MANUALE STAZIONE DI SERVIZIO

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Vespa GTS Super 300 i.e.

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Piaggio & C. S.p.A. Viale Rinaldo Piaggio, 25 - 56025 PONTEDERA (PI), Italy
www.piaggio.com

MANUALE STAZIONE DI SERVIZIO
Vespa GTS Super 300 i.e.

Questo manuale per stazioni di servizio è stato realizzato da Piaggio & C. Spa per essere utilizzato dalle officine dei concessionari e sub-agenzie Piaggio-Gilera. Si presuppone che chi utilizza questa pubblicazione per la manutenzione e la riparazione dei veicoli Piaggio, abbia una conoscenza base dei principi della meccanica e dei procedimenti inerenti la tecnica della riparazione dei veicoli. Le variazioni importanti nelle caratteristiche dei veicoli o nelle specifiche operazioni di riparazione verranno comunicate attraverso aggiornamenti di questo manuale. Non si può comunque realizzare un lavoro completamente soddisfacente se non si dispone degli impianti e delle attrezzature necessarie, ed è per questo che vi invitiamo a consultare le pagine di questo manuale riguardanti l'attrezzatura specifica e il catalogo degli attrezzi specifici.

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.

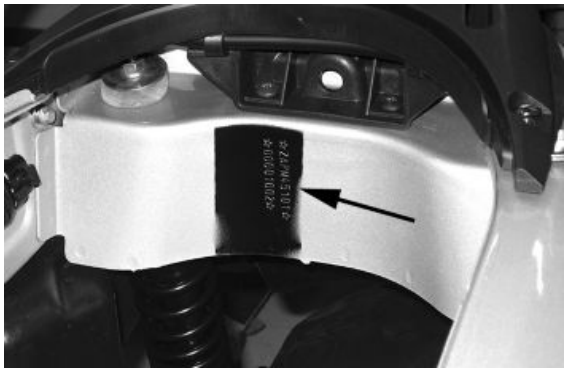
Maintenance rules

- 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

Chassis prefix: ZAPM45100000 ÷ 1001

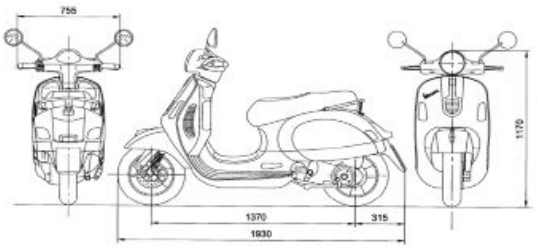
Engine prefix: M451M ÷ 1001



Dimensions and mass

WEIGHTS AND DIMENSIONS

Specification	Desc./Quantity
Kerb weight	158 ± 5 kg
Maximum weight limit	340 kg
Maximum height	1170 mm
Overall width	755 mm
Overall length	2230 mm
Wheelbase	1370 mm



Engine

DATA

Specification	Desc./Quantity
Type	single-cylinder, four-stroke and four liquid-cooled valves
Cubic capacity	278.3 cm³
Stroke	63 mm
Bore	75 mm
MAX. torque	22 Nm at 6500 rpm
Max. Power	16.4 kW at 7500 rpm
Timing system	single overhead camshaft, chain-driven, on the left-hand side, three-arm rocking levers set up with threaded set screw
Compression ratio	10.5 ÷ 11.5
Engine idle speed	1,650 ± 50 rpm
Air filter	sponge, impregnated with mixture (50% petrol and 50% oil)
Starting system	electric starter motor with freewheel
Lubrication	with lobe pump (inside the crankcase) chain-driven and double filter: mesh and paper
Fuel system	Electronic injection with electric fuel pump
valve clearance	intake: 0.10 mm - exhaust: 0.15 mm
Minimum lubrication pressure (100° C)	0.8 bar
Lubrication pressure	3.5 to 4 bar
Cooling	Forced-circulation coolant system.

OIL PUMP

Specification	Desc./Quantity
Type	Trochoidal
Distance between the rotors	Admissible limit clearance: 0.12 mm
Axial rotor clearance	Limit values admitted: 0.09 mm
Distance between the outer rotor and the pump body	Admissible limit clearance: 0.20 mm
Levelness	0.1 mm

BY-PASS

Specification	Desc./Quantity
Type	With piston
Plunger diameter	Ø 13.9 - 0.039 -0.057 mm
By-pass check up: Standard length	54.2 mm
Calibration pressure	4.5 bar

OIL FILTER

Specification	Desc./Quantity
Type	Paper with pressure relief and anti-drain back by-pass valves

OIL MINIMUM PRESSURE INDICATOR LIGHT SWITCH

Specification	Desc./Quantity
Calibration	0.3 - 0.6 bar

HEAD LUBRICATION CONTROL JET

Specification	Desc./Quantity
Diameter	1 ± 0.05 mm *

**** Tightening torque** 5÷7 N·m*

COOLING SYSTEM

Specification	Desc./Quantity
Cooling system capacity	~ 2.100 ÷ 2.150 l
Recommended fluid	AGIP PERMANENT SPEZIAL
Sealing pressure	Cap calibrated at 0.9 bar

THERMOSTAT

Specification	Desc./Quantity
Type	Wax-type, with deviator
Starts opening at	85±2°C

ELECTRIC VENTILATION

Specification	Desc./Quantity
Electric ventilation starts at	102°C
Electric ventilation stops at	96°C

WATER PUMP

Specification	Desc./Quantity
Type	Centrifugal
Control	Coaxial to crankshaft

RADIATOR

Specification	Desc./Quantity
Type	Made of aluminium in two sections

Transmission

TRANSMISSION

Specification	Desc./Quantity
Transmission	Automatic expandable pulley CVT with torque server, V-belt, automatic clutch, gear reduction unit and transmission compartment with forced air circulation cooling

Capacities

CAPACITY

Specification	Desc./Quantity
Fuel tank (including a ~ 2 l reserve)	~ 9.2 l
Cooling system fluid	~ 2.100 ÷ 2.150 l
Engine oil	approx. 1300 cc
Rear hub	250 cc

Electrical system

ELECTRICAL COMPONENTS

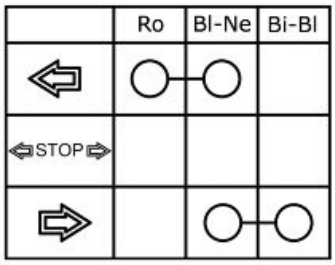
Specification	Desc./Quantity
Ignition/advance	Electronic, with inductive discharge and variable advance with three-dimensional mapping
Spark plug	CHAMPION RG 4 PHP
Battery	12V-12Ah
Fuses	One 30A fuse - One 15A fuse - Three 10A fuses - Four 7.5A fuses - One 3A fuse
Generator	alternating current

CHECKING RELAYS «A» OPERATING AS CIRCUIT BREAKERS

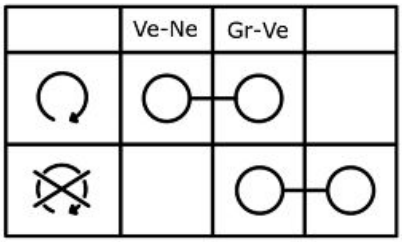
1) Check that, given regular conditions, there is no continuity between terminals 30 and 87.
2) Apply 12V voltage to power terminals 85 and 86 of the relay.
3) With the relay powered, check that there is continuity between terminals 30 and 87.
4) If these conditions are not fulfilled, the relay is damaged and must be replaced.

To check buttons and switches, check that, according to their position, the continuity of contacts is correct as indicated in the following charts.

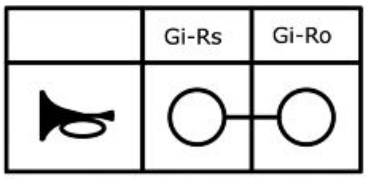
TURN INDICATORS SWITCH



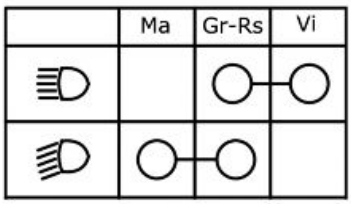
ENGINE STOP SWITCH



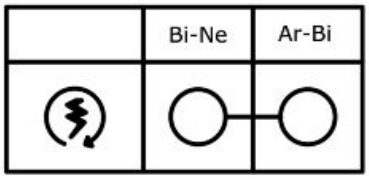
HORN BUTTON



LIGHT SWITCH



STARTER BUTTON



IGNITION SWITCH

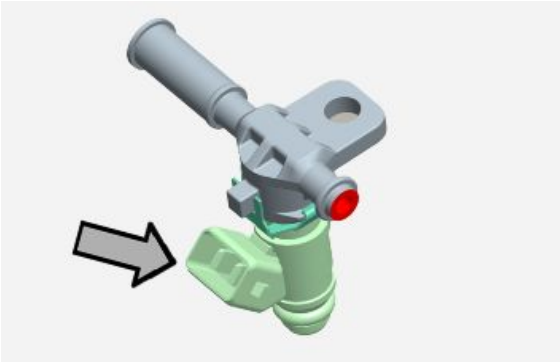
	Ar	Rs-Ne	Gr	Bi-Ne
0 LOCK				
1 OFF			○	○
2 ON	○	○		

FUEL INJECTOR

Type: 3 holes

Conicity of the nozzle: 20°

Resistance at terminals: 13.7 - 15.2 Ohm

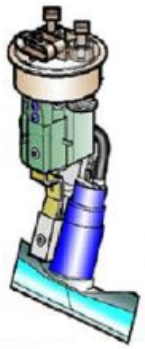


FUEL PUMP UNIT

Mechanical type pressure regulator operating at a pressure of 2.5 BAR

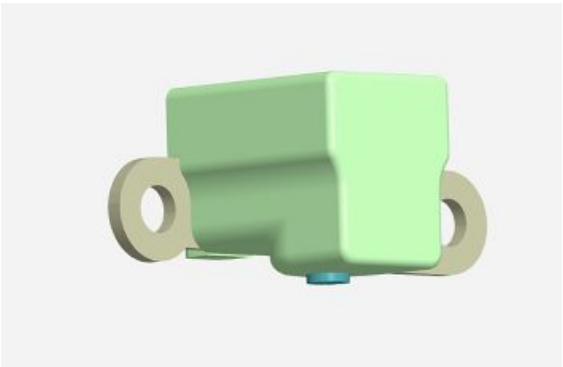
Pump winding resistance: ~ 1.5 Ohm

Input current during regular functioning: 1.4 - 1.8 A



SPEED/PHASE SENSOR

Resistance between pins 13 and 15: 100 to 150 Ohm at approx. 20°



ENGINE TEMPERATURE SENSOR

0° = 5,900 Ohm

+10° = 3,800 Ohm

+20° = 2,500 Ohm

+30° = 1,700 Ohm

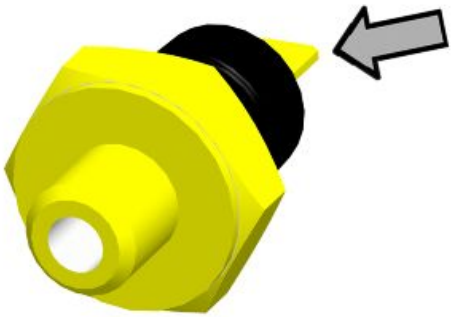
+80° = 300 Ohm

MINIMUM OIL PRESSURE SENSOR

Normally closed switch

Activation threshold: 0.3 - 0.6 BAR

With the engine off: continuity between muffler and ground



H.V. COIL

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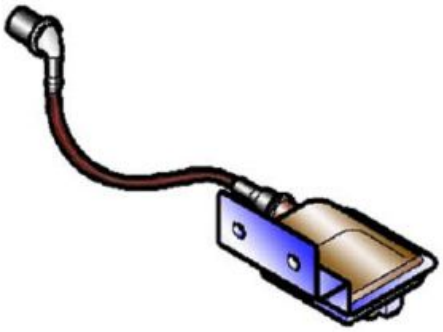
- Resistance of the primary = 0.5 Ohm ± 8%
- Resistance between primary and ground = infinite
- Resistance between primary and H.V. output = 3.1KOhm ± 9%

- Presence of battery voltage between pins 22 and 26 of the interface cable harness upon shifting to ON and for 2 sec.

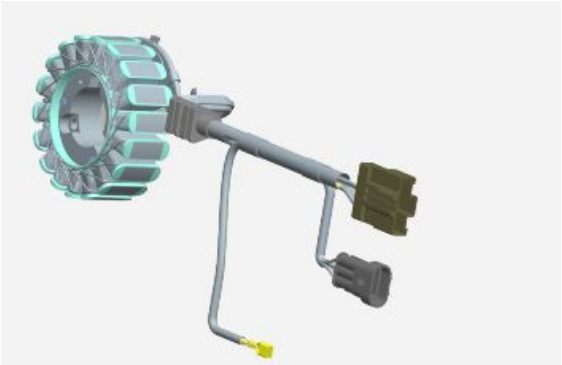


STATOR

Power: 450 W

Resistance between terminals: 0.2 - 1 Ohm

terminal insulation from ground



Frame and suspensions

CHASSIS AND SUSPENSIONS

Specification	Desc./Quantity
Type	Unitised body made of stamped plate
Front suspension	Single arm suspension (cantilever wheel) fitted with a double-acting hydraulic shock absorber with coaxial spring
Front shock absorber axial travel	86.5 mm
Rear suspension	Engine with swinging fork articulated to frame by means of an arm with 2 degrees of freedom Pair of double-acting hydraulic shock absorbers and coaxial springs with preloading adjustment in 4 positions.
Rear shock absorber axial travel	89.5 mm

Brakes

BRAKES

Specification	Desc./Quantity
Front	Ø 220 disc brake and floating calliper with Ø 25 mm twin plungers and hydraulic control (lever on the far right end of the handlebar)
Rear	Ø 220 disc brake and calliper with two Ø 30 mm counteracting plungers and hydraulic control (lever on the far left end of the handlebar)

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Front wheels - light alloy rims	3.00x12
Rear wheels - light alloy rims	3.00x12
Front tyres	120/70-12" Tubeless
Rear tyres	130/70-12" Tubeless

TYRE PRESSURE

Specification	Desc./Quantity
Front tyre pressure (when cold)	1.8 bar
Rear tyre pressure (when cold)	2 bar
Tyre pressure (when cold) with passenger	2.2 bar

N.B.

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE. REGULATE PRESSURE ACCORDING TO THE WEIGHT OF BOTH RIDER AND ACCESSORIES

Tightening Torques

STEERING ASSEMBLY

Name	Torque in Nm
Upper steering ring nut	35 to 40
Lower steering ring nut	12 - 14
Handlebar fixing screw	50 ÷ 55
Fixing screws for the handlebar control unit U-bolts	7 to 10

CHASSIS ASSEMBLY

Name	Torque in Nm
Engine-swinging arm pin	64 - 72
swinging arm bolt - body shell	76 ÷ 83
Engine and vehicle side swinging arm junction bolt	33 to 41
Bolt of the Silent block support plate	42 ÷ 52
Centre stand bolt	32 - 40
Side stand fixing bolt	35 - 40

FRONT SUSPENSION

Name	Torque in Nm
Screw fixing the shock absorber to the shock absorber - calliper attachment plate	20 to 27
Wheel axle nut	74 to 88
Wheel screw	20 - 25
Screw fixing rear mudguard to steering	5 - 6.5
shock absorber upper clamp	20 to 30

FRONT BRAKE

Name	Torque in Nm
Brake fluid pump-hose fitting	20 to 25
Brake fluid pipe-calliper fitting	19 ÷ 24
Screw fixing calliper to the shock absorber - calliper plate attachment	24 to 27
Disc tightening screw	6 (Apply LOCTITE 242 threadlock, medium strength)
Oil bleed screw	12 - 16
Pad fastening pin	19.6 ÷ 24.5
Brake pump reservoir screws	1.5 ÷ 2
Brake disc screws	8 ÷ 10

REAR SUSPENSION

Name	Torque in Nm
Retainer for left shock absorber to crankcase support plate	20 to 25
Shock absorber lower fitting	40 to 45
Shock absorber upper fitting	20 to 25
Rear wheel axle	104 to 126
Screw fixing wheel to hub	20 to 25
Screws for silencer - shock absorber support arm on engine	20 ÷ 25 (The two screws must be tightened after having done so with the rear wheel axle nut at the specified torque. Safety fasteners: see «Pre-delivery Operations»)
Engine- and vehicle-side swinging arm junction bolt	40 to 45

REAR BRAKE

Name	Torque in Nm
Brake fluid pump-hose joint	20 - 25
Brake fluid pipe-calliper fitting	20 - 25
Rear disc tightening bolt	11 to 13
Oil bleed screw	12÷16
Calliper to engine tightening screw	20 to 25
Brake pump reservoir screws	1.5 ÷ 2
Calliper coupling screw	30 ÷ 33

SILENCER

Name	Torque in Nm
Silencer heat guard fixing screw	4 ÷ 5
Screw for fixing silencer to supporting arm	20 - 25
Oxygen sensor tightening on exhaust manifold	40 - 50
Exhaust manifold-silencer joint tightening	12 to 13
Manifold - silencer diaphragm tightening clamp	16 - 18

LUBRICATION

Name	Torque in Nm
Hub oil drainage plug	15 to 17
Oil filter on crankcase fitting	27 - 33
engine oil drainage plug/mesh filter	24 to 30
Oil filter	4 to 6
Oil pump cover screws	7 - 9
Screws fixing oil pump to crankcase	5 - 6
oil pump driving crown gear screw	10 - 14
Oil pump cover plate screws	4 to 6
Oil sump screws	10 - 14
Minimum oil pressure sensor	12 - 14

CYLINDER HEAD

Name	Torque in Nm
Spark plug	12 - 14
Cylinder head cover screws	6 - 7
Head to cylinder retaining nuts	7±1 + 10±1 + 270°
Head side fixing screws	11 - 12
Starter ground screw	7 to 8.5
Tappet set screw lock nut	6 to 8
Inlet manifold screws	11 - 13
Timing chain tensioner pad screw	10 - 14
Starter ground bell screw	11 to 15
Timing chain tensioner support screw	11 - 13
Timing chain tensioner central screw	5 - 6
Camshaft retention plate screw	4 to 6

TRANSMISSION

Name	Torque in Nm
Belt support roller screw	11 - 13
Clutch assembly nut on driven pulley	45 - 50

Name	Torque in Nm
Driving pulley nut	75 - 83
Transmission cover screws	11 - 13
Driven pulley shaft nut	54 - 60
Rear hub cover screws	24 - 27

FLYWHEEL

Name	Torque in Nm
Flywheel cover screw	11 - 13
Stator unit screws	3 - 4 (Apply LOCTITE medium type 242 threadlock)
Flywheel nut	94 - 102
Pick-Up fixing screws	3 - 4
Screws fixing freewheel to flywheel	13 to 15

CRANKCASE AND CRANKSHAFT

Name	Torque in Nm
Screws for engine crankcase internal bulkhead (transmission-side half shaft)	4 to 6
Engine crankcase coupling screws	11 - 13
Starter motor screws	11 - 13
Crankcase timing cover screws	3.5 - 4.5 (Apply LOCTITE medium type 242 threadlock)

COOLING

Name	Torque in Nm
Water pump rotor cover	3 - 4
Thermostat cover screws	3 - 4
Bleed screw	3

Versions for market USA-CND

STEERING ASSEMBLY

Name	Torque in Nm
Upper steering ring nut	25.8 - 29.5 lb*ft
Lower steering ring nut	8.9 - 10.3 lb*ft
Handlebar fixing screw	36.9 - 40.6 lb*ft
Handlebar and control unit U-bolts	5.2 - 7.4 lb*ft

FRAME ASSEMBLY

Name	Torque in Nm
Engine-swinging arm pin	49.4 - 55.3 lb*ft
Swinging arm bolt - body shell	56.0 - 61.2 lb*ft
Engine and vehicle side swinging arm junction bolt	29.5 - 33.2 lb*ft
Silent-block support plate to frame	31.0 - 38.4 lb*ft
Centre stand fixing	23.6 - 29.5 lb*ft
Side stand clamp	25.8 - 29.5 lb*ft

FRONT SUSPENSION

Name	Torque in Nm
Lower shock absorber clamp	14.8 - 19.9 lb*ft
Wheel axle	54.6 - 64.9 lb*ft
Wheel to hub	14.8 - 18.4 lb*ft
Front mudguard retainer	3.7 - 4.8 lb*ft
Upper shock absorber retainer	14.8 - 22.1 lb*ft

FRONT BRAKE

Name	Torque in Nm
Brake fluid hose-pump fitting	14.8 - 18.4 lb*ft
Brake fluid pipe-calliper fitting	14.0 - 17.7 lb*ft
Clamp to shock absorber plate tightening	17.7 - 19.6 lb*ft
Oil bleed screw	8.9 - 11.8 lb*ft
Pad fastening pin	14.5 - 18.1 lb*ft

Name	Torque in Nm
Brake pump tray	1.1 - 1.5 lb*ft
Front brake disc	5.9 - 7.4 lb*ft

REAR SUSPENSION

Name	Torque in Nm
left shock absorber to crankcase support plate fixing	14.8 - 18.4 lb*ft
Lower shock absorber clamp	29.5 - 33.2 lb*ft
Upper shock absorber retainer	14.8 - 18.4 lb*ft
Rear wheel axle	76.7 - 92.9 lb*ft
Wheel to hub	14.8 - 18.4 lb*ft
Shock absorber support arm on engine	14.8 - 18.4 lb*ft
Engine- and vehicle-side swinging arm junction bolt	29.5 - 33.2 lb*ft

REAR BRAKE

Name	Torque in Nm
Brake fluid hose-pump fitting	14.8 - 18.4 lb*ft
Brake fluid pipe-calliper fitting	14.8 - 18.4 lb*ft
Rear disc tightening	8.1 - 9.6 lb*ft
Oil bleed	8.9 - 11.8 lb*ft
Brake calliper to engine	14.8 - 18.4 lb*ft
Brake pump tray	1.1 - 1.5 lb*ft
Calliper coupling	22.1 - 24.3 lb*ft

SILENCER

Name	Torque in Nm
Muffler heat guard fixing	3.0 - 3.7 lb*ft
Fixing silencer to supporting arm	14.8 - 18.4 lb*ft
Lambda probe on manifold	29.5 - 36.9 lb*ft
Exhaust manifold-silencer joint	8.9 - 9.6 lb*ft
Manifold-silencer clamp tightening	11.8 - 13.3 lb*ft

LUBRICATION

Name	Torque in Nm
Hub oil drainage plug	11.1 - 12.5 lb*ft
Oil filter fitting on crankcase	19.9 - 24.3 lb*ft
engine oil drainage plug/mesh filter	17.7 - 22.1 lb*ft
Oil filter	3.0 - 4.4 lb*ft
Oil pump cover	5.2 - 6.6 lb*ft
Pump to crankcase fixing	3.7 - 4.4 lb*ft
Oil pump driving crown gear	7.4 - 10.3 lb*ft
Oil pump cover plate	3.0 - 4.4 lb*ft
Oil sump	7.4 - 10.3 lb*ft
Oil pressure sensor	8.9 - 10.3 lb*ft

CYLINDER HEAD

Name	Torque in Nm
Spark plug	8.9 - 10.3 lb*ft
Head cover	4.4 - 5.2 lb*ft
Head fixing nuts	4.4 - 5.9 + 6.6 - 8.1 lb*ft + 270°
Head side fixing screws	8.1 - 8.9 lb*ft
Starter grounds	5.2 - 6.3 lb*ft
Tappet set screw lock nut	4.4 - 5.9 lb*ft
Intake manifold	8.1 - 9.6 lb*ft
Timing chain tensioner slider	7.4 - 10.3 lb*ft
Starter grounds housing	8.1 - 11.1 lb*ft
Timing chain tensioner support	8.1 - 9.6 lb*ft
Timing chain tensioner central screw	3.7 - 4.4 lb*ft
Camshaft retention plate	3.0 - 4.4 lb*ft

TRANSMISSION

Name	Torque in Nm
Belt support roller	8.1 - 9.6 lb*ft

Name	Torque in Nm
Clutch assembly on driven pulley	33.6 - 36.9 lb*ft
Driving pulley	55.3 - 61.2 lb*ft
Transmission cover	8.1 - 9.6 lb*ft
Driven pulley axle	39.8 - 44.3 lb*ft
Rear hub cover	17.7 - 19.9 lb*ft

FLYWHEEL

Name	Torque in Nm
Flywheel cover	8.1 - 9.6 lb*ft
Stator assembly*	2.2 - 3.0 lb*ft
FLYWHEEL	69.3 - 75.2 lb*ft
Pick-up fixing	2.2 - 3.0 lb*ft
Freewheel to flywheel fixing	9.6 - 11.1 lb*ft

CRANKCASE AND CRANKSHAFT

Name	Torque in Nm
Engine crankcase internal	3.4 - 4.4 lb*ft
Crankcase coupling	8.1 - 9.6 lb*ft
STARTER MOTOR	8.1 - 9.6 lb*ft
Crankcase timing cover*	2.6 - 3.3 lb*ft

COOLING

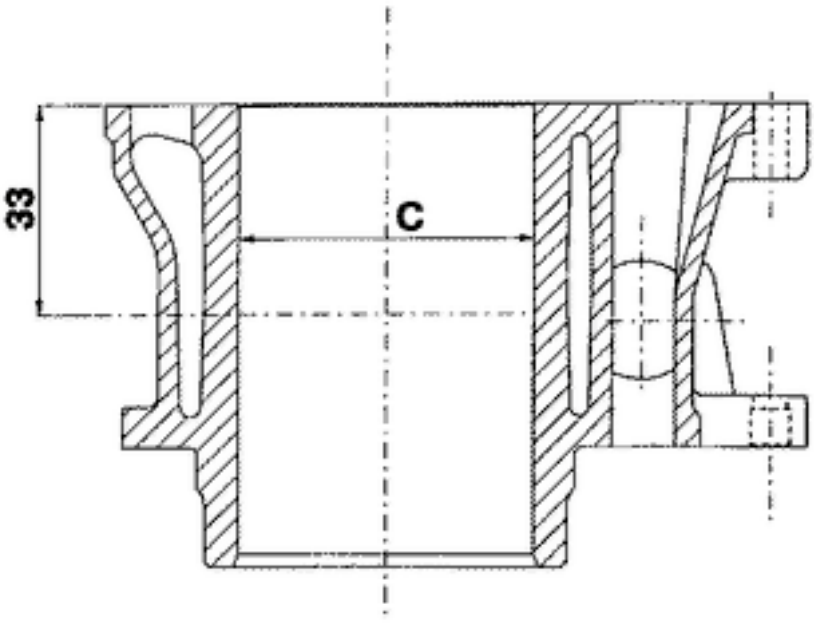
Name	Torque in Nm
Water pump rotor cover	2.2 - 3.0 lb*ft
Thermostat cover	2.2 - 3.0 lb*ft
Bleed screw	2.2 lb*ft

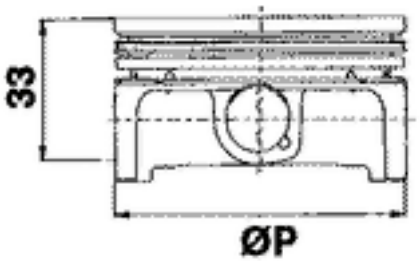
(*) with Loctite 243

Overhaul data

Assembly clearances

Cylinder - piston assy.





CYLINDER - PISTON

Specification	Desc./Quantity
Plunger diameter	74.967 +0.014 -0.014 mm
Cylinder diameter	75 +0.038 +0.01 mm

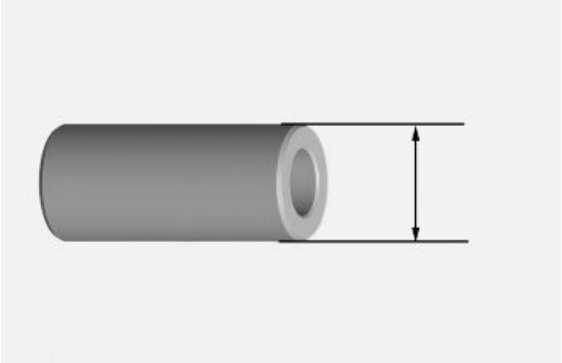
COUPLING CATEGORIES

Name	Initials	Cylinder	Piston	Play on fitting
cylinder-piston	M	75.01 ÷ 75.017	74.953 ÷ 74.960	0.050 ÷ 0.064
cylinder-piston	N	75.017 ÷ 75.024	74.960 ÷ 74.967	0.050 ÷ 0.064
cylinder-piston	O	75.024 ÷ 75.031	74.967 ÷ 74.974	0.050 ÷ 0.064
cylinder-piston	P	75.031 ÷ 75.038	74.974 ÷ 74.981	0.050 ÷ 0.064

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.

- Measure the outer diameter of the gudgeon pin.

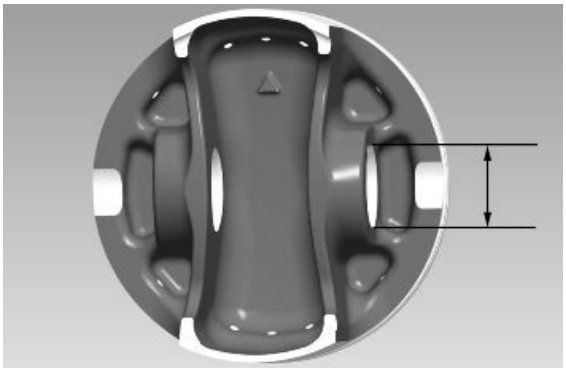


Characteristic

Pin outside diameter

16 +0 -0.004 mm

- Measure the diameter of the bearings on the piston.



Characteristic

Standard diameter

16 +0.006 +0.001 mm

- Calculate the pin - piston coupling clearance.

N.B.

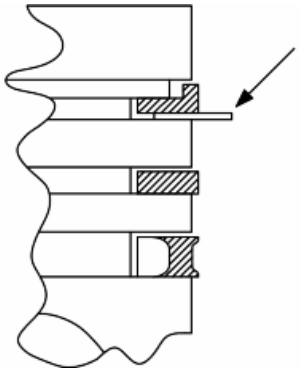
THE PIN HOUSINGS HAVE TWO LUBRICATION CHANNELS FOR THIS REASON MEASURE THE DIAMETER ACCORDING TO THE PISTON AXIS

Characteristic

Standard clearance:

0.001 - 0.010 mm

- Carefully clean the seal housings.
- Measure the coupling clearance between the sealing rings and the piston grooves using suitable sensors, as shown in the diagram.
- If the clearance is greater than that indicated in the table, replace the piston.



N.B.

MEASURE CLEARANCE BY INSERTING THE BLADE OF THE FEELER GAUGE FROM THE 2nd SEALING RING SIDE.

Fitting clearance

1st compression ring - standard coupling clearance 0.015 - 0.06 mm **1st compression ring - maximum clearance allowed after use** 0.07 mm **2nd compression ring - standard coupling clearance** 0.015 - 0.06 mm **2nd compression ring - maximum clearance allowed after use** 0.07 mm **oil scraper ring - standard coupling clearance** 0.015 - 0.06 mm **oil scraper ring - maximum clearance allowed after use** 0.07 mm

- Check that the head coupling surface is not worn or misshapen.
- Pistons and cylinders are classified according to their diameter. The coupling must be made with those of the same type (M-M, N-N, O-O, P-P).

Characteristic

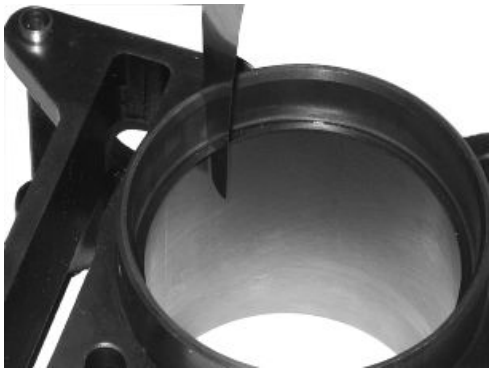
Maximum run-out allowed:

0.001 in 0.05 mm

Piston rings

Sealing rings

- Alternately insert the three sealing rings into the cylinder, in the area where it retains its original diameter. Using the piston, insert the rings perpendicularly to the cylinder axis.
- Measure the opening (see figure) of the sealing rings using a feeler gauge.
- If any measurements are greater than specified, replace the piston rings.



N.B.

BEFORE REPLACING ONLY THE PISTON RINGS, ENSURE THAT THE CLEARANCE BETWEEN THE PISTON RINGS AND THE PISTON RING GROOVES, AND BETWEEN THE PISTON AND THE CYLINDER, IS AS SPECIFIED. IN ANY

CASE, NEW PISTON RINGS USED IN COMBINATION WITH A USED CYLINDER MAY HAVE DIFFERENT BEDDING CONDITIONS THAN THE STANDARD.

Characteristic

Top piston ring

Standard opening: 0.15 to 0.30 mm

Middle piston ring

Standard opening: 0.20 ÷ 0.40 mm

scraper ring

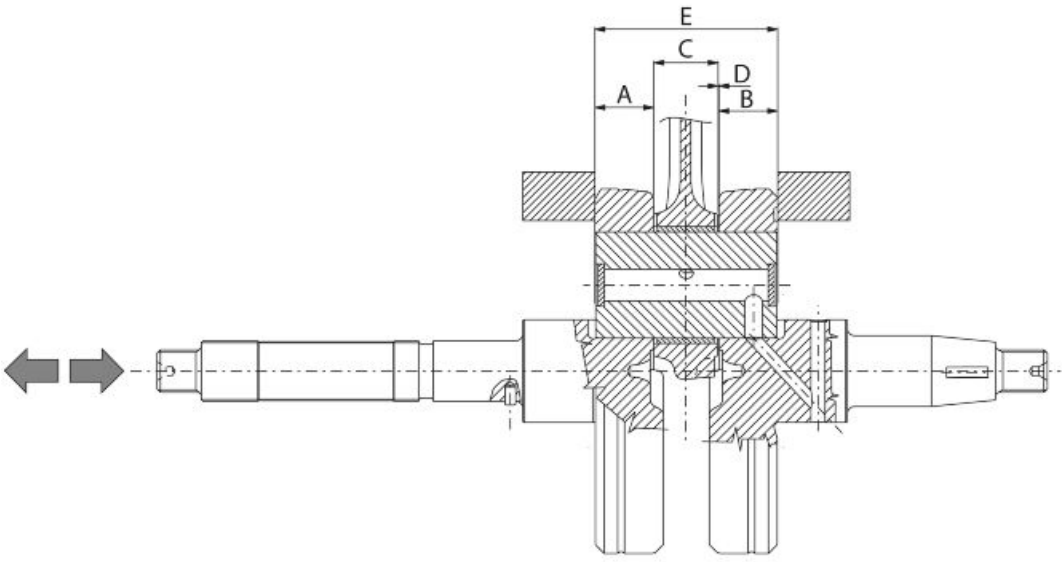
Standard opening: 0.20 ÷ 0.40 mm

Crankcase - crankshaft - connecting rod

CRANKSHAFT

Titolo	Durata/Valore	Testo Breve (< 4000 car.)	Indirizzo Immagine
Crankshaft		Crankshaft to connecting rod axial clearance	

Crankshaft to connecting rod axial clearance

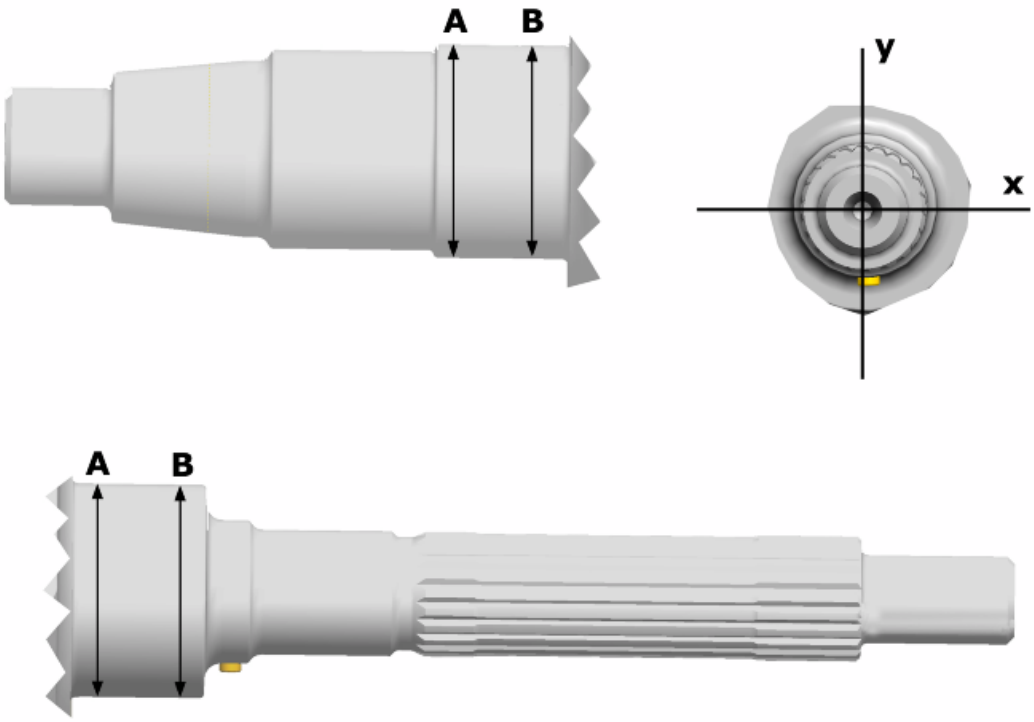


CRANKSHAFT / CONNECTING ROD AXIAL CLEARANCE

Name	Description	Dimensions	Initials	Quantity
Transmissionside half-shaft		16.6 +0-0.05	A	D = 0.20 - 0.50
Flywheel-side halfshaft		16.6 +0-0.05	B	D = 0.20 - 0.50
Connecting rod		18 -0.10 -0.15	C	D = 0.20 - 0.50
Spacer tool		51.4 +0.05	E	D = 0.20 - 0.50

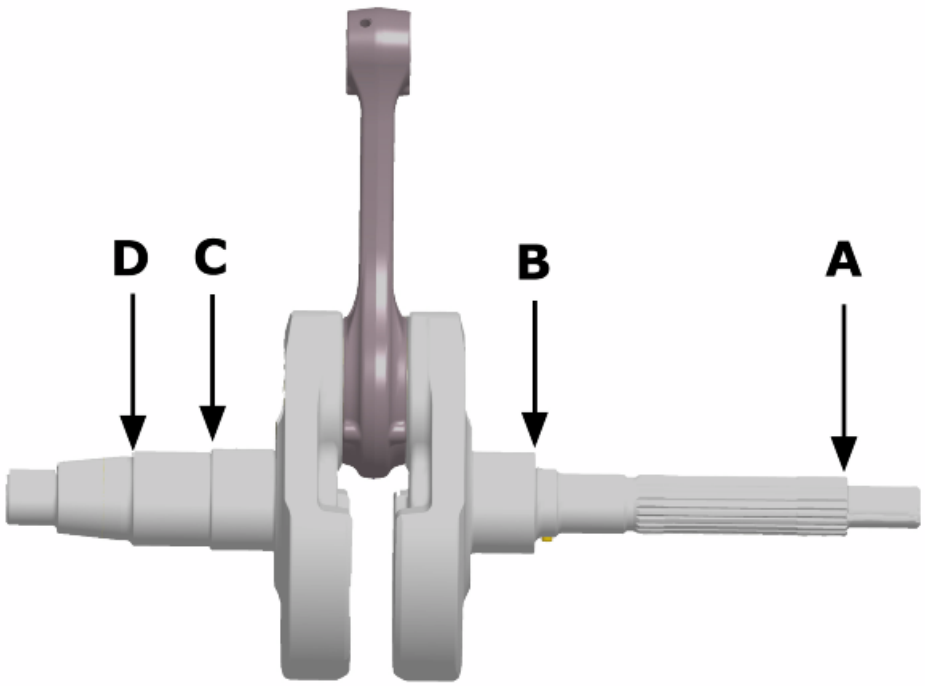
Crankshaft bearing diameter.

Measure the bearings on both x-y axes.



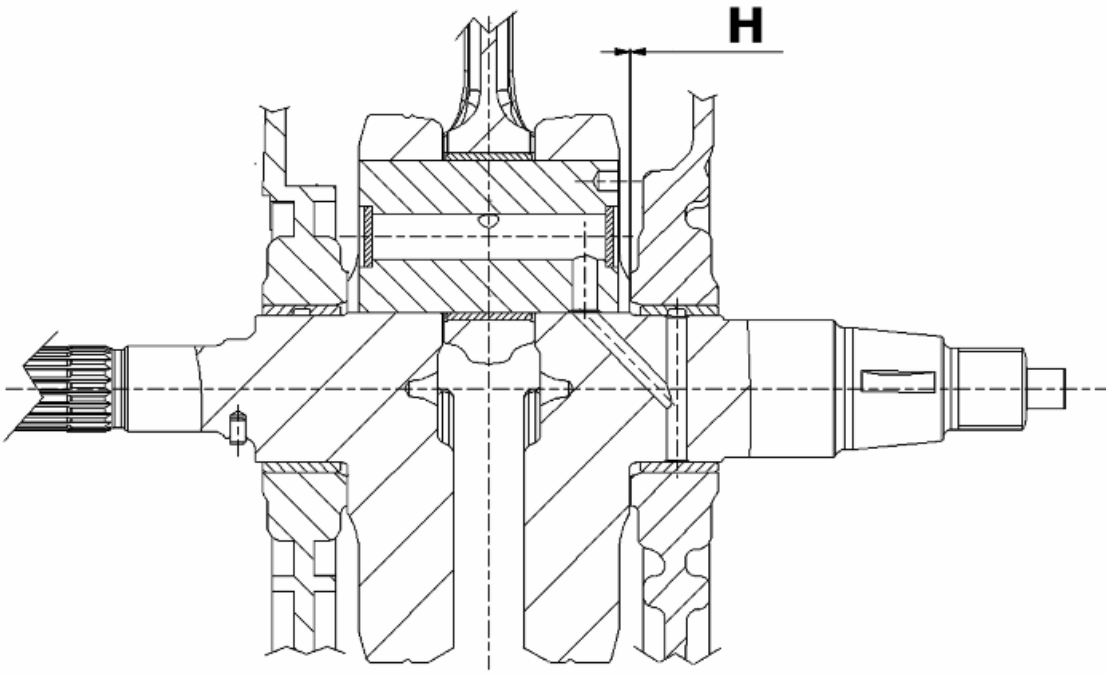
CRANKSHAFT

Specification	Desc./Quantity
Crankshaft bearings: Standard diameter: Cat. 1	28.998 ÷ 29.004 mm
Crankshaft bearings: Standard diameter: Cat. 2	29.004 ÷ 29.010 mm



MAXIMUM OFF-LINE ALLOWED

Specification	Desc./Quantity
A =	0.15 mm
B =	0.010 mm
C =	0.010 mm
D =	0.10 mm



Characteristic

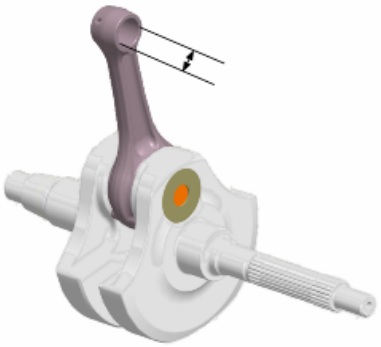
Crankshaft-crankcase axial clearance (H)

0.15 ÷ 0.43 mm

- Using a bore gauge, measure the connecting rod small end diameter.

N.B.

IF THE CONNECTING ROD SMALL END DIAMETER EXCEEDS THE STANDARD DIAMETER, SHOWS SIGNS OF WEAR OR OVERHEATING, REPLACE THE CRANKSHAFT AS DESCRIBED IN THE «CRANKCASE AND CRANKSHAFT» CHAPTER.



Characteristic

Standard diameter

16 +0.025 +0.015 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.
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.
- 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 figure.
- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.
- Check the inside diameter of the main bushings in the three directions indicated in the diagram.
- Repeat the measurements for the other bushing half. see diagram.
- There are three crankcase versions: with BLUE, YELLOW or GREEN bushings.
- There is just one type of bushing housing in the crankcase. The standard diameter of the bushings after fitting depends on the choice of coupling.
- There are 2 categories of bushing seats in the crankcase - Cat 1 and Cat 2 - just like those for the crankshaft
- The main bushings are subdivided into 3 categories according to thickness; see table below:

BUSHINGS

TYPE	IDENTIFICATION	CRANKSHAFT HALF-BEARING
B	BLUE	1.973 - 1.976
C	YELLOW	1.976 - 1.979
E	GREEN	1.979 - 1.982

COMBINATIONS

BUSHING CATEGORY	CRANKCASE HALVES CATEGORY	BUSHING INSIDE DIAMETER AFTER FITTING
B	2	29.024 ÷ 29.054

BUSHING CATEGORY	CRANKCASE HALVES CATEGORY	BUSHING INSIDE DIAMETER AFTER FITTING
C	1	29.024 ÷ 29.054
	2	29.018 ÷ 29.048
E	1	29.018 ÷ 29.048

Combine the crankshaft with two crankwebs category 1 with a crankcase category 1 (or cat. 2 with cat. 2) A spare crankcase cannot be combined with a crankshaft with mixed categories. Spare shafts have half-shafts of the same category.

CATEGORIES

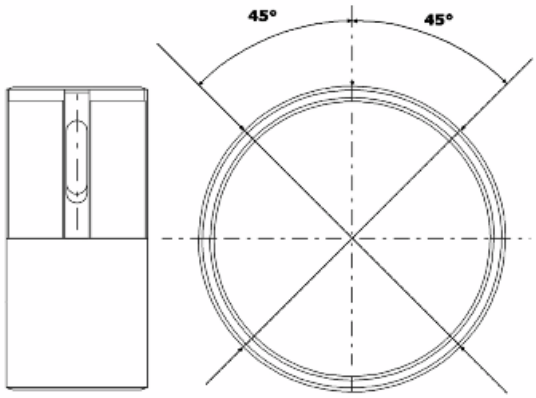
CRANKCASE HALVES	ENGINE HALF-SHAFT	BUSHING
Cat. 1	Cat. 1	E
Cat. 2	Cat. 2	B
Cat. 1	Cat. 2	C
Cat. 2	Cat. 1	C

N.B.

DO NOT TAKE THE MEASUREMENT ON THE TWO HALF-SHELL COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.

N.B.

SPARE CRANKCASES ARE SELECTED WITH CRANKCASE HALVES OF THE SAME CATEGORY AND ARE FITTED WITH CATEGORY C (YELLOW) BUSHINGS



Characteristic

Crankshaft-bushing maximum clearance allowed:

0.08 mm

Diameter of crankcase without bushing

CAT 1: 32.959 ÷ 32.965 mm

CAT 2: 32.953 ÷ 32.959 mm

Cylinder Head

Clean all the coupling surfaces thoroughly before servicing the head. Pay attention to the position of the springs and valves so as not to change the original position upon refitting them

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

Characteristic

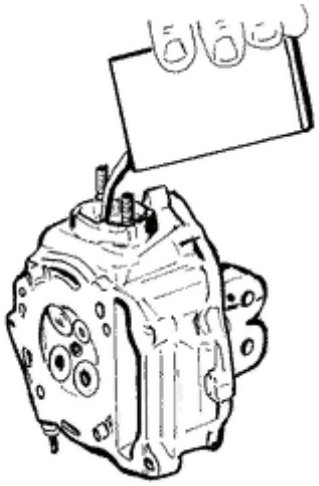
Maximum run-out allowed:

0.1 mm

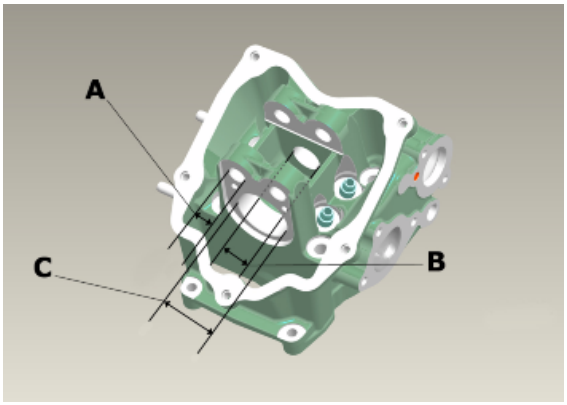
- In case of irregularities, replace the head.
- Check the sealing surfaces for the inlet and exhaust manifold.
- Check that the camshaft and the rocker pin bearings show no signs of wear.
- Check that the head cover show no signs of wear.

- Check that the coolant sealing buffer is not rusted.

- Fit the valves into the cylinder head.
- Alternatively test the intake and exhaust valves.
- The test should be carried out by filling the manifold with fuel and checking that the head does not ooze through the valves when they are just pressed by the fingers.



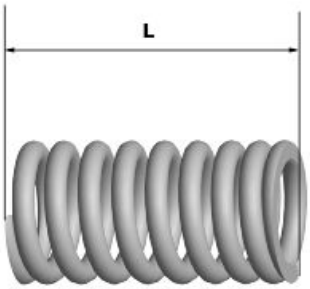
Measure the camshaft seat bearings and rocking lever support pins with a bore meter



HEAD BEARINGS

Specification	Desc./Quantity
bearing «A»	Ø 12.000 - 12.018
bearing «B»	Ø 20.000 - 20.021
bearing «C»	Ø 37.000 - 37.025

Measure the unloaded spring length



Characteristic

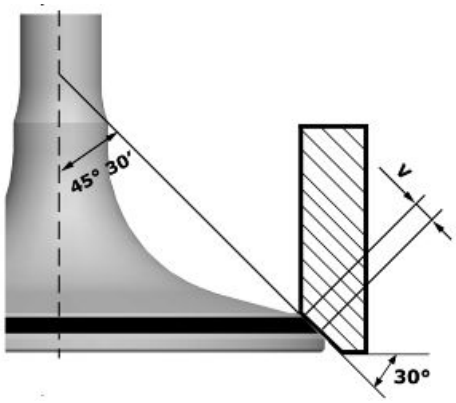
Standard length

40.2 mm

Allowable limit after use:

38.2 mm

- Remove any carbon deposits from the valve seats.
- Check the width of the mark on the valve seat «**V**» with Prussian blue.



Characteristic

Standard value:

1 - 1.3 mm

Limit allowed:

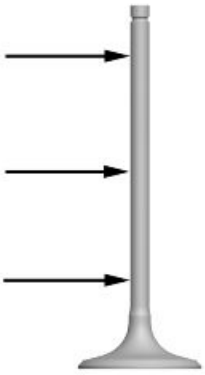
1.6 mm

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

STANDARD VALVE LENGTH

Specification	Desc./Quantity
Valve check Standard length	Intake: 94.6 mm
Valve check Standard length	Exhaust: 94.4 mm

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



STANDARD DIAMETER

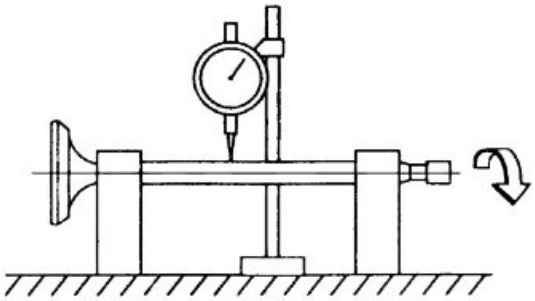
Specification	Desc./Quantity
Inlet:	4.987 ÷ 4.972 mm
Outlet:	4.975 ÷ 4.960 mm

MINIMUM DIAMETER ALLOWED

Specification	Desc./Quantity
Inlet:	4.96 mm
Outlet:	4.945 mm

- Calculate the clearance between the valve and its guide.

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

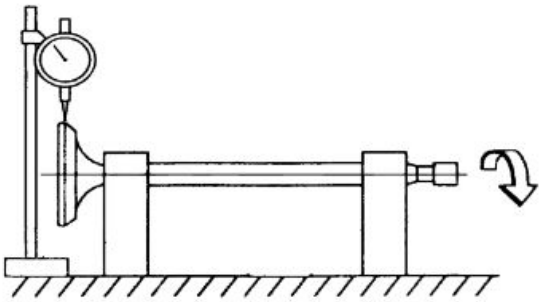


Characteristic

Limit value allowed:

0.1 mm

- Check the concentricity of the valve head by placing a dial gauge at right angles to the valve head and rotating it on the «**V**» shaped support.

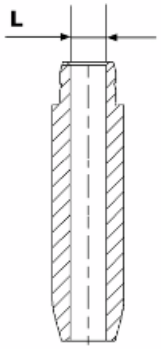


Characteristic

Limit allowed:

0.03 mm

Measure the valve guides.



Characteristic

Valve guide:

5+0.012 mm

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

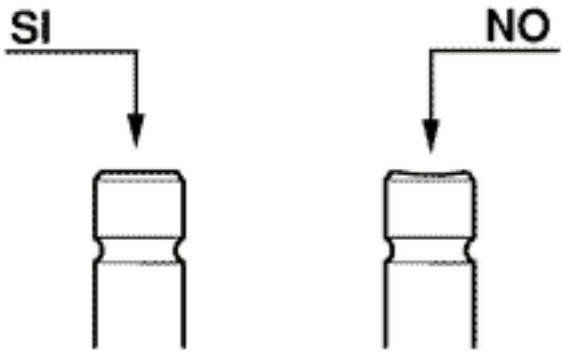
INTAKE

Specification	Desc./Quantity
Standard clearance:	0.013 ÷ 0.04 mm
Limit allowed:	0.08 mm

EXHAUST

Specification	Desc./Quantity
Standard clearance:	0.025 - 0.052 mm
Limit allowed:	0.09 mm

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



- If no faults are found during the above checks, the same valves can be reused. For better sealing results, we recommend grinding the valve seats. Grind the valves gently with fine-grained lapping compound. Upon grinding, keep the cylinder head in 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 FAYING 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 CHANGE THE VALVE FITTING POSITION (RH - LH).

- Check the camshaft bearings for signs of abnormal wear or scores.
- Using a micrometer, measure the camshaft bearings.

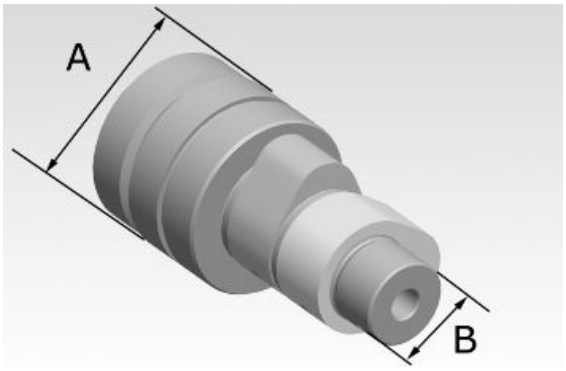
STANDARD DIAMETER

Specification	Desc./Quantity
Camshaft check: Standard diameter	Bearing A Ø: 36.95 to 36.975 mm
Camshaft check: Standard diameter	Bearing B diameter: 19.959 - 19.98 mm

MINIMUM ADMISSIBLE DIAMETER

Specification	Desc./Quantity
Camshaft check: Minimum diameter permitted	Bearing A Ø: 36.94 mm

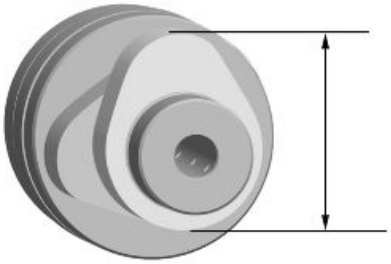
Specification	Desc./Quantity
Camshaft check: Minimum diameter permitted	Bearing B diameter: 19.950 mm



- Using a gauge, measure the height of the cams.

STANDARD HEIGHT

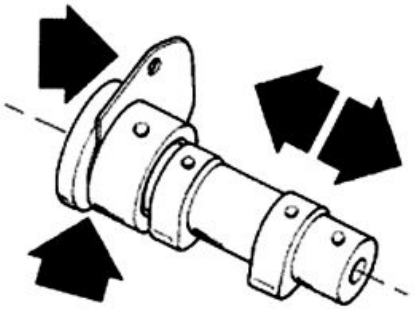
Specification	Desc./Quantity
Camshaft check: Standard height	Intake: 30.285 mm
Camshaft check: Standard height	Exhaust: 29.209 mm



Check the axial clearance of the camshaft

CAMSHAFT AXIAL CLEARANCE

Specification	Desc./Quantity
Camshaft check: Standard axial clearance:	0.11 - 0.41 mm
Camshaft check: Maximum admissible axial clearance	0.42 mm



- Check the outside diameter of the rocker pins
- Check there are no signs of wear or scoring on the rocker pins.
- Check the internal diameter of each rocker arm.

- Check there are no signs of wear on the contact pads with the cam and on the jointed adjustment plate.

ROCKING LEVERS AND PIN DIAMETER:

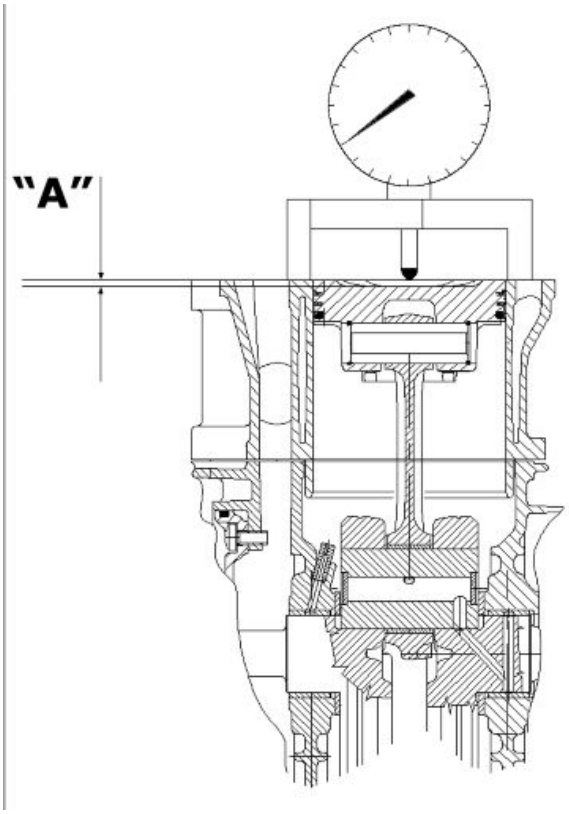
Specification	Desc./Quantity
Rocking lever inside diameter: Standard diameter	Ø 12.000 - 12.011 mm
Rocking lever pin diameter: Standard diameter	Ø 11.977 - 11.985 mm

Slot packing system

Characteristic

Compression ratio

10.5 - 11.5: 1



Distance "**A**" to be measured is a value of piston recess, it indicates by how much the piston crown descends below the plane formed by the cylinder crown. The further the piston enters into the cylinder, the thinner the base gasket to be used should be (to compensate the compression ratio) and vice versa.

N.B.

DISTANCE «A» SHOULD BE MEASURED WITH NO GASKET FITTED BETWEEN THE CRANK-CASE AND THE CYLINDER AND AFTER RESETTING THE DIAL GAUGE, WITH SUPPORT, ON A GROUND PLANE

ENGINE 300 SHIMMING

Name	Measure A	Thickness
shimming	3.70 - 3.60	0.4 ± 0.05
shimming	3.60 - 3.40	0.6 ± 0.05
shimming	3.40 - 3.30	0.8 ± 0.05

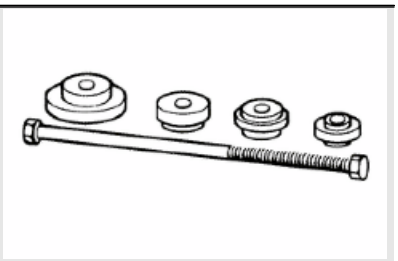
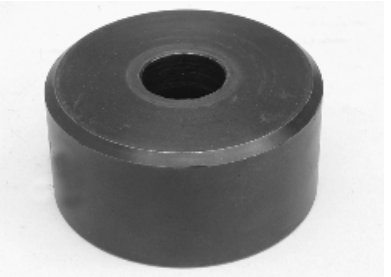
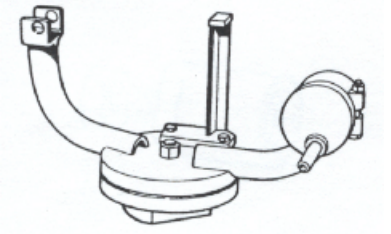
Products

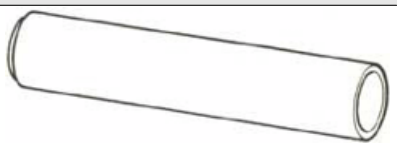
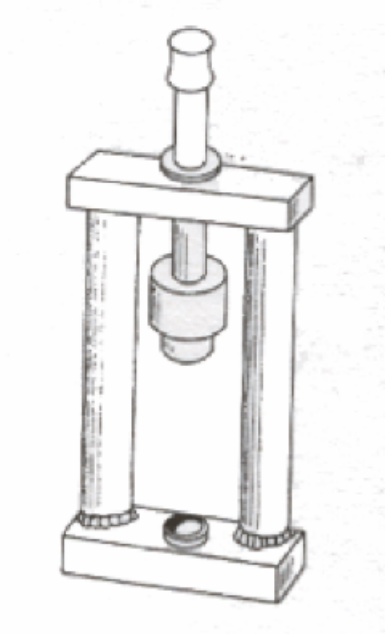
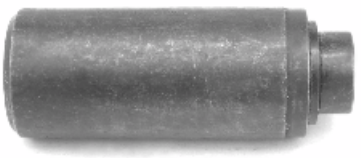
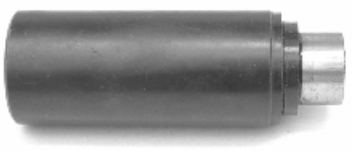
RECOMMENDED PRODUCTS TABLE

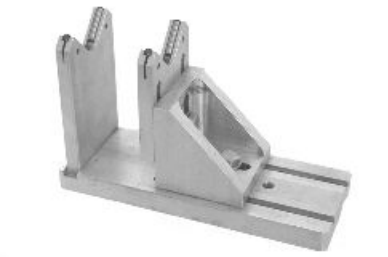
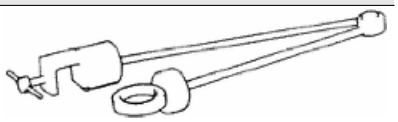
Product	Description	Specifications
AGIP GEAR SAE 80W-90	Lubricant for gearboxes and transmissions.	API GL-4
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3
AGIP FILTER OIL	Special product for the treatment of foam filters.	-
AGIP 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
AGIP BRAKE 4	Brake fluid.	SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid
AGIP PERMANENT SPECIAL	Ethylene glycol-based antifreeze fluid with organic inhibition additives. Red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16
AGIP GREASE PV2	Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.	TL 9150 066, symbol NATO G 460

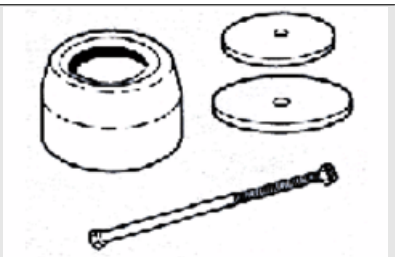
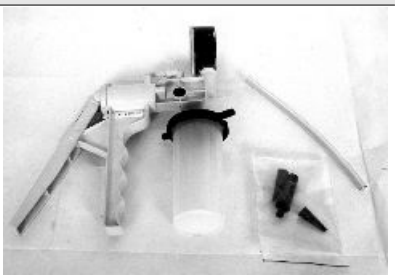
INDEX OF TOPICS

SPECIFIC TOOLS

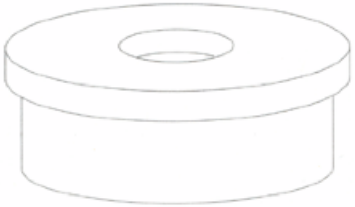
Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y017	Bell for bearings, OD 39 mm	
001467Y014	Calliper to extract 15-mm diameter bearings	
001467Y035	Bell for 47-mm outside diameter bearings	
001467Y013	Calliper to extract 15-mm diameter bearings	
005095Y	Engine support	

Stores code	Description	
002465Y	Calliper for circlips	
006029Y	Punch for fitting steering bearing seat on steering tube	
020004Y	Punch to remove steering bearings from headstock	
020021Y	Front suspension service tool	
020036Y	Punch	
020038Y	Punch	

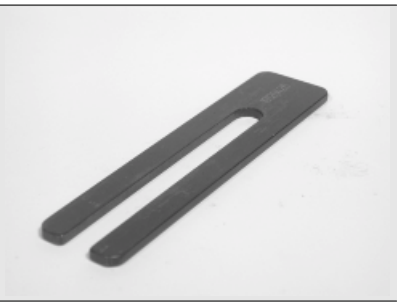
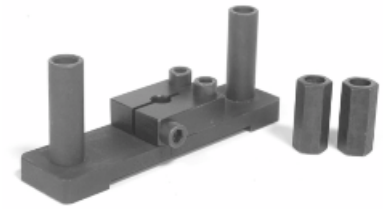
Stores code	Description	
020055Y	Wrench for steering tube ring nut	
020074Y	Support base for checking crankshaft alignment	
020115Y	Ø 18 punch	
020150Y	Air heater support	
020151Y	Air heater	
020193Y	Gauge for oil pressure check	

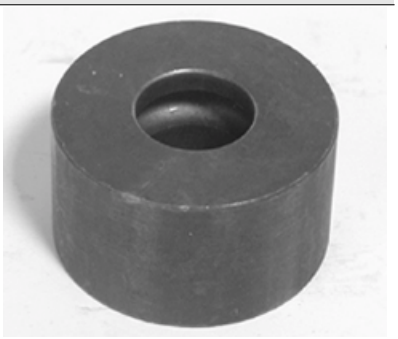
Stores code	Description	
020244Y	15-mm diameter punch	
020262Y	Crankcase splitting strip	
020271Y	Tool for removing-fitting silent bloc	
020263Y	Sheath for fitting the driven pulley	
020306Y	Punch for fitting the valve seal rings	
020329Y	Vacuum pump Mity-Vac	

Stores code	Description	
020330Y	Stroboscopic light for timing checking	
020331Y	Digital multimeter	
020332Y	Digital rpm indicator	
020335Y	Dial gauge magnetic support	
020357Y	32 x 35 mm adaptor	

Stores code	Description	
020359Y	42 x 47-mm adaptor	
020360Y	52 x 55-mm adaptor	
020363Y	20 mm guide	
020364Y	25-mm Guide	
020365Y	22 mm guide	
020375Y	28 x 30 mm adaptor	

Stores code	Description	
020376Y	Adapter handle	
020382Y	Tool for removing valve cotters fitted with part 012	
020382Y011	adaptor for valve removing tool	
020393Y	Piston fitting ring	
020412Y	15 mm guide	
020423Y	Driven pulley lock wrench	

Stores code	Description	
020424Y	Punch for fitting driven pulley roller casing	
020426Y	Piston fitting fork	
020428Y	Support to check piston position	
020431Y	Valve oil seal extractor	
020434Y	Fitting for oil pressure check	

Stores code	Description	
020441Y	26 x 28 mm adaptor	
020444Y	Tool for fitting/removing the clutch on the driven pulley	
020454Y	Tool for fitting piston pin stops (200 - 250)	
020456Y	Ø24 mm adaptor	
020467Y	Flywheel extractor	
020477Y	37-mm Adaptor	

Stores code	Description	
020480Y	Fuel pressure check set	
020483Y	30 mm guide	
020489Y	Hub cover support stud bolt kit	
020621Y	HV cable extraction adaptor	
020622Y	Transmission-side oil seal punch	
020626Y	Driving pulley lock wrench	

Stores code	Description	
020627Y	Flywheel lock wrench	
020648Y	Single battery charger	
020334Y	Multiple battery charger	
020922Y	Diagnosis Tool	

INDEX OF TOPICS

Maintenance chart

SCHEDULED MAINTENANCE TABLE

***I**: CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY.*
***C**: CLEAN, **R**: REPLACE, **A**: ADJUST, **L**: LUBRICATE*
** Replace every 2 years*

Km x 1,000	1	5	10	15	20	25	30	35	40	45	50	55	60
Safety fasteners	I		I				I				I		I
Spark plug			R		R		R		R		R		R
Drive belt				R			R			R			R
Throttle control	A		A		A		A		A		A		A
Air filter			C		C		C		C		C		C
Belt compartment air filter			I		I		I		I		I		I
Oil filter	R		R		R		R		R		R		R
Valve clearance					A				A				A
Electrical system and battery	I		I		I		I		I		I		I
Brake fluid *	I		I		I		I		I		I		I
Coolant *	I		I		I		I		I		I		I
Engine oil	R	I	R	I	R	I	R	I	R	I	R	I	R
Hub oil	R		I		R		I		R		I		R
Brake pads	I	I	I	I	I	I	I	I	I	I	I	I	I
Sliding shoes / CVT rollers			R		R		R		R		R		R
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		I		I		I
Steering	A		A		A		A		A		A		A

MAINTENANCE TABLE - TIME

Km x 1000	1	5	10	15	20	25	30	35	40	45	50	55	60
Operation Time	60'	10'	100'	45'	150'	10'	140'	10'	150'	45'	100'	10'	190'

Checking the spark advance

The ignition advance is determined electronically on the basis of parameters known by the control unit. For this reason it is not possible to interpret the reference values based on the engine rpm. The ignition advance value is detectable at any time using the diagnostic tester. It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.

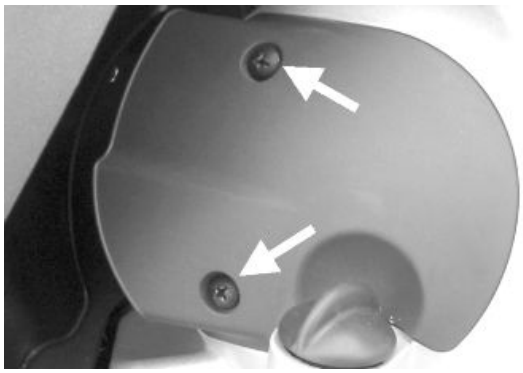
Proceed as follows:

- Remove the spark plug.
- Remove the plastic cover on the flywheel cover shown in the picture.

- Remove the transmission compartment air intake cover shown in the picture.
- Rotate the driving pulley fan using a screwdriver until the reference marks between the flywheel and flywheel cover coincide as shown in the picture.
- Bring the reference mark onto the transmission side between the fan and the transmission cover as shown in the picture.
- Refit the spark plug.
- Refit the plastic cap on the flywheel cover.
- Adjust the spark gap to the contact position (no reference mark visible) and install it on the engine between the spark plug and spark plug cap
- Connect the induction clamp on the spark gap cable respecting the proper polarity (the arrow on the clamp must be pointing at the spark plug).
- Connect the diagnostic tester.
- Start the engine.
- Select the «Parameters» function in this menu.
- Set the stroboscopic light control to the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tester.

If the values do not correspond, check:

- distribution timing
- engine speed sensor
- injection control unit



Specific tooling

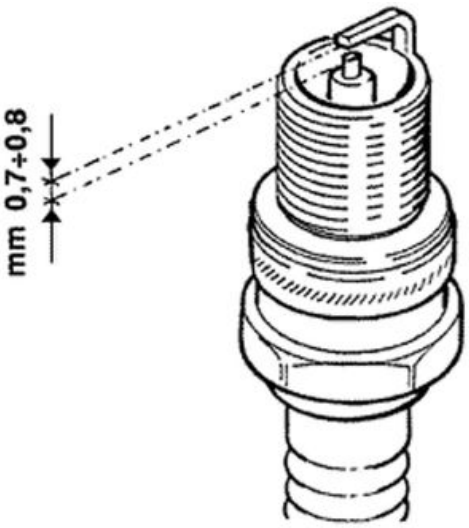
020922Y Diagnosis Tool

020330Y Stroboscopic light for timing checking

020621Y HV cable extraction adaptor

Spark plug

- Rest the scooter on its stand
- Open the saddle and take out the helmet compartment
- Disconnect the spark plug HV wire cap;
- Unscrew the spark plug using the wrench supplied;
- Check the conditions of the spark plug, make sure the insulation is intact, that the electrodes are not excessively worn or sooty, the conditions of the washer, and measure the distance between the electrodes using the appropriate feeler thickness gauge.
-Adjust the distance, if necessary, by bending the side electrode very carefully. In case of anomaly (as described before), replace the spark plug with another of the recommended type;
- Fit the spark plug with the correct inclination and manually screw it all the way down, then use the special spanner to tighten it.
- Insert the cap onto the spark plug and proceed with the reassembly operations.



CAUTION

THE SPARK PLUG MUST BE REMOVED WHEN THE MOTOR IS COLD.THE SPARK PLUG MUST BE REPLACED EVERY 20,000 KM. THE USE OF NON CONFORMING ELECTRONIC IGNITION CONTROL UNITS OR SPARK PLUGS OTHER THAN THOSE PRESCRIBED CAN SERIOUSLY DAMAGE THE ENGINE.

Characteristic

Electrode gap

0.7 to 0.8 mm

Electric characteristic

Spark plug

NGK CR8EKB

Locking torques (N*m)

Spark plug **12 - 14**

Hub oil

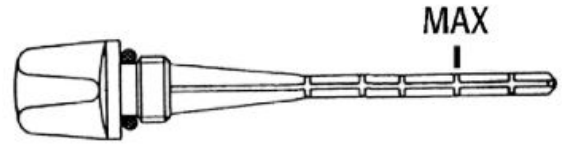
Check

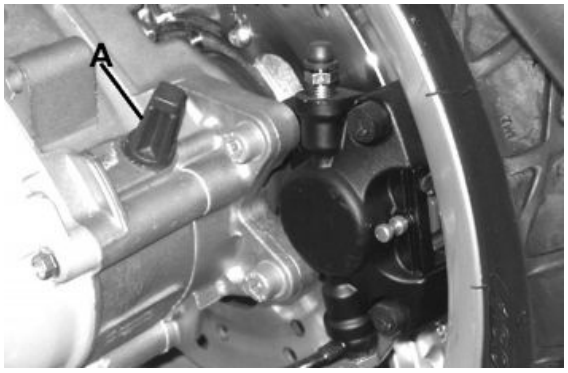
-Place the vehicle on the centre stand on flat ground;

- Remove the oil dipstick «**A**», dry it with a clean cloth and put it back into its hole **tightening it completely**;

Remove the dipstick and check that the oil level is slightly over the second notch starting from the lower end; if the level is under the MAX. mark, it needs to be filled with the right amount of hub oil.

-Screw up the oil dipstick again and make sure it is locked properly into place.



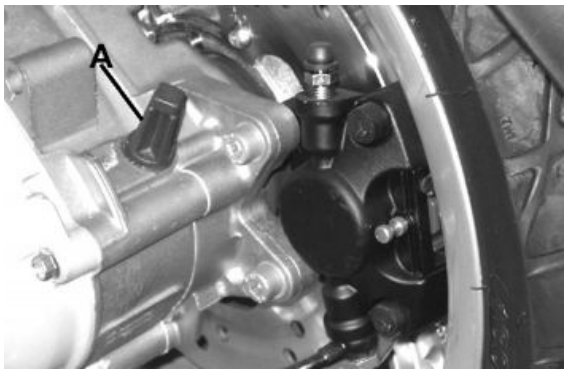


Replacement

-Remove the oil filler cap «**A**».

- Unscrew the oil drainage cap «**B**» and drain out all the oil.

- Screw in the drainage cap again and fill the hub with the prescribed oil.



Recommended products

AGIP GEAR SAE 80W-90 Lubricant for gear-boxes and transmissions.

API GL-4

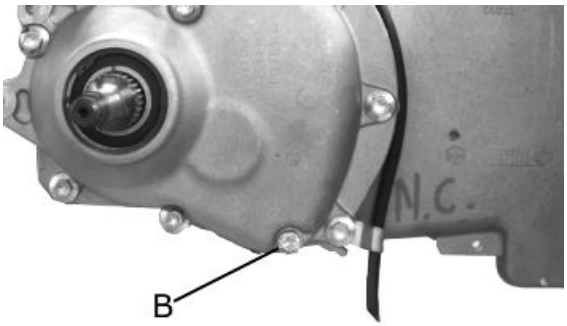
Characteristic

Rear hub oil

Capacity approximately 250 cc

Locking torques (N*m)

Hub oil drainage screw 15 to 17 Nm



Air filter

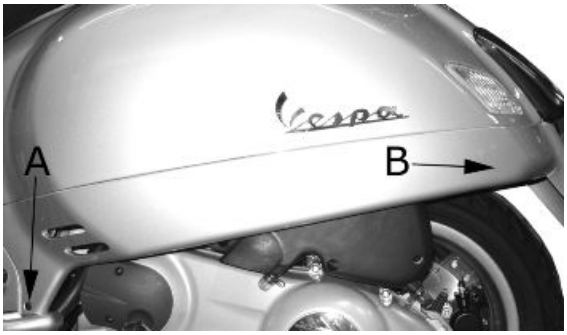
Proceed as follows:

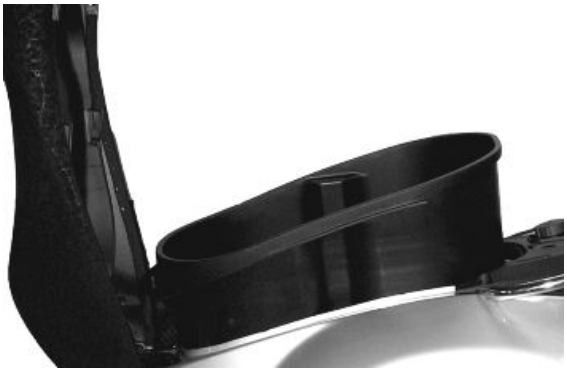
1. unscrew the fixing screw «**A**».
2. unscrew the nut «**B**» under the body.
3. remove the left side fairing.
4. remove the helmet compartment;
5. unscrew the fixing screws «**C**» that can be reached once the helmet compartment has been removed;
6. Unscrew the screws «**D**» and remove the air filter cover.

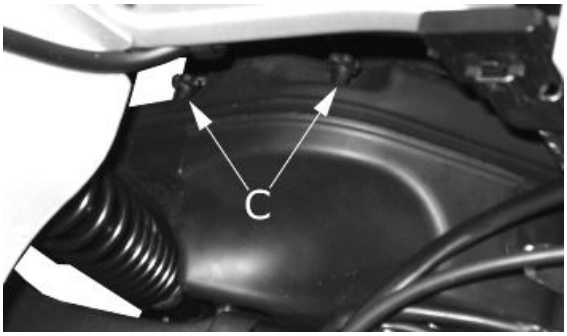
Remove the filtering element and clean it with water and shampoo; then dry it with a clean cloth and short blasts of compressed air. Finally, immerse it in a mixture of 50% oil of the recommended type and 50% petrol. Then gently squeeze the filter element between your hands, allow it to drip and then refit it. Oil or water deposits in the filter housing can be cleaned off by removing the two rubber caps «**E**».

CAUTION

IF THE VEHICLE IS USED ON DUSTY ROADS IT IS NECESSARY TO CARRY OUT MAINTENANCE CHECKS OF THE AIR FILTER MORE OFTEN TO AVOID DAMAGING THE ENGINE.







Recommended products

AGIP FILTER OIL Special product for the treatment of foam filters.

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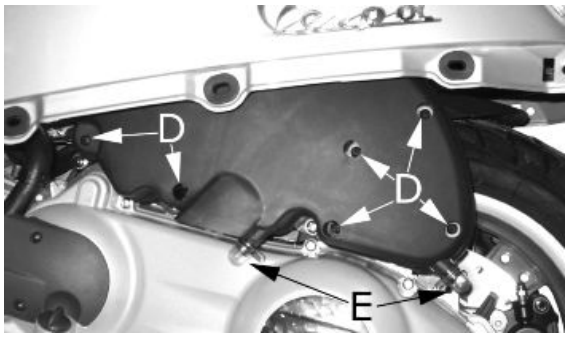
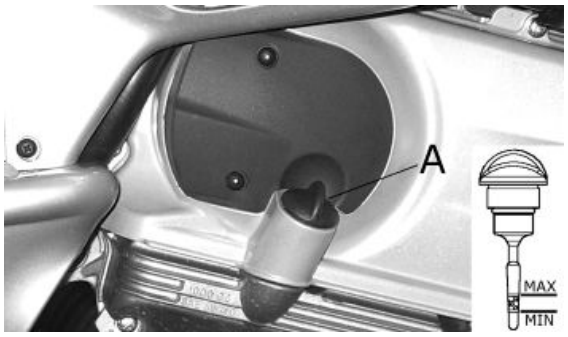


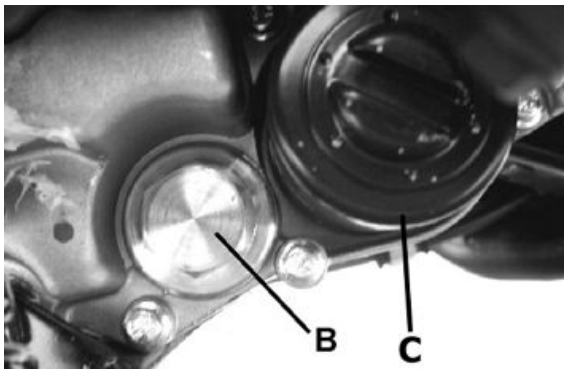
Engine oil

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

At 1,000 km and after every 10,000 km, the oil and the filter must be changed. The engine must be drained by running off the oil from drainage cap "**B**" of the flywheel side gauze pre-filter; furthermore to facilitate oil drainage, loosen the cap/dipstick "**A**". Once all the oil has drained through the drainage hole, unscrew the oil cartridge filter "**C**" 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 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.
Since a certain quantity of oil still remains in the circuit, oil must be filled from cap "**A**". Then start up the scooter, leave it running for a few minutes and switch it off: after 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

Check

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

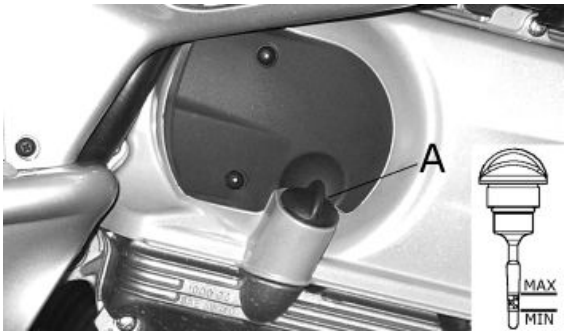
1. Place the vehicle on its centre stand and on flat ground.
2. Undo cap/dipstick "**A**", dry it off with a clean cloth and replace it, **screwing down completely**.
3. Remove the cap/dipstick again and check that the level is between the min and max. marks; top-up, if required.

The MAX level mark indicates a quantity of around 1300 cc of engine oil. 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**.

Restoration of the level from **MIN** to **MAX** requires approximately **200 cc**.



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

Oil pressure warning light

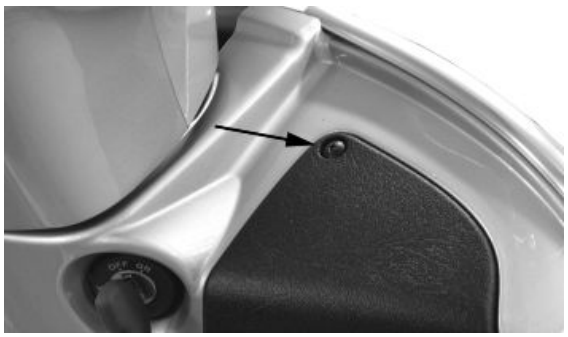
The vehicle is equipped with a telltale light on the dashboard that lights up when the key is turned to the «**ON**» position. However, this light should switch off once the engine has been started.
If the light turns on during braking, at idling speed or while turning a corner, it is necessary to check the oil level and the lubrication system.

Checking the ignition timing

- Remove the plastic cap on the flywheel cover
-Turn the flywheel until the reference mark «**T**» on the rotor matches the reference mark on the flywheel cover as shown in the figure (TDC). Make sure that the 4V reference point on the camshaft control pulley is aligned with the reference point on the head as shown in the second figure. If the reference is opposite the indicator on the head, turn the crankshaft once more.
For the use of this reference mark, remove the spark plug and turn the engine in the direction that is the reverse of the normal direction using a calliper spanner applied to the camshaft command pulley casing.

Cooling system

Adding engine coolant.
The fluid level must checked every 10,000 kilometres with a cold engine, in the way shown below:
Place the scooter on its centre stand and on flat ground.
- Undo the screw shown in the figure and remove the expansion tank cap on RHS.



- Top up if the fluid level is near or below the MIN level edge. The liquid level must always be between the MIN and MAX level.
-The coolant consists of an ethylene glycol and corrosion inhibitor based 50% de-ionised water-antifreeze solution mix.

CAUTION

DO NOT EXCEED THE MAX. LEVEL WHEN FILLING SO AS TO AVOID THE COOLANT ESCAPING FROM THE EXPANSION TANK WHEN THE VEHICLE IS IN USE.

Braking system

Level check

The brake fluid tanks for the front and rear brakes are located on the pumps under the handlebar cover. Proceed as follows:
- Remove the brake pump cover
- Rest the vehicle on its centre stand with the handlebars perfectly horizontal;
- Check the fluid level through the sight glass as shown in the figure. A certain lowering of the level is caused by wear on the pads.

Top-up

- Position the vehicle on a flat surface and on the centre stand
- Remove the brake pump cover as indicated in the photo

Check the brake fluid level through the sight glass on the pump as shown in the photograph
- If the level is below the minimum, fill using the two screws shown in the figure

- Remove the gasket and fill with DOT 4 until the spyglass is completely covered

For refitting purposes carry out the operations in the reverse order from the removal operation and respect the tightening torque of the tank cover screws.

CAUTION

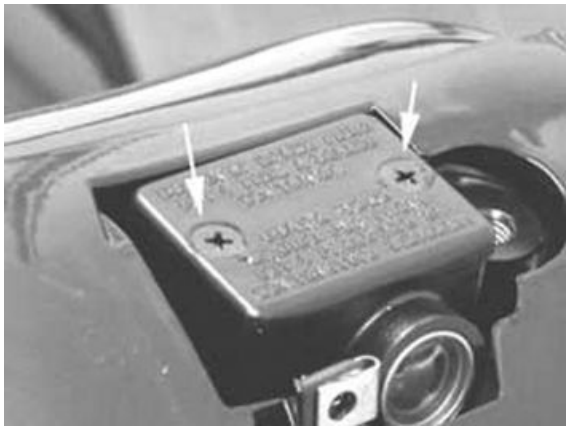
MAKE SURE THE BRAKE FLUID DOES NOT GET INTO YOUR EYES OR ON YOUR SKIN OR CLOTHES. IF THIS HAPPENS ACCIDENTALLY, WASH WITH WATER.

CAUTION

THE BRAKING CIRCUIT FLUID IS HIGHLY CORROSIVE. THEREFORE, WHEN TOPPING UP, AVOID LETTING IT COME INTO CONTACT WITH THE PAINTED PARTS OF THE VEHICLE. THE BRAKING CIRCUIT FLUID IS HYGROSCOPIC, THAT IS, IT ABSORBS HUMIDITY FROM THE SURROUNDING AIR. IF THE HUMIDITY IN THE BRAKING FLUID EXCEEDS A CERTAIN VALUE, IT WILL LEAD TO INEFFICIENT BRAKING.

CAUTION

NEVER USE BRAKE FLUID COMING FROM OPEN OR PARTIALLY USED CONTAINERS. UNDER NORMAL CLIMATIC CONDITIONS, BRAKE FLUID MUST BE CHANGED EVERY 20,000 KM OR ANYWAY EVERY 2 YEARS.



Locking torques (N*m)

Brake pump reservoir screws **15 to 20**

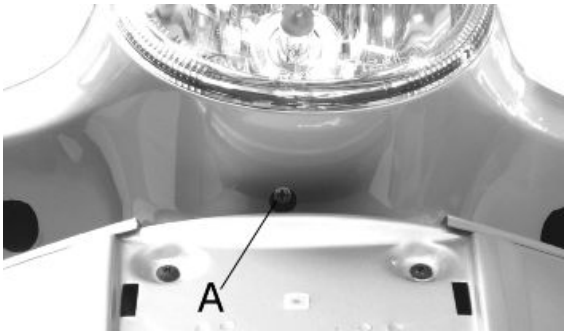
Headlight adjustment

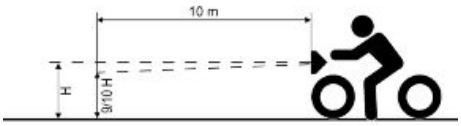
Proceed as follows:

1. 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;

2. Turn on the headlight and check that the boundary of the light beam projected onto the screen is not higher than 9/10 or lower than 7/10 of the distance between the centre of the headlight and the ground;

3. Otherwise, adjust the right headlight with screw «**A**».





N.B.

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

This section makes it possible to find what solutions to apply when troubleshooting.

For each failure, a list of the possible causes and pertaining operations is given.

Engine

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 seal	Replace the valve oil seal
Worn valve guides	Check and replace the head unit if required

Insufficient lubrication pressure

LOW 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 replace 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

Possible Cause	Operation
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 shift of the disc.
Clogged compensation holes on the pump	Clean carefully and blast with compressed air.
Swollen or stuck rubber gaskets	Replace gaskets.

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: replace them if they are recessed or if the balls are flattened.

Excessive steering play

EXCESSIVE STEERING CLEARANCE

Possible Cause	Operation
Torque not conforming	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: replace them if they are recessed or if the balls are flattened.

Noisy suspension

NOISY SUSPENSION

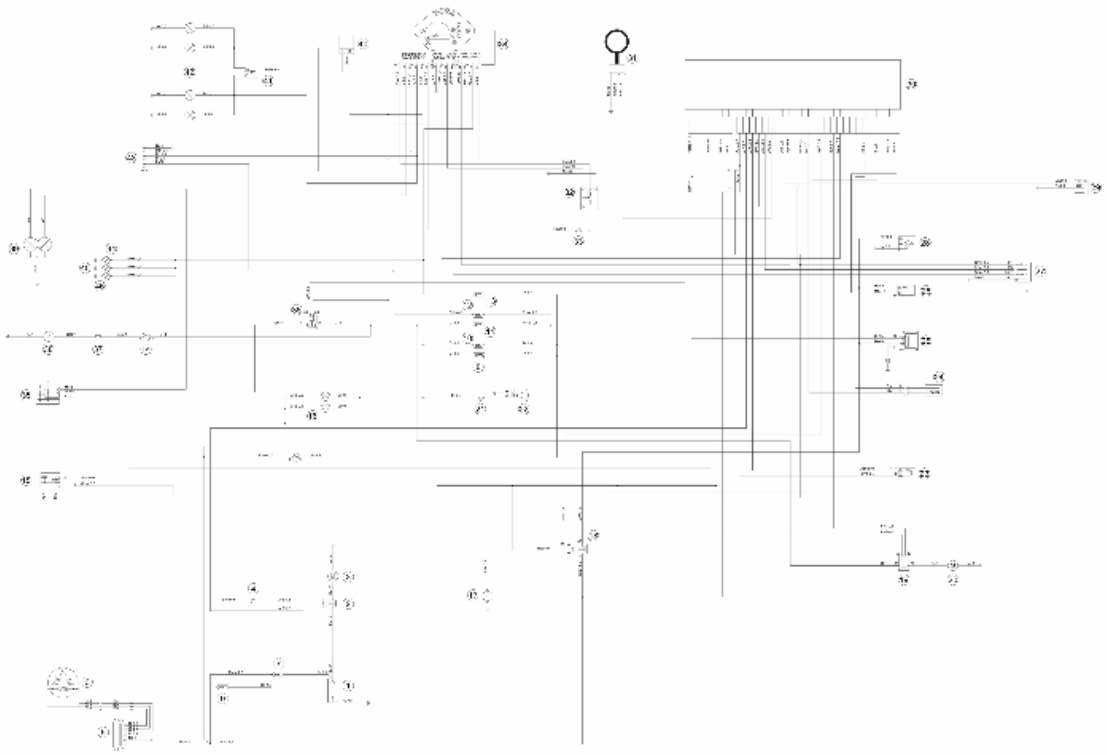
Possible Cause	Operation
Faults in the suspension system	If the front suspension is noisy, check: the efficiency of the front shock absorber; the condition of the ball bearings and relevant lock-nuts, the limit switch rubber buffers; and the movement bushings. In conclusion, check the tightening torque of the wheel hub, the brake calliper, the shock absorber disc in the attachment to the hub and the steering tube.

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



KEY

1. 12v-10Ah battery

2. Starter relay

3. Starter motor

4. Starter button

5. Voltage regulator

6. Magneto flywheel

7. Fuse No. 1 - 30A

8. Fuse No. 5 - 7.5A

9. Fuse No. 2 - 15A

10. Fuses No. 6 - 7.5A

11. Fuse No. 3 - 15A

12. Fuse No. 4 - 7.5A

13. Fuse No. 7 - 7.5A

14. Key switch contacts

15. Engine stop switch

16. N.2 stop buttons

17. Brake lamp 12v-16w

18. Injection load relay

19. Electric fan remote control

20. Radiator electric fan

21. Horn button

22. Horn

23. Lambda probe

24. Engine speed sensor

25. H.V. coil.

26. Fuel injector

27. Engine temperature sensor

28. Fuel pump

29. Diagnosis socket

30. Injection electronic control unit

31. Immobilizer antenna

32. Fuel level transmitter

33. Oil pressure sensor

34. Instrument panel

35. Light switch

36. Headlight relay

37. Saddle opening switch

38. Saddle opening actuator

39. Headlight with dual light bulb 12v-55w/60w

40. Turn indicator control device

41. Turn indicator switch

42. No. 4 bulbs for turn indicators 12v-6w*

43. Pre-installation for anti-theft device

44. No. 2 Front LED daylight running light bulb

45. No.1 rear daylight running light bulb 12v-5w

46. No. 1 license plate bulb 12v-5w

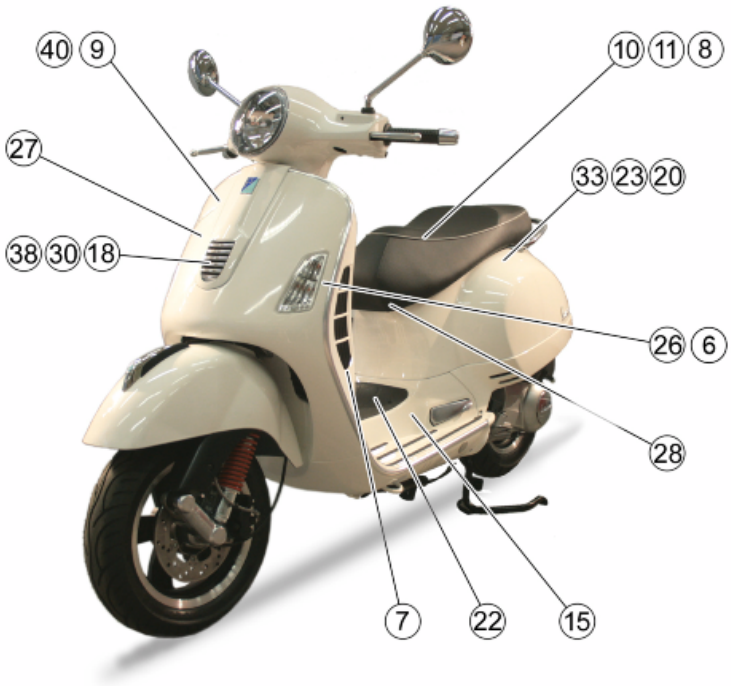
* for USA market 12V-10W bulbs are used

Key

Ar: Orange **Az:** Light Blue **Bi**: White **Bl**: Blue **Gi**: Yellow **Gr:**Grey

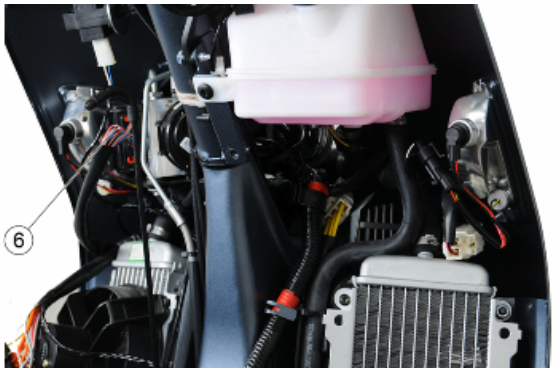
Ma:Brown **Ne:** Black **Ro**: Pink **Rs:** Red **Ve**: Green **Vi:** Purple

Components arrangement

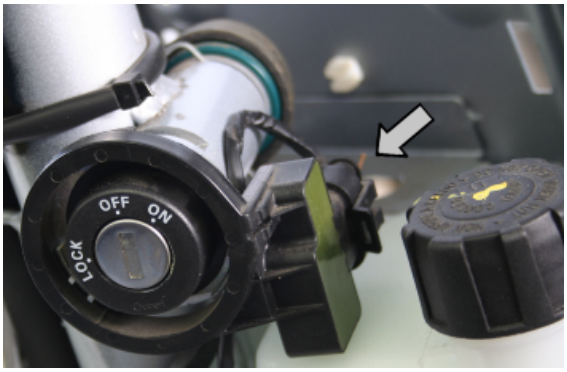


6. ABS control unit

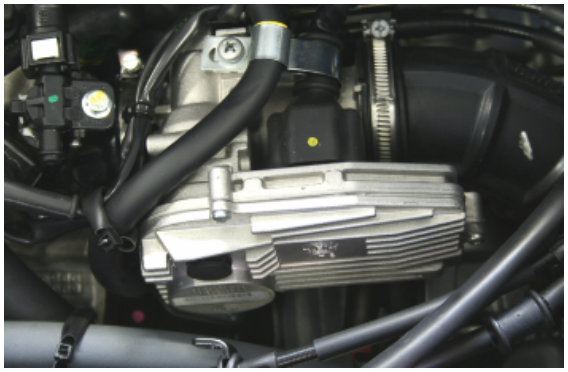
- Remove the leg shield back plate to reach it.



9. Immobilizer aerial- Remove the shield back plate to reach it.

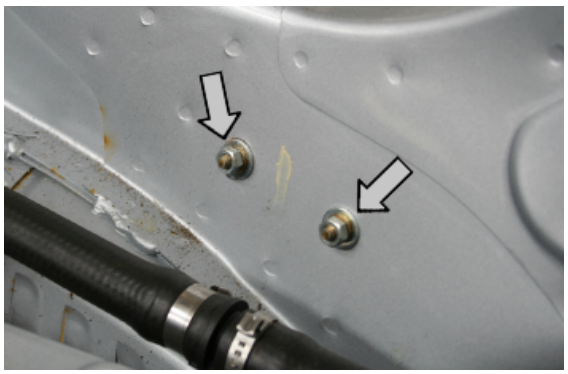


10. Injection ECU - Remove the helmet compartment to reach it.

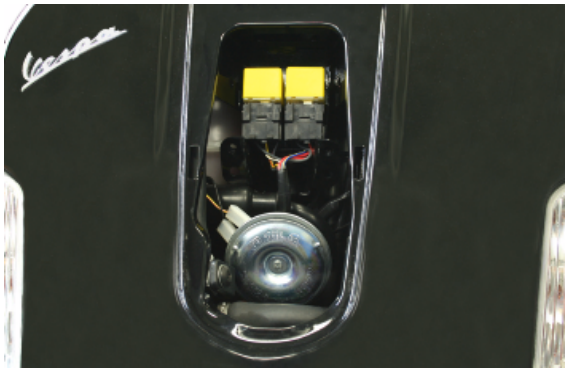


11. Diagnosis connector - Remove the helmet compartment to reach it.

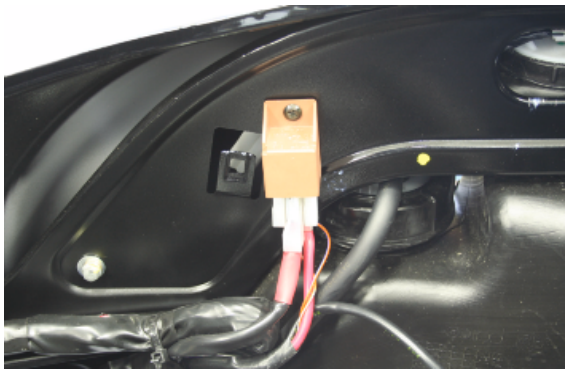
15. H.V. coil- Remove the battery to reach it; to remove the coil, first remove the footrest and undo the two screws indicated.



18-30-38 Horn - **Remote control switches** Remove front central cover to reach it.



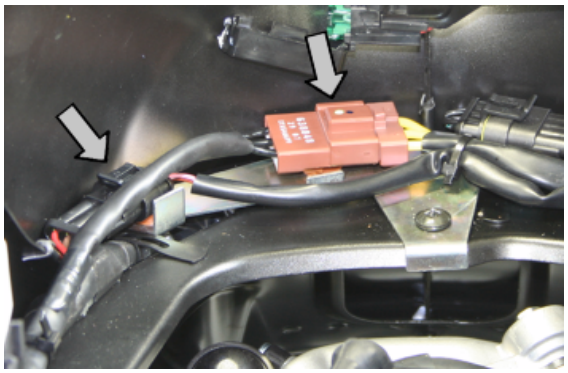
20-23. Remote control switches - Remove the front central cover and the helmet compartment to reach them.



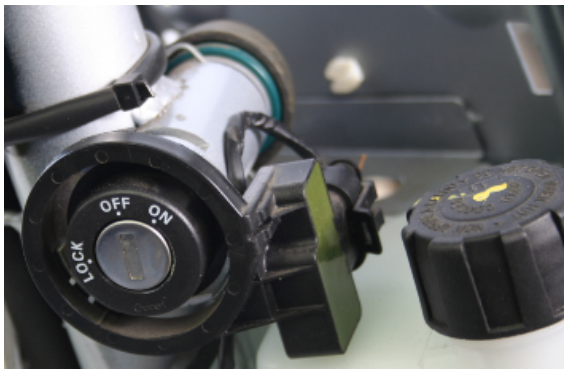
26. Main fuses - Open the front top box to reach them.

27. Voltage regulator - Remove the shield back plate to reach it.

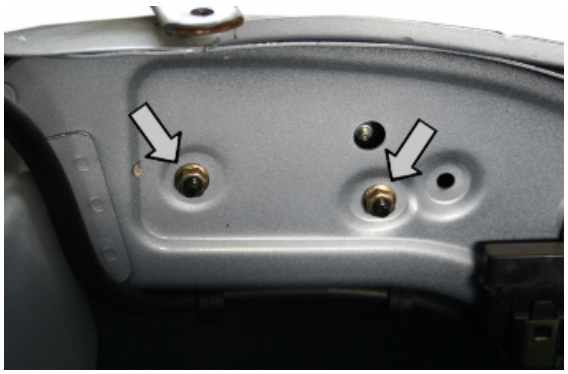
28. Magneto flywheel - Remove the flywheel cover, as described in the «Engine» chapter, to reach it. To get access to the connectors, remove the helmet compartment.



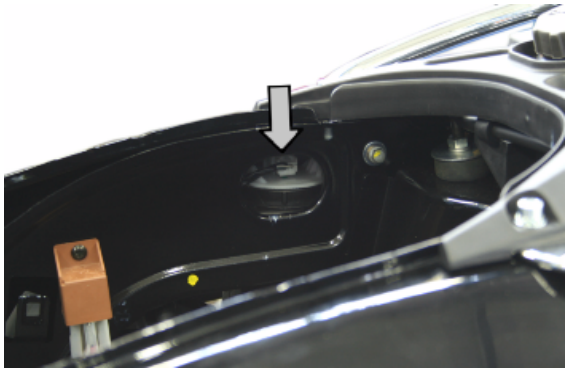
40. Key switch contacts - Remove the shield back plate to reach them.



33. Saddle-opening actuator - Remove the helmet compartment to reach it, undo the two screws indicated and remove the fixing bracket together with the actuator.



8. Fuel level transmitter - Remove the fuel tank to reach it.

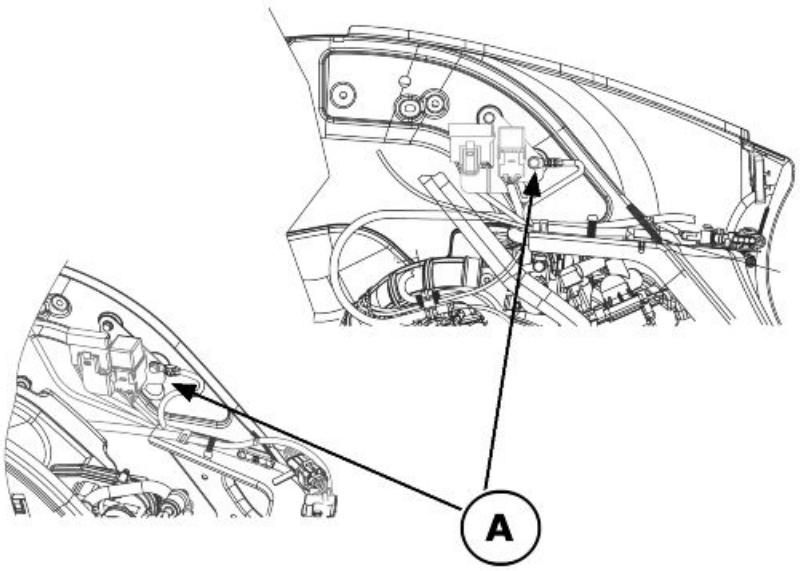


7. Oil pressure sensor - Remove the right side fairing to reach it.

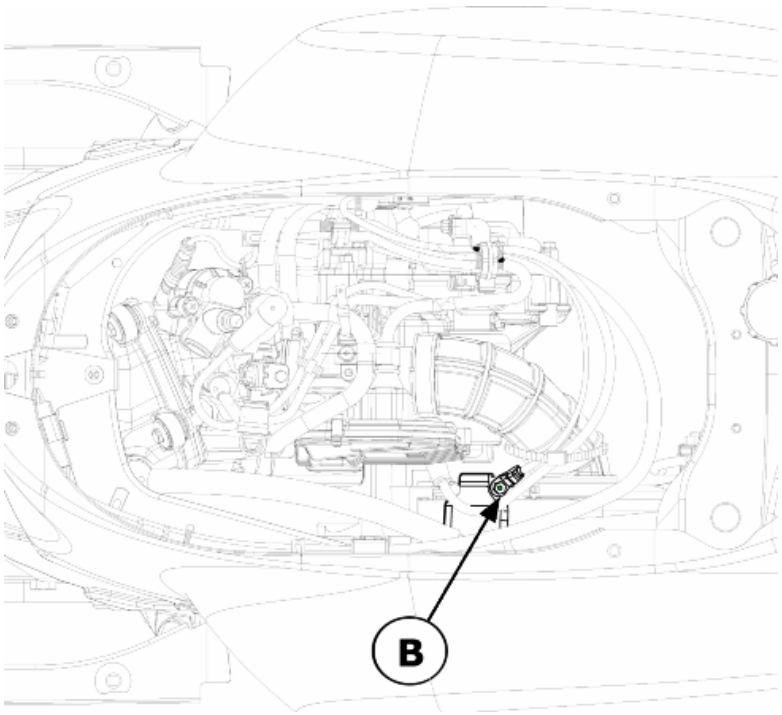
22. Battery - Remove the rear central cover to reach it.

Ground points

On the vehicle there is a ground point on the chassis marked with the letter **"A"**



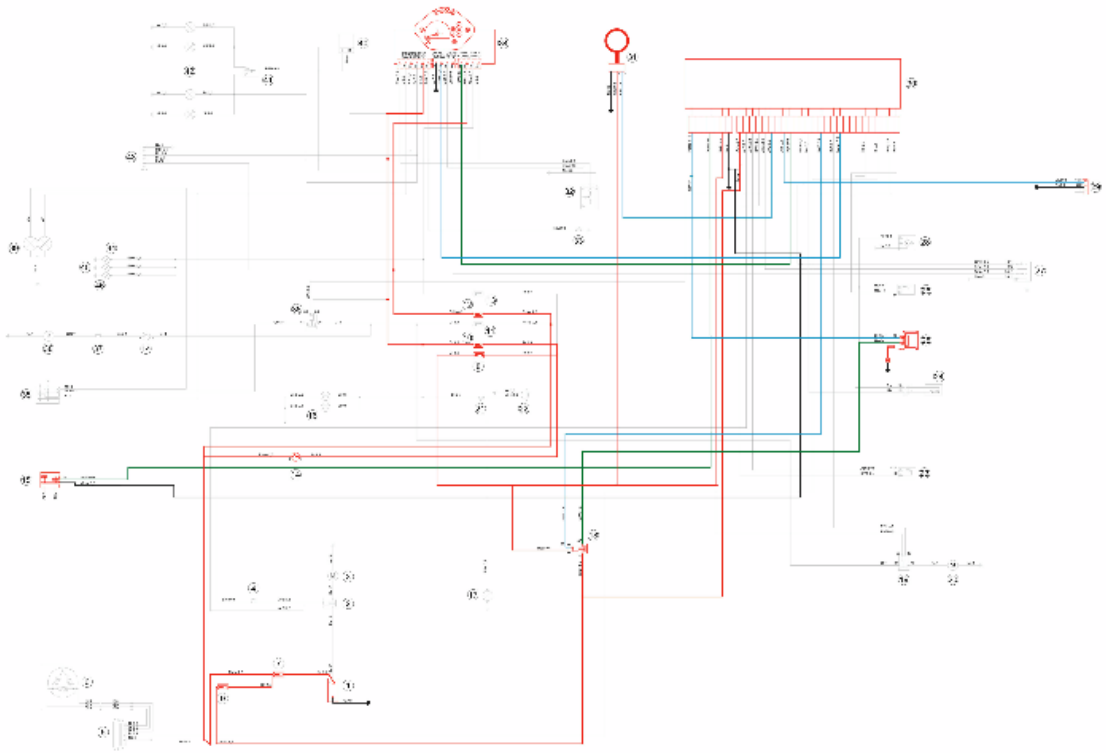
There is another ground point **"B"** on the starter motor.



Electrical system installation

Conceptual diagrams

Ignition



KEY

1. 12v-10Ah battery

7. Fuse No. 1 - 30A

8. Fuse No. 5 - 7.5A

9. Fuse No. 2 - 15A

10. Fuses No. 6 - 7.5A

11. Fuse No. 3 - 15A

12. Fuse No. 4 - 7.5A

14. Key switch contacts

15. Engine stop switch

18. Injection load relay

25. H.V. coil.

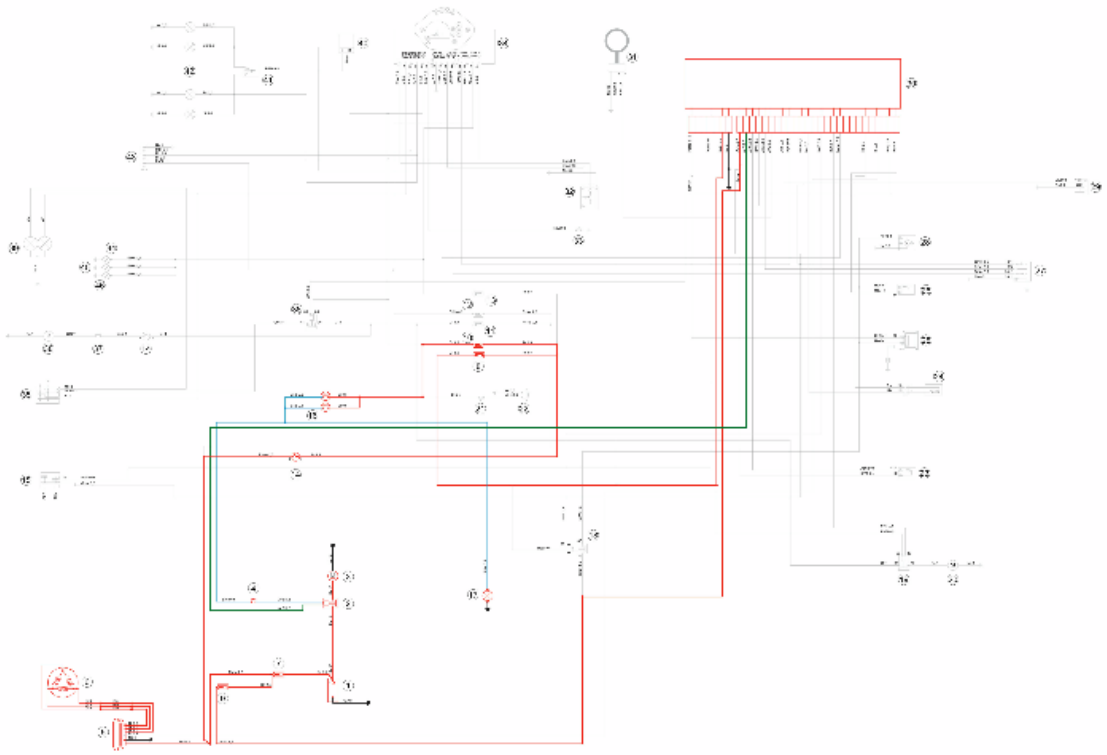
29. Diagnosis socket

30. Injection electronic control unit

31. Immobilizer antenna

34. Instrument panel

Battery recharge and starting



KEY

1. 12v-10Ah battery

2. Starter relay

3. Starter motor

4. Starter button

5. Voltage regulator

6. Magneto flywheel

7. Fuse No. 1 - 30A

8. Fuse No. 5 - 7.5A

9. Fuse No. 2 - 15A

10. Fuses No. 6 - 7.5A

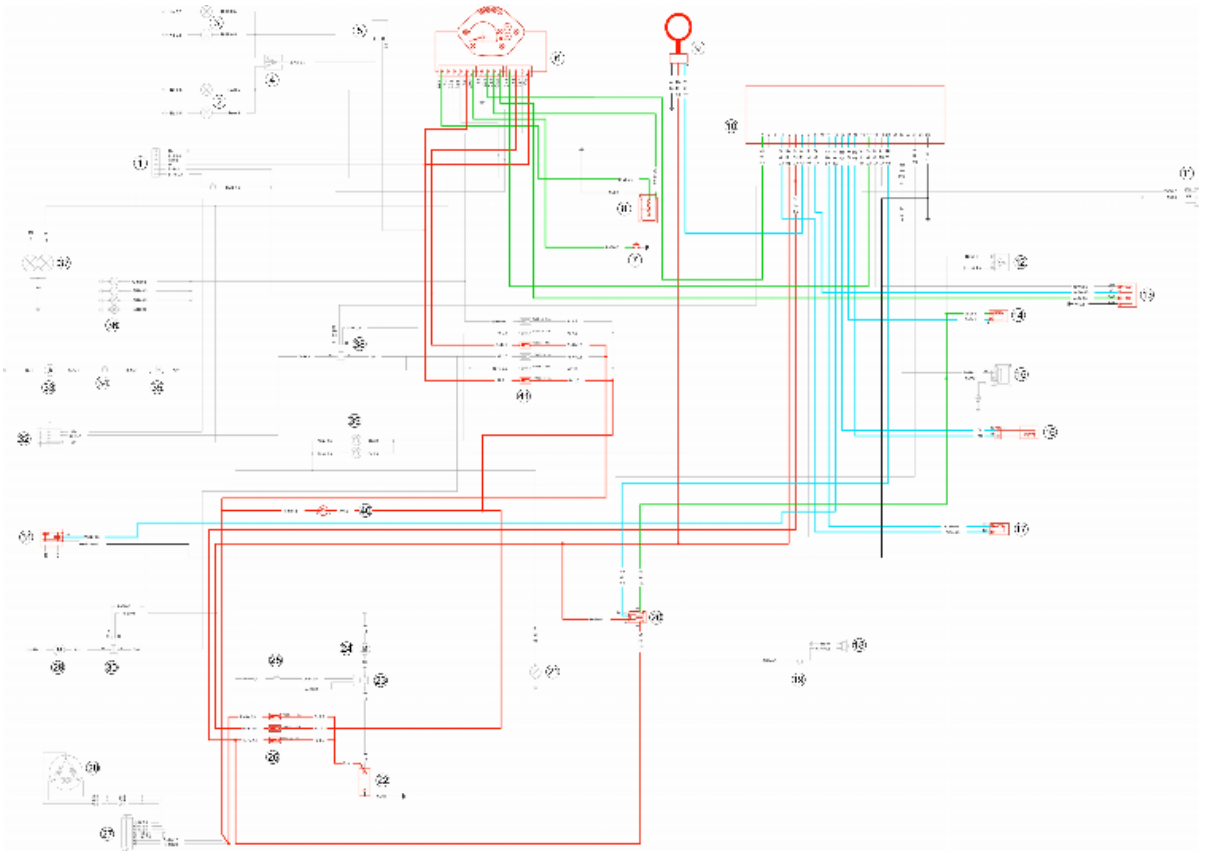
14. Key switch contacts

16. N.2 stop buttons

17. Brake lamp 12v-16w

30. Injection electronic control unit

Level indicators and enable signals section



KEY

1. 12v-10Ah battery

7. Fuse No. 1 - 30A

8. Fuse No. 5 - 7.5A

9. Fuse No. 2 - 15A

10. Fuses No. 6 - 7.5A

14. Key switch contacts

15. Engine stop switch

23. Lambda probe

24. Engine speed sensor

27. Engine temperature sensor

30. Injection electronic control unit

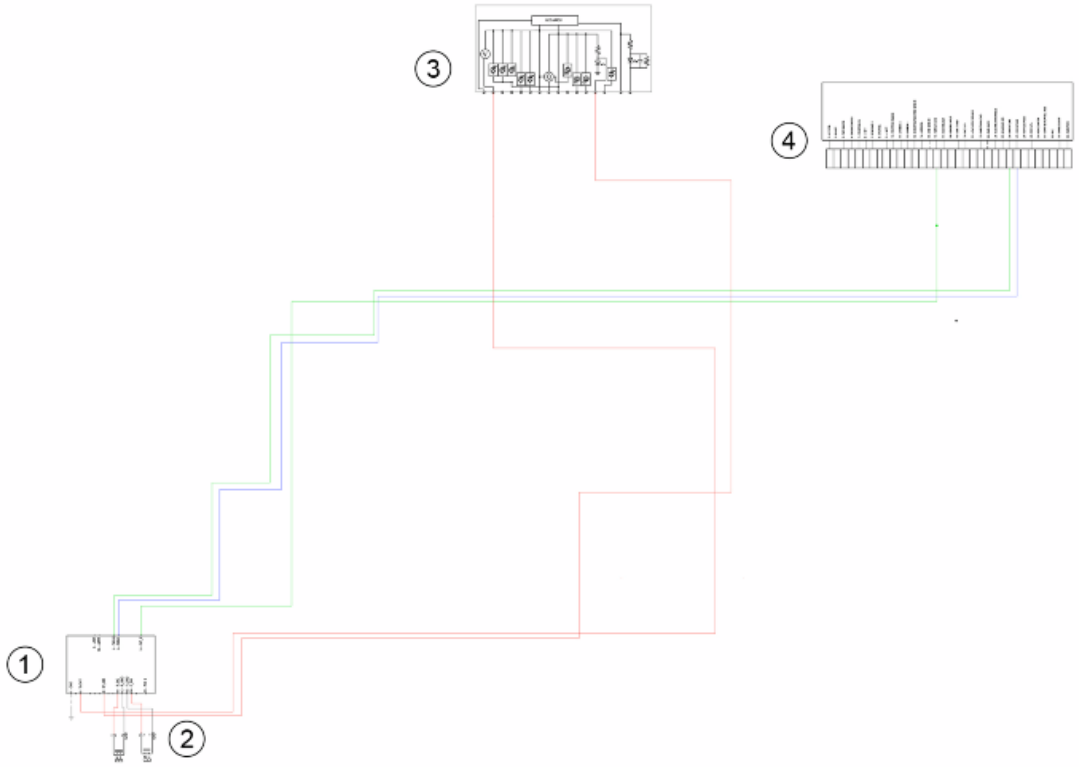
31. Immobilizer antenna

32. Fuel level transmitter

33. Oil pressure sensor

34. Instrument panel

ABS



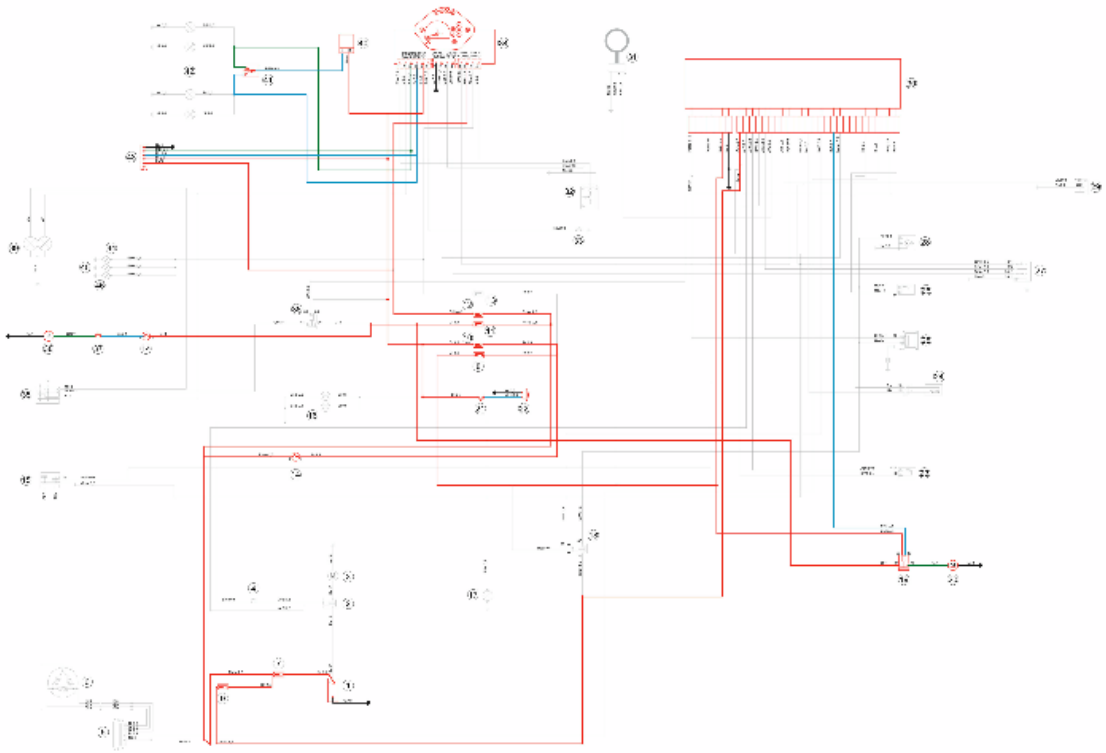
1. ABS control unit

2. Tone wheel sensors

3. Instrument panel

4. Engine control unit

Devices and accessories



KEY

1. 12v-10Ah battery

7. Fuse No. 1 - 30A

8. Fuse No. 5 - 7.5A

9. Fuse No. 2 - 15A

10. Fuses No. 6 - 7.5A

11. Fuse No. 3 - 15A

12. Fuse No. 4 - 7.5A

14. Key switch contacts

19. Electric fan remote control

20. Radiator electric fan

21. Horn button

22. Horn

30. Injection electronic control unit

34. Instrument panel

37. Saddle opening switch

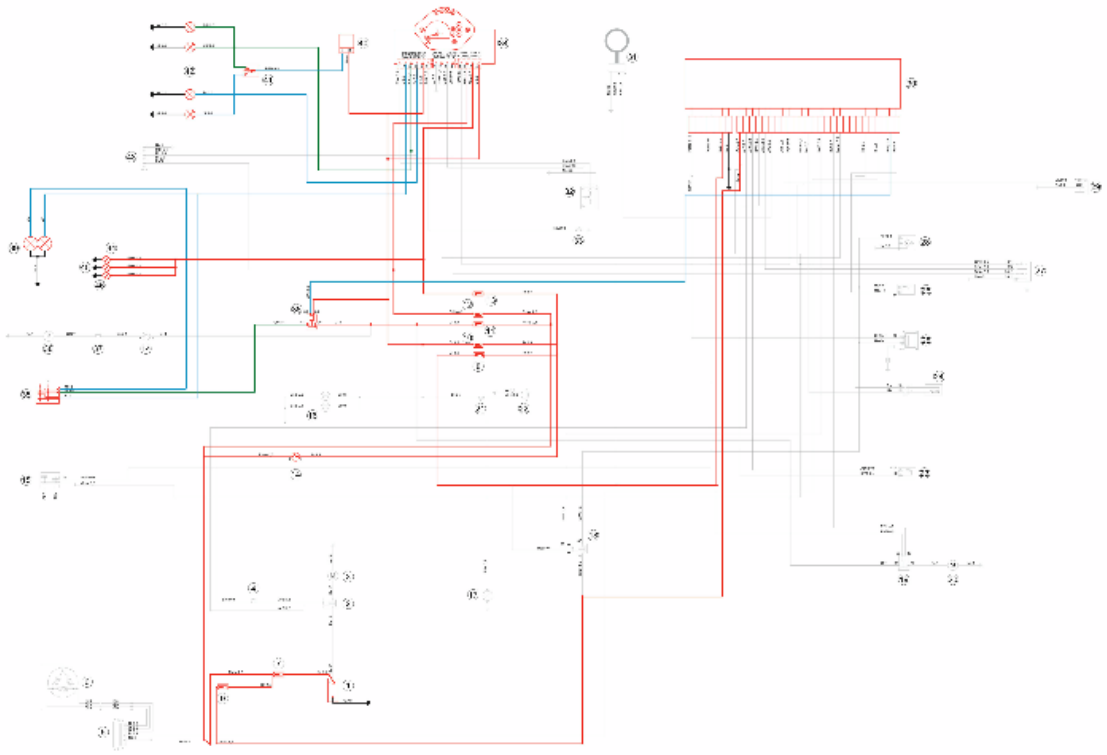
38. Saddle opening actuator

40. Turn indicator control device

41. Turn indicator switch

43. Pre-installation for anti-theft device

Lights and turn indicators



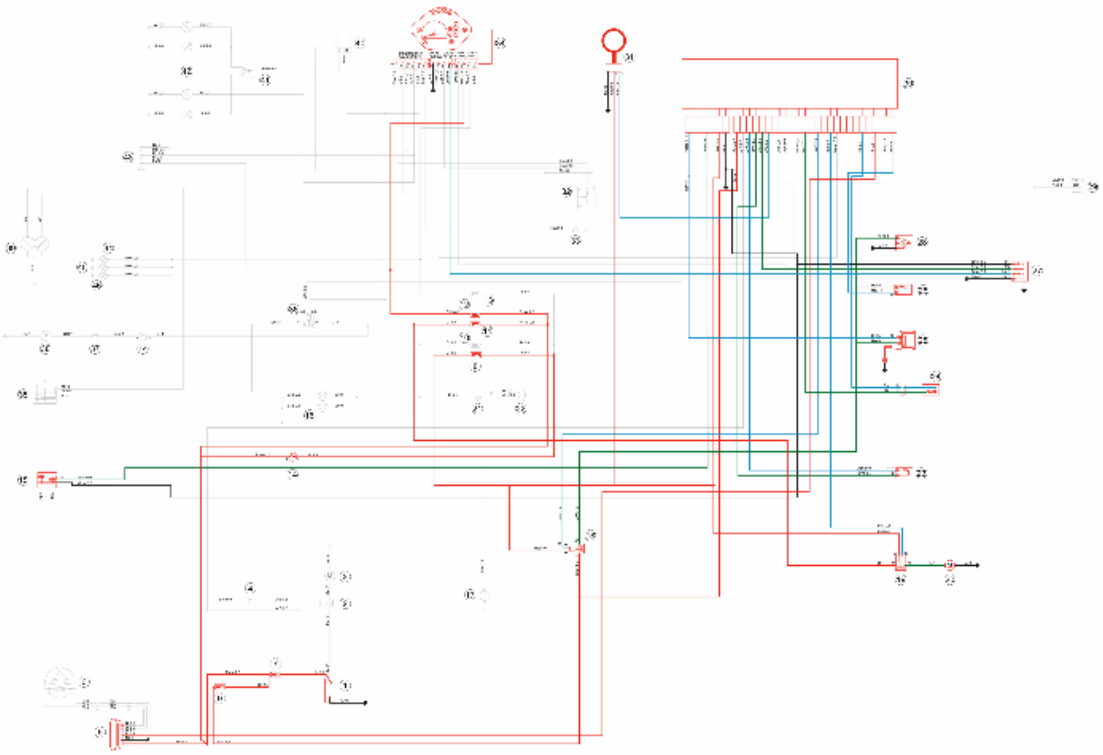
key:

1. 12v-10Ah battery
7. Fuse No. 1 - 30A
8. Fuse No. 5 - 7.5A
9. Fuse No. 2 - 15A
10. Fuses No. 6 - 7.5A
11. Fuse No. 3 - 15A
12. Fuse No. 4 - 7.5A
13. Fuse No. 7 - 7.5A
14. Key switch contacts
30. Injection electronic control unit
34. Instrument panel
35. Light switch
36. Headlight relay
39. Headlight with dual light bulb 12v-55w/60w
40. Turn indicator control device

41. Turn indicator switch
42. No. 4 bulbs for turn indicators 12v-6w
44. No. 2 Front LED daylight running light
45. No.1 rear daylight running light bulb 12v-5w
46. No. 1 license plate bulb 12v-5w

* for USA market 12V-10W bulbs are used

Injection



key:

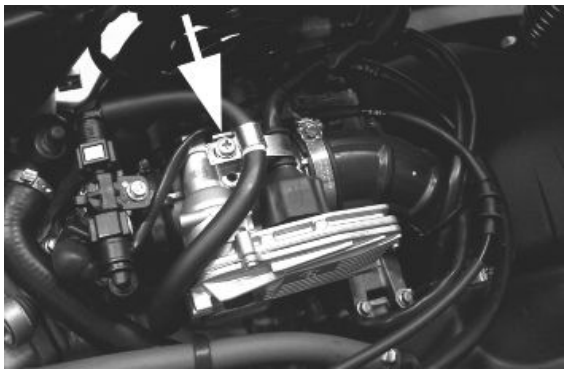
1. 12v-10Ah battery
7. Fuse No. 1 - 30A
8. Fuse No. 5 - 7.5A
9. Fuse No. 2 - 15A
11. Fuse No. 3 - 15A
12. Fuse No. 4 - 7.5A
14. Key switch contacts
15. Engine stop switch
18. Injection load relay
19. Electric fan remote control
20. Radiator electric fan
23. Lambda probe

24. Engine speed sensor
25. H.V. coil.
26. Fuel injector
27. Engine temperature sensor
28. Fuel pump
30. Injection electronic control unit
31. Immobilizer antenna
34. Instrument panel

Checks and inspections

This section is dedicated to the checks on the electrical system components.

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 aerial
- master and service keys with built-in transponder
- HV coil.
- diagnosis LED

The diagnosis LED also works as a theft-deterrent blinker. This function is activated every time the ignition switch is turned to the "OFF" position, or the emergency stop switch is turned to the "OFF" position. It remains activated for 48 hours in order not to affect the battery charge.

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 1 and fuse 5 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.

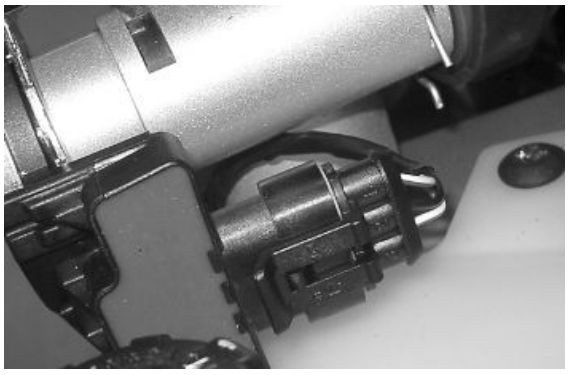
With the key switch in the ON position:

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

- There is continuity between terminals 4-19 and 4-33 with the emergency cut-out switch in the RUN position. If there is no continuity, check the contacts of the latter.

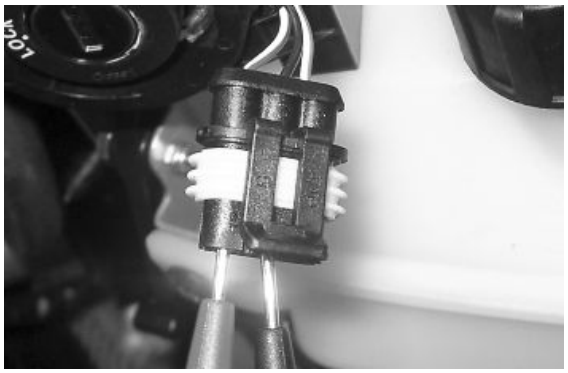
If no faults are found, replace the control unit.

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



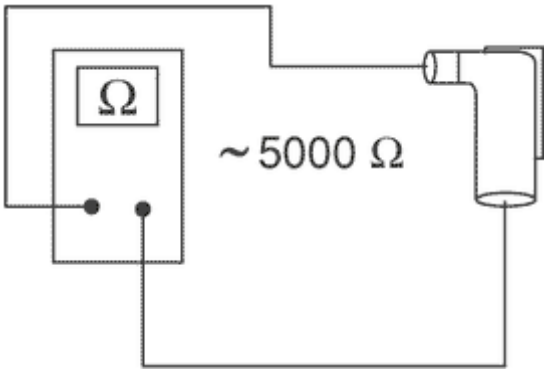
Virgin circuit

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 unprogrammed control unit provides for the recognition of the red key (master key) 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 blue key and set 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 (blue) 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, master key transponder, decoder and control unit are strictly matched.

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 so, in order to add or eliminate keys, you must repeat the procedure using all the keys you intend to keep using.

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 resistive spark plugs.

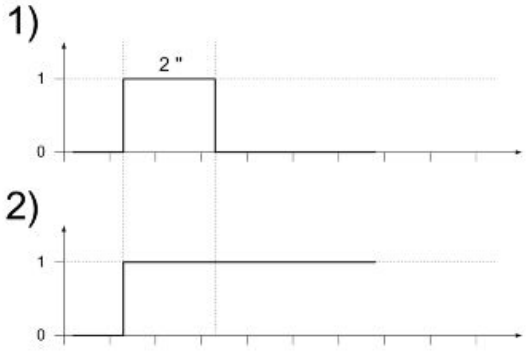
Characteristic

Shielded cap resistance

~ 5000 Ω.

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:

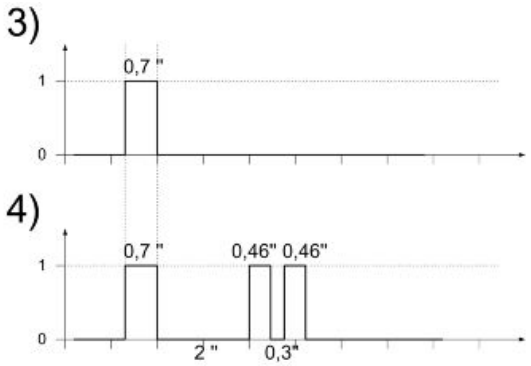


1. Previously unused control unit - key inserted: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the vehicle can be started but with a limitation imposed on the number of revs.

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.

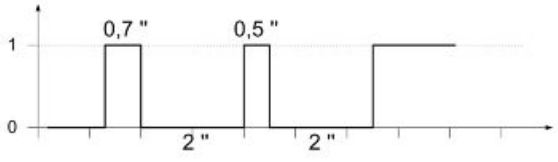


5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on steadily. The engine cannot be started. The codes that can be transmitted are:

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

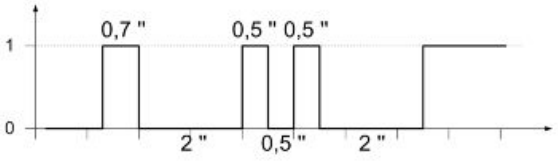
Diagnostic code - 1 flash

A one-flash code indicates a system where the serial line is not present or is not detected. Check the Immobilizer antenna wiring and change it if necessary.



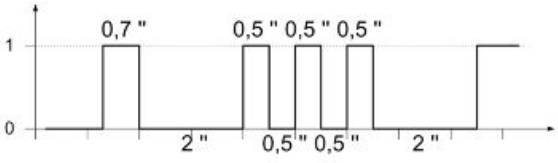
Diagnostic code - 2 flashes

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 generator is directly connected to the voltage regulator.
This, in its turn, is connected directly to the ground and the battery positive terminal passing through the 30A 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 winding

WARNING

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

1) Lift the saddle and remove the helmet compartment.

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.

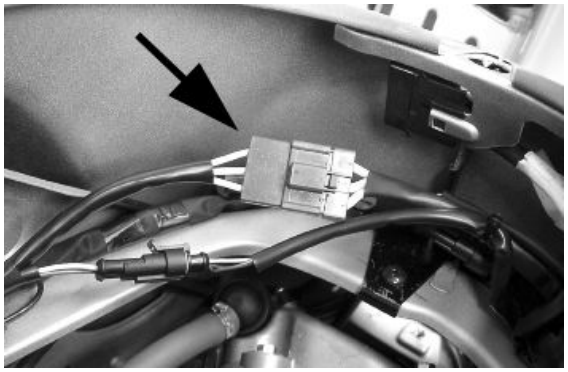
Electric characteristic

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 cover in the footrest.

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.

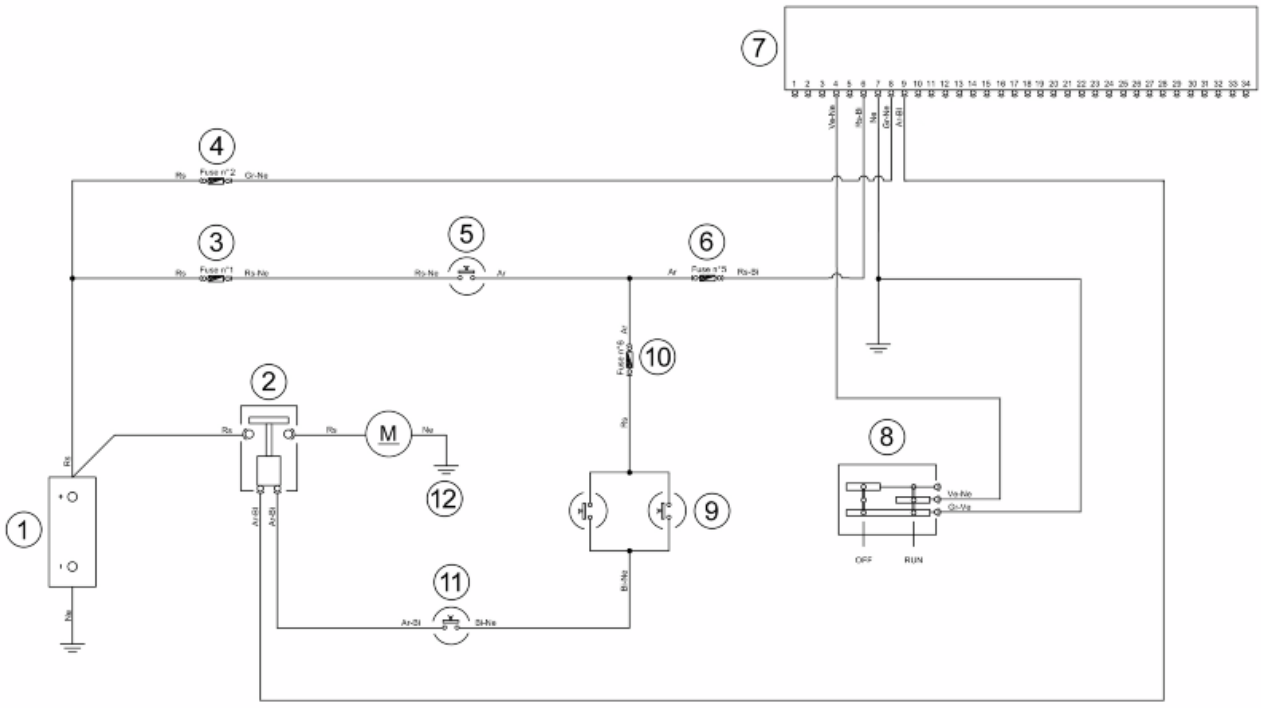
- With engine off and panel set to "ON" turn on the lights and let the battery voltage set to 12V.
- Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
- Keep the lights on and start the engine, bring it to normal speed and read the values on the ammeter.

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



KEY

1. Battery

2. Starter relay

3. Fuse No. 1

4. Fuse No. 2

5. Key switch contacts

6. Fuse No. 5

7. Electronic control unit

8. Engine stop switch

9. Stop buttons

10. Fuse No. 6

11. Starter button

12. Starter motor

WARNING

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

1) Check fuses No. 1,2,5 and 6.

2) Check key switch contacts.

3) Check the contacts of the stop buttons and the starter button.

4) With the ignition key set to «**ON**», the brake pulled and the starter button pressed, check if there is voltage between the Orange-White cable of the start-up remote control switch and the ground connection. If there is not, check the cable harnesses.

5) Check the starter relay.

6) Check that the Red cable between the battery and the starter relay is not interrupted. Also check continuity between the latter and the starter motor.

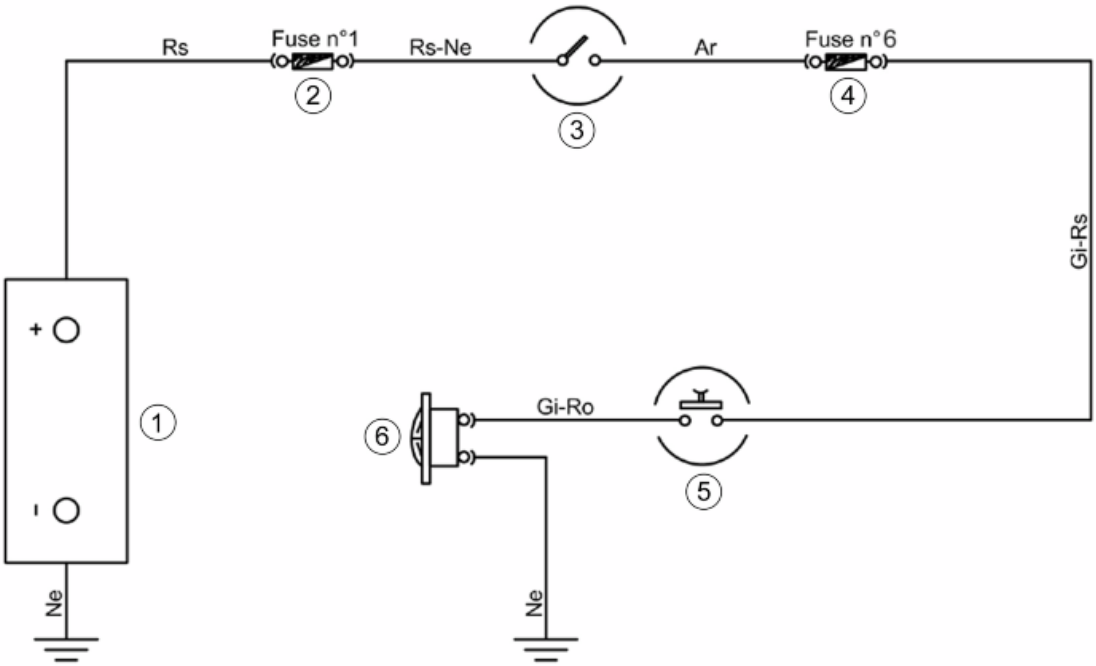
7) Check the starter motor ground connection.

8) Check that the Orange-Blue cable between the start-up remote control switch and the control unit (pin 9) is not interrupted.

9) Check the contacts of the engine stop switch and that the Green-Black cable connecting this switch to the control unit (pin 4) is not interrupted.

10) Check the engine stop switch ground connection.

Horn control



KEY

1. Battery

2. Fuse No. 1

3. Key switch contacts

4. Fuse No. 6

5. Horn button

6. Horn

WARNING

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

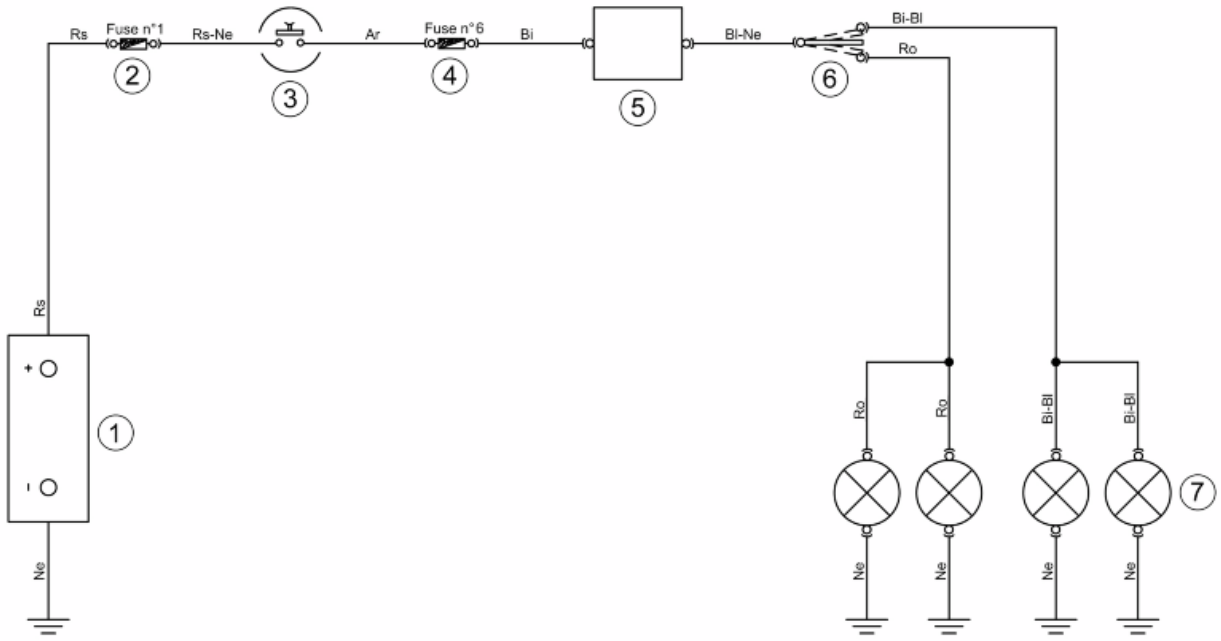
1) Check fuses No. 1 and 6.

2) Check the key switch and horn button contacts.

3) With the key switch set to «**ON**» and the horn button pressed, check if there is voltage between the Yellow-Pink cable of the horn device and the ground connection. If there is not, check the cable harnesses.

4) Check the horn device ground connection.

Turn signals system check



KEY

1. Battery

2. Fuse No. 1

3. Key switch contacts

4. Fuse No. 6

5. Turn indicator control device

6. Turn indicator switch

7. Turn indicator bulbs

WARNING

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

1) Check that bulbs operate properly.

2) Check fuses No. 1 and 6.

3) Check key switch contacts.

4) With the ignition key set to «**ON**», check if there is voltage between the Blue-Black cable of the turn indicators switch and the ground connection. If there is not, check the cable harnesses and the connections of the turn indicator control device.

5) Check the turn indicator switch contacts.

6) With the turn indicator switch pressed to the right, check if there is voltage between the White-Blue cable of the switch and the ground connection. If there is not, check the cable harnesses.

7) With the turn indicator switch pressed to the left, check if there is voltage between the Pink cable of the switch and the ground connection. If there is not, check the cable harnesses.

8) Check that the cable harnesses of the bulbs and their ground connection are not interrupted.

level indicators

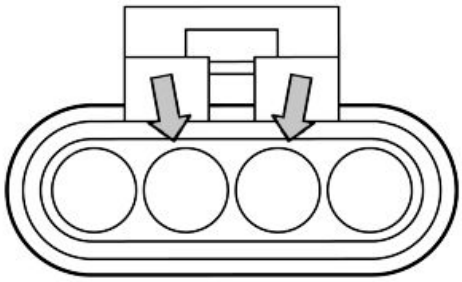
WARNING

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

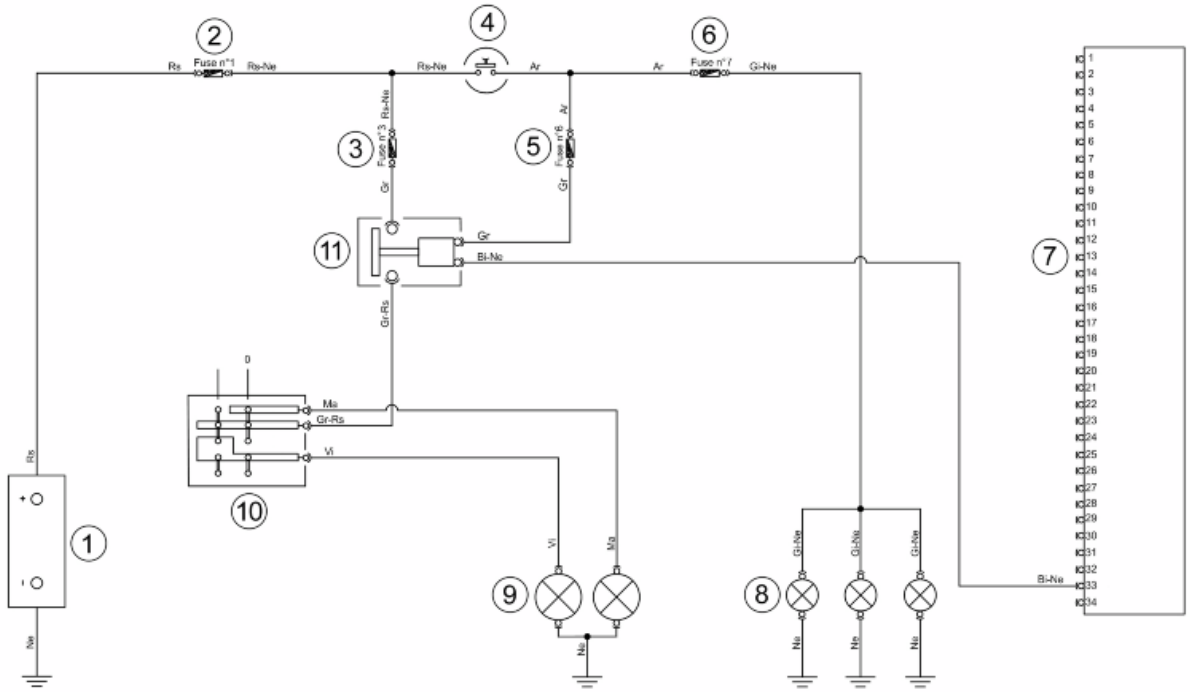
Resistance value with full tank

<= 7 Ω

Resistance value with empty tank

90 +13/-3 Ω

Lights list



KEY

1. Battery

2. Fuse No. 1

3. Fuse No. 3

4. Key switch contacts

5. Fuse No. 6

6. Fuse No. 7

7. Electronic control unit

8. Daylight running light bulbs and license plate light

9. High/low beam two-light bulb

10. Light switch

11. Headlight relay

WARNING

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

TAIL LIGHTS AND LICENSE PLATE LIGHT LINE

1) Check that bulbs operate properly.

2) Check fuses No. 1 and 7.

3) Check key switch contacts.

4) Check if there is voltage between the Yellow-Black cable of fuse No. 7 and the ground. If not, check cable harnesses.

5) Check that the cable harnesses of the bulbs and their ground connection are not interrupted.

HIGH BEAM/LOW BEAM LIGHTS LINE

1) Check that bulbs operate properly.

2) Check fuses No. 1, 3 and 6.

3) Check key switch contacts.

4) Check if there is voltage between the Grey cable of the headlight relay and the ground connection. If there is not, check the cable harnesses.

5) With the key switch set to «**ON**» and the engine running, check if there is voltage between the Yellow-Red cable of the headlight relay and the ground connection. If there is not, check the cable harnesses.

6) Check that the White-Black cable connecting the headlight relay switch and the control unit (pin 19) is not interrupted.

7) Check the headlight remote control switch.

8) Check that the Grey-Red cable of the light switch and the headlight relay switch is not interrupted.

9) Check the light switch contacts.

10) Check that the cable harnesses of the bulbs and their ground connection are not interrupted.

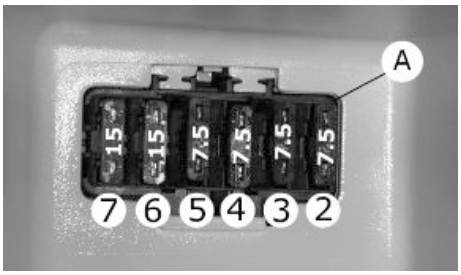
Fuses

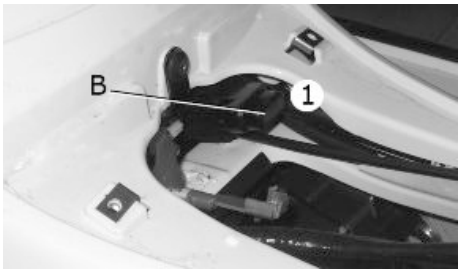
The electrical system is equipped with:

1. six protection fuses «**A**» located in the glove compartment to the left

2. of a fuse «**B**», located in the battery compartment.

The chart shows the position and specifications of the fuses in the vehicle.





CAUTION

BEFORE REPLACING A BLOWN FUSE, FIND AND SOLVE THE FAILURE THAT CAUSED IT TO BLOW. NEVER TRY TO REPLACE A FUSE WITH ANY OTHER MATERIAL (A PIECE OF ELECTRIC WIRE, FOR INSTANCE).

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.

FUSE «B»

	Specification	Desc./Quantity
1	Fuse no. 1	**Capacity:** 30 A **Protected circuits:** Main system.

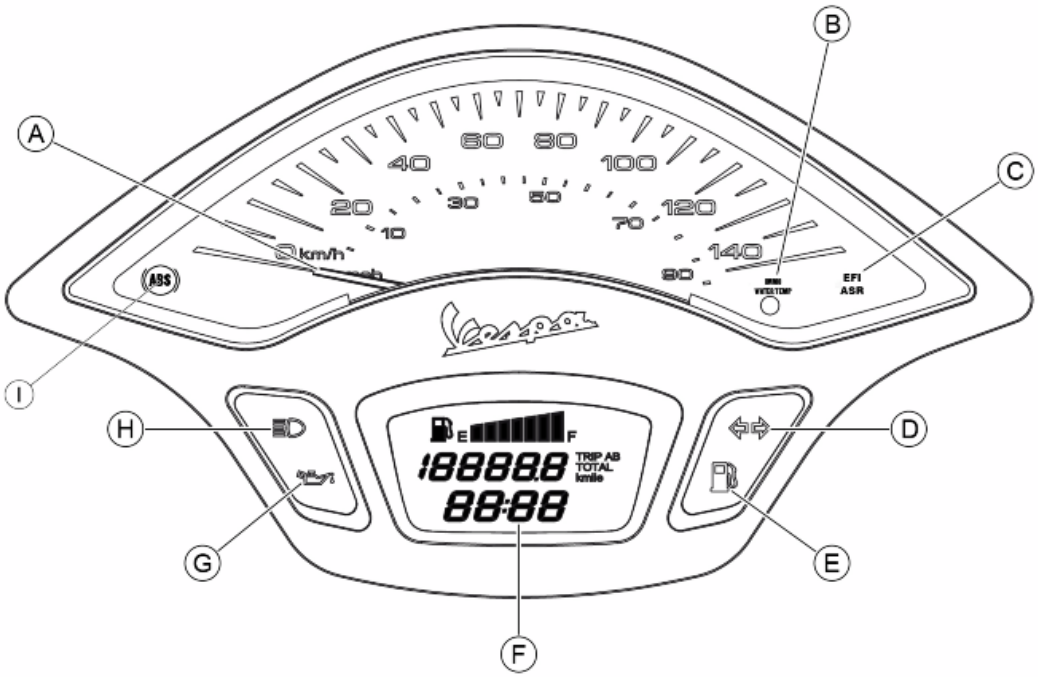
FUSES «A» ABS VERSION

	Specification	Desc./Quantity
1	Fuse no. 2	**Capacity:** 7.5 A **Protected circuits:** Inclination sensor, starter button, control unit, immobilizer aerial, ABS control unit.
2	Fuse No. 3	**Capacity:** 10 A **Protected circuits:** Control unit.
3	Fuse No. 4	**Capacity:** 7.5 A **Protected circuits:** Pre-installation for anti-theft device, turn indicators, horn, lights relay, stop lights, USB socket.
4	Fuse No. 5	**Capacity:** 15 A **Protected circuits:** Front headlight, electric fan, Pre-installation for anti-theft device, instrument panel, ignition switch.
5	Fuse No. 6	**Capacity:** 7.5 A **Protected circuits:** Taillight, instrument panel, front turn indicators.
6	Fuse No. 7	**Capacity:** 20 A **Protected circuits:** ABS control unit.

FUSES «A»

	Specification	Desc./Quantity
1	Fuse no. 2	**Capacity:** 7.5 A **Protected circuits:** Inclination sensor, starter button, control unit, immobilizer aerial.
2	Fuse No. 3	**Capacity:** 10 A **Protected circuits:** Control unit.
3	Fuse No. 4	**Capacity:** 7.5 A **Protected circuits:** Pre-installation for anti-theft device, turn indicators, horn, lights relay, stop lights, USB socket.
4	Fuse No. 5	**Capacity:** 15 A **Protected circuits:** Front headlight, electric fan, Pre-installation for anti-theft device, instrument panel, ignition switch.
5	Fuse No. 6	**Capacity:** 7.5 A **Protected circuits:** Taillight, instrument panel, front turn indicators.

Dashboard



A = Speedometer

B = Immobilizer warning light /engine temperature

C = Engine control warning light/ASR (where available)

D = Turn indicator warning light

E = Low fuel warning light

F= Digital display

G = Insufficient oil pressure warning light

H = High beam warning light

I = ABS warning light (where available)

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 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

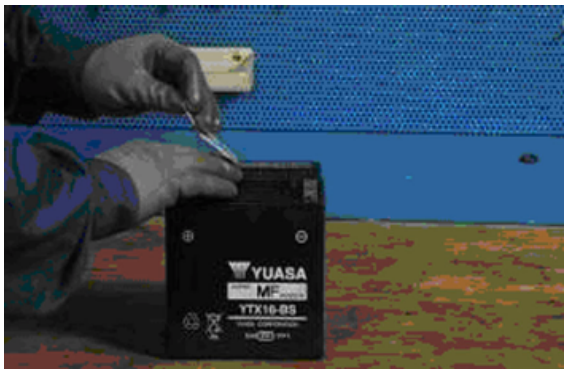
VRLA battery (valve-regulated lead-acid battery) Maintenance Free (MF)

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING. IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.
IF ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR MILK FOLLOWED BY MAGNESIUM MILK, BEATEN 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 WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

1) Battery preparation

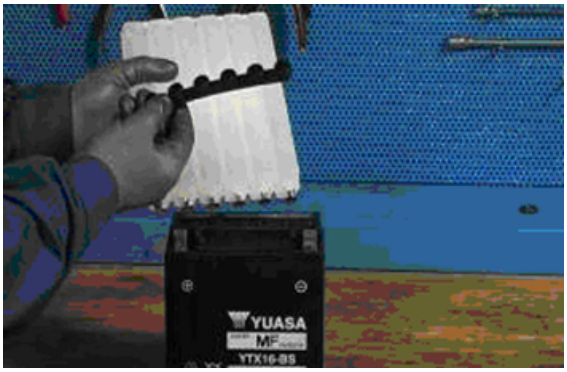
Position the battery on a flat surface. Remove the adhesive sheet closing cells and proceed as quickly as possible to run the subsequent activation phases.



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.

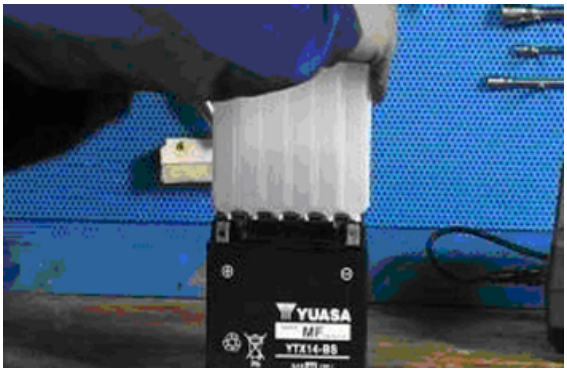
Note: Do not pierce the sealing of the container or the container itself because inside there is sulphuric acid.



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 (+)).

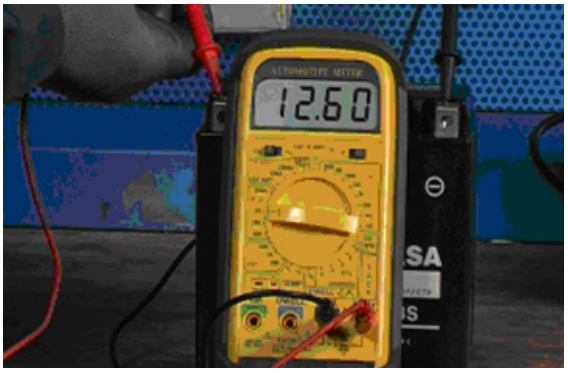
d - Press the red button, as shown in figure.

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.

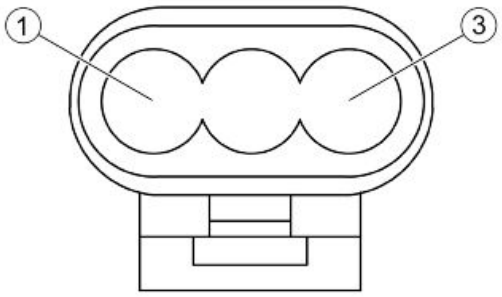
Connectors

DIAGNOSTICS CONNECTOR

1. Not connected

2. Ground lead (Black)

3. Electronic control unit (Violet - White)

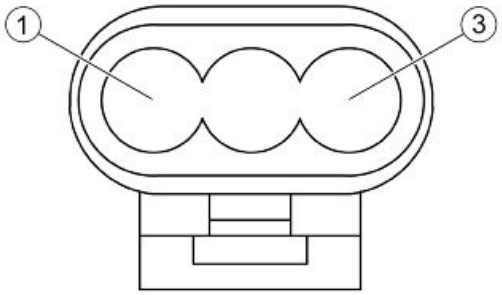


PICKUP CONNECTOR

1. Control unit positive (Red)

2. Negative from control unit (Brown)

3. Not connected



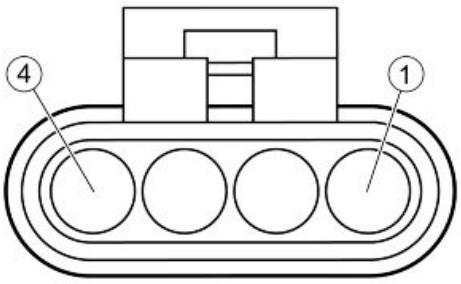
FUEL PUMP CONNECTOR

1. Power from solenoid (Black - Green)

2. Fuel level indicator (White-Green)

3. Ground lead (Black)

4. Low fuel warning light (Grey-black)



ELECTRONIC CONTROL UNIT CONNECTOR

1. H.V. COIL (Pink-Black)

2. Not connected

3. Not connected

4. Engine switch (Grey-Green)

5. Not connected

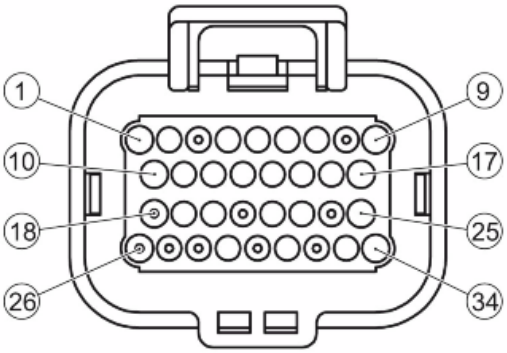
6. Live supply (Red-White)

7. Ground No. 1 (Black)

8. Not connected

9. Battery-powered (Grey-Black)

10. Start-up signal (Orange-Blue)



11. Lambda probe positive (Sky blue-Black)

12. Lambda probe negative (White-Green)

13. Water temperature sensor (Sky blue-Green)

14. Immobilizer aerial (Orange-White)

15. Not connected

16. K serial line (Purple-White)

17. Immobilizer (Red-Green)

18. Not connected

19. Side stand (Grey-Green)

20. Speed sensor negative (Brown)

21. Not connected

22. Injection load relay (Black-Purple)

23. Not connected

24. Consent to radiator electric fan (Blue-Yellow)

25. Injection warning light (Brown-Black)

26. Not connected

27. Not connected

28. Not connected

29. Engine speed sensor positive (Red)

30. Not connected

31. Lambda probe heater (White)

32. Not connected

33. Low beam lights automatic ignition enabling (White-Black)

34. Fuel injector (Red-Yellow)

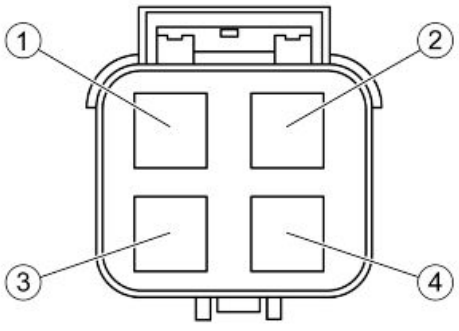
ENGINE TEMPERATURE SENSOR CONNECTOR

1. Ground lead (Grey-Green)

2. Instrument panel (Green-Yellow)

3. Electronic control unit (Sky blue - Green)

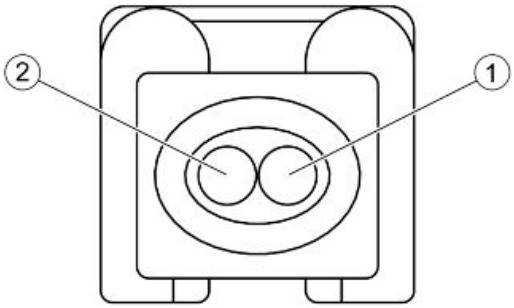
4. Ground lead (Black)



INJECTOR CONNECTOR

1. Power from relay (Black - Green)

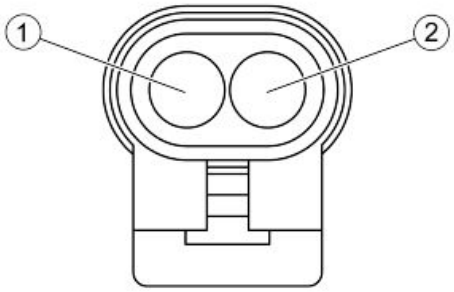
2. Electronic control unit (Red - Yellow)



LAMBDA PROBE CONNECTOR

1. Positive from control unit (Sky blue - Black)

2. Control unit negative (White - Green)



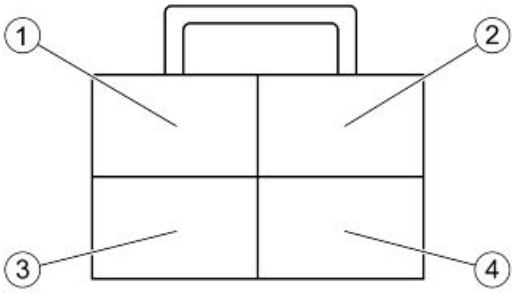
VOLTAGE REGULATOR CONNECTOR

1. Battery positive (Red-Black)

2. Ground lead (Black)

3. Battery positive (Red-Black)

4. Ground lead (Black)



INSTRUMENT PANEL CONNECTOR «A»

1. Fuel level indicator (White-Green)

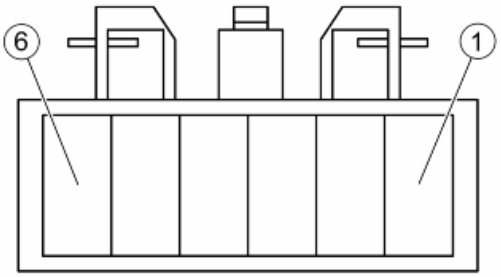
2. High-beam warning light (Violet)

3. Left indicator warning light (Pink)

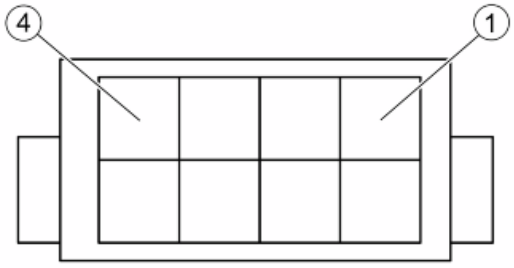
4. Right indicator warning light (White-Blue)

5. Live supply (White)

6. Oil pressure sensor (Pink-White)



INSTRUMENT PANEL CONNECTOR «B»



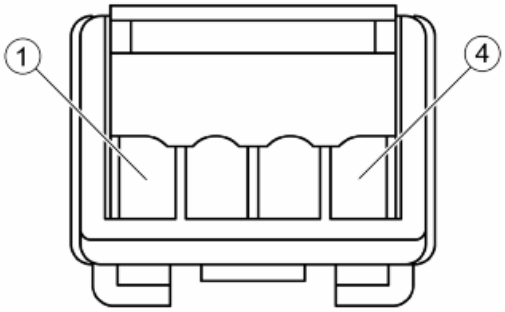
1. Ground lead (Black)

2. Injection warning light (Brown-Black)

3. Low fuel warning light (Grey-Black)

4. Water temperature (Green-Yellow)

INSTRUMENT PANEL CONNECTOR «C»



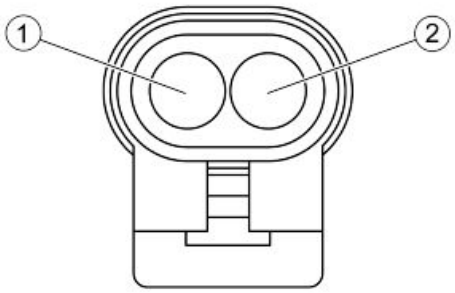
1. Immobilizer warning light (Red-Green)

2. Battery-powered (Red-Blue)

3. Lighting (Yellow - Black)

4. Key powered (White)

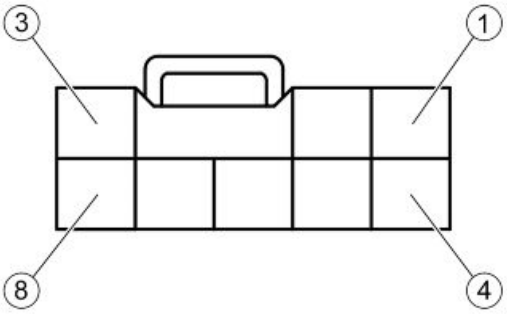
H.V. COIL CONNECTOR



1. Power from relay (Black - Green)

2. Electronic control unit (Pink - Black)

ANTITHEFT DEVICE PRE-INSTALLATION CONNECTOR



1. Ground lead (Black)

2. Right arrows (White-Blue)

3. Left arrows (Pink)

4. Battery-powered (Red-Blue)

5. Live supply (White)

6. Helmet compartment button pre-installation (Blue-Black)

7. Not connected

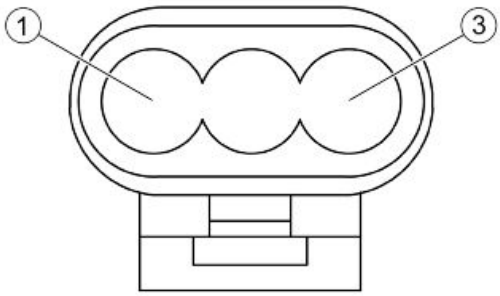
8. Not connected

IMMOBILIZER ANTENNA CONNECTOR

1. Key powered (Red-White)

2. Ground lead (Black)

3. Electronic control unit (Orange-White)



Diagnostic instrument

STARTER COMMAND

Function

Commands engine starting through the injection control unit.

Operation / Operating principle

The starter button, the brake switches, the starter relay and the injection control unit through PIN 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

Short circuit to positive:

- This malfunction is detected with a brake activated and the starter button pressed.
- 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).

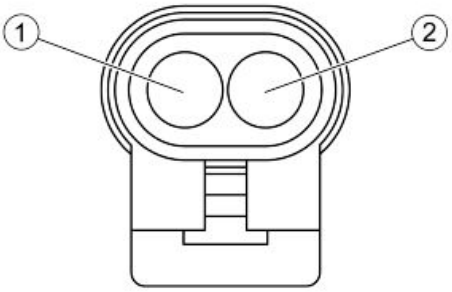
COIL

Function

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

Pinout:

1. Power from relay
2. Activation by control unit (control unit side PIN 1)



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

Troubleshooting

Short circuit 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 2: 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 2 - control unit PIN 1. If there is no continuity, restore the cable harness.
- Verify, with the key turned ON, the presence of voltage on the coil connector PIN 1. If no voltage is detected, check that the cable harness between the coil and injection relay is not interrupted: PIN 1 coil - relay.
- If the above tests provided a positive result, the coil should be replaced.

Short circuit to negative:

- Disconnect the control unit connector and the coil connector.
- Verify the coil connector PIN 2 ground insulation (or control unit connector PIN 1). If necessary, restore the cable harness.

INJECTOR

Function

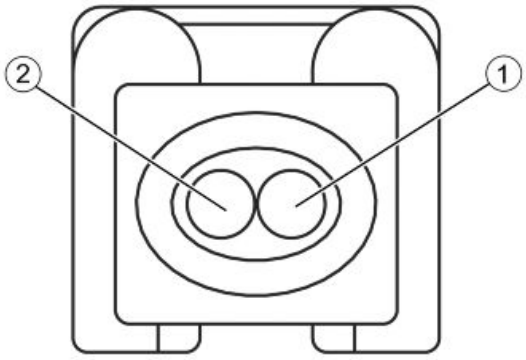
To supply the correct amount of petrol at the right timing.

Operation / Operating principle

Injector coil is excited for the petrol passage to open.

Pin-out:

1. Power from relay
2. Control unit ground



ELECTRICAL ERRORS

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

Error cause

Shorted to positive: excessive voltage at PIN 34 of the control unit connector.

Shorted to negative: null voltage at PIN 1 of the injector connector.

The circuit is open: interruption of the circuit.

Troubleshooting

Shorted 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.

Shorted 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.

The circuit is open:

- 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.

Short circuit to negative: null voltage at PIN 86 of the injection relay.

Open circuit: circuit interruption.

Troubleshooting

Short circuit 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 85 (or control unit PIN 22). If necessary, restore the cable harness.

Short circuit 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 85 - control unit PIN 22. If necessary, restore the cable harness.

ELECTRIC FAN CIRCUIT

Function

Radiator fan and coolant - Operation.

Operation / Operating principle

The control unit closes the fan control relay excitation circuit to ground until the temperature drops.

ELECTRICAL ERRORS

Fan relay P0480 - shorted to positive / shorted to negative / open circuit.

Error cause

Shorted to positive: excessive voltage at PIN 24 of the control unit connector.

Shorted to negative: null voltage at PIN 24 of the control unit connector.

Open circuit: circuit interruption.

Troubleshooting

Short circuit to positive:

- Disconnect the fan control relay and, turning the key to ON position, measure the voltage read at PIN 85 of the relay connector to the cable harness: if the voltage is 12V restore the cabling. If the voltage is zero replace the relay.

Short circuit to negative:

- Disconnect the fan control relay and the control unit.
- Verify ground insulation of the cable between the fan control relay (PIN 85) and the control unit (PIN 24). Restore the cabling if necessary.

Open circuit:

- Carry out the check procedure of the control unit and relay connectors.
- Verify electrical continuity of the cable between the relay connector (PIN 85) and the control unit connector (PIN 24).
- Verify electrical continuity of the cable between the relay connector (PIN 30) and the secondary fuse holders.
- Verify continuity between relay PIN 85 and PIN 86. If there is no continuity replace the relay.

ENGINE TEMPERATURE SENSOR

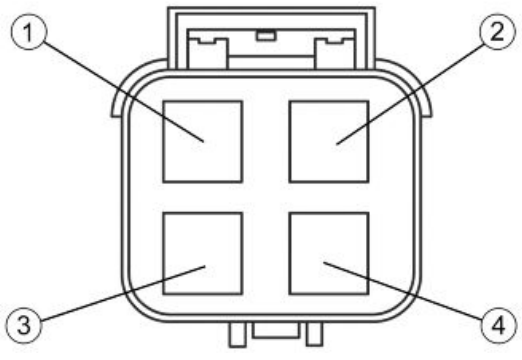
Function

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. Ground from control unit
2. Instrument panel
3. Injection ECU
4. Ground lead

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

Error cause

Open circuit or short circuit to positive:interruption of the circuit or excessive voltage at PIN 13 of the control unit connector. Short circuit to negative: null voltage between PIN 13 and 7 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 7.
- 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 3 and control unit PIN 7 - sensor PIN 1. If necessary, restore the cable harness.
- 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.

Short circuit 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 3 (or control unit PIN 13) and restore the cabling.

Short circuit to negative:

- Disconnect the sensor connector.
- Check the sensor connector PIN 3 from ground insulation.
- If there is no ground insulation restore the cabling.
- If PIN 3 is insulated from the ground and the error persists, this means that there is a probable fault in the control unit.

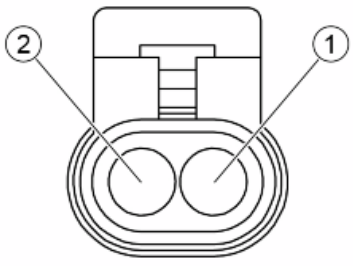
LAMBDA PROBE

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 volt-



age which is read and interpreted by the injection control unit.

Pinout:

1. Signal to the control unit (+)
2. Signal to the control unit (-)

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

Short circuit to positive: excessive voltage to PIN 11 or PIN 12 of the control unit connector. Open circuit or short circuit to negative: interruption of the circuit or zero voltage between the pins 11 and 12 of the control unit connector.

Troubleshooting

Short circuit to positive:

- Disconnect the control unit connector and the sensor connector.
- Verify that there is no short circuit with the battery positive on the PIN 1 of the sensor connector (corresponding to the PIN 11 of the control unit connector); in the presence of short circuit, restore the cable harness.
- Verify that there is no short circuit with the battery positive on the PIN 2 of the sensor connector (corresponding to the PIN 12 of the control unit connector); 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: PIN 11 of the control unit - PIN 1 of the sensor and PIN 12 of the control unit - PIN 2 of the sensor. 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 insulation from the ground of PIN 1 of the sensor connector. If there is no insulation, restore the cable harness.
- Check the insulation from the ground of PIN 2 of the sensor connector. If there is no insulation, restore the cable harness.
- If PIN 1 and 2 are insulated from ground and the error persists, it means that there is a probable defect in the control unit.

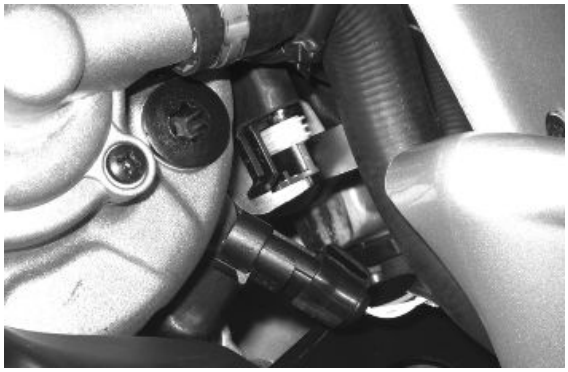
INDEX OF TOPICS

Questa sezione descrive le operazioni da effettuare per lo smontaggio del motore dal veicolo.

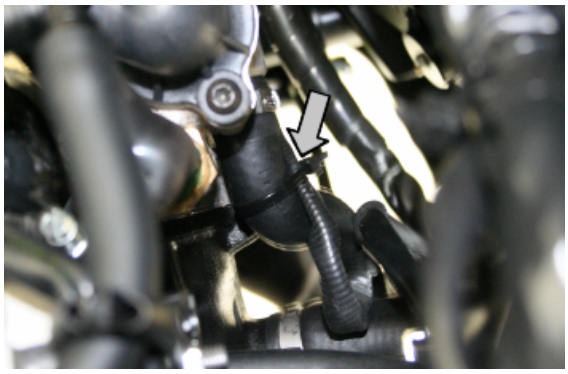
Exhaust assy. Removal

- Remove the right and left fairings and the spoiler terminals.

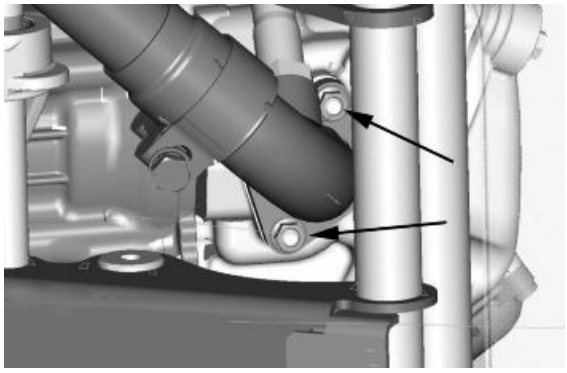
- Remove the Lambda probe from its support and disconnect it.



Remove the clamp holding the lambda probe cable to the coolant pipe indicated in the photograph



- Undo the two exhaust manifold fixings on the head. To unscrew the nuts that fix the silencer flange to the head properly, use a jointed wrench that allows, according to the travel direction, to get also at the right nut. That is difficult to do with a traditional straight wrench.



- Undo the three screws that fix the silencer to the supporting arm.
- Remove the full silencer unit.

- Remove the lambda probe from the manifold.

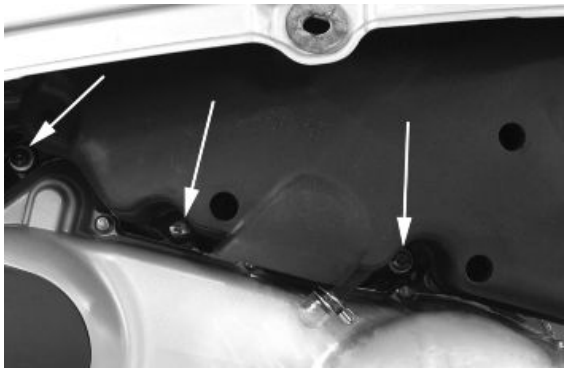
CAUTION: SHOULD IT BE NECESSARY TO REMOVE ONLY THE SILENCER TIP, ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN STUB AND TIP.

Removal of the engine from the vehicle

CAUTION

SUPPORT THE MOTORCYCLE FIRMLY.

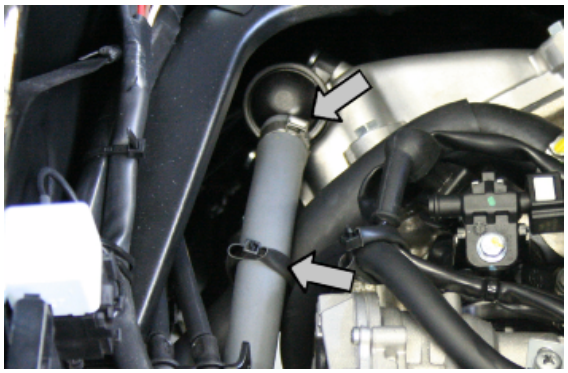
- Disconnect the battery.
- Remove the helmet compartment.
- Remove the side fairings and the spoiler terminals.
- Remove the rear brake calliper
- Remove the air cleaner from the housing by unscrewing the three screws indicated in the photograph.



CAUTION

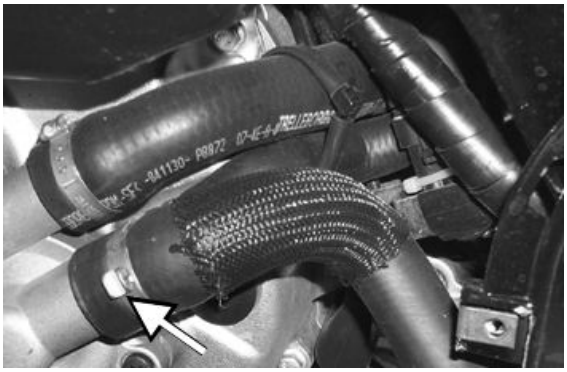
THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

- Remove the clamp from the blow-by pipe and take the pipe out; remove the retainer clamp.
- Remove the clamp indicated in the photograph and disconnect the sleeve connecting it to the throttle body.

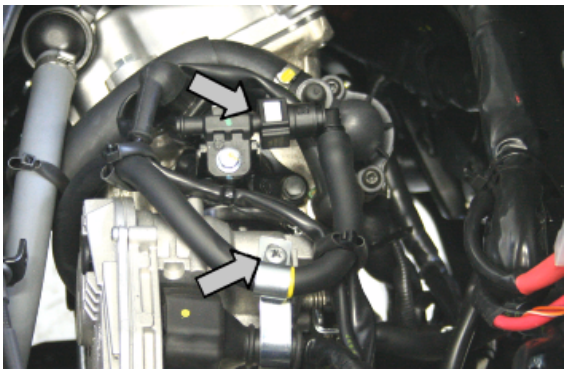


- Get a + 2.5 l container to collect the coolant.

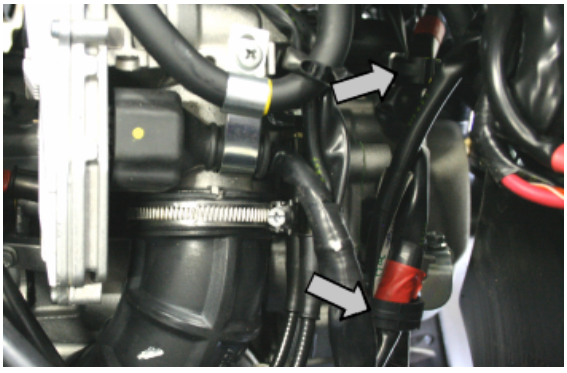
- Remove the coolant inlet pipe to the motor as indicated in the photograph.



- Disconnect the fuel pipe from the injector and remove the screw locking the retainer clamp.
- Disconnect the injector wiring and the throttle body control unit wiring.



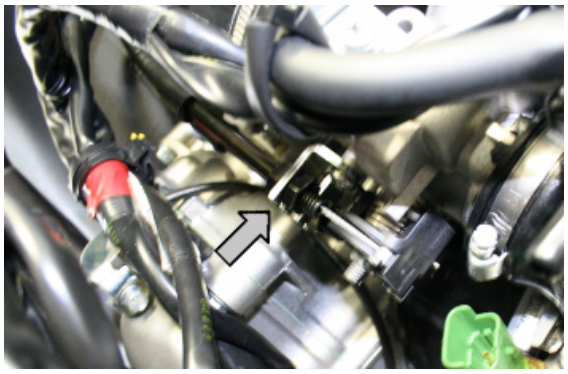
- Disconnect the cable harnesses from the two clamps indicated.



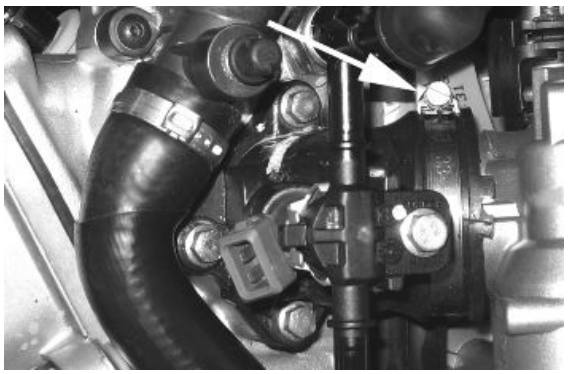
- Remove the coolant outlet pipe from the engine as indicated.

- Remove the spark plug cap.
- Remove the coolant temperature sensor connector indicated in the photo.

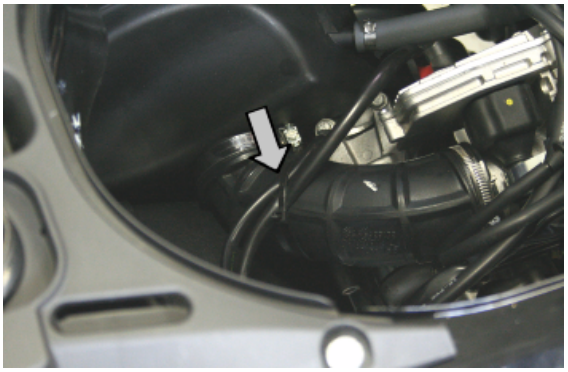
- Remove the throttle control cables from the throttle body by undoing the nuts indicated in the photograph.



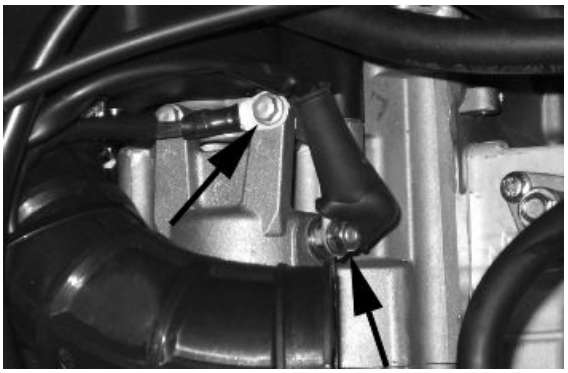
- Loosen the clamp indicated in the photograph and remove the throttle body.



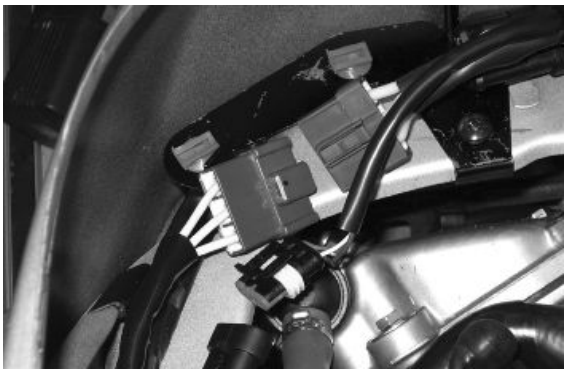
- Remove the clamp retaining the starter motor from the sleeve.

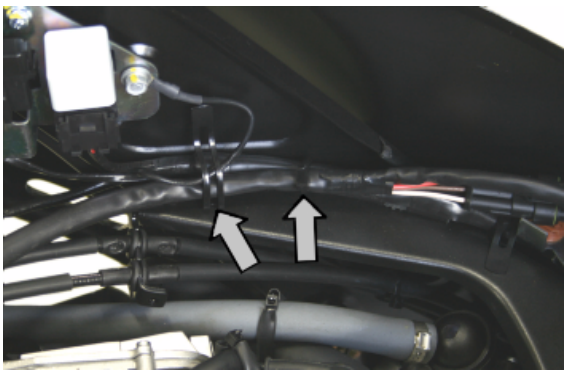


- Remove the positive and negative wiring from the starter motor as shown in the picture.

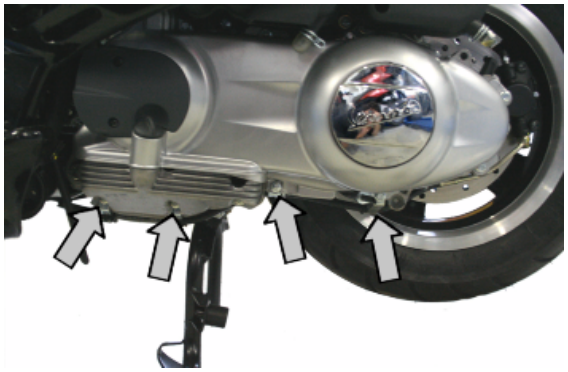


- Disconnect the connectors from the flywheel wiring as shown in the photo.
- Release the cables from the retainer clamps.

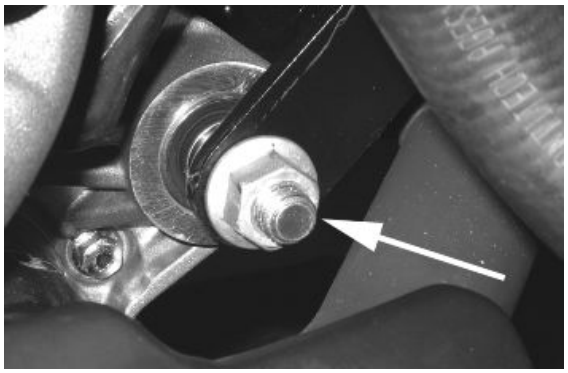


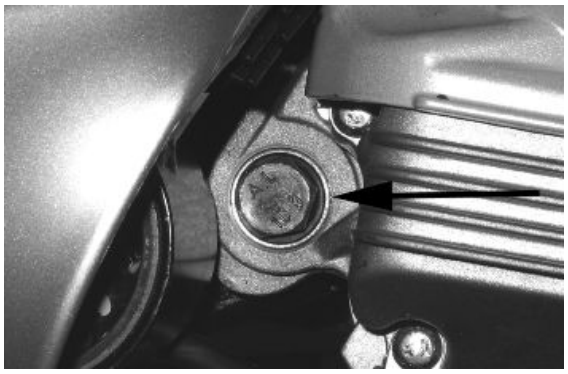


- Remove the four retainers of the rear brake pipes from the crankcase.
- Remove the rear shock absorbers.

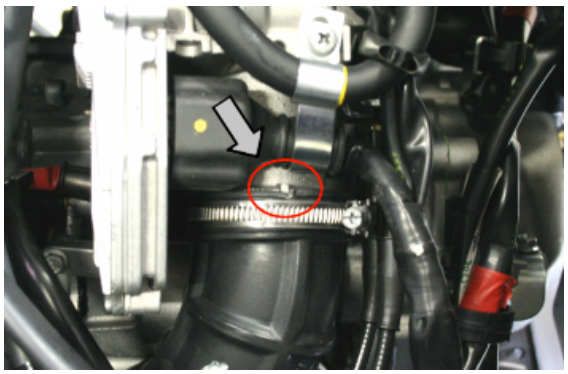


- Remove the engine-swinging arm fixing pin by undoing the nut and operating on the head of the pin as shown in the photograph.
- The engine is now free.





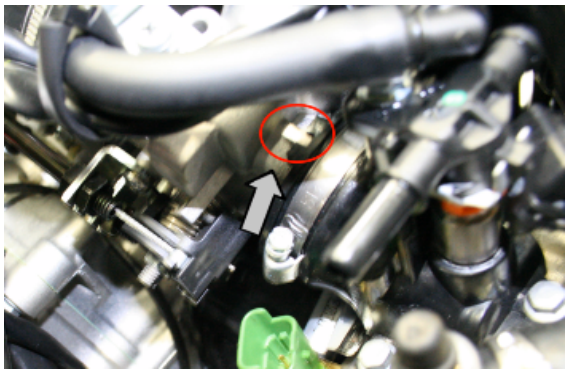
Upon refitting the engine to the vehicle, carry out the removal operations but in reverse order, and respect the tightening torque shown in the «Specifications» Chapter.
- Check that there is a small clearance when the valve is in abutment against the set screw.
- Check the engine oil level and if necessary, top it up with the recommended type.
- Fill and bleed the cooling circuit.
- Check accelerator and electric devices for correct functioning.



- Pay particular attention to the sleeve, be careful to position the throttle body reference marks as indicated in the picture.

CAUTION

PAY PARTICULAR ATTENTION TO POSITIONING THE THROTTLE CONTROL TRANSMISSION PROPERLY.



INDEX OF TOPICS

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

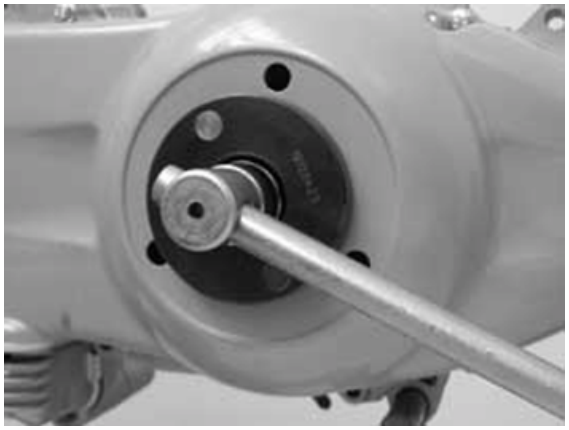
Automatic transmission

Transmission cover

- To remove the transmission cover it is necessary to remove the plastic cover first, by inserting a screwdriver in the slotted holes. Using the clutch housing lock wrench shown in the figure, remove the driven pulley shaft locking nut and washer.

Specific tooling

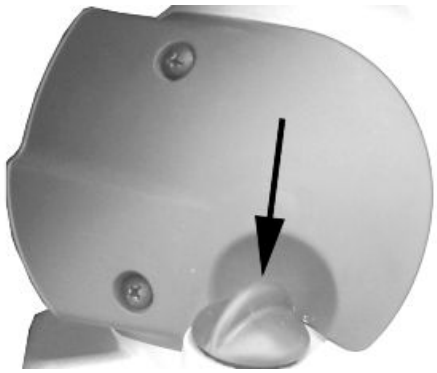
020423Y Driven pulley lock wrench



- Remove the cap/dipstick from the engine oil filling hole.
- Remove the ten screws.
- Remove the transmission cover.

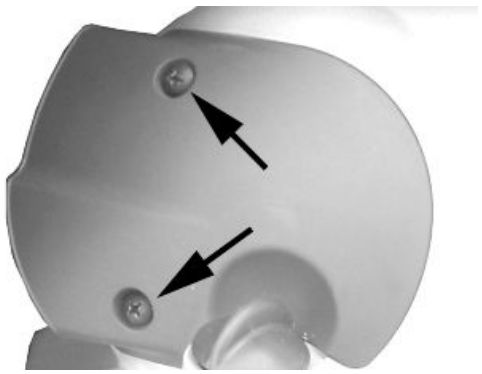
N.B.

WHEN YOU ARE REMOVING THE TRANSMISSION COVER YOU MUST BE CAREFUL NOT TO DROP THE CLUTCH HOUSING.

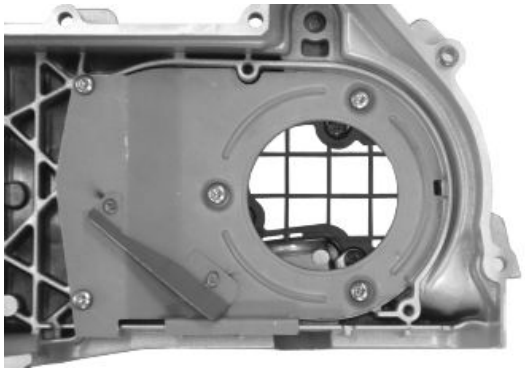


Air duct

- Remove the transmission compartment air intake cover shown in the picture.

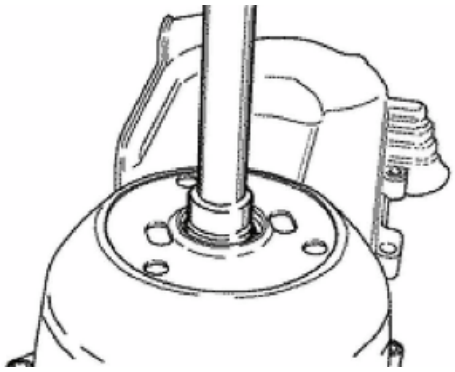


- Remove the 5 screws, found on two different levels, as well as the small casing.



Removing the driven pulley shaft bearing

- Remove the clip from the inside of the cover.
- Remove the bearing from the crankcase by means of:



Specific tooling

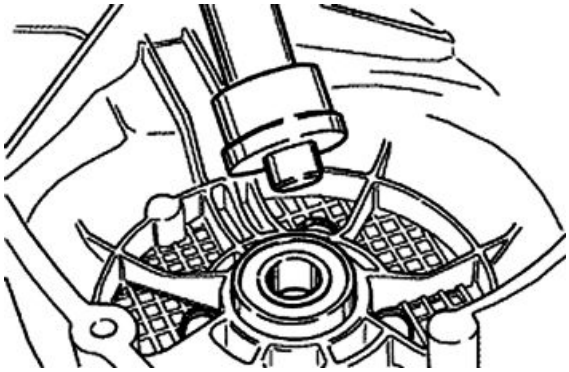
020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020412Y 15 mm guide

Refitting the driven pulley shaft bearing

- Slightly heat the crankcase from the inside so as not to damage the painted surface.
- Insert the bearing in its seat.
- Refit the Seeger ring.



CAUTION

USE AN APPROPRIATE REST SURFACE TO AVOID DAMAGING THE COVER PAINT.

N.B.

ALWAYS REPLACE THE BEARING WITH A NEW ONE UPON REFITTING.

Specific tooling

020376Y Adapter handle

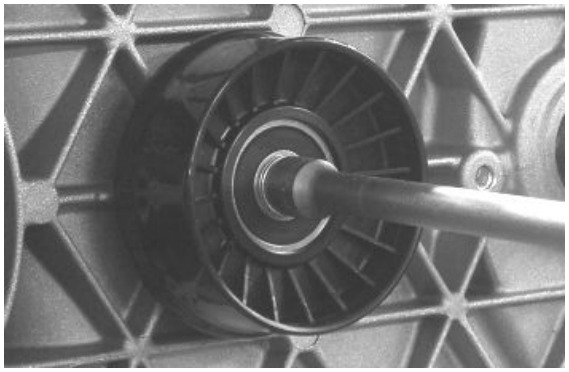
020357Y 32 x 35 mm adaptor

020412Y 15 mm guide

Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Remove the special clamping screws as indicated in the picture



- Check the outer diameter of the roller does not have defects that could jeopardise belt functioning
- For refitting, place the roller with the belt containment edge on the engine crankcase side
- Tighten the wrench to the prescribed torque.

Locking torques (N*m)

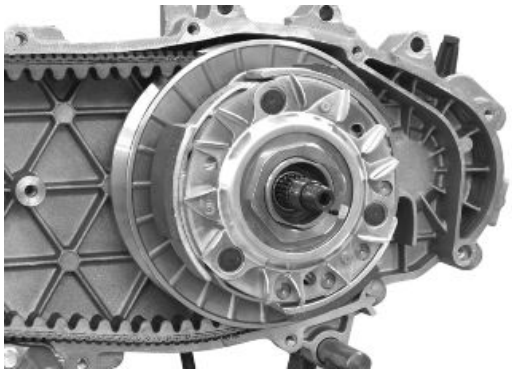
Anti-flapping roller **12 - 16**

Removing the driven pulley

- Remove the clutch housing and the driven pulley assembly.

N.B.

THE UNIT CAN ALSO BE REMOVED WITH THE DRIVING PULLEY MOUNTED.



Inspecting the clutch drum

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

Characteristic

Clutch bell max. value

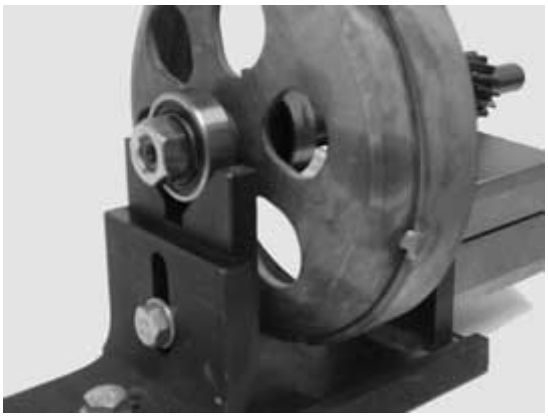
Max. value: Ø 134.5 mm

clutch housing standard value

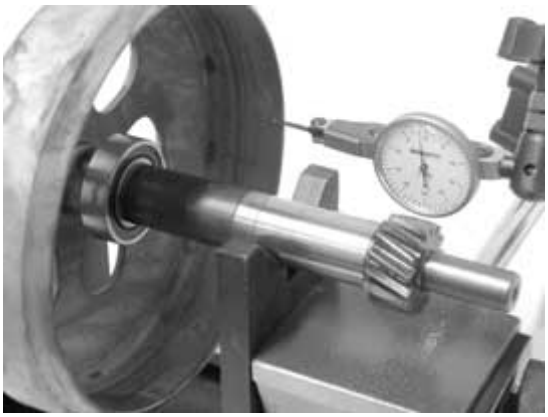
Standard value: Ø 134 to 134.2 mm

Checking the bell working surface eccentricity

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



- Using a dial gauge and the magnetic base, measure the bell eccentricity.
- Repeat the measurement at 3 positions (Central, internal, external).
- In case of faults, replace the bell.



Specific tooling

020074Y Support base for checking crankshaft alignment

020335Y Dial gauge magnetic support

Characteristic

clutch bell check: Limit eccentricity.

Admissible limit eccentricity: 0.15 mm

Removing the clutch

Fit the driven pulley spring compressor specific tool with medium length pins screwed in position **«C»** on the tool internal side.

- Introduce the adapter ring 11 with the chamfering facing the inside of the tool.
- Fit the driven pulley unit on the tool with the insertion of the 3 pins in the ventilation holes in the mass holder support.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to loosen/tighten the clutch nut.
- Use the special 46x55 wrench component 9 to remove the nut fixing the clutch in place.
- Dismantle the driven pulley components (Clutch and spring with its plastic holder)

CAUTION

THE TOOL MUST BE FIRMLY FIXED IN THE CLAMP AND THE CENTRAL SCREW MUST BE BROUGHT INTO CONTACT WITH THE TOOL. EXCESSIVE TORQUE CAN CAUSE THE SPECIFIC TOOL TO BUCKLE.

Specific tooling

020444Y011 adapter ring

020444Y009 wrench 46 x 55

020444Y Tool for fitting/removing the clutch on the driven pulley

Inspecting the clutch

- Check the thickness of the clutch mass friction material.
- The masses must exhibit no traces of lubricants; in that case, 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.
DIFFERENT CONDITIONS MAY CAUSE CLUTCH TEARING.

CAUTION

DO NOT USE TOOLS TO OPEN THE MASSES TO AVOID 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.

- Remove the 4 torque server pins and pull the pulley halves apart.

Removing the driven half-pulley bearing

- Check there are no signs of wear and/or noisiness; - Replace with a new one if there are.
- Remove the retainer ring using two flat blade screwdrivers.
- Support the pulley bushing adequately from the threaded side using a wooden surface.
- Using a hammer and pin, knock the ball bearing out as shown in the figure.

- Support the pulley properly using the bell as shown in the figure.

Specific tooling

001467Y035 Bell for 47-mm outside diameter bearings

- Remove the roller bearing using the modular punch.

Specific tooling

020376Y Adapter handle

020456Y Ø24 mm adaptor

020363Y 20 mm guide

Inspecting the driven fixed half-pulley

- Measure the outside diameter of the pulley bushing.
- Check the faying surface with the belt to make sure there are no flaws.
- Check the riveted joints are functional.
- Check evenness of the belt contact surface.

Characteristic

Half-pulley minimum diameter

Minimum admissible diameter: Ø 40.96 mm

Half-pulley standard diameter

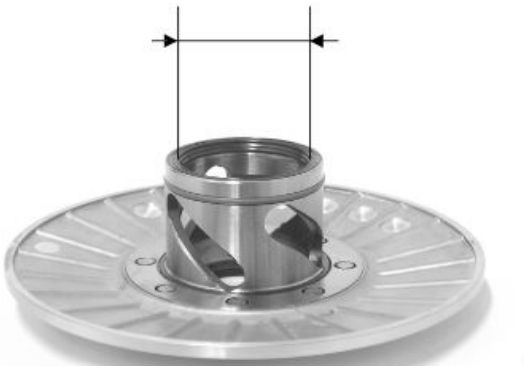
Standard diameter: Ø 40.985 mm

Wear limit

0.3 mm

Inspecting the driven sliding half-pulley

- Remove the two seal rings and the two O-rings.
- Measure the movable half-pulley bushing inside diameter.
- Check the faying surface with the belt to make sure there are no flaws.
- Check the riveted joints are functional.
- Check the evenness of the belt contact surface.



MOVABLE DRIVEN HALF-PULLEY DIMENSIONS

Specification	Desc./Quantity
Wear limit	0.3 mm
standard diameter	Ø 41.000 - 41.035 mm
maximum allowable diameter	Ø 41.08 mm

Refitting the driven half-pulley bearing

- Support the pulley bushing adequately from the threaded side using a wooden surface.
- Fit a new roller bearing as shown in the figure.
- For the fitting of the new ball bearing, follow the example in the figure using a modular punch.

Fit the retainer ring

WARNING

N.B.

FIT THE BALL BEARING WITH THE VISIBLE SHIELDING

Specific tooling

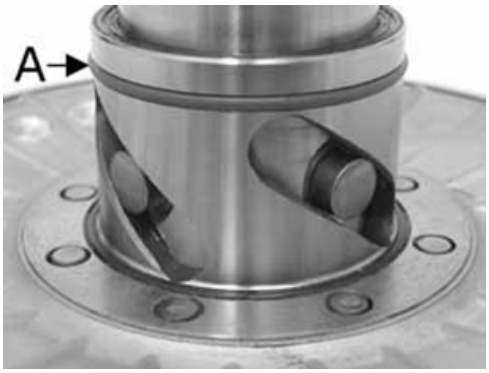
020376Y Adapter handle

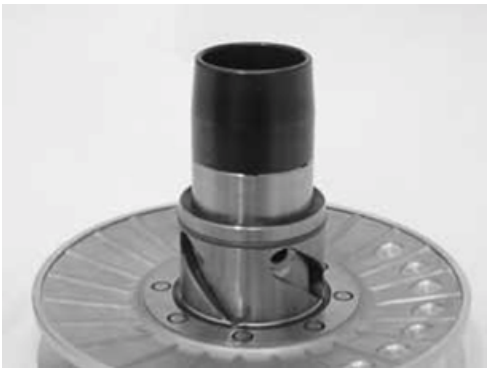
020375Y 28 x 30 mm adaptor

020424Y Punch for fitting driven pulley roller casing

Refitting the driven pulley

- Insert the new oil seals and O-rings on the movable half-pulley.
- Lightly grease the O-rings «**A**» shown in the figure.
- Fit the half-pulley over the bushing using the specific tool.
- Check that the pins are not worn and proceed to refitting them in their slots.
- Refit the torque server closure collar.
- Using a curved-spout grease gun, lubricate the driven pulley unit with approximately 6 grams of grease. Apply grease through one of the holes in the bushing until it comes out through the hole on the opposite side. This operation is necessary to avoid the presence of grease beyond the O-rings.





N.B.

THE TORQUE SERVER CAN BE GREASED WHETHER WITH BEARINGS FITTED OR WHEN THEY ARE BEING REPLACED; UNDERTAKING THE OPERATION WHEN THE BEARINGS ARE BEING SERVICED MIGHT BE EASIER.

Specific tooling

020263Y Sheath for fitting the driven pulley

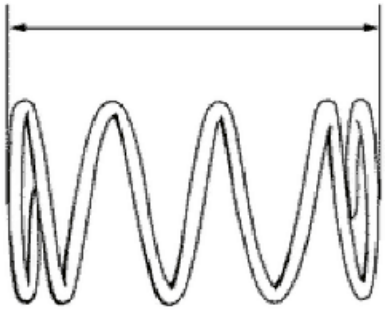
Recommended products

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

123 mm

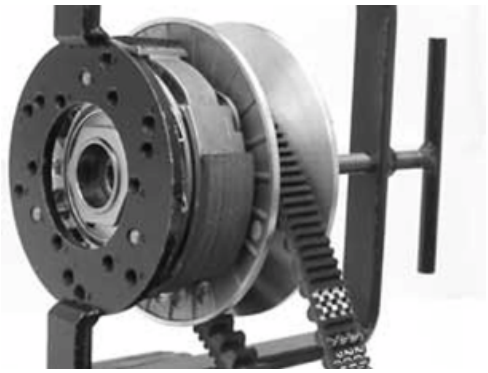
Acceptable limit after use:

118 mm

Refitting the clutch

- Support the driven pulley spring compressor specific tool with the control screw in vertical axis.
- Arrange the tool with the medium length pins screwed in position "**C**" on the inside.
- Introduce the adapter ring No. 11 with the chamfering facing upwards.
- Insert the clutch on the adapter ring.
- Lubricate the end of the spring that abuts against the torque server closing collar.
- Insert the spring with its plastic holder in contact with the clutch.
- Insert the drive belt into the pulley unit according to their direction of rotation.
- Insert the pulley unit with the belt into the tool.
- Slightly preload the spring.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to tighten the clutch nut.
- Place the tool in the clamp with the control screw on the horizontal axis.
- Fully preload the spring.
- Apply the clutch fixing nut and tighten it to the prescribed torque using the special 46x55 wrench.
- Loosen the tool clamp and insert the belt according to its direction of rotation.

- Lock the driven pulley again using the specific tool.
- Preload the clutch return spring with a traction/ rotation combined action and place the belt in the smaller diameter rolling position.
- Remove the driven pulley /belt unit from the tool.



N.B.

DURING THE SPRING PRELOADING PHASE, BE CAREFUL NOT TO DAMAGE THE PLASTIC SPRING STOP AND THE BUSHING THREADING.

N.B.

FOR DESIGN REASONS, THE NUT IS SLIGHTLY ASYMMETRIC; THE FLATTEST SURFACE SHOULD BE MOUNTED IN CONTACT WITH THE CLUTCH.

Specific tooling

020444Y Tool for fitting/removing the clutch on the driven pulley

020444Y011 adapter ring

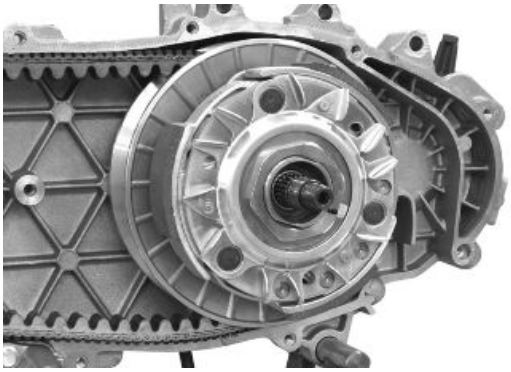
020444Y009 wrench 46 x 55

Locking torques (N*m)

Clutch assembly nut on driven pulley **45 - 50**

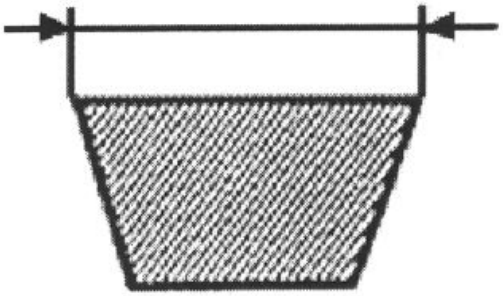
Refitting the driven pulley

- Refit the clutch bell.



Drive-belt

- Check that the driving belt is not damaged.
- Check the width of the belt.



Characteristic

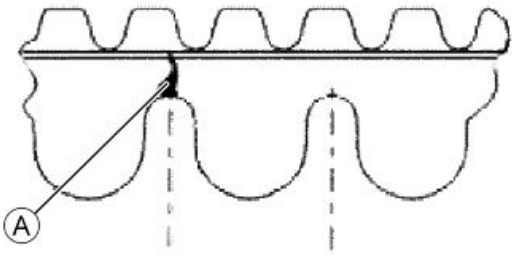
Driving belt - minimum width

19.5 mm

Driving belt - standard width

21.3 ± 0.2 mm

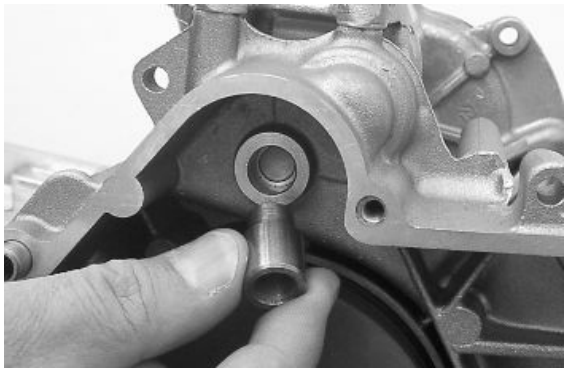
During the wear checks in foreseen in the scheduled maintenance program, you are advised to check that the rim bottom of the toothing does not show signs of incisions or cracking (see figure): The rim bottom of the tooth must not have incisions or cracking; if it does, change the belt.



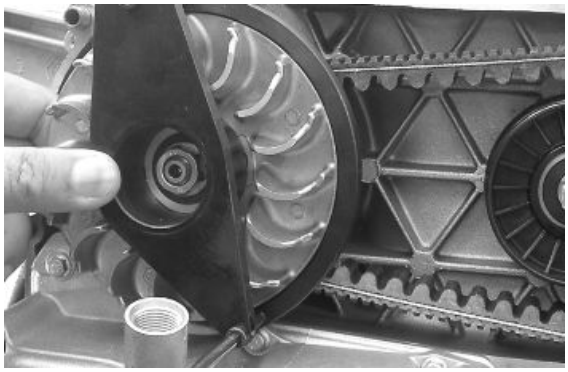
Removing the driving pulley

- Turn the crankshaft until the ropes of the pulley are on a horizontal axis

- Insert the adaptor sleeve of the appropriate tool in the hole shown in the picture



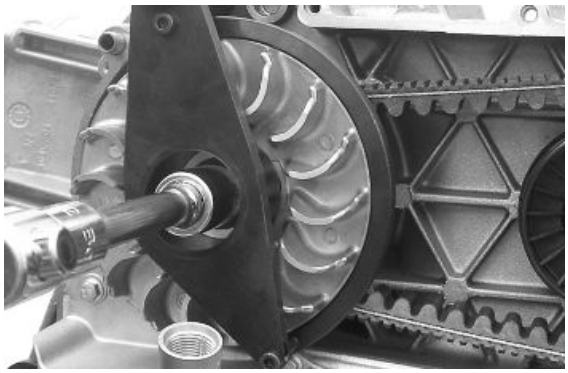
- Insert the tool in the hollows and apply the retention ring
- Bring in the ring's clamping screws while keeping the tool to support the pulley



Specific tooling

020626Y Driving pulley lock wrench

- Remove the fixing nut and the washer
- Remove the stationary drive pulley half.



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.
- Check that the O-ring is not pushed out of shape.

CAUTION

DO NOT LUBRICATE OR CLEAN SINTERED BUSHINGS

Characteristic

movable driving half-pulley bushing: Standard Diameter

26.000 - 26.021 mm

movable driving half-pulley bushing: Maximum allowable diameter

Ø 26.12 mm

Sliding bushing: Standard Diameter

Ø 25.959 - 25.98 mm

Sliding bushing: Minimum diameter permitted

Ø 25.95 mm

Roller: Standard Diameter

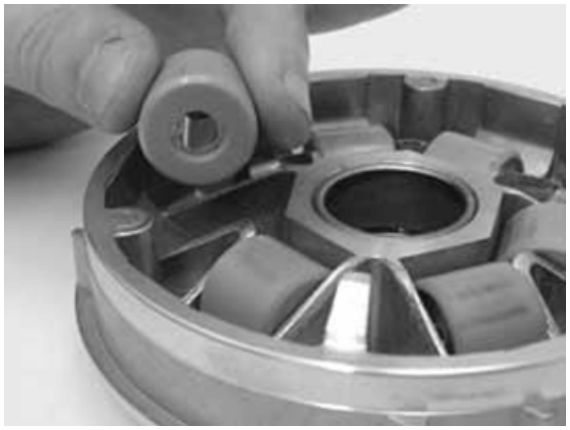
Diameter 20.5 - 20.7 mm

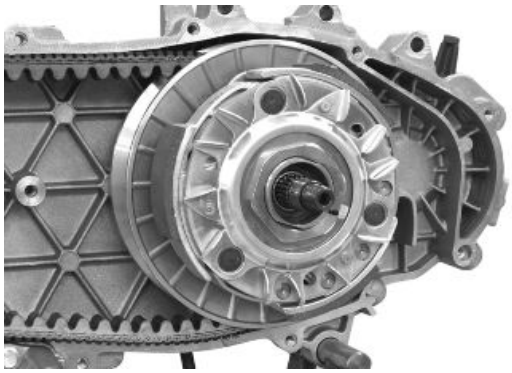
Roller: Minimum diameter allowed

Ø 20 mm

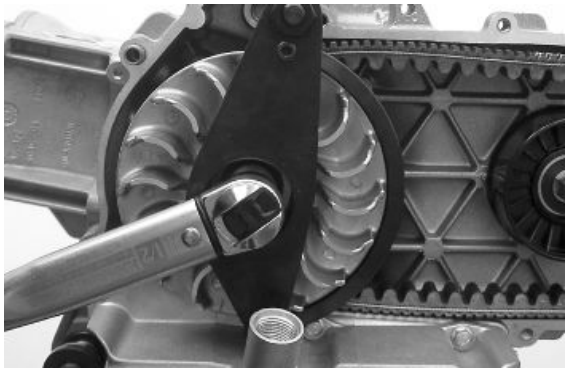
Refitting the driving pulley

- Pre-assemble the movable half-pulley with the roller contrast plate by putting the rollers in their housings with the larger support surface touching the pulley according to the direction of rotation.
- Check that the roller contact plate does not have flaws and is not damaged on the grooved edge.
- Mount the complete bushing unit on the crankshaft.
- Fit the driven pulley/Clutch/belt unit on the engine.





- Fit the steel shim in contact with the bushing and the stationary drive pulley.
- Install the appropriate tool as described in the removal phase.
-Tighten the nut with washer to the prescribed torque.



Specific tooling

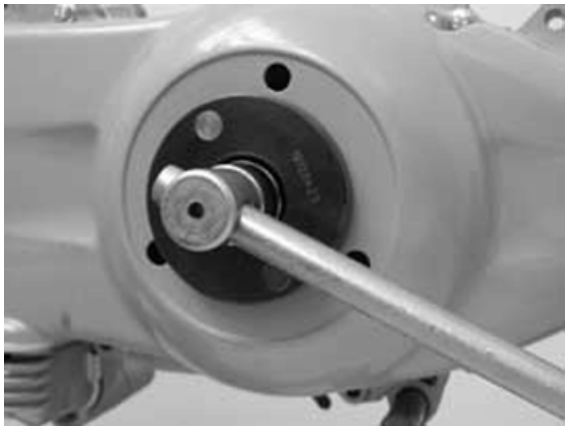
020626Y Driving pulley lock wrench

Locking torques (N*m)

Drive pulley nut 75 - 83

Refitting the transmission cover

- Check that there are 2 alignment dowels and that the sealing gasket for the oil sump on the transmission cover is adequately fitted.
- Replace the cover and tighten the 10 screws to the specified torque.
- Refit the oil loading cap/bar.
- Refit the steel washer and the driven pulley nut.
- Tighten the nut to the prescribed torque using the lock wrench and the torque wrench tools.
- Refit the plastic cover.



Specific tooling

020423Y Driven pulley lock wrench

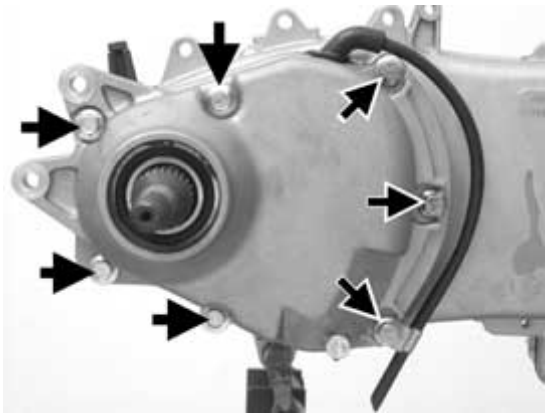
Locking torques (N*m)

Transmission cover screws 11 - 13 Driven pulley shaft nut 54 - 60

End gear

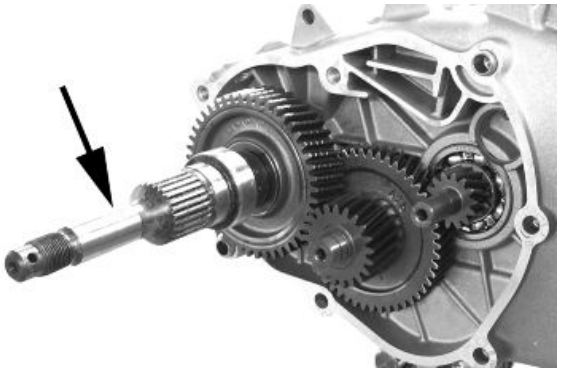
Removing the hub cover

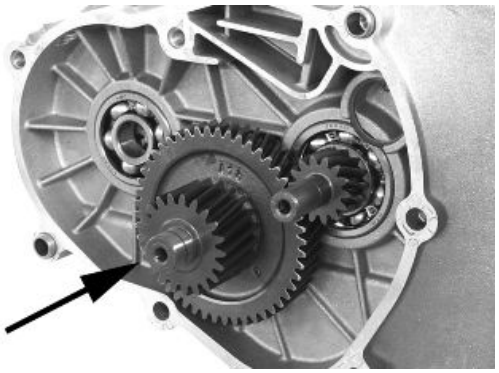
- Empty the rear hub through the oil drainage plug.
- Remove the 7 flanged screws indicated in the figure.
- Remove the hub cover and its gasket.



Removing the wheel axle

- Remove the wheel axis complete with gear.
- Remove the intermediate gear.





Removing the hub bearings

- Check the state of the bearings being examined (wear, clearance and noisiness). If faults are detected, do the following.
- Use the specific bearing extractor to remove the three 15 mm bearings (2 in the crankcase and 1 in the hub cover).

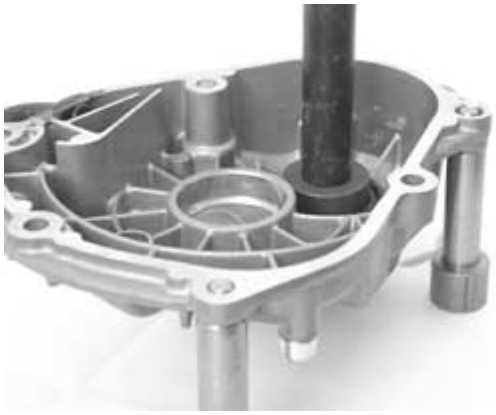
Specific tooling

001467Y013 Calliper to extract 15-mm diameter bearings

Removing the wheel axle bearings

- Take out the clip on the outside of the hub cover.
- Support the hub cover and expel the bearing.

By means of the appropriate tools, remove the oil seal as in the figure.



Specific tooling

020376Y Adapter handle

020477Y 37-mm Adaptor

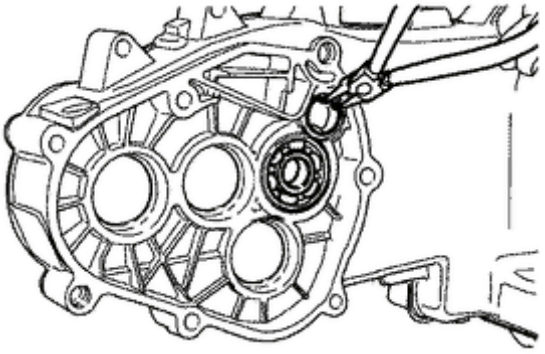
020483Y 30 mm guide

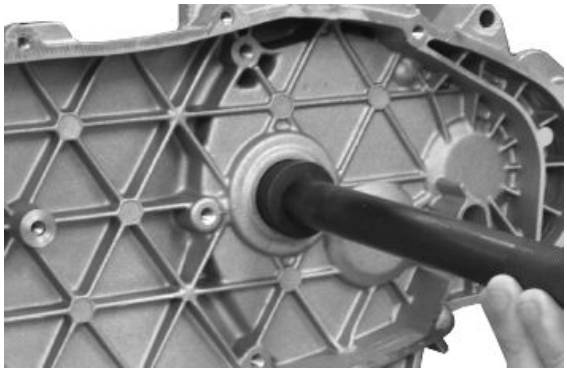
020359Y 42 x 47-mm adaptor

020489Y Hub cover support stud bolt kit

Removing the driven pulley shaft bearing

- As you need to remove the driven pulley shaft, its bearing and oil seal, remove the transmission cover as described above.
- Extract the driven pulley shaft from its bearing.
- Remove the oil seal using a screwdriver, working from inside the bearing and being careful not to damage the housing, make it come out of the belt transmission side.
- Remove the Seeger ring shown in the figure
- Remove the driven pulley shaft bearing using the modular punch.





Specific tooling

020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020363Y 20 mm guide

Inspecting the hub shaft

- Check the three shafts for wear or distortion of the toothed surfaces, the bearing housings, and the oil seal housings.
- If faults are found, replace the damaged components.

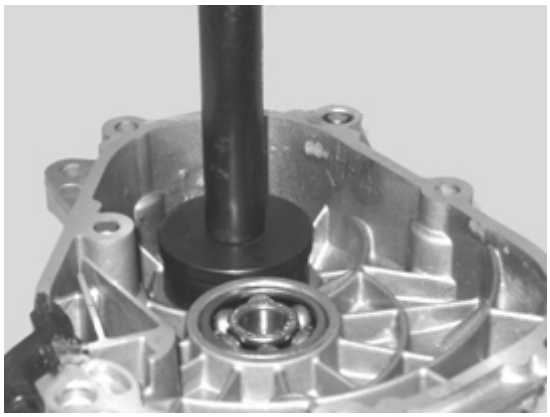
Inspecting the hub cover

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

Refitting the wheel axle bearing

- Support the hub cover on a wooden surface.
- Heat the crankcase cover with the specific heat gun.
- Fit the wheel shaft bearing with a modular punch as shown in the figure.
- Fit the Seeger ring.
- Fit the oil seal with seal lip towards the inside of the hub and place it flush with the internal surface by means of the appropriate tool used from the 52-mm side**.**

The 52-mm side of the adapter must be turned towards the bearing.



Specific tooling

020376Y Adapter handle

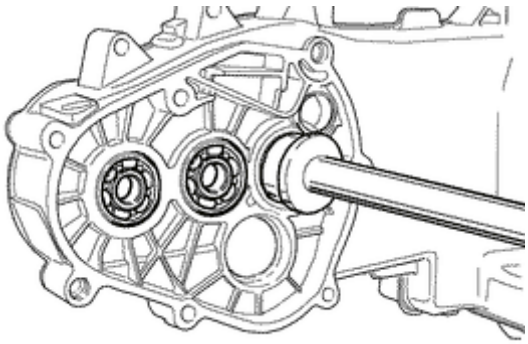
020360Y 52 x 55-mm adaptor

020483Y 30 mm guide

Refitting the hub cover bearings

In order to fit the hub box bearings, the engine crankcase and the cover must be heated with the special heat gun.

- The three 15-mm bearings must be fitted using the appropriate tools:
- The 42-mm side of the adapter must be turned towards the bearing.



Specific tooling

020150Y Air heater support

020151Y Air heater

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020412Y 15 mm guide

N.B.

TO FIT THE BEARING ON THE COVER, ADEQUATELY SUPPORT THE COVER WITH THE STUD BOLT KIT.

- Refit the driven pulley shaft bearing with a modular punch as shown in the figure.

N.B.

IF THE BEARING HAS AN ASYMMETRICAL BALL RETAINER, PLACE IT SO THAT THE BALLS ARE VISIBLE FROM THE HUB INNER SIDE.

Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020363Y 20 mm guide

N.B.

WHEN FITTING THE BEARINGS ON THE ENGINE CRANKCASE, SUPPORT THE CRANKCASE PREFERABLY ON A SURFACE TO ALLOW THE BEARINGS TO BE DRIVEN VERTICALLY.

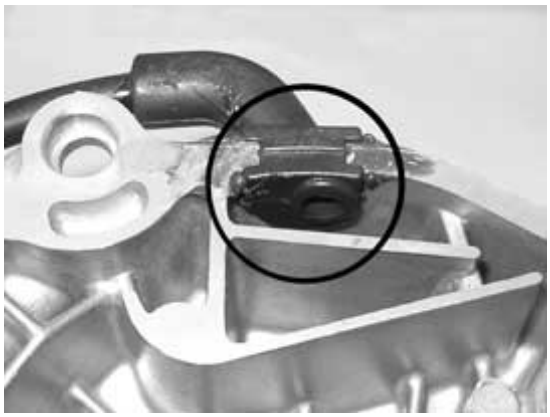
- Refit the Seeger ring with the opening facing the bearing and fit a new oil seal flush with the crankcase from the pulley side.

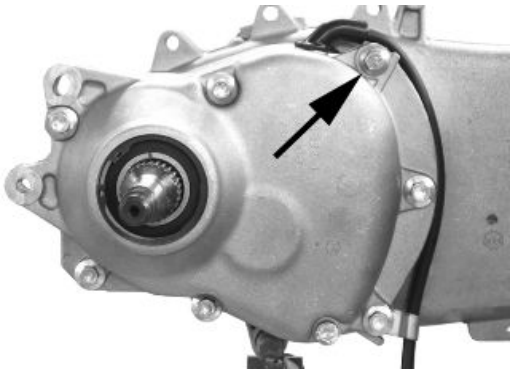
Refitting the hub bearings

- Install the three shafts in the engine crankcase as shown in the figure.

Refitting the ub cover

- Fit a new gasket together with the alignment dowels.
- Seal the gasket of the breather pipe using black silicone sealant.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.
- Position the shorter screw that can also be recognised from the different colour as shown in the figure.
- Fix the breather tube support by means of the lower screw.
- Fit the remaining screws and tighten the seven screws to the prescribed torque.

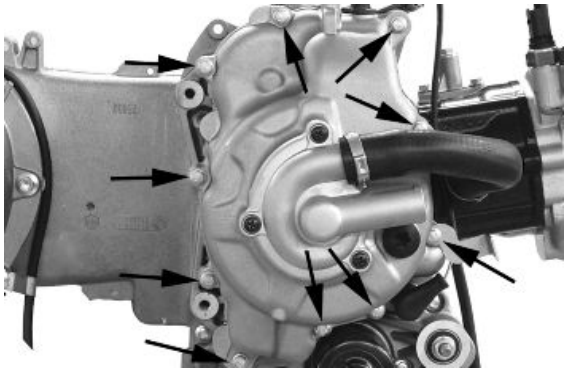




Flywheel cover

Removing the hub cover

- Remove the clip fixing the sleeve to the cylinder.
- Remove the 10 clamps
- Remove the flywheel cover.



Removing the stator

- Remove the two pick-up screws and the screw holding the wiring support and the three stator clamping screws shown in the figure.
- Remove the stator and its wiring.

Refitting the stator

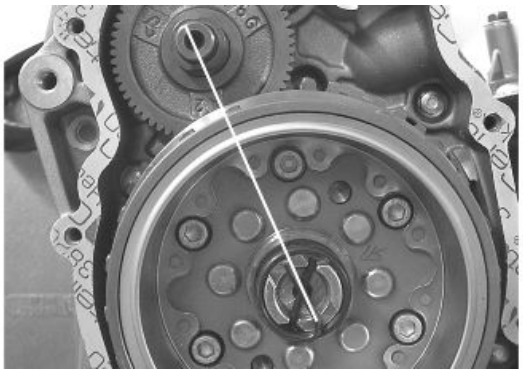
- Refit the stator and flywheel carrying out the removal procedure in reverse, tightening the retainers to the specified torque.

Locking torques (N*m)

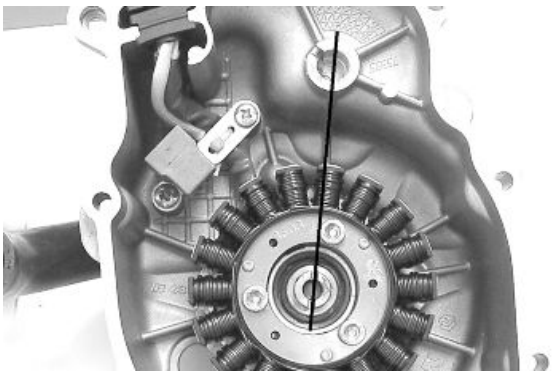
Stator assembly screws (°) 3 - 4

Refitting the flywheel cover

- Position the spline clip on the crankshaft and orient the end as shown in the figure.



- Orient the water pump shaft with reference to the transmission gear seat as shown in the picture.



- Refit the cover over the engine and tighten the screws to the prescribed torque.
- Carry out the removal steps but in the reverse order.

CAUTION

TAKE CARE TO CORRECTLY POSITION THE FLYWHEEL CONNECTOR. MAKE SURE THE CENTRING DOWELS ARE PRESENT.

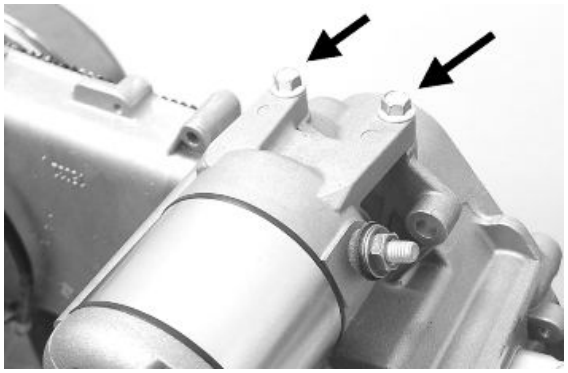
Locking torques (N*m)

Flywheel cover screws 11 - 13

Flywheel and starting

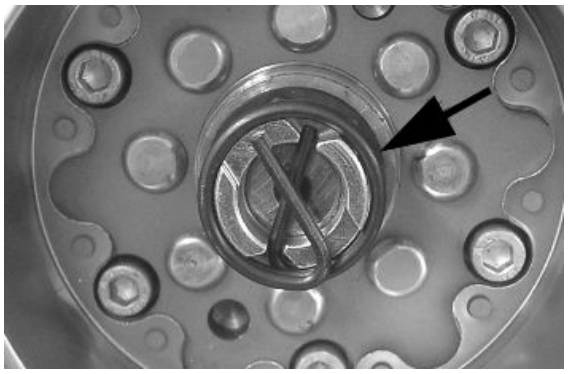
Removing the starter motor

- Remove the two screws indicated in the figure
- Take the starter motor out of its seat

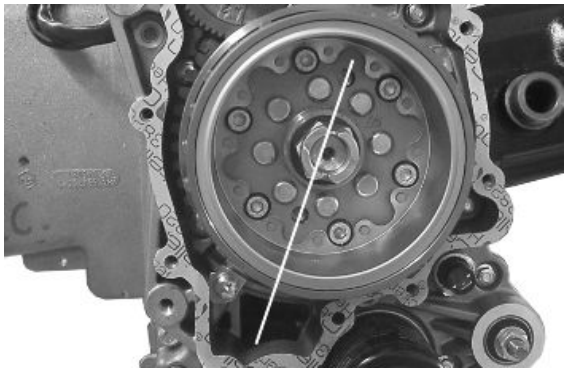


Removing the flywheel magneto

- Remove the water pump shaft and crankshaft spline clip



- Line up the two holes in the flywheel as shown in the picture



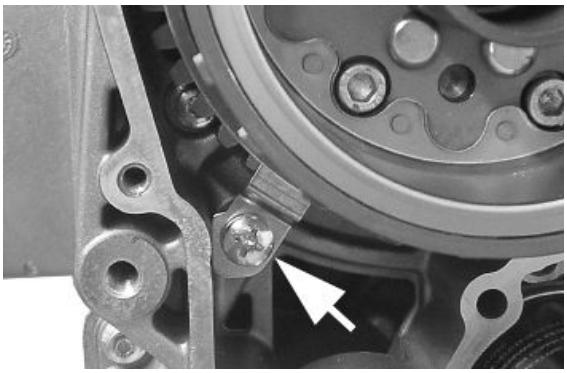
- Screw in the guide bushing that is part of the special flywheel stop tool on the flywheel as shown in the picture

- Insert the special flywheel stop tool on the flywheel as shown in the picture

Specific tooling

020627Y Flywheel lock wrench

Remove the plate indicated in the picture.



- Remove the flywheel nut with its washer
- Do up the flywheel nut by three or four threads so that the flywheel does not fall accidentally on extraction
- Screw the extractor onto the flywheel and extract it as shown in the picture

Specific tooling

020467Y Flywheel extractor

Inspecting the flywheel components

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

Refitting the free wheel

- Make sure the freewheel faying surfaces are in good condition.
- Thoroughly clean the free wheel to remove LOCTITE residue.
- Degrease the threading of the holes in the free wheel and the clamping screws.
- Apply the recommended product to the end of the screws.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

- Fit the freewheel on the magneto flywheel making sure that the ground side is in contact with the flywheel itself, i.e. with wheel Seeger ring visible.
- Lock the six clamping screws in criss-cross fashion to the prescribed torque.

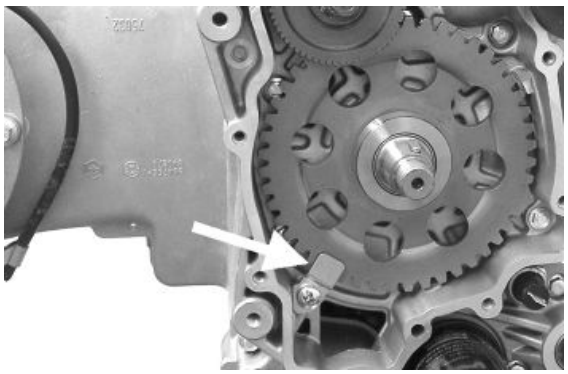
Locking torques (N*m)

Screws fixing freewheel to flywheel **13 to 15**

- Oil the free wheel "rollers".

Refitting the flywheel magneto

- Remove the freewheel retaining plate indicated in the picture
- Remove the transmission gear and the freewheel



- Insert the free wheel on the flywheel as shown in the picture
- Then refit the flywheel with free wheel and transmission gear

- Using the special flywheel lock wrench, tighten up the flywheel fixing nut to the prescribed torque
- Refit the retention plate

Specific tooling

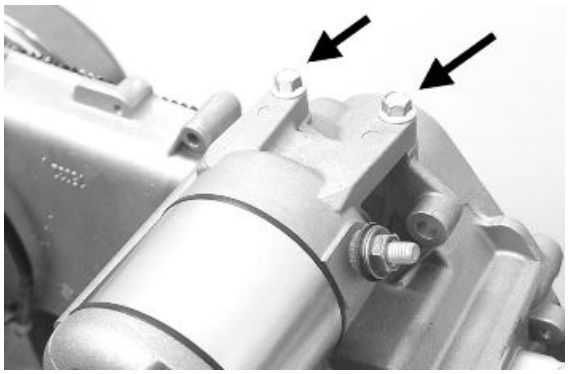
020627Y Flywheel lock wrench

Locking torques (N*m)

Flywheel nut **94 - 102**

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 2 screws to the specified torque.



Locking torques (N*m)

Starter screws **11 - 13**

Cylinder assy. and timing system

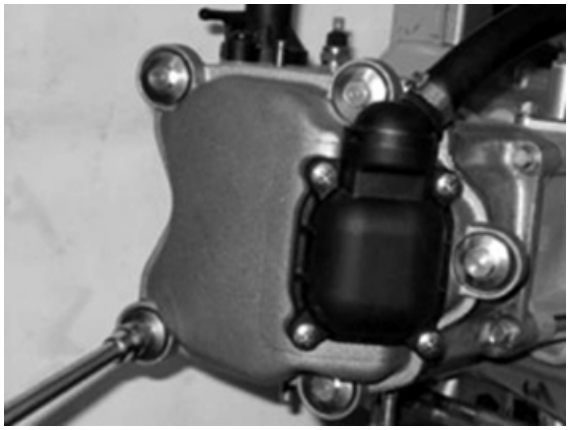
Removing the intake manifold

Loosen the 3 screws and remove the air intake manifold.

- Upon refitting, secure to the specified torque.

Removing the rocker-arms cover

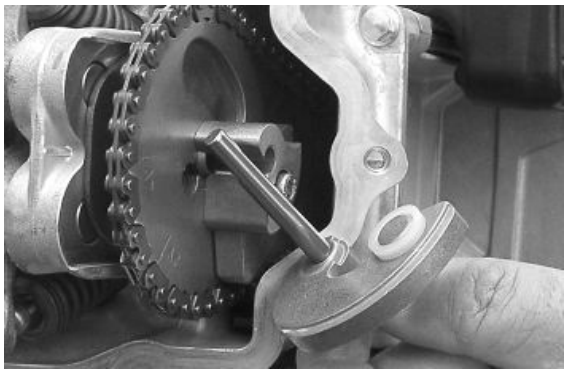
- Remove the 5 screws indicated in the figure



Removing the timing system drive

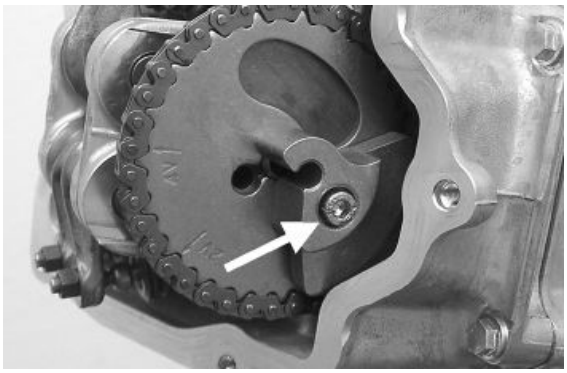
- First remove the parts listed below: transmission cover, drive pulley with belt, oil sump with spring and by-pass piston, oil pump pulley cover, O-ring on the crankshaft and the sprocket wheel separation washer.
- Remove the tappet cover.
- Remove the central screw fastener and the automatic valve lifter retaining cover, as shown in the figure.

- Remove the return spring of the automatic valve lifter unit and the automatic valve lifter unit and its end of stroke washer.



- Loosen the central screw on the tensioner first.
- Remove the two fixings shown in the figure.
- Remove the tensioner with its gasket.

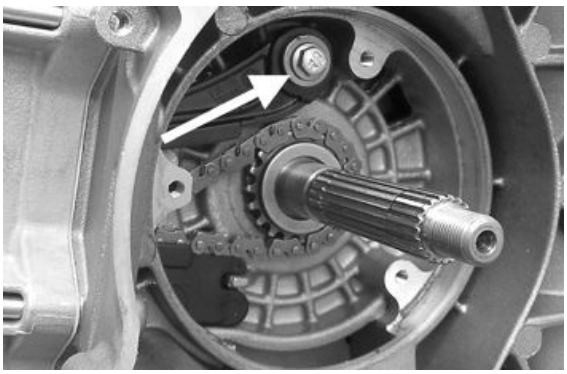
- Remove the internal hex screw and the counter-weight shown in the figure.



- Remove the camshaft control pulley with its washer.

- Remove the control sprocket wheel and the timing chain.
- Remove the screws indicated in the figure, the spacer bar and the tensioner slider.

The tensioner pad must be removed from the transmission side. As regards the lower chain guide slider, it may only be removed after the head has been removed.



N.B.

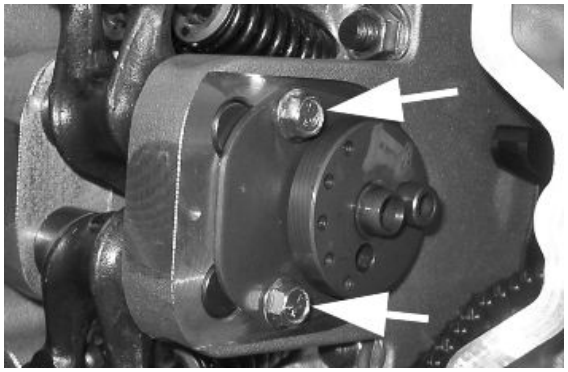
IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

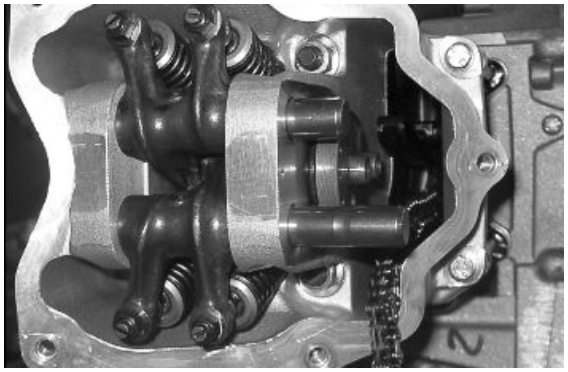
Removing the cam shaft

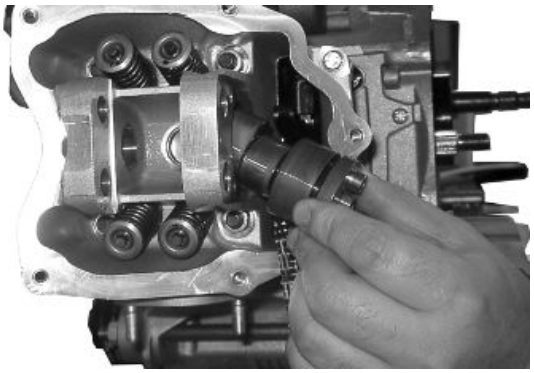
- Remove the 2 screws and the camshaft retainer shown in the diagram.
- Remove the camshaft.
- Remove the pins and the rocking levers from the flywheel side holes.

N.B.

IF NEEDED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKER PINS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE CRANKSHAFT CHAIN TENSIONER.





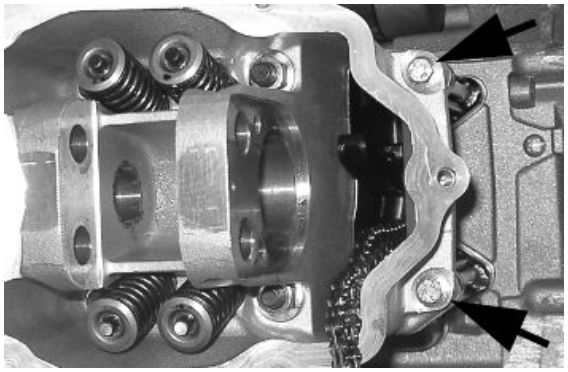


Removing the cylinder head

- Remove the spark plug.
- Remove the 2 side fixings shown in the figure.
- Loosen the 4 head-cylinder fastening nuts in two or three stages and in criss-cross fashion.
- Remove the head, the two alignment dowels and the gasket.

N.B.

IF NEEDED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKER PINS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE CRANKSHAFT CHAIN TENSIONER.



Removing the valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.
- Remove the oil guards with the appropriate tool.
- Remove the lower spring supports.

CAUTION

REPLACE THE VALVES IN SUCH A WAY AS TO RECOGNISE THEIR ORIGINAL POSITION ON THE HEAD.

Specific tooling

020382Y011 adaptor for valve removing tool

020382Y Tool for removing valve cotters fitted with part 012

020431Y Valve oil seal extractor

Removing the cylinder - piston assy.

Removing cylinder and piston

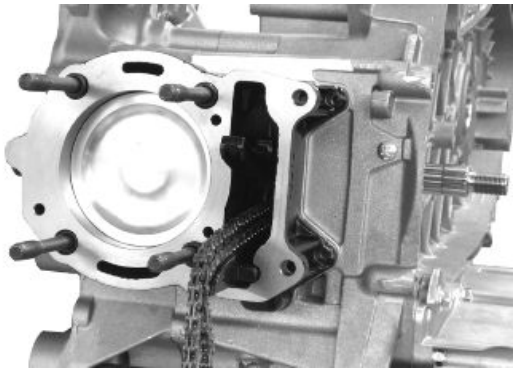
- Remove the chain guide slider.
- Remove the 4 O-rings on the stud bolts.
- Pull out the cylinder.
- Remove the cylinder base gasket.
- Remove the two stop rings, the wrist pin and the piston.
- Remove the piston seals.

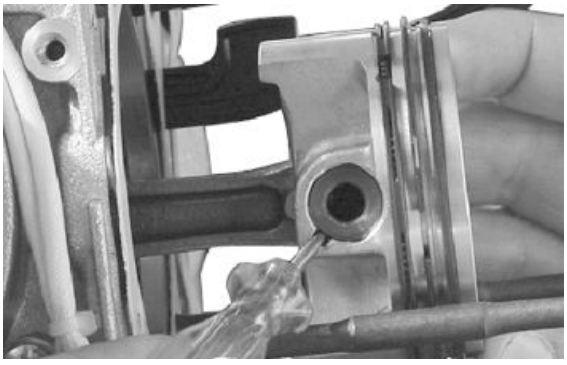
CAUTION

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

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 cylinder

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

- Install piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.
- Fit the wrist pin retainer ring onto the appropriate tool
- With opening in the position indicated on the tool
S = left
D= right

- Place the wrist pin retainer ring into position using a punch
- Fit the wrist pin snap ring using the plug as shown in the figure

N.B.

THE TOOL FOR INSTALLING THE RETAINER RINGS MUST BE USED MANUALLY.

CAUTION

USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

Specific tooling

020454Y Pin lock fitting tool

Choosing the gasket

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

Specific tooling

020428Y Support to check piston position

- With a contrasting surface, reset the dial gauge with a preloading of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Fit the tool on the cylinder without changing the dial gauge position.
- Lock the tool with the original head fixing nuts.
- Rotate the crankshaft up to TDC (the reversal 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.

N.B.

IF DEVIATIONS (OR RECESSES OR PROJECTIONS) CLOSE TO THE CHANGE OF CATEGORY ARE MEASURED, REPEAT THE MEASUREMENT AT THE OPPOSED SIDE. TO DO SO, REPEAT THE TOOL INSTALLATION BY INVERTING ITS POSITION.

See also

Slot packing system

Refitting the piston rings

- Place the scraper ring spring on the piston.
- Install the scraper ring keeping the opening opposed to the spring junction and with the writing "top" facing the piston crown. The chamfered side of the oil scraper ring should always be facing the piston crown.
- Fit the second lining with the identification letter or the writing "top" facing the piston crown. In any case, the step must be facing opposite the piston crown.
- Install the first compression lining in the direction imposed by the housing.
- It is advisable to use a fitter to facilitate the installation of the linings.

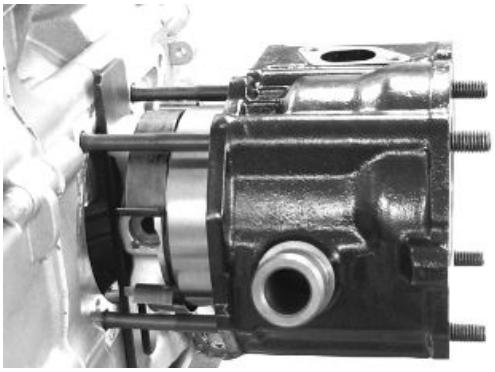
N.B.

THE TWO PISTON RINGS ARE MADE WITH A TAPERED CYLINDRICAL CONTACT CROSS-SECTION. THIS IS TO ACHIEVE A BETTER BEDDING.

- Misalign the lining openings at 120° as shown in the figure.
- Lubricate the components with engine oil.
- The engine uses the first compression lining with an L section.

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

020393Y Piston fitting ring

Inspecting the cylinder head

N.B.

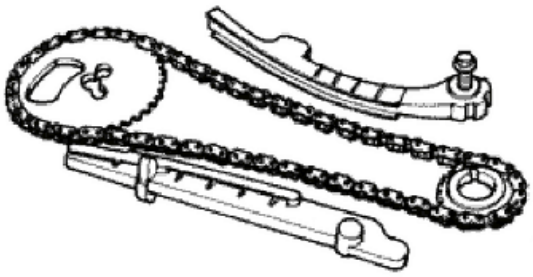
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

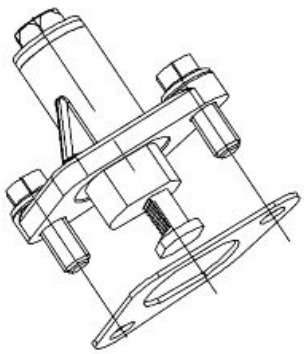
Cylinder Head

Inspecting the timing system components

- Check that the guide slider and the tensioner pad are not excessively worn.
- 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 signs of wear are found, replace the whole assembly.



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.

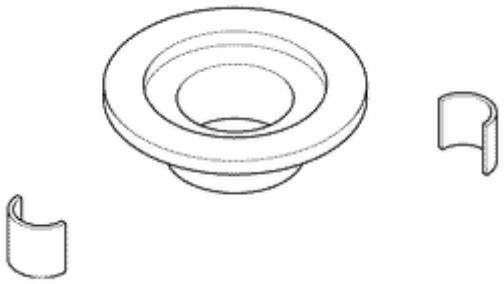
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Cylinder Head

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.



- Measure the unloaded spring length.

N.B.

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

See also

Cylinder Head

Refitting the valves

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

N.B.

DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON THE COTTERS SIDE (TURNS WITH GREATER PITCH).

Specific tooling

020306Y Punch for fitting the valve seal rings

020382Y Tool for removing valve cotters fitted with part 012

020382Y011 adaptor for valve removing tool

Inspecting the cam shaft

N.B.

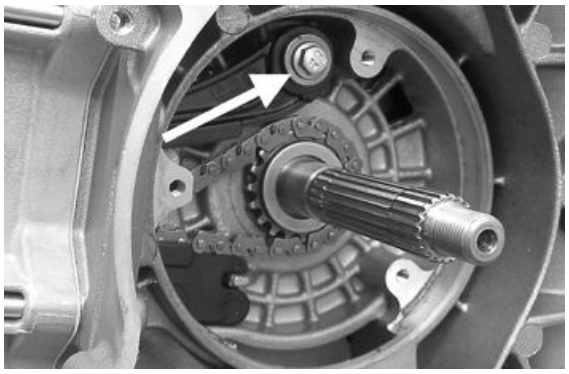
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

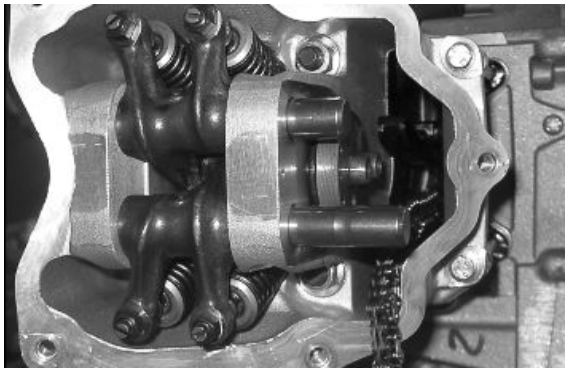
See also

Cylinder Head

Refitting the head and timing system components

- Refit the lower timing chain sprocket wheel on the crankshaft, with the chamfer facing the insertion side.
- Loop the timing chain around the sprocket on the crankshaft.
- Fit the chain tensioner slider from the cylinder head side.
- Fit the spacer and the screw fastener.
- Tighten the screws to the prescribed torque.
- Fit the pins and rocking levers.
- Lubricate the two rocking levers through the holes at the top.
- Lubricate the 2 bearings and insert the camshaft in the cylinder head with the cams corresponding to the rocking levers.
- Insert the retention plate and tighten the two screws shown in the figure to the prescribed torque.
- Refit the spacer on the camshaft.



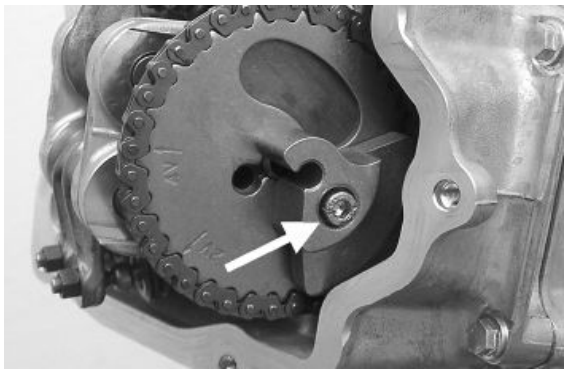


- Rotate the engine so that the piston is at top dead centre, using the reference marks on the flywheel and the crankcase.
- Holding this position insert the chain on the camshaft control pulley.
- Insert the pulley on the camshaft while keeping the reference **4V** in correspondence with the reference mark on the head.
- Fit the counterweight and tighten the clamping screw to the prescribed torque.
-Fit the end-stop ring on the automatic valve-lifter cam and fit the automatic valve-lifter cam to the camshaft.
- Fit the automatic valve lifter return spring.
- During this operation the spring must be loaded by approximately 180°.
- Fit the automatic valve-lifter retaining dish, using the counterweight screw fastener as a reference.
- Tighten the clamping screw to the prescribed torque.
- Set the tensioner cursor in the rest position.
- Fit the chain tensioner on the cylinder, using a new gasket, and tight the two screws to the specified torque.
- Insert the chain tensioning screw, together with the spring and washer, tightening it to the specified torque.
- Adjust the valve clearance.
- Fit the spark plug.

Electrode distance 0.8 mm

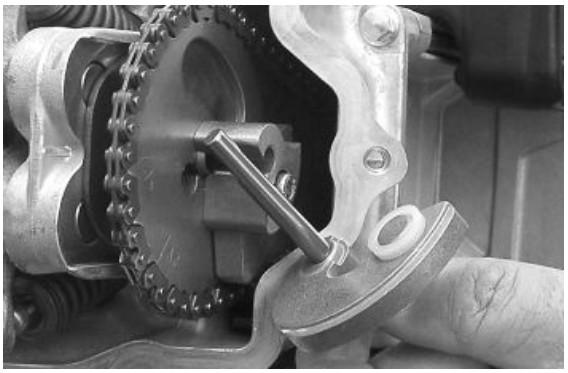
N.B.

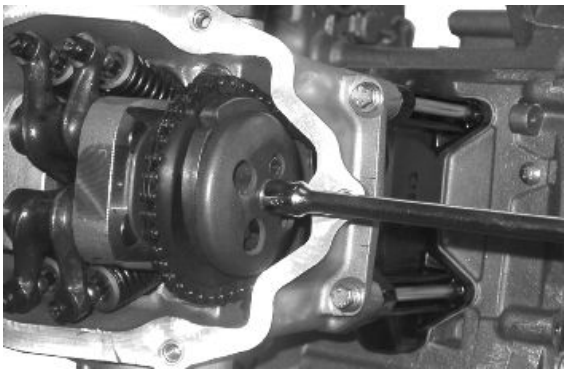
GREASE THE END STOP RING TO PREVENT IT COMING OUT AND FALLING INTO THE ENGINE.



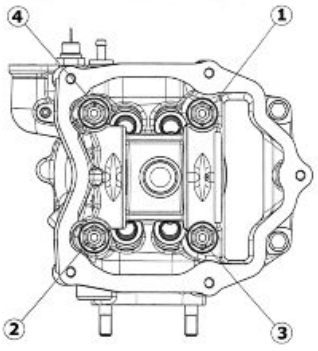
Locking torques (N*m)

Timing chain tensioner support screw 11 - 13
Spark plug 12 - 14 **Starter ground screw** 7 - 8.5
Timing chain tensioner slider screw 10 to 14
Starter ground bell screw 11 to 15 **Timing chain tensioner central screw** 5 - 6 **Camshaft retention plate screw** 4 - 6





- Fit the timing chain guide slider.
- Insert the centring dowel between the cylinder head to the cylinder, fit the cylinder head gasket and the cylinder head.
- Lubricate the stud bolt threading.
- Tighten up the nuts to an initial pre-torque of 7±1 N·m
- Tighten up the nuts to a second pre-torque of 10 ±1 N·m
- Rotate by an angle of 270°
- To carry out the operations described above, follow the tightening sequence in the figure.



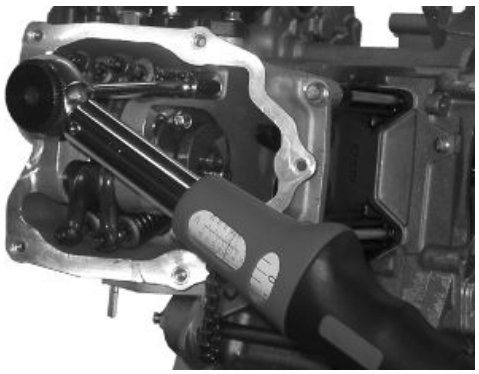
- Fit the two screws on the outside of the timing chain side and tighten them to the specified torque.

N.B.

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

Locking torques (N*m)

Timing chain tensioner support screw **11 - 13**

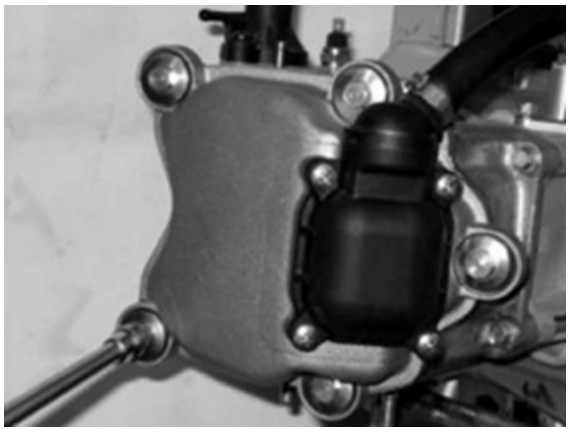


Refitting the rocker-arms cover

- Refit the cylinder head cover and tighten the 5 clamping screws to the specified torque.
- Make sure the gasket is positioned properly.

Locking torques (N*m)

Tappet cover screws **6 - 7 Nm**



Refitting the intake manifold

- Fit the intake manifold and do up the three screws.

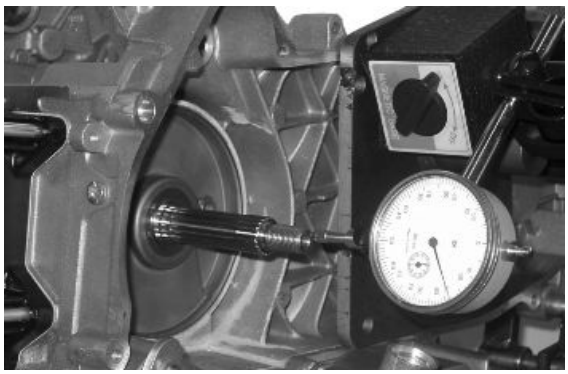
Locking torques (N*m)

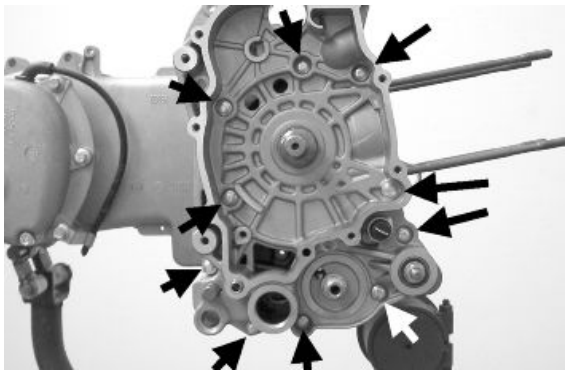
Inlet manifold screws **11 - 13**

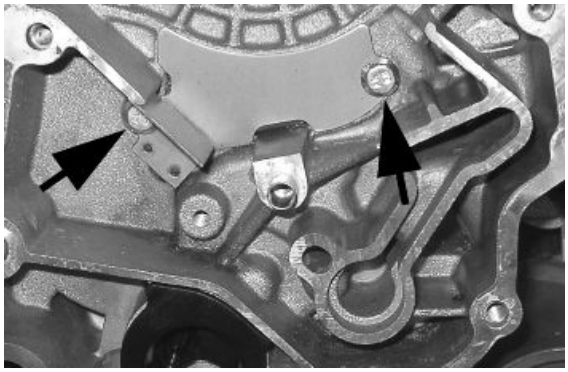
Crankcase - crankshaft

Splitting the crankcase halves

- Before opening the crankcase, it is advisable to check the axial clearance of the crankshaft. To do this, use a plate and a support with appropriate tool dial gauge.
- Upper clearances are an indication of wear on the surfaces of the crankshaft casing support.
- Remove the 10 crankshaft coupling screws.
- Separate the crankcase while keeping the crankshaft in one of the two halves of the crankcase.
- Remove the crankshaft.
- Remove the half crankcase coupling gasket.
- Remove the two screws and the internal cover shown in the diagram.
- Remove the oil guard on the flywheel side.
- Remove the oil filter fitting shown in the diagram.
- Check the axial clearance on the connecting rod.
- Check the radial clearance on the connecting rod.
-Check the surfaces that limit the axial free-play are not scored and measure the width of the crankshaft between these surfaces, as shown in the diagram.
- If the axial clearance between crankshaft and crankcase is exceeding and the crankshaft does not have any defect, the problem must be due to either excessive wear or wrong machining on the crankcase.
- Check the diameters of both the bearings of the crankshaft in accordance with the axes and surfaces shown in the figure. The half-shafts are classified in two categories Cat. 1 and Cat. 2 as shown the chart below.







CAUTION

THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH IS WITHIN THE STANDARD VALUES AND THE SURFACES SHOW NO SIGNS OF SCORING.

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.

N.B.

WHEN MEASURING THE WIDTH OF THE CRANKSHAFT, MAKE SURE THAT THE MEASUREMENTS ARE NOT MODIFIED BY THE RADII OF FITTINGS WITH THE CRANKSHAFT BEARINGS.

N.B.

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

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankshaft alignment

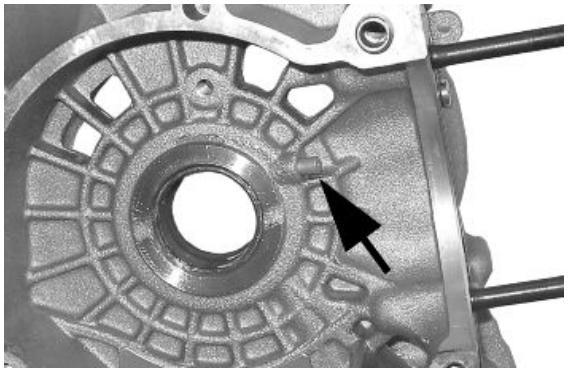
N.B.

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

See also

Crankcase - crankshaft - connecting rod

Inspecting the crankcase halves



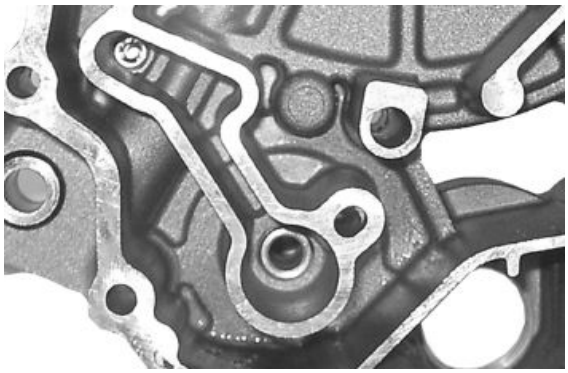
- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- On the transmission-side crankcase half, take particular care when handling the oil pump compartment and the oil ducts, the by-pass duct, the main bushings and the cooling jet on the transmission side (see diagram).
- 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

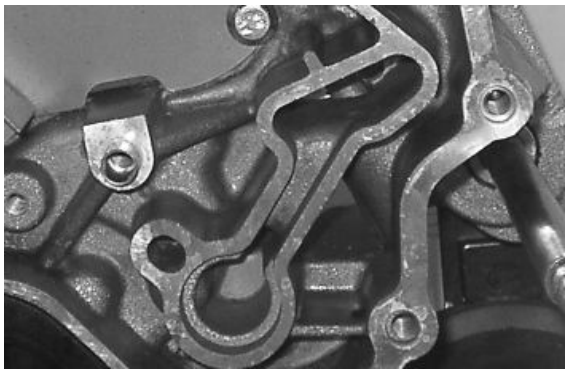
cylinder head and the oil drainage duct at the flywheel side oil seal.

- 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 and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.

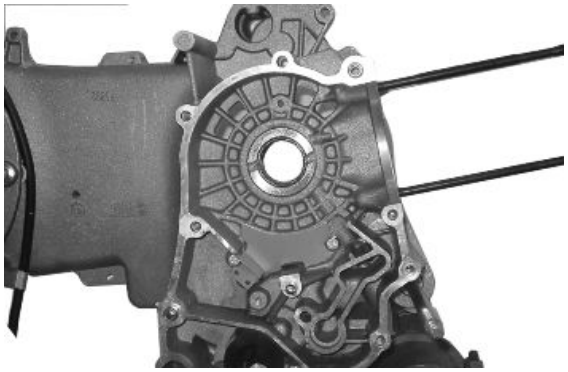
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.

Characteristic

Lubrication pressure

3.5 to 4 bar

- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposed 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 figure.
- 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.

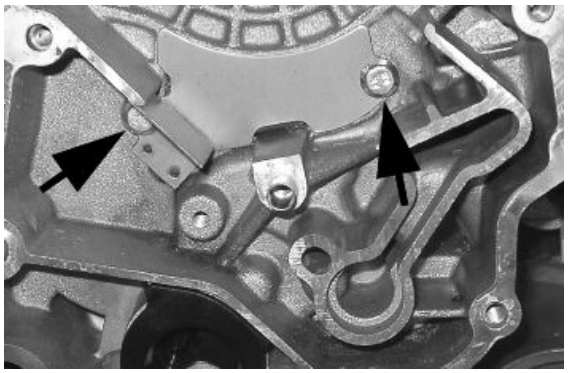
TO MEASURE WEAR LIMITS AND COUPLING CLEARANCES, SEE THE SPECIFICATIONS CHAPTER.

See also

Crankcase - crankshaft - connecting rod

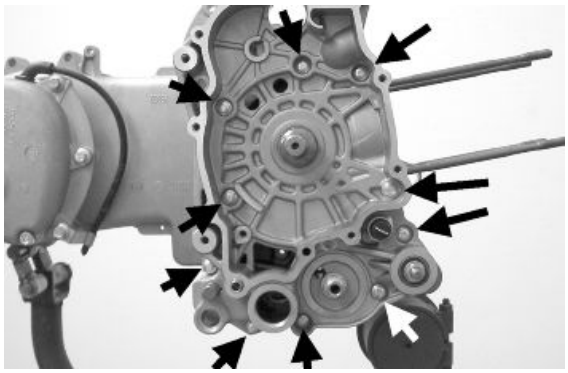
Refitting the crankcase halves

- Fit the internal shield by locking the two screws to the prescribed torque.
- Fit the oil filter fitting and tighten it to the prescribed torque.
- Position the oil pre-filter element as shown in the picture.
- Place a new gasket on one of the crankcase halves, preferably on the transmission side, together with the alignment dowels.
- Lubricate the main bushings and insert the crankshaft in the transmission side crankcase half.
- Reassemble both crankcase halves.
- Fit the 10 screws and tighten them to the specified torque.
- Fit a new O-ring on the pre-filter and lubricate it.
- Insert the filter on the engine with the relative cap. Tighten to the prescribed torque.



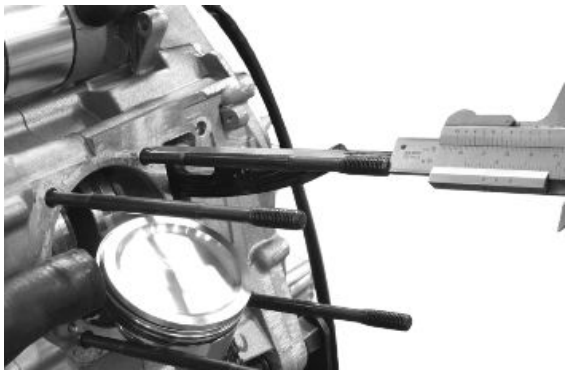
Locking torques (N*m)

Internal engine crankcase bulkhead (transmission-side half shaft) screws 4 - 6 Engine crankcase coupling screws 11 - 13 Oil filter on crankcase fitting 27 - 33 Engine oil drainage plug/ mesh filter 24 to 30



Studs

Check that the stud bolts have not worked loose from their seat in the crankcase.
Check the depth of stud bolt driving with a gauge, as indicated in the picture. If it varies significantly from the driving depth indicated, it means that the stud bolt has yielded.
In this case, replace it.



By working on two fitted cylinder head fixing nuts, nut and lock nut, as shown in the picture, remove the stud bolt from its seat.

Clean the threaded seat on the carter thoroughly.

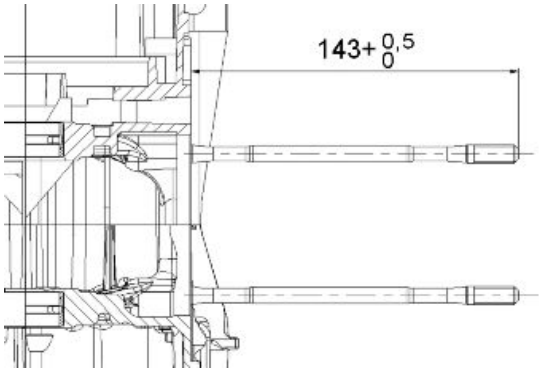
Refit a new stud bolt and apply the special product on the threading crankcase side.

Tighten up to the depth of the driving indicated.

Recommended products

Loctite Quick Set Loctite 270 high strength threadlock

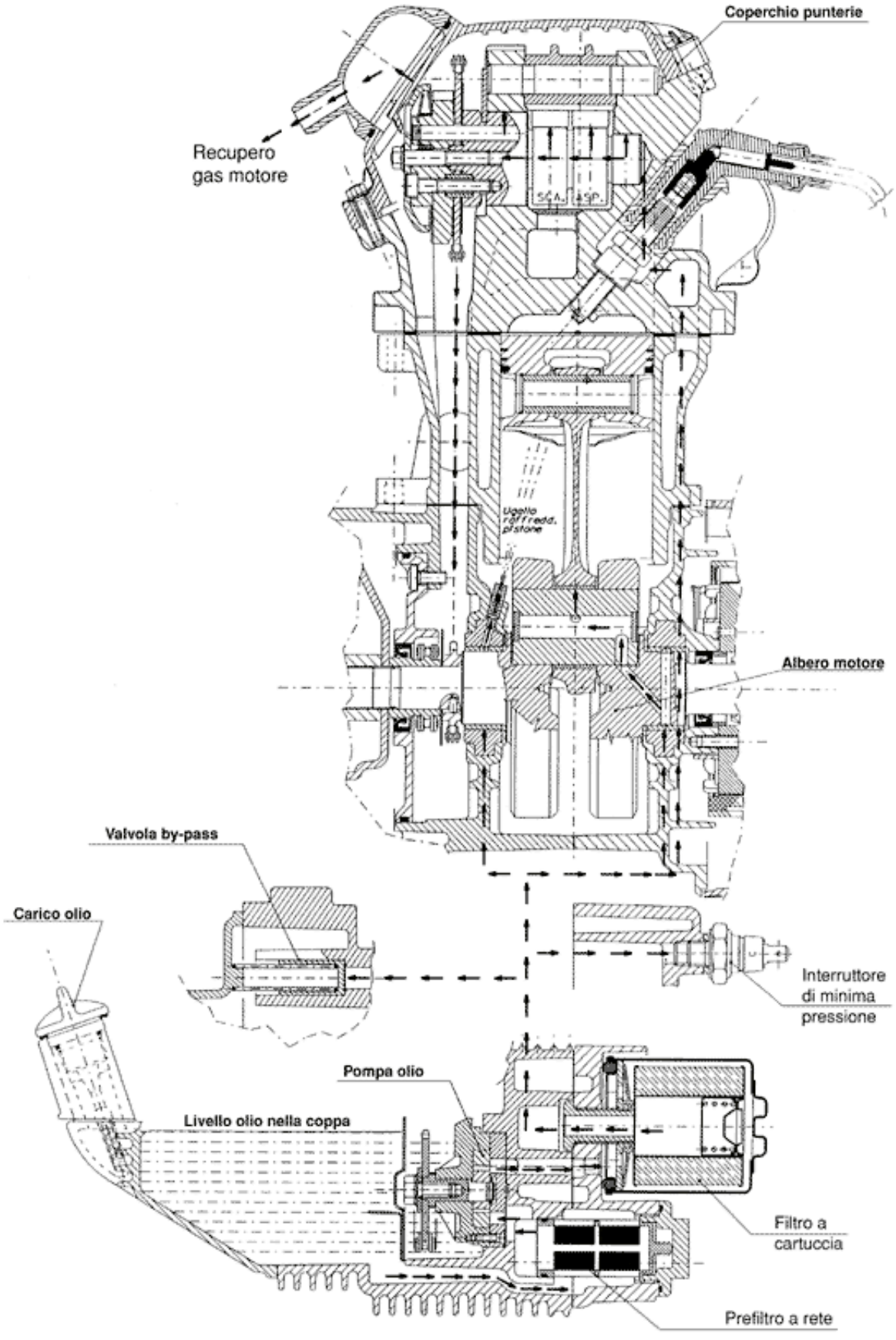
Loctite 270 high strength threadlock



Lubrication

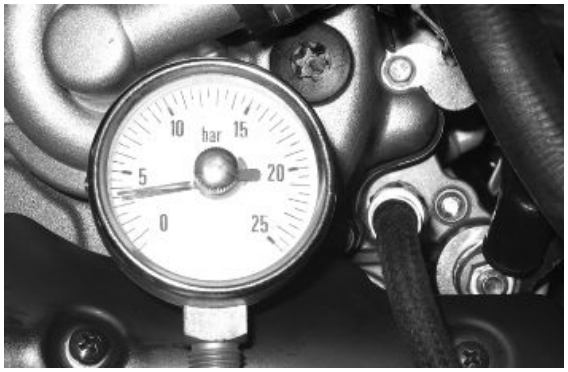
Conceptual diagrams

LUBRICATION CIRCUIT


Coperchio punterie
Recupero gas motore
Albero motore
Valvola by-pass
Carico olio
Interruttore di minima pressione
Pompa olio
Livello olio nella coppa
Filtro a cartuccia
Prefiltro a rete

Oil pressure check

- Remove the electrical minimum oil pressure switch connection and remove the switch.
- Check that the oil pressure reading is between 0.5 and 1.2 atm with the engine idling at 1650 rpm and the oil at the required temperature (wait for at least one electric ventilation).
- Check that the oil pressure is between 3.2 and 4.2 atm with the engine running at 6000 rpm and the oil at the required temperature.
- 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

Minimum pressure admitted at 6,000 rpm: 3.2 atm.

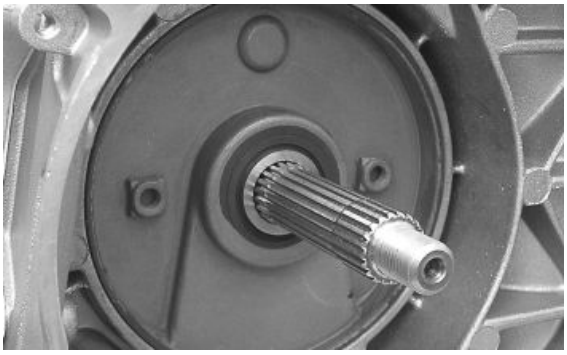
Locking torques (N*m)

Minimum oil pressure sensor **12 - 14**

Crankshaft oil seals

Removal

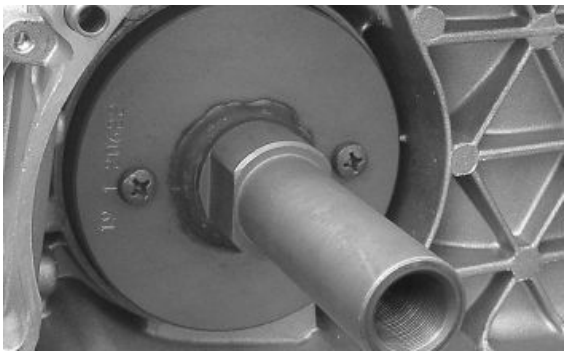
- Remove the transmission cover and the complete drive pulley beforehand



- Install the base of the appropriate tool on the oil seal using the screws provided.

Specific tooling

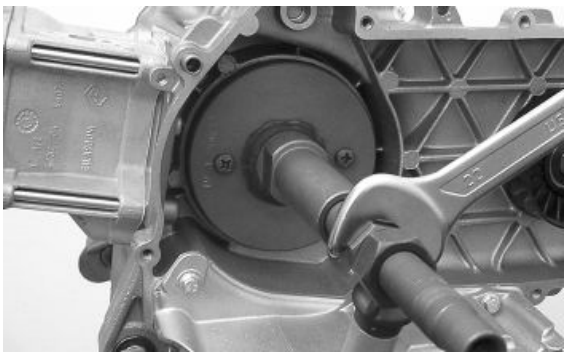
020622Y Transmission-side oil seal punch



- Screw the threaded bar onto the base of the tool and extract the oil seal.

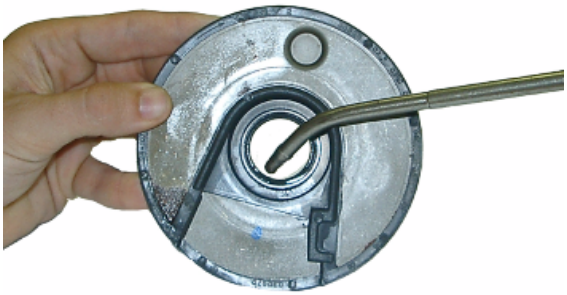
Specific tooling

020622Y Transmission-side oil seal punch



Refitting

- Always use a new oil seal upon refitting
- Prepare the new oil guard by lubricating the sealing lip.
- Preassemble the oil seal with the appropriate tool by positioning the screws.
- Insert the sheath over the crankshaft.
- Insert the tool with the oil seal on the crankshaft until it comes into contact with the crankcase.
- Insert the adaptor bushing of the tool in the hole on the crankcase.



- Orientate the oil seal by inserting the bracket which is part of the appropriate tool.
- Tighten the threaded bar onto the crankshaft as far as it will go.
- Use the nut to move the base of the tool until you can see the end of the oil seal driving stroke
- Remove all the tool components following the procedure but in reverse order

CAUTION

DO NOT LUBRICATE THE KEYING SURFACE ONTO THE ENGINE CRANKCASE.

CAUTION

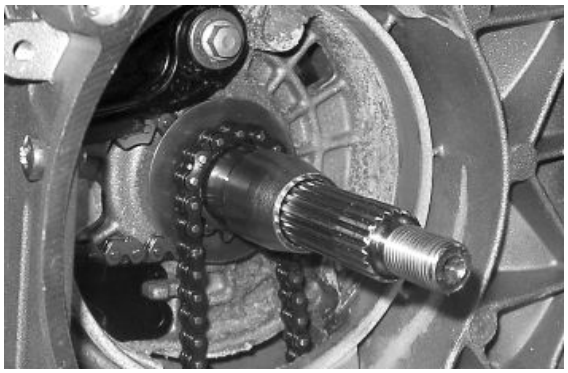
ORIENT THE OIL SEAL BY POSITIONING THE CHAIN HOUSING CHANNEL FACING DOWNWARDS. WHEN THE POSITION IS REACHED, DO NOT RETRACT THE OIL SEAL. FAILURE TO COMPLY WITH THIS RULE CAN CAUSE A WRONG POSITIONING OF THE OIL SEAL SHEATH.

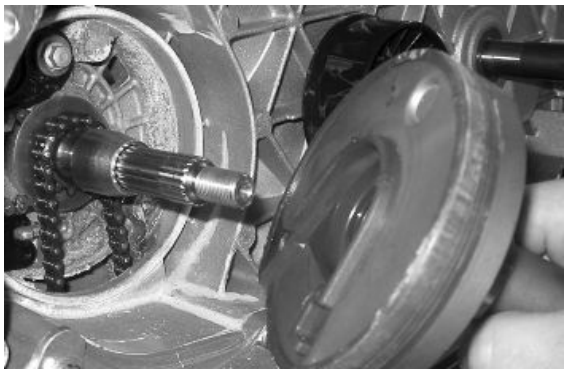
CAUTION

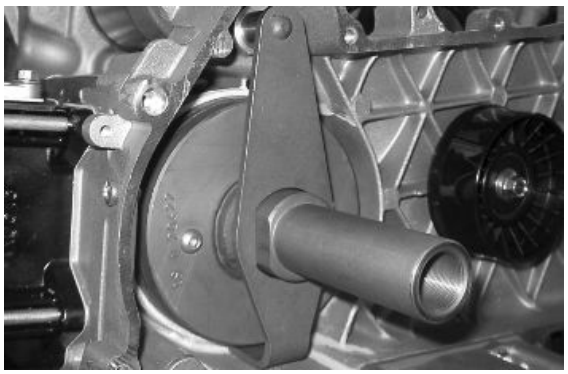
FAILURE TO COMPLY WITH THIS ASSEMBLY PROCEDURE CAN SERIOUSLY DAMAGE THE ENGINE DUE TO THE WRONG TENSIONING OF THE OIL PUMP CONTROL CHAIN.

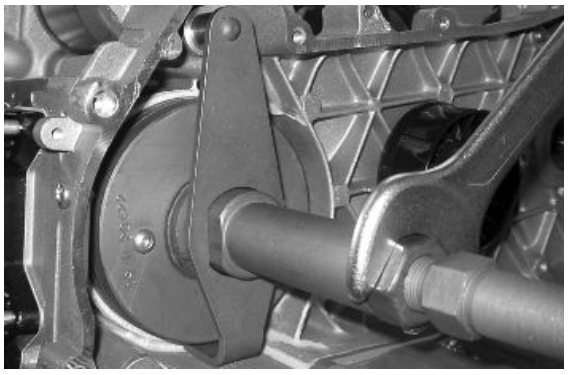
Specific tooling

020622Y Transmission-side oil seal punch





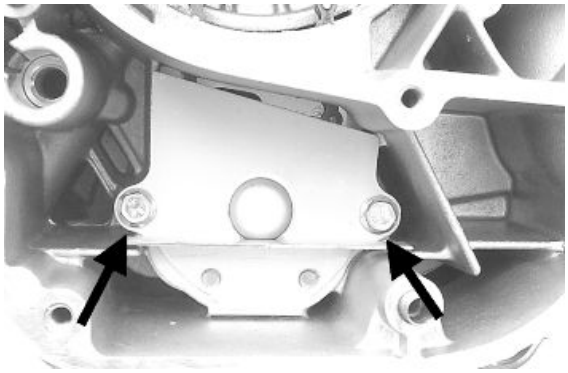




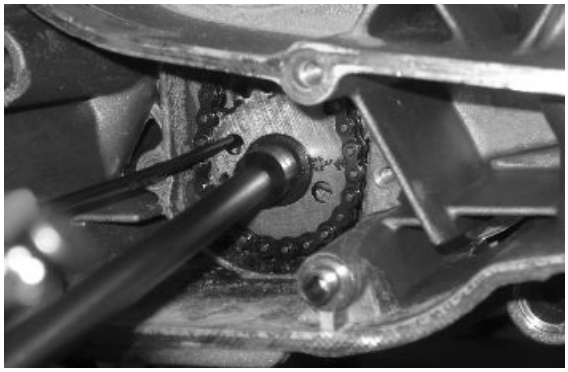
Oil pump

Removal

- Undo the two clamping screws in the figure and remove the cover over the pump control sprocket.



- Block the rotation of the oil pump control pulley with a screwdriver inserted through one of its two holes.
- Remove the central screw with cup washer, as shown in the diagram.
- Remove the chain with the sprocket.
- Remove the control sprocket wheel with relative O-ring.
- Remove the oil pump by undoing the two screws in the figure.
- Remove the oil pump seal.

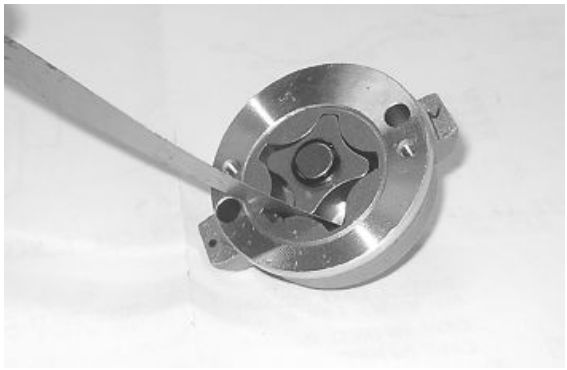


N.B.

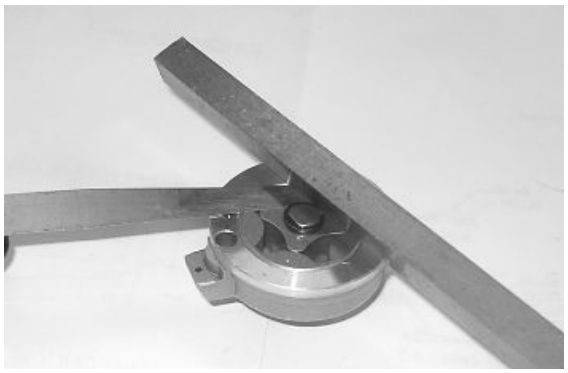
IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

Inspection

- Remove the two screws and the oil pump cover.
- Remove the circlip retaining the innermost rotor.
- Remove and wash the rotors thoroughly with petrol and compressed air.
- Reassemble the rotors in the pump body, keeping the two reference marks visible. Replace the retainer ring.



- Check the clearance between the rotors in the position shown in the diagram using a feeler gauge.
Measure the distance between the outer rotor and the 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

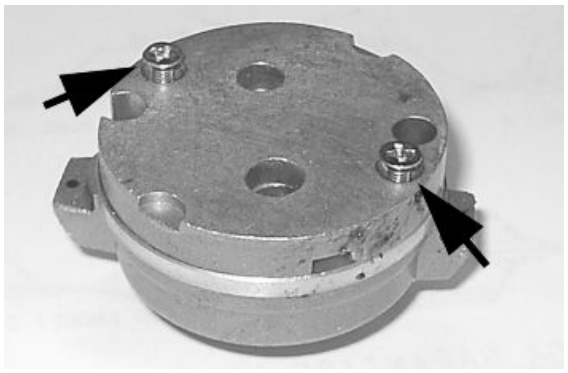
Admissible limit clearance: 0.20 mm

Distance between the rotors

Admissible limit clearance: 0.12 mm

Refitting

- Check there are no signs of wear on the oil pump shaft or body.
- Check there are no signs of scoring or wear on the oil pump cover.
- If you detect non-conforming measurements or scoring, replace the faulty parts or the unit.
- Fit the pump cover in the position that permits the crankcase clamping screws to be aligned.
- Make sure the gasket is positioned properly and refit the pump on the engine crankcase. The pump can only be fitted in one position. - Tighten the screws to the prescribed torque.



- Fit the sprocket wheel with a new O-ring.
- Fit the chain.
- Fit the central screw and the cup washer. Tighten to the prescribed torque.
-Fit the oil pump cover, by tightening the two screws to the prescribed torque.

N.B.

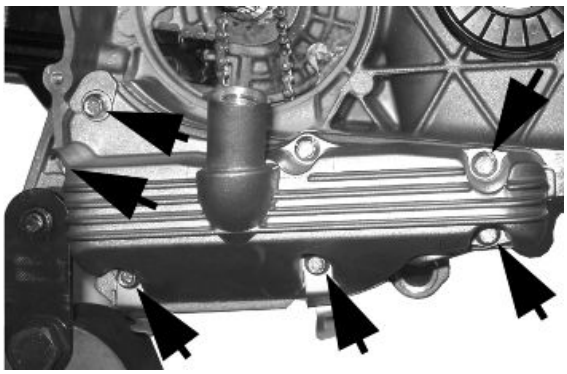
FIT THE BELLEVILLE WASHER SO THAT ITS OUTER RIM TOUCHES THE PULLEY. MAKE SURE THAT THE PUMP TURNS FREELY.

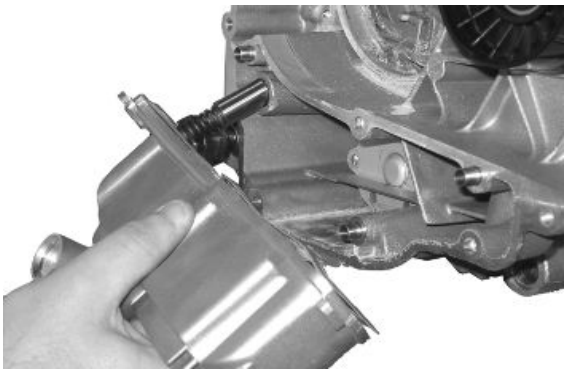
Locking torques (N*m)

Screws fixing oil pump to crankcase 5 - 6 Oil pump command sprocket screw 10 to 14 Oil pump cover screws 0.7 ÷ 0.9

Removing the oil sump

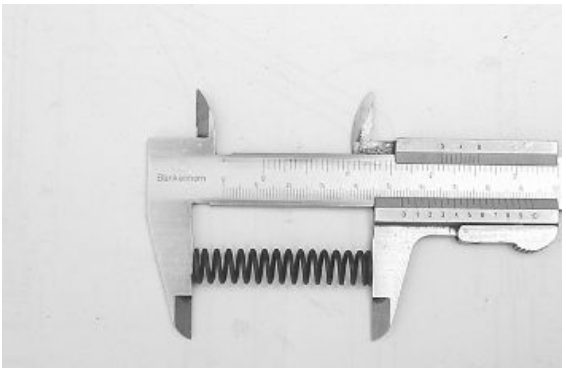
- Remove the oil filler plug, the transmission cover, the complete driving pulley assembly with belt and the sprocket wheel, as described in the "Transmission" chapter.
- Drain the oil as described above.
- Remove the 7 screws, shown in the diagram, and the 2 rear brake fluid pipe fixing brackets.
- Remove the screw, the by-pass piston, the gasket and the centring dowels shown in the figure.





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.



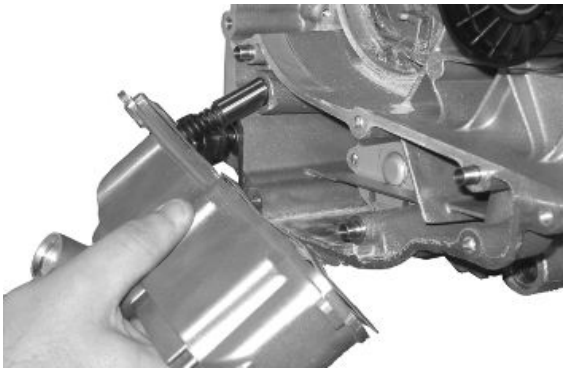
Characteristic

By-pass check up: Standard length

54.2 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 two centring dowels.
- Refit the sump, taking care to locate the spring in the appropriate recess machined into the inside of the sump.
- Refit the rear brake cable 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 chapter "Crankcase and Crankshaft", regarding lubrication of the crankshaft and connecting rod

Locking torques (N*m)

Oil sump screws **10 to 14**

INDEX OF TOPICS

MIU injection system

This vehicle is fitted with an integrated injection and ignition system.

Injection is indirect in the manifold through an electro-injector.

The injection and ignition are timed on the four-stroke cycle by means of a tone wheel keyed on to the crankshaft (24-2 teeth) and pick-up sensor.

Combustion and ignition are managed on the basis of engine revs and throttle valve opening. Further corrections are made according to the following parameters:

- Coolant temperature
- Intake air temperature
- Lambda probe

The system implements cold engine idle fuel/air mixture correction with a stepper motor on a by-pass circuit of the throttle valve. The control unit manages the Stepper motor and the injector opening time, thereby ensuring the idle steadiness and the proper combustion.

In all conditions of use, mixture preparation is managed by modifying the injector opening time.

The fuel system pressure is kept constant in relation to ambient pressure.

The **fuel supply circuit** consists of:

- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

Pump, filter and regulator are placed into the fuel tank using a single support.

The injector is connected by a pipe with fast-release fittings. The pressure regulator is located at the beginning of the circuit.

The fuel pump is controlled by the MIU control unit; therefore the vehicle's safety is enhanced.

The **ignition circuit** consists of:

- HV coil
- HV cable
- Shielded cap
- MIU control unit
- Spark plug

The MIU control unit manages the ignition with the best advance ensuring 4-stroke timing (ignition only in the compression stroke) at the same time.

The MIU injection-ignition system controls engine functions by means of a pre-set program.

Should any input signals fail, an acceptable working order of the engine is ensured to allow the user to reach a service station.

Obviously, this cannot happen when the rev counter signal is missing, or when the failure concerns the control circuits:

- Fuel pump

- HV coil
- Injector

The control unit is fitted with a self-diagnosis system connected to a warning light on the instrument panel.

Failures are detected and restored by the diagnostic tester.
In any case, when the fault is no longer present, data storage is automatically wiped clean after 16 cycles of use (cold starting, running at regular engine temperature, stop).
The diagnostic tester is also required for adjusting idle speed carburetion.

Specific tooling

020922Y Diagnosis Tool

The MIU injection-ignition system carries out checks on the rpm indicator and the electric fan for radiator cooling.
The MIU control unit has a decoder for the anti-theft immobilizer system.
The MIU control unit is connected to a diagnostic LED on the instrument panel, that also carries out the deterrent flashing functions.

The MIU control unit power supply is furthermore controlled by the emergency switch; to allow further safety of the vehicle.

Precautions

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 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 functional checks are performed, make sure that the battery voltage exceeds 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 MIU control unit 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. In order to not cause damage, disconnect and reconnect the connectors of the MIU system only after proven necessary. 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 MIU control unit.

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

Troubleshooting tips

1 A MIU failure is more likely to be due to the connections than to the components.

Before searching the MIU system for failures, check:

A: Power supply

a. Battery voltage

b. Blown fuse

c. Relays

d. Connectors

B: Chassis ground connection

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: Others

a. Incorrect distribution timing

b. Wrong idle mixture

c.Incorrect reset of the throttle valve position sensor

2 MIU system failure may be caused by loose connectors. Make sure that all connections are properly implemented.

Check the connectors as follows:

A check that the terminals are not bent.

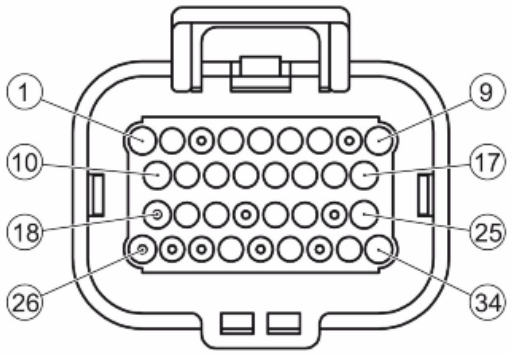
B check that the connectors have been properly connected.

C - Check whether the malfunction can be fixed by shaking the connector slightly.

3 Check the entire system before replacing the MIUIf the fault is fixed by replacing the MIU control unit, install the original control unit again and check if the fault occurs again.

4 Use a multimeter with an internal resistance of more than 10K Ohm /V when troubleshooting. Instruments that are not suitable might damage the MIU central control unit. The instruments to be preferred have a definition over 0.1V and 0.5 W and an accuracy over 2%.

Terminals setup



ELECTRONIC CONTROL UNIT CONNECTOR

1. H.V. COIL (Pink-Black)

2. Not connected

3. Not connected

4. Engine switch (Grey-Green)

5. Not connected

6. Live supply (Red-White)

7. Ground No. 1 (Black)

8. Not connected

9. Battery-powered (Grey-Black)

10. Start-up signal (Orange-Blue)

11. Lambda probe positive (Sky blue-Black)

12. Lambda probe negative (White-Green)

13. Water temperature sensor (Sky blue-Green)

14. Immobilizer aerial (Orange-White)

15. Not connected

16. K serial line (Purple-White)

17. Immobilizer (Red-Green)

18. Not connected

19. Side stand (Grey-Green)

20. Speed sensor negative (Brown)

21. Not connected

22. Injection load relay (Black-Purple)

23. Not connected

24. Consent to radiator electric fan (Blue-Yellow)

25. Injection warning light (Brown-Black)

26. Not connected

27. Not connected

28. Not connected

29. Engine speed sensor positive (Red)

30. Not connected

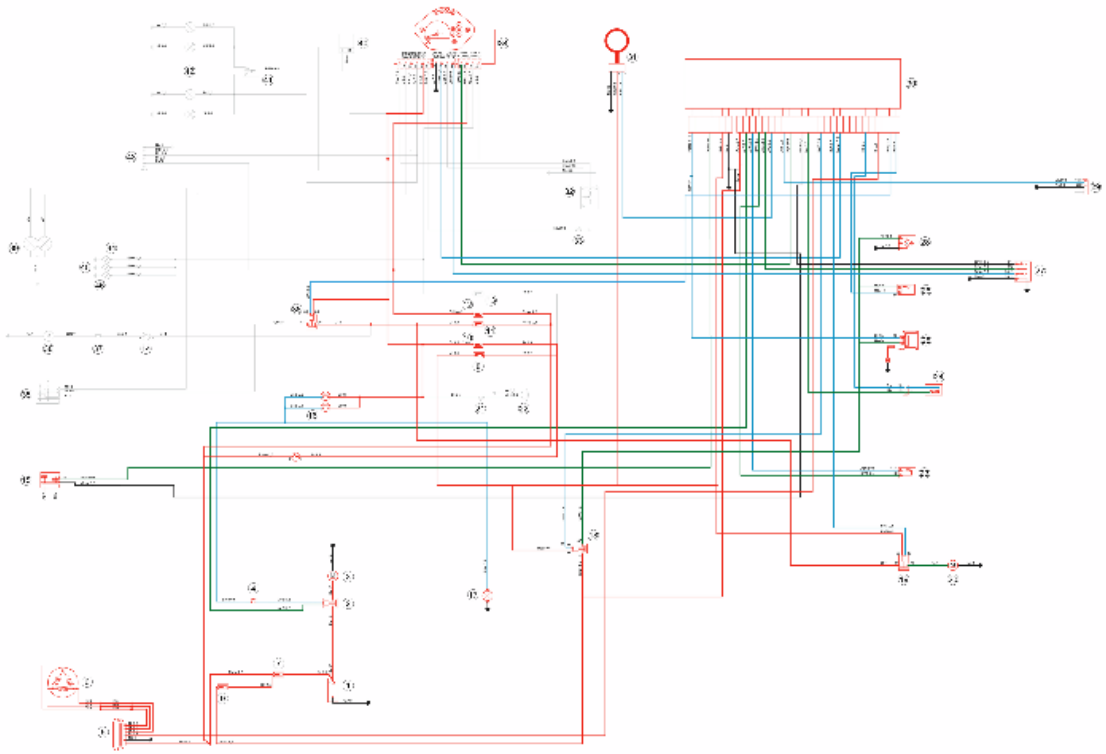
31. Lambda probe heater (White)

32. Not connected

33. Low beam lights automatic ignition enabling (White-Black)

34. Fuel injector (Red-Yellow)

EMS circuit diagram



1. Battery 12V - 12 Ah
2. Starter relay
3. Starter motor

4. Starter button
5. Voltage regulator
6. Magneto flywheel
7. Fuse No. 1 - 30A
8. Fuse No. 5 - 7.5A
9. Fuse No. 2 - 15A
10. Fuses No. 6 - 7.5A
11. Fuse No. 3 - 15A
12. Fuse No. 4 - 7.5A
14. Key switch contacts
15. Engine stop switch
16. N.2 stop buttons
17. Brake lamp 12v-16w
18. Injection load relay
19. Electric fan remote control
20. Radiator electric fan
23. Lambda probe
24. Engine speed sensor
25. H.V. coil.
26. Fuel injector
27. Engine temperature sensor
28. Fuel pump
29. Diagnosis socket
30. Injection electronic control unit
31. Immobilizer antenna
34. Instrument panel
36. Headlight 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
Faults detected by self-diagnosis	Pump relay HV coil Injector Engine speed timing sensor
Fuel system	Fuel present in the tank

Possible Cause	Operation
	Fuel pump activation Fuel pressure (low) Injector flow (low)
Power to the spark plug	Spark plug Shielded cap HV Coil (secondary insulation)
Parameter reliability	Coolant temperature Distribution timing - injection ignition Intake 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 Coolant temperature
Start-up speed	Starter motor and solenoid Battery Ground connections
End of compression pressure	End of compression pressure
Power to the spark plug	Spark plug Shielded cap HV coil Engine speed timing sensor Ignition advance
Fuel system	Fuel pressure (low) Injector flow (low) Injector seal (poor)
Correctness of the parameters	Coolant 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 Coolant temperature
Ignition efficiency	Spark plug Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant 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

Possible Cause	Operation
	Injector flow

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 Coolant temperature
Ignition efficiency	Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant 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 flow

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 Coolant temperature Lambda probe
Correctness of the parameters	Throttle valve position sensor Stepper Coolant 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 flow
Exhaust system seal (seepage)	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

Possible Cause	Operation
	Additional air pipe and Stepper
Intake system sealing	Intake sleeve Filter box
Ignition system	Spark plug wear check
Parameter reliability	Throttle valve position signal Coolant temperature indicator 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 Coolant temperature Lambda probe

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 Coolant temperature Lambda probe
Power to spark plug	Spark plug Shielded cap HV Cable HV Coil
Intake system	Air filter Filter box (sealing) Intake sleeve (sealing)
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Fuel system	Fuel level in the tank Fuel pressure Fuel filter Injector flow

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 Coolant temperature Lambda probe
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Intake system sealing	Intake sleeve

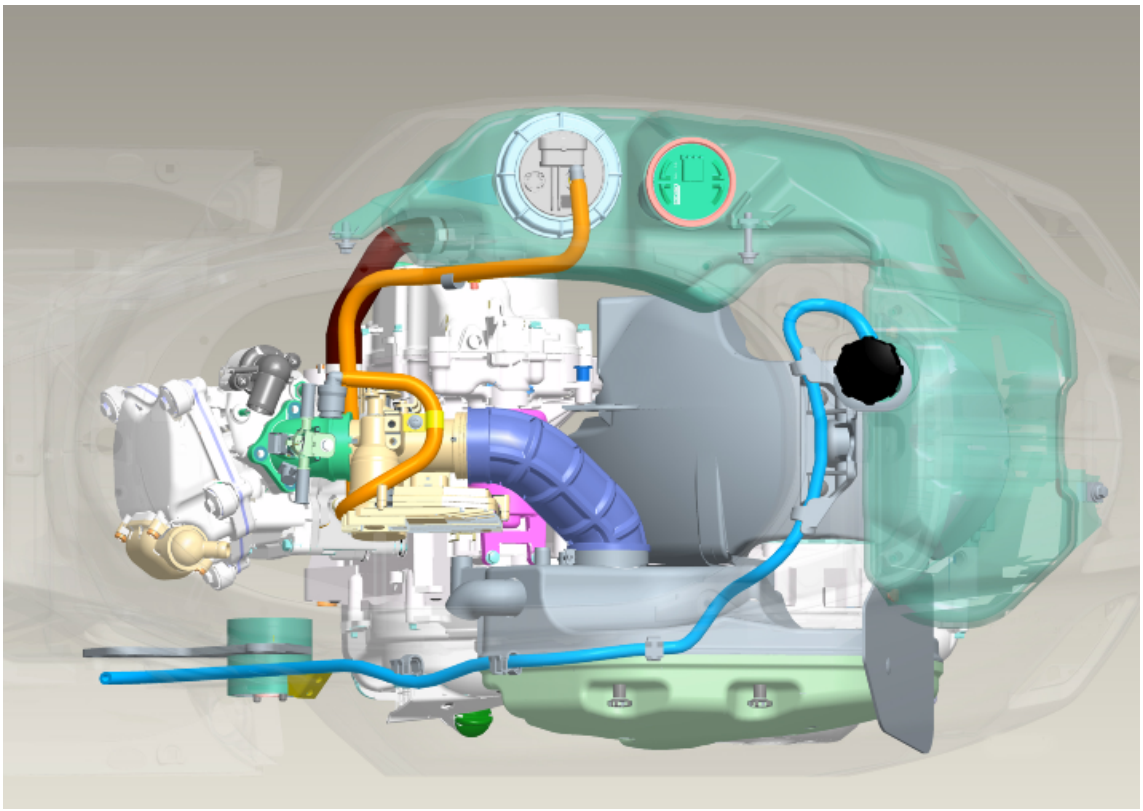
Possible Cause	Operation
	Filter box
TPS reset successful	TPS reset successful
Fuel system	Fuel pressure Fuel filter Injector flow Fuel quality
Selecting the thickness for the cylinder base gasket	Selecting the thickness for the cylinder base gasket

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.

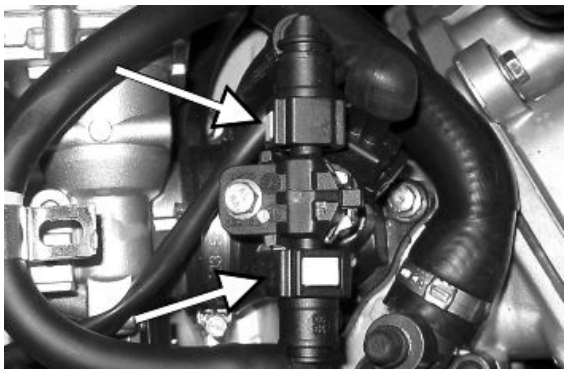
The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.



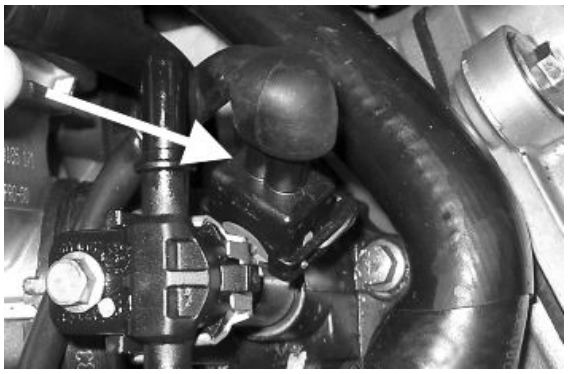
Removing the butterfly valve

Remove the fuel piping clamping screw indicated in the figure.

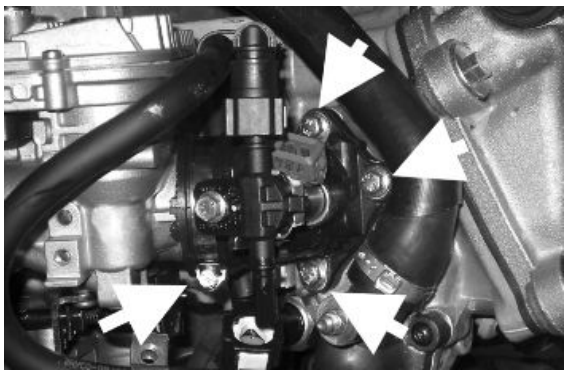
Remove the fast-release fittings from the injector support.



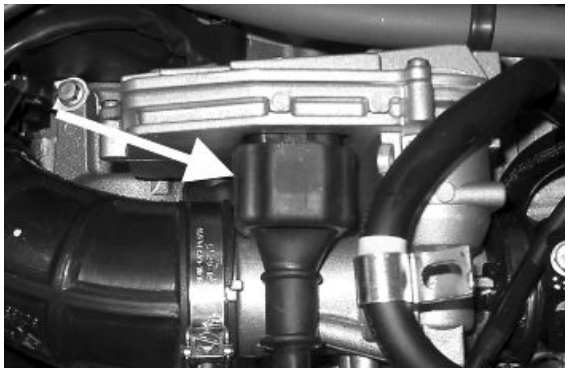
Remove the injector connector.



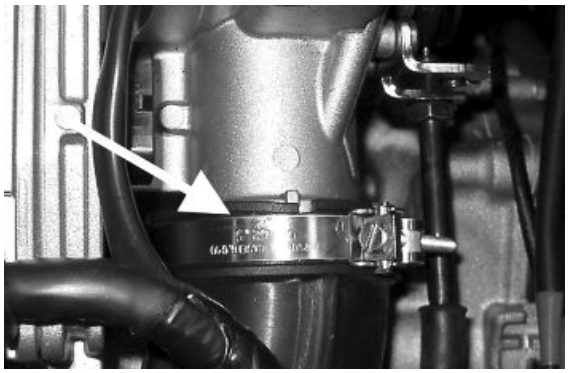
Remove the three screws fixing the manifold to the cylinder head and the clip fixing the throttle body to the manifold.



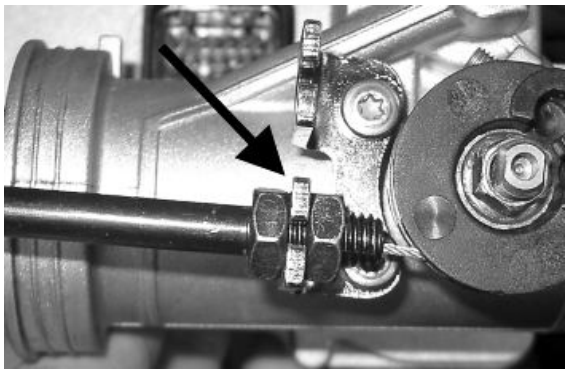
Remove the MIU ECU connector.



Remove the clip fixing the throttle body to the air cleaner bellows.



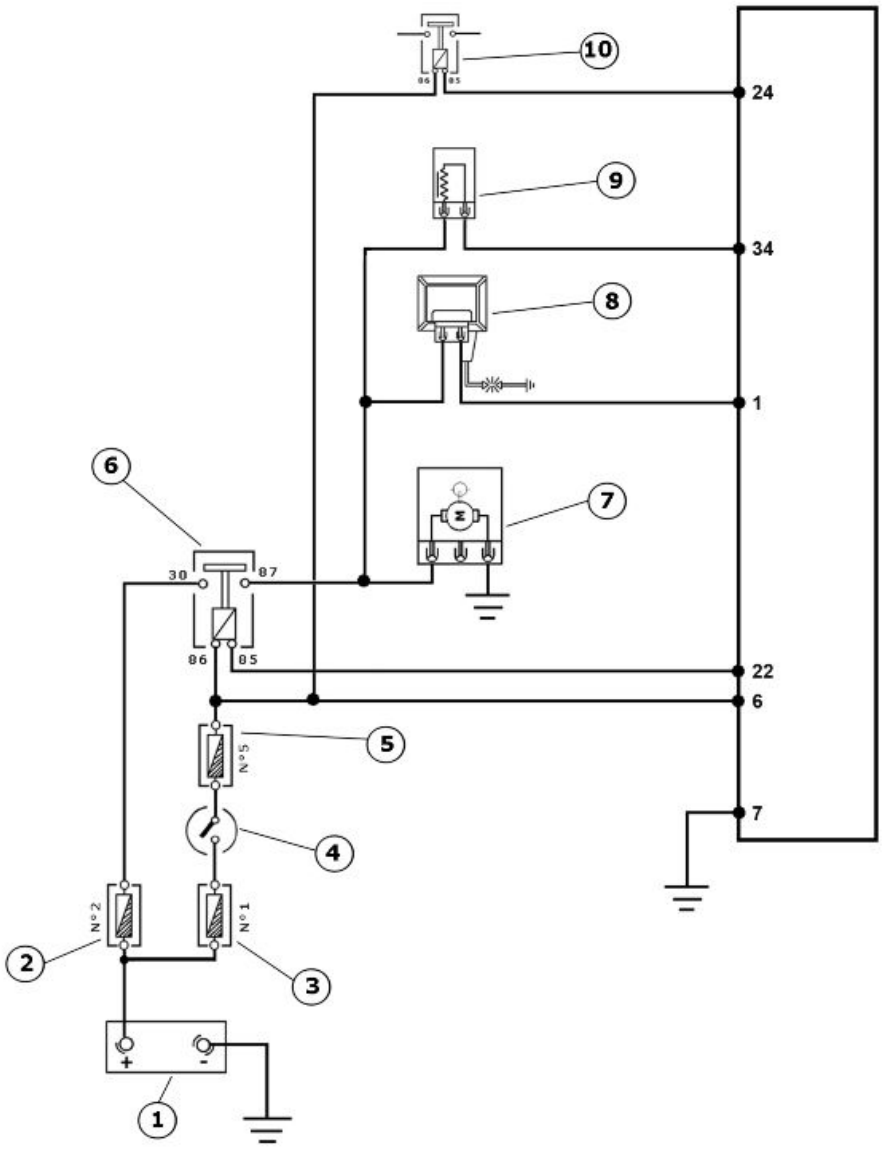
Remove the gas command fitting as indicated in the picture



Refitting the butterfly valve

To refit, perform the operations in the reverse order from the removal operations being careful to position the clip fixing the throttle body to the air filter bellows at 45° as shown in the photograph.

Pump supply circuit



1. Battery 12V
2. Fuse No. 2 of 15A
3. 30A fuse No. 1
4. Key switch contacts
5. Fuse No. 5 of 7.5A
6. Injection load remote control
7. Fuel pump
8. H.V. coil.

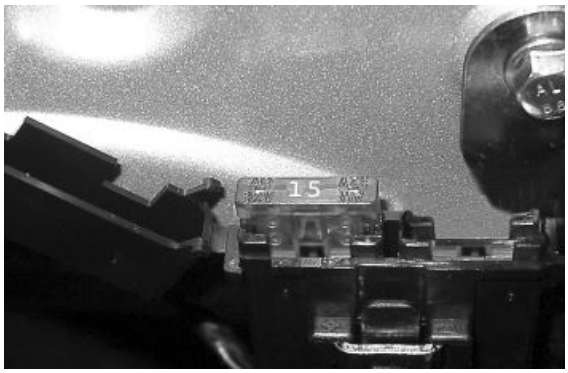
9. Fuel injector
10. Electric fan solenoid

When switched to "ON", the fuel pump starts to rotate for two seconds and then stops. When the engine starts, in the presence of rpm timing signal the pump is continuously supplied.

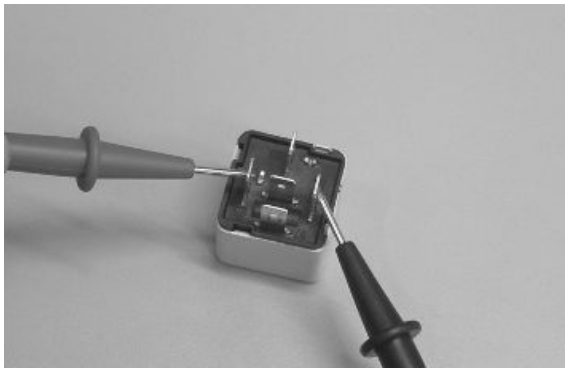
ELECTRICAL DATA

- Pump winding resistance ~ 1.5 Ohm
- Input current during regular operation 1.4 ÷ 1.8 A
- Input current to the closed hydraulic circuit ~ 2 A (to be checked with appropriate tool for fuel pressure control choking the circuit on the return pipe)

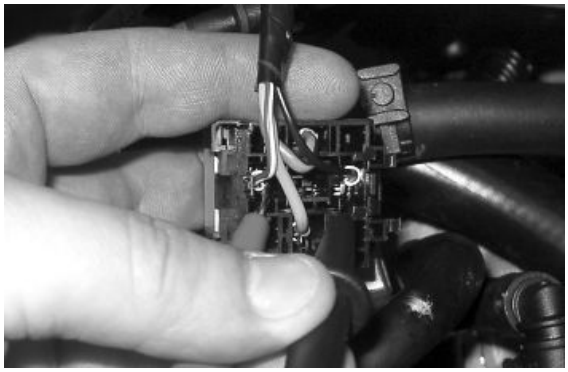
Check that the injection load 15A fuse No. 2 works properly.
Check that the 7.5A fuse No. 5 for live control unit power works properly.



Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 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 remote control.

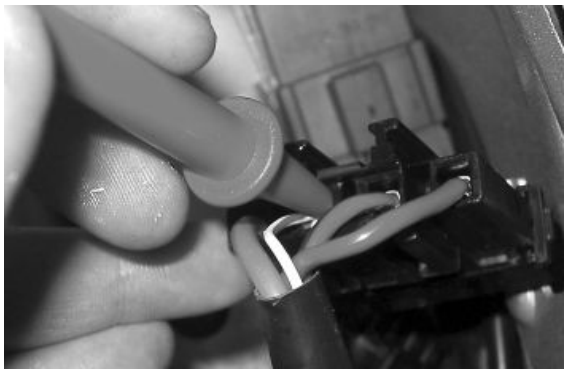


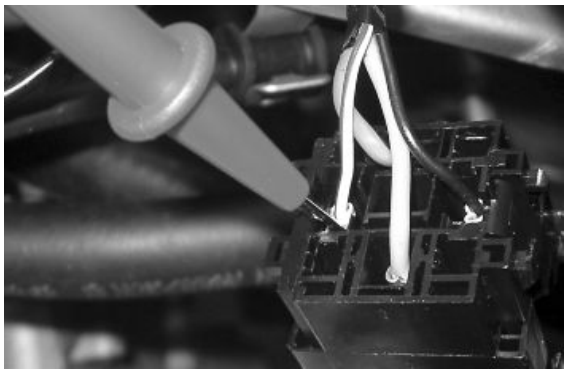
Check the power supply line of the injection load solenoid energising coil: after switching to "ON", make sure there is battery voltage, for two seconds, between the Red-White cable and Black-Purple cable of the solenoid control base. If there is not, check the continuity of the Red-White cable between the fuse box under the saddle hinge and the remote control base and of the Black-Purple cable between pin 22 of the control unit and the remote control base.

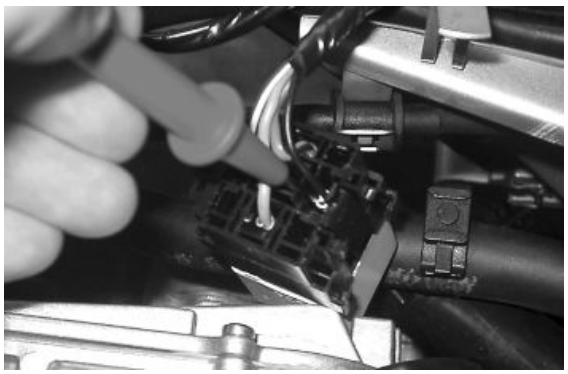


N.B.

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



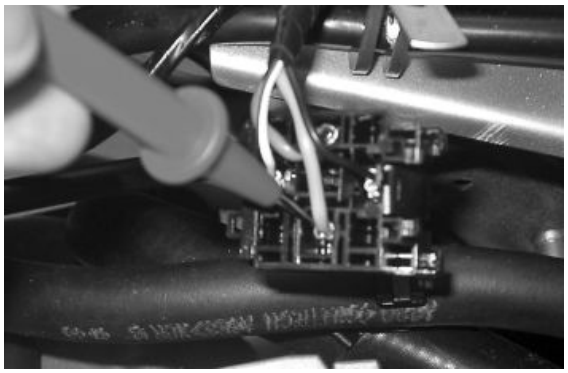


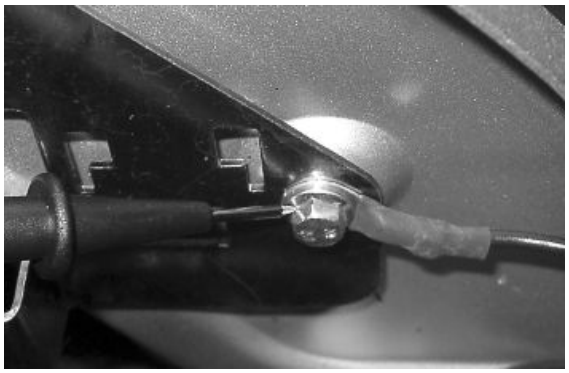


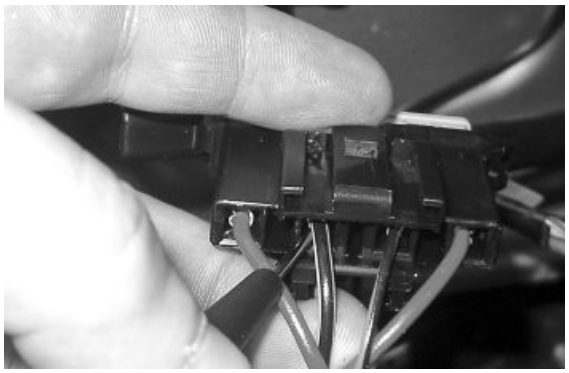
Check the presence of fixed voltage between the grey/black cable of the remote control base and earth. If there is none check the continuity of the grey/black cable between the fuse box (No. 2 15 A) and the remote control base.

N.B.

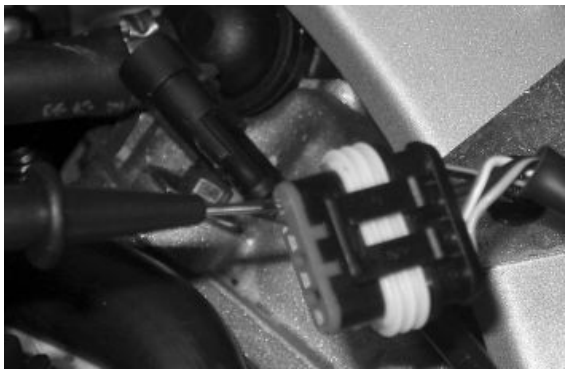
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).



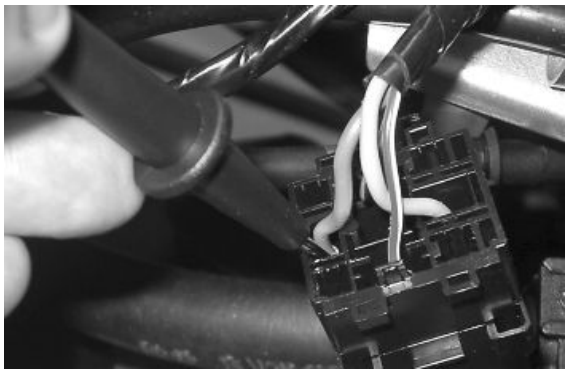




pump circuit 6



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 remote control base. Check the efficiency of the ground line of the fuel pump by measuring the continuity between the pump connector black cable, system side, and the ground.



If, when switching to "ON", the pump continues to turn after two seconds of activation, check, with the control unit disconnected and the injection load remote control disconnected, that the Black-Purple cable (pin 20 on the interface wiring) is insulated from the ground.

Specific tooling

020331Y Digital multimeter

Circuit leak test

Install the specific tool for checking the fuel pressure, with the pipe fitted with the gauge.

Check during regular operation by placing the appropriate tool between the pump and the injector. With the battery voltage> 12 V check that the fuel pressure is 2.5 BAR and that the input current is 1.4 to 1.8 A

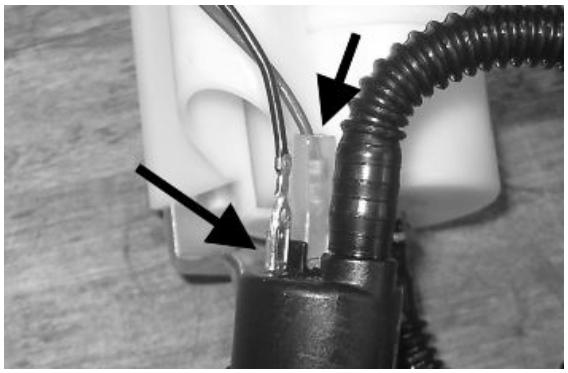
With the battery voltage > 12 V, check the capacity of the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool. Make a graded burette available with a flowrate of approximately 1 L. Rotate the pump using the active diagnosis of the palm top computer. Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 2.5 BAR. Check that, in fifteen seconds, the pump has a flowrate of around 110cc.

Specific tooling

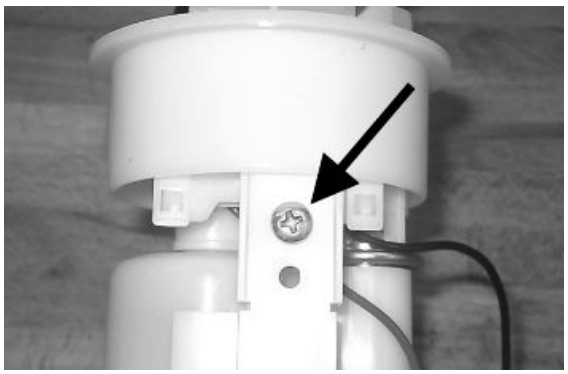
020480Y Fuel pressure check set

Fuel filter check

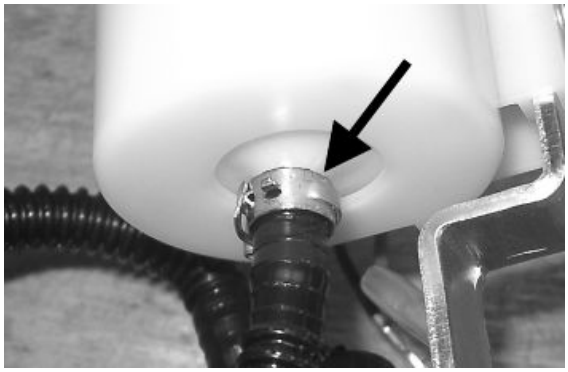
Disconnect the terminals from the electric pump



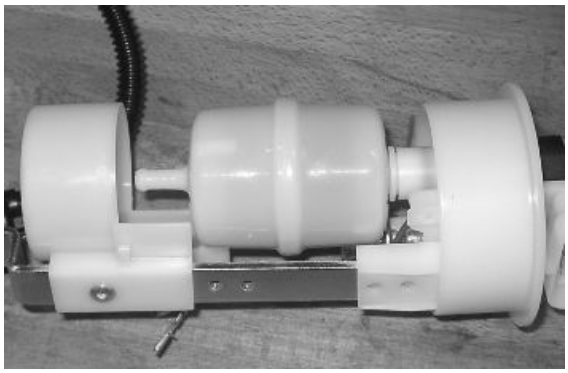
Remove the screw indicated in the photograph



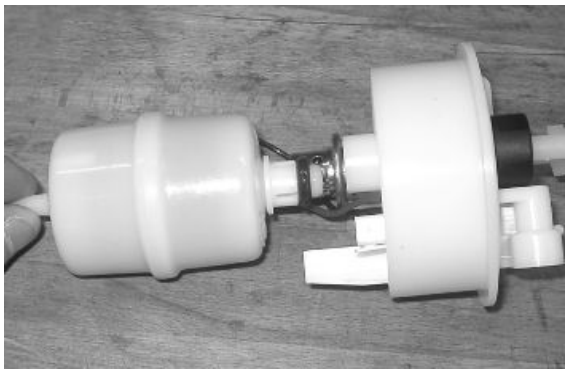
Remove the clamp fixing the piping to the filter shown in the photograph



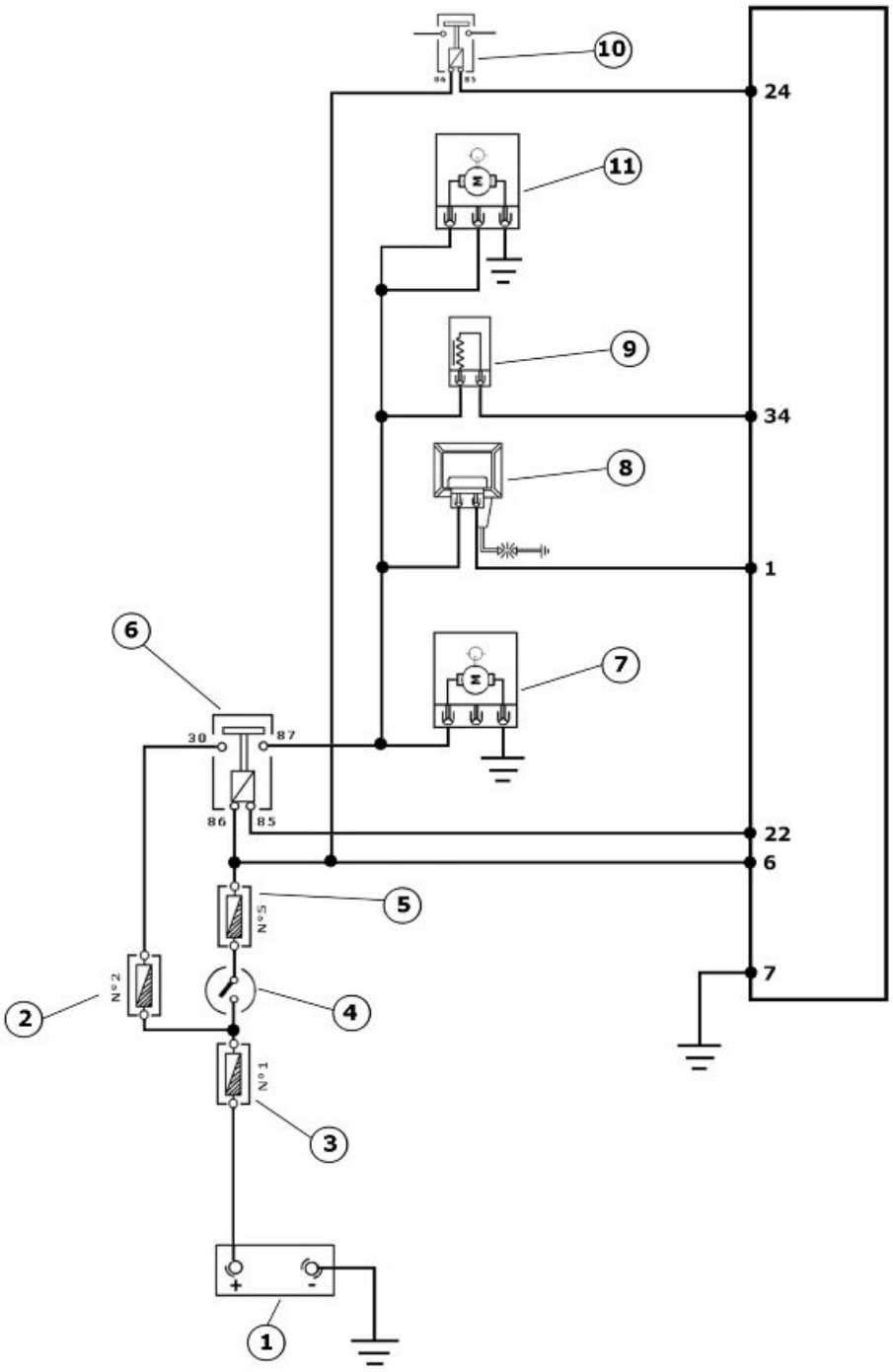
Separate the lower part of the pump support as shown in the photograph.



Remove the filter from the pump support



Inspecting the injector circuit

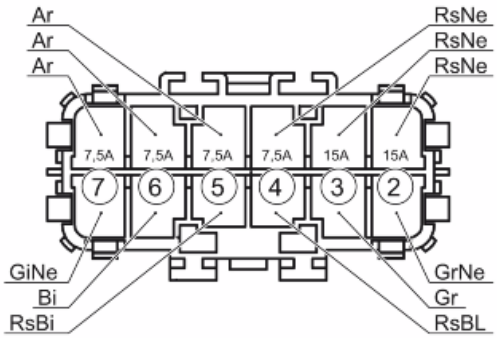


1. Battery 12V
2. Fuse No. 2 of 15A
3. 30A fuse No. 1
4. Key switch contacts

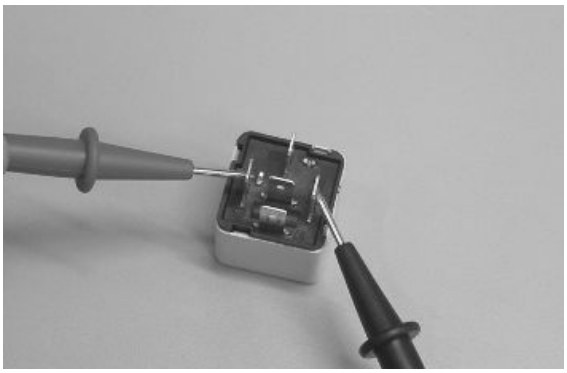
5. Fuse No. 5 of 7.5A
6. Injection load relay
7. Fuel pump
8. H.V. coil.
9. Fuel injector
10. Electric fan solenoid
11. Coolant electric pump

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

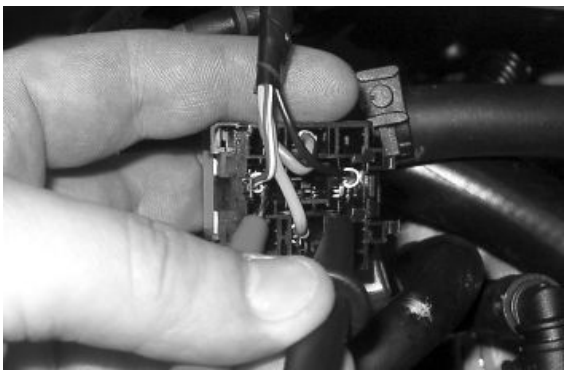
Check that the injection load 15A fuse No. 2 works properly.
Check that the 7.5A fuse No. 5 for live control unit power works properly.



Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 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 remote control.

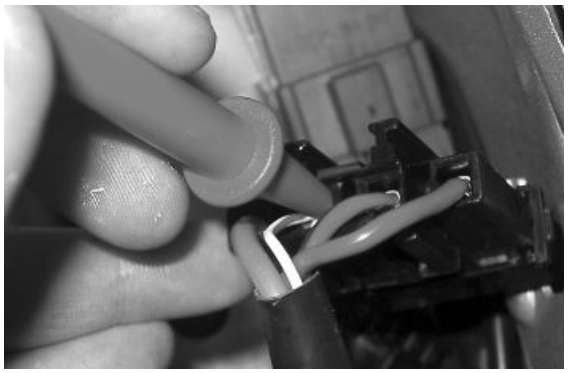


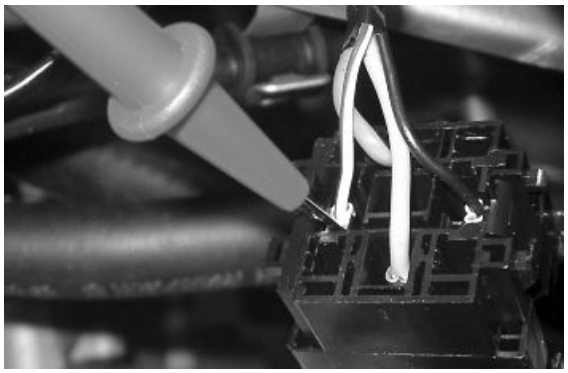
Check the power supply line of the injection load solenoid energising coil: after switching to "ON", make sure there is battery voltage, for two seconds, between the Red-White cable and Black-Purple cable of the solenoid control base. If there is not, check the continuity of the Red-White cable between the fuse box under the saddle hinge and the remote control base and of the Black-Purple cable between pin 22 of the control unit and the remote control base.

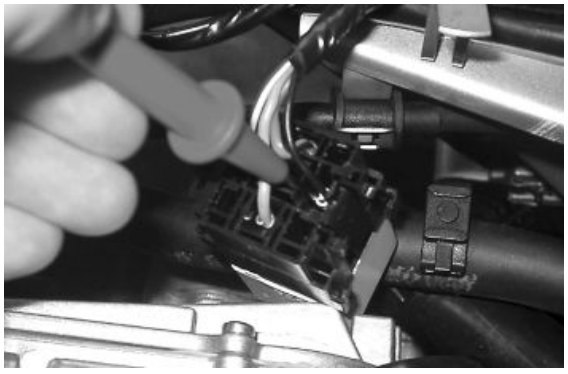


N.B.

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



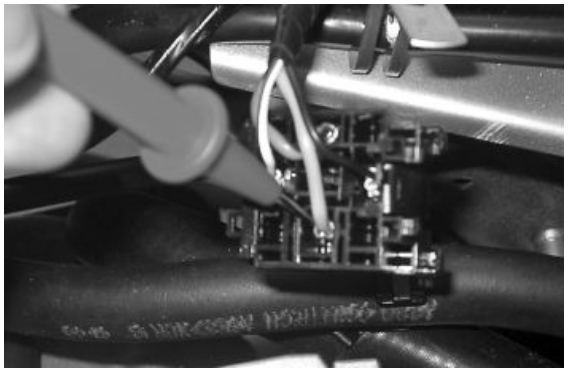


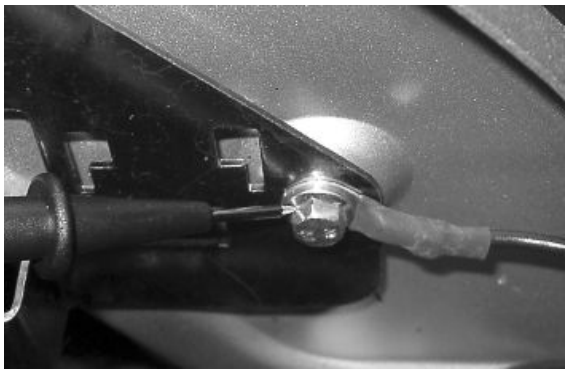


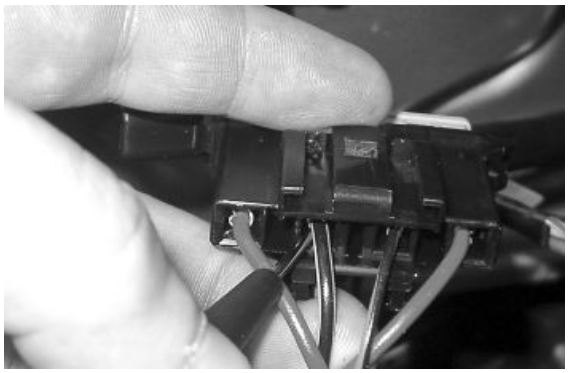
Check the presence of fixed voltage between the grey/black cable of the remote control base and earth. If there is none check the continuity of the grey/black cable between the fuse box (No. 2 15 A) and the remote control base.

N.B.

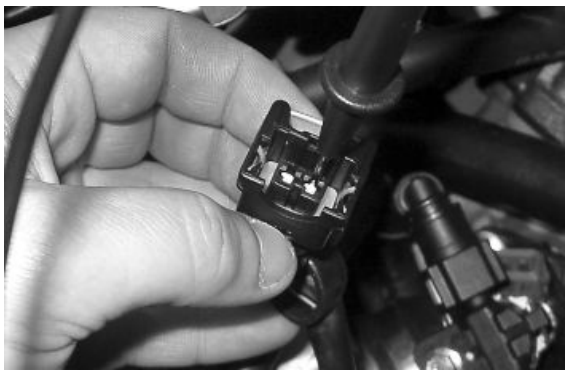
CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, ELECTRONIC CONTROL UNIT, FUSES, ETC.).







With the control unit and the injector disconnected, check the continuity of the Red-Yellow cable between pin 34 of the interface wiring and the injector connector



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

Inspecting the injector hydraulics

To carry out the injector check, remove the intake manifold by removing the three clamping screws at the head and the clip connecting the control unit to the manifold.

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 with the cable that is part of the equipment for 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

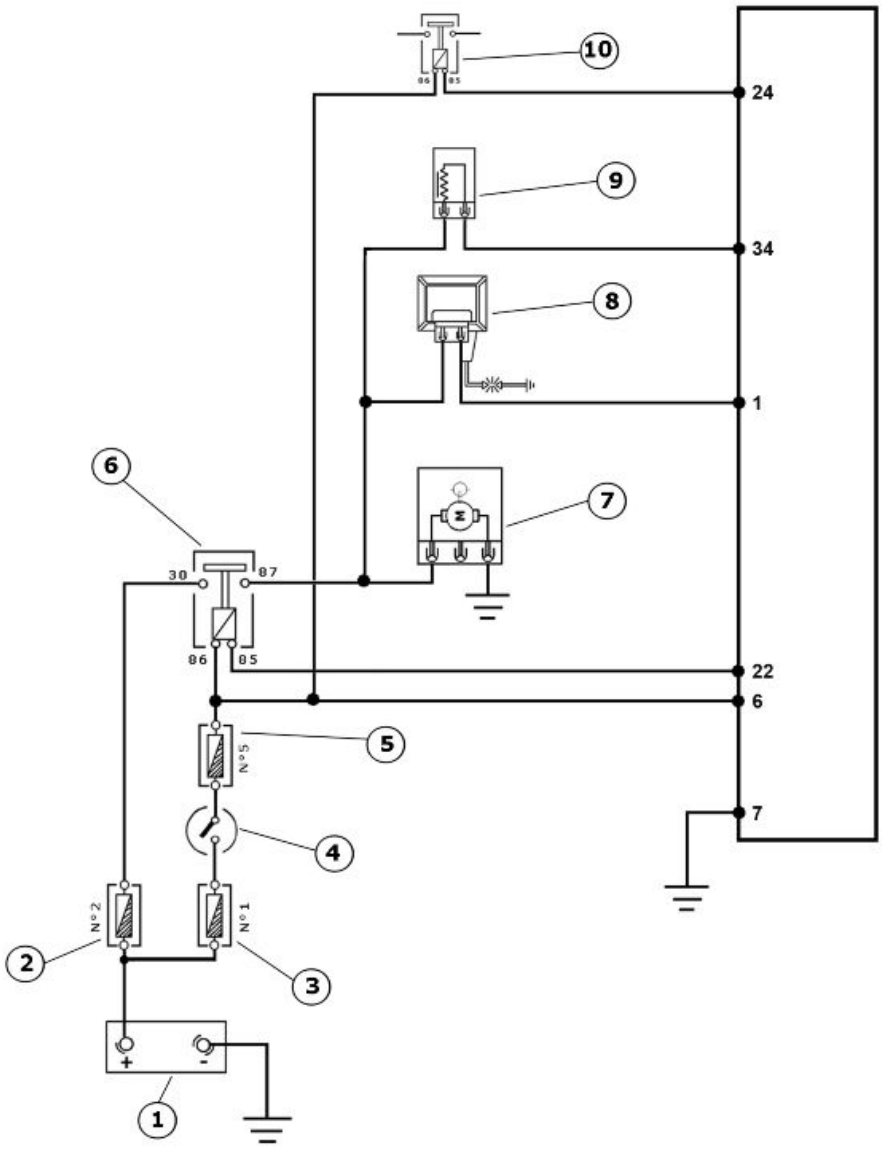
020480Y Fuel pressure check set

Proceed with the injector seal test.

Dry the injector outlet with a blast of compressed air. Activate the fuel pump. Wait for one minute, making sure there are no leaks coming from the injector. Slight oozing is normal.

Value limit = 1 drop per minute

HT coil



1. Battery 12V
2. Fuse No. 2 of 15A
3. 30A fuse No. 1
4. Key switch contacts
5. Fuse No. 5 of 7.5A
6. Injection load remote control
7. Fuel pump
8. H.V. coil.

9. Fuel injector
10. Electric fan solenoid

The combined ignition/injection system is a high-efficiency induction system.
The control unit manages two significant parameters:
- Ignition advance

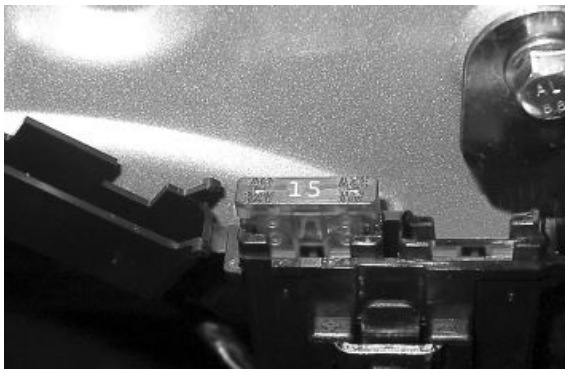
This is optimised at once according to the engine revs, engine load, temperature and ambient pressure.
With idle engine, it is optimised to obtain the stabilisation of the speed at 1450 ± 50 R/1'.
- Magnetisation time

The coil magnetisation time is controlled by the control unit. The power of the ignition is increased during the engine start-up phase.
The injection system recognises the 4-stroke cycle so ignition is only commanded in the compression phase.

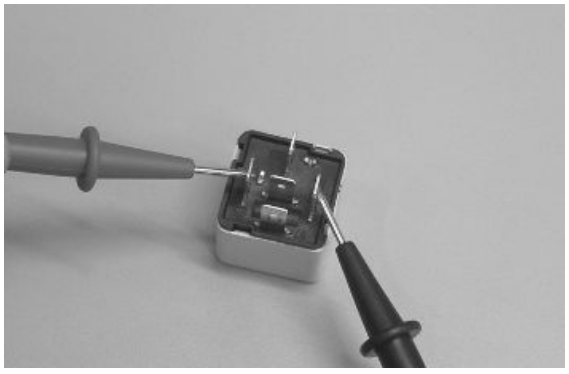
Specific tooling

020331Y Digital multimeter

Check that the injection load 15A fuse No. 2 works properly.
Check that the 7.5A fuse No. 5 for live control unit power works properly.



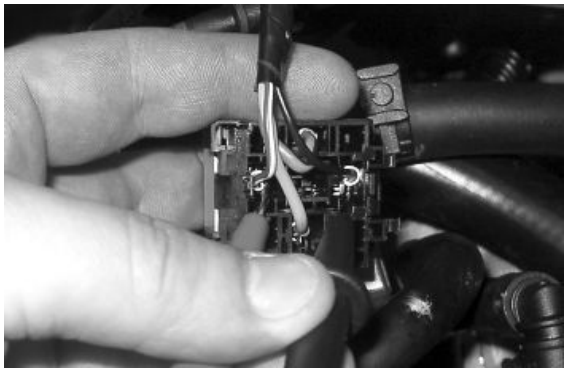
Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

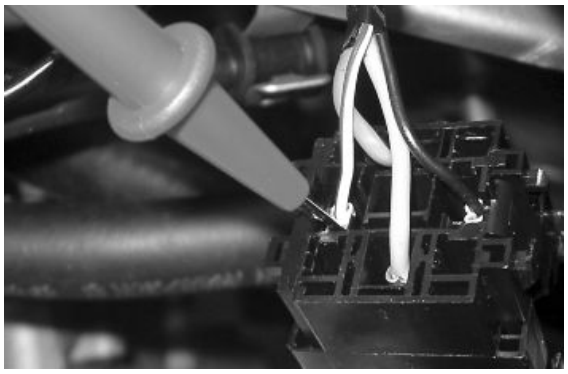


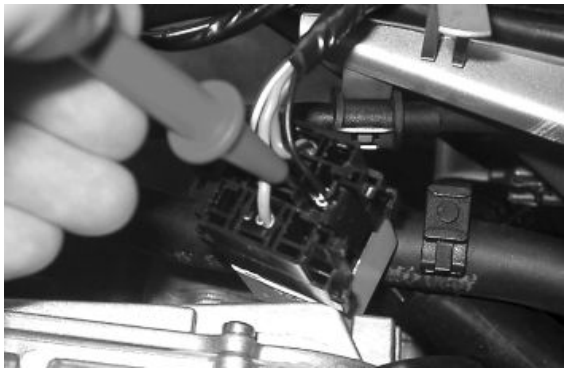
Check the power supply line of the injection load solenoid energising coil: after switching to "ON", make sure there is battery voltage, for two seconds, between the Red-White cable and Black-Purple cable of the solenoid control base. If there is not, check the continuity of the Red-White cable between the fuse box under the saddle hinge and the remote control base and of the Black-Purple cable between pin 22 of the control unit and the remote control base.

N.B.

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



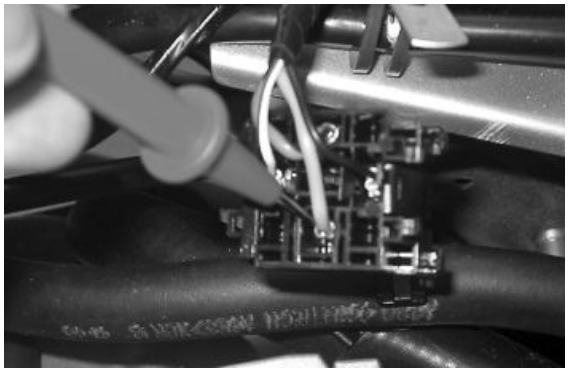


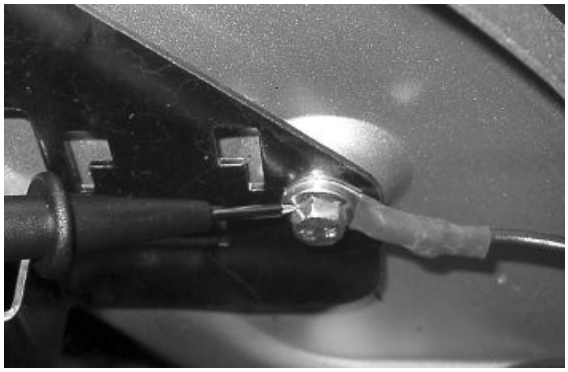


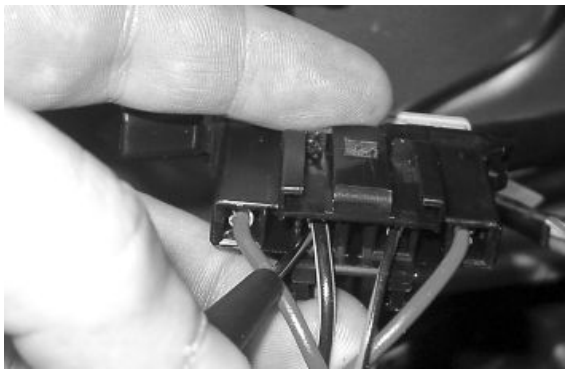
Check the presence of fixed voltage between the grey/black cable of the remote control base and earth. If there is none check the continuity of the grey/black cable between the fuse box (No. 2 15 A) and the remote control base.

N.B.

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







Zeroing the throttle

Throttle valve position signal reset (TPS reset)

The MIU control unit is supplied with a throttle valve position sensor that is pre-calibrated.

Pre-calibration entails regulating the minimum opening of the throttle valve to obtain a specific air flow under pre-set reference conditions.

Pre-calibration ensures optimal air flow for the control of the idle speed.

This regulation must not be tampered with in any way whatsoever.

The injection system will complete the management of the idling through the Stepper and the variation of the ignition advance.

After the pre-calibration the throttle body has an open valve with a variable angle depending on the tolerances of the machining of the pipe and the valve itself.

The valve position sensor can also have various fitting positions. For these reasons the mVs of the sensor with the valve at idle can vary from one throttle body to another.

To obtain the optimum carburetion, especially at small openings of the throttle valve, it is essential to match the throttle body with the control unit following the procedure known as TPS resetting.
With this operation we inform the control unit, as a starting point, of the mV value corresponding to the pre-calibrated position.
To reset, proceed as follows.

Connect the diagnostic tester.

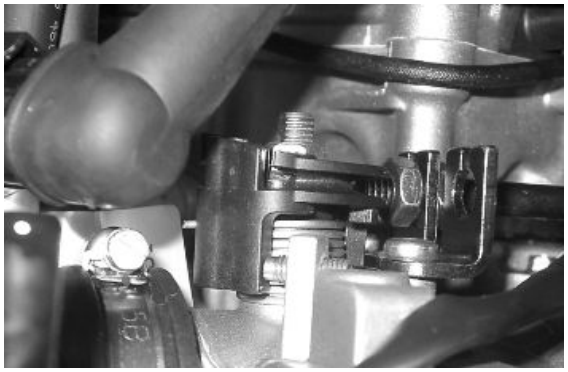
Shift to «**ON**».

Select the functions of the diagnostic tester on «**TPS RESET**».

Specific tooling

020922Y Diagnosis Tool

Make sure that the throttle valve control is in contact with the stop screw.



Guaranteeing that this position will be kept, give the confirmation for the TPS reset procedure.

Reset should be performed in the following cases:

- on first fitting.

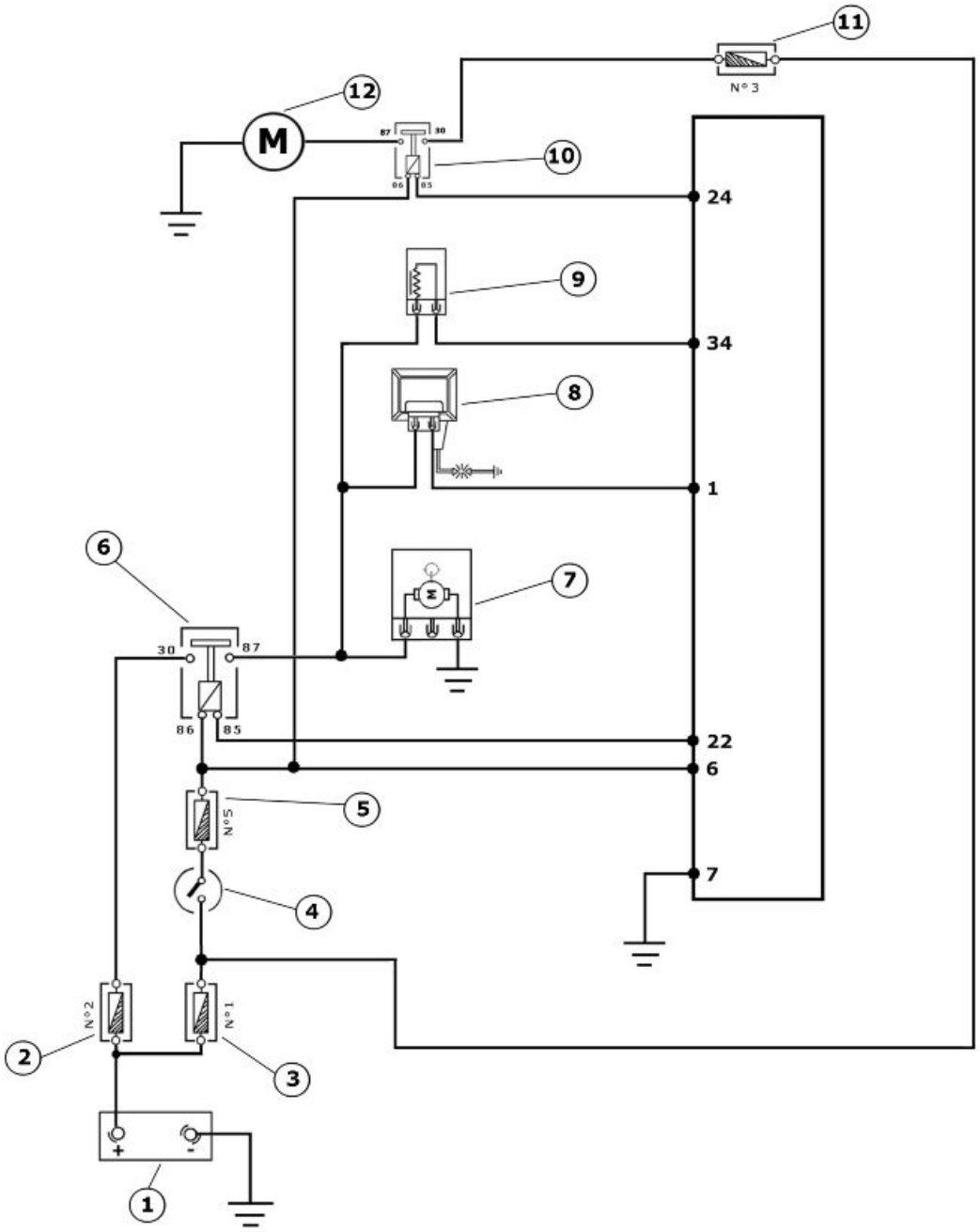
- if the injection control unit is replaced.

N.B.

THE TPS RESETTING PROCEDURE MUST NOT BE CARRIED OUT WITH A USED THROTTLE BODY BECAUSE POSSIBLE VALVE WEAR AND STOP WEAR FOR THE MINIMUM OPENING MAKE THE AIR FLOW DIFFERENT FROM THAT OF THE PRE-CALIBRATION.

Given that the TPS resetting is also done when the control unit is replaced, place the control unit - filter box bellows at 45° during the refitting operation as shown in the picture.

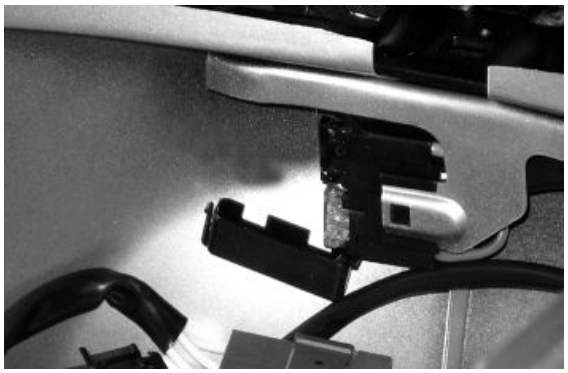
Impianto elettroventilatore



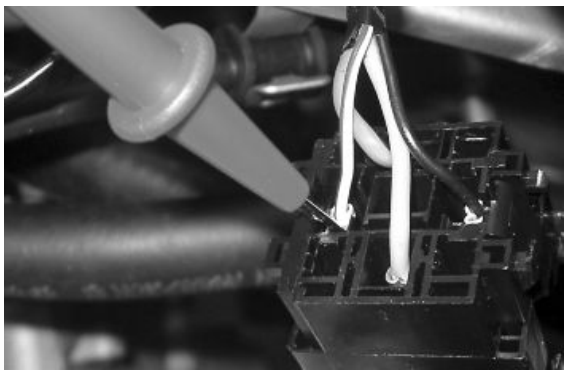
1. Battery 12V
2. Fuse No. 2 of 15A
3. 30A fuse No. 1
4. Key switch contacts
5. Fuse No. 5 of 7.5A
6. Injection load relay
7. Fuel pump

8. H.V. coil.
9. Fuel injector
10. Electric fan solenoid
11. 15A fuse No. 3
12. Electric fan motor

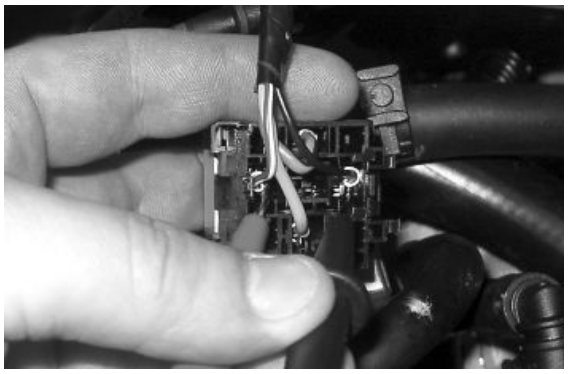
Check that the 7.5A fuse No. 5 works properly



With the key switch set to ON, check if there is +12 V battery voltage between the RED - WHITE cable of the electric fan remote control and the ground connection.
Check if the RED - WHITE cable between the fuse box (under the saddle) and the electric fan remote control base is not interrupted

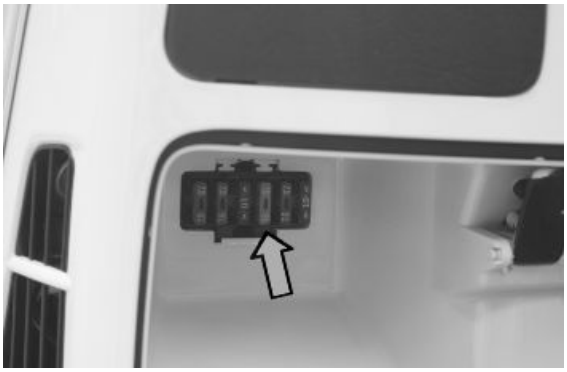


Using a diagnosis Palmtop, carry out an active diagnosis for the "ELECTRIC FAN". Check if there is battery voltage at pins 85 - 86 of the electric fan relay

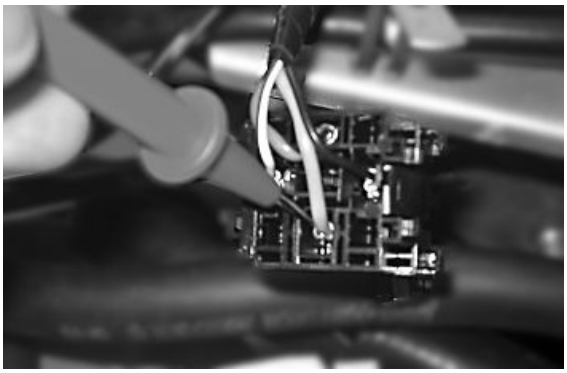


Check if the BLUE - YELLOW cable between the control unit pin 8 and the electric fan remote control base is not interrupted

Check the 15A Fuse No. 3



Check if there is +12 V voltage between the GREY cable of the electric fan remote control base and the ground connection.
Check if the RED - BLACK cable between the fuse box under the seat and the fuse box in the glove-box compartment is not interrupted.
Check if the GREY cable between the fuse box in the glove-box compartment and the electric fan remote control base is not interrupted.
Check if the RED cable between the electric fan remote control base and the electric fan motor is not interrupted.
Check that the electric fan motor is earthed.



INDEX OF TOPICS

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

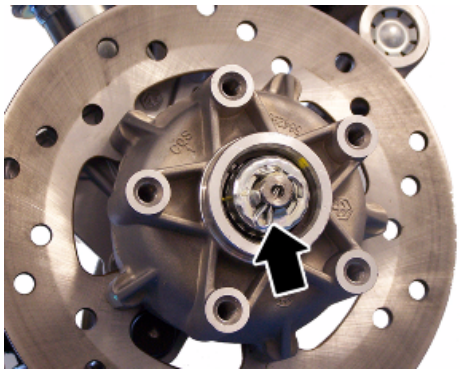
Front

Removing the front wheel

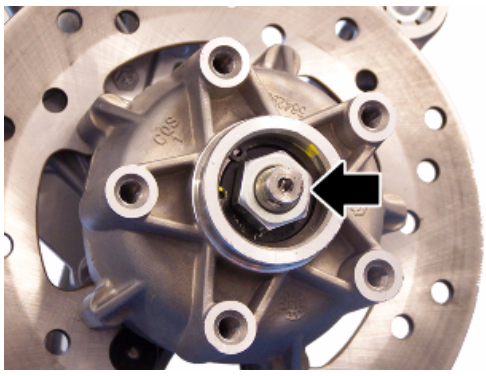
- Support the vehicle adequately.
- Loosen the five screws fixing the wheel to the hub.

Front wheel hub overhaul

- Support the vehicle adequately.
- Remove the front wheel.
- Remove the front brake calliper.
- Remove the cotter pin and remove the cap.



- Unscrew the nut fixing the front wheel hub.



- Remove the wheel hub.

- Remove the ball bearing check Seeger ring indicated in the picture

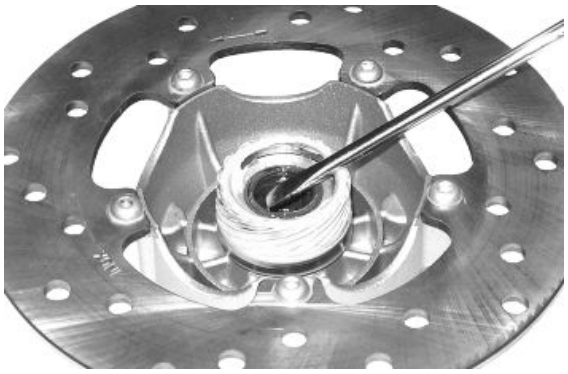
Extract the ball bearing using the specific tool

Specific tooling

001467Y014 Calliper to extract 15-mm diameter bearings

001467Y017 Bell for bearings, OD 39 mm

- Remove the oil seal on the roller bearing side using a screwdriver.



- Remove the roller bearing using the specific tool

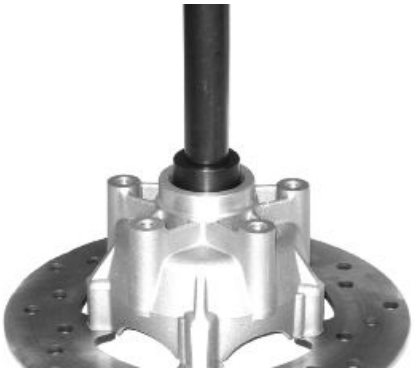
Specific tooling

020376Y Adapter handle

020456Y Ø24 mm adaptor

020363Y 20 mm guide

- Heat the roller bearing seat with a heat gun
- Use the specific tool to introduce and push the bearing until it stops, with the shielded side facing out
- Refit the ball bearing check Seeger ring



Specific tooling

020151Y Air heater

020376Y Adapter handle

020357Y 32 x 35 mm adaptor

020412Y 15 mm guide

- Use the specific tool to fit and push the roller casing until it stops
- Refit the oil seal on the roller bearing side
- Lubricate the area between the roller bearing and the ball bearing

Specific tooling

020038Y Punch

Recommended products

AGIP GREASE MU3 Yellow-brown, lithium-base, medium-fibre multipurpose grease.

ISO L-X-BCHA 3 - DIN 51 825 K3K -20

- To refit, follow the removal steps but in reverse order; be careful to tighten to the prescribed torque.

Locking torques (N*m)

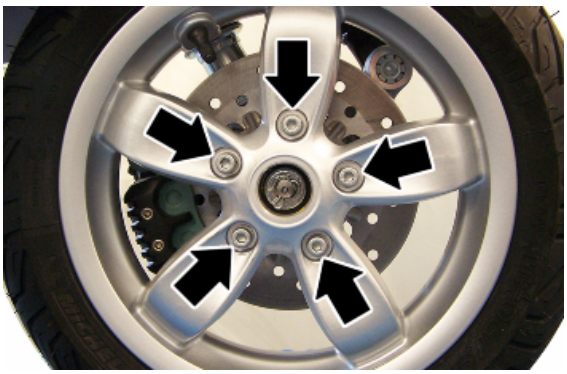
Front wheel axle nut 75 to 90

Refitting the front wheel

- Upon refitting, tighten the five screws to the prescribed torque.

Locking torques (N*m)

Wheel rim screws 20 - 25



Steering column

Removal

After removing the upper seat, lean the vehicle on one side and extract the steering tube completely from the fork.

Specific tooling

020055Y Wrench for steering tube ring nut

Overhaul

Servicing the front suspension-steering assembly, described below, deals mainly with replacing parts (pin- NADELLA roller bushings - sealing rings unit and dust gaiter) which connect the steering tube to the front wheel holder swinging hub.

N.B.

BEFORE PROCEEDING WITH THE DESCRIBED SERVICE, CHECK THAT THE STEERING TUBE AND THE WHEEL HOLDER HUB ARE IN EXCELLENT CONDITIONS: ONLY THEN IS THE SERVICE JUSTIFIABLE.
MOREOVER, REMEMBER THE STEERING TUBE SHOULD BE REPLACED WITH A NEW ONE WHEN DEFORMED.

a = Ø 12 Punch

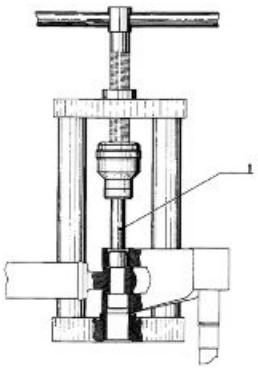
b = Sharp-edged end

Use a suitable punch with the dimensions indicated on the figure; hit with a mallet until the wedging washer is crushed and then extract it with the help of a pointed end.

Repeat the operation for the second washer using the punch on the side opposite to the one shown in the figure.

Use the tool fitted with part 1 as shown in the figure and move the tool handgrip until the pin and the NADELLA are simultaneously ejected in the direction opposite the tool thrusting force.

After removing the pin and the first NADELLA, the swinging hub gets detached from the steering tube.



To remove the second NADELLA, use the tool fitted with part 2 instead of part 1, on the side opposite the one shown in the figure.

N.B.

DURING THE REMOVAL OPERATIONS DESCRIBED ABOVE, THE ROLLER BUSHINGS ARE DESTROYED WHEN THE EXTRACTOR IS USED. UPON REFITTING, IT IS THEREFORE NECESSARY TO USE NEW BUSHINGS AS WELL AS A NEW PIN, NEW SEALING RINGS AND DUST GAITER.

Specific tooling

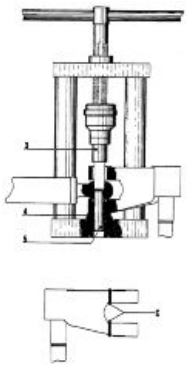
020021Y Front suspension service tool

Connect the swinging hub to the steering tube with the guiding pin.

- Use the tool fitted with part 3 on the stem and part 4.

Lubricate the pin with recommended grease and insert it temporarily on the swinging hub, move the tool handgrip until part 3 is fully inserted on the steering tube.

After fitting the pin, insert the two spacers, slightly hitting them with the mallet.



N.B.

BEFORE PROCEEDING WITH THE DESCRIBED FITTING, PLACE THE TWO DUST GAITER RINGS ON THE SWINGING HUB AS SHOWN IN THE FIGURE.

Specific tooling

020021Y Front suspension service tool

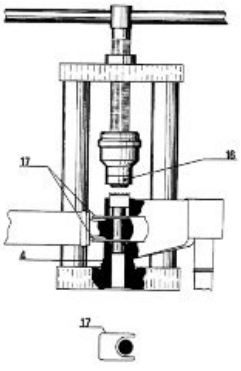
Recommended products

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

-

Insert the sealing ring on the pin and the roller bushing with its wedging washer at the same time.

- Remove the tool and the part 5 (guide), which has been partially ejected during the previous pin fitting phase, and leave part 4 always fitted.
- Replace part 3 with part 16 (on the stem).
- By moving the tool handgrip, push the wedging washer - roller bushing - seal ring unit, placing part 16 until it stops on the swinging hub.



- Repeat the above operation using the tool with part 16 and part 22, instead of part 4, always fitted to the stem, on the side opposite that indicated in the figure to fit the second wedging washer - roller bushing - sealing ring unit.

WARNING

BEFORE PROCEEDING WITH THE DESCRIBED PRE-FITTING, DIP THE SEALING RINGS IN MINERAL OIL AND THE "NADELLA" ROLLER BUSHINGS (PREVIOUSLY WASHED IN PURE PETROL OR NEUTRAL PETROLEUM TO ELIMINATE THE ANTIRUST PROTECTION), HALF-FILLED WITH GREASE.

Specific tooling

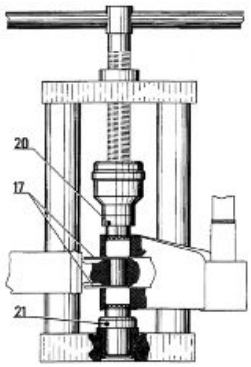
020021Y Front suspension service tool

Recommended products

AGIP GREASE MU3 Yellow-brown, lithium-base, medium-fibre multipurpose grease.

ISO L-X-BCHA 3 - DIN 51 825 K3K -20

- Use the tool fitted with part 20 on its stem and part 21 on the tool base as shown in the figure.
- By moving the tool handgrip, push the two NADELLA bushings until their internal bottoms make contact with the pin end.
- Use the tool fitted with parts 3 and 4 to fit the pin, and press moving the tool handgrip, until wedging the washers on the swinging hub.
- Now, remove the two spacers (parts 17 and 16) and, once the space between the NADELLAs - steering tube and swinging hub - has been fully filled with grease, move the dust gaiter rings until they are placed in that space.
- By wedging the washers as described above, the front suspension unit refitting stage is finished.



Recommended products

AGIP GREASE MU3 Yellow-brown, lithium-base, medium-fibre multipurpose grease.

ISO L-X-BCHA 3 - DIN 51 825 K3K -20

Refitting

CAUTION

USE NEW ROLLER CASINGS, PIN, SEALING RINGS AND DUST GUARDS FOR REFITTING.

When fitting the fork, lubricate with the steering bearing tracks with the recommended grease.

Tighten the lower ring nut **"A"** and the upper ring nut **"B"** to the specified torque

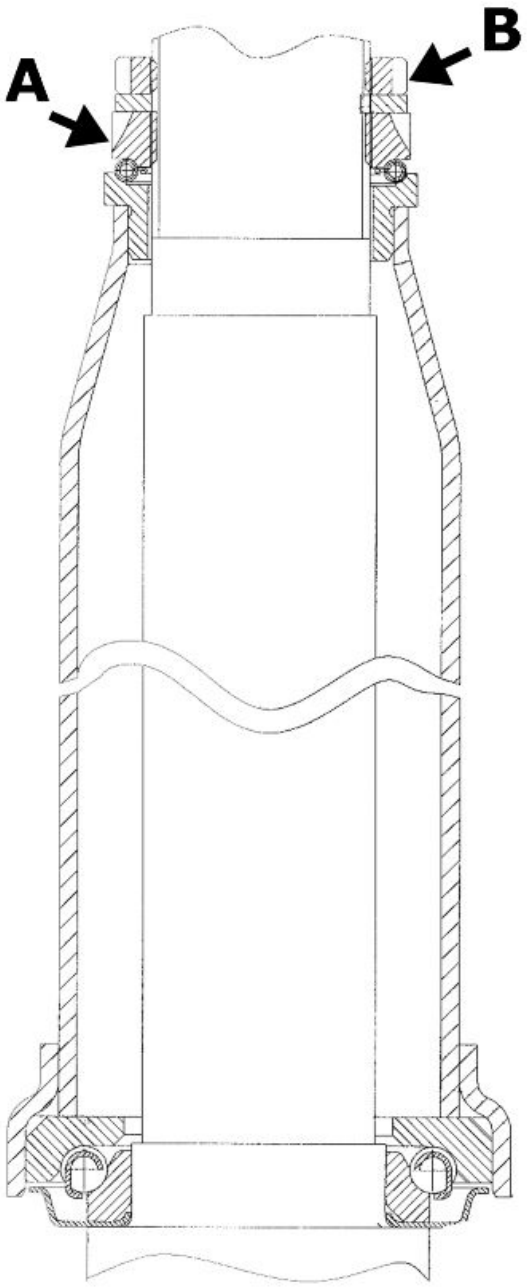
Recommended products

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

TL 9150 066, symbol NATO G 460

Locking torques (N*m)

Lower steering ring nut 8 ÷ 10 **Upper steering ring nut** 35 to 40

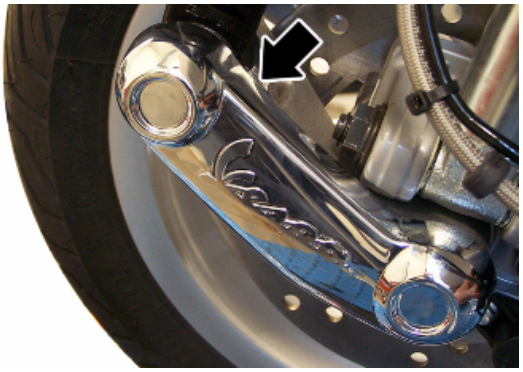


Front shock absorber

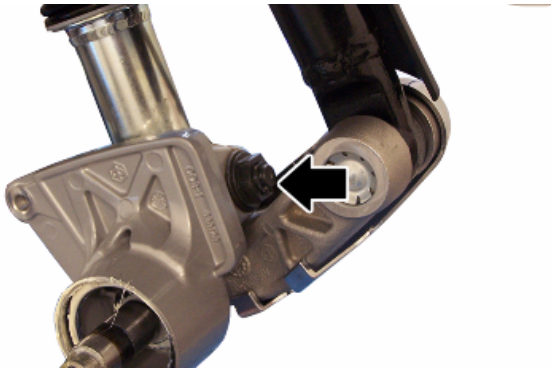
Removal

- Unscrew the fixing screw of the shock absorber cover and remove the plastic by unscrewing it downwards.

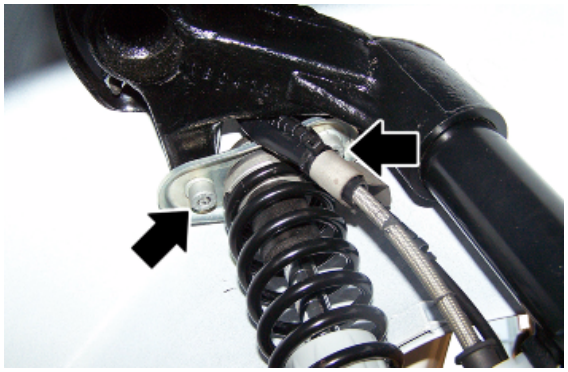
- Remove the swinging hub cover by disengaging the fittings.



- Support the vehicle adequately.
- Remove the wheel hub.
- Remove the seeger indicated in the photograph.
- Unscrew and remove the shock absorber lower retainer.
- Remove the brake calliper shock absorber support.



- Remove the two upper fixing screws.



- Remove the front shock absorber.

Refitting

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

Locking torques (N*m)

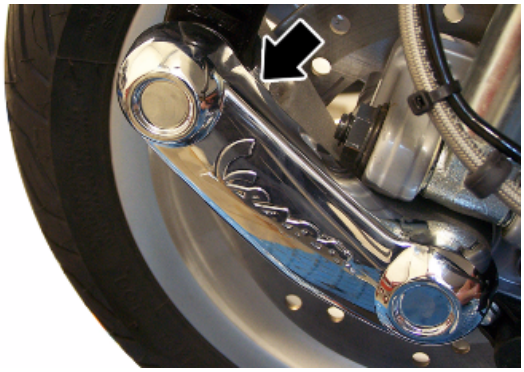
shock absorber lower clamping 20 - 27 shock absorber upper clamp 20 to 30

Shock-absorber - calliper bracket

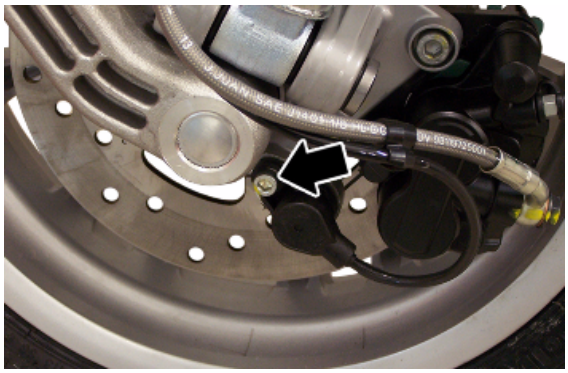
Removal

- Unscrew the fixing screw of the shock absorber cover and remove the plastic by unscrewing it downwards.

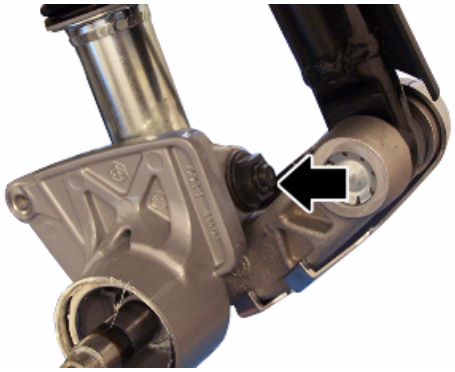
- Remove the swinging hub cover by disengaging the fittings.



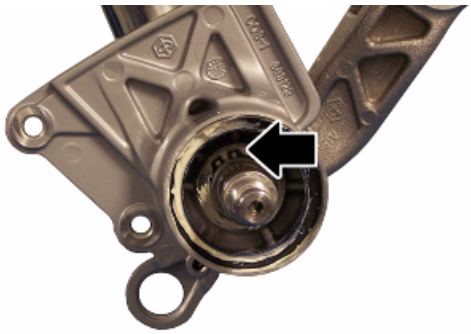
- Undo the indicated screw and remove the speed sensor.



- Remove the front wheel hub with the brake disc.
- Remove the seeger indicated in the photograph.
- Unscrew and remove the front shock absorber lower retainer.



- Remove the bracket locking Seeger ring
- Unscrew the bracket



- Before refitting the bracket in the wheel axle, place the O-ring as shown in the photograph so that it is correctly placed after fitting the bracket.
- Refit the washer and the Seeger ring.
- Refit the lower screws fixing the shock absorber to the bracket and tighten at the prescribed torque.

Locking torques (N*m)

Lower shock absorber clamp 20 to 27

Overhaul

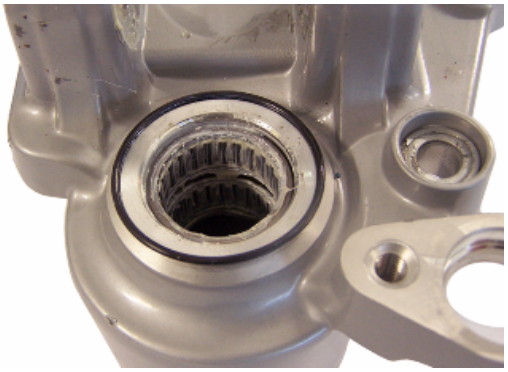
- Remove the two roller bearings from the bracket with the specific tool operating on the shock absorber attachment side as shown in the photograph

Specific tooling

020376Y Adapter handle

020441Y 26 x 28 mm adaptor

020365Y 22 mm guide



- Remove the oil seal on the wheel hub side with the screwdriver as shown in the photograph

- 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 Adapter 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

020036Y Punch

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

Specific tooling

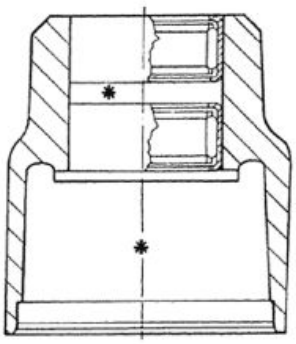
020037Y Punch

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

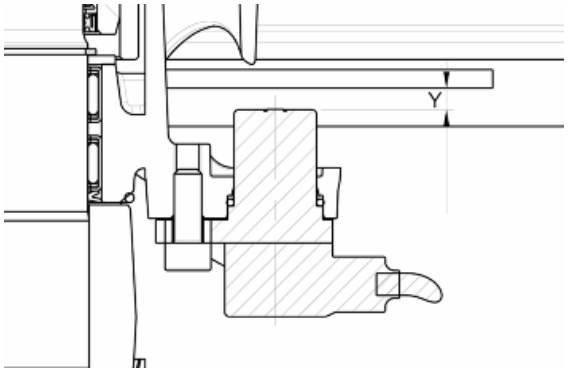
Recommended products

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

TL 9150 066, symbol NATO G 460

PAY PARTICULAR ATTENTION TO THE FITTING OF THE SPEED SENSOR; PROCEED AS FOLLOWS:

- Mount the sensor on its seat.
- Measure the distance «**Y**» between the brake disc and the sensor with a feeler gauge.
- Based on the measured distance, insert the calibration thickness number (from the spare parts catalogue) indicated in the table between sensor and support.



Characteristic

Calibration thickness

0.3 ± 0.03 mm

Locking torques (N*m)

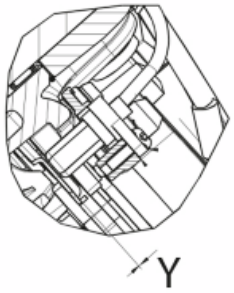
Speed sensor fastener screw **8 ÷ 10**

SPEED SENSOR MOUNTING

Distance (mm)	Calibration thickness number
Y = 4.7 - 5	1
Y = 4.4 - 4.6	2
Y = 4.3 - 4.1	3
Y = 4 - 3.8	4
Y = 3.7 - 3.5	5
Y = 3.4 - 3.2	6

ABS VERSION

Check the distance Y between the sensor and the tone wheel.



Characteristic

Sensor distance - tone wheel

Y > 0.8 mm

Steering bearing

Removal

- Use the specific tool both to remove the lower seat of the upper bearing and to remove the upper seat of the lower bearing fitted on the chassis.

N.B.

TO REMOVE THE LOWER SEAT OF THE LOWER STEERING BEARING JUST USE A SCREWDRIVER AS A LEVER BETWEEN THE SEATING AND THE SLEEVE.

Specific tooling

020004Y Punch to remove steering bearings from headstock

- Remove the fifth wheel fitting and the dust gaiter on the steering bearing as shown in figure, using the specific tool. Proceed giving a few taps with the mallet.

Specific tooling

020004Y Punch to remove steering bearings from headstock

- Refit the fifth wheel fitting and the dust gaiter on the steering bearing until they stop, using the specific tool.

Specific tooling

006029Y Punch for fitting steering bearing seat on steering tube

Rear

Removing the rear wheel

- Remove the bracket supporting the rear shock absorber and the muffler;
- Remove the rear wheel by unscrewing the 5 screws indicated in the photograph

Refitting the rear wheel

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

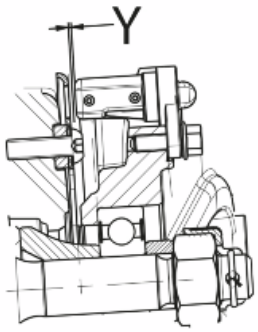
Locking torques (N*m)

Wheel fixing screws: 20 - 25

ABS VERSION

Check the distance Y between the sensor and the tone wheel.

If it results lower than indicated insert a 669282 washer between the sensor and the sensor support bracket.



Characteristic

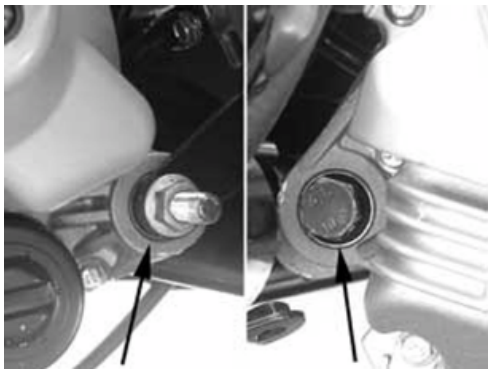
Sensor distance - tone wheel

Y > 0.4 mm

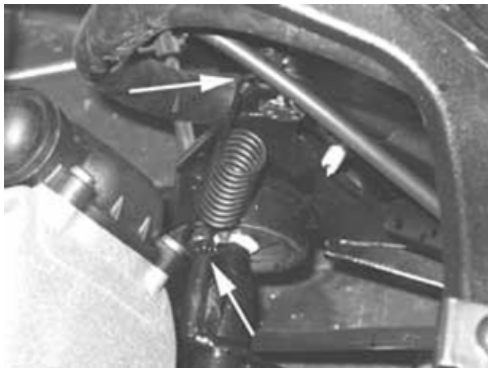
Swing-arm

Removal

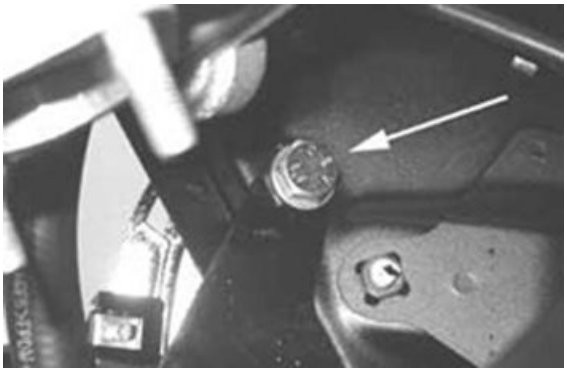
- Place the vehicle on its centre stand;
- Remove the engine housing
- Remove the swinging arm/engine fitting shown in the picture
- Move the engine back



- Remove the spring anchoring the swinging arm to the chassis as shown in the picture



- Remove the two screws fixing the buffer support bracket to the chassis



- Remove the left and right caps located under the footrest to reach the pin fixing the swinging arm to the body.
- Remove the pin. Then remove the swinging arm.

- Check the entire swinging arm assembly.
- Check all the centring bushing components and silent block rubber buffers.
- Replace the work components that cause excessive clearance on the rear suspension.

Overhaul

- Check there is no sticking in the movement of the connection of the swinging arm on the engine side to the swinging arm on the chassis side.
- Check the axial clearance between the two swinging arms using a feeler gauge

Characteristic

Standard clearance

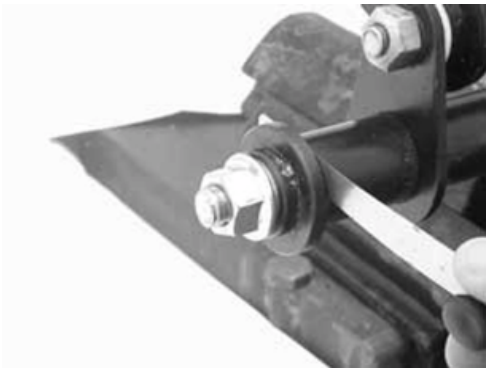
0.40 - 0.60 mm

Allowable limit after use:

1.5 mm

- In order to check the clearance of the swinging arm on the frame side, prepare a retainer using the fixing pin of the swinging arm on the frame and two rings from the special tool 020229Y. Alternatively, use two washers with 12-mm inside diameter for pins, minimum 30-mm outside diameter and 4-mm thick at least.

- Check there is no sticking in the rotation.
- Check the axial clearance of the swinging arm on the chassis side



Characteristic

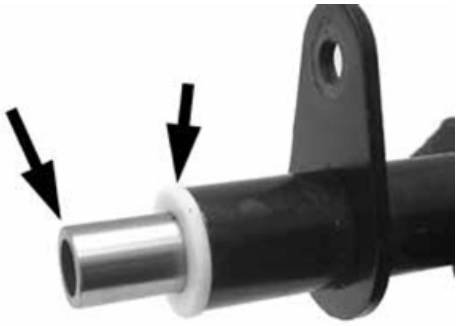
Standard clearance

0.40 - 0.60 mm

Allowable limit after use:

1.5 mm

- Separate the swinging arm on the engine side from the vehicle side arm.
- Remove the plastic bushings and the internal spacer shown in the picture.



- Using a suitable pin remove the roller casings as shown in the pictures

- Using an appropriate tool plant new roller casings, being careful to position the bearings with the seal rings facing outwards

Specific tooling

020244Y 15-mm diameter punch

020115Y Ø 18 punch

Characteristic

Length of the swinging arm tube on the engine side:

L 175.3 + 0.3 0

Length of the internal swinging arm spacer on the engine side:

L 183 + 0.3 0

Engine side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Chassis side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Length of the internal swinging arm spacer on the frame side:

290 ± 0.1 mm

Length of the swinging arm tube on the chassis side:

283 ± 0.1 mm

- Lubricate roller casings and the plastic bushings with grease
- Insert the spacers
- Assemble the two arms with the relative bolt in the position shown in the picture
- Adjust the bolt as shown in the picture
- Position the chassis side swinging arm with the most protruding part pointing towards the silent block side as shown in the picture

Recommended products

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

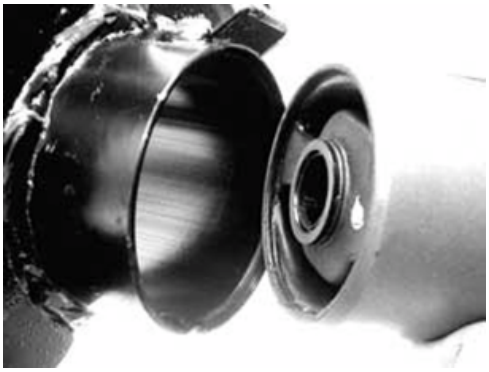
TL 9150 066, symbol NATO G 460

- Make sure the silent bloc is not broken. If it is, replace the coupling.
- Remove the Seeger ring shown in the picture

- Remove the full silent bloc bracket
- Undo the silent bloc ring shown in the picture

- Hold the full silent bloc bracket in the clamp
- Using the appropriate tool, remove the silent bloc from the bracket from the side corresponding to the inside of the vehicle. This is to guarantee the tool is centred properly on the support

- Install a new silent bloc, making sure it aligns properly with the reference tooth.
- Fit the silent blocs, making sure the chamfered part of the silent bloc matches the chamfered part of the bracket



- Using the appropriate tool, fit the silent bloc as shown in the picture

Refitting

- To refit, perform the removal operations in reverse.
- Grease the bearings and the rolling parts with the recommended grease.

-Complete the fitting by tightening the nuts on the relative bolts to the proper tightening torque.

Locking torques (N*m)

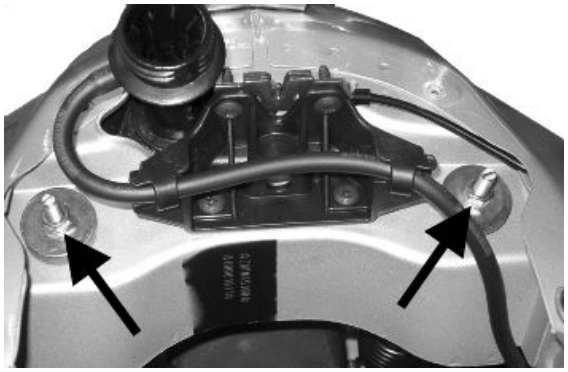
Engine- and vehicle-side swinging arm junction bolt 40 to 45 Swinging arm pin - Engine 64 ÷ 72 Body shell - Swinging arm pin 76 ÷ 83 Screw fixing the silent-block support plate to the body 42 ÷ 52

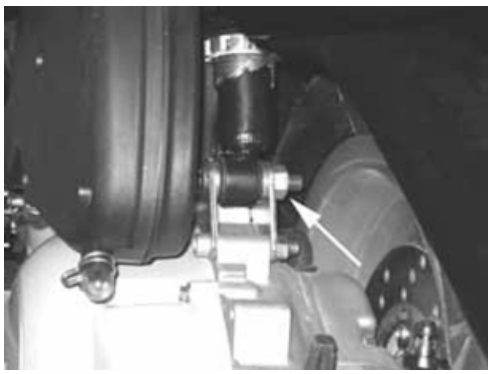
Shock absorbers

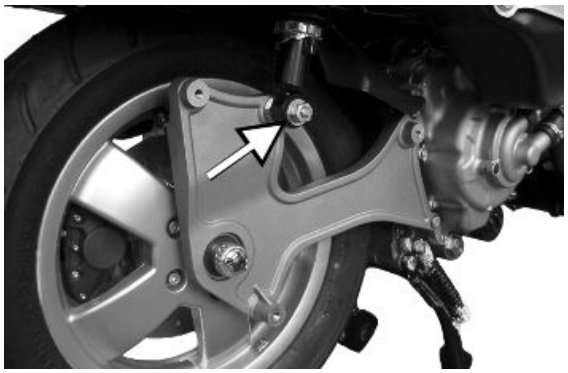
Removal

Proceed as follows:

- place the vehicle on its centre stand;
- remove the luggage rack
- lift the engine a little with a jack so as to free the two shock absorbers;
- remove the muffler assembly;
- undo the shock absorber spring assembly clamping screw from the support fixed to the engine on the one side and from that fixed to the silencer on the other;
- unscrew the two upper nuts (one on each side) fixing the shock absorber spring assembly to the frame and remove the shock absorbers.







Refitting

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

Locking torques (N*m)

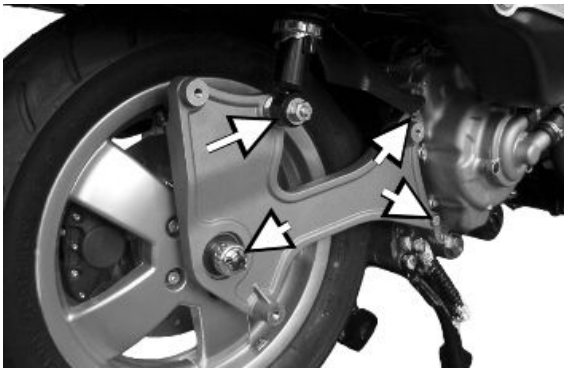
Shock absorber lower fitting 40 to 45 Upper shock absorber fixing screw 20 to 25 Nm

Exhaust bracket

Removal

Remove the complete silencer.

- Remove the two fixing screws of the bracket to the engine crankcase
- Remove the split pin, the cover and the fixing nut of the rear wheel axle and its spacer
- Remove the shock absorber lower clamp



Refitting

- The refitting procedure is in the reverse order of the removal operation being careful to respect the torques indicated and the spacer assembly layout as shown in the photo.

Locking torques (N*m)

Bracket fixing screws to the engine crankcase: 20 - 25 Shock absorber lower fitting 40 to 45 Wheel axle clamping 104 ÷ 126

Centre-stand

REMOVAL

- Use a jack to support the vehicle properly.
- Remove the two return springs from the centre stand.
- Undo the nut shown in the figure.
- Remove the pin from the right side.
- Remove the centre stand.

FITTING

- On refitting tighten the nut to the specified torque.

Locking torques (N*m)

Centre stand bolt 32 - 40

Side stand

REMOVAL

- Uncouple the centre stand return spring;

Remove the screw shown in the photograph

FITTING

To refit, carry out the removal operations in reverse order and comply with the specified torque.

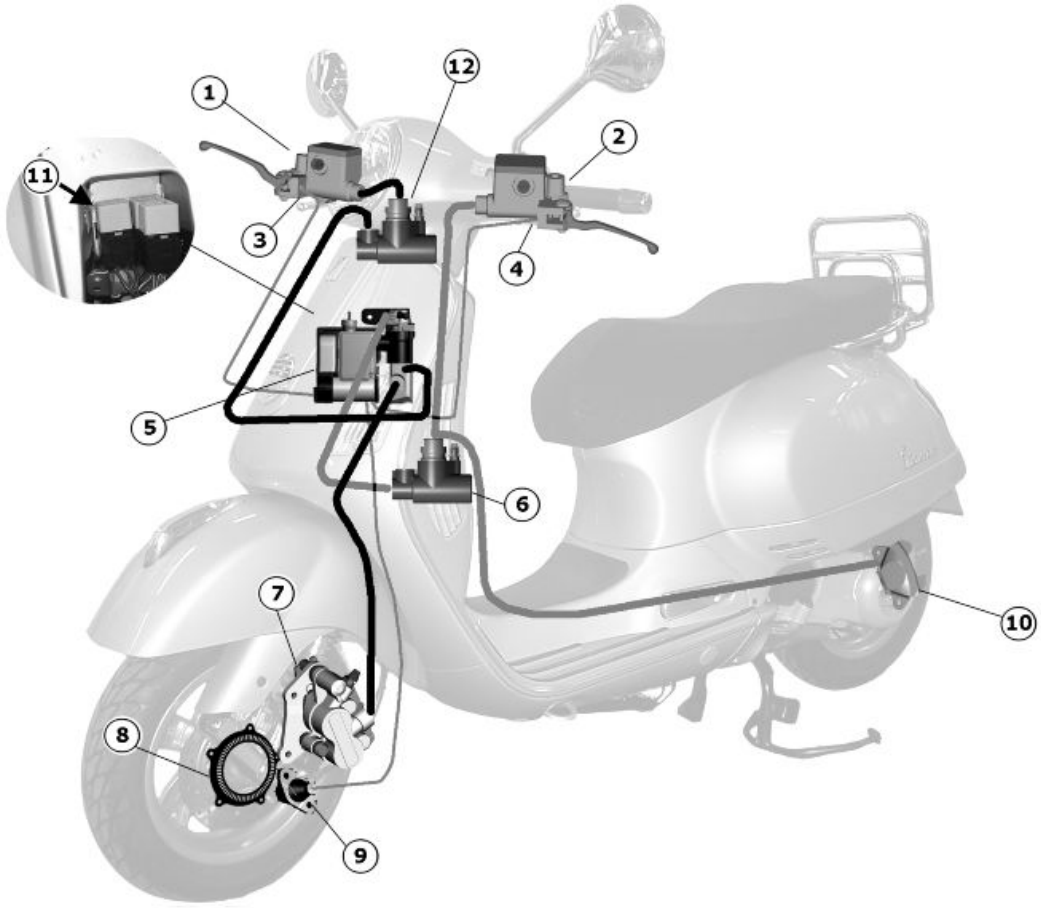
Locking torques (N*m)

Side stand fixing bolt **35 - 40**

INDEX OF TOPICS

This section is dedicated to the description of the brake system components.

ABS



COMPONENT LAYOUT

Specification	Desc./Quantity
Front brake pump	
Rear brake pump - integral	
Front brake stop light switch	
Rear brake stop light switch - integral	
Modulator	
Delay valve	Causes a delay of the front brake activation when operating the left control lever
Front brake calliper	
Tone wheel	
Speed sensor	
Rear brake calliper	
ABS relay	
Compensator	

CAUTION

When removing the front wheel, for example in the event of changing the tyre, pay attention not to damage the tone wheel.
Visually check the integrity of the tone wheel and perform a test ride, carrying out the complete check of the ABS system before delivering the vehicle to the customer.
The damage of the tone wheel leads to a continuous functioning of the modulator pump, even with the brake lever deactivated.

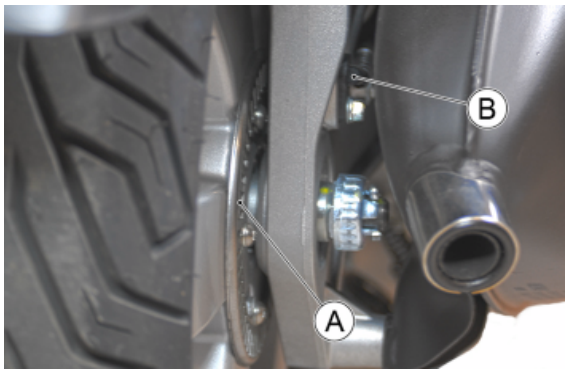
CAUTION

AT EACH REMOVAL AND REFITTING OF THE FRONT WHEEL, CHECK THE DISTANCE BETWEEN SPEED SENSOR AND TONE WHEEL, WHICH MUST BE BETWEEN 0.5 mm AND 1.5 mm. IF NECESSARY ADJUST IT BY ADDING OR TAKING OFF CALIBRATED WASHERS OF 0.5 mm THE ABS SYSTEM CHECK STARTS EVERY TIME TURNING THE KEY TO "ON" AND CAN BE REPEATED, ESPECIALLY AT HARSH CLIMATES, AFTER STARTING, AS IT IS DUE TO NORMAL BATTERY VOLTAGE LOWERING CAUSED BY THE STARTER.

The vehicle is equipped with a locking ABS system on the wheels.

A: Tone wheel

B: Speed sensor



- ABS: It is a hydraulic - electronic device that limits the pressure within the braking circuit when a sensor, located on the wheel, detects its tendency to lock. This system prevents the wheels from locking to avoid the risk of falling.

In case of failure of the ABS system, immediately reported to the rider with ABS warning light on the instrument panel, the vehicle retains the characteristics of a conventional braking system. In case of ABS warning light, reduce speed and go to an Authorised Service Centre for the appropriate checks.. The safety provided by the ABS does not, in any case, justify risky manoeuvres. The stopping distance may be greater, compared to a conventional vehicle equipped with traditional braking in the following conditions:

- Riding on rough roads, with gravel or snow
- Riding on roads with holes or bumps

It is therefore recommended to reduce speed in these conditions.

AT VERY LOW SPEEDS (LESS THAN 3 MPH) THE ABS SYSTEM IS DISABLED.
IT IS RECOMMENDED TO PAY ATTENTION THEREFORE IN CASES OF BRAKING IN LOW GRIP CONDITIONS AT LOW SPEED (FOR EXAMPLE BRAKING ON GARAGE FLOOR TILES AFTER HAVING RIDDEN ON WET ROADS OR SIMILAR SITUATIONS)

N.B.

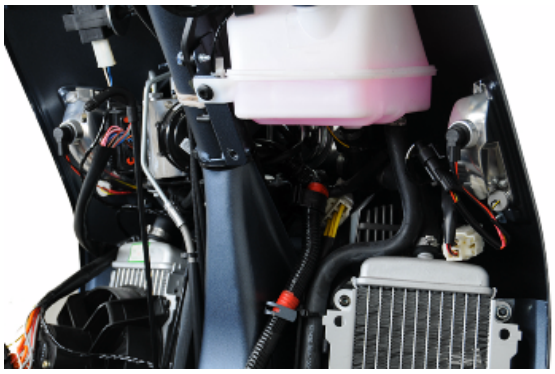
THE ABS WARNING LIGHT TURNS ON AND STAYS ON UNTIL REACHING 3 MPH.

CAUTION

IN THE EVENT OF MALFUNCTION OF THE BATTERY, THE ABS - ASR SYSTEM TURNS OFF.

Modulator

To access the ABS system modulator remove the leg shield back plate.



ASR

System ASR

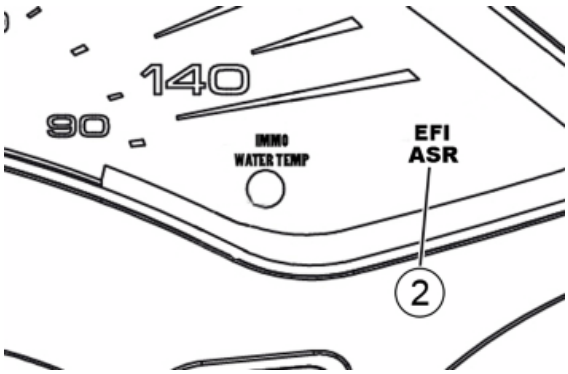
ASR SYSTEM

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 the vehicle.

WARNING

THE ASR SYSTEM IS BASED ON THE RECOGNITION OF SPEED DIFFERENCES BETWEEN FRONT AND REAR WHEEL. IN ORDER FOR THE SYSTEM TO MAINTAIN 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.

- BUTTON «1» (with the engine running): on / off.
- «2» EFI/ASR WARNING LIGHTIndication light ASR and EFI operation (engine malfunction).



N.B.

THE WARNING LIGHT PERFORMS AN INITIAL CHECK WITH KEY ON; AFTERWARDS OPERATE AS DESCRIBED BELOW.

N.B.

THE ENGINE MALFUNCTION (EFI) HAS PRIORITY TO THE ASR FUNCTION.

WARNING

UNDER NORMAL OPERATION (ASR INSERTED), THE ENGINE MALFUNCTION WARNING LIGHT IS OFF.

Flashing mode:

- Frequency of 5 flashes per second (5 Hz), with vehicle running: the system is up and running (conditions of low grip and intervention to reduce engine power); we recommend the utmost caution because the grip limit has been exceeded; restore the vehicle safety conditions by gently reducing the throttle opening.

- Frequency of 2 flashes per second (2 Hz), with vehicle running: the system is in calibration phase; for the correct procedure refer to the following.

- Lit with moving vehicle: the system is disabled and will not intervene in case of loss of grip.

If the deactivation was voluntary (by pressing the appropriate button **«1»** for 1 second with the engine running) it is recommended to reactivate the system as soon as possible.

To ensure maximum safety of the vehicle it is advisable to keep the system active. Deactivation may be necessary only in case of starting with very low grip surfaces (mud, snow) on which the operation of the ASR could actually prevent the movement of the vehicle.

WARNING

THE ASR SYSTEM IS ACTIVATED AT EVERY «ON» POSITIONING OF THE IGNITION SWITCH. IF DISABLED BY THE USER, THE ASR SYSTEM KEEPS THE STATE OF INACTIVITY ONLY IF THE VEHICLE IS OFF, BY USING THE ENGINE STOP SWITCH; AT THE NEXT KEY ON THE ASR SYSTEM IS ENABLED AUTOMATICALLY.

CAUTION

IT IS EMPHASISED THAT THE RIDING AUXILIARY SYSTEM CAN NOT CHANGE THE PHYSICAL LIMITS OF GRIP AND IS NOT A SUBSTITUTE FOR PROPER MANAGEMENT OF POWER, BOTH ON STRAIGHT STRETCHES AND IN TURNS. THEREFORE, IT IS RECOMMENDED TO ALWAYS USE THE VEHICLE WITH THE UTMOST CARE AND IN ACCORDANCE WITH THE REGULATIONS IN FORCE.

CAUTION

AT LOW SPEED (LESS THAN 5 KM/H), THE ASR SYSTEM DOES NOT WORK.
IT IS RECOMMENDED TO PAY PARTICULAR ATTENTION IN THE EVENT OF ACCELERATION FROM STANDSTILL IN CONDITIONS OF LOW GRIP, ESPECIALLY IN THE FIRST METRES.

N.B.

IN CASE OF ROADS FULL OF HOLES THERE MAY OCCUR BRIEF ACTIVATION OF THE ASR SYSTEM. THIS OCCURS UNDER NORMAL OPERATING CONDITIONS OF THE VEHICLE.

N.B.

THE DEVICE PREVENTS IMPRESSING ON THE REAR HIGH SPEED ROTATION WHEEL WITH THE VEHICLE ON THE CENTRE STAND. IT IS RECOMMENDED NOT TO INSIST WITH THE THROTTLE GRIP IN THIS PARTICULAR CONDITION.

CAUTION

A POOR STATE OF MAINTENANCE OF THE TYRES CAN RESULT IN ABNORMAL OPERATION OF THE ASR SYSTEM.
IN CASE OF REPEATED INTERVENTIONS OF THE ASR, EVEN ON ROAD SURFACES WITH GOOD GRIP OR SMALL THROTTLE OPENINGS, IT IS NECESSARY TO CHECK FOR WEAR AND/ OR THE STATE OF INFLATION OF TYRES FIRST. IF THE PROBLEM PERSISTS, CONTACT AN AUTHORISED SERVICE CENTRE.

CAUTION

IN THE EVENT OF MALFUNCTION OF THE BATTERY, THE ABS - ASR SYSTEM TURNS OFF.

ASR SYSTEM CALIBRATION PROCEDURE.

In order to maintain the effectiveness of the ASR system following the replacement of one or both tyres a calibration procedure of the system must be performed as follows on a straight flat stretch of road. Please note that the request for activation of the procedure (steps 1 to 4) must be completed within 60 sec from ignition on the engine.

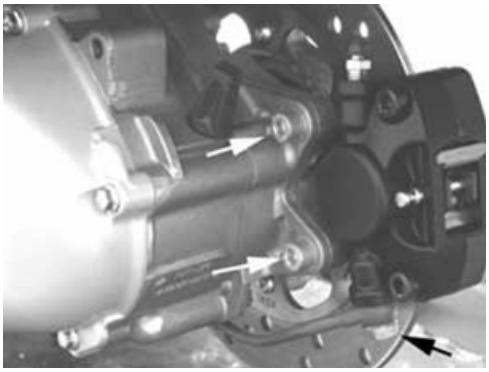
• It is necessary that the diagnostic phase of the ASR systems and ABS is complete: for this purpose, after the key ON, ride a short distance above 5 km/h and wait for the flashing of the ABS warning light and EFI/ASR to stop.

• Turn the ASR system off by pressing the button «**1**» on the handlebar and check that the ASR disabling warning light «**2**» is on.
• Allow the engine to idle 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 activation of the procedure will be confirmed by turning on the EFI/ASR «**2**» warning light with a frequency of 2 flashes per second (2 Hz).
• Accelerate to a constant speed of 30 to 40 km/h and maintain it for at least 7 to 8 seconds.
• The end of the procedure will be indicated by the flashing EFI/ASR warning light «**2**».
• Once the procedure is complete it is necessary to turn off the vehicle panel (key off) and wait 30 seconds before turning the panel on (key on).
• In case of failure to complete the procedure within 2 minutes the EFI/ASR warning light «**2**» will stay on steady and the ASR will remain off until the panel is turned off (key off).
• To restart the ASR it is necessary to turn on vehicle panel (key on).
It is however necessary to repeat the process until it succeeds.

Rear brake calliper

Removal

- Remove the rear wheel.
- Remove the brake pad retention pin snap ring.
- Using a pin partially remove the brake pad retention pin.
- Remove the screws fixing the brake calliper to the crankcase then remove the brake calliper complete with pipe.
- Complete the extraction of the pad retention pin, the spring and the pads.



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 steps but in reverse order and tighten to the prescribed torque.

Locking torques (N*m)

Calliper fixing screw 24 ÷ 27

If the calliper is replaced:

CAUTION

ONCE REFITTING IS FINISHED, BLEED THE SYSTEM.

CAUTION

ALWAYS USE NEW COPPER WASHERS.

Locking torques (N*m)

Screw fixing the oil connection to the calliper 19 ÷ 24

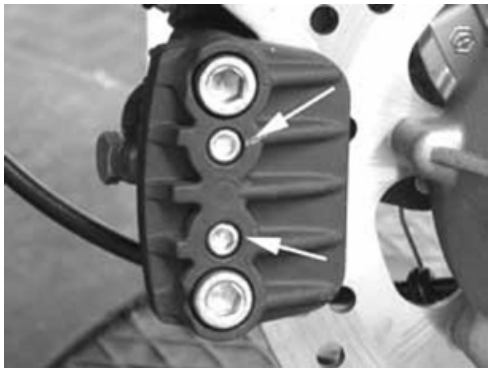
Front brake calliper

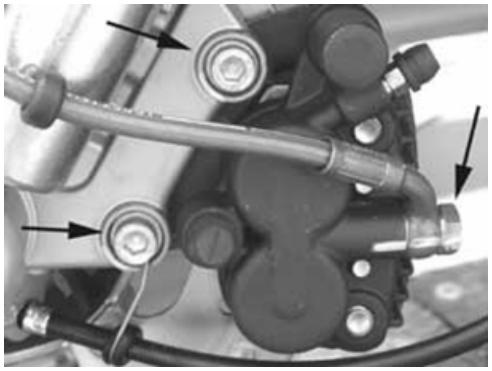
Removal

- Remove the front wheel
- Pre-loosen the two fixing pins of the brake pads
- Remove the two front brake calliper devices fastening them to the support as shown in the photograph.

N.B.

WHEN A PROCEDURE IS PLANNED INCLUDING THE SERVICE OR REPLACEMENT OF THE CALLIPER, FIRST LOOSEN THE FITTING CONNECTING THE PIPE TO THE BRAKE CALLIPER





Refitting

Insert the following on the front brake body:

-The sealing rings and the pistons (1).

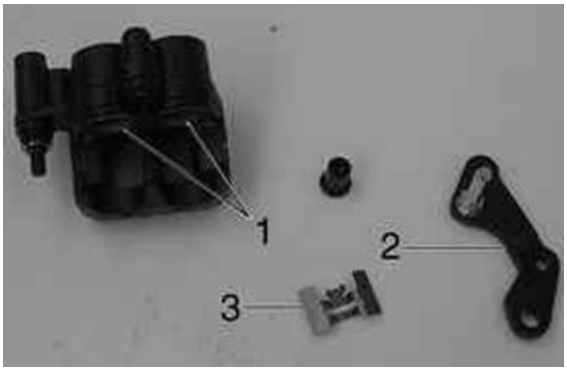
-Refit the plate (2).

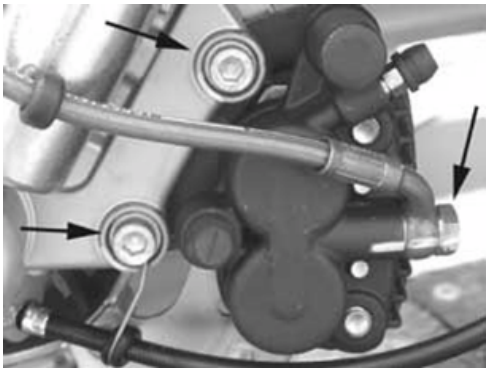
- Arrange the pad holding clamp (3).

-Refit the pads and bleed air.

-Place the calliper on the disk and lock it to the support by tightening the bolts at the prescribed torque.

-Lock the pipe joint to the calliper at the prescribed torque.





CAUTION

ALWAYS USE NEW COPPER WASHERS.

Locking torques (N*m)

Screws fixing the front calliper to the support: 24 ÷ 27 Screw fixing the oil connection to the calliper 19 ÷ 24

Rear brake disc

Removal

- Remove the rear brake calliper.

- Remove the brake disc and the hub from the wheel axle

- To remove the brake disc from the hub, hold the unit firmly with a vice and operate on the 5 fixing screws indicated in the photograph

Refitting

- To reassemble the brake disc on the hub, carry out the removal operations in the reverse order arranging the brake disc on the hub on the side opposite the wheel keying

- Follow the direction of rotation shown by the arrow and tighten to the prescribed torque.

- Fit the hub unit

- disc in the wheel axle

Locking torques (N*m)

Disk to the hub 11 - 13

Disc Inspection

- Remove the rear brake calliper.
- Check the disc thickness with a micrometer

Characteristic

Standard thickness:

3.5 mm

- Repeat the measurement at no fewer than six points on the disc.
- Check the regular nature of the rotation of the brake disc assembly using the appropriate tool fixed onto the brake calliper as shown in the photo.
- In order to be able to anchor the appropriate tool properly use a metal plate with M8 threaded hole and fix it to one of the two rear brake calliper attachment points.
- Suitably fix the flange to the wheel axle with the original nut and spacer and a Æ 17 mm bearing.

N.B.

SO AS NOT TO GET A DISTORTED READING, CAUSE THE DRIVEN PULLEY SHAFT TO TURN IN ORDER TO ROTATE THE DISC.

Specific tooling

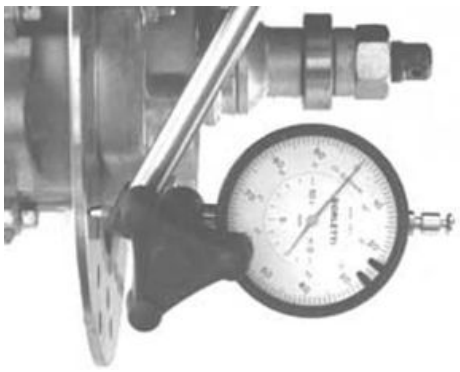
020335Y Dial gauge magnetic support

Characteristic

Max. deviation allowed:

0.1 mm

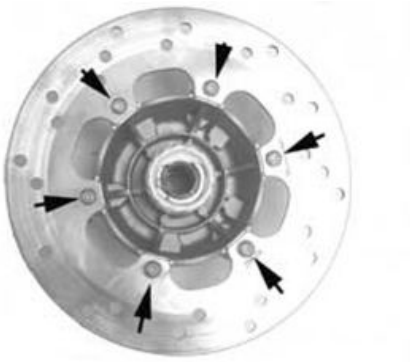
- If you detect incorrect values, replace the disc. If the anomaly persists, replace the hub.



Front brake disc

Removal

- Remove the front wheel
- Remove the front brake calliper
- Remove the hub and the disc operating on the wheel axle nut
- Hold the hub and the disc firmly and remove the brake disc undoing the six screws indicated in the photograph

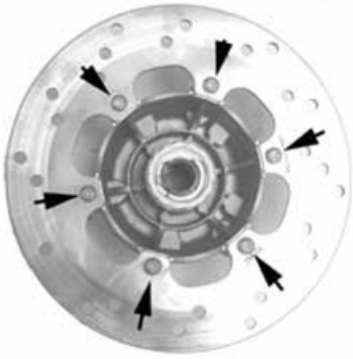


Refitting

- Carry out the operations in the reverse order from the removal being careful to respect the direction of disc rotation shown by the arrow printed on it
- Tighten the six screws to the specified torque.

Locking torques (N*m)

Brake disc screws **8 ÷ 10**



Disc Inspection

- Remove the front wheel
- Use a micrometer to check the disc thickness as shown in the photograph
- Repeat the measurement in at least 6 points on the disk
- Remove the front brake calliper
- In order to secure the appropriate tool adequately use a metal plate with M8 threaded hole and fix it to one of the two front brake calliper attachment points
- Place the dial gauge on the disk outer edge
- Make the wheel hub turn and check the disk deviation

Specific tooling

020335Y Dial gauge magnetic support

Characteristic

Standard thickness:

3.5 mm

Max. deviation allowed:

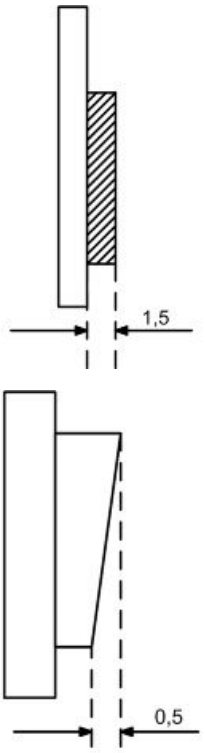
0.1 mm

Front brake pads

Removal

- Remove the front wheel
- Pre-loosen the two fixing pins of the brake pads
- Remove the brake calliper
- Remove permanently the two pad fixing screws
- Check that there are no flaws or warping. If there is, replace it.
- Check the thickness of the friction material is more than 1.5 mm. If it is not, replace it
- The replacement must be made with greater residual thickness if the brake pad has not worn

evenly. A 0.5 mm thickness difference in the residual friction material is permitted



Refitting

To fit, proceed as follows:

- Insert the two pads in the callipers.
- Screw the two pad lock pins to the correct torque, and apply the recommended product.
- Fit the calliper on its support, tightening the two screws to the specified torque.

N.B.

IF IT IS NOT POSSIBLE TO CORRECTLY POSITION THE CALLIPER ON THE DISC DURING FITTING, GENTLY EXPAND THE PADS.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

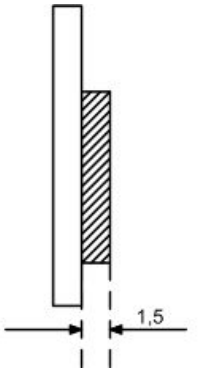
Screw tightening calliper to support 24 - 27 Pad fastening pin 19.6 - 24.5

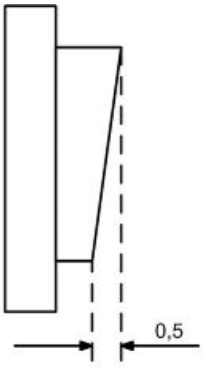
Rear brake pads

Removal

- Remove the rear brake calliper.
- Remove the snap ring, slide off the pad retention pin and the clip.

- Remove the brake pads and check there are no faults or warping. Otherwise, replace them.
- Check the thickness of the friction material is more than 1.5 mm. If it is not, replace it
- The replacement must be made with greater residual thickness if the brake 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 as in the photo.

- Insert the lock on the bolt and then the protection cover

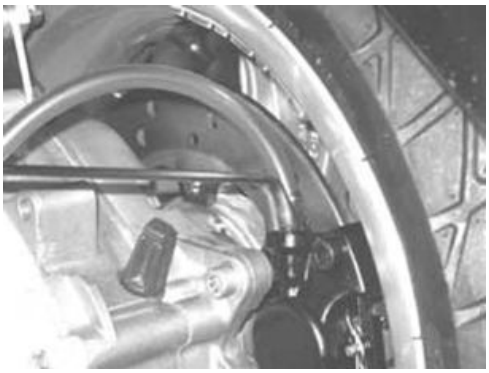
N.B.

FAILURE TO RESPECT THE PAD POSITIONING REQUIREMENTS WITH RESPECT TO THE DIRECTION OF ROTATION COULD COMPROMISE PROPER BRAKE FUNCTIONING AND NOISELESSNESS.

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 left-had brake lever, load the system and bring it up to the required pressure.
- Keeping the left-hand brake lever pulled, loosen the bleed screw to permit the air in the system to escape. 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

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 Vacuum pump Mity-Vac

Locking torques (N*m)

System bleed calliper fitting: 12 to 16 Nm

Brake fluid level check

- Position the vehicle on a flat surface and on the centre stand
- Remove the brake pump cover as indicated in the photo

- Use the appropriate spyglass on the pump to check the level of the brake fluid, as shown in the photograph

- If the level is below the minimum, fill up by acting on the two screws shown in the figure.
- Remove the gasket and fill with recommended brake fluid until the spyglass is completely covered.

CAUTION

MAKE SURE THE BRAKE FLUID DOES NOT GET INTO YOUR EYES OR ON YOUR SKIN OR CLOTHES. IF THIS HAPPENS ACCIDENTALLY, WASH WITH WATER.

CAUTION

THE BRAKING CIRCUIT FLUID IS HIGHLY CORROSIVE. THEREFORE, WHEN TOPPING UP, AVOID LETTING IT COME INTO CONTACT WITH THE PAINTED PARTS OF THE VEHICLE. THE BRAKING CIRCUIT FLUID IS HYGROSCOPIC, THAT IS, IT ABSORBS HUMIDITY FROM THE SURROUNDING AIR. IF THE HUMIDITY IN THE BRAKING FLUID EXCEEDS A CERTAIN VALUE, IT WILL LEAD TO INEFFICIENT BRAKING.

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 liquid in open or partially used containers.

Under standard climatic conditions, replace coolant as indicated in the scheduled maintenance table.

For refitting purposes carry out the removal operations but in reverse order and respect the tightening torques of the tank cover screws.

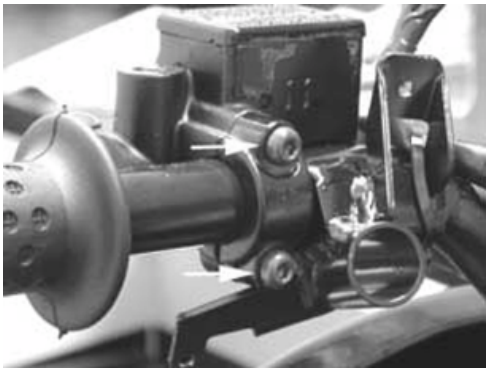
Locking torques (N*m)

Brake pump reservoir screws 1.5 ÷ 2

Front brake pump

Removal

- Remove the rear handlebar cover.
- Remove the two screws fixing the brake pump to the handlebar indicated in the photograph
- Remove the oil pipe joint from the pump
- Remove the connector to the stop light switch



Overhaul

Proceed as follows:

1) Remove the brake lever by loosening the retaining screw; open the cover (2) and take out the diaphragm (3);

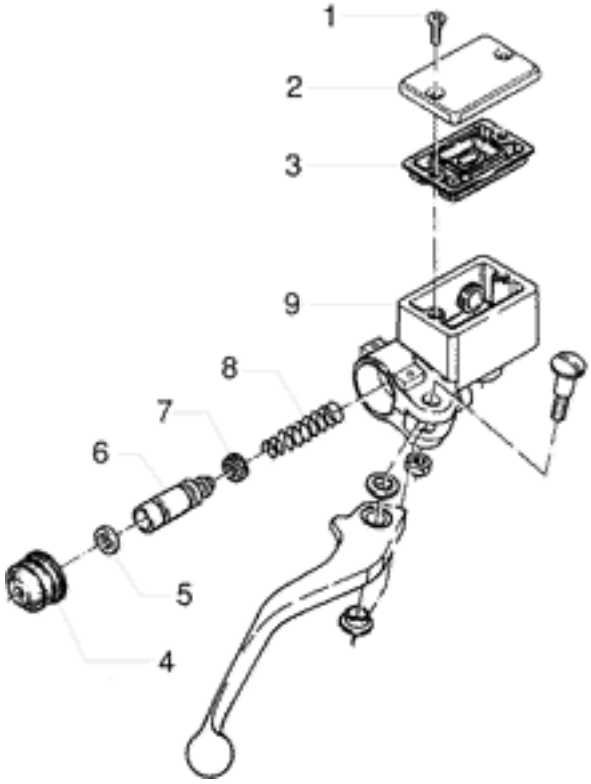
2) remove the cap (4) and take out the internal parts in order;

3) Check that:

- The pump body shows no signs of internal damage or corrosion;
- The plunger shows no sign of damage or abnormal wear;
- The piston return spring is in good condition.

CAUTION

ALL THE SEALS AND GASKETS MUST BE REPLACED EVERY TIME THE PUMP IS SERVICED.



1. Reservoir cap screw
2. Reservoir cap.
3. Diaphragm.
4. Bellows.
5. Sealing ring
6. Piston.
7. Gasket.
8. Spring.
9. Tank

Refitting

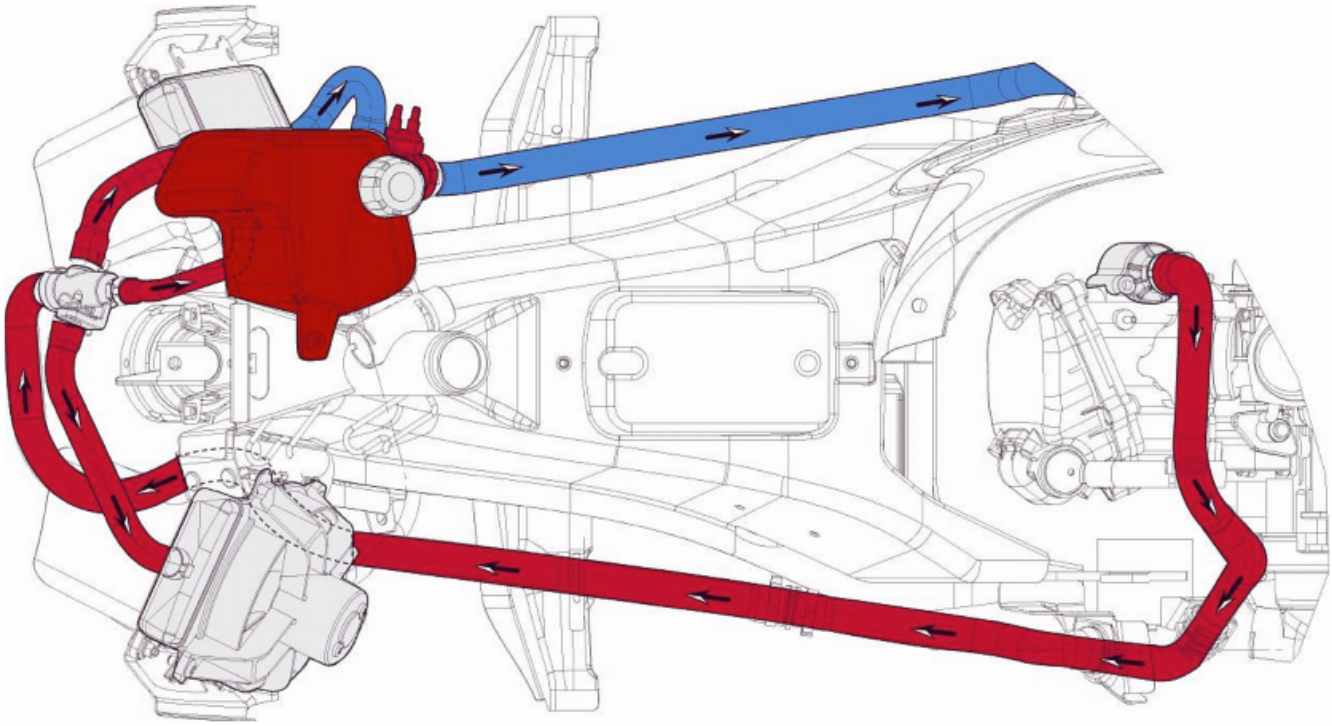
For refitting, follow the operations in reverse order observing the tightening torque.

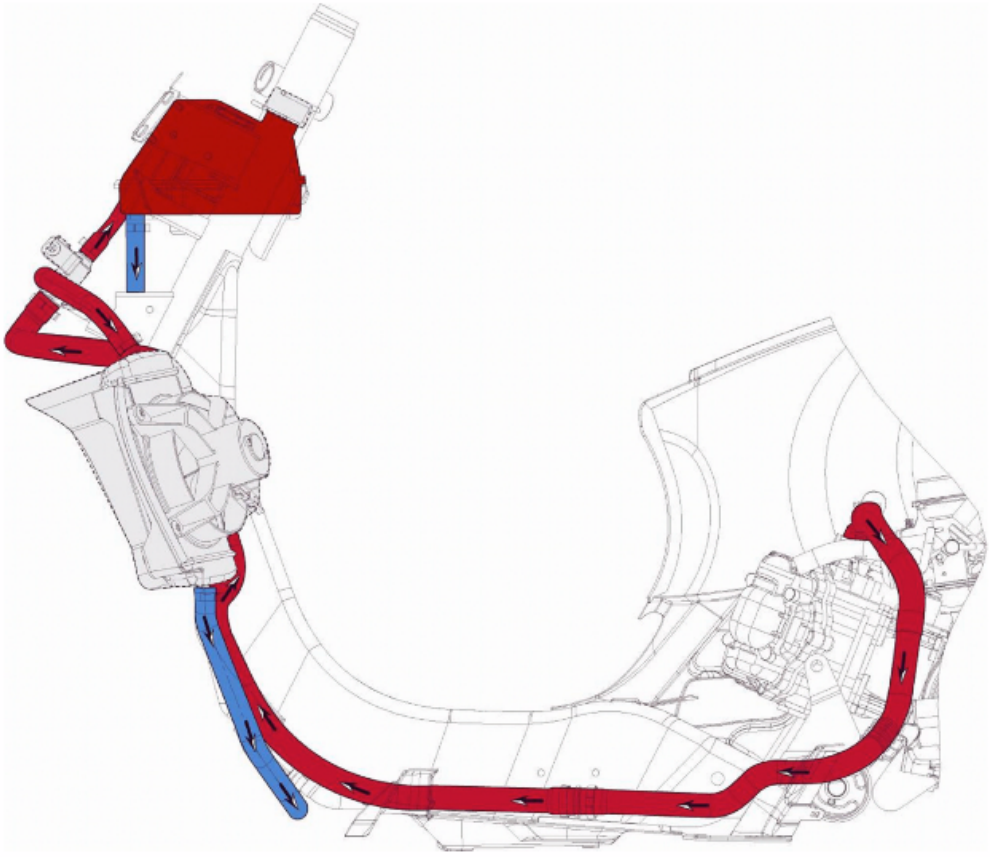
Locking torques (N*m)

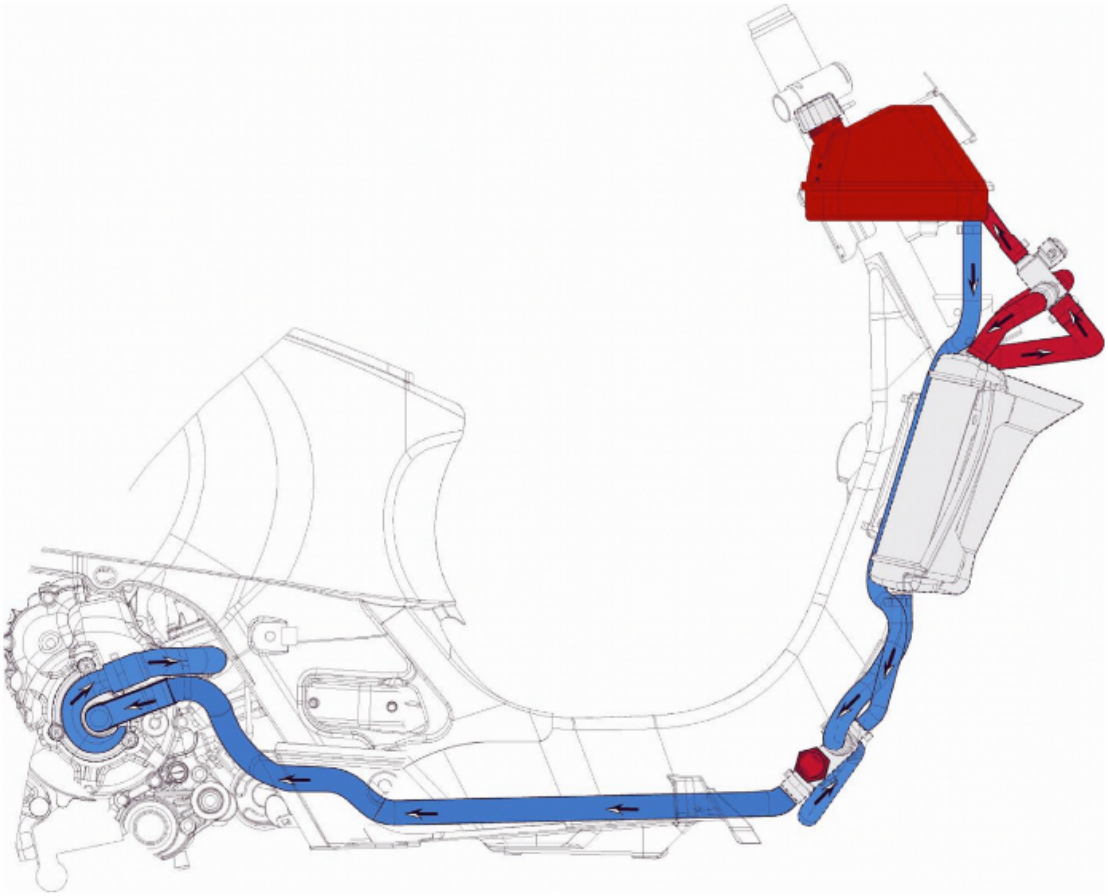
Oil pipe joint to the pump: 20 - 25 Brake pump fixing screws to the handlebar: 7 to 10 Nm

INDEX OF TOPICS

Circuit diagram







System bleed

- Start up the engine until the operating temperature is reached.
- Remove the rubber hood over the bleed valve
- Obtain a rubber tube that is of the right length to connect the valve to the expansion tank
- Place one end of the pipe on the bleed valve and the other in the expansion tank
- Loosen the screw by **two** turns until the communication hole is revealed with the head as shown in the picture
- Wait until only coolant comes out of the rubber pipe so as to eliminate any air bubbles inside the circuit.
- Tighten the bleed valve respecting the maximum torque.

- Bring the coolant up to the correct level inside the expansion tank

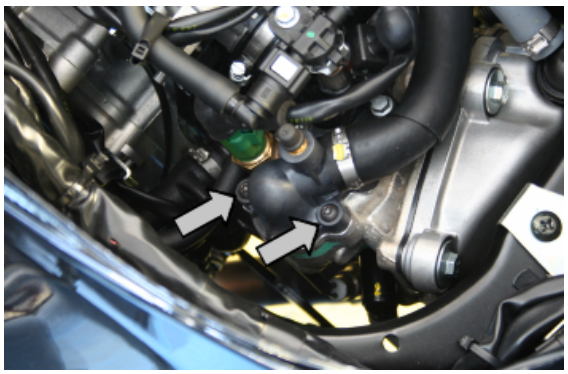
Locking torques (N*m)

Bleed screw 3

Thermostat

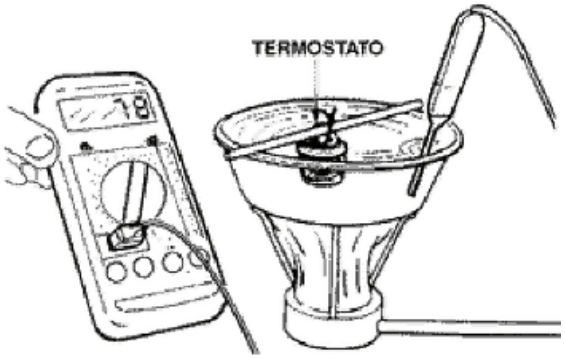
Removal

- Remove the helmet compartment.
- Place a + 2.0 l container under the vehicle to collect the coolant.
- Undo the two screws indicated, lift the cover and remove the thermostat.



Check

1) Visually inspect that the thermostat is not damaged.
2) Fill a metal container with approx. 1 litre of water.
Immerse the thermostat, and keep it in the centre of the container.
Immerse the multimeter temperature probe, and keep it close to the thermostat.
Heat up the container using the thermal gun.



Check the temperature at which the thermostat starts to open:

Heat up until the thermostat is completely open.

3) Replace the thermostat if it is not working properly.

CAUTION

TO EXECUTE THE TEST CORRECTLY, MAKE SURE NEITHER THE THERMOSTAT NOR THE THERMOMETER TOUCHES THE CONTAINER.

Specific tooling

020331Y Digital multimeter

020151Y Air heater

THERMOSTAT

Specification	Desc./Quantity
Type	Wax-type, with deviator
Starts opening at	85±2°C

Refitting

- Follow the removal steps but in reverse order; be careful to tighten screws to the prescribed torque.

Locking torques (N*m)

Thermostat cover screws 3 - 4

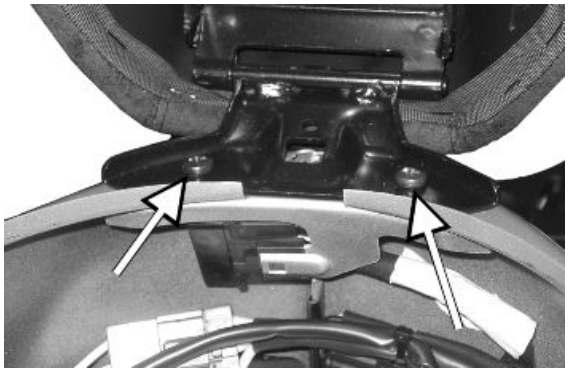
- Once the cooling circuit is restored, refill using the recommended product and purge the circuit as expressly indicated in the «Cooling System» chapter.

INDEX OF TOPICS

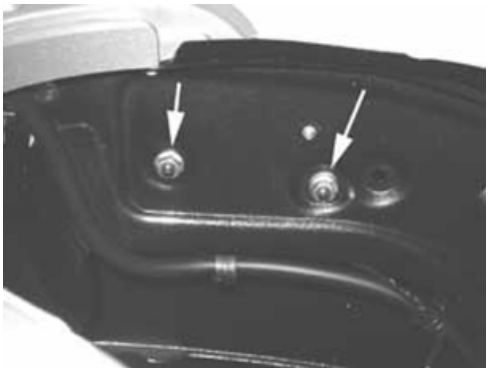
This section è is dedicated to the operations that can be carried out on the vehicle's bodywork.

Seat

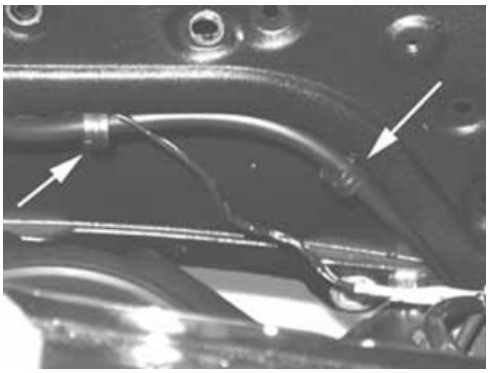
- Remove the helmet compartment
- Remove the two screws shown in the photograph
- Remove the saddle



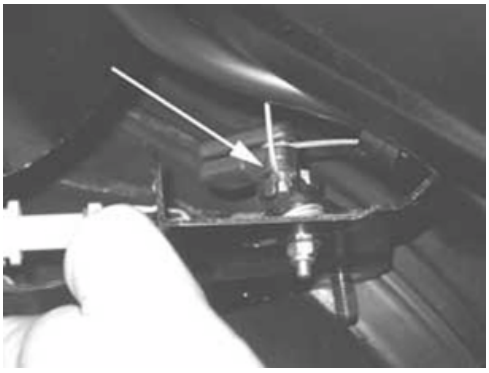
- Remove the helmet compartment
- Remove the 2 nuts indicated in the photograph



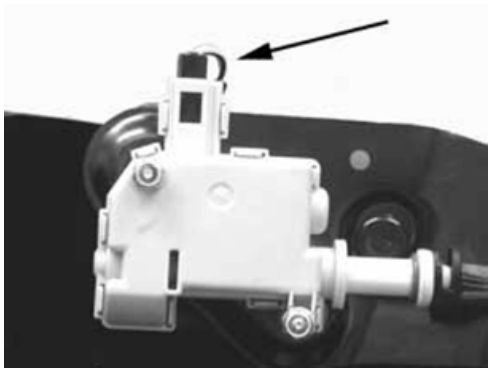
- Free the electric cables form the retaining clamps indicated in the photograph



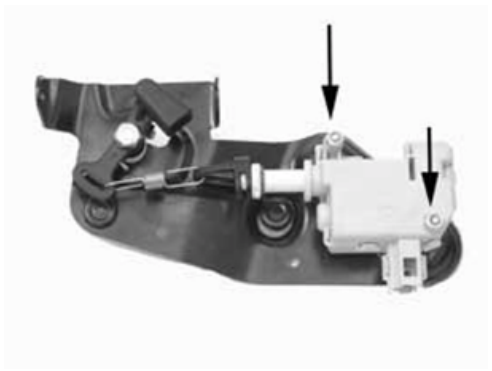
- Remove the saddle opening transmission cable
- Remove the saddle manual opening transmission cable.



- Remove the electric connector from the saddle opening actuator

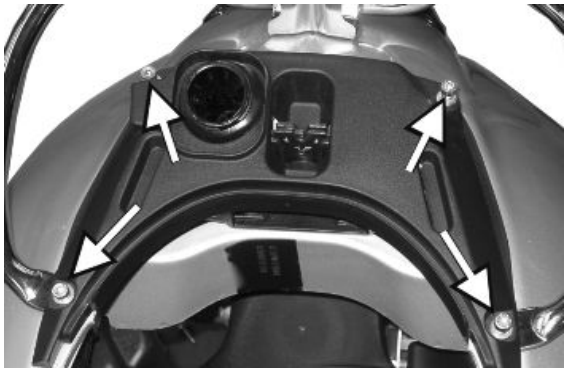


- Remove the two screws shown in the photograph
- Remove the clip from the transmission
- Remove the actuator from the supporting bracket

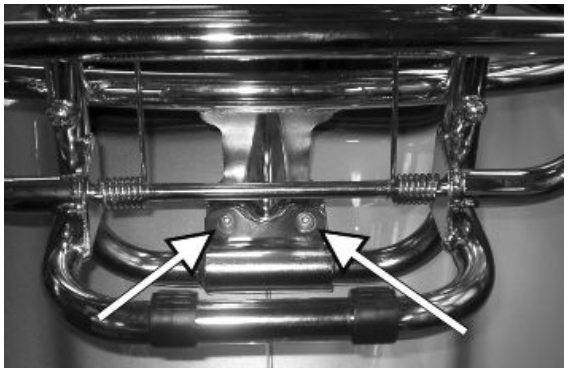


Rear rack

- Remove the helmet compartment
- Remove the 4 screws indicated in the figure



- Remove the two screws, indicated in the figure, that fix the luggage rack to the body



Rear handlebar cover

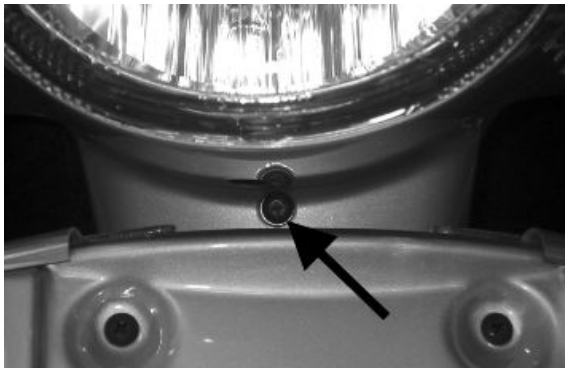
- Remove the front handlebar cover
- Undo the 5 screws indicated in the photograph
-Disconnect the odometer cable
-After disconnecting the wiring remove the rear handlebar.

Instrument panel

- Remove the rear handlebar cover;
- Remove the four screws indicated in the figure
- Remove the instrument panel.

Front handlebar cover

- Remove the rear-view mirrors.
- Remove the front central cover.
- Remove the front screw indicated in the figure.



-Undo the 2 screws indicated in the figure;

- Remove the front handlebar cover

- Disconnect the front headlamp connectors

Headlight assy.

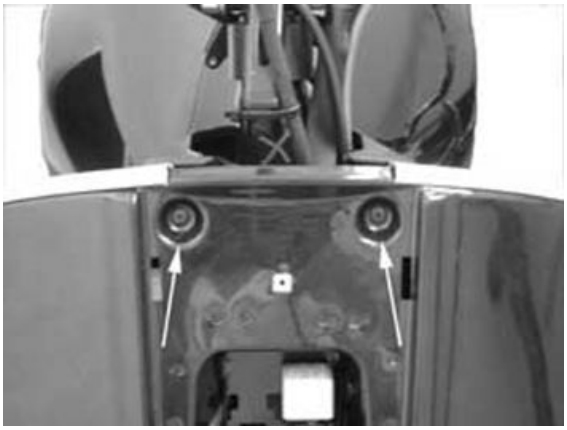
- Remove the front handlebar cover.

- Undo the four screws indicated.

- Operate the screw indicated in the figure to remove the front turn indicator

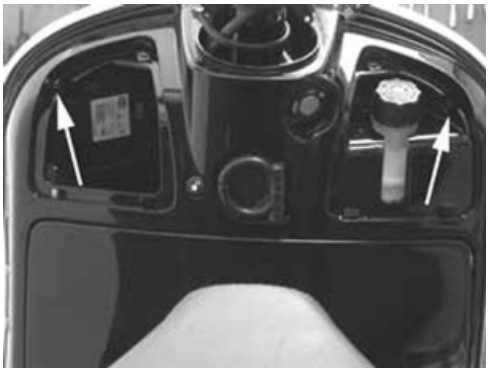
Knee-guard

- Remove the rear handlebar cover.
- Remove the two screws indicated in the photograph and located on the shield under the grille

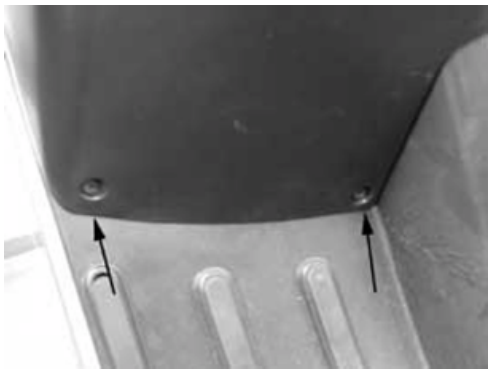


- Remove the expansion tank cover and then its cap
- Remove the central screw inside the glove-box, indicated in the photograph

- Remove the two screws indicated in the photograph and located below the expansion tank cover and the left cover respectively



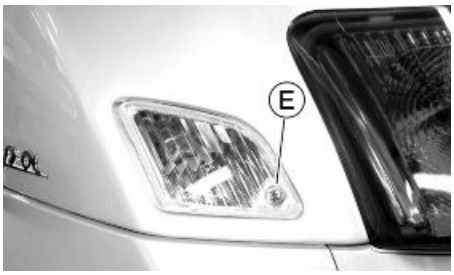
- Remove the shield back plate lower screws, to the right and left side of the shield back plate, as indicated in the photograph



- Remove the electric saddle opening switch, the fuse box and the manual saddle opening cable as shown in the photograph

Taillight assy.

- Operate the screw indicated in the figure to remove the rear turn indicator



Remove screw «**A**» to remove the rear headlight assembly.

Access to taillight bulbs, stop light bulb and license plate bulb.

To reassemble, repeat the operation but in reverse order.

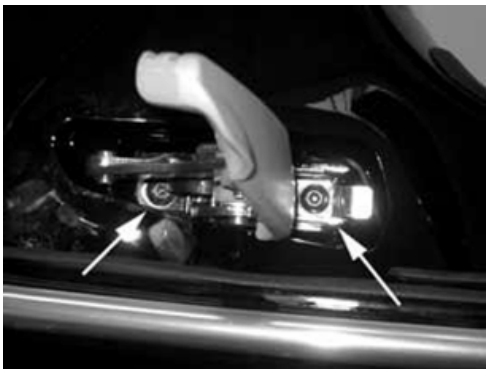
N.B.

IF MISTING IS NOTICED ON THE INSIDE OF THE HEADLAMP GLASS, THIS DOES NOT INDICATE A FAULT AND IS ATTRIBUTABLE TO HUMIDITY AND/OR TO LOW TEMPERATURES.
THE PHENOMENON SHOULD QUICKLY DISAPPEAR WHEN THE LIGHT IS SWITCHED ON.
THE PRESENCE OF DROPS OF WATER, ON THE OTHER HAND, COULD INDICATE THAT WATER IS INFILTRATING. CONTACT THE AFTER-SALES SERVICE NETWORK.

Footrest

- Remove the shield back plate
- Remove the battery compartment cover
- Remove the side fairings
- Remove the central screw located under the battery compartment cover as indicated in the figure

- Remove the passenger footrests undoing the two screws indicated in the figure



- Remove the right and left screws fixing the footrest indicated in the figure

- Remove the right and left lower covers as shown in the figure

- Remove the screws under the non-slip rubber mat of the footrest as indicated in the photograph

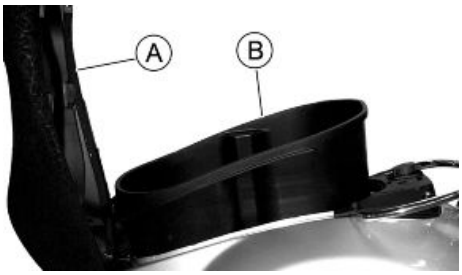
Side fairings

Unscrew the fixing screw "A"

Unscrew the nut "B" under the body.

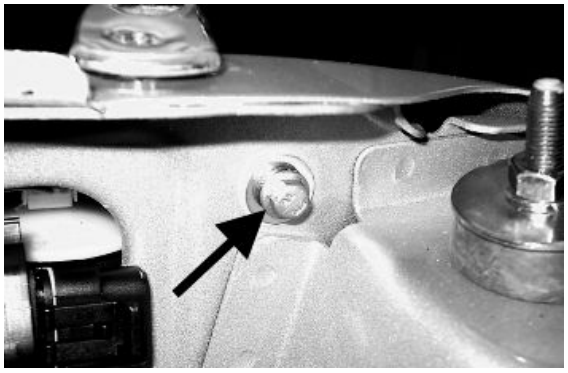
Helmet bay

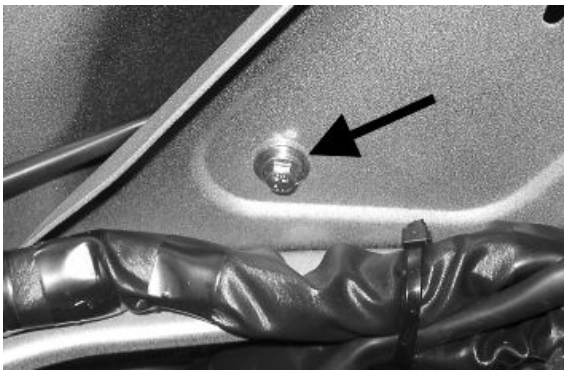
- Lift the saddle and remove the helmet compartment



Fuel tank

- Remove the helmet compartment
- Remove the side fairings
- Remove the luggage rack
- Remove the shock absorber upper clamps
- Remove the two screws, indicated in the figure, that fix the tank to the body

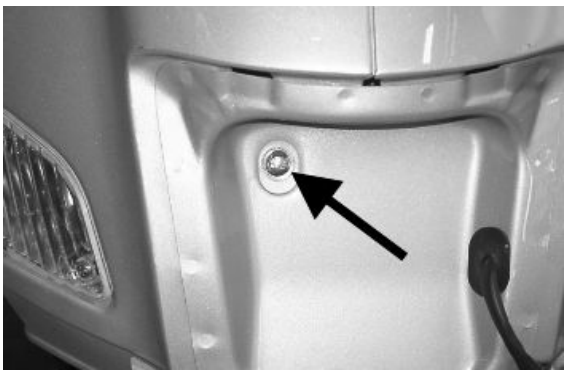




- Remove the screw indicated in the figure that fixes the tank to the body after removing the rear headlight assembly

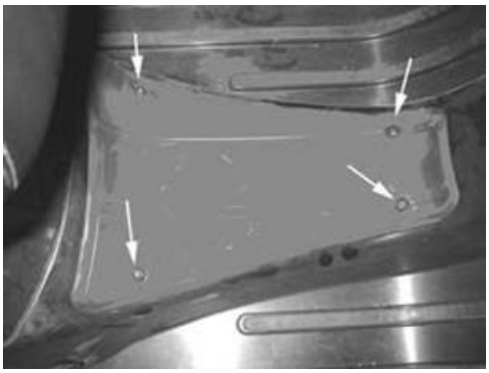
- Remove the two turn indicators
- Use a jack to lift the body so that there is enough space between the vehicle rear side and the engine to slide off the tank

To refit, perform the steps in the reverse direction to disassembly



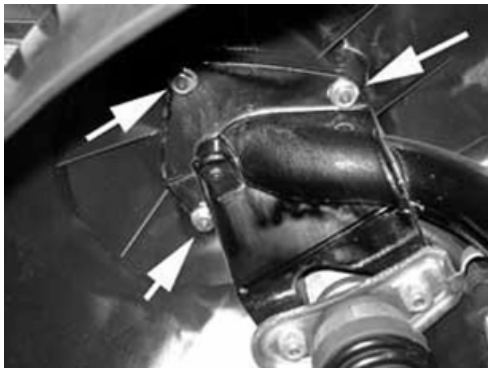
Rear central cover

- Remove the four screws indicated in the figure



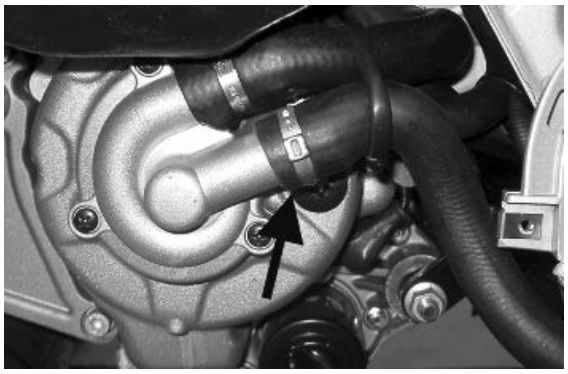
Front mudguard

- First remove the steering tube and uncouple the front brake pipes from the calliper in order to remove the front mudguard
- Remove the three mudguard-steering tube clamps indicated in the figure

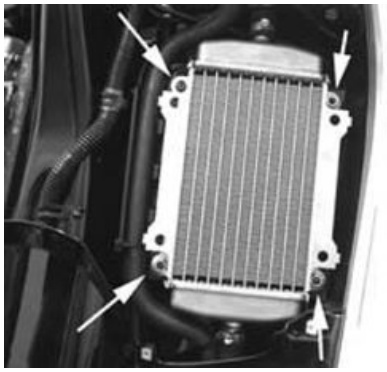


Radiator fan

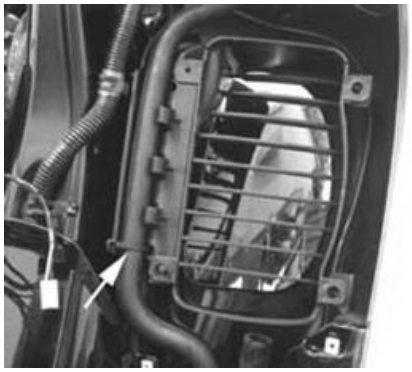
- In order to carry out any operation on the radiator unit, flow out the coolant in the coolant delivery pipe in the pump, indicated in the photograph.



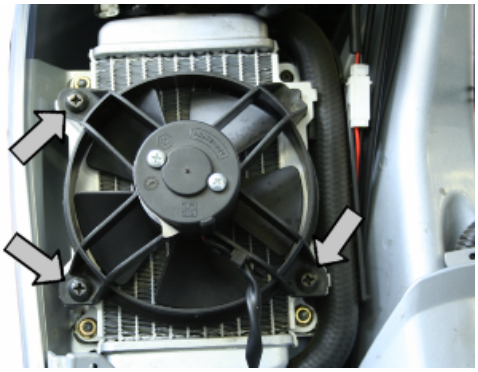
- Remove the shield back plate;
- Remove the coolant feed and return hoses from the right radiator;
- Unscrew the 4 screws fixing the radiator to the body;
- Detach the radiator



- Detach the pipe from the plastic duct by removing the plastic clip shown in the photograph. Then remove the duct.



- The same procedure also applies to the left radiator for which it is necessary to remove the electric fan first by undoing the three screws indicated in the photograph and afterwards disconnect the connector.



To refit, perform the removal operations but in reverse order being careful when positioning the news clips for the fluid hoses and when filling the cooling system.

Front central cover

- Remove the "PIAGGIO" clip-on badge
- Unscrew the screw indicated in the figure
- Remove the grille

INDEX OF TOPICS

Carry out the listed checks before delivering the motorcycle.

Warning - Handle fuel with care.

Aesthetic inspection

Appearance check:

- Paintwork
- Fitting of Plastic Parts
- Scratches
- Dirt

Tightening torques inspection

Lock check

- Safety locks
- Fixing screws

Safety locks

Rear shock absorber upper fixing
Rear shock absorber lower fixing
Lower front shock absorber fitting
Front wheel axle nut
Front wheel screws
Rear wheel screws
Front and rear wheel hub nut
Front and rear brake calliper clamping screws
Frame - swinging arm bolt *
Swinging arm bolt - Engine
Engine arm pin - Frame arm
Handlebar lock nut
Steering lower ring nut
Upper steering ring nut

Electrical system

• Main switch

• Lights: high-beam lights, low-beam lights, taillights (front and rear) and relevant warning lights

- Headlight adjustment according to the regulations currently in force

• Front and rear stop light buttons and relative light •Turn indicators and relative telltales

• Instrument lighting

• instruments: fuel and temperature indicator

•Instrument panel lights

• Horn

• Electrical start up

• Engine stopping with emergency stop switch

• electric saddle opening button

CAUTION

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS BATTERY LIFE.

CAUTION

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

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING.
IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.
IF ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THAT RECOMMENDED. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

Levels check

Level check:

- Hydraulic brake system liquid level.
- Rear hub oil level
- Engine coolant level
- Engine oil level

Road test

Test ride:

- Cold start
- Instrument panel operation
- Response to throttle control
- Stability when accelerating and braking
- Front and rear brake efficiency
- Front and rear suspension efficiency
- Abnormal noise

Static test

Static control after the test ride:

• Hot engine restart

• Minimum seal (turning the handlebar)

• Uniform steering rotation

• Possible losses

• electric radiator fan operation

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES AS TYRES MAY BURST.

Functional inspection

Functional Checks:

• Hydraulic braking system: lever travel

• Clutch: proper functioning check

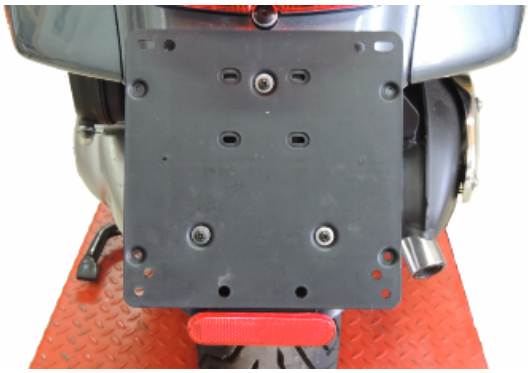
• Engine: proper general functioning and no abnormal noise check

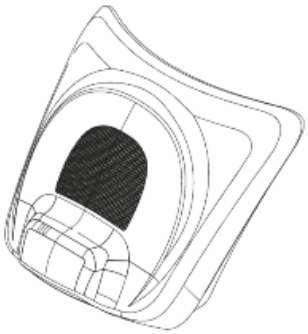
• Other: papers check, chassis and engine number check, tools and equipment, licence plate fitting, lock check, tyre pressure check, rear-view mirror and any accessory fitting

Specific operations for the vehicle

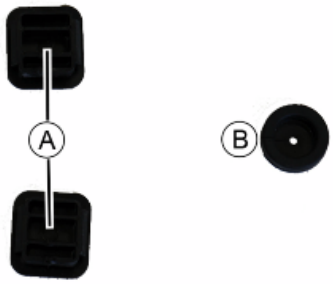
N.B.

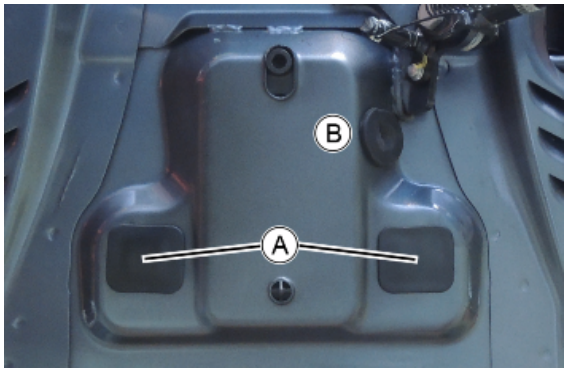
Install the rear retro-reflector up to the indicated frame, below the number plate located in the provided package:
VESPA GTS 300:
ZAPM4520000086963
VESPA GTS 300 ABS:
ZAPM4520200003098
From the next frame on, this is not necessary as the vehicle is equipped with a light with integrated retro-reflector.





Install the underbody caps as shown in the figure.





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