SERVICE STATION MANUAL

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Vespa 946

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SERVICE STATION MANUAL
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This service station manual has been drawn up by Piaggio & C. Spa to be used by the workshops of Piaggio dealers. It is assumed that the user of this manual for maintaining and repairing Piaggio vehicles has a basic knowledge of mechanical principles and vehicle repair technique procedures. Any significant changes to vehicle characteristics or to specific repair operations will be communicated by updates to this manual. Nevertheless, no mounting work can be satisfactory if the necessary equipment and tools are unavailable. It is therefore advisable to read the sections of this manual concerning special tools, along with the special tool catalogue.

N.B. 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.

INDEX OF TOPICS

INDEX OF TOPICS

This section describes the general specifications of the vehicle.

Rules

This section describes general safety rules for any maintenance operations performed on the vehicle.

Safety rules

- If work can only be done on the vehicle with the engine running, make sure that the premises are well ventilated, using special extractors if necessary; never let the engine run in an enclosed area. Exhaust fumes are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with abundant water and seek immediate medical attention.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
- Fuel is highly flammable and it can be explosive given some conditions. Do not smoke in the working area, and avoid naked flames or sparks.
- Clean the brake pads in a well-ventilated area, directing the jet of compressed air in such a way that you do not breathe in the dust produced by the wear of the friction material. Even though the latter contains no asbestos, inhaling dust is harmful.

Maintenance rules

- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spares may damage the vehicle.
- Use only the appropriate tools designed for this vehicle.
- Always use new gaskets, sealing rings and split pins upon refitting.
- After removal, clean the components using non-flammable or low flash-point solvents. Lubricate all the work surfaces, except tapered couplings, before refitting these parts.
- After refitting, make sure that all the components have been installed correctly and work properly.
- Use only equipment with metric sizes for removal, service and reassembly operations. Metric bolts, nuts and screws are not interchangeable with coupling members using English measurements. Using unsuitable coupling members and tools may damage the vehicle.
- When carrying out maintenance operations on the vehicle that involve the electrical system, make sure the electrical connections have been made properly, particularly the ground and battery connections.

Vehicle identification

Identification registration numbers are made up of a prefix and a number, stamped on the chassis and on the engine. These numbers must always be quoted when ordering spare parts. We recommend checking that the chassis registration number stamped on the vehicle corresponds with that on the vehicle documentation.

CAUTION

PLEASE REMIND THAT ALTERING IDENTIFICATION REGISTRATION NUMBERS CAN LEAD TO SERIOUS PENAL SANCTIONS (IMPOUNDING OF THE VEHICLE, ETC.).

VEHICLE IDENTIFICATION

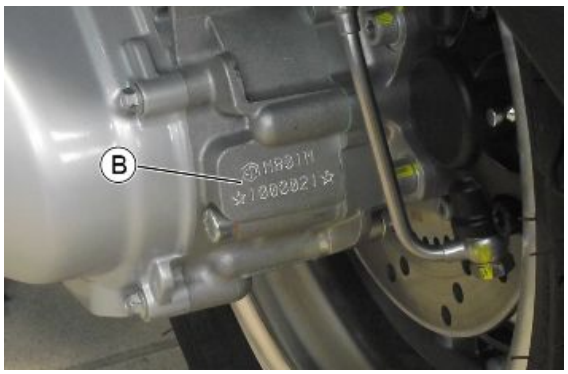
Specification	Desc./Quantity
Chassis prefix	ZAPM80100
Engine prefix	M801M

Chassis number

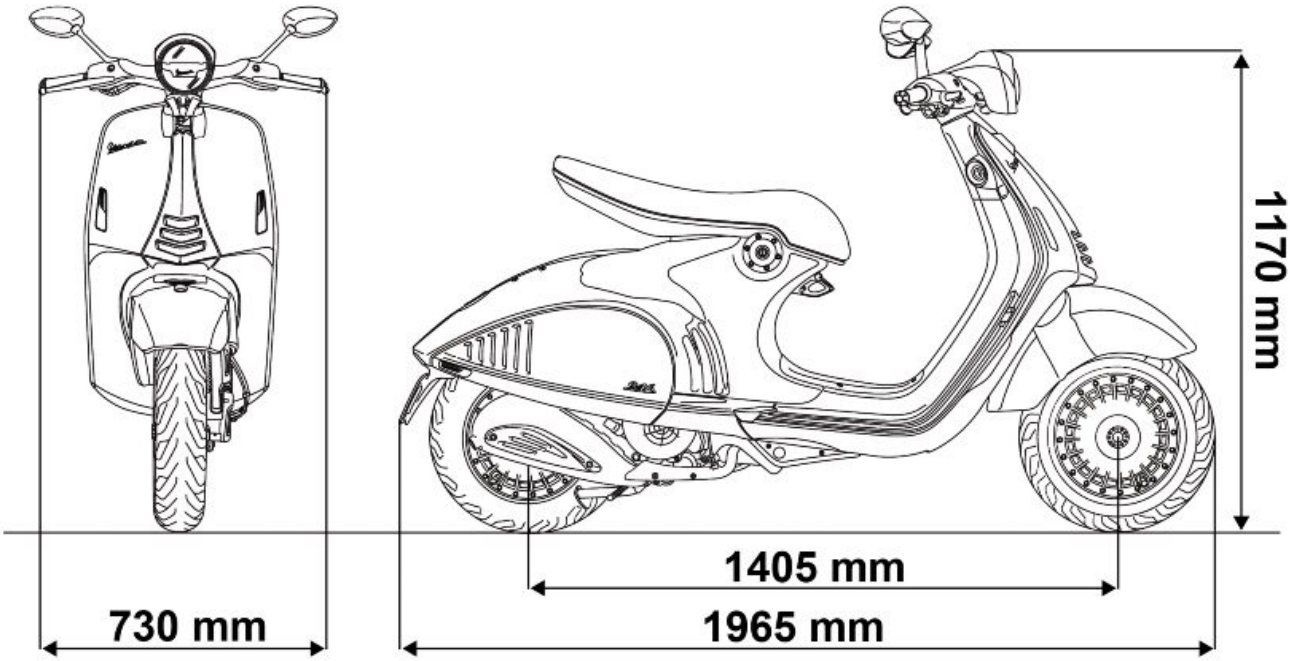
To read the chassis number «**A**» the saddle must be lifted.

Engine number

The engine number «**B**» is stamped on the rear part of the engine itself.



Dimensions and mass



WEIGHTS AND DIMENSIONS

Specification	Desc./Quantity
Length	1965 mm
Width	730 mm
Height	1170 mm
Wheelbase	1,405 mm
Kerb weight	147 kg
Maximum weight allowed	340 kg

Engine

125 CM³ ENGINE SPECIFICATIONS

Specification	Desc./Quantity
Type	Single-cylinder, 4-stroke
Engine capacity	124 cm³
Bore x stroke	52.0 x 58.6 mm
Max. power	8.5 kW at 8,750 rpm
MAX. torque	9.6 Nm at 7,750 rpm
Compression ratio	(10.5±0.5):1
Idle speed	(1,750±100) rpm
Valve clearance (cold engine)	intake: 0.08 mm exhaust: 0.08 mm
Timing system	3 valves (2 intake, 1 drainage). single overhead camshaft chain-driven.
Transmission	CVT expandable pulley variator with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling.
Final reduction gear	Gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.
Cooling	Forced-air circulation cooling.

Specification	Desc./Quantity
Electric	Starter
Ignition	Electronic inductive discharge ignition, with variable advance and separate HV coil.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK CR8EB
Electrode gap	0.7 - 0.8 mm
Fuel system	Electronic injection with Ø 28 mm throttle body, single injector
Fuel	Unleaded petrol (95 RON)
Exhaust silencer	Absorption-type exhaust muffler with catalytic converter.
Emissions compliance	EURO 3

Transmission

TRANSMISSION

Specification	Desc./Quantity
Transmission	CVT expandable pulley variator with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling.
Final reduction gear	Gear reduction unit in oil bath.

Capacities

CAPACITIES

Specification	Desc./Quantity
Engine oil quantity	1,340 cm³ (of which 120 cm³ in the filtering cartridge)
Hub oil quantity	300 cm³
Fuel tank capacity	8.45±0.1 l (reserve about 1.5 l)

Electrical system

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Electric	Starter
Ignition	Electronic inductive discharge ignition, with variable advance and separate HV coil.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK CR8EB
Electrode gap	0.7 - 0.8 mm

Frame and suspensions

TEAIO E SOSPENSIONI

Specification	Desc./Quantity
Chassis	Stamped plate body with welded structural reinforcements.
Front suspension	Single arm with helical spring and single double-acting hydraulic shock absorber.
Rear suspension	Double-acting shock absorber, adjustable to four positions at preloading.

Brakes

FRENI

Specification	Desc./Quantity
Front brake	Ø 220 mm disc brake with hydraulic control activated by handlebar right-side lever.
Rear drum	Ø 220-mm disc brake with hydraulic control operated by the handlebar left-hand lever.

Wheels and tyres

RUOTE E PNEUMATICI

Specification	Desc./Quantity
Wheel rim type	Light alloy wheel rims.
Front wheel rim	12" x 3.00
Rear wheel rim	12" x 3.00
Front tyre	Tubeless, 120/70 - 12" 51P
Rear tyre	Tubeless 130/70 - 12" 62P
Front tyre pressure	1.8 bar
Rear tyre pressure (with passenger)	2.0 bar (2.2 bar)

Tightening Torques

FRONT SUSPENSION

Name	Torque in Nm
Brake pipes to calliper fixing screw	20 - 25
Tone wheel sensor	3.4 - 3.8
Screws fastening the shock absorber bracket	20 - 25
Shock absorber head nut	19 - 29
Front wheel to hub fixing screws	20 to 25
Front wheel axle nut	74 to 88
Front brake calliper	24 - 27

REAR SUSPENSION

Name	Torque in Nm
Rear wheel to hub fixing screws	20 to 25
Rear wheel axle nut	104 - 126
Screws fixing strut bracket to crankcase	20 - 25
suspension strut screws	67 - 73
nut fixing suspension linkage pin	81 - 90
Shock absorber to linkage fixing screw	67 to 73
Screws fastening the shock absorber bracket	20 - 25
Shock absorber head nut	114 - 126
Brake pipes to calliper fixing screw	20 - 25
Tone wheel sensor	3.4 - 3.8
Engine-swinging arm pin	40 to 45
swinging arm to engine - frame pin locknut	76 to 83
Silent block bracket screw	42 to 52
Swinging arm to frame pin locknut	40 to 45

FLYWHEEL

Name	Torque in Nm
Flywheel cover screw	11 ÷ 13
Starter sprocket check fixing screw	5 - 6
Starter motor fixing screws	11 ÷ 13
Flywheel fixing nut	100 to 110
Freewheel fixing screws	10 to 11

FLYWHEEL COVER

Name	Torque in Nm
Pick-up screws	3 - 4
Stator fixing screws	5 to 6 (Loctite 242)
Stator cable plates clamping screws	3 - 4
Fixing clamps of head pump cover by-pass pipe	1.3 to 1.7
Coil fixing screw	11 ÷ 13

CRANKCASE

Name	Torque in Nm
Calibrated fixing dowel	5 - 7
Oil filter cover	24 to 30
Engine oil level shaft	1.3 to 1.7
Engine-crankcase coupling screws	11 ÷ 13
Rear brake screw	15 to 17
Oil sensor	12 - 14
Oil filter	5 - 6
Oil drain screw	14.7 to 16.7
Oil pump bulkhead screw	4 - 6
Freewheel fixing screws	10 to 11
Oil pump fixing screw	5 - 6
Oil pump command sprocket screw	10 to 14
Rotor cover	1 to 1.50
Rotor clamp	3 to 4

HEAD AND CYLINDER

Name	Torque in Nm
Head cover screws	10.8 to 12.7
Cylinder head nut (PRE-TIGHTENING)	6 - 8
Cylinder head nut (TIGHTENING)	9 to 11 (Tighten to the prescribed torque and then proceed with 270.0°±5.0° rotation)
Cylinder stud bolt fitting	See section ENGINE/LUBRICATION/STUD BOLT
Throttle body clamp screws	1.3 to 1.7
Tensioner spring retaining screw	5 - 6
Fastener chain tensioner	11 ÷ 13
Thermostat cover screws	3 - 4
Pressure reducer counterweight retainer screw	7 - 8.5
Injection manifold fixing screws	11 ÷ 13
Valve clearance adjustment screw	6 to 9
Spark plug tightening	10 - 12
Timing system sprocket fixing screw	4 - 6
Screws fixing cylinder to crankcase	10.8 to 12.7
Head blow by	3 to 4

TRANSMISSION AND FINAL REDUCTION

Name	Torque in Nm
Transmission cover screws	11 - 13
Final reduction cover screws	24 - 27
Driven pulley fixing nut	53 to 59
Oil drain screw	14.7 to 16.7
Freewheel fixing screws	10 to 11
Driving pulley retainer nut	75 to 83

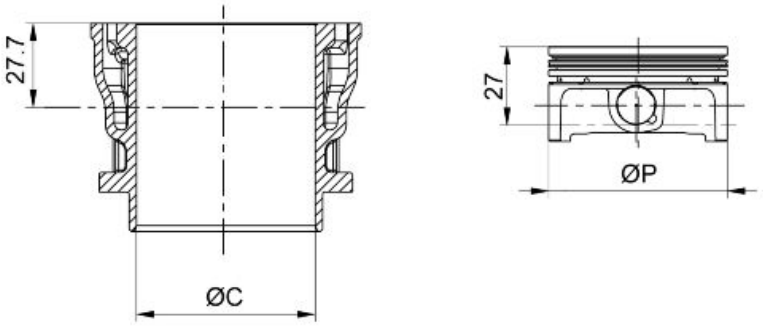
LUBRICATION

Name	Torque in Nm
Crankcase timing cover screws	11 ÷ 13
Screws fixing oil pump to the crankcase	4 - 6
Pump rod screw	13 - 15
Minimum oil pressure sensor locking	12 to 14 (LOCTITE 5091 Edge closure between metal body and plastic block)

Overhaul data

Assembly clearances

Cylinder - piston assy.



CYLINDER - PISTON

Specification	Desc./Quantity
Plunger diameter	51.961 (±0.014) mm
Cylinder diameter	52 (+0.008 -0.020) mm

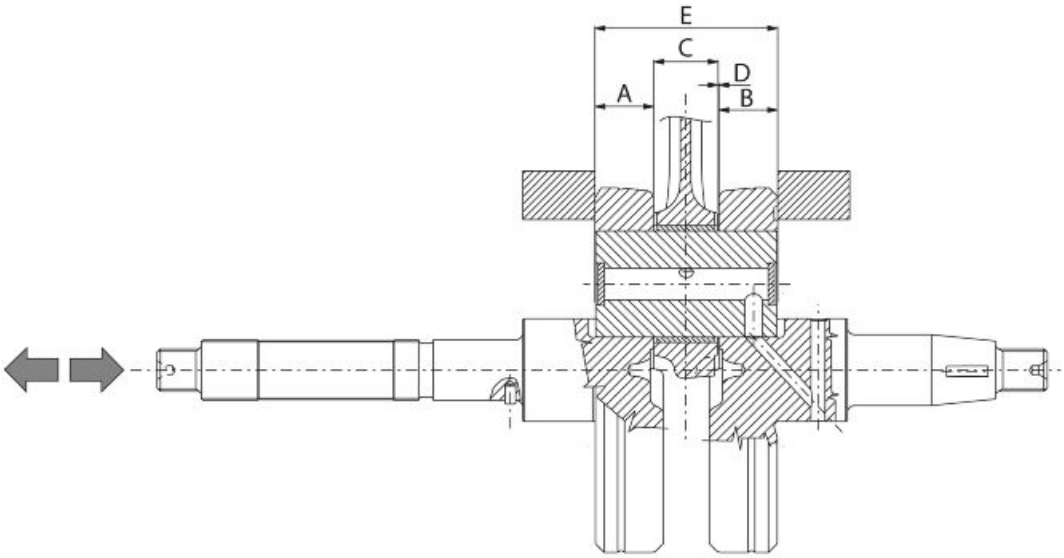
COUPLING CATEGORIES

Name	Initials	Cylinder	Piston	Play on fitting
cylinder - piston	A	51.980 - 51.987	51.947 - 51.954	0.026 - 0.040
cylinder - piston	B	51.987 - 51.994	51.954 - 51.961	0.026 - 0.040
cylinder - piston	C	51.994 - 52.001	51.961 - 51.968	0.026 - 0.040
cylinder - piston	D	52.001 - 52.008	51.968 - 51.975	0.026 - 0.040

N.B.

THE PISTON MUST BE INSTALLED WITH THE ARROW FACING TOWARDS THE EXHAUST SIDE, THE PISTON RINGS MUST BE INSTALLED WITH THE WORD «TOP» OR THE STAMPED MARK FACING UPWARDS.

Crankcase - crankshaft - connecting rod

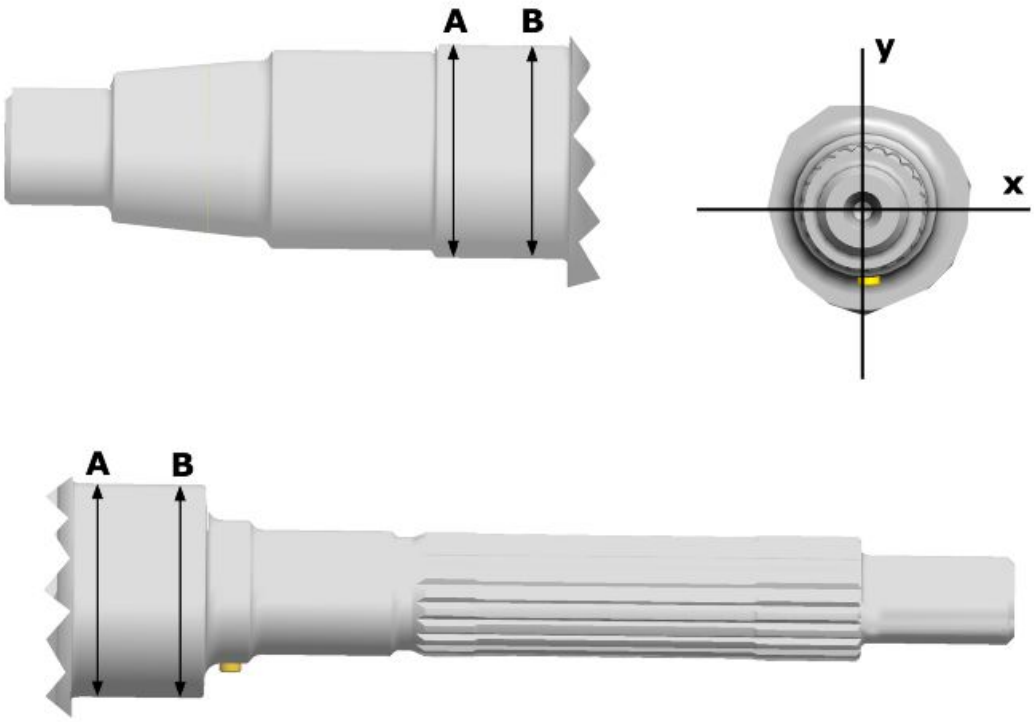


AXIAL CLEARANCE BETWEEN CRANKSHAFT AND CONNECTING ROD

Name	Code	Sizes	Assembly clearance
Transmissionside half-shaft	A	18.1 (+0; -0.05) mm	D = 0.20 - 0.50
Flywheel-side halfshaft	B	18.1 (+0; -0.05) mm	D = 0.20 - 0.50
Connecting rod	C	15 (-0.10; -0.15) mm	D = 0.20 - 0.50
Spacer tool	E	51.4 (+0.05; +0) mm	D = 0.20 - 0.50

Diameter of crankshaft bearings.

Measure the bearings on both axes x-y.



CRANKSHAFT

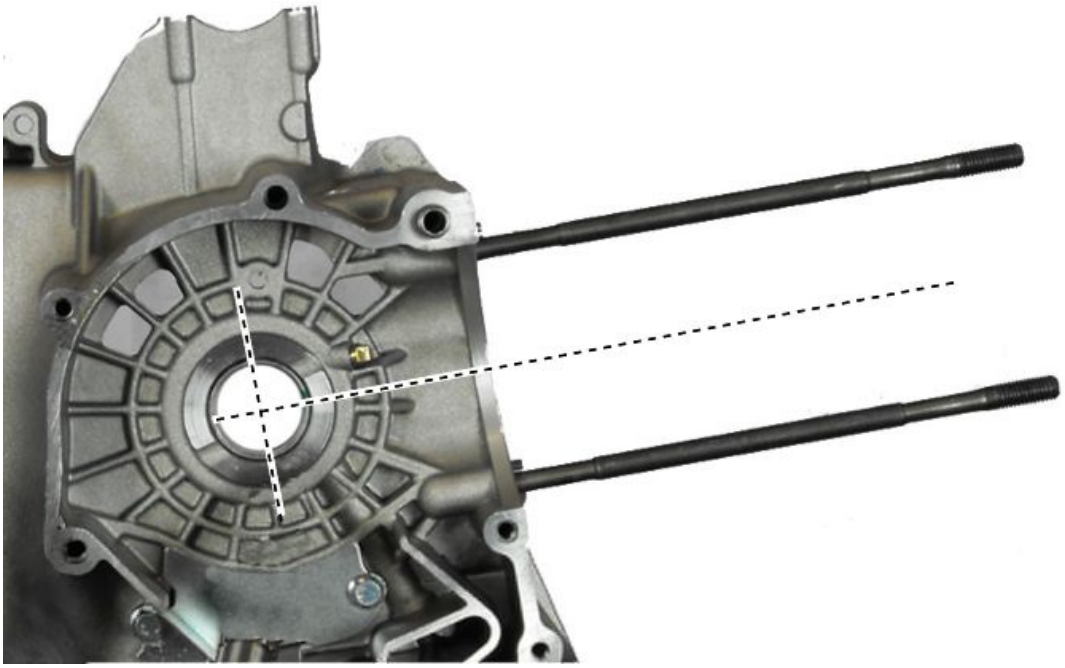
Specification	Desc./Quantity
Crankshaft bearings: Standard diameter: Cat. 1	26.998 to 27.004 mm
Crankshaft bearings: Standard diameter: Cat. 2	27.004 to 27.010 mm

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.

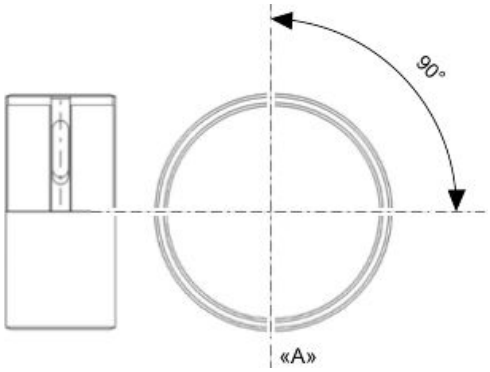
Characteristic

«A»

AXIS CYLINDER



- The main bushings have 2 half-bearings, 1 with and 1 without the lubrication channel.
- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposite the cylinder.
- To prevent shutters in the oil feeding channels, the matching surface of the two half-bearings must be perfectly orthogonal to the cylinder axis, as shown in the photo.



Characteristic

«A»

AXIS CYLINDER

BUSHINGS

TYPE	IDENTIFICATION	CRANKSHAFT HALF-BEARING
B	BLUE	1.971 to 1.976
C	YELLOW	1.974 to 1.979
E	GREEN	1.977 to 1.982

- The section of the oil feeding channels is also influenced by the driving depth of the bushings.
- Visually check the wear of the bushings: in the coupling ends shown in the photo the bushing usually keeps the original look, check in the rest of the bushing if there is evident removal of material. If this occurs as stated, proceed to replace the crankcase halves.

N.B.

SMALL MARKS AND SCRATCHES OF THE SHAFT ROTATION ARE NORMAL SIGNS OF ENGINE USAGE, AND DO NOT AFFECT THE CORRECT FUNCTIONING.

Measurement of crankcase halves - crankshaft coupling clearance.

- The nominal diameters of the bushings, even if of the same coupling category, may differ by hundredths due to the plastic slackening of the material of the crankcase due to the driving load.
- Measure along the axis of the « **A**» cylinder, using a bore meter at two depths indicated in the figure, the diameter of the bushings.
- After measuring the two diameters, take the average.

Characteristic

«A»

AXIS CYLINDER

- The bushings housing hole in the crankcase half is divided into two categories depending on the size, Category 1 and Category 2.

DIAMETER OF CRANKCASE WITHOUT BUSHING

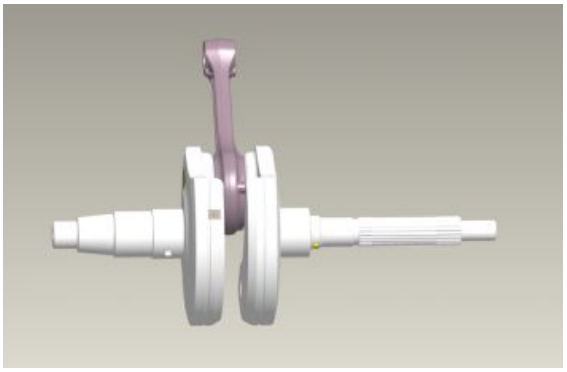
Specification	Desc./Quantity
CAT 1	30.959 to 30.965 mm
CAT 2	30.953 to 30.959 mm

- Combine the shaft with two category 1 crankwebs with the category 1 crankcase (or cat. 2 with cat. 2). Furthermore a spare crankcase cannot be matched with a crankshaft with mixed categories. The spare crankshaft has half-shafts of the same category.
- According to the classification of the shaft CAT.1 - CAT.2 combine a complete crankcase pre-fitted with suitable bushings according to the starting shaft.

CATEGORIES

CRANKCASE HALVES	ENGINE HALF-SHAFT	BUSHING
Cat. 1	Cat. 1	E
Cat. 2	Cat. 2	B
Cat. 1	Cat. 2	C
Cat. 2	Cat. 1	C

THE CRANKSHAFT is available in two **CATEGORIES:**



Characteristic

Crankshaft category:

CAT. 1 - CAT. 2

CRANKSHAFT CATEGORY IDENTIFICATION:

The identification is indicated on the counterweight shoulder «***1 - *2**», if carried out with micropinholing. Otherwise, «**1 - 2**» if done manually with an electric pen. The spare part identification is located on the package with **a drawing number** plus **FC1/FC2** or (**001/002**).

If a crankshaft comprising two half-shafts of different categories needs to be replaced, also replace both crankcase halves, combining the two components (Shaft and Crankcase) featuring the same category.

Cylinder Head

Before performing head service operations, thoroughly clean all coupling surfaces. Note the position of the springs and the valves so as not to change the original position during refitting

- Using a trued bar and a feeler gauge, check that the cylinder head surface is not worn or distorted.

Characteristic

Maximum allowable run-out:

0.03 mm

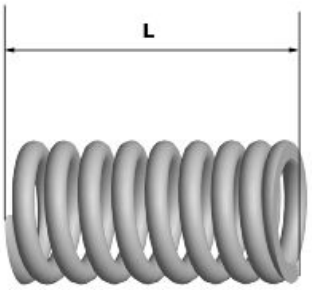
- In case of faults, replace the head.
- Check the sealing surfaces for the exhaust manifold.
- Check that the camshaft and the rocking lever pin capacities exhibit no wear.
- Check that the head cover shows no signs of wear.
- Check that there is no cooling liquid leakage from the seals.

- Insert the valves into the cylinder head.
- Alternatively check the intake and exhaust valves.
- The test is carried out by filling the manifold with petrol and checking that the head does not ooze through the valves when these are just pressed with the fingers.

HEAD BEARINGS

Specification	Desc./Quantity
bearing «A»	Ø 10.000 (+0.015) mm
bearing «B»	Ø 28.000 (+0.007 +0.028) mm
bearing «C»	Ø 42.000 (+0.009 +0.034) mm

Measure the unloaded spring length

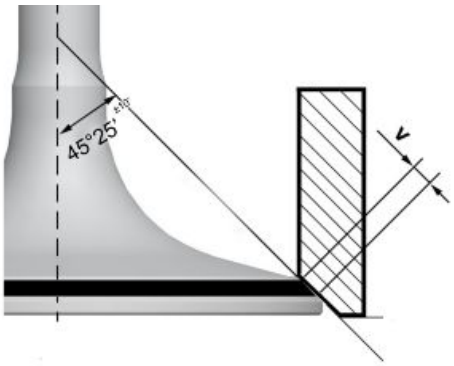


Characteristic

Standard length

35.8 mm

- Clean the valve seats of any carbon residues.
- Using the Prussian blue, check the width of the impression on the valve seat "**V**".



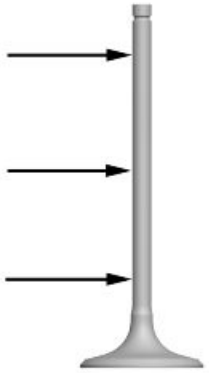
Characteristic

Standard value:

1 - 1.3 mm

- If the impression width on the valve seat is larger than the prescribed limits, true the seats with a 45° mill and then grind.
- In case of excessive wear or damage, replace the head.

- Measure the diameter of the valve stems in the three positions indicated in the diagram.

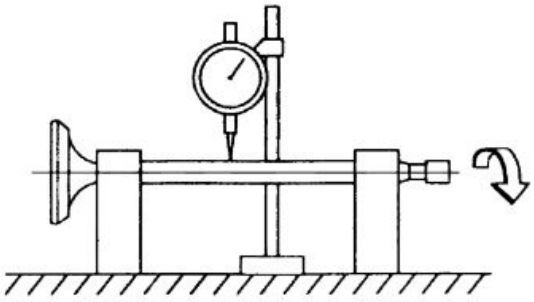


STANDARD DIAMETER

Specification	Desc./Quantity
Intake:	4.030 to 4.015 mm
Exhaust:	4.975 to 4.960 mm

- Calculate the clearance between the valve and the valve guide.

- Check the deviation of the valve stem by resting it on a «**V**» shaped abutment and measuring the extent of the deformation with a dial gauge.

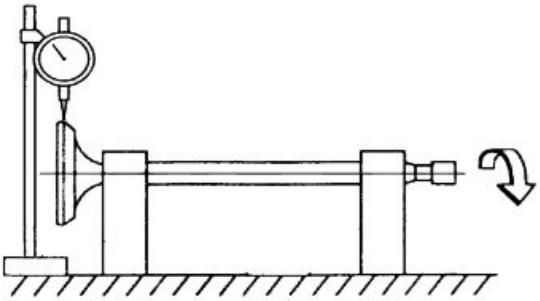


Characteristic

Limit values admitted:

0.02 mm

- Check the oscillation of the valve head by arranging a dial gauge at right angle relative to the valve head and rotate it on a "**V**" shaped abutment.

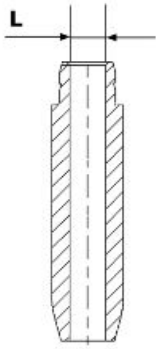


Characteristic

Limit allowed:

0.3 mm

Measure the valve guide.



Characteristic

Valve guide:

4.3 ± 0.1 mm

- After measuring the valve guide diameter and the valve stem diameter, check clearance between guide and stem.

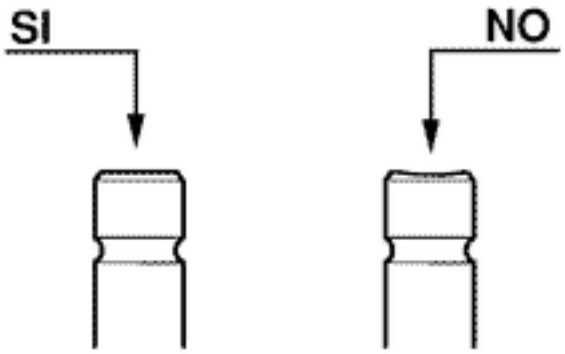
INTAKE

Specification	Desc./Quantity
Standard clearance:	0.10 mm
Limit allowed:	0.08 mm

EXHAUST

Specification	Desc./Quantity
Standard clearance:	0.15 mm
Limit allowed:	0.1 mm

- Check that there are no signs of wear on the mating surface with the set screw articulated terminal.



- If no anomalies are found during the above checks, you can use the same valves. To obtain better sealing performance, grind the valve seats. Grind the valves gently with a fine-grained lapping compound. During the grinding, keep the cylinder head with the valve axes in a horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).

CAUTION

TO AVOID SCORING THE MATING SURFACE, DO NOT ROTATE THE VALVE WHEN NO LAPPING COMPOUND IS LEFT. CAREFULLY WASH THE CYLINDER HEAD AND THE VALVES WITH A SUITABLE PRODUCT FOR THE TYPE OF LAPPING COMPOUND BEING USED.

CAUTION

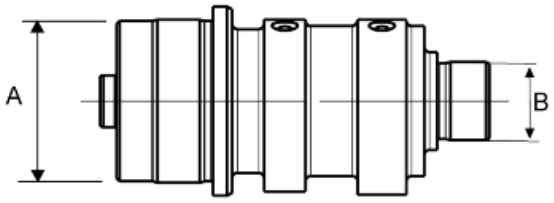
DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

- Check that the camshaft bearings exhibit no scores or abnormal wear.

- Using a micrometer, measure the camshaft bearings.

STANDARD DIAMETER

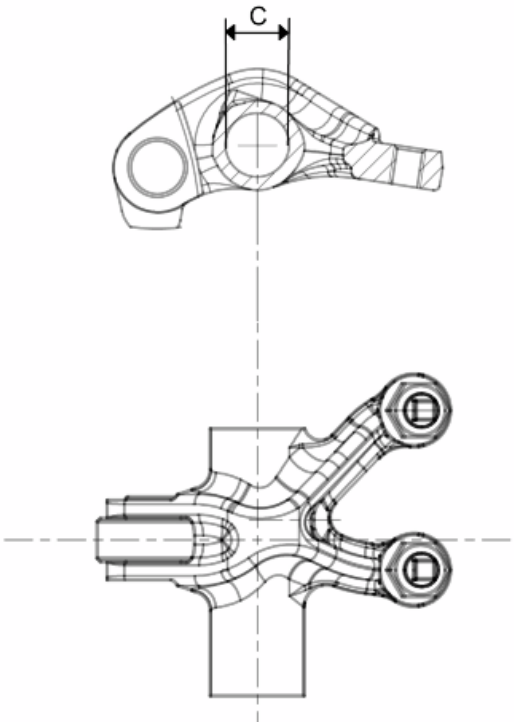
Specification	Desc./Quantity
Camshaft check: Standard diameter	Bearing A Ø: 25.002 to 25.015 mm
Camshaft check: Standard diameter	Bearing B diameter: 12.002 to 12.013 mm



- Measure the external diameter of the rocker pins
- Check the rocker pins do not show signs of wear or scoring.
- Measure the internal diameter of each rocker
- Check there are no signs of wear on the pad in contact with the cam and on the jointed adjustment plate.

ROCKING LEVERS AND PIN DIAMETER:

Specification	Desc./Quantity
Rocking lever inside diameter: Standard diameter (C)	Ø 10.015 to 10.035 mm
Rocking lever pin diameter: Standard diameter (D)	Ø 10.015 to 10.023 mm

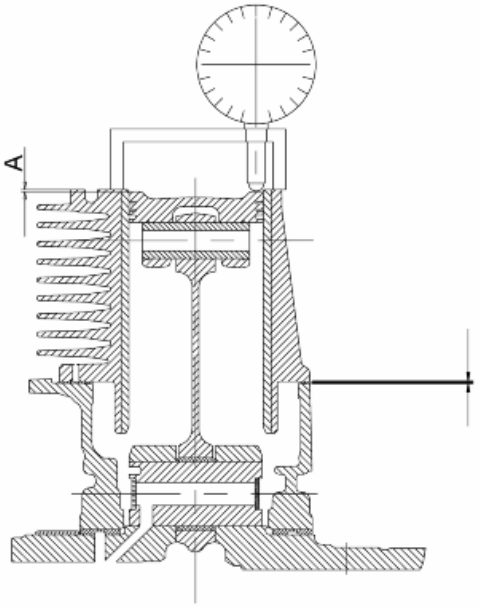


Slot packing system

Characteristic

Compression ratio 125

10 : 1



Measurement "**A**" to be taken is a value of piston re-entry, it indicates by how much the plane formed by the piston crown falls below the plane formed by the top of the cylinder. The further the piston falls inside the cylinder, the less the base gasket to be applied (to recover the compression ratio) and vice versa.

N.B.

MEASUREMENT "A" MUST BE TAKEN WITHOUT ANY GASKET FITTED BETWEEN THE CRANK-CASE AND CYLINDER AND AFTER RESETTING THE DIAL GAUGE, EQUIPPED WITH A SUP-PORT, ON A GROUND PLANE

ENGINE SHIMMING

Name	Measure A	Thickness
Shimming	0 - -0.1	0.8 ± 0.05
Shimming	-0.1 - -0.3	0.6 ± 0.05
Shimming	-0.3 - -0.4	0.4 ± 0.05

Products

RECOMMENDED PRODUCTS TABLE

Product	Description	Specifications
AGIP GEAR SAE 80W-90	Lubricant for gearboxes and transmissions.	API GL-4
AGIP BRAKE 4	Brake fluid.	Synthetic fluid SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3
AGIP FILTER OIL	Special product for the treatment of foam filters.	-
AGIP GREASE MU3	Yellow-brown, lithium-base, medium-fibre multipurpose grease.	ISO L-X-BCHA 3 - DIN 51 825 K3K -20
AGIP GP 330	Water repellent stringy calcium spray grease.	R.I.D./A.D.R. 2 10°b) 2 R.I.Na. 2.42 - I.A.T.A. 2 - I.M.D.G. class 2 UN 1950 Page 9022 EM 25-89

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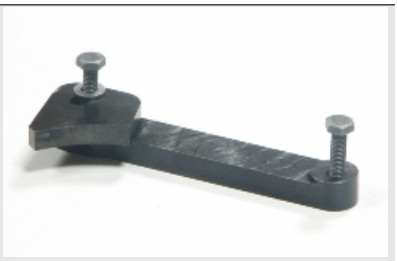
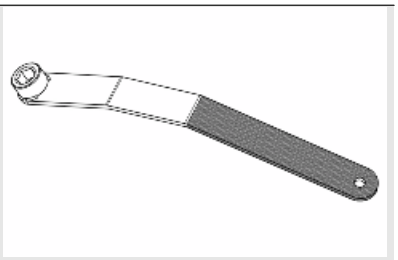
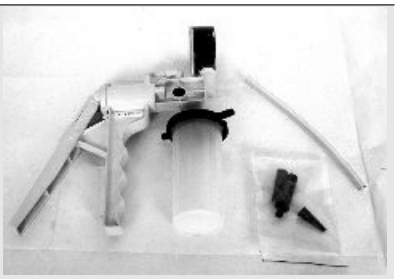
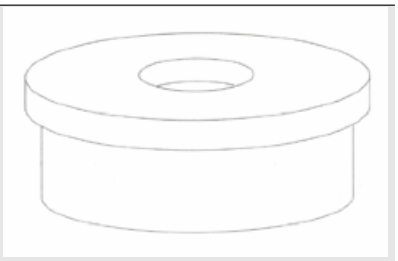
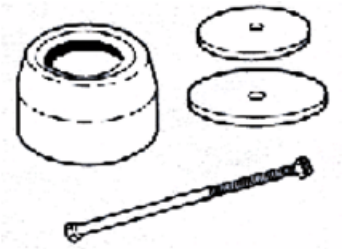
SPECIFIC TOOLS

Stores code	Description	
020937Y	Driven pulley lock	
020938Y	Driving pulley lock	
020939Y	Flywheel retainer	
020940Y	Flywheel cover oil seal gasket	
020941Y	Crankshaft timing adjustment tool	
020942Y	Piston protrusion check tool	

Stores code	Description	
020933Y	Flywheel extractor	
020922Y	Diagnosis Tool	
020959Y	Spanner for the bag hook	
020335Y	Magnetic mounting for dial gauge	
020329Y	Mity-Vac vacuum-operated pump	
020376Y	Adaptor handle	

Stores code	Description	
020441Y	26 x 28 mm adaptor	
020365Y	22 mm guide	
020360Y	52 x 55-mm Adaptor	
020375Y	28 x 30 mm adaptor	
001467Y010	Driver for OD 25 mm bearings	
001467Y013	Calliper to extract ø 15-mm bearings	

Stores code	Description	
001467Y008	Pliers to extract 17 mm ø bearings	
020271Y	Tool for removing-fitting silent bloc	
020439Y	17-mm guide	
020456Y	Ø 24 mm adaptor	
020412Y	15-mm guide	
020648Y	Single battery charger	

Stores code	Description	
020331Y	Digital multimeter	

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Maintenance chart

SCHEDULED MAINTENANCE TABLE

I: CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE, IF NECESSARY C: CLEAN; R: REPLACE; A: ADJUST; L: LUBRICATE
** Check level every 2,500 km*
*** Replace every 2 years*

km x 1,000	1	5	10	15	20	25	30
Safety fasteners	I		I		I		I
Spark plug		I	R	I	R	I	R
Centre stand		L	L	L	L	L	L
Drive belt			R		R		R
Throttle control	A		A		A		A
Roller housing			I		I		I
Air filter			I		I		I
CVT Filter			I		I		I
Engine oil filter	R		R		R		R
Valve clearance	A		A		A		A
Electrical system and battery	I	I	I	I	I	I	I
Cylinder ventilation system							I
Brake levers	L		L		L		L
Brake fluid **	I	I	I	I	I	I	I
Engine oil*	R	I	R	I	R	I	R
Hub oil			I		I		I
Headlight direction adjustment			A		A		A
Brake pads	I	I	I	I	I	I	I
Tyre pressure and wear	I	I	I	I	I	I	I
Vehicle road test	I	I	I	I	I	I	I
Suspension			I		I		I
Steering	A		A		A		A
Transmission			L		L		L
Labour time (minutes)	100	50	180	50	180	50	190

N.B.

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

Spark plug

Remove the battery compartment cover.

Remove the spark plug cap.

Unscrew and remove the spark plug with the supplied wrench.

Check the spark plug status and the electrode gap

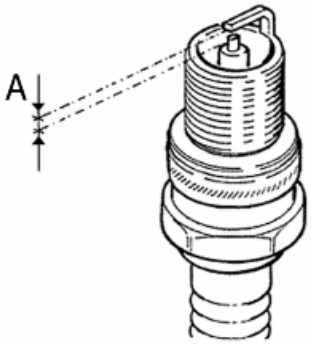
Characteristic

Electrode gap «A»

0.7 - 0.8 mm

Spark plug

NGK CR8EB



Screw the spark plug again to the prescribed torque

Locking torques (N*m)

Spark plug tightening 10 - 12

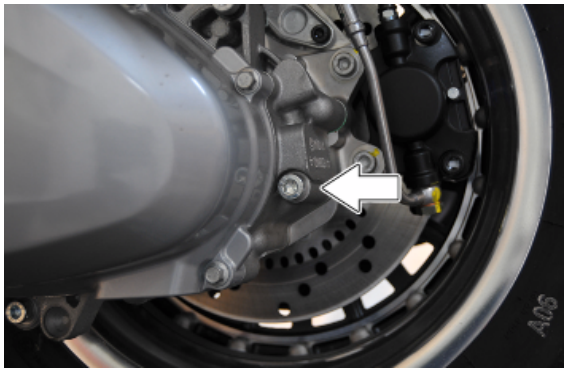
Hub oil

Check

Check oil level with the vehicle placed on the centre stand and on a flat surface.

Undo the indicated screw and check for oil by inserting a shank/plug. The level should be just under the lower margin of the fill hole.

In case of oil leakage, carefully clean the transmission crankcase with a cloth.

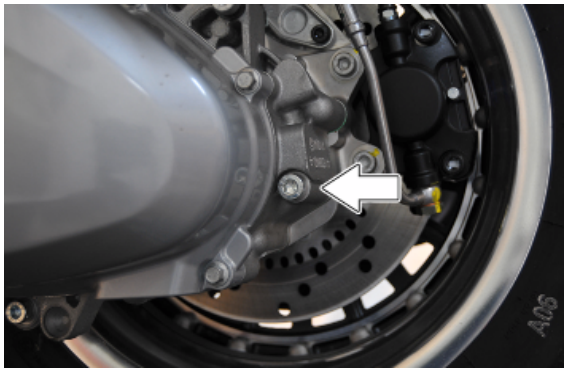


CAUTION

REPLACE THE COPPER GASKET EACH TIME THE LEVEL CHECK AND/OR HUB OIL DRAINAGE SCREW IS UNSCREWED.

Replacement

Remove the hub oil level check screw.



Prepare an adequately sized container under the crankcase at the height of the wheel hub.

Unscrew the oil drainage screw and drain out all the oil.

Tighten the oil drain screw to the prescribed torque.

CAUTION

REPLACE THE COPPER GASKET EACH TIME THE LEVEL CHECK AND/OR HUB OIL DRAINAGE SCREW IS UNSCREWED.

Locking torques (N*m)

Hub oil drainage screw 15 to 17

Insert through the level check hole the prescribed amount of oil.

Recommended products

eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

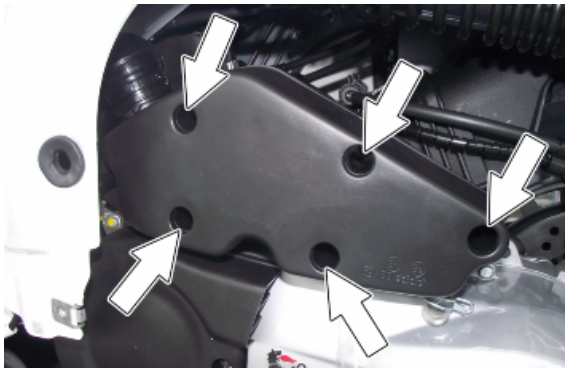
Characteristic

Hub oil quantity

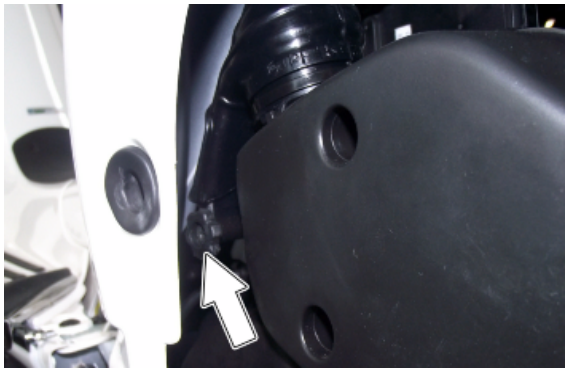
300 cm^3

Air filter

- Remove the left side panel.
- Undo the screws indicated.



Unscrew the screw indicated in the figure and remove the filter cover complete with air duct.



- Remove the filter element and clean it with water and shampoo, then dry it off with a clean cloth and small compressed air jets and immerse it in recommended oil. Then gently squeeze the filter element between your hands, allow it to drip and then refit it.

CAUTION

IF THE VEHICLE IS USED ON DUSTY ROADS, IT IS NECESSARY TO SERVICE THE AIR FILTER AND THE CVT FILTER MORE OFTEN TO AVOID DAMAGING THE ENGINE.

Recommended products

Oil for air filter sponge Special product for the treatment of foam filters.

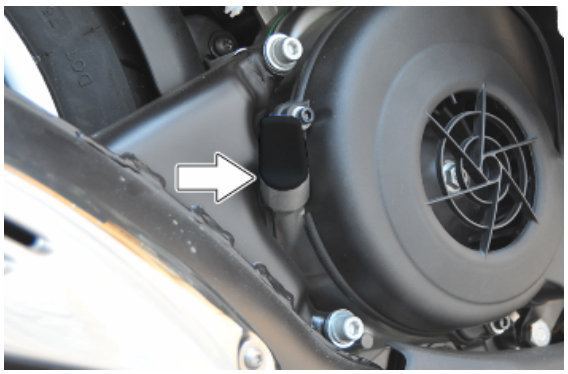
-

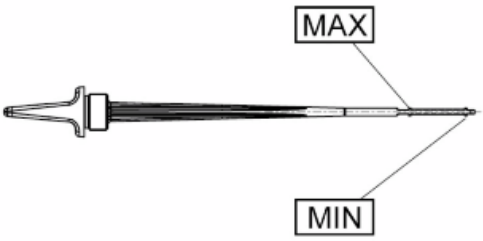
Engine oil

In four stroke engines, the engine oil is used to lubricate the timing elements, the bench bearings and the thermal group. **An insufficient quantity of oil can cause serious damage to the engine.**
In all four stroke engines, the deterioration of the oil characteristics, or a certain consumption should be considered normal, especially if during the run-in period. Consumption levels in particular can be influenced by the conditions of use (e.g.: oil consumption increases when driving at "full throttle".

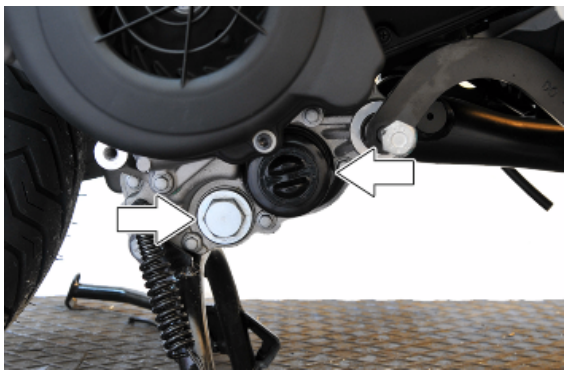
Replacement

Change oil and replace filter as indicated in the scheduled maintenance table.
- Remove the silencer.
- The engine must be emptied by draining off the oil through the drainage plug of the mesh pre-filter, flywheel side; furthermore to facilitate oil drainage, loosen or remove the cap/dipstick.
- Once all the oil has drained through the drainage hole, unscrew the oil cartridge filter and remove it.
- Make sure the pre-filter and drainage plug O-rings are in good conditions.
- Lubricate them and refit the mesh filter and oil drain cap by tightening to the prescribed torque.
- Refit the new cartridge filter being careful to lubricate the O-ring before fitting it.
- Change the engine oil.





Since a certain quantity of oil still remains in the circuit, oil must be filled from oil dipstick/cover. Then start up the vehicle, leave it running for a few minutes and switch it off: after about five minutes check the level and if necessary top up without exceeding the MAX level. The cartridge filter must be replaced every time the oil is changed. Use new oil of the recommended type for topping up and changing purposes.



N.B.
THE ENGINE MUST BE HOT WHEN THE OIL IS CHANGED.

Recommended products

eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

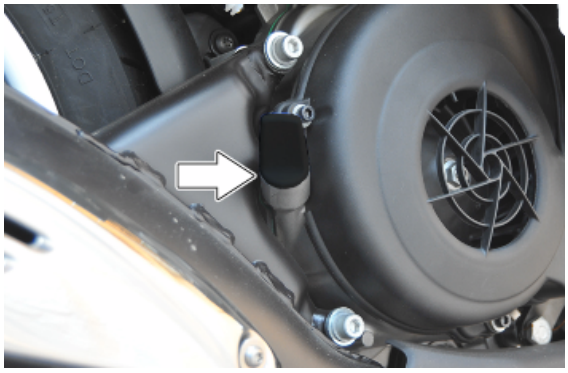
JASO MA, MA2 - API SL - ACEA A3

Characteristic

Engine oil

1,340 cm³ (of which 120 cm³ in the filtering cartridge)

Check



This operation must be carried out with the engine cold and following the procedure below:

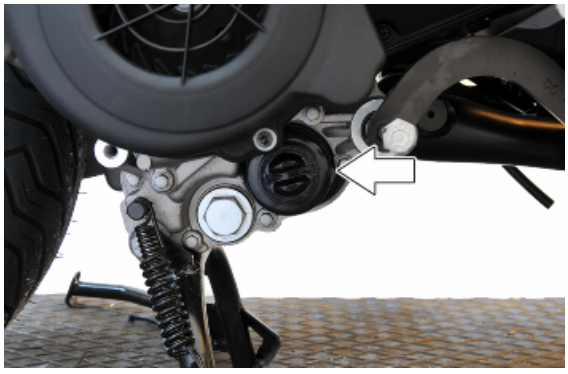
- Place the vehicle on its centre stand and on flat ground.
- Remove the right side fairing.
- Undo cap/dipstick, dry it off with a clean cloth and reinsert it, screwing down completely.
- Remove the cap/dipstick again and check that the level is between the MIN and MAX reference marks; top up if necessary.

If the check is carried out after the vehicle has been used, and therefore with a hot engine, the level will be lower; in order to carry out a correct check, wait at least 10 minutes after the engine has been stopped so as to get the correct level.

Engine oil top-up

The oil should be topped up after having checked the level and in any case by adding oil without ever exceeding the MAX. level.

Engine oil filter



Change oil and replace filter as indicated in the scheduled maintenance table. Use new oil of the recommended type for topping up and changing purposes.

Make sure the pre-filter and drainage plug O-rings are in good conditions. Lubricate them and refit the mesh filter and the oil drainage plug, screwing them up to the prescribed torque. Refit the new

cartridge filter being careful to lubricate the O-ring before fitting it. Change the engine oil.

Recommended products

eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

Characteristic

Engine oil

1,340 cm³ (of which 120 cm³ in the filtering cartridge)

Oil pressure warning light

The vehicle is equipped with a telltale light on the dashboard that lights up when the key is turned to the «ON» position. However, this light should switch off once the engine has been started.

If the light turns on during braking, at idling speed or while turning a corner, it is necessary to check the oil level and the lubrication system.

Checking the ignition timing

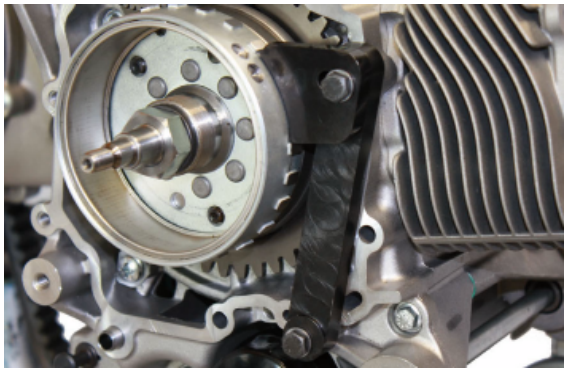
Position the engine at top dead centre (TDC) in compression. To do this, use the appropriate tools. Use the holes on the engine crankcase to secure the tool.

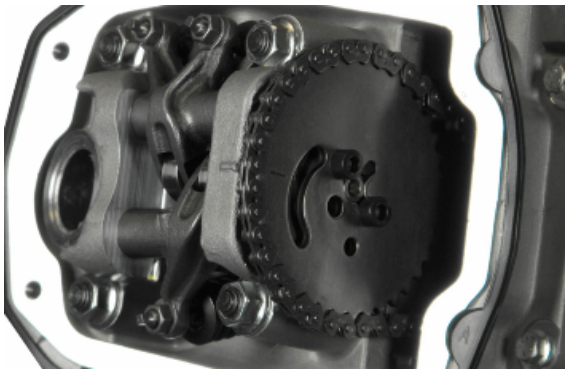
Position the specific tool in the window between the flywheel pick-up references as illustrated in the figure.

The arrows stamped respectively on the valve frame and sprocket must coincide.

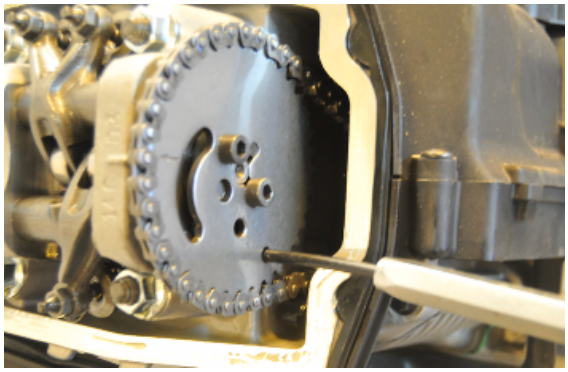
N.B.

IF THE TIMING UNIT IS NOT IN PHASE CHECK THE CORRECT FITTING OF COMPONENTS.



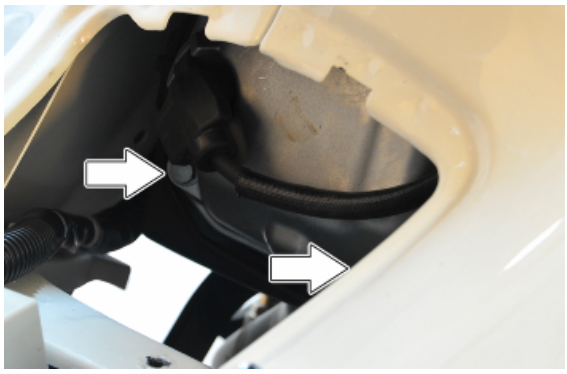


- As a further verification of the correct distribution timing, insert a pin into the hole on the gear of the camshaft and check that it coincides with the special blind hole on the frame of the head.

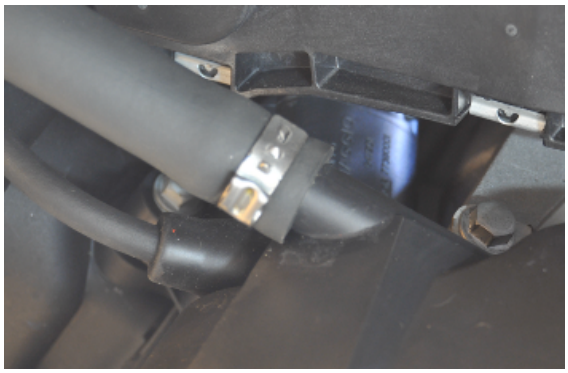


Checking the valve clearance

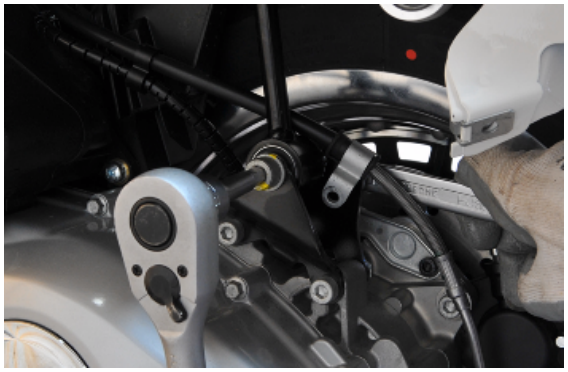
Remove the lower screws of the tappet cover.



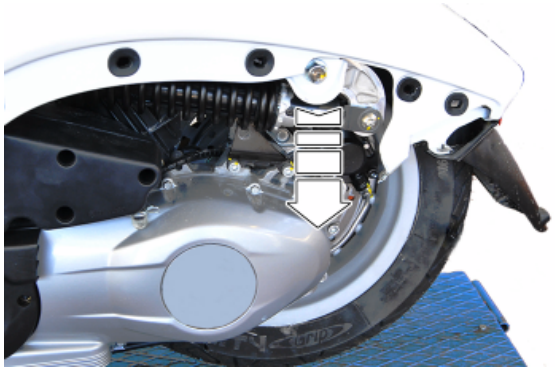
Remove the vapours recovery pipe from the filter box.



Remove the lower pin of the steering shock absorber strut.



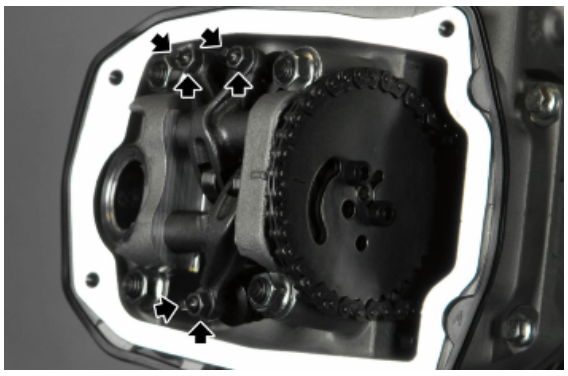
Lower the body until the upper screws of the tappet cover are free.



Unscrew the upper screws of the tappet cover and remove the cover to access the valve clearance registers.

-To check valve clearance, centre the reference marks of the timing system.

- Use a feeler gauge to check that the clearance between the valve and the register corresponds with the indicated values. When the valve clearance values, intake and exhaust respectively, are different from the ones indicated below, adjust them by loosening the lock nut and operating on the corresponding set screw, as shown in the figure.



Characteristic

Valve clearance (cold engine)

intake: 0.08 mm exhaust: 0.08 mm

Braking system

Level check

- Rest the vehicle onto the centre stand, with the handlebar centred.
- Check the level of liquid using the warning lights «A» and «B».

A certain lowering of the level is caused by wear on the brake pads.

Top-up

Remove the handlebar cover as described in the corresponding chapter.

For both brakes remove the reservoir cap by loosening the relative screws, remove the gasket and top-up using only the fluid specified without exceeding the maximum level.

CAUTION

ONLY USE DOT 4-CLASSIFIED BRAKE FLUID.

CAUTION

BRAKE FLUID IS HYGROSCOPIC; THAT IS, IT ABSORBS MOISTURE FROM THE SURROUNDING AIR. IF THE CONTENT OF MOISTURE IN THE BRAKE FLUID EXCEEDS A CERTAIN VALUE, BRAKING WILL BE INEFFICIENT.
NEVER USE BRAKE FLUID FROM OPEN OR PARTIALLY USED CONTAINERS.
UNDER NORMAL CLIMATIC CONDITIONS, REPLACE FLUID AS INDICATED IN THE SCHEDULED MAINTENANCE TABLE.

CAUTION

BRAKING CIRCUIT FLUID IS HIGHLY CORROSIVE; MAKE SURE THAT IT DOES NOT COME INTO CONTACT WITH THE PAINTWORK.

CAUTION

AVOID CONTACT OF THE BRAKE FLUID WITH YOUR EYES, SKIN, AND CLOTHING. IN CASE OF ACCIDENTAL CONTACT, WASH WITH WATER.

N.B.

SEE THE BRAKING SYSTEM CHAPTER WITH REGARD TO THE CHANGING OF BRAKE FLUID AND THE BLEEDING OF AIR FROM THE CIRCUITS.

Recommended products

AGIP BRAKE 4 Brake fluid.

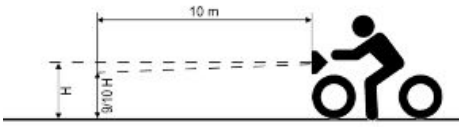
Synthetic fluid SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4

Locking torques (N*m)

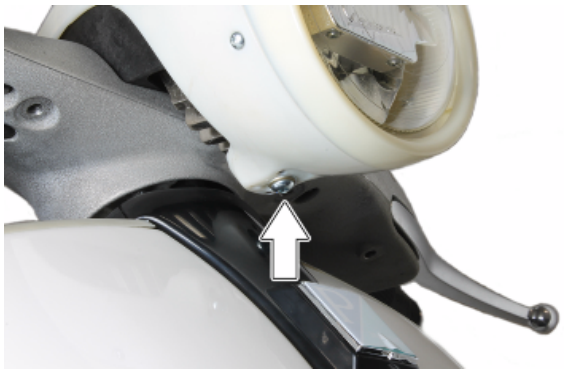
Brake pump reservoir screw **15 - 20**

Headlight adjustment

- Position the vehicle in running order and with the tyres inflated to the prescribed pressure, onto a flat surface 10 m away from a half-lit white screen; ensure that the longitudinal axis of the vehicle is perpendicular to the screen.



- Turn on the headlight and check that the border of the projected light beam on the screen is not higher than 9/10 or lower than 7/10 f the height from the ground to the centre of vehicle headlamp;
- If this is not the case, adjust the headlight by operating the screw indicated.



WARNING

THE ABOVE PROCEDURE COMPLIES WITH THE "EUROPEAN STANDARDS" REGARDING MAXIMUM AND MINIMUM HEIGHT OF LIGHT BEAMS. REFER TO THE STATUTORY REGULATIONS IN FORCE IN EVERY COUNTRY WHERE THE VEHICLE IS USED.

INDEX OF TOPICS

Engine

Poor performance

POOR PERFORMANCE

Possible Cause	Operation
Air filter blocked or dirty.	Remove the sponge, wash with water and car shampoo, soak it with specific oil for the treatment of foam filters. Press with your hand without squeezing, allow it to drip dry and refit
Excessive drive belt wear	Check it and replace, if necessary
Lack of compression: parts, cylinder and valves worn	Replace the worn parts
Oil level exceeds maximum	Check for causes and fill to reach the correct level
Excess of scales in the combustion chamber	Descale the cylinder, the piston, the head and the valves
Incorrect timing or worn timing system elements	Time the system again or replace the worn parts
Silencer obstructed	Replace
Inefficient automatic transmission	Check the rollers and the pulley movement, replace the damaged parts and lubricate the movable guide of the driven pulley with grease.
Wrong valve adjustment	Adjust the valve clearance properly
Overheated valves	Remove the head and the valves, grind or replace the valves
Valve seat distorted	Replace the head unit
Worn cylinder, Worn or broken piston rings	Replace the piston cylinder assembly or just the piston rings

Starting difficulties

DIFFICULTY STARTING UP

Possible Cause	Operation
Flat battery	Check the state of the battery. If it shows signs of sulphation, replace it and bring the new battery into service by charging it for not more than ten hours at a current of 1/10 of the capacity of the battery itself.
Faulty spark plug	Replace the spark plug
Incorrect valve sealing or valve adjustment	Inspect the head and/or restore the correct clearance
Starter motor and start-up system fault	Check starter motor.
Altered fuel characteristics	Drain off the fuel no longer up to standard; then, refill
Air filter obstructed or dirty.	Remove the sponge, wash with water and car shampoo, then soak it in a mixture of 50% petrol and 50% specific oil. Press with your hand without squeezing, allow it to drip dry and refit.
Fuel pump fault	Check the pump.

Excessive oil consumption/Exhaust smoke

EXCESSIVE CONSUMPTION

Possible Cause	Operation
Wrong valve adjustment	Adjust the valve clearance properly
Overheated valves	Remove the head and the valves, grind or replace the valves
Misshapen/worn valve seats	Replace the head unit
Worn cylinder, Worn or broken piston rings	Replace the piston cylinder assembly or piston rings
Worn or broken piston rings or piston rings that have not been fitted properly	Replace the piston cylinder unit or just the piston rings
Oil leaks from the couplings or from the gaskets	Check and replace the gaskets or restore the coupling seal
Worn valve oil guard	Replace the valve oil seal
Worn valve guides	Check and replace the head unit if required

Insufficient lubrication pressure

POOR LUBRICATION PRESSURE

Possible Cause	Operation
By-Pass remains open	Check the By-Pass and replace if required. Carefully clean the By-Pass area.
Oil pump with excessive clearance	Perform the dimensional checks on the oil pump components
Oil filter too dirty	Replace the cartridge filter
Oil level too low	Restore the level adding the recommended oil type

Transmission and brakes

Clutch grabbing or performing inadequately

IRREGULAR CLUTCH PERFORMANCE OR SLIPPAGE

Possible Cause	Operation
Faulty clutch	Check that there is no grease on the masses. Check that the clutch mass faying surface with the bell is mainly in the centre with equivalent characteristics on the three masses. Check that the clutch housing is not scored or worn in an anomalous way

Insufficient braking

INEFFICIENT BRAKING SYSTEM

Possible Cause	Operation
Inefficient braking system	Check the pad wear (1.5 min). Check that the brake discs are not worn, scored or warped. Check the correct level of fluid in the pumps and change brake fluid if necessary. Check there is no air in the circuits; if necessary, bleed the air. Check that the front brake calliper moves in axis with the disc.
Fluid leakage in hydraulic braking system	Failing elastic fittings, plunger or brake pump seals, replace
Brake disc slack or distorted	Check the brake disc screws are locked; measure the axial shift of the disc with a dial gauge and with wheel mounted on the vehicle.

Brakes overheating

BRAKE OVERHEAT

Possible Cause	Operation
Defective plunger sliding	Check calliper and replace any damaged part.
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the vehicle to measure the axial deviation of the disc.
Clogged compensation holes on the pump	Clean carefully and blast with compressed air
Swollen or stuck rubber gaskets	Replace gaskets.

Electrical system

Battery

BATTERY

Possible Cause	Operation
Battery	The battery is the electrical device in the system that requires the most frequent inspections and thorough maintenance. If the vehicle is not used for some time (1 month or more) the battery needs to be recharged periodically. The battery runs down completely in the course of 5 to 6 months. If the battery is fitted on a motorcycle, be careful not to invert the connections, keeping in mind that the black ground wire is connected to the negative terminal while the red wire is connected to the terminal marked+. Follow the instructions in the ELECTRICAL SYSTEM chapter for the recharging of the batteries.

Steering and suspensions

Heavy steering

STEERING HARDENING

Possible Cause	Operation
Steering hardening	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: if they are recessed or if the balls are squashed, replace them.

Excessive steering play

EXCESSIVE STEERING CLEARANCE

Possible Cause	Operation
Excessive steering clearance	Check the tightening of the top ring nut. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: replace if they are recessed.

Noisy suspension

NOISY SUSPENSION

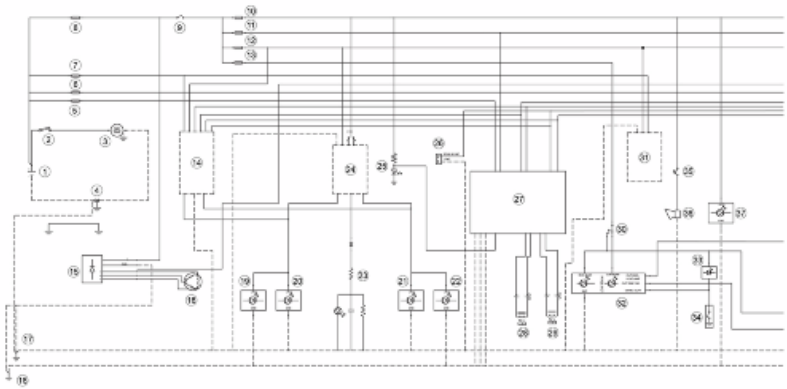
Possible Cause	Operation
NOISY SUSPENSION	If the front suspension is noisy, check: that the front shock absorber works properly and the ball bearings are good condition. Finally, check the locking torque of the wheel axle nut, the brake calliper and the disc. Check that the swinging arm connecting the engine to the chassis and the rear shock absorber work properly.

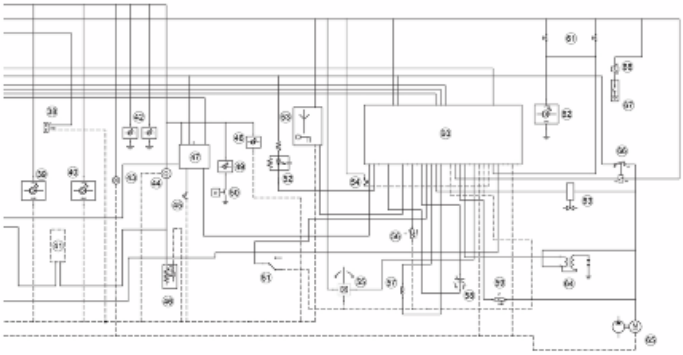
Suspension oil leakage

OIL LEAKAGE FROM SUSPENSION

Possible Cause	Operation
Faulty or broken seals	Replace the shock absorber Check the condition of wear of the steering covers and the adjustments.

INDEX OF TOPICS





1. Battery
2. Starter relay contacts
3. Starter motor
4. Engine ground node
5. Fuse No.3 - 20 A
6. Fuse No.2 - 10 A
7. Fuse No.4 - 7.5 A
8. Fuse No.1 - 20 A
9. Key switch contacts
10. Fuse No.6 - 7.5 A
11. Fuse No.7 - 5 A
12. Fuse No.8 - 7.5 A
13. Fuse No.9 - 5 A
14. PMP pre-installation
15. Voltage regulator
16. Flywheel
17. Front ground node
18. Rear ground node
19. Rear left turn indicator
20. Front left turn indicator
21. Front right turn indicator

22. Rear right turn indicator
23. Turn indicator warning light
24. Turn indicator control
25. ABS warning light
26. Diagnostics socket
27. ABS control unit
28. Rear wheel speed sensor
29. Front wheel speed sensor
30. Light switch
31. Alarm pre-installation
32. Headlight
33. High beam warning light
34. Lights ignition enabling
35. Horn button
36. Horn
37. Rear tail light
38. USB socket connector
39. Right front daylight running light
40. Left front daylight running light
41. PMP pre-installation
42. Instrument panel lighting
43. License plate light
44. Fuel gauge
45. MODE button
46. Fuel level sensor
47. LCD instrument panel
48. Graphic icon
49. Oil pressure warning light
50. Oil pressure sensor
51. engine stop switch
52. Immobilizer LED
53. Immobilizer antenna
54. Starter button
55. Inclination sensor
56. Engine temperature sensor
57. Pick up
58. Oxygen sensor
59. Oxygen sensor heater

60. C.D.I.
61. Stop buttons
62. Stop light
63. Injector
64. H.V. coil
65. Fuel pump
66. Injection load relay
67. Start-up enabling switch
68. Starter relay coil

Ar = Orange, **Az** = Sky Blue, **Bi** = White, **Bl** = Blue, **Gi** = Yellow, **Gr** = Grey, **Ma** = Brown, **Ne** = Black, **Ro** = Pink, **Rs** = Red, **Ve** = Green, **Vi** = Purple

Components arrangement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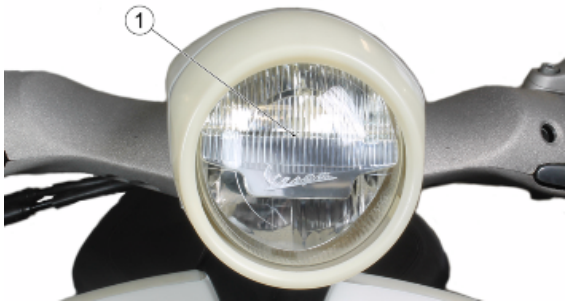
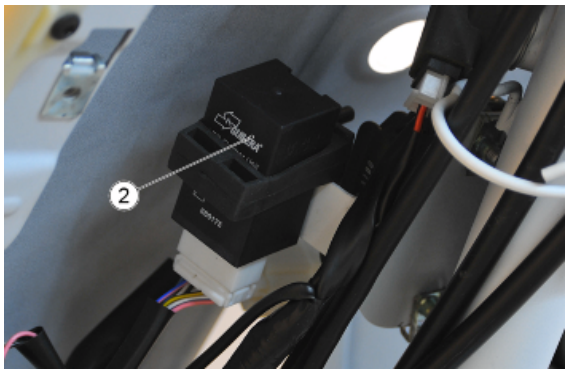
1. Headlight.

(for connector see point 19).



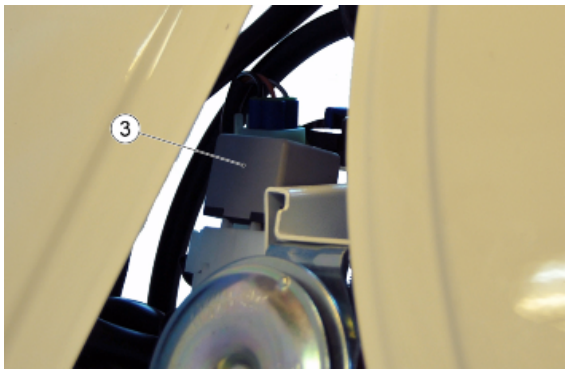
2. Turn indicator control.

Remove the leg shield back plate to reach it.



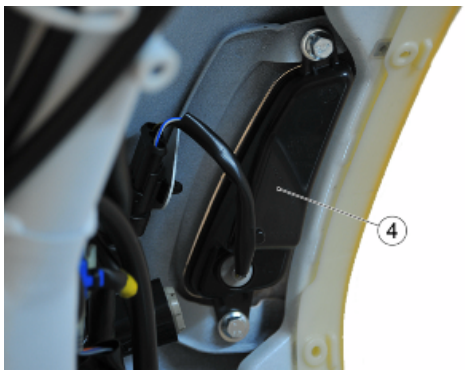
3. Injection load relay

Remove the leg shield back plate to reach it.



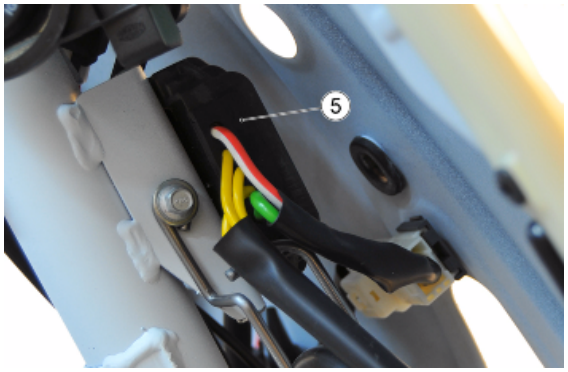
4. Front right turn indicator.

Remove the leg shield back plate and the footrest to reach it.



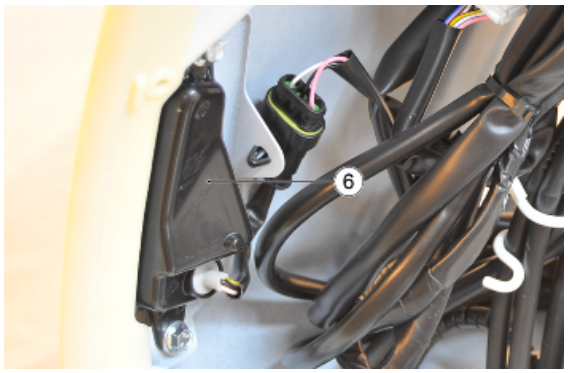
5. Voltage regulator.

Remove the leg shield back plate, the footrest and the legshield to reach it.



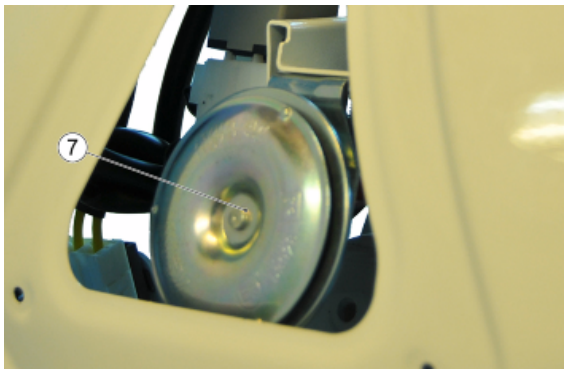
6. Front left turn indicator.

Remove the leg shield back plate and the footrest to reach it.



7. Horn

Remove the leg shield back plate, the footrest and the legshield to reach it.



8. Diagnostics socket.

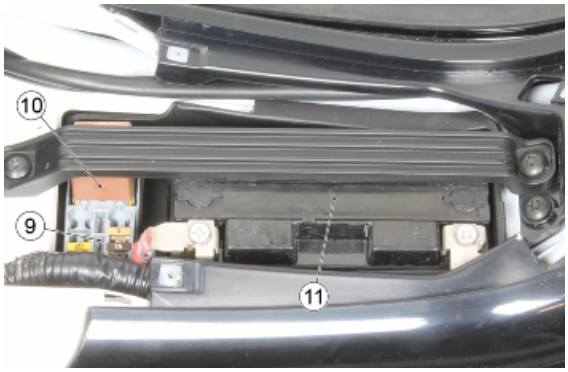
Remove the battery compartment cover to reach it.

9. Fuses.

10. Starter motor relay.

11. Battery

Remove the battery compartment cover to reach it.



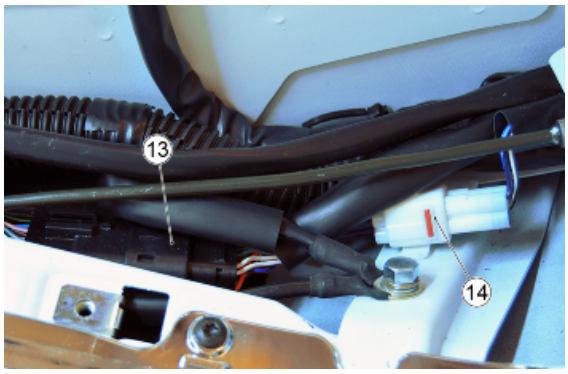
12. Oxygen sensor.

(for connector see point 24).

13. Frame - engine cable harness connector «A».

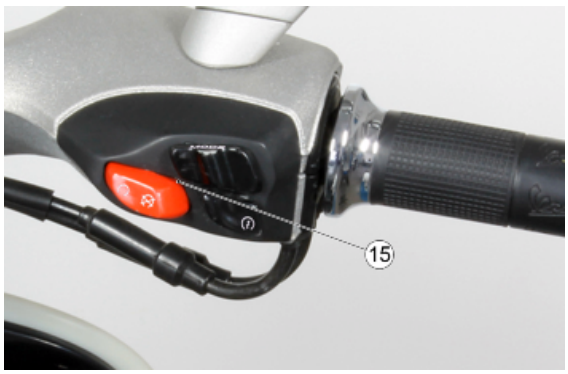
14. Frame - engine cable harness connector «B».

Remove the leg shield back plate and the footrest to reach it.



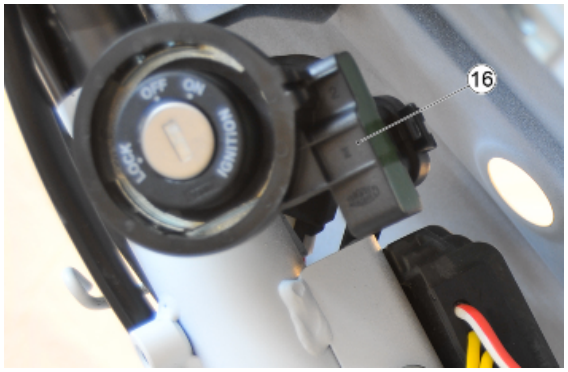
15. Electrical device right.

(for connector see point 21).



16. Immobilizer.

Remove the leg shield back plate to reach it.



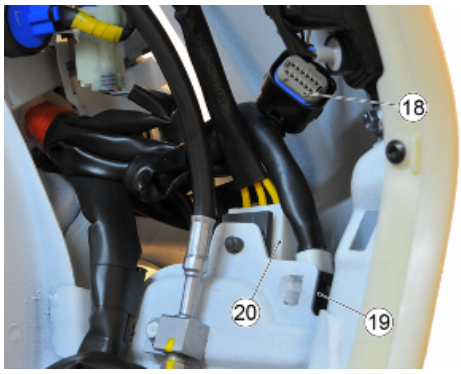
17. USB socket (pre-installation for accessory).

18. PMP connector (pre-installation for accessory).

19. Headlight connector.

20. Voltage regulator connector.

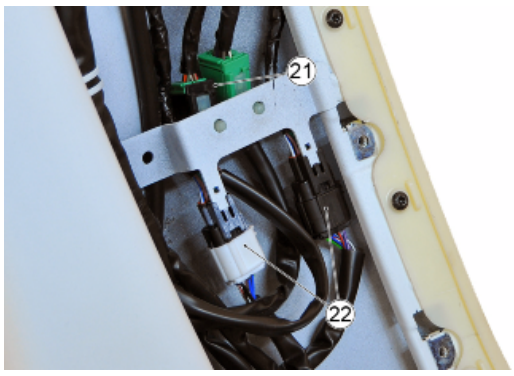
Remove the leg shield back plate and the footrest to reach it.



21. Electronic devices connectors.

22. Instrument panel connectors.

Remove the leg shield back plate and the footrest to reach it.



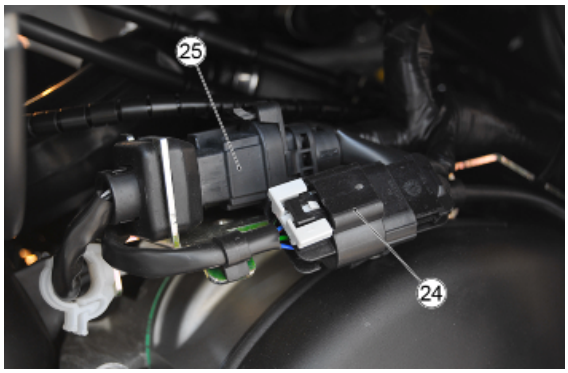
23. Fuel pump connector.

Remove the left side fairing to reach it.

24. Oxygen sensor connector

25. Magneto flywheel connector.

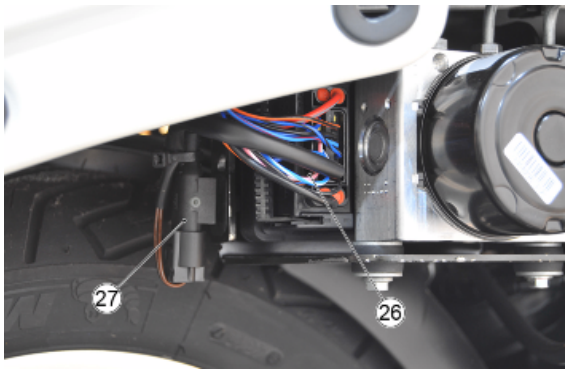
Remove the right side fairing to reach it.



26. ABS control unit.

27. Rear speed sensor connector.

Remove the right side fairing to reach it.



28. Rear right turn indicator.

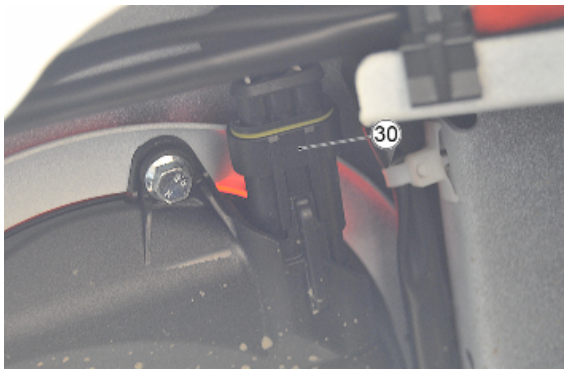
Remove the right side fairing to reach it.

29. License plate light.

Remove the license plate light to reach it.

30. Rear light.

Remove the right side fairing to reach it.



31. Instrument panel.

(for connector see point 22).

32. Electric device left.

(for connector see point 21).

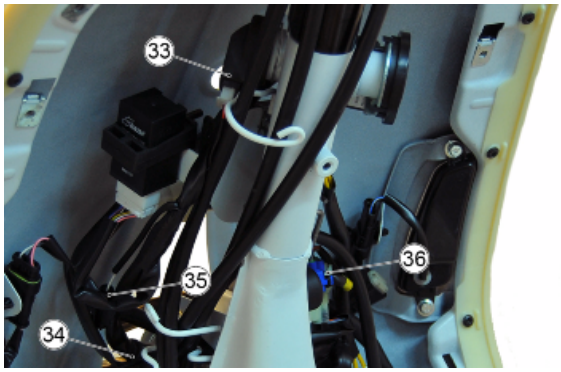
33. Ignition switch connector.

34. Voltage regulator connector.

35. Boost.

36. Tip over sensor.

Remove the leg shield back plate to reach it.

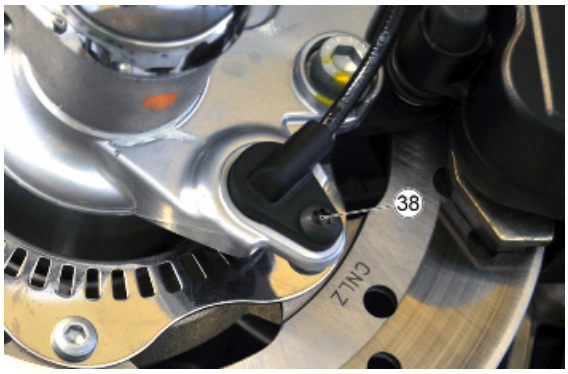


37. Front speed sensor connector.

Remove the leg shield back plate and the footrest to reach it.

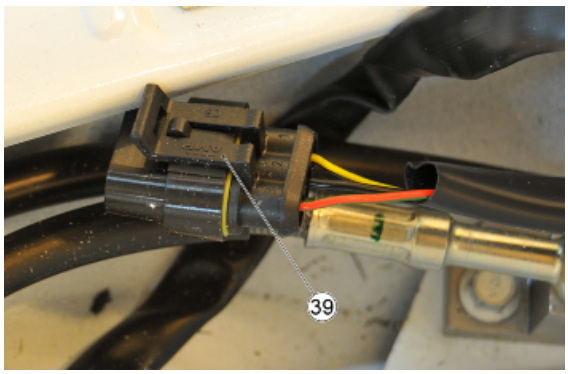
38. Front wheel speed sensor.

(for connector see point 37).



39. GPS connector (pre-installation for accessory).

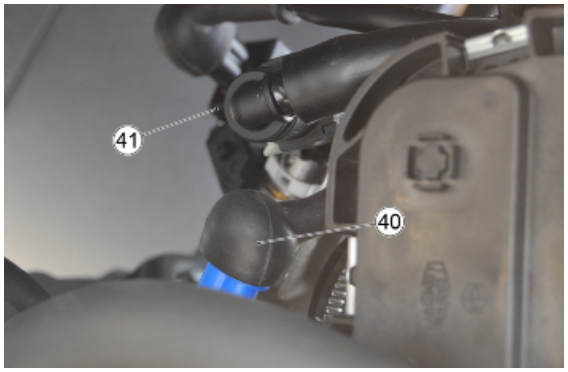
Remove the leg shield back plate and the footrest to reach it.



40. Engine temperature sensor.

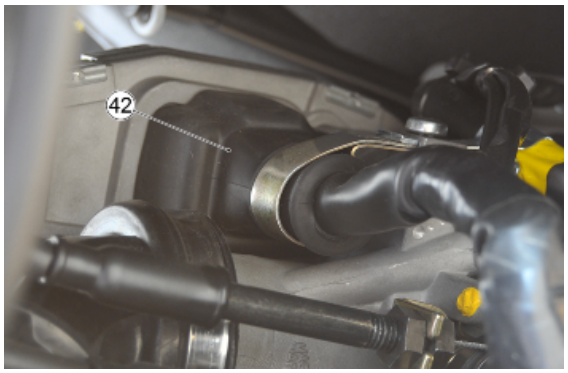
41. Injector.

Remove the right side fairing and the left side fairing to reach it.



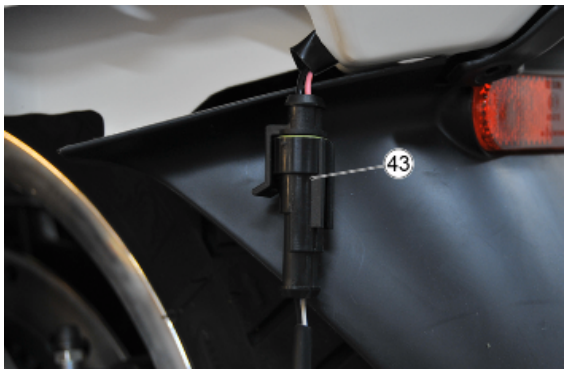
42. CDI control unit

Remove the right side fairing to reach it.



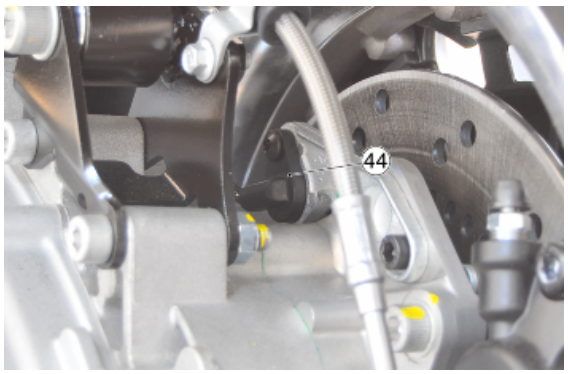
43. Rear left turn indicator.

Remove the left side fairing to reach it.



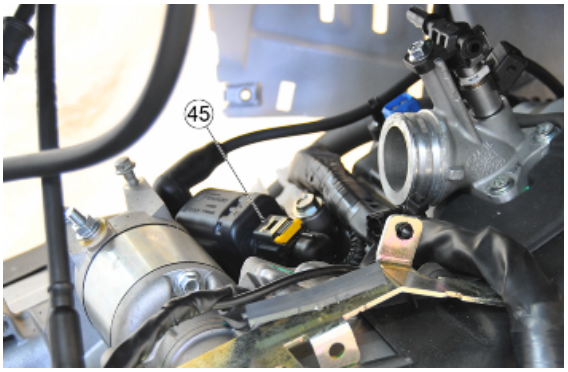
44. Rear wheel speed sensor.

(for connector see point 27).



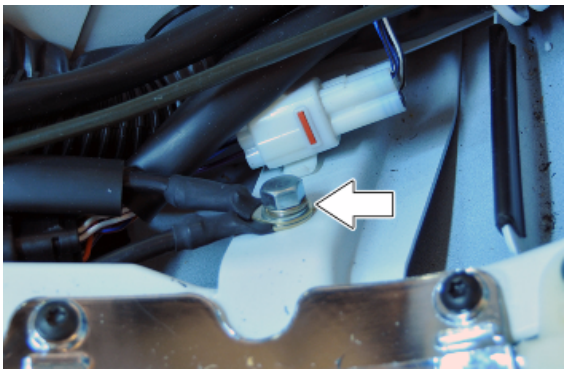
45. H.V. coil

Remove the right side fairing, the left side fairing, the air filter and the throttle body to reach it.

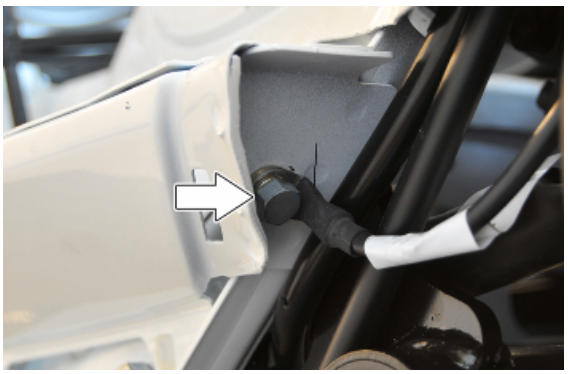


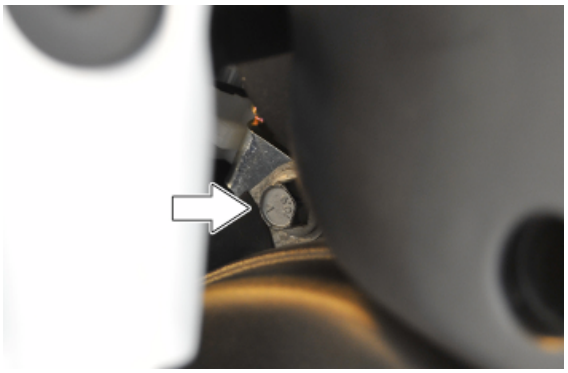
Ground points

Front ground point - under the footrest on the right part of the vehicle.



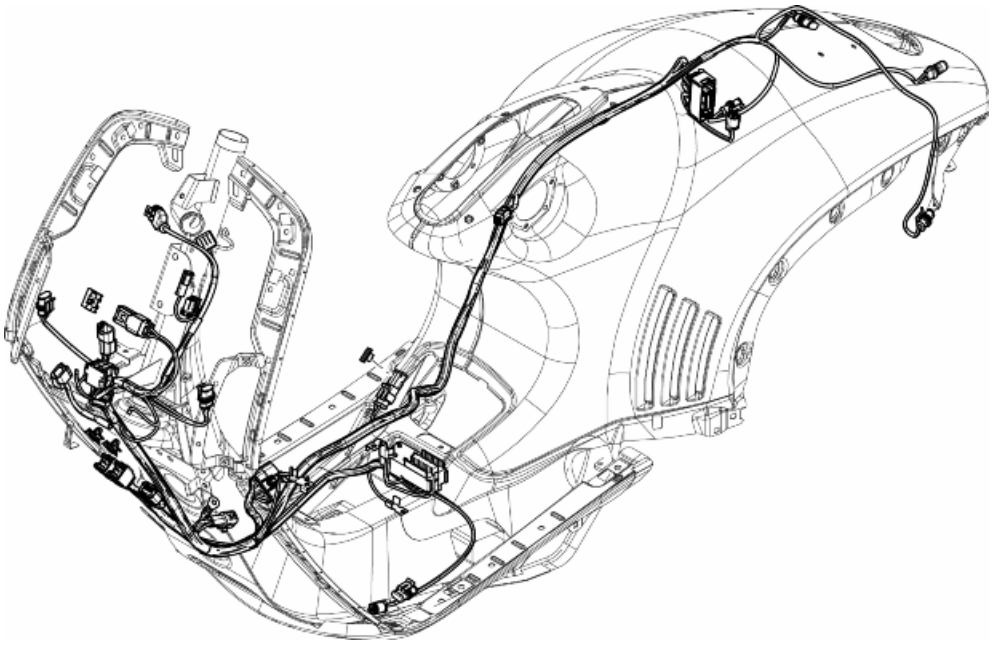
Engine - frame ground point - under the left spoiler and the left side fairing.



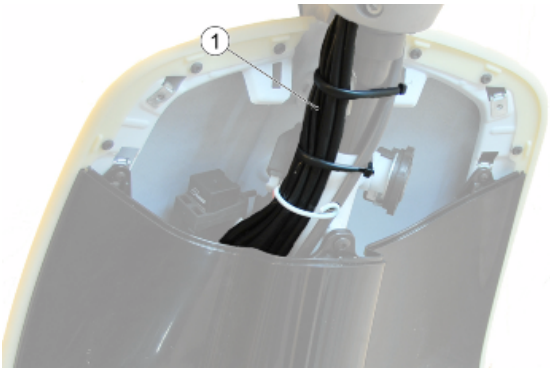


Electrical system installation

Front side



1. Headlight, electrical devices and instrument panel cable harness



2. Left turn indicator cable harness

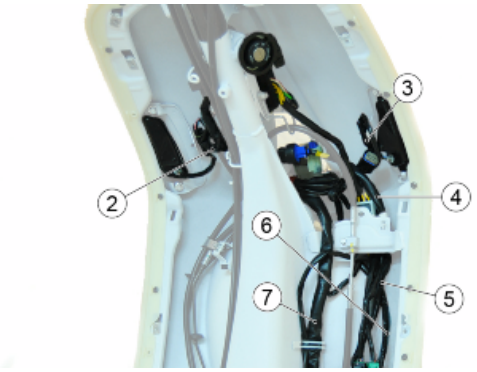
3. Right turn indicator cable harness

4. Headlight cable harness

5. Electrical devices cable harness

6. Instrument panel cable harness

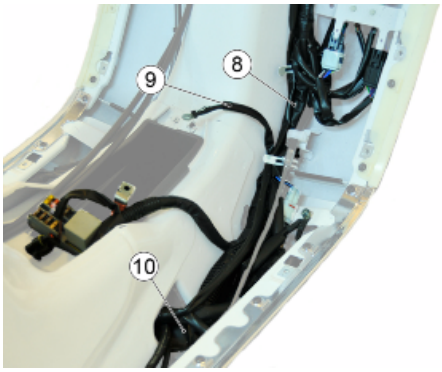
7. Frame main cable harness



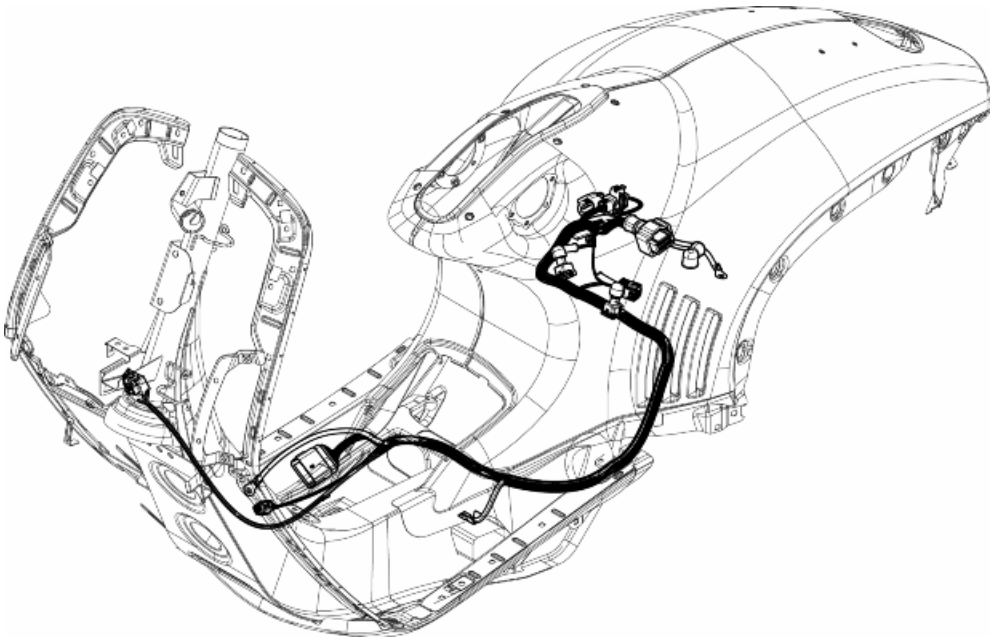
8. Main cable harness

9. Battery negative cable harness

10. Engine main cable harness



Back side



1. Engine main cable harness

2. Engine main cable harness

3. H.V. coil cable harness

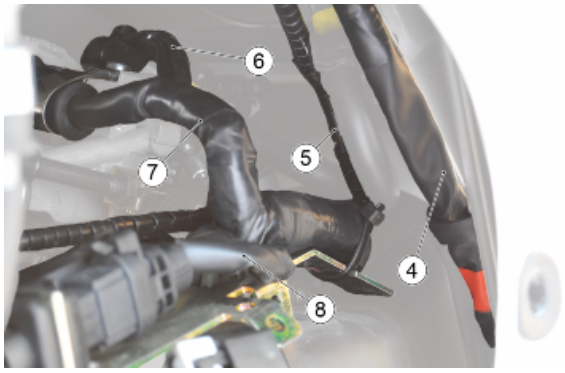
4. ABS control unit cable harness

5. Rear wheel speed sensor cable harness

6. Engine temperature sensor and injector cable harness

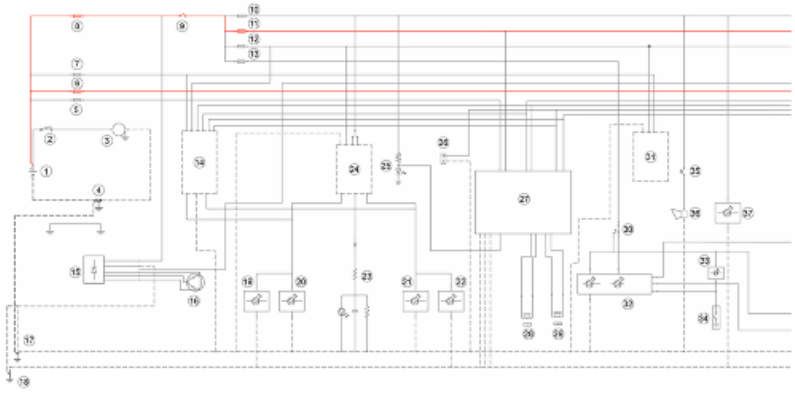
7. CDI control unit cable harness

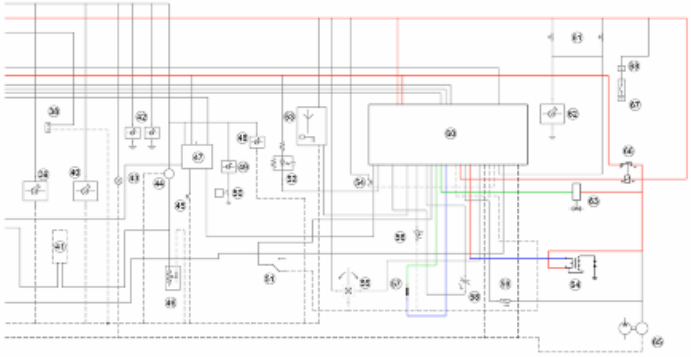
8. Flywheel and oxygen sensor cable harness



Conceptual diagrams

Ignition

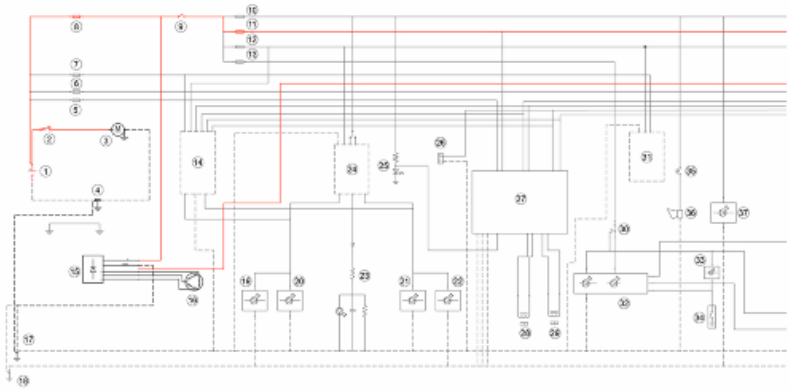


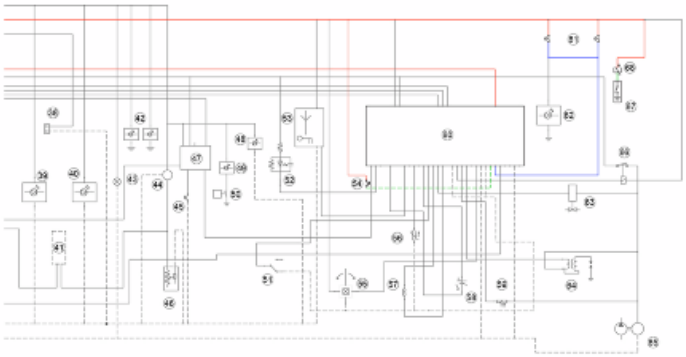


1. Battery

6. Fuse No.2 - 10 A
8. Fuse No.1 - 20 A
9. Key switch contacts
11. Fuse No.7 - 5 A
17. Front ground node
18. Rear ground node
57. Pick up
60. C.D.I.
63. Injector
64. H.V. coil
66. Injection load relay

Battery recharge and starting

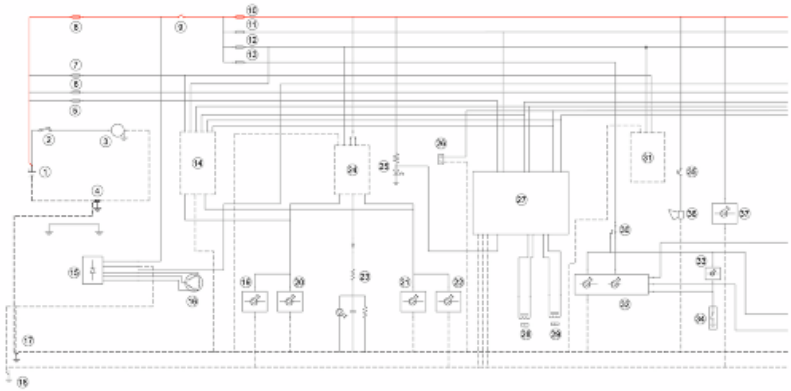


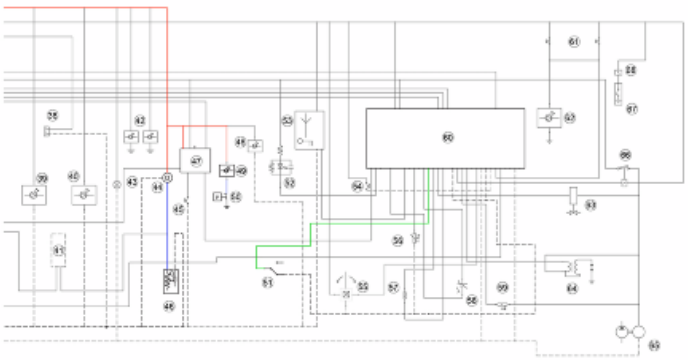


1. Battery
2. Starter relay contacts
3. Starter motor
4. Engine ground node
8. Fuse No.1 - 20 A
9. Key switch contacts
11. Fuse No.7 - 5 A
15. Voltage regulator

16. Flywheel
17. Front ground node
18. Rear ground node
54. Starter button
60. C.D.I.
61. Stop buttons
66. Injection load relay
67. Start-up enabling switch

Level indicators and enable signals section

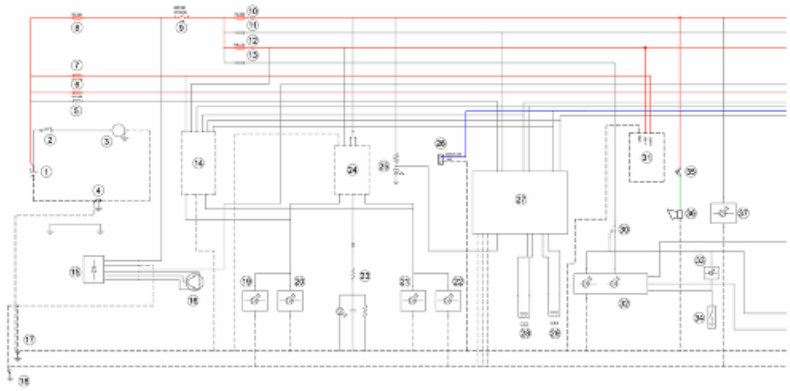


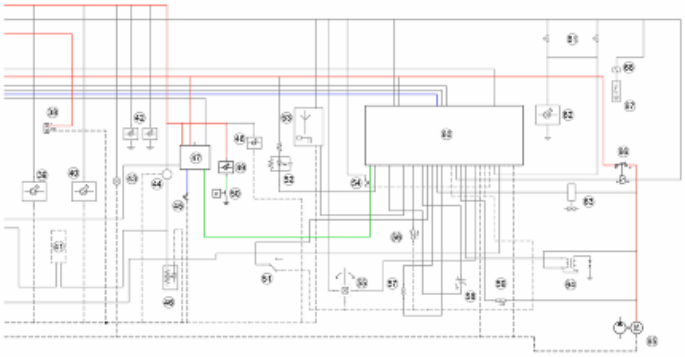


1. Battery
8. Fuse No.1 - 20 A
9. Key switch contacts
10. Fuse No.6 - 7.5 A
17. Front ground node
18. Rear ground node
44. Fuel gauge
46. Fuel level sensor
49. Oil pressure warning light
50. Oil pressure sensor

51. engine stop switch

Devices and accessories

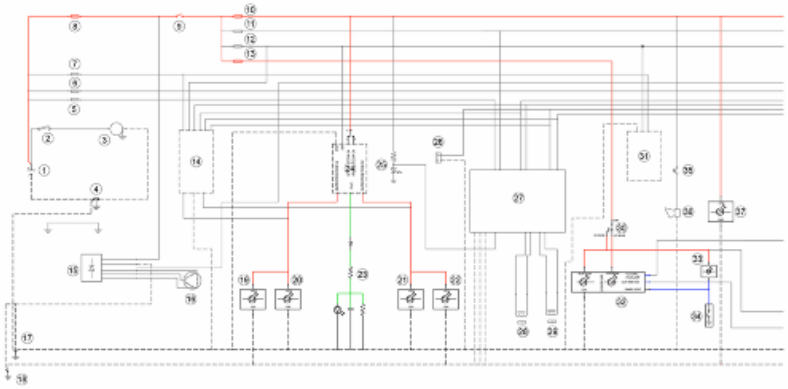


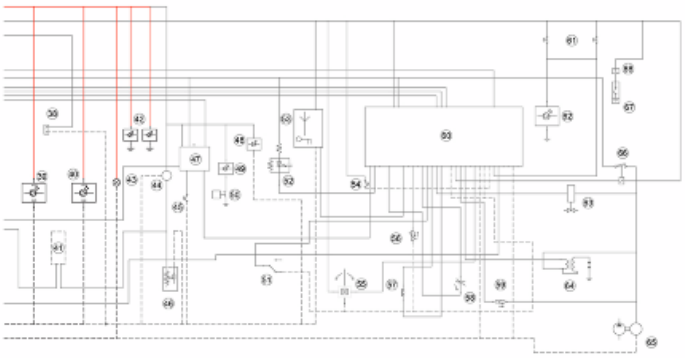


1. Battery
6. Fuse No.2 - 10 A
8. Fuse No.1 - 20 A
9. Key switch contacts
10. Fuse No.6 - 7.5 A
12. Fuse No.8 - 7.5 A
17. Front ground node
18. Rear ground node
31. Alarm pre-installation
35. Horn button
36. Horn
38. USB socket connector
45. MODE button
47. LCD instrument panel
48. Graphic icon
49. Oil pressure warning light
50. Oil pressure sensor
60. C.D.I.

65. Fuel pump
66. Injection load relay

Lights and turn indicators



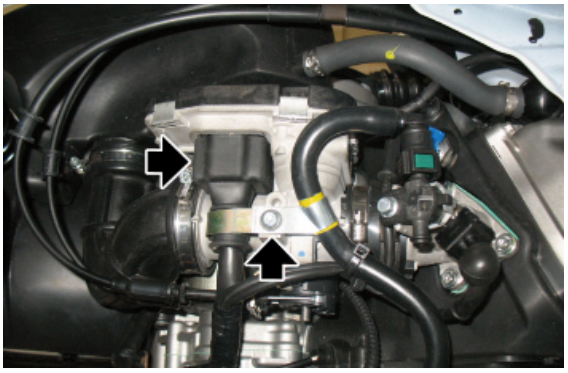


1. Battery
8. Fuse No.1 - 20 A
9. Key switch contacts
10. Fuse No.6 - 7.5 A
13. Fuse No.9 - 5 A
17. Front ground node
18. Rear ground node
19. Rear left turn indicator
20. Front left turn indicator
21. Front right turn indicator
22. Rear right turn indicator
23. Turn indicator warning light
24. Turn indicator control
30. Light switch
32. Headlight
33. High beam warning light
34. Lights ignition enabling

37. Rear tail light
39. Right front daylight running light
40. Left front daylight running light
42. Instrument panel lighting
43. License plate light

Checks and inspections

Immobiliser



The electronic ignition system is controlled by the control unit with the integrated Immobilizer system. The immobiliser is an antitheft system which allows the vehicle to function only if it is activated by means of the coded keys that the control unit recognises. The code is integrated in a transponder in the key block. This allows the driver clear operation without having to do anything other than just turning the key. The Immobilizer system consists of the following components:

- Control unit
- Immobilizer antenna
- master and service keys with built-in transponder
- HV coil
- diagnosis LED

The diagnosis led also works as a blinking light to deter theft. This function is activated every time the ignition switch is turned to "OFF" and it remains active 48 hours so as not to damage the battery charging process.

When the ignition switch is turned to "ON", it interrupts the function of the immobiliser lamp and a start enable lamp comes "ON".

The duration of the flash depends on the programming of the electronic control unit

If the LED is off regardless of the position of the ignition switch and/or the instrument panel is not initiated, check if:

- there is battery voltage
- that fuse No. 1 and fuse No. 2 are in good conditions.
- there is power to the control unit as specified below:

Remove the connector mounting bracket shown in the photograph and disconnect the connector from the control unit. Check the following conditions:

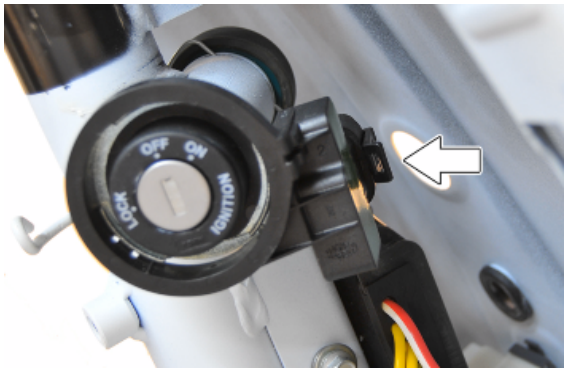
With the key switch set to OFF:

• there is battery voltage between terminals 7-9 and terminal 9-chassis ground (fixed power supply). If there is no voltage check that fuse 2 and its cable are in working order.

With the key switch in the ON position:

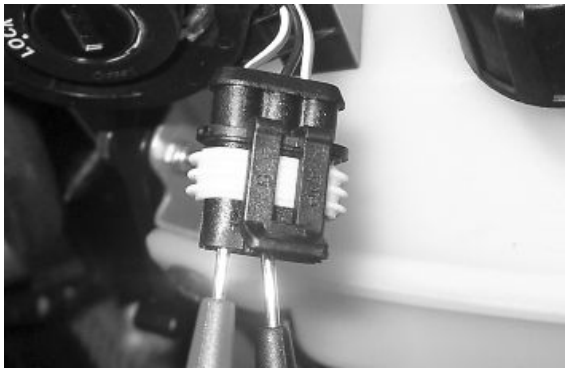
• there is battery voltage between terminals 6-7 and terminal 6-chassis ground (fixed power supply). If there is no voltage, check the ignition key contacts, that fuse 5 and its cable are in working order.

After removing the leg shield back plate, remove the electrical connection from the aerial as shown in the picture.



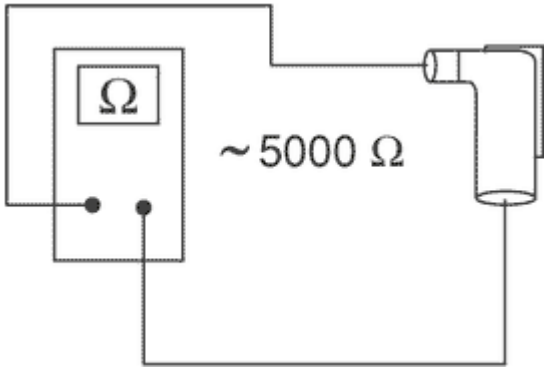
Remove the protective base from the connector.

With the ignition switch at ON check there is battery voltage between the Red-White and Black cables



Virgin circuit

When the ignition system is not encrypted, any key will start the engine but limited to 2000 rpm. The keys can only be recognised if the control unit has been programmed properly. The data storage procedure for a previously not programmed control unit provides for the recognition of the Master as the first key to be stored to memory: this becomes particularly important because it is the only key that enables the control unit to be wiped clean and reprogrammed for the memorisation of the service keys. The Master and service keys must be used to code the system as follows:



- Insert the Master key, turn it to «ON» and keep this position for two seconds (lower and upper limits 1 to 3 seconds).
- Insert the service key and turn it to «ON» for 2 seconds.
- If you have copies of the key, repeat the operation with each key.
- Insert the MASTER key again and turn it to «ON» for 2 seconds.

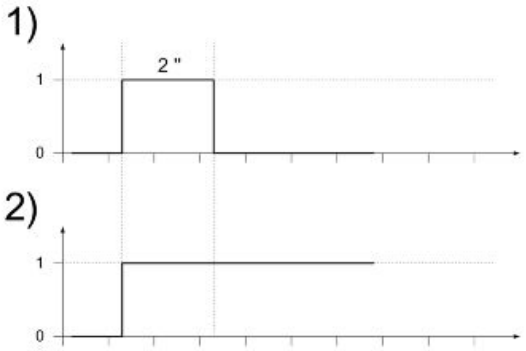
The maximum time to change keys is 10 seconds. A maximum of 7 service keys can be programmed at one time.

It is essential to adhere to the times and the procedure. If you do not, start again from the beginning. Once the system has been programmed, the

Master key transponder is strictly matched with the control unit. With this link established, it is now possible to encode new service keys, in the event of losses, replacements, etc. Each new programming deletes the previous one; to add or delete a key it is therefore necessary to repeat the procedure using all the keys that you intend to keep in use. If a service key becomes uncoded, the efficiency of the high voltage circuit shielding must be thoroughly inspected: In any case it is advisable to use resistor spark plugs.

Diagnostic codes

The Immobilizer system is tested each time the ignition key is turned from «OFF» to «ON». During this diagnosis phase a number of control unit statuses can be identified and various light codes displayed. Regardless of the code transmitted, if at the end of the diagnosis the LED remains off permanently, the ignition is enabled. If, however, the LED remains on permanently, it means the ignition is inhibited:

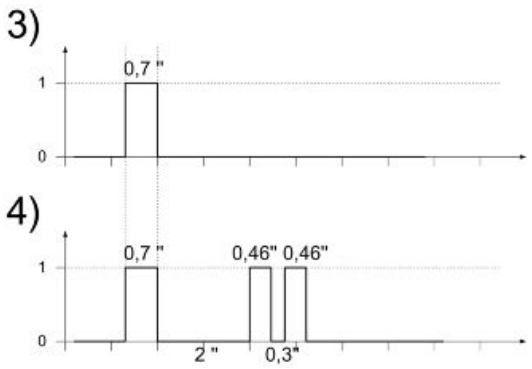


1. Previously unused control unit - key inserted: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the vehicle can be started but with a limitation imposed on the number of revs.

2. Previously unused control unit - transponder absent or cannot be used: the LED is on permanently. In this condition no operations are possible including the start up of the vehicle.

3. **Programmed control unit - the service key in (normal condition of use)**: a single 0.7-second flash is displayed, after which the LED remains off steadily. The engine can be started.

4. **Programmed control unit - Master key in**: a 0.7-sec flash is displayed followed by the LED remaining off for 2 sec and then by short 0.46-sec flashes, the same number of times as there are keys stored in the memory including the Master key. When the diagnosis has been completed, the LED remains permanently OFF. The engine can be started.



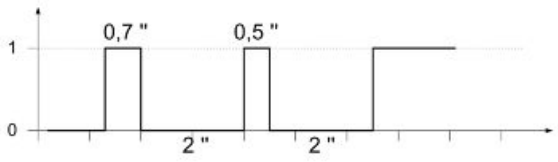
5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on steadily. The engine cannot be started. The codes that can be transmitted are:

- 1-flash code
- 2-flash code
- 3-flash code

Diagnostic code - 1 flash

DIAGNOSIS CODE 1 FLASH This error is identified as a serial failure. (damaged or shorted to ground). With this code proceed with the following checks:

- Antenna power supply: On pin 1 and 2 there must be battery voltage with the key turned to «**ON**». (Pin 1 positive, pin 2 negative). Test the continuity and the insulations of the serial line. Check the continuity between pin 3 of the antenna and the corresponding pin on the control unit pin 14. Carefully check that the connections are free of oxidation. A more detailed control can be performed by detecting the voltage relative to the ground on the serial line. Under normal operating conditions, after switching to «**ON**», the voltage read with a multimeter has medium values equal to 6-7 V.



In case of code 1, the voltage will be about 11V high. Detecting this condition, disconnect the connector from the injection control unit and repeat the control.

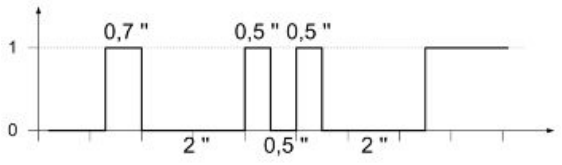
CAUTION

IF THE VOLTAGE ON THE SERIAL TURNS TO 0 VOLT, THE ANTENNA IS CERTAINLY DAMAGED. OTHERWISE IF DETECTING HIGH VOLTAGE, THERE COULD BE A DAMAGE INSIDE THE CONTROL UNIT.

Diagnostic code - 2 flashes

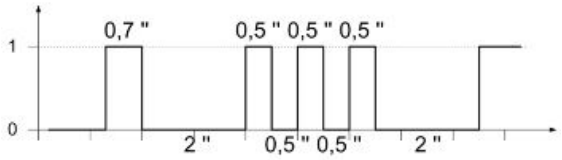
A two-flash code shows a system where the control unit does not show the transponder signal. This might depend on the inefficiency of the immobilizer antenna or the transponder.

Turn the switch to ON using several keys: if the code is repeated even with the Master key, check the aerial wiring and change it if necessary. If this is not the case, replace the defective key and/or reprogram the control unit. Replace the control unit if the problem continues.



Diagnostic code - 3 flashes

A three-flash code indicates a system where the control unit does not recognise the key. Turn the switch to ON using several keys: if the error code is repeated even with the Master key, replace the control unit. If this is not the case, reprogram the decoder.



Battery recharge circuit

The charging circuit consists of three-phase alternator and a permanent magneto flywheel.

The alternator is directly connected to the voltage regulator.

This, in its turn, is connected directly to the ground and the battery's positive terminal passing through the 20A protective fuse.

The three-phase alternator provides good recharge power and at low revs a good compromise is achieved between generated power and idle stability.

Stator check

Checking the stator windings

WARNING

THIS CHECK-UP CAN BE MADE WITH THE STATOR PROPERLY INSTALLED.

1) Remove the leg shield back plate and the footrest.

2) Disconnect the connector between stator and regulator with the three yellow cables as shown in the picture.

3) Measure the resistance between each of the yellow terminals and the other two.

Electric characteristic

Resistance:

0.2 - 1 Ω

4) Check that there is insulation between the each yellow cable and the ground.

5) If values are incorrect, replace the stator.

Recharge system voltage check

Look for any leakage

1) Access the battery by removing the specific cover.

2) Check that the battery does not show signs of losing fluid before checking the output voltage.

3) Turn the ignition key to position OFF, connect the terminals of the tester between the negative pole (-) of the battery and the black cable and only then disconnect the black cable from the negative pole (-) of the battery.

4) With the ignition key always at OFF, the reading indicated by the ammeter must be ≤ 0.5 mA.

Charging current check

WARNING

BEFORE CARRYING OUT THE CHECK, MAKE SURE THAT THE BATTERY IS IN GOOD WORKING ORDER.

1) Place the vehicle on its centre stand

2) With the battery correctly connected to the circuit, place the multimeter leads between the battery terminals..

3) Start the engine, ensure that the lights are all out, increase the engine speed and at the same time measure the voltage.

Electric characteristic

Voltage ranging between 14.0 and 15.0V at 5000 rpm.

Maximum current output check.

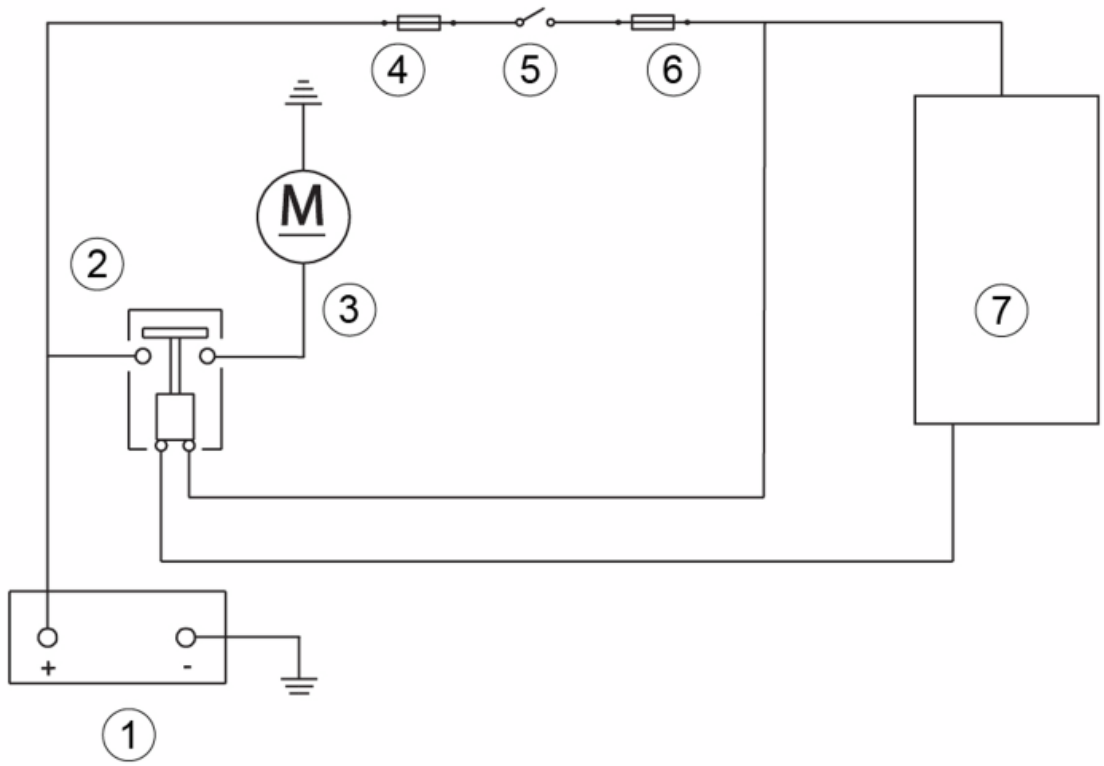
- With engine off and panel set to "ON" turn on the lights and let the battery voltage set to 12V.
- Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
- Keep the lights on and start the engine, bring it to normal speed and read the values on the ammeter.

With an efficient battery a value must be detected: > 20A

VOLTAGE REGULATOR/RECTIFIER

Specification	Desc./Quantity
Type	Non-adjustable three-phase transistor
Voltage	14 to 15V at 5000 rpm with lights off

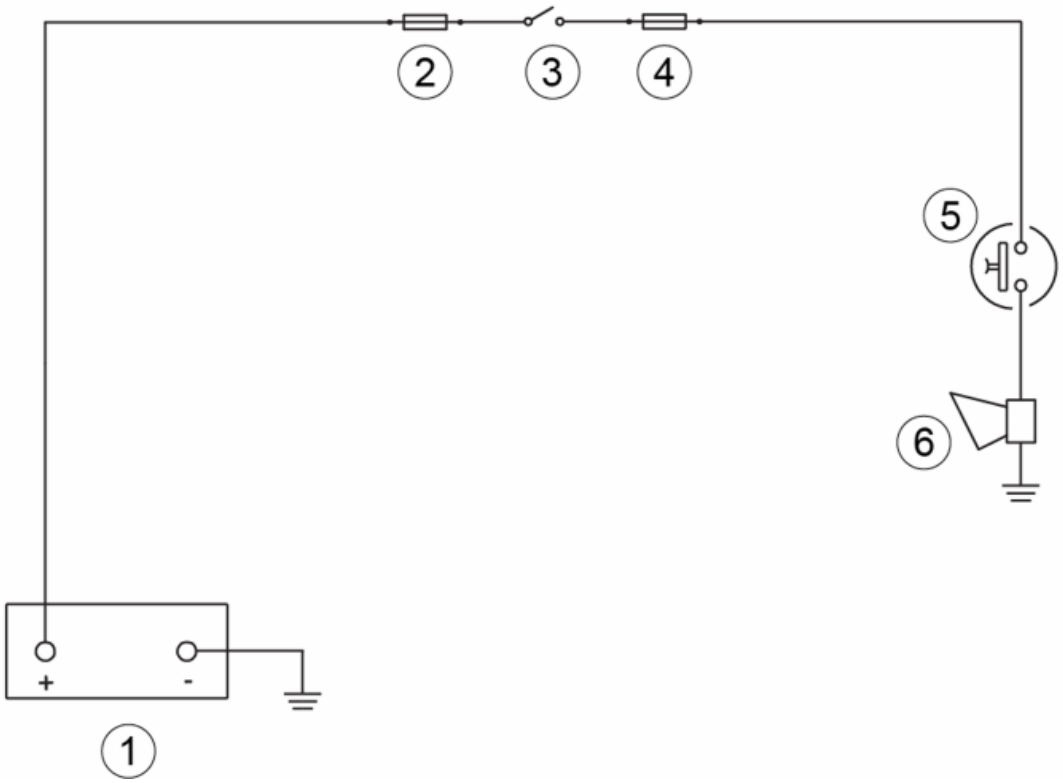
Starter motor



1. Battery
2. Starter motor relay
3. Starter motor
4. Fuse No. 1
5. Key switch contacts
6. Fuse No. 7

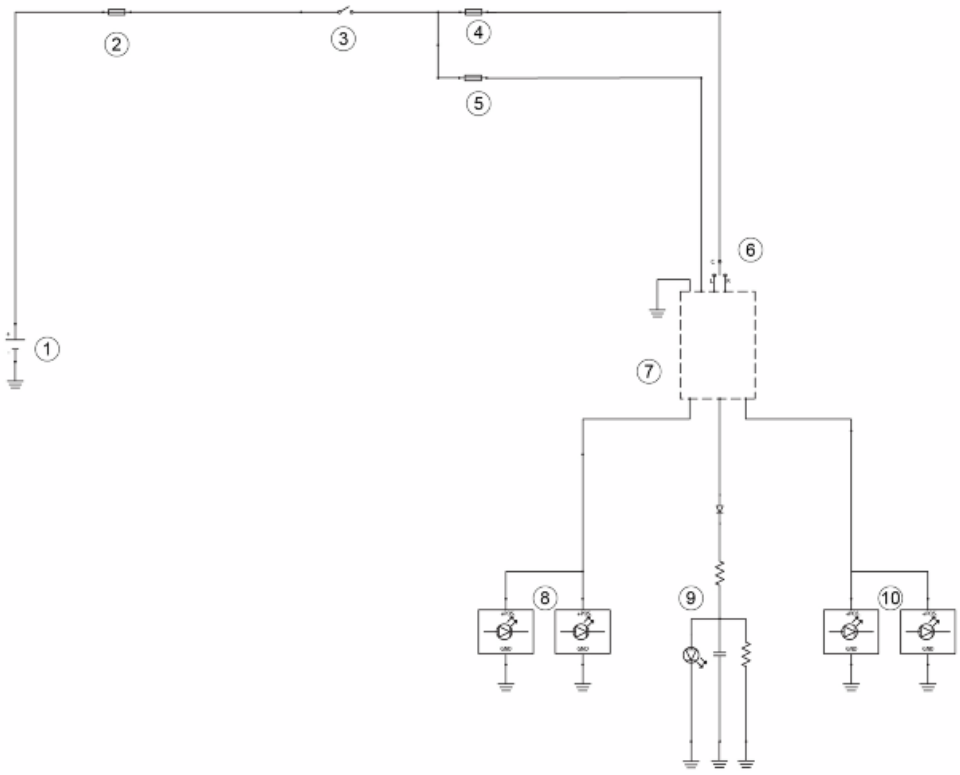
7. CDI control unit

Horn control



1. Battery
2. Fuse No. 1
3. Key switch contacts
4. Fuse No. 6
5. Horn button
6. Horn

Turn signals system check



1. Battery
2. Fuse No. 1
3. Key switch contacts
4. Fuse No. 6
5. Fuse No. 8
6. Turn indicator switch
7. Turn indicator control
8. Left turn indicator
9. Turn indicator warning light
10. Right turn indicators

level indicators

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

If faults are detected:

1) With a multimeter, check resistance values between the White-Green cable and the Black cable of the fuel level transmitter under different conditions.

2) If the transmitter operates correctly but the indication on the instrument panel is not exact, check that the cable harnesses between them are not interrupted.

Electric characteristic

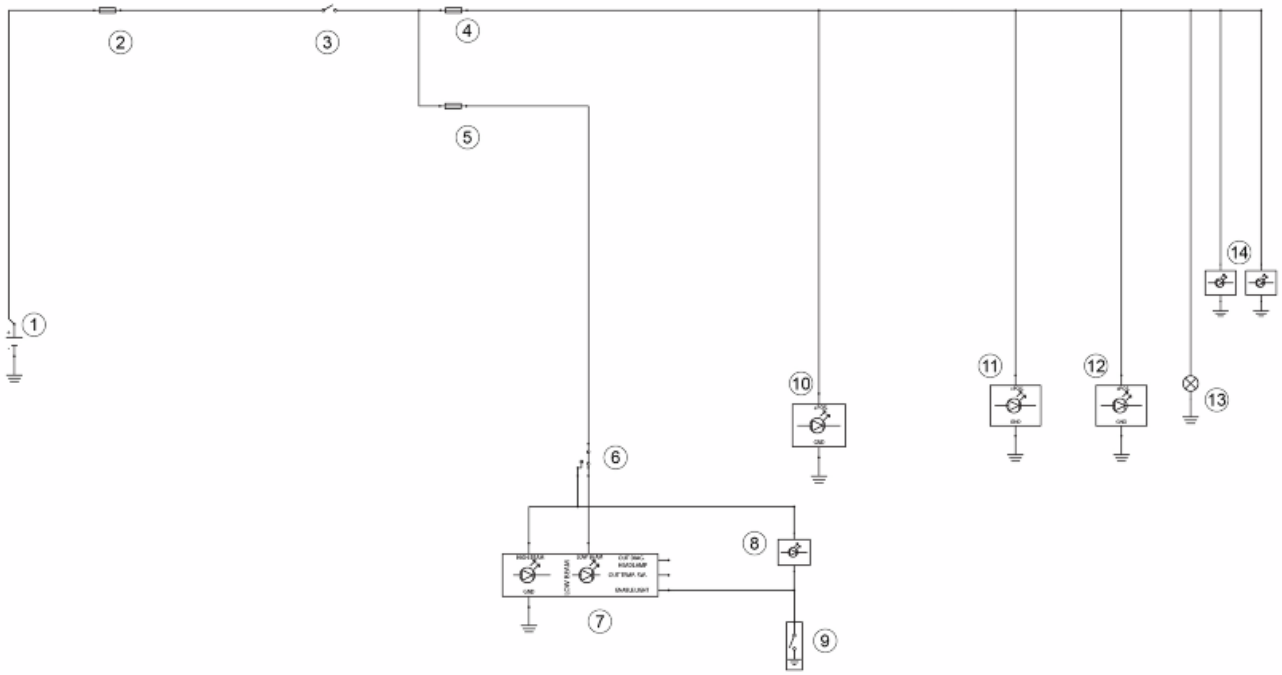
Resistance value when the tank is full

<= 7 Ω

Resistance value when the tank is empty

90 +13/-3 Ω

Lights list



1. Battery
2. Fuse No. 1
3. Key switch contacts
4. Fuse No. 6
5. Fuse No. 9
6. Light switch
7. Headlight
8. High-beam warning light
9. Lights ignition enabling
10. Rear tail light
11. Left front daylight running light
12. Right front daylight running light
13. License plate light

14. Instrument panel lighting lights

Fuses

The electrical system is protected by fuses located under the central cover. To access them operate as described in the «Battery» paragraph.

CAUTION

BEFORE REPLACING THE FUSE IT IS NECESSARY TO FIND AND SOLVE THE FAILURE THAT CAUSED IT TO BLOW.
DO NOT REPLACE THE FUSE WITH ANY ALTERNATIVE FORM OF CONDUCTOR.

CAUTION

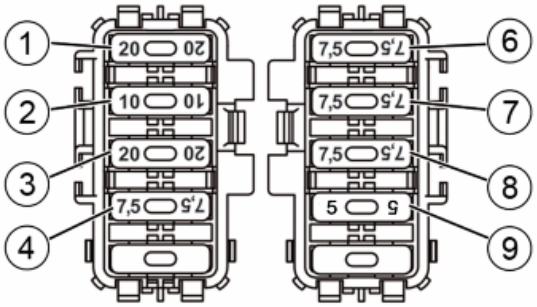
IN ORDER TO AVOID DAMAGING THE ELECTRICAL SYSTEM, NEVER DISCONNECT THE WIRING WHILE THE ENGINE IS RUNNING. DO NOT TIP THE VEHICLE TOO MUCH IN ORDER TO AVOID DANGEROUS LEAKAGE OF THE BATTERY ELECTROLYTE.

CAUTION

MODIFICATIONS OR REPAIRS TO THE ELECTRICAL SYSTEM, PERFORMED INCORRECTLY OR WITHOUT STRICT ATTENTION TO THE TECHNICAL SPECIFICATIONS OF THE SYSTEM CAN CAUSE MALFUNCTIONING AND RISK OF FIRE.

CAUTION

PROCEED WITH CAUTION.
DO NOT DAMAGE THE TONGUES OR THEIR SEATS. HANDLE THE PAINTED AND PLASTIC COMPONENTS CAREFULLY. DO NOT SCRATCH OR DAMAGE THEM.

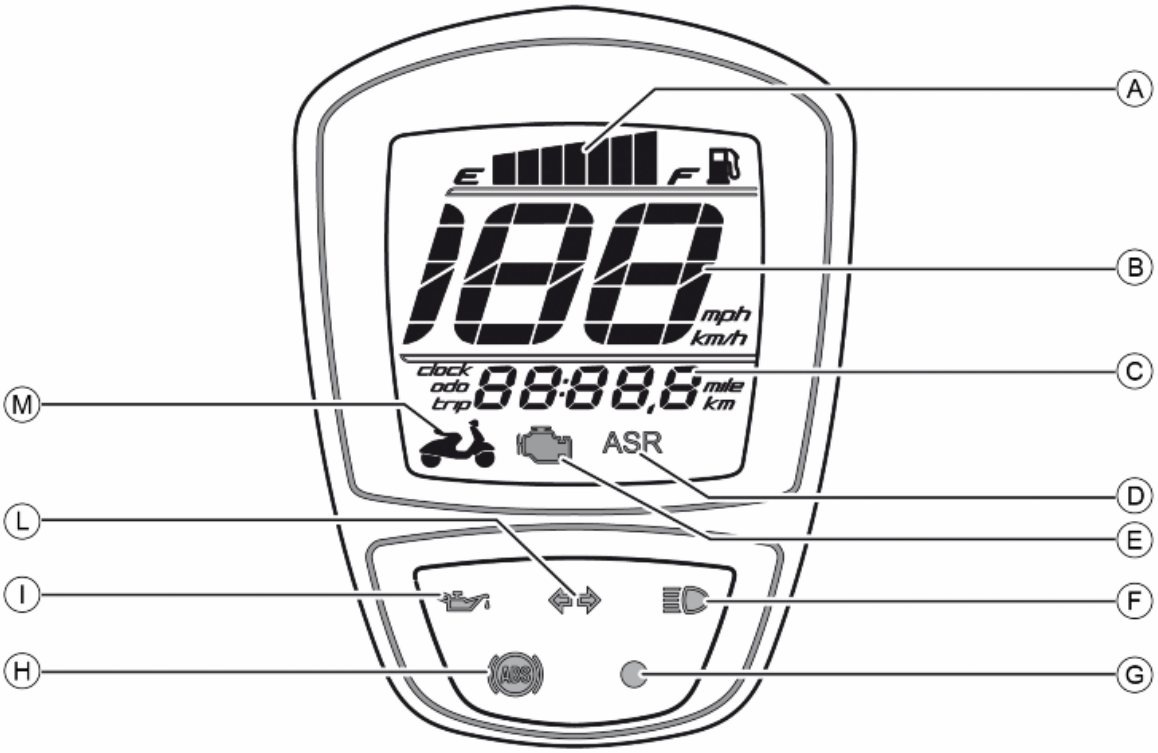


FUSES

Specification	Desc./Quantity
Fuse No. 1	**Capacity:** 20 A **Protected circuits:** vehicle general
Fuse No. 2	**Capacity:** 10 A **Protected circuits:** battery-powered injection solenoid, injection control unit and immobilizer LED, digital display.
Fuse No. 3	**Capacity:** 20 A **Protected circuits:** battery-powered, ABS control unit.
Fuse No. 4	**Capacity:**7.5 A **Protected circuits:**battery-powered PMP pre-installation (accessory) and antitheft pre-installation.
Fuse No. 6	**Capacity:** 7.5 A **Protected circuits:** key powered, fuel level indicator, license plate light, instrument illumination, turn indicator control, ABS warning light, horn, rear daylight running lights, front daylight running lights.
Fuse No. 7	**Capacity:** 5A **Protected circuits:** key powered, immobilizer antenna, tip over sensor, starter circuit, stop button, stop light, ABS control unit and engine control unit.

Specification	Desc./Quantity
Fuse No. 8	**Capacity:** 7.5 A **Protected circuits:** key powered, USB socket pre-installation (accessory), turn indicator control device, antitheft pre-installation.
Fuse No. 9	**Capacity:** 5A **Protected circuits:** key powered, high beam and headlight warning light.

Dashboard



key:

A = Fuel gauge with petrol symbol

B = Speedometer

C = Multifunction indicator

D = ASR Icon

E = Engine control icon

F = High-beam warning light

G = Immobilizer warning LED

H = ABS warning light

I = Low engine oil pressure warning light

L = Turn indicator warning light

M = Miniature «VESPA 946»

By turning the ignition key to the «**ON**» position all the digital display functions will light up for a few seconds.

MULTIFUNCTION INDICATOR «C»

Acting on the MODE button this indicator displays the following functions in sequence:

- Clock (CLOCK)
- Total odometer (ODO)
- Partial odometer (TRIP)

For this indicator «**C**» and for the speed indicator «**B**» the unit of measurement can be changed (from Km to Miles and from Kph to mph) with the following procedure:

- turn the key to the «**OFF**» position;
- press the MODE button to the left;
- Holding in the MODE button, turn the key to the «**ON**» position;
- after about 2 seconds release the MODE button.

N.B.

THE NAVIGATION OF THE DISPLAY DEFINES:
- «SHORT PRESS»: PRESSING THE BUTTON INDICATED FOR LESS THAN TWO SECONDS;
- «LONG PRESS»: PRESSING THE BUTTON INDICATED FOR MORE THAN TWO SECONDS.

Sealed battery

If the vehicle is provided with a sealed battery, the only maintenance required is the check of its charge and recharging, if necessary.

These operations should be carried out before delivering the vehicle, and on a six-month basis while the vehicle is stored in open circuit.

Besides upon pre-delivery it is therefore necessary to check the battery charge and recharge it, if required, before storing the vehicle and afterwards every six months.

INSTRUCTIONS FOR THE BATTERY REFRESH AFTER OPEN-CIRCUIT STORAGE

1) Voltage check

Before installing the battery on the vehicle, check the open circuit voltage with a standard tester.

- If voltage exceeds 12.60 V, the battery can be installed without any renewal recharge.
- If voltage is below 12.60 V, a renewal recharge is required as explained in 2).

2) Constant voltage battery charge mode

- Constant voltage charge equal to 14.40 to 14.70V
- Initial charge voltage equal to 0.3 to 0.5 for Nominal capacity
- Charge time:

10 to 12 h recommended

Minimum 6 h

Maximum 24 h

3) Constant current battery charge mode

- Charge current equal to 1/10 of the battery rated capacity
- Charge time: Maximum 5 h

Battery installation

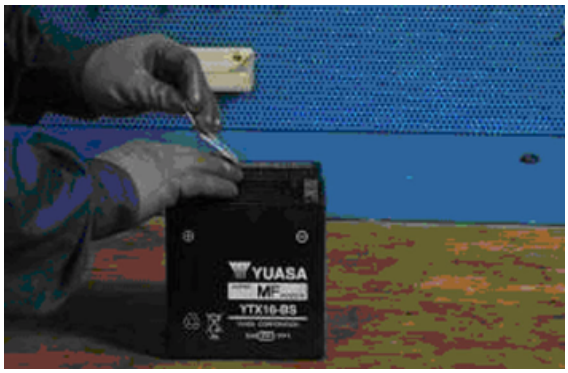
VRLA battery (valve-regulated lead-acid battery) Maintenance Free (MF)

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING. IN CASE OF CONTACT WITH YOUR EYES OR SKIN, RINSE WITH ABUNDANT WATER FOR ABOUT 15 MINUTES AND SEEK IMMEDIATE MEDICAL ATTENTION.
IN THE EVENT OF ACCIDENTAL INGESTION OF THE LIQUID, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR MILK. MAGNESIUM MILK, BATTERED EGG 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 PROTECT YOUR EYES WHEN WORKING CLOSE TO BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

1) Battery preparation

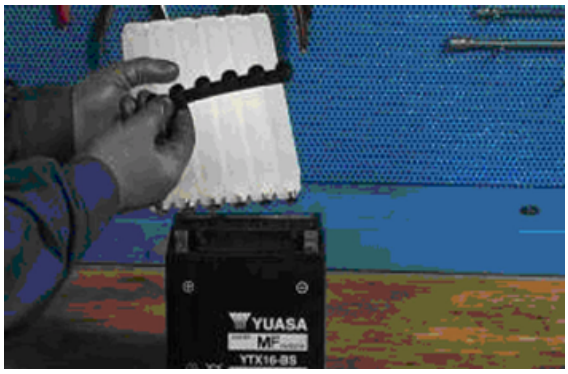
Position the battery on a flat surface. Remove the adhesive sheet closing cells and proceed as quickly as possible to run the subsequent activation phases.



2) Electrolyte preparation.

Remove the container of the electrolyte from the pack. Remove and preserve cover strips from the container, in fact, the strip will later be used as a closing cover.

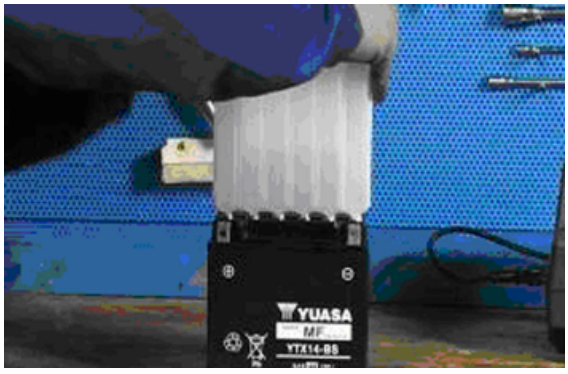
Note: Do not pierce the sealing of the container or the container itself because inside there is sulphuric acid.



3) Procedure for filling the battery with acid.

Position the electrolyte container upside down with the six areas sealed in line with the six battery filler holes. Push the container down with enough force to break the seals. The electrolyte should start to flow inside the battery.

Note: Do not tilt the container to prevent the flow of electrolyte from pausing or stopping.



4) Control the flow of electrolyte

Make sure air bubbles are rising from all six filling holes. Leave the container in this position for 20 minutes or more.

Note: If there are no air bubbles coming out of the filling holes, lightly tap the bottom of the container two or three times. Do not remove the container from the battery.

5) Take out the container.

Make sure all the electrolyte in the battery is drained. Gently tap the bottom of the container if electrolyte remains in the container. Now, gently pull the container out from the battery, only do this when the container is completely empty, and proceed immediately to the next point.

6) Battery closing.

Insert the airtight cover strips into the filling holes. Press horizontally with both hands and make sure that the strip is levelled with the top part of the battery.

Note: To do this, do not use sharp objects that could damage the closing strip, use gloves to protect your hands and do not bring your face close to the battery.

The filling process is now complete.

Do not remove the strip of caps under any circumstances, do not add water or electrolyte.

Place the battery down for 1 to 2 hours prior to the charging from the battery.

7) Recharging the new battery

With the above-mentioned procedure, the battery will have gained around 70% - 75% of its total electrical capacity. Before installing the battery on the vehicle, it must be fully charged and then must be recharged.

If the battery is to be installed on the vehicle prior to this pre-charged one, the battery will not be able to exceed 75% charge without jeopardising its useful life on vehicle.

The dry charge battery MF like the completely loaded YTX, must have a no-load voltage between 12.8 - 13.15 V Bring the battery to full charge, using the 020648Y battery charger:

a - select the type of battery with the red switch on the left of the panel battery charger panel

b - select NEW on the yellow timer

c - connect the clamps of the battery charger to the battery poles (black clamp to negative pole (-) and red clamp to positive pole (+)).

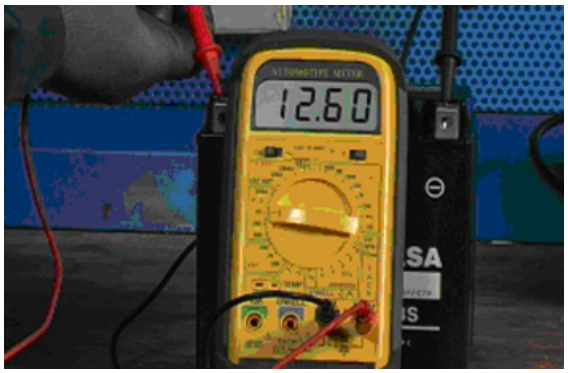
d - Press the red button, as shown in figure.

e - Press the "MF" black button to activate the battery recharge **Maintenance Free** as shown in figure.

f - Check the ignition of the green LED indicated with a red arrow in figure.

g - The activation cycle of the new battery lasts for 30 minutes after the ignition of the recharge LED has taken place

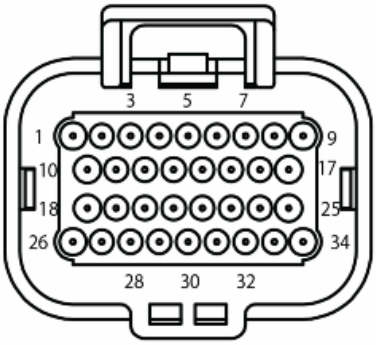
h - Disconnect the clamps from the battery and check the voltage, if voltages are detected of less than 12.8 V, proceed with a new recharge of the battery starting from point c of the recharge procedure of **the new battery**, otherwise go to point i



i - The battery is now completely activated, disconnect the battery charger from the fuel supply grid, disconnect the clamps from the battery and proceed to fitting the battery on the vehicle.

Connectors

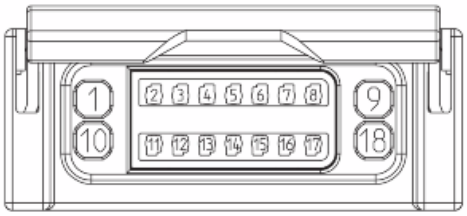
CDI CONTROL UNIT



1. RoNe - H.V. coil
2. Bi - Boost
3. GrNe - Tip over sensor
4. Ar - Engine stop switch
5. MaRs - Starter button
6. ArBL - + Key
7. Ne - Ground 1
8. Vi - Stop buttons
9. RsBi - + battery
10. ViBi - Start-up enabling switch
11. VeBL - Lambda +
12. AzNe - Lambda -
13. AzVe - Engine temperature sensor
14. ArBi - Immobilizer antenna
15. GrVe - Sensor ground
16. ArNe - K Line
17. Gi - Immobilizer
18. AzBi - External temperature sensor
19. GrVe - Sensor ground
20. Ma - Pick up -
21. N.c.
22. NeVi - injection load relay
23. Ne - ground 2
24. BLNe - Graphic icon vespa 946

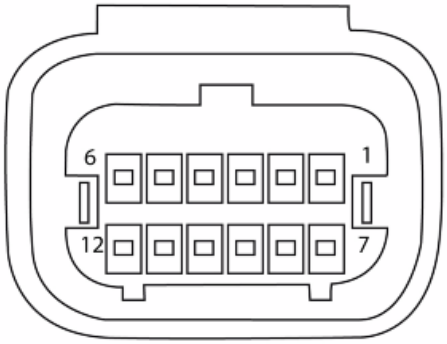
25. MaBi - Engine control icon
26. AzBi - CAN H line
27. RoBi - CAN L line
28. N.C.
29. Rs - pick up +
30. N.C.
31. AzRs - lambda heater
32. BL - asr icon
33. BiNe - Lights ignition enabling
34. RsGi - injector

ABS CONTROL UNIT



1. Ne - Ground
2. Ne - Ground
3. Az - Speedometer signal
4. ArBL - + Key
5. AzBi - CAN H line
6. RoBi - CAN L line
7. N.C.
8. BL - ABS warning light
9. N.C.
10. N.C.
11. Ma - Rear wheel speed signal
12. MaNe - Rear wheel speed ground signal
13. AzNe - Front wheel speed ground signal
14. AzRs - Front wheel speed signal
15. Ne - Ground
16. ArNe - K Line
17. N.C.
18. RsGr - + Battery

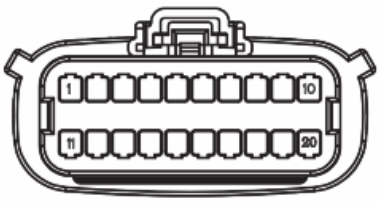
PIAGGIO MULTIMEDIA PLATFORM



1. RsVe - + Battery
2. GiNe - + Key
3. ArNe - K Line
4. Vi - High beam lights
5. N.C.
6. BiBl - Right turn indicators
7. RoBi - CAN L line

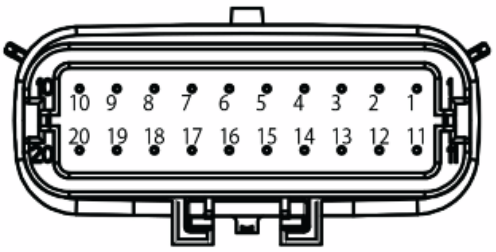
8. AzBi - CAN H line
9. Az - Speedometer signal
10. Ne - Ground
11. BiVe - Fuel level indicator
12. - Left turn indicators

ENGINE CABLE HARNESS CONNECTOR «A»



1. MaBi - Engine control icon
2. ArBl - + battery
3. RsBi - + key
4. ArBi - Immobilizer antenna
5. ArNe - K Line
6. Gi - Immobilizer LED
7. BiNe - Lights ignition enabling
8. NeVi - injection load relay
9. ViBi - Start-up enabling switch
10. Ar - Engine stop switch
11. MaRs - Starter button
12. Ne - Ground
13. NeVe
14. AzBi - CAN H line
15. RoBi - CAN L line
16. GrNe - Tip over sensor
17. GrVe - Sensor ground
18. RsBL - ASR icon
19. bi - boost
20. BiRo - Oil pressure sensor

frame cable harness connector «a»

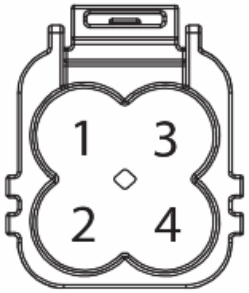


1. MaBi - Engine control icon
2. ArBl - + battery
3. RsBi - + key
4. ArBi - Immobilizer antenna
5. ArNe - K Line
6. Gi - Immobilizer LED
7. BiNe - Lights ignition enabling
8. NeVi - injection load relay
9. ViBi - Start-up enabling switch
10. Ar - Engine stop switch

11. MaRs - Starter button
12. Ne - Ground
13. NeVe
14. AzBi - CAN H line
15. RoBi - CAN L line
16. GrNe - Tip over sensor
17. GrVe - Sensor ground
18. RsBL - ASR icon
19. bi - boost
20. BiRo - Oil pressure sensor

engine cable harness connector «b»

1. AzBi - External temperature sensor
2. BiNe - Stop buttons
3. BLNe - Graphic icon vespa 946
4. N.c.

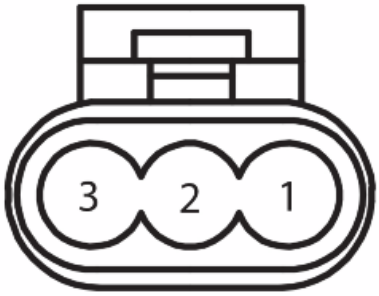


frame cable harness connector «b»

1. AzBi - External temperature sensor
2. BiNe - Stop buttons
3. BLNe - Graphic icon vespa 946
4. N.C.

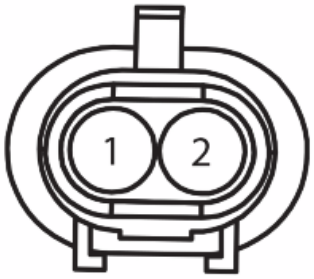
PRE-INSTALLATION GPS

1. GiNe - + Key
2. Ne - Ground
3. RsVe - + Battery



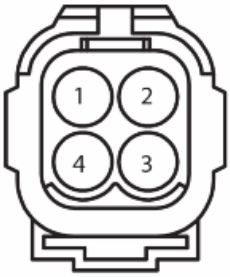
USB PORT

1. GiNe - + Key
2. Ne - Ground



TIP OVER SENSOR

1. N.C.
2. GrVe - Ground
3. ArBL - + Key
4. GrNe - Signal



FRONT SPEED SENSOR

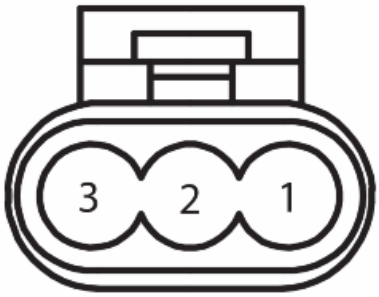
1. AzNe - Ground
2. AzRs - Signal

REAR SPEED SENSOR

1. MaNe - Ground
2. Ma - Signal

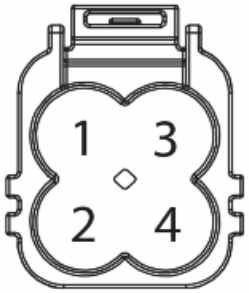
IMMOBILIZER ANTENNA

1. ArBL - + Key
2. Ne - Ground
3. ArBi - Ignition enabling



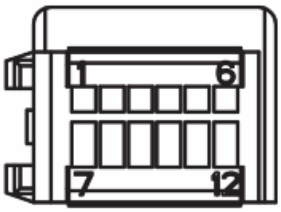
FUEL PUMP

1. BiVe - Fuel level indicator
2. Ne - Ground
3. NeVe - + pump
4. GrNe - - pump



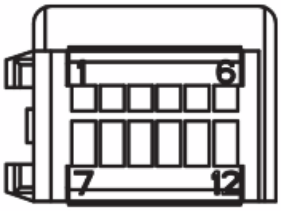
ELECTRICAL DEVICE RIGHT

1. ArBi - Stop button
2. BiNe - Stop button
3. ArBL - Starter button
4. MaRs - Starter button
5. Ve - MODE button
6. Ne - Ground
7. GrVe - Sensor ground
8. Ar - Engine stop switch
9. NC
10. NC



ELECTRIC DEVICE LEFT

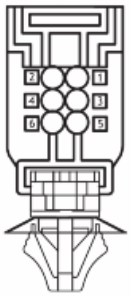
1. BiNe - Stop button
2. ArBL - Stop button
3. Bi - Horn
4. Bi - + Key
5. BiRo
6. GrBL
7. Gr - Com
8. Ma - Low beam lights
9. Vi - High beam lights



10. GrNe - Horn

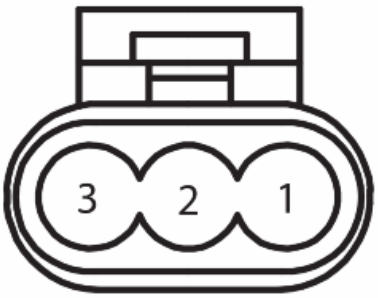
HEADLIGHT

1. Ne - Ground
2. AzBi - External temperature sensor
3. Ma - Low beam lights
4. Vi - High beam lights
5. BiNe - Lights ignition enabling
6. BiRs - Headlight diagnostic



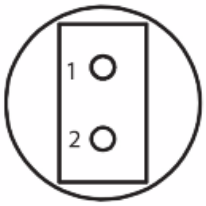
TAILLIGHT

1. Bi - Daylight running light
2. Ne - Ground
3. BiNe - Stop light



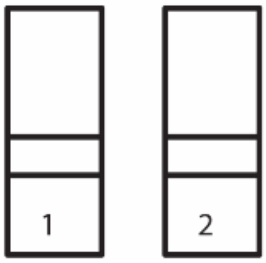
LICENCE PLATE LIGHTING

1. Bi - Positive
2. Ne - Ground



HORN

1. GrNe - Positive
2. Ne - Ground



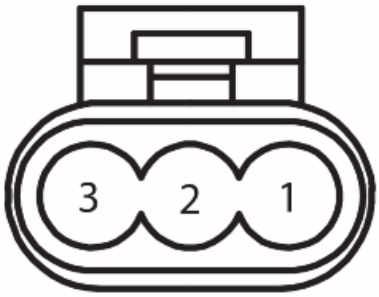
INSTRUMENT PANEL CONNECTOR «A»

1. Gi - Immobilizer LED
2. RsBi - + battery
3. BL - ABS warning light
4. MaBi - Engine control icon
5. N.C.
6. Ve - MODE button
7. BLNe - Graphic icon vespa 946
8. N.C.
9. RsBL - ASR icon
10. Vi . High-beam warning light

INSTRUMENT PANEL CONNECTOR «B»

1. BiRs - Headlight diagnostic
2. BiNe - Lights ignition enabling
3. BiRo - Oil pressure warning light
4. Bi - + Key
5. BiVe - Fuel level indicator
6. Ne - Ground
7. N.C.
8. BLRo
9. Az - Speedometer
10. N.C.

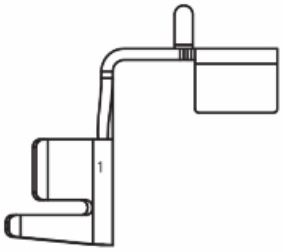
DIAGNOSTICS SOCKET



1. N.C.
2. Ne - Ground
3. ArNe - K Line

BATTERY POSITIVE

1. Rs

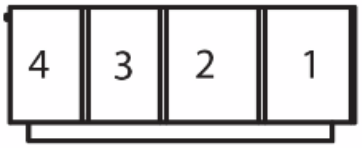


BATTERY NEGATIVE

1. Ne

IGNITION SWITCH

1. Ar - Key ON
2. RsNe - + Battery
3. N.C.
4. N.C.

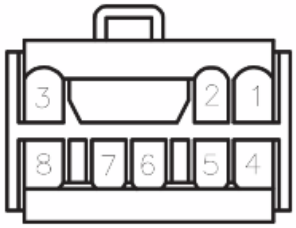


VOLTAGE REGULATOR

1. RsNe - Positive
2. Ne - Ground

TURN INDICATOR CONTROL

1. BiRo - Left indicator input
2. Ne - Ground
3. Ro - Left indicator output
4. GrBL - Right indicator input
5. BLRo - Turn indicator warning light
6. N.C.
7. GiNe - + Key
8. BiBL - Right indicator output



REAR LEFT TURN INDICATOR

1. Ro - +
2. Ne - Ground

REAR RIGHT TURN INDICATOR

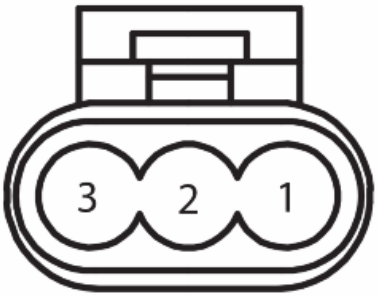
1. BiBL - +
2. Ne - Ground

FRONT LEFT TURN INDICATOR

1. Ro - +
2. Ne - Ground
3. Bi - Daylight running light

FRONT RIGHT TURN INDICATOR

1. BiBL - +
2. Ne - Ground
3. Bi - Daylight running light

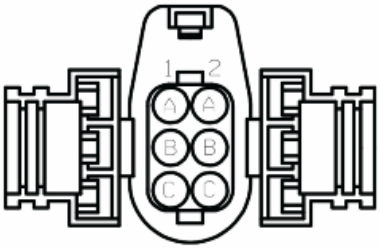


VOLTAGE REGULATOR

1. Gi - Flywheel
2. Gi - Flywheel
3. Gi - Flywheel

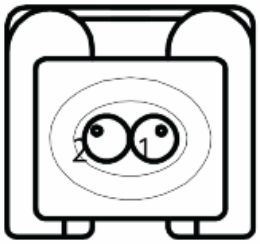
MAGNETO FLYWHEEL

1A. Gi - Voltage regulator
2A. BiRo - Oil pressure sensor
1B. Ma - Pick up -
2B. Gi - Voltage regulator
1C. Gi - Voltage regulator
2C. Rs - Pick up -



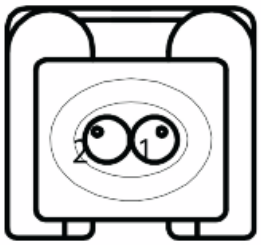
FUEL INJECTOR

1. NeVe - Positive
2. RsGi - Negative



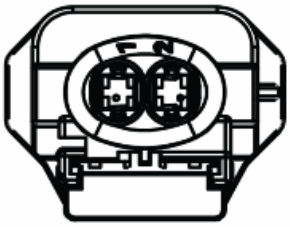
ENGINE TEMPERATURE SENSOR

1. AzVe - Positive
2. Gr Ve - Negative



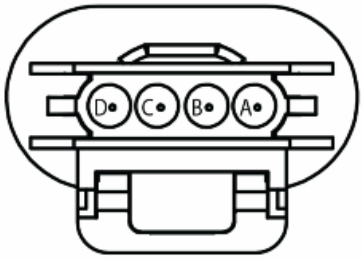
HV COIL

1. RoNe - Negative
2. NeVe - Positive



OXYGEN SENSOR

A. NeVe - + heater
B. AzRs - - heater
C. VeBL - Lambda +
D. AzNe - Lambda -



STARTER MOTOR POSITIVE

1. Rs

OXYGEN SENSOR

A. NeVe - + heater

B. AzRs - - heater

C. VeBL - Lambda +

D. AzNe - Lambda -

Diagnostic instrument

STARTER COMMAND

Function

Commands engine starting through the injection control unit.

Operation / Operating principle

The starter button, the brake switches, the starter command relay and the injection control unit between PIN 5 and 10 are involved.

ELECTRICAL ERRORS

Starter command P0170 - shorted to positive.

Error cause

Shorted to positive: excessive voltage at PIN 10 of the control unit connector.

Troubleshooting

Shorted to positive:

- This malfunction is detected with a brake activated and the starter button pressed (voltage of 12V read at PIN 5)
- If the battery voltage does not drop (thanks to the absorption of the starter command relay excitation coil) the control unit understands that PIN 10 is shorted to battery.
- Restore the cabling (if the short is in the cabling) or the relay (if the short is in the relay).

ENGINE TEMPERATURE SENSOR

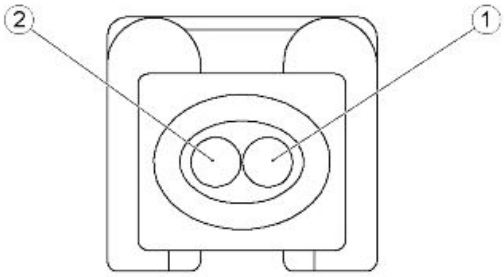
Function

Serves the purpose of communicating the engine temperature to the control unit in order to optimise performance.

Operation / Operating principle

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

Pinout:



1. Injection ECU
2. Ground from control unit

Engine temperature sensor P0115 - open circuit or shorted to positive / shorted to negative.

Error cause

Open circuit or shorted to positive: interruption of the circuit or excessive voltage at PIN 13 of the control unit connector. Shorted to negative: null voltage between PIN 13 and 15 of the control unit connector.

Troubleshooting

Open circuit:

- Disconnect the connector of the control unit.
- Measure the resistance value of the sensor at different temperatures between PIN 13 and 15.
- Disconnect the sensor connector.
- Check the continuity of the cable harness between the sensor connector and control unit connector: Control unit PIN 13 - sensor PIN 1 and control unit PIN 15 - sensor PIN 2. Restore the cabling if necessary.
- If the cabling is intact but the sensor resistance value is incorrect, this means that the sensor is faulty and must be replaced, otherwise proceed with the checks.

Shorted to positive:

- With the sensor connector and the control unit disconnected, verify that the fault is shorted with the battery positive of sensor connector PIN 1 (or control unit PIN 13) and restore the cabling.

Shorted to negative:

- Disconnect the sensor connector.
- Check the sensor connector PIN 1 ground insulation.
- If there is no ground insulation restore the cabling.
- If PIN 1 is insulated from the ground and the error persists, this means that there is a probable fault in the control unit.

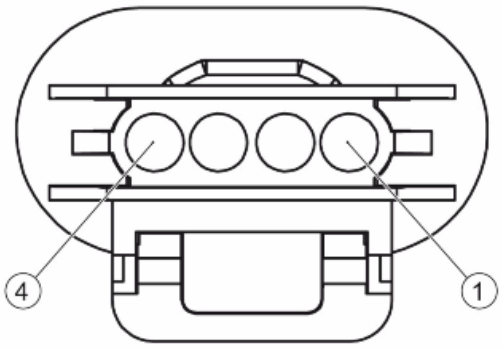
LAMBDA PROBE

Function

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

Operation / Operating principle

Based on the difference of oxygen in the exhaust fumes and the environment, this generates voltage which is read and interpreted by the injection control unit. 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.

Pinout:

1. Heater supply (1)
2. Heater ground (2)
3. Sensor signal + (3)
4. Sensor signal - (4)

ELECTRICAL ERRORS

Check the air-fuel ratio / Lambda probe P0130 - short circuit to positive / open circuit, short circuit to negative or carburetion excessively lean / signal not plausible for abnormal title correction or probe signal fault.

Error cause

Shorted to positive: excessive voltage at PIN 11 or PIN 12 of the control unit connector.
Circuit open or short circuit to negative:interruption of the circuit or null voltage between control unit connector PIN 11 and 12.

Troubleshooting

Short circuit to positive:
- Disconnect the control unit connector and the sensor connector.
- Verify that there is no short to battery positive on sensor connector PIN 3 (corresponding to control unit connector PIN 11); in the presence of short circuit, restore the cable harness.
- Verify that there is no short to battery positive on sensor connector PIN 4 (corresponding to control unit connector PIN 12); in the presence of short circuit, restore the cable harness.

Open circuit:
- Disconnect the control unit connector and the sensor connector.
- Check the continuity of the cable harness between the sensor connector and control unit connector: Control unit PIN 11 - sensor PIN 3 and control unit PIN 12 - sensor PIN 4. If necessary, restore the cable harness.
- If the cable harness is intact and the error persists, proceed with the following checks.

Short circuit to negative:
- Disconnect the sensor connector and the control unit connector.
- Check the sensor connector PIN 3 from ground insulation. If there is no insulation, restore the cable harness.
- Check the sensor connector PIN 4 from ground insulation. If there is no insulation, restore the cable harness.
- If PIN 3 and PIN 4 are insulated from the ground and the error persists, this means that there is a probable fault in the control unit.

P0135 Lambda probe heating - shorted to positive / shorted to negative / open circuit.

Error cause

Shorted to positive: excessive voltage at PIN 31 of the control unit connector.

Shorted to negative: lack of insulation from ground on the sensor connector PIN 1.

Open circuit: circuit interruption.

Troubleshooting

Shorted to positive:

- Disconnect the control unit connector and the sensor connector.
- Verify that there is no short to battery positive on sensor connector PIN 2 (corresponding to control unit connector PIN 31); if there is a short, restore the cabling.

Open circuit:

- Disconnect the control unit connector and the sensor connector.
- Check continuity of the cabling between the sensor connector and the control unit connector: control unit PIN 31 - sensor PIN 2. Restore the cabling if necessary.
- Verify continuity of the cabling between the sensor connector and the injection relay: sensor PIN 1 - injection relay PIN 3. Restore the cabling if necessary.
- If the cable harness is intact and the error persists, proceed with the following checks.

Shorted to negative:

- Disconnect the sensor connector.
- Check the insulation from the ground of PIN 2 of the sensor connector. If there is no insulation, restore the cable harness.
- If PIN 2 is insulated from ground and in the absence of other errors (fuel pump, injector, coil), this means that the control unit is most likely faulty.

INJECTOR

Function

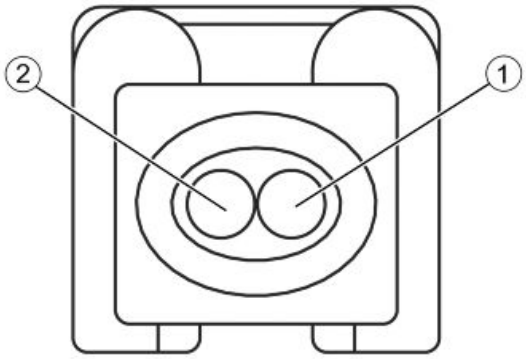
Provide the correct amount of fuel at the correct time.

Operation / Operating principle

Injector coil is excited for the petrol passage to open.

Pinout:

1. Power from relay
2. Ground from control unit



ELECTRICAL ERRORS

Injector P0201 - short circuit to positive / short circuit to negative / open circuit.

Error cause

Short circuit to positive: excessive voltage to PIN 34 of the control unit connector.

Short circuit to negative: zero voltage to the PIN 1 of the injector connector.

Open circuit: circuit interruption.

Troubleshooting

Short circuit to positive:

- Disconnect the injector connector, turn ignition switch to ON and activate the component using the diagnostic tool.
- Verify the absence of voltage at the injector connector PIN 2; if present restore the cable harness, otherwise proceed with the following checks.

Short circuit to negative:

- Disconnect the injector connector, turn ignition switch to ON and activate the component using the diagnostic tool.
- Verify the presence of voltage at the ends of the injector connector; if there is no voltage, restore the cable harness, otherwise proceed with the following checks.

Open circuit:

- Perform the check of the injector and control unit connectors.
- Verify continuity of the cable harness between the control unit connector and the injector connector (control unit PIN 34 - injector PIN 2). If there is no continuity, restore the cable harness.

FUEL PUMP

ELECTRICAL ERRORS

Fuel pump relay P0230 - shorted to positive / shorted to negative / open circuit.

Error cause

Shorted to positive: excessive voltage at PIN 22 of the control unit connector.

Shorted to negative: null voltage at PIN 85 of the injection relay.

Open circuit: circuit interruption.

Troubleshooting

Shorted to positive:

- Disconnect the injection relay, turn the key to ON and activate the relay through the diagnostics instrument.
- Verify the presence of voltage between relay connector PIN 86 and 85 toward the cabling.
- If no voltage is read, disconnect the control unit and verify insulation from battery positive of the relay PIN 86 (or control unit PIN 22). Restore the cabling if necessary.

Shorted to negative:

- Disconnect the injection relay and the control unit.
- Verify ground insulation of the relay connector PIN 86 and 85 toward the cabling: if there is no insulation, restore the cabling.

Open circuit:

- Disconnect the injection relay and the control unit.
- Verify continuity of the cabling between the relay and control unit: Relay PIN 86 - control unit PIN 22. Restore the cabling if necessary.

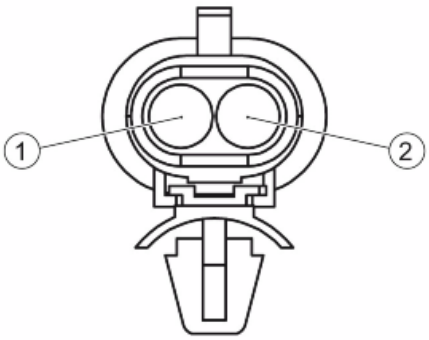
COIL

Function

Allows generation of the electrical discharge on the spark plug, with an increase of voltage.

Pinout:

1. Activation by control unit (control unit side PIN 1)
2. Relay powered (PIN 87 relay side)



ELECTRICAL ERRORS

H.V. Coil P0351 - shorted to positive / open circuit or shorted to negative.

Error cause

Shorted to positive: excessive voltage at PIN 1 of the control unit connector.

Circuit open or shorted to negative: interruption of the circuit or null voltage at PIN 1 of the control unit connector.

Troubleshooting

Shorted to positive:

- Disconnect the coil connector, turn the key to ON and activate the component through the diagnostics instrument.
- Verify the presence of voltage on the coil connector PIN 1: if present, restore the cabling, otherwise replace the coil.

Open circuit:

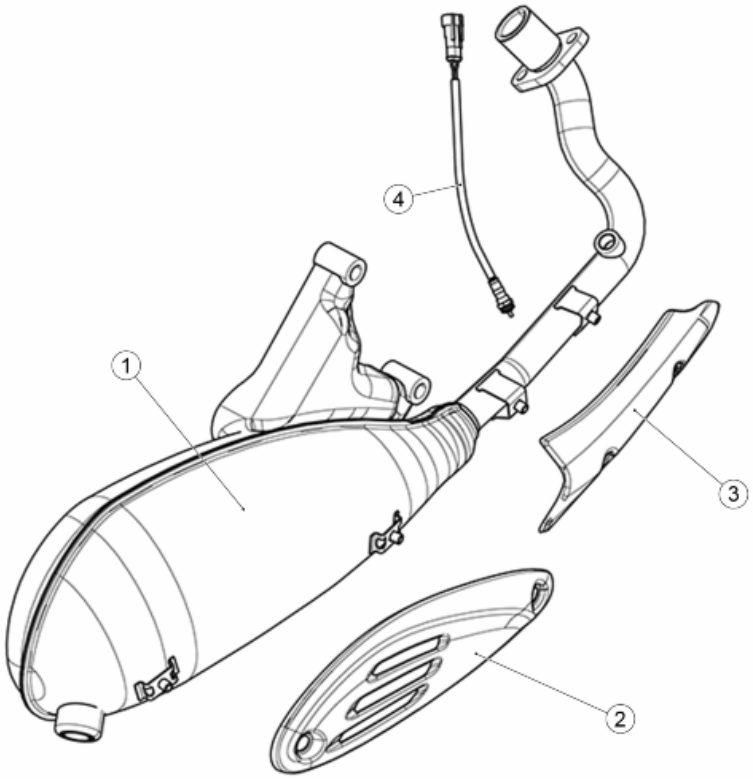
- Carry out the check procedure of the coil and control unit connectors.
- Verify continuity of the cabling between the coil and control unit: Coil PIN 1 - control unit PIN 1. In the absence of continuity restore the cabling.
- Verify, with the key turned ON, the presence of voltage on the coil connector PIN 2: If no voltage is read, verify the continuity of the cabling between coil and injection relay (No. 35 on the electrical circuit diagram): Coil PIN 2 - relay PIN 87.
- If the above tests provided a positive result, the coil should be replaced.

Shorted to negative:

- Disconnect the control unit connector and the coil connector.
- Verify the coil connector PIN 1 ground insulation (or control unit connector PIN 1). Restore the cabling if necessary.

INDEX OF TOPICS

Exhaust assy. Removal



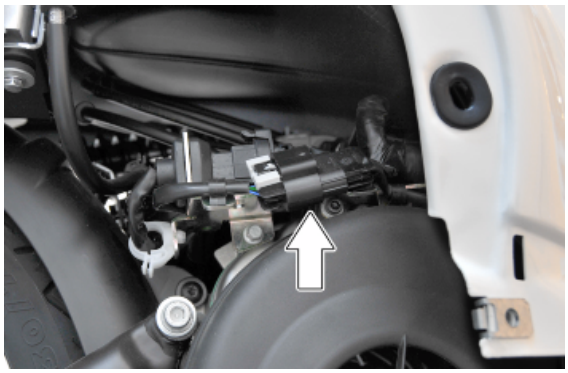
1. Silencer

2. Silencer heat guard

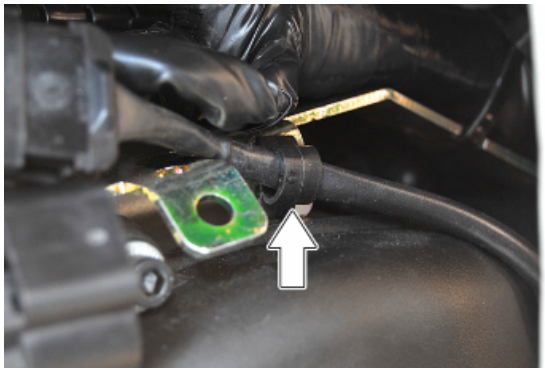
3. Manifold heat guard

4. Oxygen sensor

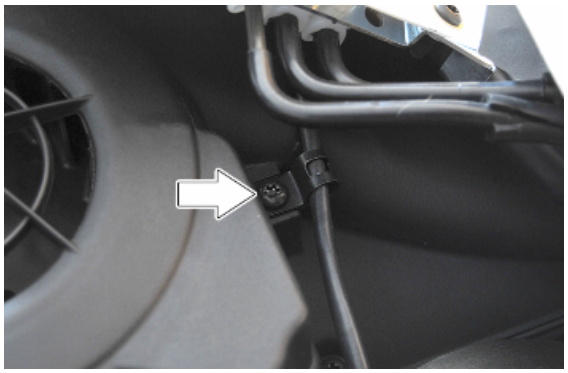
- Remove the right side fairing.
- Disconnect the oxygen sensor connector.



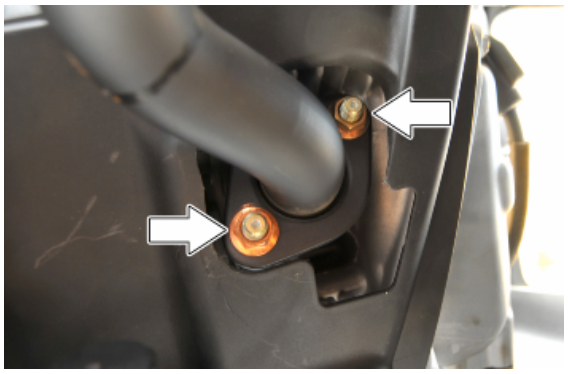
Remove the oxygen sensor cable from the lock on the bracket.



Unscrew the screw of the clamp retaining the oxygen sensor cable to the crankcase.



Unscrew the nuts fixing the silencer to the head.



Undo the screws fixing the silencer to the crankcase and remove the silencer.

CAUTION

FREE THE CABLES OF THE OXYGEN SENSOR BEFORE REMOVING THE SILENCER, PUTTING THIS CABLE HARNESS UNDER AN EXCESSIVE VOLTAGE MAY DAMAGE IT.

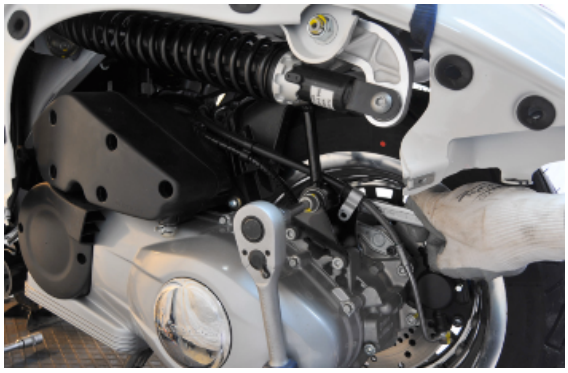
To refit, follow the previous operations but in reverse order, observing the prescribed torques.

Locking torques (N*m)

Oxygen sensor tightening on exhaust manifold 40 - 50 Screws fixing silencer to the crankcase 24 - 27

Removal of the engine from the vehicle

- Remove the right and left side fairings.
- Remove the battery cover.
- Remove the full silencer unit.
- Remove the air filter.
- Remove the rear mudguard.
- Adequately support the rear part of the vehicle and unscrew the screw fixing the shock absorber strut to the bracket on the crankcase.



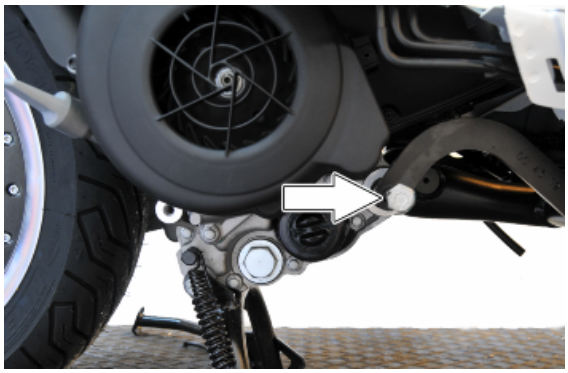
CAUTION

SUPPORT THE VEHICLE ADEQUATELY.

WARNING

CARRY OUT THESE OPERATIONS WHEN THE ENGINE IS COLD.

- Remove the pin connecting the swinging arm to the engine by unscrewing the nut on the left side of the vehicle.
- Lift the rear part of the vehicle as far as possible.



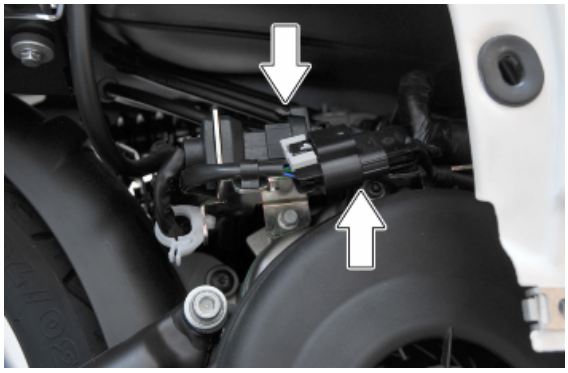
CAUTION

DURING THE LIFTING OPERATIONS, PAY ATTENTION THAT THE CABLE HARNESS, TRANSMISSIONS AND PIPES ARE NOT TIGHTENED.

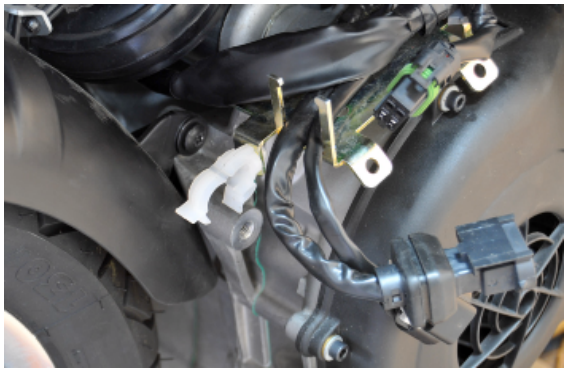
WARNING

PAY ATTENTION TO THE STABILITY OF THE VEHICLE.

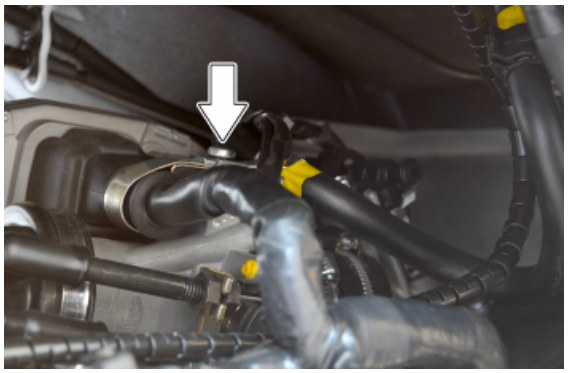
Disconnect the stator and pick-up connectors.



Free the stator and pick-up connectors from the fittings on the crankcase.



Unscrew the screw retaining the clamp of the control unit cable harness to the crankcase.



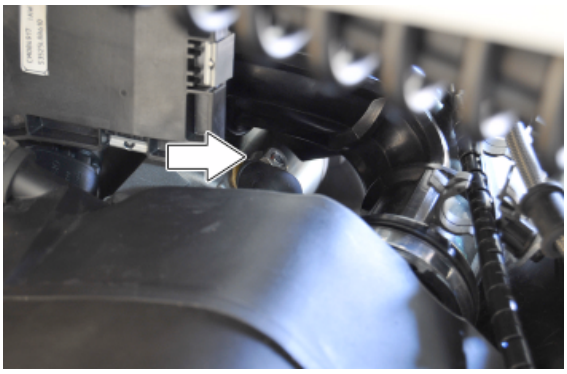
Remove the ECU connector.

Undo the connecting screw on the frame - engine ground frame.

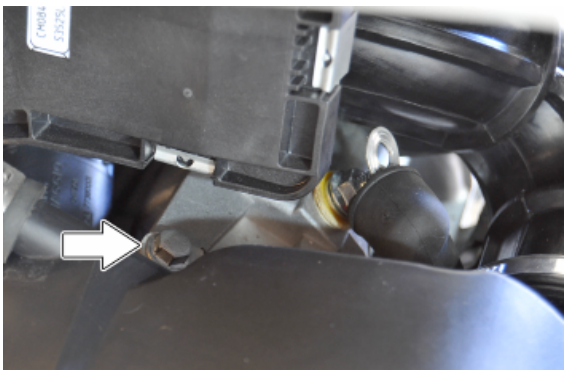
Remove the injector connector.

Remove the engine temperature sensor connector.

Remove the starter motor power supply cable by unscrewing the nut.

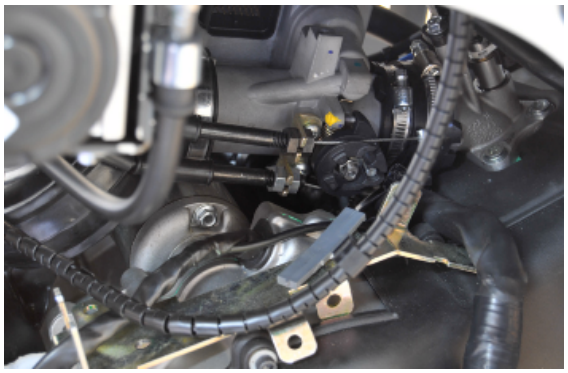


Remove the ground cable on the starter motor by unscrewing the nut.

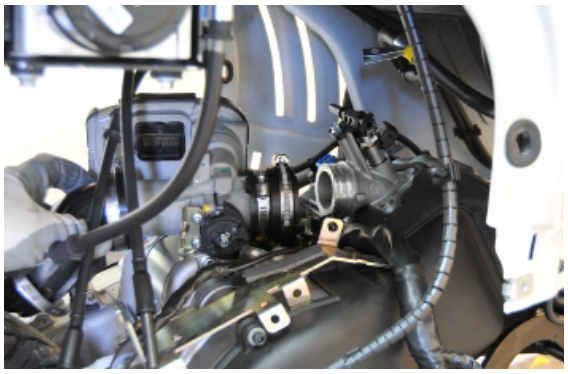


Remove the fuel pipe paying attention to possible leaks due to the pressure in the pipes.

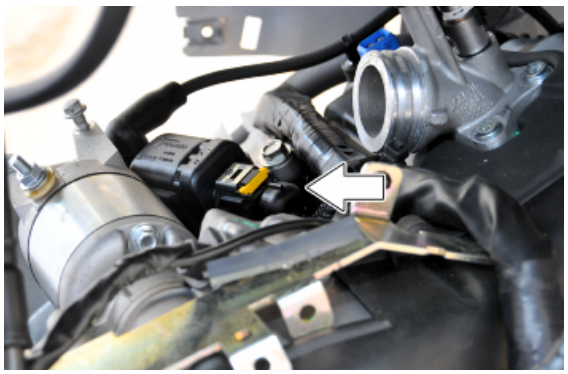
Disconnect the throttle grip cables from the throttle body



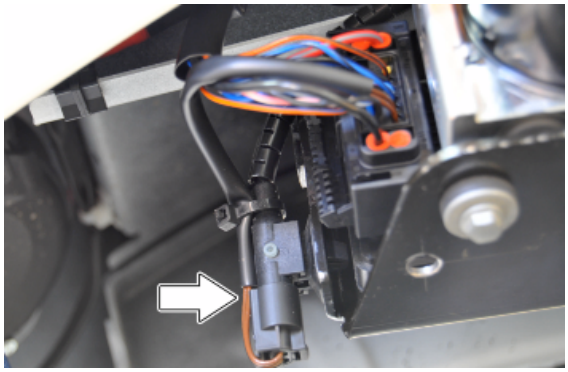
Remove the throttle body freeing the main cable harness by loosening the clamp fastening the manifold.



Disconnect the HV coil connector.



- Disconnect the rear ABS sensor connector by freeing it from the retaining clamps.
- Remove the rear brake calliper as described in the corresponding chapter.



To refit, follow the previous operations but in reverse order, observing the prescribed torques indicated in the SPECIFICATIONS chapter.

WARNING

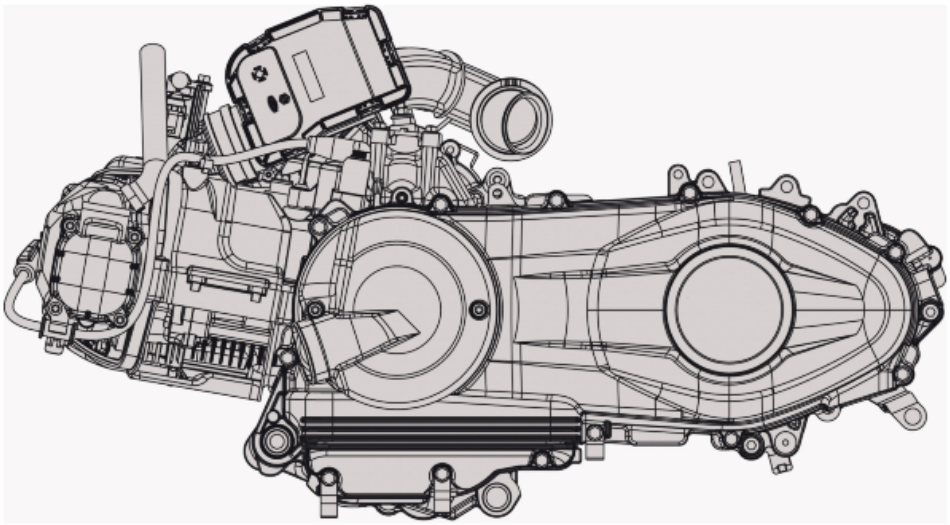
EACH TIME THAT THE CONNECTOR OF THE CONTROL UNIT IS DISCONNECTED, THE LEARNING OF THE CONTROL UNIT MUST BE PERFORMED AS DESCRIBED IN THE INJECTION/ FITTING OF THE THROTTLE BODY CHAPTER.

See also

Tightening Torques

INDEX OF TOPICS

This section describes the operations to be carried out on the engine and the tools to be used.



Automatic transmission

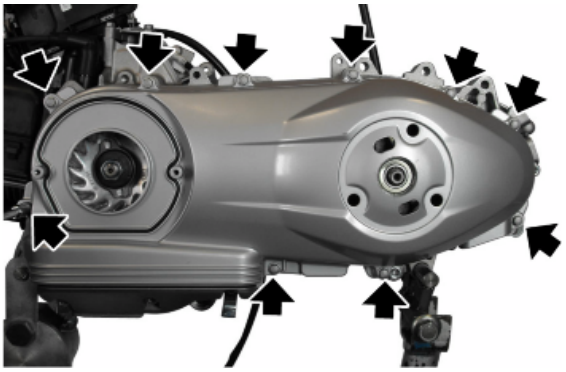
Transmission cover

- Remove the air duct.
- Remove the plastic cover that has the vehicle logo on it.
- Insert the specific tools, rotate the engine until the driven pulley stops and remove the nut, recovering the washer.

Specific tooling

020937Y Driven pulley lock

- Unscrew the ten screws fixing the engine and remove the transmission cover.

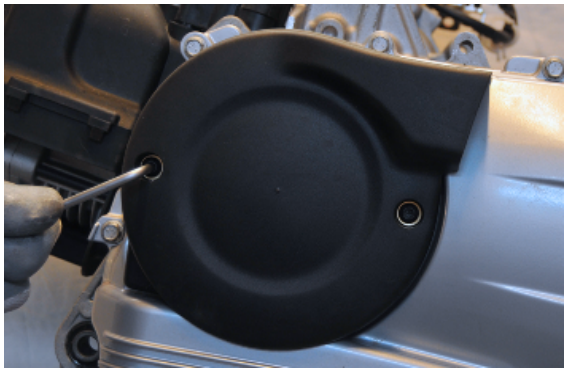


See also

Air duct

Air duct

- Unscrew the two screws indicated and remove the duct.



Removing the driven pulley shaft bearing

- Remove the Seeger ring.

CAUTION

PLACE THE COVER ON A SURFACE, REMOVING OR EXCLUDING THE ALIGNMENT DOWELS.

- Support the transmission cover adequately.
- Using appropriate tools, remove the bearing.

Specific tooling

020376Y Adaptor handle

020357Y 32 x 35-mm Adaptor

020412Y 15-mm guide

Refitting the driven pulley shaft bearing

- Use the heat gun to heat the inner part of the lid.
- Using the equipment plant a new bearing, apply grease on the adapter and guide in order to maintain the position of the bearing during operation on the vertical axis.

Specific tooling

020151Y Air heater

020376Y Adaptor handle

020358Y 37 x 40-mm Adaptor

020412Y 15-mm guide

- Insert the Seeger ring.
- Insert the alignment dowels if removed during disassembly.

Removing the driven pulley

- Undo the clutch fixing screw, recovering the lining.
- Remove the clutch drum.
- Remove the driven pulley.

Inspecting the clutch drum

- Check that the clutch bell is not worn or damaged.
- Measure the clutch bell inside diameter.

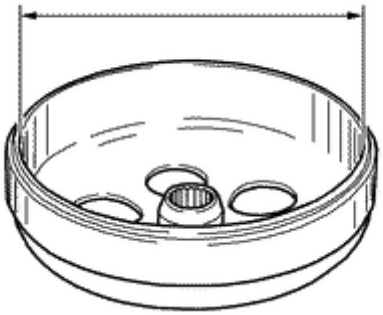
Characteristic

Max. value clutch housing

Max. value: Ø 134.5 mm

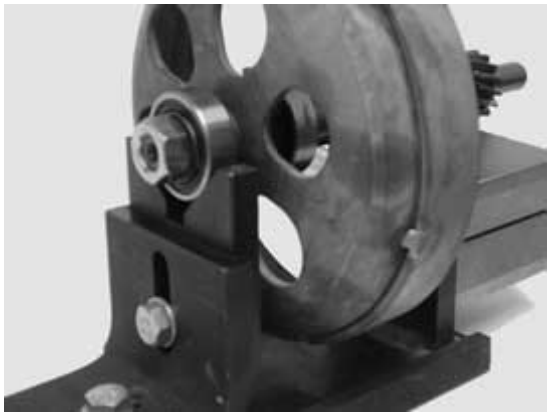
clutch housing standard value

Standard value: Ø 134 - 134.2 mm

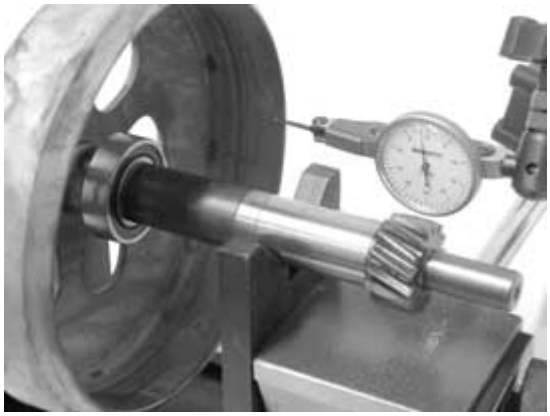


Checking the bell working surface eccentricity

- Install the bell on a driven pulley shaft using 2 bearings (inside diameter: 15 and 17 mm).
- Lock with the original spacer and nut.
- Place the bell/shaft unit on the support to check the crankshaft alignment.



- Using a feeler dial gauge and the magnetic base, measure the bell eccentricity.
- Repeat the measurement in 3 positions (Central, internal, external).
- If faults are found, replace the bell.



Specific tooling

020074Y Support base for checking crankshaft alignment

020335Y Magnetic mounting for dial gauge

Characteristic

clutch housing inspection: Limit eccentricity.

Admissible limit eccentricity: 0.15 mm

Removing the clutch

- Prepare the locking tool for the driven pulley with the pins half-screwed in the tool set to «**C**».
- Introduce the adapter ring 11 with the chamfering facing the inside of the tool.

- Fit the driven pulley unit in the tool so as the bolt get into the masses clutch support holes. Afterwards make the support screw make contact with a minimum force.
- Using the specific wrench, inserted 46 mm from the side, remove the clutch central locking nut.

- Separate the components of the driven pulley.

CAUTION

THE TOOL MUST BE FIRMLY FIXED IN THE VICE AND THE CENTRAL SCREW MUST NOT BE TIGHTENED WITH EXCESSIVE TORQUE AS THIS MAY DAMAGE THE PULLEY OR DEFORM THE SPECIFIC TOOL.

Specific tooling

020444Y Tool for fitting/ removing the driven pulley clutch

020444Y011 adapter ring

020444Y009 wrench 46 x 55

Inspecting the clutch

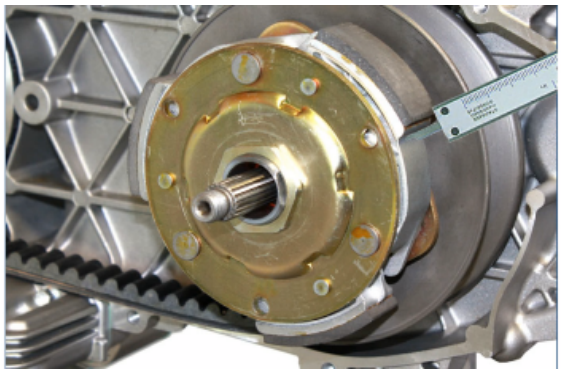
- Check the thickness of the clutch mass friction material.
- The masses must not show traces of lubricants; otherwise, check the driven pulley unit seals.

N.B.

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL FAYING SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER.
VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

CAUTION

DO NOT OPEN THE MASSES USING TOOLS TO PREVENT A VARIATION IN THE RETURN SPRING LOAD.



Characteristic

Check minimum thickness

1 mm

Pin retaining collar

- Simultaneously turn and pull the collar manually to remove it.

N.B.

USE TWO SCREWDRIVERS IF YOU HAVE ANY DIFFICULTY.

N.B.

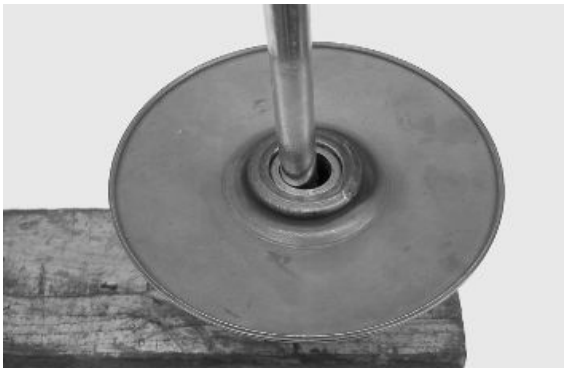
BE CAREFUL NOT TO PUSH THE SCREWDRIVERS IN TOO FAR TO AVOID DAMAGE THAT COULD COMPROMISE THE O-RING SEAL.

Removing the driven half-pulley bearing

- Remove the retainer ring using two flat blade screwdrivers.
- Using a hammer and pin, knock the ball bearing out as shown in the figure.
- Remove the roller bearing using the specific extractor.

N.B.

REST THE HALF-PULLEY ON A WOOD SURFACE TO AVOID DAMAGING THE THREADED RINGLET OF THE DRIVEN PULLEY UPON REMOVING IT.



Specific tooling

001467Y008 Pliers to extract 17 mm ø bearings

001467Y009 Bell for OD 42-mm bearings

Inspecting the driven fixed half-pulley

- Measure the outside diameter of the pulley bushing.

Characteristic

Standard diameter:

Ø 40.1 ± 0.05 mm

Refitting the driven half-pulley bearing

- Assemble a new roller bearing using the specific punch, fit the bearing with the label facing outward and insert it completely up to the punch on the half-pulley.

N.B.

REST THE HALF-PULLEY ON A WOOD SURFACE TO AVOID DAMAGING THE THREADED RINGLET OF THE DRIVEN PULLEY UPON REMOVING IT.

Specific tooling

020424Y Driven pulley roller casing fitting punch

- To assemble the new ball bearing insert it completely down in its housing with the specific punch and finally assemble the Seeger ring.

Specific tooling

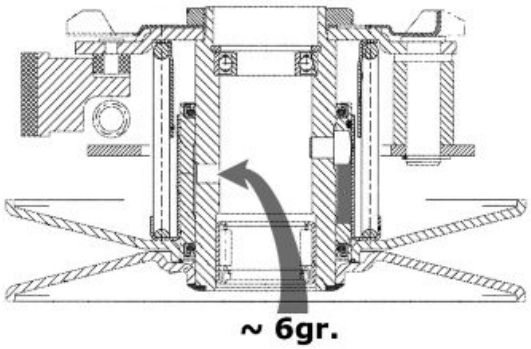
020375Y 28 x 30 mm adaptor

020376Y Adaptor handle

020439Y 17-mm guide

Refitting the driven pulley

- Check that the faying surfaces between the 2 half-pulleys and the belt do not show any signs of wear, scoring and grease.
- Insert the new oil seals and O-rings on the movable half-pulley.
- Assemble the half-pulley on the ringlet with the appropriate protection sheath.
- Make sure the pins and collar are not worn, reassemble the pins and collar.
- Use a greaser with a curved spout to lubricate the driven pulley unit with around 6 g of grease. This operation must be done through one of the holes inside the bushing until grease comes out of the opposite hole. This operation is necessary to avoid the presence of grease beyond the O-rings.



Specific tooling

020263Y Driven pulley assembly sheath

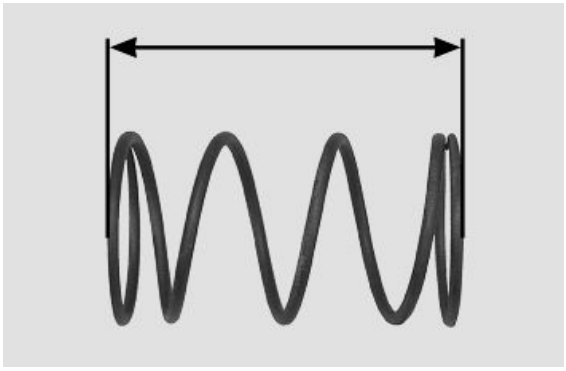
Recommended products

AGIP GREASE SM 2 Gray black smooth-textured lithium grease, containing molybdenum disulphide.

-

Inspecting the clutch spring

- Measure the length of the spring when it is relaxed.



Characteristic

Standard length:

106 mm

Refitting the driven pulley

- Reassemble the clutch housing and spacer.

Drive-belt

- Make sure the drive belt is not damaged and does not show abnormal wear.
- Replace as indicated in the scheduled maintenance table.

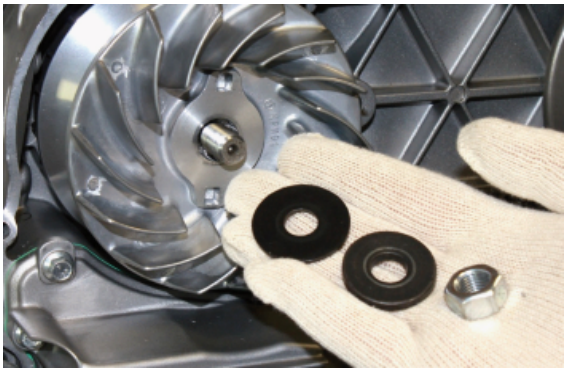
Removing the driving pulley

- Using specific tools, lock the driving pulley and loosen the nut.

Specific tooling

020938Y Driving pulley lock

- Remove the flat washer and the cup washer.



- Remove the stationary half-pulley and the washer.

- Disengage the belt.
- Remove the complete roller housing.

Inspecting the rollers case

- Check that the internal bushing shown in the figure is not abnormally worn and measure inner diameter A.
- Measure outer diameter B of the pulley sliding bushing shown in the figure.
- Check that the rollers are not damaged or worn.
- Check the guide shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt faying surfaces on both pulley halves.

- Check that stationary driving pulley does not show signs of abnormal wear on the grooved edge and on the surface in contact with the belt.

CAUTION

DO NOT LUBRICATE OR CLEAN SINTERED BUSHINGS

Characteristic

Movable driving half-pulley bushing:

Ø30 (+0.081 +0.060) mm

Sliding bushing:

Ø26 (-0.020 -0.041)mm

Characteristic

CVT rollers ø 19 mm

Wear limit ø 18.4 mm

Refitting the driving pulley

- Perform the operations in reverse order of disassembly.

CAUTION

INSERT THE ROLLERS WITH THE LARGEST SUPPORT SURFACE ACCORDING TO THE DIRECTION OF ROTATION.

- Tighten the torque using the specific tool to lock the pulley.

CAUTION

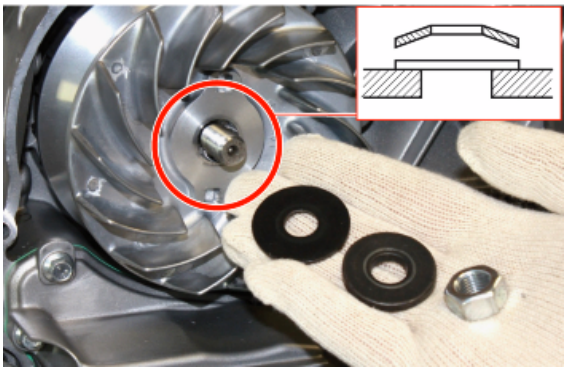
DURING THE INSTALLATION PAY SPECIAL ATTENTION TO THE ASSEMBLY OF THE BELLEVILLE SPRING, AS SHOWN IN FIGURE.

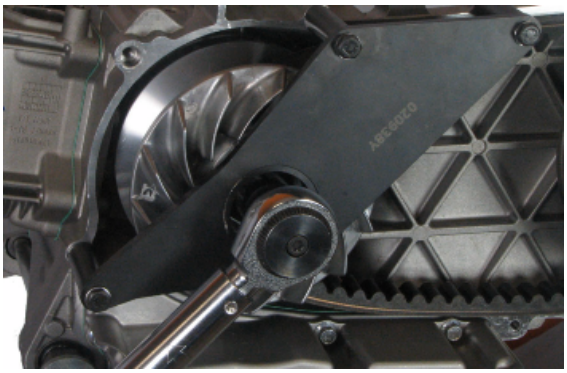
Specific tooling

020938Y Driving pulley lock

Locking torques (N*m)

Driving pulley retainer nut 75 to 83





Refitting the transmission cover

Follow the removal steps but in reverse order; be careful to tighten to the prescribed torques.

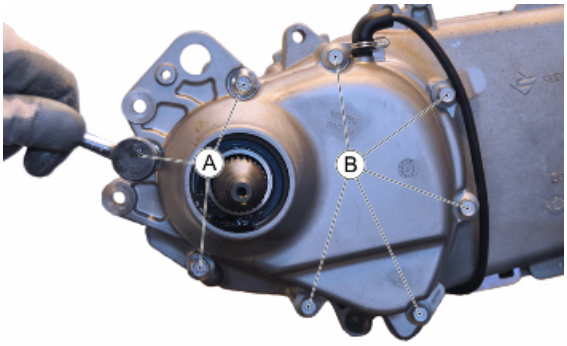
Locking torques (N*m)

Clutch cover retainer screws 10.8 to 12.8

End gear

Removing the hub cover

- Drain the oil of the final drive as described in the chapter «MAINTENANCE».
- Remove the 3 screws «**A**» and the 5 screws «**B**».



- Remove the breather pipe.
- Remove the cover.

Removing the hub bearings

Removing the clutch shaft bearing

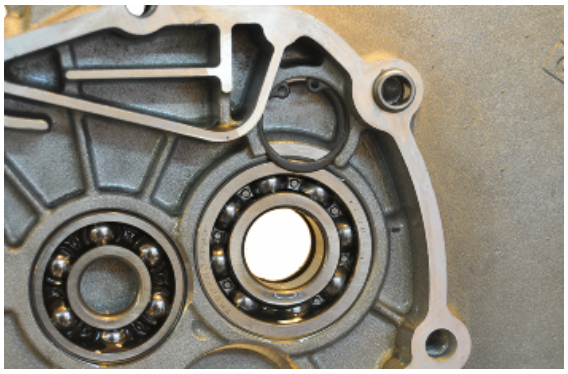
- Remove the Seeger ring.
- Remove the oil seal from the opposite side.
- Remove the bearing working from the external side and using the specific tools.

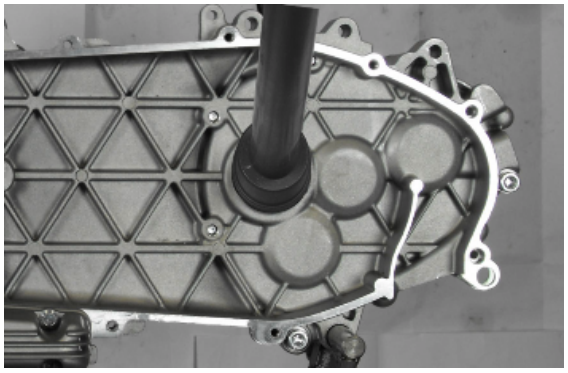
Specific tooling

020376Y Adaptor handle

020363Y 20-mm guide

020359Y 42 x 47-mm Adaptor





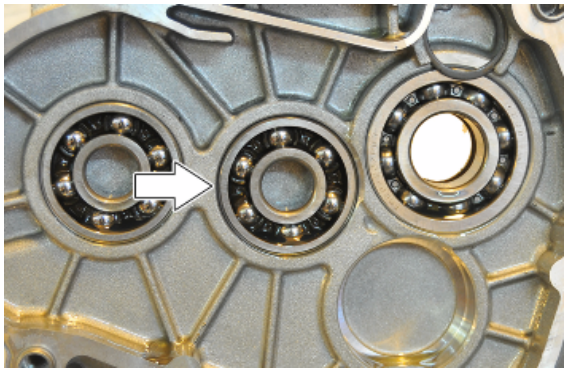
Removing the intermediate gear bearing

- Remove the bearing using the specific tools .

Specific tooling

001467Y009 Bell for OD 42-mm bearings

001467Y013 Calliper to extract ø 15-mm bearings



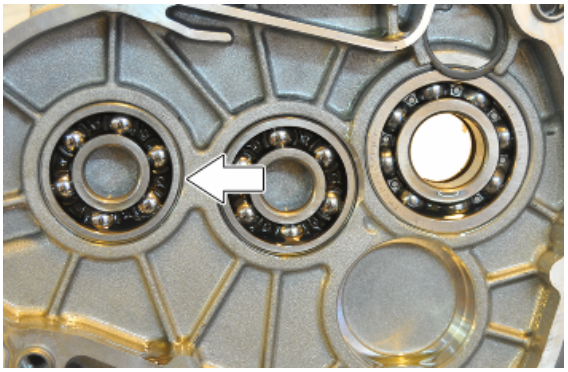
Removing the Wheel axle bearing

- Remove the bearing using the specific tools .

Specific tooling

001467Y009 Bell for OD 42-mm bearings

001467Y013 Calliper to extract ø 15-mm bearings



Removing the wheel axle bearings

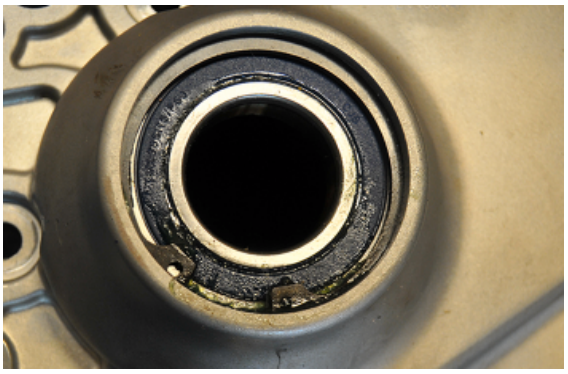
- Support the hub cover properly to avoid damaging the sealing surface with the crankcase
- Remove the Seeger ring from the outside.
- Operating on the inside, remove the oil seal.
- Remove the wheel axle bearing using the specific tool.

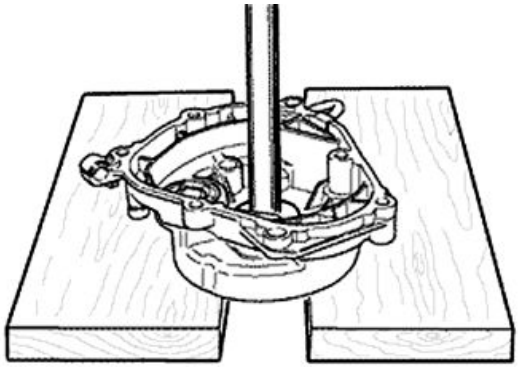
Specific tooling

020376Y Adaptor handle

020364Y 25-mm guide

020359Y 42 x 47-mm Adaptor





Removing the intermediate gear bearing

- Using the specific tools remove the bearing.

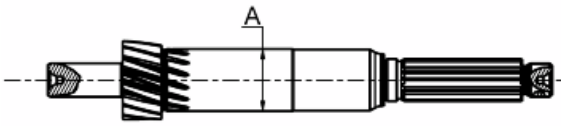
Specific tooling

001467Y013 Calliper to extract ø 15-mm bearings

001467Y009 Bell for OD 42-mm bearings

Inspecting the hub shaft

- Check the three shafts and the intermediate gear for wear or distortion of the toothed surfaces, the bearing housings, and the oil seal housings.
- In case of faults, replace the damaged parts.



Characteristic

Driven pulley shaft

A: 22(-0.01 -0.02)mm

Wheel axle

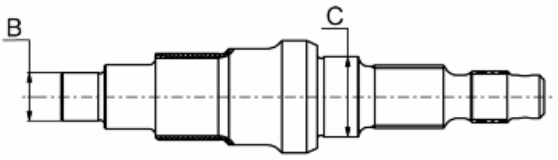
B: 15(-0.010 -0.020)mm

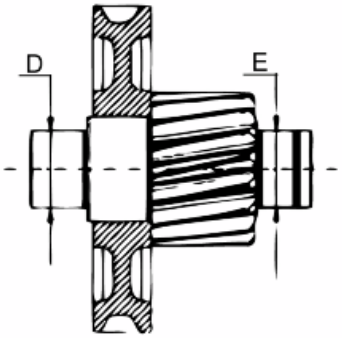
C: 25(-0.007 -0.020)mm

Intermediate gear

D: 15(-0.01 -0.02)mm

E: 15(-0.01 -0.02)mm





Inspecting the hub cover

- Check that the fitting surface is not dented or distorted.
- Check the bearing bearings.
- In case of faults, replace the damaged components.

Refitting the driven pulley shaft bearing

- Use the heat gun to heat the bearing seat.
- Using the specific equipment set a new bearing.
- Insert a locking seeger.

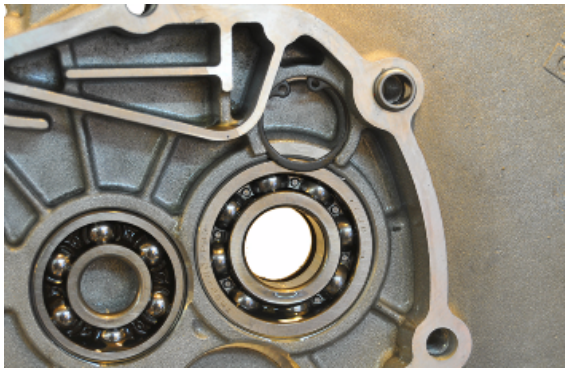
Specific tooling

020151Y Air heater

020376Y Adaptor handle

020360Y 52 x 55-mm Adaptor

020363Y 20-mm guide



Fitting the transmission shaft bearing

- Use the heat gun to heat the bearing seat.
- Set a new bearing using the specific equipment.

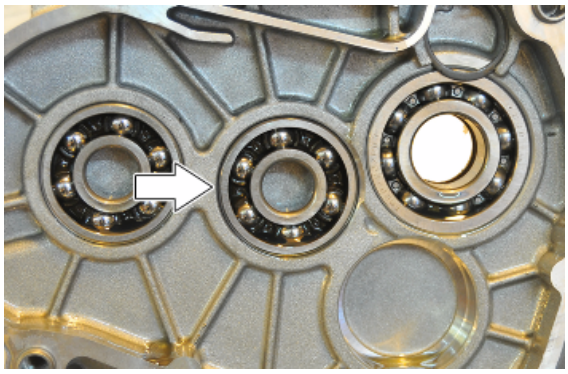
Specific tooling

020151Y Air heater

020376Y Adaptor handle

020359Y 42 x 47 mm Adaptor - For main bearings and wheel axle

020412Y 15-mm guide



Fitting the Wheel axle bearing

- Use the heat gun to heat the bearing seat.
- Set a new bearing using the specific equipment .

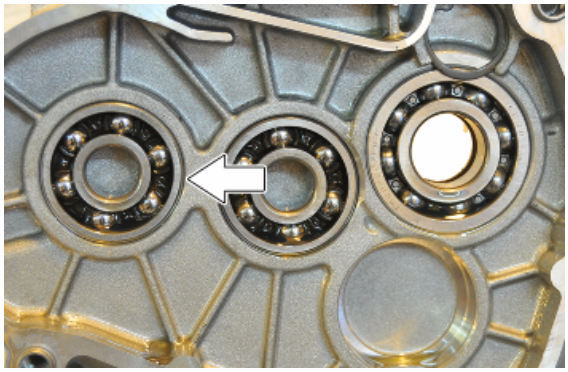
Specific tooling

020151Y Air heater

020376Y Adaptor handle

020359Y 42 x 47 mm Adaptor - For main bearings and wheel axle

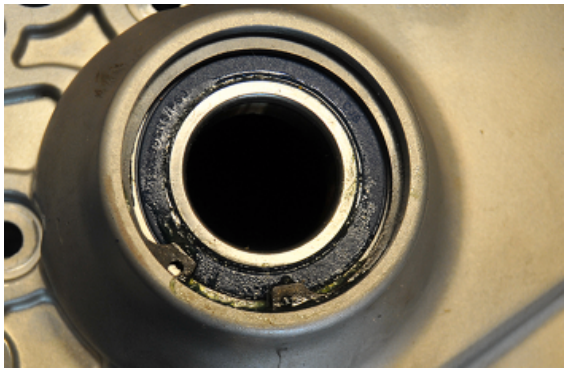
020412Y 15-mm guide



Refitting the hub cover bearings

Fitting the Wheel axle bearing

- Use the heat gun to heat the bearing seat.
- Plant a new bearing using the equipment, apply grease on the adapter and guide in order to maintain the position of the bearing during operation on the vertical axis.
- Insert the Seeger ring.



Specific tooling

020151Y Air heater

020376Y Adaptor handle

020360Y 52 x 55-mm Adaptor

020364Y 25-mm guide

Fitting the transmission gear bearing

- Use the heat gun to heat the bearing seat.
- Using the equipment set a new bearing.

Specific tooling

020151Y Air heater

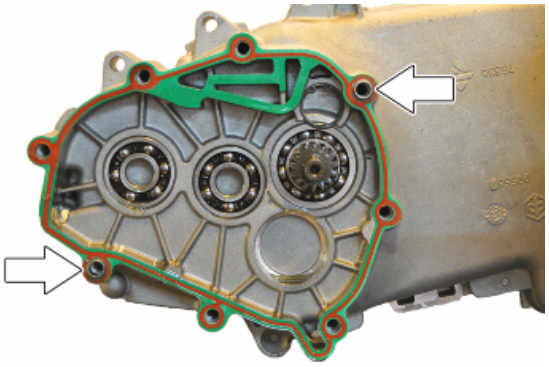
020376Y Adaptor handle

020359Y 42 x 47-mm Adaptor

020412Y 15-mm guide

Refitting the ub cover

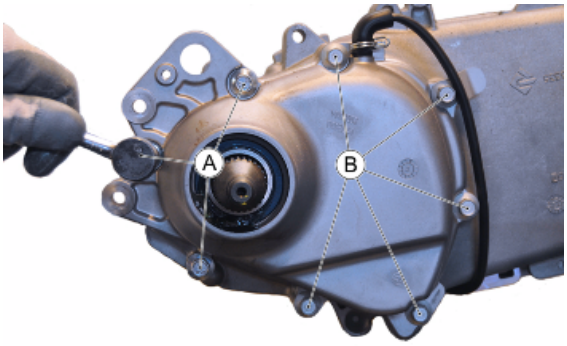
- Clean the engine crankcase and reduction cover surfaces adequately.
- Working in reverse with respect to the disassembly, inert the command pinion and the intermediate gear into the hub box.
- Pay attention to the correct positioning of the alignment dowels.
- Insert the gasket.



- Tighten the screws «A» and «B» to the prescribed torque.
- Restore the hub oil as described in the chapter MAINTENANCE

Locking torques (N*m)

Hub cover screws 24 to 27



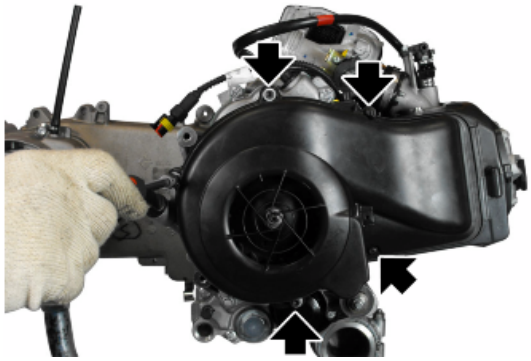
See also

Replacement

Flywheel cover

Cooling hood

- Unscrew the five indicated screws and remove the cooling cap.

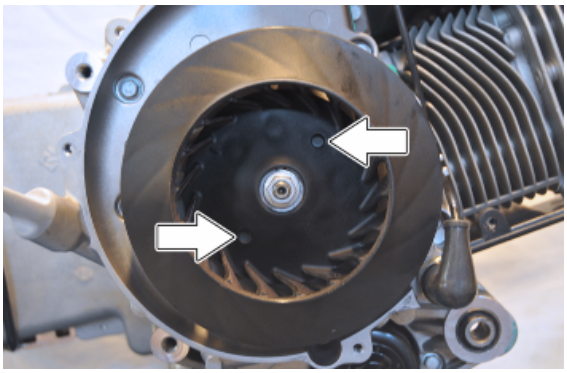


Cooling fan

- By inserting the specific tool in the indicated holes, unscrew the nut fixing the cooling fan.
- Remove the cooling fan.
- Recover the wrench.

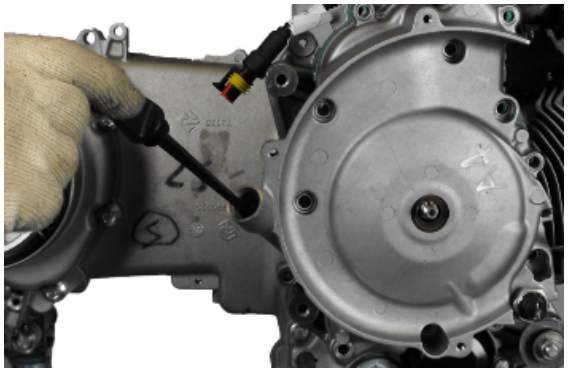
Specific tooling

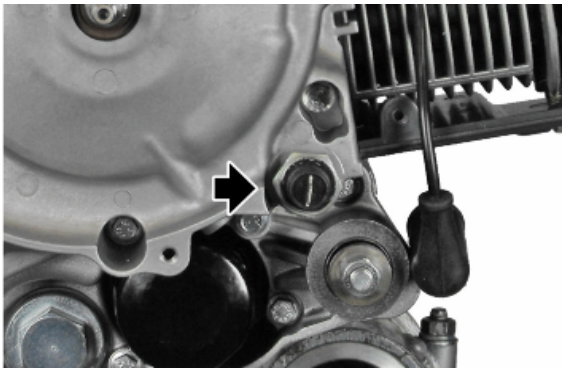
020442Y Pulley lock wrench

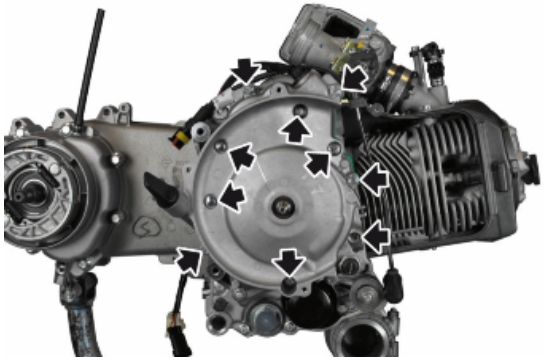


Removing the hub cover

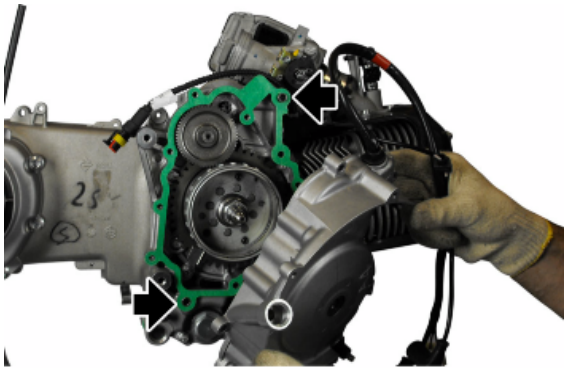
- Remove the oil dipstick.
- Remove the sensor connector.
- Unscrew the eleven fixing screws of the flywheel cover.





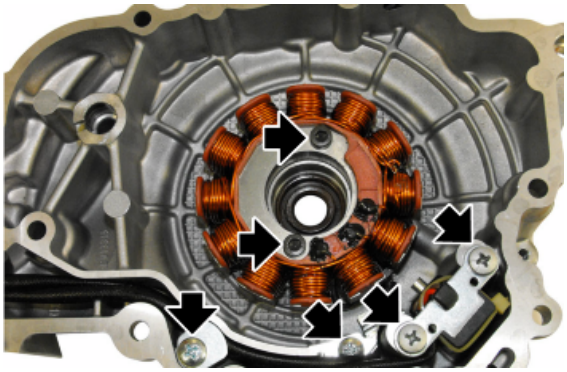


- Remove the cover.
- Remove the gasket.
- Pay attention to the alignment dowels.



Removing the stator

- Remove the flywheel cover.
- Unscrew the 2 flywheel fixing screws and the four pick-up fixing screws and cable harness retainer screws.



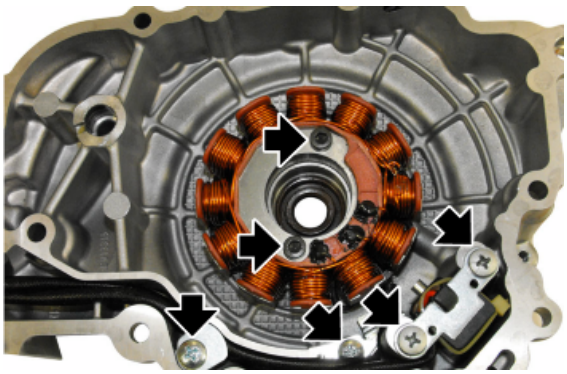
- Remove the flywheel and the pick-up complete with cable harness.

Refitting the stator

- Refit the stator and flywheel carrying out the removal procedure in reverse, tightening the retainers to the specified torque.
- Respect the operation of the pick-up.

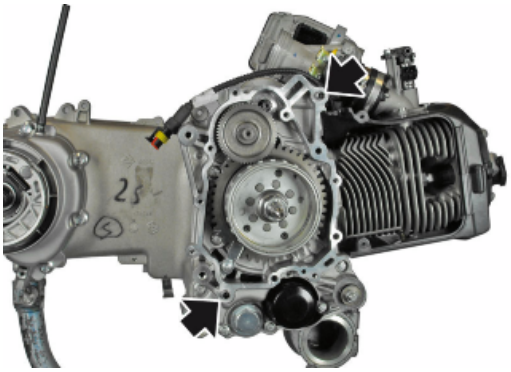
Locking torques (N*m)

Stator fixing screws 8 to 10 **Pickup fixing screws** 3 to 4



Refitting the flywheel cover

- Fit the gasket and be careful with the two alignment dowels.



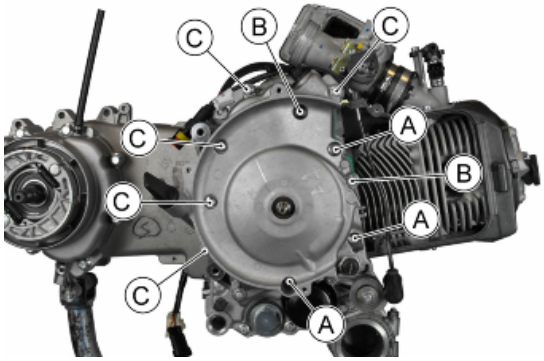
- Tighten the screws and tighten to the specified torque.

CAUTION

TO AVOID DAMAGING THE OIL SEAL, USE THE SPECIFIC TOOL PRIOR TO POSITIONING THE FLYWHEEL COVER.

Specific tooling

020940Y Flywheel cover oil seal gasket



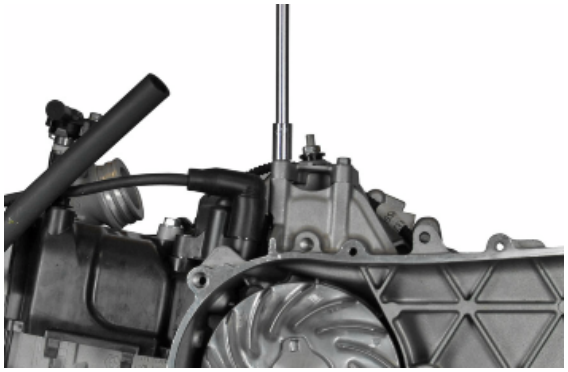
FLYWHEEL COVER SCREWS

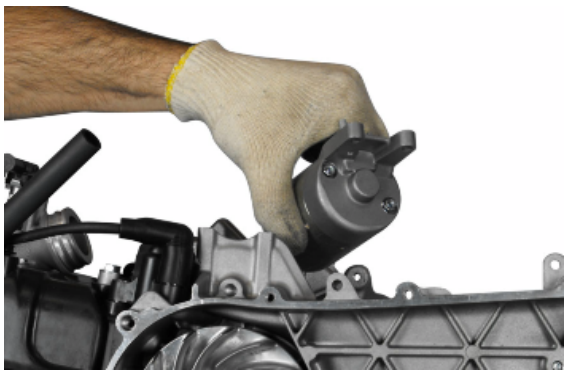
POSITION	SIZES	TORQUE (Nm)
A	M6x90	11 to 13
B	M6x35	11 to 13
C	M6x30	11 to 13

Flywheel and starting

Removing the starter motor

- Undo the two fixing screws and remove the starter motor.





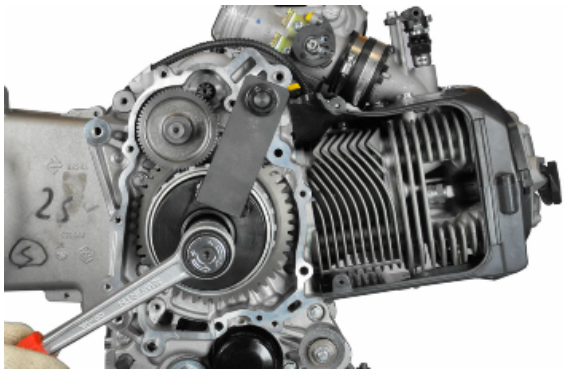
Removing the flywheel magneto

- Undo the screw indicated and remove the plate.

- Install the specific tool and unscrew the retainer nut of the flywheel, recovering the washer.

Specific tooling

020939Y Flywheel retainer

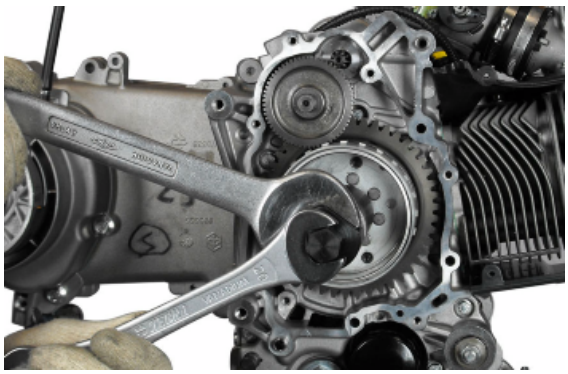


- Before screwing in the flywheel extractor the protection tool provided in the specific tool must be positioned.

Specific tooling

020933Y Flywheel extractor

- Acting on the extractor, remove the flywheel together with the starting sprocket and intermediate gear.



Inspecting the flywheel components

- Check the integrity of the internal plastic parts of the flywheel and the Pickup control plate.

- Check the integrity of the internal plastic parts of the flywheel and the Pickup control plate.

Refitting the flywheel magneto

- Perform the procedure in reverse order of disassembly, taking care to tighten to specified torque.

Locking torques (N*m)

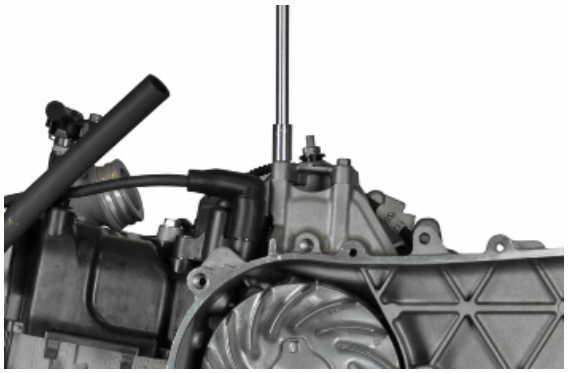
Flywheel fixing nut 100 to 110

Refitting the starter motor

- Fit a new O-ring on the starter motor and lubricate it.
- Fit the starter motor on the crankcase and lock the two screws to the prescribed torque.

Locking torques (N*m)

Starter motor screws 10.8 to 12.8



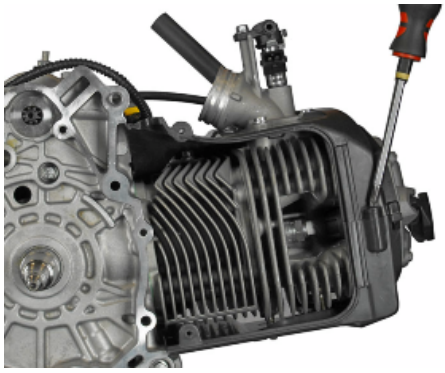
Cylinder assy. and timing system

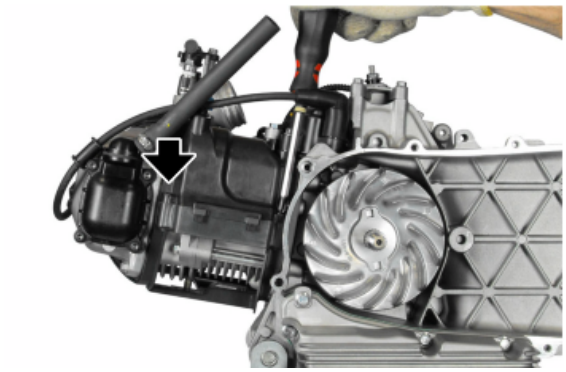
Removing the intake manifold

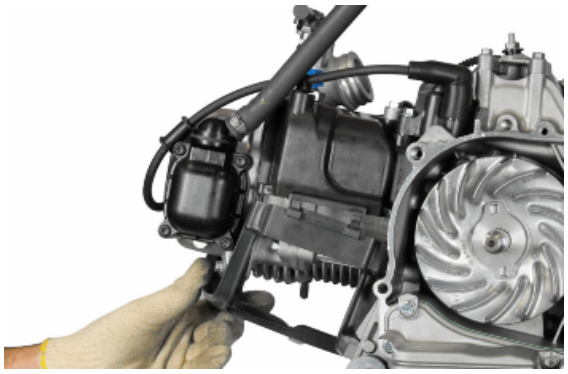
- The intake manifold is positioned on the head, loosen the clamps and remove the sleeve connecting to the throttle body.
- Undo the three manifold fixing screws and remove it.

Removing the rocker-arms cover

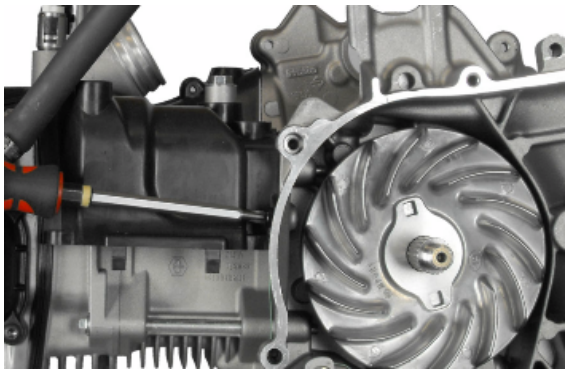
- Remove the protective cover, undoing the three screws.

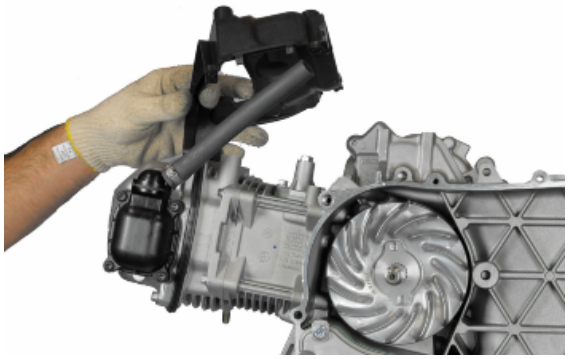






- Remove the engine temperature sensor.
- Undo the screw indicated.
- remove the upper part of the cover.

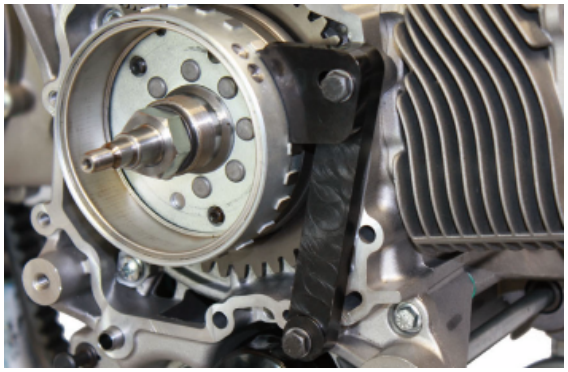




- Unscrew the four screws and remove the tappet cover.

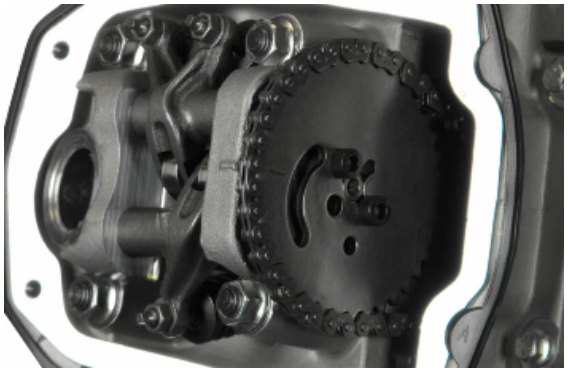
Removing the timing system drive

- Before carrying out operations on the timing system we recommend positioning the engine at TDC in compression. To do this use the specific tools.
- Use the holes on the engine crankcase to secure the tool.
- Position the specific tool in the window between the flywheel pick-up references as illustrated in the figure.



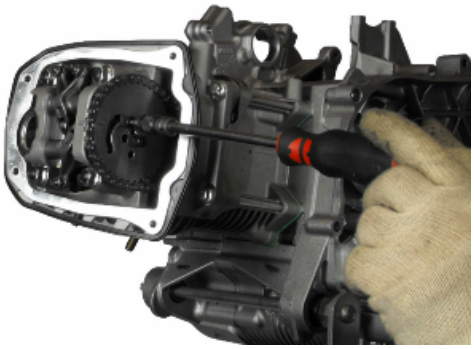
Specific tooling

020941Y Crankshaft timing adjustment tool

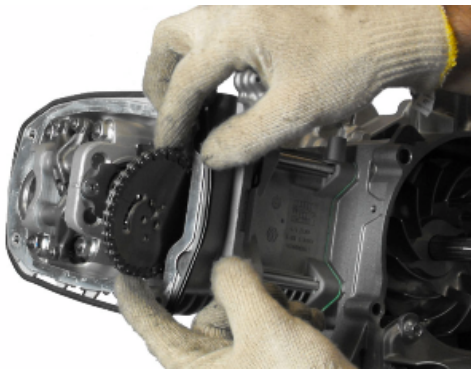


- First loosen the tensioner and unscrew the fixing screws.
- Remove the tensioner complete with gasket.

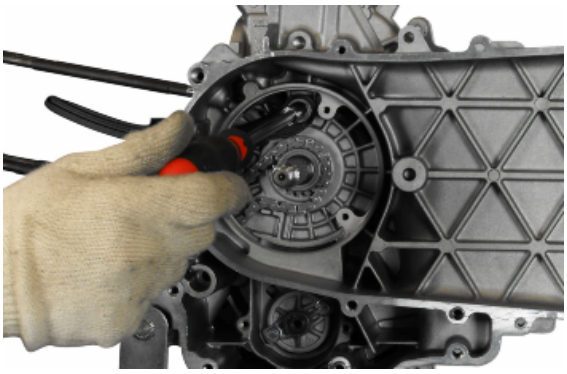
- Undo the two screws on the timing system gear.



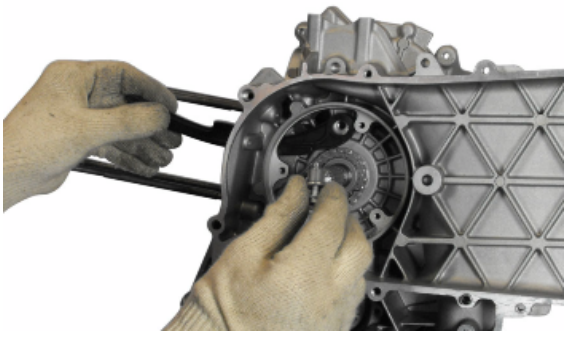
- Disengage the timing system gear and remove the camshaft control sprocket.
- Remove the cylinder as described in section «**Engine/Piston cylinder disassembly**»



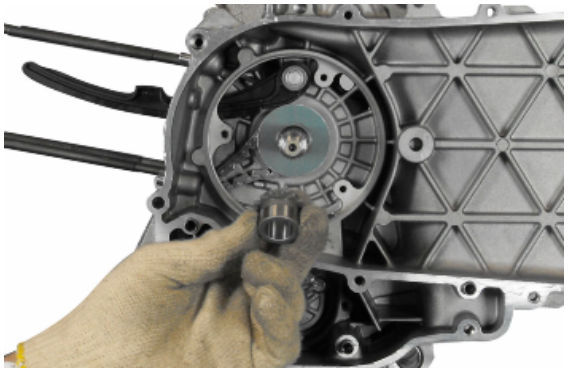
After removing the head the camshaft control components can be removed:
- Remove the inspection cover as described in sec. «**Lubrication/Main bushing oil seals removal**».
- Remove the oil pump command as described in section «**Lubrication/Oil pump/Disassembly** ».
- Undo the chain tensioner pad fixing screw, remove the bushing and the slider.

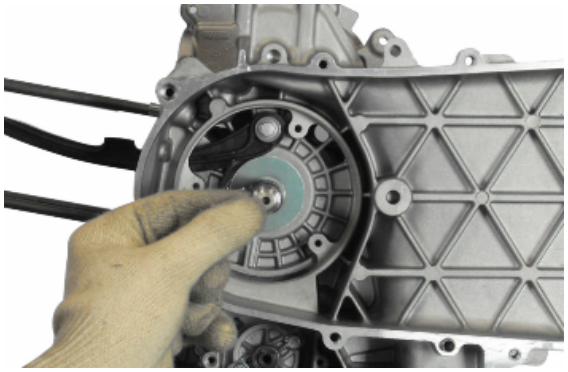


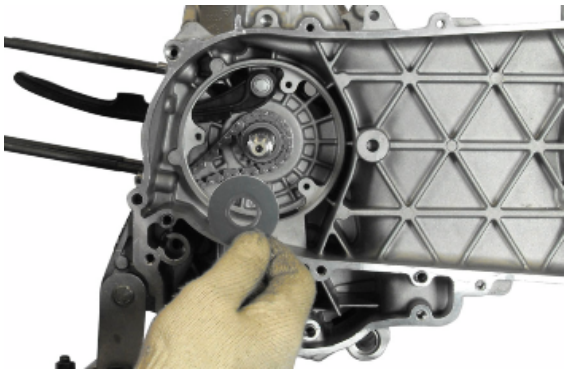
- Remove the chain tensioner pad.



- Remove the control gear.
- Remove the seal OR.
- Remove the flat washer.

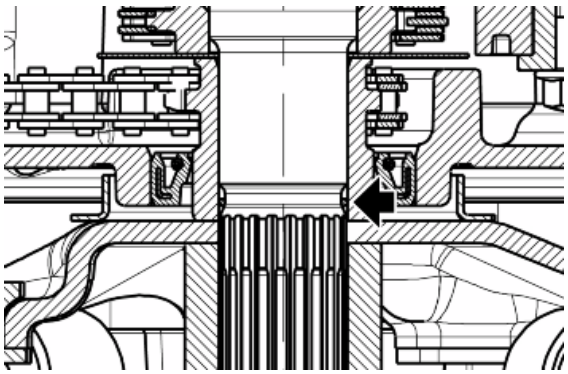




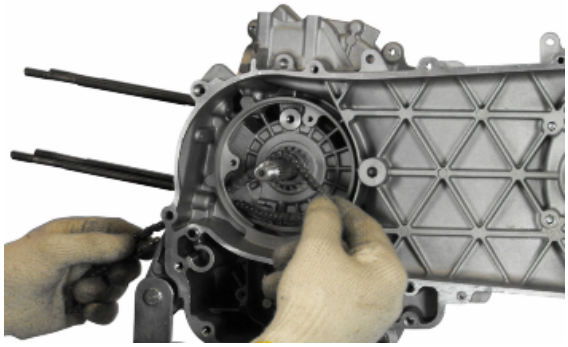


CAUTION

REMEMBER TO CORRECTLY POSITION THE SEAL OR IN THE REFITTING PHASE.



- Release the timing chain from the crankshaft.
- Remove the control gear.



See also

Removal
Removing the cylinder - piston assy.

Removing the cam shaft

- Undo the camshaft lock screw.

- Remove the lock.
- Remove the two pins and the rockers.
- Remove the camshaft.

Removing the cylinder head

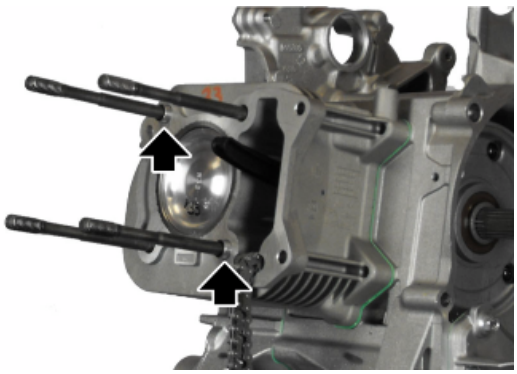
- Gradually loosen the four screws in crossed sequence and recover the washers.
- Undo the two external screws.

- Remove the cylinder head.
- Remove the chain guide slider and the gasket.

- Remove the gasket.

N.B.

ON ASSEMBLY PAY CLOSE ATTENTION TO THE TWO DOWELS.



Removing the valves

- Use the specific tool to remove the cotters, cap and spring.

CAUTION

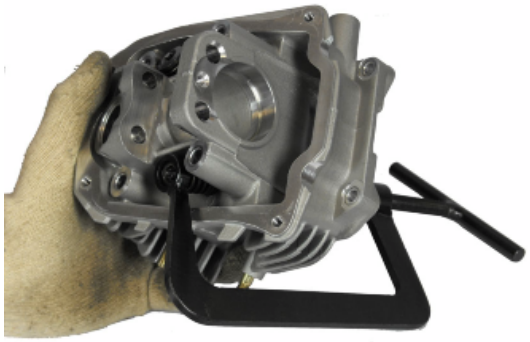
PROPERLY REPLACE THE PADS AND ROCKERS SO AS TO PRESERVE THE COUPLINGS.

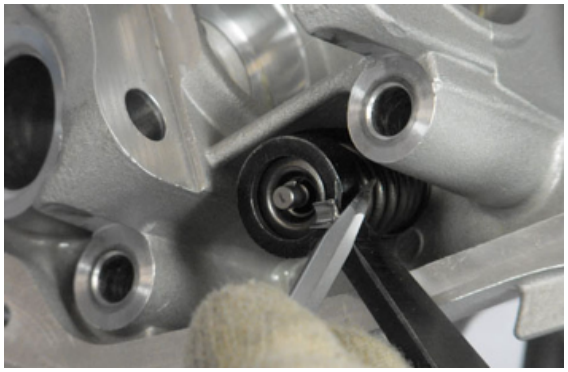
CAUTION

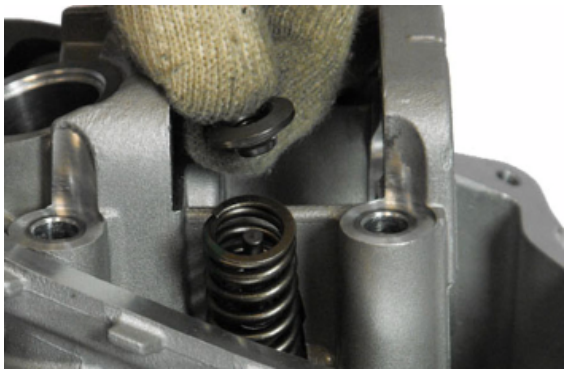
DURING ASSEMBLY, POSITION THE VALVE SPRINGS WITH THE GREEN COLOURED COIL FACING UPWARD.

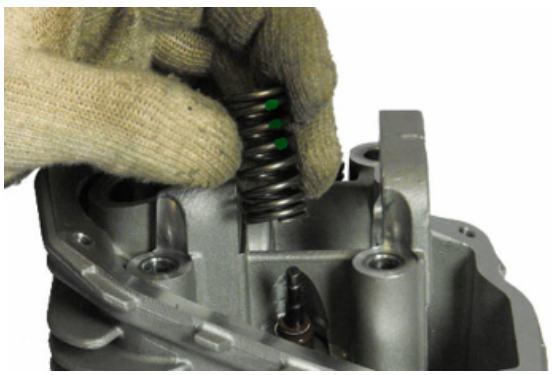
Specific tooling

020382Y Valve fitting/ removal tool





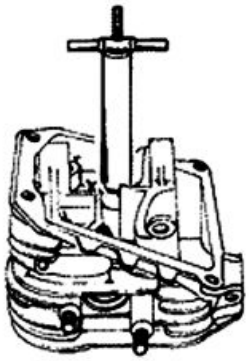




- Use the specific tool to remove the valve oil seal.

Specific tooling

020431Y Valve oil seal extractor



- Slide off the valve and remove the lower support.

Removing the cylinder - piston assy.

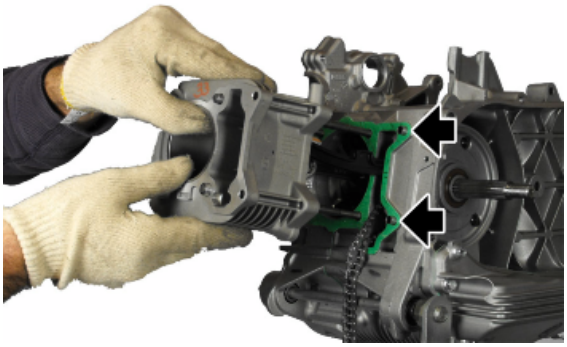
- Remove the cylinder, paying attention to the cylinder-crankcase alignment dowels.

CAUTION

TO PREVENT DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

N.B.

IN ORDER NOT TO DAMAGE THE BASE GASKET WITH THE PISTON LOCK FORK 020426Y DURING THE MOUNTING PHASE, IT IS RECOMMENDED TO INSERT THE ALIGNMENT DOWELS OF THE CYLINDER - CRANKCASE UNDER THE CYLINDER DURING THE ASSEMBLY.

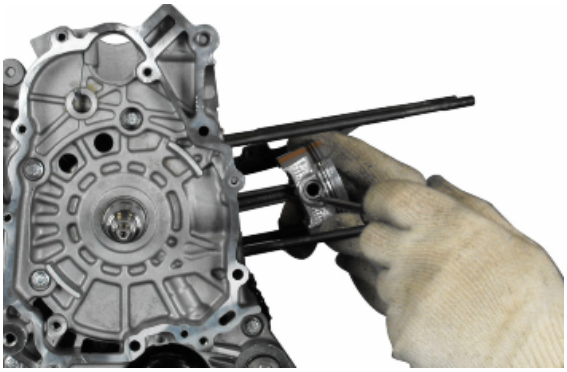


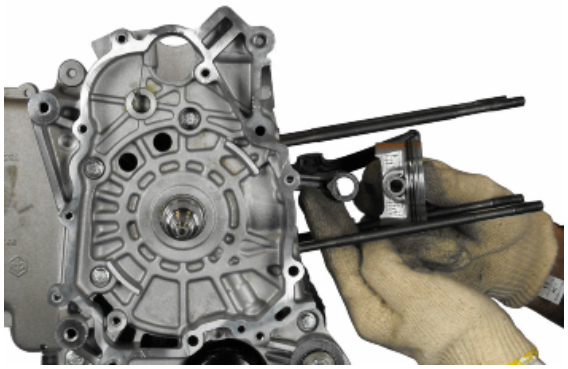
- Remove the base gasket.

- Remove the retainer rings and remove the piston.

N.B.

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.





Inspecting the small end

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the wrist pin

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder - piston assy.

Inspecting the piston

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder - piston assy.

Inspecting the piston rings

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

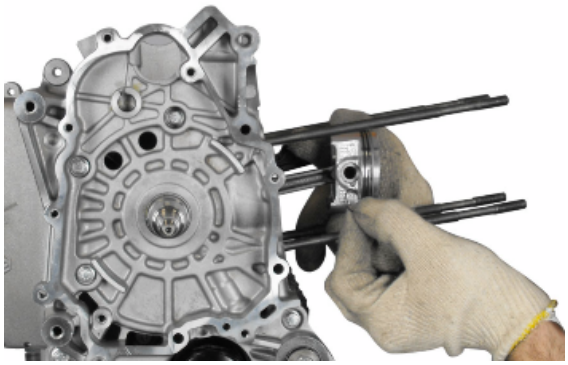
Piston rings

Removing the piston

- Fit the piston and pin onto the connecting rod, aligning the piston arrow towards the engine direction of rotation.

CAUTION

AT EVERY NEW MOUNTING USE RETAINER RING PINS.



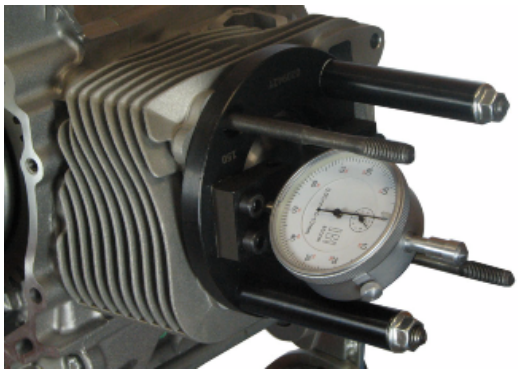
Choosing the gasket

- Provisionally fit the piston into the cylinder, without any base gasket.
- Assemble a dial gauge on the specific tool.

Specific tooling

020942Y Piston protrusion check tool

- Using an abutment plane, reset the dial gauge with a preload of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the original head fixing nuts.
- Rotate the crankshaft up to the TDC (the inversion point of the dial gauge rotation)
- Measure the deviation from the reset value.



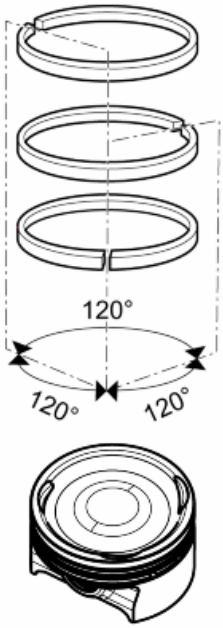
- By means of the table, see the Specifications chapter identify the cylinder base gasket thickness to be used for refitting. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.

See also

Slot packing system

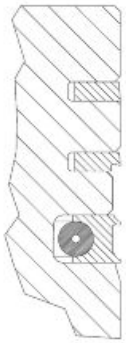
Refitting the piston rings

- Pistons (like cylinders) are supplied in 4 categories: A, B, C and D, and must be fitted so that the reference arrow faces the exhaust duct. The letter is found at the centre of the piston.
- Fit the sealing rings with the word TOP or the identification letter facing upwards. In any case, the step must be facing opposite the piston crown.
- Sealing rings are manufactured with a cylinder contact conical cross-section and piston gaps must be offset by 120° in order to obtain a better bedding.
- Lubricate rings with engine oil when fitting them.



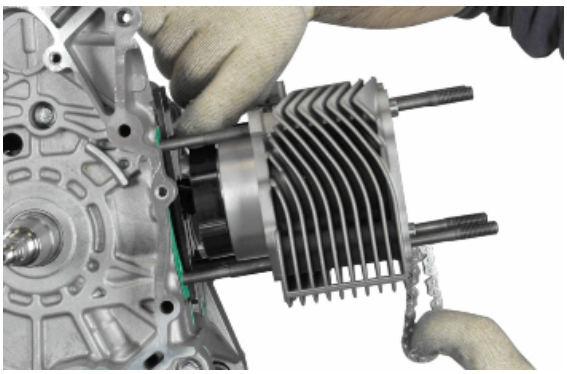
CAUTION

AT EVERY NEW MOUNTING USE RETAINER RING PINS.



Refitting the cylinder

- Insert the cylinder base gasket with the thickness determined above.
- Using the fork support and the piston ring retaining band, refit the cylinder as shown in the figure.



N.B.

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW OUT THE LUBRICATION DUCT AND OIL THE CYLINDER BARREL.

Specific tooling

020426Y Piston fitting fork

020427Y Piston assembly band

Recommended products

eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

Inspecting the cylinder head

N.B.

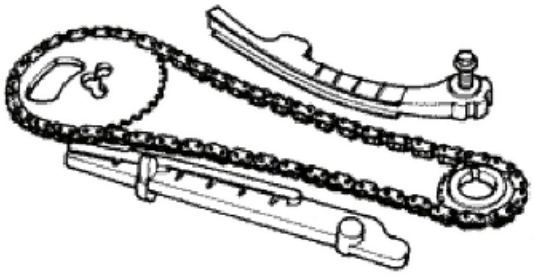
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

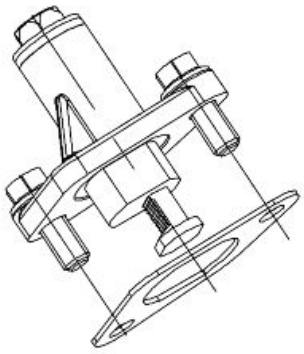
See also

Cylinder Head

Inspecting the timing system components

- Check that the guide slider and the tensioner slider are not worn out.
- Ensure that the camshaft control pulley chain assembly and the sprocket wheel are not worn.
- If you detect wear, replace the parts or, if the chain, sprocket wheel and pulley are worn, replace the whole unit.
- Remove the centre screw with the washer and the tensioner spring. Check that the one-way mechanism is not worn.
- Check the condition of the tensioner spring.
- If examples of wear are found, replace the whole unit.





Inspecting the valve sealings

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder Head

Inspecting the valves

N.B.

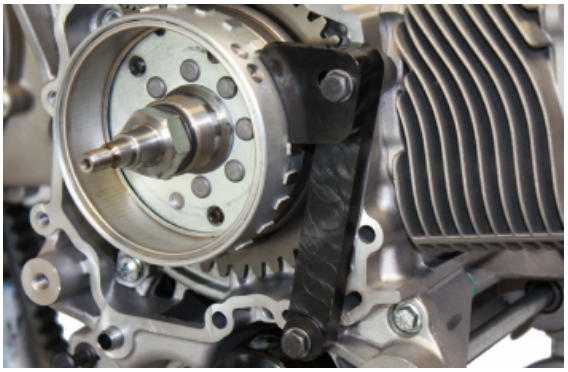
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

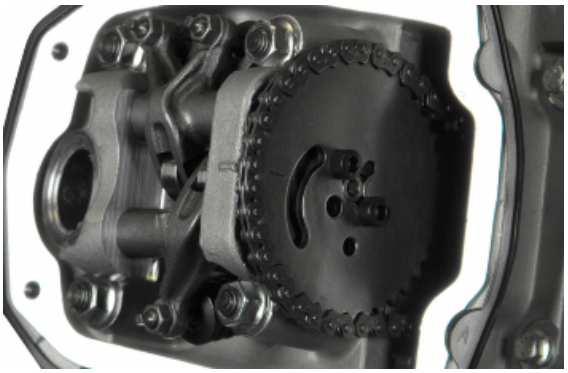
See also

Cylinder Head

VALVE CLEARANCE CHECK

- Remove the cover.
- Position the engine to the TDC in compression.

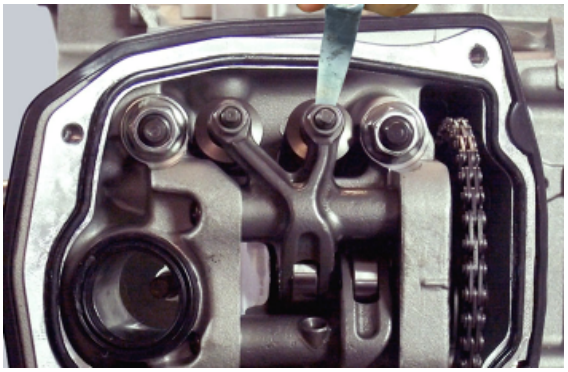




- Using a feeler gauge check the valve clearance.

CAUTION

- USE THE FEELER GAUGE LATERALLY, IN LINE WITH THE VALVES, IN ORDER TO PREVENT ACCIDENTAL BENDING OF THE BLADE THAT MAY AFFECT THE MEASUREMENTS.



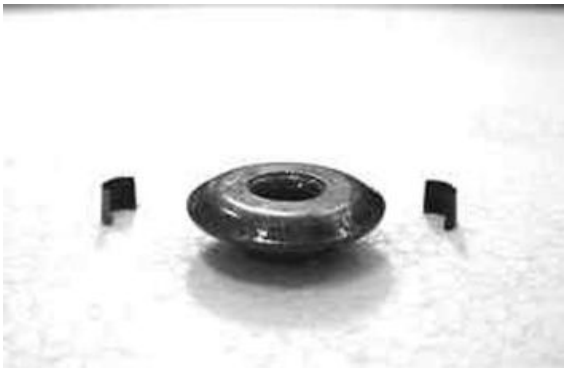
Characteristic

Valve clearance (cold engine)

intake: 0.08 mm exhaust: 0.08 mm

Inspecting the springs and half-cones

- Check that the upper and lower supporting spring washers, the cotters and the oil seal show exhibit no signs of abnormal wear. Replace a component when worn.



N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

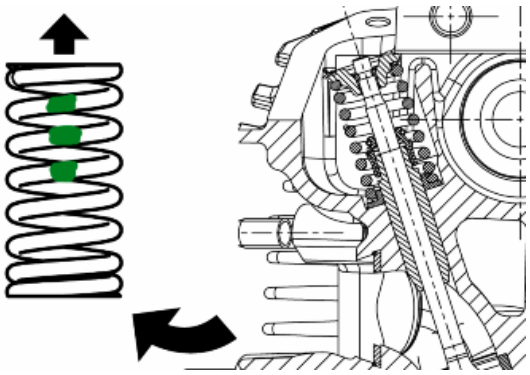
See also

Cylinder Head

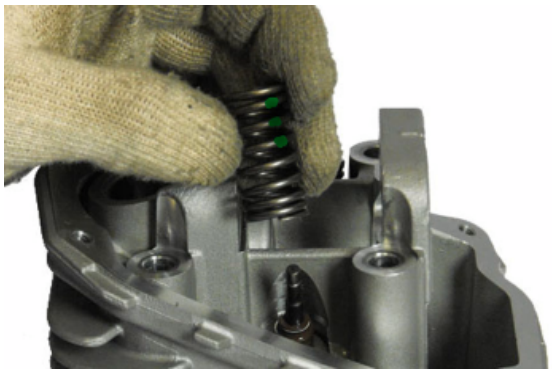
Refitting the valves

CAUTION

MOUNT THE VALVE SPRINGS WITH THE GREEN COLOURED COIL FACING UPWARD.

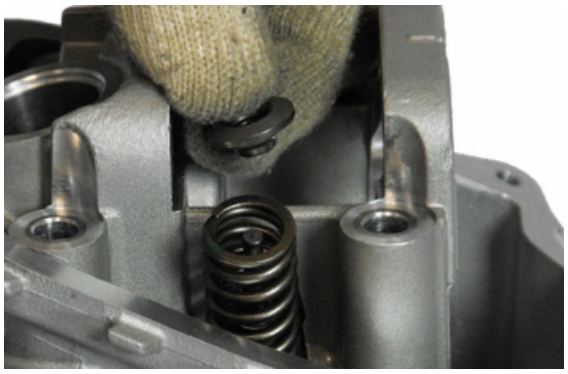


- Lubricate the valve guides with engine oil.
- Place the valve spring supports on the head.
- Using the special punch, fit the three valve seal rings alternately.
- Fit the valves, the springs and the spring retaining caps. Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.



N.B.

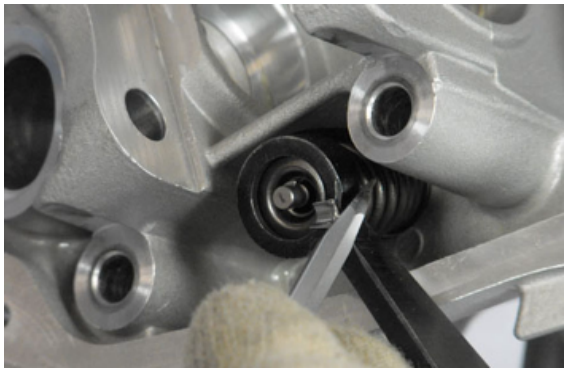
DO NOT CHANGE THE POSITIONS THE VALVES ARE FITTED IN FIT THE VALVE SPONGES WITH THE REFERENCE COLOUR ON COTTER SIDE (TURNS WITH GREATER PITCH).

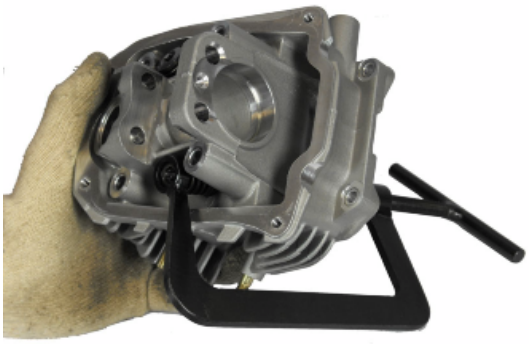


Specific tooling

020382Y Valve fitting/ removal tool

020431Y Valve oil seal extractor





Inspecting the cam shaft

N.B.

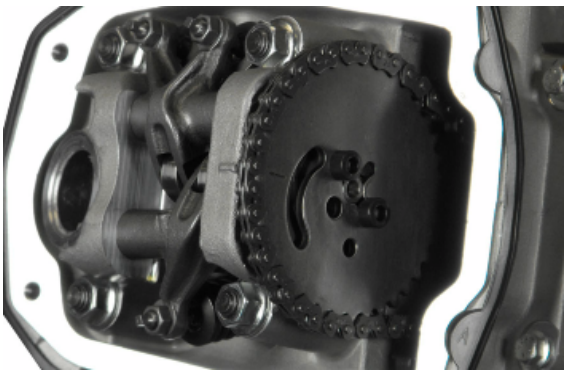
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

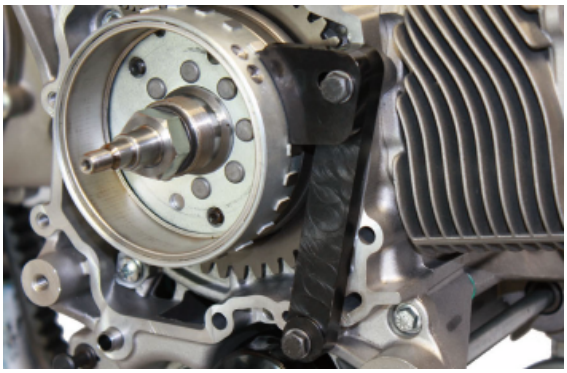
See also

Cylinder Head

Refitting the head and timing system components

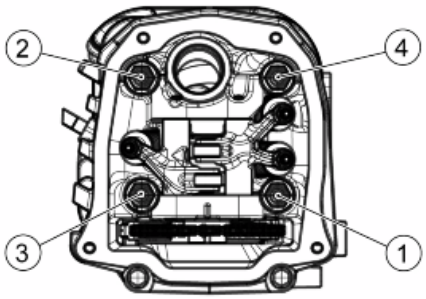
- Position the crankshaft to the TDC in compression.





- Insert the head gasket and check the correct operation of the alignment dowels.
- Insert the chain guide slider.
- Insert the head.
- Lubricate the stud bolt threads with engine oil.

- Tighten the nuts to an initial pre-torque of 9-11 Nm.
- Tighten up the nuts by rotating 270.0±5.0° with crossed sequence.
- Fit the two screws on the outside of the timing chain side and tighten them to the specified torque.



CAUTION

DO NOT PERFORM 270° IN ONE ROTATION. PERFORM WITH THREE GRADUAL ROTATIONS, OBSERVING THE SEQUENCE INDICATED ON THE STUD BOLTS.

N.B.

BEFORE INSTALLING THE HEAD, MAKE SURE THAT THE LUBRICATION CHANNEL IS CLEAN USING A COMPRESSED AIR JET.

CAUTION

ALWAYS USE A NEW HEAD GASKET UPON REFITTING.

Locking torques (N*m)

Cylinder head nut (TIGHTENING) 9 to 11 (Tighten to the prescribed torque and then proceed with 270.0°±5.0° rotation) **Screws fixing cylinder to crankcase** 10.8 to 12.7

Refitting the rocker-arms cover

- Remove the cylinder head cover and tighten the four clamping screws to the prescribed torque.
- Pay attention to the integrity of rubber gaskets, replace them if necessary.
- Make sure the gasket is positioned properly.

Locking torques (N*m)

Head cover screws 10.8 to 12.7

Refitting the intake manifold

- Follow the disassembly process in reverse order to refit.

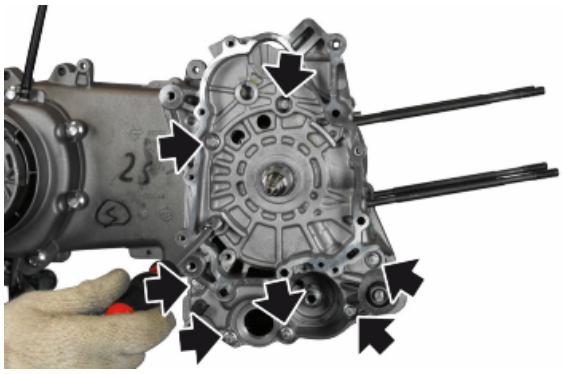
Locking torques (N*m)

Intake manifold fixing screws 10.8 to 12.8

Crankcase - crankshaft

Splitting the crankcase halves

- Undo the eight crankcase coupling screws.
- Separate the crankcase halves while keeping the crankshaft in one of these two halves.
- Only after the halves have been separated, can the crankshaft be checked.



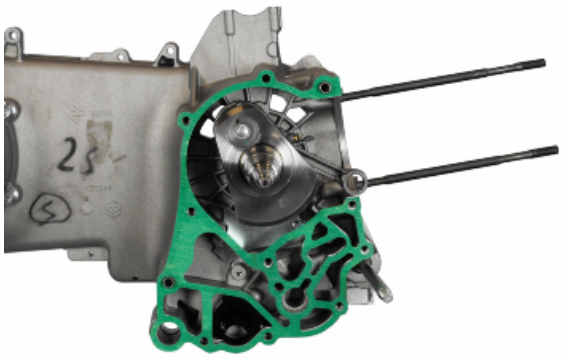
CAUTION

WHILE OPENING THE CRANKCASES AND REMOVING THE CRANKSHAFT, CHECK THAT THE THREADED SHAFT ENDS DO NOT INTERFERE WITH THE MAIN BUSHINGS. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BUSHINGS.

CAUTION

KEEP THE CRANKSHAFT IN ONE OF THE TWO HALVES OF THE CRANKCASE WHEN SEPARATING IT. IF YOU FAIL TO DO THIS, THE CRANKSHAFT MIGHT ACCIDENTALLY FALL.

- Remove the gasket and be careful with the alignment dowels.



Inspecting the crankshaft components

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankshaft alignment

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankcase halves

- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- On the transmission-side crankcase half, take particular care when handling the oil pump compartment and the oil ducts, the by-pass duct, the main bushings and the cooling jet on the transmission side.
- Take particular care, also, that there are no signs wear in the oil by-pass valve housing (see Chapter Lubrication), as this could prevent a good seal in the piston, which regulates the oil pressure.
- On the flywheel side crankcase half, take particular care cleaning the oil ducts for the main bushings, the oil duct for the jet that lubricates the cylinder head and the oil drainage duct at the flywheel side oil seal.
- Inspect the coupling surfaces on the crankcase halves for scratches or deformation, taking particular care with the cylinder/crankcase surfaces and the crankcase halves surfaces.
- Defects in the crankcase coupling gasket between the crankcase halves or the mating surfaces shown in the diagram, could cause a drop in the oil pressure lubricating the main bushings and connecting rod.
- Check the main bearing seats that limit axial clearance in the crankshaft show no signs of wear. The dimension between these seats is measured by way of the procedure described previously for measuring the crankshaft axial clearance and dimensions.

N.B.

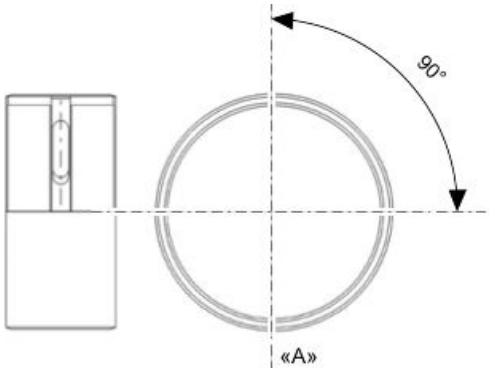
THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES PISTON CROWN COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAKS CAN CAUSE A CONSIDERABLE DROP IN THE LUBRICATION PRESSURE FOR MAIN BUSHINGS AND CONNECTING ROD.

N.B.

THE HEAD LUBRICATION CHANNEL IS PROVIDED WITH A SHUTTER JET; THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION; THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP. THE JET CLOGGING IMPAIRS THE HEAD LUBRICATION AND THE TIMING MECHANISMS. A JET FAILURE CAUSES A DECREASE OF THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.

Inspecting the crankshaft plain bearings

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure (3.2 bar) and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.



Characteristic

«A»

AXIS CYLINDER

- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.

N.B.

TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Coupling chart

N.B.

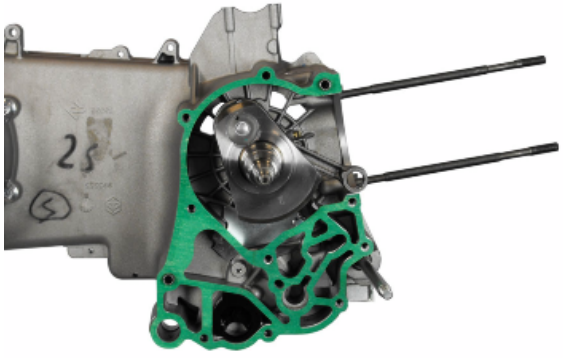
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

Refitting the crankcase halves

- Follow the removal steps but in reverse order; be careful to respect the prescribed tightening torques.
- Insert the by-pass.
- Insert a new gasket and be careful with the alignment dowels.
- Maintaining the crankshaft inserted in the flywheel side crankcase, couple the crankcase halves.
- Insert the screws and tighten to specified torque.



CAUTION

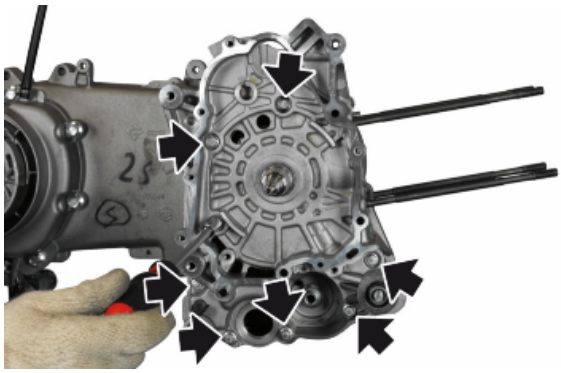
CAREFULLY CHECK THE CLEANING OF THE BY-PASS DUCT.
CHECK THAT THE PISTON SLIDES BY HAND, FREELY AND WITHOUT STICKING.

CAUTION

IT IS ADVISABLE TO INSERT THE CRANKSHAFT IN THE FLYWHEEL SIDE CRANKCASE HALF TO PREVENT, WITH ACCIDENTAL MOVEMENTS DURING INSERTION, THE OIL PUMP CONTROL TOOTHING FROM DAMAGING THE BUSHINGS.

Locking torques (N*m)

Engine-crankcase coupling screws 11 ÷ 13



- Complete the coupling operations with the verification of the crankshaft axial clearance.
- Using specific tools to support the dial gauge, verify that the fitting clearance is within the limits.
- Higher clearances are signs of wear of the crankshaft - crankcase supporting surfaces.

Characteristic

Crankshaft-crankcase axial clearance

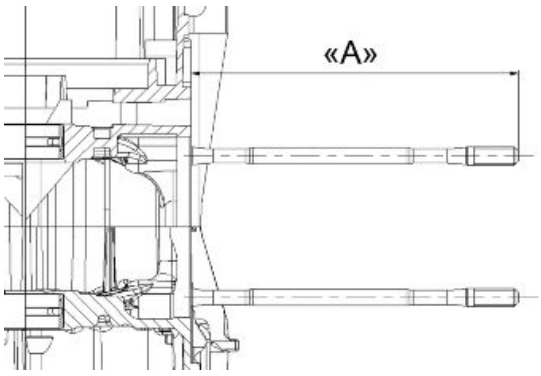
0.2 to 0.5 mm

Studs

- Using two nuts, fitted as nut and lock nut type, remove and then drive from the seat.
- Proceed with a thorough cleaning of the threaded seat on the crankcase.
- Screw the new stud bolts up to the driving depth indicated.

N.B.

NEW STUD BOLTS DO NOT NEED THREADLOCK, AS THEY COME EQUIPPED WITH SCOTCH-GRIP.



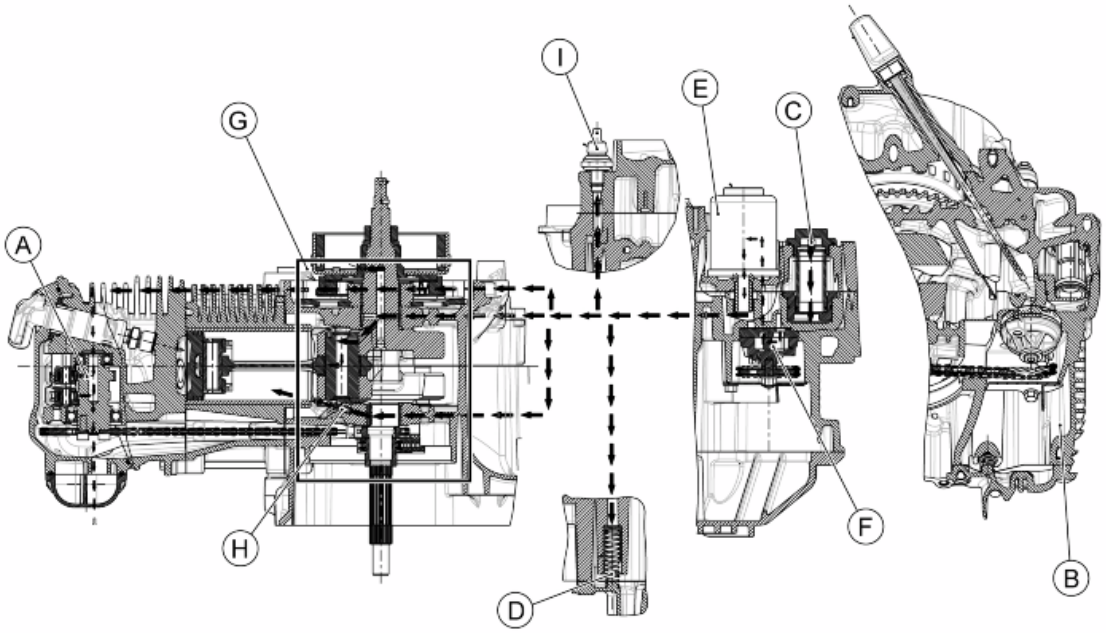
Characteristic

Driving depth of stud bolts «A»

170 mm+ 0.5

Lubrication

Conceptual diagrams



The lobe pump «**F**» sucks the oil from the sump, through the mesh pre-filter «**C**», it pushes it into the cartridge filter «**E**» where there is also a safety valve «**D**».
Through the suitable passages found in the crankcases, the oil enters the crank chamber «**G**» where the main bearings are lubricated and the big end (with high pressure), the piston pin and connecting rod small end via spray «**H**».
Subsequently the oil arrives at the timing system where it lubricates the camshaft «**A**» and from this, valves and rockers. The oil passes through the timing chain duct and returns to the sump «**B**» by gravity.
In the system there is a minimal oil pressure sensor «**I**» and a spray that serves to lubricate the stator «**L**».

Oil pressure check

- After removing the flywheel cover as described in the "Flywheel" chapter, remove the electric connexion of the minimum oil pressure switch and then remove the switch.
- With the engine idling at 1750 rpm and the oil temperature at ~90°C, check that the oil pressure is between 0.5 to 1.2 atm.
- With the engine idling at 5000 rpm and the oil temperature at ~90°C, check that the oil pressure is between 3.2 to 4.2 atm.
- Remove the appropriate tools once the measurement is complete, refit the oil pressure switch and washer, tightening it to the specified torque and fit the flywheel cover.
- If the oil pressure is not within the specified limits, in the following order, check: the oil filter, the oil by-pass valve, the oil pump and the crankshaft seals.

N.B.

THE CHECK MUST BE CARRIED OUT WITH OIL AT THE CORRECT LEVEL AND WITH AN OIL FILTER IN PROPER CONDITION.

Characteristic

Oil pressure

Operating pressure

- At 1750 rpm: (0.5 to 1.2)bar
- At 5000 rpm: (3.2 to 4.2)bar

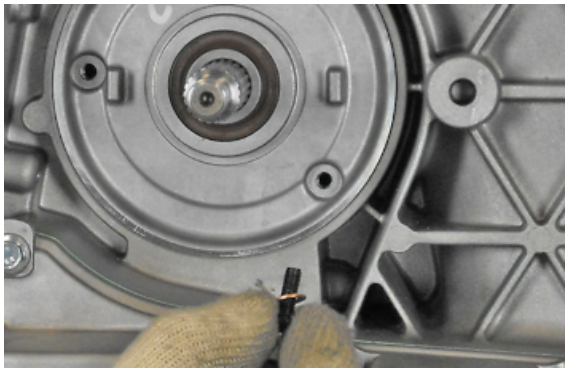
Locking torques (N*m)

Minimum oil pressure sensor **12 to 14**

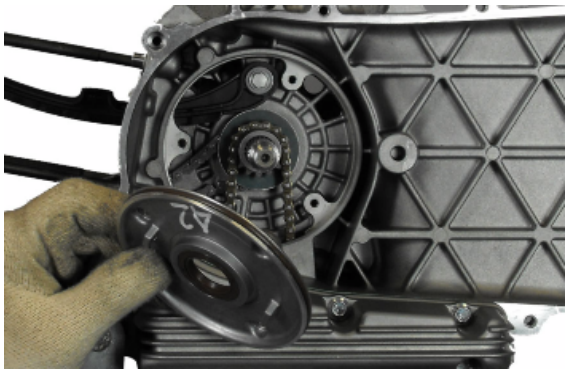
Crankshaft oil seals

Removal

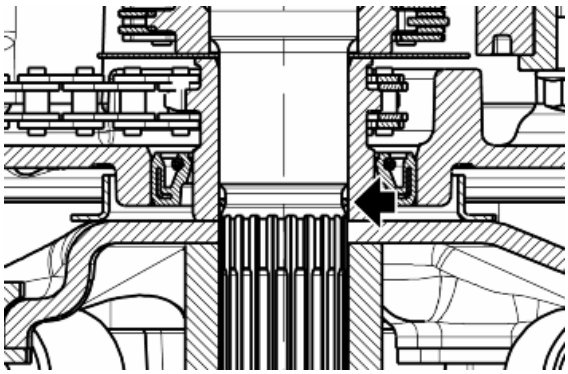
- Unscrew the three screws and remove them, complete with the copper gaskets.



- Using pliers remove the door by acting on the appendices.



- Remove the spacer and the O-ring.



Refitting

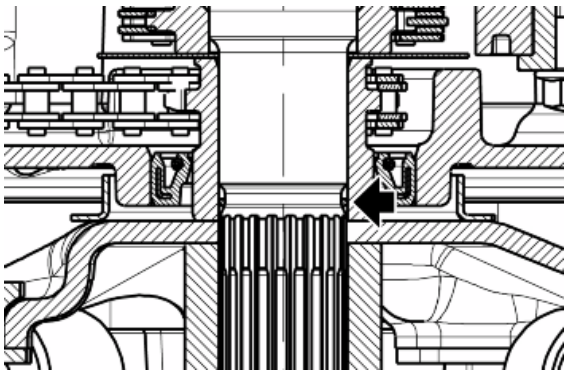
- Insert the components making sure to thoroughly grease the O-ring and the fork oil seal.
- Follow the steps in reverse order taking care to tighten to torque.

WARNING

IN ORDER TO PREVENT ABNORMAL FORMATIONS OF DIRT DUE TO THE RELEASE OF GREASE, WE RECOMMEND FIRST LUBRICATING THE SEAL RING STOPS WITH A BRUSH.

Locking torques (N*m)

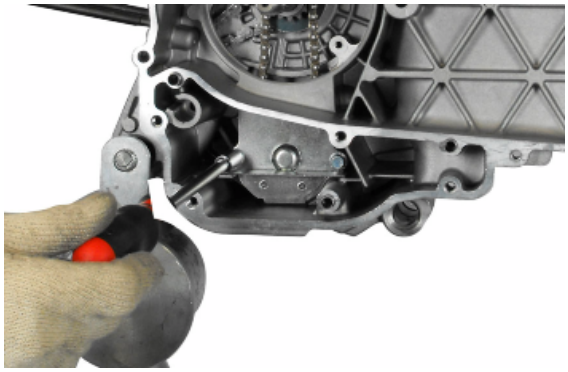
Crankcase timing cover screws 11 ÷ 13

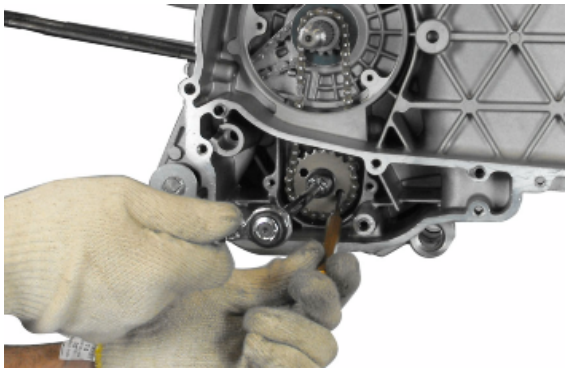


Oil pump

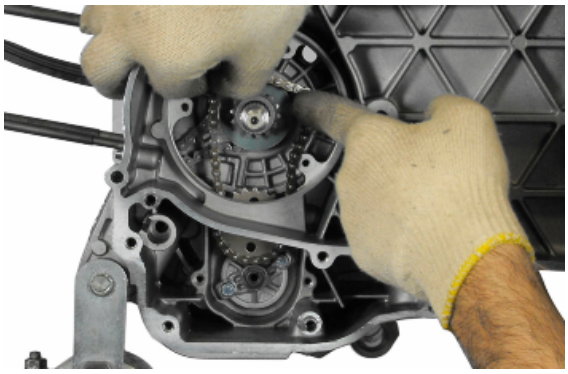
Removal

- Remove the oil sump and the by-pass.
- Remove the oil shield.
- Preventing rotation, unscrew the water pump command screw and collect the washer.

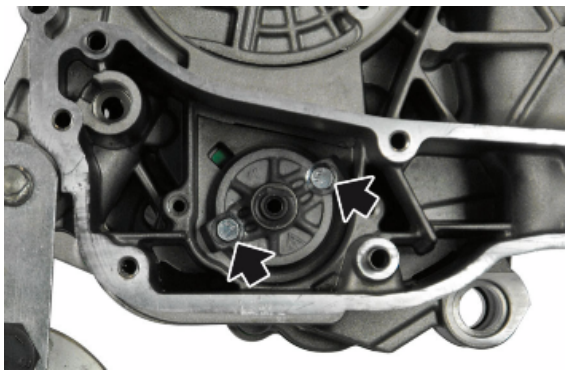




- Remove the oil pump command sprocket complete with chain.



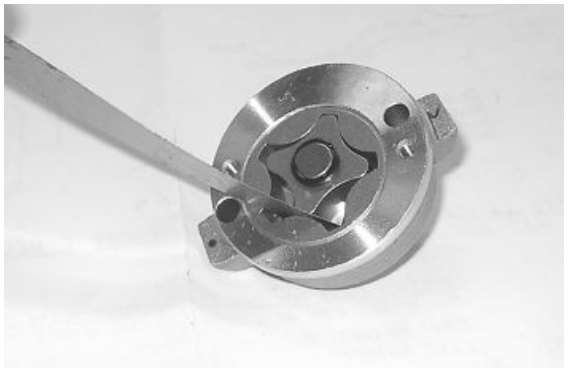
- Unscrew the two screws and remove the oil pump.

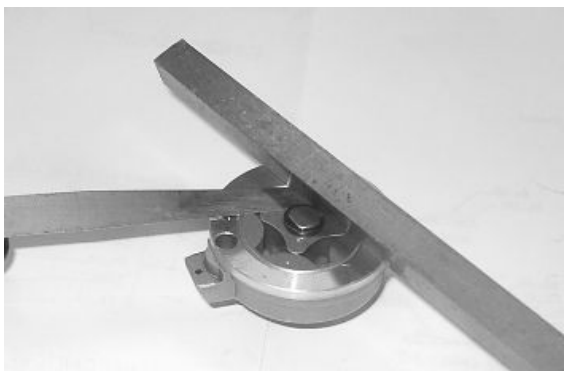


Inspection

- Remove the two screws and remove the oil pump cover.
- Remove and wash the rotors thoroughly with petrol and compressed air.
- Reassemble the rotors in the pump body, keeping the two reference marks visible.
- Using a feeler gauge, check the distance between the rotors in the position shown in the figure.
- Check the distance between the outer rotor and pump body, see figure.

Check the axial clearance of the rotors using a trued bar as shown in the figure.





Characteristic

Axial rotor clearance

Limit values admitted: 0.09 mm

Distance between the outer rotor and the pump body

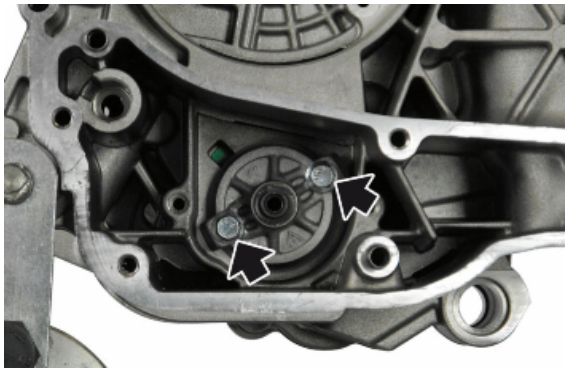
Admissible limit clearance: 0.20 mm

Distance between the rotors

Admissible limit clearance: 0.12 mm

Refitting

- Follow the steps in reverse order to the removal, tightening the screws to the specified torque.
- Insert the oil pump.
- Insert the control sprocket and the chain.



N.B.

FIT THE BELLEVILLE WASHER SO THAT ITS OUTER RIM TOUCHES THE PULLEY. MAKE SURE THAT THE PUMP TURNS FREELY.

Recommended products

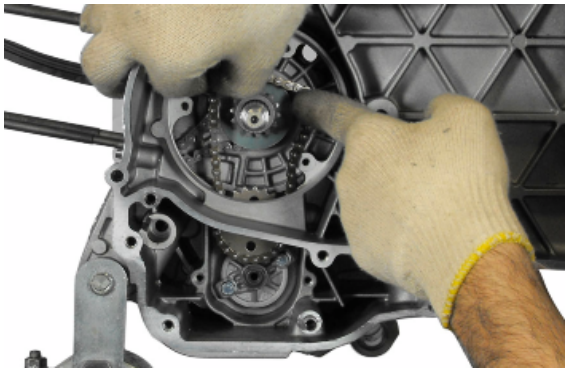
Loctite 243 Medium strength threadlock

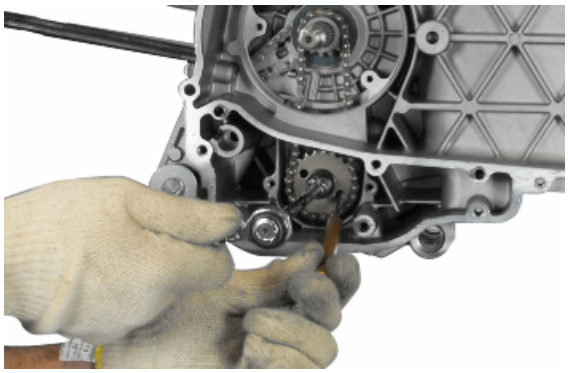
Medium Loctite 243 threadlock

Locking torques (N*m)

Screws fixing oil pump to the crankcase 5 to 6

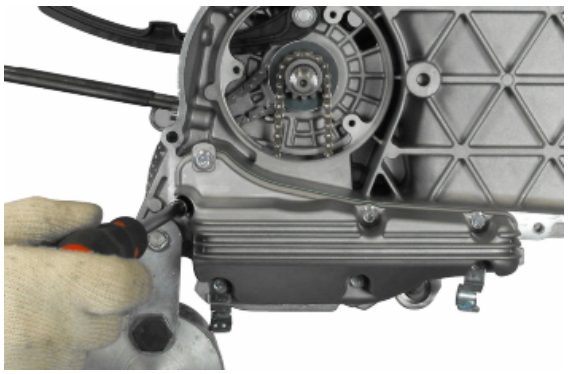
- Preventing rotation, tighten the water pump command screw complete with washer.

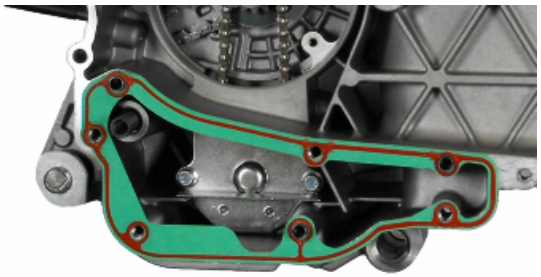


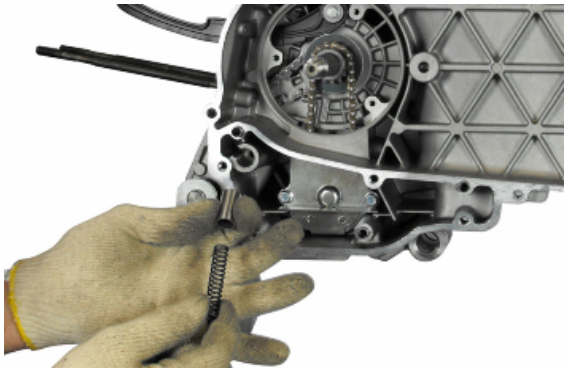


Removing the oil sump

- Remove the oil filler plug, the transmission cover, the complete drive pulley assembly with belt and the sprocket wheel, as described in the Transmission chapter.
- Drain the oil as described above.
- Remove the seven screws indicated in the figure with the two rear brake transmission retainer brackets.
- Remove the washers, the spring and the by-pass piston.







Inspecting the by-pass valve

- Check the unloaded spring length.
- Check that the small piston is not scored.
- Ensure that it slides freely on the crankcase and that it guarantees a good seal.
- If not, eliminate any impurities or replace defective parts.

Characteristic

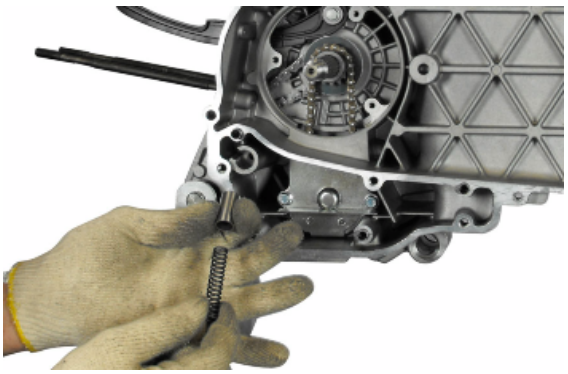
Standard length

52.4 mm

Piston standard diameter

12.861 + 12.843 mm

Refitting the oil sump



- Refit the by-pass piston in its housing.
- Insert the pressure-regulating spring.
- Fit a new sump seal.
- Refit the sump, taking care to locate the spring in the appropriate recess machined into the inside of the sump.
- Refit the rear brake transmission mounting brackets and the screws in the reverse order from which they were removed.
- Tighten the screws to the prescribed torque.
- Refit the driving pulley assembly, the drive belt, the sprocket wheel and the transmission cover, as described in the "Transmission" chapter.
- **When testing the lubrication system, refer to the "Crankcase and Crankshaft" chapter, regarding lubrication of the connecting rod assembly**

Locking torques (N*m)

Locking torque **11 to 13**

INDEX OF TOPICS

Precautions

Troubleshooting hints

1. An injection system fault is more likely to be caused by a connection than a component.

Before troubleshooting the system, carry out the following checks:

A: Electrical power supply

a. Battery voltage

b. Blown fuse

c. Solenoids

d. Connectors

B: Chassis ground

C. Fuel system

a. Broken fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty spark plug

b. Broken coil

c. Broken shielded cap

E: Intake circuit

a. Dirty air filter

b. Dirty by-pass circuit

c. Faulty Stepper motor

F: Other

a. Incorrect distribution timing

b. Wrong idle mixture

c.Incorrect reset of the throttle valve position sensor

2. EMS faults may be caused by loose connectors. Make sure that all connections are properly implemented.

Check the connectors taking into consideration the following point:

A: check that the terminals are not bent.

B: check that the connectors have been properly connected.

C. check whether the failure changes if the connector is slightly vibrating.

3. Before replacing the EMS ECU, check the whole system thoroughly. If the fault is fixed even by replacing the control unit, install the original control unit again and check if the fault occurs again.

4. Use a multimeter with an internal resistance over 10 KW/V for troubleshooting. Using unsuitable instruments may damage the ECU. The instruments to be preferred have a definition over 0.1V and 0.5W and an accuracy over ± 2%.

1. Before repairing any part of the injection system, check if any faults have been stored. Do not disconnect the battery before checking for faults.

2. The fuel supply system is pressurised at 250 kPa (2.5 BAR). Before disconnecting the fast-release fitting of the fuel supply pipe, check that there are no naked flames. Do not smoke. Act with caution to avoid spraying fuel to your eyes.

3. When repairing electric components, the battery must always be disconnected unless it is strictly necessary for the battery to be connected.

4. When carrying out functional tests, ensure that battery voltage is above 12V.

5. Before attempting to start the vehicle, ensure that there are at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.

6. If a long period is envisaged with the vehicle not in use, fill the tank to at least the halfway mark. This will ensure the pump will be covered by fuel.

7. When washing the vehicle, do not spray excessive water on electric components and wiring.

8. In the event of ignition problems, begin troubleshooting from the battery and the injection system connections.

9. Before disconnecting the ECU connector, perform the following steps in the order shown:

- Set the switch to «**OFF**»
- Disconnect the battery

Failure to respect this norm may damage the control unit.

10. Do not invert the poles when fitting the battery.

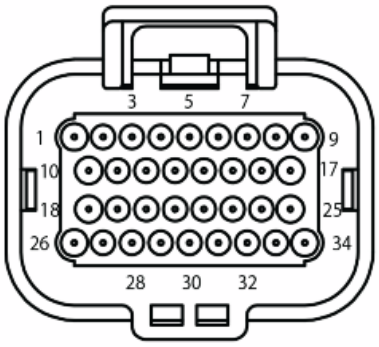
11. To avoid causing any damage, disconnect and reconnect the system connectors only if required. Before reconnecting, check that the connectors are dry.

12. When carrying out electric inspections, do not force the tester probes into the connectors. Do not take measurements not specifically foreseen by the manual.

13. At the end of every check performed with the diagnostic tester, remember to protect the system connector with its cap. Failure to observe this precaution may damage the control unit.

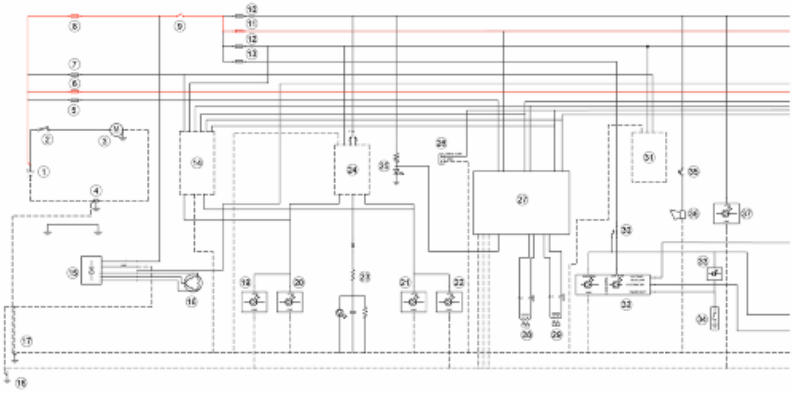
14. Before reconnecting the quick couplers of the power supply system, check that the terminals are perfectly clean.

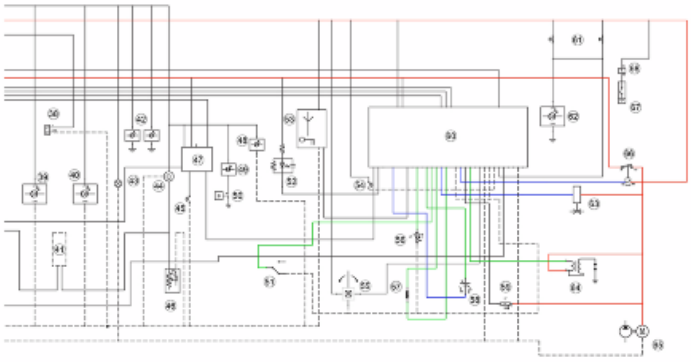
Terminals setup



1. H.V. coil
2. Boost
3. Overturn sensor
4. engine stop switch
5. Starter button
6. + Key
7. Ground lead 1
8. Stop buttons
9. + Battery
10. Start-up enabling switch
11. Lambda +
12. Lambda -
13. Engine temperature sensor
14. Immobilizer antenna
15. Sensor ground
16. K Line
17. Immobilizer
18. External temperature sensor
19. Sensor ground
20. Pick up -
21. NC
22. Injection load relay
23. Ground lead 2
24. Tyre pressure sensor
25. Injection telltale light
26. CAN H line
27. CAN L line
28. NC
29. Pick up +
30. NC
31. Oxygen sensor heater
32. ASR warning light
33. Lights ignition enabling
34. Injector

EMS circuit diagram





1. Battery
6. Fuse no. 2
8. Fuse No. 1
9. Ignition switch
11. Fuse No. 7
18. Rear ground node
51. engine stop switch
56. Engine temperature sensor
57. Pick up
58. Oxygen sensor
59. Oxygen sensor heater
60. Engine control unit
63. Injector
64. H.V. coil
65. Fuel pump
66. Injection load relay

Troubleshooting procedure

Engine does not start

ENGINE DOES NOT START IF ONLY PULLED

Possible Cause	Operation
Immobiliser enabling signal	System not encoded System not efficient, repair according to the indications of the self-diagnosis
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor
Fuel system	Fuel in the tank Fuel pump activation Fuel pressure (low) Injector capacity (low)
Power to spark plug	Shielded spark plug cap HV coil (secondary insulation)
Parameter reliability	Engine temperature Distribution timing - injection ignition Air temperature
End of compression pressure	End of compression pressure

Starting difficulties

ENGINE STARTER PROBLEMS

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature
Starter speed	Starter motor and solenoid Battery Ground connections
End of compression pressure	End of compression pressure
Power to spark plug	Spark plug Shielded cap HV coil Speed-timing sensor Ignition advance
Fuel system	Fuel pressure (low) Injector capacity (low) Injector sealing (poor)
Correctness of the parameters	Engine temperature Stepper throttle valve position intake air temperature (steps and actual opening) Cleaning of the auxiliary air pipe and throttle valve Air filter efficiency

Engine stops at idle

ENGINE DOES NOT IDLE/ IDLING IS UNSTABLE/ IDLING TOO LOW

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature
Ignition efficiency	Spark plug Ignition timing

Possible Cause	Operation
Correctness of the parameters	Throttle valve position sensor Stepper Engine temperature sensor Intake air temperature sensor
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Engine does not rev down

ENGINE DOES NOT RETURN TO IDLING SPEED/IDLING SPEED TOO HIGH

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature
Ignition efficiency	Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Engine temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Exhaust backfires in deceleration

EXHAUST BACKFIRES WHEN DECELERATING

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature Oxygen sensor
Correctness of the parameters	Throttle valve position sensor Stepper Engine temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Possible Cause	Operation
Exhaust system sealing (infiltrations)	Manifold - head Manifold - silencer silencer welding

Engine revs irregularly

ENGINE IRREGULAR PERFORMANCE WITH VALVE SLIGHTLY OPEN

Possible Cause	Operation
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing	Intake sleeve Filter box
Ignition system	Spark plug wear check
Parameter reliability	Throttle valve position signal Engine temperature signal Intake air temperature indicator Ignition advance
TPS reset successful	TPS reset successful
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature Oxygen sensor

Poor performance at full throttle

POOR ENGINE PERFORMANCE AT FULL POWER/ ENGINE IRREGULAR PERFORMANCE ON PICKUP

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature Oxygen sensor
Spark plug power supply	Spark plug Shielded cap HV cable HV coil
Intake system	Air filter Filter box (sealing) Intake sleeve (sealing)
Parameter reliability	Throttle valve position signal Engine temperature signal Intake air temperature indicator Ignition advance
Fuel system	Fuel level in the tank Fuel pressure Fuel filter Injector capacity

Engine knocking

PRESENCE OF KNOCKING (COMBUSTION SHOCKS)

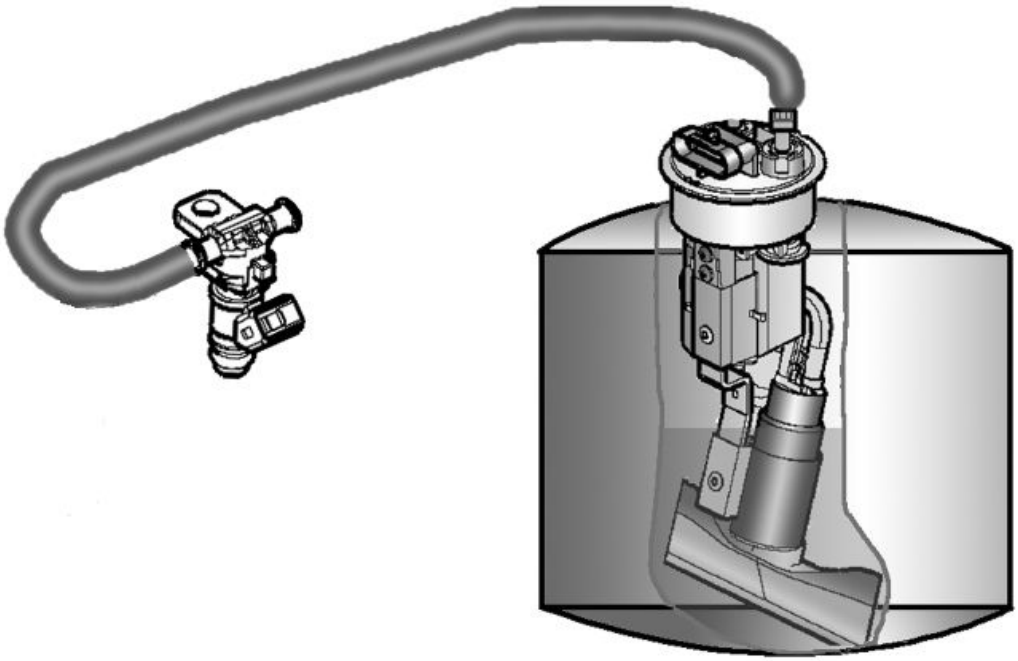
Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Engine temperature Oxygen sensor
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal Engine temperature signal Intake air temperature indicator Ignition advance
Intake system sealing	Intake sleeve Filter box
TPS reset successful	TPS reset successful
Fuel system	Fuel pressure Fuel filter Injector capacity Fuel quality
Selection of the cylinder base gasket thickness	Selection of the cylinder base gasket thickness

Fuel supply system

The fuel supply circuit includes the electric pump, the filter, the pressure regulator, the electro-injector and the fuel delivery pipes.

The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.



Refitting the injector

- The injector on this vehicle is a twin head injector with angle different to 90°, an incorrect positioning of the injector in the throttle body can cause serious malfunction; it must be observed that the pin of the spring is placed inside the recess in the injector body as shown in figure.

Removing the butterfly valve

Preventively remove:

- Left side fairing
- Right side fairing
- Air filter
- Rear suspension strut.

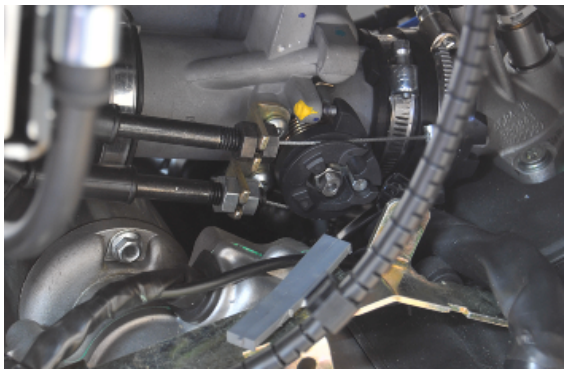
Slightly lift the rear part of the vehicle

CAUTION

DURING THE LIFTING OPERATIONS, PAY ATTENTION THAT THE CABLE HARNESS, TRANSMISSIONS AND PIPES ARE NOT TIGHTENED.

Unscrew the screw locking the clamp retaining the crankcase to the control unit cable harness.

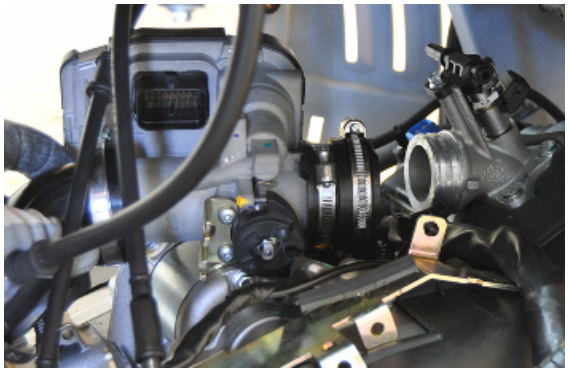
Loosen the adjustment nut and remove the throttle grip cables.



Disconnect the control unit connector.

Loosen the clamp fastening the throttle body to the manifold.

Remove the throttle body.



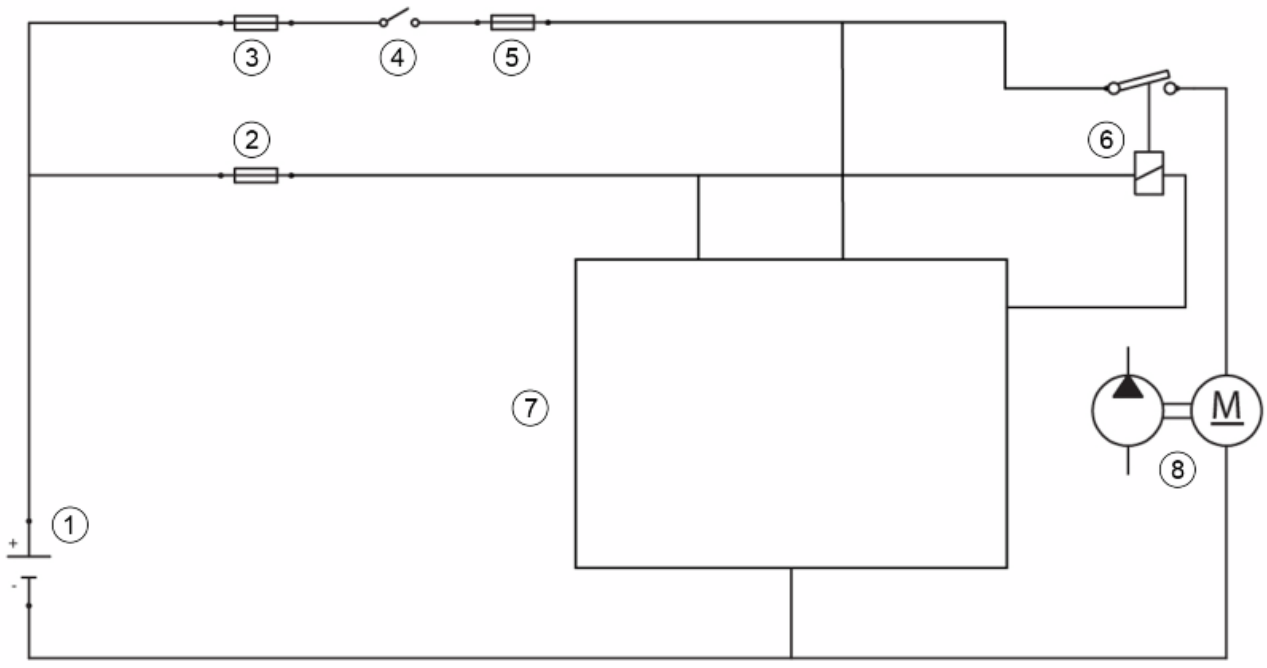
Refitting the butterfly valve

- To refit, perform the removal operations in reverse.

After the refitting proceed as follows

- Turn the ignition switch "ON"
- Wait 10 seconds
- Turn the ignition switch "OFF"
- Turn the ignition switch "ON"
- Wait 30 seconds
- Turn the ignition switch "OFF"
- Start the vehicle on the stand and keep it running for at least 5 minutes

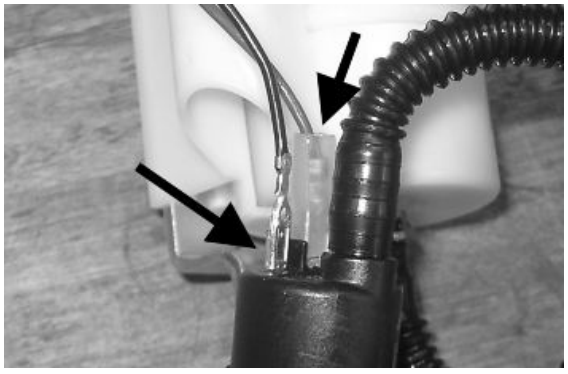
Pump supply circuit



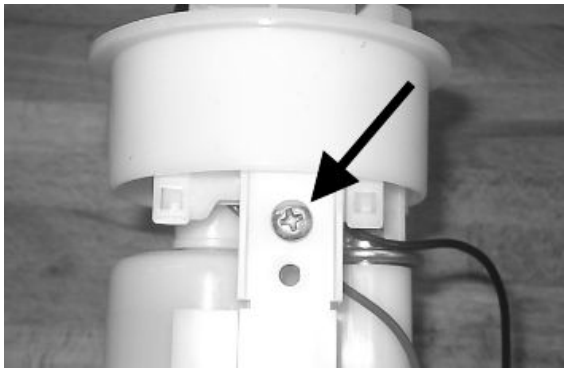
1. Battery
2. Fuse 2 - 10 A
3. Fuse 1 - 20 A
4. Ignition switch
5. Fuse 7 - 5 A
6. Injection load relay
7. Electronic control unit
8. Fuel pump

Fuel filter check

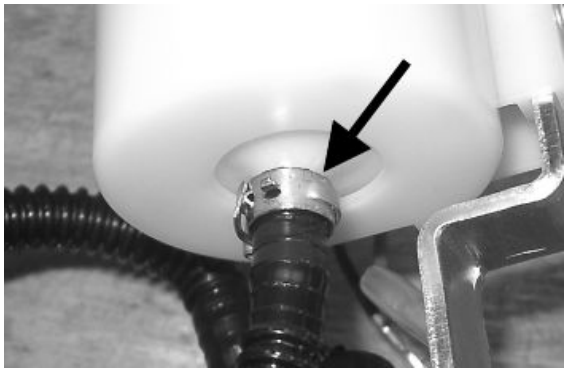
Disconnect the terminals from the electric pump



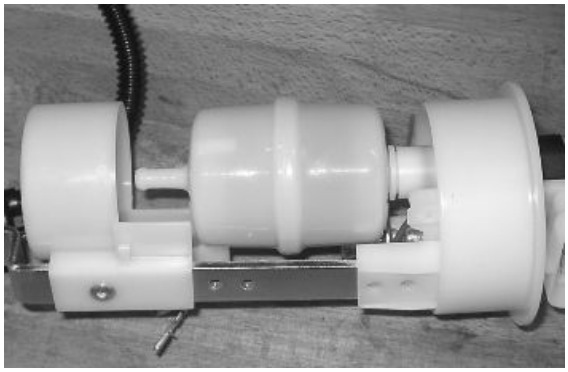
Remove the screw shown in the picture



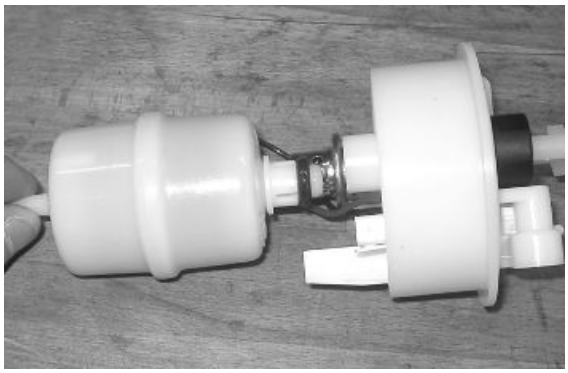
Remove the clip fixing the piping to the filter shown in the picture



Separate the lower part of the pump mounting as shown in the picture.



Remove the filter from the pump mounting



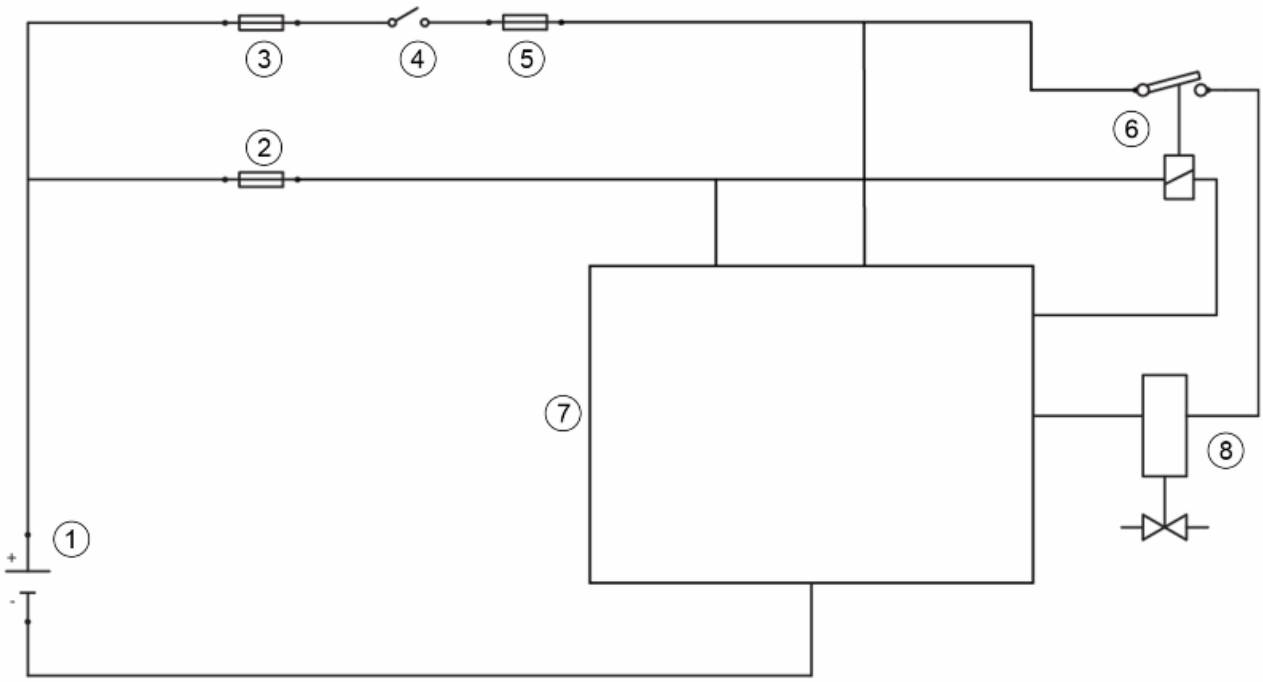
FITTING

For the fitting proceed in reverse order paying attention to the fitting angle of the pump flange in the tank

CAUTION

DURING THE FITTING OF THE FUEL PUMP IN THE TANK PAY ATTENTION TO THE FITTING ANGLE OF THE FLANGE.

Inspecting the injector circuit



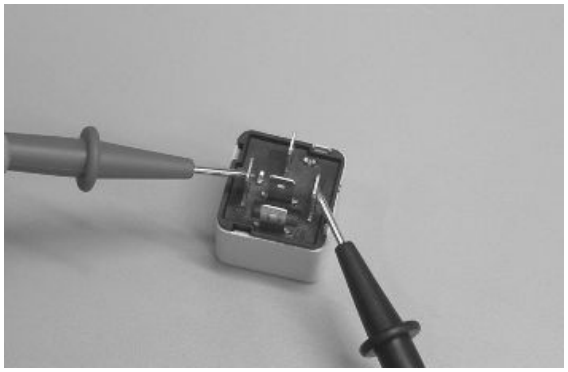
1. Battery
2. Fuse 2 - 10 A
3. Fuse 1 - 20 A
4. Ignition switch
5. Fuse 7 - 5 A
6. Injection load relay
7. Electronic control unit
8. Injector

Check the resistance at the injector ends: 14.5 ± 5% Ohm

Check function of fuses No. 1, 2 and 7 for the ECU and injection load relay.

Check functionality of the injection load relay, also located behind the front grille: check the resistance of the energising coil between pins 86 and 85: 40 - 80 Ohm

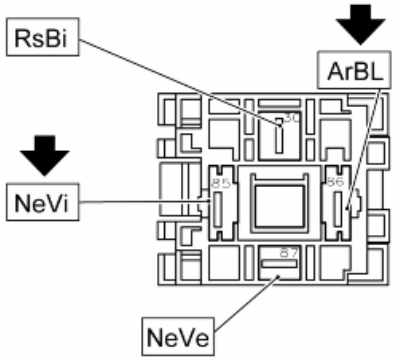
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the relay.



WARNING

TO INDICATE THE RELAY OF THE DESIRED FUNCTION, REFER TO THE PIN-CABLE COLOUR RELATIONSHIP WITH THE ATTACHED ELECTRIC SYSTEM DIAGRAM.

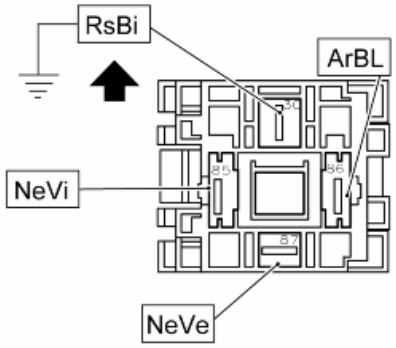
Check the power supply line of the injection load remote control energising coil: after switching to "ON", make sure there is battery voltage, for 2 seconds, between the Orange-Blue cable and Black-Purple cable of the solenoid base. Otherwise check the continuity of the Orange-Blue cable between the fuse-box and the relay base and of the Black-Purple cable between pin 22 of the control unit and the relay base.



N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (RELAYS, CONTROL UNIT, FUSES ETC.).

Check the presence of fixed voltage between the Red-White cable of the relay base and ground. Otherwise, check the continuity of the Red-White cable between the fuse-box (No. 02 10 A) and the relay base.



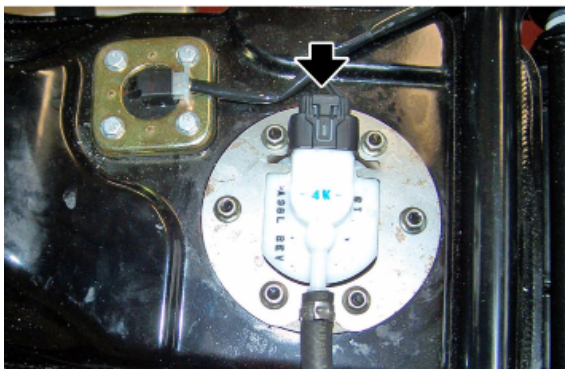
N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (RELAYS, CONTROL UNIT, FUSES ETC.).

See also

Fuses

Check, on switching to "ON", that there is battery voltage, for about two seconds, to the Black-Green cable of the pump connector and ground with pump connector disconnected. Otherwise, check the continuity of the Black-Green cable between the pump connector and the relay base.

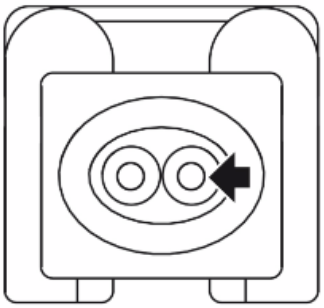


Verificare l'efficienza della linea di massa della pompa carburante misurando la continuità tra cavetto nero connettore pompa, lato impianto, e massa.

Specific tooling

020331Y Digital multimeter

Switch to «ON» and check if there is voltage, with injector disconnected and control unit connected, between the Black-Green cable of the injector connector and the ground lead



With injector disconnected and the injector load relay disconnected, check the continuity of the Black-Green cable between the injector connector and relay base.

Inspecting the injector hydraulics

- Remove the engine from the vehicle as described in the corresponding chapter.
- Remove the injector by unscrewing the screw fixing the injector to the head.

Install the specific tool to check the fuel pressure and position the manifold on a graduated container of at least 100 cm³.
Connect the injector to the wire supplied with the injection tester.
Connect the clamps of the cable to an auxiliary battery.
Activate the fuel pump with the active diagnosis.
Check that, within fifteen seconds, approximately 40 cm³ of fuel is dispensed with an adjustment pressure of approximately 2.5 Bar.

Specific tooling

020480Y Petrol pressure check kit

Tachometer

Disconnect the fuel pipe connector. Start up the engine and wait for it to stop. With the wiring connected to the control unit and system try to start up the engine and check that the voltage between pin 20 and 29 is around 2.8 V

- Check the continuity between pin 29 of the injection control unit and the red cable of the engine speed sensor.
- Check the continuity between pin 20 of the injection control unit and the brown cable of the engine speed sensor.

- Check that the pins 20 and 29 of the control unit are insulated from each other and insulated from the ground.

Specific tooling

020331Y Digital multimeter

INDEX OF TOPICS

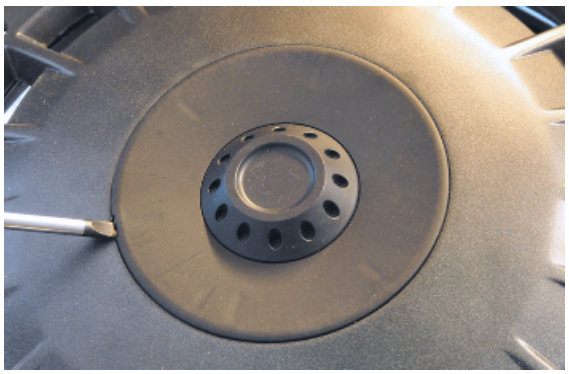
Sospensioni anteriore

This section is dedicated to operations that can be carried out on the suspensions.

Front

Removing the front wheel

Remove the plastic cover levering in the appropriate slit.

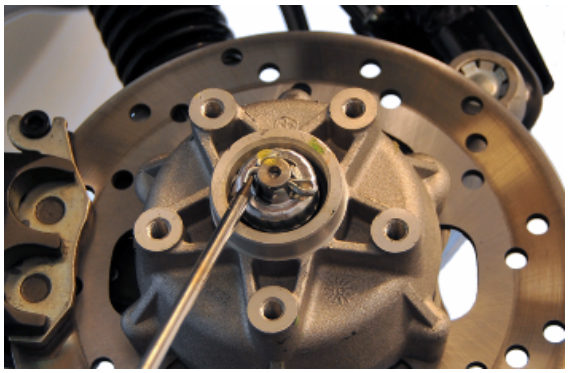


Undo the screws fixing the wheel to the wheel hub.

Front wheel hub overhaul

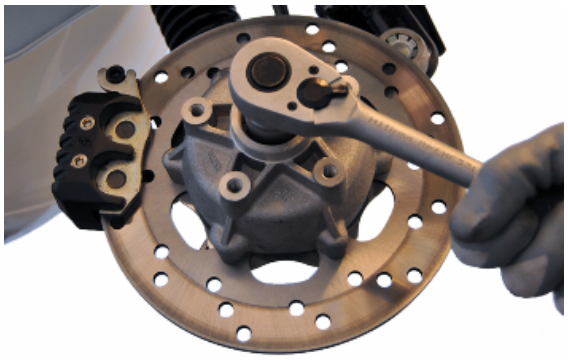
WHEEL HUB REMOVAL

- Remove the front wheel.
- Remove the front brake calliper.
- Remove the cotter pin.

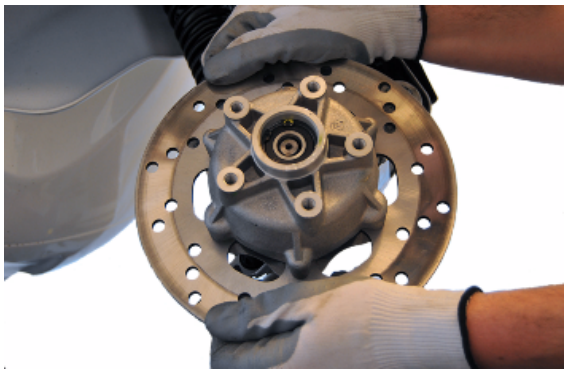


- Remove the nut cover.

- Remove the nut of the wheel axle.



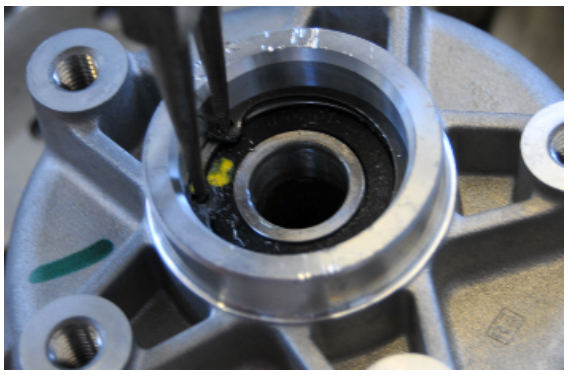
- Remove the wheel hub.



WHEEL HUB SERVICE

If, due to an excessive clearance, it is necessary to replace the bearings, proceed as follows.

- Remove the retainer ring of the bearing.



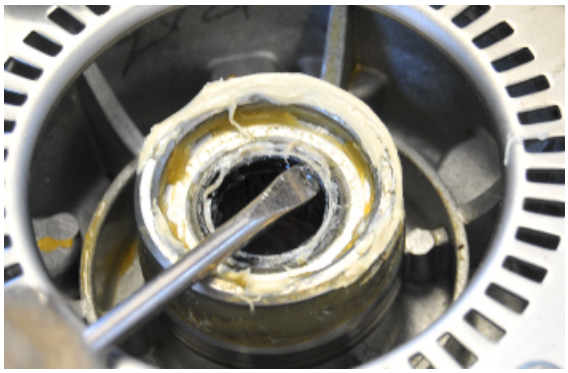
- With the extractor and the bell remove the bearing on the outside.

Specific tooling

001467Y009 Bell for OD 42-mm bearings

001467Y013 Calliper to extract ø 15-mm bearings

- Remove the oil seal of the bearing on brake disc side.



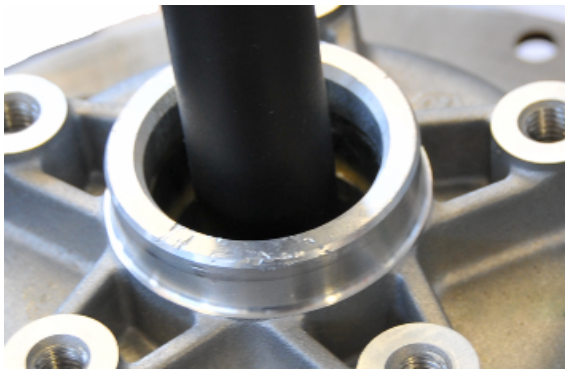
- Remove the bearing using the guide, the adaptor and the handle.

Specific tooling

020363Y 20-mm guide

020456Y Ø 24 mm adaptor

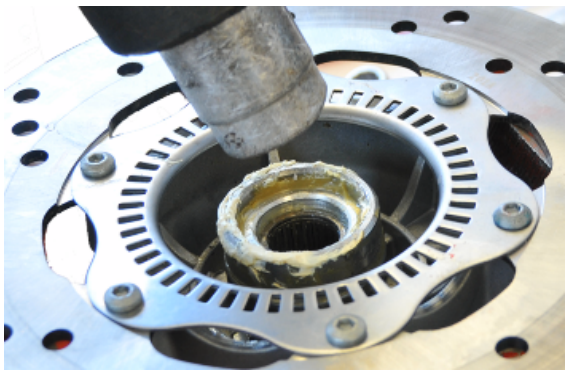
020376Y Adaptor handle



- With a specific gun heat the seat of the bearing on the brake disc side.

Specific tooling

020151Y Air heater



- Use guide, adaptor and handle to drive the bearing into its seat as far as it will go and insert the oil seal.

Specific tooling

020363Y 20-mm guide

020357Y 32 x 35-mm Adaptor

020376Y Adaptor handle

- Heat the seat of the bearing from the opposite side of the brake disc.

Specific tooling

020151Y Air heater

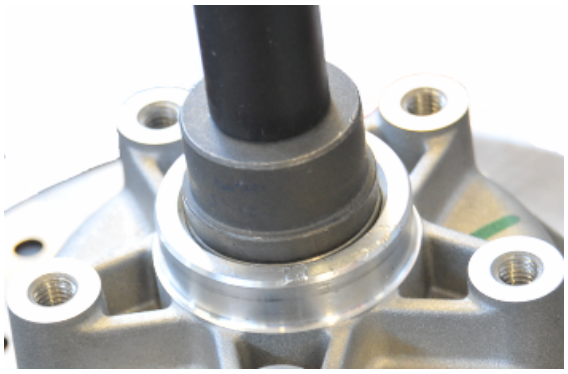
- Drive the bearing in the seat as far as it will go using the guide, the adaptor and the handle.

Specific tooling

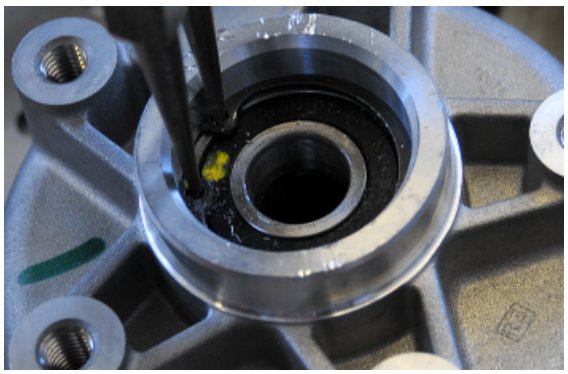
020412Y 15-mm guide

020357Y 32 x 35-mm Adaptor

020376Y Adaptor handle

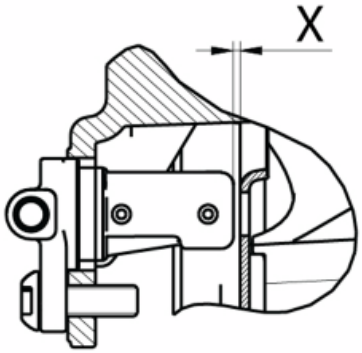


- Insert the retainer ring.



Refitting the front wheel

- Proceed with the operations in the reverse order, paying attention to the tightening torques and check the distance between front speed sensor and tone wheel. In the event that it is not correct, insert a washer of 0.6 ± 0.05 mm between ABS sensor and support until reaching the correct value.



Characteristic

Tone wheel distance - Sensor X

0.9 ÷ 1.2 mm

Locking torques (N*m)

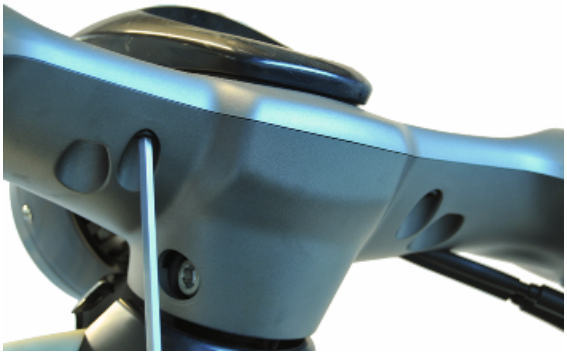
Front wheel axle nut 74 to 88 **Front wheel to hub fixing screws** 20 to 25

Handlebar

Removal

Preventively remove:

- the leg shield back plate
- The footrest
- The mirrors
- The connectors of the instrument panel, headlights and electrical devices
- Release the cable harness of the instrument panel, headlights and electrical devices.
- Undo the screws indicated.



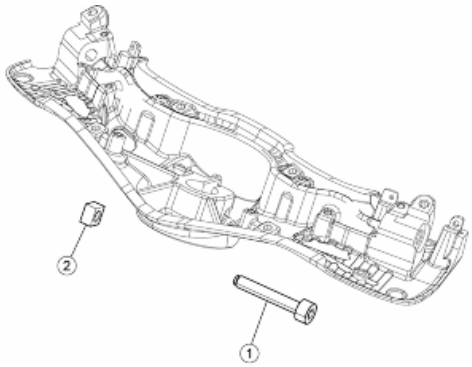
- Remove the front handlebar cover complete with the light unit and the instrument panel.
- Remove the cables of the accelerator.

- Remove the brakes piping paying attention to the brake fluid drainage.
- Remove the front and rear brake pumps.
- Undo the screw indicated and remove the rear handlebar cover.

Refitting

- Proceed with the operations in the reverse order, observing the tightening torques and paying attention to the correct passage of the cables, the piping and the cable harness.

THE FIXING SCREW OF THE HANDLEBAR ON THE STEERING PIPE «1» AND THE NUT «2» MUST BE REPLACED AT EVERY REMOVAL.



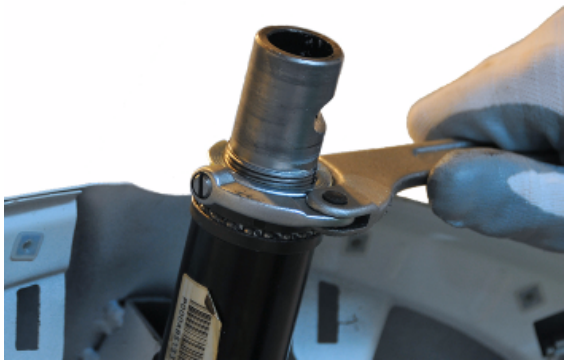
Locking torques (N*m)

Handlebar locking screw 40 to 45

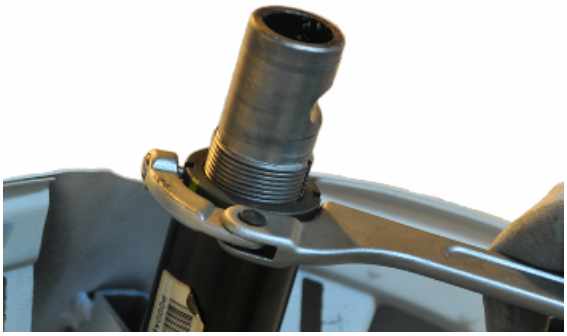
Steering column

Removal

- Remove the handlebar
- Remove the front wheel
- Remove the piping of the front brake calliper
- Remove the front speed sensor
- Remove the upper ring nut



- Remove the lower ring and the upper ball bearing
- Slide off the steering pipe from the headstock.



Overhaul

If you have to replace the bearings, due to an excessive clearance, proceed as follows:

- Remove the lower steering bearing using the extractor.

Specific tooling

020004Y Punch for removing steering bearings from headstock

- Insert the new lower steering bearing.

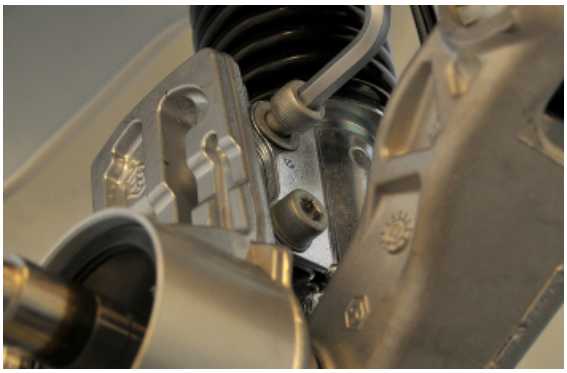
Refitting

- For the removal operations, proceed in reverse order.

Front shock absorber

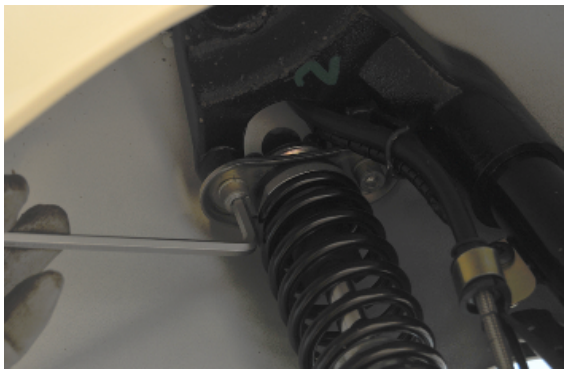
Removal

- Support the vehicle adequately
- Remove the wheel hub
- Loosen the shock absorber lower clamps and remove the brake calliper shock absorber mounting.



- Loosen the screws fixing the front brake pipe retainer clamp and the front speed sensor cable in order to reach the upper clamps.

- Unscrew the upper fixing nuts and remove the shock absorber.



Refitting

To refit, carry out the removal operations in reverse order, observing the prescribed tightening torques.

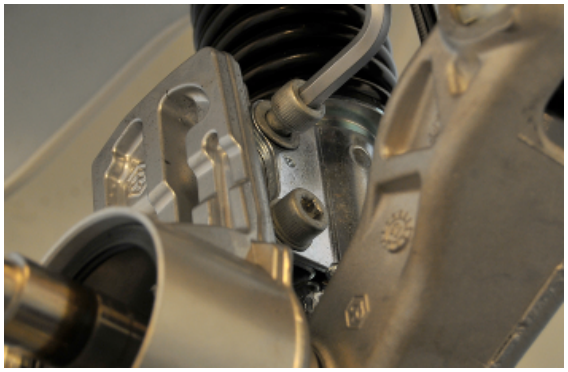
Locking torques (N*m)

Lower shock absorber clamp 19 to 26 Upper shock absorber retainer 20 to 25

Shock-absorber - calliper bracket

Removal

- Remove the front wheel hub
- Remove the front shock absorber lower clamps



- Remove the bracket locking Seeger ring
- Unscrew the bracket

Overhaul

- The bracket for the shock absorber -calliper attachment has two roller bearings separated one from the other as shown in the photograph

- Remove the two roller bearings from the bracket with the specific tool operating on the shock absorber attachment side as shown in the photograph

Specific tooling

020376Y Adaptor handle

020441Y 26 x 28 mm adaptor

020365Y 22 mm guide

- Remove the oil seal on the wheel hub side.

- Suitably hold the brake calliper - shock absorber attachment bracket
- Fit a new oil seal and move it until it stops using the specific tool

Specific tooling

020376Y Adaptor handle

020360Y 52 x 55-mm Adaptor

- Assemble a new roller bearing on the shock absorber side and move it until it stops using the specific tool.

Specific tooling

020365Y 22 mm guide

020375Y 28 x 30 mm adaptor

020376Y Adaptor handle

- Suitably hold the brake calliper - shock absorber - brake calliper.
- Assemble a new roller bearing on the wheel hub side and move it until it stops using the specific tool.

Specific tooling

020365Y 22 mm guide

020375Y 28 x 30 mm adaptor

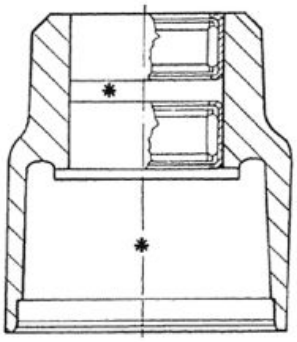
020376Y Adaptor handle

Refitting

- Refit the parts in reverse order of the removal operation.

CAUTION

BEFORE CARRYING OUT REFITTING OPERATIONS IN THE AREAS MARKED WITH AN ASTERISK, LUBRICATE THEM WITH THE RECOMMENDED PRODUCT



Specific tooling

020036Y Punch

020037Y Punch

Recommended products

AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

TL 9150 066, NATO G 460 symbol

Rear

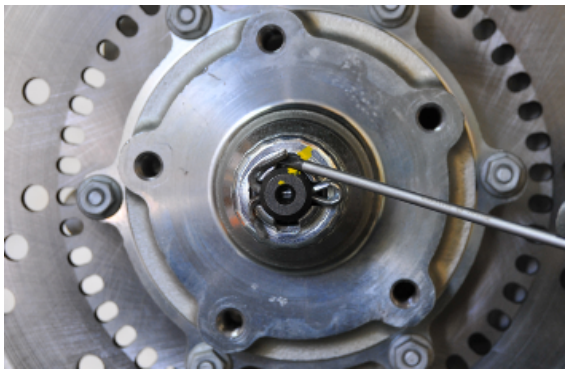
Removing the rear wheel

- Remove the silencer.
- Remove the cover of the wheel pin nut.

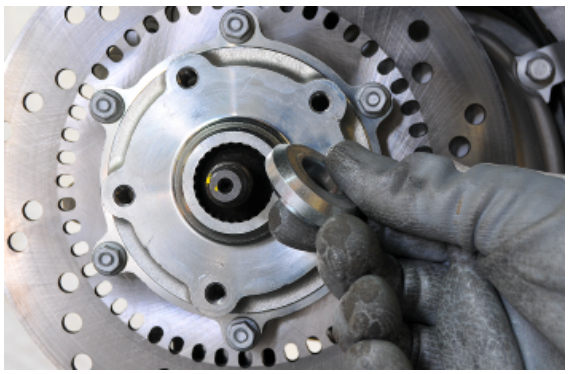
- Unscrew the indicated screws and remove the rear wheel.

WHEEL HUB REMOVAL

- Remove the rear brake calliper.
- Remove the cotter pin.



- Remove the cover of the wheel hub nut and unscrew the nut.
- Remove the wheel hub paying attention to the present thickness.

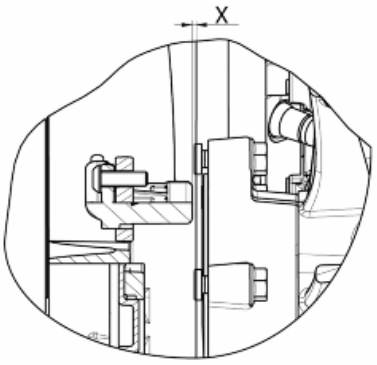


Refitting the rear wheel

WHEEL HUB ASSEMBLY

Carry out the operations in the reverse order, observing the prescribed tightening torques

- Check the distance between the front speed sensor and the tone wheel, in the event that it is not correct, insert a washer of 0.3 ± 0.05 or 0.6 ± 0.05 between ABS sensor and support until reaching the correct value.



Characteristic

Tone wheel distance - Sensor X

0.9 ÷ 1.2 mm

Locking torques (N*m)

Rear wheel hub nut 104 to 126

- Tighten the screws fixing the wheel to the hub.

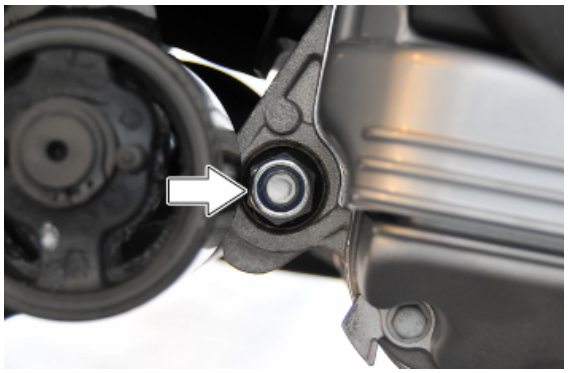
Locking torques (N*m)

Rear wheel to hub fixing screws 20 to 25

Swing-arm

Removal

- Support the vehicle adequately.
- Unscrew the nut of the engine swinging arm pin and remove the pin.



- Unscrew the nut of the engine swinging arm - chassis swinging arm pin and remove the pin.

- Unscrew the nut of the chassis swinging arm pin and remove the pin.

- Remove the seeger ring locking the silentblock.

- Undo the fixing screw of the silentblock bracket and remove the bracket.

Overhaul

Proceed with the service if there is an excessive clearance of the motor regarding the body.

- Remove the plastic thickness of the swinging arm on the chassis side.

- Remove the axis of the swinging arm on the frame side.

- Remove the bearings from both sides of the swinging arm using an extractor and bell.

Specific tooling

001467Y010 Driver for OD 25 mm bearings

001467Y013 Calliper to extract ø 15-mm bearings

- Remove the plastic thickness of the swinging arm on the engine side.

- Remove the axis of the swinging arm on the engine side.

- Remove the bearings from both sides of the swinging arm using an extractor and bell.

Specific tooling

001467Y010 Driver for OD 25 mm bearings

001467Y008 Pliers to extract 17 mm ø bearings

- Remove the silentblock from the bracket using an appropriate extractor.

Specific tooling

020271Y Tool for removing-fitting silent bloc

- Place the silentblock in the bracket using the specific tool.

Specific tooling

020271Y Tool for removing-fitting silent bloc

For both bearings of the swinging arm on the engine side proceed as follows:

- Use handle and guide to drive the bearing into its seat.

Specific tooling

020439Y 17-mm guide

020456Y Ø 24 mm adaptor

020376Y Adaptor handle

For both bearings of the swinging arm on the frame side proceed as follows:

- Use handle, adaptor and guide to drive the bearing into its seat.

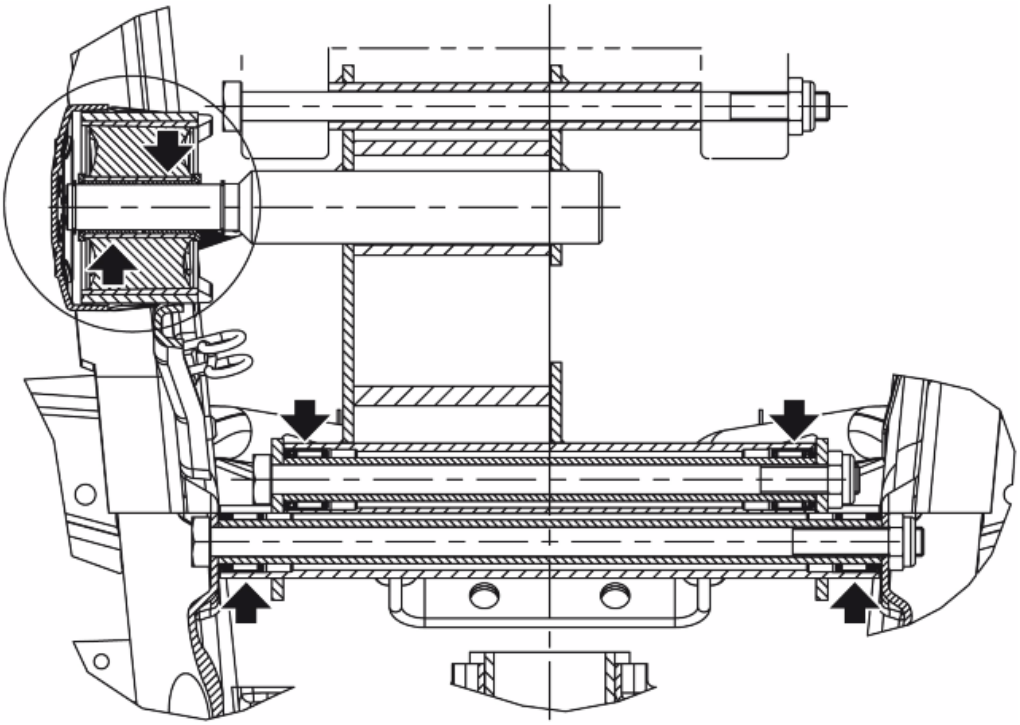
Specific tooling

020412Y 15-mm guide

020456Y Ø 24 mm adaptor

020376Y Adaptor handle

- Insert the axis into the swinging arm on the engine side and then insert the thickness.
- Insert the axis into the swinging arm on the frame side and then insert the thickness.
- Grease in the points indicated by arrows.



Refitting

- Proceed the removal operations but in the reverse order, observing the prescribed tightening torques.

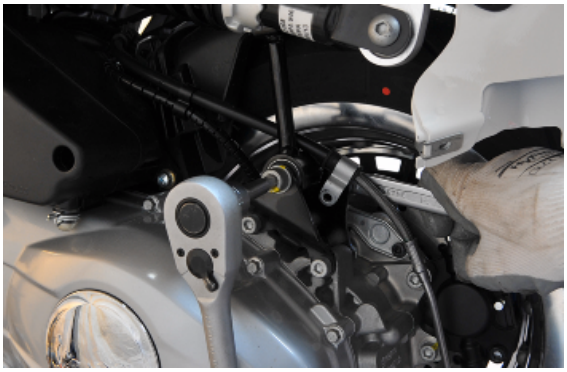
Locking torques (N*m)

Silent block bracket screw 42 to 52 swinging arm to engine - frame pin locknut 76 to 83 Swinging arm to frame pin locknut 40 to 45 Engine-swinging arm pin 40 to 45

Shock absorbers

Removal

- Support the vehicle adequately.
- Undo and remove the screw fixing the strut to the bracket.



- Unscrew the fixing screw of the shock absorber to the linkage.

- Unscrew the screw fixing the strut to the linkage of the shock absorber.

- Unscrew the lock-nut of the linkage pin and slide the pin from the opposite side.

- Unscrew the screws fixing the shock absorber to the body.

Refitting

Proceed the removal operations but in the reverse order, observing the prescribed tightening torques.

REAR SHOCK ABSORBER TIGHTENING TORQUES

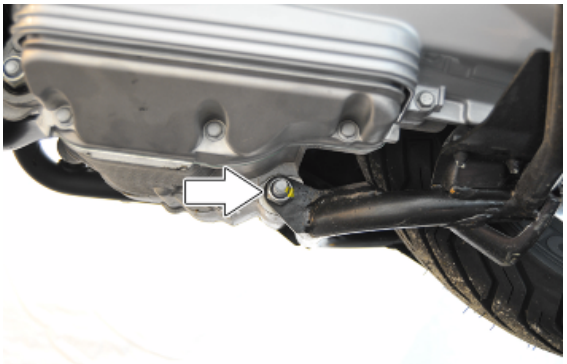
Name	Torque in Nm
Fixing screws upper shock absorber	20 to 25
Shock absorber to linkage fixing screw	67 to 73
Lock-nut of the linkage	81 to 90
Strut to linkage fixing screw	67 to 73
Strut to bracket fixing screw	67 to 73
Screws fixing bracket to crankcase	20 to 25

Centre-stand

REMOVAL CENTRE STAND

- Support the vehicle adequately.
- Remove the two stand return springs.

- Unscrew the nut fixing the stand to the engine and remove the pin from the opposite side.



FITTING CENTRE STAND

- To refit, proceed in reverse order, observing the prescribed tightening torques.

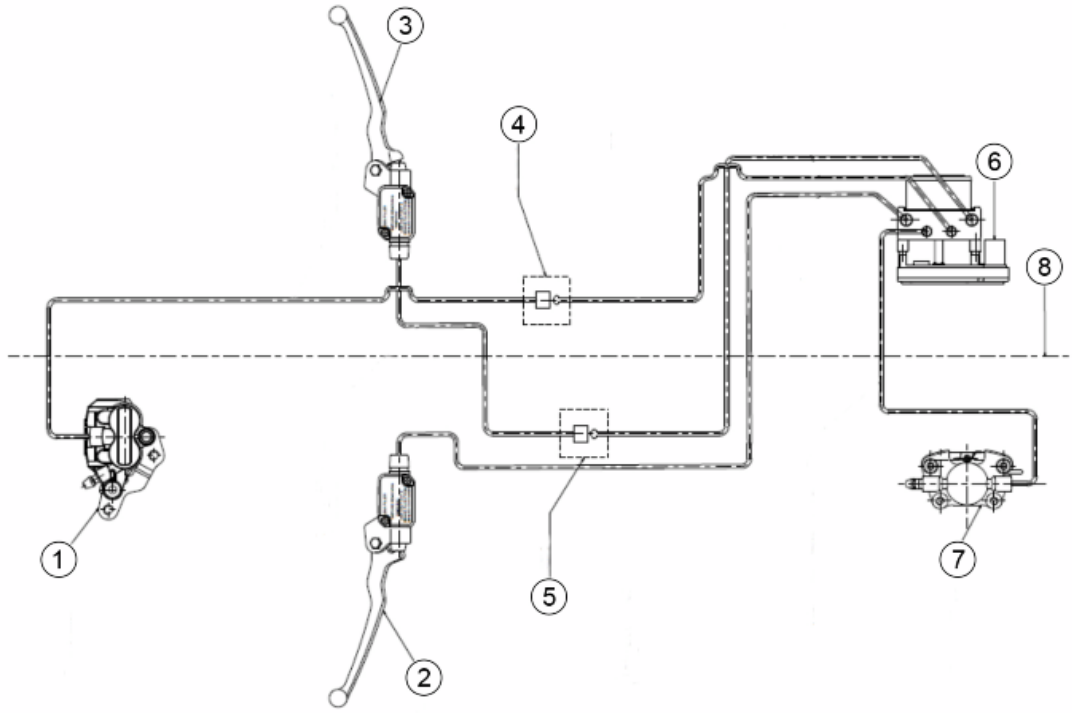
Locking torques (N*m)

Centre stand axis nut 40 to 45

INDEX OF TOPICS

ABS

Operating diagram



1. Front brake calliper

2. Rear brake pump

3. Front brake pump

4. Right joint

5. Left joint

6. ABS Modulator

7. Rear brake calliper

8. Vehicle centre

Guide to diagnosis

At each key **ON**, if at least one current or memorised system error is not identified:

-the ABS warning light flashes.

When exceeding 5 km/h:

-if no errors are detected the ABS warning light turns off

-if at least one malfunction is detected, the ABS warning light turns on permanently.

The ABS system is disabled!

The system is still fully functional like any other brake system without ABS.

The detection of malfunctions may require more or less time depending on the type of fault.

Following the detection logic one or more conditions must persist within a certain time to detect errors. If during this time one of the conditions is lost and then reappears, the timer is reset and the system is not able to detect the fault.

The ABS system continues to be inactive.

GUIDE TO ABS FAULT DIAGNOSIS

1. ABS LAMP ON

2. CONNECT THE DIAGNOSTIC TOOL

- DOES THE DIAGNOSTIC TOOL COMMUNICATE? (NO, go to point 3; YES, go to point 4)

3. PERFORM THESE CHECKS:

A. Ground PIN 7 and PIN 23

B. +12V at PIN 9

C. +12V at PIN 6 with key «ON»

4. ARE THERE ANY ERRORS? YES, go to point 5; NO, go to point 6)

5. CONSULT THE ERRORS DISPLAY TABLE

6. ABS WARNING LIGHT ACTIVATION

IS IT ACTIVATED?(YES, go to point 7; NO, go to point 8)

7. CONTACT TECHNICAL SERVICE

8. PERFORM THESE CHECKS:

A. Continuity cable between PIN 8 of the ABS control unit connector and PIN 3 of the connector «A» of the instrument panel.

B. Check the connectors - refer to the operations described in this chapter.

If the above checks are OK, the causes can be:

C. ABS control unit malfunction

D. Instrument panel malfunction

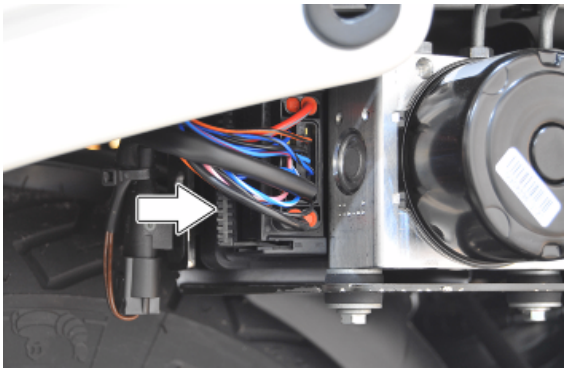
Modulator

N.B.

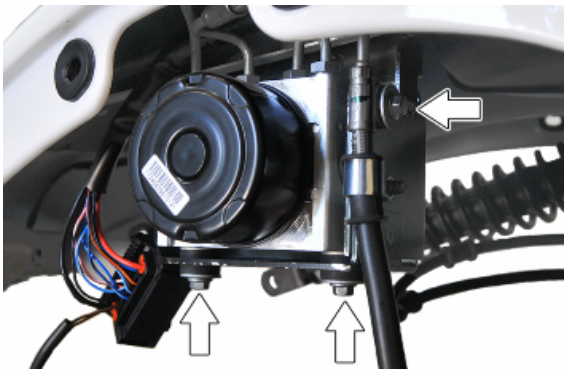
IN THE EVENT OF MALFUNCTION OF THE ABS SYSTEM, IT IS NECESSARY TO REPLACE THE ENTIRE MODULATOR THAT IS PROVIDED FOR THE BRAKES FLUIDS NECESSARY FOR THE OPERATION.

MODULATOR REMOVAL

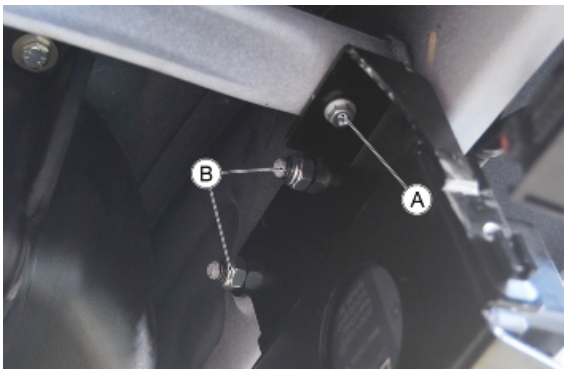
- Remove the right side fairing and the left side fairing.
- Disconnect the connector of the ABS control unit.



- Undo the screws fixing the control unit to the bracket.



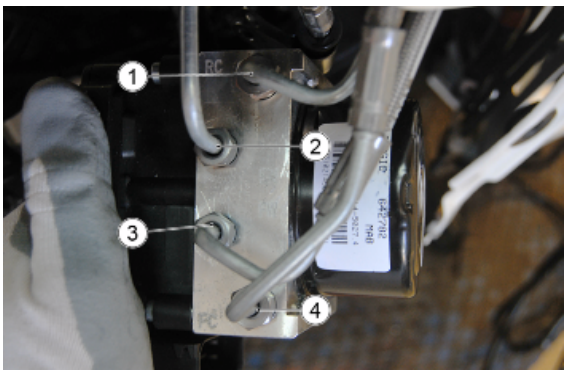
- Unscrew the screw «A» and the nuts «B» fixing the bracket of the control unit to the body.



- Unscrew the nuts, remove and close the brake oil tubes in sequence (1) - (2) - (4) - (3).

N.B.

PAY ATTENTION TO THE LOSS OF BRAKE FLUID DURING THE REMOVAL OF THE PIPING FROM THE MODULATOR. USE A SMALL CONTAINER AND A CLOTH.



MODULATOR INSTALLATION

When installing the ABS modulator, repeat the operations described in the removal in reverse order, paying close attention when inserting the pipes.

Before installing the side fairings, bleed the brake system in order to restore the correct operation of the braking system.

MODULATOR TIGHTENING TORQUES

Name	Torque in Nm
Bracket screw ABS control unit	6 to 8
Bracket nuts ABS control unit	20 to 25
Screws fixing ABS control unit to bracket	8 to 10
Nuts fixing system piping to the ABS control unit	17 to 20

ASR

System ASR

The ASR system is a device to help riding that helps the rider during acceleration manoeuvres, especially on slippery surfaces or in conditions that can cause sudden slippage of the rear wheel. The ASR in these situations automatically intervenes by reducing engine output within the limit imposed by the grip conditions, contributing significantly to the maintenance of stability of the vehicle.

WARNING

THE ASR SYSTEM IS BASED ON THE RECOGNITION OF SPEED DIFFERENCES BETWEEN FRONT AND REAR WHEEL.
IN ORDER THAT THE SYSTEM MAINTAINS MAXIMUM EFFICIENCY IN ALL CONDITIONS, THE CALIBRATION PROCEDURE MUST BE PERFORMED EVERY TIME, EVEN IN CASE OF REPLACEMENT OF JUST ONE TYRE.
FOR THE CALIBRATION OF THE CONTROL UNIT PERFORM THE PROCEDURE BELOW.

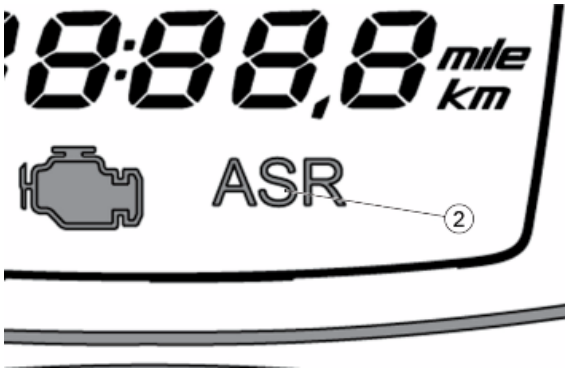
CAUTION

THE PROCEDURE ACTIVATION REQUEST MUST BE COMPLETED WITHIN 60 SECONDS FROM WHEN THE ENGINE IS STARTED.

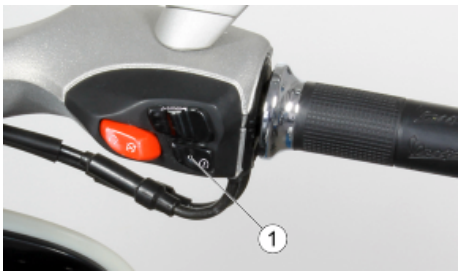
Complete the ASR and ABS system diagnostic cycle: turn the ignition switch to ON, ride a short distance at a speed above 5 Km/h and wait for the flashing of the ABS warning light and ASR icon to turn off.

- Press the «1» (START) button of the handlebar to deactivate the ASR system.

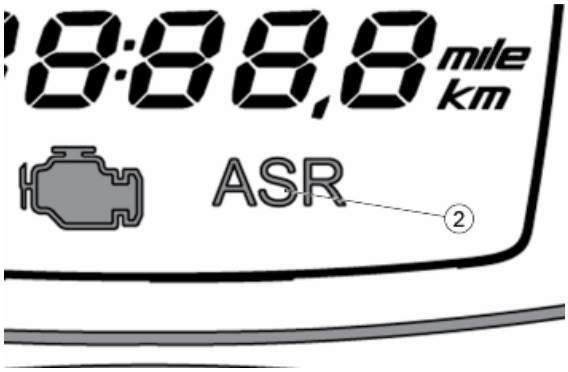
- Check that the deactivation icon of the ASR «2» is on.



- Leave the engine running at idle speed for at least 3 seconds.
- Press the ASR on/off button «1» and one of the two brake levers simultaneously for at least 4 seconds.



- The ASR icon «2» flashes slowly to confirm that the procedure has been activated.
- Ride the vehicle at a constant speed between 30 and 40 Km/h for at least 7 to 8 seconds.
- The ASR icon «2» stops flashing to confirm that the procedure has been completed.



- After completing the procedure, switch off the instrument binnacle (ignition switch OFF) and wait 30 seconds before turning the ignition switch ON again.

CAUTION

IF THE PROCEDURE IS NOT COMPLETED WITHIN 2 MINUTES IT WILL BE CONSIDERED AS FAILED AND THE ASR ICON «2» WILL REMAIN ON WITH A STEADY LIGHT. THE ASR WILL BE DEACTIVATED UNTIL THE INSTRUMENT PANEL IS TURNED OFF (KEY OFF). TO REACTIVATE THE ASR SYSTEM THE VEHICLE IGNITION MUST BE TURNED BACK ON (KEY ON). REPEAT THE PROCEDURE UNTIL COMPLETED SUCCESSFULLY.

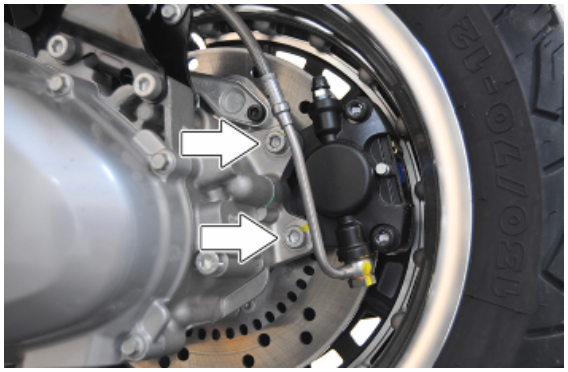
Rear brake calliper

Removal

Remove the complete silencer.

- Remove the rear wheel.

- Remove the two screws indicated



N.B.

IF IT IS NECESSARY TO REPLACE OR SERVICE THE BRAKE CALLIPER, BEFORE REMOVING THE FITTINGS FIXING THE CALLIPER TO THE SUPPORT BRACKET, FIRST LOOSEN THE OIL HOSE FITTING AFTER HAVING EMPTIED THE SYSTEM OF THE CIRCUIT BEING EXAMINED.

Refitting

- Follow the removal procedures but in reverse order and tighten to the prescribed torques with the recommended product.

Locking torques (N*m)

Rear brake calliper fixing screws 20 to 25

- If the calliper was replaced, bleed the system.

CAUTION

ONCE REFITTING IS FINISHED, BLEED THE SYSTEM.

CAUTION

ALWAYS USE NEW COPPER WASHERS.

Locking torques (N*m)

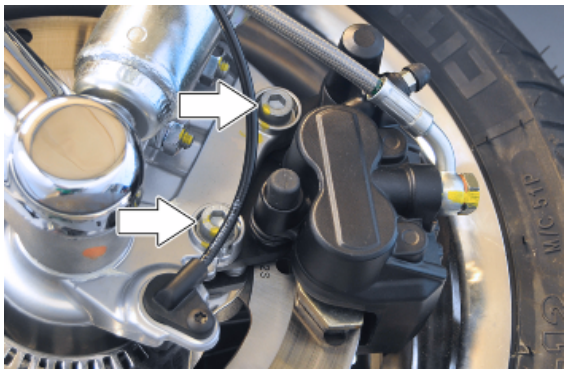
Rear brake calliper-pipe fitting 20 to 25

Front brake calliper

Removal

- Adequately support the vehicle and remove the front wheel.

- Undo the screws indicated.



N.B.

SHOULD IT BE NECESSARY TO REPLACE THE CALLIPER, FIRST LOOSEN THE FITTING CONNECTING THE PIPE TO THE BRAKE CALLIPER.

Refitting

- To fit the calliper, follow the above operations but in reverse order.

Locking torques (N*m)

Screw tightening calliper to support 20 to 25

- If the calliper was replaced, bleed the system.

CAUTION

ALWAYS USE NEW COPPER WASHERS.

CAUTION

ONCE REFITTING IS FINISHED, BLEED THE SYSTEM.

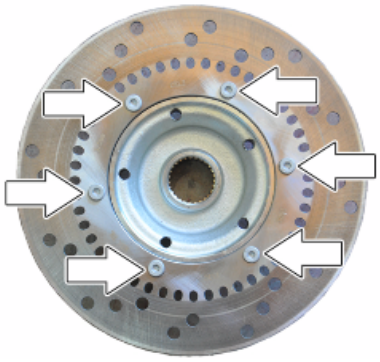
Locking torques (N*m)

Brake fluid pipe-calliper fitting 20 to 25

Rear brake disc

Removal

- Remove the rear wheel hub.
- Unscrew the indicated nuts.



Refitting

- For removal, proceed in reverse order, paying attention to the prescribed torques
- Check the gap between tone wheel and rear speed sensor

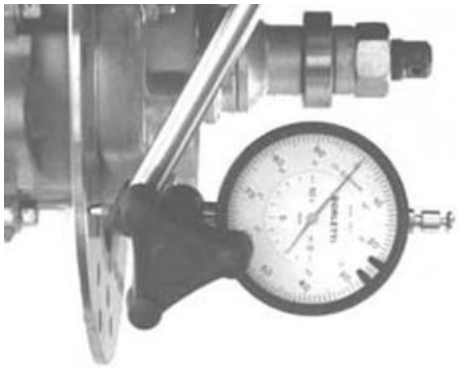
Locking torques (N*m)

Brake disc screws 8 to 10

Disc Inspection

- Remove the rear wheel.
- Use a calliper to check the disc thickness as shown in the photograph.
- Repeat the measurement at no fewer than six points on the disc.

- Remove the rear brake calliper.
- Place the dial gauge on the disc outer edge.
- Make the wheel hub turn and check the disc deviation.



Specific tooling

020335Y Magnetic mounting for dial gauge

Characteristic

STANDARD THICKNESS

4 +0.2 -0.2 MM

MINIMUM THICKNESS

3.5 MM

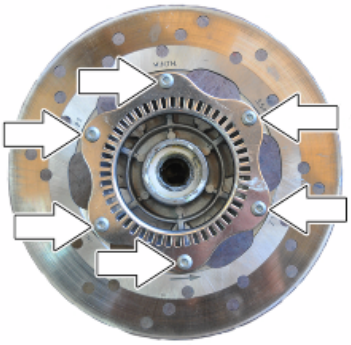
Max. deviation allowed:

0.1 mm

Front brake disc

Removal

- Remove the front wheel hub.
- Undo the screws indicated.



Refitting

- Carry out the removal steps but in the reverse order, paying attention to the prescribed torques.
- Check the gap between tone wheel and front speed sensor.

Locking torques (N*m)

brake disc screws 8 to 10

Disc Inspection

- Remove the rear wheel.
- Use a calliper to check the disc thickness as shown in the photograph.
- Repeat the measurement at no fewer than six points on the disc.

- Remove the rear brake calliper.
- Place the dial gauge on the disc outer edge.
- Make the wheel hub turn and check the disc deviation.

Specific tooling

020335Y Magnetic mounting for dial gauge

Characteristic

STANDARD THICKNESS

4 +0.2 -0.2 MM

MINIMUM THICKNESS

3.5 MM

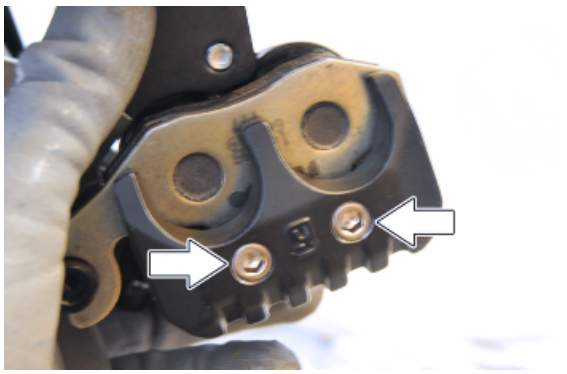
Max. deviation allowed:

0.1 mm

Front brake pads

Removal

- Remove the brake calliper.
- Undo the indicated screws and remove the brake pads.



Refitting

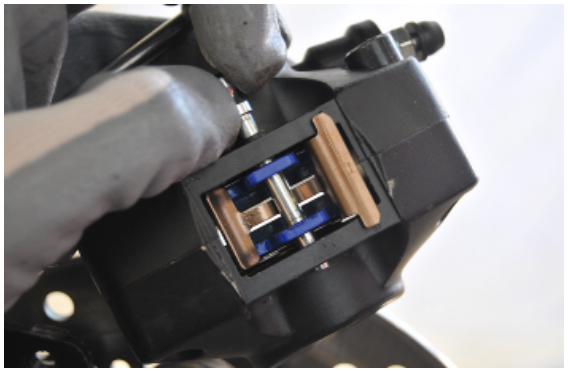
- Follow the process in reverse order to refit.

Rear brake pads

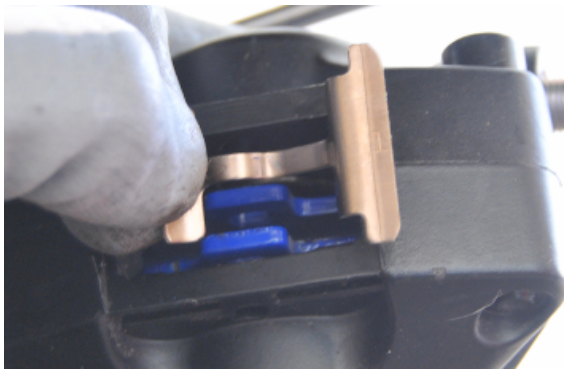
Removal

- Remove the rear wheel.
- Remove the brake calliper.
- Remove the locking spring of the pin.

- Remove the pin.

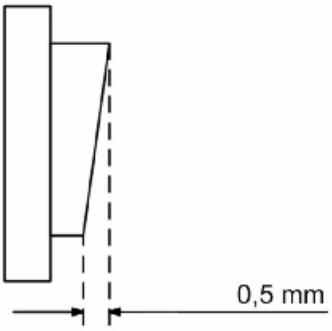


- Remove the spring.



- Remove the pads.
- Check that there are no faults or warping. If there are, replace them.
- Check that the thickness of the friction material is more than 1.5 mm. Otherwise, proceed with replacement.

- The replacement must be made with greater residual thickness if the pad has not worn evenly.
A 0.5 mm thickness difference in the residual friction material is permitted



Refitting

- Insert the brake pads.
- Insert the fixing pin being careful to position the clip with the ends towards the bleed screw.
- Insert the locking on the pin.
- Fix the brake calliper to the bracket and tighten the screws to the specified torque.

CAUTION

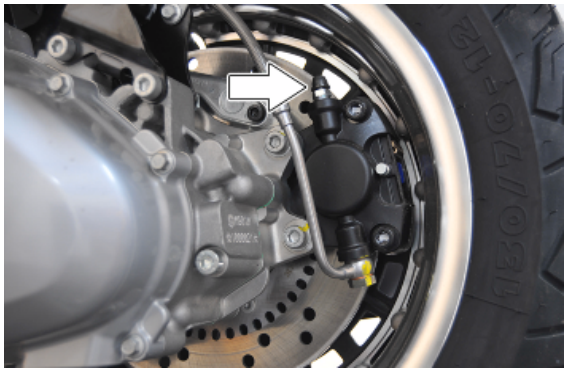
BEFORE USING THE BRAKE, OPERATE THE LEVER A FEW TIMES.

Locking torques (N*m)

Rear brake calliper tightening screw 20 to 25 Nm

Fill

Rear - combined



- Remove the rubber cap from the bleed screw.
- Insert a rubber pipe in the bleed screw to permit the brake fluid to be recovered.
- With the brake lever, load the system and bring it up to the required pressure.
- Keeping the brake lever pulled, loosen the bleed screw to purge the air in the system. Then tighten the bleed screw
- Repeat the operation until only brake fluid comes out of the rubber pipe.
- Remove the fluid recovery pipe and refit the rubber cap over the bleed screw.
- Top up the brake fluid to the right level in the reservoir. If necessary, bleeding can be done using a special vacuum pump

CAUTION

THE BLEEDING OPERATIONS OF THE BRAKING SYSTEM, EVEN FOR THE VERSION EQUIPPED WITH ABS SYSTEM, DO NOT ALLOW THE USE OF DIAGNOSTIC TESTER, AND ARE THEREFORE EQUAL TO THOSE DESCRIBED FOR THE STANDARD BRAKE SYSTEM.

N.B.

DURING THE BLEEDING OPERATIONS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE BODYWORK SO AS NOT TO DAMAGE IT. FURTHERMORE, DURING THE BLEEDING OPERATIONS REGARDING THE BRAKE CALLIPERS, MAKE SURE THE BRAKE FLUID DOES NOT COME INTO CONTACT WITH THE DISC BRAKES AND WITH THE BRAKE PADS. FAILURE TO OBSERVE THIS PRECAUTION WILL ENDANGER THE PROPER WORKING AND EFFICIENCY OF THE BRAKING SYSTEM

Specific tooling

020329Y Mity-Vac vacuum-operated pump

Locking torques (N*m)

Oil bleed screw **12 to 16**

Front

- Remove the rubber cap from the bleed screw.
- Insert a rubber pipe in the bleed screw to permit the brake fluid to be recovered.
- With the brake lever, load the system and bring it up to the required pressure.
- Keeping the brake lever pulled, loosen the bleed screw to purge the air in the system. Then tighten the bleed screw
- Repeat the operation until only brake fluid comes out of the rubber pipe.
- Remove the fluid recovery pipe and refit the rubber cap over the bleed screw.
- Top up the brake fluid to the right level in the reservoir. If necessary, bleeding can be done using a special vacuum pump

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Specific tooling

020329Y Mity-Vac vacuum-operated pump

Locking torques (N*m)

Oil bleed screw **12 to 16**

Brake fluid level check

The front and rear brake fluid reservoirs are both positioned on the handlebar. Proceed as follows:

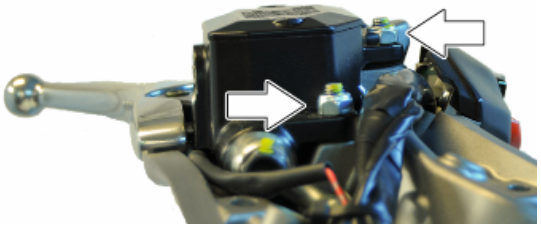
- Rest the vehicle onto the centre stand, with the handlebar centred.
- Check the fluid level through the sight glass «**A**» and «**B**».

A certain lowering of the level is caused by wear on the brake pads.

Front brake pump

Removal

- Remove the front handlebar cover.
- Drain the braking system.
- Disconnect the brake oil pipe from the pump, paying attention to a possible escape of remaining oil.
- Disconnect the connector of the brake stop button.
- Unscrew the nuts fixing the pump to the handlebar.
- Remove the brake pump with the lever.



Refitting

- Upon refitting, perform the operation but in reverse order.
- Tighten the hydraulic line to the prescribed torque and purge the system.
- When the operation is over, tighten the brake fluid bleed screw to the prescribed torque.

CAUTION

WHEN CARRYING OUT THE OPERATION, BRAKE FLUID MAY LEAK FROM BETWEEN THE BLEED SCREW AND ITS SEAT ON THE CALLIPER. CAREFULLY DRY THE CALLIPER AND DEGREASE THE DISC SHOULD THERE BE BRAKE FLUID ON IT.

WARNING

BRAKE FLUID IS HYGROSCOPIC; THAT IS, IT ABSORBS MOISTURE FROM THE SURROUNDING AIR. IF THE LEVEL OF MOISTURE IN THE FLUID EXCEEDS A GIVEN VALUE, BRAKING WILL BE INEFFICIENT. THEREFORE, ALWAYS USE FLUID FROM SEALED CONTAINERS. UNDER NORMAL DRIVING AND CLIMATIC CONDITIONS YOU SHOULD CHANGE THIS FLUID EVERY TWO YEARS. IF BRAKES ARE USED INTENSELY AND/OR IN HARSH CONDITIONS, CHANGE THE FLUID MORE FREQUENTLY.

N.B.

WHILE REFITTING, REPLACE THE COPPER GASKETS ON THEIR FITTINGS.

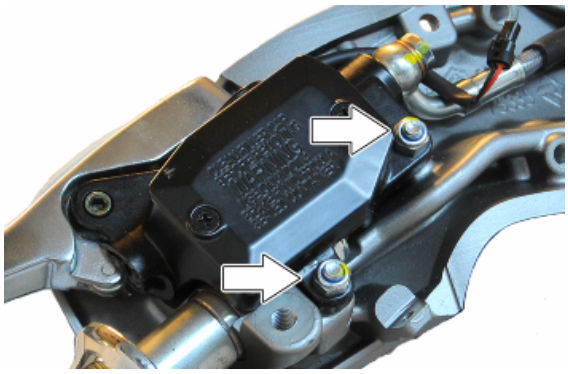
Locking torques (N*m)

Brake fluid pump-hose joint 19 to 22 Handlebar brake pump nuts 7 to 10

Rear brake pump - combined

Removal

- Remove the front handlebar cover.
- Drain the braking system.
- Disconnect the brake oil pipe from the pump, paying attention to a possible escape of remaining oil.
- Disconnect the connector of the brake stop button.
- Unscrew the nuts fixing the pump to the handlebar.
- Remove the brake pump with the lever.



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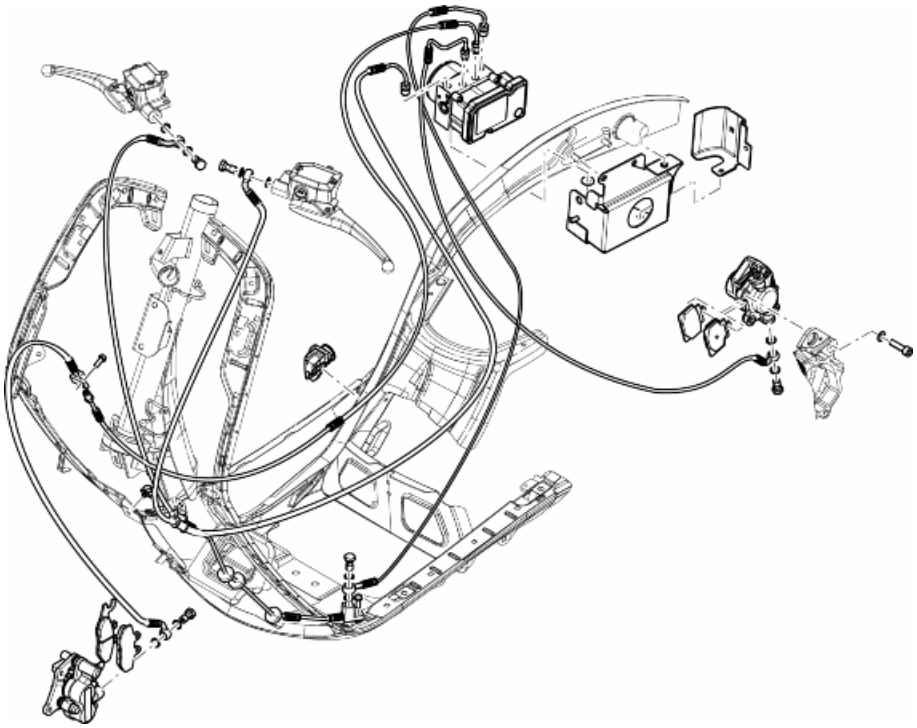
Locking torques (N*m)

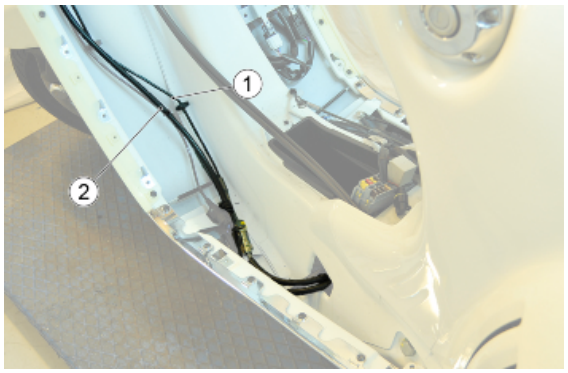
Brake fluid pump-hose joint 19 to 22 Handlebar brake pump nuts 7 to 10

Brake pipes

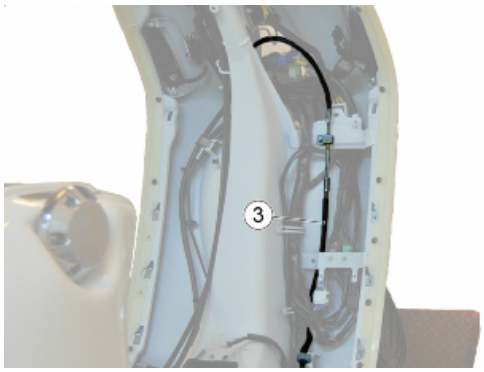


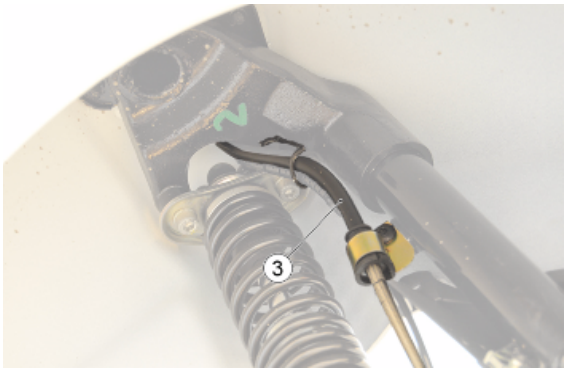
1 - Front brake pump pipe

2 - Rear brake pump pipe

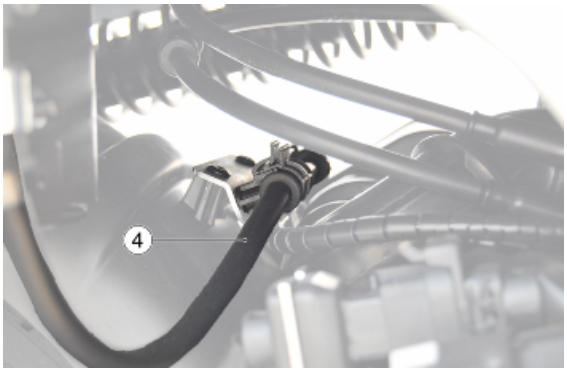


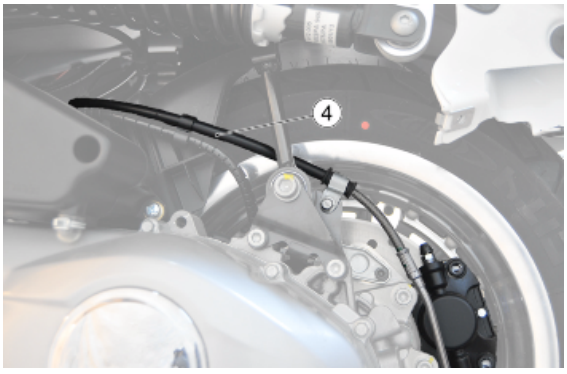
3 - Front brake calliper pipe





4 - Rear brake calliper pipe



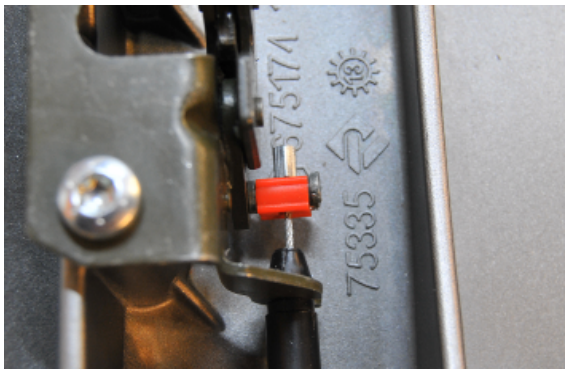


INDEX OF TOPICS

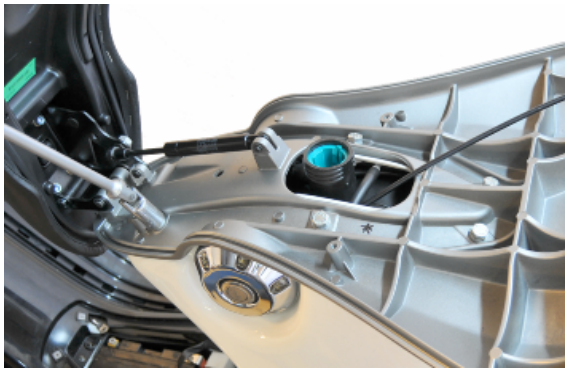
Seat

- With the open saddle, remove the 8 screws of the saddle cover.
- Remove the saddle cover by unscrewing the fuel tank cap.

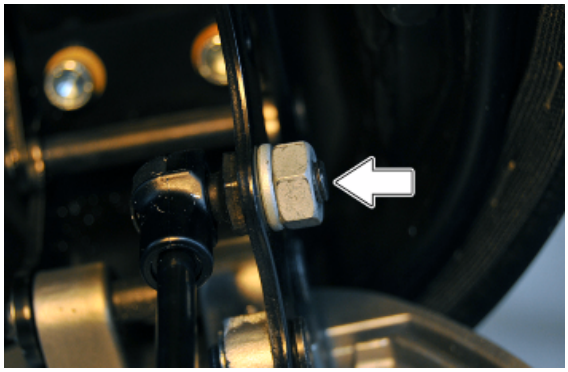
- Disconnect the cable from the saddle lock.



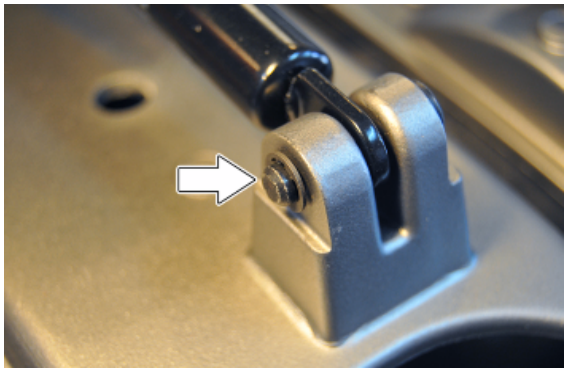
- Remove the 6 indicated screws and remove the saddle with the support.



- Remove the gas spring from the saddle by unscrewing the indicated nut.



- Remove the gas spring from the saddle support by removing the seeger ring and the indicated pin.

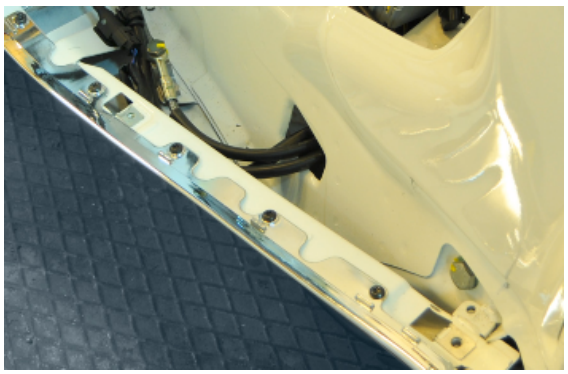


- Remove the 4 screws fixing the saddle to the support and separate the saddle from the support.

Side fairings

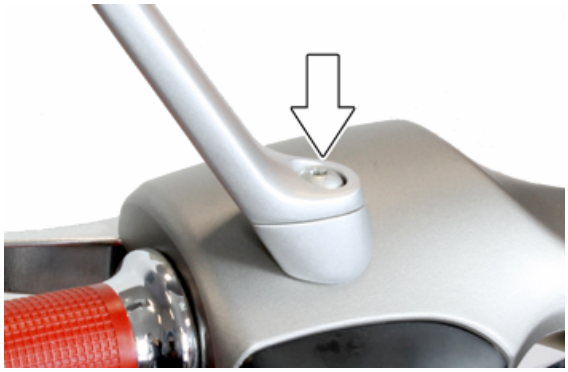
- Remove the leg shield back plate.
- Remove the footrest.
- For both sides of the vehicle remove the 9 retainer screws of the upper bumpers.

- Remove the 5 retainer screws of the lower bumpers.



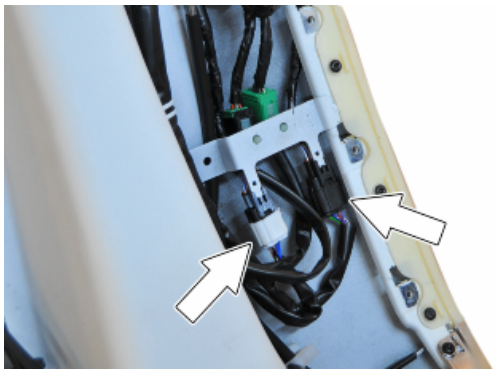
Driving mirrors

- Undo the screw indicated to remove the mirror.



Rear handlebar cover

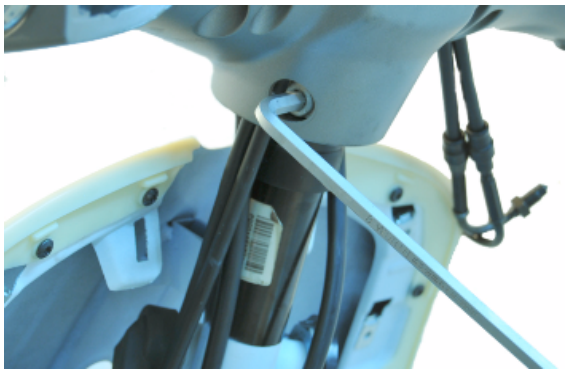
- Remove the leg shield back plate.
- Remove the footrest
- Remove the front handlebar cover.
- Remove the cables of the throttle control.
- Disconnect the front and rear stop connectors.
- Remove the front and rear brake pump.
- Remove the front and rear brake pipes.
- Remove the right and left controls.
- Disconnect the right and left controls connectors.



- Remove the screw fixing the handlebar cover to the steering pipe and remove the handlebar cover.

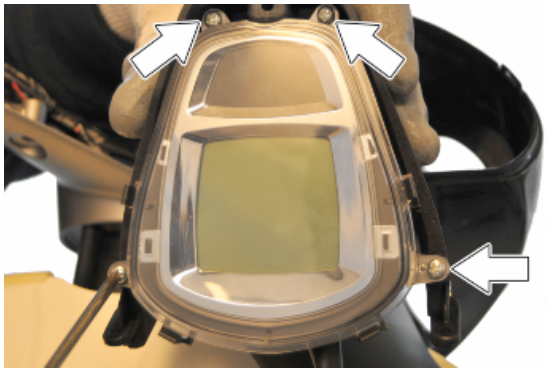
WARNING

THE SCREW AND THE NUT TIGHTENING THE HANDLE-BAR MUST BE REPLACED AFTER EACH REMOVAL.



Instrument panel

- Remove the leg shield back plate.
- Remove the footrest.
- Disconnect the connectors of the headlight assembly and the instrument panel and free the cables from the retaining clamps.
- Remove the front handlebar cover.
- Remove the headlight assembly.
- Remove the instrument panel by unscrewing the 4 screws fixing it to the support of the headlight assembly.

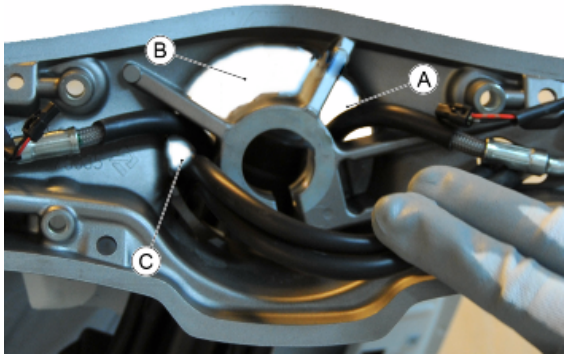


- During the refitting, pay attention to the correct cable channels in the rear handlebar cover.

A- Front brake pipes

B - Instrument panel cable harness, electric devices cable harness, headlight cable harness.

C - Rear brake pipes, throttle grip cables.



Front handlebar cover

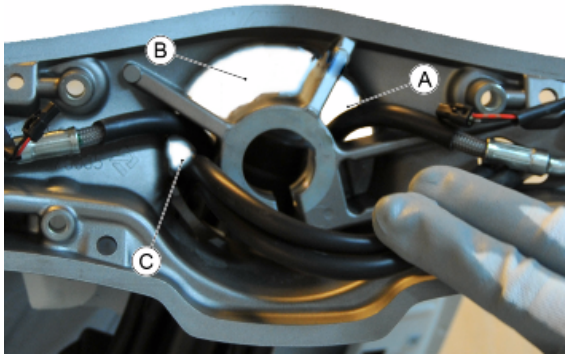
- Remove the leg shield back plate.
- Remove the footrest
- Disconnect the connectors of the headlight assembly and the instrument panel and free the cables from the retaining clamps.
-Remove the rear-view mirrors.
- Undo the 4 screws indicated on both sides of the vehicle.

- When removing the front headlight assembly pay attention to the correct cable channels.

A- Front brake pipes

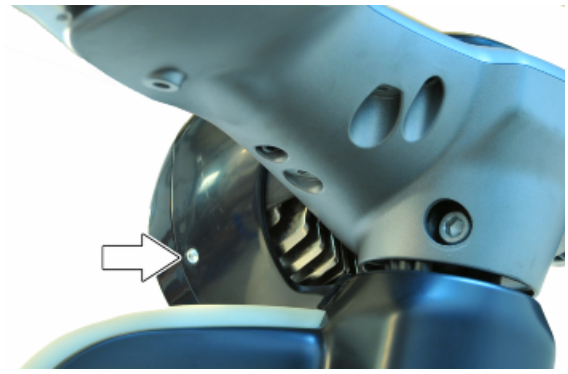
B - Instrument panel cable harness, electric devices cable harness, headlight cable harness.

C - Rear brake pipes, throttle grip cables.



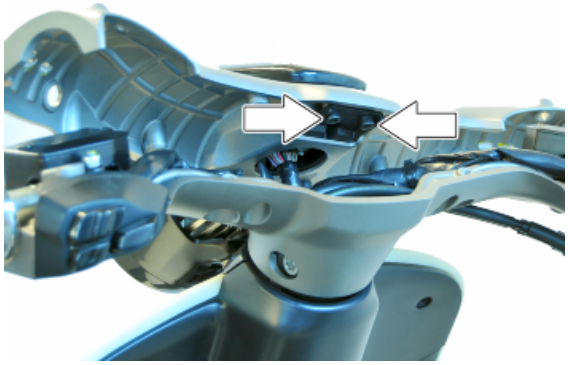
Headlight assy.

- Remove the leg shield back plate.
- Remove the footrest.
- Disconnect the connectors of the headlight assembly and the instrument panel and free the cables from the retaining clamps.
- Remove the headlight frame by unscrewing the 2 indicated screws.

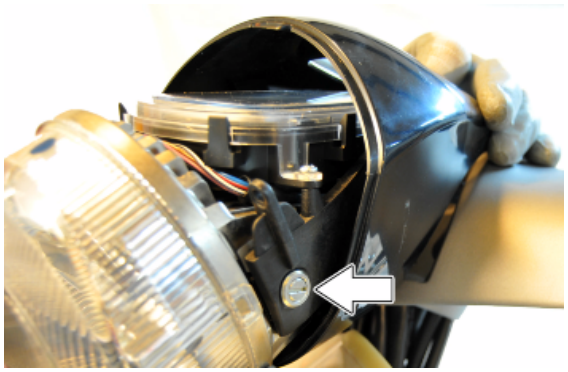


- Remove the headlight cover by unscrewing the indicated screws on both sides of the headlight.

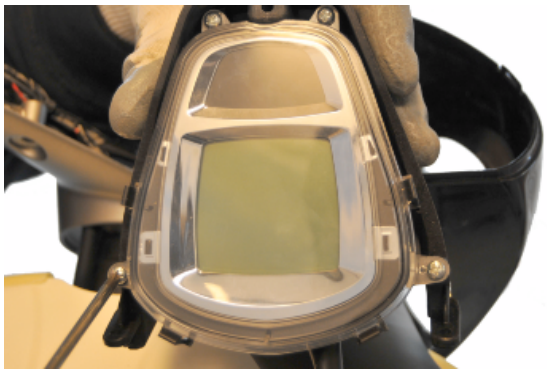
- Remove the front handlebar cover.
- Undo the 2 screws indicated.



- Remove the screw indicated on both sides of the headlight.



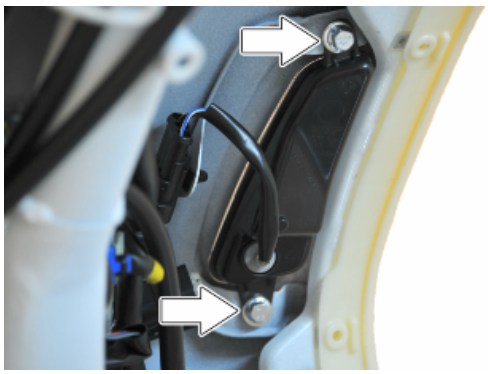
- Remove the instrument panel by freeing the headlight cable harness.



TURN INDICATORS

- Remove the leg shield back plate.
- Remove the footrest.
- Disconnect the connectors of the turn indicators.

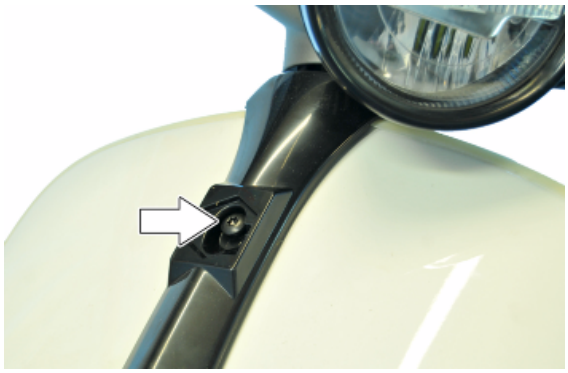
- Unscrew the 2 indicated screws and remove the turn indicators.



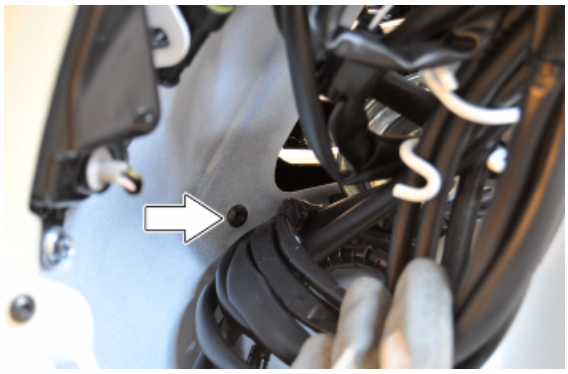
Legshield

- Remove the leg shield back plate.
- Remove the footrest.
- Remove the piaggio clip-on badge.

- Undo the screw indicated.

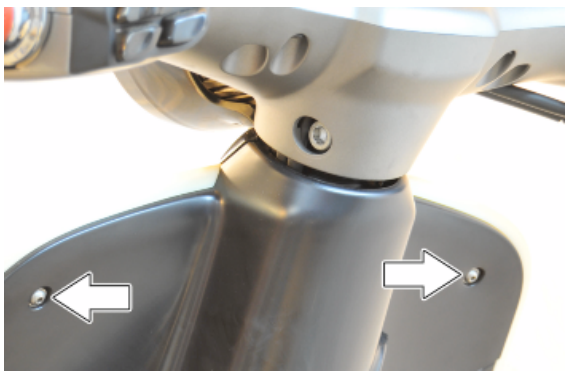


- Undo the screw indicated on both sides of the vehicle.

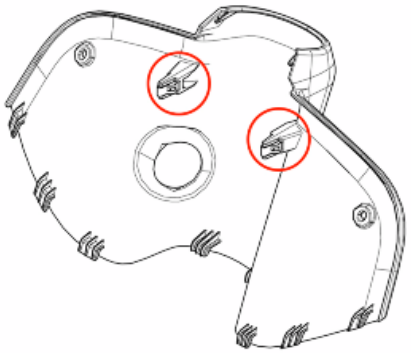


Knee-guard

- Undo the screws indicated.



- Remove the leg shield back plate and pay attention to the clips in the indicated area.



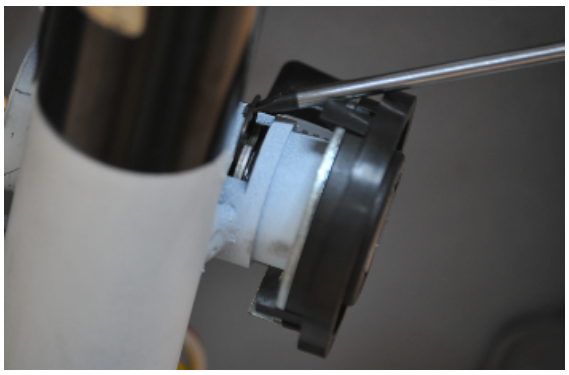
Removing the ignition key-switch when on *off*

- Remove the leg shield back plate.
- Remove the footrest.
- Disconnect the key switch contacts connector.

- Disconnect the immobilizer connector.

- Remove the locking spring of the key switch contacts connector.

- Remove the lock spring of the locking.



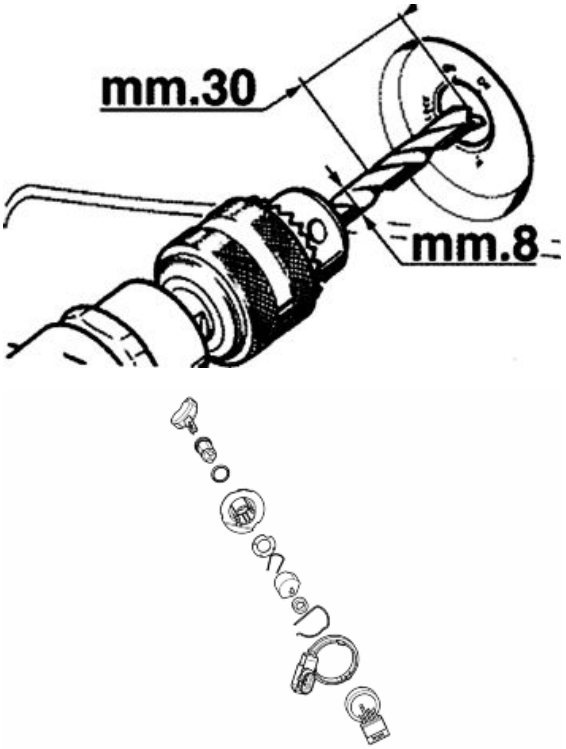
- Remove the lock.

- Remove the steering lock.

Removing the ignition key-switch when on *lock*

- Remove the leg shield back plate.
- Remove the switch of the key switch.

- Make a hole on the block using a drill as shown in the figure.
- Insert the wheel cylinder with the key and with the anchoring tab facing down halfway on the lock body taking care that the insertion phase of the key is oriented matching "ON" (the only position that enables the cylinder to get into the lock body); now turn the key leftwards to "OFF" and at the same time press until the cylinder is completely in.



See also

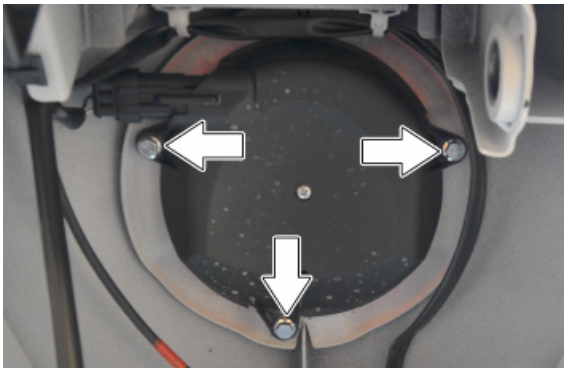
Knee-guard

Taillight assy.

- Unscrew the pin fixing the rear suspension strut to the bracket on the crankcase.

- Pay attention that the cable of the ABS sensor and the rear brake pipe are not tensed, lift the rear part of the vehicle.
- Disconnect the rear light assembly connector.

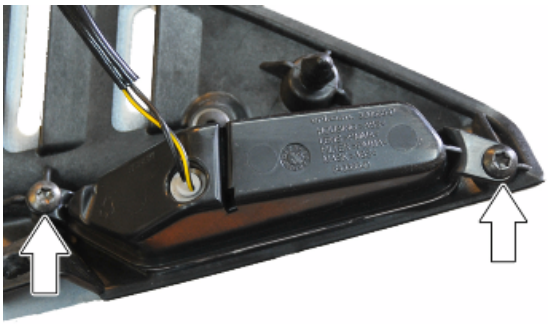
- Unscrew the 3 screws indicated and remove the headlight assembly.



TURN INDICATORS

- Remove the side fairings.
- Disconnect the connectors of the turn indicators.

- Remove the 2 screws indicated.



License plate light

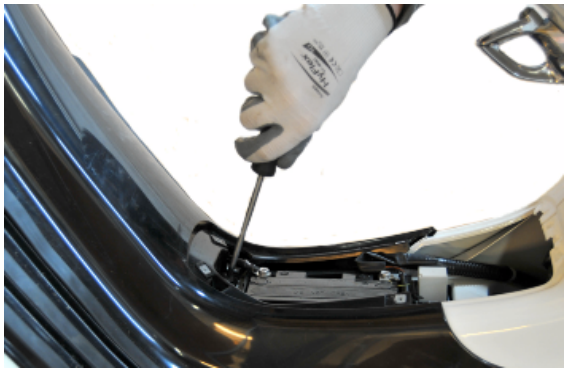
- Undo the screws indicated.

- Remove the license plate light by sliding it from the support.

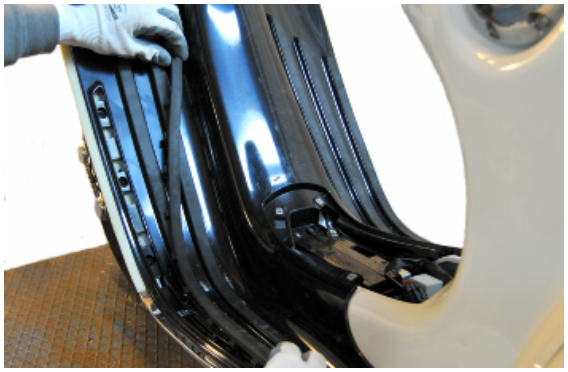
Footrest

- Remove the leg shield back plate.
- Undo the 3 screws indicated.

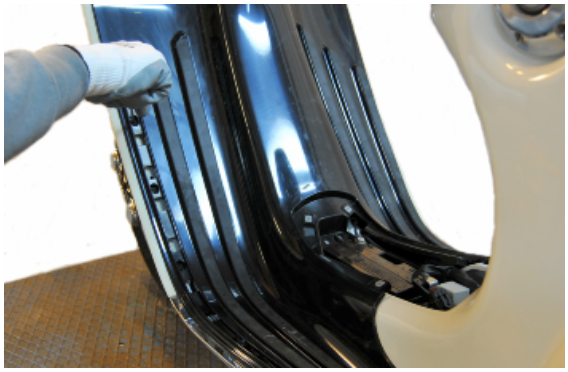
- Remove the battery cover
- Undo the screw indicated.



- Remove the external footrest strips.



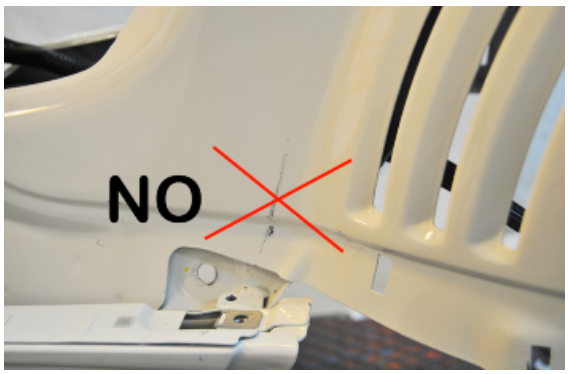
- Remove the 5 screws under each footrest strip.



- Remove the spoilers from both sides of the vehicle.

- Unscrew the screws under the spoilers.

- Remove the footrest, sliding it from the front part of the vehicle. Pay attention not to damage the bodywork.



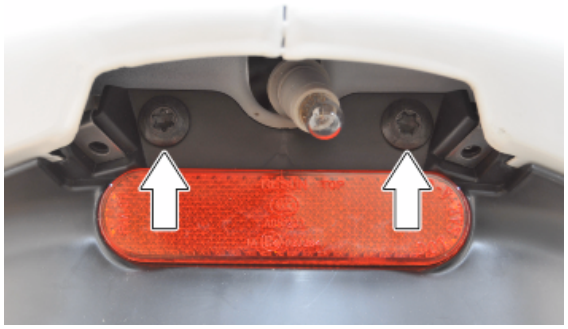
Side fairings

- Remove the spoilers.
- Undo the screw indicated.

- Undo the indicated screw

License plate holder

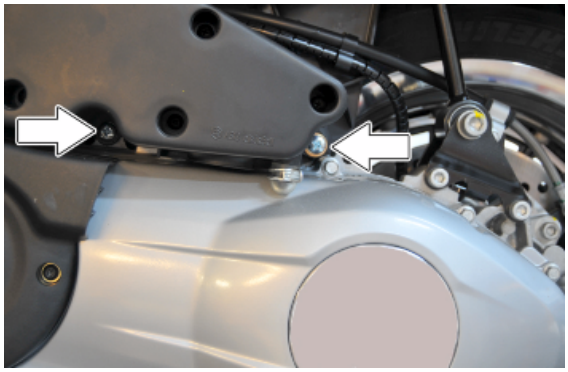
- Remove the license plate light.
- Undo the 2 screws indicated.



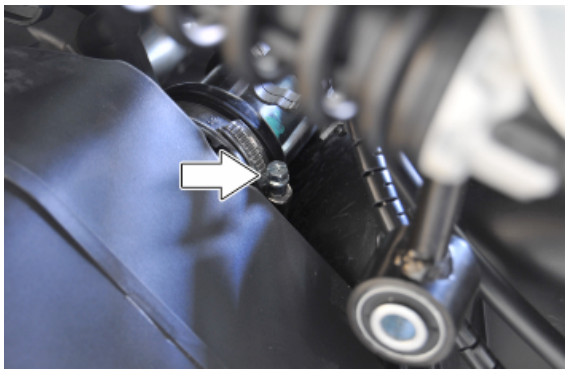
- Undo the 2 screws indicated on both sides of the vehicle.

Air filter

- Remove the left side panel.
- Undo the 2 screws indicated.

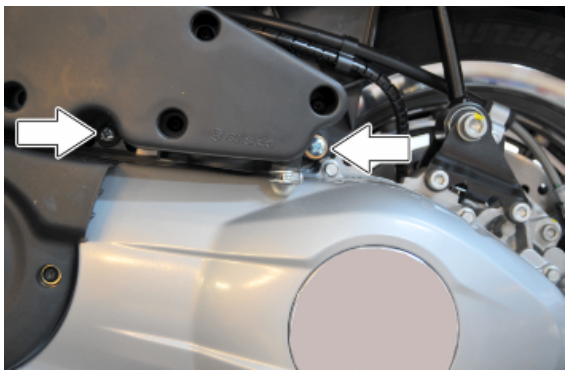


- Loosen the hose clamp indicated and remove the filter box.

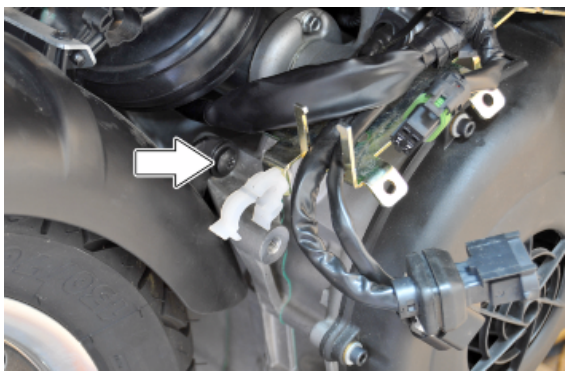


Rear mudguard

- Remove the side fairings.
- Remove the silencer.
- Undo the 2 screws indicated.



- Undo the screw indicated and remove the mudguard.



Vano portabatterie - inverter

- Undo the 4 screws indicated.

spoiler

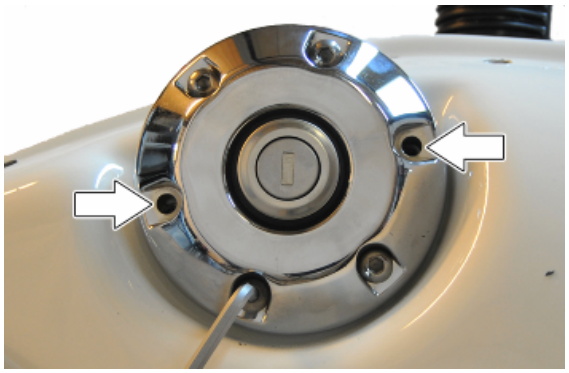
- Remove by turning the spoilers towards the outside.

Fuel tank

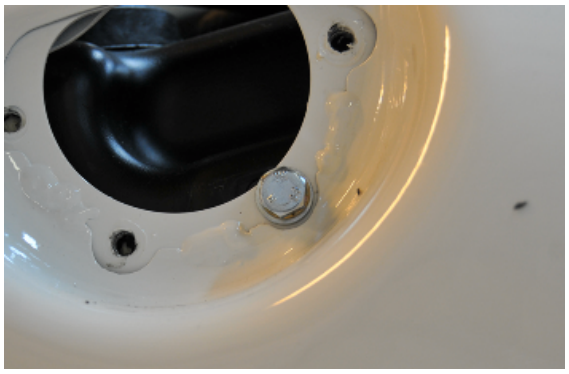
- Remove the tank cover.
- Remove the engine.
- Remove the fuel pump connector on the upper part of the engine housing.

- Unscrew the rear tank fixing screw.

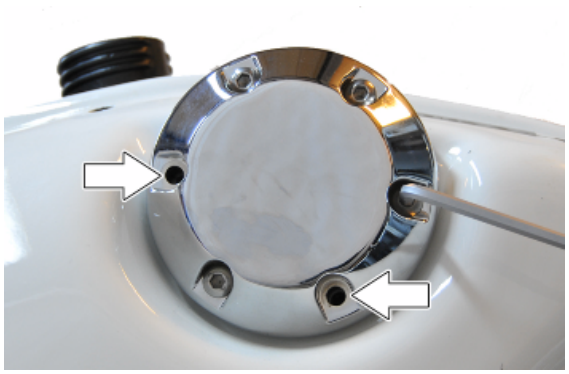
- Remove the locking by unscrewing the 3 screws indicated.



- Remove the tank fixing screw.



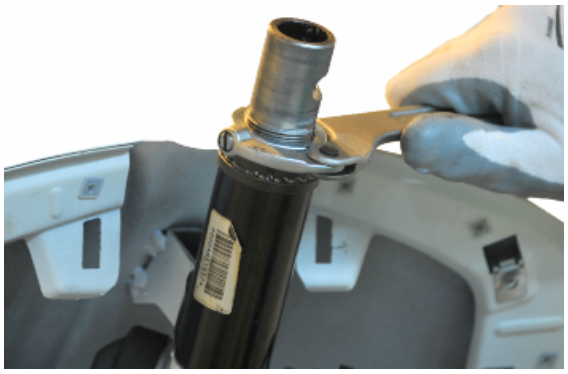
- Unscrew the right side cover by unscrewing the 3 screws indicated.



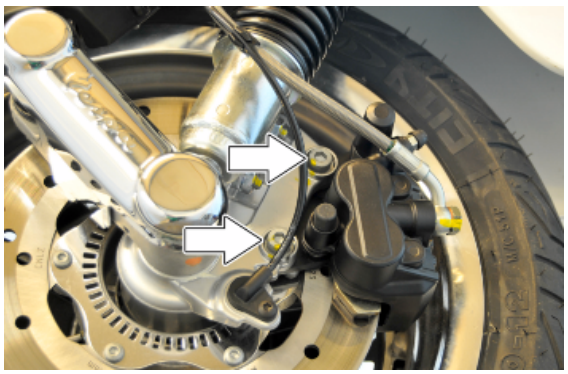
- Unscrew the tank fixing screw.
- Slide off the tank towards the rear part of the vehicle.

Front mudguard

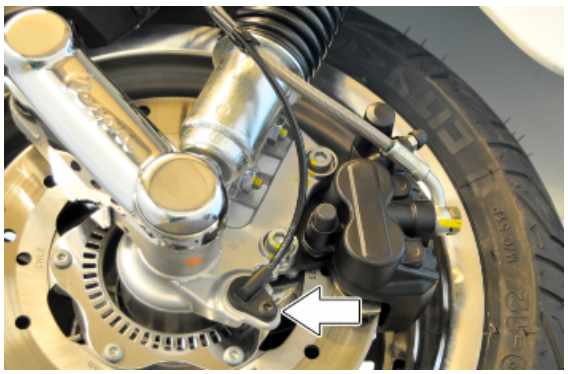
- Remove the front handlebar cover.
- Remove the rear handlebar cover.
- Remove the upper steering bearing.



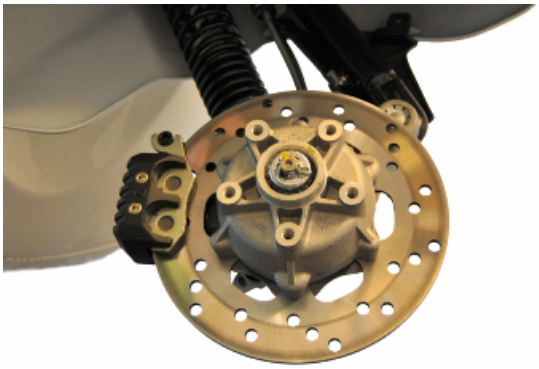
- Remove the front brake calliper.



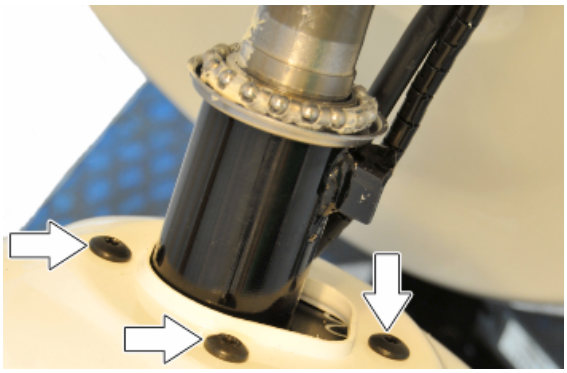
- Remove the front ABS sensor.



- Adequately support the vehicle and remove the front wheel.



- Slide off the steering pipe.
- Undo the 3 screws indicated.



- Slide off the mudguard from the steering pipe.

INDEX OF TOPICS

Aesthetic inspection

Appearance check:

- Paintwork
- Fitting of plastics
- Scratches
- Dirt

Tightening torques inspection

SAFETY LOCKS CHECK

- Safety fasteners
- Fixing screws

SAFETY FASTENERS

Check that there is a yellow mark on the following clamps:

- Rear suspension strut fixing
- Rear shock absorber fixing
- Rear shock absorber linkage fixing
- Front ABS sensor
- Rear ABS sensor
- Front brake calliper
- Rear brake calliper
- Handlebar locking screw
- Swinging arm pin - Frame
- Swinging arm pin - Engine
- Engine arm pin - Frame arm

See also

System ASR

Electrical system

Electrical system:

- Battery
- Main switch
- Headlamps: high beam lights, low beam lights, tail lights and their warning lights
- Adjusting the headlights according to the regulations currently in force
- Rear light, brake light and license plate light
- Front and rear stop light switches
- Turn indicators and their warning lights
- Instrument panel lights

- Instrument panel: fuel gauge
- Instrument panel warning lights
- Horn
- Starter

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 THE LIFE OF THE BATTERY.

WARNING

KEEP SPARKS AND NAKED FLAMES AWAY FROM THE BATTERY WHILE RECHARGING. REMOVE THE BATTERY FROM THE VEHICLE, DISCONNECTING THE NEGATIVE TERMINAL FIRST.

CAUTION

WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE.

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING.
IN CASE OF CONTACT WITH YOUR EYES OR SKIN, RINSE WITH ABUNDANT WATER FOR ABOUT 15 MINUTES AND SEEK IMMEDIATE MEDICAL ATTENTION.
IF IT ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP THEM AWAY FROM NAKED FLAMES, SPARKS AND CIGARETTES. IF THE BATTERY IS CHARGED IN A CLOSED PLACE, TAKE CARE TO ENSURE ADEQUATE VENTILATION. ALWAYS PROTECT YOUR EYES WHEN WORKING CLOSE TO 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

Level check:

- Hydraulic braking system fluid level.
- Rear hub oil level
- Engine oil level

Road test

Test ride

- Position the vehicle on the stand and keep it running for at least 5 minutes
- Cold start
- Instrument operations
- Response to the throttle control
- Stability on acceleration and braking
- Rear and front brake efficiency

- Rear and front suspension efficiency
- Abnormal noise

CAUTION

POSITION THE VEHICLE ON THE STAND AND KEEP IT RUNNING FOR AT LEAST 5 MINUTES BEFORE PERFORMING THE TEST RIDE.

N.B.

DURING THE ROAD TEST CARRY OUT THE ASR SYSTEM CALIBRATION PROCEDURE.

Static test

Static control after the test ride:

- Restarting when warmed up
- Minimum hold (turning the handlebar)
- Uniform turning of the steering
- Possible leaks

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES OR TYRES MAY BURST.

Functional inspection

Functional Checks:

Braking system (hydraulic)

- Lever travel

Braking system (mechanical)

- Lever travel

Clutch

- Proper functioning check

Engine

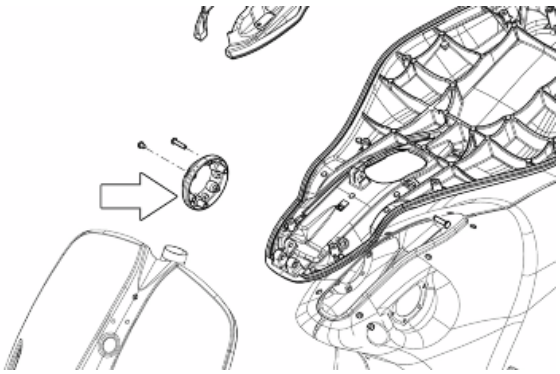
- Proper general functioning and no abnormal noise check

Others

- Check documentation
- Check the chassis and engine numbers
- Tool kit
- License plate fitting
- Check locks
- Check tyre pressures
- Installation of mirrors and any accessories

Specific operations for the vehicle

In the «Delivery Kit» contained in the vehicle package you will find the right hand cap indicated in the figure which must be fitted during the pre-delivery phase.



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