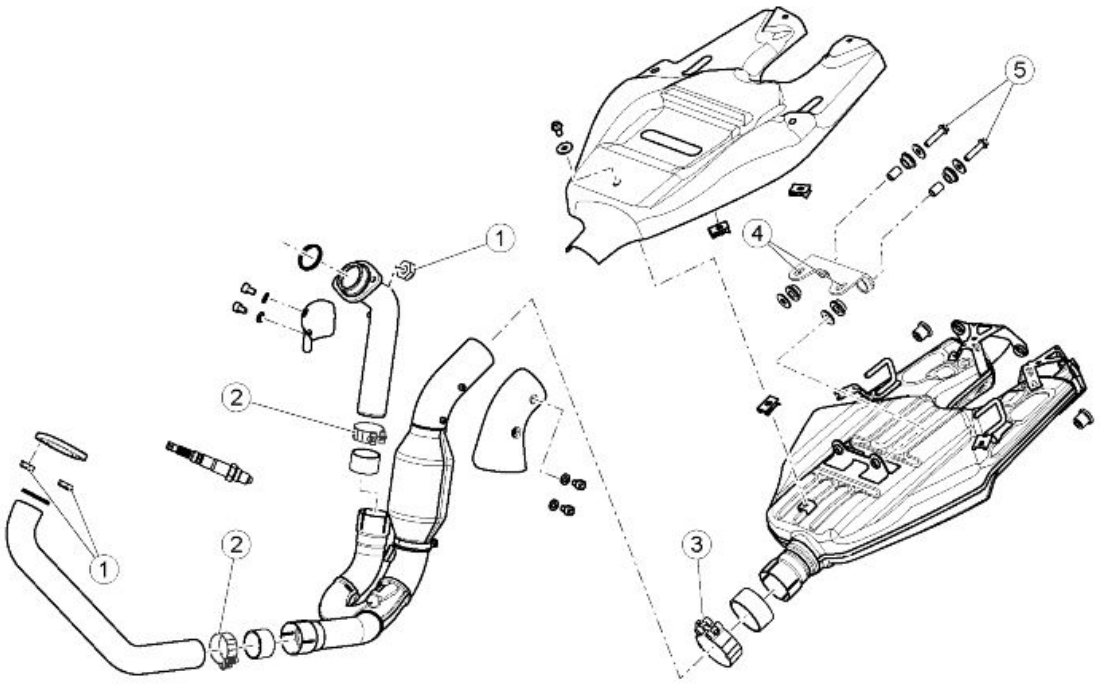
SWINGARM

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm Pin adjustment bushing	-	1	12 Nm (8.85 lb ft)	-
2	Swingarm pin ring nut	-	1	60 Nm (44.25 lb ft)	-
3	Swingarm pin nut	-	1	90 Nm (66.38 lb ft)	-
4	TPSI screw fastening rear stand bushing	M6x40	2	10 Nm (7.37 lb ft)	-
5	TBEI screw fastening chain guard to swingarm	M5x9	1	6 Nm (4.42 lbf ft)	-
6	TBEI screw fastening rear mudguard to swingarm	M5x9	2	6 Nm (4.42 lbf ft)	Loctite 243
7	TBEI screw fastening chain guard to rear mudguard	M5x9	1	4 Nm (2.95 lbf ft)	-
8	TBEI screw fastening chain guide to swingarm	M5x9	2	6 Nm (4.42 lbf ft)	-
9	Wheel axle nut	M25x1.5	1	120 Nm (88.5 lbf ft)	-
10	Flanged TBEI screw fastening chain casing	M5x9	2	4 Nm (2.95 lbf ft)	Loctite 243



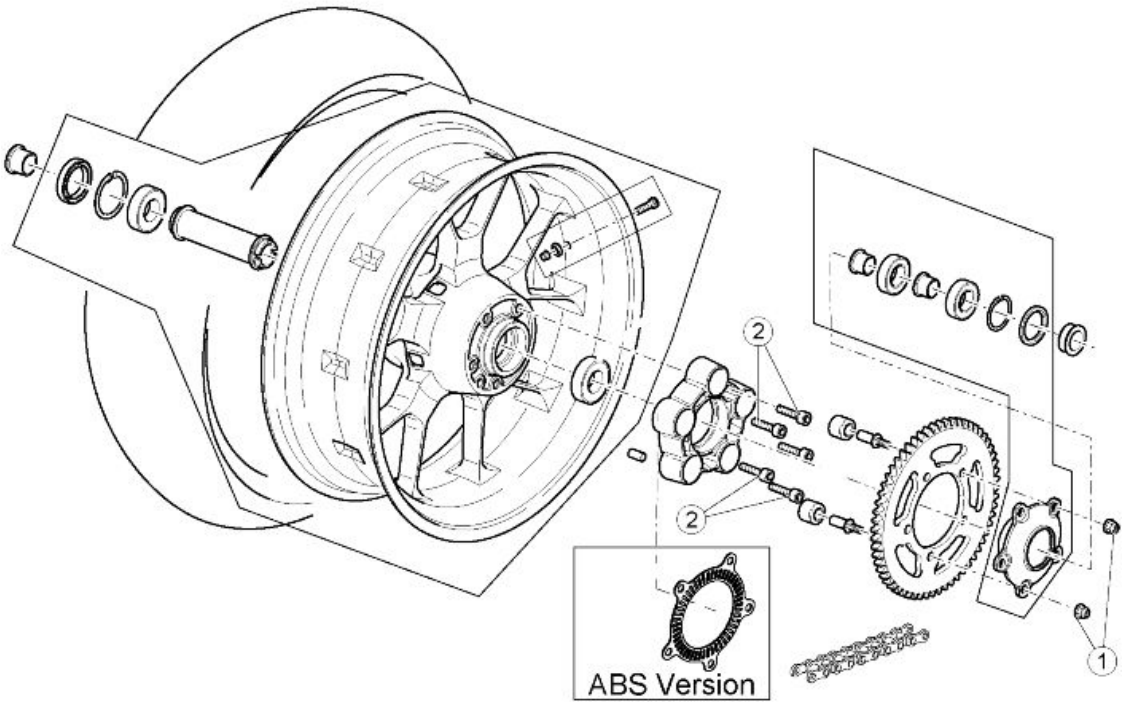
REAR SUSPENSION

pos.	Description	Type	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lbf ft)	-
2	Lower TCEI mounting screw	M10x90	1	50 Nm (36.88 lbf ft)	-



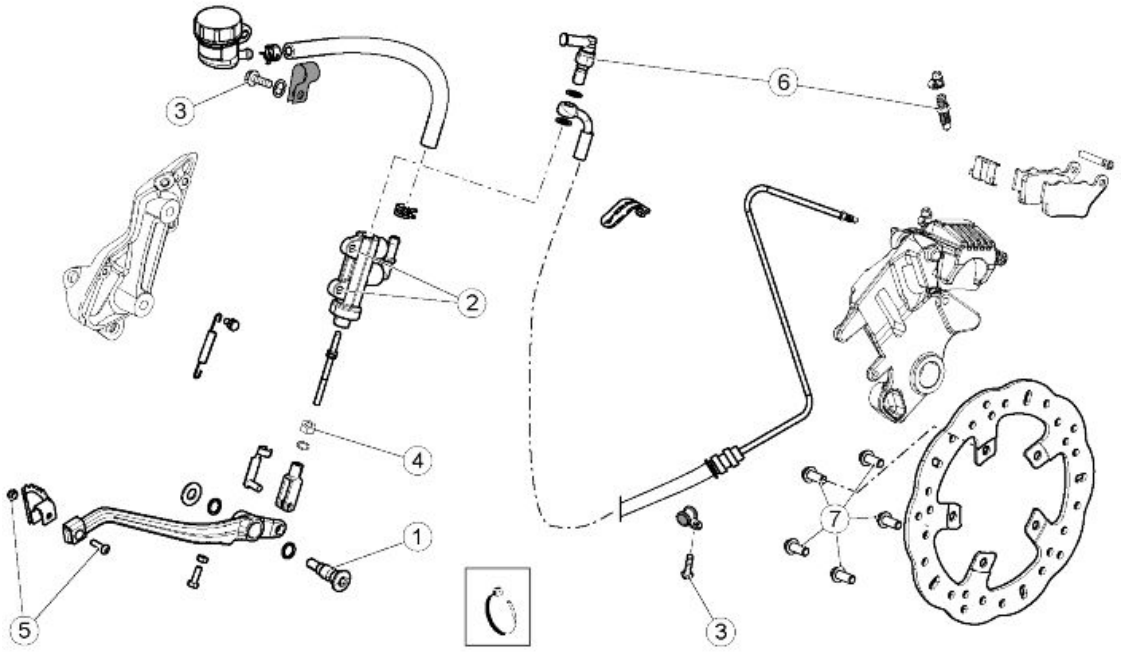
EXHAUST SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	SERPRESS self-locking nut fastening flange on head	M8	4	25 Nm (18.44 lbf ft)	-
2	Primary Clamp (between front/rear manifolds and central manifold)	M6	2	7 Nm (5.16 lbf ft)	-
3	Silencer Clamp (between central manifold and silencer)	M6	1	7 Nm (5.16 lbf ft)	-
4	Self-tapping TE screw fastening silencer mounting bracket to saddle mounting	M8x20	2	25 Nm (18.44 lbf ft)	-
5	Self-tapping TE screw fastening front silencer fixture to silencer mounting bracket	M8x35	2	35 Nm (25.81 lbf ft)	-



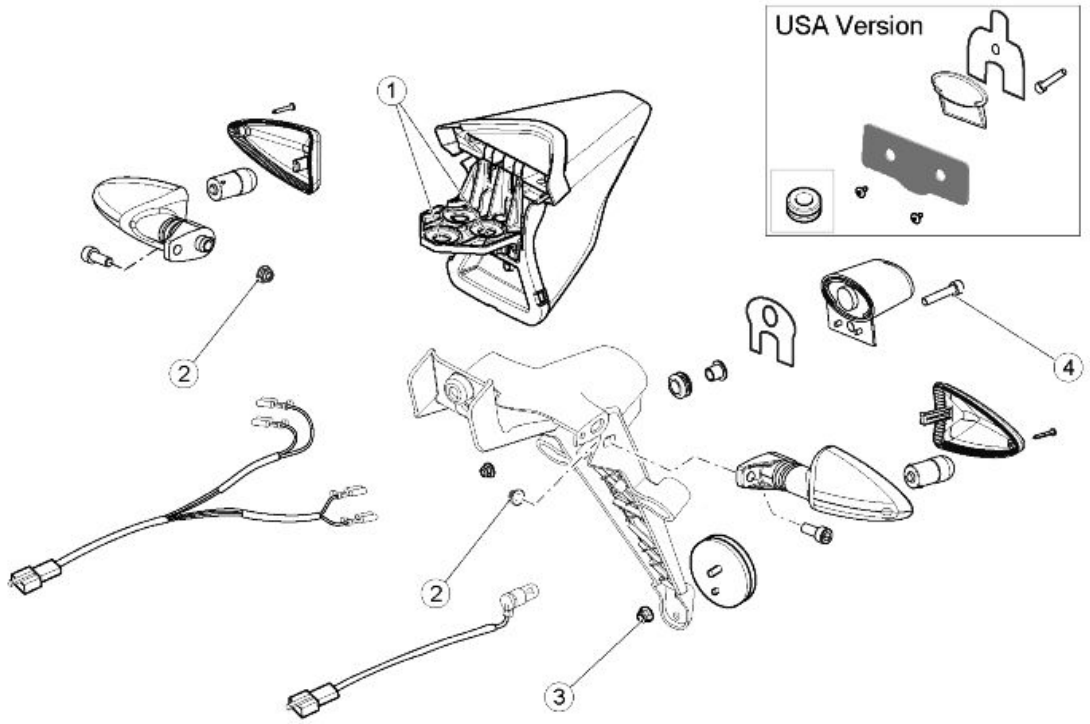
REAR WHEEL

pos.	Description	Type	Quantity	Torque	Notes
1	Lower self-locking nut fastening sprocket to sprocket carrier	M10	5	50 Nm (36.88 lb ft)	-
2	TCEI screw fastening flexible coupling mounting on wheel	M10x30	5	50 Nm (36.88 lb ft)	Loctite 270



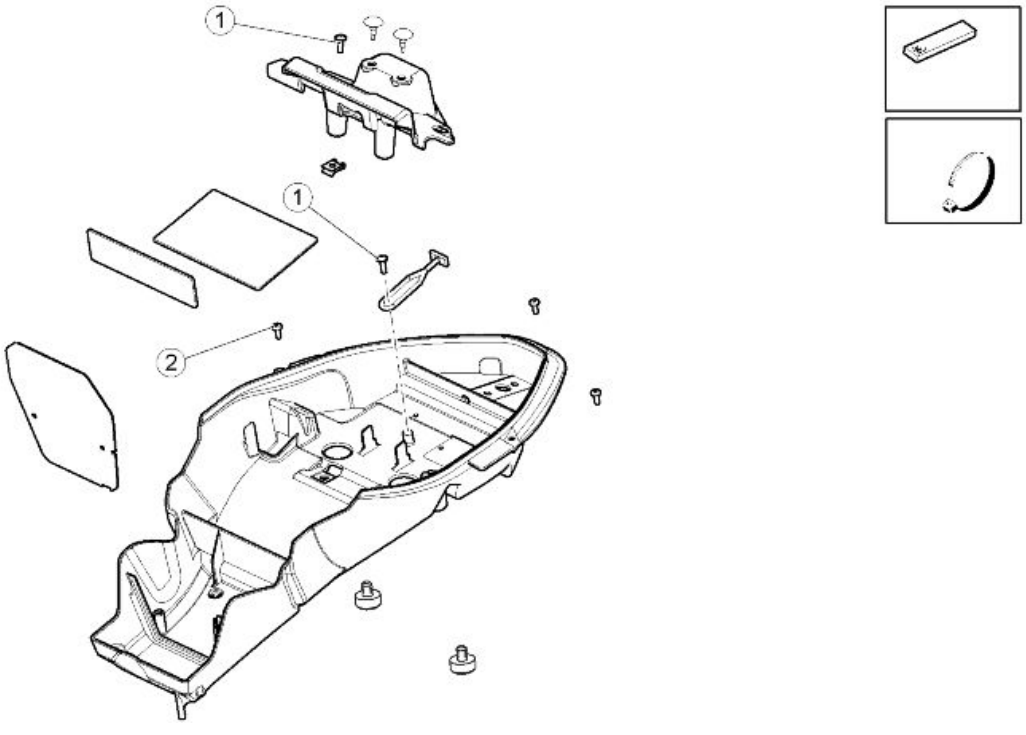
REAR BRAKE

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake lever pin	M6	1	25 Nm (18.44 lbf ft)	-
2	Flanged TE screw fastening pump to footrest mounting	M6x20	2	10 Nm (7.37 lbf ft)	-
3	TBEI screw fastening oil pipe to swingarm and rubber pipe to footrest mounting	M5x12	4	6 Nm (4.42 lbf ft)	-
4	Flanged self-locking nut	M6	1	10 Nm (7.37 lbf ft)	-
5	Screw + nut fastening pedal to brake lever	M6	1+1	10 Nm (7.37 lbf ft)	-
6	Brake pipe union	M10x1	2	25 Nm (18.44 lbf ft)	-
1	Flanged TE screw fastening rear disc	M8x20	5	30 Nm (22.13 lbf ft)	Loctite 243
-	Flanged TE screw	M6x16	1	10 Nm (7.37 lbf ft)	-



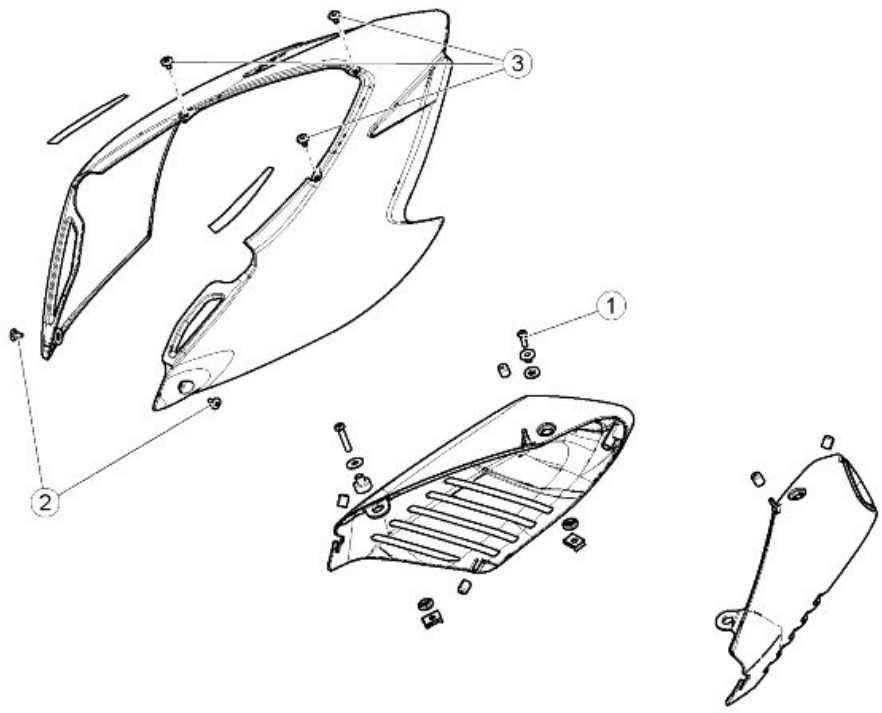
TAILLIGHT

pos.	Description	Type	Quantity	Torque	Notes
1	TE screw fastening tail light to license plate mounting frame	M6x45	3	10 Nm (7.37 lbf ft)	-
2	Fastener for rear turn indicators	M6	2	3 Nm (2.21 lbf ft)	-
3	Reflector fastener	M5	2	2 Nm (1.47 lbf ft)	-
4	Fastener for license plate light	M5	1	5 Nm (3.69 lbf ft)	-



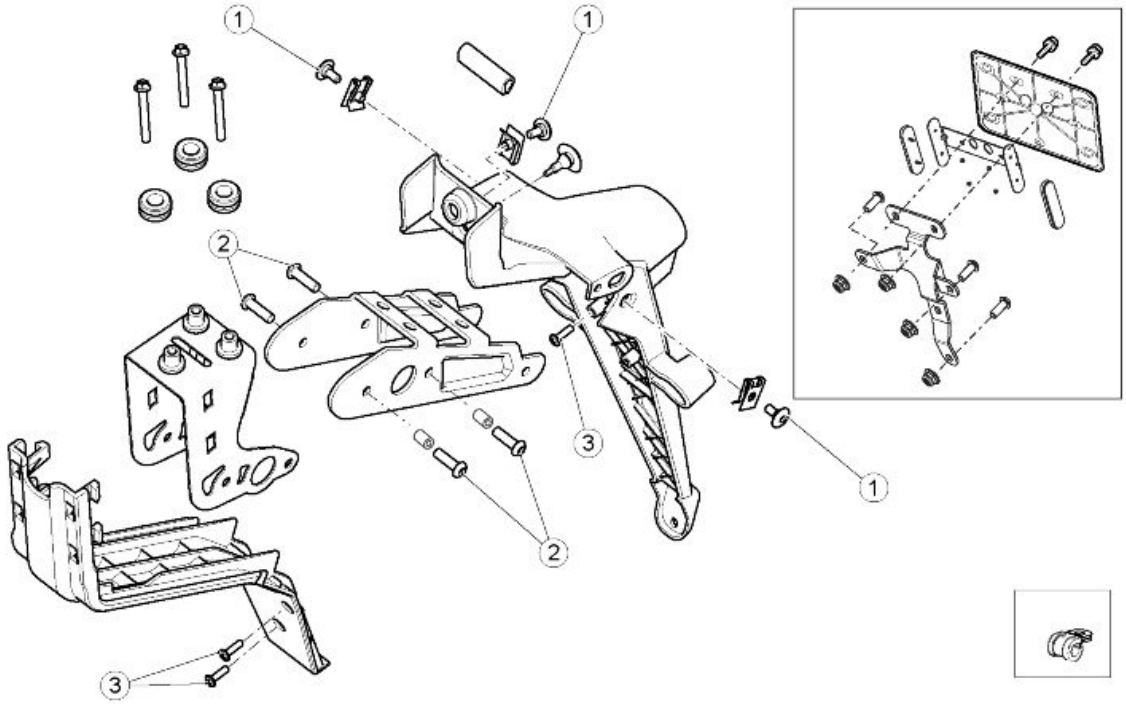
REAR BODYWORK 1

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening battery cover to compartment	M5	2+1	4 Nm (2.95 lbf ft)	-
2	TBEI screw fastening battery compartment to saddle mounting	M5x9	2	6 Nm (4.42 lbf ft)	-



REAR BODYWORK 2

pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening LH - RH covers to silencer	M6x20	4	10 Nm (7.37 lbf ft)	-
2	TBEI screw fastening tail fairing to saddle mounting	M5x9	2	6 Nm (4.42 lbf ft)	-
3	Screw fastening tail fairing to battery compartment	-	3	4 Nm (2.95 lbf ft)	-



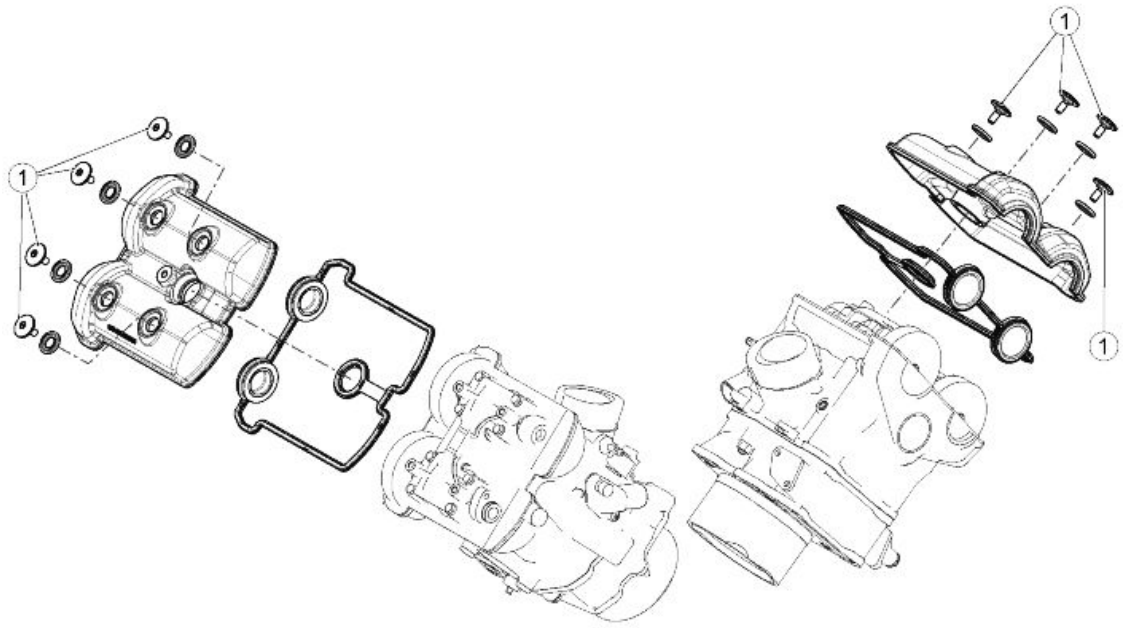
REAR BODYWORK 3

pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening license plate mounting to mounting	M5x9	3	6 Nm (4.42 lbf ft)	-
2	Fastener for license plate mounting frame assembly to gusset plate - saddle lock	M6	4	10 Nm (7.37 lbf ft)	-
3	Screw fastening license plate mounting cover to license plate mounting	-	3	0.8 Nm (0.59 lbf ft)	-

ABS SYSTEM

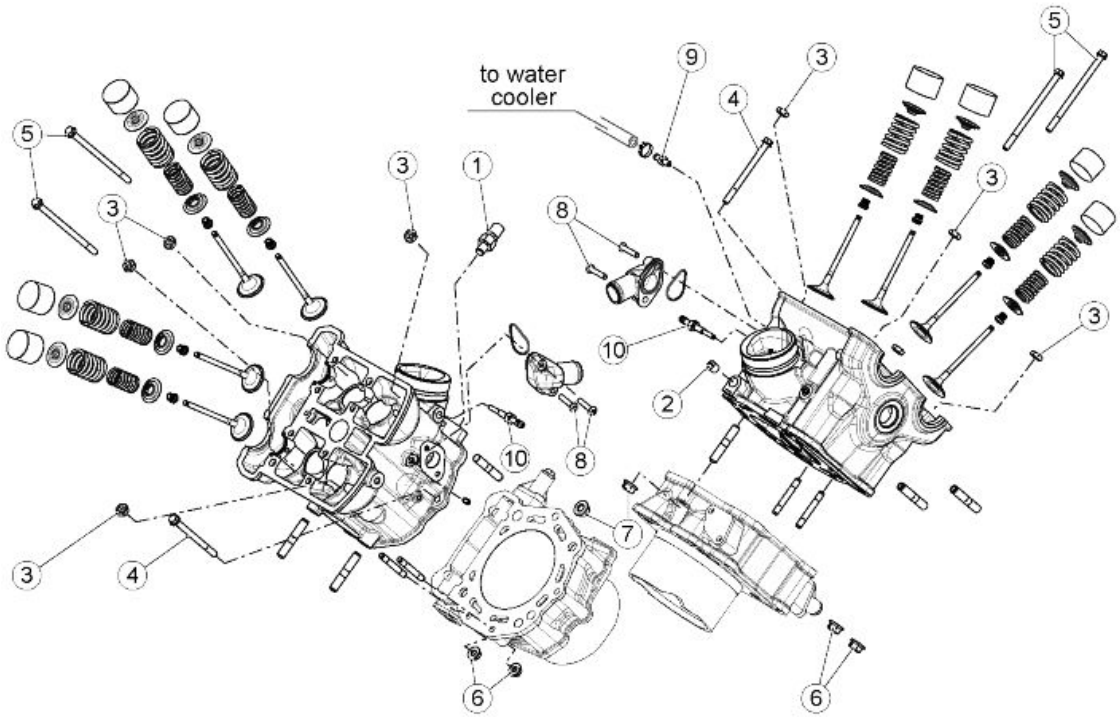
pos.	Description	Type	Quantity	Torque	Notes
-	ABS ECU fastener screw	M6x25	1	10 Nm (7.37 lbf ft)	Loctite 243
-	ABS ECU fastener nut	M6	2	10 Nm (7.37 lbf ft)	-

Engine



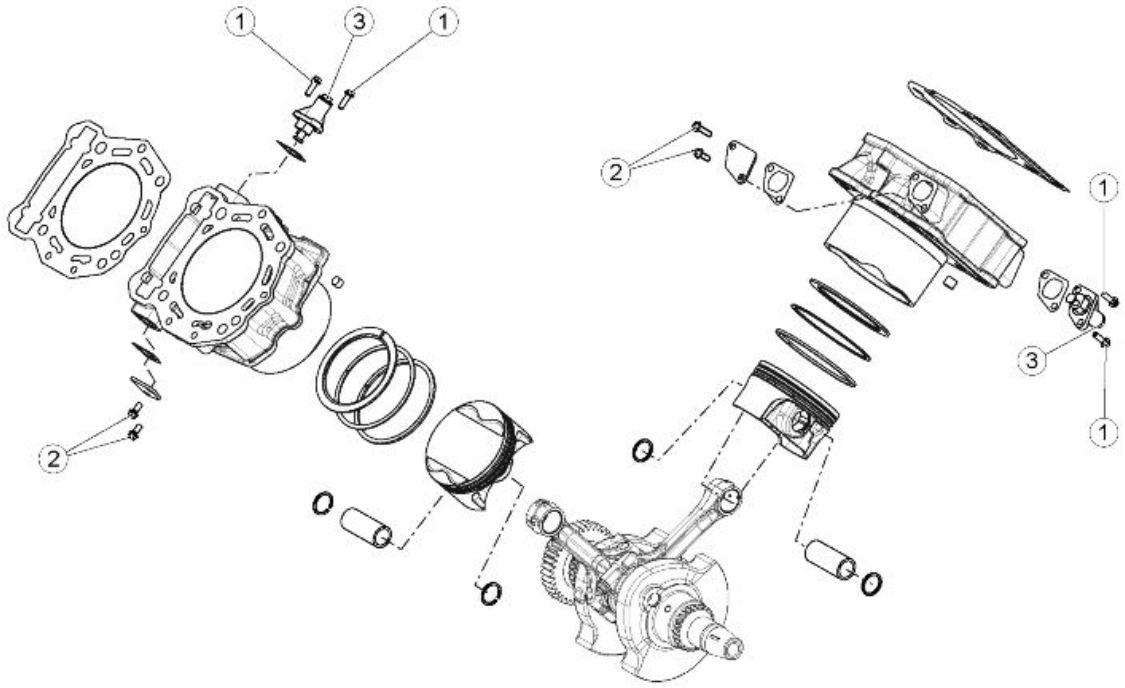
HEAD COVER

pos.	Description	Type	Quantity	Torque	Notes
1	Special screw for fastening head cover	M6	8	9 Nm (6.64 lbf ft)	-



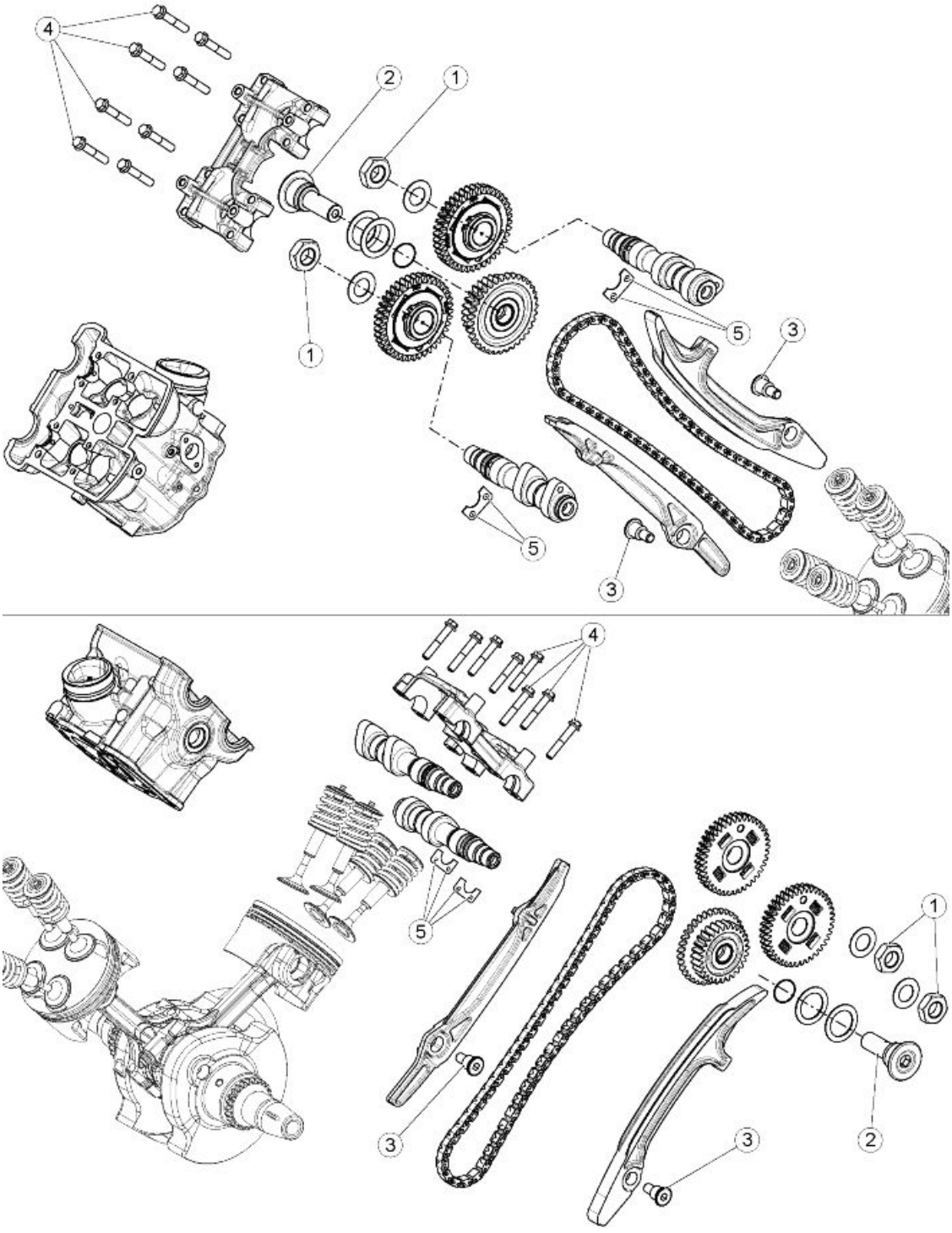
HEAD

pos.	Description	Type	Quantity	Torque	Notes
1	Water Temperature Sensor	M12x1.5	1	23 Nm (16.96 lbf ft)	-
2	Threaded plug for water sensor seat	M12x1.5	1	10 Nm (7.38 lbf ft)	Loctite Drise AL 506
3	Head stud bolt fastener nut - pre-tightening	M10x1.25	8	10 Nm (7.38 lbf ft)	Lubricate the threads before tightening
3	Head stud bolt fastener nut - tightening	M10x1.25	8	13 Nm (9.59 lbf ft) + 90° + 90°	Lubricate the threads before tightening
4	Fastener for Head / Cylinder / Outer side crankcase	M6	2	13 Nm (9.59 lbf ft)	-
5	Fastener for Head / Cylinder / Inner side crankcase	M6	4	12 Nm (8.85 lbf ft)	-
6	Nut fastening Stud Bolts / Head	M6	4	12 Nm (8.85 lbf ft)	-
7	Nut fastening Stud Bolts / Head	M8	2	26 Nm (19.18 lbf ft)	-
8	Bleed union fastener screw	M5	4	6.5 Nm (4.79 lbf ft)	-
9	Water bleed union (steel)	-	1	3.50 Nm (2.58 lbf ft)	Loctite 243
10	Water bleed union (brass)	-	2	2 Nm (1.48 lbf ft)	Loctite 243



CYLINDER

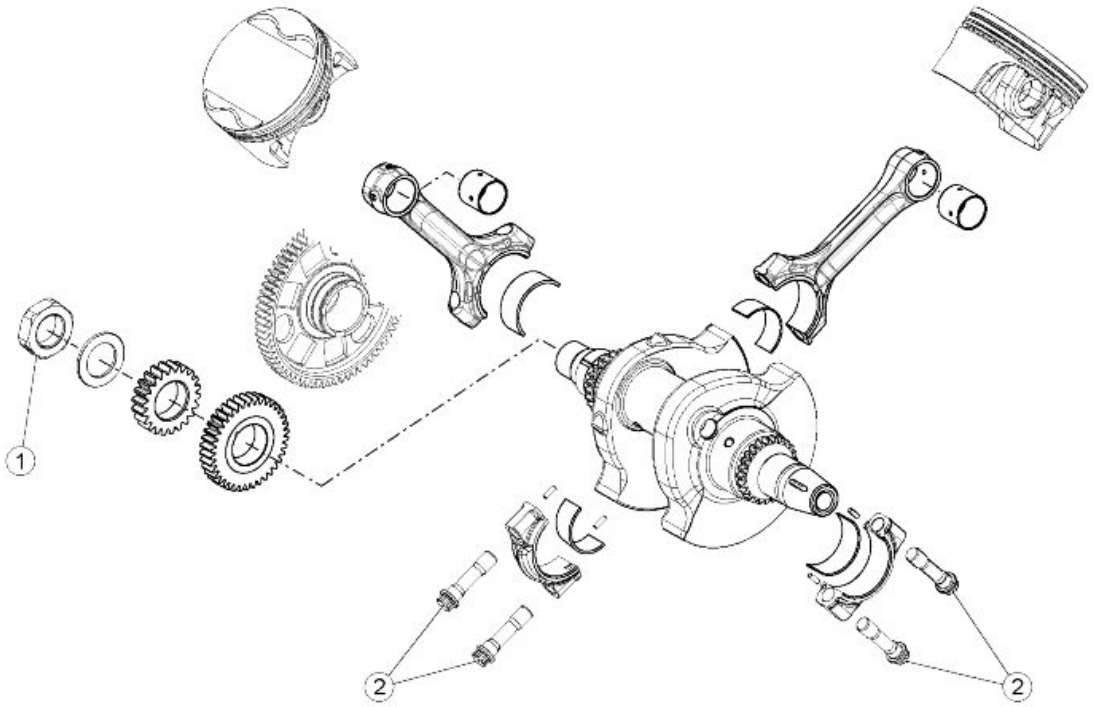
pos.	Description	Type	Quantity	Torque	Notes
1	Chain tensioner fastener screw	M6	4	13 Nm (9.59 lb ft)	-
2	Cylinder plate fastener screw	M6	4	7.84-9.81 Nm (5.78-7.23 lb ft)	-
3	Chain tensioner adjustment screw	M6	2	5.50 Nm (4.06 lb ft)	-



TIMING SYSTEM

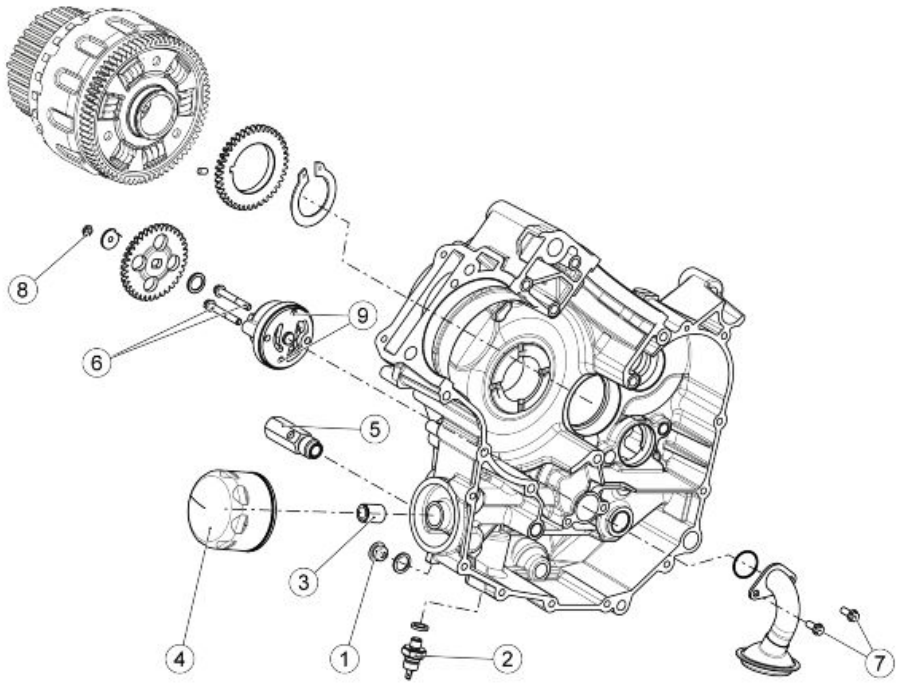
pos.	Description	Type	Quantity	Torque	Notes
1	Camshaft gear fastener nut - pre-tightening	M15x1	4	30 Nm (22.13 lbf ft)	-
1	Camshaft gear fastener nut - tightening	M15x1	4	90 Nm (66.38 lbf ft)	-
2	Timing drive gear fastener screw	M24x1.5	2	40 Nm (29.50 lbf ft)	3M SCOTCH GRIP 2353
3	Special screw for fastening mobile / fixed shoes	M8	4	19 Nm (14.01 lbf ft)	Loctite 242

pos.	Description	Type	Quantity	Torque	Notes
4	Cam tower / head fastener screws - pre-tightening	M6	16	4.90 - 6.86 Nm (3.61 - 5.06) lbf ft	-
4	Cam tower / head fastener screws - tightening	M6	16	9.81 - 12.75 Nm (7.24 - 9.40 lbf ft)	-
4	Viti fissaggio castelletto / testa - serraggio	Torx	16	12 - 14 Nm (8.85 - 10.32 lbf ft)	-
5	Camshaft retainer plate fastener screw	torx M3	8	3 Nm (2.21 lbf ft)	Loctite 270



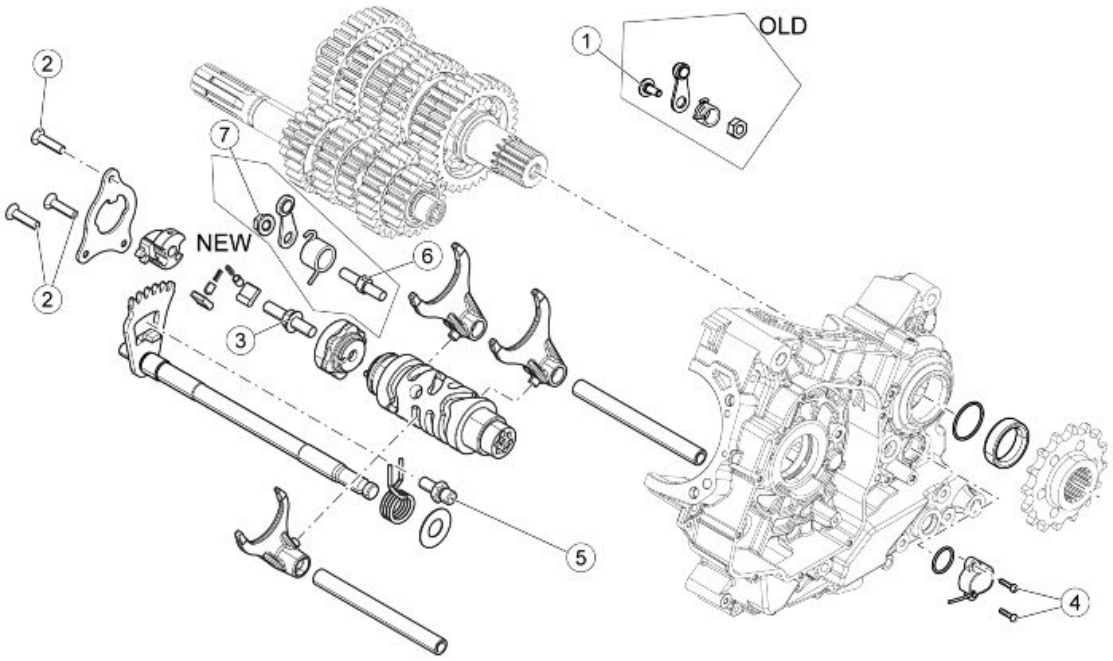
CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Crankshaft primary gear fastener nut	M24x1.5	1	270 Nm (199.14 lbf ft)	Anticlockwise nut
2	Connecting rod screw	M10	4	15 + 30 Nm (11.06 + 22.13 lbf ft) + 50° ± 2°, final control torque 65 - 78 Nm (47.94 - 57.53 lbf ft)	Lubricate the threads before tightening



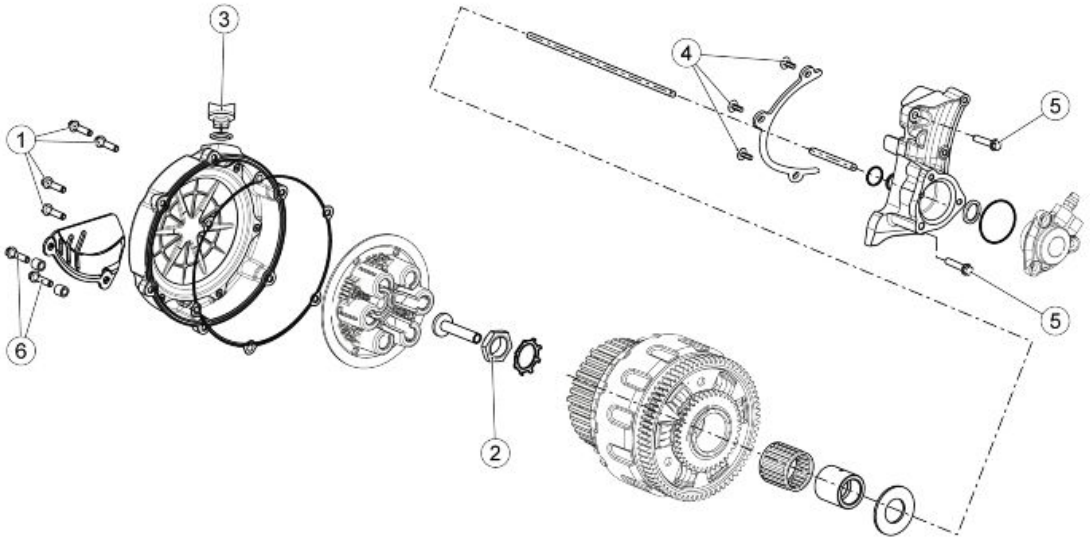
OIL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Oil drainage plug	M16x1.5	1	19 Nm (14.01 lbf ft)	-
2	Fastening oil sensor on clutch side crankcase half	-	1	13 Nm (9.59 lbf ft)	-
3	Fastening oil filter union on clutch side crankcase half	-	1	20 Nm (14.75 lbf ft)	-
4	Oil filter	-	1	14 Nm (10.33 lbf ft)	-
5	Oil pressure regulator valve	3/4" Unf 16	1	43 Nm (31.72 lbf ft)	-
6	Oil pump fastener screw	M6	2	5.50 Nm (4.06 lbf ft)	Loctite 242
7	Rose pipe fastener screw	-	2	12 Nm (8.85 lbf ft)	-
8	Complete oil pump gear fastener	-	1	9-11 Nm (6.64-8.11 lbf ft)	-
9	Oil pump cover fastener screw	M3	2	0.80 Nm (0.59 lbf ft)	-



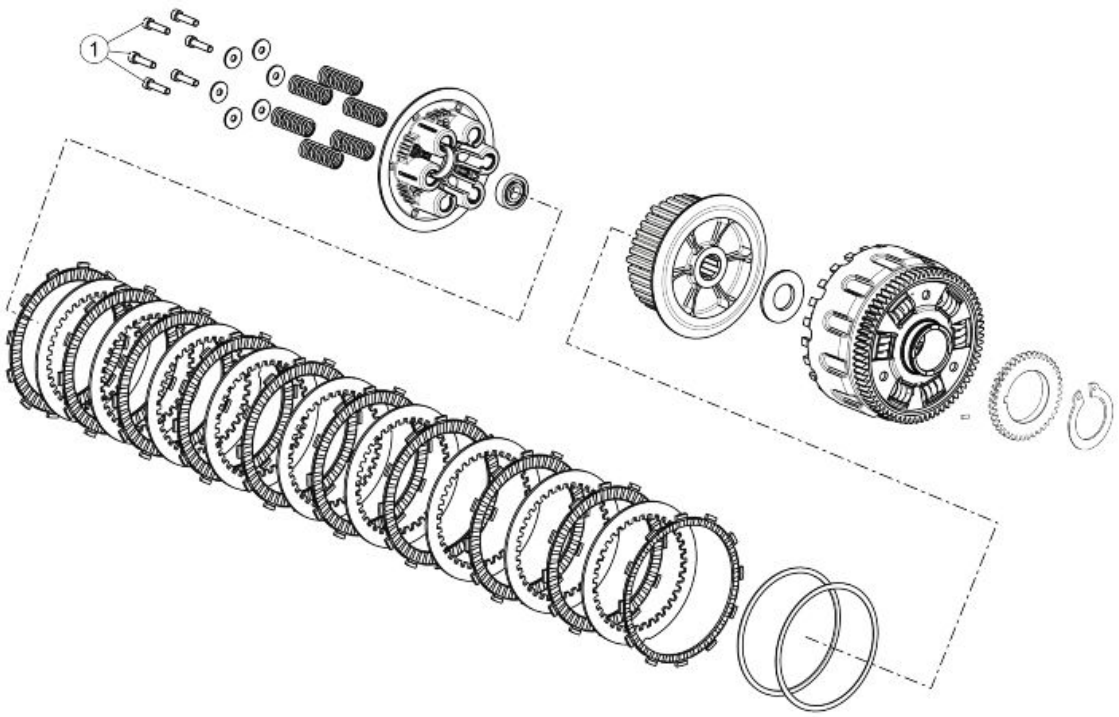
GEAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Gear retainer pawl fastener screw	M6	1	12 Nm (8.85 lb ft)	Loctite dry loc 2040
2	Selector plate fastener screw	M5	3	5.50 Nm (4.06 lb ft)	3M SCOTCH GRIP 2353
3	Screw fastening Desmodromic selector drum / Selector sprocket	M8	1	20 Nm (14.75 lb ft)	3M SCOTCH GRIP 2353
4	Gear sensor fastener screw	M5	2	5.50 Nm (4.06 lb ft)	Loctite 270
5	Selector pin fastener onto clutch side crankcase half	M10x1.5	1	16 Nm (11.80 lb ft)	Loctite 242
6	Gear retainer pawl fastener pin	-	1	11-13 Nm (8.11-9.59 lb ft)	-
7	Gear retainer pawl fastener flanged nut	-	1	10-12 Nm (7.38-8.85 lb ft)	-



CLUTCH COVER

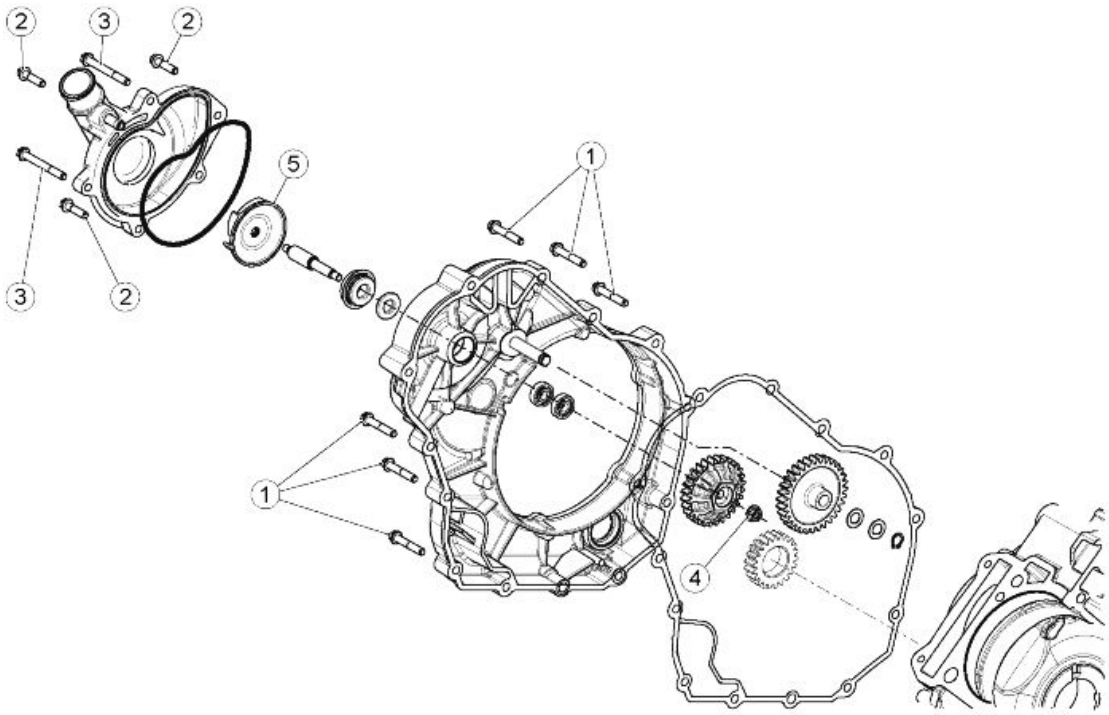
pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screw for Clutch Cover / Clutch side cover	M6	4	13 Nm (9.59 lbf ft)	-
2	Clutch fastener nut	M24x1.5	1	180 Nm (132.76 lbf ft) ± 5%	Chamfer
3	Fastening oil filler plug on Clutch cover	-	1	2 Nm (1.48 lbf ft)	-
4	Screw fastening fixing Plate / Clutch control Mounting	M5	3	5.50 Nm (4.06 lbf ft)	-
5	Screw fastening clutch control mounting on flywheel side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
6	Clutch Cover / Clutch side Cover TCEI fixing screw (inox protection)	M6x55	2	10 Nm (7.38 lbf ft)	-



CLUTCH

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch spring fastener screw	M6	6	12 Nm (8.85 lbf ft)	-

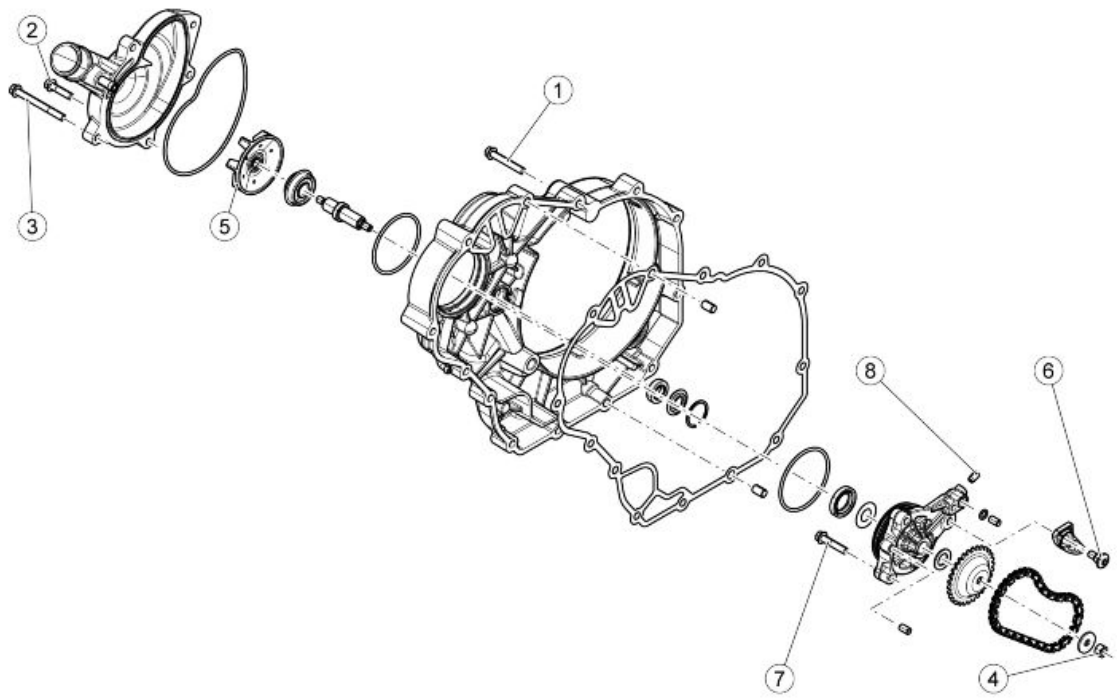
OPTION 01



WATER PUMP

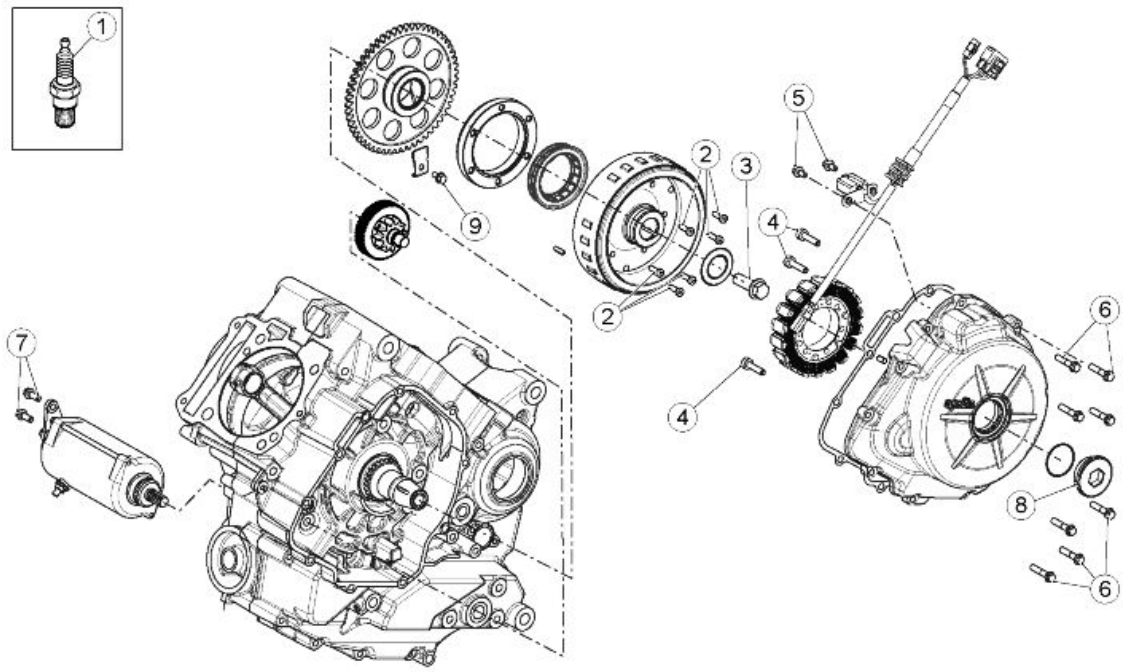
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	13	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening pump drive input gear on shaft	M6	1	12 Nm (8.85 lbf ft)	Loctite 244
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-

OPTION 02



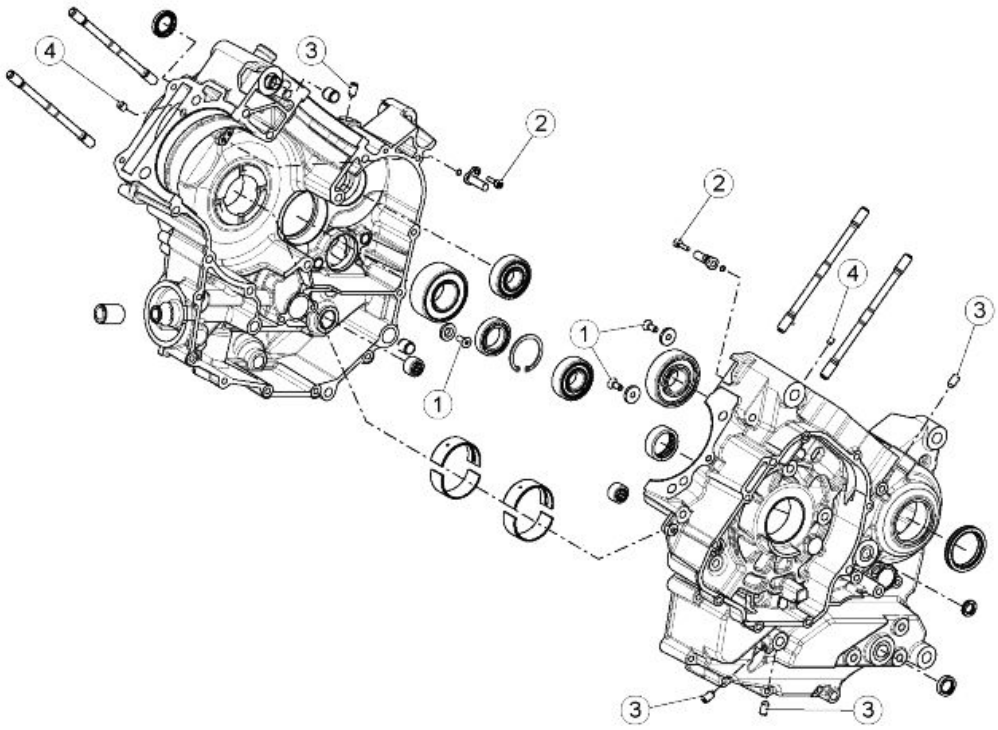
WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening water pump drive gear sprocket	M6	1	12 Nm (8.85 lbf ft)	-
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slider to water pump	M6	1	8-10 Nm (5.90-7.38 lbf ft)	-
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP 2353



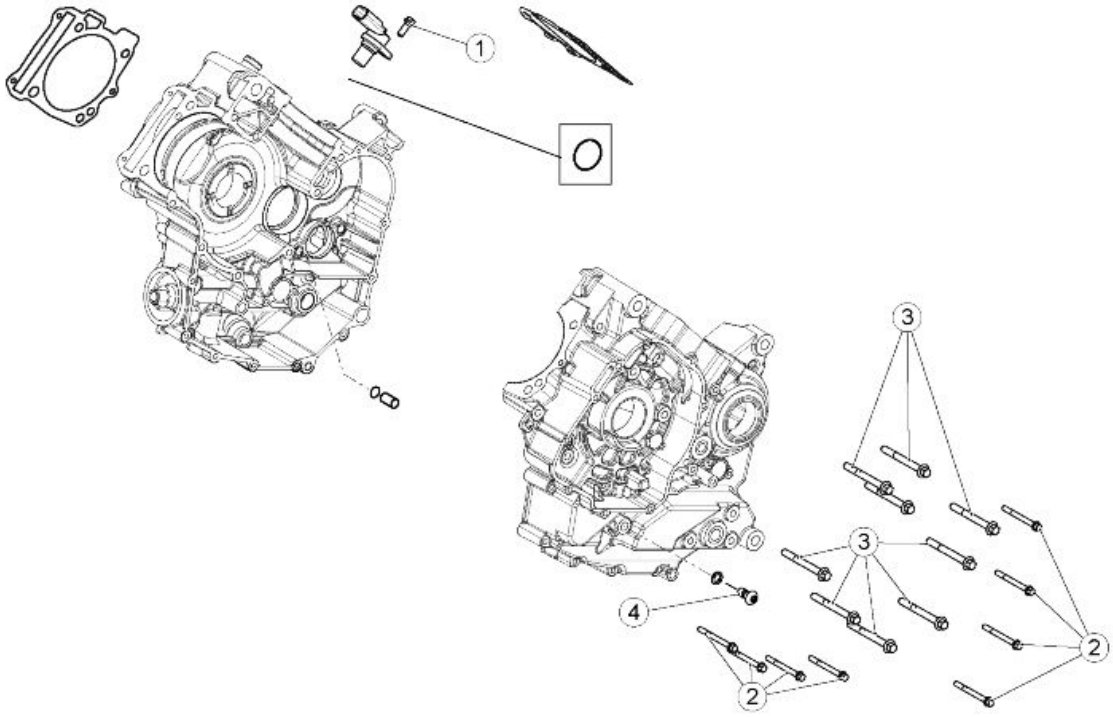
IGNITION

pos.	Description	Type	Quantity	Torque	Notes
1	Spark plug	-	2	13 Nm (9.59 lbf ft)	-
2	Freewheel Ring fastener screw	M6	6	14 Nm (10.33 lbf ft)	Loctite 242
3	Screw fixing rotor - Crankshaft - (12 mm - 0.47 in)	M12x1.25	1	130 Nm (95.88 lb ft)	-
3	Screw fixing rotor - Crankshaft - (14 mm - 0.55 in)	M12x1.25	1	190-200 Nm (140.14-147.51 lb ft)	-
4	Screw fastening Stator / Flywheel Cover	M6	3	9 Nm (6.64 lb ft)	-
5	Screw fastening pick-up / Flywheel cover	M5	2	3.50 Nm (2.58 lbf ft)	-
6	Flywheel cover fastener screw	M6	10	13 Nm (9.59 lb ft)	-
7	Screw fastening starter motor bracket to crankcase	M6	2	13 Nm (9.59 lbf ft)	-
8	Crankshaft access cap	-	1	4 Nm (2.95 lb ft)	-
9	Retainer plate fastener screw	M6	1	8 Nm (5.90 lbf ft)	-
-	Screw fastening bracket to starter motor	M6x14	2	13 Nm (9.59 lbf ft)	-
-	Pick-up cable retainer screw	M5	2	3 Nm (2.21 lbf ft)	-



CRANKCASE 1

pos.	Description	Type	Quantity	Torque	Notes
1	Bearing retainer fastener screw	M6	3	10 Nm (7.38 lbf ft)	Loctite 270
2	Piston oil jet fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 242
3	Tapered plug for crankshaft main bearing lubrication	M8x1	4	15 Nm (11.06 lbf ft)	-
4	Calibrated Brass dowel fixed to complete crankcase	M8	2	5.50 Nm (4.06 lbf ft)	-



CRANKCASE 2

pos.	Description	Type	Quantity	Torque	Notes
1	Engine speed sensor fixing screw	M6	1	13 Nm (9.59 lbf ft)	Loctite 243
2	Screw fastening flywheel side / clutch side crankcase halves	M6	8	13 Nm (9.59 lbf ft)	-
3	Screw fastening flywheel side / clutch side crankcase halves	M8	9	29 Nm (21.39 lbf ft)	-
4	Special calibrated screw for gearbox lubrication	-	1	18 Nm (13.28 lbf ft)	-

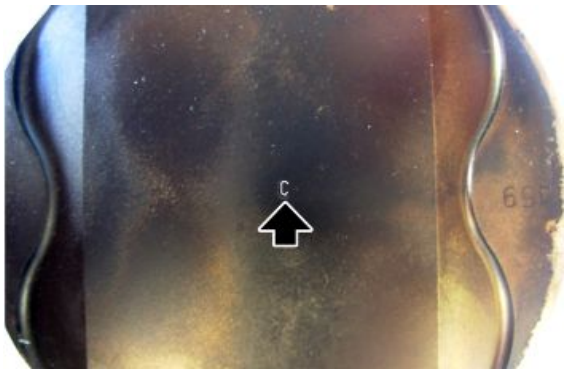
Overhaul data

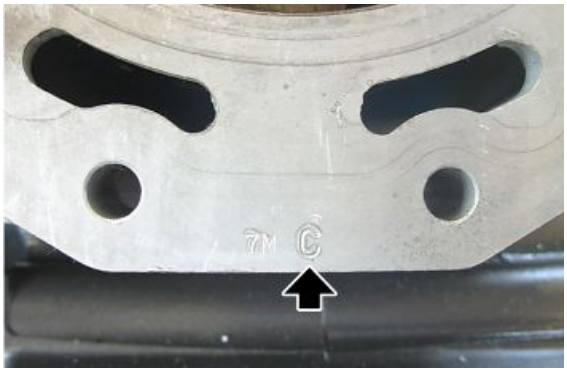
Assembly clearances

Cylinder - piston assy.

The pistons are available in four size types (A, B, C, D) to be coupled to the four cylinder types (A, B, C, D).

Only one type of piston ring is available.





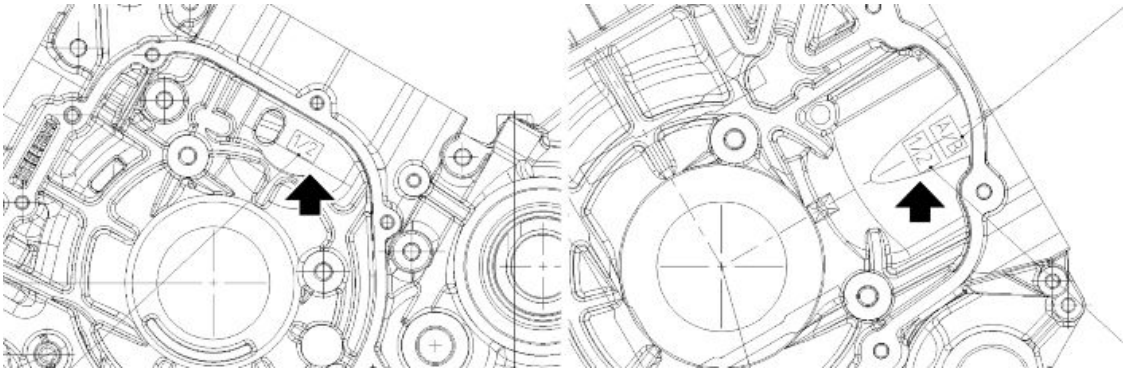
CYLINDER - PISTON COUPLING

Specification	Desc./Quantity
Piston - cylinder coupling Type A	Cylinder: 91.990 - 91.977 mm (3.6216 - 3.6219 in) Piston: 91.933 - 91.940 mm (3.6217 - 3.6197 in)
Piston - cylinder coupling Type B	Cylinder: 91.997 - 92.004 mm (3.6219 - 3.6222 in) Piston: 91.940 - 91.947 mm (3.6197 - 3.6199 in)
Piston - cylinder coupling Type C	Cylinder: 92.004 - 92.011 mm (3.6222 - 3.6225 in) Piston: 91.947 - 91.954 mm (3.6199 - 3.6202 in)
Piston - cylinder coupling Type D	Cylinder: 92.011 - 92.018 mm (3.6225 - 3.6227 in) Piston: 91.954 - 91.961 mm (3.6202 - 3.6205 in)
Fitting clearance	0.050 - 0.064 mm (0.00197 - 0.00252 in)

Crankcase - crankshaft - connecting rod

INTERNAL MARKING ON FIRST GENERATION CRANKCASES

Crankcases are classified in two classes (1 or 2) depending on the diameter of the main bearing seat. The class is indicated on both crankcase halves, specifically, in the rear cylinder area on flywheel side crankcase halves and in the front cylinder area on clutch side crankcase halves.

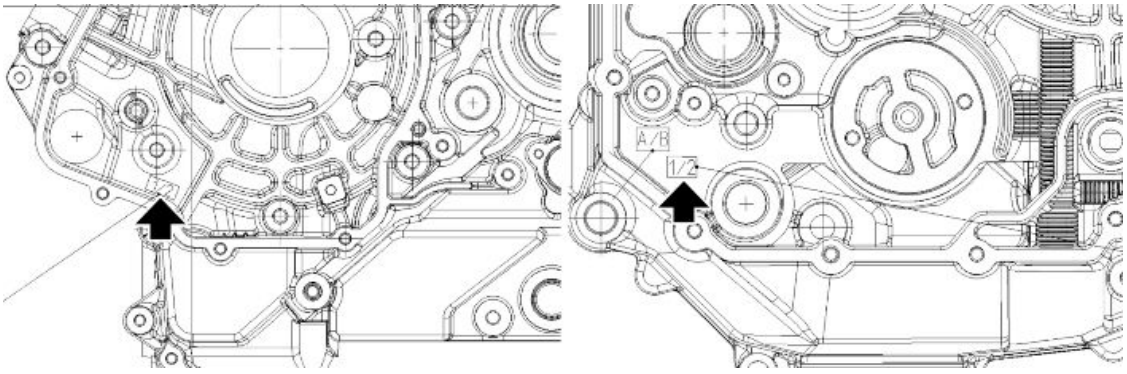


CRANKCASE CLASSES

Specification	Desc./Quantity
Crankcase class 1	Bushing seat diameter: 53.954 - 53.960 mm (2.1241 - 2.1244 in)
Crankcase class 2	Bushing seat diameter: 53.960 - 53.966 mm (2.1244 - 2.1246 in)

INTERNAL MARKING ON SECOND GENERATION CRANKCASES

Crankcases are classified in two classes (1 or 2) depending on the diameter of the main bearing seat. The class is indicated on both crankcase halves, specifically, in the starter gear area on flywheel side crankcase halves and in the gearbox control mechanism area on clutch side crankcase halves.



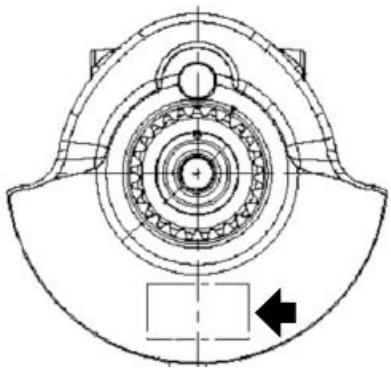
See also

Removing the flywheel cover

There are three crankshaft classes selectable for each bearing:

- 4 - 5 - 6 for the flywheel side;
- 7 - 8 - 9 for the clutch side;

The class is stamped on the outer face of the crankshaft counterweight.



NOTE

TWO DIFFERENT CRANKSHAFT CLASSES MAY BE POSSIBLE ON THE TWO BEARINGS.

CRANKSHAFT CLASSES

Specification	Desc./Quantity
Crankshaft classes 4 - 7	Main journals - diameter: 49.978 - 49.984 mm (1.9676 - 1.9679 in)
Crankshaft classes 5 - 8	Main journals - diameter: 49.972 - 49.978 mm (1.9674 - 1.9676 in)
Crankshaft classes 6 - 9	Main journals - diameter: 49.990 - 49.984 mm (1.9681 - 1.9679 in)

Once the categories below are checked:

- crankcase
- flywheel side main journal
- clutch side main journal

choose the bushings used for assembly from the following table

See also

Removing the flywheel cover

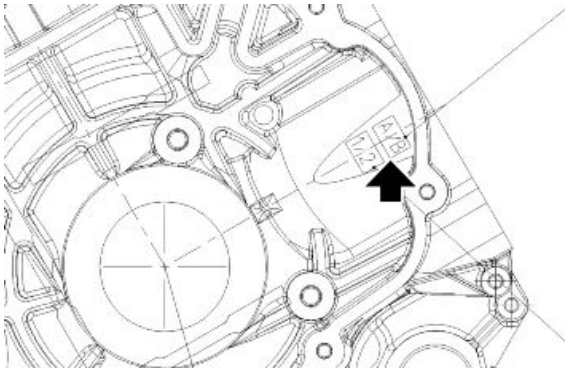
MAIN BUSHINGS

Main journal	Crankcase class 1	Crankcase class 2
Class 4 main journal (l.v.)	Semi-bushing type A (red)	Semi-bushing type B (blue)
Class 5 main journal (l.v.)	Semi-bushing type B (blue)	Semi-bushing type C (yellow)
Class 6 main journal (l.v.)	Semi-bushing type E (green)	Semi-bushing type A (red)
Class 7 main journal (l.f.)	Semi-bushing type A (red)	Semi-bushing type B (blue)
Class 8 main journal (l.f.)	Semi-bushing type B (blue)	Semi-bushing type C (yellow)
Class 9 main journal (l.f.)	Semi-bushing type E (green)	Semi-bushing type A (red)

Crankcase class (internal marking on first generation crankcases)

Two different crankcase classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

The class is indicated on the clutch side crankcase half near the front cylinder area.



NOTE

IN THE EVENT OF CRANKCASE REPLACEMENT, THE PRIMARY REDUCTION GEAR IS SUPPLIED READY MESHED.

CRANKCASE CLASSES 01

Specification	Desc./Quantity
Crankcase class A	Centre-to-centre distance: 110.50 - 110.54 mm (4.3504 - 4.3519 in)
Crankcase class B	Centre-to-centre distance: 110.46 - 110.50 mm (4.3488 - 4.3504 in)

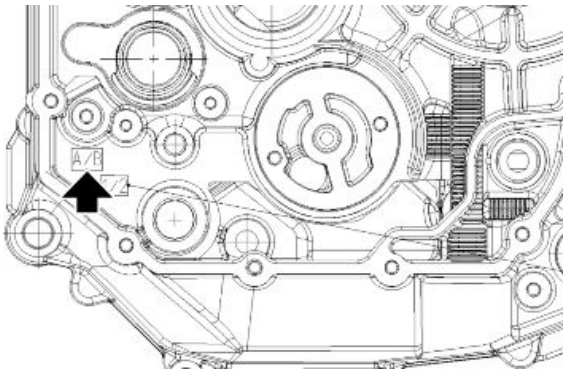
See also

Removing the flywheel cover

Crankcase class (internal marking on second generation crankcases)

Two different crankcase classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

The class is indicated on the clutch side crankcase half, in the gearbox control mechanism area.



NOTE

IN THE EVENT OF CRANKCASE REPLACEMENT, THE PRIMARY REDUCTION GEAR IS SUPPLIED READY MESHED.

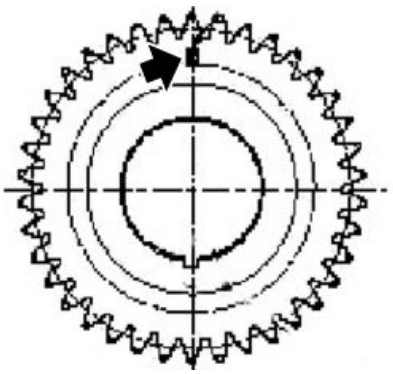
CRANKCASE CLASSES 02

Specification	Desc./Quantity
Crankcase class A	Centre-to-centre distance: 110.50 - 110.54 mm (4.3504 - 4.3519 in)
Crankcase class B	Centre-to-centre distance: 110.46 - 110.50 mm (4.3488 - 4.3504 in)

Class one

Two different pinion classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

On class B pinions only, the class is indicated on the pinion itself.



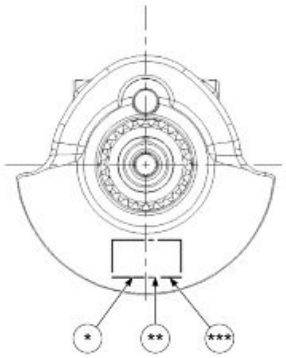
See also

Removing the flywheel cover

Crankshaft class (crank pin)

There are four different classes of crankshaft available (0, 1, 2, 3), selected in relation to crank pin diameter.

There are four different classes of crankshaft available (E1, E2, ...) selectable in relation to connecting rod weight.



Key:

* Class according to connecting rod weight.

** Class according to crank pin diameter.

*** Serial number for traceability and indicating date.

SHAFT CATEGORY

Class	Crank pin diameter (mm)
0	42.000 - 42.006 mm (1.65354 - 1.65377 in)
1	41.994 - 42.000 mm (1.65330 - 1.65354 in)
2	41.988 - 41.994 mm (1.65307 - 1.65330 in)
3	41.982 - 41.988 mm (1.65283 - 1.65307 in)

See also

Removing the flywheel cover

Selecting bushings

There is only one dimension class for the connecting rod. As a result, the bushings used must be selected in accordance with the dimension class of the crank pin.

BUSHINGS

Crank pin diameter	Connecting rod class 1
Crankshaft class 0	Semi-bushing type E (green)
Crankshaft class 1	Semi-bushing type A (red)
Crankshaft class 2	Semi-bushing type B (blue)
Crankshaft class 3	Semi-bushing type C (yellow)

Selecting connecting rods

Not all weight classes are available as spare parts. Only the two most significant weight classes are available - refer to the following table for selection:

CONNECTING RODS

Class according to crankshaft weight	Original connecting rod class
E1	Brown connecting rod
E2	Blue connecting rod
E3	Yellow connecting rod
E4	Green connecting rod
E5	Pink connecting rod
E6	Black connecting rod
E7	White connecting rod

CAUTION

THE CONNECTING RODS INSTALLED ON THE SAME ENGINE MUST BE OF THE SAME COLOUR AND MUST USE THE SAME TYPE OF ASSEMBLY WITH THE CRANKSHAFT.

WHEN REFITTING, ALSO ENSURE THAT THE SEMI-BUSHINGS ARE ALL OF THE SAME CLASS.

See also

Removing the flywheel cover

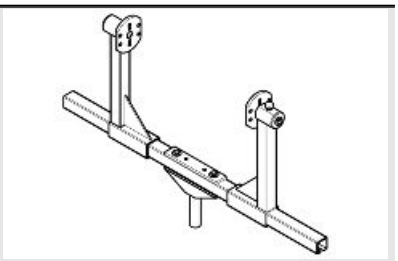
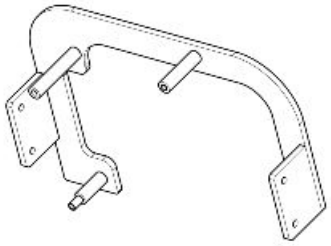
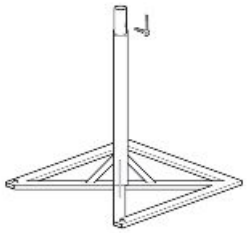
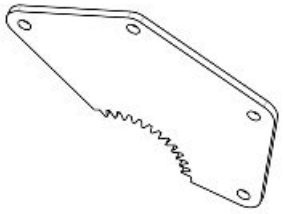
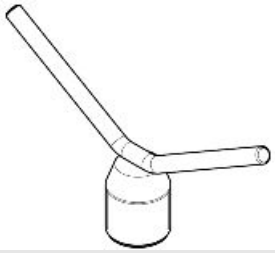
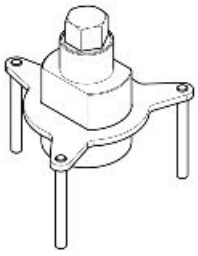
Recommended products chart

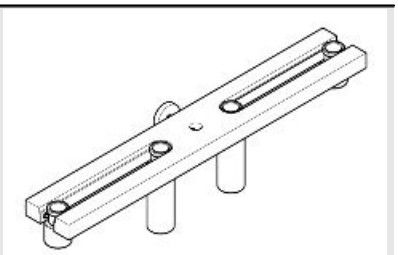
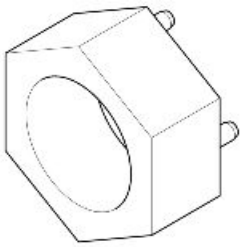
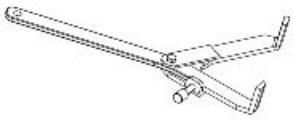
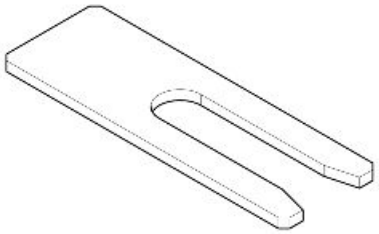
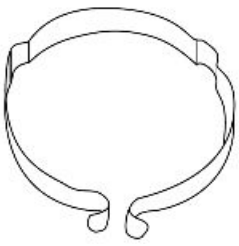
RECOMMENDED PRODUCTS TABLE

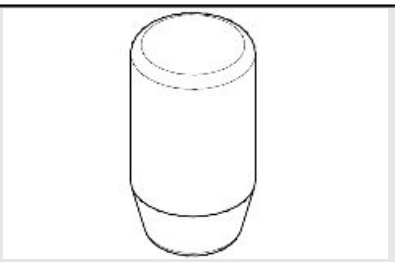
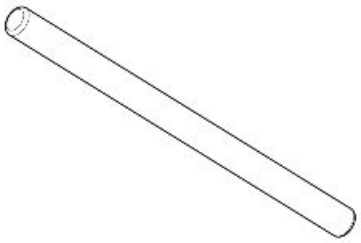
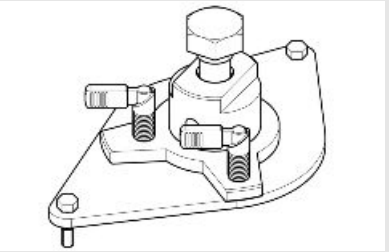
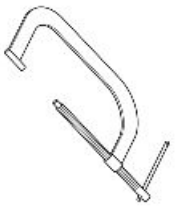
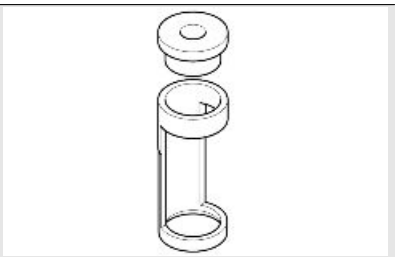
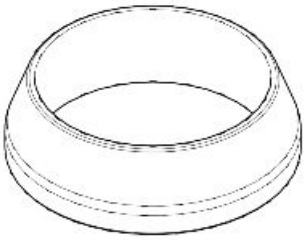
Product	Description	Specifications
ENI i-RIDE PG 15W-50	Engine oil	Use branded oils with performance equivalent to or exceeding API SJ, JASO MA - ACEA A3 - JASO MA2 specifications.
AGIP FORK 5W	Fork oil (Showa)	SAE 5W
FUCHS TITAN SAF 1091 (Sachs)	Fork oil	-
AGIP MP GREASE	Black smooth textured lithium-calcium soap based grease containing EP (extreme pressure) additives with optimal water-repellent properties	ISO L-X-BCHB 2 - DIN 51 825 KP2K-20
AGIP CHAIN LUBE SPRAY	Spray lubricating grease	-
AGIP BRAKE 4	Brake fluid	SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid
AGIP BRAKE 5.1	Clutch fluid	FMVSS 116 - DOT 5.1 Non-silicone synthetic fluid
AGIP PERMANENT SPECIAL	Ethylene glycol-based antifreeze fluid with organic inhibition additives. Red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16

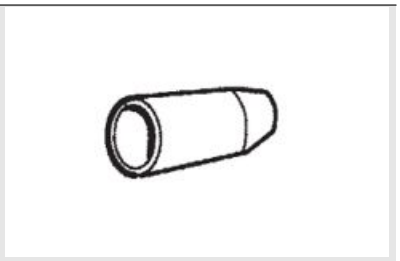
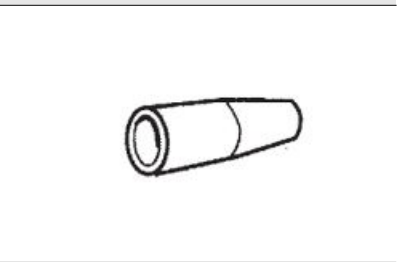
INDEX OF TOPICS

SPECIAL TOOLS

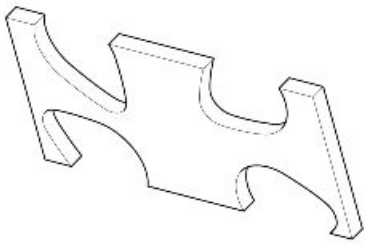
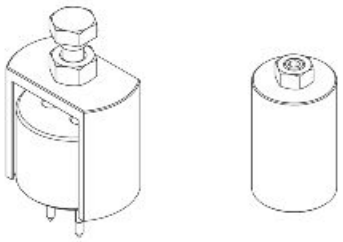
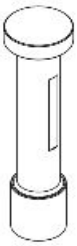
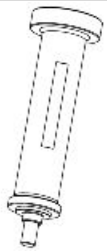
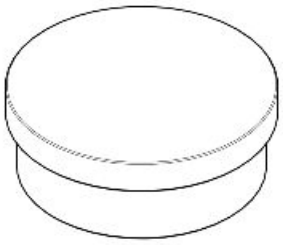
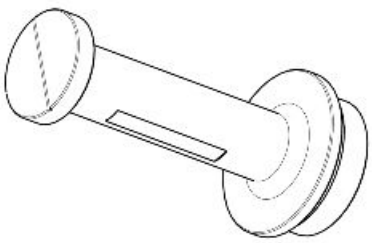
Stores code	Description	
020709Y	Engine support	
020710Y	Engine plate	
AP8140187	Engine support stand	
020711Y	Engine pinion locking	
020712Y	Handle for Flywheel cover removal	
020713Y	Flywheel extractor	

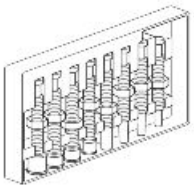
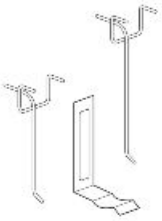
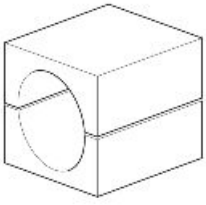
Stores code	Description	
020714Y	Dial gauge mounting	
020715Y	Tone wheel removal	
9100896	Clutch housing locking tool	
020716Y	Connecting rod locking	
020470Y	Pin snap ring fitting tool	
AP8140302	tool for sealing ring fitting	

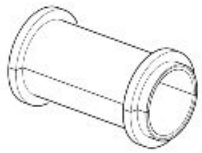
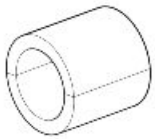
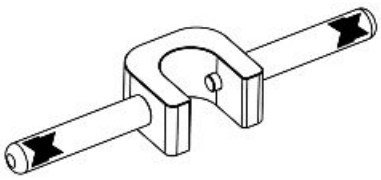
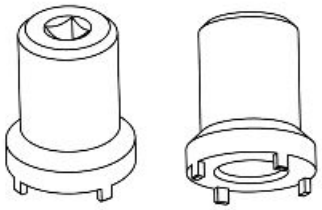
Stores code	Description	
020718Y	Camshaft gear alignment pin	
020719Y	Timing pin	
020720Y	Timing tool	
AP8140179	Valve spring compressor	
020721Y	Adaptor for valve removal	
020722Y	Guide for oil seal	
020376Y	Adapter handle	

Stores code	Description	
020629Y	8 mm (0.31 in) guide	
020412Y	15-mm Oil seal guide	
020439Y	17-mm guide for oil seal	
020263Y	Sheath for fitting the driven pulley	
020365Y	22 mm (0.87 in) guide	
020364Y	25-mm Guide	

Stores code	Description	
020483Y	30 mm guide	
020441Y	Oil seal punch	
020358Y	37 x 40-mm adaptor	
020357Y	32 x 35 mm adaptor	
020359Y	42 x 47-mm adaptor	
020360Y	52 x 55-mm adaptor	

Stores code	Description	
020723Y	Jig for timing overhead camshafts	
020724Y	Gear control rod roller cage punch	
020661Y	Water pump overall seal replacement kit	
020725Y	Punch for water pump overall sealing	
020885Y	Water pump oil seal punch	
020726Y	Extractor for bushings	
020727Y	Punch for bushings	

Stores code	Description	
AP8140180	Extractor for bushings	
8140181	manometer for fuel - oil - compression pressure	
AP8140199	Tool panel	
8202222	Generic adhesive film for panel	
8140426	Hooks for panel	
020880Y	Panel graphics	
AP8140149	Protection for fitting operations	

Stores code	Description	
AP8140189	Oil seal fitting tool for Ø 43 mm (1.69 in) orifices	
AP8140146	Weight	
020889Y	Pumping member ring nut locking spanner	
020888Y	Pliers for pre-fill pipe	
020884Y	46 mm wrench for steering ring nut	
020890Y	Pumping member stanchion support rod	

INDEX OF TOPICS

MAINTENANCE	MAIN

Maintenance chart

Correct maintenance is fundamental for ensuring the longevity of your vehicle and maintaining optimum function and performance.

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 services must be carried out at the specified intervals and mileage, as soon as the pre-determined mileage is reached. Carrying out scheduled services on time is essential for the validity of your warranty. 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.

NOTE

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

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

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

(1) Check and clean and adjust or replace, if necessary, every 1.000 Km (621.37 mi)

(2) Replace every 2 years

(3) Replace every 4 years

(4) At each engine start

(5) Check every month

(6) Check each time the rear tyre is replaced

(7) Replace at whichever of the following occurs first: 40.000 km (24,854 mi) or 48 months

ROUTINE MAINTENANCE TABLE

km x 1,000	1	5	10	15	20	25	30	35	40
Rear shock absorber					I				I
Spark plug					R				R
Drive chain (2)	I				I				I
Transmission cables and controls	I				I				I
Steering bearings and steering clearance	I				I				I
Wheel bearings					I				I
Control unit diagnosis	I				I				I
Brake discs	I				I				I
Air filter			I		R		I		R
Engine oil filter	R				R				R
Fork					I				I
General vehicle operation	I				I				I
Valve clearance	I				A				A
Cooling system					I				I
Braking systems	I				I				I
Light circuit	I				I				I

km x 1,000	1	5	10	15	20	25	30	35	40
Safety switches					I				I
Clutch control fluid (2)	I				I				I
Brake fluid (2)	I				I				I
Coolant (2)	I				I				I
Fork oil (7)									R
Engine oil	R				R				R
Light aiming					I				I
Fork oil seals					I				I
Flexible coupling (6)					I				I
Tyres - pressure/wear (5)	I	I	I	I	I	I	I	I	I
Wheels	I				I				I
Bolts and nuts tightening	I				I				I
Suspension and setting	I				I				I
Fault warning light on instrument panel (4)									
Fuel lines (3)					I				I
Clutch wear					I				I
Brake pad wear	I	I	I	I	I	I	I	I	I
Labour time (minutes)	230	10	30	10	340	10	30	10	400

Spark plug

At regular intervals, remove the spark plug and clean off any carbon deposits or replace as required.

CAUTION

ALWAYS REPLACE BOTH SPARK PLUGS EVEN IF ONLY ONE NEEDS REPLACING.

- Remove the saddle.
- Remove the lower air deflector.
- Remove the side fairings.

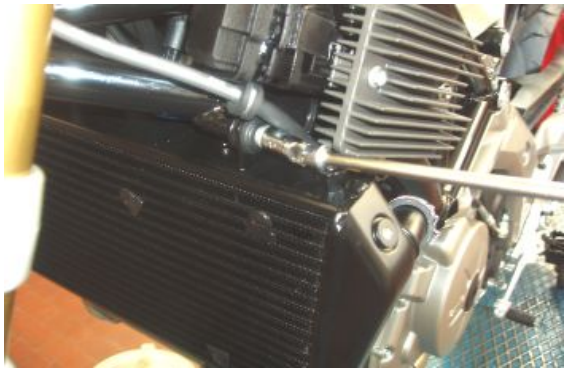
In order to reach the spark plugs:

CAUTION

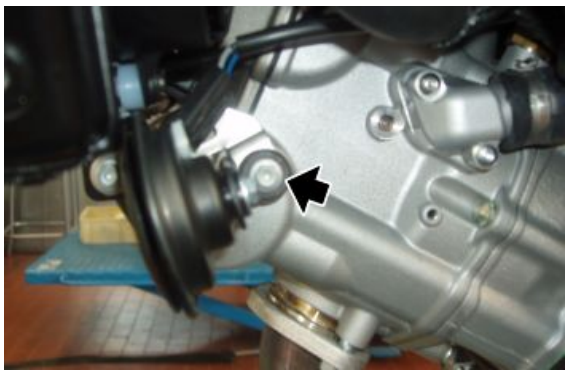
BEFORE CARRYING OUT THE FOLLOWING OPERATIONS AND IN ORDER TO AVOID BURNS, LEAVE ENGINE AND SILENCER TO COOL OFF TO AMBIENT TEMPERATURE.

FRONT SPARK PLUG

- Working on the left side of the vehicle, unscrew and remove the screw.



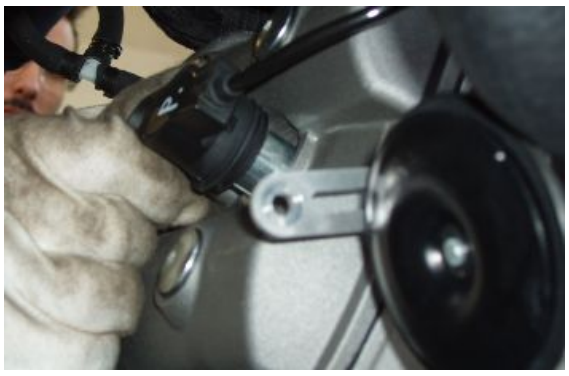
- Undo and remove the screw, remove the horn.



- Turn the radiator forwards and lower it to act on the coil.

- Undo and remove the screw.

- Slide off the front coil.



- Unscrew and remove the front spark plug.

REAR SPARK PLUG

- Lift the tank.
- Unscrew and remove the rear coil fixing screw.

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

- Check the gap between the electrodes with a feeler gauge.

CAUTION

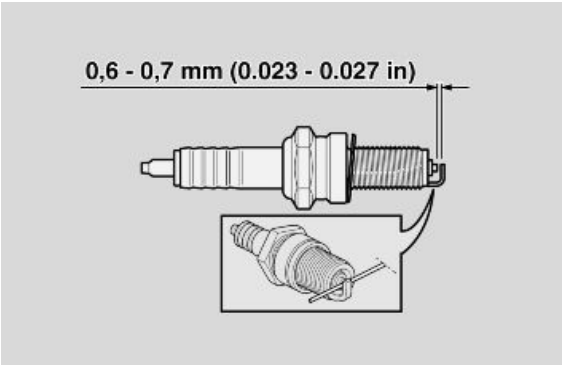
DO NOT ATTEMPT TO READJUST THE ELECTRODE GAP.

The electrode gap should be between 0.6 ÷ 0.7 mm (0.023 ÷ 0.027 in). Otherwise, replace the spark plug.

- Make sure the washer is in good conditions.

Installation:

- Once the washer is fitted, screw the spark plug carefully to avoid damaging the thread.
- Tighten it using the spanner supplied in the toolkit, make each spark plug complete 1/2 a turn to press the washer.



CAUTION

TIGHTEN THE SPARK PLUG CORRECTLY, OTHERWISE THE ENGINE MAY OVERHEAT AND GET IRRETRIEVABLE DAMAGED. USE ONLY THE RECOMMENDED TYPE OF SPARK PLUG, OTHERWISE, THE ENGINE DURATION AND PERFORMANCE COULD BE COMPROMISED.

Locking torques (N*m)

Spark plug 13 Nm (9.59 lbf ft)

Engine oil

Check

Check the engine oil level frequently.

NOTE

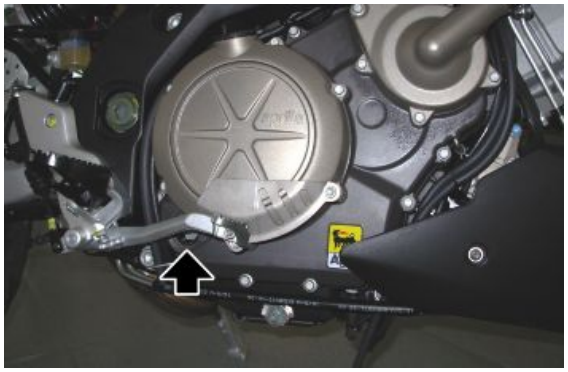
CARRY OUT MAINTENANCE OPERATIONS AT HALF THE INTERVALS SPECIFIED IF THE VEHICLE IS USED IN PARTICULAR RAINY OR DUSTY CONDITIONS, OFF ROAD OR FOR TRACK USE.

ENGINE OIL LEVEL MUST BE CHECKED WHEN THE ENGINE IS WARM.
IF YOU CHECK LEVEL WHEN THE ENGINE IS COLD, OIL LEVEL COULD TEMPORARILY DROP BELOW THE "MIN" MARK.
THIS SHOULD NOT BE CONSIDERED A PROBLEM PROVIDED THAT THE ALARM WARNING LIGHT AND THE ENGINE OIL PRESSURE ICON DO NOT TURN ON SIMULTANEOUSLY ON THE DISPLAY.

CAUTION

DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE AND OBTAIN THE OPERATING TEMPERATURE OF ENGINE OIL.
PREFERABLY CHECK THE OIL AFTER A JOURNEY OF AFTER TRAVELLING APPROXIMATELY 15 Km (10 miles) IN EXTRAURBAN CONDITIONS (ENOUGH TO WARM UP THE ENGINE OIL TO OPERATING TEMPERATURE).

- Shut off the engine.
- Keep the vehicle upright with both wheels on the ground.
- Check the correct oil level through the appropriate sight glass on the engine crankcase.



MAX = maximum level.

MIN = minimum level

- The oil level is correct when it is close to the "MAX" reference.

Replacement

Check the engine oil level frequently.

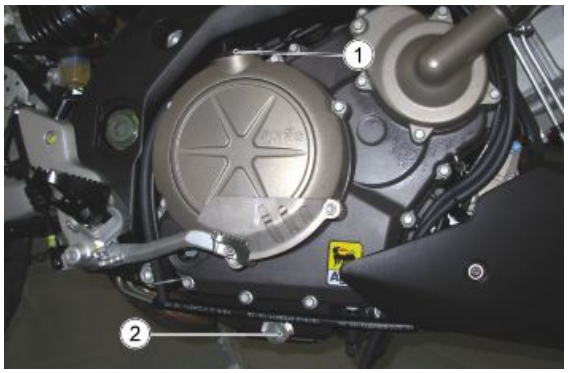
To change the oil:

CAUTION

HOT OIL IS MORE FLUID AND WILL DRAIN OUT MORE EASILY AND COMPLETELY; IDEAL TEMPERATURE IS REACHED AFTER THE ENGINE HAS RUN FOR ABOUT TWENTY MINUTES.

OIL BECOMES VERY HOT WHEN THE ENGINE IS HOT; BE CAREFUL NOT TO GET BURNED WHEN CARRYING OUT THE OPERATIONS DESCRIBED BELOW.

- Use a cloth to wipe off any mud deposit on the area next to the filler plug (1).
- Place a container with + 4000 cm^3 (244 cu.in) capacity under the drainage plug (2).
- Unscrew and remove the drainage plug (2).
- Unscrew and remove the filler plug (1).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Replace the sealing washer of the drainage plug (2).
- Remove any metal scrap attached to the drainage plug (2) magnet.
- Screw and tighten the drainage plug (2).



Locking torques (N*m)

Oil drainage plug - M16x1.5 19 Nm (14.01 lbf ft)

- Replace the oil filter.
- Fill up to the right engine oil level by adding recommended engine oil.

See also

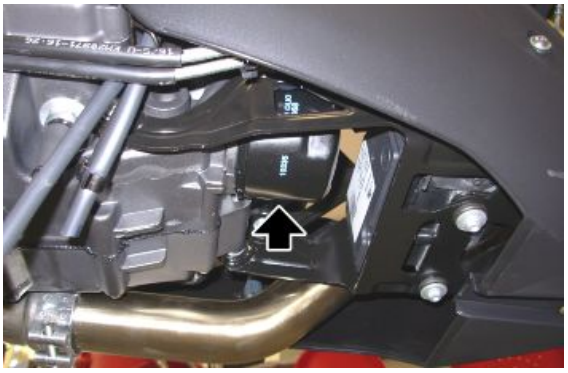
Engine
oil filter
Check

Engine oil filter

- Drain the engine oil.
- Remove the oil filter.
- Fit a new engine oil filter.
- Add engine oil up to the correct level.

CAUTION

NEVER REUSE AN OLD FILTER.

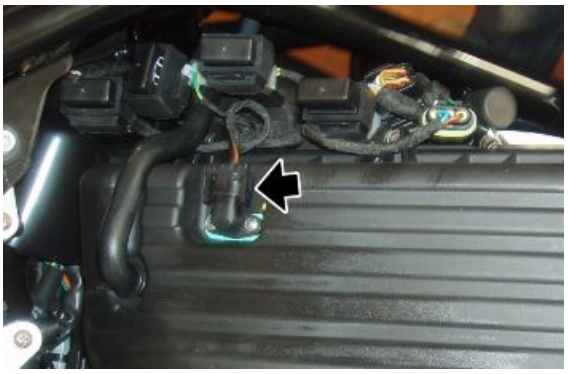


See also

Replacement

Air filter

- Remove the fuel tank.
- Disconnect the air temperature sensor.



- Undo and remove the nine screws.

- Remove the clamp and slide off the blow-by tube.

- Remove the filter box cover.

- Working on both ducts, turn the upper part of the intake ducts anticlockwise and remove it.

- Remove the filtering element.

COVER THE INTAKE DUCTS WITH A CLEAN CLOTH SO THAT FOREIGN BODIES DO NOT GET INTO THE INLET DUCTS. UPON REFITTING AND BEFORE PLACING THE FILTER BOX COVER, MAKE SURE NEITHER THE CLOTH NOR ANY OTHER OBJECT HAS BEEN LEFT INSIDE THE FILTER BOX. MAKE SURE THE FILTERING ELEMENT IS CORRECTLY PLACED SO THAT UNFILTERED AIR DOES NOT FLOW IN. DO NOT FORGET THAT EARLY WEAR OF THE PISTON RINGS AND THE CYLINDER CAN BE CAUSED BY A MALFUNCTIONING OR MISPLACED FILTERING ELEMENT.

REFITTING

- Upon refitting, pay attention when inserting intake ducts and check that the bayonet joint is released once every duct has been inserted and rotated.

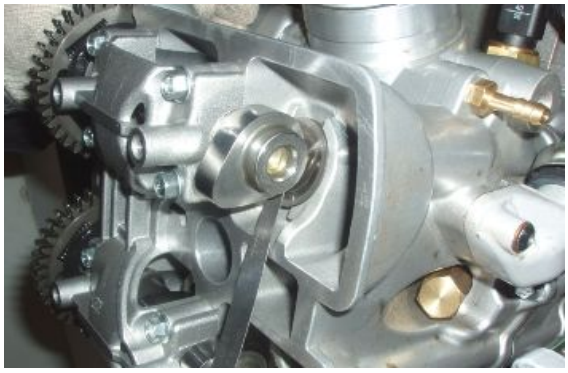
Checking the valve clearance

The following operation can be carried out also with the engine fitted on the vehicle.

- Remove both head covers.

CAUTION

WHENEVER THE HEAD COVER IS REMOVED, ALL FOUR RUBBER RINGS AND THE GASKET SHOULD BE REPLACED.



- Using a thickness gauge, measure the distance between the tip of the crankshaft and the valve bowl.
- Take note of the measurement.

If valve clearance is not within the tolerance range, adjust as follows:

- Take the engine to the TDC.
- Lock the camshafts by using the corresponding timing pins.

Specific tooling

020719Y Timing pin

Characteristic

Intake valve clearance

0.11 - 0.18 mm (0.0043 - 0.0071 in)

Exhaust valve clearance

0.16 - 0.23 mm (0.0063 - 0.0091 in)

- Remove one camshaft at a time
- Leave the other camshaft assembled and blocked by means of the timing pin.

CAUTION

IF BOTH CAMSHAFTS ARE REMOVED, THE ENGINE SPINS MAKING TIMING NECESSARY.

- Remove the bowl tappets and the adjustment shims using a magnet.

NOTE

GREASE THE BOWL TAPPETS AND THE ADJUSTMENT SHIMS PROPERLY EACH TIME THEY ARE REMOVED.

- Replace calibrated pads with a pad thick enough to correct the valve clearance previously detected.
- List of calibrated break pads:

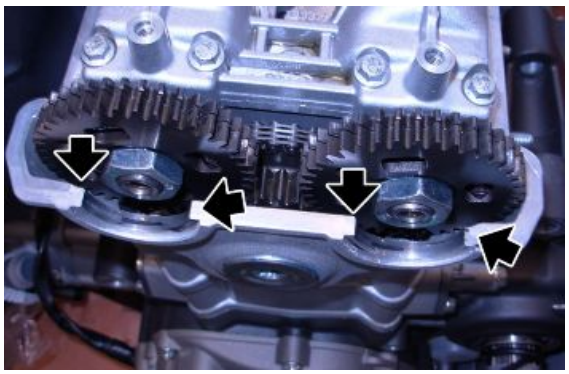
1. Calibrated pad 2.60
2. Calibrated pad 2.65
3. Calibrated pad 2.70
4. Calibrated pad 2.75
5. Calibrated pad 2.80
6. Calibrated pad 2.85
7. Calibrated pad 2.90
8. Calibrated pad 2.95
9. Calibrated pad 3.00
10. Calibrated pad 3.05
11. Calibrated pad 3.10
12. Calibrated pad 3.15
13. Calibrated pad 3.20
14. Calibrated pad 3.25
15. Calibrated pad 3.30
16. Calibrated pad 3.35
17. Calibrated pad 3.40
18. Calibrated pad 2.55
19. Calibrated pad 2.50
20. Calibrated pad 2.45
21. Calibrated pad 2.40

CAUTION

BEFORE REFITTING HEAD COVERS, CLEAN HEAD AND COVER SURFACES CAREFULLY.

- Apply THREEBOND on the head cover perimeter along the gasket housing.

- Apply THREEBOND on the head in the areas indicated in the figure.



See also

Removing the head cover

INDEX OF TOPICS

TROUBLESHOOTING	TROUBL

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 CONTROL UNIT THROUGH NAVIGATOR BY SELECTING "SELF-DIAGNOSIS, APRILIA, DORSODURO, 750 i.e."
- 3 - ARE CURRENT- "ATT"- or STORED- "MEM"- ERRORS SHOWN IN THE "ERRORS DISPLAY" SCREEN PAGE?

YES, go to 4; NO, go to 12.

- 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)" 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 SENSOR CORRECTION" SCREEN PAGES, WITH ENGINE AT IDLE AND ENGINE TEMPERATURE AT > 90°C, DOES THE VALUE VARY WITHIN THE 0.9 - 1.1 RANGE?

YES, go to 15; NO, note C

- 15 - IN THE "ENGINE PARAMETER READING" SCREEN PAGE AND WITH ENGINE AT IDLE, ARE "FRONT THROTTLE CORRECTION PARAMETERS" OR "REAR THROTTLE CORRECTION" WITHIN THE (-0.4° - +0.4°) RANGE? AND IN THE SAME SCREEN PAGE, ARE THE "FRONT THROT., POT. 1 (DEGREES)" AND " "REAR THROT., POT. 1 (DEGREES)", WITH ENGINE AT IDLE, > OR = A 0.5°? CAUTION: THE DIFFERENCE OF THE THROTTLE CORRECTION VALUES BETWEEN THE REAR AND FRONT CYLINDER MUST NOT BE >0.4°

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

Engine

The engine does not start

THE ENGINE DOES NOT START

CAUTION

NAVIGATOR SHOULD BE WORKING PROPERLY AND UPGRADED.

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) SECONDARY 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 FAILURE INDICATION IS SHOWN. IS THE FUEL PUMP ACTIVATED?

  YES, go to 27; NO, go to 2

- 2 - DOES NAVIGATOR COMMUNICATE WITH THE CONTROL UNIT?

  YES, go to 3; NO, go to 4

- 3 - ACTIVATE ONE INJECTOR BY MEANS OF NAVIGATOR ("DEVICES ACTIVATION" SCREEN PAGE, INJECTOR ICON): IS THE INJECTOR ACTIVATED?

  YES, go to 17; NO, go to 12

- 4 - WITH THE IGNITION OFF, CHECK FOR VOLTAGE ON THE ORANGE/RED WIRE OF THE MAIN INJECTION RELAY (POLARISED) 39.

  YES, go to 6; NO, go to 5

- 5 - LOCATE THE INTERRUPTION IN THE ORANGE/RED WIRE FROM THE MAIN INJECTION RELAY (POLARISED) 39 TO BATTERY POSITIVE.
- 6 - WITH THE IGNITION ON, CHECK FOR VOLTAGE ON THE GREEN/BLACK WIRE OF THE MAIN INJECTION RELAY (POLARISED) 39.

  YES, go to 8; NO, go to 7

- 7 - LOCATE THE GREEN/BLACK WIRE FROM THE MAIN INJECTION RELAY (POLARISED) 39 TO THE IGNITION SWITCH - END
- 8 - IS THE BLUE CABLE GROUNDED?

  YES, go to 10; NO, go to 9

- 9 - RESTORE THE CABLE HARNESS.
- 10 - CHECK IF THERE IS VOLTAGE ON THE RED/BLACK CABLE.

  NOT OK, go to 11; OK, go to 12

- 11 - REPLACE THE MAIN INJECTION RELAY (POLARISED) 39 - END
- 12 - CHECK FOR VOLTAGE ON THE ORANGE/RED WIRE OF THE AUXILIARY INJECTION RELAY 40.

YES, go to 13; NOT OK, go to 14

- 13 - CHECK IF THERE IS VOLTAGE ON THE YELLOW/PURPLE CABLE.

OK, go to 15; NOT OK, go to 16

- 14 - RESTORE THE CABLE HARNESS - END
- 15 - SET THE KEY TO "OFF" AND THEN "ON": DOES THE VOLTAGE ON THE YELLOW/PURPLE CABLE REACH APPROX. 1-2V FOR 2 SECONDS?

YES, go to 17; NO, go to 18

- 16 - REPLACE THE AUXILIARY INJECTION RELAY 40- END
- 17 - WITH THE IGNITION OFF, CHECK THE RED/BROWN WIRE FROM THE AUXILIARY INJECTION RELAY 40 TO THE FUEL PUMP CONNECTOR FOR CONTINUITY AND GROUND INSULATION.

YES, go to 20; NO, go to 19

- 18 - WHEN THE KEY IS TURNED TO "OFF", CHECK CONTINUITY AND GROUND INSULATION OF THE YELLOW/PURPLE CABLE FROM THE RELAY TO PIN 62, VEHICLE CONNECTOR.

YES, go to 22; NO, go to 21

- 19 - RESTORE THE CABLE HARNESS.
- 20 - CHECK THERE IS GROUND INSULATION FOR THE BLUE CABLE OF THE PUMP CONNECTOR.

OK, go to 24; NOT OK, go to 23

- 21 - RESTORE THE CABLE HARNESS - END
- 22 - CHECK THE VEHICLE CONNECTOR.

OK, go to 25; NOT OK, go to 26

- 23 - RESTORE THE CABLE HARNESS - END
- 24 - CHECK THAT THE RESISTANCE OF THE PUMP IS APPROX. 1 OHM. IF THE RESISTANCE IS INCORRECT, REPLACE THE PUMP - END
- 25 - REPLACE THE CONTROL UNIT - END
- 26 - RESTORE THE CABLE HARNESS - END
- 27 - DOES THE MOTOR TURN WHEN THE STARTER BUTTON IS PRESSED?

YES, go to 29; NO, go to 28

- 28 - WHAT DOES THE "START-UP ENABLING SWITCH" STATUS ON NAVIGATOR (DEVICE STATUS/ICON "0/1" SCREEN PAGE) MEAN?

YES, go to 43; NO, go to 64

- 29 - CHECK FOR VOLTAGE ON THE BROWN/WHITE WIRE OF STARTER MAINTENANCE RELAY (POLARISED) 37

OK, go to 30; NOT OK, go to 31

- 30 - WITH THE STARTER MAINTENANCE RELAY (POLARISED) 37 DISCONNECTED, KEEP THE STARTER BUTTON PRESSED AND CHECK THAT A VOLTAGE OF APPROX. 1-2V IS MEASURED ON THE YELLOW/RED WIRES

OK, go to 32; NOT OK, go to 33

- 31 - CHECK FOR CONTINUITY ON THE BROWN/WHITE CABLE

OK, go to 31a; NOT OK, go to 31b

31a - WITH THE LIGHT LOGIC RELAY 7 DISCONNECTED, CHECK THE CONTINUITY BETWEEN PIN 87 AND PIN 30

OK, go to 31c; NOT OK, go to 31d

31b - RESTORE THE CABLE HARNESS

31c - CHECK CONTINUITY ON GREEN/WHITE CABLE FROM THE LIGHT LOGIC RELAY 7 TO SECONDARY FUSE B

OK, go to 31e; NOT OK, go to 31f

31d - REPLACE THE RELAY - END

31e - CHECK CONTINUITY ON RED/BLACK CABLE FROM SECONDARY FUSE B THE TO MAIN INJECTION RELAY 39

OK, go to 4; NOT OK, go to 31g

31f - RESTORE THE CABLE HARNESS

31g- RESTORE THE CABLE HARNESS

- 32 - CHECK CONTINUITY OF PINK/BLACK CABLE FROM STARTER MAINTENANCE RELAY (POLARISED) 37 TO START BUTTON CONNECTOR

OK, go to 34; NOT OK, go to 35

- 33 - RESTORE THE CABLE HARNESS
- 34 - CHECK THAT THE STARTER MAINTENANCE RELAY (POLARISED) 37 WORKS CORRECTLY

OK, go to 36; NOT OK, go to 37

- 35 - RESTORE THE CABLE HARNESS
- 36 - CHECK CONTINUITY OF PINK/BLACK CABLE FROM STARTER MAINTENANCE RELAY (POLARISED) 37 TO PIN14 ON VEHICLE CONNECTOR

OK, go to 38; NOT OK, go to 39

- 37 - REPLACE THE STARTER MAINTENANCE RELAY (POLARISED) 37
- 38 - CHECK THE VEHICLE CONNECTOR (PIN 14)

OK, go to 40; NOT OK, go to 41

- 39 - RESTORE THE CABLE HARNESS
- 40 - REFER TO THE CHAPTER ON "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/ ENGINE REVOLUTION SENSOR"; FOLLOW THE TROUBLESHOOTING STEPS IN THE SECTION REFERRING TO "NAVIGATOR: ELECTRICAL ERRORS".

CAUTION: failure NOT identified, go to 42; failure identified, END

- 41 - RESTORE THE CABLE HARNESS
- 42 - CHECK INJECTORS AND ENGINE FOR CORRECT MECHANICAL OPERATION, CHECK FUEL CIRCUIT PRESSURE.
- 43 - WHEN THE STARTER BUTTON IS PRESSED, DOES THE VOLTAGE TO THE YELLOW/PINK WIRE OF THE CONTROL RELAY (START LOGIC) 38 CHANGE TO APPROX. ZERO?

YES, go to 44; NO, go to 45

- 44 - CHECK FOR VOLTAGE ON THE RED/BLACK WIRES OF THE COMMAND RELAY (START LOGIC) 38

YES, go to 50; NO, go to 51

- 45 - CHECK CONTINUITY AND GROUND INSULATION OF THE YELLOW/PINK CABLE FROM THE RELAY TO THE ENGINE CONNECTOR (PIN 2)

OK, go to 47; NOT OK, go to 46

- 46- RESTORE THE CABLE HARNESS - END
- 47 - CHECK THE CONTROL UNIT CONNECTOR

OK, go to 49; NOT OK, go to 48

- 48 - RESTORE THE CABLE HARNESS - END
- 49 - REPLACE THE CONTROL UNIT - END
- 50 - WHILE PRESSING THE STARTER BUTTON, DISCONNECT THE CONNECTOR FOR THE WHITE/SKY BLUE AND WHITE/RED WIRES OF THE STARTER RELAY 34 AND CHECK FOR VOLTAGE ON YELLOW/RED WIRE OF THE (START LOGIC) CONTROL RELAY 38

OK, go to 52; NOT OK, go to 53

- 51 - REPLACE THE RELAY - END
- 52 - PRESSING THE STARTER BUTTON, CHECK IF THERE IS VOLTAGE TO THE YELLOW/RED CABLE OF THE START-UP RELAY

OK, go to 54; NOT OK, go to 55

- 53 - REPLACE THE RELAY - END
- 54 - CHECK IF THE BLUE WIRE OF THE STARTER RELAY 34 IS GROUNDED

OK, go to 56; NOT OK, go to 57

- 55 - RESTORE THE CABLE HARNESS -END
- 56 - WITH THE IGNITION OFF, CHECK FOR VOLTAGE ON THE REAR RED WIRE (WITH CAP) OF THE STARTER RELAY 34

OK, go to 58; NOT OK, go to 59

- 57 - RESTORE THE CABLE HARNESS -END
- 58 - WITH THE STARTER BUTTON PRESSED, CHECK FOR VOLTAGE ON THE FRONT RED WIRE OF THE STARTER RELAY 34

OK, go to 60; NOT OK, go to 61

- 59 - RESTORE THE CABLE HARNESS
- 60 - CHECK FOR CONTINUITY ON THE RED WIRE BETWEEN THE STARTER RELAY 34 AND THE STARTER MOTOR

YES, go to 62; NO, go to 63

- 61 - REPLACE THE STARTER RELAY 34 - END
- 62 - REPLACE THE STARTER MOTOR - END
- 63 - RESTORE THE CABLE HARNESS - END
- 64 - WHAT DOES THE "FALL SENSOR" STATUS ON NAVIGATOR (DEVICE STATUS/ ICON "0/1" SCREEN PAGE) MEAN?

If "NORMAL" is shown, go to 65; If "TIP OVER" is shown, go to 68

- 65 - WITH THE SWITCH SET TO "RUN", WHAT DOES THE "RUN-STOP SWITCH" STATUS ON NAVIGATOR ("DEVICE STATUS/ICON "0/1" SCREEN PAGE) MEAN?

If "RUN" is shown, go to 66; If "STOP" is shown, go to 67

- 66 - USING NAVIGATOR CHECK THAT THE SIDE STAND, NEUTRAL SENSOR AND CLUTCH SENSOR FUNCTION CORRECTLY; OPERATE ANY DEVICE AND CHECK THE SUITABLE INDICATION ON THE "DEVICE STATUS/ICON "0/1" SCREEN PAGE

If "MALFUNCTION" is shown, go to 71; If "CORRECT OPERATION" is shown, go to 72

- 67 - REFER TO THE CHAPTER ON "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/ FALL SENSOR; INDICATION ON NAVIGATOR ALWAYS STOP- END
- 68 - IS THE SENSOR VERTICAL?

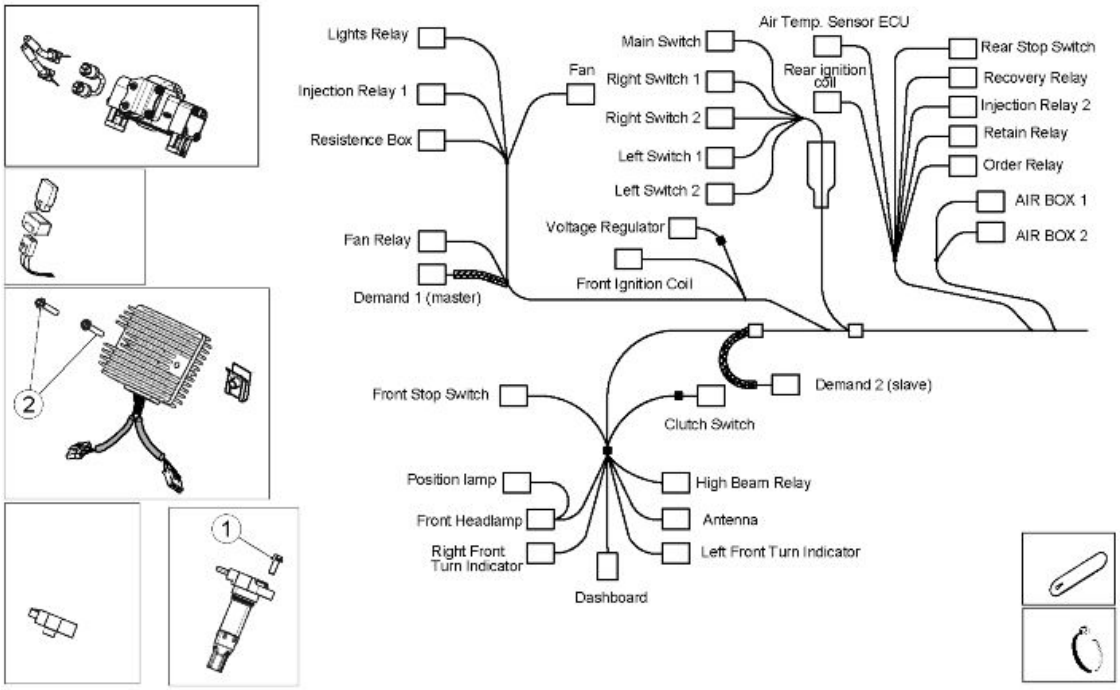
YES, go to 69; NO, go to 70

- 69 - REFER TO THE CHAPTER ON "ELECTRICAL SYSTEM/CHECKS AND CONTROLS/ FALL SENSOR, INDICATION ON NAVIGATOR ALWAYS TIP OVER - END
- 70 - SET THE SENSOR TO THE CORRECT POSITION - END
- 71 - ACCORDING TO THE FAILURE, REFER TO CHAPTER ON "ELECTRICAL SYSTEM/ CHECKS AND CONTROLS/GEAR IN NEUTRAL SENSOR", or "CLUTCH LEVER SENSOR" or "SIDE STAND SENSOR" - END

- 72 - REPLACE THE CONTROL UNIT - END

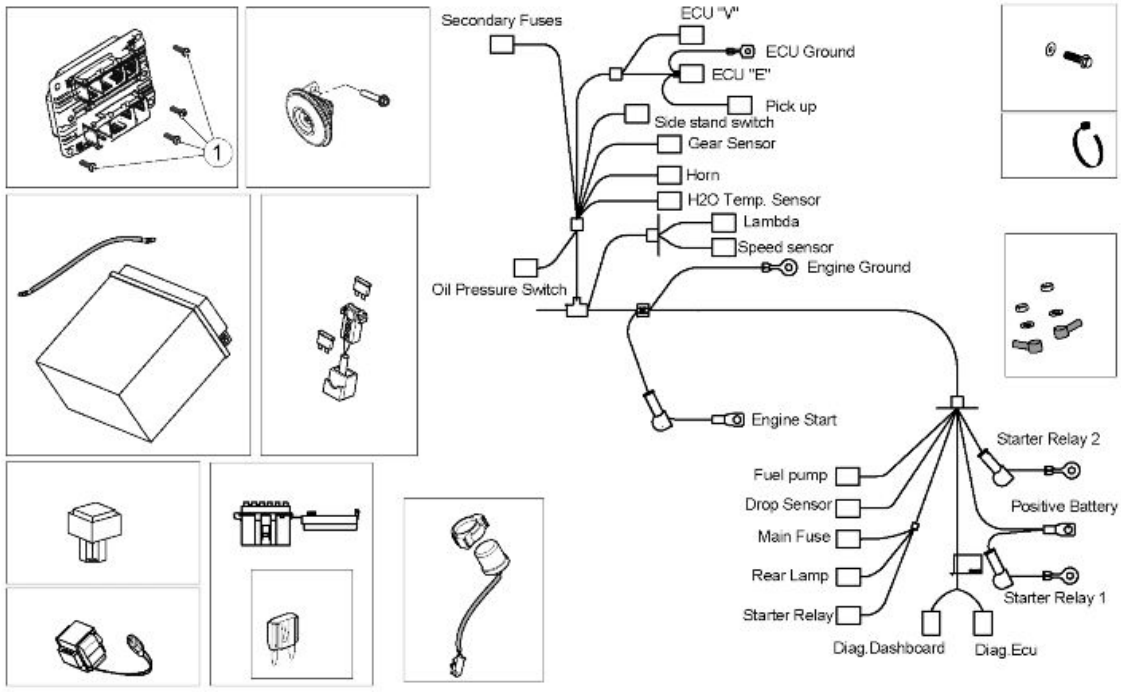
INDEX OF TOPICS

ELECTRICAL SYSTEM	ELE SYS



ELECTRICAL SYSTEM 1

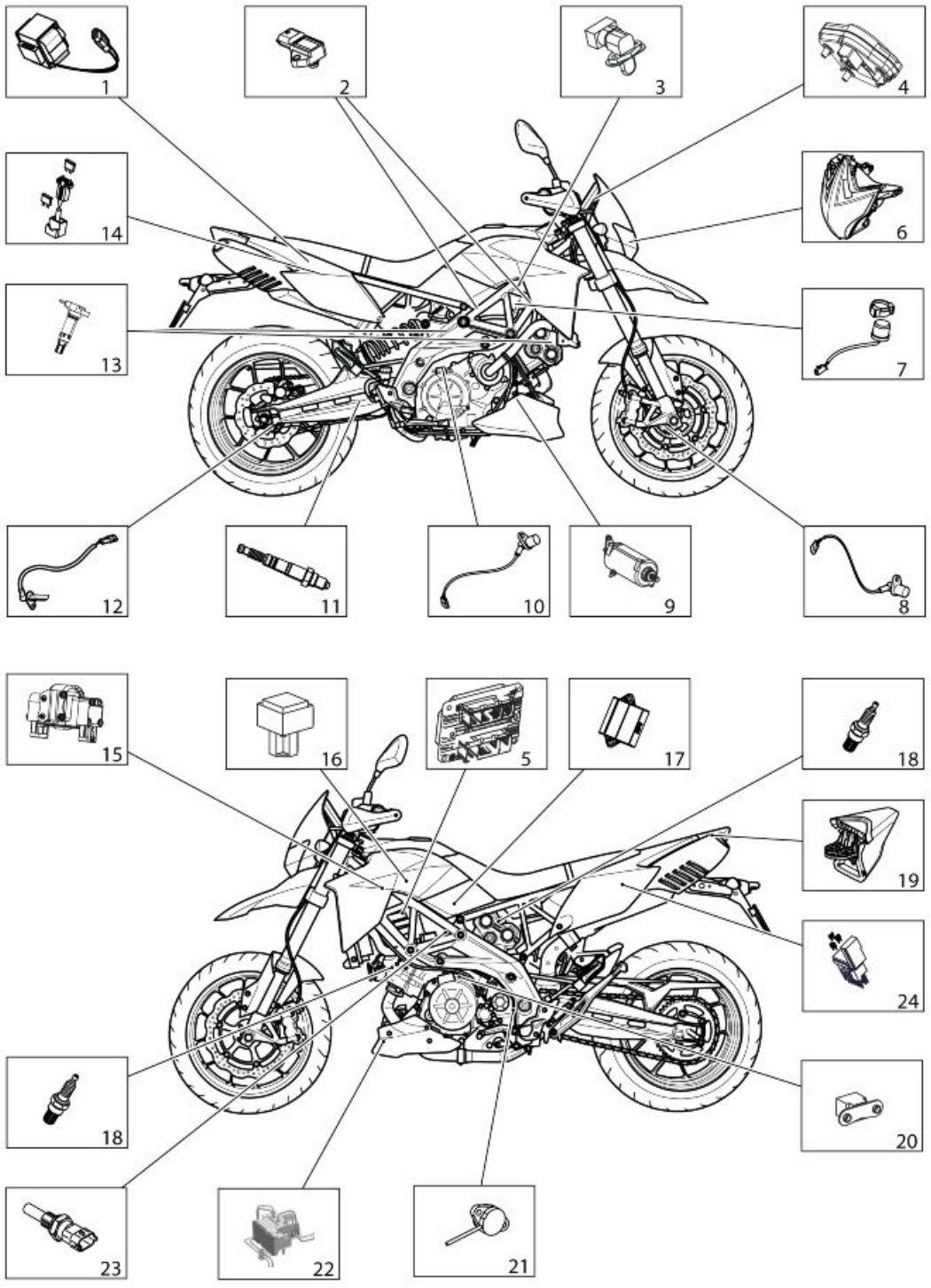
pos.	Description	Type	Quantity	Torque	Notes
1	Coil fixing screw	M6	2	13 Nm (9.59 lbf ft)	-
2	TE screw fastening regulator to frame	M6x30	2	10 Nm (7.37 lbf ft)	-



ELECTRICAL SYSTEM 2

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening ECU to filter box base	-	4	2.5 Nm (1.47 lbf ft)	-
-	Starter relay fastener	-	2	3 - 4.2 Nm (2.21 - 3.1 lbf ft)	-

Components arrangement



Key

1. fall sensor
2. Intake air pressure sensor
3. Intake air temperature sensor
4. Instrument panel
5. Engine control unit
6. Headlamp
7. Start-up relay
8. Front ABS sensor
9. Starter motor
10. Engine revolution sensor
11. Lambda probe
12. Rear ABS sensor
13. Coils
14. Main fuses
15. Hand grip position sensor
16. Main injection relay
17. Throttle control unit
18. Spark plugs
19. Taillight
20. Engine revolution sensor - pick up
21. Gear in neutral sensor
22. ABS control unit (modulator)
23. Engine temperature sensor
24. Secondary fuses

CAUTION

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

RELAY LAYOUT ON THE WIRING DIAGRAM AND ON THE VEHICLE

LIGHT LOGIC RELAY

- Location on the wiring diagram: 7
- Location on the vehicle: under the fuel tank, right side, first relay starting from the rear side.

START-UP RELAY

- Location on the wiring diagram: 34
- Location on the vehicle: under the fuel tank, left side, second relay starting from the front.

RETENTION RELAY

- Location on the wiring diagram: 37
- Location on the vehicle: under the fuel tank, right side, second relay starting from the front.

CONTROL RELAY

- Location on the wiring diagram: 38
- Location on the vehicle: under the fuel tank, right side, third relay starting from the front.

MAIN INJECTION RELAY

- Location on the wiring diagram: 39
- Location on the vehicle: under the fuel tank, left side, third relay starting from the front.

AUXILIARY INJECTION RELAY

- Location on the wiring diagram: 40
- Location on the vehicle: under the fuel tank, right side, second relay starting from the front.

FAN CONTROL RELAY

- Location on the wiring diagram: 41
- Location on the vehicle: under the fuel tank, left side, first relay starting from the front.

HIGH BEAM LIGHTS RELAY

- Location on the wiring diagram: 64
- Location on the vehicle: under the fuel tank, right side, first relay starting from the front.

RECOVERY LOGIC RELAY (URGENT SERVICE)

- Location on the wiring diagram: 65
- Location on the vehicle: behind the instrument panel.

Electrical system installation

INTRODUCTION

Scope and applicability

The position of the cable harnesses, how they are fixed to the motorcycle and potential problems are defined on the following sections in order to reach the objectives of vehicle reliability.

Materials used and corresponding quantities

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

- 1 Main Cable Harness
- 1 Filter Box Cable Harness
- 1 Taillight Cable harness
- 1 Relay-Starter Motor Cable
- 1 Battery - Engine Ground Cable
- 2 Caps for Magura Switches
- 1 Injection Main Relay
- 6 Relays 12 V / 30 A
- 1 Start-up Relay
- Medium black clamps 178 x 4 (7.01 x 0.16 in)

- Small black clamps 98 x 2.5 (3.86 x 0.01 in)
- 1 10-cm (3.94 in) spiral for start-up cable
- 1 Pick-Up divider cable harness (if fitted)

Motorcycle division

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

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

SPECIAL CHECKS FOR THE CORRECT CONNECTION AND LAYING OF CABLES

Carry out the checks described below once the electrical system is refitted, connectors reconnected and clamps and retainers restored.

- Check the connector block for connections and correct tightening in the following connectors.

1. Instrument panel connector: FRONT SECTION.
2. Handgrip sensor connectors: CENTRAL SECTION, TABLE G
3. Pick Up Connector: CENTRAL SECTION.
4. Side Stand Switch Connector: CENTRAL SECTION, TABLE C.
5. Regulator Connector: CENTRAL SECTION, TABLE O.
6. Front cylinder coil and rear cylinder coil connectors.
7. Filter Housing Connectors.
8. ECU and Ground Lead Connectors for the filter casing: CENTRAL SECTION, TABLE C.
9. Fuel Pump Connector.
10. Key Connector - Right Light Switch Connectors - Left Light Switch Connectors: Connectors inside the housing behind the radiator: FRONT SECTION, TABLE B.

- THE CONNECTORS LISTED ARE CONSIDERED CRITICAL IN COMPARISON WITH ANY OTHER BECAUSE THE VEHICLE WILL STOP IF THEY ARE ACCIDENTALLY DISCONNECTED.
- Undoubtedly the connection of the rest of connectors is also important and essential for the correct operation of the vehicle.

Front side

CAUTION

ONCE THE ELECTRICAL SYSTEM IS REFITTED, THE CONNECTORS RECONNECTED AND CLAMPS AND RETAINERS RESTORED, CARRY OUT THE CHECKS INDICATED UNDER "SPECIAL CHECKS FOR THE CORRECT CONNECTION AND LAYING OF CABLES" IN THE "ELECTRICAL SYSTEM INSTALLATION" SECTION.

TABLE A - RECOVERY

1. 12V 30A Relay
    - Fasten cable harness with retaining straps as shown in the figure.

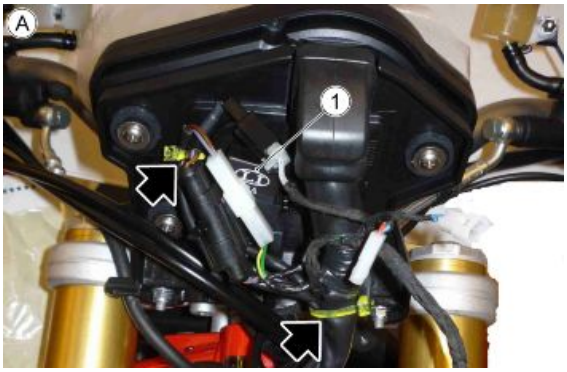


TABLE B - FASTENING SWITCH CABLE HARNESSES

- Fasten switch cable harnesses with a rubber retainer.

TABLE C - FRONT ABS SENSOR FASTENER

1. Cable grommets;
2. Front ABS sensor;
    - Leave the cable loosen so that it makes a slight curve and the cable grommet must be turned towards the outside of the fork.

TABLE D - Lay the cable as shown and fasten it with a 2.5x160 clamp

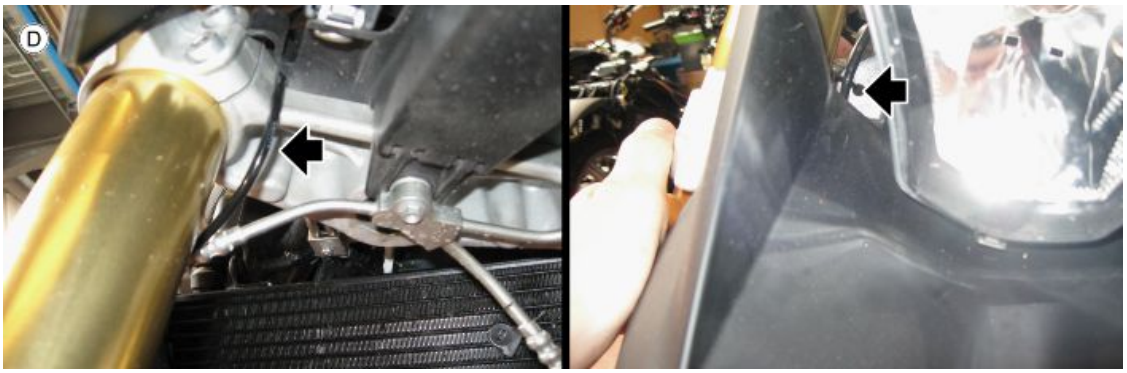


TABLE E - Fasten with a 2.5x160 clamp

Central part

CAUTION

ONCE THE ELECTRICAL SYSTEM IS REFITTED, THE CONNECTORS RECONNECTED AND CLAMPS AND RETAINERS RESTORED, CARRY OUT THE CHECKS INDICATED UNDER "SPECIAL CHECKS FOR THE CORRECT CONNECTION AND LAYING OF CABLES" IN THE "ELECTRICAL SYSTEM INSTALLATION" SECTION.

TABLE A - MAIN CABLE HARNESS LAYING

- View of main cable harness laying without airbox.

TABLE B - CABLE HARNESS FOR RELAY UNIT

The shortest cables must be connected to the three closest relays

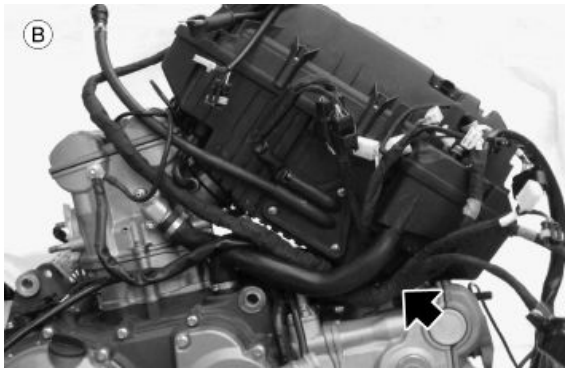


TABLE C

To lay the auxiliary fuses box under the airbox:

- slide off the protection cap.
- reinsert it observing the correct poles

1. Side stand switch
2. Neutral switch
3. Horn
4. Control unit connectors

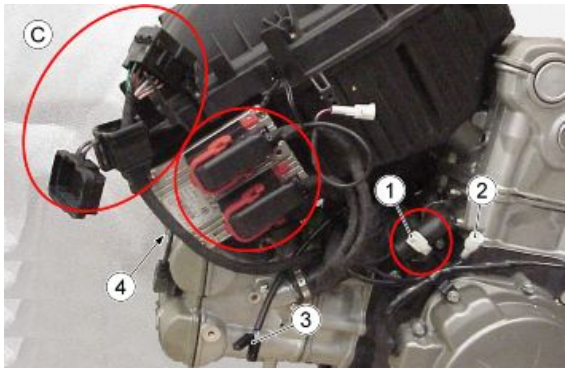


TABLE D

The generator output cable must be laid behind the thermostatic valve, under the airbox.

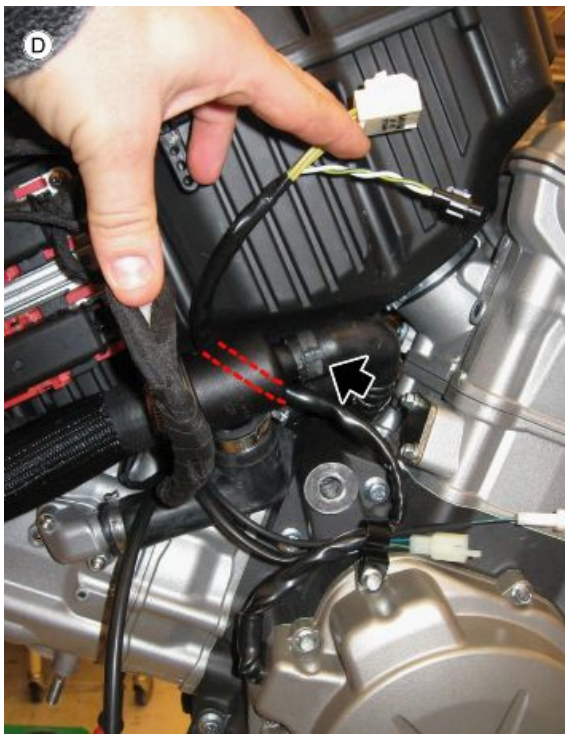


TABLE E

5. Cable guide already fitted on engine

6. Rubber cap

TABLE F

4.5x180 (0.18x7.08) Clamps

TABLE G

Plastic cable guide holding the auxiliary fuses branch and the cylinder coil cable 1 (horizontal).

TABLE H

4.5x290 (0.18x11.42) Clamp

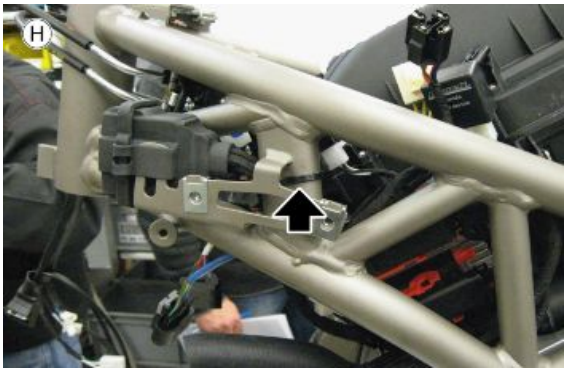


TABLE I

1. 12V / 30A Fan relay
2. Relay with ignition maintenance diode (service) 12V / 20A
3. Main injection relay
4. Resistance module
5. High- and low-beam lights relay
6. Auxiliary injection relay
7. Control relay
8. Logic relay

TABLE J

4.5x290 (0.18x11.42) Clamp

TABLE K

Plastic cable guide that holds the lambda probe branch, the rear stop switch branch and the rear wheel speed sensor.

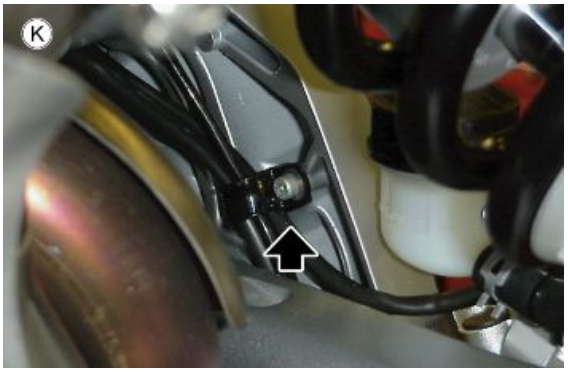


TABLE L

First of all connect the light switches connectors and the key switch inside the rubber cap and position the latter as in the figure, then the Demand Master (BLUE tape) connector and then the "regulator" connector.

9. Regulator connector
10. Rubber cap that hosts light switch and key switch connectors.
11. Demand 1 Master Connector

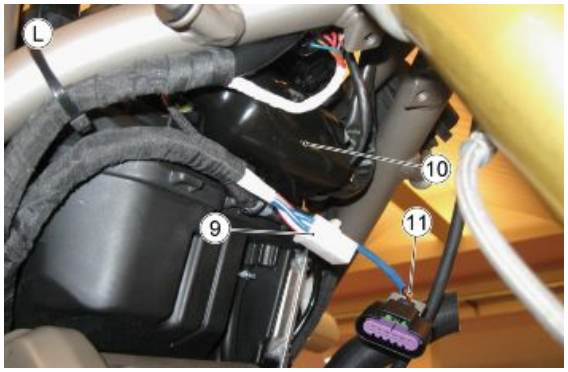


TABLE M

The clamp holds the cables going out from the light switches and the immobilizer aerial cable going out from the key switch.

4.5x180 (0.18x7.08) Clamp

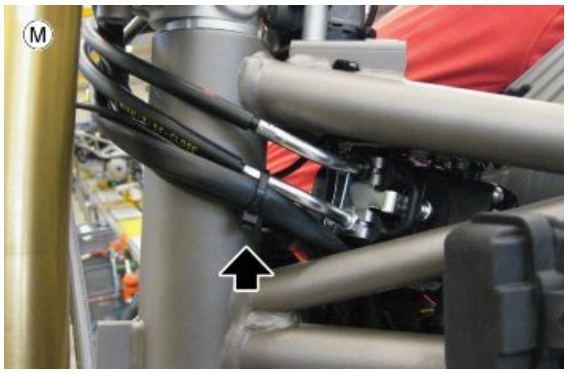


TABLE N

2.5x160 (0.10x6.30) Clamp

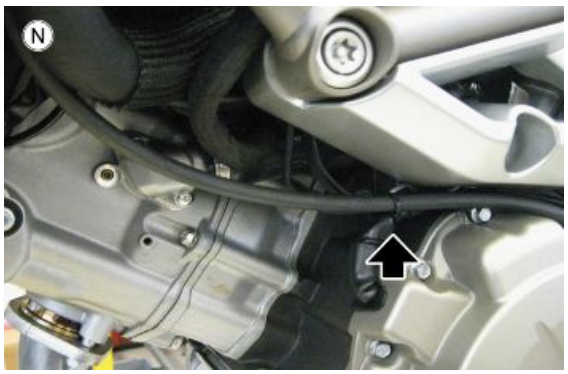


TABLE O

12. Cable grommet
13. 2.5x98 (0.10x3.86) Clamps
14. 4.5x290 (0.18x11.42) Clamps

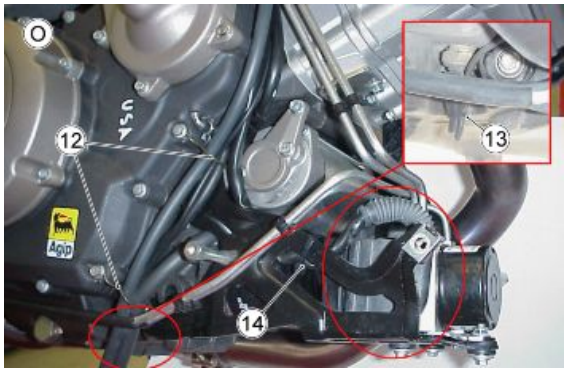


TABLE O1

- Clamp.

TABLE P

Engine attachment clamps that coil the main cable harness and the engine - battery ground connection cable harness.

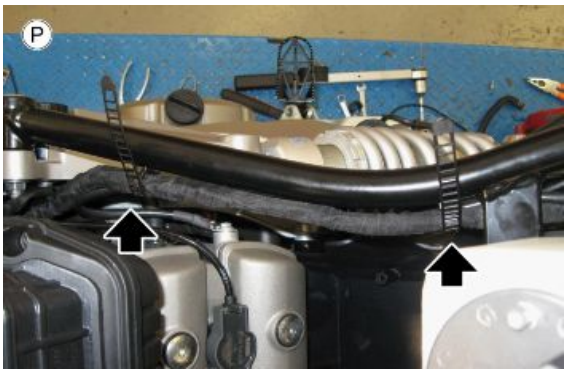


TABLE Q

Rubber clamp

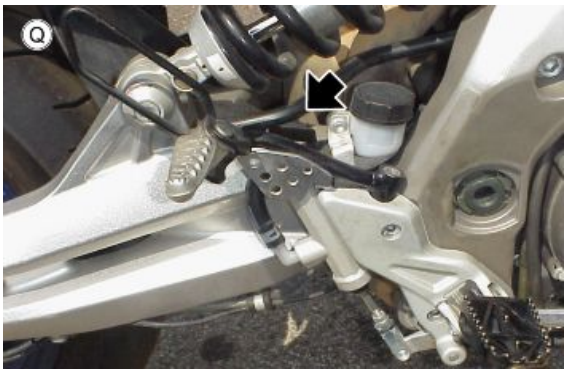


TABLE R

Metallic cable guide

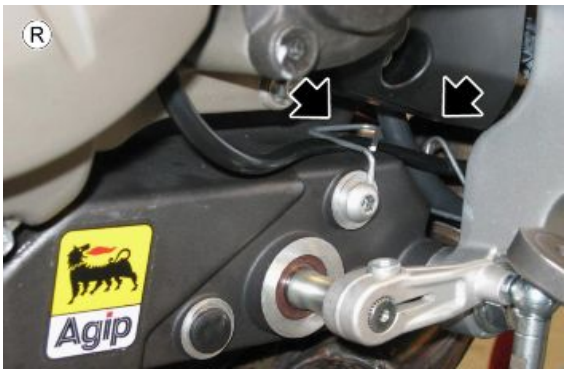


TABLE S

15. Side stand switch output sheath
16. Battery compartment bleed pipe
17. Cable grommet

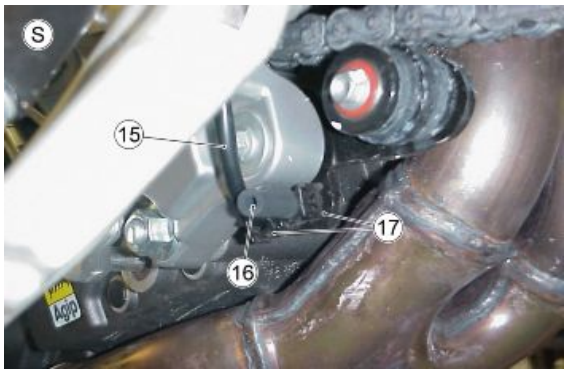


TABLE T

The cables fastened to the engine ground must face downwards.

18. Main cable harness engine earthing on the left
19. Battery ground lead on the right

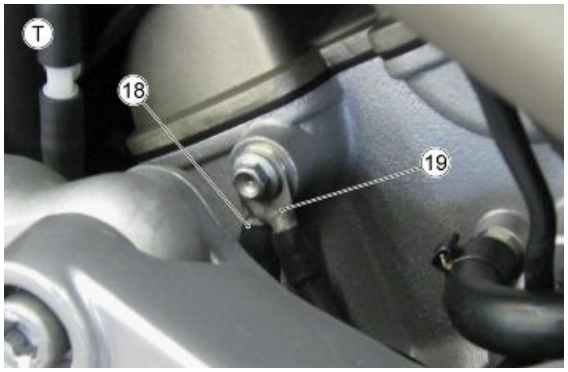


TABLE U

2 4.5x180 (0.18x7.08) Clamps

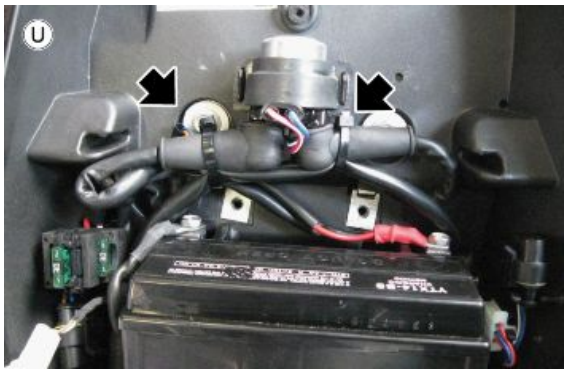


TABLE V - LAMBDA PROBE

Place the cable harness of the lambda probe in the cable grommet on the clutch crankcase.

20. Fasten the cable harness to the chassis with the clamp.
21. Place the cable harness of the lambda probe behind the cable grommet on the clutch crankcase.

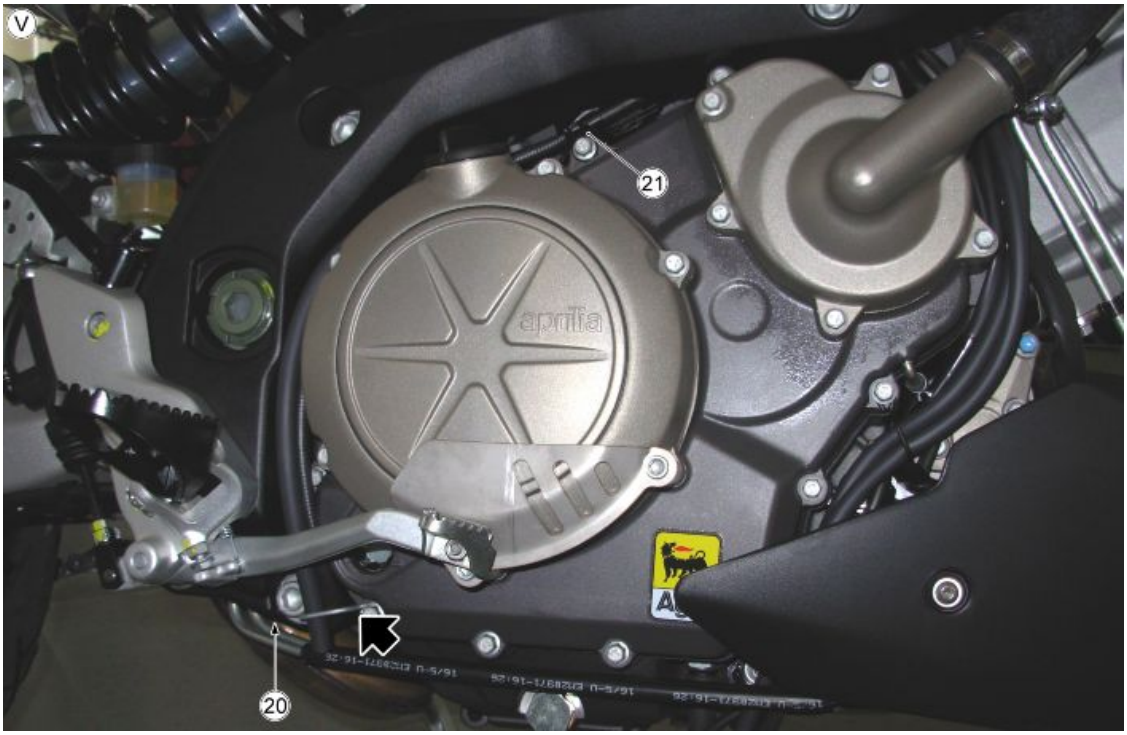


TABLE Z

Connector insertion on Demand and secondary lock closing

TABLE ZA-ZB

Tables with tips on filter box cable harness fitting.

TABLE ZC-ZD

Tables with tips for fitting ground lead and start-up cable

22. Cable grommet

23. ABS cable harness connecting cable

24. Starter motor cable coiled with pigtail wire L=10 cm (3.93 in)

25. 4.5x290 (0.18x11.42) Clamp

26. 2.5x160 (0.10x6.30) Clamp

ZD - engine- battery ground connection cable path

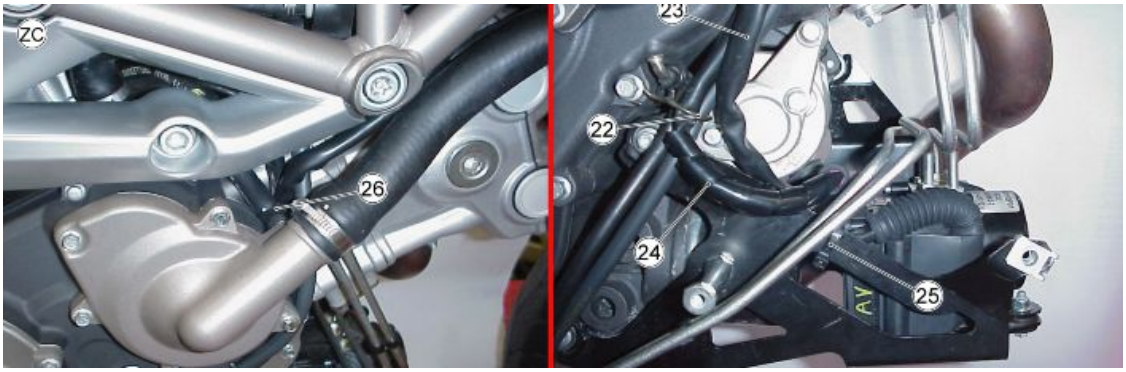


TABLE ZE

Procedure for the correct insertion of the ABS control unit connector

The initial position of the lever that couples the connector must be as shown in figures 1 and 2

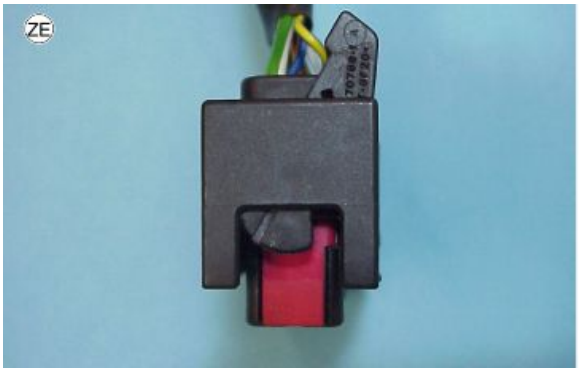


TABLE ZF

Place the connector on the opposite side of the control unit and lower the driving lever until the "click" that signals the end of the stroke is heard

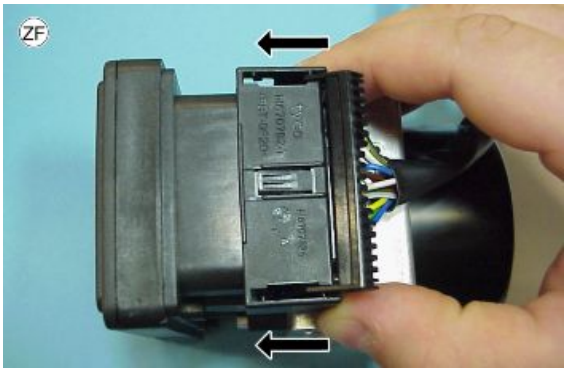


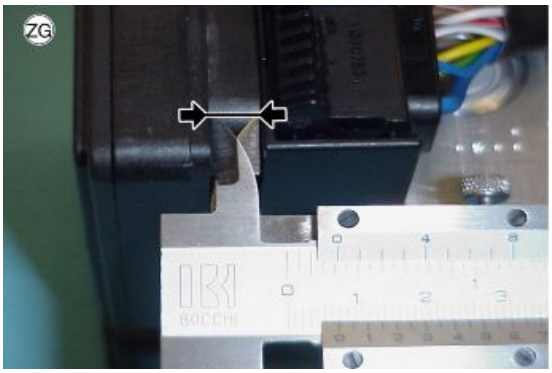
TABLE ZG

When the connector is fully inserted, the distance between the connector and the ABS control unit must be 7.5 mm (0.29 in).

If the initial position of the connector and the driving lever is not as shown in figure ZE, the connector will not get properly coupled and the distance measured will be longer (12 mm approx. (0.47 in)).

In this case, repeat the operation as described in the ZF-ZG picture.

It is advisable to create a template to check the correct connector insertion.



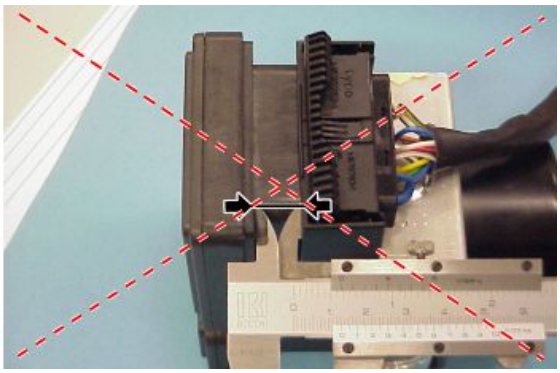


TABLE ZH

27. Fasten the cable harness with a clamp.

Insert the housing as shown in the figure.

Back side

TABLE A - Taillight cable harness fitting

1. 2.5x98 (0.10x3.86) Clamp
2. 4.5x180 (0.18x7.08) Clamp

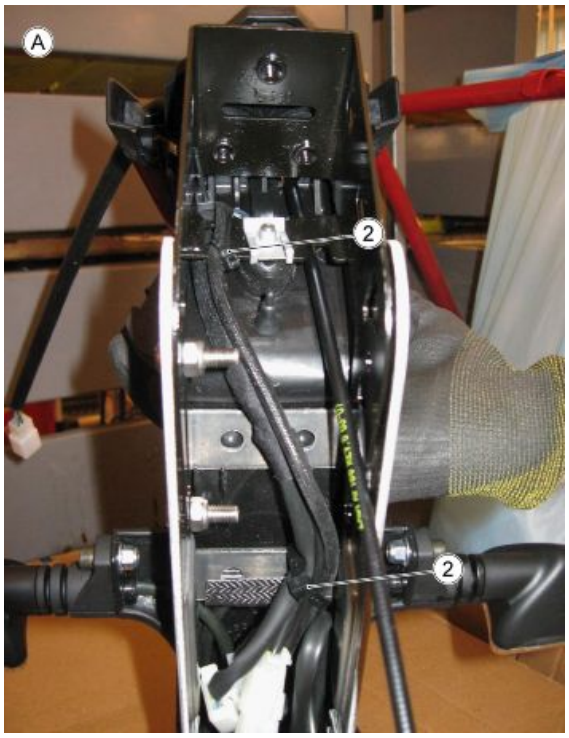


TABLE B - SPEED SENSORS / FRONT AND REAR WHEEL ABS FITTING

TABLE B1

2.5x160 mm (0.01x6.30 in) Clamps

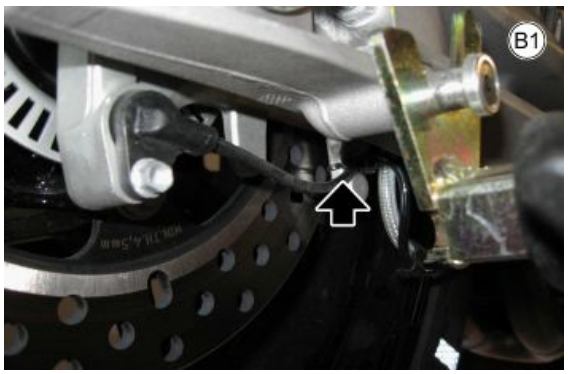


TABLE B1/A

3. 2.5x160 mm (0.01x6.30 in) Clamps

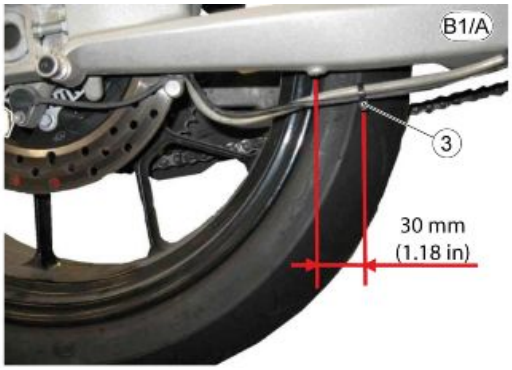


TABLE B2

4. 2.5x160 mm (0.01x6.30 in) Clamps

5.4.5x180 mm (0.18x7.08 in) Clamps

6. Cable grommet

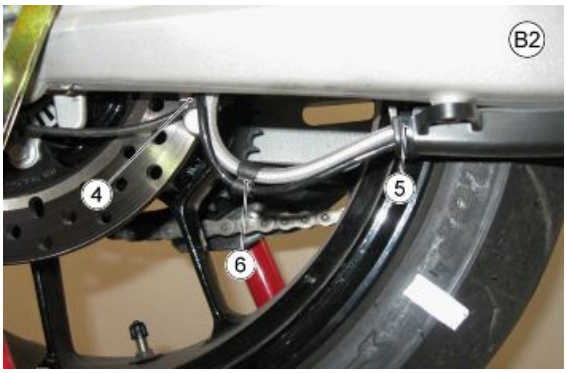


TABLE B2/A

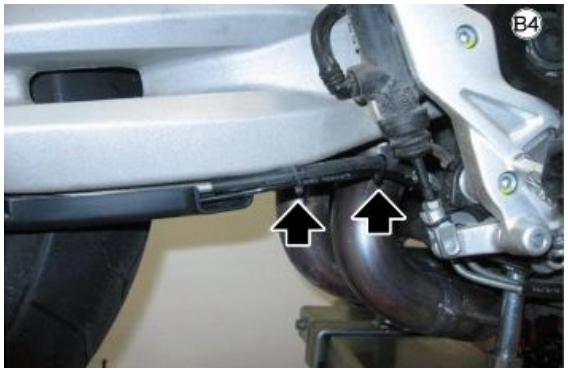
Spiral length 110 mm (4.33 in)

TABLE B3

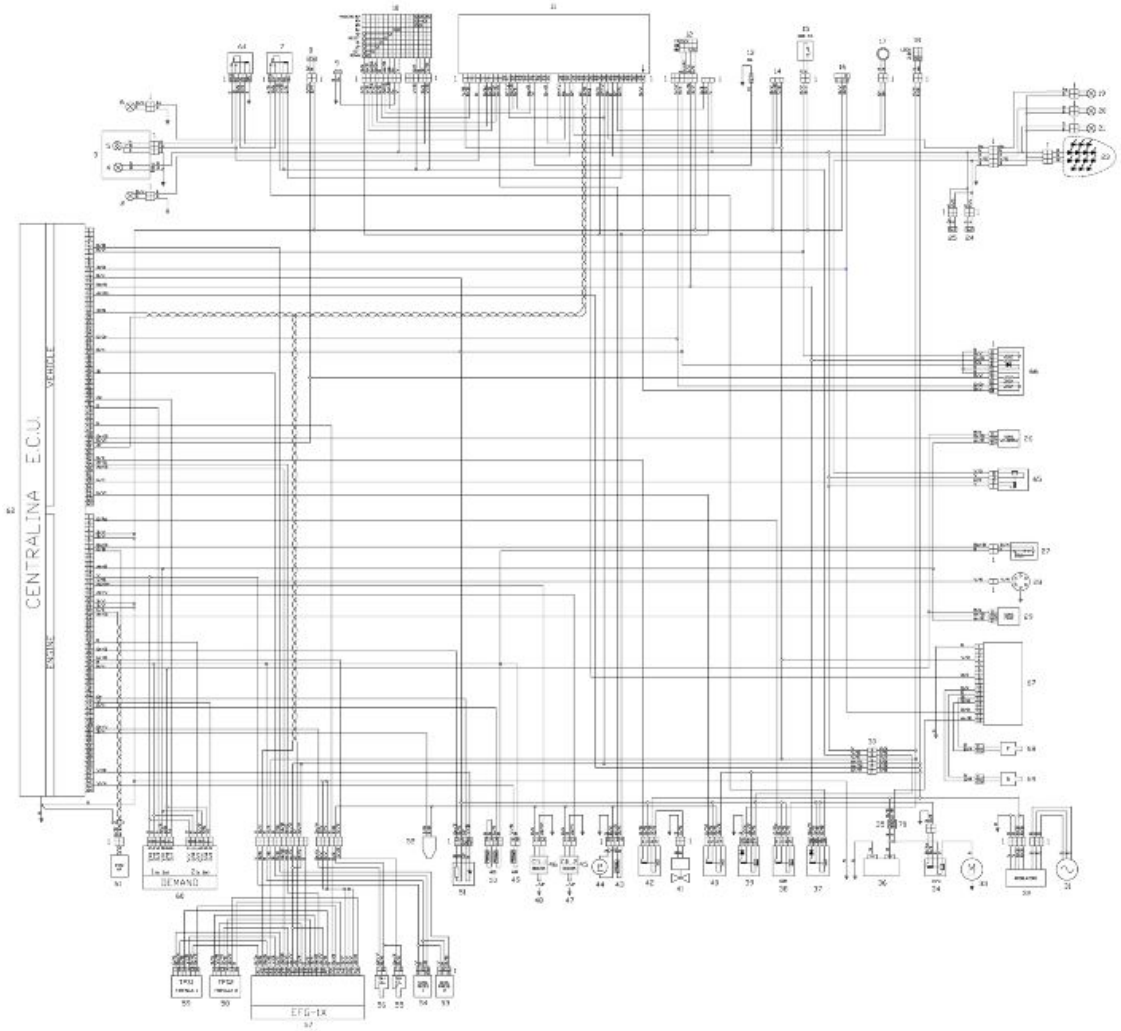
Cable guide

TABLE B4

2.5x160 mm (0.1x6.30 in) Clamps



General wiring diagram



key:

1. MULTIPLE CONNECTORS
2. FRONT RIGHT TURN INDICATOR
3. COMPLETE HEADLAMP
4. TAIL LIGHT BULB
5. TWIN HIGH-/LOW BEAM BULB
6. FRONT LEFT TURN INDICATOR
7. LOGIC RELAY WITH N.C. MATING
8. CLUTCH SWITCH
9. HORN
10. Left light switch
11. INSTRUMENT PANEL
12. Right light switch

13.OIL PRESSURE SENSOR
14.INSTRUMENT PANEL DIAGNOSIS
15.SIDE STAND SWITCH
16.ECU AND ABS DIAGNOSIS
17.IMMOBILIZER AERIAL
18.IGNITION SWITCH
19.REAR LEFT TURN INDICATOR
20.Rear right turn indicator
21.LICENSE PLATE LIGHT BULB
22.-
23.COMPLETE TAILLIGHT (WITH LED)
24.REAR STOP SWITCH
25.FRONT STOP SWITCH
26.SPEED SENSOR
27.Fall sensor
28.NEUTRAL SENSOR
29.TIMING SENSOR (OPTIONAL)
30.Secondary fuses
31.Flywheel
32.Voltage regulator
33.STARTER MOTOR
34.START-UP RELAY
35.MAIN FUSE
36.BATTERY
37.START-UP MAINTENANCE RELAY
38.CONTROL RELAY (START-UP LOGIC)
39.MAIN INJECTION RELAY (POLARISED)
40.AUXILIARY INJECTION RELAY
41.FAN
42.FAN CONTROL RELAY
43.FUEL LEVEL SENSOR
44.FUEL PUMP
45.REAR CYLINDER COIL
46.FRONT CYLINDER COIL
47.REAR CYLINDER SPARK PLUG
48.FRONT CYLINDER SPARK PLUG
49.INTAKE AIR TEMPERATURE SENSOR
50.Water Temperature Sensor

51.LAMBDA PROBE
52.PURGE VALVE (OPTIONAL)
53.REAR CYLINDER PRESSURE SENSOR
54.FRONT CYLINDER PRESSURE SENSOR
55.REAR CYLINDER INJECTOR
56.FRONT CYLINDER INJECTOR
57.EFG 1X THROTTLE CONTROL UNIT
58.REAR CYLINDER THROTTLE
59.FRONT CYLINDER THROTTLE
60.DEMAND CONTROL UNIT
61.PICK-UP
62.ECU
63.-
64.LOW-/HIGH- BEAM / PASSING LIGHT RELAY WITH N.C. MATTING
65.RECOVERY LOGIC RELAY (URGENT SERVICE)
66.PROTECTION RESISTANCES
67.ABS CONTROL UNIT
68.FRONT ABS SENSOR
69.REAR ABS SENSOR
70.ABS CONTROL UNIT FUSE

Colour key:

Ar Orange
Az Sky blue
B Blue
Bi White
G Yellow
Gr Grey
M Brown
N Black
R Red
Ro Pink
V Green
Vi Purple

Conceptual diagrams

Checks and inspections

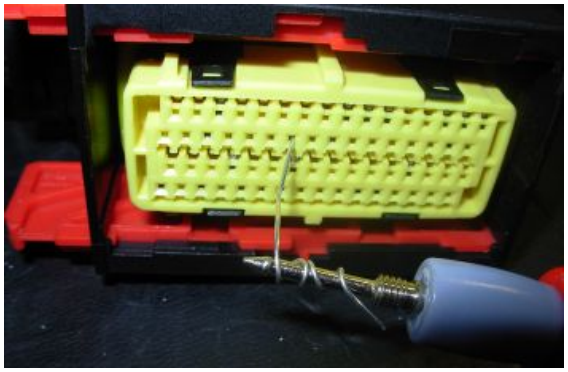
GENERAL CONCEPTS OF ELECTRICAL TROUBLESHOOTING

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

CAUTION

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

CONNECTOR CHECK PROCEDURE



The procedure includes the following checks:

1. Observation and check of the connector correct position on the component or on the coupling connector, making sure that the locking catch is released.

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

CAUTION

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

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

CONTINUITY check

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

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

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

GROUND CONNECTION check

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

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

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

VOLTAGE check

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

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

CAUTION

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

Dashboard

In case the EFI warning light turns on and the words SERVICE or URGENT SERVICE are shown on the display, due to an error detected in the injection ECU, the malfunction indication will be deactivated only after the vehicle has been used for a pre-set number of minutes of operation. However, even though the malfunction is no longer present and the control unit considers the error no longer current but memorised (MEM error indication on Navigator), the instrument panel may keep showing there is an error present.

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:

98789

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:

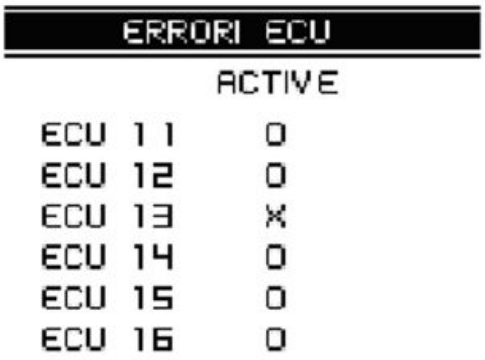
- Exit
- ECU diagnosis
- INSTRUMENT PANEL ERRORS

- Error Clearing
- VEHICLE SERVICING RESET
- Update
- CHANGE KEYS
- KM / MILES

ECU diagnosis

In this mode a chart is displayed showing potential errors in the control unit.

IT IS NECESSARY TO REFER TO THE ERROR INDICATIONS GIVEN BY NAVIGATOR FOR THIS VEHICLE.



The instrument panel does not keep all previous errors stored in its memory.

INSTRUMENT PANEL ERRORS

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

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

Battery recharge circuit

RECHARGING SYSTEM

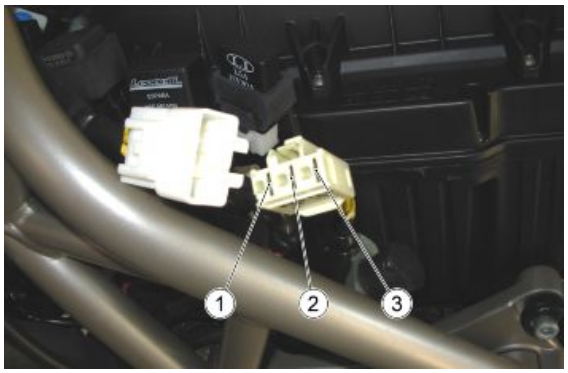
- Remove the tank and the filter casing;
- Disconnect the three-way connector (1) (white).

NOTE

THE ENGINE SIDE IS IDENTIFIED WITH THE LETTER "A"

Measurement of resistance (with engine off)

- For a correct detection of the alternator resistance, an ambient temperature measurement must be carried out and afterwards a heat stabilisation (after turning fan on) by using a tester, using alternatively the 3 connector pins: stage "1" (pin 1-2), stage "2" (pin 1-3), stage "3" (pin 2-3).



- Take the measurement; The correct value is determined by the value measured for each stage in which from time to time the resistance of the tester wires is subtracted, obtained by touching the two lugs.

Example:

- Resistance of stage 1 read on the display = 0.65 Ohm

- Resistance of the wires read on the display = 0.47 Ohm

- Effective resistance stage 1 = 0.65-0.47 = 0.18 Ohm
- If there is a significant difference between one stage and another (other than 0.15 Ohm), this means that the alternator is defective and must be replaced.

RESISTANCE MEASUREMENT

Winding stage	Ambient temperature (ohm)	Afterwards heat stabilisation (ohm)
Stage 1	0.15 - 0.20	0.18 - 0.23
Stage 2	0.15 - 0.20	0.18 - 0.23
Stage 3	0.15 - 0.20	0.18 - 0.23

Empty voltage

- Disconnect the three-way connector (1);
- For a correct detection of the alternator voltage, a measurement must be carried out using alternatively the 3 engine side connector pins: stage "1" (pin 1-2), stage "2" (pin 1-3), stage "3" (pin 2-3).
- Take the measurements;
- If there is a significant difference between one stage and another (other than 15 V), this means that the alternator is defective and must be replaced.

CAUTION

WITH THE ENGINE HOT THE VALUES RECORDED ARE ON AVERAGE 4-5 V LESS THAN THOSE DETECTED WITH THE ENGINE COLD.

EMPTY VOLTAGE

rpm	2000	6000	8000
Vm linked voltage Reference values (V rms)	20 - 30	75 - 85	95 - 105

Short circuit current

- For a correct detection of the short circuit current, a connector must be prepared that generates a downstream short circuit between the three alternator cables;
- Start the engine and with an ammeter clamp measure each single cable.
- If there is a significant difference between the measure of the single cables (other than 10 A), this means that the alternator is defective and must be replaced.

CAUTION

WITH THE ENGINE HOT THE VALUES RECORDED ARE ON AVERAGE 2-3 A LESS THAN THOSE DETECTED WITH THE ENGINE COLD.

WARNING

NEVER KEEP THE ENGINE RUNNING FOR MORE THAN ONE MINUTE; FAILURE TO DO SO COULD CAUSE SERIOUS OVERHEATING DAMAGES TO THE MOTORCYCLE CIRCUITS.

COLD SHORT CIRCUIT CURRENT

RPM	2000	4000	6000	8000
RMS DC current (Arms) (average of the 3 stage currents)	26 - 31	26 - 31	26 - 31	26 - 31

Voltage on battery poles with engine speed always between 3000 - 5000 RPM

- Start the engine, after about one minute of operating bring the speed to 3000-5000 RPM, then measure with a tester the voltage at the battery poles that must always be between 13V and 15V. Otherwise, if the correct operation of the alternator has already been checked, replace the regulator.

CAUTION

PERFORM THE CHECK DESCRIBED ABOVE WITH A BATTERY IN GOOD CONDITION (START VOLTAGE ABOUT 13V) MAKING SURE THAT THERE ARE NO ELEMENTS IN THE SHORT CIRCUIT.

level indicators

Fuel reserve sensor

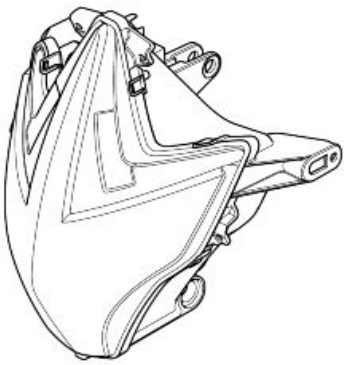
Check proper operation of the sensor by adding a 2W bulb in series to the sensor.

Place a bulb between the battery power supply cable and the connector terminal and connect the negative terminal to the ground connection:

- if the sensor is submerged in petrol (sensor high electrical resistance, approx. 5-7 kOhm), the bulb should remain off.
- if the sensor is not submerged in petrol, the bulb should turn on.

Lights list

Front headlamp



Characteristic

Front daylight running light

12V - 6W H6

Low beam light

12 V - 50 W H4

High beam light

12 V - 60 W H4

Taillight

Characteristic

Rear daylight running light / stop light

LED

Fuses

AUXILIARY FUSES

A - Coil, Light logic relay, Recovery logic relay, Stop, Horn, Tail lights, License plate light (10A).

B - Low-beam / high-beam lights (15A).

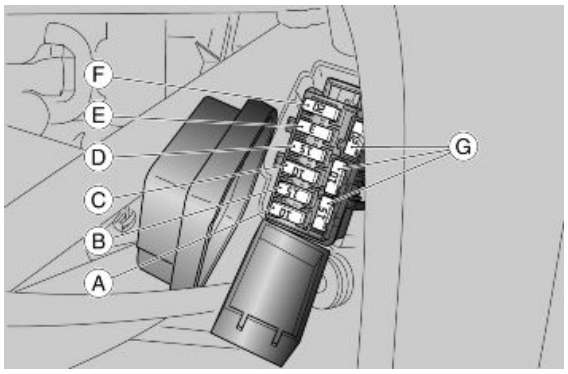
C - Live positive lead to EFG-1x control unit and to instrument panel, Instrument panel diagnosis (10 A).

D - Instrument battery positive and EFG-1x control unit (15 A).

E - Permanent positive, ECU power supply (3A).

F - Oxygen sensor heater, Coils, Start-up logic, Fan and injection relay, Fuel pump, Purge valve, Injectors, ECU, Start-up logic (20A).

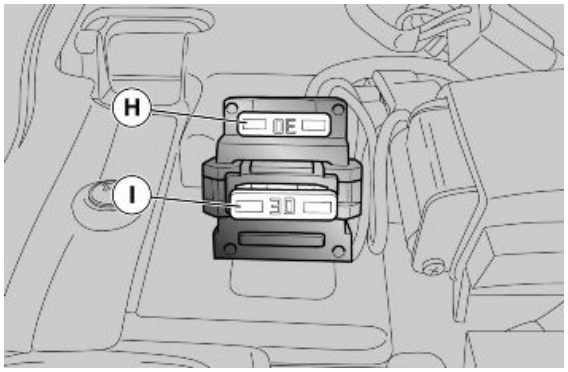
G - Spare fuses (10 - 15 - 20 A)



MAIN FUSES

H - Spare fuses (30 A)

I - Battery charging, fan relay, live positive (30 A)



Control unit

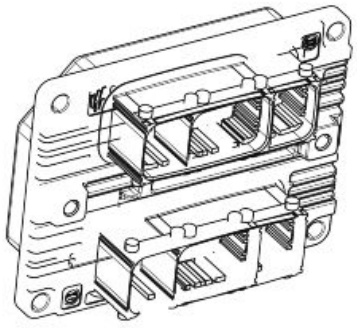
MARELLI CONTROL UNIT

Function

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

Location:

- left side, next to the engine



Connector location:

- ENGINE connector: upper connector with control unit on the vehicle; a letter E is stamped on the control unit, to the right of the connector.
- VEHICLE connector: lower connector with control unit on the vehicle; a letter V is stamped on the control unit, to the right of the connector.

Pin-out: see the CONNECTORS section

NAVIGATOR: STATUSES

Engine status

Example value: Indefinite_Key ON_Running engine_Stopped_Power latch_Power latch 2_Power latch finished

Engine mode

Example value: Indefinite_Start-up_Stable_Idle_Acceleration_Deceleration_Enters Cut Off_Cut Off_Exits Cut Off

Immobilizer signal

Example value: 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 signal

Example value: 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 if the immobilizer does not send the start-up consent to the control unit, the status is NO.

NAVIGATOR: FUEL INJECTION SYSTEM

PARAMETERS

Target idle rpm

NAVIGATOR: 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.

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).

Troubleshooting

- Continue fault search for the other errors detected.

Safety Engine Stop P0609

Error cause

- As the level 3 safety system (control EEPROM) has detected a fault, the control unit has shut off the engine (D gravity).

Troubleshooting

- Replace Marelli control unit.

Reset lines error P0610- circuit not operational

Error cause

- Problems on the reset lines (PINS 55 and 56 of the VEHICLE connector) of the throttle motors: lines used to interrupt motor functioning for safety reasons.

Troubleshooting

- Check the VEHICLE connector of the Marelli control unit, the filter box large connector and the throttle control unit connector: if not OK, restore. If OK, check continuity between the Marelli control unit and the throttle control unit connector from VEHICLE PIN 55 to PIN B7 and from PIN 56 to PIN A7: if not OK, restore. If OK, check that with throttle control unit connector disconnected and with key set to ON, there is no voltage on PINS A7 and B7: if there is voltage, replace the cable harness. If there is no voltage, check that PINS A7 and B7 are insulated from ground connection: if they are not insulated from the ground connection, replace the cable harness. If they are insulated, replace the throttle control unit or the Marelli control unit.

NAVIGATOR: NOTES

After installing the control unit and setting the key to ON, wait for 3 seconds, time during which the control unit detects the throttle valve position.
Connect to Navigator and check that the status for **Throttle self-learning is carried out** and the status for **Handle self-learning is not carried out** (this last status entails Urgent service being displayed on the instrument panel).
If Throttle Self-learning shows **Not carried out**, go to stage 1. If it shows **Carried out**, go to stage 2.
Stage 1: current errors have probably been detected by the control unit: solve these malfunctions and check the Throttle Self-learning status again. 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 it is not correct or the voltage detected on the throttle is out of scale (check with Navigator) or if current errors are probably detected by the control unit: solve these malfunctions and repeat the procedure.

Battery

Characteristic

Battery

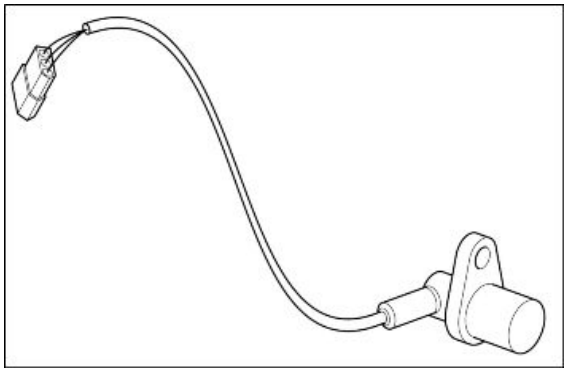
12V - 10 Ah

Battery installation

NOTE

THE FIRST TIME THE ENGINE IS STARTED AFTER RECONNECTING THE BATTERY LEADS, WAIT 20 SECONDS BETWEEN THE MOMENT THE KEY IS SET TO "KEY ON" AND THE MOMENT THE STARTER BUTTON CAN BE PUSHED.
THE ENGINE WILL NOT START IF START-UP IS ATTEMPTED BEFORE THE PRE-SET 20 SECONDS ELAPSE.

Speed sensor



VEHICLE FRONT SPEED SENSOR

FUNCTION: To indicate the vehicle speed by reading the front wheel turning speed.

OPERATION / OPERATING PRINCIPLE: Magnetoresistive sensor: a square-wave pulse is generated with voltage approx. between 11.55 V and 11.25 V

WIRING DIAGRAM Level in wiring diagram: ABS.

REMOVAL

LOCATION ON THE VEHICLE:on the fork, right stem, next to the brake calliper support.

CONNECTOR LOCATION (if available): under the helmet compartment.

PINS

- PIN 1- Ground connection (white)
- PIN 2 - Power supply voltage/Output signal (white/brown)

NAVIGATOR

Parameters: Speed (km/h) - Vehicle speed.

ELECTRICAL ERRORS

Speed sensor

5D90 electric malfunction: Electrical fault in sensor or cable harness.

Troubleshooting: Check the sensor connector and the ABS control unit connector. If they are not OK, restore the connectors. If they are OK, check continuity of the white/brown cable between PIN 2 of the sensor on the cable harness side and PIN 14 of the ABS control unit connector. If there is no continuity, restore them. If there is, PIN 2 of the sensor on the cable harness side, with the sensor disconnected and key set to ON, must have 12V voltage approximately: if there is no voltage, check PIN 2 for continuity with the vehicle ground connection: if it is grounded, restore the cable harness. If OK, replace the control unit. If PIN 2 has approx. 12 V, check the continuity of the white cable between PIN 1 of the sensor on the cable harness side and PIN 13 of the ABS control unit connector. If there is no continuity, restore the cable harness. If there is, replace the logic errors sensor.

LOGIC ERRORS

Speed sensor

5D91 the signal works irregularly: faulty sensor or signal interference.

Troubleshooting: Check speed sensor retainer. If it is not OK, restore it. If it is OK, check if the tone wheel is dirty, deformed or wrongly fixed. If any of this happens, replace the tone wheel. Otherwise, replace the speed sensor.

5D92 the signal decreases periodically: Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.

Troubleshooting: Check if the tone wheel is dirty, deformed or wrongly fixed. If the tone wheel is not OK, replace it. If it is OK, check for possible faults in the wheel bearings and if it is not OK, replace the bearings.

5D93 missing signal or speed measured too low in relation to the rear wheel: faulty sensor or missing sensor/tone wheel. Or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

5D94 no acceleration after pressure reduction: Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

5D95 excessive speed measured: Faulty sensor or tone wheel, or tone wheel with wrong number of teeth or wrong tyre size.

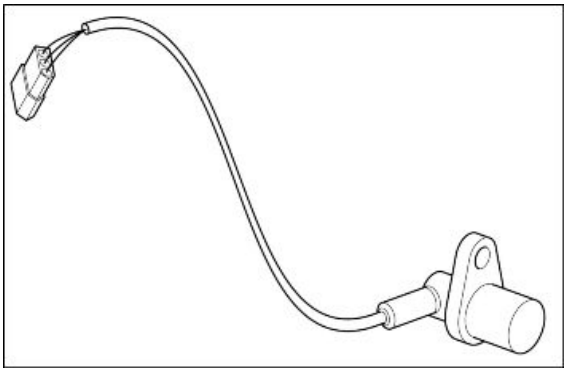
Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, check that the tyre size is the correct one. If it is not OK, replace it. If it is OK, check that the tyre pressure is the correct one. If it is not OK, restore it; if it is OK, replace the speed sensor.

VEHICLE REAR SPEED SENSOR

FUNCTION: To indicate the vehicle speed by reading the rear wheel turning speed.

OPERATION / OPERATING PRINCIPLE: Magnetoresistive sensor: a square-wave pulse is generated with voltage approx. between 11.55 V and 11.25 V

WIRING DIAGRAM Level in wiring diagram: ABS.



REMOVAL

LOCATION ON THE VEHICLE:on the swingarm, right side, under the chain tension screw.

CONNECTOR LOCATION (if available): under the saddle, right side.

PINS

- PIN 1- Ground connection (yellow)
- PIN 2 - Power supply voltage/Output signal (yellow/brown)

NAVIGATOR

Parameters: Speed (km/h) - Vehicle speed.

ELECTRICAL ERRORS

Speed sensor

5DA0 electric malfunction: Electrical fault in sensor or cable harness.

Troubleshooting: Check the sensor connector and the ABS control unit connector. If they are not OK, restore the connectors. If they are OK, check continuity of the yellow/brown cable between PIN 2 of the sensor on the cable harness side and PIN 11 of the ABS control unit connector. If there is no continuity, restore them. If there is, PIN 2 of the sensor on the cable harness side, with the sensor disconnected and key set to ON, must have 12V voltage approximately: if there is no voltage, check PIN 2 for continuity with the vehicle ground connection: if it is grounded, restore the cable harness. If OK, replace the control unit. If PIN 2 has approx. 12 V, check continuity of the yellow cable between PIN 1 of the sensor on the cable harness side and PIN 12 of the ABS control unit connector. If this is not OK, restore the cable harness. If it is OK, replace the sensor.

LOGIC ERRORS

Speed sensor

5DA1 the signal works irregularly:faulty sensor or signal interference.

Troubleshooting: Check speed sensor retainer. If it is not OK, restore it. If it is OK, check if the tone wheel is dirty, deformed or wrongly fixed. If any of this happens, replace the tone wheel. Otherwise, replace the speed sensor.

5DA2 the signal decreases periodically: Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.

Troubleshooting: Check if the tone wheel is dirty, deformed or wrongly fixed. If the tone wheel is not OK, replace it. If it is OK, check for possible faults in the wheel bearings and if it is not OK, replace the bearings.

5DA3 no signal or speed measured too low in relation to the front wheel: Faulty sensor or missing sensor/tone wheel. Or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

5DA4 missing acceleration after pressure reduction: Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

5DA5 excessive measured speed: Faulty sensor or tone wheel, or tone wheel with wrong number of teeth or wrong tyre size.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, check that the tyre size is the correct one. If it is not OK, replace it. If it is OK, check that the tyre pressure is the correct one. If it is not OK, restore it; if it is OK, replace the speed sensor.

Engine rpm sensor

ENGINE SPEED SENSOR

Function

It informs crankshaft position and speed to the Marelli control unit.

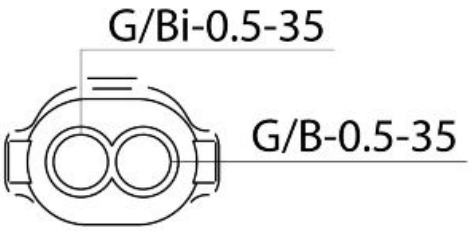
Operation / Operating principle

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: inside the flywheel cover
- connector (if available): near the Marelli control unit



Electrical characteristics:

- Resistance at ambient temperature:
  130 +/- 20 Ohm

Pin-out:

1. Negative signal
2. Positive signal

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.

NAVIGATOR: PARAMETERS

Engine rpm

NAVIGATOR: STATUSES

Synchronised panel

Example value: 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

Example value: No_under analysis_standby_Yes

The parameter refers to the engine revs signal: in case the signal has not been correctly identified yet, the under analysis or standby statuses may be displayed.

NAVIGATOR: ACTIVATION

-

NAVIGATOR: ELECTRICAL ERRORS

-

CAUTION

IF THE ELECTRIC CIRCUIT IS INTERRUPTED OR SHORT-CIRCUITED OR NO ERROR IS DISPLAYED, CHECK THE ENGINE SPEED SENSOR CONNECTOR AND THE MARELLI CONTROL UNIT CONNECTOR: IF NOT OK, RESTORE; IF OK, CHECK THE SENSOR ELECTRIC CHARACTERISTIC IS THE CORRECT ONE: IF IT IS NOT, REPLACE THE SENSOR. IF IT IS THE CORRECT ONE, CHECK THAT THERE IS CONTINUITY ON BOTH CABLES, SUPPLY INSULATION AND GROUND CONNECTION 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 PINS 9 AND 23 OF THE MARELLI CONTROL UNIT ENGINE CONNECTOR.

NAVIGATOR: LOGIC ERRORS

Engine speed sensor P0336 - Synchronism lost

Error cause

- Displayed if the signal is not as the control unit expects, for example due to voltage fluctuations not correctly repeated.

Troubleshooting

- Check that the flywheel teeth are clean and the sensor is adequately placed in its fitting: if not OK, restore; if OK, replace the sensor.

Twistgrip position sensor

THROTTLE GRIP POSITION SENSOR

Function

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

Operation / Operating principle

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

Level in electrical circuit diagram: Throttle grip position sensor.

Location:

- on the vehicle: under the fuel tank
- connector: direct to the Marelli control unit

Electrical characteristics:

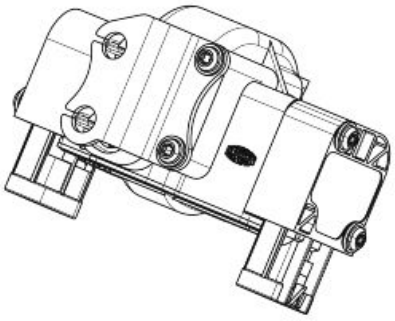
- Not detected by a multimeter as they are contactless: read voltage on the 4 tracks through Navigator.

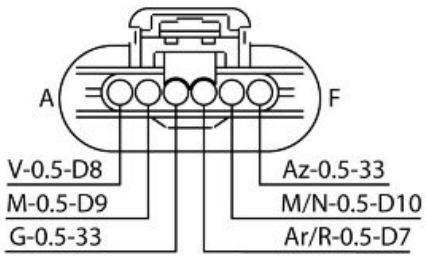
CAUTION

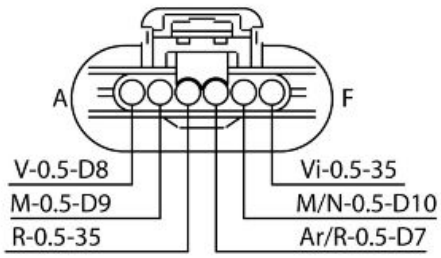
BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

CAUTION

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







NAVIGATOR: PARAMETERS

Left side throttle grip position sensor - track A

example value: 1107 mV

Voltage value of the left potentiometer track A

Left side throttle grip position sensor - track B

example value: 1107 mV

Voltage value times 2 of the left potentiometer track B

Right side throttle grip position sensor - track C

3560 mV

Voltage value of the left potentiometer track C

Right side throttle grip position sensor - track D

3555 mV

Voltage value times 2 of the left potentiometer track D

Throttle grip position sensor

1107 mV

Voltage corresponding to the potentiometer track A

Throttle grip opening percentage

0 %

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

NAVIGATOR: STATUSES

Throttle grip

Example value: Slightly twisted_choked_fully twisted

Handle self-learning

Example value: carried out/not carried out

NAVIGATOR: PARAMETER ADJUSTMENT

Handle self-learning

NAVIGATOR: ELECTRICAL ERRORS

Left side 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 42 of the VEHICLE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 42 of the VEHICLE connector.

Troubleshooting

- shorted to positive: check the value shown by the parameter of the left Throttle Grip Position Sensor - track A: disconnect the left connector and see the value displayed by Navigator: 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

Left side Throttle Grip Position sensor - track B P0151- short circuit to positive / open circuit, short circuit to negative

Error cause

- Voltage that is excessive / equal to zero has been detected at PIN 40 of the VEHICLE connector.

Troubleshooting

- short circuit to positive: check the value shown by the parameter of the left Throttle Grip position Sensor track B: disconnect the left connector and see the value displayed by Navigator: 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.

Right side 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 30 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 30 of the ENGINE connector.

Troubleshooting

- shorted to positive: check the value shown by the parameter of the right Throttle Grip position Sensor - track C: disconnect the right connector and see the value displayed by Navigator: 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

Right side 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 44 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 44 of the ENGINE connector.

Troubleshooting

- shorted to positive: check the value shown by the parameter of the right Throttle Grip Position Sensor - track D: disconnect the right connector and see the value displayed by Navigator: 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.

NAVIGATOR: LOGIC ERRORS

Left side Throttle Grip Position (tracks A-B) P0154 - illogical signals.

Error cause

- Two illogical voltage signals have been detected at PINS 42 and 40 of the VEHICLE connector (tracks A-B)

Troubleshooting

- Check the parameters of the left 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.

Right side Throttle Grip Position (tracks C-D) P0155 - illogical signal.

Error cause

- Two illogical voltage signals have been detected at PINS 30 and 44 of the ENGINE connector (tracks A-B)

Troubleshooting

- Check the parameters of the left 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 - illogical signal.

Error cause

- The value of the left side sensor (tracks A-B) does not coincide with the value of the right side sensor (tracks C-D).

Troubleshooting

- Replace the throttle grip sensor

RESET PROCEDURE

If the Marelli control unit or the throttle grip sensor is replaced, check the Handle self-learning with the diagnosis instrument: once the check is completed, make sure that the Handle self-learning status indicates: carried out.

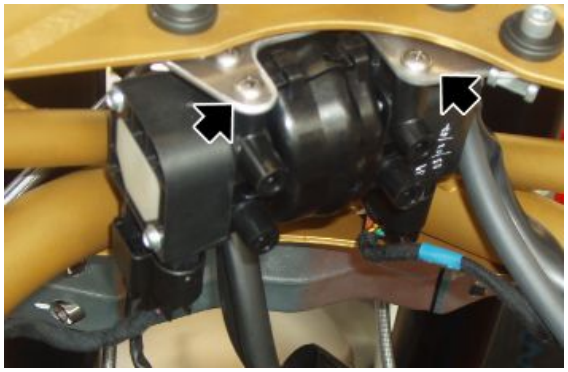
CAUTION

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

NOTES The two connectors which get to the throttle grip sensor are the same but they should NEVER be inverted. Mark or check the connector marking before removing them (blue stamp+blue band).

Removal

- When required, disconnect the corresponding connectors, undo and remove the two screws and remove the throttle grip position sensor.



Intake pressure sensor

INTAKE AIR PRESSURE SENSOR

Function

The pressure sensors (one per cylinder) are fundamental not only for the injection configuration at low and stabilised speeds, but also for checking the Ride by wire system: their signal is connected to a TORQUE CHAIN for checking the correct opening of the throttle valves.

Operation / Operating principle

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

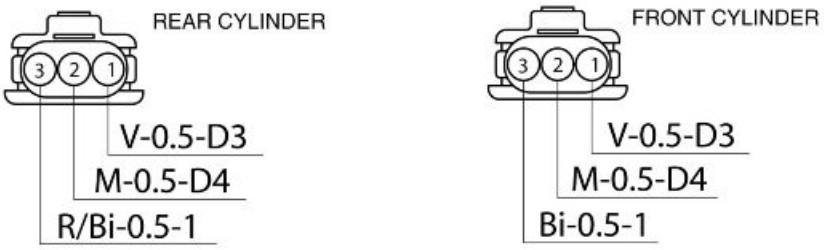
Level in electrical circuit diagram:intake air pressure sensor

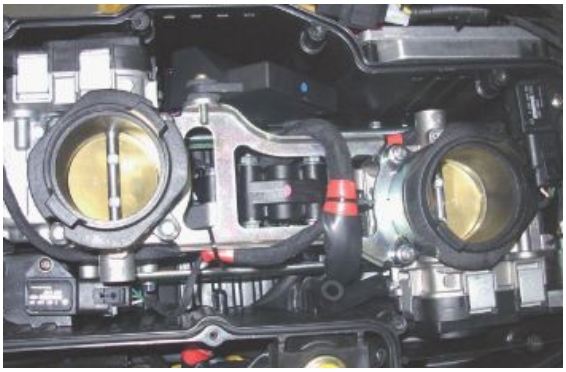
Location:

- on the vehicle: inside the filter box
- connector: on the sensor

Pin-out:

1. Fuel system
2. Ground connection
3. Output signal





NAVIGATOR: PARAMETERS

Front Cylinder Intake Pressure

example value: 1003 mbar

Pressure read by the front sensor.

Rear Cylinder Intake Pressure

example value: 1004 mbar

Pressure read by the rear sensor.

Front Cylinder estimated Intake Pressure

example value: 1003 mbar

Pressure estimated by the control unit according to the throttle position.

Rear Cylinder estimated Intake Pressure

example value: 1004 mbar

Pressure estimated by the control unit according to the throttle position.

NAVIGATOR: ELECTRICAL ERRORS

Front cylinder air pressure sensor P0105 - short circuit to positive / open circuit, short circuit to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 34 of the VEHICLE connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 34 of the VEHICLE connector.

Troubleshooting

- If short circuit to positive, see that the parameter of the front Cylinder Intake Pressure on the diagnosis instrument reads approx. 1200 mbar; disconnect the large connector from the filter box: if the value does not vary, it means that the cable is shorted between the filter box connector and the control unit connector; restore the cable harness. If the value varies, reconnect the filter box connector and disconnect the sensor connector: if the value does not vary, it means that the cable is shorted between the filter box connector and the sensor connector; restore the cable harness. Replace the sensor if the value varies.

- If the circuit is open, short circuit to negative, check filter box large connector, the Marelli control unit connector and the sensor connector. If not OK, restore. If everything is OK, and with key set to OFF, check if there is continuity between the VEHICLE PIN 34 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 this is not correct, set the key to OFF and check continuity between the ENGINE connector PIN 15 and the sensor connector PIN 1: If not OK, restore the cable harness; if it is 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.

Rear cylinder air pressure sensor P0106 -short circuit to positive / open circuit, short circuit to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 5 of the VEHICLE connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 5 of the VEHICLE connector.

Troubleshooting

- If short circuit to positive, see that the parameter of the front Cylinder Intake Pressure on the diagnosis instrument reads approx. 1200 mbar; disconnect the large connector from the filter box: if the value does not vary, it means that the cable is short circuited between the filter box connector and the control unit connector; restore the cable harness. If the value varies, reconnect the filter box connector and disconnect the sensor connector: if the value does not vary, it means that the cable is short circuited between the filter box connector and the sensor connector; restore the cable harness. Replace the sensor if the value varies.
- If the circuit is open, short circuit to negative, check the filter box large connector, the Marelli control unit connector and the sensor connector; If not OK, restore. If everything is OK, and with key set to OFF, check if there is continuity between the VEHICLE PIN 5 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 this is not correct, set the key to OFF and check continuity between the ENGINE connector PIN 15 and the sensor connector PIN 1: If not OK, restore the cable harness; if it is 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.

NAVIGATOR: LOGIC ERRORS

front 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 filter box large connector, the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, check that cable resistance between VEHICLE connector PIN 34 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 5 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 intake air in the front 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, cut or wrongly connected pipe between sensor and throttle body or 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 intake air in the rear 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, cut or wrongly connected pipe between sensor and throttle body or 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 front cylinder intake manifold pressure P0215 - pressure too high/pressure too low.

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 rear cylinder intake manifold pressure P0216 - pressure too high/pressure too low.

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.

Pressure too low at front cylinder manifold error P0217 - signal not valid.

- 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 rear 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.

Engine temperature sensor

ENGINE TEMPERATURE SENSOR

Function

tells the engine temperature to the control unit so as to optimise its operation.

Operation / Operating principle

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

Level in electrical circuit diagram: Temperature sensors

Location:

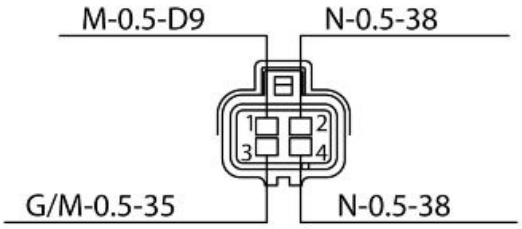
- on the vehicle: on the front cylinder on the internal side facing the rear cylinder
- connector: on the sensor

Electrical characteristics:

- Resistance at 25°: 2.05 kOhm +/- 100 Ohm
- Resistance at 60°: 575 Ohm +/- 15 Ohm
- Resistance at 90°: 230 Ohm +/- 5 Ohm

Pin-out:

1. Yellow brown: 0-5 V signal: PIN B1
2. Brown: PIN B2 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.

NAVIGATOR: PARAMETERS

Engine temperature

example value: 75° C

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

Engine Temp. before Recovery

example value: -40° C

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

NAVIGATOR: 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 45 of the ENGINE connector. If shorted to negative: voltage equal to zero has been detected at PIN 45 of the ENGINE connector.
- 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 it is OK, check the continuity between the ENGINE connector PIN 45 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 it is correct, it means that the error cause is that the cable is short circuit to positive and it is necessary to restore the cable harness between the ENGINE PIN 45 and the 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 35 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.

Troubleshooting

- If shorted to negative, check sensor correct resistance: if resistance is null, replace the sensor; if resistance is correct, it means that the cable has ground connection: restore the cable harness.

NAVIGATOR: 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.

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 Navigator if the temperature indicated is the

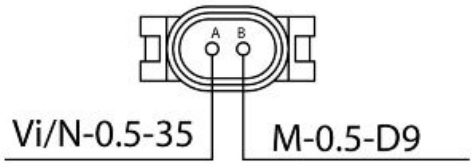
same as the engine temperature. Check also that the sensor electrical characteristics are observed: replace the sensor if not OK; if it is OK, check the sensor connector and the Marelli control unit connector

Air temperature sensor

INTAKE 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 electrical circuit diagram: Temperature sensors

Location:

- on the vehicle: on filter box
- on connector sensor: near the probes

Electrical characteristics:

- Resistance at 0°: 32.5 kΩ +/- 5%
- Resistance at 25°: 10.0 kΩ +/- 5%

Pin-out:

1. 0-5 V signal: PIN 1
2. Ground connection: PIN 2

CAUTION

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NAVIGATOR: PARAMETERS

Air temperature

Example value: 26° C

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

Air Temp. before Recovery

Example value: -40° C

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

NAVIGATOR: 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 63 of the ENGINE connector. If shorted to negative: voltage equal to zero has been detected at PIN 63 of the ENGINE connector.

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 it is OK, check continuity between the ENGINE connector PIN 63 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 it is OK, it means that the error cause is that the cable is short circuit to positive and it is necessary to restore the cable harness between the ENGINE PIN 63 and the 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 35 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 cable has ground connection: restore the cable harness.

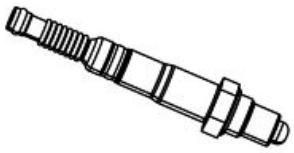
NOTES No error is detected if the sensor does not work correctly or the control unit connector or sensor terminals are rusty: then check through Navigator if the temperature indicated is plausible in relation to the ambient temperature. Check also that the sensor electrical characteristics are observed: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

Lambda sensor

LAMBDA PROBE

Function

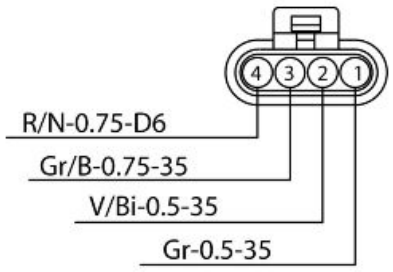
In charge of telling the control unit whether the mixture is lean or rich.



Operation / Operating principle

The Marelli injection control unit reads and interprets a voltage generated by the difference in oxygen content between the exhaust fumes and the

ambient. It does not require an external supply source but, in order to work properly, it should reach a high operating temperature: that is why there is a heating circuit inside.



Level in electrical circuit diagram: Lambda probe

Location:

- on the vehicle: exhaust pipe
- connector: over the clutch side housing

Electrical characteristics:

- Oxygen probe with preheating circuit (power 7W)
- It generates voltage within: 0 - 1000 mV
- Heater circuit: continuity (7 - 9 Ohm at ambient temperature)

Pin-out:

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

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

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NAVIGATOR: PARAMETERS

Lambda probe

example value: 0 - 1000 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 sensor correction

example value: 1.00

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 corre-

sponds 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.

NAVIGATOR: STATUSES

Lambda

Example value: 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

Example value: 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.

NAVIGATOR: ACTIVATION

Lambda probe heating

The auxiliary injection relay (No. 40 in the wiring diagram, placed under the fuel tank, right side, second relay starting from the front; 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.

NAVIGATOR: ELECTRICAL ERRORS

Lambda probe P0130 - Shorted to positive.

Error cause

- Excessive voltage (battery voltage) has been detected at PIN 43 of the ENGINE connector. Caution: the 'lambda probe' parameter is not the real value that is read; a recovery value is displayed instead.

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

Error cause

- 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.

Troubleshooting

- 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.
- circuit is open, shorted to negative: check the continuity from probe connector (PIN 3 and 4) towards the probe: if not OK, replace the probe; if it is correct, check the sensor connector and the Marelli control unit connector. If not OK, restore. If OK, and with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if not ok, check the red/black cable between the probe connector and the auxiliary injection relay (No. 40 in the wiring diagram, located under the fuel tank, right side, second relay starting from the front; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil and injector errors, check the relay and its excitation and power line; if there is voltage at PIN 4, check the grey/blue cable ground insulation (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the grey/blue cable (between the sensor connector PIN 3 and the ENGINE PIN 32) and restore the cable harness.

NAVIGATOR: LOGIC ERRORS

Lambda probe P0134 - voltage without variation.

Error cause

- An abnormal behaviour of the voltage at PIN 43 of the ENGINE connector has been detected: the voltage, that should vary over time, keeps a constant value.

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 43 and PIN 60 and restore the cable harness.

CAUTION

IN CASE THE Lambda sensor correction PARAMETER, WITH ENGINE AT IDLE AND H2O T >90 °C, WHICH IS NOT WITHIN THE 0.9 - 1.1 RANGE, WITHOUT ERRORS, CHECK:
- IF < 0.9, THE PROBE READS LEAN COMBUSTION CONDITIONS AND THE CONTROL UNIT INCREASES INJECTION TIME; CAUSES: CHECK FOR INCORRECT AIR INTAKE, LITTLE PETROL, RUSTY TERMINAL CONTACTS, DEFECTIVE PROBE.
- IF > 1.1, THE PROBE READS RICH COMBUSTION CONDITIONS AND THE CONTROL UNIT REDUCES INJECTION TIME; CAUSES: LITTLE AIR, EXCESSIVE PETROL, DEFECTIVE PROBE.

Injector

INJECTOR

Function

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

Operation / Operating principle

Injector coil is excited for the petrol passage to open.

Level in electrical circuit diagram: Coils and injectors.

Location:

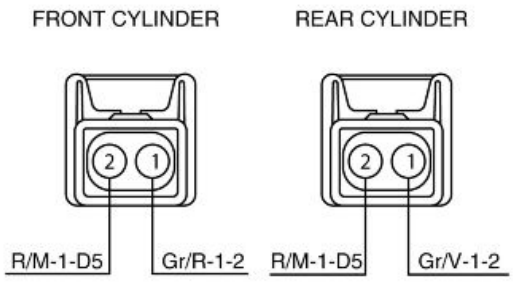
- on the vehicle: inside the filter box
- connector: on injector

Electrical characteristics:

- 14.8 Ohm +/- 5% (at 20 °C (68 °F))

Pin-out:

1. Supply: "+"
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.

NAVIGATOR: PARAMETERS

Front cylinder injection time

Rear cylinder injection time

NAVIGATOR: ACTIVATION

Front injector

The auxiliary injection relay (No. 40 in the wiring diagram, placed under the fuel tank, right side, second relay starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the grey/green cable of the injector 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.

Rear injector

The auxiliary injection relay (No. 40 in the wiring diagram, placed under the fuel tank, right side, second relay starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the grey/red cable of the injector 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.

NAVIGATOR: ELECTRICAL ERRORS

Front cylinder injector P0201 - shorted to positive / shorted to negative / open circuit.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 50 of the ENGINE connector.
- If shorted to negative: no voltage has been detected.
- If the circuit is open: an interruption has been detected.

Troubleshooting

- shorted to positive: disconnect the injector connector, set key to ON, activate the component with Navigator and check the voltage on the grey/green cable on the filter box small connector towards the Marelli control unit: if there is voltage, restore the cable harness between the filter box connector and the Marelli control unit. If there is no voltage, reconnect the connector and check if there is voltage at PIN -: if there is voltage, restore the filter box cable harness. If there is no voltage, replace the sensor.
- shorted to negative: disconnect the injector connector, set the key to ON and check if there is a ground connection on the grey/green cable: if there is voltage, restore the cable harness between the filter box connector and the Marelli control unit; if there is no voltage, reconnect the connector and disconnect the injector connector and check if there is a ground connection on PIN -: if there is voltage, restore the filter box cable harness. If there is no voltage, replace the injector.
- the circuit is open: check the component correct electrical characteristic: if it is not correct, replace the component; if it is correct, check the filter box small connector, the connector on the component and the Marelli control unit connector: If not OK, restore; if OK, check cable continuity between ENGINE PIN 50 and component PIN - and restore the cable harness.

Front cylinder injector P0202 - See front injector

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 34 of the ENGINE connector.
- If shorted to negative: no voltage has been detected.
- If the circuit is open: an interruption has been detected.

Troubleshooting

- shorted to positive: disconnect the injector connector, set key to ON, activate the component with Navigator and check the voltage on the grey/green cable on the filter box small connector towards the Marelli control unit: if there is voltage, restore the cable harness between the filter box connector and the Marelli control unit. If there is no voltage, reconnect the

connector and check if there is voltage at PIN -: if there is voltage, restore the filter box cable harness. If there is no voltage, replace the sensor.

- shorted to negative: disconnect the injector connector, set the key to ON and check if there is a ground connection on the grey/red cable: if there is voltage, restore the cable harness between the filter box connector and the Marelli control unit; if there is no voltage, reconnect the connector and disconnect the injector connector and check if there is a ground connection on PIN -: if there is voltage, restore the filter box cable harness. If there is no voltage, replace the injector.
- the circuit is open: check the component correct electrical characteristic: if it is not correct, replace the component; if it is correct, check the filter box small connector, 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.

Coil

COIL

Function

Spark generation.

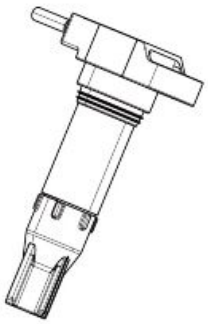
Operation / Operating principle

Inductive discharge system.

Level in electrical circuit diagram:coils and injectors.

Location:

- on the vehicle: on the cylinder head
- connector (if available): -

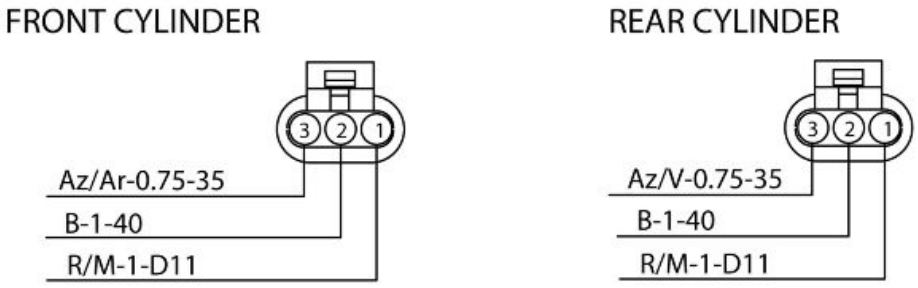


Electrical characteristics:

- Primary circuit resistance: approx. 1 Ohm at 20°C between PIN 1 and 3.
- Secondary circuit resistance: MOhm value range (with positive probe on coil).

Pin-out:

1. Supply + batt V
2. Secondary circuit ground connection
3. Activation from control unit



CAUTION

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NAVIGATOR: PARAMETERS

Rear coil ignition advance

Front coil ignition advance

NAVIGATOR: STATUSES

-

NAVIGATOR: ACTIVATION

Front coil

The auxiliary injection relay (No. 40 in the wiring diagram, placed under the fuel tank, right side, second relay starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the sky blue/orange 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.

Rear coil

The auxiliary injection relay (No. 40 in the wiring diagram, placed under the fuel tank, right side, second relay starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the sky blue/green 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.

NAVIGATOR: ELECTRICAL ERRORS

Lambda probe P0130 - shorted to positive / circuit, shorted to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 17 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 17 of the ENGINE connector.

Troubleshooting

- shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with Navigator and check voltage at connector PIN 3: if there is voltage, restore the cable harness; if voltage = 0, replace the coil. Open circuit, shorted to negative: check the coil connector and the Marelli control unit connector. If not OK, restore; if everything is OK, check cable continuity between the two cable terminals. If there is no 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 the cable harness.

Rear coil P0352- shorted to positive / open circuit, shorted to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 19 of the ENGINE connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 19 of the ENGINE connector.

Troubleshooting

- Shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with Navigator and check voltage at connector PIN 3: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check the coil connector and the Marelli control unit connector. If not OK, restore; if everything is OK, check cable continuity between the two cable terminals. If there is no 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 the cable harness.

NAVIGATOR: LOGIC ERRORS

-

Throttle body

THROTTLE BODY

Function

To inform the throttle control unit the position of the two throttle valves and to drive them both.

Operation / Operating principle

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

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.

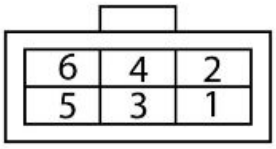
Every 150 key-ONs, however, the throttle valves are forced to activation. If start-up is attempted during this activation (which requires 3 seconds), the engine will not start.

Level in electrical circuit diagram:

throttle control unit.

Location:

- on the vehicle: inside the filter box
- connector: on the throttle body



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

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.

NAVIGATOR: PARAMETERS

Front throttle Potentiometer 1 (voltage)

Example value: 800 mV

The value in the example refers to engine conditions with key set to ON.

Front throttle Potentiometer 2 (voltage)

Example value: 3878 mV

The value in the example refers to engine conditions with key set to ON.

Rear throttle Potentiometer 1 (voltage)

Example value: 780 mV

The value in the example refers to engine conditions with key set to ON.

Rear throttle Potentiometer 2 (voltage)

Example value: 3756 mV

The value in the example refers to engine conditions with key set to ON.

Front throttle Potentiometer 1 - 2 (degrees) / Rear throttle Potentiometer 1 - 2 (degrees)

Example value: 6.5°

With key set to ON, the throttle is kept in position by the springs (approximately 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 (approximately 5 - 7°).

Front / rear cylinder throttle correction

Example value: 0.0°

For example, if there is a hole in the intake manifold, the pressure read is different from the pressure estimated by the control unit and the system tries to reach an "estimated" situation by opening the throttle a little bit more; therefore, this parameter takes a value different from zero: an acceptable value should be between -0.7º and +0.7º.

Front cylinder Limp home position / Rear cylinder Limp home position

Example value: 800 mV / 780 mV

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

Front throttle lower position / Rear throttle lower position

Example value: 502 mV / 492 mV

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

NAVIGATOR: STATUSES

Throttle Self-learning

Example value:carried out/not carried out

Indicates whether or not the self-acquisition process has been carried out through the diagnosis instrument.

NAVIGATOR: ACTIVATION

-

NAVIGATOR: ELECTRICAL ERRORS

Potentiometer 1 sensor, front throttle position P0120

Example value:short circuit to positive / open circuit, short circuit to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN A6 of the throttle control unit. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN A6 of the throttle control unit.

Troubleshooting

- shorted to positive: check the value shown by the parameter of the front throttle Potentiometer 1 (voltage): disconnect the left connector and see the value displayed by Navigator: 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 throttle valve 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 P0122

Example value:short circuit to positive / open circuit, short circuit to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN A5 of the throttle control unit. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN A5 of the throttle control unit.

Troubleshooting

- shorted to positive: check the value shown by the parameter of the front throttle Potentiometer 2 (voltage): disconnect the left connector and see the value displayed by Navigator: 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 throttle valve 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, rear throttle position P0125

Example value:short circuit to positive / open circuit, short circuit to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN B6 of the throttle control unit. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN B6 of the throttle control unit.

Troubleshooting

- 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 Navigator: 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 throttle valve 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 P0127

Example value:short circuit to positive / open circuit, short circuit to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN B5 of the throttle control unit. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN B5 of the throttle control unit.

Troubleshooting

- 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 Navigator: 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 throttle valve 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.

Front throttle supply voltage during self-acquisition P0164

Example value: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

- The throttle test is not carried out when the key is set to ON because the test could show unreal errors (because the voltage is too low). Voltage is detected by the Marelli control unit.

Front throttle control circuit P0166

Example value: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 C1 of the throttle control unit connector. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected.

Troubleshooting

- 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

- 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 it is, there is a short circuit in the cable ground connection; if it is not, replace the throttle body.
- open circuit, overcurrent, excessive inside temperature: check the throttle body connector and the throttle control unit connector. If not OK, restore. If everything is OK, disconnect the throttle body connector (PIN 3) and the throttle control unit connector (C1) and check the circuit continuity between the two terminals; 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 A1 and C1 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 throttle control unit.

Rear throttle supply voltage during self-acquisition P0184

Example value: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

- The throttle test is not carried out when the key is set to ON because the test could show unreal errors (because the voltage is too low). Voltage is detected by the Marelli control unit.

Rear throttle control circuit P0186

Example value:short circuit to positive / short circuit to negative / open circuit, overcurrent, excessive internal temperature.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 8A of the throttle control unit connector. If shorted to negative: no voltage has been detected. If the circuit is open, there is overvoltage or excessive internal temperature: an interruption or excessive ampere input or control unit overheating has been detected.

Troubleshooting

- 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.
- 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 it is, there is a short circuit in the cable ground connection; if it is not, replace the throttle body.

- open circuit, overcurrent, excessive inside temperature: check the throttle body connector and the throttle control unit connector. If not OK, restore. If everything is OK, disconnect the throttle body connector (PIN 3) and the throttle control unit connector (C8) and check the circuit continuity between the two terminals; 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 A8 and C8 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 throttle control unit.

NAVIGATOR: LOGIC ERRORS

Potentiometer 1 sensor, front throttle position P0121 - signal not valid.

Error cause

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

Troubleshooting

- Check the 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 throttle control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the throttle control unit (PIN 6A) 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 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 1 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 throttle valve control unit connector. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 5A) 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 valve position sensors P0124 - illogical 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 throttle control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the throttle control unit (PIN 6A) is a few tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 5A) 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, rear 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 throttle control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the throttle control unit (PIN 6B) 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 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 throttle control unit connector. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 5B) 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 sensors P0129 - illogical 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 throttle control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the throttle control unit (PIN 6B) is a few tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 5B) is a few tenths of an Ohm. If one of the two is different, restore the cable harness. If correct, replace the complete throttle body.

Front throttle Limp Home self-acquisition P0160 - test failed.

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 they are, replace the throttle body.

Front throttle mechanical springs self-acquisition P0161 - test failed.

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 they are, replace the throttle body.

Front throttle minimum mechanical position self-acquisition P0162 - test failed.

Error cause

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

Troubleshooting.

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

Detection of front throttle valve Recovery conditions (air Tº,water Tº) 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 they are, replace the throttle body.

Front throttle first self-learning NOT performed P0165 - test not carried out.

Error cause

- The first throttle self-acquisition process has not been successful or has not been carried out. 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 P0167 - misalignment between control and activation.

Error cause

- The throttle mechanical control may be damaged.

Troubleshooting.

- Replace the throttle body.

Rear throttle Limp Home self-acquisition P0180 - test failed.

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 they are, replace the throttle body.

Rear throttle mechanical spring self-acquisition P0181 - test failed.

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 they are, replace the throttle body.

Rear throttle minimum mechanical position self-acquisition P0182 - test failed.

Error cause

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

Troubleshooting.

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

Detection of the rear throttle Recovery conditions (air Tº, water Tº) 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 they are, replace the throttle body.

Rear throttle first self-acquisition NOT performed P0185 - test not carried out.

Error cause

- The first throttle self-acquisition process has not been successful or has not been carried out. 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 P0187 - misalignment between control and activation.

Error cause

- The throttle mechanical control may be damaged.

Troubleshooting.

- Replace the throttle body.

RESET PROCEDURE

If the Marelli control unit or the throttle body is replaced, do not start the engine within the 3 seconds after the key is set to ON; during this time the control unit carries out the throttle self-learning process: then make sure that the throttle self-learning status reads: carried out. If the indication is "Not carried out", delete any possible errors present in the vehicle. Carry out Throttle self-learning process on the adjustable parameters screen page (screwdriver and hammer), and check again that the throttle self-learning status reads: carried out.

Engine oil pressure sensor

ENGINE OIL PRESSURE SENSOR

Function: it indicates to the instrument panel if there is enough oil pressure (0.5 + / - 0.2 bar (7.25 + / - 2.9 PSI)) in the engine.

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

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

Pin-out: Voltage 5V

Instrument panel

Error DSB 07

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.

Error DSB 08

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

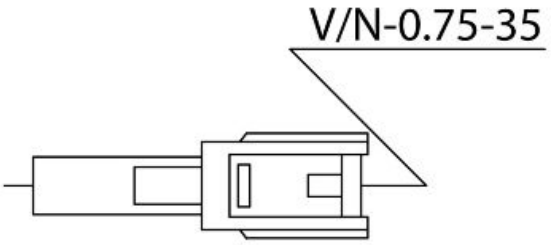
- Check if oil pressure is low with the specific gauge.

Neutral sensor

GEAR IN NEUTRAL SENSOR

Function

it tells the gear position to the control unit: if it is in neutral or in gear.



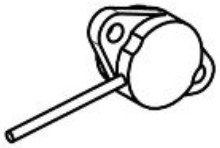
Operation / Operating principle

for gear in neutral, the circuit is closed to ground connection: then, via CAN, the control unit sends the signal to the instrument panel which turns on the neutral speed warning light.

Level in electrical circuit diagram: Start-up enabling switches

Location:

- on the vehicle: left side of the vehicle, near flywheel cover
- connector: upper part of the flywheel cover



Electrical characteristics:

- gear in neutral: closed circuit (continuity)
- gear engaged: open circuit (infinite resistance)

Pin-out:

1. Voltage 12V

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.

NAVIGATOR: STATUSES

Gear in neutral

Example value:yes/no

NAVIGATOR: NOTES

- Indication on the instrument panel always gear engaged: check the correct position of the cable terminals on the connector and the correct connection of the cables on the terminals. If they are not correct, restore the cable harness; if correct, disconnect the connector and, with gear in neutral, check continuity to terminal ground connection, sensor side: if there is no continuity, replace the sensor (after checking cable continuity on the sensor side and the correct mechanical position). If there is, check the correct position of the terminal on the

control unit connector and the correct connection of the cables on the terminals. If they are not correct, restore the cable harness; if OK, check the cable continuity between the sensor connector and ENGINE connector PIN 16: if there is no continuity, restore the cable harness. If there is, replace the instrument panel if the vehicle performance is correct (the engine starts with gear in neutral but the neutral warning light is off) or replace the control unit if the vehicle performance is not correct (the engine does not start with gear in neutral).

- Indication on the instrument panel always gear in neutral: disconnect the terminals from the sensor and check if there is continuity between the ground connection and the PIN towards the sensor, with gear engaged: if there is continuity, replace the sensor. If it is insulated from the ground connection, it means that the green/black cable from sensor PIN 1 to ENGINE connector PIN 16 is shorted to ground: restore the cable harness

Clutch lever sensor

CLUTCH LEVER SENSOR

Function

It tells the clutch lever position to the control unit.

Operation / Operating principle

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

Level in electrical circuit diagram: Start-up enabling switches.

Location:

- on the vehicle: under clutch lever
- connector: behind the instrument panel

Electrical characteristics:

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

Pin-out:

1. Voltage 12V
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.

NAVIGATOR: STATUSES

Clutch

Example value: Indefinite - released - pulled

The statuses regularly viewed are Released / Pulled

Troubleshooting:

- Indication on Navigator always released: check the correct position of the cable terminals on the connector and the correct connection of the cables on the terminals. If they are not correct, restore the cable harness; if correct, disconnect the two terminals from the sensor and, with key set to ON, check continuity to ground connection of PIN 2: if there is no continuity, restore the cable harness; if there is, replace the sensor
- Indication on Navigator 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 the sensor. If the circuit is open, it means that the brown/purple cable from sensor PIN 1 to ENGINE connector PIN 50 is shorted to ground: restore the cable harness

Side stand sensor

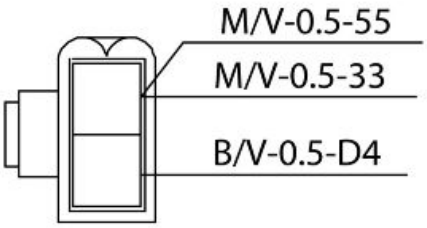
SIDE STAND SENSOR

Function

It tells the side stand position to the control unit.

Operation / Operating principle

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



Level in electrical circuit diagram: Start-up enabling switches

Location:

- on the vehicle: on the side stand
- connector: left side, near the Marelli control unit

Electrical characteristics:

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

Pin-out:

1. Ground connection
2. Voltage 12V

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.

NAVIGATOR: STATUSES

Side stand

Example value:up/down

Indication on Navigator **always down**: check the connector: if not OK, restore; if it is OK, disconnect the two terminals from the sensor and check continuity to ground of PIN 1: if there is no continuity, restore the cable harness; if there is, replace the sensor.

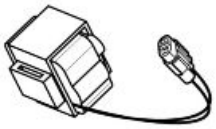
Indication on Navigator **always up**: disconnect the terminals from the sensor and check if there is continuity between the two PINS, with stand down: if there is continuity, replace the sensor; if the circuit is open, it means that the brown/green cable from sensor PIN 2 to ENGINE connector PIN 6 is short circuit to ground: restore the cable harness.

Bank angle sensor

FALL SENSOR

Function

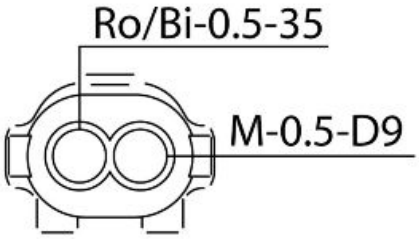
it tells the vehicle position to the control unit.



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 electrical circuit diagram: Start-up enabling switches.



Location:

- on the vehicle: under the saddle
- connector: near the sensor

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.

NAVIGATOR: PARAMETERS

Fall sensor

Example value: Normal / Tip over

Indication on Navigator 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 no continuity, replace the sensor; if there is, check the connector. If not OK, restore the cable harness; if OK, check continuity to ground of PIN 1: if there is no continuity, restore the cable harness; if there is, with key set to ON, check if there is 5V voltage at PIN 2. If there is not, check the Marelli control unit connector (ENGINE connector PIN 8).

Indication on Navigator 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

Electric fan circuit

ELECTRIC FAN CIRCUIT

Function

Radiator fan and coolant - Operation.

Operation / Operating principle

When the control unit detects a temperature of approx. 102 °C, it closes the fan control relay pickup circuit to ground.

Level in electrical circuit diagram:electric fan

Location:

- the relay is located under the fuel tank, left side, first front relay (CHECK, however, the identification of the relay with the colour of the cables).

Electrical characteristics:

- relay normally open;
- drive coil resistance 110 Ohm (+/- 10 %)

NAVIGATOR: STATUSES

Fan relay

Example value:on/off

NAVIGATOR: ACTIVATION

Fan:

The fan relay (No. 44 in the wiring diagram, placed under fuel tank, left side, first front relay; 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.

NAVIGATOR: ELECTRICAL ERRORS

Cooling fan relay P0480 - shorted to positive / shorted to negative / open circuit.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 54 of the VEHICLE connector.
- If shorted to negative: short circuit to ground detected.
- If the circuit is open: interrupted circuit detected. Excessive voltage can only be detected after the fan relay gets activated.

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 correct, restore the cable harness (pink/blue 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 correct, restore the cable harness (pink/blue cable).
- If the circuit is open: check the relay connector and the Marelli control unit VEHICLE connector: If not OK, restore; if OK, restore the cable harness (red/blue cable).

RUN/STOP switch

Run / stop switch

Function

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

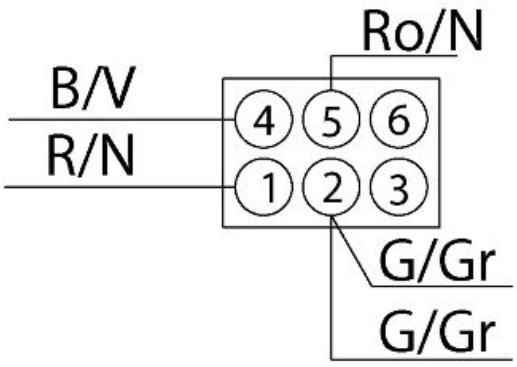
Operation / Operating principle

If the driver wants to shut off the engine or to disable engine start-up, the switch should be open, i.e. the Marelli control unit should not detect voltage at VEHICLE connector PIN 26.

Level in electrical circuit diagram: Start-up enabling switches.

Location:

- on the vehicle: right light switch
- connector: fixed to the "L" support bracket placed over the clutch housing.



Electrical characteristics:

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

Pin-out:

1. Yellow/grey cable: -
2. Red/black cable: Voltage 12V

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.

NAVIGATOR: PARAMETERS

-

NAVIGATOR: STATUSES

Run / stop switch

Example value:Run/Stop

Indication on Navigator always STOP: disconnect the connector and, with the switch set to RUN, check if there is continuity toward the switch of the two yellow/grey and red/black cables: if there is no continuity, replace the sensor; if there is, check the connector. If not OK, restore the cable harness; if it is OK, with key set to ON, check if there is voltage to the red/black cable: if there is no voltage, restore the cable harness; if there is, check the yellow/grey cable ground insulation: if there is continuity to ground, restore the cable harness; if it is correct, take the key to OFF and check the VEHICLE connector

is in good conditions and the continuity of the grey/yellow cable between the sensor in question and the VEHICLE connector PIN 26: if not OK, restore the cable harness; if OK, replace the Marelli control unit.
Indication on Navigator always RUN: disconnect the connector and, with the switch set to STOP, check if there is continuity between the two cables of the switch: if there is continuity, replace the switch; if there is not, it means that, with key set to ON, the yellow/grey cable is shorted to positive: restore the cable harness.

Throttle control unit

THROTTLE CONTROL UNIT

Function

It receives the throttles target position from the Marelli control unit and it moves them so that they reach that target by reading their position through the potentiometers (2 per throttle body).

Level in wiring diagram:throttle control unit

Location:

- on the vehicle: inside the filter casing
- connector: on the control unit

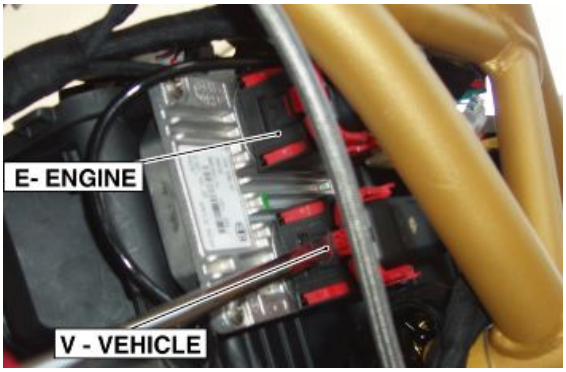
Pin-out: see the CONNECTORS section

See also

Throttle control unit

Connectors

ECU

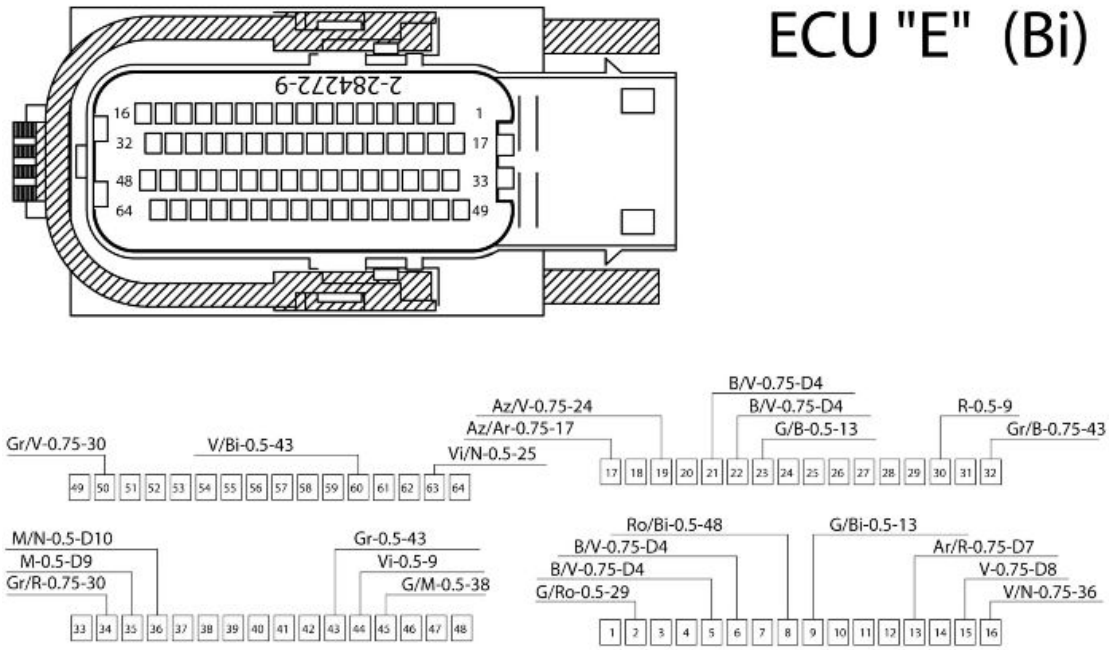


MARELLI CONTROL UNIT PIN OUT

	Specification	Desc./Quantity
1	Key switch	Vehicle connector: 12/29
2	Revolution sensor input (+)	Engine connector: 9
3	Revolution sensor input (-)	Engine connector: 23
4	Vehicle speed input	Vehicle connector: 49
5	Throttle grip input - Track A	Vehicle connector: 42
6	Throttle grip input - Track B	Vehicle connector: 40
7	Throttle grip input - Track C	Engine connector: 30
8	Throttle grip input - Track D	Engine connector: 44
9	Front cylinder intake pressure sensor input	Vehicle connector: 34
10	Rear cylinder intake pressure sensor input	Vehicle connector: 5
11	Water temperature sensor input	Engine connector: 45
12	Side stand input	Vehicle connector: 6
13	"start engine" input	Vehicle connector: 14
14	Clutch sensor input	Vehicle connector: 50
15	Fall sensor input	Engine connector: 8
16	Gear/neutral input	Engine connector: 16
17	Start-up control output	Engine connector: 2
18	Serial line K for diagnosis	Vehicle connector: 10
19	Auxiliary injection relay control output	Vehicle connector: 62
20	Front coil control output	Engine connector: 17
21	Rear coil control output	Engine connector: 19
22	Front injector control output	Engine connector: 50
23	Rear injector control output	Engine connector: 34
24	Air temperature sensor input	Engine connector: 63
25	Front throttle reset output	Vehicle connector: 56
26	Rear throttle reset output	Vehicle connector: 55
27	"Engine stop" input	Vehicle connector: 26
28	Electric fan relay control output	Vehicle connector: 54
29	STOP light relay control output	Vehicle connector: 59
30	Lambda heater control output	Engine connector: 32
31	Lambda sensor input (+)	Engine connector: 43
32	Lambda sensor input (-)	Engine connector: 60
33	Purge Canister valve control output (optional)	Engine connector: 51
34	Control unit direct power supply	Vehicle connector: 16
35	Power ground connection 1	Engine connector: 21
36	Power ground connection 2	Engine connector: 5
37	Power ground connection 3	Engine connector: 22
38	Power ground connection 4	Engine connector: 6
39	Reference voltage output +5V: tracks A-C and pressure sensor	Engine connector: 15
40	Reference voltage output +5V: tracks B-D and speed sensor	Engine connector: 13
41	Analogue ground connection 1	Engine connector: 35
42	Analogue ground connection 2	Vehicle connector: 46 Engine connector: 36
43	CAN H Line (high speed)	Vehicle connector: 51
44	CAN L Line (high speed)	Vehicle connector: 20
45	Timing sensor	Engine connector: 24

NOTE

THE CONNECTOR CAN BE VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR.



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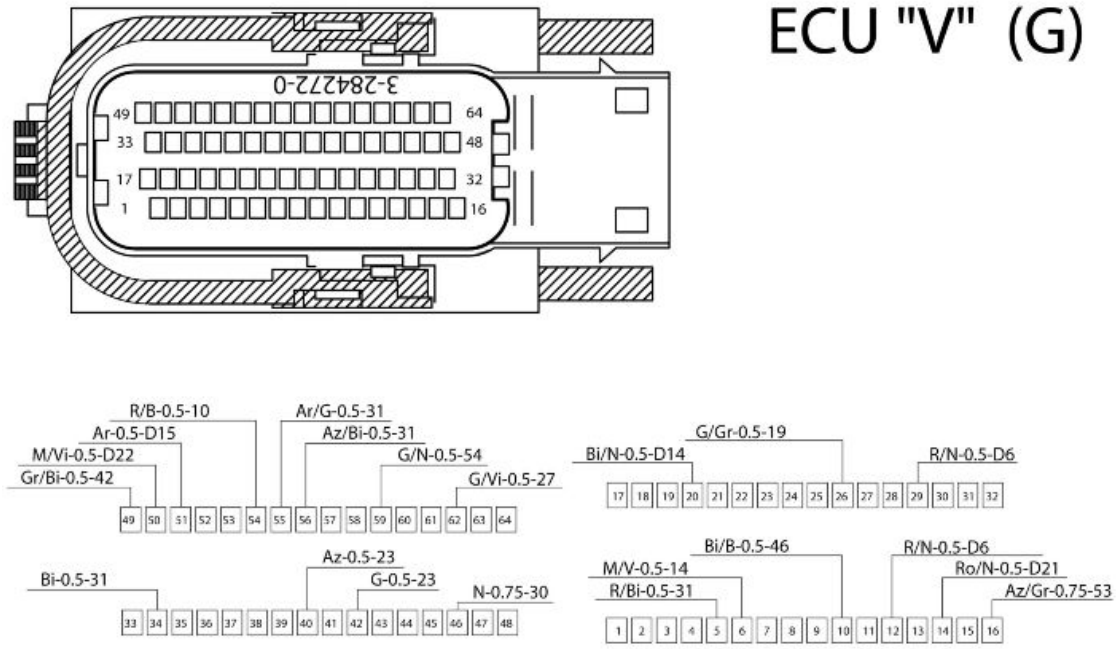


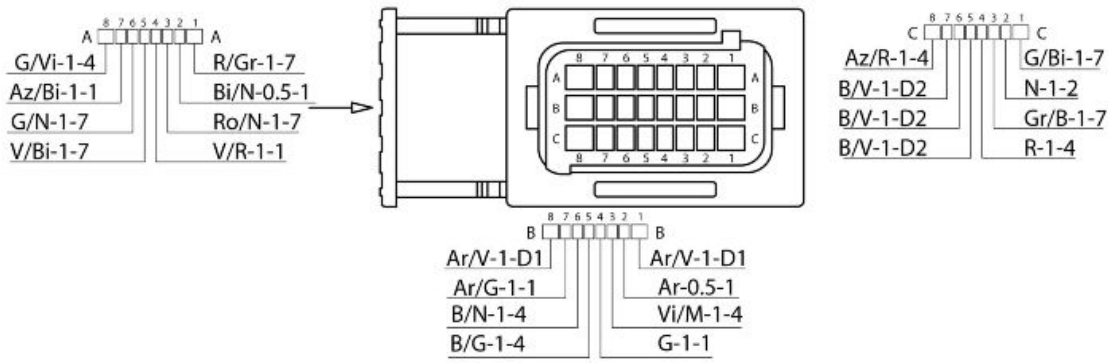
Throttle control unit

EFI THROTTLE CONTROL UNIT PIN OUT

	Specification	Desc./Quantity
1	1A - Front throttle motor control (-)	Front throttle body PIN: 5
2	2A - CAN L	
3	3A - Voltage for front throttle potentiometers (+ 5 V)	Front throttle body PIN: 2
4	4A - Key input	
5	5A - Input for front throttle potentiometer 2 signal	Front throttle body PIN: 4
6	6A - Input for front throttle potentiometer 1 signal	Front throttle body PIN: 1
7	7A - Front throttle reset signal input	
8	8A - Rear throttle motor control (+)	Rear throttle body PIN: 3
9	1B - Battery power supply input	
10	2B - CAN H	
11	3B - Voltage for rear throttle potentiometers (+ 5 V)	Rear throttle body PIN: 2
12	4B - Firmware reprogramming power supply	
13	5B - Input for rear throttle potentiometer 2 signal	Rear throttle body PIN: 4
14	6B - Input for rear throttle potentiometer 1 signal	Rear throttle body PIN: 1
15	7B - Rear throttle reset signal input	
16	8B - Battery power supply input	
17	1C - Front throttle motor control (+)	Front throttle body PIN: 3
18	2C - Ground connection	
19	3C - Ground connection	Front throttle body PIN: 6
20	4C - Ground connection	Rear throttle body PIN: 6
21	5C - Ground connection	
22	6C - Ground connection	
23	7C - Ground connection	
24	8C - Rear throttle motor control (-)	Rear throttle body PIN: 5

NOTE

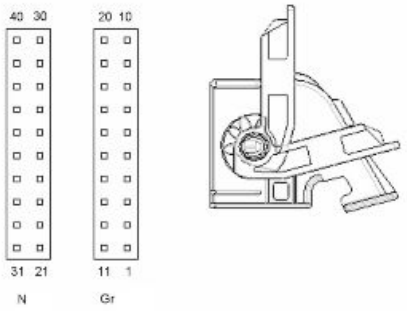
THE CONNECTOR CAN BE VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR.



Dashboard

NOTE

THE CONNECTOR CAN BE VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR.



INSTRUMENT PANEL PIN

	Specification	Desc./Quantity
1	GREY BODY: + Live	PIN 1
2	GREY BODY: Right indicator control	PIN 2
3	GREY BODY: *	PIN 3
4	GREY BODY: High-beam lights input	PIN 4
5	GREY BODY: *	PIN 5
6	GREY BODY: Select 3 (Set)	PIN 6
7	GREY BODY: Select 2 (Down)	PIN 7
8	GREY BODY: Select 1 (Up)	PIN 8
9	GREY BODY: Fuel reserve sensor	PIN 9
10	GREY BODY: *	PIN 10
11	GREY BODY: + Battery	PIN 11
12	GREY BODY: Left indicator control	PIN 12
13	GREY BODY: Hazard control	PIN 13
14	GREY BODY: *	PIN 14
15	GREY BODY: *	PIN 15
16	GREY BODY: Indicator reset	PIN 16
17	GREY BODY: Oil sensor input	PIN 17
18	GREY BODY: 750/1200 Selection	PIN 18
19	GREY BODY: *	PIN 19
20	GREY BODY: K Line	PIN 20
21	BLACK BODY: + Battery	PIN 21
22	BLACK BODY: Front left turn indicator activation	PIN 22
23	BLACK BODY: Front right turn indicator activation	PIN 23
24	BLACK BODY: Aerial 2	PIN 24
25	BLACK BODY: *	PIN 25
26	BLACK BODY: CAN H	PIN 26
27	BLACK BODY: CAN L	PIN 27
28	BLACK BODY: ABS warning light input	PIN 28
29	BLACK BODY: *	PIN 29
30	BLACK BODY: Ground for sensors	PIN 30
31	BLACK BODY: + Battery	PIN 31
32	BLACK BODY: Rear left turn indicator activation	PIN 32
33	BLACK BODY: Rear right turn indicator activation	PIN 33
34	BLACK BODY: Aerial 1	PIN 34
35	BLACK BODY: Light relay activation	PIN 35
36	BLACK BODY: *	PIN 36
37	BLACK BODY: *	PIN 37
38	BLACK BODY: General ground	PIN 38
39	BLACK BODY: General ground	PIN 39
40	BLACK BODY: General ground	PIN 40

Can line

CAN line

Function

It allows communication between the Marelli injection control unit, the throttle control unit and the instrument panel.

Level in electrical circuit diagram:CAN line

Pin-out: see wiring diagram

NAVIGATOR: ELECTRICAL ERRORS

U1602 CAN line without signals - Bus Off.

Error cause

- No communication on CAN line (PIN 20 and/or PIN 51 VEHICLE): 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: if not OK, restore; if OK, check the ground insulation of the two CAN lines from PIN 20 and PIN 51 of the VEHICLE connector: If not OK, restore the cable harness; if OK, check continuity of the two CAN lines from the Marelli control unit VEHICLE connector to the filter box large connector and 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 connector, filter box large 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.

Mute Node CAN Line, U1601 - Mute Node

Error cause

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

Troubleshooting

- Replace the Marelli control unit.

CAN line to 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 to the throttle control unit, U1705 - no signal

Error cause

- No signal is received by the throttle control unit.

Troubleshooting

- Check the filter box large connector and the throttle control unit connector: if not OK, restore; if OK, check the continuity of the two lines from the filter box large connector to the VEHICLE connector of the Marelli control unit: if not OK, restore the cable harness; if OK, check the continuity of the two lines from the filter box large connector to the throttle control unit connector: if not OK, restore the cable harness; if OK, replace the throttle control unit.

NAVIGATOR: LOGIC ERRORS

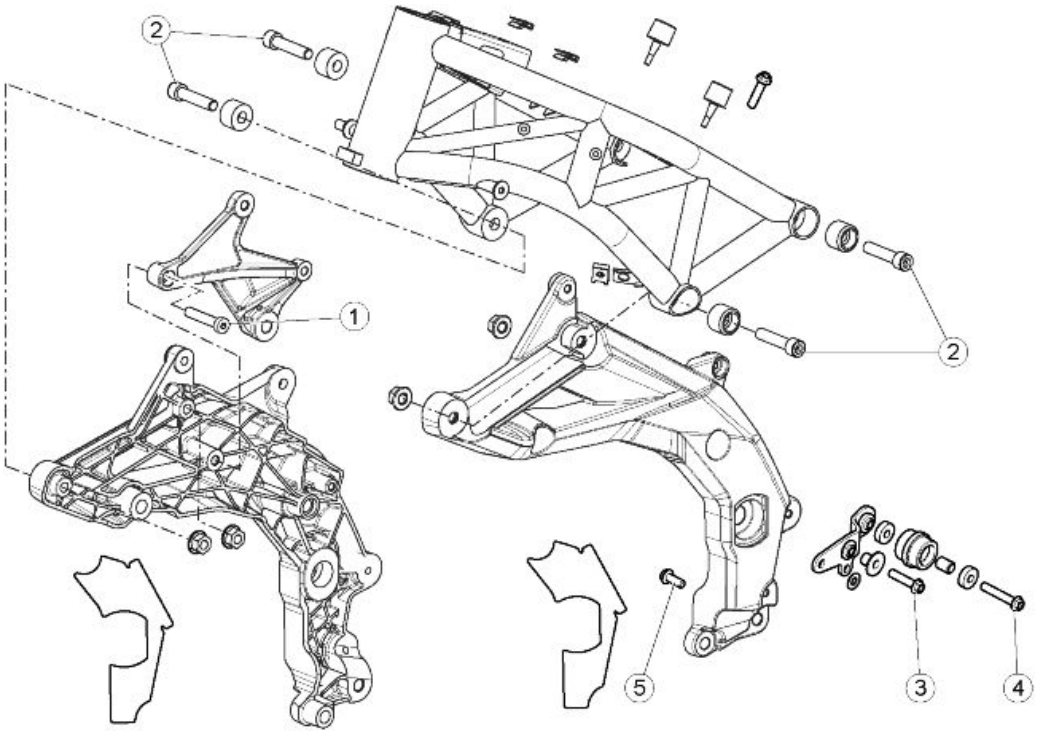
CAN Line to throttle control unit, U1706 - no message update.

Error cause

- No updated signal is received from the throttle control unit.

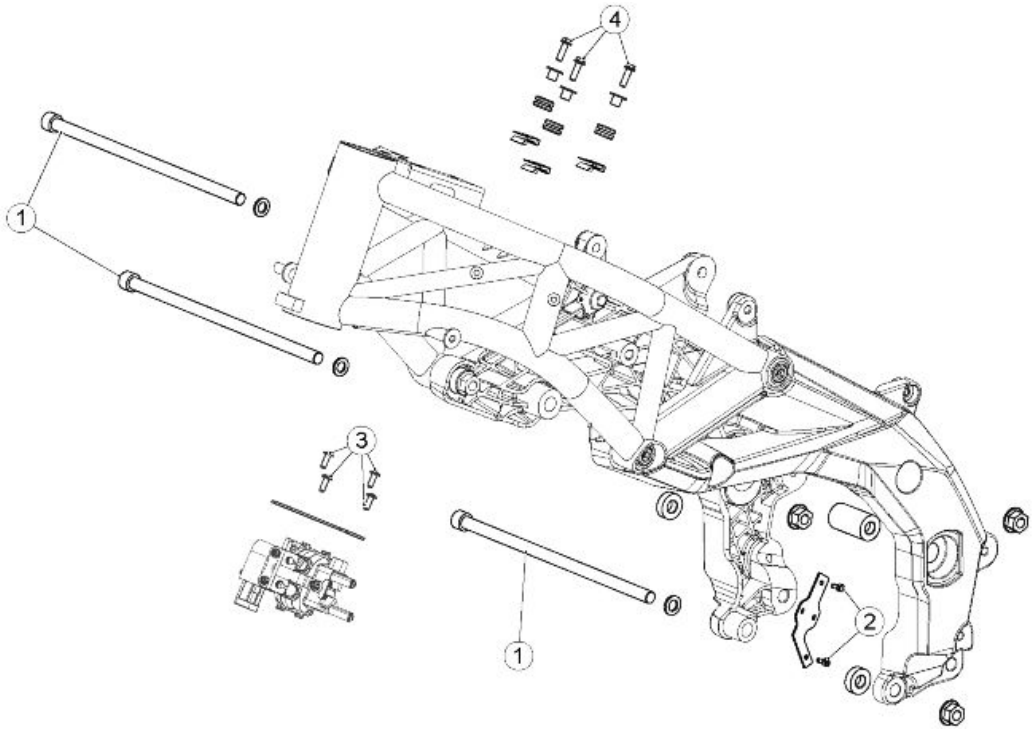
INDEX OF TOPICS

ENGINE FROM VEHICLE	ENG VE



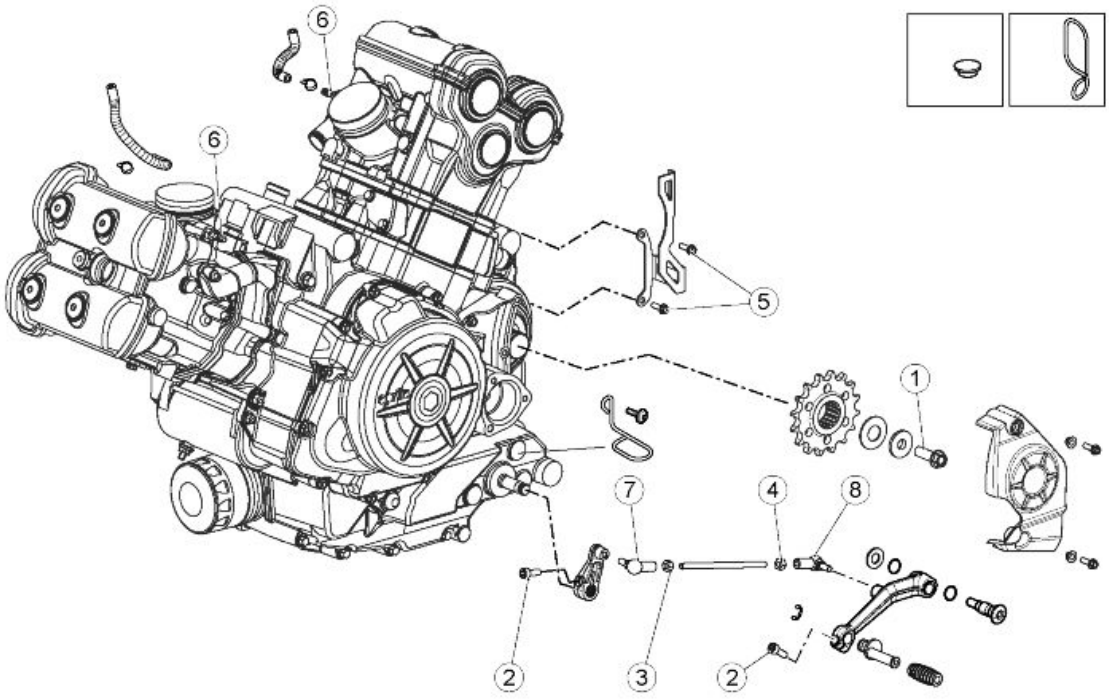
FRONT CHASSIS

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening shock absorber counterplate to RH frame bracket	M10x30	1	50 Nm (36.88 lbf ft)	-
2	TC TORX screw fastening trellis frame to frame side panels	M12x53	4	80 Nm (59 lbf ft)	-
3	Screw fastening chain roller bracket to LH plate	M8x35	1	25 Nm (18.44 lbf ft)	Loctite 243
4	Screw fastening chain roller to chain roller bracket	M8x45	1	25 Nm (18.44 lbf ft)	Loctite 243
5	Screw fastening chain roller bracket to LH plate	M8x20	1	25 Nm (18.44 lbf ft)	Loctite 243



CENTRE FRAME

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screws fastening side panels to engine	M12x282	3	80 Nm (59 lbf ft)	-
2	TCEI screw fastening lambda probe plate to RH frame (pre-fit on RH side panel	M4x10	2	3 Nm (2.3 lbf ft)	-
3	SWP self-tapping screw fastening demand sensor mounting to demand sensor	M5x14	4	2.6 Nm (1.92 lbf ft)	-
4	Flanged TE screw fastening demand sensor to frame	M6x20	3	10 Nm (7.37 lbf ft)	-



ENGINE

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screw fastening pinion	M10x1.25x25	1	50 Nm (36.88 lbf ft)	Loctite 270
2	TCEI screw fastening Pin to gearbox lever and Gearbox Lever to knurled shaft	M6x16	2	10 Nm (7.37 lbf ft)	-
3	LH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
4	RH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
5	Screw fastening engine bracket / clutch side crankcase half	M6	2	12 Nm (8.85 lbf ft)	-
6	Map sensor union (brass)	-	2	2 Nm (1.48 lbf ft)	Loctite 243
6	Map sensor union (steel)	-	2	3.50 Nm (2.58 lbf ft)	Loctite 243
7	LH ball joint on gearbox control lever	-	1	10 Nm (7.37 lbf ft)	Loctite 243
8	RH ball joint on gearbox control lever	-	1	10 Nm (7.37 lbf ft)	Loctite 243
-	Fastener for positive cable on engine	-	1	10 Nm (7.37 lbf ft)	-
-	TE screw fastening negative cable to engine	M6x12	1	10 Nm (7.37 lbf ft)	-

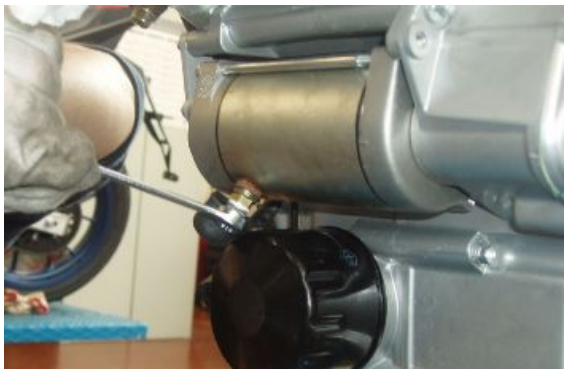
Vehicle preparation

- Remove the air filter box.
- Remove the coolant radiator.
- Remove the exhaust system.
- Place the optional under-sump and rear wheel service stands.
- Unscrew and remove the screw and move the coil.

- Disconnect the engine temperature sensor connector.

- Disconnect the engine oil pressure sensor connector.

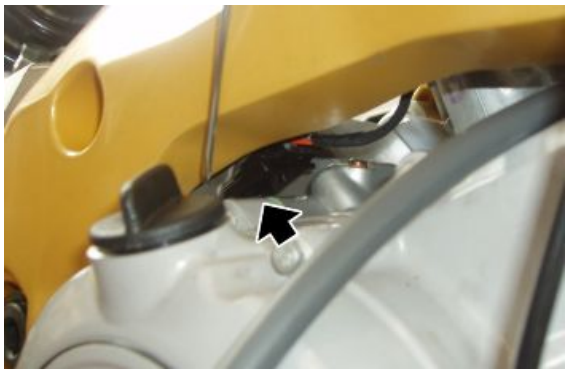
- Disconnect the starter motor power supply cable.



- Unscrew and remove the screw and collect the washer.
- Disconnect the ground leads.

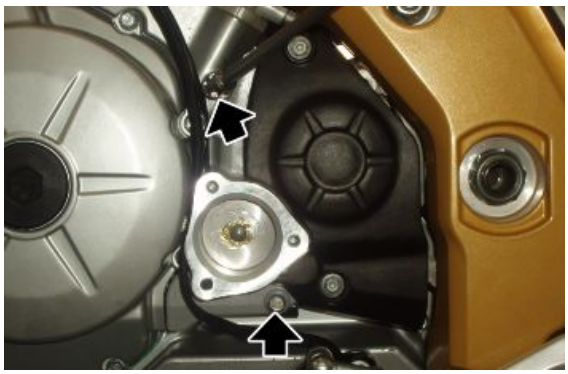
- Move the breather pipe.

- Disconnect the speed sensor connector.



- Unscrew and remove the three screws.
- Remove the clutch control cylinder.
- Lock the plunger using a clamp.

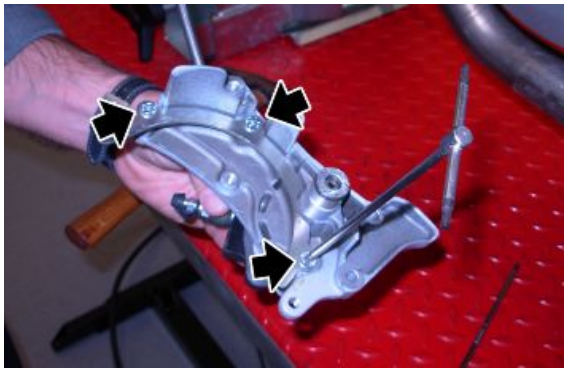
- Unscrew and remove the two screws.
- Remove the chain guard.



- Unscrew and remove the three screws fixing the chain guide.
- Remove the clutch pin.

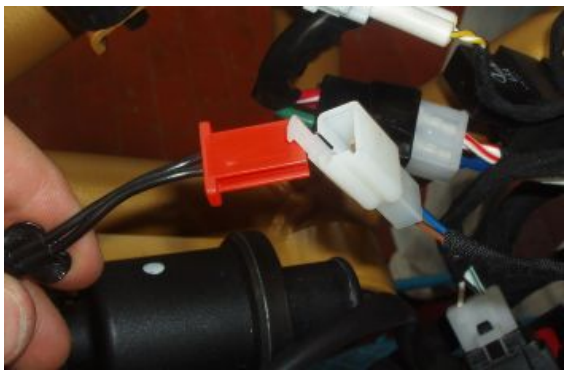
CAUTION

UPON REFITTING, PROPERLY GREASE THE O-RING INDICATED WITH THE ARROW AND BE CAREFUL NOT TO PINCH IT.



- Disconnect the gear in neutral sensor connector.

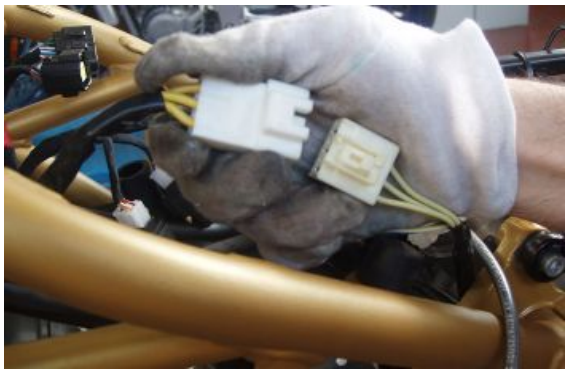
- Disconnect the side stand sensor connector.



- Loosen the screw and slide off the gear transmission connecting rod keeping it linked to the gear shift lever through the rod.

- Slacken the gearing chain tension.
- Unscrew and remove the screw; collect the washer and the spacer.
- Slide off the pinion from the chain and remove.

- Disconnect the generator connections.



See also

Air box
Removing the radiator

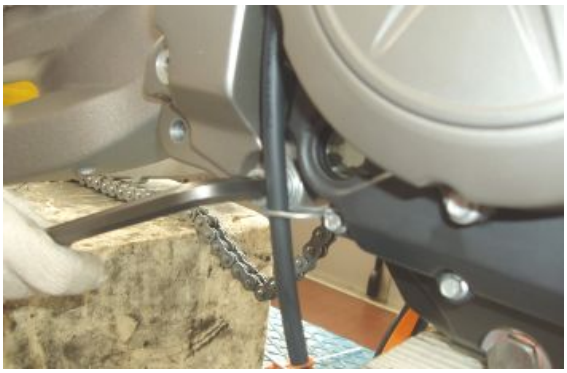
Removing the engine from the vehicle

- Carry out the operations described under Vehicle preparation.
- Support the engine by means of belt and hoist.
- Working on the left side, unscrew and remove the two upper nuts.

- Working on the right side, slightly slide off the two upper bolts.
- Collect the spacers on the opposite side.
- Check spacers length so as not to interchange them upon refitting
- Remove the two upper bolts and collect the washers.

- Working on the left side, unscrew and remove the lower bolt.

- Working on the right side, slightly slide off the lower bolt.
- Collect the spacer on the opposite side.
- Remove the lower pin and collect the washer.



- Lower the engine.

See also

Vehicle preparation

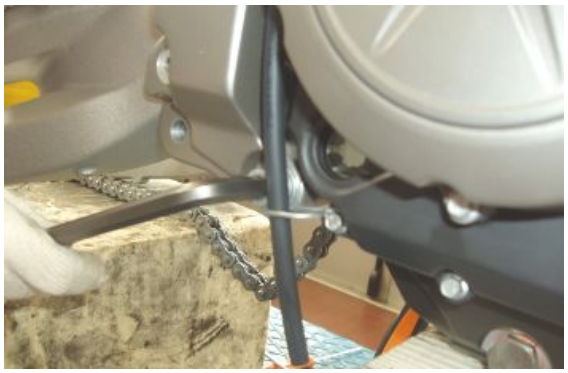
Installing the engine to the vehicle

- Place the engine on a suitable lower stand.
- Lift the engine.
- Place the engine so that the rear attachments on the chassis are aligned.

- Working on the right side, insert the three bolts with their washers.
- Working on the right side, place the spacers on the three bolts between the engine block and the chassis.

CAUTION

THE SPACERS HAVE DIFFERENT SIZES. REFIT THEM IN THE SAME WAY THEY WERE BEFORE BEING REMOVED.



- Working from the left side, tighten the three nuts.
- Release the engine from the belt and the hoist.
- Refit the pinion and restore the gearing chain clearance.
- Reconnect the electric connections and clamp the cable harnesses.
- Carry out the vehicle preparation operations but in reverse order, restore the correct level of all fluids and carry out the adjustments that may be required.

See also

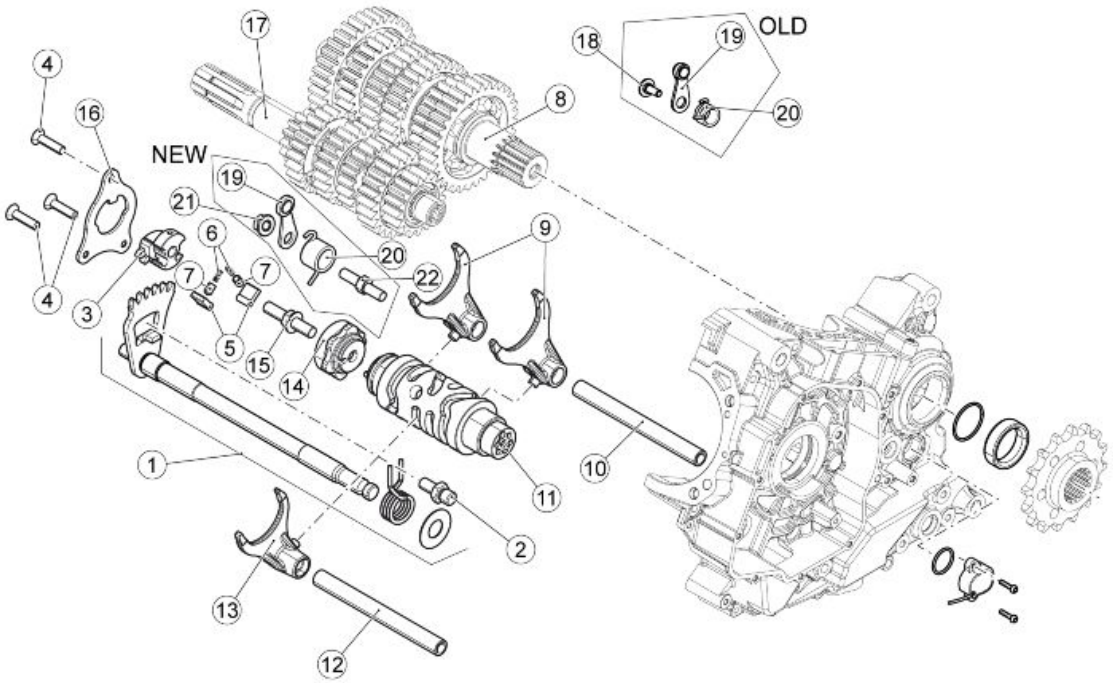
Vehicle preparation
Adjusting

INDEX OF TOPICS

ENGINE	ENG

Gearbox

Diagram



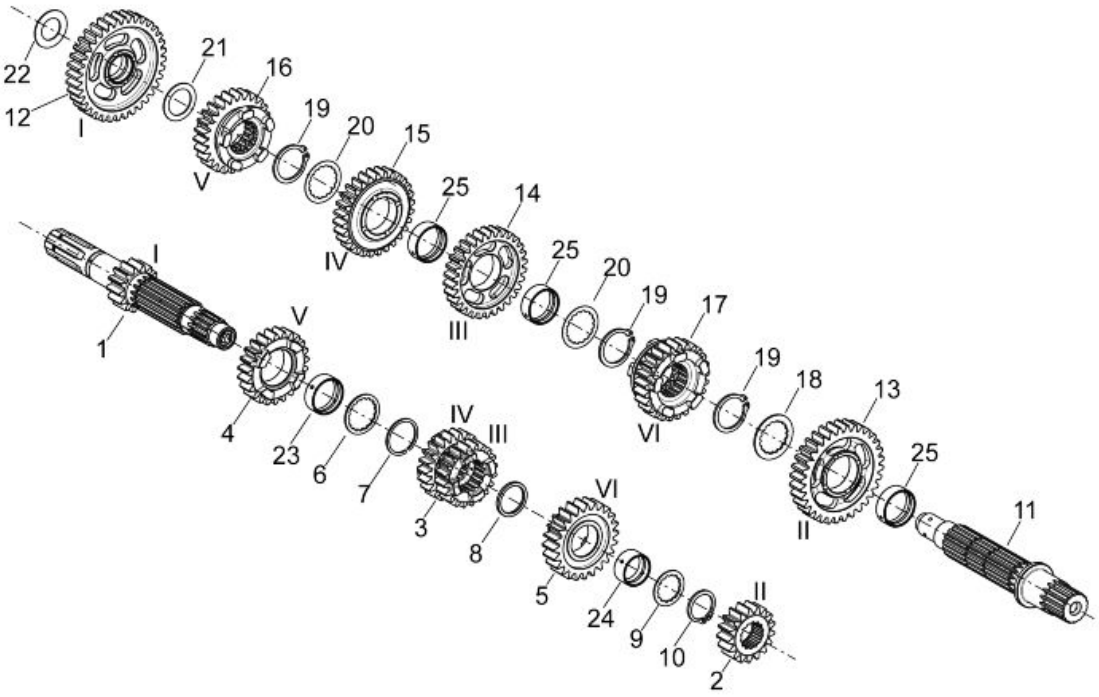
Key

1. Complete gear shaft and spring
2. Selector lock
3. Selector sprocket wheel
4. M5x16 Screw
5. Sprocket wheel pawl
6. Spring
7. Pin for spring
8. Complete transmission gear shaft
9. Forks
10. Fork shaft
11. Gear selector
12. Fork shaft
13. Fork
14. Gear selector drum
15. M8x1.25 threaded pin
16. Selector locking plate

17.Complete main gear shaft
18.TE flanged screw, M6x15
19.Complete index lever
20.Spring
21.Nut
22.Threaded pin

Gearbox shafts

Gearbox shafts diagram



key:

1. Main gear shaft Z=14
2. 2nd gear on primary Z=17
3. 3rd - 4th gear on secondary Z=20/22
4. 5th gear on primary Z=23
5. 6th gear on primary Z=24
6. Thrust washer
7. Circlip
8. Thrust washer
9. Thrust washer
10. Circlip

11. Transmission shaft
12. 1st gear on primary Z=36
13. 2nd gear on secondary Z=32
14. 3rd gear on secondary Z=30
15. 4th gear on secondary Z=28
16. 5th gear on secondary Z=26
17. 6th gear on secondary Z=25
18. Thrust washer
19. Circlip
20. Thrust washer
21. Thrust washer
22. Thrust washer
23. Floating bushing
24. Floating bushing
25. Floating bushing

Disassembling the gearbox

- Remove the gear selector as described in the Crankcase Opening section.
- Remove the two bolts of the forks.

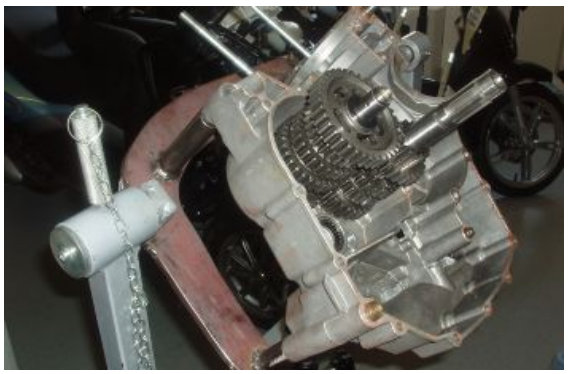
- Slide off the desmodromic drum control.

- Remove the three gear selection forks.

CAUTION

THE MAIN SHAFT FORK IS SMALLER THAN THOSE OF THE SECONDARY SHAFT.
ALL THE SECONDARY SHAFT FORKS ARE THE SAME SIZE.

- Carefully rotate the engine support.



- Carefully slide off the whole gear unit.

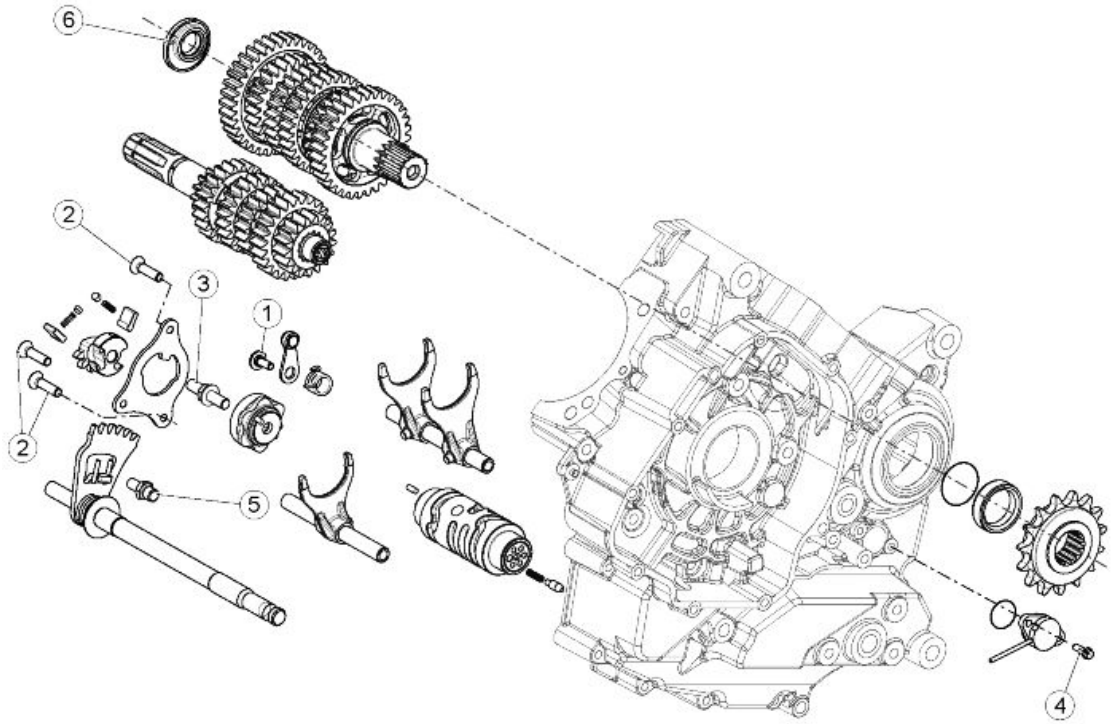
Refitting

- Repeat the removal operations but in reverse order, make sure that the shim washer is fitted to the secondary shaft.

See also

Splitting the crankcase halves

Gear selector



GEAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Gear retainer pawl fastener screw	M6	1	12 Nm (8.85 lbf ft)	-
2	Selector plate fastener screw	M5	3	5.50 Nm (4.06 lbf ft)	-
3	Screw fastening Desmodromic selector drum / Selector sprocket	M8	1	23 Nm (16.96 lbf ft)	-
4	Gear sensor fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 243
5	Selector pin fastener onto clutch side crankcase half	M10x1.5	1	16 Nm (11.80 lbf ft)	-
6	Tightening tone wheel on secondary gearbox	M16x1	1	43 Nm (31.72 lbf ft)	Loctite 270

Removing the gear selector

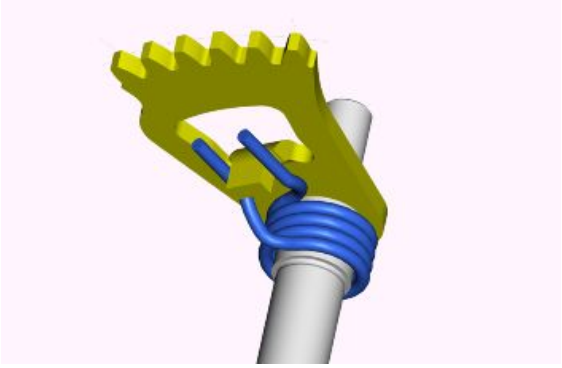
To remove the gear selector refer to the operations described under Crankcase opening.

Checking the gear selector

Selector spring

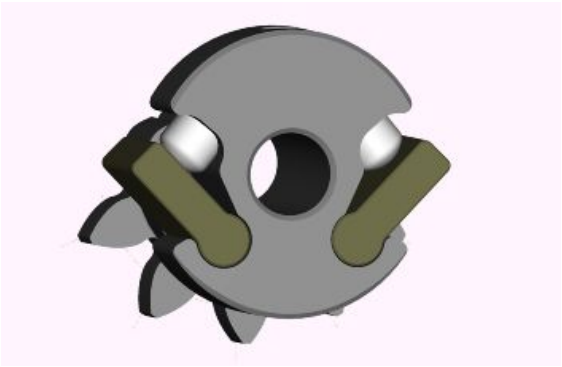
Make sure that the spring ends on the two shifting positions (forward = downshifting and backward = up-shifting) are always in contact with the selector plate

Make sure that the clearance between the end of the spring on the selector plate and the stop pin is almost null, when in home position (see diagrams)



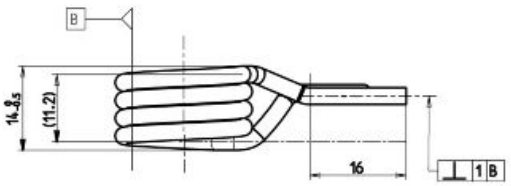
Pawl

Make sure that both pawl tips run free, without jamming



Selector plate spring

With a thickness gauge, check that the spring is not deformed by over-stretching.



Gearbox Selector Shaft

Removal

- Place the left hand crankcase in a press and extract the roller cage with the specific tool.

NOTE

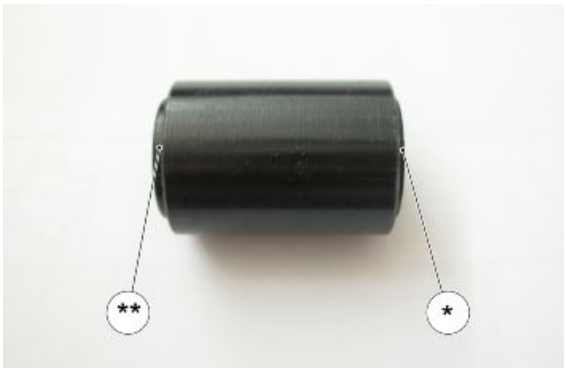
REPEAT THE SAME OPERATION FOR THE RIGHT HAND CRANKCASE HALF.

Specific tooling

020724Y Gear control rod roller cage punch

INSTALLATION

- Place the left hand crankcase in a press and install the roller cage with the specific tool.



CAUTION

TO INSTALL THE ROLLER CAGE IN THE RIGHT HAND CRANKCASE HALF, WORK WITH THE CYLINDER ON THE SIDE OF THE 1 mm (*) STEP ON THE TOOL TURNED TOWARD THE ROLLER CAGE, WHEREAS TO INSTALL THE CAGE IN THE LEFT HAND CRANKCASE HALF, USE THE CYLINDER ON THE SIDE OF THE 2 mm (**) STEP ON THE TOOL.

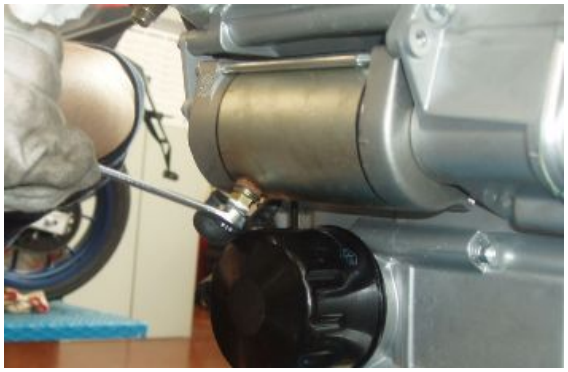
Specific tooling

020724Y Gear control rod roller cage punch

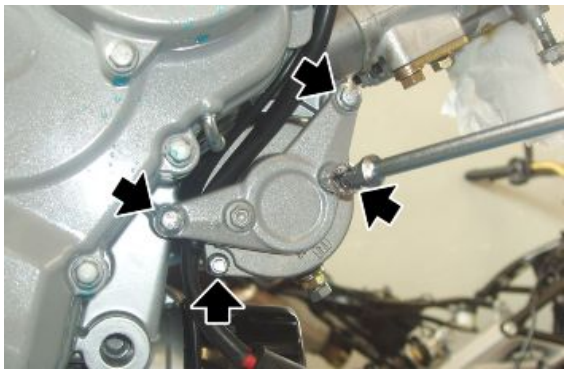
Starter motor

Removing the starter motor

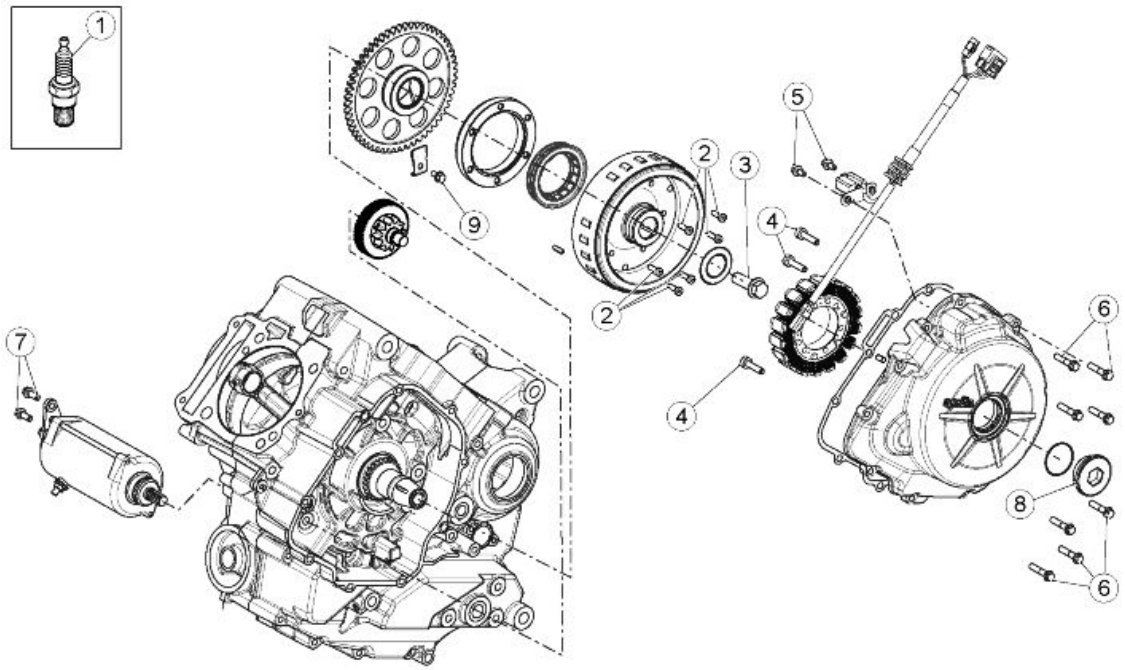
- Disconnect the starter motor power supply cable.



- Undo and remove the four screws and remove the starter motor.



Generator side



IGNITION

pos.	Description	Type	Quantity	Torque	Notes
1	Spark plug	-	2	13 Nm (9.59 lbf ft)	-
2	Freewheel Ring fastener screw	M6	6	14 Nm (10.33 lbf ft)	Loctite 242
3	Screw fixing rotor - Crankshaft - (12 mm - 0.47 in)	M12x1.25	1	130 Nm (95.88 lb ft)	-
3	Screw fixing rotor - Crankshaft - (14 mm - 0.55 in)	M12x1.25	1	190-200 Nm (140.14-147.51 lb ft)	-
4	Screw fastening Stator / Flywheel Cover	M6	3	9 Nm (6.64 lb ft)	-
5	Screw fastening pick-up / Flywheel cover	M5	2	3.50 Nm (2.58 lbf ft)	-
6	Flywheel cover fastener screw	M6	10	13 Nm (9.59 lb ft)	-
7	Screw fastening starter motor bracket to crankcase	M6	2	13 Nm (9.59 lbf ft)	-
8	Crankshaft access cap	-	1	4 Nm (2.95 lb ft)	-
9	Retainer plate fastener screw	M6	1	8 Nm (5.90 lbf ft)	-
-	Screw fastening bracket to starter motor	M6x14	2	13 Nm (9.59 lbf ft)	-
-	Pick-up cable retainer screw	M5	2	3 Nm (2.21 lbf ft)	-

Removing the flywheel cover

- Remove the flywheel cover inspection cap.

- Unscrew and remove the ten screws (1 - 2).

NOTE

SCREW (2) ON THE FLYWHEEL COVER IS SHORTER THAN SCREWS (1).

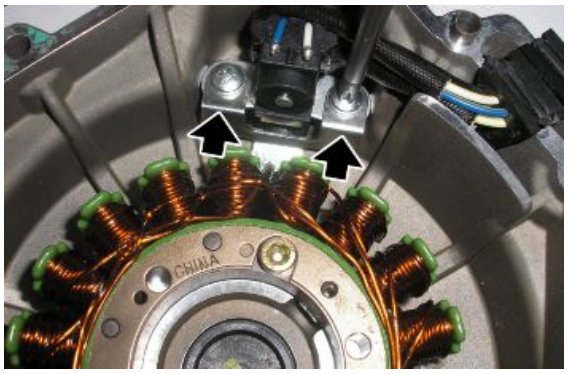
- Remove the flywheel cover using the specific tool.

Specific tooling

020712Y Handle for Flywheel cover removal

Removing the flywheel cover components

- Remove the two pick-up fixing screws.



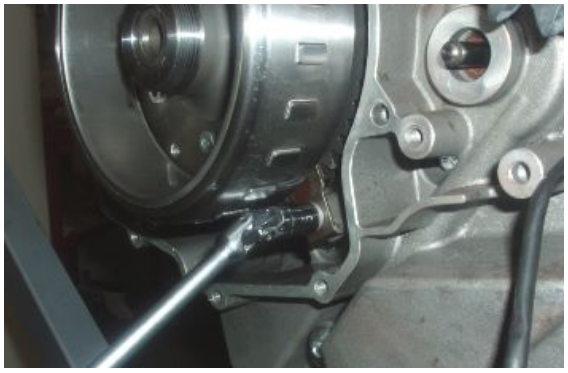
- Remove the three stator fixing screws.

CAUTION

THE PICK-UP AND STATOR SHALL BE REMOVED SIMULTANEOUSLY AS THEY ARE PART OF THE SAME ELECTRICAL BRANCH.

Magneto flywheel removal

- Remove the flywheel cover.
- Unscrew and remove the screw and remove the retention plate.



- Heat the magneto flywheel with the specific heater.
- Lock the flywheel using the specific tool and loosen the screw.

Specific tooling

020713Y Flywheel extractor

- Screw the anticlockwise bolt of the special tool on the external body.
- Keeping the external body blocked and gripping the key, screw the anticlockwise bolt so as to remove the flywheel from the crankshaft.

Specific tooling

020713Y Flywheel extractor

- Unscrew and remove the anticlockwise bolt of the special tool from the external body.
- Unscrew the screw from the crankshaft.

Specific tooling

020713Y Flywheel extractor

- Remove the flywheel together with the freewheel.

- Remove the start-up transmission gear.
- In case of malfunction, the start-up transmission gear cannot be overhauled. Therefore, the complete transmission gear should be replaced.

- Collect the crankshaft woodruff key.

Freewheel removal

- Heat the magneto flywheel with the specific heater.
- Undo and remove the six screws.
- Remove the freewheel from the magneto flywheel.

Installing the flywheel

- Insert the woodruff key on the crankshaft.

- Insert the start-up transmission gear after applying a layer of grease.

- Insert the flywheel on the crankshaft.
- Screw the screw together with the washer but without tightening.

- Place the appropriate tool for locking the flywheel.
- Locking the flywheel in position, using the specific tool, tighten the screw on the crankshaft.

CAUTION:

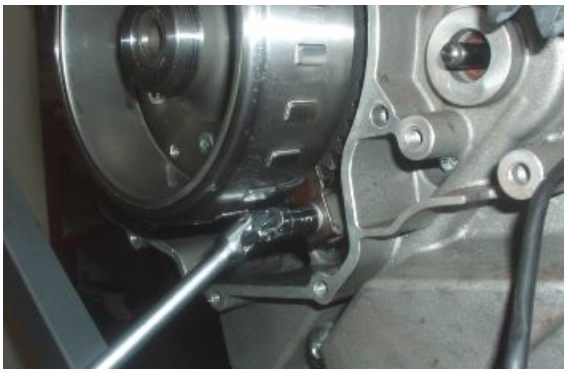
TO APPLY THE CORRECT TIGHTENING TORQUE, CHECK THE MEASURE OF THE SCREW THAT CAN BE M12 OR M14.

- Remove the special tool.

Specific tooling

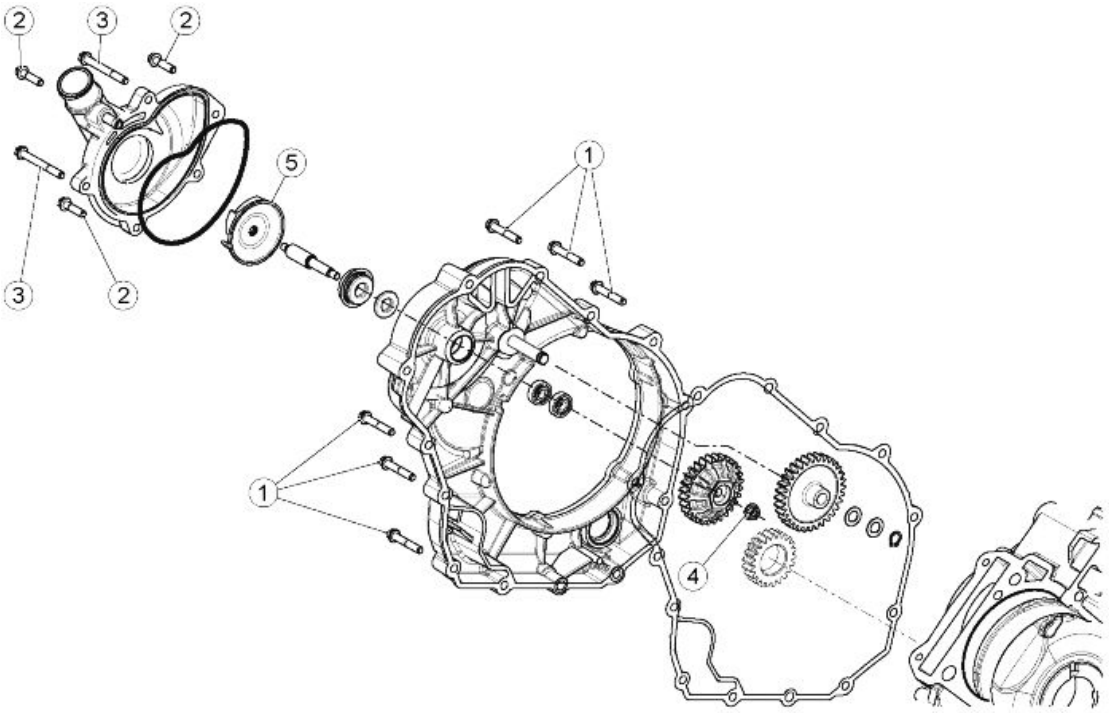
020713Y Flywheel extractor

- Place the retention plate.
- Tighten the screw.



Clutch side

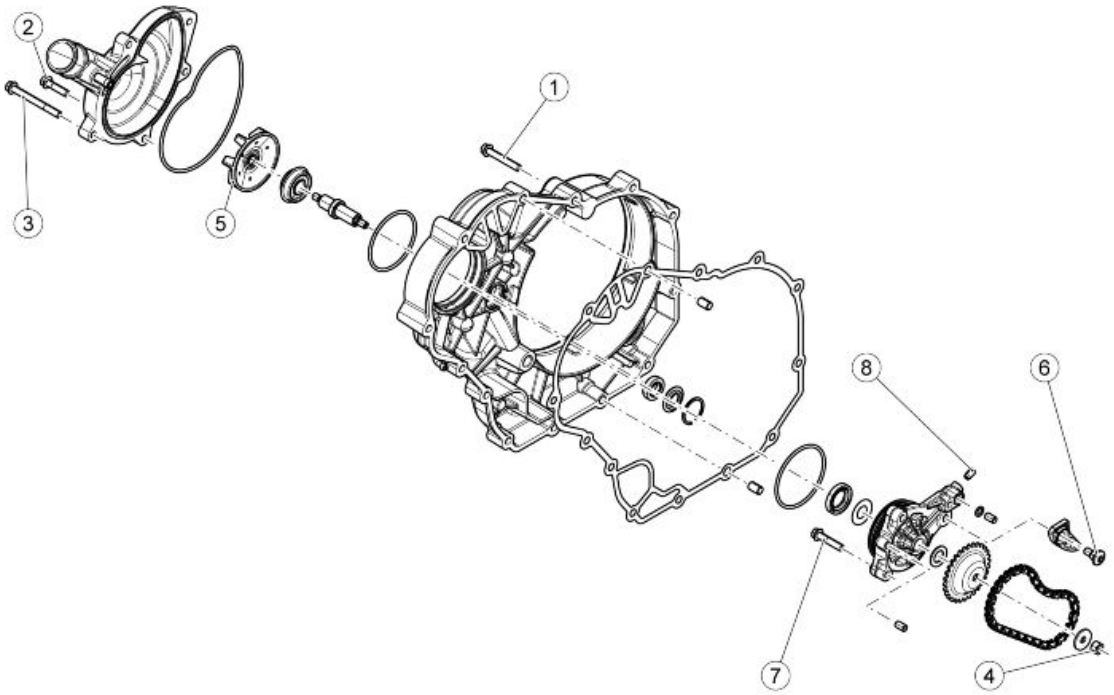
OPTION 01



WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	13	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening pump drive input gear on shaft	M6	1	12 Nm (8.85 lbf ft)	Loctite 244
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-

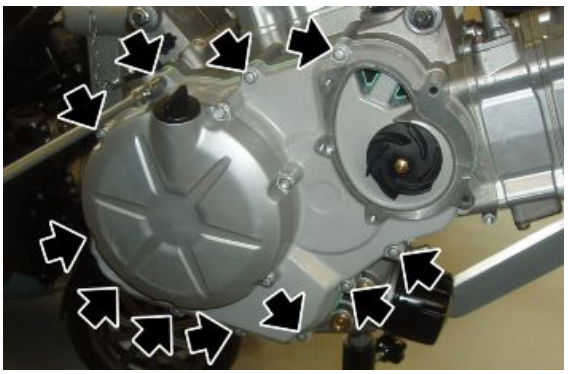
OPTION 02



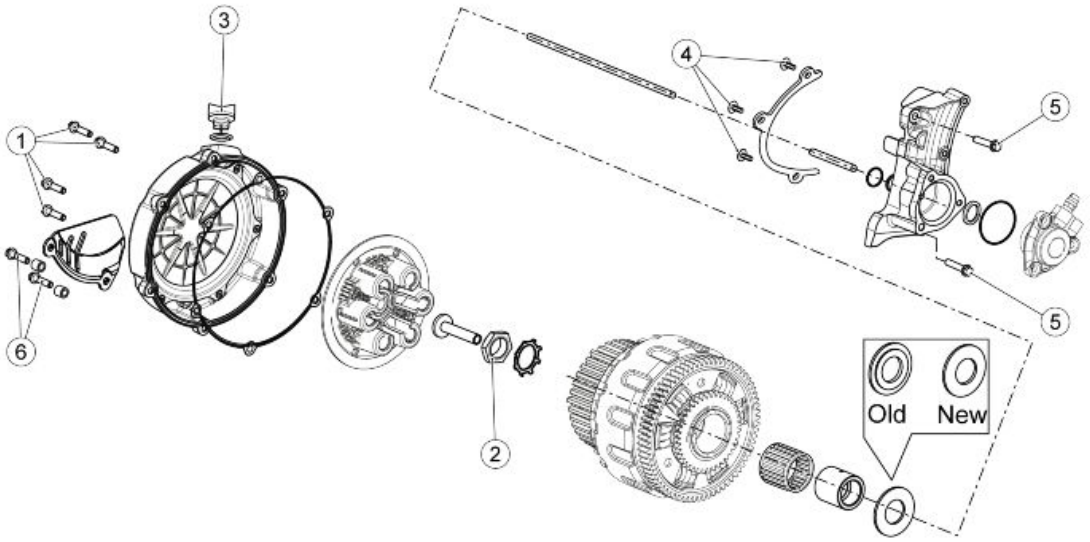
WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening water pump drive gear sprocket	M6	1	12 Nm (8.85 lbf ft)	-
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slider to water pump	M6	1	8-10 Nm (5.90-7.38 lbf ft)	-
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP 2353

- Remove the water pump cover.
- Undo and remove the eleven screws working in a diagonal sequence.
- Collect the gasket.



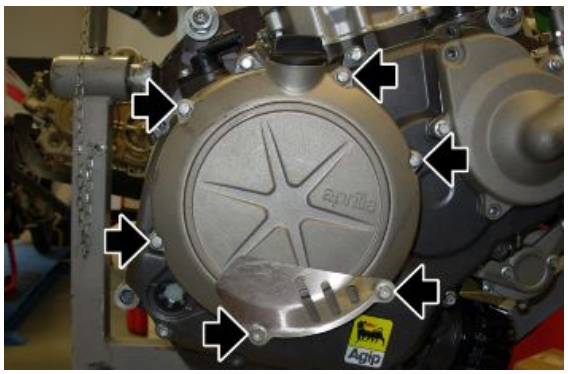
Removing the clutch cover



CLUTCH COVER

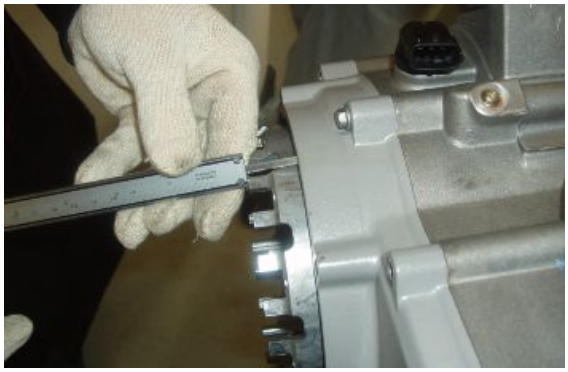
pos.	Description	Type	Quantity	Torque	Notes
1	Fastener screw for Clutch Cover / Clutch side cover	M6	4	13 Nm (9.59 lbf ft)	-
2	Clutch fastener nut	M24x1.5	1	180 Nm (132.76 lbf ft) ± 5%	Chamfer
3	Fastening oil filler plug on Clutch cover	-	1	2 Nm (1.48 lbf ft)	-
4	Screw fastening fixing Plate / Clutch control Mounting	M5	3	5.50 Nm (4.06 lbf ft)	-
5	Screw fastening clutch control mounting on flywheel side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
6	Clutch Cover / Clutch side Cover TCEI fixing screw (inox protection)	M6x55	2	10 Nm (7.38 lbf ft)	-

- Undo and remove the perimeter fastener screws.
- Remove the protection plate and the clutch cover and collect the spacers.

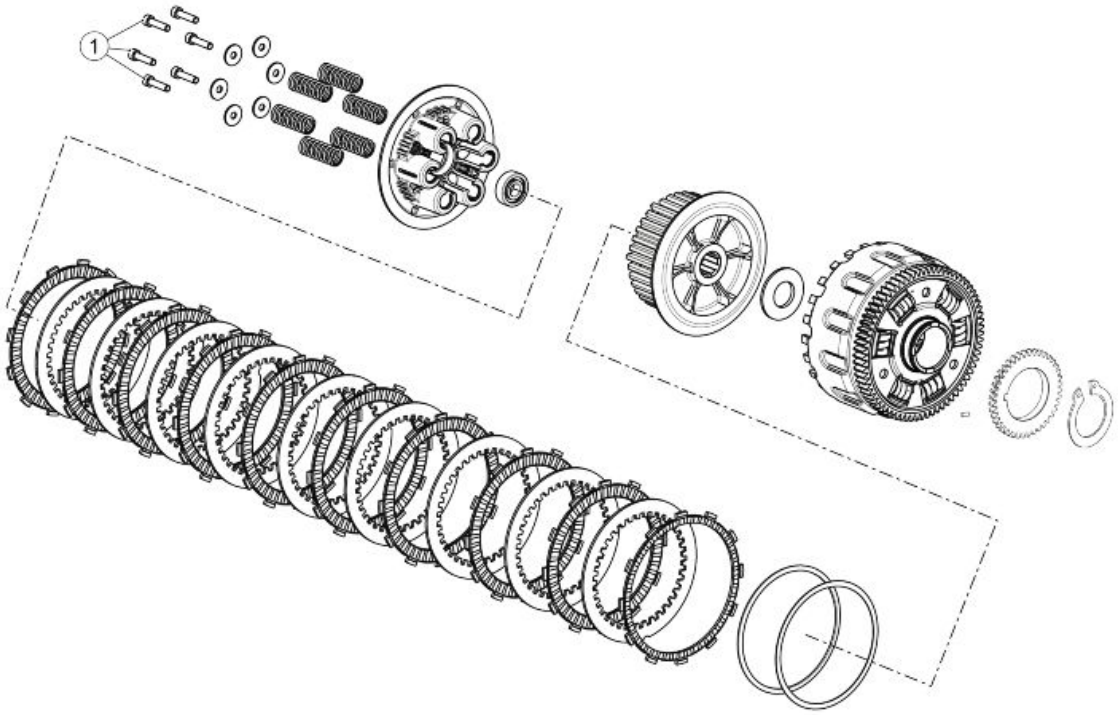


Removing the clutch cover alone is only recommended when replacing the clutch plates. When removing the entire clutch assembly, removing the clutch side crankcase is recommended.
However, removing the entire clutch assembly is possible by removing the clutch cover alone. In this case, proceed as follows:

- measure the projection of the clutch housing from the crankcase before disassembling;
- when refitting, check that the projection has not changed before tightening the clutch nut. If the projection has changed, rotate the crankshaft to correctly engage the engine oil pump drive gear on the clutch housing with the oil pump driven gear.



Disassembling the clutch



CLUTCH

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch spring fastener screw	M6	6	12 Nm (8.85 lbf ft)	-

- Remove the clutch side housing.
- 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.

- Remove the mushroom head clutch control rod.

- Remove the discs.
- Remove the shim and the cup spring.

- Fasten the clutch housing using the specific tool.

Specific tooling

9100896 Clutch housing locking tool

- Undo and remove the clutch hub nut, retrieving the washer.

- Remove the clutch hub.

- Retrieve the special washer between the clutch hub and the clutch housing.

- Collect the clutch housing.

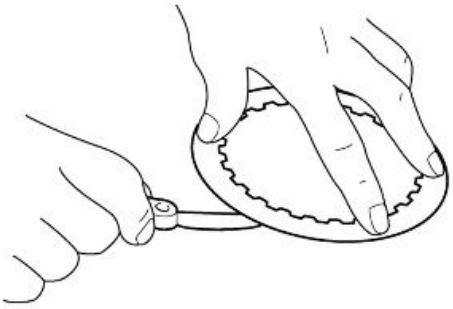
- Collect the spacer and the needle bearings.

- Collect the shim washer.

Checking the clutch plates

- Lay the friction discs and steel discs on a level surface and check them for cracks and potential distortions.

Maximum distortion allowed: 0.20 mm (0.0079 in)



- Measure the driving plate thickness at four positions, replace them all if not complying with specifications.

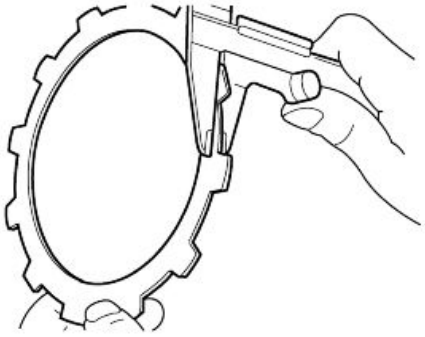
CAUTION

THE STEEL DISCS MUST SHOW NO SCORES OR TEMPERING COLOUR.

- Measure the thickness of the clutch discs at four positions, replace them if not complying with specifications.

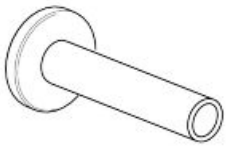
Thickness of nine drive discs: 2.5 mm (0.10 in).

Driven disc thickness: 2,75 - 2,85 mm (0.108 ÷ 0.112 in).



MUSHROOM VALVE CHECK

- Check if the valve slides freely, without jamming.
- Blow compressed air into the valve and check that the lubricating oil passage holes open.



Checking the clutch housing

- Remove the clutch bell.
- Remove the seeger ring.

- Remove the oil pump control gear.

UPON REFITTING, THE GEAR COLLAR MUST ALWAYS BE FACING THE CLUTCH BELL.

- Remove the rotation locking pin from the oil pump control gear.

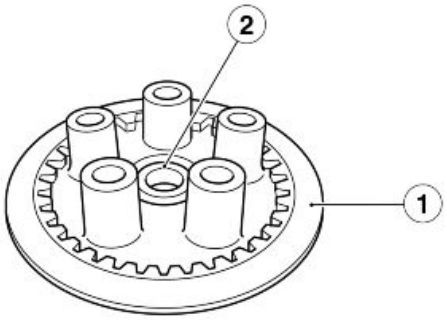
Check the clutch bell for damage and wear that may result in clutch irregular operation. Deburr the teeth or replace the bell.

MAIN DRIVEN GEAR CHECK

Check the main driven gear for damage and wear and, if necessary, replace the main transmission driving gear and the clutch bell all together.
Make sure there is not excessive noise during operation; if necessary, replace the main transmission driving gear and the clutch bell all together.

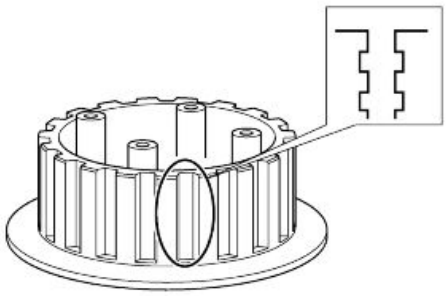
Checking the pusher plate

Check the thrust plate and the bearing for damage and wear. If necessary, replace the parts.



Checking the clutch hub

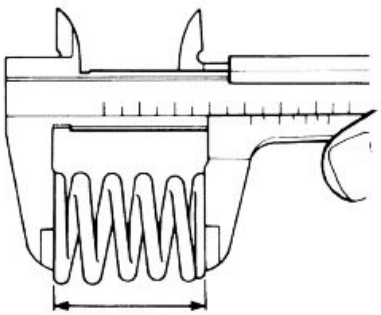
Check the clutch hub for damage and wear that may result in clutch irregular operation. If necessary, replace the bell.



Checking the 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.

Clutch spring length when unloaded: 46.6 mm (1.83 in)



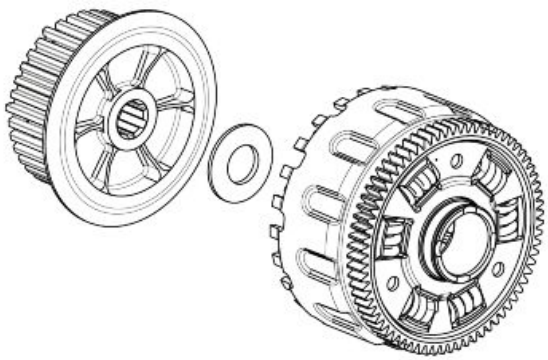
Assembling the clutch

- Fit the shim washer.

- Fit the needle bearing and the spacer.

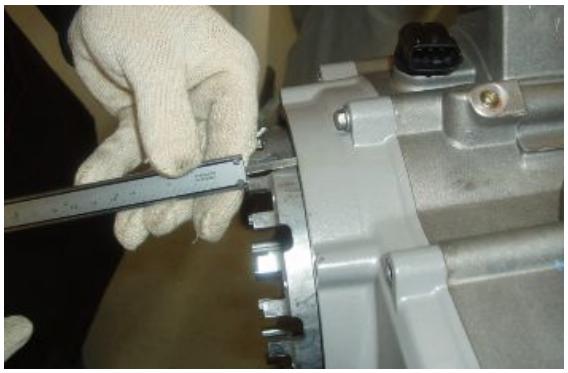
- Fit the clutch housing.
- Make sure that the oil pump control drive gear of the clutch housing engages correctly with the oil pump driven gear.

- Place the washer correctly between the clutch housing and the hub.



- Position the clutch hub.

- Fit the clutch cover.
- Check that the measurement has not changed compared with the one carried out upon removal; tighten the clutch nut afterwards. If it has changed, rotate the crankshaft so that the oil pump control drive gear engages correctly with the oil pump driven gear on the clutch bell.



- Fit the washer and a new clutch hub nut.
- Tighten the clutch hub nut using the specific tool.

Specific tooling

9100896 Clutch housing locking tool

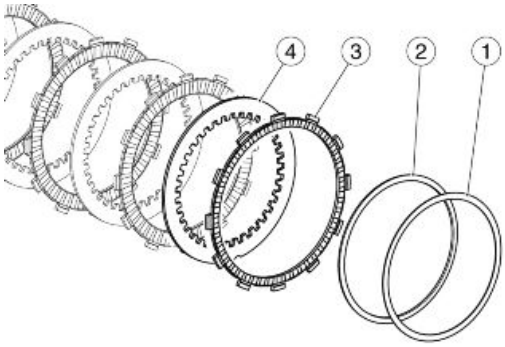
- Tighten the nut and proceed to caulk.

- Insert the flat ring (1).
- Insert the cupped ring (2).

CAUTION

BE CAREFUL WITH THE CUPPED RING FITTING SIDE; THE RING CONE SHALL BE DIRECTED TOWARDS THE ENGINE.

- Fit the lathed driven disc (3).
- Fit the nitrided steel disc (4).

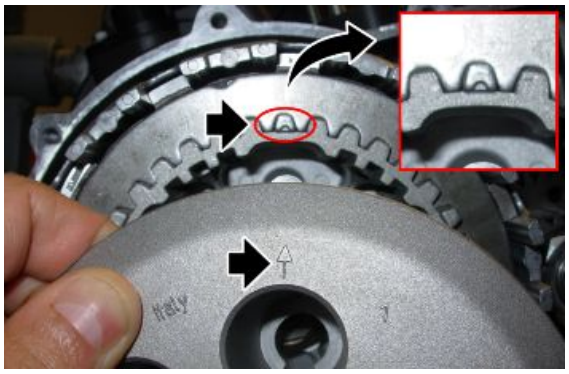


- Fit the clutch plates. Start with the friction material discs and alternate with steel discs.
- Position all friction material discs with their teeth aligned in one of the long slots of the clutch housing.
- Place the control rod.

- Place the thrust plate.

CAUTION

ENSURE TO ALIGN THE ARROW ON THRUST PLATE WITH THE MACHINED REFERENCE ON HUB.



- Fit the clutch springs.
- Fit the screw washers.
- Tighten the six screws operating in stages and diagonally.

- Replace the gasket upon refitting.

Head and timing

Removing the head cover

The operations described below are valid for both heads.

- Unscrew and remove the four screws and collect the rubber rings.
- Remove the head cover.

Removing the cylinder head

NOTE

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

- Remove the head cylinder unit.
- Unscrew and remove the screw on the intake side.

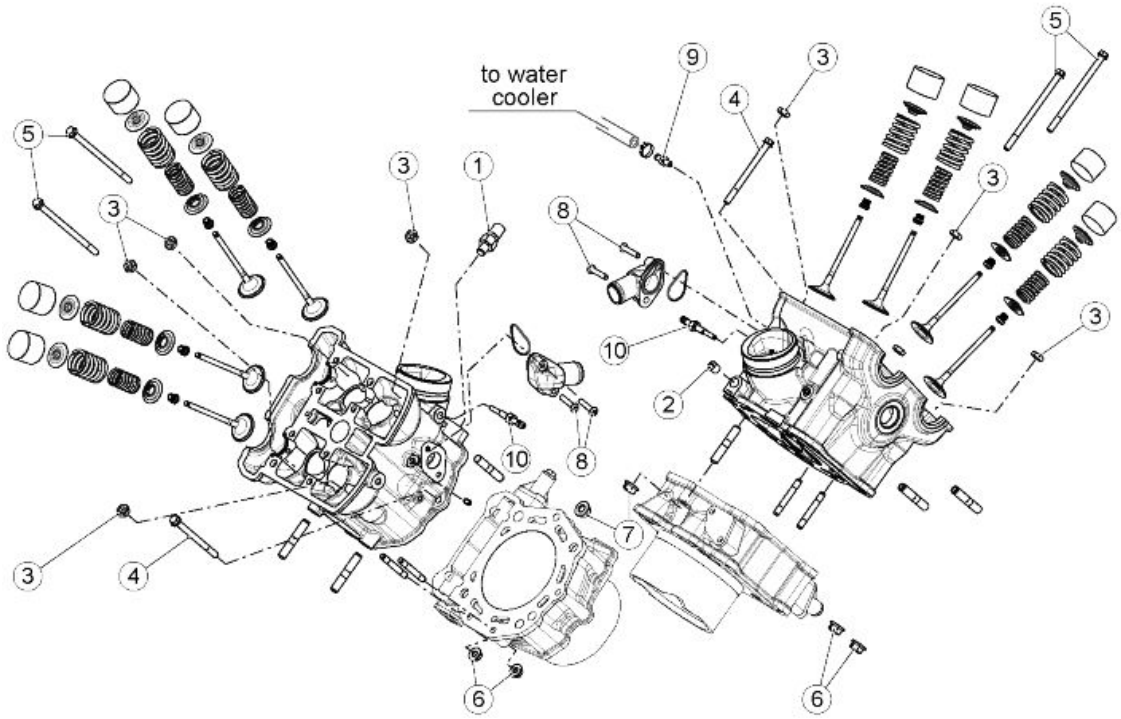
- Unscrew and remove the screws on the exhaust side.

- Separate the cylinder from the head.
- Collect the gasket.

See also

Removing the cylinder

Cylinder head



HEAD

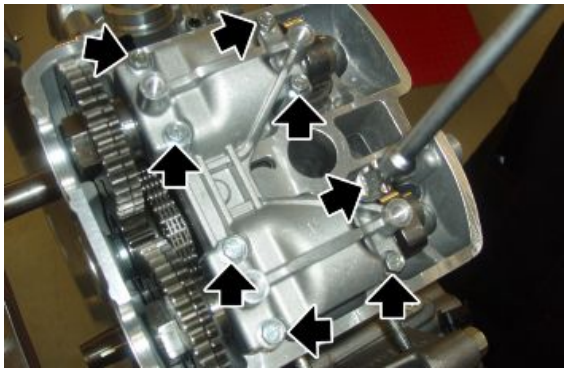
pos.	Description	Type	Quantity	Torque	Notes
1	Water Temperature Sensor	M12x1.5	1	23 Nm (16.96 lbf ft)	-
2	Threaded plug for water sensor seat	M12x1.5	1	10 Nm (7.38 lbf ft)	Loctite Drise AL 506
3	Head stud bolt fastener nut - pre-tightening	M10x1.25	8	10 Nm (7.38 lbf ft)	Lubricate the threads before tightening
3	Head stud bolt fastener nut - tightening	M10x1.25	8	13 Nm (9.59 lbf ft) + 90° + 90°	Lubricate the threads before tightening
4	Fastener for Head / Cylinder / Outer side crankcase	M6	2	13 Nm (9.59 lbf ft)	-
5	Fastener for Head / Cylinder / Inner side crankcase	M6	4	12 Nm (8.85 lbf ft)	-
6	Nut fastening Stud Bolts / Head	M6	4	12 Nm (8.85 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
7	Nut fastening Stud Bolts / Head	M8	2	26 Nm (19.18 lbf ft)	-
8	Bleed union fastener screw	M5	4	6.5 Nm (4.79 lbf ft)	-
9	Water bleed union (steel)	-	1	3.50 Nm (2.58 lbf ft)	Loctite 243
10	Water bleed union (brass)	-	2	2 Nm (1.48 lbf ft)	Loctite 243

Removing the overhead camshaft

- Remove the clutch side crankcase half.
- Rotate the crankshaft until the rear cylinder reaches the TDC.

First remove the rear head cover in order to remove the rear head camshafts.
First remove the front head cover in order to remove the front head camshafts.
Mark the head camshafts, the corresponding sprocket wheels and cam caps in order not to interchange them upon refitting.



- Undo and remove the eight cam cap screws working in a diagonal sequence and in stages.
- Remove the cam cap carefully so as not to go through it and damage the seats of the calibrated dowels.

- Remove the camshafts with the gears.

Removing the valves

- When removing the valve, mark the components according to the position and the cylinder they belong to, in order to refit the components to their correct positions.

- 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

020721Y Adaptor for valve removal

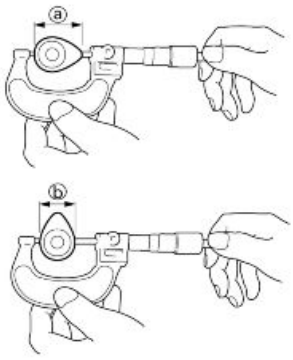
- Remove the cotters using a magnet.

- Release the valve springs.
- Remove the valve spring fittings and the springs.

- Remove the valves.

Checking the overhead camshaft

Check that the camshaft toothed wheel works properly: if it is damaged or does not move smoothly, replace both the timing chain and the camshaft toothed wheel.



CAMSHAFT LOBES

- Check that they do not show blue colouring, pitting or scratches; otherwise, replace the camshaft and the relevant toothed wheel.
- Use a micrometer to check the sizes (a) and (b) of the camshaft lobes.

Camshaft lobes sizes:

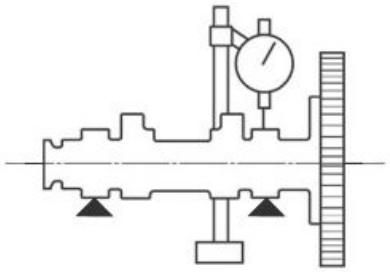
Inlet

- a: 36.28 / 36.32 mm (1.4283 / 1.4299 in); Limit: 36.15 mm (1.4232 in);
- b: 28 mm (1.1023 in);

Outlet

- a: 35.13 / 35.17 mm (1.3831 / 1.3846 in); Limit: 35.00 mm (1.3779 in);
- b: 28 mm (1.1023 in);

- 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 component.



Camshaft eccentricity maximum limit 0.040 mm (0.0016 in)

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.

CAUTION

THE SEAT (1) ON THE VALVE HEAD CANNOT BE REGROUND. IF REQUIRED, REPLACE THE VALVE.
GRINDING WITH ABRASIVE PASTE IS ALLOWED; VALVE STEM END REGRINDING IS NOT ALLOWED.

Clean off any combustion residues from the valves.

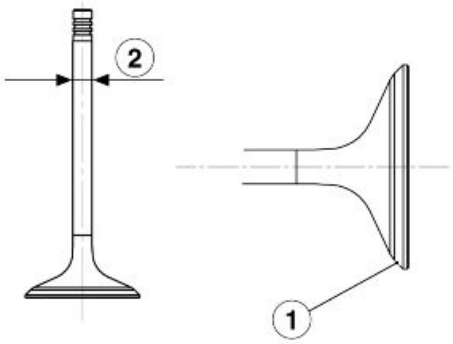
Check the seat (1) on the valve head with a ruler flush.

The surface of the seat must not be concave; replace the valve if necessary.

Check the clearance between the stem and the valve guide:

inlet: **0.013 - 0.040 mm (0.00051 - 0.00157 in); limit: 0.080 mm (0.00315 in)**

outlet: **0.025 - 0.052 mm (0.00098 - 0.00205 in); limit: 0.100 mm (0.00394 in)**

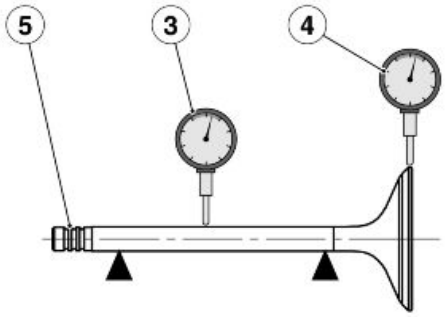


Check the valve eccentricity:

valve stem (3) maximum eccentricity allowed: 0.05 mm (0.00197 in)

valve head (4) maximum eccentricity allowed: 0.05 mm (0.00197 in)

Check that the fixing grooves (5) of the valve cotters are in proper conditions.



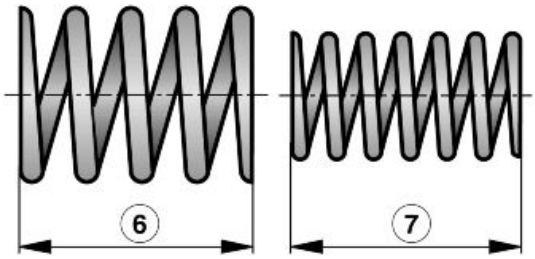
VALVE SPRINGS

Carry out a measurement and a visual inspection of the valve springs for damage, distortion or loss of tension.

Measure the spring length at release position.

Valve springs: **minimum wear limit (6) 42.5 mm (1.673 in).**

Valve springs: **minimum wear limit (7) 38 mm (1.496 in).**



Checking the cylinder head

- Using a round scraper, clean off any carbon deposits in the combustion chamber.

CAUTION

DO NOT USE A POINTED INSTRUMENT TO AVOID DAMAGING OR SCRATCHING THE SPARK PLUG THREADS OR THE VALVE SEATS.

- Check the head for damage or scratches and replace it if necessary.
- Check there are no mineral deposits or rust in the head water cooled jacket; clean off if required.
- Use a checking ruler and a thickness gauge positioned diagonally to the ruler to measure the cylinder head distortion.

Maximum cylinder head distortion: 0.03 mm (0.0012 in)

- Check that the tappet covers and the camshaft toothed wheel cover are not damaged or worn; replace the defective part(s).

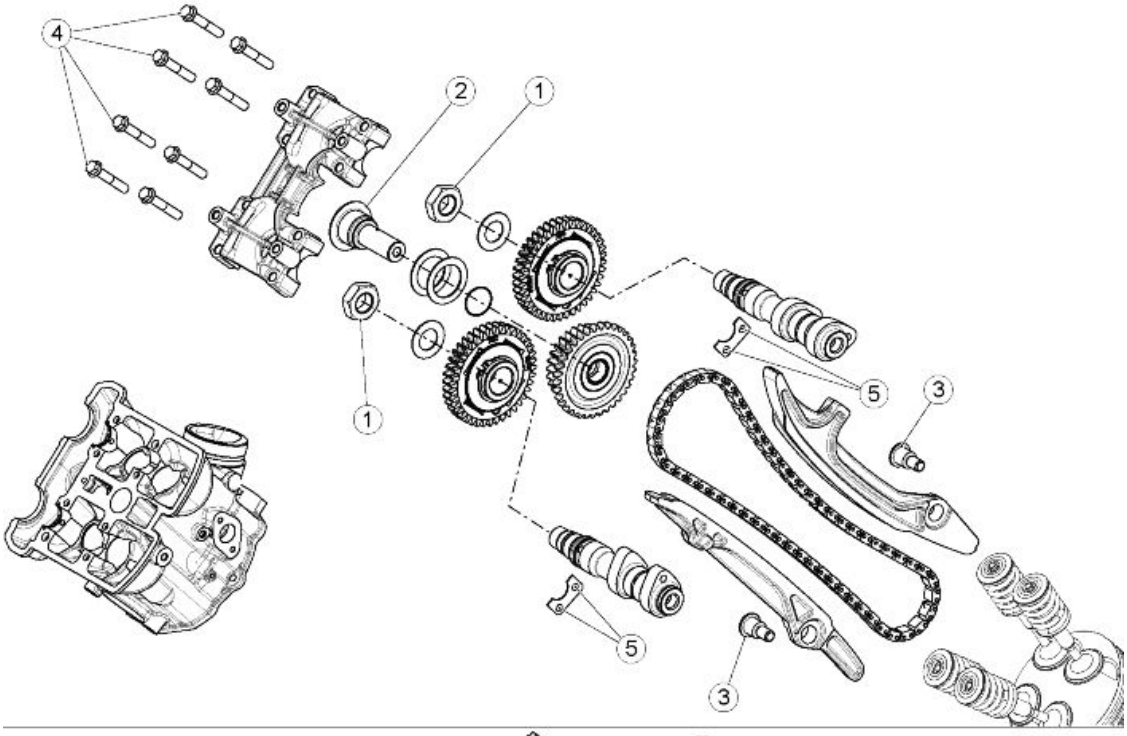
Installing the overhead camshaft

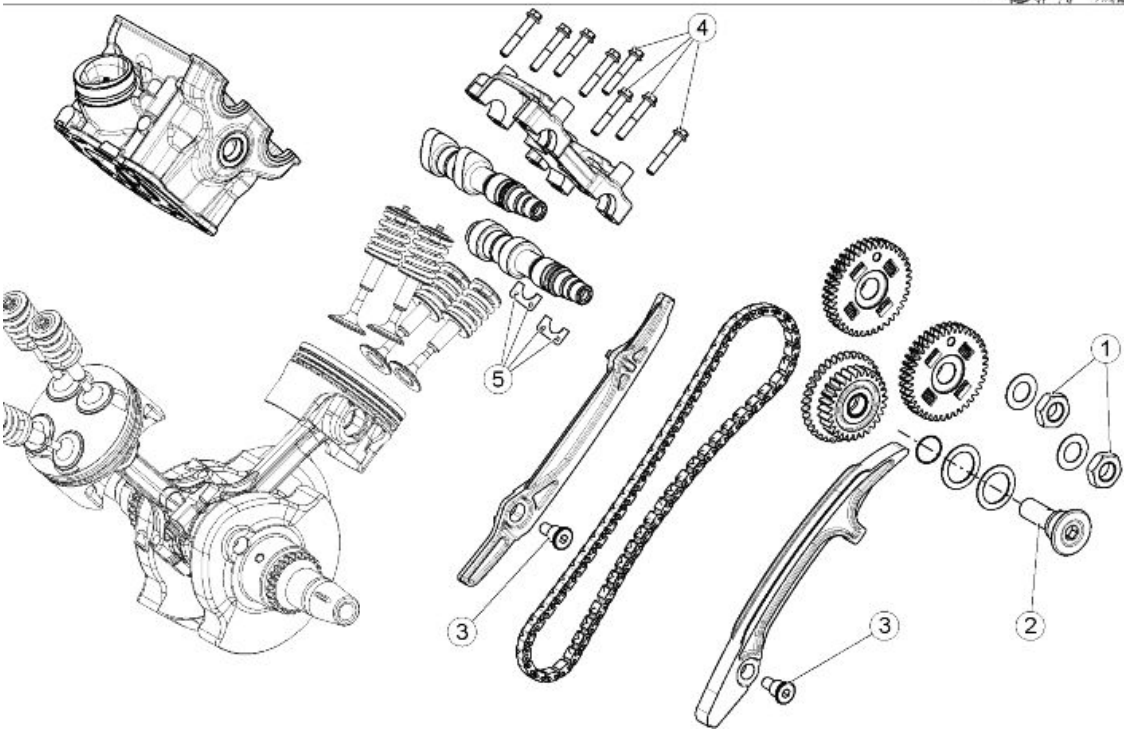
The camshaft refitting procedure is described in the "Timing" section.

See also

Timing

Timing





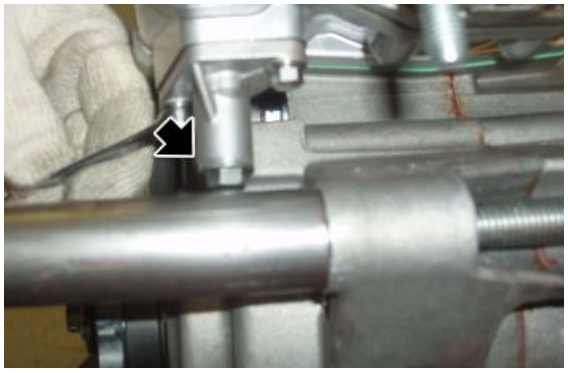
TIMING SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Camshaft gear fastener nut - pre-tightening	M15x1	4	30 Nm (22.13 lbf ft)	-
1	Camshaft gear fastener nut - tightening	M15x1	4	90 Nm (66.38 lbf ft)	-
2	Timing drive gear fastener screw	M24x1.5	2	40 Nm (29.50 lbf ft)	3M SCOTCH GRIP 2353

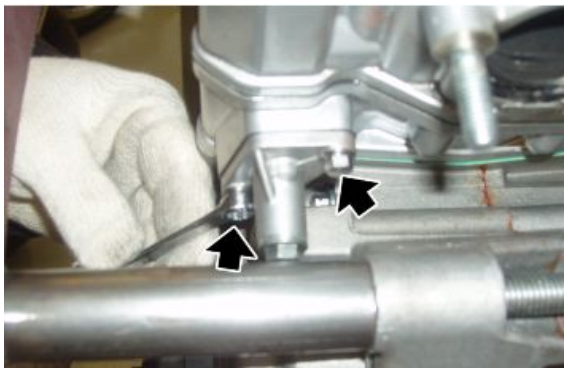
pos.	Description	Type	Quantity	Torque	Notes
3	Special screw for fastening mobile / fixed shoes	M8	4	19 Nm (14.01 lbf ft)	Loctite 242
4	Cam tower / head fastener screws - pre-tightening	M6	16	4.90 - 6.86 Nm (3.61 - 5.06) lbf ft	-
4	Cam tower / head fastener screws - tightening	M6	16	9.81 - 12.75 Nm (7.24 - 9.40 lbf ft)	-
4	Viti fissaggio castelletto / testa - serraggio	Torx	16	12 - 14 Nm (8.85 - 10.32 lbf ft)	-
5	Camshaft retainer plate fastener screw	torx M3	8	3 Nm (2.21 lbf ft)	Loctite 270

Removing the chain tensioner

- Unscrew and remove the screw and collect the washer and the internal spring.



- Unscrew and remove the two screws.
- Remove the chain tensioner and collect the gasket.



Chain removal

- Remove the chain tensioner.
- Remove the main pinion.
- Remove the movable chain slider and release the fixed chain slider from the clamp.
- Unscrew and remove the pin of the timing chain intermediate gear paying attention not to damage the O-ring.
- Collect the washer.

- Remove the timing chain intermediate gear.

- Slide off the timing chain from the crankshaft.

NOTE

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

See also

Removing the chain sliders
Removing the chain tensioner

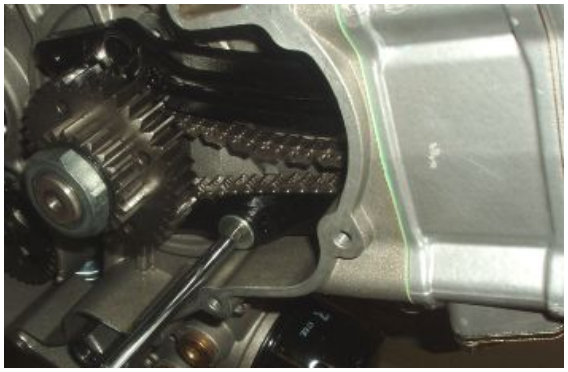
Removing the chain sliders

- Remove the chain tensioner and the camshafts from the corresponding head.

FRONT HEAD

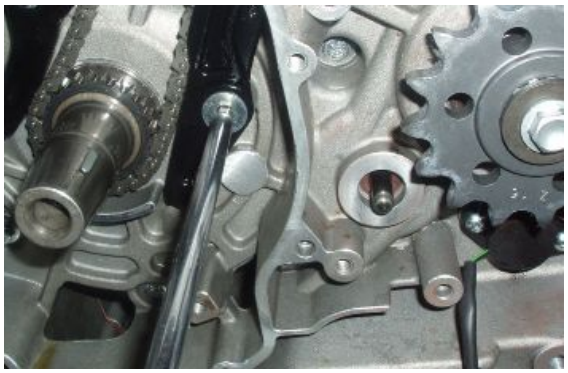
- First remove the clutch cover in order to remove the chain sliders from the front head.
- Unscrew and remove the movable chain tensioner slider screw.
- Slide it off from the head to remove it.

- Unscrew and remove the fixed chain tensioner slider screw.
- First remove the head in order to remove it.

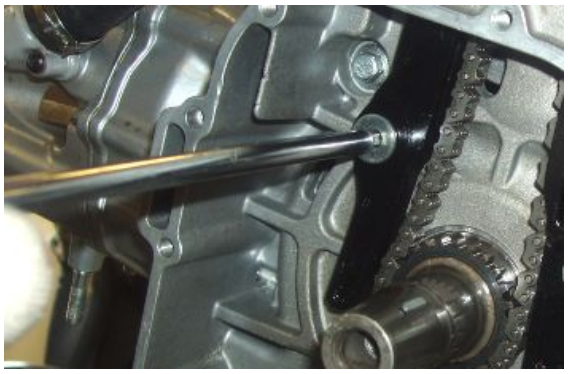


REAR HEAD

- First remove the flywheel in order to remove the chain sliders from the front head.
- Unscrew and remove the movable chain tensioner slider screw.
- Slide it off from the head to remove it.



- Unscrew and remove the fixed chain tensioner slider screw.
- First remove the head in order to remove it.



See also

Removing the chain tensioner
Removing the head cover

Magneto flywheel removal

Checking the chain

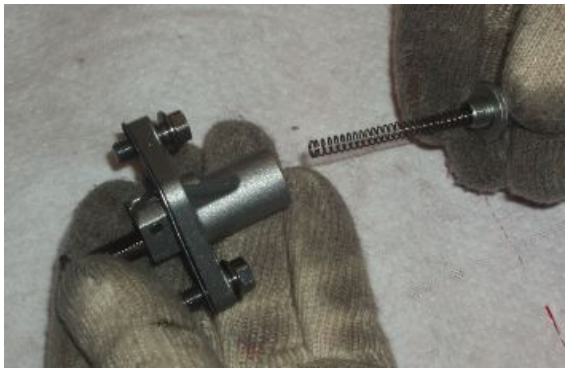
Check the timing chain for damage or stiffness while moving. If required, replace both the timing chain and the camshaft sprocket wheels.

Check the timing chain guide for damage. If necessary, replace the parts.

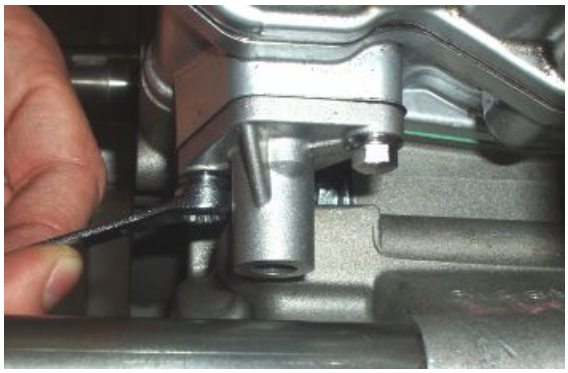
Installing the chain tensioner

Refit the removed timing system chain tensioner on the cylinder - head:

- Fit the timing chain on the crankshaft and on the intermediate gear.
- Remove the screw and collect the washer and the spring.



- Fit the chain tensioner body on the cylinder and insert a new paper gasket.
- Tighten the two screws to the prescribed torque.



- Insert the spring and tighten the screw together with the washer.

Cam timing

Timing

- Rotate the crankshaft until the front cylinder piston reaches the top dead centre.
- Lock the crankshaft with the specific special tool

Specific tooling

020720Y Timing tool

If necessary, remove the timing system gears from the camshafts:

- Place the camshaft with the timing system gear on a vice and protect the cams of the camshaft adequately.
- Unscrew and remove the nut.

ANTICLOCKWISE NUT FOR BOTH REAR CYLINDER SHAFTS, AN ANTICLOCKWISE ARROW HAS BEEN PUNCHED ON IT.

- Collect the washer.
- Remove the timing system gear from the camshaft.

- Clean gears surfaces (camshaft cone and gear cone) with: "System MC 217 spray metal cleaner".
- Pre-fit the gear on the camshaft, so that it can turn freely.
- Place the two camshafts in the head seats and align the two camshaft holes with the head holes.

- Align the clearance recovery gear to the main timing system gear using the specific tool.

Specific tooling

020718Y Camshaft gear alignment pin

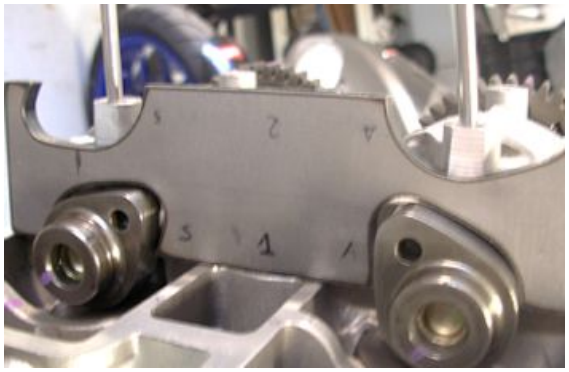
- Using the specific jig, check the correct position of the cams.

NOTE

USE OF THE JIG: THIS TOOL IS PLACED ON THE CAMS WITHOUT THE CAM TOWER, USING THE PROFILE MARKED WITH THE NUMBER OF THE CYLINDER BEING USED, WITH THE MARKINGS FACING THE FLYWHEEL SIDE.

NOTE

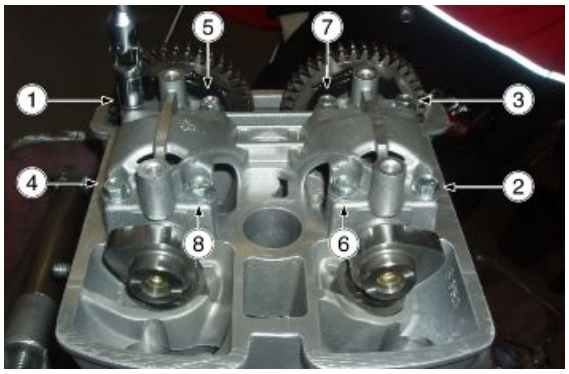
THE JIG IS NOT A TOOL DESIGNED FOR TIMING BUT FOR IDENTIFYING THE CORRECT DIRECTION FOR CAMSHAFT FITTING (THE SHAFTS MAY BE FITTED ROTATED BY 180° WITH REFERENCE TO THE CORRECT POSITION).



Specific tooling

020723Y Jig for timing overhead camshafts

- Place the cam tower.
- Pre-tighten the eight screws in the sequence indicated, to the prescribed torque.
- Tighten the eight screws in the sequence indicated, to the prescribed torque.
- Carry out camshaft timing with the appropriate dowels.



Specific tooling

020719Y Timing pin

Locking torques (N*m)

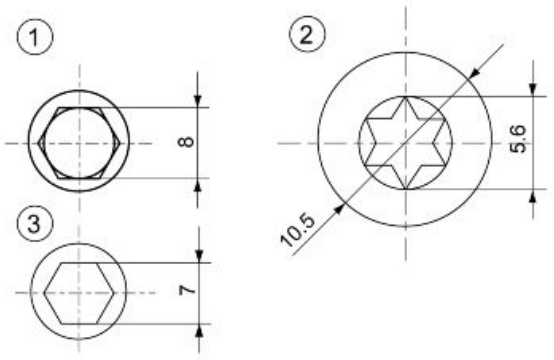
Cam tower / head fixing screws - M6 (16) **Pre-tightening: (4.90 - 6.86) Nm ((3.61 - 5.06) lb ft) Tightening: (9.81 - 12.75) Nm ((7.24 - 9.40) lb ft)**

CAUTION

PAY ATTENTION TO THE SCREW FIXING TYPE OF THE VALVE CAM TOWER,
THREE DIFFERENT TYPES OF SCREWS CAN BE FOUND.

- HEXAGONAL HEAD WITH 8 MM (0.31 in) SOCKET (1).
- HEAD WITH TORX MARK (2).
- FLANGED HEXAGONAL HEAD WITH 7 MM (0.27 in) SOCKET (3).

FOR THIS LAST TYPE, THE TIGHTENING TORQUE GOES TO 12-14 Nm (8.85-10.32 lb ft). THE PRE-TIGHTENING IS THE SAME. THE SCREWS AND CAM TOWER CANNOT BE INTERCHANGED WITH THE PREVIOUS ONES.



CAUTION

INSTALL THE CAMSHAFT TIGHTENING NUTS WITH THE MARK FACING UP.

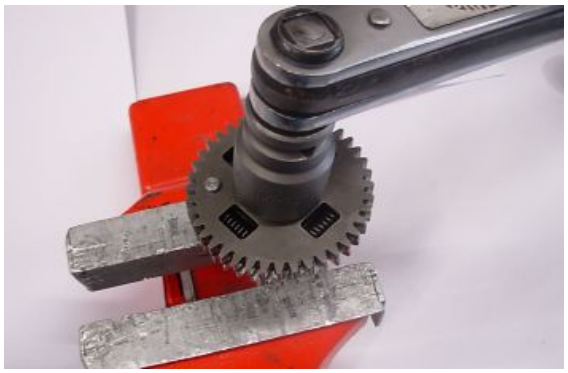
- Pre-tighten the gear nut on the camshaft.

REFIT THE NUT WITH THE MACHINED SURFACE FACING THE GEAR (THE MATERIAL ACRONYM SHOULD BE VISIBLE).

Locking torques (N*m)

Nut fixing camshaft gears (pre-tightening) - M15x1 (4) 30 Nm (22.13 lb ft)

- Remove the camshaft, lock it on a vice with aluminium jaws, then tighten it to the prescribed torque.



DO NOT TIGHTEN THE CAMSHAFT GEAR NUT TO THE ULTIMATE TIGHTENING TORQUE WITH THE SHAFT MOUNTED ON THE CYLINDER.
THIS OPERATION WOULD IRRETRIEVABLY DAMAGE THE HEAD.

Locking torques (N*m)

Nut fixing camshaft gears - M15x1 (4) 90 Nm (66.38 lb ft)

- Remove the gear alignment tool.

Specific tooling

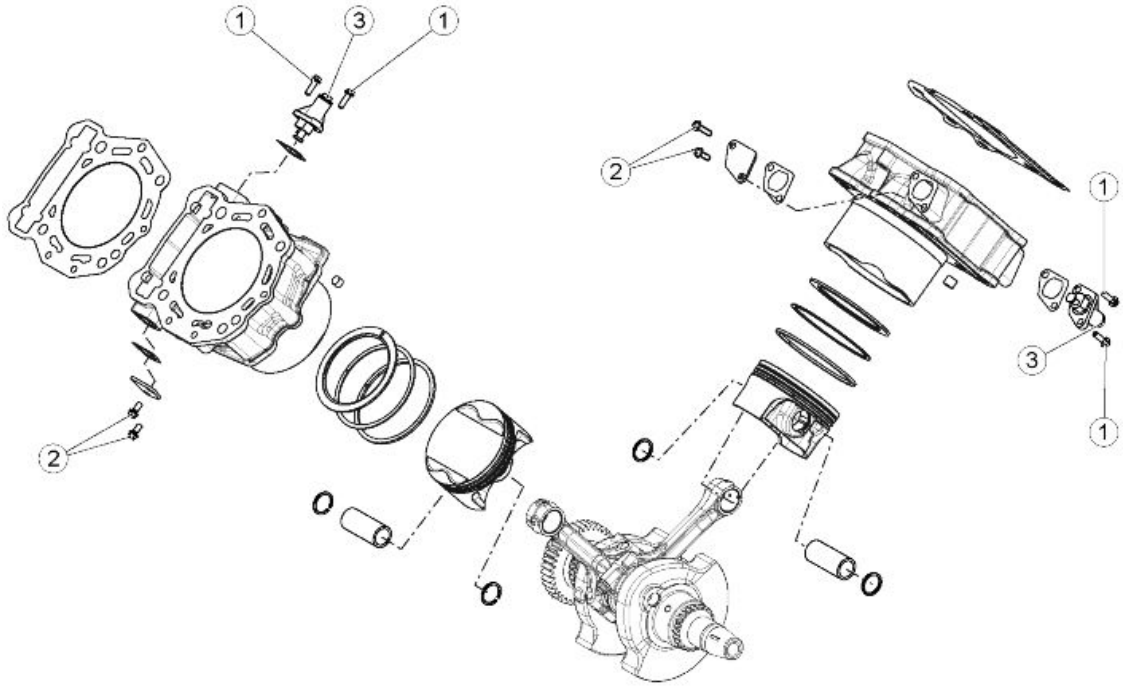
020718Y Camshaft gear alignment pin

- Release the crankshaft from the specific special tool.
- Rotate the crankshaft in the riding direction until the rear cylinder piston reaches the top dead centre.
- Lock the crankshaft with the specific special tool.
- Carry out the timing operations performed for the front cylinder.

Specific tooling

020720Y Timing tool

Cylinder-piston assembly

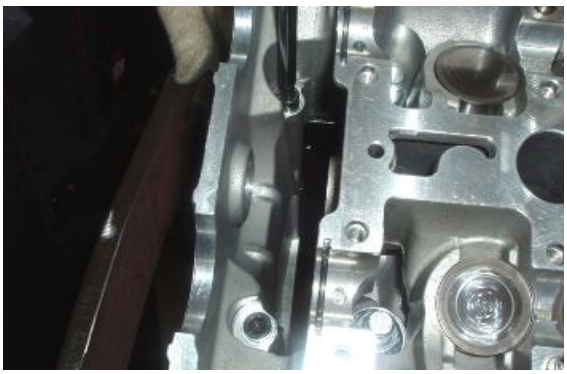


CYLINDER

pos.	Description	Type	Quantity	Torque	Notes
1	Chain tensioner fastener screw	M6	4	13 Nm (9.59 lb ft)	-
2	Cylinder plate fastener screw	M6	4	7.84-9.81 Nm (5.78-7.23 lb ft)	-
3	Chain tensioner adjustment screw	M6	2	5.50 Nm (4.06 lb ft)	-

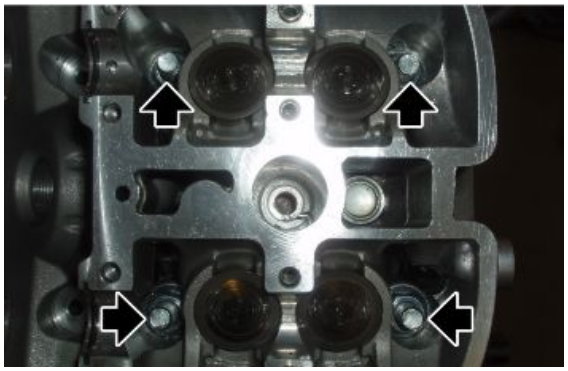
Removing the cylinder

- Remove the timing chain.
- Unscrew and remove the two head fastener screws located in the timing chain compartment.



- Unscrew and remove the outer screw.

- Unscrew and remove the four nuts, proceeding in stages and in a diagonal pattern.
- Ease the cylinder head assembly off the stud bolts.
- Remove the three nuts fastening the cylinder head on the intake and exhaust sides.



- Remove the gasket between the cylinder and the crankcase.

See also

Chain removal

Disassembling the piston

- Remove the head and cylinder.
- Take out the pin locking ring.

- Lock the connecting rod using the specific tool.
- Slide off the pin and remove the piston.

Specific tooling

020716Y Connecting rod locking

- Lock the connecting rod using circlips.

FOR SAFETY REASONS COVER THE CRANKCASE WITH A CLEAN CLOTH SO THAT THE SEEGER RINGS DO NOT FALL INTO THE CRANKCASE.

- Remove the top ring, the intermediate ring and the three oil scraper rings.

See also

Removing the cylinder head
Removing the cylinder

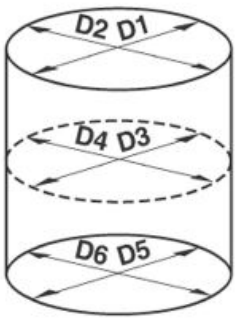
Checking the cylinder

- All seal surfaces must be clean and flat.
- Make sure all threads are in proper conditions.
- Check cylinder sliding surface for signs of friction and scratches. Also check the seal surfaces for damages.

CAUTION

IF THE GROOVES ON THE CYLINDER LINER ARE EVIDENT, REPLACE THE CYLINDER AND THE PISTON.

- Clean off lime scales on the cylinder cooling slots.
- Measure the cylinder bore at a distance of 10 - 43 - 90 mm (0.39 - 1.69 - 3.54 in) from the head coupling surface; the highest value should be considered to estimate wear limits.



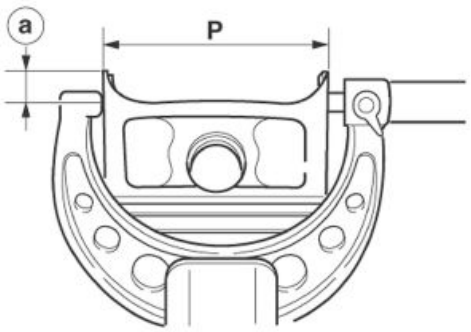
Cylinder bore "C": 92.000 mm (3.6220 - in) C= D1 or D2 max

Cylindricity tolerance: 0.020 mm (0.00079 in)

Replace the cylinder, the piston and the piston ring all together if not complying with specifications.

Checking the piston

- Measure the piston skirt diameter "P" with a micrometer (a=10 mm (0.39 in) from the piston lower border).
- Calculate the clearance between piston and cylinder as follows:



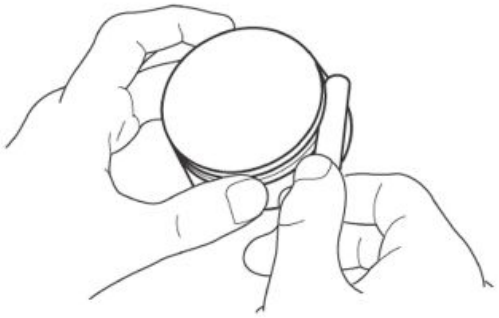
Piston - cylinder clearance C = C - P

Piston - cylinder clearance: 0.050 - 0.064 mm (0.00197 - 0.00252 in) Limit: 0.100 mm (0.00039 in)

- Replace the cylinder, the piston and the piston ring all together if not complying with specifications.

PISTON RINGS

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



Piston ring side clearance:

Top ring (1st slot): 0.030 - 0.065 mm (0.0012 - 0.0026 in)

Intermediate ring (2nd slot): 0.020 - 0.055 mm (0.0008 - 0.0022 in)

Oil scraper ring (3rd slot): 0.010 - 0.045 mm (0.0004 - 0.0018 in)

- Fit the piston ring to the cylinder.
- Level the installed piston ring with the piston crown.

- Measure piston ring port and replace it if not complying with specifications.

CAUTION

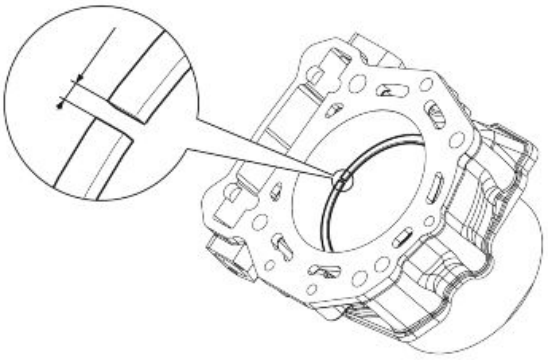
IT IS NOT POSSIBLE TO MEASURE THE GAP OF THE OIL SCRAPER RING END: IF CLEARANCE IS EXCESSIVE, REPLACE THE THREE PISTON RINGS.

Piston ring end gap:

Top ring: 0.25 - 0.40 mm (0.0079 - 0.0157 in)

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

Oil scraper ring: 0.20 - 0.70 mm (0.0079 - 0.0276 in)



PIN

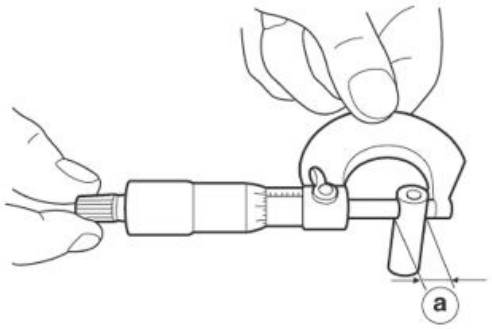
- Clean off combustion residues from the piston crown and from the area above the top ring.
- Check for cracks on the piston and for compression on the piston sliding surface (seizing); Replace the piston if required.

CAUTION

SMALL STRIATIONS ON THE PISTON LINER ARE ADMISSIBLE.

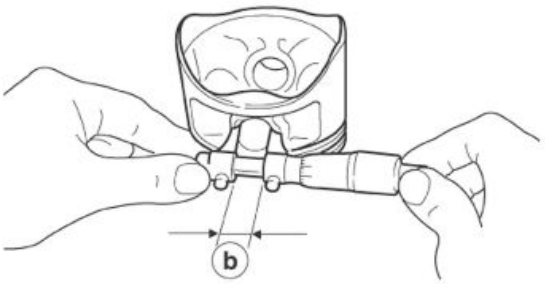
- Measure the pin outside diameter (a) and if not complying with specifications, replace the pin.

Pin outside diameter: 22.00 - 21.97 mm (0.8661 - 0.8650 in) Limit: 21.96 mm (0.8646 in)



- Measure the pin housing diameter (b) and replace the piston if not complying with specifications.

Pin housing diameter (b): 22.010 - 22.015 mm (0.8665 - 0.8667 in)



- Calculate the clearance between pin and pin hole and, if not complying with specifications, replace both pin and piston.

Pin - piston clearance: C = b - a

0.010 - 0.045 mm (0.0004 - 0.0018 in)

Limit: 0.060 mm (0.0024 in)

CAUTION

AD OGNI TIPO DI CILINDRO, IN ALLUMINIO O IN GHISA, DEVE ESSERE ACCOPPIATO L'APPOSITO PISTONE.

CYLINDER - PISTON COUPLING

Specification	Desc./Quantity
Piston - cylinder coupling Type A	Cylinder: 91.990 - 91.977 mm (3.6216 - 3.6219 in) Piston: 91.933 - 91.940 mm (3.6217 - 3.6197 in)
Piston - cylinder coupling Type B	Cylinder: 91.997 - 92.004 mm (3.6219 - 3.6222 in) Piston: 91.940 - 91.947 mm (3.6197 - 3.6199 in)
Piston - cylinder coupling Type C	Cylinder: 92.004 - 92.011 mm (3.6222 - 3.6225 in) Piston: 91.947 - 91.954 mm (3.6199 - 3.6202 in)
Piston - cylinder coupling Type D	Cylinder: 92.011 - 92.018 mm (3.6225 - 3.6227 in) Piston: 91.954 - 91.961 mm (3.6202 - 3.6205 in)
Fitting clearance	0.050 - 0.064 mm (0.00197 - 0.00252 in)

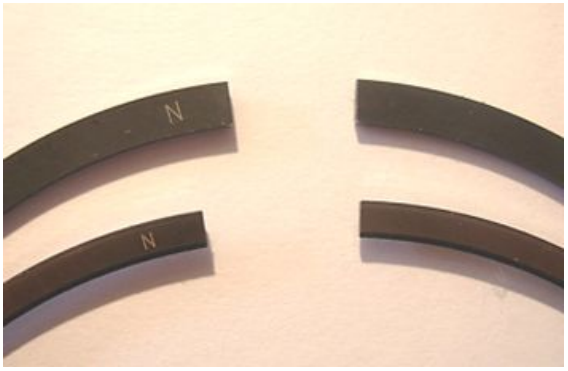
Sui pistoni accoppiabili con i cilindri in ghisa è riportata l'indicazione "GH".

Fitting the piston

An arrow stamped on the piston crown indicates the exhaust side.

- When refitting the piston rings on the piston, the arrow stamped inside the piston must be turned towards the operator.

The piston rings are different and must be installed with the "N" marking at the top.



- Fit the lower oil scraper ring on the piston with the gap turned towards the exhaust side.

- Install the remaining piston rings on the piston, offsetting the gaps in the rings by 90° relative to each other.
- Fit a new retainer ring on the piston.
- Fit the piston on the connecting rod and install the gudgeon pin.

Specific tooling

020470Y Pin snap ring fitting tool

- Fit a new retainer ring on the piston to fasten the gudgeon pin.

Specific tooling

020470Y Pin snap ring fitting tool

Installing the cylinder

Fit the stud bolts, if previously removed.

CAUTION

THE STUD BOLTS SHOULD BE FITTED SO THAT THEY PROTRUDE.
DISTRIBUTE Loctite 270 (high-strength) ON THE THREAD AND SCREW THE STUD BOLT ON THE CRANKCASE UNTIL THEY PROTRUDE BY 137 mm (5.39 in), THEN MAKE SURE THE Loctite HAS SET.

- Insert a new cylinder base gasket, it should be as thick as the gasket previously removed: 0.40 - 0.50 - 0.60 mm (0.0157 - 0.0197 - 0.0236 in).
- The silicone side should be facing the crankcase.

CAUTION

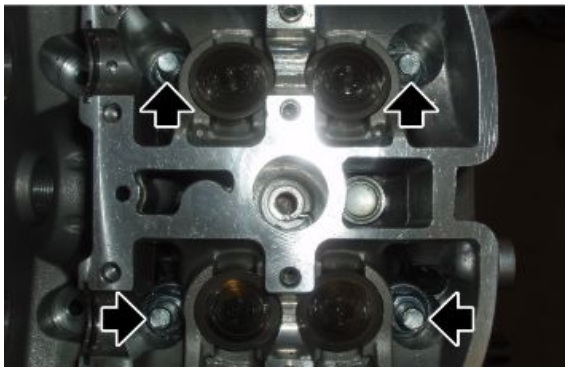
IF THE ORIGINAL GASKET THICKNESS CANNOT BE CHECKED OR SHOULD THE CYLINDER BE REPLACED, REFER TO THE "BASE GASKET SELECTION" SECTION.

- Before fitting the cylinder, place the chain sliders and the timing chain on the crankshaft; fit the timing chain on the crankshaft from the base side.

NOTE

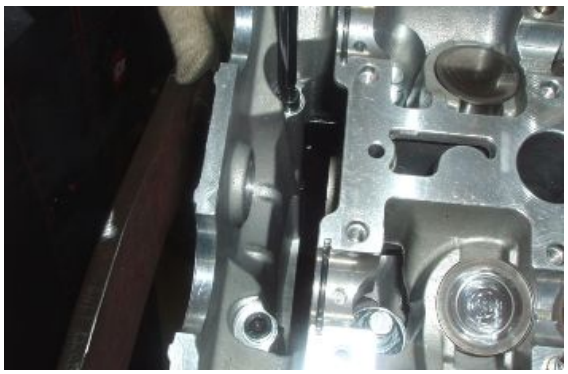
BEFORE FITTING THE CYLINDER, CAREFULLY BLOW AIR INTO THE LUBRICATION DUCT AND LUBRICATE THE CYLINDER LINER.

- Insert the cylinder-head unit on the stud bolts.
- Working in a diagonal sequence and in stages, screw the four nuts once the stud bolt threads have been greased.

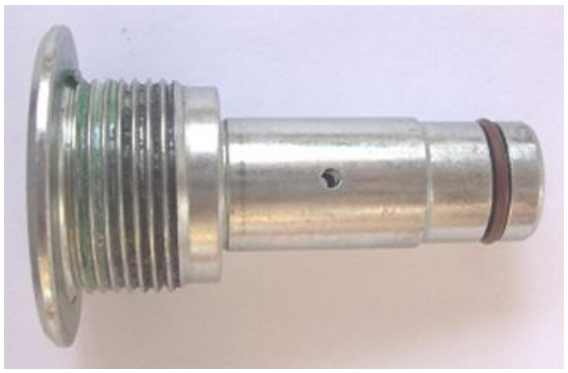


- Screw the screw located outside the cylinder.

- Tighten the three screws on the intake and discharge sides.
- Screw the two head fixing screws located inside the timing chain compartment.



- Check that the intermediate gear pin lubrication holes are clean.



- With a hook, hold the timing chain.
- Fit the timing chain on the intermediate gear.
- Slide in the pin together with a new O-Ring and a washer.

- Check that the axial clearance between the pin and the gear is between 0.30 and 0.60 mm (0.0118 - 0.0236 in).

- Tighten the intermediate gear pin once Loctite residues are thoroughly removed and a high-strength threadlock is applied on the thread.
- Make sure that both timing chain sliders are correctly fitted.
- Refit the overhead camshafts following the procedure described in the "Timing" section.

See also

Selecting the base gasket

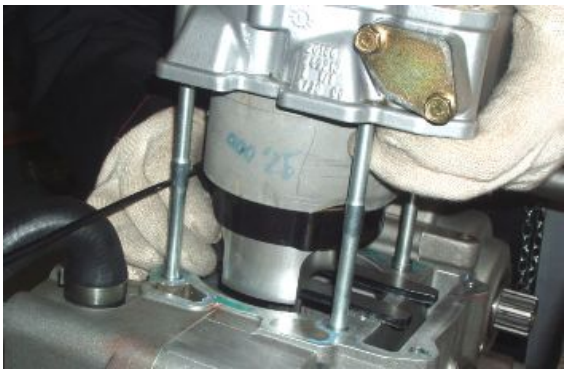
Selecting the base gasket

- Place the specific special tool on the piston, which should have sealing rings and be fitted on the connecting rod.
- Lock the special tool with the clamp.

Specific tooling

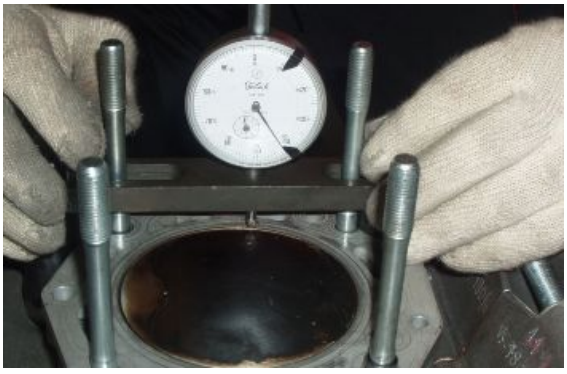
AP8140302 tool for sealing ring fitting

- Temporarily, fit the piston to the cylinder, without base or head gasket.
- Remove the clamp from the sealing ring locking tool.
- Remove the special tool for locking the connecting rod.



- Fit a dial gauge on the specific tool.
- Set the dial gauge to zero on a reference surface with a medium preload, e.g. 5 mm (0.2 in). Keeping the zero setting, fit the tool on the cylinder and lock it with two nuts (10 Nm - 7.38 lb ft) as shown in the figure.

Specific tooling



020714Y Dial gauge mounting

- Rotate the crankshaft up to the TDC (the reversal point of the dial gauge rotation).
- Lock the crankshaft at TDC using the specific tool.
- Calculate the difference between the two measurements: using the chart below, identify the thickness of the cylinder base gasket to be used upon refitting. By correctly identifying the cylinder base gasket thickness, an adequate compression ratio can be maintained
- Remove the specific tool and the cylinder.

Specific tooling

020720Y Timing tool

BASE GASKET

Specification	Desc./Quantity
Measured protrusion -0.10 / + 0.0 mm (- 0.0039 / 0.0000 in)	Gasket 0.4 mm (0.0157 in)
Measured protrusion 0.05 / 0.10 mm (0.0020 / 0.0039 in)	Gasket 0.5 mm (0.0197 in)
Measured protrusion 0.15 / 0.30 mm (0.0059 / 0.0118 in)	Gasket 0.6 mm (0.0236 in)

Installing the cylinder head

- Place the fixed chain tensioner slider on the cylinder timing chain compartment, opposite to the chain tensioner.

- Fit a new gasket between the cylinder and the head.
- Couple the cylinder and the head.

- Screw without tightening the two screws on the outlet side.

- Screw without tightening the screw on the intake side.
- Tighten the cylinder-head fixing screws to the prescribed torque.
- Place the cylinder-head unit on the crankcase stud bolts.

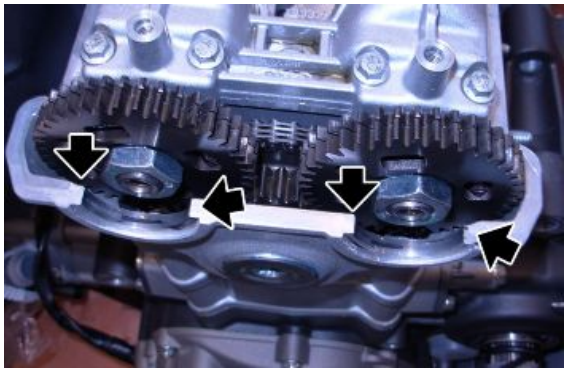
Installing the head cover

CAUTION

BEFORE REFITTING HEAD COVERS, CLEAN HEAD AND COVER SURFACES CAREFULLY.

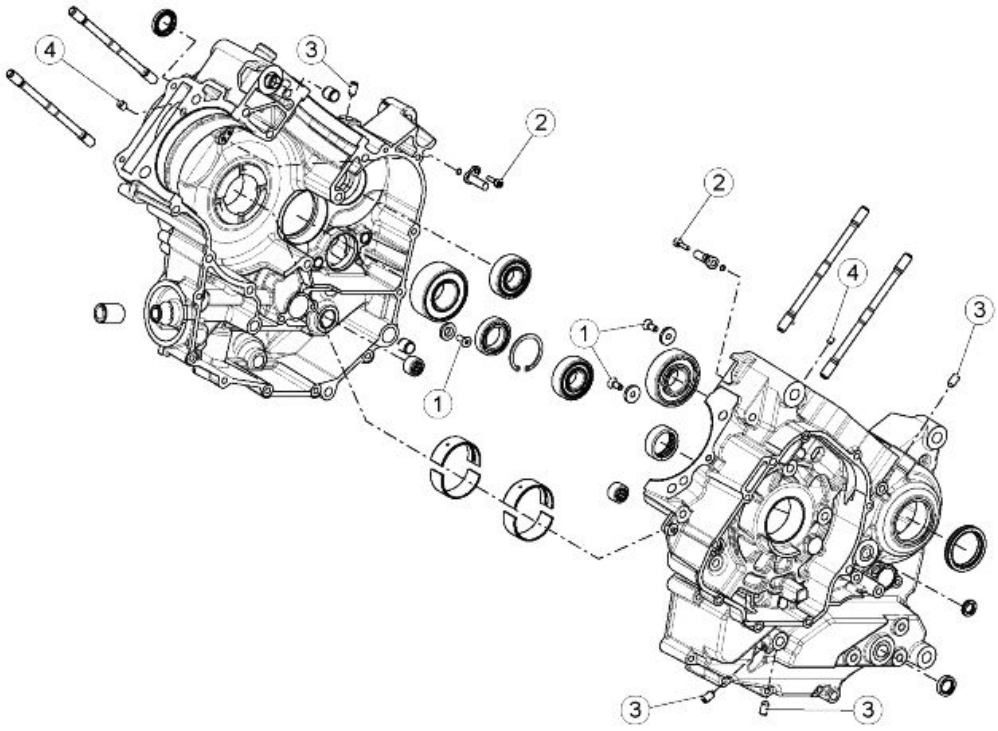
- Apply THREEBOND on the head cover perimeter along the gasket housing.

- Apply THREEBOND on the head in the areas indicated in the figure.



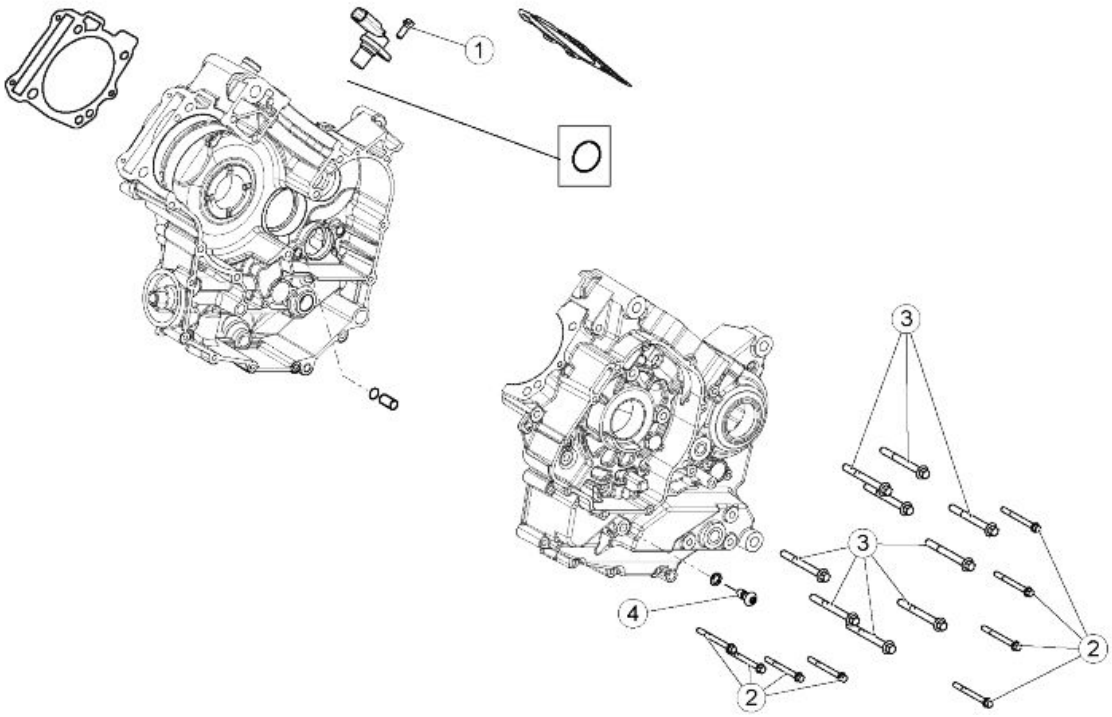
- For the remaining operations, follow the removal operations but in reverse order.

Crankcase - crankshaft



CRANKCASE 1

pos.	Description	Type	Quantity	Torque	Notes
1	Bearing retainer fastener screw	M6	3	10 Nm (7.38 lbf ft)	Loctite 270
2	Piston oil jet fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 242
3	Tapered plug for crankshaft main bearing lubrication	M8x1	4	15 Nm (11.06 lbf ft)	-
4	Calibrated Brass dowel fixed to complete crankcase	M8	2	5.50 Nm (4.06 lbf ft)	-

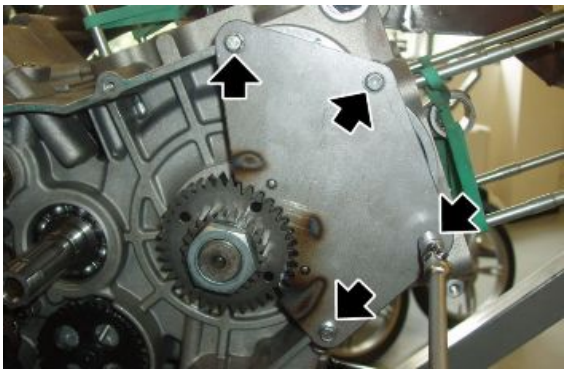


CRANKCASE 2

pos.	Description	Type	Quantity	Torque	Notes
1	Engine speed sensor fixing screw	M6	1	13 Nm (9.59 lbf ft)	Loctite 243
2	Screw fastening flywheel side / clutch side crankcase halves	M6	8	13 Nm (9.59 lbf ft)	-
3	Screw fastening flywheel side / clutch side crankcase halves	M8	9	29 Nm (21.39 lbf ft)	-
4	Special calibrated screw for gearbox lubrication	-	1	18 Nm (13.28 lbf ft)	-

Splitting the crankcase halves

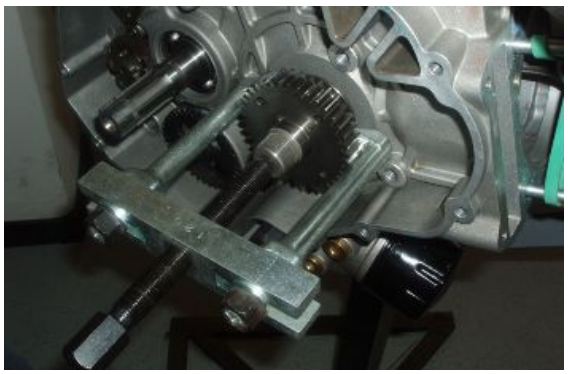
- Fit the special tool, tightly fastening the four screws securing the tool onto the crankcase.
- Unscrew and remove the crankshaft fastener nut anticlockwise using the special tool, retrieving the washer.



Specific tooling

020711Y Engine pinion locking

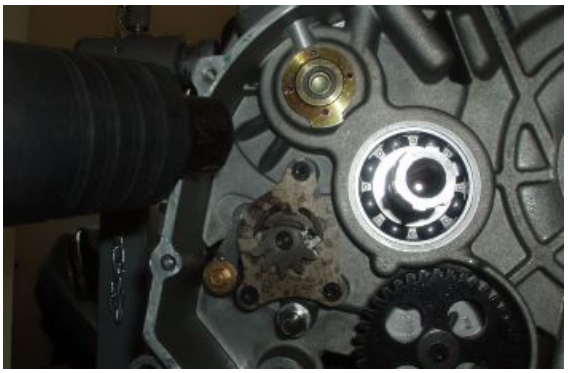
- Use a commercially available extractor to remove the crankshaft gear.



- Remove the gearbox control rod, retrieving the washer.

- Unscrew and remove the screw fixing the speed sensor.
- Remove the speed sensor with caution.

- Heat the screws of the gearbox selector mounting plate.



- Unscrew and remove the three screws fastening the gearbox selector mounting plate.

- Remove the plate complete with selector

- Unscrew the two neutral sensor fastener screws.

- Remove the neutral sensor.

- Retrieve the sensor contact complete with spring.

- If the pinion has been removed, refit, fastening with the special tool.

Specific tooling

9100896 Clutch housing locking tool

The tone wheel is fixed with Loctite threadlock and must therefore be heated with a special hot air gun, taking particular care not to heat excessively.

- Remove the speed sensor tooth with the special tool.

When refitting, fix the tone wheel with strong Loctite threadlock.

Specific tooling

020715Y Tone wheel removal

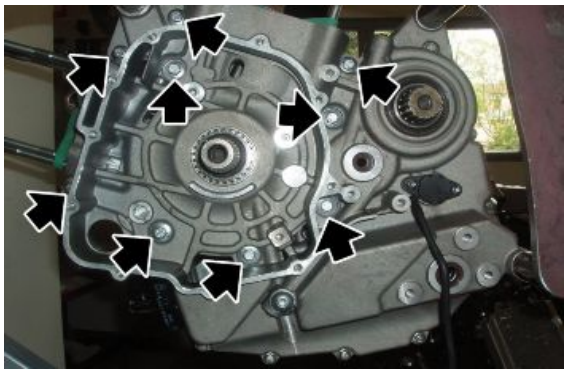
- Unscrew and remove the selector drum fastener screw.

- Remove the selector drum.

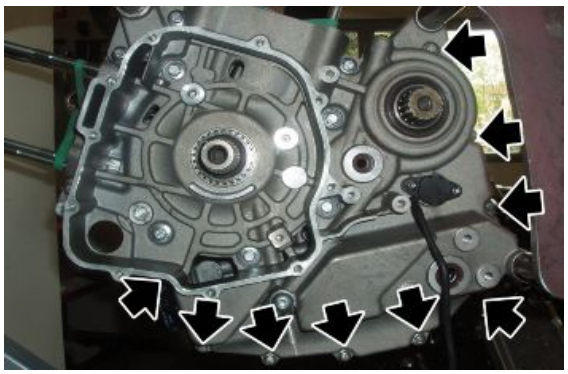
- Remove the pinion.

- Remove the clutch control rod.

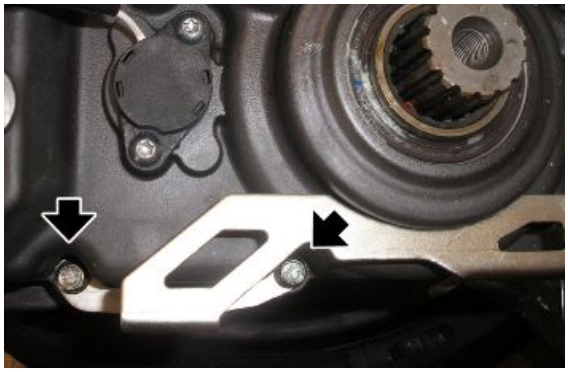
- Working on the left hand side, unscrew and remove the nine M8 crankcase fastener screws.



- Working on the left hand side, unscrew and remove the nine M6 crankcase fastener screws.



- Remove the fuel vapour breather pipe mounting plate.



CAUTION

DURING REASSEMBLY, REMEMBER TO FIT THE FUEL VAPOUR BREATHER PIPE MOUNTING PLATE NEAR THE PINION.

- Rotate the engine and the engine mounting into a horizontal position.

- Unscrew and remove the pin, then re-tighten by one turn to give the crank-case halves clearance and verify tight-ness.

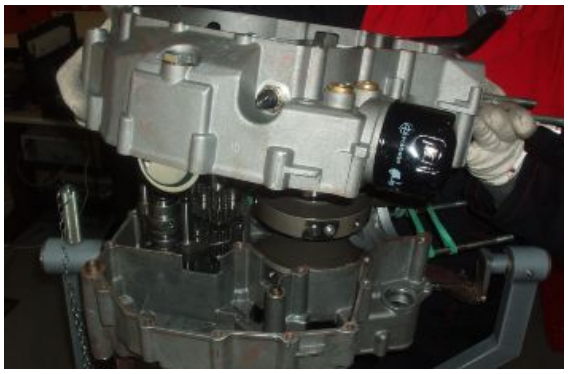
CAUTION

TAKE PARTICULAR CARE TO ENSURE THAT THE ENGINE AND ENGINE MOUNTING ARE STABLE AND ENSURE THAT THE ENGINE IS SECURELY FASTENED TO THE MOUNTING PLATE.

- Remove the two screws fastening the mounting.

- Separate the crankcase halves by giving short taps with a rubber mallet.

- Open the crankcase halves.



- Retighten the two screws to the engine mounting.

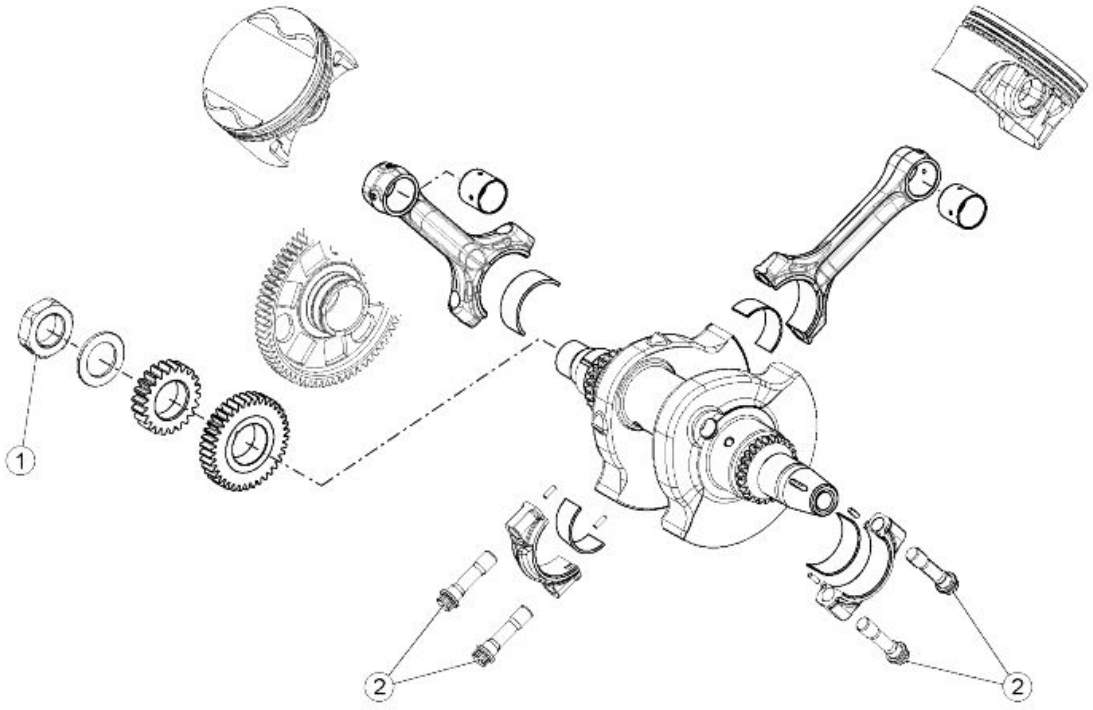
- If necessary, unscrew and remove the two screws fastening the rose pipe.
- Remove the rose pipe.

See also

Removing the cylinder

Magneto flywheel removal

Removing the crankshaft



CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Crankshaft primary gear fastener nut	M24x1.5	1	270 Nm (199.14 lbf ft)	Anticlockwise nut
2	Connecting rod screw	M10	4	15 + 30 Nm (11.06 + 22.13 lbf ft) + 50° ± 2°, final control torque 65 - 78 Nm (47.94 - 57.53 lbf ft)	Lubricate the threads before tightening

- Remove the crankshaft.

See also

Splitting the
crankcase halves

Inspecting the crankcase halves

BEARINGS AND OIL SEAL CHECK

Thoroughly clean the two sections of the crankcase, the ball bearings, the threads of the crankcase fixing screws and the bearing seats with a non-aggressive solvent. Clean the seal surfaces and check that they are not damaged.

CAUTION

TO AVOID DAMAGING BOTH CRANKCASE HALVES PLACE THEM ON A FLAT SURFACE.

Check that both crankcase halves are not cracked or damaged.

Check that all threads are in proper conditions.

Check that all oil seals remaining in their position are not worn or damaged.

Check all ball bearings for clearance, smoothness and potential distortions.

CAUTION

LUBRICATE BALL BEARINGS WITH ENGINE OIL BEFORE FURTHER CHECKING.

If the internal ring does not rotate smoothly and silently or if there is some noise while it turns, it means that the bearing is faulty and must be replaced.

OIL FILTER AND OIL DELIVERY PIPE CHECK

Check the oil filter for damage. If necessary, replace the part.

Clean the oil net with petrol and inspect the net links for potential damage.

CHECK THE ENGINE OIL FILTER O-RING.

LUBRICATION CHECK

- Working on both crankcase halves, remove and thoroughly clean the nozzle that lubricates the piston crown.

REPLACE THE SPRAY NOZZLE O-RING IF NECESSARY.

- Replace the O-ring on the oil passage duct.

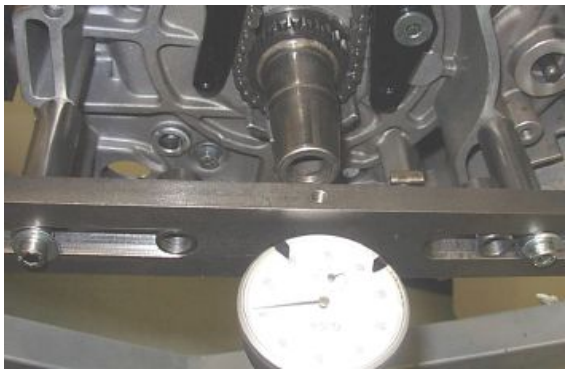
Before refitting

UPON REFITTING THE CRANKSHAFT, GREASE THE SHAFT BUSHING-CONNECTING ROD COUPLING.

Inspecting the crankshaft components

Crankshaft axial clearance check

- The shaft axial clearance on the crankcase should be checked with a comparator mounted on the specific comparator support.
- The clearance should be between 0.1 - 0.4 mm (0.0039 - 0.0157 in).
- If the clearance is beyond tolerance, check the reference surfaces.



Specific tooling

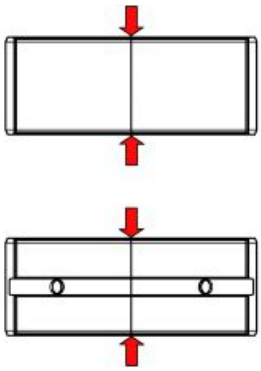
020714Y Dial gauge mounting

Main bearing journal

Removal

- Mark the position of the original semi-bushings on the crankcase.

- To reduce the installation force necessary, score an incision approximately 0.5 mm (0.02 in) deep (without cutting into the steel shell) in each semi-bushing in the area indicated in the figure.



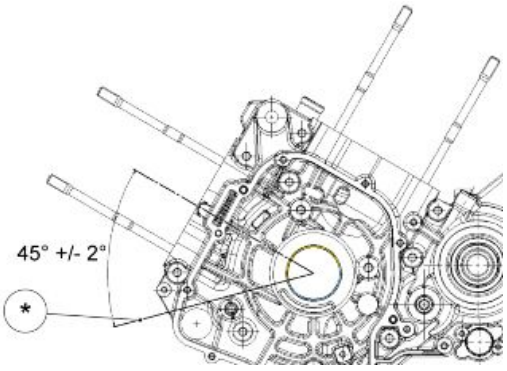
- Remove the bushings with the crankcase cold, using a press and the specific tool and pushing inward from the outside of the crankcase.

Specific tooling

020726Y Extractor for bushings

Installing

- The orientation of the semi-bushings must match the specifications indicated in the drawing as closely as possible.



NOTE

WHEN REPLACING THE SEMI-BUSHINGS ALONE, THE NEW COMPONENTS MUST BE THE SAME COLOUR AS THE REMOVED COMPONENTS. IF THE COLOUR OF THE OLD COMPONENTS IS NO LONGER VISIBLE, USE THE TABLE TO IDENTIFY THE CORRECT COMPONENTS, REFERRING TO THE CRANKCASE AND CRANKSHAFT CLASSES.

Key:

* Semi-bushing joint line.

- Fit the new bushings with the crankcase cold, using a press and the specific tool and pushing outward from the inside of the crankcase, until the punch comes into contact with the crankcase surface.

Specific tooling

020727Y Punch for bushings

Assembling the connecting rod

CAUTION

TO FIT THE CONNECTING RODS, CHECK THE COUPLING TYPES INDICATED IN THE "CRANKCASE- CRANKSHAFT CONNECTING ROD" SECTION, IN THE "CHARACTERISTICS" CHAPTER OF THE WORKSHOP MANUAL.

Installing the crankshaft

- Place the left side crankcase half on the engine support adequately.
- Place the crankshaft on the seat of the crankcase half with caution.

Refitting the crankcase halves

- Fit the strum box, if previously removed.
- Tighten the two strum box fixing screws.

- Turn the engine support into horizontal position.
- Place the left crankcase half on the engine support, fitting it on the engine support pins.

CAUTION

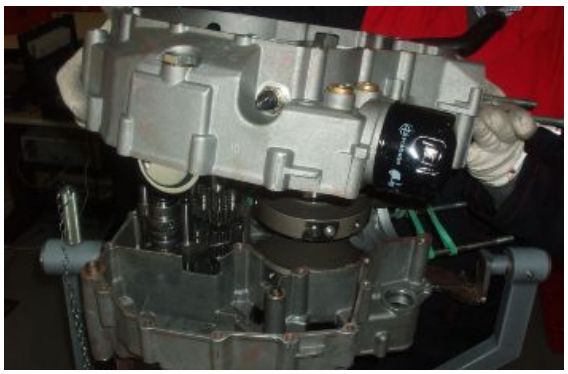
TAKE PARTICULAR CARE TO ENSURE THAT THE ENGINE AND ENGINE MOUNTING ARE STABLE AND ENSURE THAT THE ENGINE IS SECURELY FASTENED TO THE MOUNTING PLATE.

- Fit the complete transmission gears unit.

- Apply black sealing paste (Threebond) on the left crankcase half.

CAUTION

BE CAREFUL NOT TO APPLY THREEBOND IN EXCESS AS IT MAY BLOCK OIL DUCTS THROUGH THE CRANKCASE HALVES.

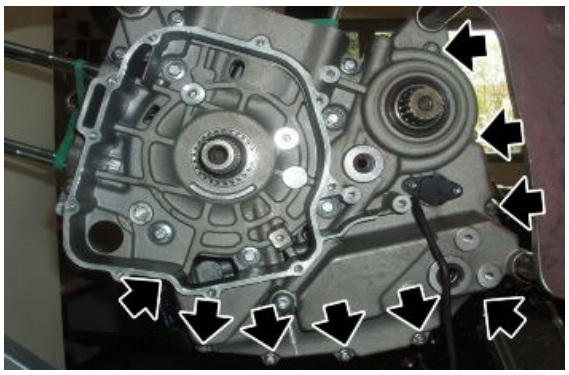


- Place the right crankcase half with the aid of a rubber hammer.

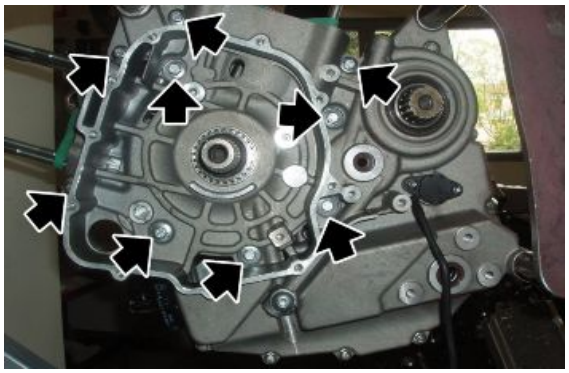
- Tighten the two fixing pins.

- Rotate the engine and the engine support into vertical position.

- Working on the left side, place the nine M6 screws fixing the crankcase.



- Working on the left side, place the nine M8 screws fixing the crankcase.
- Tighten all the crankcase fixing screws, both M6 and M8 type.



- Slide in the clutch control rod.

- Place the pinion.

- Place the gear selector drum and check that it is correctly timed; thrust the desmo drum axially from the fly-wheel side so that the timing roller pro-trudes.

- Tighten the gear selector drum fixing screw.

- Position the tone wheel.

- Tighten the tone wheel with the special tool.

Use Loctite medium-strength for sealing.

Specific tooling

020715Y Tone wheel removal

- Tighten the pinion fixing nut using the special tool.

Specific tooling

9100896 Clutch housing locking tool

- Position the sensor contact together with the spring.

- Place the neutral sensor and lubricate its seat to facilitate refitting.

BE CAREFUL NOT TO DAMAGE THE O-RING WHEN INSERTING THE SENSOR IN ITS POSITION.

- Tighten the two screws fixing the neutral sensor.

- Position the plate together with the selector.

- Tighten the three screws fixing the gear selector plate by applying Loctite medium-strength.

- Place the speed sensor with caution.
- Tighten the speed sensor fixing screw.

- Place the transmission control rod with the washer.

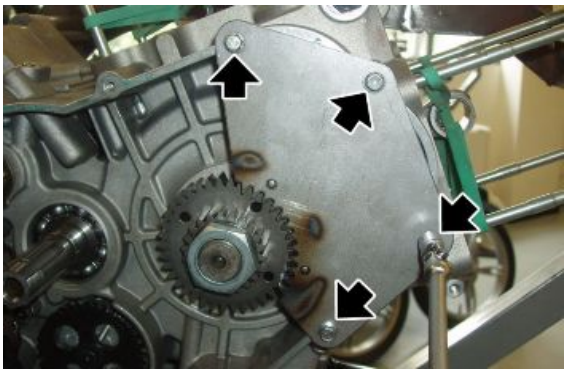
- Remove the grease off the primary pinion tapered pins - crankshaft coupling surfaces .
- Position the crankshaft gear.

- Position the washer and the crankshaft lock-nut.

- Fit the special tool and fix it steadfastly to the crankcase by tightening the four fixing screws on the crankcase.
- Tighten the crankshaft gear lock-nut.

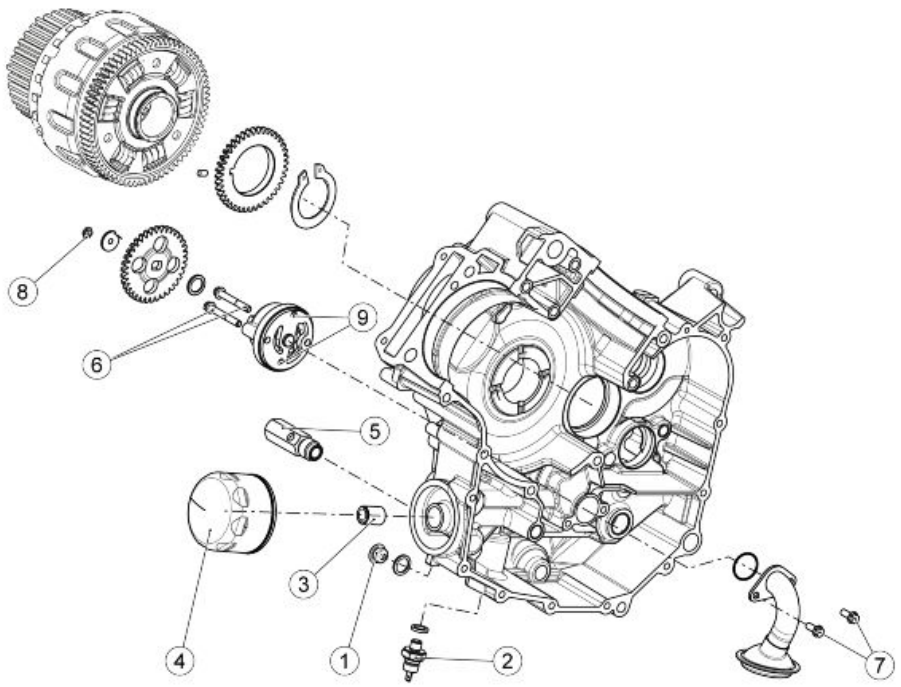
Specific tooling

020711Y Engine pinion locking



Lubrication

Oil pump



OIL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Oil drainage plug	M16x1.5	1	19 Nm (14.01 lbf ft)	-
2	Fastening oil sensor on clutch side crankcase half	-	1	13 Nm (9.59 lbf ft)	-
3	Fastening oil filter union on clutch side crankcase half	-	1	20 Nm (14.75 lbf ft)	-
4	Oil filter	-	1	14 Nm (10.33 lbf ft)	-
5	Oil pressure regulator valve	3/4" Unf 16	1	43 Nm (31.72 lbf ft)	-
6	Oil pump fastener screw	M6	2	5.50 Nm (4.06 lbf ft)	Loctite 242
7	Rose pipe fastener screw	-	2	12 Nm (8.85 lbf ft)	-
8	Complete oil pump gear fastener	-	1	9-11 Nm (6.64-8.11 lbf ft)	-
9	Oil pump cover fastener screw	M3	2	0.80 Nm (0.59 lbf ft)	-

Removing

OLD GENERATION PUMP REMOVAL

- Lock the pump gear with the commercially available hook spanner and undo the screw; then collect the washer.

- Collect the shim washer.

- Undo and remove the two screws fixing the oil pump.

- Remove the entire pump.

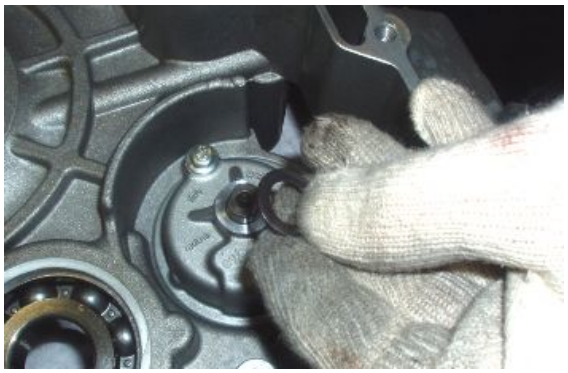
NEW GENERATION PUMP REMOVAL

- Press the raised side of the safety washer using a screwdriver.

- Lock the pump gear with a commercial hook spanner and unscrew the nut, collecting the safety washer.

- Remove the water pump gear.

- Collect the shim washer.



- Undo and remove the two screws fixing the oil pump.

- Remove the entire pump.

Inspection

- Undo and remove the two fixing screws.

- Using a thickness gauge check clearance between rotor and stator and replace the rotor / stator unit if necessary.

clearance between rotor and stator: 0.04 ± 0.10 mm (0.0016 in - 0.0039 in).

- Slide off the shaft with the cover.

- Collect the lock pin from the shaft.

- Remove the oil pump rotor.

- Remove the oil pump stator.

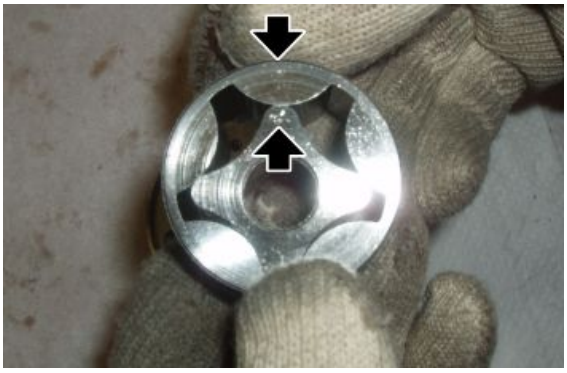
CAUTION

CHECK THAT THE ROTOR AND STATOR ARE NOT DAMAGED (NO EVIDENT ABRASIONS, SCORES OR ANY OTHER MARKS).

Installing

NOTE

PAY ATTENTION TO ALIGN THE REFERENCES ON STATOR AND ROTOR DURING INSTALLATION AND CHECK CLEARANCE WITH A FEELER GAUGE.
IF REQUIRED, REPLACE THE STATOR / ROTOR UNIT.

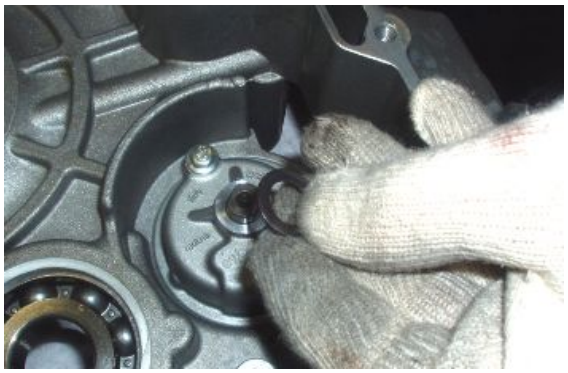


OLD GENERATION PUMP INSTALLATION

- Fit the oil pump in its seat.

- Tighten both oil pump fixing screws.

- Fit the shim washer.



- Fit the oil pump gear and fasten it through appropriate screw with corresponding washer.

- By means of a commercial hook spanner, lock the pump and tighten the screw to the prescribed torque.

NEW GENERATION PUMP INSTALLATION

- Fit the oil pump in its seat.

- Tighten both oil pump fixing screws.

- Fit the shim washer.

- Fit the oil pump gear.

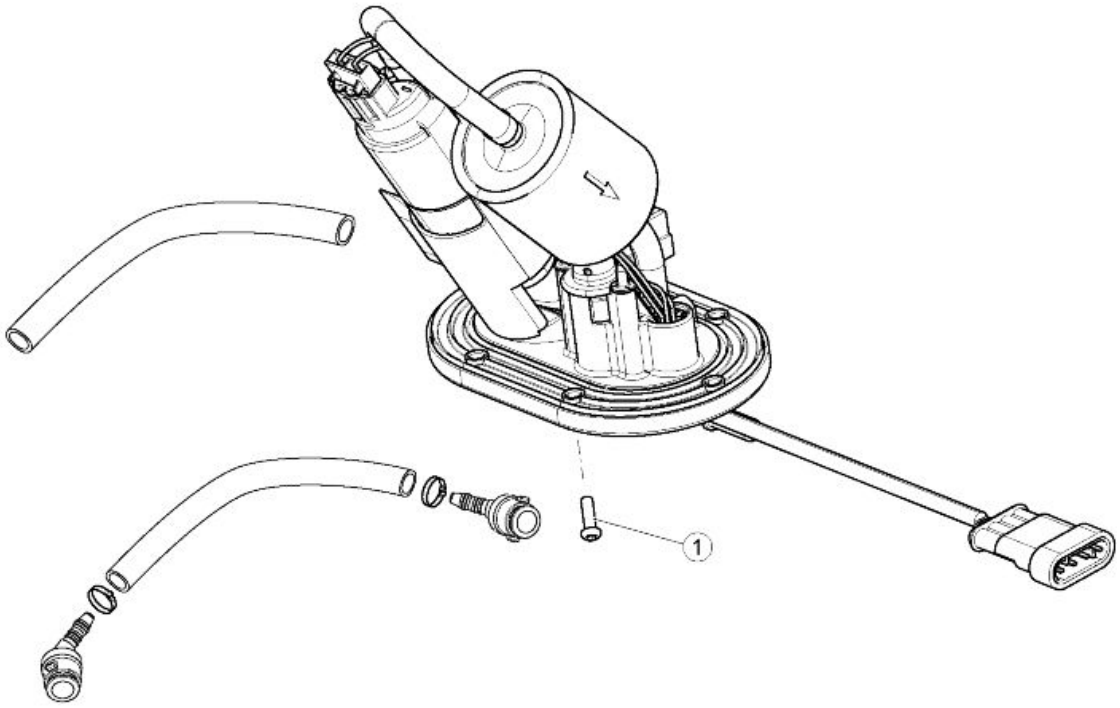
- Fit the safety washer.
- By means of a commercial hook spanner, lock the pump and tighten the nut to the prescribed torque.

- By means of a screwdriver, lift and bend the safety washer opposite the fitting tabs, until it rests on the nut.

INDEX OF TOPICS

POWER SUPPLY	P SUPP

Fuel pump



FUEL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	TEFL screw fastening fuel pump	M5x16	6	6 Nm (4.42 lbf ft)	-

Electrical characteristics:

- Resistance: 0.7 +/- 0.2 Ohm

NAVIGATOR: ELECTRICAL ERRORS

Fuel pump relay control P0230

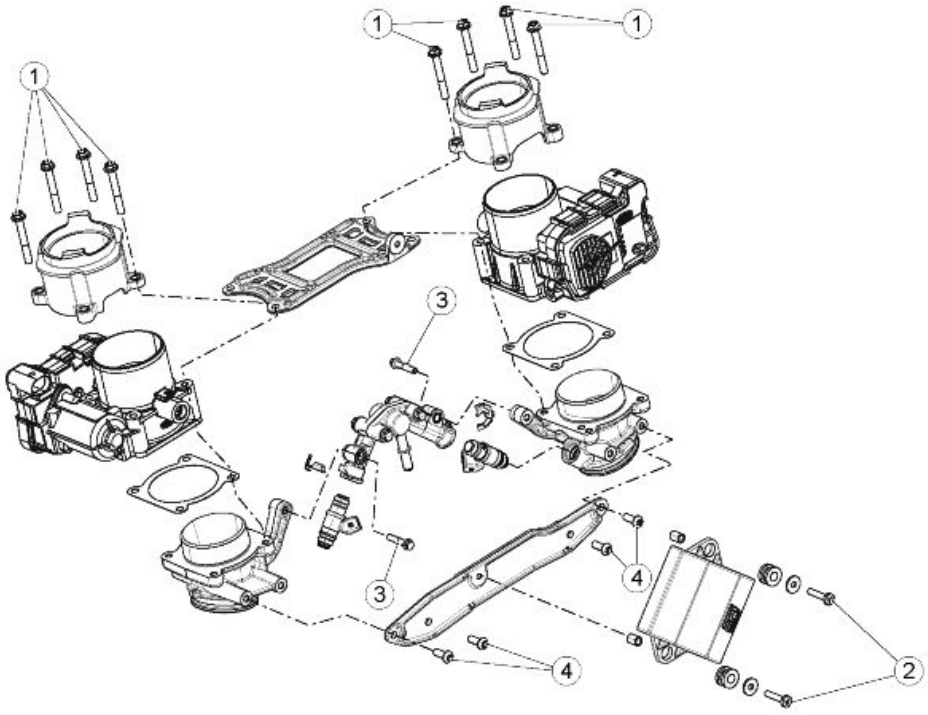
Example value: shorted to positive / open circuit, shorted to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 62 of the VEHICLE connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 62 of the VEHICLE connector

Injection

Diagram



THROTTLE BODY

pos.	Description	Type	Quantity	Torque	Notes
1	Intake union fastener screw	M6	8	12 Nm (8.85 lb ft)	Loctite 242
2	RBW control unit fastener screw	M5	2	3.50 Nm (2.58 lbf ft)	Loctite 242
3	Injector fastener screw	M6	2	12 Nm (8.85 lb ft)	Loctite 242
4	Injection Throttle Body fastener screw	M6	8	12 Nm (8.85 lb ft)	Loctite 242

Ride by Wire

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. Therefore, there is a "Throttle map" to which the control unit refers in order to decide the position at which the throttle valves should be and at what speed they should reach the pre-set position. The main parameters which influence the throttle map are:

- Throttle position and opening/closing speed
- Engine rpm
- Inlet pressure read at each inlet manifold
- Rear and front throttle valve position
- Air temperature

The functions required from the Marelli control unit therefore are:

1. Ride by Wire system control (throttle map)
2. Injection/ignition control
3. System safety checks

1 - Ride by Wire system control

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

Marelli 5DM electronic control unit Besides the regular control functions of the injection system, it supervises the throttle bodies: Through the throttle grip position sensor, it reads the torque demand and, through the THROTTLE MAP, it decides the throttle opening and sends the command to the throttle valve control unit. It checks the correct operation of each component (Self-diagnosis), of the system (Safety), and carries out the emergency procedure (Recovery).

EFI throttle control unit The control unit receives the target throttle opening to be carried out and it actuates on the control acting on the throttle body motors.

It checks (through the throttle position sensor signal) that the throttle bodies have reached the target position.

It communicates the position reached to the Marelli control unit. It does not actuate on Safety strategies.

Throttle Body The two throttle bodies are made up of:

- Throttle valve with 2 return springs for the controlled minimum opening position.
- DC electrical motor
- Tinned double throttle position sensors with magnetic control (contactless)

The throttle bodies do not require any maintenance and cannot be overhauled. In case of electric or mechanic malfunction, replace the whole unit.

Pressure sensors The pressure sensors (one per cylinder) are fundamental not only for the injection map at low and stabilised speeds but also for checking the Ride by Wire system: their signal is connected to a TORQUE CHAIN for checking the correct opening of the throttle valves.

Intake air temperature sensor The signal coming from the sensor is used to calculate the estimated torque since the oxygen in the air also depends on its density which varies according to temperature.

2 - Injection/ignition control

Map for injection type (alpha-D)/rpm where:

- alpha is the throttle position
- D is the pressure measured at inlet ducts
- Rpm are the engine revolutions
- At idle and for slow and stabilised speeds D/n

- For medium-high throttle openings alpha/n
- For temporary speed (speed change) alpha/n
- The main parameters that correct the injection map are:
- Engine temperature
- Atmospheric pressure (calculated)
- Lambda probe signal
- Air temperature

3 - System safety checks

The checks are structured in several levels:

- Level 1 - sensor correct operation
- Level 2 - comparison between requested torque and estimated torque generated by the engine
- Level 3 - a microprocessor controls the correct operation of the regular microprocessor

The consequent maintenance operations may be of different gravity according to the level and the defective component:

A the malfunction does not affect riding in safety, the warning light turns on, the word Service is displayed, the signal recovery value considered not reliable is used and the engine works regularly.

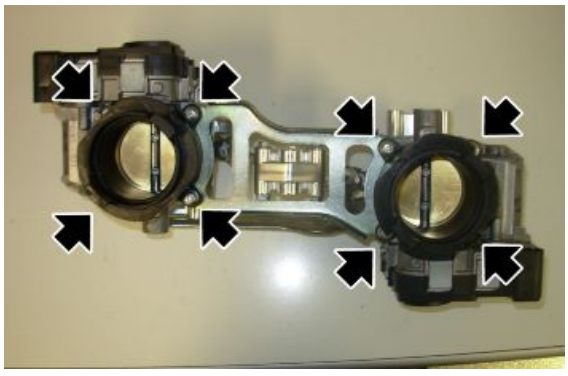
B the malfunction may affect riding in safety, the warning light turns on, the message Urgent Service is displayed, the torque demands are not fully activated (reduced torque).

C the malfunction may affect riding in safety, the warning light turns on, the message Urgent Service is displayed, the engine operates in Limp Home function (accelerated idle), the throttles which are at the position exclusively depending on the springs are not moved. The engine may shut off during the operation if it is running at idle speed and the gear is in neutral.

D the malfunction may affect riding in safety, the warning light turns on, the message Urgent Service is displayed, the engine stops running.

Removing the throttle body

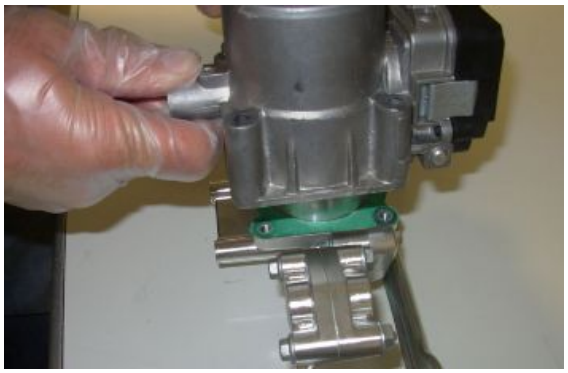
- Remove the filter casing.
- Working on both bodies, undo and remove the four screws and slide off the filter support.



- Remove the upper plate.

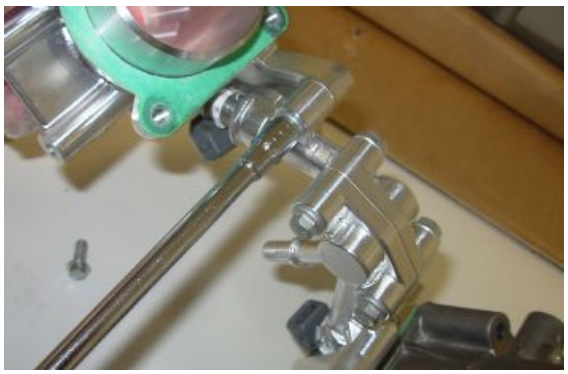
- Remove both bodies.

UPON REFITTING, REPLACE THE THROTTLE BODY GASKET WITH A NEW ONE OF THE SAME TYPE.



- Working on both bodies, undo and remove the two plate screws.

- Remove the plate.
- Working on both bodies, undo and remove the screw and detach the body.



- Working on the body in question, remove the injector, slide off the clip and the injector itself.

CAUTION

NEVER UNDO THE SCREWS IN THE FIGURE

Use of diagnostics instrument for injection system

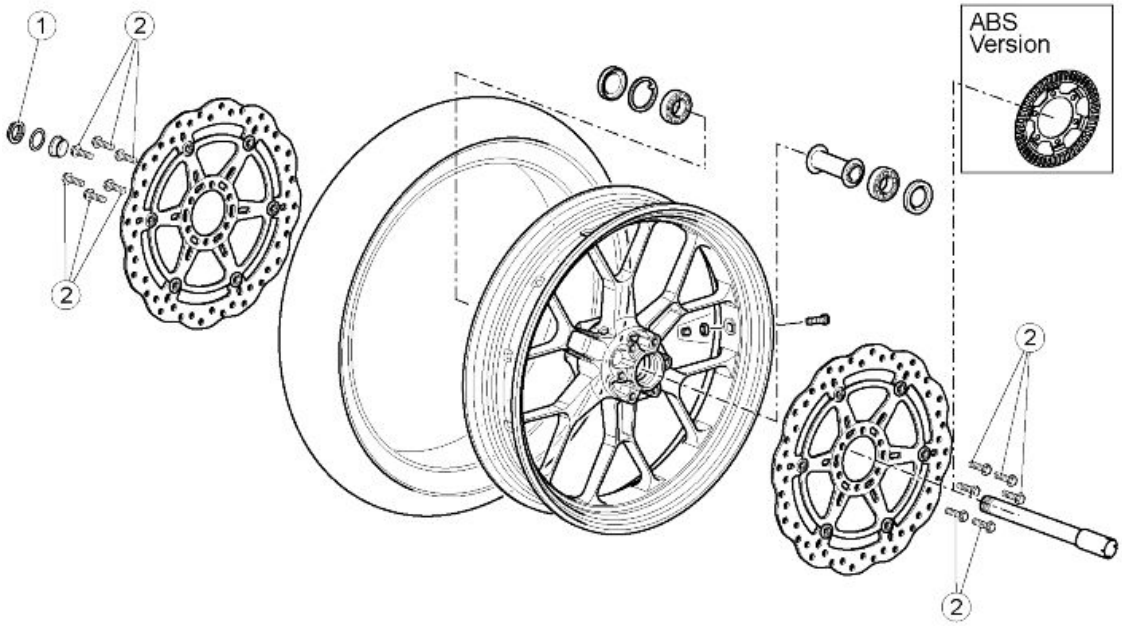
The complete list of all the parameters- device status, errors, etc.- is available at the home page of the website **www.serviceaprilia.com** in the search section: Parameters Navigator.

The same parameters- device status, errors, etc. -are grouped per type of component they refer to in the **Electrical system chapter, Checks and Controls**

INDEX OF TOPICS

SUSPENSIONS	SUSP

Front



FRONT WHEEL

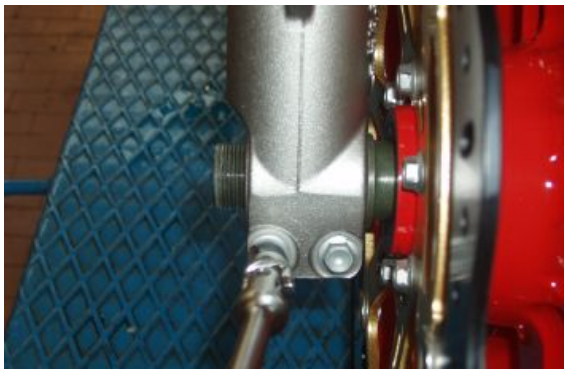
pos.	Description	Type	Quantity	Torque	Notes
1	Wheel axle nut	-	1	80 Nm (59 lbf ft)	-
2	TE flanged screw fastening front disc	M8x20	12	30 Nm (22.13 lbf ft)	Loctite 243

Removing the front wheel

- Hold the vehicle front part.
- Unscrew the screws fixing the front pliers and slide them off the disc.

- 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.

- Collect the spacer from the front wheel right side.

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.

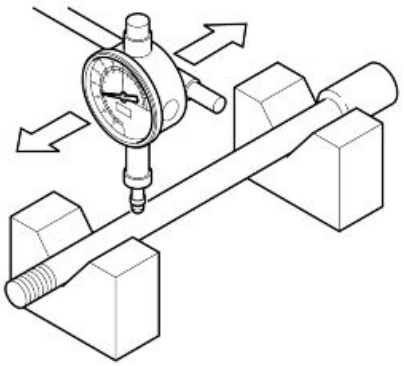
GASKETS

- 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.

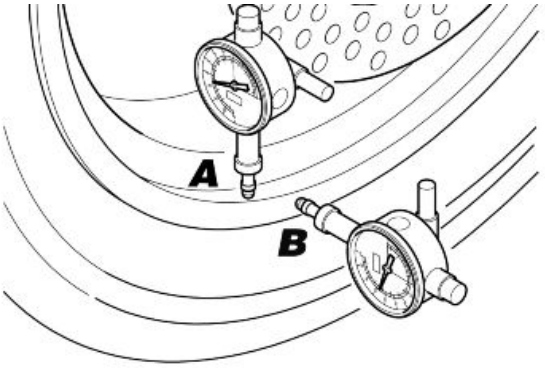


Characteristic

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.

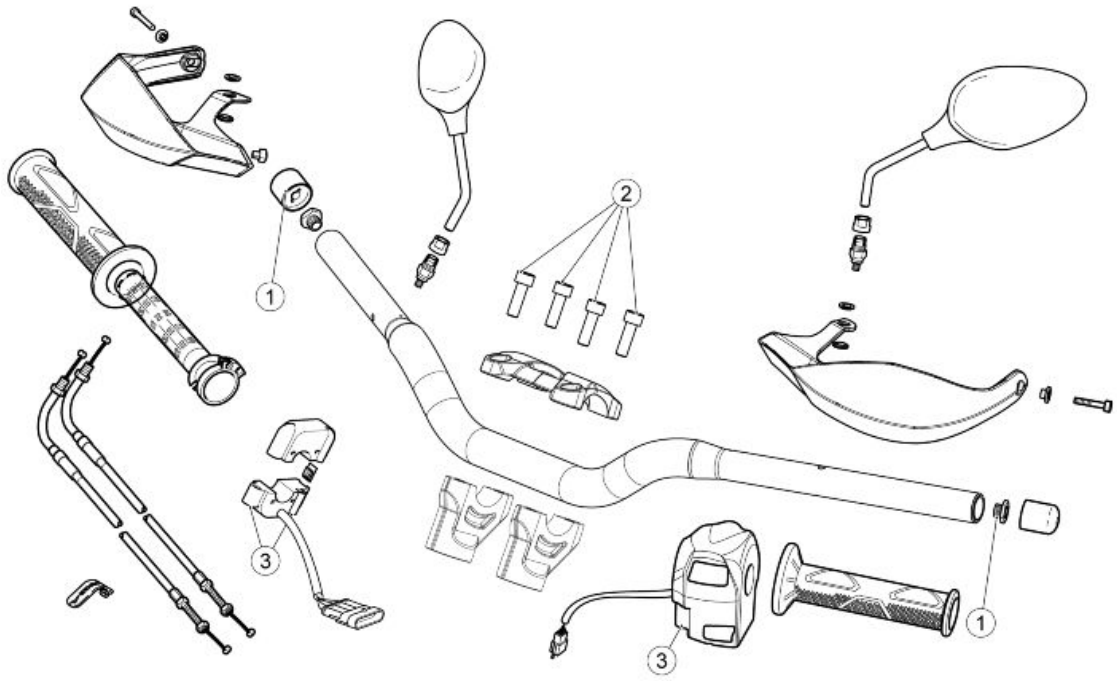


Characteristic

Maximum radial and axial eccentricity:

2 mm (0.0079 in)

Handlebar

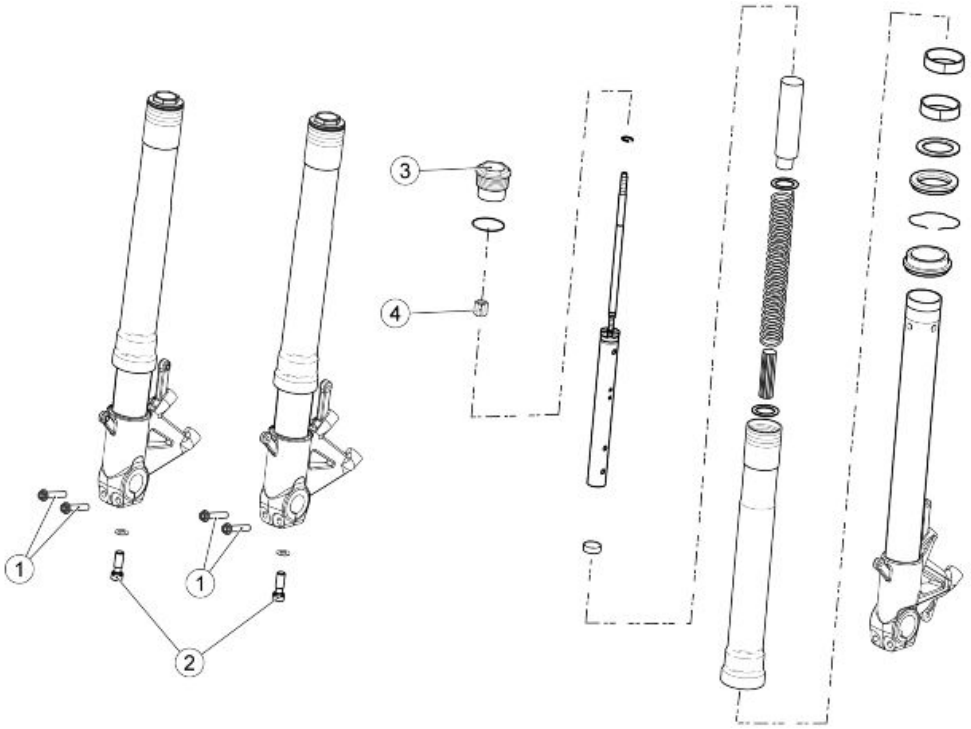


HANDLEBAR

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening counterweight to handlebar end	M6x50	2	10 Nm (7.37 lbf ft)	-
2	Stainless steel TCC screw fastening upper U-bolt to lower clamp	M8x25	4	25 Nm (18.44 lbf ft)	-
3	Screws fastening light switch assembly	-	2 + 2	1.5 Nm (1.11 lbf ft)	-

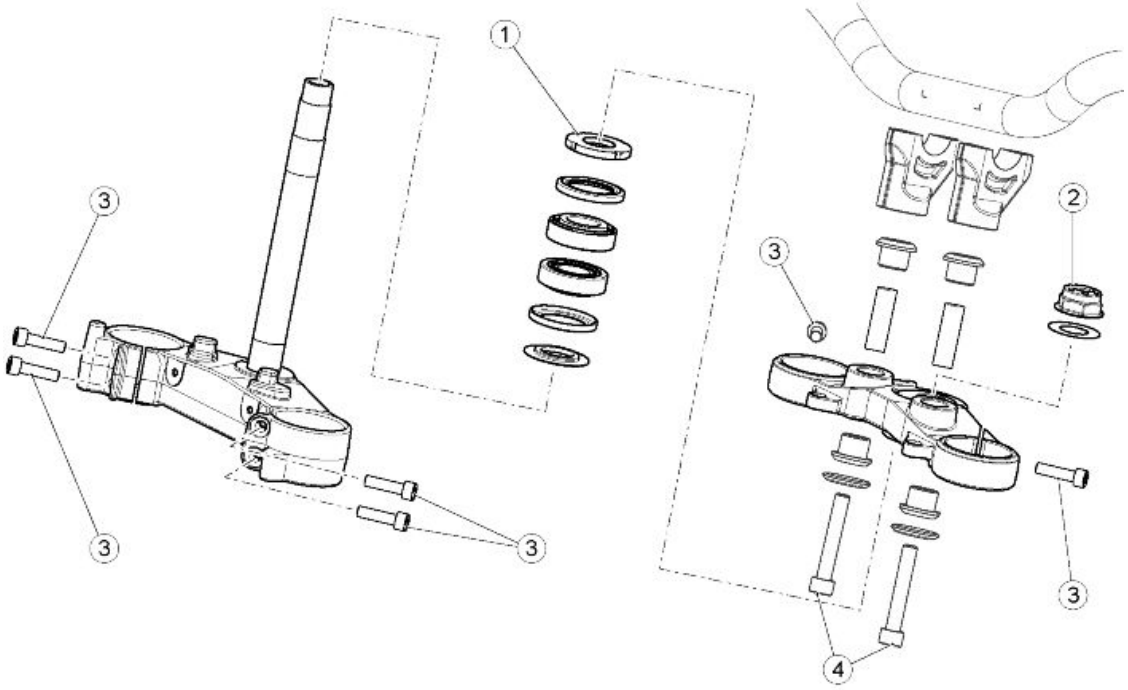
Front fork

Diagram



FRONT FORK

pos.	Description	Type	Quantity	Torque	Notes
1	Screws (fasten onto fork hubs)	M6x40	4	12 Nm (8.85 lb ft)	-
2	Screw (Pumping member pin fixing to the stem base)	-	2	30 Nm (22.13 lb ft)	-
3	Upper cover	-	2	20 Nm (14.75 lb ft)	-
4	Upper cover locking nut	-	2	20 Nm (14.75 lb ft)	-

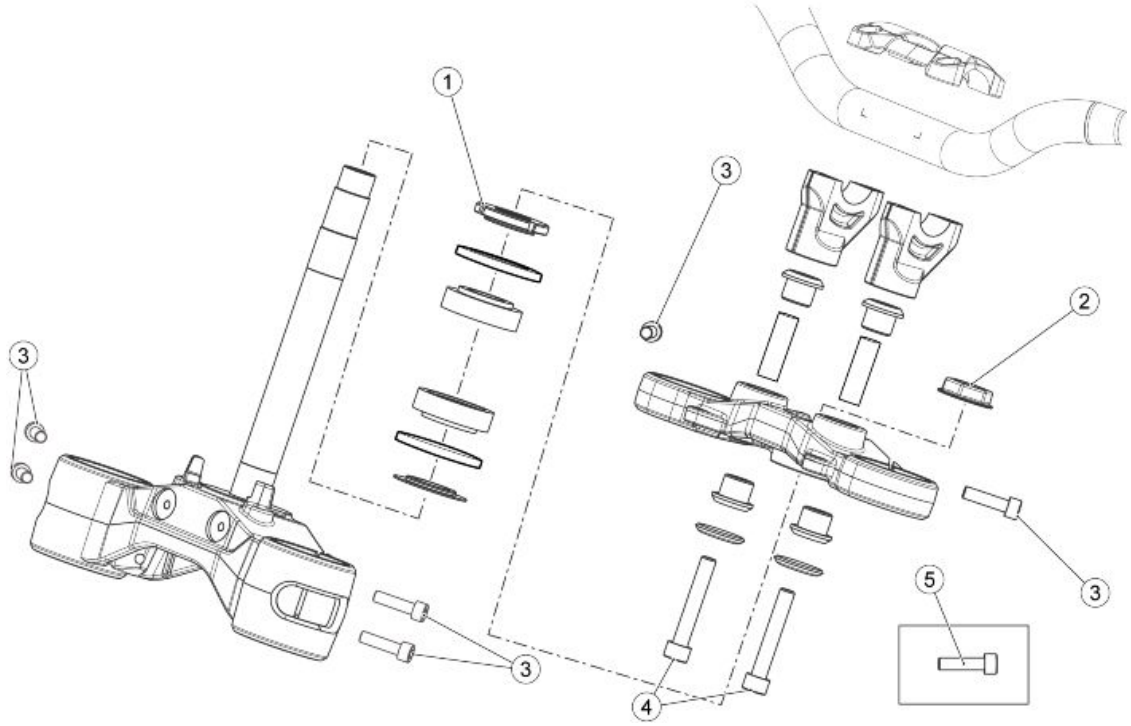


OPTION 01- Steering upper plate **without** a headstock cut.

STEERING - OPTION 1

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-

OPTION 02- Steering upper plate **with** a headstock cut.

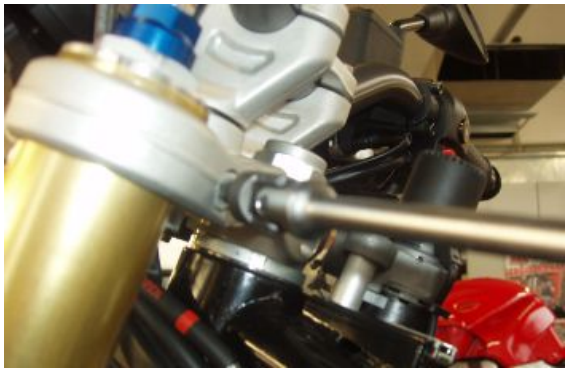


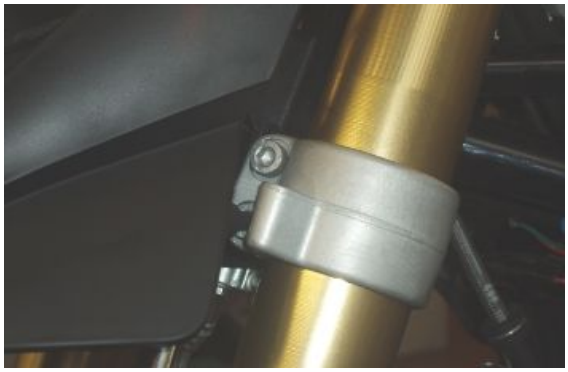
STEERING

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock nut - pre-tightening	M22x1	1	10 Nm (7.37 lb ft)	Loctite 243
2	Headstock nut	M22x1	1	25 Nm (18.44 lb ft)	Loctite 243
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-
5	Steering upper plate clamp closing screw	M8x30	1	25 Nm (18.44 lb ft)	Loctite 243

Removing the fork legs

- Remove the front wheel.
- Support the stanchion and loosen the screws on the upper and then the lower plate.
- Remove the stanchion.





Disassembling the fork

NOTE

THE OPERATIONS DESCRIBED BELOW ARE VALID FOR BOTH STEMS.

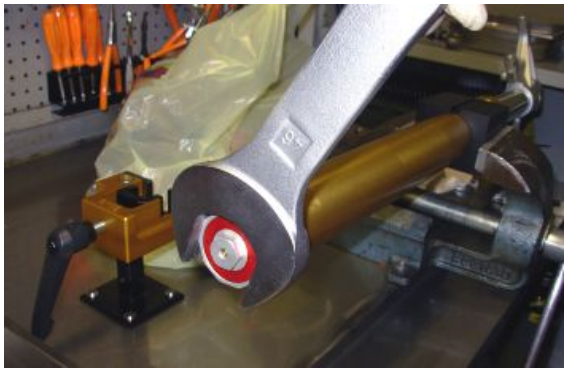
- Using the appropriate tool fasten the fork in the vice.

Specific tooling

AP8140149 Protection for fitting operations

- Operating on the upper screw, unload the spring.

- Loosen the cover without unscrewing it completely.



- Place the fork vertically locking it in a vice by the specific tool.
- Completely unscrew the plug.

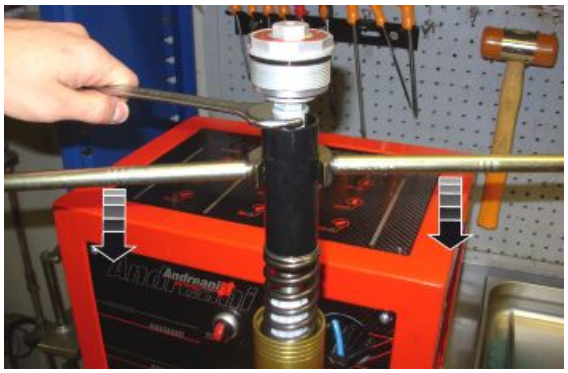
Specific tooling

AP8140149 Protection for fitting operations

- Using the specific tool, fixed to the pre-loading pipe, compress the spring.
- Insert a spanner in the lock nut of the cover.

Specific tooling

020888Y Pliers for pre-fill pipe



- Unscrew the cap and remove it.

- Remove the spring preload pipe.

- Remove the lock nut and the washer.

- Remove the spring paying attention to drain the oil correctly.

- Drain the oil into a container of suitable capacity to collect fluids.

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

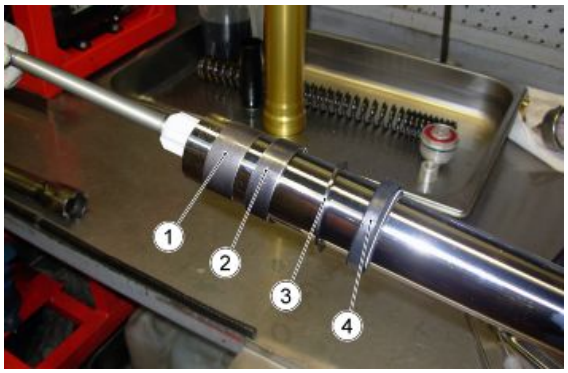
- Discharge the fork, remove the internal dipstick of the pumping member pin (1) and the washer (2).
- Operate repeatedly on the pumping member pin (3) so as to drain completely the oil from inside.

- Slide off the dust scraper from the sleeve using a screwdriver as a lever.
- During this operation, pay attention not to damage the sleeve rim.

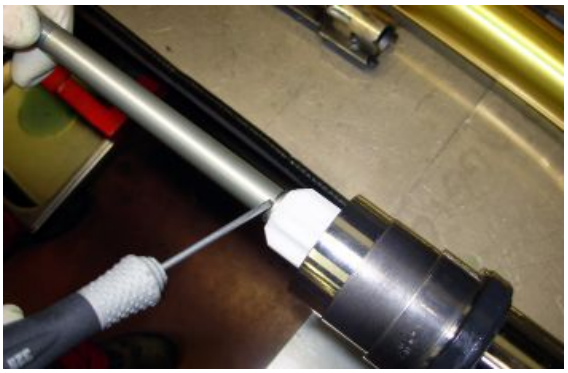
- Remove the retainer ring.

- Take out the sleeve from the stem using the stem as a hammer puller.

- Remove the fixed bushing (1), the movable bushing (2), the ring (3) and the oil seal (4) from the stem.



- Remove the lock seeger ring of the spring guide.
- Remove the spring guide.



- Using a hook spanner lock the pumping member pin
- Remove the stem bottom screw.

Specific tooling

020889Y Pumping member ring nut locking spanner

- Remove the pumping member pin.

Checking the components

Stem

Check the sliding surface for scorings and/or scratches.

These scorings can be eliminated by rubbing them with wet sandpaper (grain 1).

If the scorings are deep, replace the stem.

Use a dial gauge to check that the stem bending is below the limit value.

If over the value, replace the stem.

CAUTION

A BENT STEM SHOULD NEVER BE STRAIGHTENED BECAUSE ITS STRUCTURE WOULD BE WEAKENED AND USING THE VEHICLE MAY BECOME DANGEROUS.

Characteristic

Bending limit:

0.2 mm (0.00787 in)

Sleeve

Check that there are no damages and/or cracks; otherwise, replace it.

Spring

Check the spring is in good conditions.

Check that the following components are in good conditions:

- upper bushing;

- lower bushing;

- piston.

If there are signs of excessive wear or damage, replace the affected component.

CAUTION

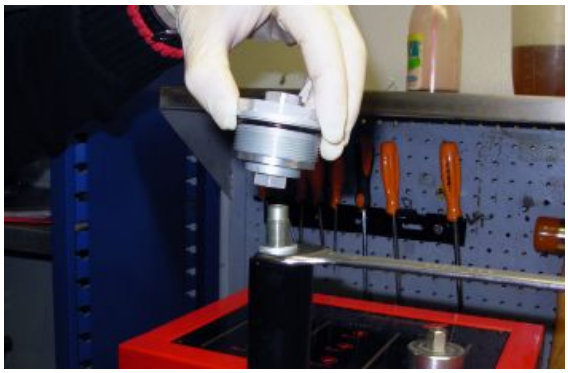
REMOVE ANY IMPURITY IN THE BUSHINGS, TAKING CARE NOT TO SCRATCH THEIR SURFACE.

Replace the following components with new ones:

- seal ring;

- dust gaiter;

- O-Ring on the cap.



Reassembling the fork

NOTE

THE OPERATIONS DESCRIBED BELOW ARE VALID FOR BOTH STEMS.

- Lock the stem in a vice without damaging the surface.
- Protect the bearing tube end with adhesive tape.
- Lubricate the sliding edges with fork oil or sealing grease.
- Fit the dust gaiter, the retainer ring and the dust scraper on the stem.

- Fit the ring, the movable bushing and, after removing the tape, fit the fixed bushing.

- Fit the sleeve on the stem and set the oil seal into position with the aid of the specific tool.

Specific tooling

AP8140189 Oil seal fitting tool for Ø 43 mm (1.69 in) orifices

AP8140146 Weight

- Insert the retainer ring in its position.

- Fit the dust gaiter with the specific tool.

Specific tooling

AP8140189 Oil seal fitting tool for Ø 43 mm (1.69 in) orifices

AP8140146 Weight

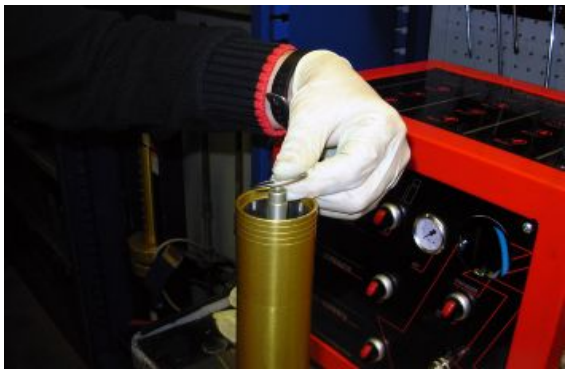
- Insert the pumping member pin in the stem.

- Using a hook spanner lock the pumping member pin and tighten the fixing screw on the fork end to the prescribed torque.

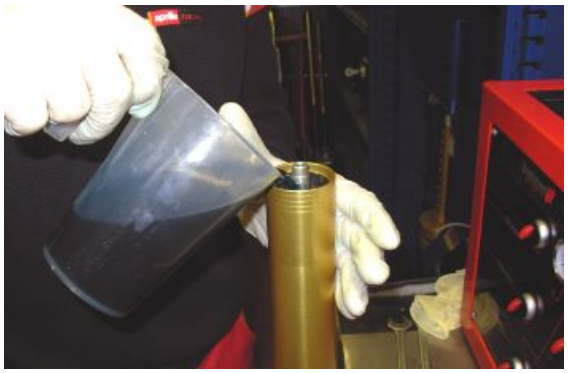
Specific tooling

020889Y Pumping member ring nut locking spanner

- Insert the spring guide and lock it by the appropriate seeger.
- Place the fork vertically.
- Insert the washer.



- Refill the fork with oil according to the prescribed quantity.



- Fit the spring.

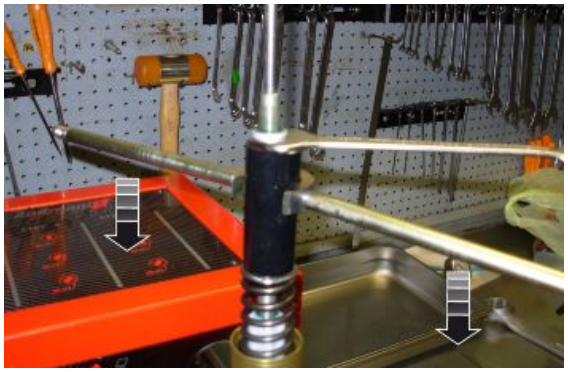
CAUTION

BE CAREFUL WHEN INSERTING THE SPRING SINCE THE COMPRESSED SPIRAL PART MUST BE PLACED DOWNWARDS.

See also

Filling oil

- Insert the washer that will be supported on the spring
- Insert and hand tighten the nut on the pumping member pin
- Place the preload pipe.
- Tighten the appropriate tool on the pumping member pin rod and keep it raised to allow, inserting a wrench in the nut by compressing the spring.



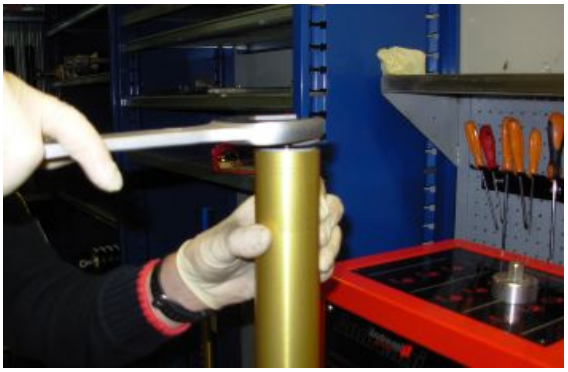
Specific tooling

020890Y Pumping member stanchion support rod

AP8140147 Spacer tool

- Tighten the nut as much as possible.
- Insert the cover and tighten until it stops.

- Remove the specific tools.
- Screw the cover in the sleeve to the prescribed torque.



Filling oil

- Place the sleeve upright in a vice fitted with protection shoes.
- Compress the sleeve in the stem. Place a support under the stem in order to leave it compressed.
- Pour part of the fork oil into the sleeve.
- Wait some minutes until the oil fills all the ducts.
- Pour the remaining oil.
- Pump out oil a few times.
- Measure the air gap between the oil level and the rim.

THE SLEEVE MUST BE PERFECTLY UPRIGHT IN ORDER TO MEASURE THE CORRECT OIL LEVEL. THE OIL LEVEL MUST BE THE SAME IN BOTH STANCHIONS.

Specific tooling

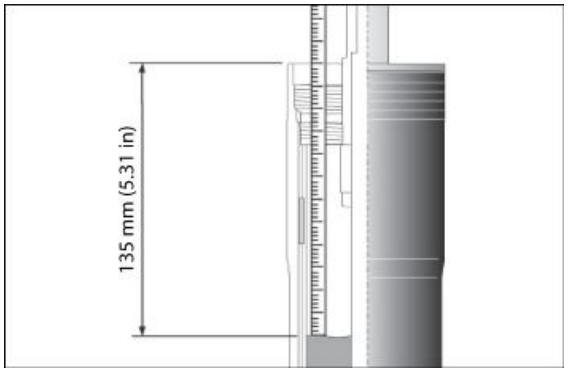
AP8140149 Protection for fitting operations

Oil level: 135 mm (5.31 in) (from the sleeve edge, without a spring and with preload pipe).

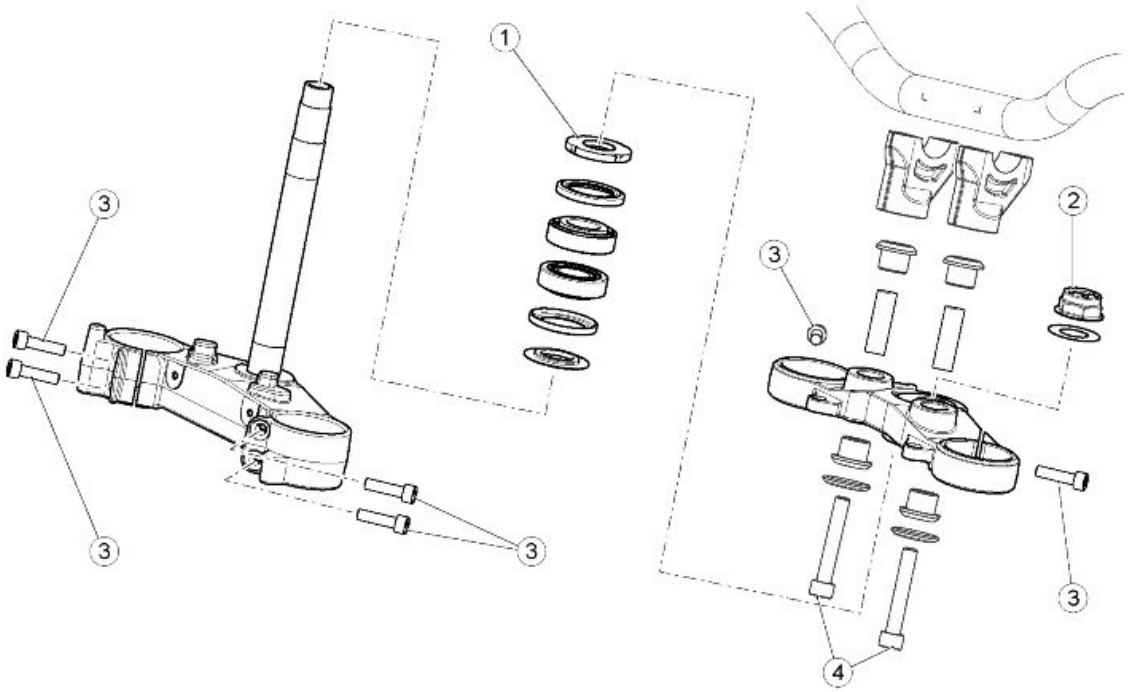
Characteristic

Fork oil (check also the correct air level in the stem)

441 cm³ (26.91 cu.in) (for each stanchion)



Steering bearing

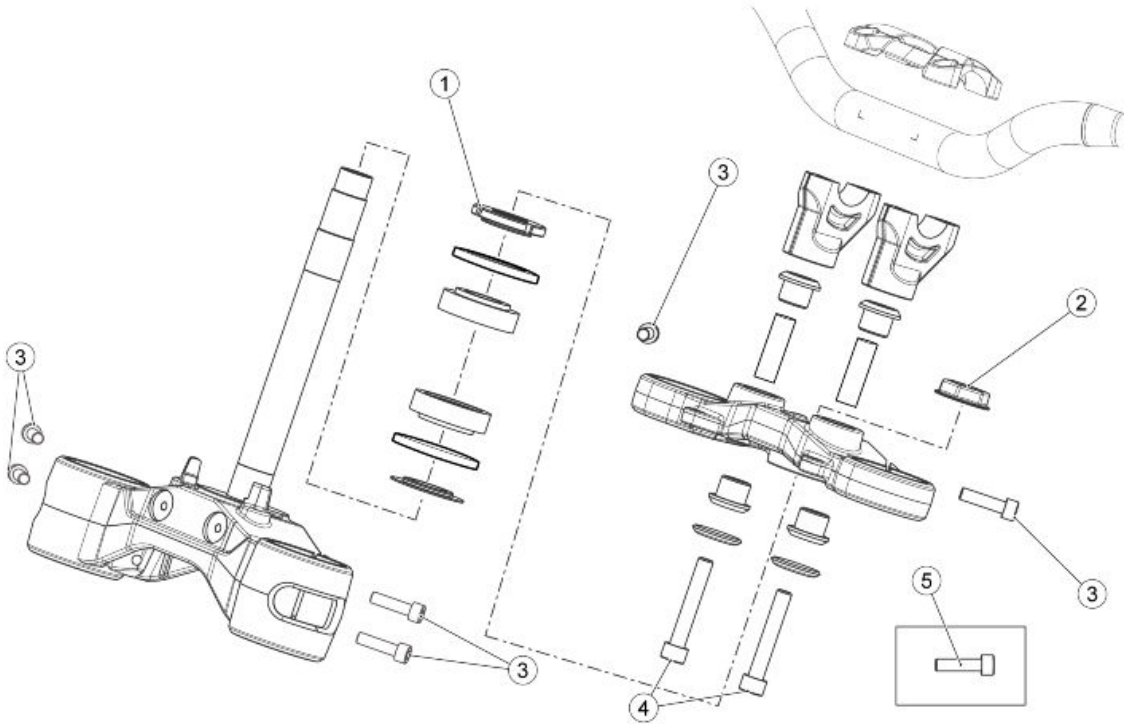


OPTION 01- Steering upper plate **without** a headstock cut.

STEERING - OPTION 1

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-

OPTION 02- Steering upper plate **with** a headstock cut.



STEERING

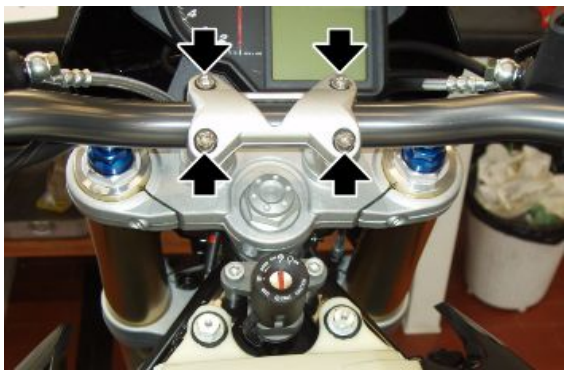
pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-
2	Headstock nut - pre-tightening	M22x1	1	10 Nm (7.37 lb ft)	Loctite 243
2	Headstock nut	M22x1	1	25 Nm (18.44 lb ft)	Loctite 243
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-
5	Steering upper plate clamp closing screw	M8x30	1	25 Nm (18.44 lb ft)	Loctite 243

Adjusting play

- Place the vehicle so that the front wheel is off the ground.
- Carry out a handlebar rotation test, using a dynamometer at the hand grip external end.
- The handlebar resistance to rotation must be of 400 ± 150 g (0.88 ± 0.33 lb) in both directions.
- Adjust if clearance is detected.

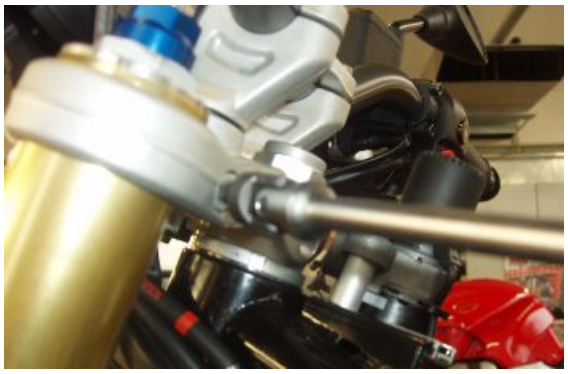
OPTION 01- Steering upper plate **without** a headstock cut.

- Unscrew and remove the U-bolt four fixing screws.
- Remove the U-bolt.
- Remove the handlebar and place it paying attention that oil in the clutch and front brake tanks does not spill out.



- Unscrew and remove the top bolt on the headstock and retrieve the washer.

- Operating from both sides, loosen the screws fixing the stanchions to the upper plate.



- Undo and remove the two screws fixing the instrument panel support to the fork upper plate.

- Slide off the fork upper plate by moving it towards the instrument panel.

Get the suitable tool for the tightening of the ring nut. Carry out the following operations:
- carry out a first tightening of the ring nut to the indicated tightening torque for the settlement of the steering package.
- turn the steering completely from both sides, for several times.

Loosen the ring nut completely.
- carry out the final tightening of the ring nut to the indicated tightening torque.

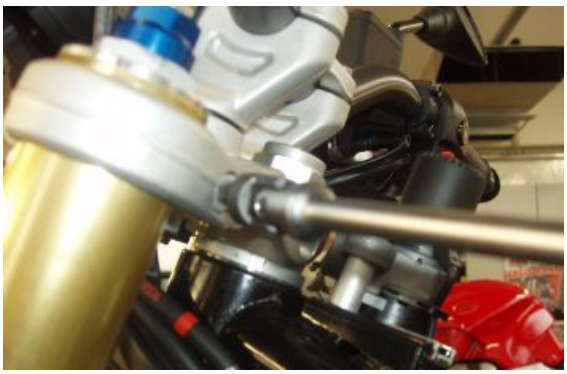
Specific tooling

020884Y 46 mm wrench for steering ring nut

STEERING RING NUT

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-

- Fit the entire fork upper plate, adjusting with short taps with a rubber hammer
- Tighten the nut to the specified torque.



- Tighten the fixing screws of the upper plate to the prescribed tightening torque.

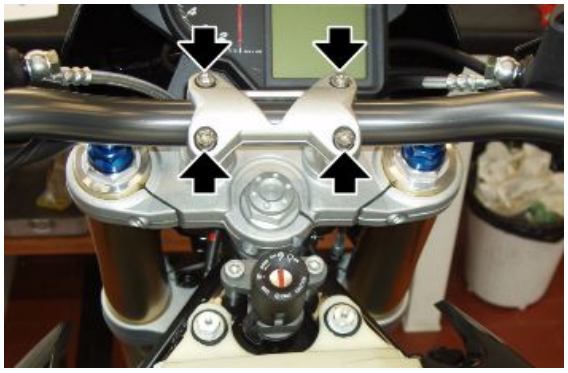
STEERING UPPER PLATES

pos.	Description	Type	Quantity	Torque	Notes
2	Headstock nut	M22x1	1	100 Nm (73.76 lbf ft)	
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-

When refitting the U-bolt, position the two references facing the front part of the vehicle.

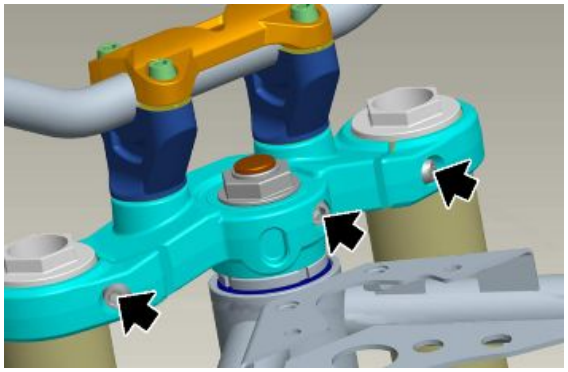
OPTION 02- Steering upper plate **with** a headstock cut.

- Unscrew and remove the U-bolt four fixing screws.
- Remove the U-bolt.
- Remove the handlebar and place it paying attention that oil in the clutch and front brake tanks does not spill out.



- Undo and remove the top bolt on the headstock.

- Screw the fixing screws of the upper plate.



- Undo and remove the two screws fixing the instrument panel support to the fork upper plate.

- Slide off the fork upper plate by moving it towards the instrument panel.

Get the suitable tool for the tightening of the ring nut. Carry out the following operations:
- carry out a first tightening of the ring nut to the indicated tightening torque for the settlement of the steering package.
- turn the steering completely from both sides, for several times.
Loosen the ring nut completely.
- carry out the final tightening of the ring nut to the indicated tightening torque.

Specific tooling

020884Y 46 mm wrench for steering ring nut

STEERING RING NUT

pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	30 Nm (22.13 lb ft)	Steering package settlement
1	Headstock ring nut - tightening	M25x1	1	12 Nm (8.85 lb ft)	-

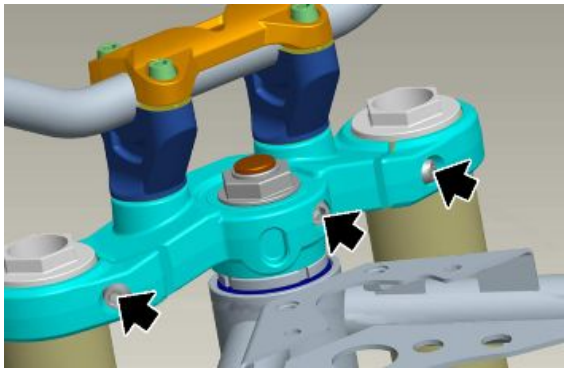
- Fit the entire fork upper plate, adjusting with short taps with a rubber hammer.
- Scatter the nut thread with the specific product and pre-fit it to the indicated tightening torque.

Recommended products

LOCTITE® 243 Loctite adhesive to assemble cylindrical pieces

Loctite adhesive to assemble cylindrical pieces

- Tighten the fixing screws of the upper plate to the prescribed tightening torque.



- Finish the nut tightening to the indicated tightening torque.

STEERING UPPER PLATE

pos.	Description	Type	Quantity	Torque	Notes
2	Headstock nut - pre-tightening	M22x1	1	10 Nm (7.37 lb ft)	Loctite 243
2	Headstock nut	M22x1	1	25 Nm (18.44 lb ft)	Loctite 243
3	Stainless steel TCC screw fastening stanchions to upper and lower yokes	M8x30	6	25 Nm (18.44 lb ft)	-

When refitting the U-bolt, position the two references facing the front part of the vehicle.

Assembling

- Grease the lower and upper bearing rollers
- Prefit the shim, dust gaiter and lower bearing on the steering yoke as shown in the figure.

Recommended products

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 -22°F to +284°F (-30°C to +140°C), drop point between 302ºF to 446°F (150°C to 230°C), high corrosion protection qualities and good water and rust resistance.

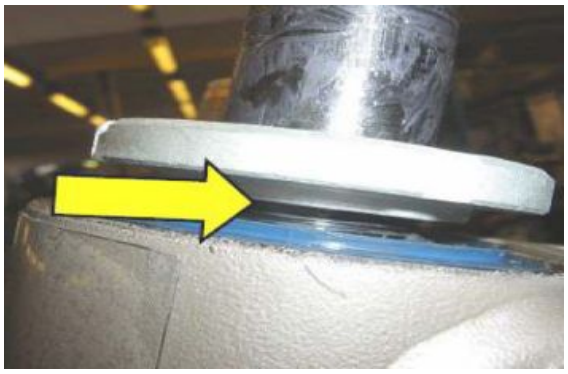
- Install the upper bearing on the steering tube as shown in the figure, with the conical part facing down.

- After inserting, the bearing must slide freely on the steering column till matching with the steering bearing conic in the frame.
- Ensure the bearing mating in its seat, using a teflon buffer from a suitable diameter.

- Fit the specific upper seal ring with the lip placed upwards and the surface with the words downwards.
- Enter it on the column and place it on the upper rim of the headstock.
- Finish inserting, until the stop, with the teflon buffer and rubber hammer.

- Pass with a brush on the seal ring to lay down potential grease storage.

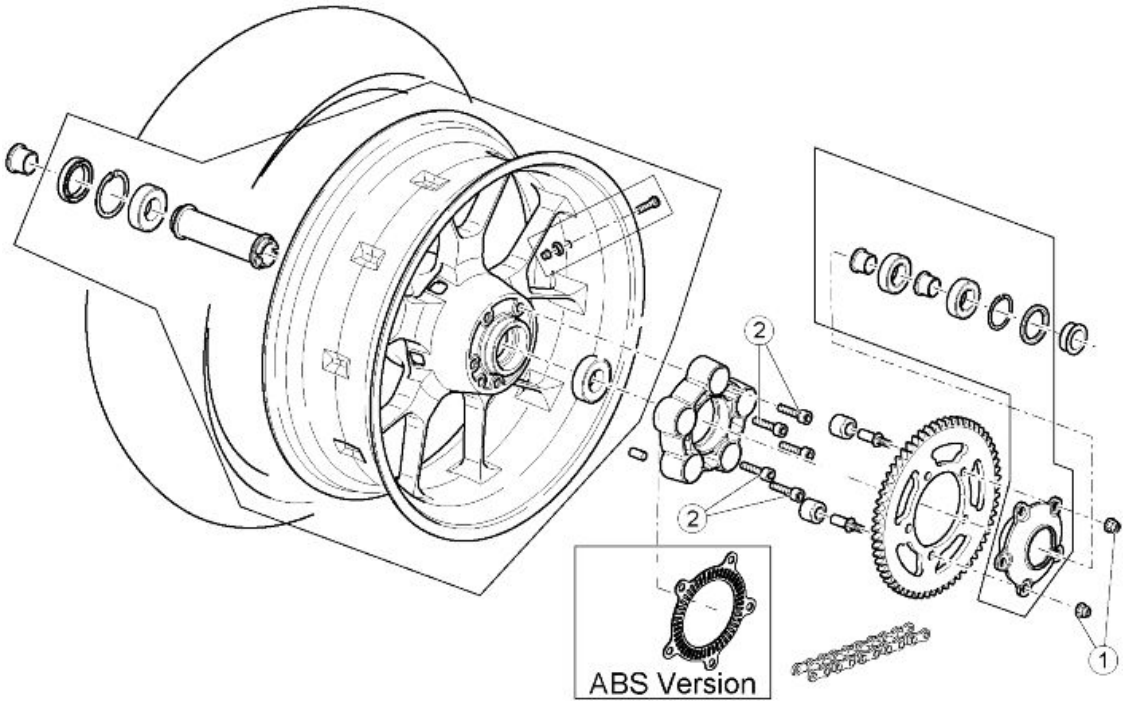
- Place the tightening ring nut with the rim placed downwards.
- Carry out the steering bearings clearance adjustment.



See also

Assembling

Rear

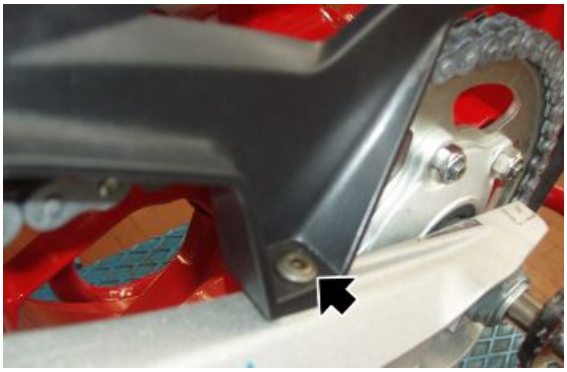


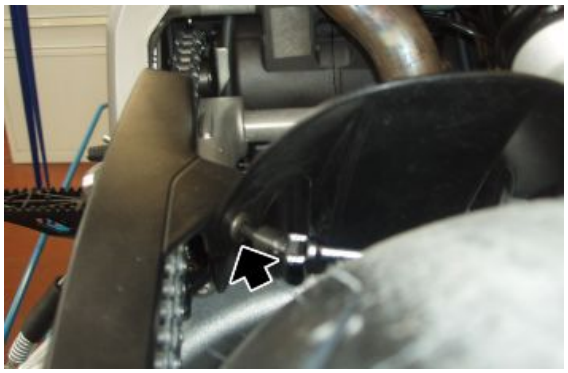
REAR WHEEL

pos.	Description	Type	Quantity	Torque	Notes
1	Lower self-locking nut fastening sprocket to sprocket carrier	M10	5	50 Nm (36.88 lb ft)	-
2	TCEI screw fastening flexible coupling mounting on wheel	M10x30	5	50 Nm (36.88 lb ft)	Loctite 270

Removing the rear wheel

- Place the vehicle on its rear service stand.
- Fasten the vehicle handlebar to the bench using belts.
- To facilitate operations, it is advisable to remove the chain protection by unscrewing the two screws.





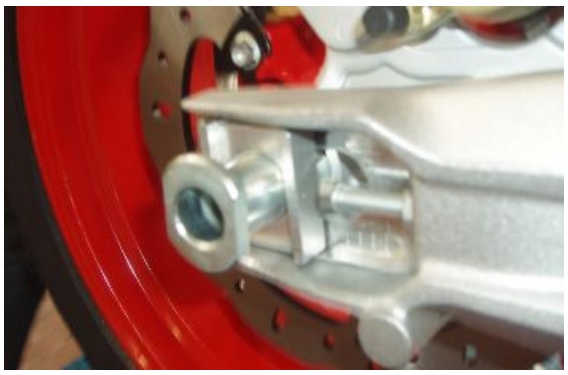
CAUTION

RIMUOVERE IL SENSORE VELOCITA' PRIMA DI PROCEDERE CON LA RIMOZIONE DELLA RUOTA POSTERIORE EVITANDO QUINDI DI DANNEGGIARLO

- Fully slacken the gearing chain tension.
- Make the wheel move forward and release the gearing chain from the sprocket.

- Unscrew and remove the nut on the wheel axle.
- Collect the thrust washer and the right chain tensioner slider.

- Working on the right side, hit the wheel axle lightly so as to take out the head from its housing.
- Working on the left side, slide off the wheel axle together with the chain guide slider.
- Remove the wheel by freeing the disc from the brake calliper.



- Collect the spacer from the rear wheel right side.

- Working from the left side, unscrew and remove the five nuts and remove the sprocket and the bolts.

- Unscrew and remove the five screws and remove the anti-vibration buffer holder.
- Check the flexible couplings according to the routine maintenance table.

See also

Adjusting

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.

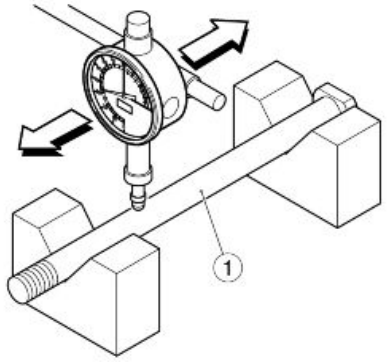
REAR WHEEL GASKETS

- 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).



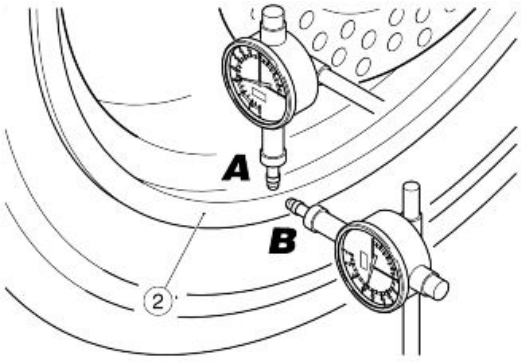
Characteristic

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.



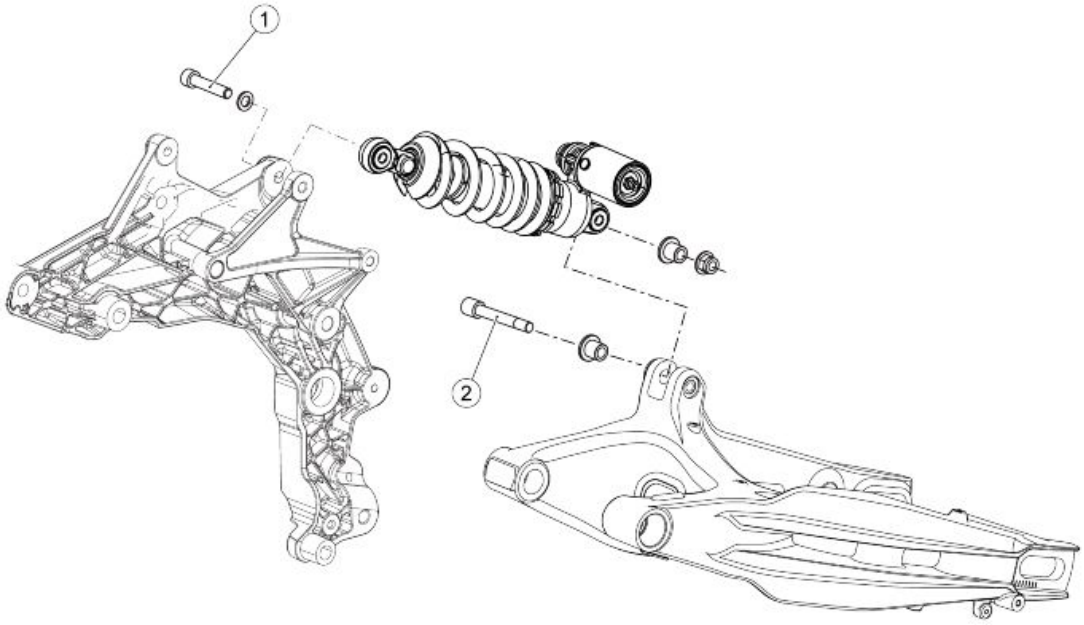
An excessive eccentricity is usually caused by worn or damaged bearings. Replace the rim (2) if after replacing the bearings, the value is not within the specified limit.

Characteristic

Maximum radial and axial eccentricity:

2 mm (0.0079 in)

Shock absorbers



REAR SUSPENSION

pos.	Description	Type	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lbf ft)	-
2	Lower TCEI mounting screw	M10x90	1	50 Nm (36.88 lbf ft)	-

Removing

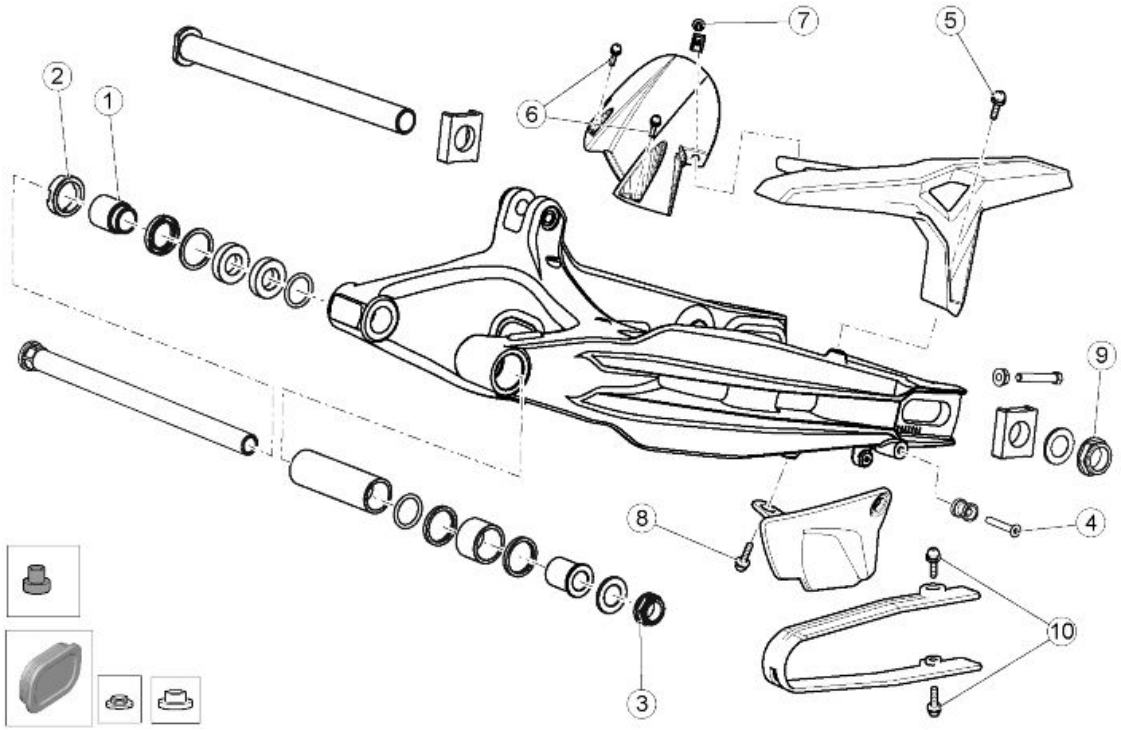
- Place the optional under-sump and rear wheel service stands.
- Unscrew and remove the upper screw and collect the washer.

- Loosen the under-sump optional service stand to lower the engine.
- Unscrew and remove the lower screw and retrieve the nut.
- Remove the shock absorber.

INDEX OF TOPICS

CHASSIS	CHAS

Swinging arm



SWINGARM

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm Pin adjustment bushing	-	1	12 Nm (8.85 lb ft)	-
2	Swingarm pin ring nut	-	1	60 Nm (44.25 lb ft)	-
3	Swingarm pin nut	-	1	90 Nm (66.38 lb ft)	-
4	TPSI screw fastening rear stand bushing	M6x40	2	10 Nm (7.37 lb ft)	-
5	TBEI screw fastening chain guard to swingarm	M5x9	1	6 Nm (4.42 lbf ft)	-
6	TBEI screw fastening rear mudguard to swingarm	M5x9	2	6 Nm (4.42 lbf ft)	Loctite 243
7	TBEI screw fastening chain guard to rear mudguard	M5x9	1	4 Nm (2.95 lbf ft)	-
8	TBEI screw fastening chain guide to swingarm	M5x9	2	6 Nm (4.42 lbf ft)	-
9	Wheel axle nut	M25x1.5	1	120 Nm (88.5 lbf ft)	-
10	Flanged TBEI screw fastening chain casing	M5x9	2	4 Nm (2.95 lbf ft)	Loctite 243

Removing

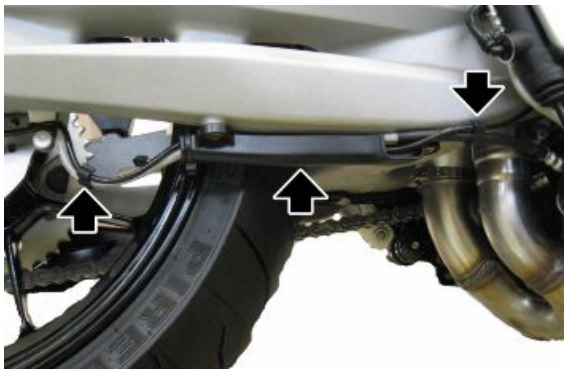
- Remove the exhaust system.
- Support the vehicle by means of the engine service stand and a hoist with belts fastened to the rear section of the frame.
- Remove the rear wheel.

- Slide off the rear calliper holding plate, keeping it linked to the brake pipe.

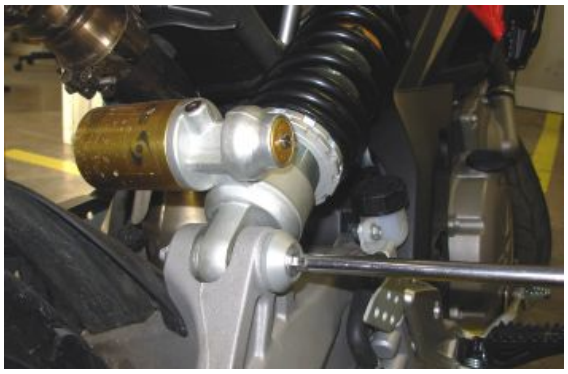
CAUTION

DO NOT ACTUATE ON THE REAR BRAKE LEVER AFTER REMOVING THE WHEEL. OTHERWISE, THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEAT, RESULTING IN BRAKE FLUID LEAKAGE.

- Unscrew and remove the two lower swingarm screws.
- Remove the cable guides.



- Unscrew and remove the shock absorber lower screw and collect the nut.
- Fasten the shock absorber to the chassis.



- With the specific box-spanner, unscrew and remove the locking ring nut.

- Working from the left side, unscrew and remove the nut and collect the washer.

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.

- Working on the right side, unscrew and remove the swingarm bolt.

UPON REMOVING THE REAR SWINGARM PAY ATTENTION NOT TO JAM THE GEARING CHAIN.

See also

Removing the rear wheel

Drive chain

Adjusting

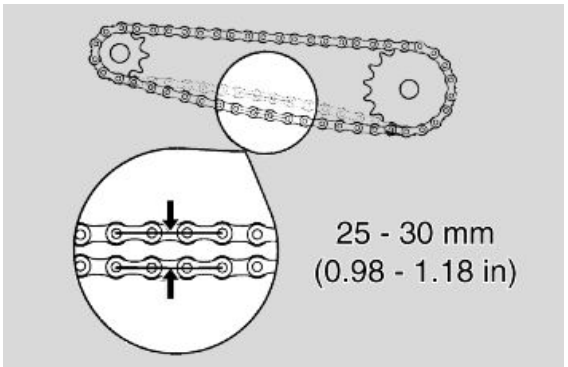
The vehicle is fitted with an endless chain, without master link.

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.

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 approx. 25 - 30 mm (0.98 - 1.18 in).



- Move the vehicle forward so as to check vertical oscillation of the chain in other positions too. clearance should remain constant at all wheel rotation phases.
- If clearance is uniform but over 30 mm (1.18 in) or below 25 mm (0.98 in), adjustment is necessary.

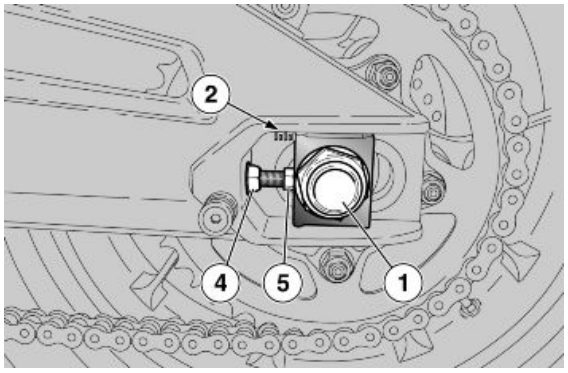
ADJUSTMENT

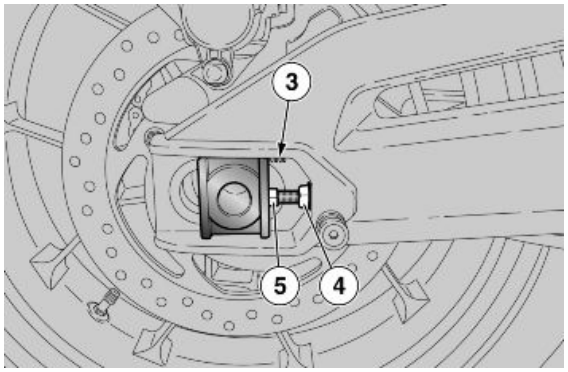
CAUTION

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

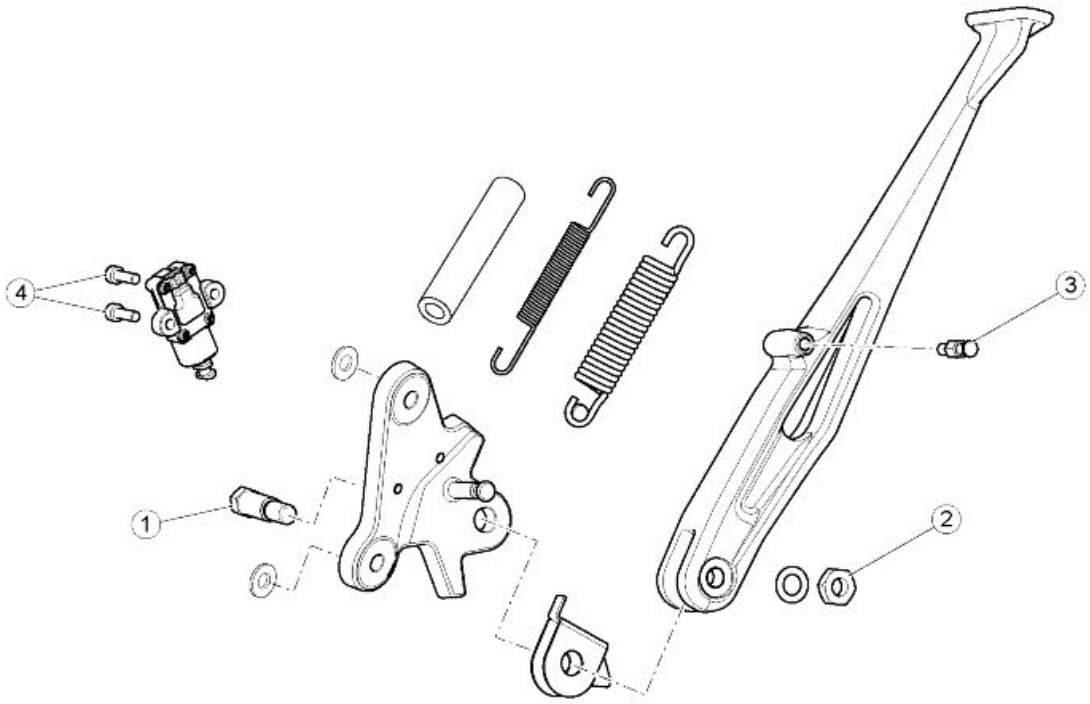
Do not wash the chain with water jets, steam jets, high-pressure water jets and highly flammable solvents.

- 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.

Stand

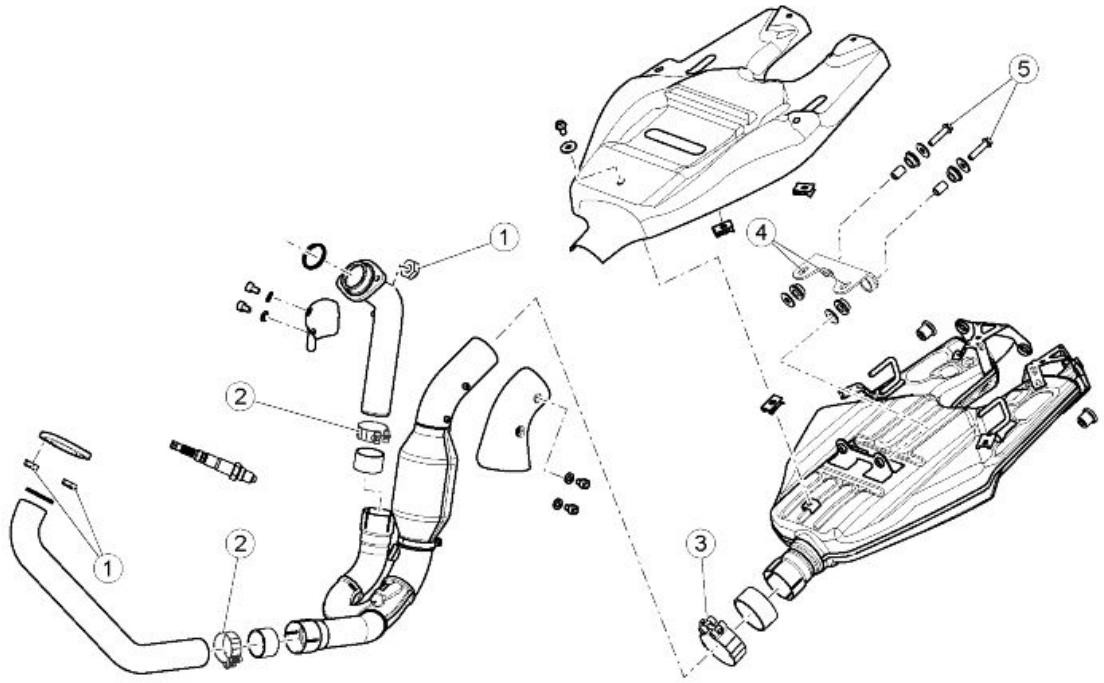


STAND ASSEMBLY

pos.	Description	Type	Quantity	Torque	Notes
1	Stand screw	M10x1.25	1	10 Nm (7.37 lbf ft)	Loctite 243
2	Thin nut	M10x1.25	1	30 Nm (22.13 lbf ft)	Loctite 243
3	Spring fixing pin	-	1	7.5 Nm (5.53 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
4	TCEI screw fastening stand switch	M5x16	2	7 Nm (5.16 lbf ft)	-

Exhaust



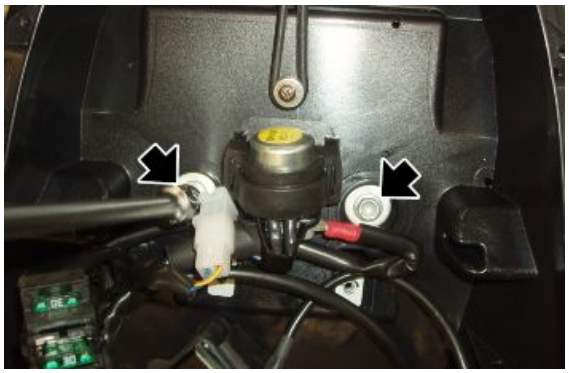
EXHAUST SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	SERPRESS self-locking nut fastening flange on head	M8	4	25 Nm (18.44 lbf ft)	-
2	Primary Clamp (between front/rear manifolds and central manifold)	M6	2	7 Nm (5.16 lbf ft)	-
3	Silencer Clamp (between central manifold and silencer)	M6	1	7 Nm (5.16 lbf ft)	-
4	Self-tapping TE screw fastening silencer mounting bracket to saddle mounting	M8x20	2	25 Nm (18.44 lbf ft)	-
5	Self-tapping TE screw fastening front silencer fixture to silencer mounting bracket	M8x35	2	35 Nm (25.81 lbf ft)	-

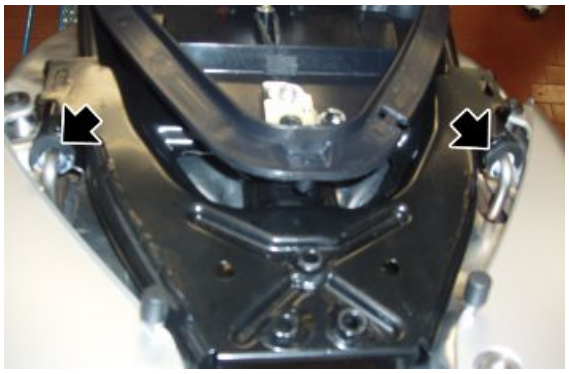
Removing the tail pipe

- Loosen the clamp between the exhaust end and the manifold.

- Remove the saddle.
- Undo and remove the two upper screws and collect the washers.

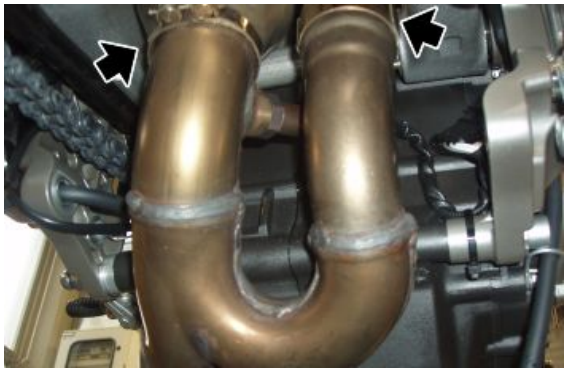


- Remove the exhaust end backwards by sliding off the two brackets from the rubber rings in the upper section and the bracket from the chassis retainer in the lower part.



Removing the manifold - tail pipe

- Remove the front exhaust manifold.
- Disconnect the lambda probe.
- Loosen the exhaust manifold and the exhaust end clamps from the rear cylinder.



- Remove the manifold - terminal coupling.

See also

Removing the exhaust manifold

Removing the exhaust manifold

The engine and the exhaust system components get very hot and remain in this condition for a certain time interval 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.

FRONT

- Unscrew and remove the two nuts on the head exhaust stud bolts.

- Loosen the clamp.
- Remove the exhaust manifold.

REAR

- Loosen the exhaust pipe between the manifold and the exhaust end.
- Unscrew and remove the two nuts on the head exhaust stud bolts.

See also

Removing the manifold - tail pipe

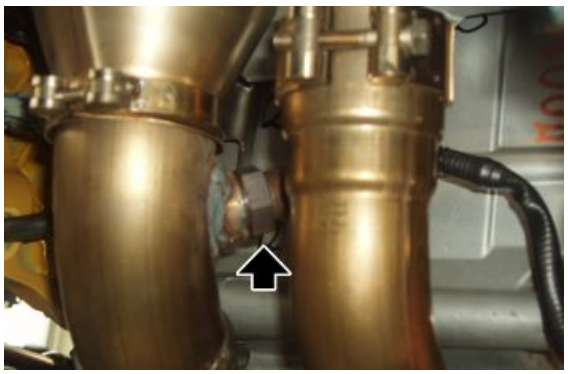
Removing the lambda sensor

- Unscrew and remove the fixing screw of the lambda probe connector bracket.

- Move the breather pipe and the bracket with the lambda probe connector fixed to it.

- Disconnect the lambda sensor connector.

- Unscrew and remove the lambda sensor.



INDEX OF TOPICS

BRAKING SYSTEM	BRAK SYS

Interventions rules

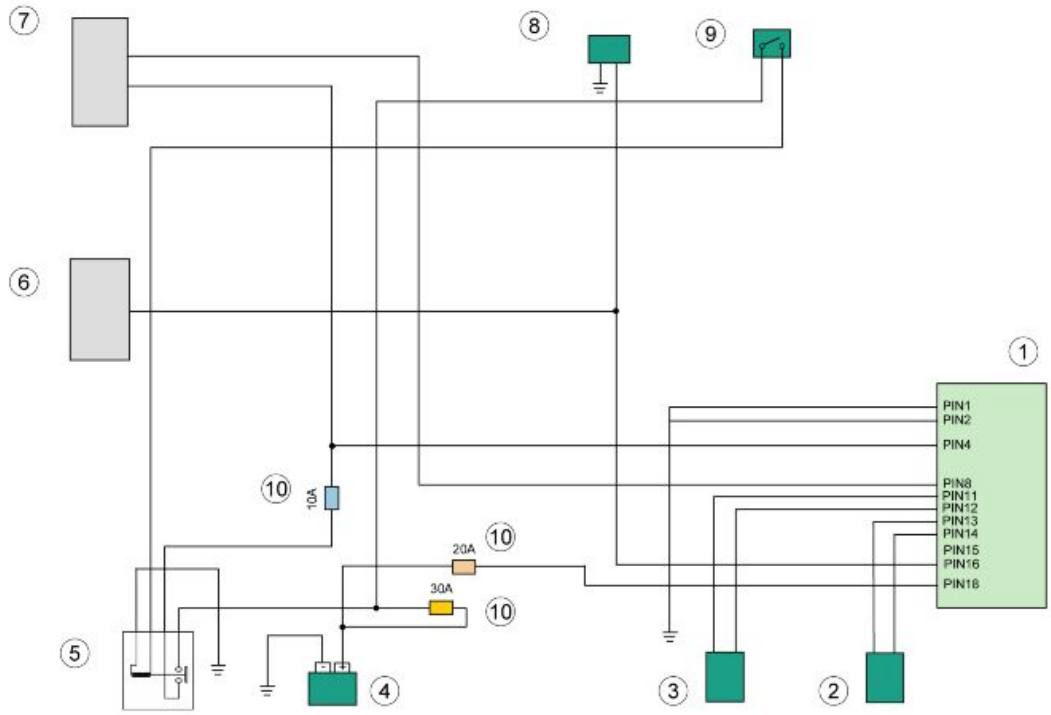
CAUTION

THE FRONT BRAKE DISC SHAPE DOES NOT CHANGE THE OPERATING AND MAINTENANCE SPECIFICATIONS OF THE SYSTEM.

ABS

ABS SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
-	ABS ECU fastener screw	M6x25	1	10 Nm (7.37 lbf ft)	Loctite 243
-	ABS ECU fastener nut	M6	2	10 Nm (7.37 lbf ft)	-



key:

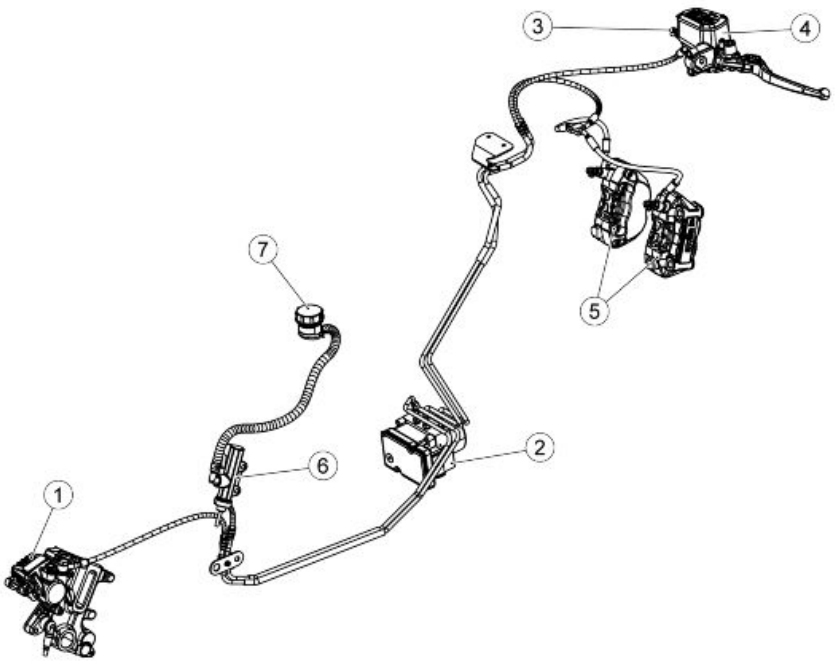
1. ABS ECU control unit
2. Front ABS sensor
3. Rear ABS sensor
4. Battery
5. Main relay
6. ECU
7. Instrument panel
8. K line (diagnosis)
9. Key
10. Fuses

ABS ECU control unit pin configuration

- PIN 1 - GND - Ground
- PIN 2 - PCC1 - Vehicle identification ground connection
- PIN 4 - IGN - Injection
- PIN 8 - WL - Alarm warning light
- PIN 11 - R_SIGN - Rear ABS sensor signal
- PIN 12 - R_GND - Rear ABS sensor ground connection
- PIN 13 - F_GND - Front ABS sensor ground connection
- PIN 14 - F_SIG - Front ABS sensor signal
- PIN 15 - PCC2 - Vehicle identification ground connection

- PIN 16 - ISO_K - K line (diagnosis)
- PIN 18 - KL30 - Power supply

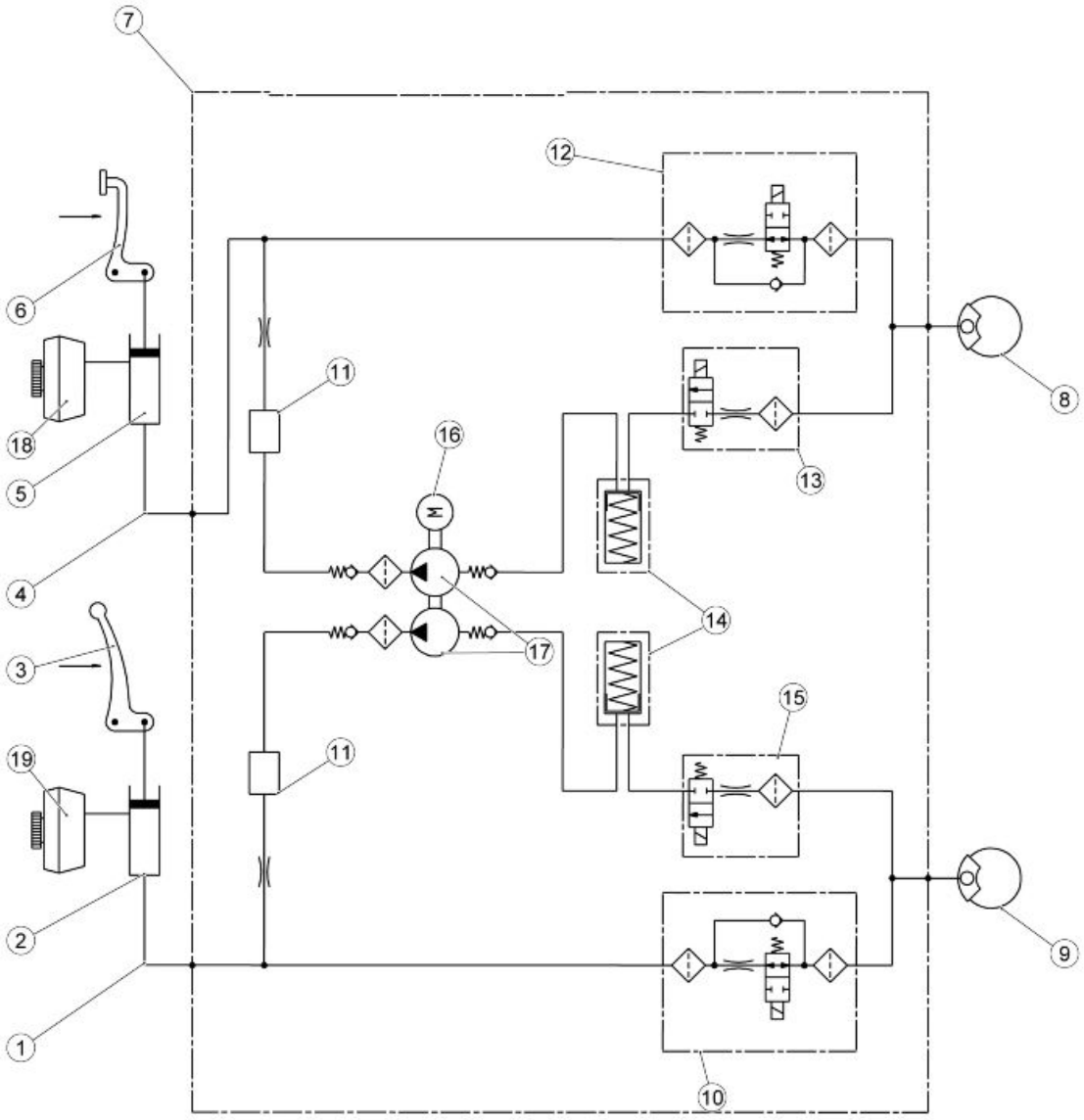
Foreword



key:

1. Rear brake calliper
2. Modulator
3. Front bleed valve
4. Front brake reservoir
5. Front brake callipers
6. Rear brake pump
7. Rear brake reservoir

Operating diagram



ABS functional diagram key

1. Front system circuit
2. Front brake pump
3. Front brake lever
4. Rear system circuit

5. Rear brake pump
6. Rear brake pedal control
7. ABS control unit
8. Rear brake calliper
9. Front calliper (2 callipers)
10. Front brake circuit intake solenoid valve (normally open)
11. Humidifier
12. Rear brake circuit intake solenoid valve (normally open)
13. Rear brake exhaust circuit solenoid valve (normally closed)
14. Rear/front brake circuit low pressure accumulator
15. Front brake exhaust circuit solenoid valve (normally closed)
16. DC electric motor
17. Double circuit hydraulic pump (ABS)
18. Rear brake reservoir
19. Front brake reservoir

ABS OPERATION

General specifications:

The front circuit is similar to the rear circuit.

- The ABS inlet valve (10 - 12) is normally open and it is closed only when the system intervenes to avoid wheel locking.
- The outlet valve (13 - 15) is normally closed and it is opened only when the system intervenes to avoid wheel locking.
- When the system is in standby, the ABS processor never stops monitoring the speed of the wheels in order to assess potential wheel slippage.
- When in standby, the system does not intervene at all when the rider brakes; the braking system is the same as the one without ABS.

Stages in ABS cycle (the following operations refer to the front circuit but are also applicable to the rear one):

A - Brake activation: the rider starts braking as he would usually do.

B - Pressure reduction: it coincides with danger recognition (wheel slippage above threshold): the system closes the inlet valve (10-12) and opens the outlet valve (13-15) temporarily.

At this stage the rider cannot increase the pressure on the callipers (8-9) and the system reduces the pressure on the callipers partially. The excess fluid temporarily fills the front reservoir (18-19) until the ABS pump (17) self-activates and delivers the fluid back to the brake pump (2-5).

C - Pressure maintained: the pressure in the callipers (8-9) remains low until total recovery of speed / wheel grip.

The system restores the fluid taken from the calliper (8-9) in the section of the system between the brake pump (2-5) and the ABS inlet valve (10-12).

D - Pressure restored: by opening the inlet valve (10-12) momentarily, the pressure of the callipers (8-9) is increased until maximum deceleration is reached. Then, the system gives the control over the braking back to the rider.

E - If the wheel does not reach complete grip, the system continues operating as before until complete grip is obtained or until the vehicle stops. An error can be detected if the duration of the pressure reduction phase exceeds the pre-set time limit.

ABS SYSTEM DESCRIPTION

The ABS system is a device to avoid wheels locking in case of emergency braking, increasing vehicle braking stability when compared to a traditional braking system.

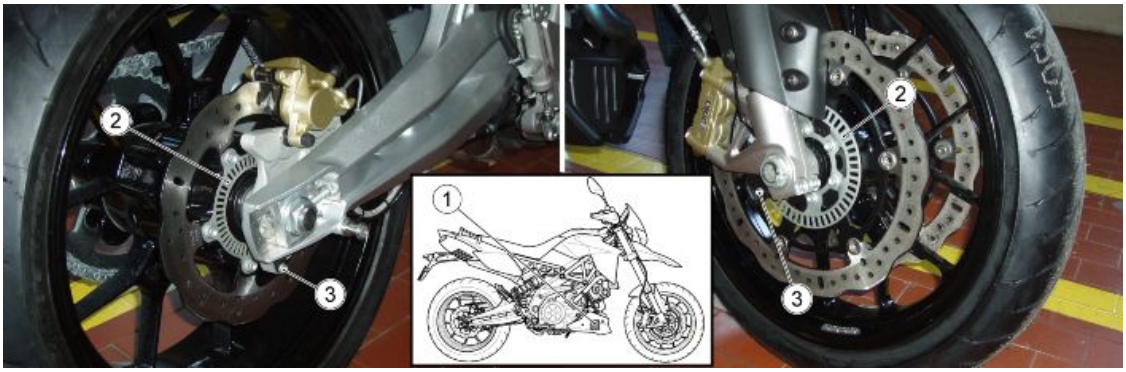
Sometimes when the brake is operated, the tyre locks with a consequent loss of grip, which makes it difficult to control the vehicle. A position sensor (3) on the tone wheel (2), forming an integral unit with the vehicle wheel, "reads" the status of the vehicle wheel spotting any possible lock.

A control unit (1) signals this out and adjusts the pressure in the braking circuit accordingly.

NOTE

WHEN THE ABS SYSTEM STARTS WORKING, A VIBRATION IS FELT ON THE BRAKE LEVER.

THE WHEEL ANTILOCK BRAKING SYSTEM DOES NOT PREVENT FALLS WHILE ON A BEND. AN EMERGENCY BRAKING WITH THE VEHICLE INCLINED, HANDLE BAR TURNED, ON UNEVEN OR SLIPPERY ROADS, OR WITH POOR GRIP CREATES LACK OF STABILITY DIFFICULT TO HANDLE. THEREFORE, RIDE CAREFULLY AND SENSIBLY AND ALWAYS BRAKE GRADUALLY. BRAKING WHILE TURNING A CORNER IS SUBJECT TO LAWS OF PHYSICS WHICH NOT EVEN ABS CAN ELIMINATE.



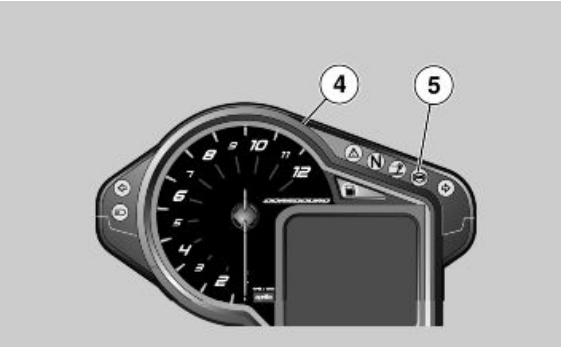
When the sensors (3) detect a significant speed difference between the rear and the front wheels (for example, when rearing up on the back wheel), the ABS system could take this as a dangerous situation. In this case, two things may occur:

- The ABS system intervenes by releasing pressure from the calliper until the wheel turns again at the same speed of the other wheel. It is not possible to brake for an instant.
- if the speed difference lasts long, the system may detect an error and deactivate the ABS system. As a consequence, the system works like any regular braking system.

Riding with an active ABS system

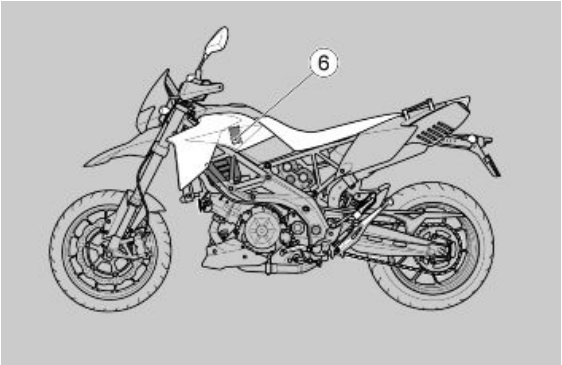
- At engine start-up, the ABS warning light (5) on the instrument panel (4) turns on and remains on until the vehicle exceeds 5 km/h (3.1 mph).

If the ABS warning light remains on when the vehicle is running, it means that a fault has been detected and the ABS system has been automatically deactivated.



20 A fuse (ABS Main fuse) (6)

Protects: ABS Control unit.



Guide to diagnosis

PREMISE

Each time the key is ON, at least one current or stored* error of the ABS system is often detected:

- the EFI warning light turns on permanently and the word ABS is shown on the display (NA 850 Mana ABS).
- the ABS warning light turns on permanently (SL 750 SHIVER ABS / DORSODURO 750 ABS).

If on the vehicle NA 850 Mana ABS, temporary errors of other control units are detected, the word ABS shown on the display is displayed instead of the word relative to the other control units where errors have been detected (e.g. GEAR or SERVICE).

The ABS system is deactivated!

The system operates perfectly just as any other braking system without ABS

*** The diagnosis requires exceeding the 5 km/h.**

Each time the key is ON, if at least one current or stored* error of the ABS system is not detected:

- the EFI warning light flashes and the word ABS is shown on the display (NA 850 Mana ABS).
- the ABS warning light flashes (SL 750 Shiver ABS / Dorsoduro 750 ABS)

When the 5 km/h (3.11 mph) are exceeded:

- if errors are not detected

- the EFI warning light turns off and the word ABS on the display disappears (NA 850 Mana ABS).
- the ABS warning light turns off (SL 750 Shiver ABS / Dorsoduro 750 ABS)

- if at least one malfunction is detected

- the EFI warning light turns on permanently and the word ABS appears on the display (NA 850 Mana ABS)
- the ABS warning light turns on permanently (SL 750 Shiver ABS / Dorsoduro 750 ABS)

The ABS system is deactivated!

The system operates perfectly just as any other braking system without ABS.

The detection of malfunctions may require more or less time according to the type of failure.
Error detection logic foresees that for the errors to be diagnosed one or more conditions must persist within a given time.
If during this given time one of the conditions is missing but then it comes back, the timer is reset and the system is no longer able to diagnose the error.
The ABS system is still inactive.

Example:

- error code 5D93 requires some minutes before it is diagnosed during the given time:

- A - The EFI warning light keeps flashing with the word ABS on the display (NA 850 Mana ABS)
- B - The ABS warning light keeps flashing (SL 750 Shiver ABS / Dorsoduro 750 ABS)

ABS FAULTS - GUIDE TO THE DIAGNOSIS

1a. **NA 850 Mana** - ABS WARNING LIGHT + ICON 1b. **Dorsoduro 750 - SL 750 Shiver** - ABS WARNING LIGHT LIT

2- CONNECT NAVIGATOR

DOES NAVIGATOR COMMUNICATE? (NO, go to 3; YES, go to 4)

3.PERFORM THESE CHECKS:

- A. Ground connection PIN 1
- B. +12V at PIN 18
- C. +12V at PIN 4 with key ON

4. **ARE THERE ANY ERRORS? (YES, go to 5; NO, go to 6)**

5. CONSULT THE ERRORS TABLE

6. ABS WARNING LIGHT ACTIVATION

ACTIVE?(YES, go to 7; NO, go to 8)

7. CONTACT TECHNICAL SERVICE

8. CHECK:

- A. Cable continuity between PIN 8 of the ABS control unit connector and PIN 28 of the instrument panel.
- B. Check connectors - refer to the operations described in the chapter

If the previous checks are OK, the causes might be:

- C. ABS control unit malfunction
- D. Instrument panel malfunction

NOTE: to check the wheel speed sensor using the NAVIGATOR, follow the instructions given in chapter "ELECTRICAL SYSTEM/CHECKS AND TESTS/SPEED SENSOR".

Use of diagnostics instrument for ABS system

ECU INFO screen page

This screen page shows general data regarding the control unit, for example software type, mapping, control unit programming date

INFO ECU SCREEN PAGE

Characteristic	Value/example	Unit of measurement	Notes
Vehicle manufacturing date			
Frame number			
Software version			
Vehicle code	Mana/Shiver/Dorsoduro/Scarabeo		The vehicle code stored in the control unit is read.
Vehicle identification according to the status of Pin 2 and 15 of the ABS control unit connector	Mana/Shiver/Dorsoduro/Scarabeo		The vehicle type (Mana/Shiver/Dorsoduro) is defined according to the connection found for PIN 2 and PIN 15 of the ABS control unit connector. see the following table

NOTE: the "X" in the table identifies the connector pin is grounded.

aprilia		PIN2	PIN15
	Shiver		X
	Mana	X	
	Scarabeo	X	X
	Dorsoduro		

PARAMETERS screen page

This screen page shows the parameters measured by the several sensors (engine revs, engine temperature, etc.) or values set by the control unit (injection time, ignition advance, etc.)

PARAMETERS

Characteristic	Value/example	Unit of measurement	Notes
Front wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed
Rear wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed
Battery voltage	11.9	V	

ACTIVATION screen page

This screen page is used to delete errors in the control unit memory and to activate some systems controlled by the control unit.

ACTIVATION

Characteristic	Value/example	Unit of measurement	Notes
Front brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
Rear brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
ABS warning light			During the test the warning light stays on
Ambient parameter error reading (1)			The ambient parameters are 4: Number of error detections, Operation cycles from the last detection, Battery voltage, Speed.
Ambient parameter error reading (2)			Number of error detections: number of times the error has been detected by the control unit;
Ambient parameter error reading (3)			for example, if it indicates 2, it means that the error has been detected (ATT), then it has not been detected for a while (sent to the MEM) and then it has been detected again.
Ambient parameter error reading (4)			Operation cycles from the last reading: a cycle is counted if the following occurs: key ON and speed over 20 km/h.
Ambient parameter error reading (5)			If for example 5 is shown, it means that the last time the error has been measured was 5 cycles ago.
Error clearing (1)			Press "enter" to transfer errors from the memory (MEM) to the historical record (STO).
Error clearing (2)			In the next connection between Navigator and the control unit, the historical errors (STO) are no longer shown.

ERRORS screen page

This screen page shows potential errors detected in the vehicle (ATT) or stored in the control unit (MEM) and it allows to check error clearing (STO).

ERRORS

Characteristic	Value/example	Unit of measurement	Notes
Front speed sensor: 5D90 electric malfunction			Electrical fault in sensor or cable harness
Front speed sensor: 5D91 the signal works irregularly			Faulty sensor or signal interference
Front speed sensor: 5D92 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Front speed sensor: no signal or speed measured too low in relation to the rear wheel 5D93			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth
Front speed sensor: 5D94 no acceleration after pressure reduction			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel
Front speed sensor: 5D95 excessive measured speed			Faulty sensor/tone wheel, or tone wheel with wrong number of teeth or wrong tyre size
Rear speed sensor: 5DA0 electric malfunction			Electrical fault in sensor or cable harness
Rear speed sensor: 5DA1 the signal works irregularly			Faulty sensor or signal interference
Rear speed sensor: 5DA2 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Rear speed sensor: 5DA3 no signal or speed measured too low in relation to the front wheel			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth
Rear speed sensor: 5DA4 no acceleration after pressure reduction			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel
Rear speed sensor: excessive measured speed 5DA5			Faulty sensor or tone wheel with wrong number of teeth or wrong tyre size
Control unit: missing valve calibration 5DD2			Possible control unit fault
Control unit 5DD3			Possible control unit fault
Recirculation pump 5DF0			Possible control unit fault
Recirculation pump 5DF1			Possible control unit fault
Control unit 5DF2			Possible control unit fault
Low electric voltage - long period measurement 5DF3			Voltage too low measured for 30 seconds at PIN 18 of the ABS control unit:
Control unit 5DF5			Possible control unit fault
High electric voltage 5DF7			Excessive voltage measured at PIN 18 of the ABS control unit
Vehicle code 5E59			Inconsistency detected between memory coding (INFO ECU/Vehicle code) and what is measured at cable harness identification PIN (INFO ECU screen page, Vehicle identification line - Pins 2-15 of ABS control unit)
Control unit F000			Possible control unit fault

SETTINGS screen page

This screen page is used to adjust some control unit parameters.

ADJUSTMENTS

Characteristic	Value/example	Unit of measurement	Notes
Coding (1)			Used for re-coding the control unit or coding a new one.
Coding (2)			Vehicle identification is done according to the connection of PINS 2 and 15 of the ABS control unit connector and is stored in the control unit memory.
Coding (3)			The identification can be read in the INFO ECU screen page in the line: Vehicle code.

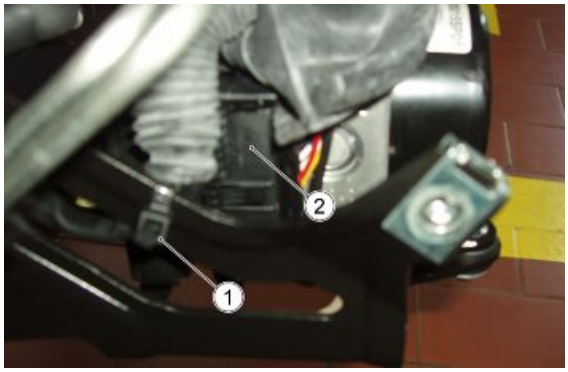
NOTE: the "X" in the table identifies the connector pin is grounded.

aprilia		PIN2	PIN15
	Shiver		X
	Mana	X	
	Scarabeo	X	X
	Dorsoduro		

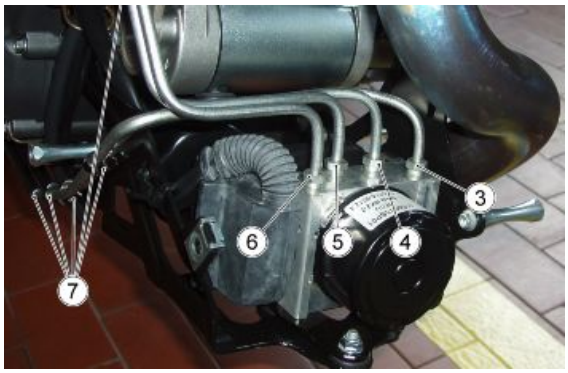
Modulator

MODULATOR REMOVAL

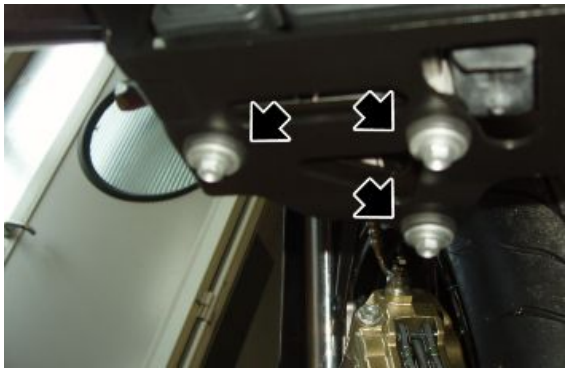
- Remove the fairing lug.
- Release clamp (1) and disconnect connector (2).



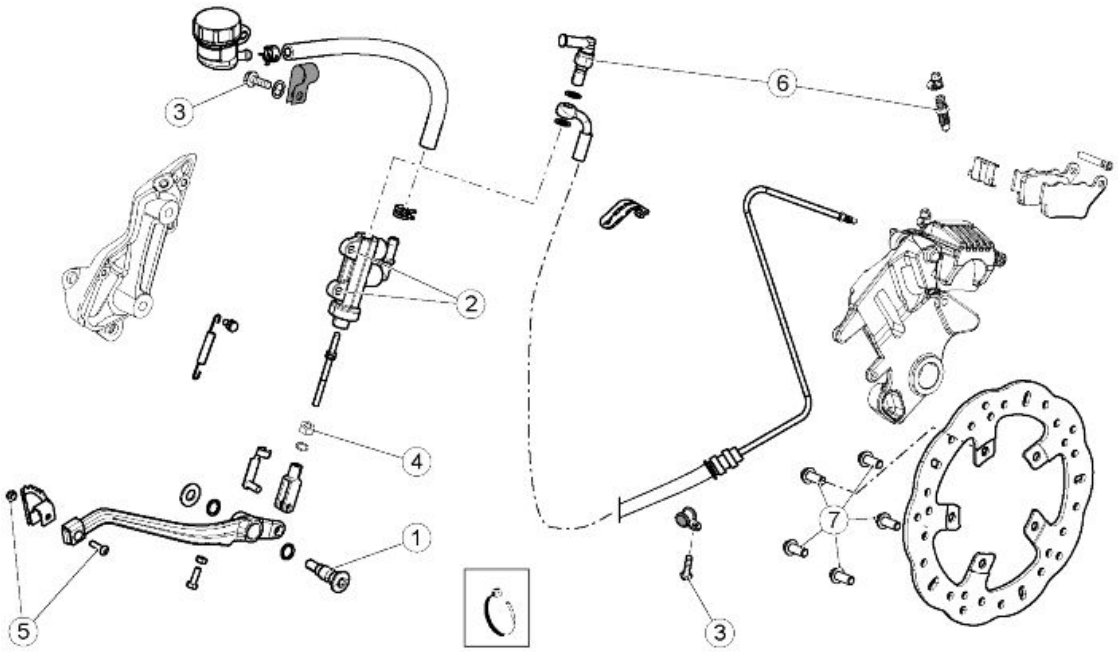
- By unscrewing the nuts, remove and plug the brake oil pipes following this sequence: (3) - (4) - (6) - (5).



- Slide off the rear system pipes from the hooks (7).
- Undo and remove the three screws, collect the washers and remove the ABS modulator.



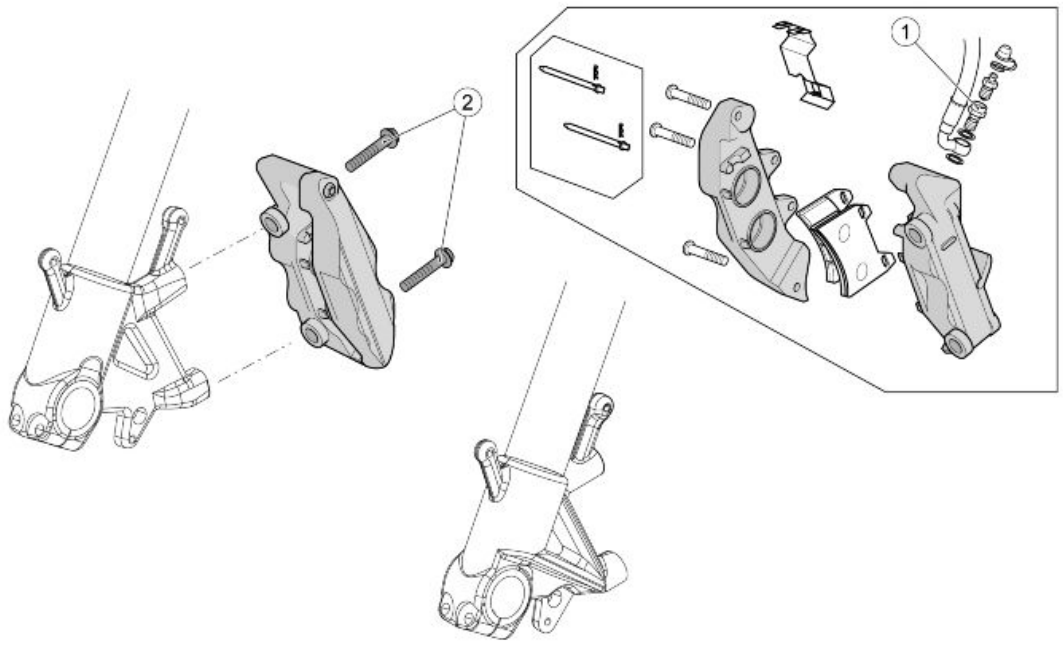
Rear brake calliper



REAR BRAKE

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake lever pin	M6	1	25 Nm (18.44 lbf ft)	-
2	Flanged TE screw fastening pump to footrest mounting	M6x20	2	10 Nm (7.37 lbf ft)	-
3	TBEI screw fastening oil pipe to swingarm and rubber pipe to footrest mounting	M5x12	4	6 Nm (4.42 lbf ft)	-
4	Flanged self-locking nut	M6	1	10 Nm (7.37 lbf ft)	-
5	Screw + nut fastening pedal to brake lever	M6	1+1	10 Nm (7.37 lbf ft)	-
6	Brake pipe union	M10x1	2	25 Nm (18.44 lbf ft)	-
1	Flanged TE screw fastening rear disc	M8x20	5	30 Nm (22.13 lbf ft)	Loctite 243
-	Flanged TE screw	M6x16	1	10 Nm (7.37 lbf ft)	-

Front brake calliper



FRONT BRAKE

pos.	Description	Type	Quantity	Torque	Notes
1	Union with breather (fixing pipe to callipers)	M10x1	2	25 Nm (18.44 lbf ft)	-
2	TEFL screw (Fixing calliper to fork stems)	M10x1.25	4	50 Nm (36.88 lbf ft)	-
-	Fastener for brake pipe on steering base	M6x25	1	10 Nm (7.37 lbf ft)	-

Front brake pads

Removal

- Turn the pins and remove both split pins.

- Remove both pins.
- Collect the anti-vibration springs.

- Extract one pad at a time.

CAUTION

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.

Rear brake pads

Removal

- Remove the safety circlip.

- Unscrew and remove the pin.

- Extract one pad at a time.

CAUTION

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.

Bleeding the braking system

Front

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and poor braking efficiency.

CONSIDERING THE DANGER FOR VEHICLE AND RIDER, IT IS STRICTLY NECESSARY, AFTER REFITTING BRAKES AND RESTORING THE BREAKING 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.
- Quickly press and release the front brake lever several times and then keep it fully pressed.
- Loosen the bleed valve 1/4 of a turn so that the brake fluid flows into the container. This will release the tension on the brake lever and will make it reach the end of stroke.
- Close the bleed valve before the lever reaches its end of stroke.
- Repeat the operation until the fluid draining into the container is air-bubble free.

NOTE

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.

- Screw the bleeding valve and remove the pipe.
- Top-up the reservoir until the correct brake fluid level is obtained.
- Refit and block the front brake oil reservoir cap.
- Refit the rubber protection cover.

Rear

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and 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. 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.

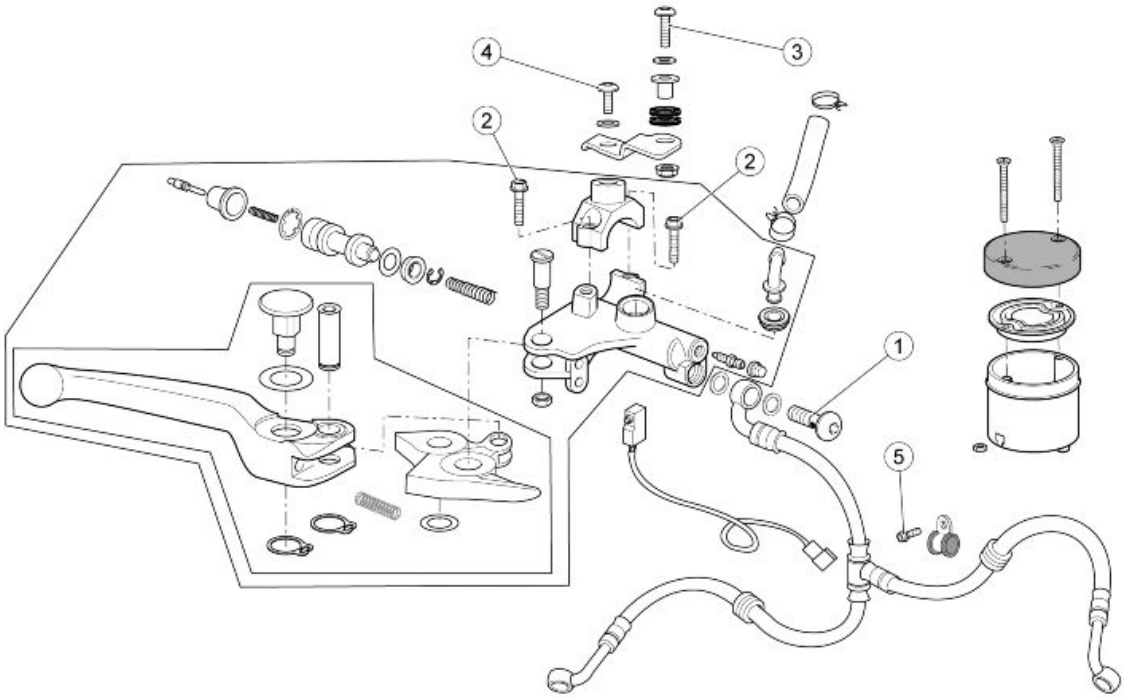
- Remove the rubber protection cover from the bleed valve.
- Insert the transparent plastic pipe in the rear brake calliper bleed valve and insert the other end of this pipe into a container to collect the fluid.
- Remove the rear brake fluid reservoir cap.
- Quickly press and release the rear brake lever several times and then keep it fully pressed.
- Loosen the bleed valve 1/4 of a turn so that the brake fluid flows into the container. This will release the tension on the brake lever and will make it reach the end of stroke.
- Close the bleed valve before the lever reaches its end of stroke.
- Repeat the operation until the fluid draining into the container is air-bubble free.

NOTE

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.

- Screw the bleeding valve and remove the pipe.
- Top-up the reservoir until the correct brake fluid level is obtained.
- Refit and lock the rear brake oil reservoir cap.
- Refit the rubber protection cover.

Front brake pump

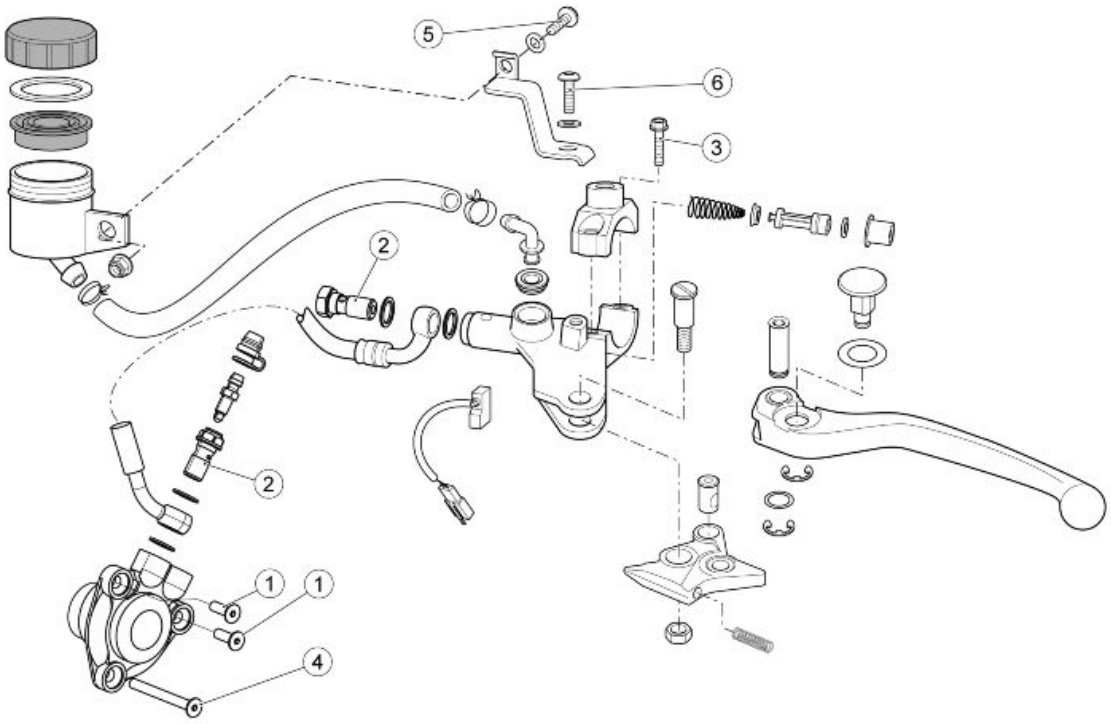


FRONT BRAKE PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Pipe union fastening brake pipe to pump	M10x1	1	25 Nm (18.44 lbf ft)	-
2	Fastener for front brake pump on handlebar	-	2	10 Nm (7.37 lbf ft)	-
3	TBEI screw fastening the brake tank to the plate	M6x20	1	10 Nm (7.37 lbf ft)	-
4	Plate fixing screw	M6x12	1	10 Nm (7.37 lbf ft)	-
5	Screw fastening the brake pipe to steering base	M6x25	1	10 Nm (7.37 lbf ft)	-

INDEX OF TOPICS

CLUTCH SYSTEM	CLU SYS



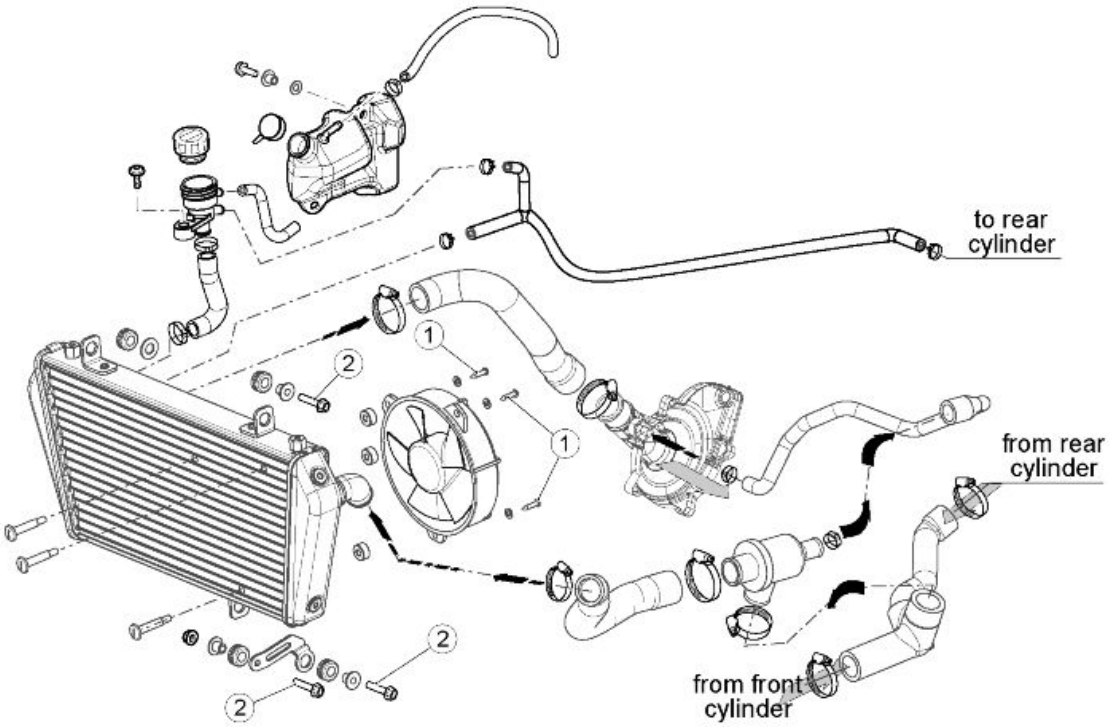
CLUTCH PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch cylinder fastener	M6	2	10 Nm (7.37 lbf ft)	-
2	Union with breather and fixing pipe	M10x1	1+1	25 Nm (18.44 lbf ft)	-
3	Fastener for clutch pump on handle-bar	-	2	10 Nm (7.37 lbf ft)	-
4	Screw fastening clutch control mounting on flywheel side crankcase half	M6	1	10 Nm (7.37 lbf ft)	-
5	TBEI tank fixing screw	M5x10	1	6 Nm (4.42 lbf ft)	-
6	TBEI plate fixing screw	M6x12	1	10 Nm (7.37 lbf ft)	-

INDEX OF TOPICS

COOLING SYSTEM	COOL SYS

Circuit diagram

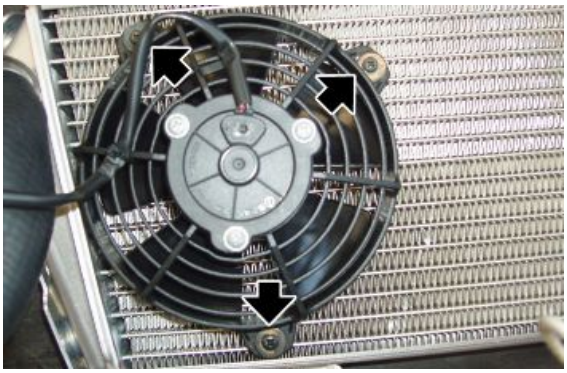


COOLING SYSTEM

pos.	Description	Type	Quantity	Torque	Notes
1	Fan fastener screw	-	3	3 Nm (2.21 lbf ft)	-
2	Flanged TE screw fixing LH side radiator to trellis frame and radiator bracket to engine	M6x25	2	10 Nm (7.37 lbf ft)	-

Electric fan

- Remove the radiator
- Undo and remove the three screws and collect the washers; remove the electric fan.



See also

Removing the radiator

Coolant replacement

- Remove the right side fairing.

- Place a container of suitable capacity.
- Loosen the screw, move the clamp and slide off the sleeve.

- Remove the cap.

- Empty the system into the specific container.
- Loosen the screw and move the clamp.

- Slide off the sleeve and empty the system completely.

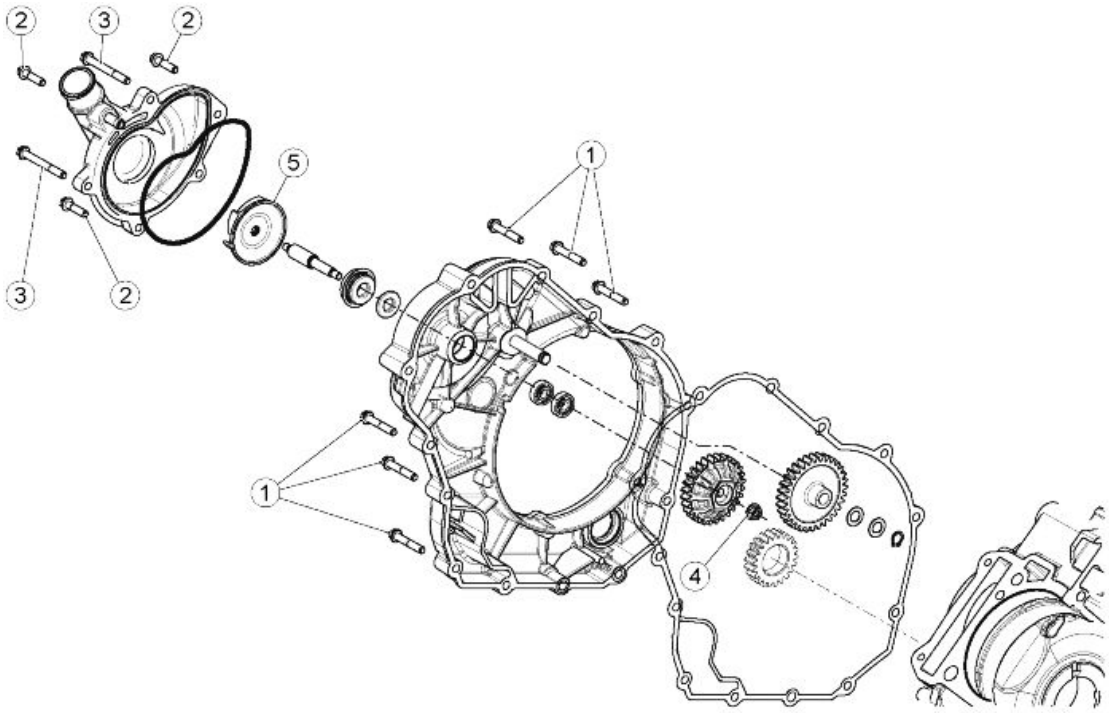
CAUTION

SHOULD GREASE BE NOTED IN THE WATER THIS IS TO BE CONSIDERED NORMAL BECAUSE DURING THE ASSEMBLY PHASE OF THE WATER PUMP SIGNIFICANT LUBRICATION OF THE SAME IS REQUIRED IN ORDER TO PREVENT DAMAGE.

- Refit both sleeves, place the corresponding clamps and tighten their screws.
- Fill the expansion tank up to the marked level.
- After bleeding the air from the tank, fit the expansion tank cap.
- Refit the front protection and tighten the screw.
- Fit the right side fairing.

Water pump

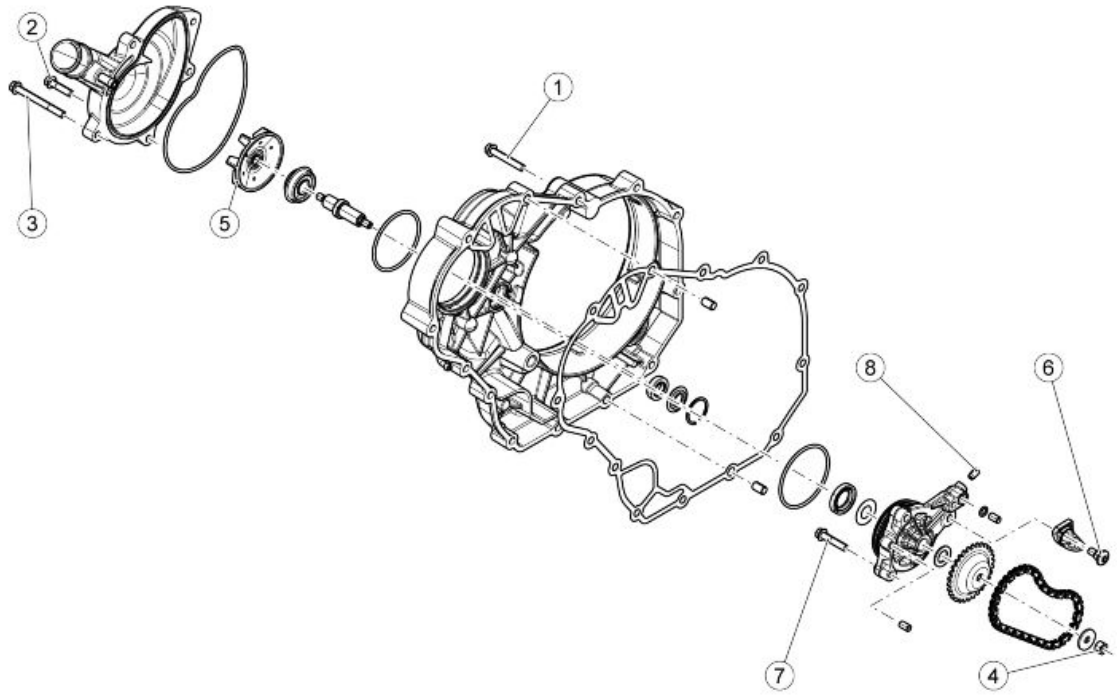
OPTION 01



WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	13	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening pump drive input gear on shaft	M6	1	12 Nm (8.85 lbf ft)	Loctite 244
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-

OPTION 02



WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening water pump drive gear sprocket	M6	1	12 Nm (8.85 lbf ft)	-
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slider to water pump	M6	1	8-10 Nm (5.90-7.38 lbf ft)	-
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP 2353

Removal

OPTION 01

COVER REMOVAL

- Drain off the cooling circuit completely.
- Undo and remove the five screws.
- Remove the water pump cover.

PUMP ROTOR REMOVAL

- Remove the clutch-side cover.
- Lock the pump shaft with a universal wrench on the hexagonal insert on the shaft.

- Unscrew and remove the anticlockwise nut fixing the rotor.
- Remove the rotor.

- Unscrew and remove the rotor control gear fixing nut and act on the gear hexagonal insert.
- Remove the rotor control gear.
- From the cover inside to the outside, remove the rotor control shaft with a punch and a rubber hammer.

- Use a screwdriver to remove the upper part of the shaft and integrated seal assembly as indicated.

CAUTION

BEFORE TIGHTENING THE 3 SCREWS, ENSURE THAT THE TOOL IS PERFECTLY CENTRED WITH THE SEAL AND THAT THE SCREWS ARE PERPENDICULAR TO THE SURFACE OF THE SEAL ITSELF. TIGHTENING THE SCREWS INCORRECTLY MAY DAMAGE THE OIL SEAL UNDERNEATH THE WATER SEAL AND THE COVER ITSELF.

- Fit the tool and use the specific punch to make 3 holes in the integrated seal.

Specific tooling

020661Y Water pump overall seal replacement kit

- Tighten the three screws.

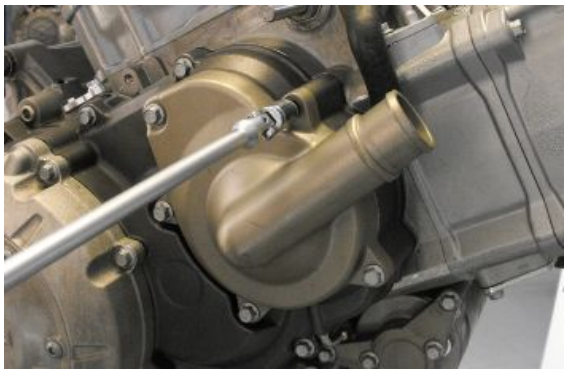
- Fit the upper part of the tool.
- Fully tighten the pin with the bolt.
- Preventing the bolt from turning, tighten the nut to that the lower part of the tool, onto which the shaft and integrated seal are connected, raises.

- Remove the oil seal.

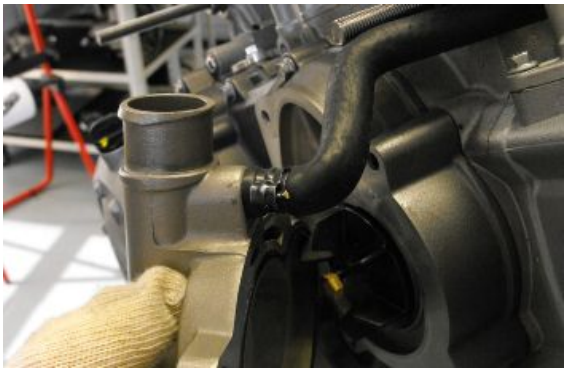
OPTION 02

COVER REMOVAL

- Drain off the cooling circuit completely.
- Unscrew and remove the five water pump cover fixing screws.



- Release the clamp.



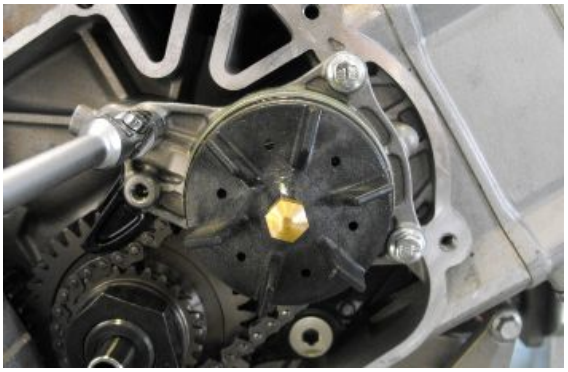
- Remove the water pump cover.

PUMP ROTOR REMOVAL

- Remove the water pump cover H20.
- Unscrew and remove the impeller paying attention to the left-handed threading of the pin.

COMPLETE H2O PUMP REMOVAL

- Remove the clutch cover.
- Unscrew and remove the three H2O pump fixing screws.



- Remove the H2O pump and slide off the drive chain.

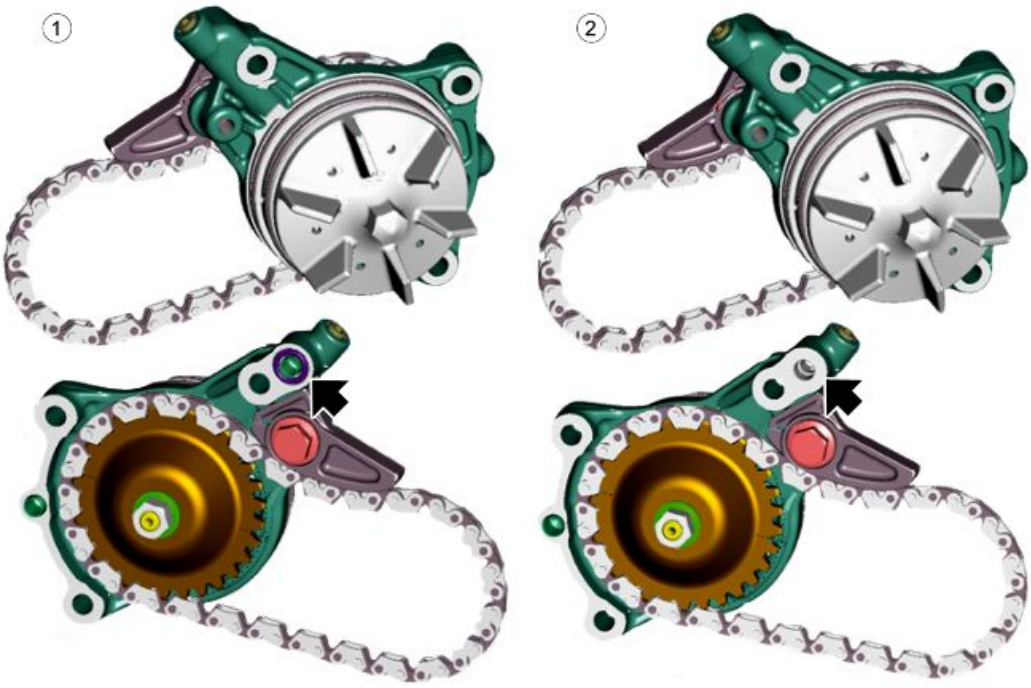
NOTE

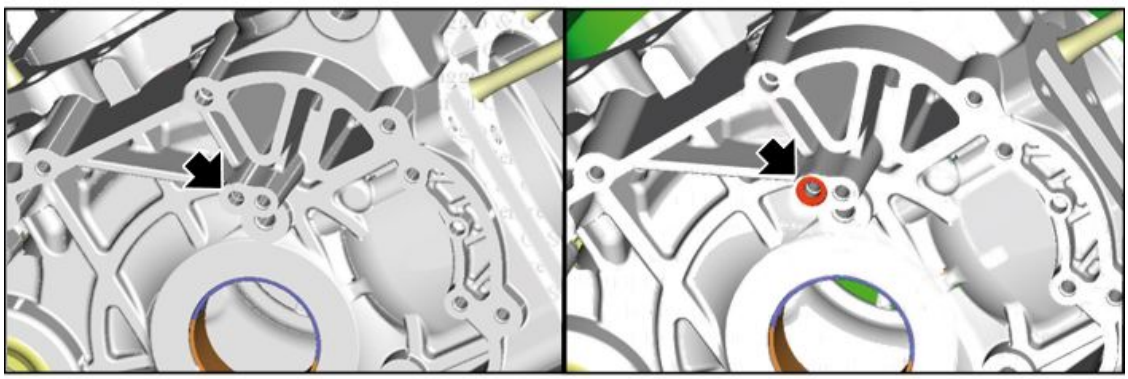
REPLACE THE O-RINGS ON REASSEMBLY

Installing

CAUTION

PAY ATTENTION TO THE TYPE OF PUMP FITTED DURING FITTING. THERE ARE TWO TYPES, WITH (1) AND WITHOUT O-RING (2). THEY CANNOT BE INTERCHANGED BETWEEN THEM.
IT IS POSSIBLE TO CHECK THE PRESENCE OF O-RING ON THE CARTER OR DIRECTLY ON THE PUMP. THE SEAT MUST BE AS SHOWN IN THE FIGURE.
FURTHERMORE, THE CARTERS STAMPED WITH NUMBER 28127 AND FOLLOWING ARE ALL WITH O-RING SEAT.





OPTION 01

REFITTING

- Insert a new oil seal using the appropriate tool to a depth of 2 mm (0.079 in) (determined by the tool), relative to the upper part of the crankcase, at the end of the flanged part of the seat orifice.

CAUTION

AFTER INSTALLING THE OIL SEAL, CHECK THAT THE WATER DRAINAGE HOLE UNDER THE OIL SEAL ITSELF IS NOT OBSTRUCTED.

Specific tooling

020885Y Water pump oil seal punch

- Fit a new shaft and integrated seal assembly using the specific tool.

Specific tooling

020725Y Punch for water pump overall sealing

- Fit the rotor drive gear.
- Fit the rotor drive gear fastener nut, applying leverage on the hexagonal insert on the gear itself.

- Fit the rotor and tighten with the relative nut while preventing the pump shaft from turning with a spanner.

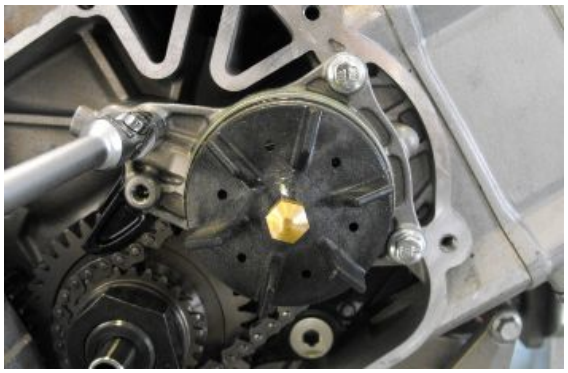
- Fit the water pump cover, fastening the five screws.

OPTION 02

COMPLETE H2O PUMP INSTALLATION

- Insert the drive chain and position the H2O pump in its seat.

- Insert the three H2O pump fixing screws and tighten then to the prescribed torque.



- Spread grease generously on the side of the H2O pump, thereby facilitating insertion of the cover.

CAUTION

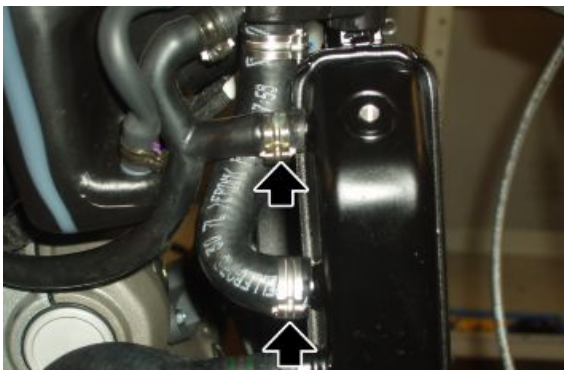
DURING ASSEMBLY OF THE COVER BE CAREFUL TO INSERT IT PERPENDICULARLY TO THE CRANKCASE WITH UNIFORM PRESSURE ON THE ENTIRE SURFACE, THEREFORE AVOIDING DAMAGE TO THE O-RINGS.

Removing the radiator

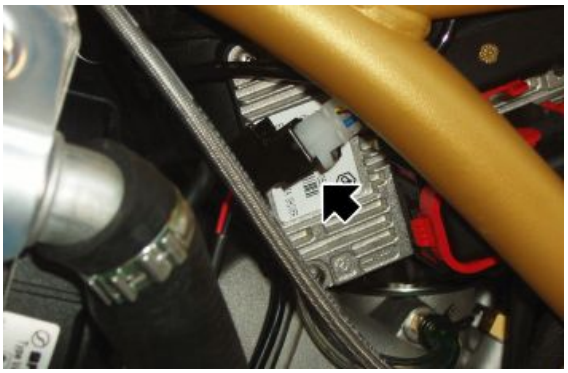
- Drain off the cooling system.

- Undo and remove the screw.
- Remove the filler.

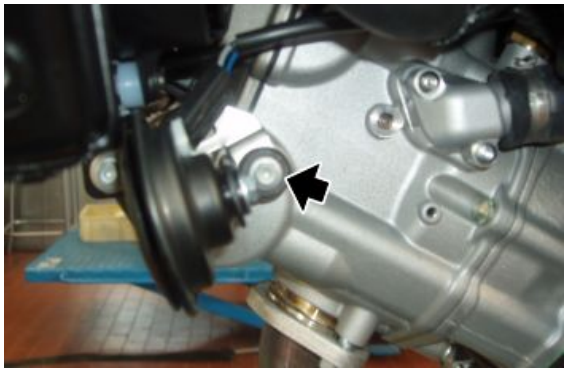
- Remove both clamps and slide off the corresponding pipes.



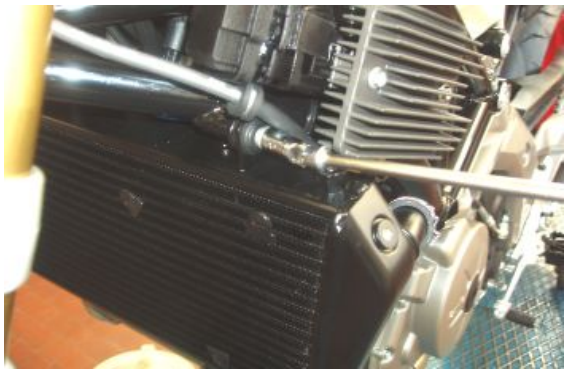
- Disconnect the electric fan connector.



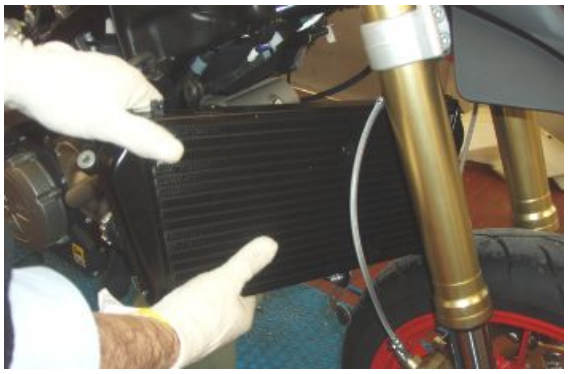
- Undo and remove the screw, remove the horn.



- Working on the left side of the vehicle, unscrew and remove the screw.



- Lower the radiator from the upper fixing side to the chassis and remove it by sliding it off toward the vehicle right-hand side.



- To install the radiator, follow the operations explained above but in reverse order, and replace all the clamps removed.
- Restore the correct coolant level.

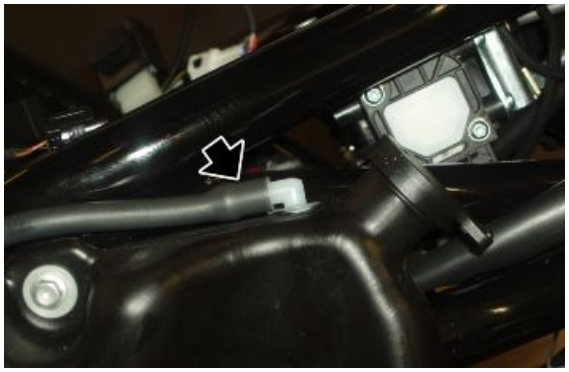
See also

Coolant replacement

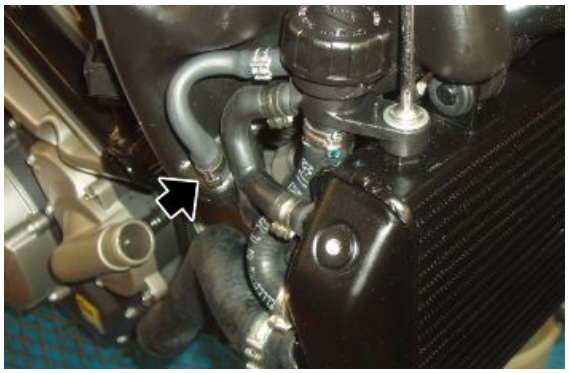
Removing the expansion tank

- Remove the right side fairing.

- Loosen and move the clamp.
- Slide off the pipe.



- Release the clamp.
- Slide off the pipe.



- Undo and remove the screw and collect the washer.
- Slide off the expansion tank.

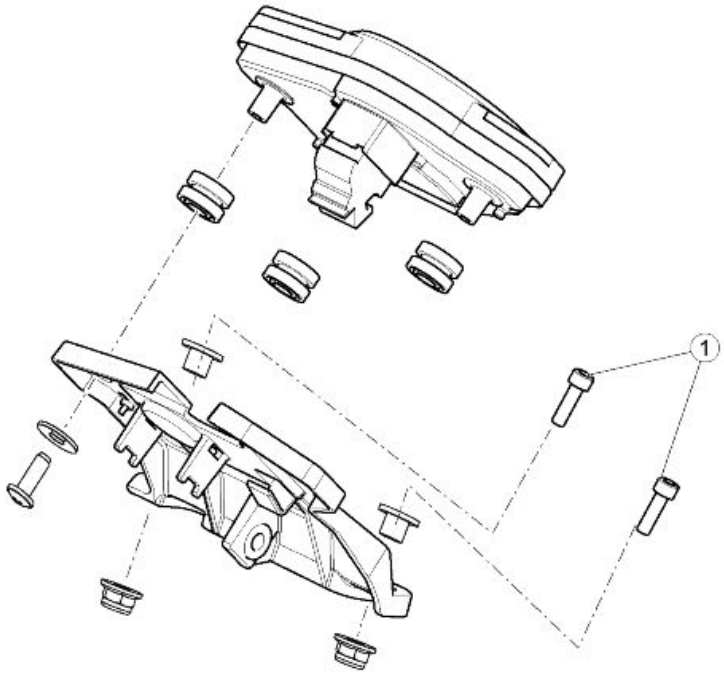
Thermostatic valve

Traditional circuit, three-way thermostatic valve:

1. Hot water inlet from the heads.
2. Outlet towards the short circuit (direct to the pump).
3. Outlet towards the radiator

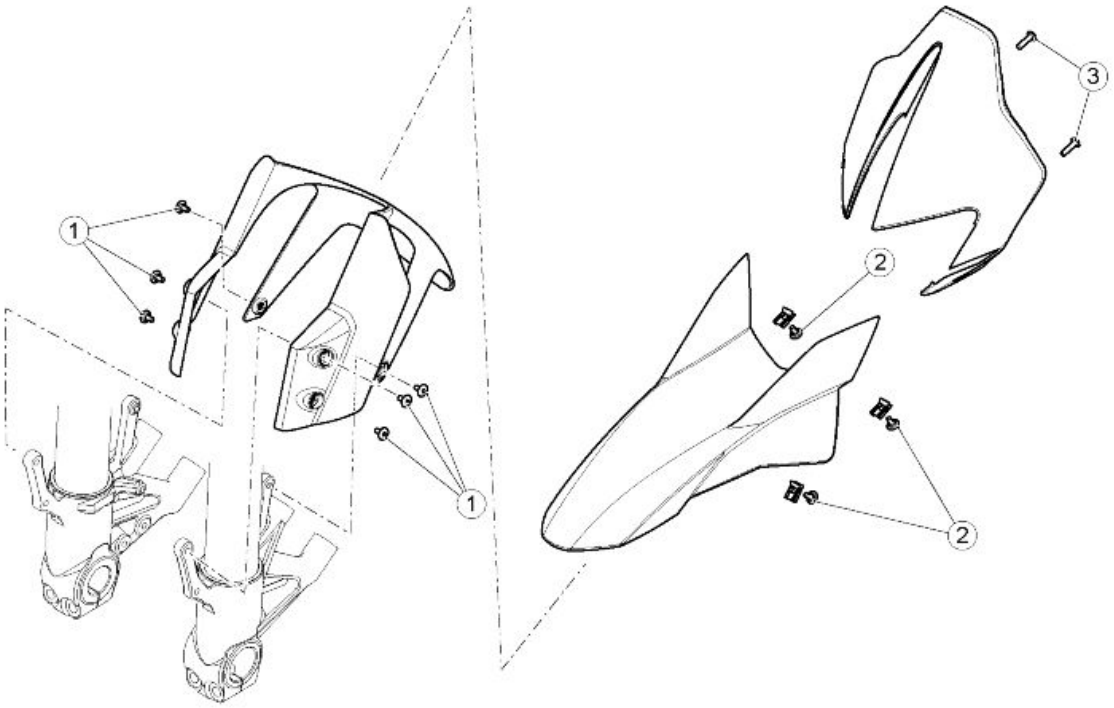
INDEX OF TOPICS

BODYWORK	BODYW



INSTRUMENT PANEL

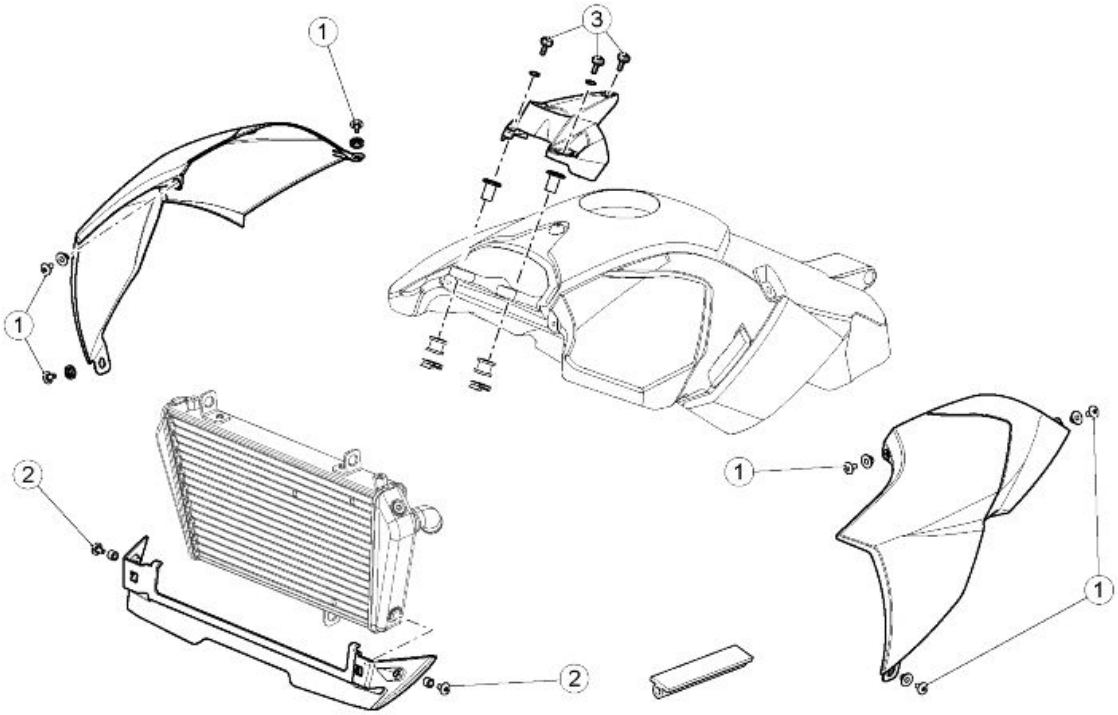
pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening instrument panel mounting to fork yoke	M6x20	2	10 Nm (7.37 lbf ft)	-



FRONT MUDGUARD

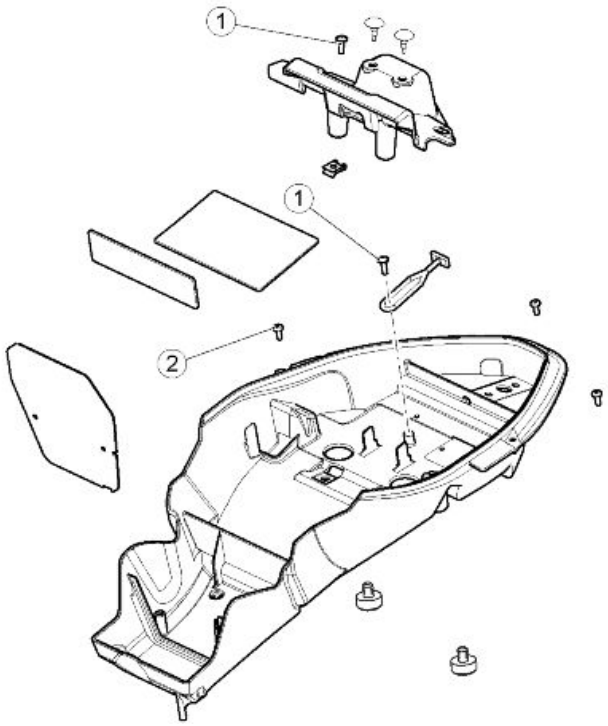
pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening fork guard to calliper mounting bracket	M5x9	6	6 Nm (4.42 lbf ft)	Loct. 243

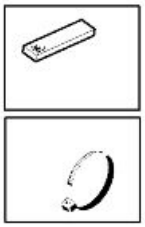
pos.	Description	Type	Quantity	Torque	Notes
2	TBEI screw fastening mudguard to stanchions	M5x9	4	4 Nm (2.95 lbf ft)	-
3	Screw fastening number panel to headlamp	-	4	1 Nm (0.74 lbf ft)	-



FRONT BODYWORK

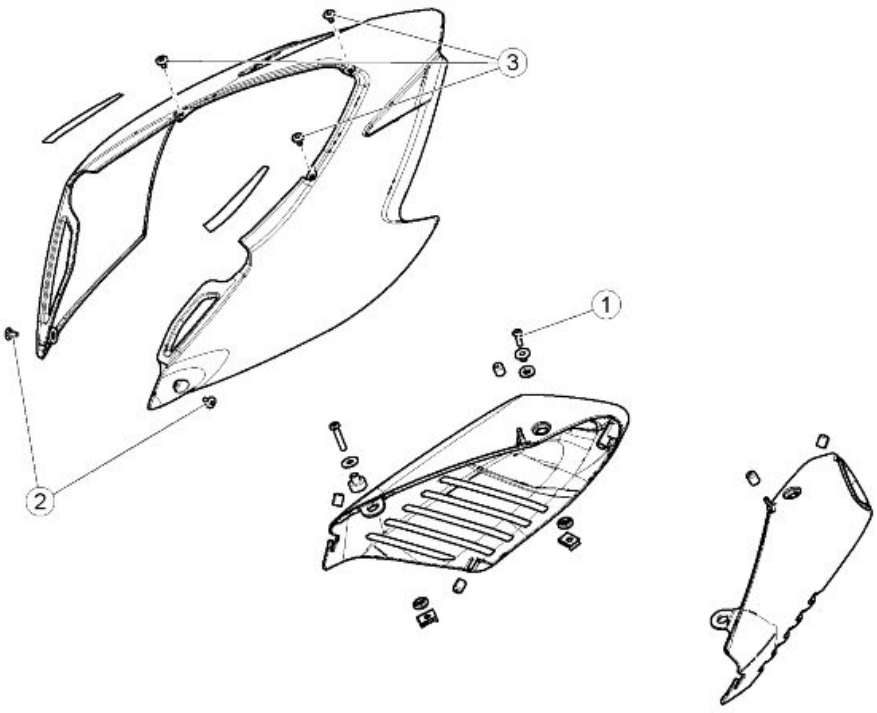
pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening front side panels to tank	M5x9	6	4 Nm (2.95 lbf ft)	-
2	TBEI screw fastening front side panels and duct to radiator	M6x16	4	6 Nm (4.42 lbf ft)	-
3	TBEI screw fastening ignition block cover to spacer	M5x9	3	4 Nm (2.95 lbf ft)	-
-	Front tank fastener spacer	M6	2	10 Nm (7.37 lbf ft)	-





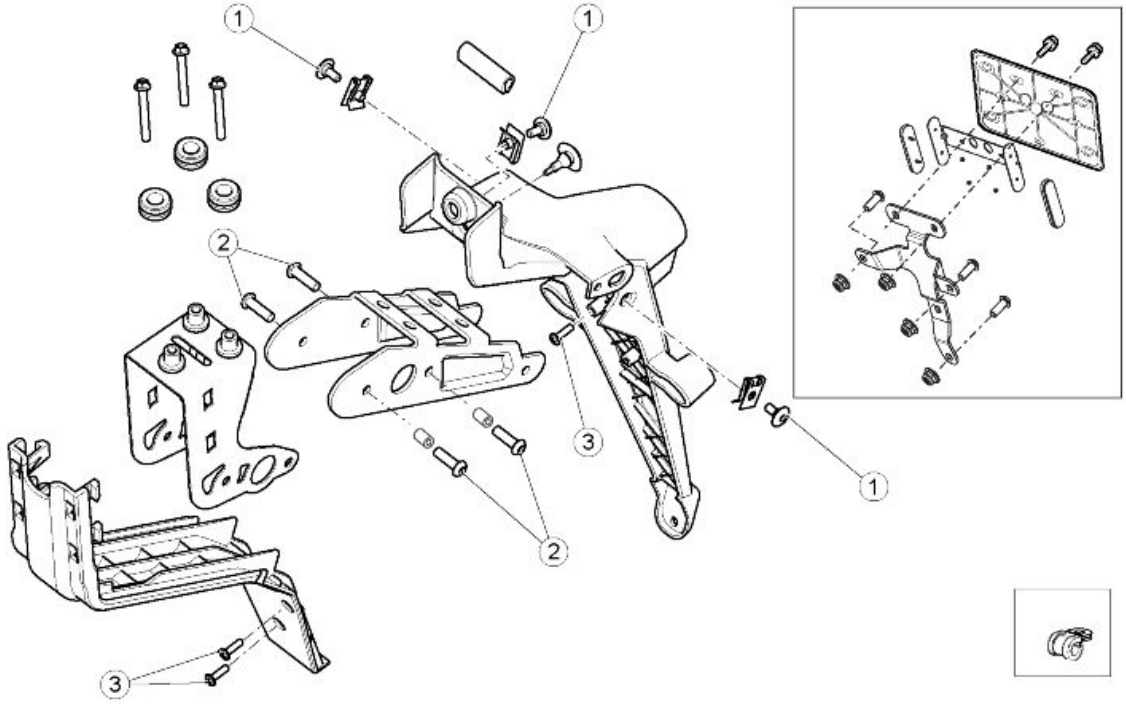
REAR BODYWORK 1

pos.	Description	Type	Quantity	Torque	Notes
1	Screws fastening battery cover to compartment	M5	2+1	4 Nm (2.95 lbf ft)	-
2	TBEI screw fastening battery compartment to saddle mounting	M5x9	2	6 Nm (4.42 lbf ft)	-



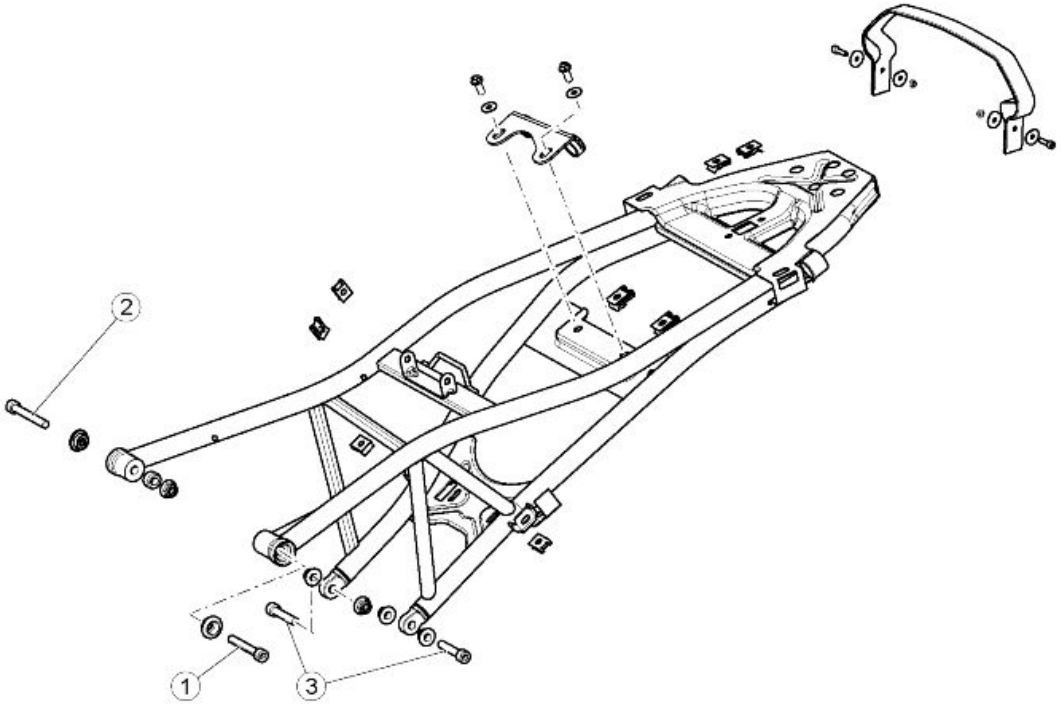
REAR BODYWORK 2

pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening LH - RH covers to silencer	M6x20	4	10 Nm (7.37 lbf ft)	-
2	TBEI screw fastening tail fairing to saddle mounting	M5x9	2	6 Nm (4.42 lbf ft)	-
3	Screw fastening tail fairing to battery compartment	-	3	4 Nm (2.95 lbf ft)	-



REAR BODYWORK 3

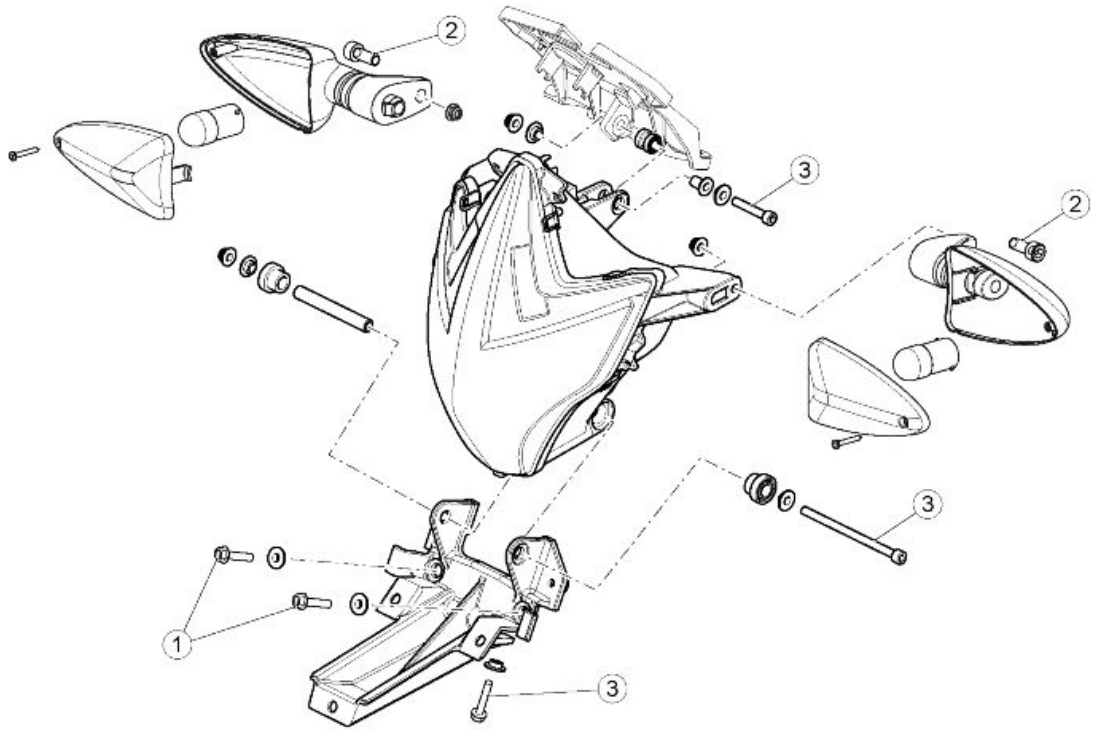
pos.	Description	Type	Quantity	Torque	Notes
1	TBEI screw fastening license plate mounting to mounting	M5x9	3	6 Nm (4.42 lbf ft)	-
2	Fastener for license plate mounting frame assembly to gusset plate - saddle lock	M6	4	10 Nm (7.37 lbf ft)	-
3	Screw fastening license plate mounting cover to license plate mounting	-	3	0.8 Nm (0.59 lbf ft)	-



SADDLE MOUNTING

pos.	Description	Type	Quantity	Torque	Notes
1	Upper LH TCEI screw fastening saddle mounting to frame	M8x55	1	25 Nm (18.44 lbf ft)	-
2	Upper RH TCEI screw fastening saddle mounting to frame	M8x60	1	25 Nm (18.44 lbf ft)	-
3	Lower TCEI screw fastening Saddle mounting to frame	M8x40	2	25 Nm (18.44 lbf ft)	-
-	TCEI screw fastening passenger grab handles to frame	M8x80	4	30 Nm (22.13 lbf ft)	-

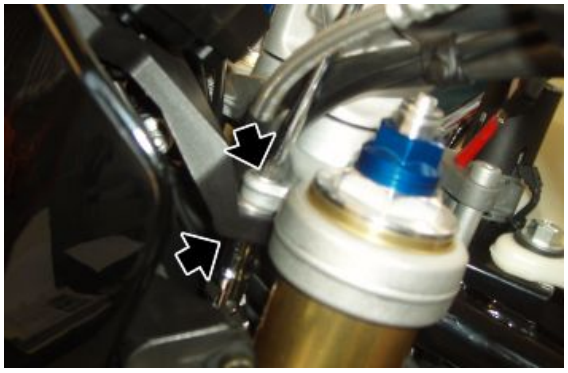
Headlight assy.



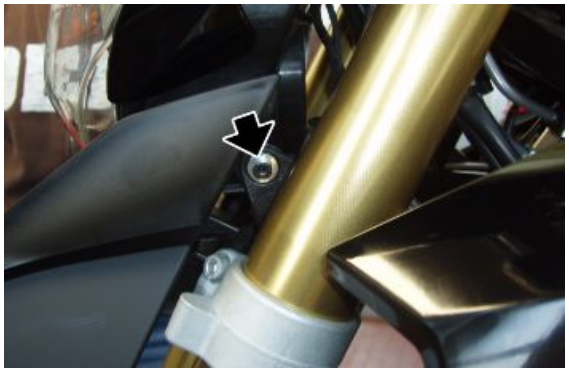
HEADLAMP

pos.	Description	Type	Quantity	Torque	Notes
1	TE screw fastening headlamp to headlamp mounting and mudguard to steering base	M6x16	2	10 Nm (7.37 lbf ft)	-
2	Fastener for front turn indicators	M5	2	3 Nm (2.21 lbf ft)	-
3	TCEI screw fastening headlamp mounting to fork yoke	M6	3	10 Nm (7.37 lbf ft)	-

- Operating from both sides, unscrew and remove the front frame fixing screw and collect the nut.

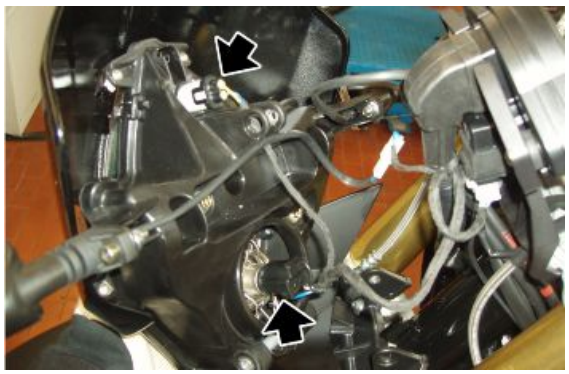


- Remove the instrument panel.
- Working from the vehicle left side, unscrew and remove the pin, and collect the nut and the washer from the right side.



- Disconnect the front turn indicator cable harness.

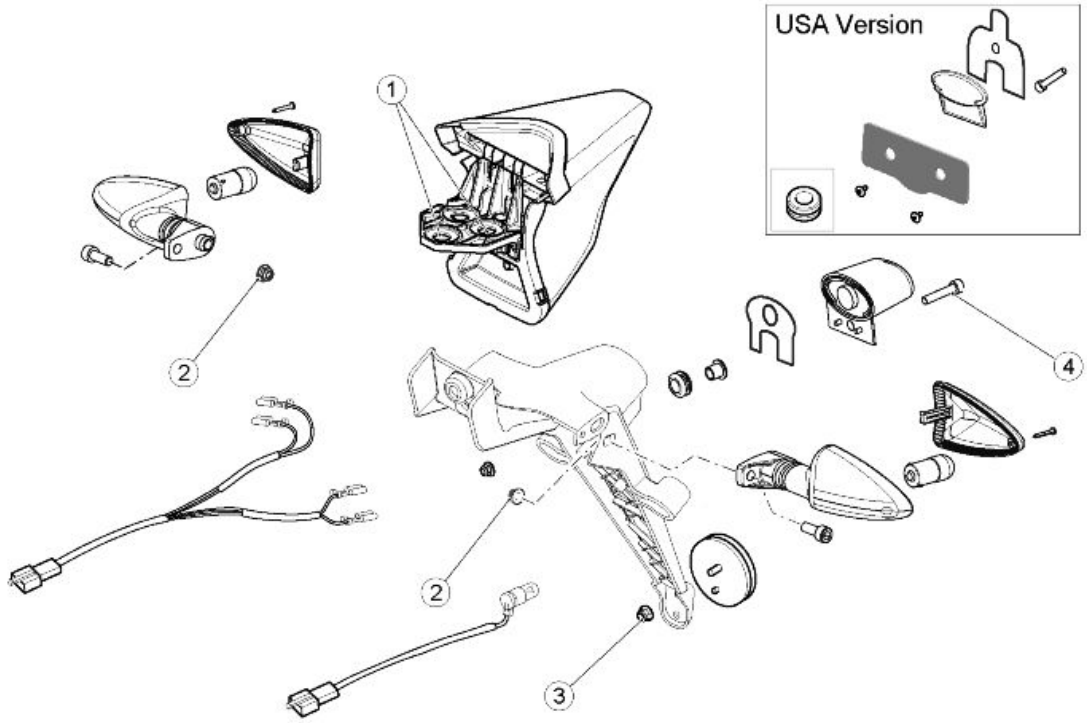
- Disconnect the headlamp connector and remove the headlamp assembly.



See also

Instrument cluster support

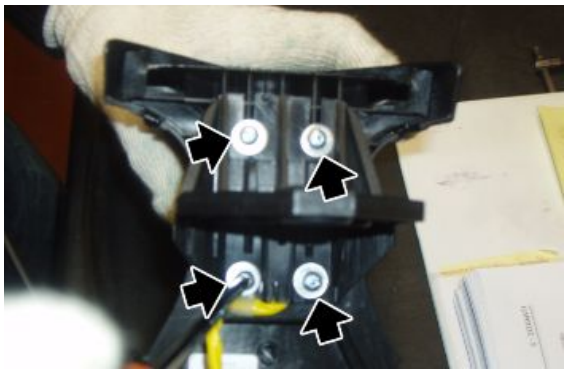
Taillight assy.



TAILLIGHT

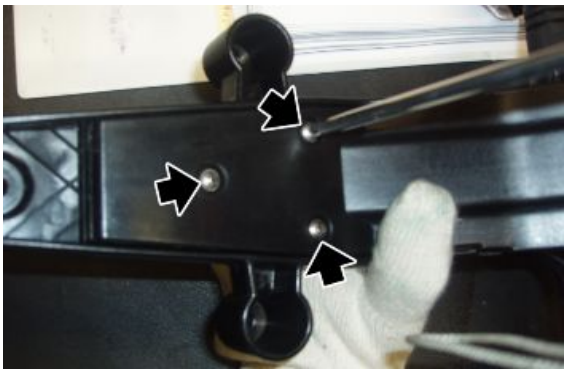
pos.	Description	Type	Quantity	Torque	Notes
1	TE screw fastening tail light to license plate mounting frame	M6x45	3	10 Nm (7.37 lbf ft)	-
2	Fastener for rear turn indicators	M6	2	3 Nm (2.21 lbf ft)	-
3	Reflector fastener	M5	2	2 Nm (1.47 lbf ft)	-
4	Fastener for license plate light	M5	1	5 Nm (3.69 lbf ft)	-

- Remove the license plate support.
- Unscrew and remove the four screws.



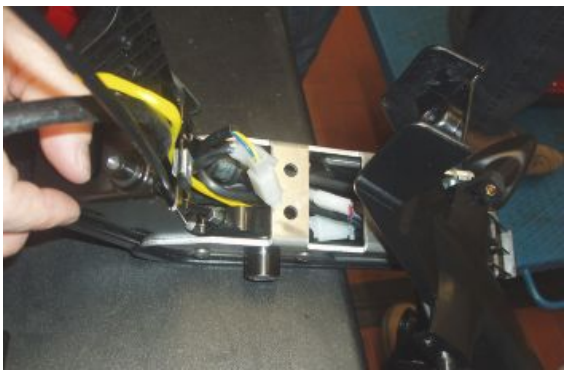
- Unscrew and remove the screw.

- Unscrew and remove the three internal screws.



- Working from both sides, unscrew and remove the screw.

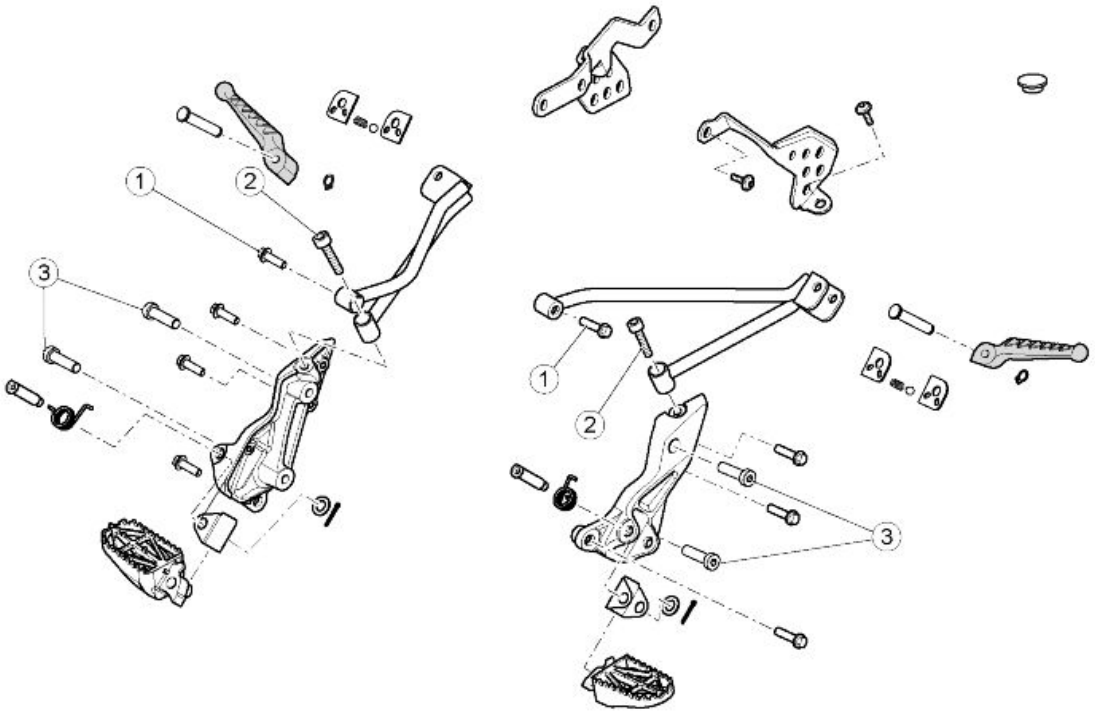
- Disconnect the taillight connectors.
- Remove the taillight.



See also

Tail guard

Footrest

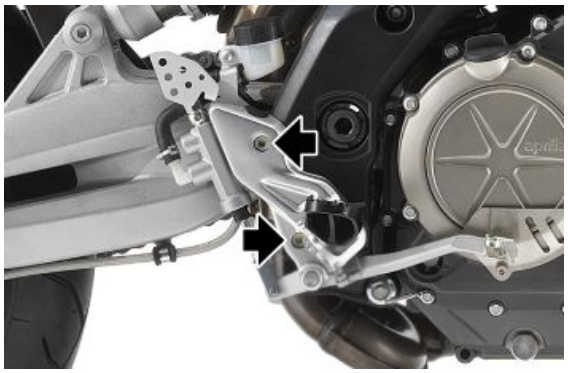


FOOTPEGS

pos.	Description	Type	Quantity	Torque	Notes
1	Upper screw fastening passenger footrests to frame side panels	M8x35	2	25 Nm (18.44 lbf ft)	Loct. 243
2	Lower TCEI screw fastening passenger footrests to rider footrest mounting	M8x35	2	25 Nm (18.44 lbf ft)	Loct. 243
3	TCEI screw fastening rider footrest mounting to frame	M8x35	4	28 Nm (20.65 lbf ft)	Loctite 243

RIGHT FOOTREST

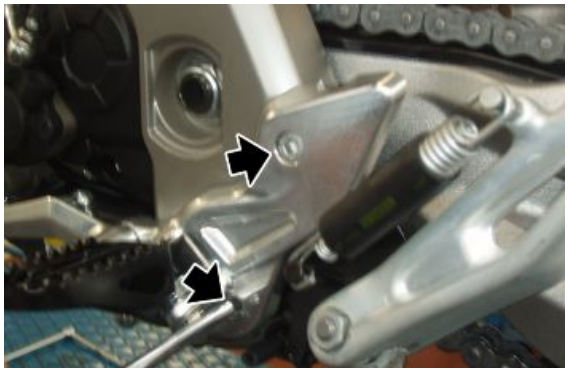
- Undo and remove the two external screws.



- Remove the right footrest
- Unscrew and remove both rear brake pump internal fixing screws.

LEFT FOOTREST

- Unscrew and remove the two external screws.



- Loosen the gear shift lever rod screw.
- Slide off the gear shift lever rod.
- Remove the left footrest.

Side body panels

- Unscrew and remove the screw.

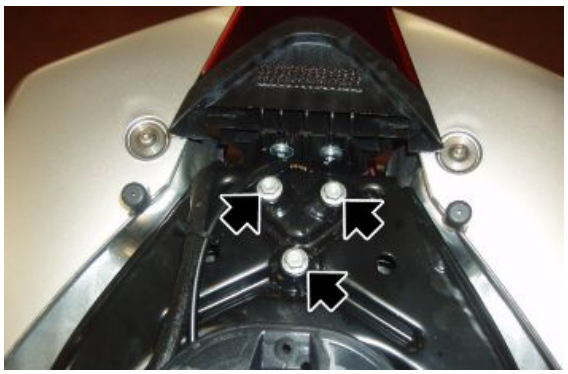
- Unscrew and remove the rear screw.

- Remove the side fairing.

License plate holder

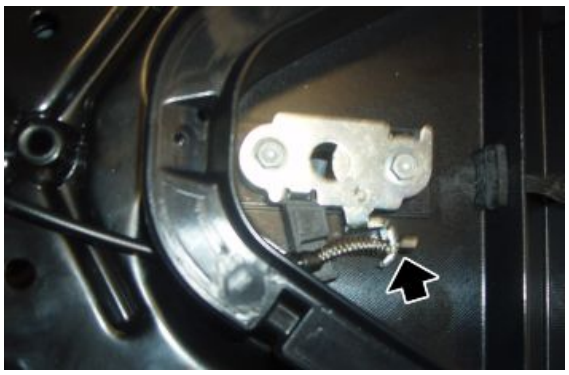
PLATE HOLDER REMOVAL

- Remove the saddle.
- Remove the tail fairing.
- Unscrew and remove the three screws.



- Disconnect the taillight connector.
- Release the taillight cable harness from the clamps.

- Disconnect the saddle unlocking cable.



- Slide off the license plate holder towards the back.

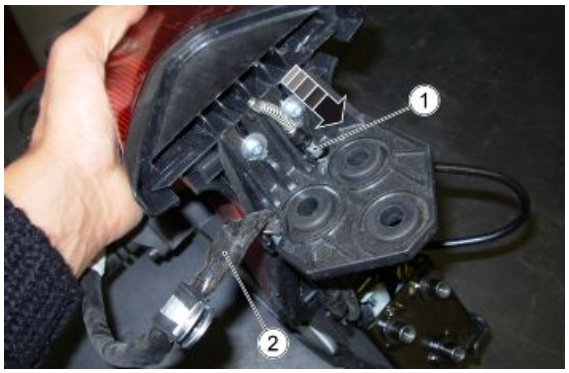
See also

Seat
Tail guard

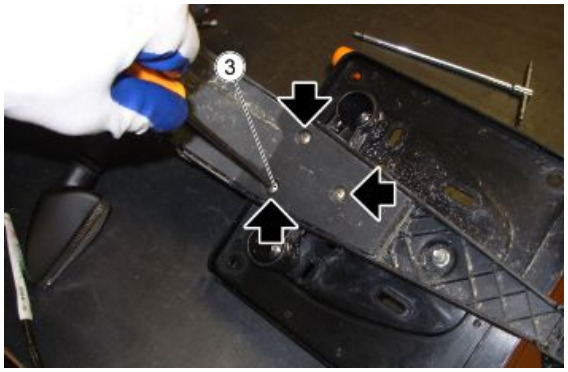
LICENCE PLATE HOLDER REMOVAL

OPTION 01

- Remove the saddle unlocking cable (1) from the taillight and release the cable harness (2)

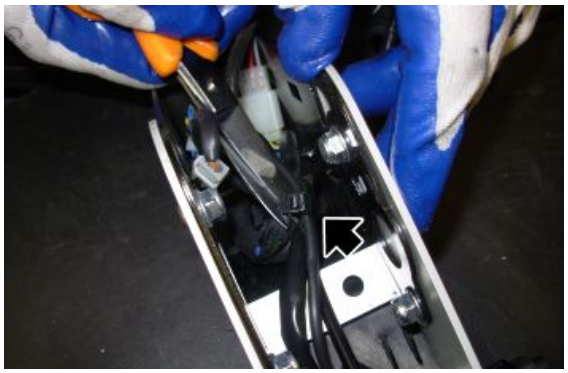


- Remove the three rear lower screws (3).

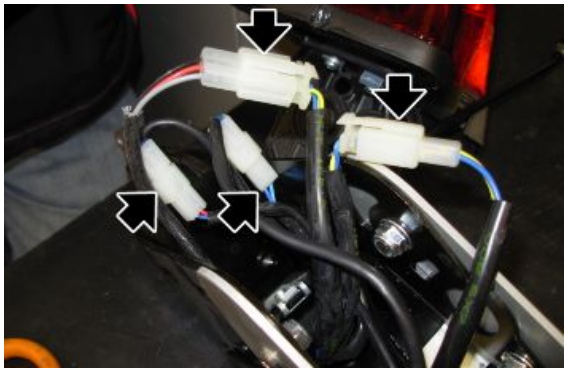


- Remove the rear cover of the license plate holder assembly (4)

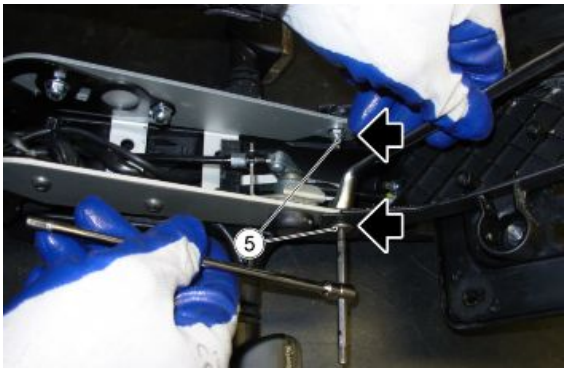
- Remove the cable harness clamp



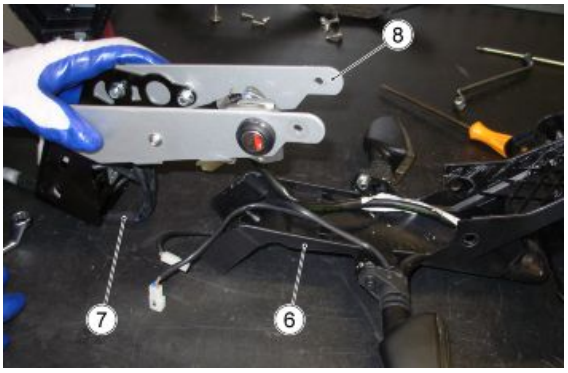
- Disconnect the connectors



- Remove the screws (5) that secure the license plate holder to the internal structure and be sure to collect the internal nuts

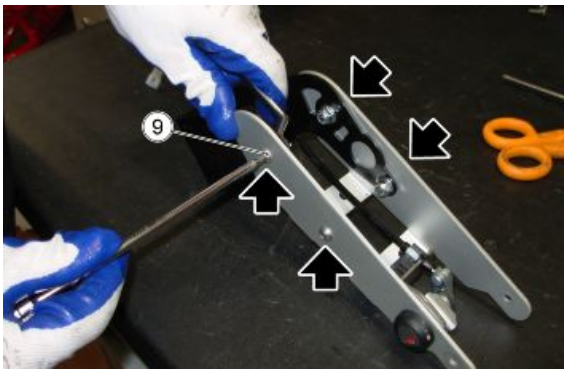


- Separate the license plate holder (6) by removing the rear cable harness (7) from the internal structure (8)

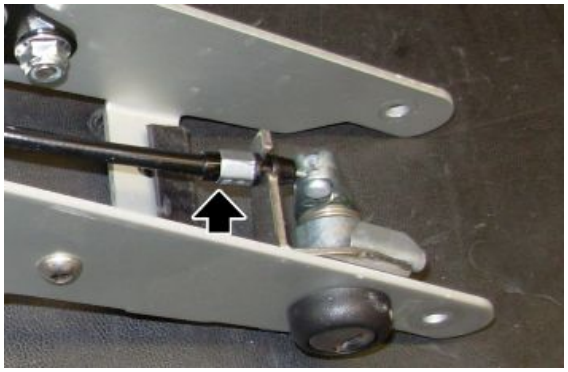


- Turn the turn indicators by 180 degrees and remove them.

- Remove the four screws (9) that secure the two components of the internal structure of the license plate holder and be sure to collect the internal nuts

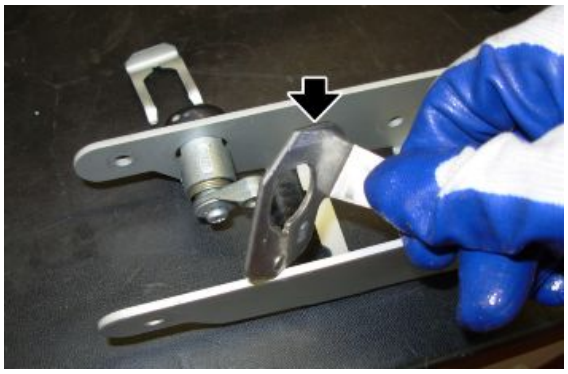


- Release the opening cable and remove it



- Remove the fork spring

- Remove the hose control plate



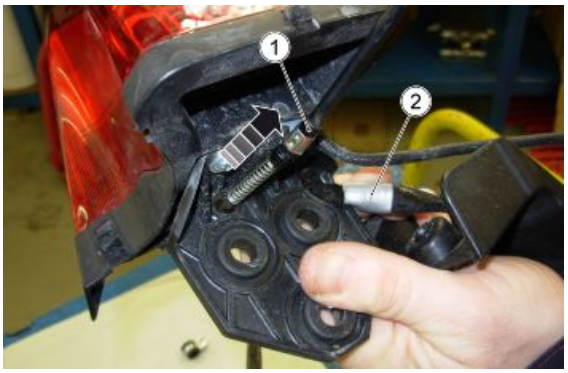
- Remove the license plate light fixing screw in order to remove the lamp holder and be sure to collect the nut

- Remove the lamp holder to replace the license plate light bulb.

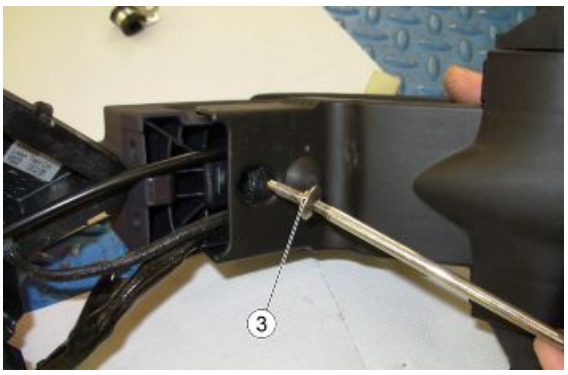
- Remove the lock block

OPTION 02

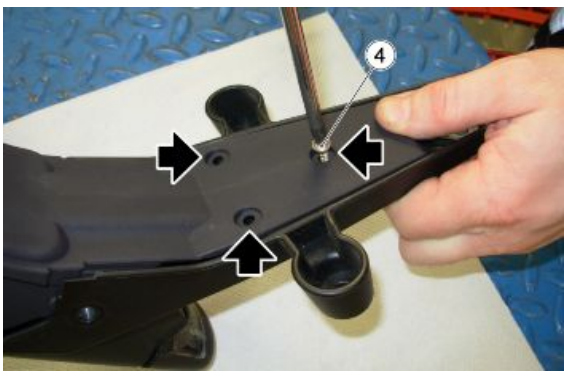
- Remove the saddle unlocking cable (1) from the taillight and release the cable harness (2)



- Remove the taillight
- Remove the screw (3)

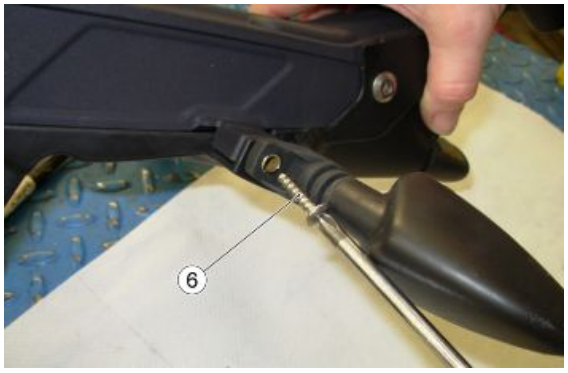


- Remove the three rear screws (4)

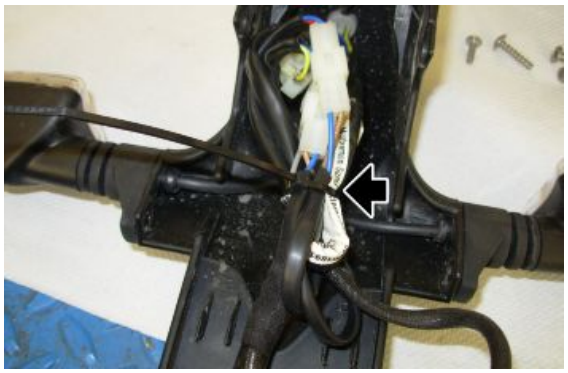


- Remove the screw (5) and the same from the opposite side

- Remove the screw (6) that secures the turn indicator to the license plate holder and to the rear section.
- Repeat the operation for the screw that secures the other turn indicator.
- Now it is possible to separate the front section of the plate from the rear.



- Remove the clamp and release the cable harness

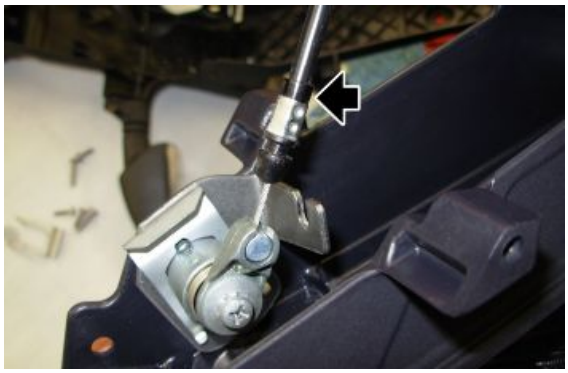


- Turn the turn indicators by 180 degrees and remove them.

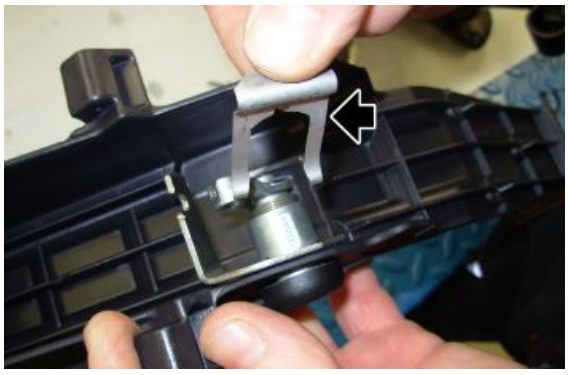
- Remove the license plate light fixing screw in order to remove the lamp holder and be sure to collect the nut

- Remove the lamp holder to replace the license plate light bulb.

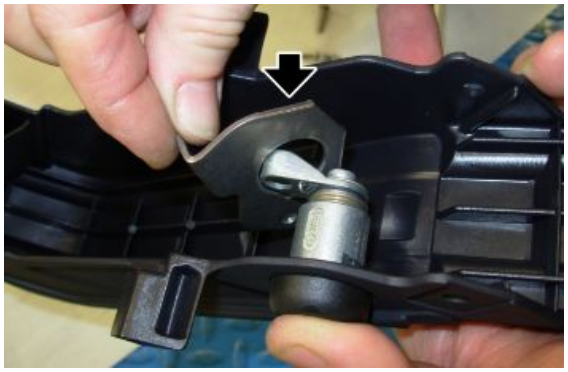
- Release the opening cable and remove it



- Remove the fork spring

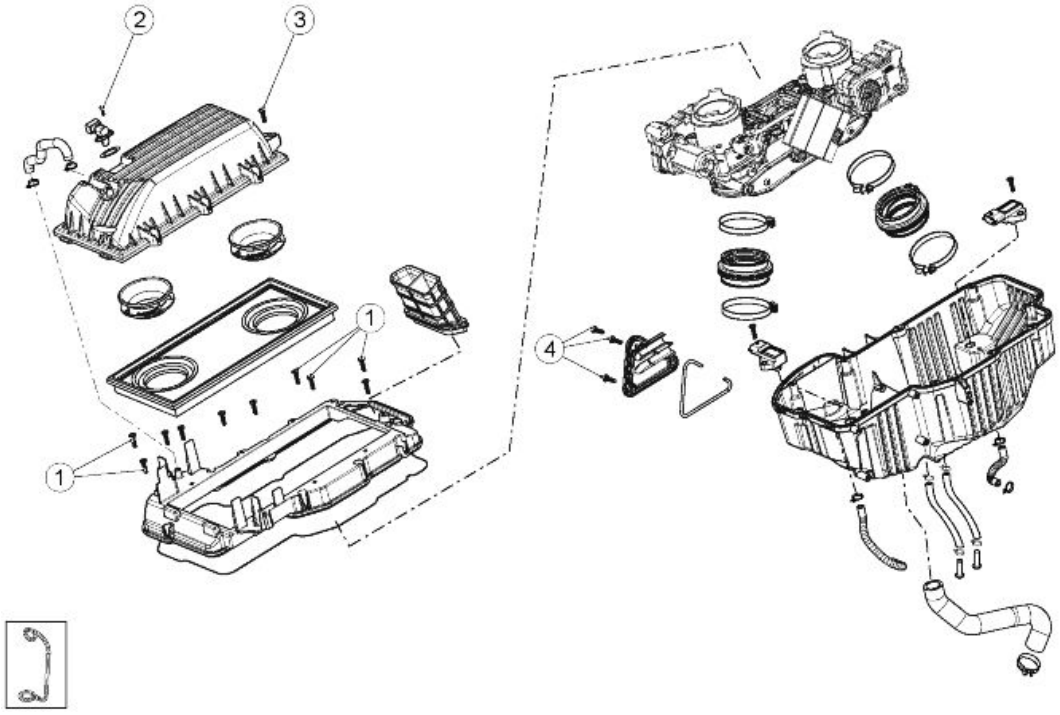


- Remove the hose control plate



- Remove the lock block

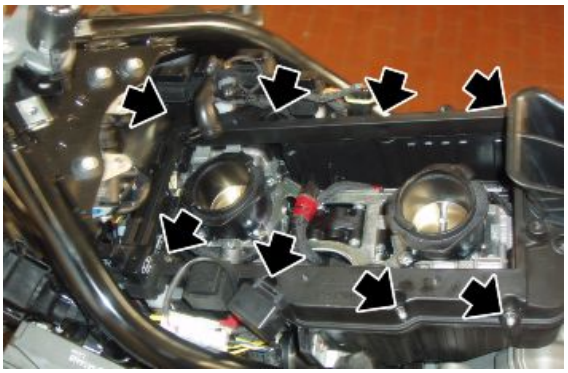
Air box



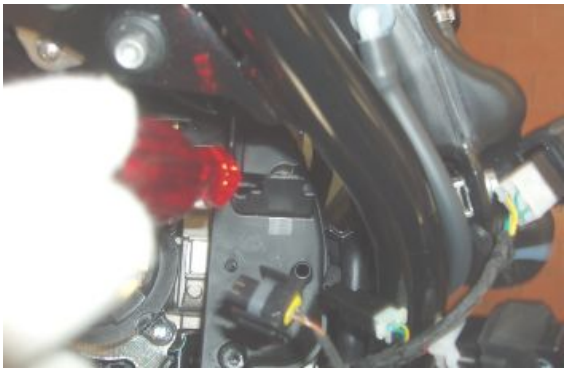
AIR FILTER BOX

pos.	Description	Type	Quantity	Torque	Notes
1	Cross head self-tapping screw fastening separator / filter box	M5x20	10	3 Nm (2.21 lbf ft)	-
2	SWP self-tapping screw	M2.9x12 TCCR	2	3 Nm (2.21 lbf ft)	-
3	Cross head self-tapping screw fastening cover / filter box	M5x20	8	3 Nm (2.21 lbf ft)	-
4	Cross head self-tapping screw fastening lateral cap / filter box	M5x20	3	3 Nm (2.21 lbf ft)	-
-	Cross head self-tapping screw	M5x10	2	3 Nm (2.21 lbf ft)	-

- Remove the air filter.
- Slide off the electrical components fastened to the air filter box.
- Undo and remove the eight screws.



- Unscrew and remove the inner screw.



- Unscrew and remove the screw.

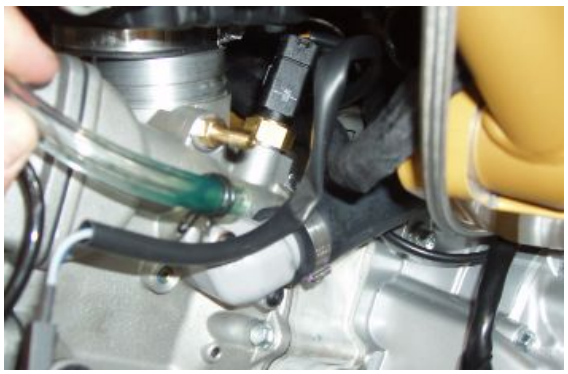
- Remove the filter support partition.

- Release the cable harness from the clamps.

- Unscrew and remove the two screws after loosening the front and rear manifold clamps.

- Loosen the clamp to slide off the bleed pipe.

- Lift the filter box and working on both cylinders, loosen and move the clamp and slide off the oil vapour recovery pipe.



- Working on the left side, disconnect the two control unit connectors.

CAUTION

THE CONNECTORS ARE MARKED BY THE LETTERS "V" (VEHICLE) AND "E" (ENGINE).
DO NOT INTERCHANGE THEM WHEN REFITTING.

- Unscrew and remove the screw and remove the ground lead.

- Disconnect the two connectors.

- Remove the filter box together with the throttle body, by lifting it up from behind.

CAUTION

COVER THE SLEEVE OPENINGS SO THAT NO FOREIGN BODIES COME IN.

Should the throttle body be removed, disconnect either the map sensor pipes or the intake ducts; it is necessary to check the air system tightness. Using Navigator, check the following parameters:

a - take the vehicle temperature to 90 °C (194 °F) or above.

b - front cylinder throttle valve correction between - 60 and 60.

b - rear cylinder throttle valve correction between - 60 and 60.

c - potentiometer 1 front throttle valve value is 0.5 or above.

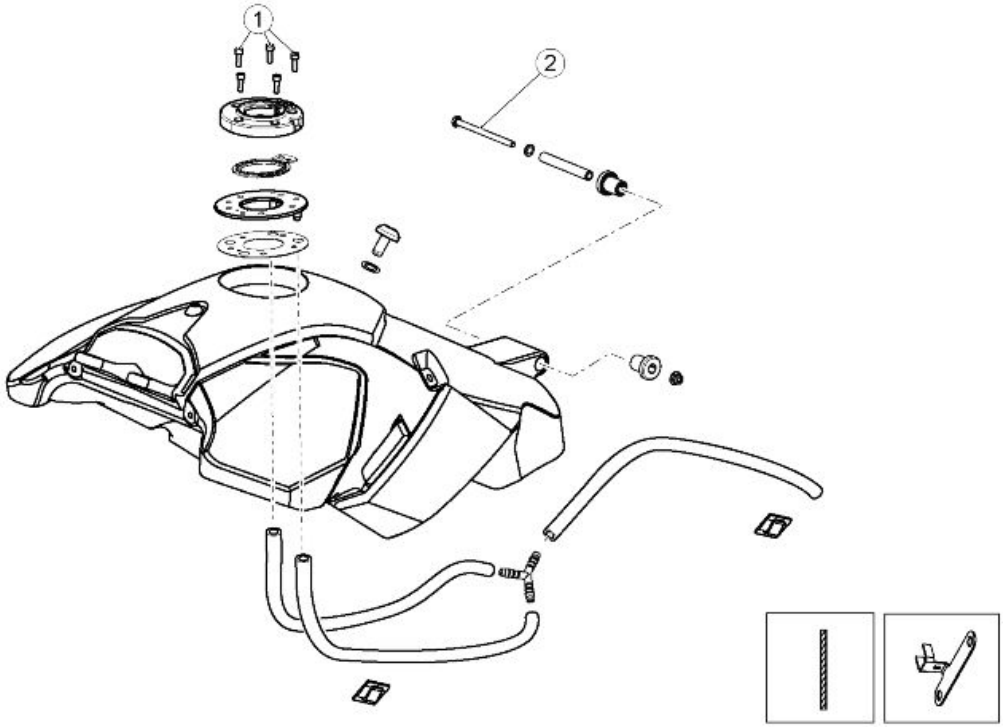
d - potentiometer 1 rear throttle valve value is 0.5 or above.

e - the difference of throttle valve correction values between the front and rear cylinders should not exceed 0.6.

See also

Air filter

Fuel tank



FUEL TANK

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening filler cap flange	M5x16	5	3 Nm (2.21 lbf ft)	-
2	Rear TE screw fastening tank	M6x90	1	10 Nm (7.37 lbf ft)	-

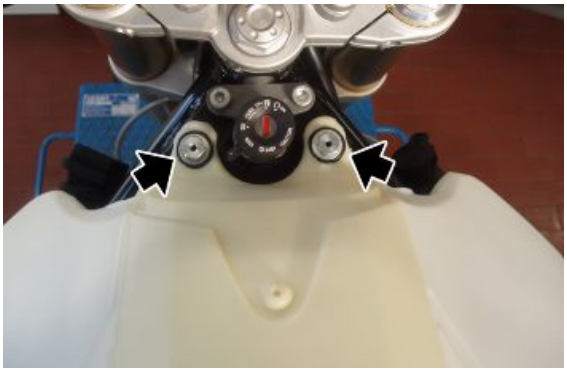
CAUTION

DURING FUEL TANK LIFTING AND REPOSITIONING, BE CAREFUL SO AS NOT TO CRUSH/ BEND OR SLIDE OFF TANK BREATHERS FROM THE CORRESPONDING TUBE-GUIDES

LIFTING THE FUEL TANK

- Remove the saddle.
- Remove both side fairings.

- Undo and remove the two tank front screws.

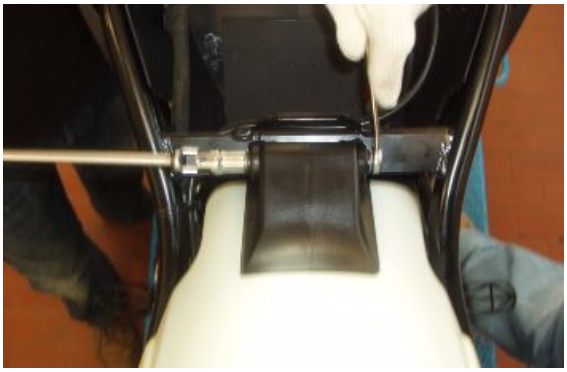


See also

Side body panels

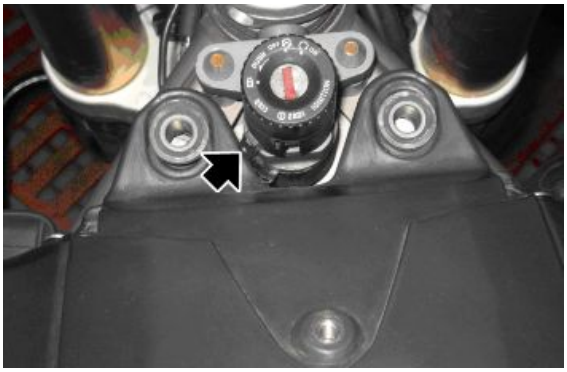
TANK REMOVAL

- Undo and remove the rear screw.



- Remove the rubber ring on the ignition lock.

- Pay attention not to damage the immobilizer aerial.



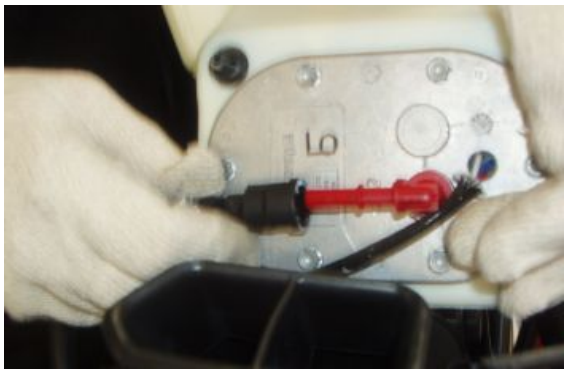
- Draw the tank backward as much as you can in order to avoid interferences in the front part when lifting the tank.

CAUTION

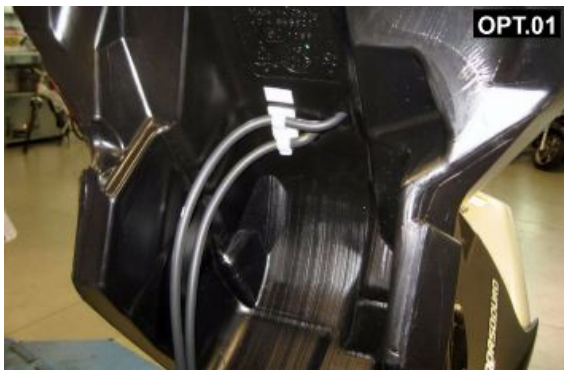
PAY ATTENTION WHEN LIFTING THE TANK SINCE IF BREATHER PIPES ARE NOT ACCOMPANIED, THEY MAY TEAR.

- Insert a pin in the rear fixing screw hole so that you can lift the tank and be able to disconnect the breather pipes.

- Disconnect the fuel pipe.



OPTION 01



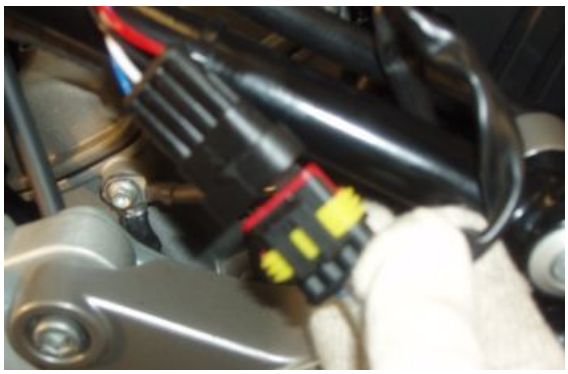
- If there is a "Y" joint, disconnect the tank breather pipe and when refitting it, place it according to the new standard following the refitting procedure.

OPTION 02

- Disconnect the breather pipes from the tank.

- Release the cable harness from the clamps.

- Disconnect the fuel pump connector.
- Remove the tank.



CAUTION

UPON REFITTING THE TANK, FOLLOW THE SAME STEPS BUT IN REVERSE ORDER. CONNECT AGAIN THE FUEL PIPES AND THE FUEL PUMP CONNECTOR. REMEMBER TO SLIDE OFF THE PIN PREVIOUSLY FITTED AND TO DRAW THE TANK BACKWARD AS MUCH AS POSSIBLE IN ORDER TO FIT IT PROPERLY.

Instrument cluster support

- Working on both sides, loosen the nuts and screws and remove them.

- Disconnect the connectors of arrow indicators, headlamps, ignition switch assembly and relay.

- Remove the three screws that fix the instrument panel.

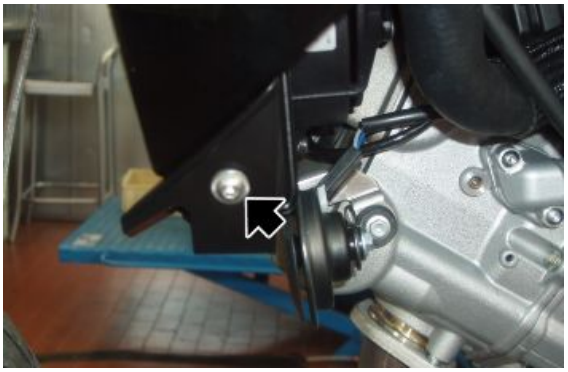
- Slide off the instrument panel from its support.

- Disconnect the instrument panel connector.

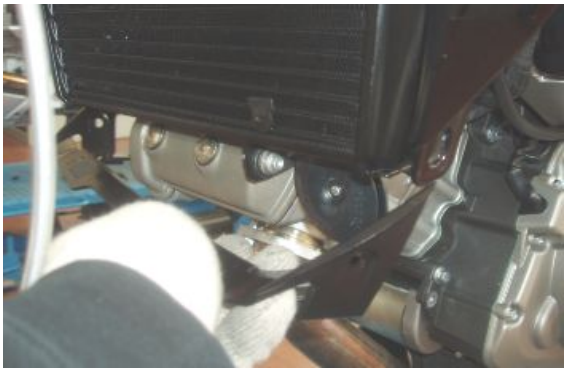
- Remove the instrument panel.

Radiator cover

- Working from both sides, unscrew and remove the screw.

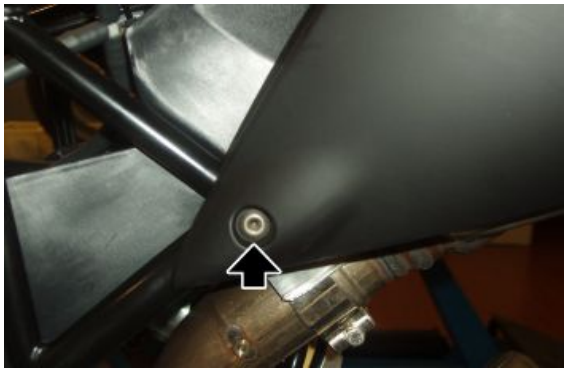


- Remove the radiator cover.



Tail guard

- Remove the saddle.
- Remove the rear passenger grab handle (if present).
- Working from both sides, unscrew and remove the external screw.



- Unscrew and remove the three screws.
- Slide off the tail fairing backwards.

INDEX OF TOPICS

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.
IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.
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.

Specific operations for the vehicle

LEFT

- Remove the left side chain protection

- Fit a left bracket and a left chain protection; fasten then with a TEFL M8x35 mm screw at the top and with a TCEI M8x35 mm screw at the bottom

NOTE

FINGER TIGHTEN THE SCREWS AND AFTERWARDS USE THE SPECIFIC WRENCH

WARNING

OPERATIONS REQUIRED TO RENDER VEHICLE COMPLIANT WITH TWO SEATER TYPE APPROVAL.

RH

- Remove the rubber cap.

- Remove the shock absorber protection on the exhaust.

- Fit a right bracket; fasten then with a TEFL M8x35 mm screw at the top and with a TCEI M8x35 mm screw at the bottom.

NOTE

FINGER TIGHTEN THE SCREWS AND AFTERWARDS USE THE SPECIFIC WRENCH

- Refit the shock absorber protection on the exhaust.

HAND GUARDS

- Remove the TCEI M6 X 50 screw which fastens the antivibration weight.

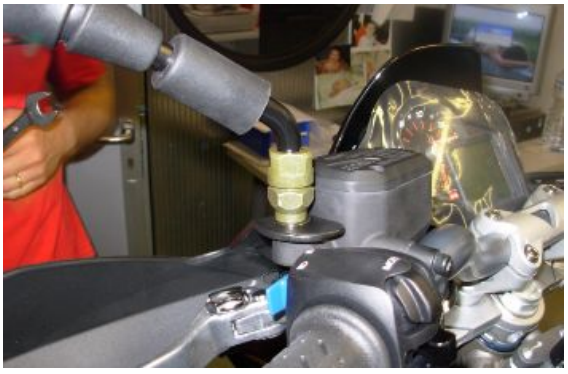
- Fit the rubber ring in the hand guards.

- Place the lower spacer on the rear view mirror hole.

- Place the hand guards fastening them on the sides using TCEI M6 X 50 screw being careful when inserting the bushing.

- Place the upper spacer on the rear view mirror hole.

- Fit the rear view mirror screwing the corresponding support column.



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PERFORM THE SAME PROCEDURE FOR BOTH HAND GUARDS

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