PIAGGIO

WORKSHOP MANUAL

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BV 500 USA

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PIAGGIO & C. S.p.A. - After Sales Service
www.piaggio.com
V.le R. Piaggio, 23 - 56025 PONTEDERA (Pi)

WORKSHOP MANUAL
BV 500 USA

This workshop manual has been drawn up by Piaggio & C. Spa to be used by the workshops of Piaggio-Gilera dealers. This manual is addressed to Piaggio service mechanics who are supposed to have a basic knowledge of mechanics principles and of vehicle fixing techniques and procedures. Any important changes made to the vehicles or to specific fixing operations will be promptly reported by updates to this manual. Nevertheless, no fixing work can be satisfactory if the necessary equipment and tools are unavailable. It is therefore advisable to read the sections of this manual relating to specific tools, along with the specific tool catalogue.

N.B. Provides key information to make the procedure easier to understand and carry out.

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

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

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

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

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

INDEX OF TOPICS

INDEX OF TOPICS

This section describes the general characteristics of the vehicle.

Rules

This section provides the main information for the vehicle overhaul.

Safety rules

- Should it be necessary to keep the engine running while servicing, make sure that the area or room is well ventilated, and use special exhaust fans, if required. Never let the engine running in closed rooms. In fact, exhaust gases are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, cloths and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or clothes, rinse thoroughly with water and consult a doctor immediately.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks and flames when close to the battery, especially during recharge.
- Fuel is highly flammable, and in some conditions it can be explosive. Do not smoke in the working area, and avoid free flames or sparks.
- Clean the brake pads in a well ventilated environment, directing the compressed air jet so as to not intake the dust produced by the wear of the friction material. Even though the latter contains no asbestos, dust inhalation is harmful.

Safety 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 specific tools designed for this vehicle.
- Always use new gaskets, sealing rings and split pins upon reassembly.
- After removal, clean the components using non-flammable or low fire-point solvent. Lubricate all working surfaces before reassembly, except for conical couplings.
- After reassembly, check that all components have been installed properly and that they are in good working order.
- For removal, overhaul and reassembly operations use only tools provided with metric measures. Metric bolts, nuts and screws are not interchangeable with coupling members with English measurement. Using improper coupling members and tools may impair the vehicle.
- Should any interventions to the vehicle electric system be required, check that the elec-

trical connections - especially earth and battery connections - have been implemented properly.

Vehicle identification

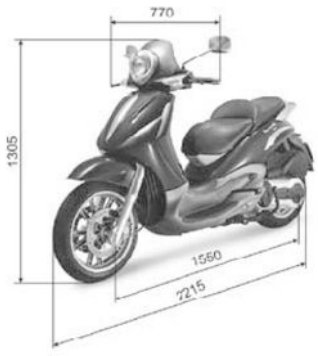
Chassis prefix: ZAPM34100

Engine prefix: M341M

Dimensions and mass

WEIGHT

Specification	Desc./Quantity
Total weight when load-less in running	193 Kg
Width (at the handles)	770 mm
Length	2215 mm
Wheel base	1550 mm
Height	1305 mm



Engine

ENGINE

Specification	Desc./Quantity
Engine	Four-stroke mono-cylinder

Specification	Desc./Quantity
Bore	92 mm
Stroke	69 mm
Cubic capacity	460 cm³
Compression ratio	10.5 : 1
Timing system	Single head camshaft with integrated rpm-rev sensor, control from flywheel side chain, 4 valves and automatic start-up valve lifting device.
Valves play: intake:	0,15 mm (cold).
Valves play: exhaust	0,15 mm (cold).
Valve play adjustment	by threaded adjuster on the rockers
Engine idle	1450 ± 50 g/min.
Air filter	sponge, impregnated with mixture (50% fuel and 50% oil)
CO % value (measured on the manifold intake)	1 ÷ 1,5 %
Start-up system	Electric starter system with free wheel.
Lubrication	By trochoidal pump (inside the crankcase), pressure adjustment by-pass and oil filter.
Lubrication pressure	4 bar
Minimum allowed (at 100° C)	0,8 bar
Power supply	Electronic ignition with electric fuel pump, throttle body Ø 38 mm and single injector.
Max power (shaft)	29 KW (39 CV) at 7250 rpm
Max torque (shaft)	40 N·m (4Kgm) at 5500 rpm
Cooling system	liquid, by engine-motored pump, 3-way thermostat and electric fan.

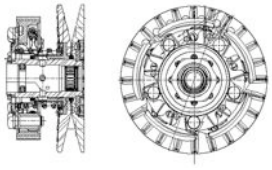
Transmission

TRASMISSION

Specification	Desc./Quantity
Trasmission	With automatic expandable pulley variator, trapezoidal belt, automatic clutch, gear reducer and transmission compartment with forced circulation.

Clutch

This is to inform you that in order to improve the overall performance of the clutch, starting from



engine no. M341M 33318, a new 5-roller centrifuge clutch, dwg. no. 842559, has been introduced.

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil (empty)	1.7 lt. (empty)
Engine oil (change)	1.5 lt. (at oil filter change)
Fuel tank	~13,2 litres (including reserve ~ 3 l)
Rear hub	~ 250 cc.
Cooling system fluid	~1,7 liter
Front fork	~ 195 ± 3 cc in each fork leg

Electrical system

ELECTRIC SYSTEM

Specification	Desc./Quantity
Ignition type	Inductive, high efficiency, integrated with injection, variable advance and separate HV coil.
Spark plug	NGK CR7EKB
Spark plug	CHAMPION RG6YC
Battery	Dry charge lead battery 12V-12Ah
Fuses	1 to 30A - 2 to 15A - 2 to 10A - 3 to 7,5A - 1 to 5A-1 to 3A
Generator	In three-phase alternating current

Frame and suspensions

CHASSIS AND SUSPENSIONS

Specification	Desc./Quantity
Frame	Welded steel pipes with pressed sheet metal stiffening
Front suspension	Hydraulic telescopic fork with Ø41 mm stems
Front fork max stroke	104 mm
Rear suspension	Engine based on oscillating fork pivoted to the chassis by 1-freedom degree oscillating arm. Pair of dual effect hydraulic shock absorbers and

Specification	Desc./Quantity
	coaxial springs with 4-position preload adjustment
Max. rear shock absorber travel	95,5 mm

Brakes

BRAKES

Specification	Desc./Quantity
Front right	Disc brake, 260 mm diameter, with hydraulic command activated from the handlebar by right-hand lever.
Integral	Disc brake, 260 mm front diameter (vehicle LH side) and 240 mm rear diameter, with hydraulic command located on the handlebar LH lever. The front disc is interlocked with a pressure distribution valve.

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Light alloy rims (Front rim)	16"x3"
Light alloy rims (rear rim)	14"x4,50"
Tyres (front)	Pirelli 110/70 - 16" - GTS 23 M/C - 52 S - TUBELESS
Tyres (rear)	Pirelli 150/70 14" - GTS 24 M/C - 66 S - TUBELESS
Tyre pressure (when cold) front:	2,2 bar
Tyre pressure (when cold) rear:	2,2 bar (2.3 bar with passenger)

N.B.

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

IT IS NECESSARY TO ADOPT EXCLUSIVELY «S» CLASS TYRES, WHICH GUARANTEE THE CHARACTERISTICS REQUIRED FOR THE SPEED THAT MAY BE REACHED BY THE VEHICLE. USING ANY OTHER TYRE MAY RESULT IN INSTABILITY. IT IS RECOMMEDED TO USE THE TYRES SELECTED BY PIAGGIO.

Tightening Torques

CHASSIS

Name	Torque in Nm
Motor pump locking ring nut	20
Chassis cross-member lower screws	16 ?
Chassis front cross-member upper screws	6 ?

BRAKING SYSTEM

Name	Torque in Nm
Brake caliper coupling	20 ÷ 24
Brake disc fastening screw	11 ÷ 13
Rear brake disc set screw	11 ÷ 13
Front brake caliper fixing on fork	20 ÷ 25
Tube union / brake caliper:	20 ÷ 25
System bleed pliers union	12 ÷ 16

FRONT SUSPENSION

Name	Torque in Nm
Side stand nut	45 ÷ 50
Lower ring nut settling torque	20 ÷ 25 *
Fork stem fixing to the plate	20 ÷ 25
Steering lower ring nut	10 ÷ 13 **
Steering wheel upper ring nut:	36 ÷ 39
Stem upper cap	35 ÷ 55
Screw securing handlebar to steering tube	45 ÷ 50
Pumping fastening screw	25 ÷ 35
Safety screw on leg	6 ÷ 7
Wheel fastening screws	33 ÷ 37

** tighten and loosen thoroughly. ** tighten and loosen by 90°*

REAR SUSPENSION

Name	Torque in Nm
Counter-nut:	40÷50 Nm
Oscillating arm pin nut for fixing to chassis	66÷73
Central stand fixing	25 ÷ 30
Rear shock absorber upper fixings	33÷41
Silencer heat-guard fixing	6 - 8

Name	Torque in Nm
Rear shock absorber upper fastening	33 ÷ 41
Oscillating arm fixing to the engine on silencer-side	66÷70
Oscillating arm fixing to the engine on transmis-sion-side	100 - 120
Side stand fixing	15 ÷ 20
Shock absorber bracket fixing to the case	20÷25
Rear shock absorber bracket fixing to the silencer support arm	20 - 25
Tie rod fixing	33 - 41
Bolt securing swing-arm to engine	14 - 17
Rear wheel axle	104 ÷ 126

ENGINE UNIT

Name	Torque in Nm
Starter motor fastening screws	11 - 13

THERMAL UNIT AND TIMING SYSTEM

Name	Torque in Nm
Spark plug	12÷14 Nm
Head fastening columns:	***
Head fixing nuts	10 - 12
Exhaust / intake head fastening nuts:	10 - 12
Head lubrication control jet	5 - 7
Cooling fluid temperature sensor	10 ÷ 12
Balance weight mass fastening screw	7 - 8.5
Tightening sliding block fastening screw:	10 - 14
Stroke revolution sensor fastening screws:	3 - 4
Injector fixing screw	3 - 4
Phase revolution sensor fastening screw	3 ÷ 4
Valve lifting device mass stop bell fastening screws:	30 - 35
Intake manifold fastening screws	11 - 13
Tappet cover fastening screws:	7 - 9
Throttle body set screws	11 - 13
Camshaft retaining bracket fastening screws	4 - 6
Head fastening screws:	10 - 12

**** Apply a preliminary torque of 7 N·m in a crossed sequence. - Tighten by 90° in a crossed sequence. - Tighten again by 90° in a crossed sequence.*

CRANKCASE AND DRIVING SHAFT

Name	Torque in Nm
Nut securing countershaft	25 - 29
Oil filter:	12 - 16
Engine oil drain plug	24 ÷ 30 N•m
Engine crankcase coupling screws	11 ÷ 13
Oil pump screw tightening torque	5 ÷ 6 Nm
Gear fixing on driving shaft screws:	10 -12
Closing plate fastening screws:	8 - 10

FINAL REDUCTION

Name	Torque in Nm
Hub cover screws	24 ÷ 27

TRANSMISSION COVER

Name	Torque in Nm
Driven pulley nut:	92 - 100
Driven pulley shaft nut:	160 - 175
Anti-flapping roller screw	16,7 ÷ 19,6
M8 set screws for transmission cover	23 ÷ 26
M6 set screws	11 ÷ 13
Anti-flapping roller fastening screw	17 - 19
Clutch ring nut:	65 - 75
viti convogliatore aria	7 9 N m
Water pump cover screws	3 ÷ 4
Outside transmission cover screws:	7 ÷ 9
Flywheel cover screws	11 ÷ 13

FLYWHEEL COVER

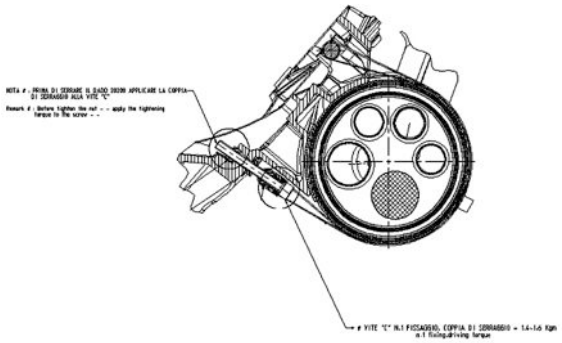
Name	Torque in Nm
Flywheel lock nut:	115 - 125
Stator fastening screws:	8 - 10
Blow-by recovery duct fastening screws:	3 - 4
Free wheel fixing screws on the flywheel	13 - 15
Wiring guide bracket fastening screws:	3 - 4

LUBRICATION

Name	Torque in Nm
Oil pump cover screws	0,7 ÷ 0,9
Screws fixing the oil pump to the crankcase	5 ÷ 6

TECHNICAL UPDATES

This is to inform you that the tightening torque for screws with dwg. no. 842502 has been increased from 8-10 Nm to 14-16 Nm, to prevent the exhaust pipe from coming loose.

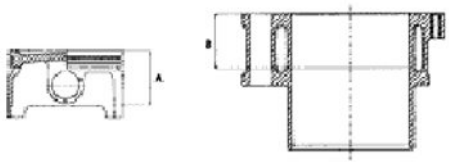


Overhaul data

This section provides the main information for the vehicle overhaul.

Assembly clearances

Cylinder - piston assy.



HEIGHT AT WHICH THE DIAMETER SHOULD BE MEASURED

Specification	Desc./Quantity
A	43,2 mm
B	43 mm

CYLINDER - PISTON

Specification	Desc./Quantity
Cylinder Ø C	92+0,018-0,01
Piston Ø P	91,916-0,029-0,057

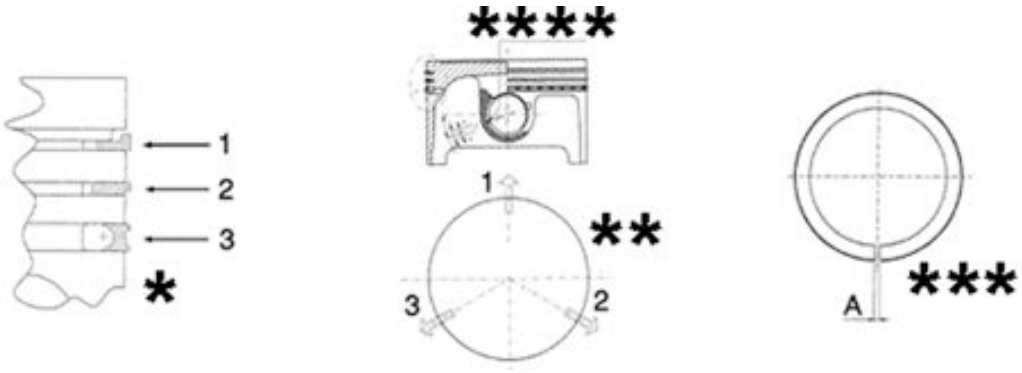
CATEGORIES OF COUPLING

Name	Play	Initials	Cylinder	Piston	Play on fitting
Cylinder- Piston	</>	A	91,990÷91,997	91,947÷91,954	0,036÷0,050
Cylinder- Piston	</>	B	91,997÷92,004	91,954÷91,961	0,036÷0,050
Cylinder- Piston	</>	C	92,004÷92,011	91,961÷91,968	0,036÷0,050
Cylinder- Piston	</>	D	92,011÷92,018	91,968÷91,975	0,036÷0,050

N.B.

DER KOLBEN MUSS SO EINGEBAUT WERDEN, DASS DER PFEIL AUF DIE AUSLASSSEITE WEIST. DIE KOLBENRINGE MÜSSEN SO EINGEBAUT WERDEN, DASS DIE MARKIERUNG «TOP» ODER DAS MARKENZEICHEN NACH OBEN WEIST.

Piston rings



* Fit linings 2 and 3 with «TOP» upwards.

** Arrange the strip opening as shown.

*** Value «A» of the sealing ring into the cylinder

**** Ring opening

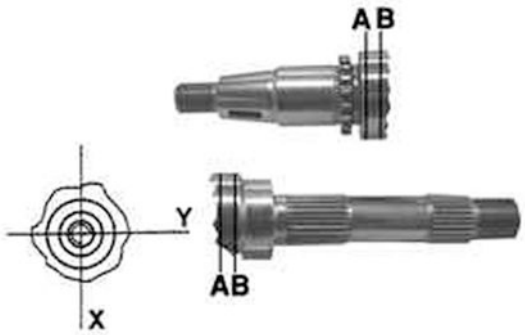
PISTON RINGS

Name	Play	Initials	Cylinder	Piston	Play on fitting
1° compression lining	92 x 1,5	A	0,15 ÷ 0,35	0,5	</>
2° lining	92 x 1,25	A	0,25 ÷ 0,50	0,65	</>
Scraper ring lining	92 x 2,5	A	0,25 ÷ 0,50	0,65	</>

Crankcase - crankshaft - connecting rod

Driving shaft - crankcase axial clearance

Measure the capacity on both axes x-y.



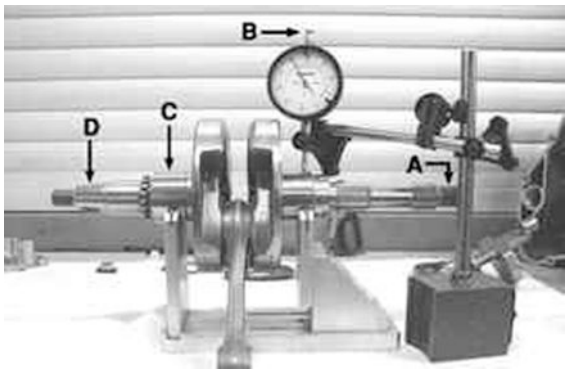
CRANKSHAFT

Specification	Desc./Quantity
Cat. 1	Standard diameter: 40,010 ÷ 40,016
Cat. 2	Standard diameter: 40,016 ÷ 40,022

Crankshaft alignment

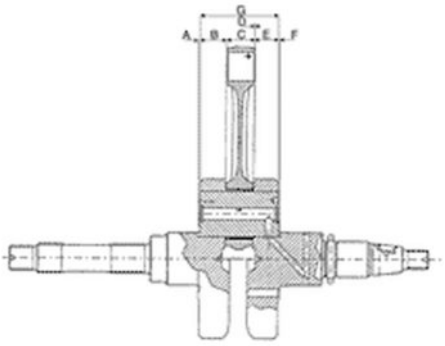
Specific tooling

020335Y Magnetic stand and comparator



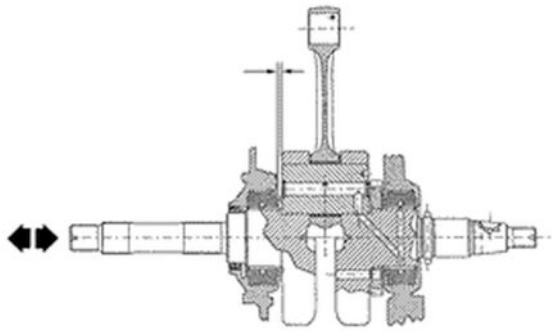
MAX ADMISSIBLE DISPLACEMENT

Specification	Desc./Quantity
A =	0,15 mm
B =	0,010 mm
C =	0,010 mm
D =	0,10 mm



END PLAY BETWEEN DRIVING SHAFT AND CONNECTING ROD

Name	Description	Dimensions	Initials	Quantity
Transmission-side shoulder		0,8 ± 0,025	A	D= 0,20 ÷ 0,40
Transmission-side half-shaft		19,6 + 0,050	B	D= 0,20 ÷ 0,40
Connecting rod		22 0,10-0,15	C	D= 0,20 ÷ 0,40
Flywheel-side shoulder		13 ± 0,025	F	D= 0,20 ÷ 0,40
Flywheel-side half-shaft		19,6 +0,050	E	D= 0,20 ÷ 0,40
Complete driving shaft		63,5+0,1-0,05	G	D= 0,20 ÷ 0,40



Characteristic

Driving shaft / crankcase axial clearance:

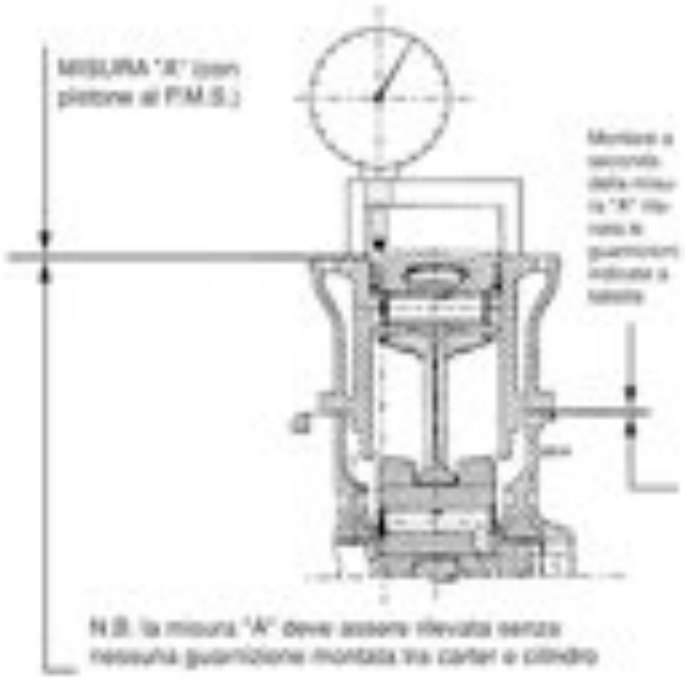
0.1 - 0.405 mm (when cold)

Slot packing system

Shimming system for limiting the compress. ratio = 10.5: 1

CAUTION

THE MEASURE «A» IS A PROJECTION OR RECESS VALUE OF THE PISTON TOP FROM THE CYLINDER PLANE.
MEASURE «A» ALLOWS DETERMINING THE THICKNESS OF THE BASE GASKET TO BE APPLIED TO THE CYLINDER BASE TO RECOVER THE COMPRESSION RATIO. THE MORE THE PLANE FORMED BY THE PISTON TOP PROTRUDES FROM THE PLANE FORMED BY THE CYLINDER TOP, THE THICKER THE BASE GASKET. ON THE OTHER HAND, THE MORE THE PISTON TOP IS RECESSED INTO THE CYLINDER TOP PLANE, THE SMALLER THE GASKET THICKNESS.



BASE GASKET THICKNESS

Name	Measure A	Thickness
MEASURE TAKEN «A»	- 0,185 ÷ - 0,10	0,4 ± 0,05
MEASURE TAKEN «A»	- 0,10 ÷ + 0,10	0,6 ± 0,05
MEASURE TAKEN «A»	+ 0,10 ÷ + 0,185	0,8 ± 0,05

N.B.

VALUES INDICATED WITH «-» REFER TO RECESSES OF THE PISTON TOP FROM THE CYLINDER PLANE.

Products

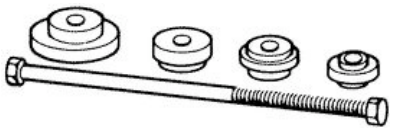
PRODUCTS

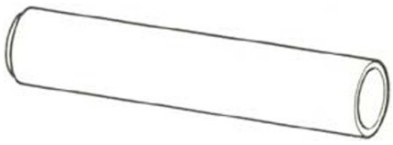
Product	Description	Specifications
TUTELA ZC 90	Rear hub oil	SAE 80W/90 Oil that passes API GL3 specifications
SELENIA Air Filter Oil	Oil for air filter sponge	Mineral oil with specific additive for ingreasing the ISO VG 150
SELENIA HI Scooter 4 Tech	Engine oil	Synthetic oil SAE 5W/40 that passes the API SG specification.
TUTELA TOP 4	Brake fluid	Synthetic fluid SAE J1703, NHTSA 116 DOT 4, ISO 4925
PARAFLU MOTO RIDER (Ready to use)	Cooling fluid	Mono-ethylene glycol based anti-freeze, CUNA NC 956-16 fluid

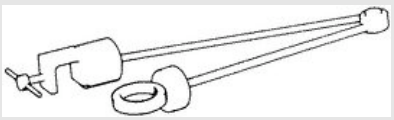
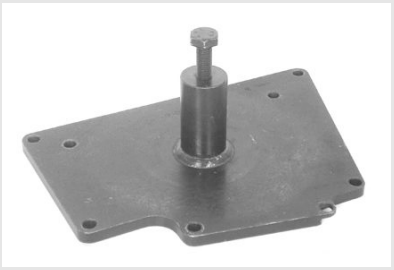
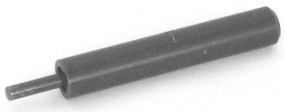
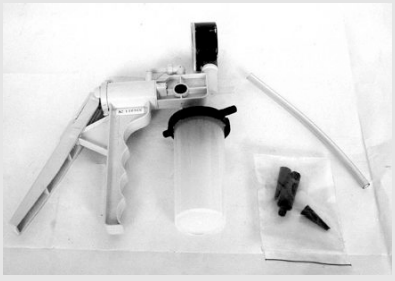
Product	Description	Specifications
MONTBLANC MOLYBDENUM GREASE	Grease for driven pulley shaft compensating ring and mobile driven pulley sliding seat	Molybdenum bisulphide grease
TUTELA ZETA 2	Grease for steering, seats of pin and swing arm	Lithium soap and zinc oxide grease NLG12
SELENIA FORK0 10 W	Oil for front staple	Hydraulic oil SAE 10 W
PIAGGIO CODE 602683M	Muffler cleaning paste	Specific product for cleaning and polishing stainless steel muffer
TUTELA TP1	Grease for brake control lever, gas	NLGI 1-2 calcium soap based white spray grease

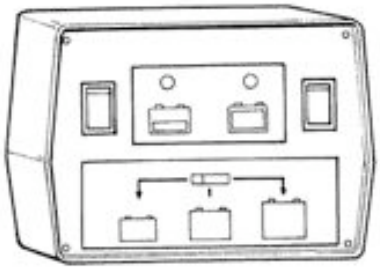
INDEX OF TOPICS

TOOLS

Stores code	Description	
001330Y	Steering seat installer, to be fitted with parts: 001330Y009-For lower seat, 001330Y013-For upper seat	
001467Y002	Bell	
001467Y006	20-mm pliers	
001467Y007	Bell	
001467y008	17 mm pliers (driven pulley bearings)	
001467Y014	15 mm pliers	

Stores code	Description	
001467Y031	Bell	
001467y034	15-mm pliers	
001467Y035	Bell	
002465Y	Pliers for snap rings	
006029y	Drift for fitting thrust ring seats on steering tube	
020004Y	Drift for removing thrust rings from steering head tube	
020055Y	Steering tube ring nut spanner	

Stores code	Description	
020150Y	Support for air heater "METABO HG 1500/2"	
020151Y	Air heater "METABO HG 1500/2"	
020193Y	Oil pressure gauge	
020201Y	Spacer bushing driving tube	
020262Y	Crankcase detachment plate	
020306Y	Valve sealing ring drift	
020329Y	Pump MITYVAC	

Stores code	Description	
020330Y	Timing light for two- and four-stroke engines	
020331Y	Digital multimeter	
020333Y	Single battery charger	
020334Y	Multiple battery charger	

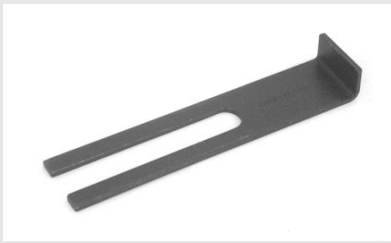
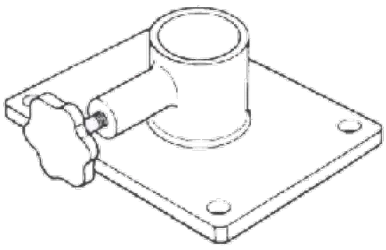
Stores code	Description	
020335Y	Magnetic stand and comparator	
020357Y	32 x 35 mm adaptor	
020358y	37 x40 adaptor	
020359Y	42 x 47 mm hub bearing fitting adaptor	
020360Y	52 x 55 mm adaptor	
020364Y	25 mm guide	
020376Y	Handle for punches	
020382Y012	bush (Valves removing tool)	
020412Y	15 mm guide	

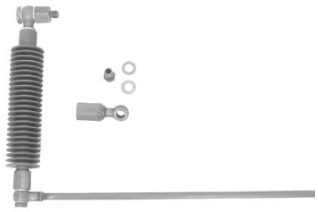
Stores code	Description	
020424Y	Driven pulley roller casing drift	
020431Y	Valve oil seal extractor	
020434Y	Oil pressure gauge connection	
020439Y	17 mm guide	
020444Y	Driven half pulley spring compressor tool	
020456Y	Ø 24 mm adaptor	

Stores code	Description	
020458Y	Steering tube lower bearing extractor	
020459Y	Drift for fitting bearing on steering tube	
020460Y	Tester and scooter diagnosis	
020467Y	Flywheel extractor	
020468Y	Band clamp	

Stores code	Description	
020469Y	Reprogramming kit	
020470Y	Pin retainers installation tool	
020471Y	Pin for counter-shaft timing	
020472Y	Flywheel removing tool lock wrench	
020474Y	Driving pulley stop wrench	

Stores code	Description	
020475Y	Driving pulley stop wrench	
020476Y	Column kit	
020478Y	Punch for driven pulley roller casing	
020479Y	Counter-shaft lock wrench	
020480Y	Fuel pressure check kit	

Stores code	Description	
020481Y	Control unit interface wiring	
020482Y	Engine support.	
020483Y	30 mm guide	
020512Y	Cylinder piston fitting fork	
020527Y	Engine support base	
020604Y011	Adapter to be setup	

Stores code	Description	
020565Y	Compass flywheel stop spanner	
020623Y	Gas collection kit for preliminary overhaul	
020625Y	Exhaust gases collecting kit	
494929	Exhaust gas analyser	

INDEX OF TOPICS

Maintenance chart

Adequate maintenance is a determining factor in the vehicle's duration in optimal function and performance conditions.

For this purpose, PIAGGIO has prepared a series of inspection and maintenance operations that can be paid for, grouped together in the summary table on the next page. It is a good rule to point out any small function anomalies to an **Authorized Piaggio Dealer or Service Centre** at once, without waiting until the next time your vehicle is serviced, in order to remedy them as soon as possible.

It is indispensable to have your vehicle serviced at the prescribed intervals of time, even if you have not reached the predicted mileage. Punctual vehicle servicing is necessary for the correct use of the guarantee. For all further information regarding the Guarantee application modes and the execution of the «Programmed Maintenance» refer to the «Guarantee Booklet».

EVERY 2 YEARS

Action
Cooling Fluid - Replacement
Brake fluid - Change

EVERY 3,000 KM

Action
Engine Oil - Level Check/Top up
Brake pads - Check condition + wear

AT 1,000 KM OR 4 MONTHS

Action
Engine oil - Replacement
Hub Oil - Replacement
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check

Action
Steering - Adjust
Brake levers - Grease
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Electrical system and battery - Check
Vehicle and brake test - Road test

AT 6,000 KM OR 12 MONTHS

Action
Engine oil - Replacement
Hub Oil - Level Check
Spark Plug / Electrodes distance - Check
Air Filter - Cleaning
Oil filter - Replacement
Valve Play - Check
Base vent - Check
Variator rollers - Change
Transmission Belt - Check
Cooling fluid level - Check
Brake fluid level - Check
Electrical system and battery - Check
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 12,000 KM OR 24 MONTHS AND 60,000 KM

Action
Engine oil - Replacement
Hub Oil - Level Check
Spark plug/Electrode gap - Change
Air Filter - Cleaning
Oil filter - Replacement
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check
Variator rollers - Change
Roller support sliding blocks - Check/Replacement

Action
Transmission Belt - Replacemen
Cooling fluid level - Check
Steering - Adjust
Brake levers - Grease
Transmissions - Lubricate
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Suspensions - Check
Electrical system and battery - Check
Headlight - Adjust
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 18,000 KM AND AT 54,000 KM

Action
Engine oil - Replacement
Hub Oil - Level Check
Spark Plug / Electrodes distance - Check
Air Filter - Replacement
Oil filter - Replacement
Valve Play - Check
Base vent - Check
Variator rollers - Change
Transmission Belt - Check
Cooling fluid level - Check
Radiator - External cleaning/Check
Brake fluid level - Check
Electrical system and battery - Check
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 24,000 KM

Action
Engine oil - Replacement
Hub Oil - Replacement
Idle speed / Fuel - Change

Action
Air Filter - Cleaning
Oil filter - Replacement
Petrol filter - Check
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check
Variator rollers - Change
Roller support sliding blocks - Check/Replacement
Driven pulley bushing - Check / Greasing
Transmission Belt - Replacemen
Cooling fluid level - Check
Steering - Adjust
Brake levers - Grease
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Suspensions - Check
Electrical system and battery - Check
Headlight - Adjust
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 30,000 KM, 42,000 KM AND 66,000 KM

Action
Engine oil - Replacement
Hub Oil - Level Check
Spark Plug / Electrodes distance - Check
Air Filter - Cleaning
Oil filter - Replacement
Base vent - Check
Variator rollers - Change
Transmission Belt - Check
Cooling fluid level - Check
Brake fluid level - Check
Electrical system and battery - Check
Tires-inflation and wear - Check

Action
Vehicle and brake test - Road test

AT 36,000 KM

Action
Engine oil - Replacement
Hub Oil - Level Check
Spark plug/Electrode gap - Change
Air Filter - Replacement
Oil filter - Replacement
Valve Play - Check
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check
Variator rollers - Change
Roller support sliding blocks - Check/Replacement
Transmission Belt - Replacemen
Cooling fluid level - Check
Radiator - External cleaning/Check
Steering - Adjust
Brake levers - Grease
Flexible brake lines - Change
Transmissions - Lubricate
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Suspensions - Check
Electrical system and battery - Check
Headlight - Adjust
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 48,000 KM

Action
Engine oil - Replacement
Hub Oil - Replacement
Idle speed / Fuel - Change
Air Filter - Cleaning

Action
Oil filter - Replacement
Fuel filter - Change
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check
Variator rollers - Change
Roller support sliding blocks - Check/Replacement
Driven pulley bushing - Check / Greasing
Transmission Belt - Replacemen
Cooling fluid level - Check
Steering - Adjust
Brake levers - Grease
Transmissions - Lubricate
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Suspensions - Check
Electrical system and battery - Check
Headlight - Adjust
Tires-inflation and wear - Check
Vehicle and brake test - Road test

AT 72,000 KM

Action
Engine oil - Replacement
Hub Oil - Replacement
Spark plug/Electrode gap - Check/Change
Air Filter - Replacement
Oil filter - Replacement
Petrol filter - Check
Valve Play - Check
Combustion - Check/ Adjustment
Seals/injection system hoses - Visual check
Base vent - Check
Variator rollers - Change
Roller support sliding blocks - Check/Replacement

Action
Driven pulley bushing - Check / Greasing
Transmission Belt - Replacemen
Cooling fluid level - Check
Radiator - External cleaning/Check
Steering - Adjust
Brake levers - Grease
Flexible brake lines - Change
Brake fluid level - Check
Nuts, bolts and fasteners - Check
Suspensions - Check
Electrical system and battery - Check
Headlight - Adjust
Tires-inflation and wear - Check
Vehicle and brake test - Road test
Transmissions - Lubricate

Spark plug

Check and replacement

CAUTION

THE SPARK PLUG MUST BE REMOVED WITH COLD ENGINE. THE SPARK PLUG SHOULD BE CHECKED EVERY 6,000 KM AND REPLACED EVERY 12,000 KM. THE USE OF NON-CONFORMING IGNITION CONTROLLERS, AND SPARK PLUGS OTHER THAN THOSE PRE-SCRIBED CAN SERIOUSLY DAMAGE THE ENGINE.

Characteristic

Recommended spark plugs:

CHAMPION RG6YC - NGK CR 7 EKB

- Position the vehicle on center stand.
- Open the door on the left side and remove the relevant screw lifting from the lower part in the specific groove.
- Disconnect the shielded sparkplug cap
- Unscrew the sparkplug.

- Check the conditions of the sparkplug, make sure the insulation is intact, that the electrodes are not excessively worn or grimy, the conditions of the washer, and measure the distance between the electrodes using a specific feeler.

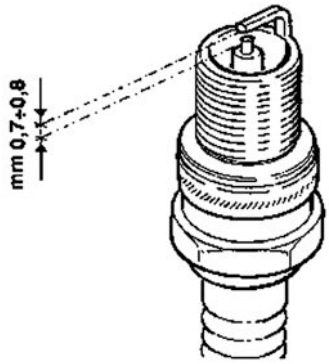
Characteristic

Electrode distance

0.7-0.8 mm

Adjust the distance if necessary, carefully bending the earth electrode. In the event of irregularity, replace the sparkplug with a recommended type.

- Fit the sparkplug with the correct inclination and manually screw it all the way down, then use the specific spanner to tighten it.



Locking torques (N*m)

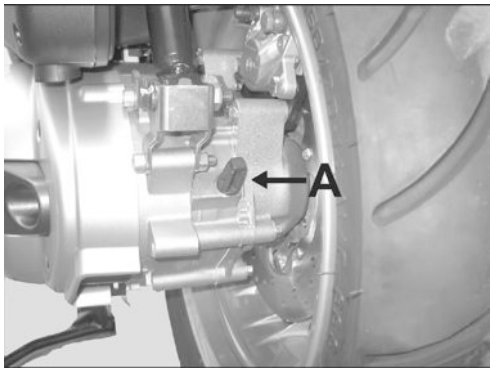
Spark plug 12÷14 Nm

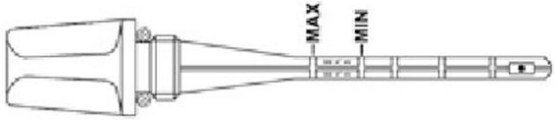
- Insert the cap onto the spark plug and proceed with the reassembly operations.

Hub oil

Check

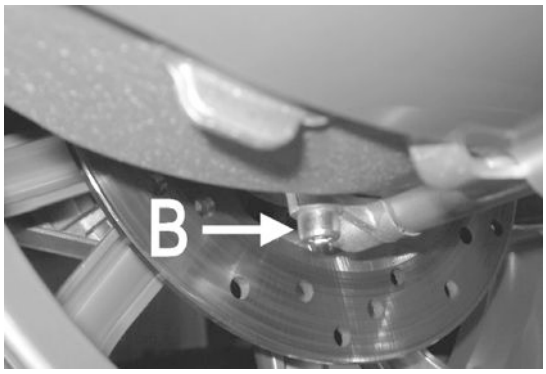
- Take the vehicle to a flat ground and rest it on the central stand.
- Unscrew the oil bar «A», dry it with a clean cloth and reinsert it, screwing it in thoroughly.
- Pull out the bar and check that the oil level is between the MAX and MIX levels indicated on the bar (see figure); if the level is below the MIN value, restore the proper amount of oil in the hub.
- Screw the oil bar back on, checking that it is tightly in place.





Replacement

- Remove the oil loading cap «A».
- Prepare a suitable container.
- Remove the oil drainage cap «B» and let the oil drain out completely.
- Tighten the drainage cap with its gasket and refill.
- Remove the oil loading cap



Recommended products

TUTELA ZC 90 Rear hub oil

SAE 80W/90 Oil that passes API GL3 specifications

Characteristic

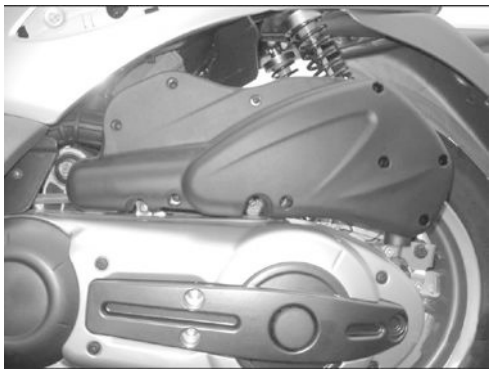
Rear hub oil

Capacity: ~250 cc

Air filter

- Loosen the 9 fixing screws and remove the cleaner cap.
- Remove the filtering element.
- Replace the air filter with a new one.

Check the blow-by and condensate exhaust pipe and empty it, if full.



Cleaning (Every 12,000 Km):

- Wash with water and shampoo.
- Dry with light jets of compressed air and wipe with a clean cloth.
- Soak with a 50% fuel-oil mixture.
- Let the filter cartridge drip and then squeeze it between the hands without wringing.
- Refit the filter element.

CAUTION

DO NOT RUN THE ENGINE IF THE AIR FILTER IS NOT IN PLACE AS THIS WOULD RESULT IN EXCESS-

IVE WEAR OF THE CYLINDER AND PISTON AS WELL AS IN DAMAGE TO THE CARBURETTOR.

CAUTION

IF THE VEHICLE HAS RIDDEN ON DUSTY ROADS, THE AIR FILTER MUST BE CLEANED MORE FREQUENTLY THAN WHAT INDICATED IN THE SCHEDULED MAINTENANCE TABLE.

Recommended products

Selenia Air Filter Oil Air filter sponge oil

Mineral oil with specific additives to increase adhesion ISO VG 150

N.B.

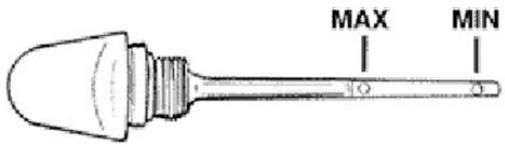
FAILURE TO OBSERVE THE RULES REGARDING THE FILTERING ELEMENT CLEANING COULD CAUSE AN IMPROPER LUBRICATION OF THE SAME. A POOR LUBRICATION AFFECTS THE FILTERING CAPACITY. AN EXCESSIVE LUBRICATION CAUSES A CONCENTRATION OF THE CARBURETION.

Engine oil

Engine oil is used in 4-stroke engines in order to lubricate the timing gears, the bench supports and the thermal group. **An insufficient quantity of oil can cause serious damage to the engine itself.** In all 4T engines, the decay of the oil characteristics, as well as a certain level of consumption, should be considered normal, especially during running in. Consumption can particularly reflect the conditions of use (e.g.: when driving at full acceleration all the time, oil consumption increases).

Check

This operation must be done with a cold engine following the procedure below:



1) Rest the vehicle on the central stand and on a flat ground.

2) Unscrew the cap/bar «**A**», dry it with a clean cloth and reinsert it, **screwing it thoroughly**.

3) Remove the cap/bar again and check that the level is between the max and min levels; top up, if required.

Topping up from the **MIN** to **MAX** level requires around 400 cc.

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

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**.

The restoration level between the **MIN** and **MAX** levels implicates a quantity of oil **~400 cc**.

Engine oil filter

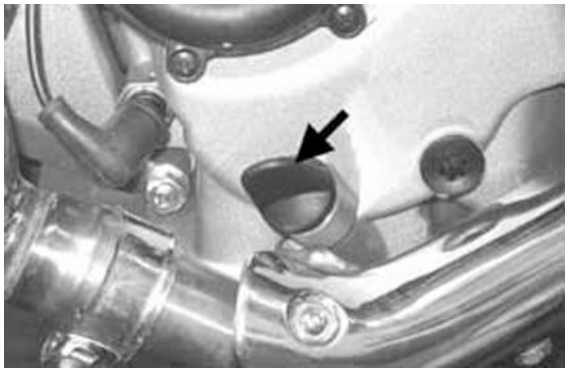
CAUTION

DO NOT DISPERSE OIL IN THE ENVIRONMENT. OIL, GASKET AND FILTER SHOULD BE DISPOSED OF ACCORDING TO THE REGULATIONS IN FORCE.

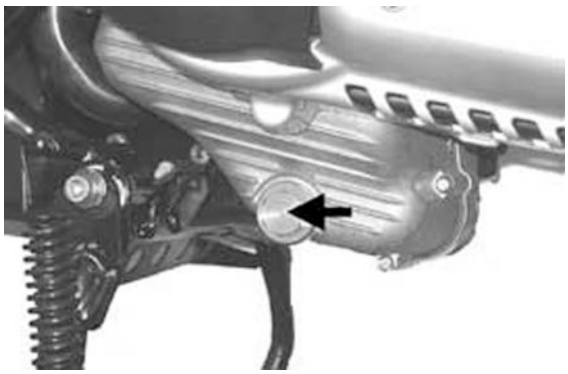
WARNING

AVOID TOUCHING PARTS OF THE ENGINE WHEN HOT, AS THIS MAY CAUSE BURNS.

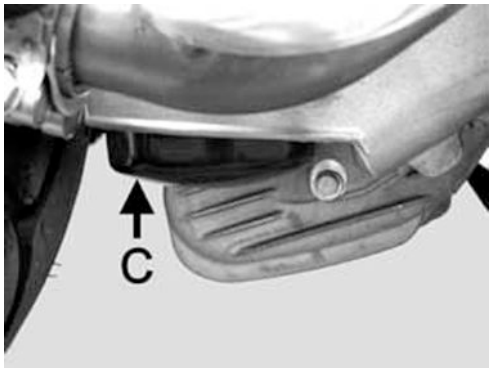
- Remove the muffler.
- Remove the fill cap



- Remove and clean the mesh pre-filter of the drain cap with compressed air.



- Use a belt spanner for filters to remove cartridge filter «**C**».
- Make sure the prefilter and drain cap o-rings are in good condition.
- Lubricate them and refit the mesh filter and oil drain cap by tightening to the prescribed torque.
- Refit a new cartridge filter making sure to lubricate the o-ring before fitting, then screw until it comes into contact with the seal and further tighten to the prescribed torque.



- Refit the muffler.
- Add recommended engine oil.
- Start the engine and let it run for a few minutes and then turn it off. After 5 minutes check the level and top up if needed, **never exceed the MAX level.**

N.B.

IF THE OIL IS CHANGED WITHOUT CHANGING THE CARTRIDGE FILTER (1ST COUPON) ADD AROUND 1500 CC OF OIL INSTEAD OF 1700 CC SINCE PART OF THE LUBRICATION CIRCUIT IS FILLED.

Characteristic

Engine oil:

1700cc

Locking torques (N*m)

Engine oil drain plug 24 ÷ 30 N•m Oil filter: 12 - 16

Oil pressure warning light

Indicator light (oil pressure low)

The vehicle is equipped with a warning light on the instrument panel 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 valve clearance

- To check the play in the valves collimate the references between the cam shaft control pulley and head.
- Use a feeler to make sure the play between the valve and register screw correspond to the indicated values. If the play does not correspond, adjust it by loosening the counternut using a screw-

driver on the register screw as shown in the figure.

Characteristic

Valves play: intake:

0,15 mm (cold).

Valves play: exhaust

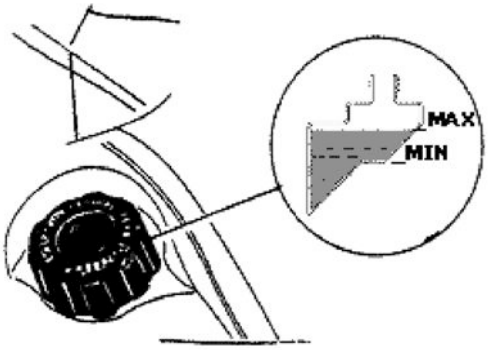
0,15 mm (cold).

Cooling system

Level check

The fluid level inspection should be carried out every 6,000 km when the motor is cold, following the methods indicated below:

- Rest the vehicle on the central stand and on a flat ground.
- Loosen the screw shown in the figure and remove the expansion tank cover located on the right side of the vehicle.
- Remove the expansion tank cap and top up, if the fluid level is near to or below the MIN level into the expansion tank. The fluid level should always be between the «MIN» and «MAX» level.
- To check the level, look into the expansion tank: the two marks into the expansion tank indicate the two levels, «MIN» and «MAX».
- The cooling fluid consists of a mixture of 50% demineralised water and ethylene glycol and corrosion inhibitors based anti-freeze solution.



CAUTION

TO PREVENT THE COOLANT FROM LEAKING OUT

OF THE EXPANSION TANK DURING USE, BE SURE TO NEVER EXCEED THE MAX LEVEL WHEN RE-FILLING

N.B.

THE COOLING FLUID CONSISTS OF A MIXTURE OF DEMINERALISED WATER AND FLUID FOR SEALED CIRCUITS. THE RESULTING MIXTURE ALLOWS A DECREASE OF THE FREEZING POINT TO -35°C. THE MIXTURE AT A PRESSURE OF 0.9 BAR INCREASES THE BOILING POINT TO APPROX. 125°C. THE RECOMMENDED FLUID IS ALSO PROTECTIVE FOR ALUMINIUM ALLOYS, AND OVER TIME THIS FEATURE MAY DECREASE. PERIODICAL REPLACEMENT IS THEREFORE ADVISABLE.

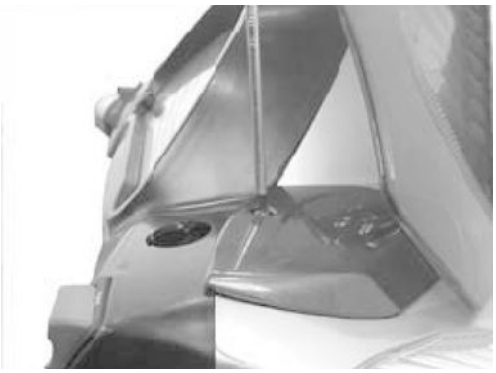
See also

Cooling system

Braking system

Level check

- Rest the vehicle on a flat ground and on the central stand.
- Remove the brake pump cover as shown in the figure.



- Check the brake fluid level by the special indicator located on the pump, as shown in the figure.

N.B.

THE LEVEL TENDS TO DROP AS THE BRAKE PADS GET WORN, A MINIMUM LEVEL SHOULD NOT BE

REACHED. IF THE LEVEL IS TOO LOW, CHECK AND FIX THE SYSTEM SEALS, IF REQUIRED.TOP UP THE PUMP TANK, IF REQUIRED, CONSIDERING THAT THE «MAX» LEVEL MUST ONLY BE OBTAINED WITH NEW PADS.

Top-up

CAUTION

USE ONLY DOT 4 BRAKE FLUID.

Proceed as follows:

- Rest the vehicle on a flat ground and on the central stand.
- Remove the brake pump cover as shown in the figure.

- Remove the tank cap by loosening its two screws, remove the gasket and top up the level, using only the prescribed fluid without exceeding the maximum level.

CAUTION

KEEP THE BRAKE FLUID AWAY FROM THE SKIN, THE EYES AND CLOTHING. IN CASE OF CONTACT, RINSE GENEROUSLY WITH WATER.

WARNING

THE BRAKING CIRCUIT FLUID HAS A STRONG CORROSIVE POWER: DO NOT LET IT COME INTO CONTACT WITH THE PAINTED PARTS.

WARNING

THE BRAKING CIRCUIT FLUID IS HYGROSCOPIC, I.E., IT ABSORBS HUMIDITY FROM THE SURROUNDING AIR. IF THE HUMIDITY IN THE BRAKING FLUID EXCEEDS A CERTAIN VALUE, IT WILL LEAD TO INEFFICIENT BRAKING. NEVER USE BRAKING FLUID FROM CONTAINERS THAT HAVE ALREADY BEEN OPENED, OR PARTIALLY USED.

Characteristic

Prescribed fluid:

TUTELA TOP 4

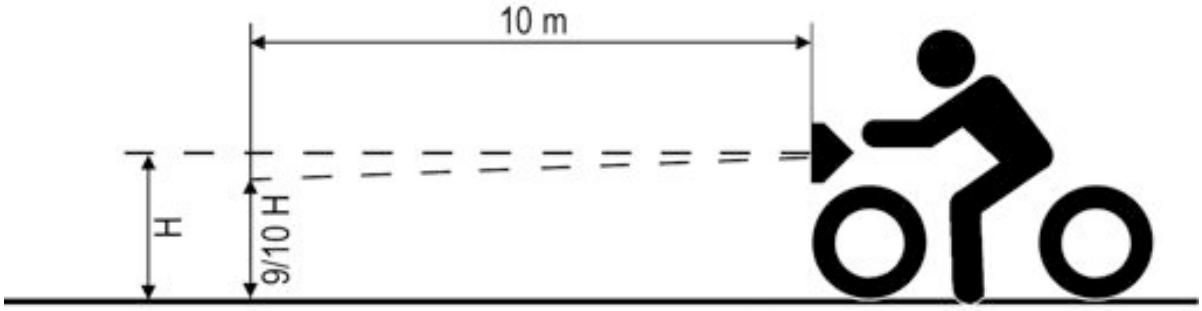
In normal weather conditions, the fluid should be replaced every 20,000 km or in any case every 2 years.

N.B.

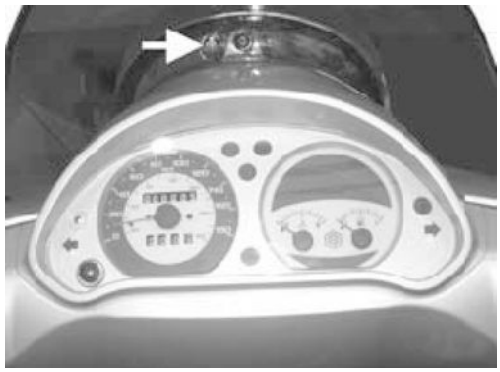
TO REPLACE THE BRAKE FLUID AND VENT AIR FROM THE CIRCUITS, SEE THE "BRAKING SYSTEM" CHAPTER.

Headlight adjustment

- Place the vehicle in use conditions, with tyres inflated at the prescribed pressure on flat ground at 10 m from a white screen placed in dim light.
- Make sure that the vehicle's axle is perpendicular to the screen.
- Turn the headlight on and check that the limit of the light beam projected onto the screen does not exceed 9/10 of the headlight centre height from the ground and that it is not less than 7/10.



- Otherwise, adjust the right headlight by the screw shown in the figure, which can be accessed by removing the front shield connecting member.



WARNING

THE PROCEDURE DESCRIBED ABOVE COMPLIES WITH THE "EURONORM" CONCERNING THE MAX. AND MIN. HEIGHT OF THE LIGHT BEAM OF A ROAD VEHICLE. PLEASE CHECK WITH THE LOCAL AUTHORITIES FOR WHAT REQUIREMENTS MUST BE FULFILLED IN EVERY SINGLE COUNTRY WHERE THE VEHICLE IS TO BE USED.

Checking the end compression pressure

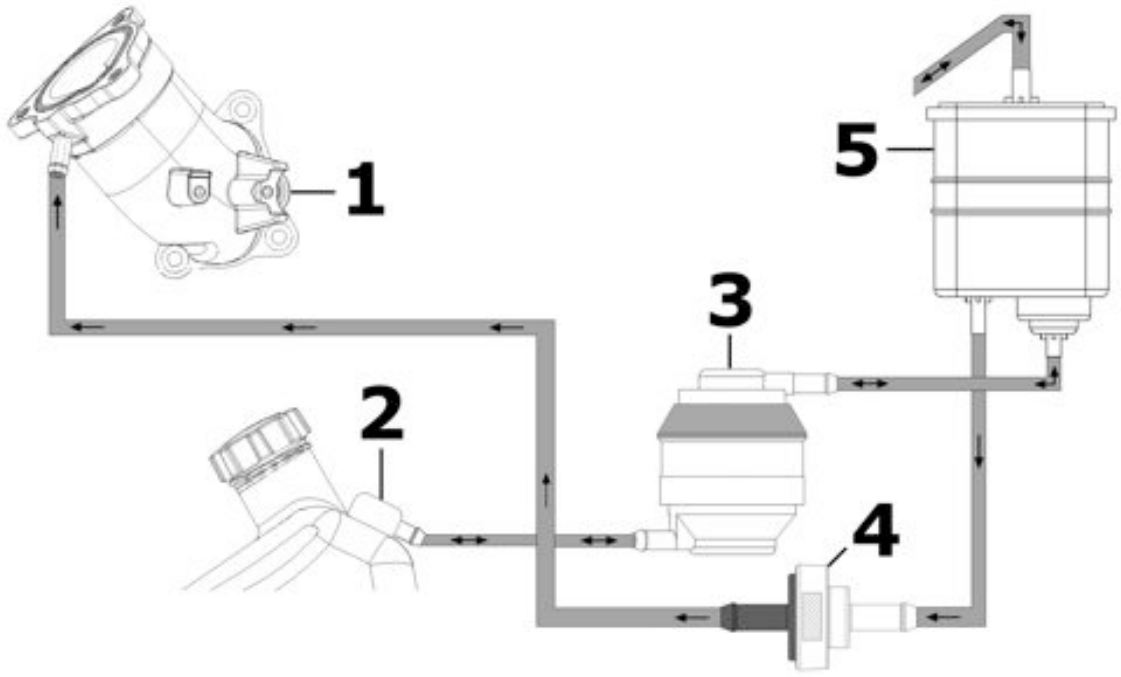
- Remove the spark plug cap with cold engine.
- Remove the ignition spark plug.

- Fit a compression test gauge into the spark plug seat using a 10-mm spark plug union at the proper tightening torque.
- Disconnect the stroke revolution sensor connector.
- Let the engine run by the starter and with the throttle body in fully open position as long as the gauge value is steady. If pressure is correct (> 11 bar), remove the tool and reinstall the spark plug, the cap and the stroke revolution connector.
- If the pressure is less than what indicated, check the rpm at which the test is carried out; if it is less than 450 rpm, check the start-up system; if not, check the following:
- Timing
- Valve clearance
- Valve seal
- Lining seal
- Proper compression ratio selection

Locking torques (N*m)

Compression test union: 10

Anti-evaporation system



System components: Intake manifold with vacuum outlet Fuel tank vent Roll-over valve Safety valve Canister (active carbon filter)

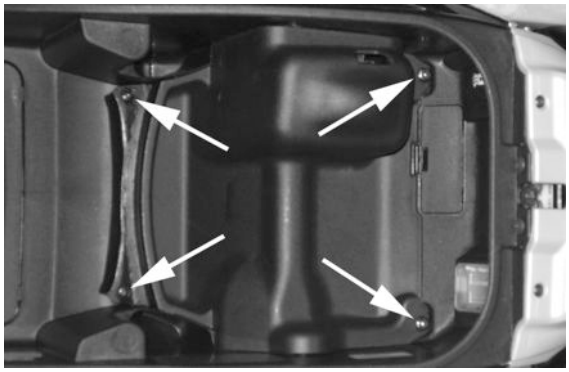
Removing system components

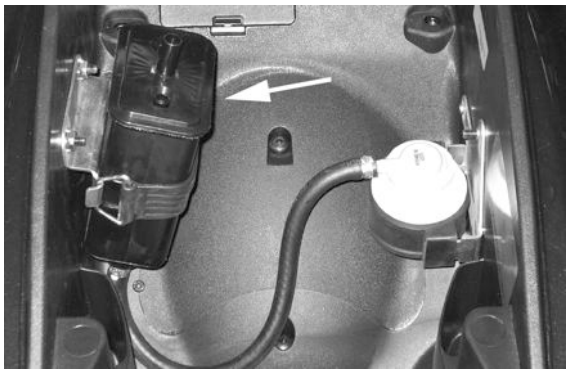
• Canister Removal

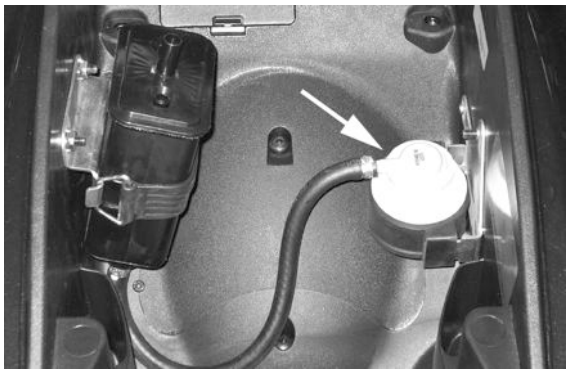
Gain access to the canister by removing the cover located inside the helmet compartment. Release the retaining belt and metallic clamps, then remove the hoses.

• Roll-over and/or Safety Valve Removal

Remove the cover, release the metallic clamps, and then remove the hoses. The two valves are not supported.

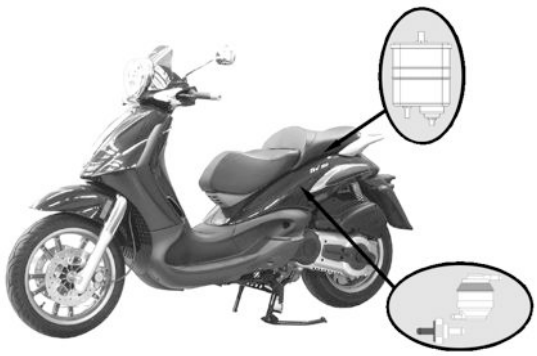






Refitting system components

- Replace the components inserting the piping properly and fastening them with new metal strips.
- Be careful to the direction of installation of the components. The safety valve and the Roll-over valve, if fitted in the reverse direction, affect the operation of the entire anti-evaporation system.



Canister inspection

The Canister is fundamental for treating the hydrocarbons contained inside the volume of gas departing the fuel tank when the internal pressure rises (due to the heat induced by the radiator, engine or ambient temperature).

The volume of air is limited by the operation of ventilation valve (Roll-over).

Even though the quantity of hydrocarbons coming from the tank is fairly small, active carbon should be regenerated by a reversed flow of the ambient air sucked in by the engine, to prevent the saturation of the canister.

This carbon pollution and regeneration phenomena occur during each cycle of utilization of the vehicle.

To check the Canister, it is necessary to proceed with its removal, whilst keeping the two hoses attached.

• Shake the Canister and ensure it emits no noise.

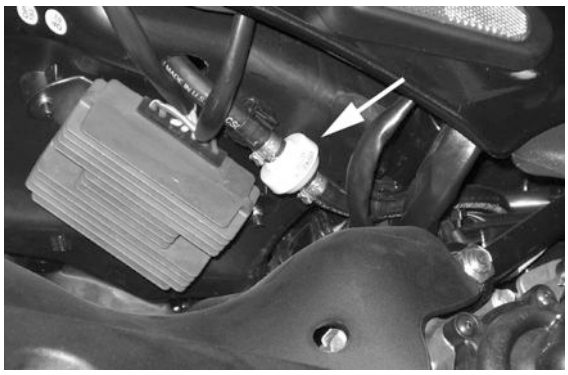
• Using a compressed air gun, blow the 3 ducts and ensure this does not result in a pressure build-up inside the Canister.

• Ensure the airflow is undisturbed and no carbon residues exit the hose.

Replace the Canister if noisy, clogged up, or leaking carbon residues.

Safety valve check

The Canister is cleaned by an air flow controlled by the vacuum inlet located on the intake manifold.



To guarantee the correct operation of the engine, the mass air flow must not be excessively large; this is obtained by using a narrow section (0.9mm) for the inlet on the intake manifold.

The Canister tubing connections comprise the in-

stallation of a safety valve.
This is a unidirectional valve that ensures the air flow towards the manifold when the control vacuum is over 200mbar.
The engine vacuum at idle causes a weak air flow that can be easily compensated for with the idle adjustment parameters.
When the vehicle is stationary, the safety valve will be shut due to the lack of control vacuum; for this reason, any expansion of the fuel tank will not pollute the intake manifold thus preventing engine floods.

The valve should preferably be removed from the vehicle upon inspection; alternatively, it will be sufficient to access the tubing on the manifold side.

• Connect the MITYVAC pump on the engine side duct.
• Set the pump control onto "vacuum", then slowly apply vacuum to check the valve opening threshold.
If different pressures are found, replace the valve.
N.B. If the opening vacuum is too high, it causes a lack of active carbon regeneration; on the other hand, if it is too low, it increases the air flow rate to the engine, thus causing a poor fuel-oxygen mixture at idle.

Characteristic

Standard opening vacuum

200 ÷ 260 mbar

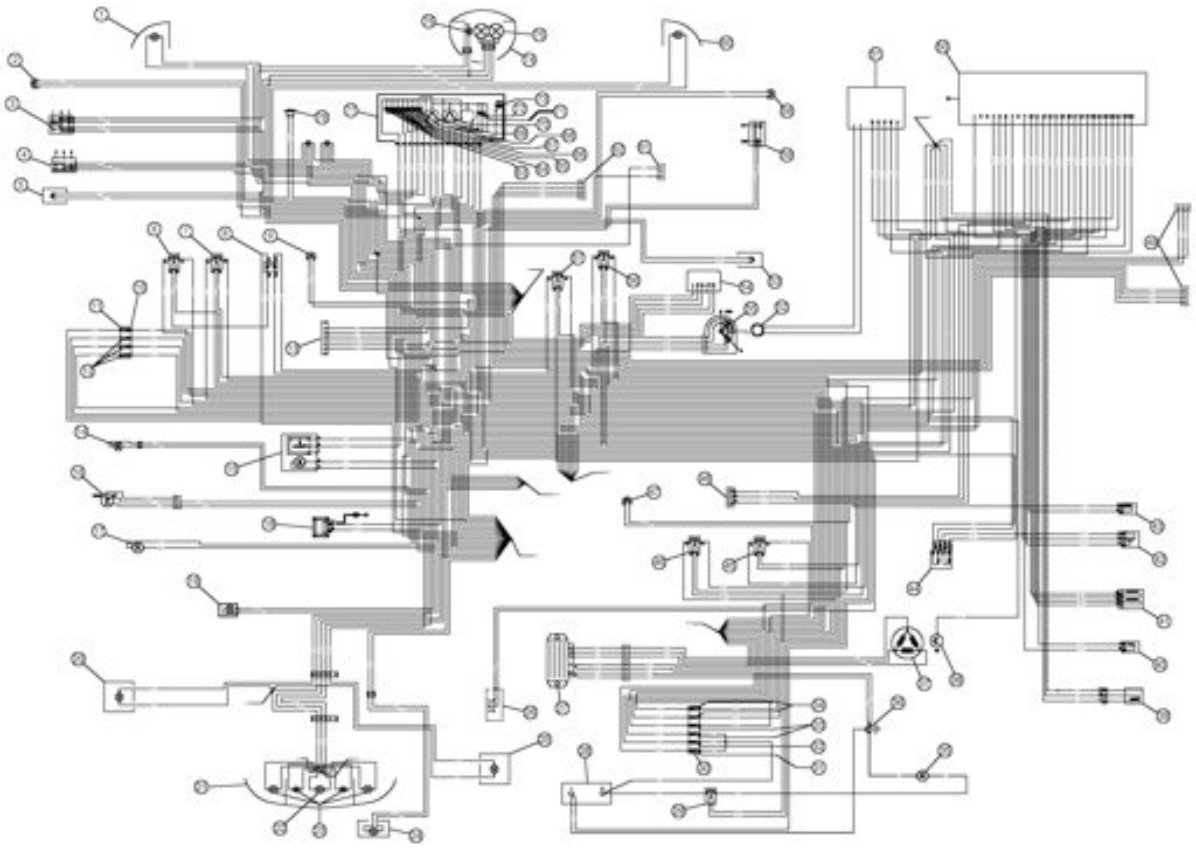
Roll-over valve check

The valve should allow the following results:

• Tank aeration when running (ambient air enters into the tank based on the volume of fuel used).
• Tank pressurization (the tank internal temperature may rise when running or while stopped. The valve should pressurize the tank so to limit the amount of fuel vapors departing towards the Canister).
Prevent the liquid fuel pollution of the Canister (if the vehicle falls, the valve should interrupt the connection to the Canister).

The valve must be removed from the vehicle upon inspection.
A MITYVAC pump and a length of pipe are needed for the inspection; proceed as follows:
• Attach the MITYVAC pump to the lower joint to the safety valve (white).
• Set the pump control onto "vacuum" and, whilst keeping the valve aligned with its **vertical axis**, check that air may be sucked in without observing any movements on the manometer needle gauge.
• Set the pump onto "pressure" and, whilst keeping the valve aligned with its **vertical axis**, check that the valve can be pressurized to values slightly below 0.1bar (~60mbar).
N.B. The calibration pressure can be easily recognized as, when reached, the valve will start to discharge air thus emitting a weak noise.
• Align the valve with its **horizontal axis** and check that it can be pressurized to values much higher than the calibration pressure (e.g. 0.5bar without it necessarily being maintained).
Replace the valve if anomalies are found.
N.B. Any valve failure may cause the fuel tank to deform or increase of the Canister operating requirements.

INDEX OF TOPICS



ELECTRICAL COMPONENTS

	Specification	Desc./Quantity
1	Front LHS turn signal light	
2	Light switch with flash	
3	Turn signal switch	
4	Horn button	
5	Four 30A relays	
6	Main remote control switch	
7	Light remote control switch	
8	Diode unit	
9	Saddle opening button	
10	Front fuse box	
11	Fuse	15 A
12	No. 3 7.5A fuses	
13	Anti-theft alarm fitting	
14	Electric fan	
15	Fuel level sender with pump	
16	Side stand switch	

	Specification	Desc./Quantity
17	Saddle opener actuator	
18	H.V. coil	
19	Lamp	
20	Chassis wire unit	
21	Headlight	
22	Speedometer	
23	Diagnostic and deterring LED	
24	Fuel reserve indicator	
25	Engine oil pressure indicator	
26	Water thermometer	
27	Fuel level gauge	
28	Engine warning indicator	
29	High-beam warning light	
30	Rhs turn signal warning light	
31	Lhs turn signal warning light	
32	Instrument lighting	
33	Headlamp warning light	
34	Front turn signal light bulb 12V-10W	
35	Intercom fitting	
36	Engine stop deviator	
37	Fitting for accessories	
38	Front wire node (black)	
39	Indicators remote control switch	
40	Electric fan remote control switch	
41	Light switch	
42	Starter button	
43	Damper for fuel level indicator	
44	Key switch	
45	Immobilizer aerial	
46	Decoder	
47	Front ground node	
48	Injection electronic control unit	
49	Intercom pre-wiring	
50	Petrol injector	

	Specification	Desc./Quantity
51	Throttle potentiometer	
52	Idle adjustment motor	
53	Air temperature sensor	
54	Engine rpm sensor	
55	Shielded bi-polar cable	
56	Engine water temperature sensor	
57	Engine oil pressure sensor	
58	Flywheel magneto	
59	Frame ground	
60	Ground cable	
61	Starter motor wire	
62	Starter motor	
63	Starter relay	
64	Battery	12V-12Ah
65	Rear fuse box	
66	Fuse 30A	
67	Fuse 15A	
68	Two 10A fuses	
69	Fuse 5A	
70	Fuse 3A	
71	L.V. socket (12V - 180W)	
72	12V D.C. regulator	
73	Wire node (red-black)	
74	Engine stop remote control switch	
75	Two 30A relays	
76	Controller remote control switch	
77	ECU diagnostic socket	
78	Wire node (red-yellow)	
79	Wire node (yellow-black)	
80	Helmet compartment light button	
81	Rear wire node (black)	

Electrical cables color:

B = White, **Bl** = Blu, **G** = Yellow, **Mr** = Brown, **N** = Black, **Gr** = Gray,

Rs = Pink, **R** = Red, **Vi** = Purple, **V** = Green

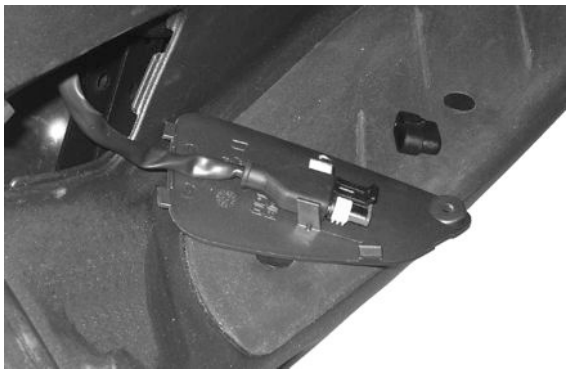
CAUTION

SHOULD ANY INTERVENTIONS TO THE ELECTRIC SYSTEM BE REQUIRED, MAKE SURE THAT THE LEADS TO THE ELECTRONIC IGNITION DEVICE ARE PROPERLY CONNECTED ACCORDING TO POLARITY AND TO THE LEAD COLOURS.

Components arrangement

Diagnostic socket

To gain access to the diagnostic socket, remove the door located on the rhs footrest.

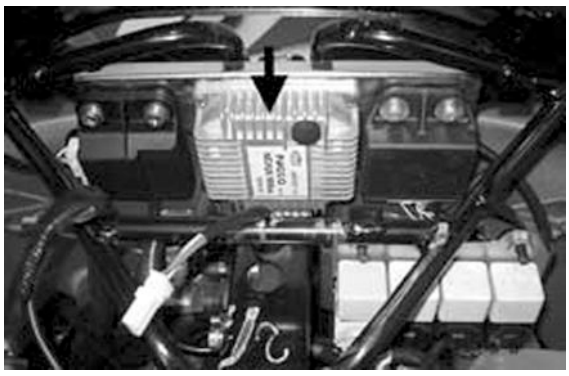


H.V. coil

To access the HV coil, remove the left side.

ECU controller

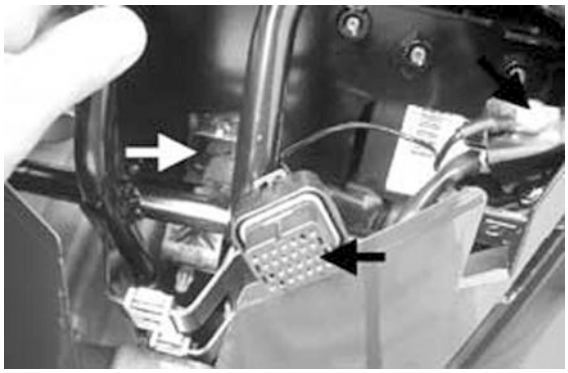
To access the immobilizer controller, remove the top counter shield.



To access the connector, remove the windscreen with relevant support and the metal plate supporting the ECU, Decoder and saddle opening remote control units.

N.B.

ONCE YOU HAVE INSERTED THE CONTROLLER INTERFACE WIRING RECONNECT THE SCREW AND THE EARTH CABLE.

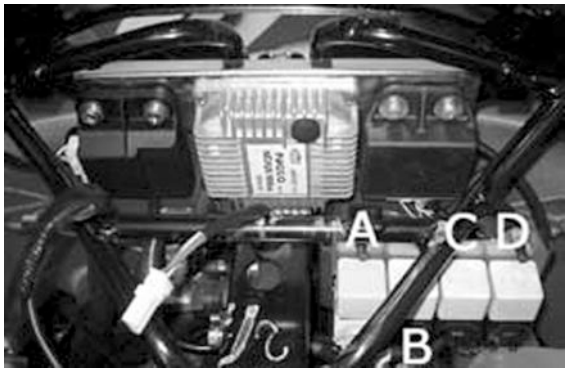


Immobilizer decoder

To access the immobilizer decoder, remove the top counter shield.

Relays and diode unit

To access the relays and the diode unit, remove the top counter shield.

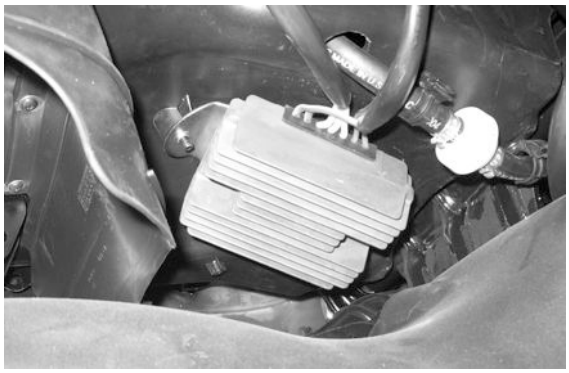


[/]

Specification	Desc./Quantity
A =	DIODE UNIT
B =	ELECTRIC FAN REMOTE CONTROL SWITCH
C =	ENGINE STOP REMOTE CONTROL SWITCH
D =	CONTROL UNIT REMOTE CONTROL SWITCH

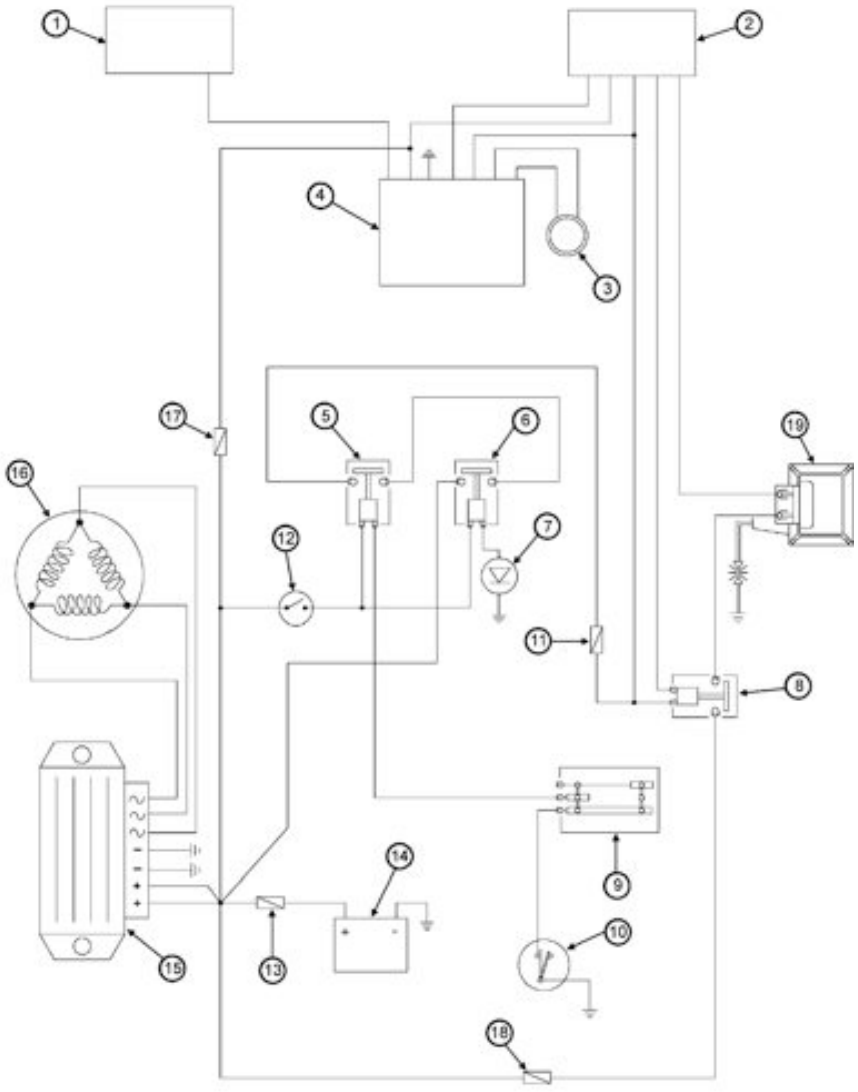
Voltage regulator

The voltage regulator is located underneath the helmet compartment.



Conceptual diagrams

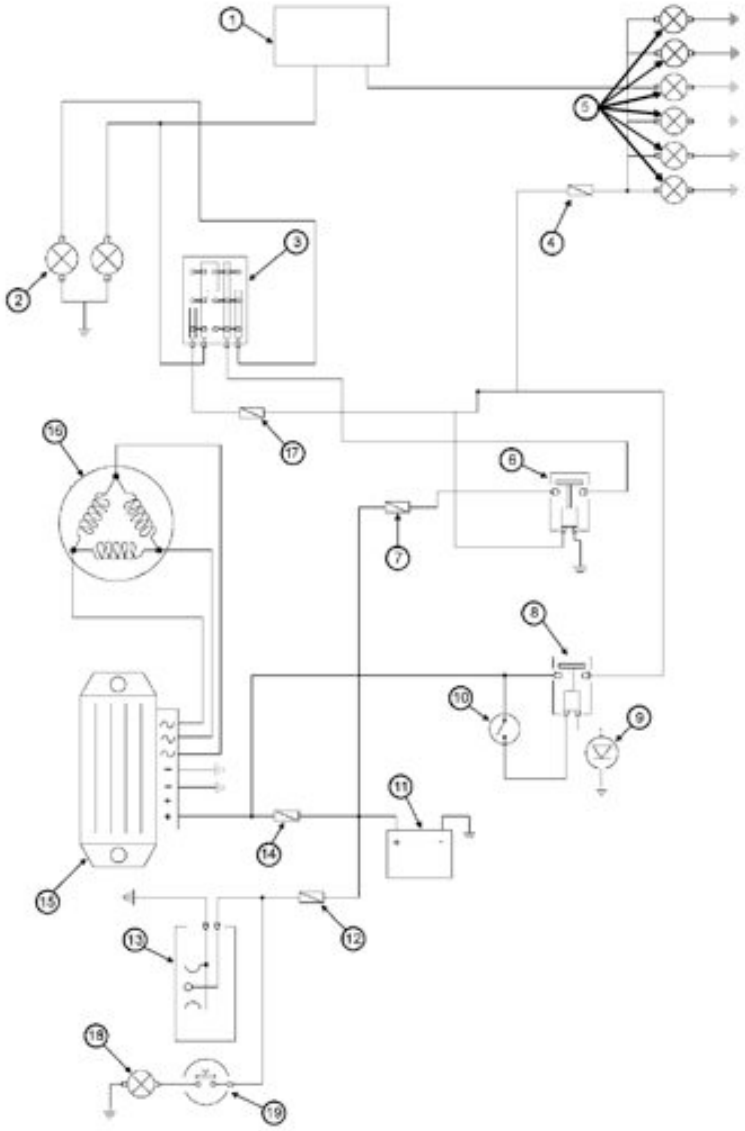
Ignition



IGNITION

	Specification	Desc./Quantity
1	Speedometer	
2	Electronic controller	
3	Antenna	
4	Immobilizer	
5	Engine stop remote control switch	
6	Main remote control switch	
7	Diode	2 A
8	Controller remote control switch	
9	Emergency stop switch	
10	Side stand switch	
11	Fuse No. 4 (5A)	
12	Ignition key-switch	
13	Main fuse (30A)	
14	Battery	12V-12Ah
15	Voltage regulator	
16	Flywheel magneto	
17	Fuse No. 2 (10A)	
18	H.V. coil	

Headlights and automatic starter section

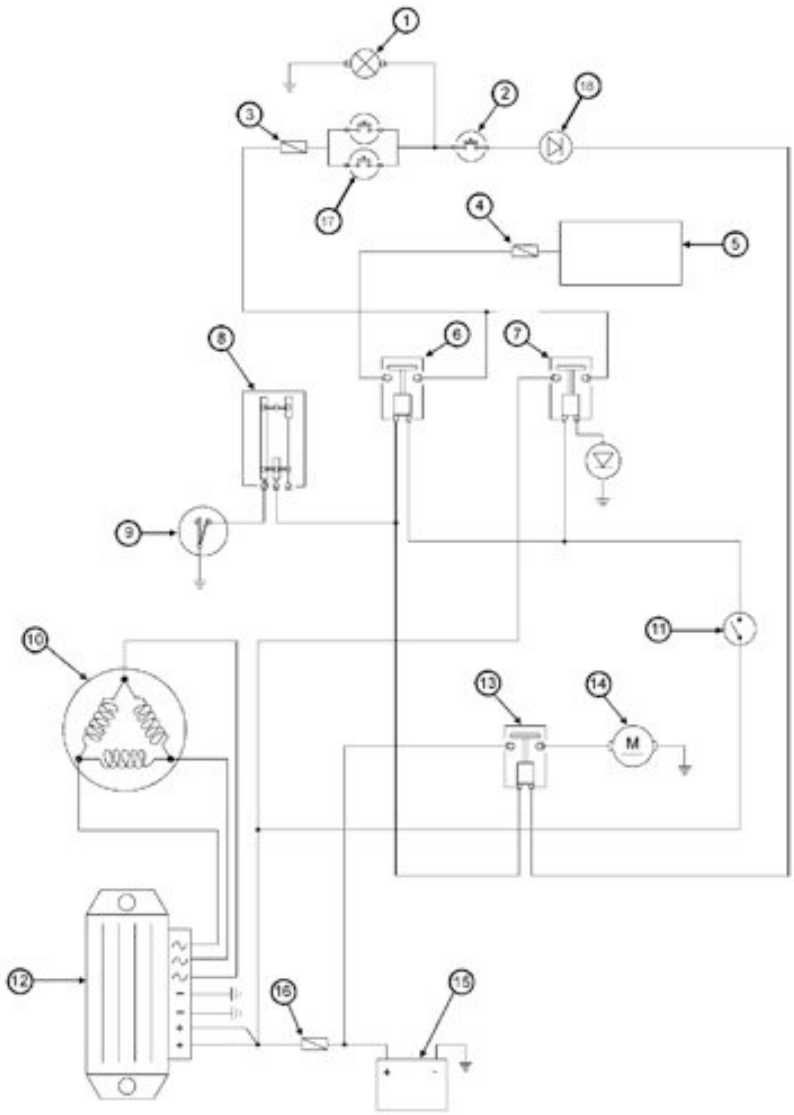


HEADLIGHTS AND AUTOMATIC STARTER

	Specification	Desc./Quantity
1	Speedometer	
2	Duel light lamp	
3	Light switch with flash	
4	Fuse No. 9 (7.5A)	
5	Side lights (4 rear) and license plate lamp	
6	Light remote control switch	
7	Fusibile n. 6 (10A)	
8	Main remote control switch	
9	Diode	2 A
10	Ignition key-switch	

	Specification	Desc./Quantity
11	Battery	12V-12Ah
12	Fuse No. 5 (15A)	
13	L.V. socket (12V - 180W)	
14	Main fuse (30A)	
15	Voltage regulator	
16	Flywheel magneto	
17	Fuse n.7 (15A)	
18	Under-saddle compartment light	
19	Under-saddle compartment light switch	

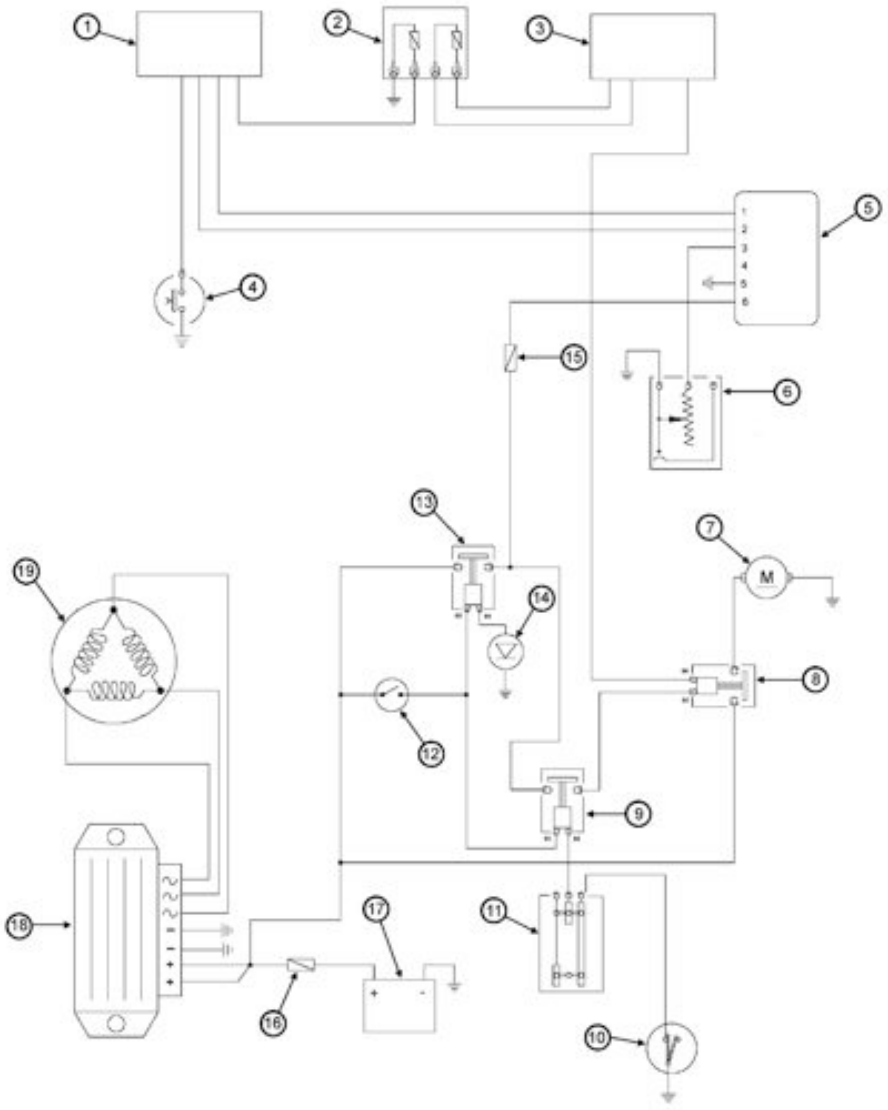
Battery recharge and starting



BATTERY RECHARGE AND STARTING

	Specification	Desc./Quantity
1	Stop light bulb	
2	Starter button	
3	Fuse No. 8 (7.5A)	
4	Fuse No. 4 (5A)	
5	Electronic controller	
6	Engine stop remote control switch	
7	Main remote control switch	
8	Emergency stop switch	
9	Stand switch	
10	Flywheel magneto	
11	Key switch	
12	Voltage regulator	
13	Starter relay	
14	Starter motor	
15	Battery	12V-12Ah
16	Main fuse (30A)	
17	Front and rear brake light button	
18	Diode	

Level indicators and enable signals section

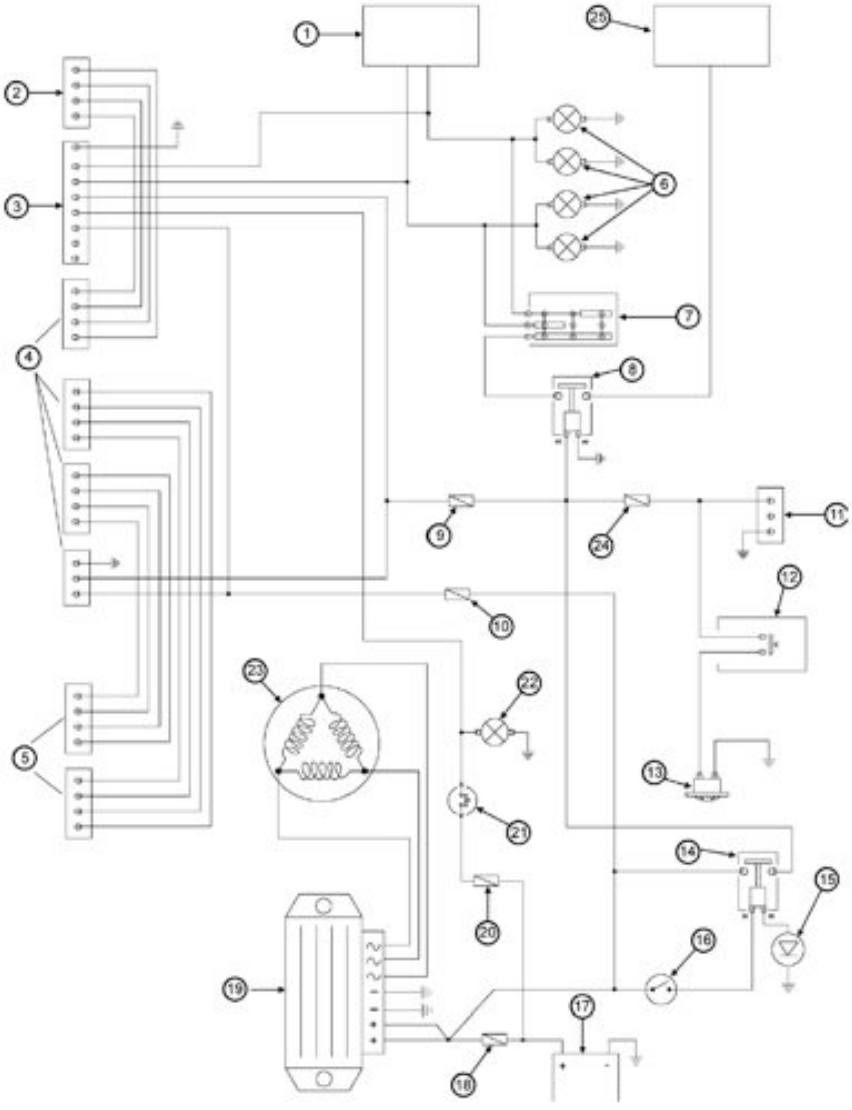


LEVEL INDICATORS AND ENABLE SIGNALS SECTION

	Specification	Desc./Quantity
1	Speedometer	
2	Engine water temperature sensor	
3	Electronic controller	
4	Engine oil pressure sensor	
5	Damper for fuel level indicator	
6	Fuel level gauge	
7	Radiator electric fan	
8	Electric fan remote control switch	
9	Engine stop remote control switch	
10	Side stand switch	
11	Emergency stop switch	

	Specification	Desc./Quantity
12	Ignition key-switch	
13	Main remote control switch	
14	Diode	2 A
15	Fuse No. 8 (7.5A)	
16	Main fuse (30A)	
17	Battery	12V-12Ah
18	Voltage regulator	
19	Flywheel magneto	

Turn signal lights



TURN INDICATORS AND HORN

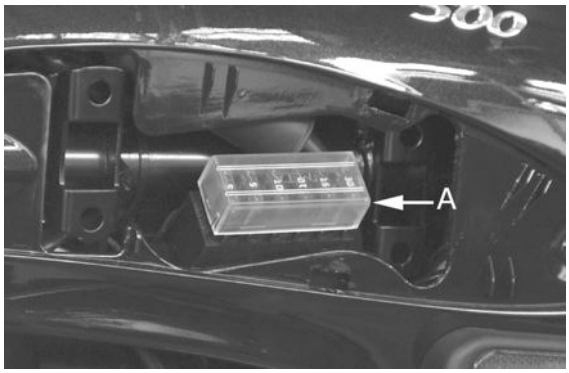
	Specification	Desc./Quantity
1	Speedometer	
2	Predisposizione display	
3	Anti-theft alarm fitting	
4	Radio-interphone prewiring	
5	Connettori interfono	
6	Turn signal lights	
7	Turn signal switch	
8	Indicators remote control switch	
9	Fuse No. 8 (7.5A)	
10	Fuse n. 10 (7,5A)	
11	Fitting for accessories	
12	Horn button	
13	Claxon 12V c.c.	
14	Main remote control switch	
15	Diode	2 A
16	Ignition key-switch	
17	Battery	12V-12Ah
18	Main fuse (30A)	
19	Voltage regulator	
20	Fuse No. 5 (15A)	
21	Helmet compartment light button	
22	Helmet compartment light	
23	Flywheel magneto	
24	Fuse n.7 (15A)	
25	Electronic controller	

Checks and inspections

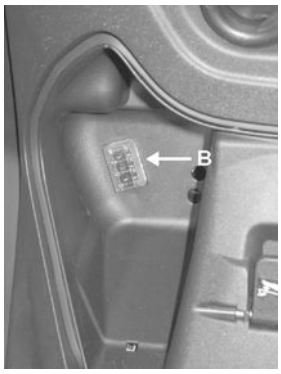
Fuses

The electric system is equipped with:

- Six fuses «A» located inside the right side.



- Four fuses «B» for the system circuitry safety, located inside the trunk in the upper left side of the compartment.



Never try to replace a fuse using different material (for example a piece of electric wire) or a fuse with higher amperage.

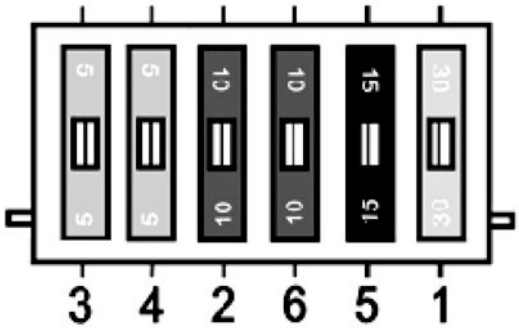
The tables show the position and the characteristics of the fuses present in the vehicle.

CAUTION

BEFORE REPLACING THE BLOWN FUSE, TRY TO ELIMINATE THE FAULT THAT HAS CAUSED IT TO BLOW.
NEVER TRY TO REPLACE A FUSE USING DIFFERENT MATERIAL (FOR EXAMPLE A PIECE OF ELECTRIC WIRE) OR A FUSE WITH HIGHER AMPERAGE.

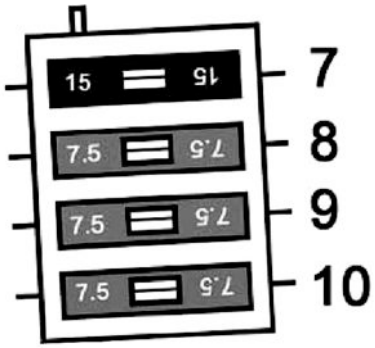
FUSE BOX A

	Specification	Desc./Quantity
1	1 - General	**Fuse**: 30A
2	2 - Electronic control unit remote control switch	**Fuse**: 10A
3	3 - Immobilizer, ECU power supply	**Fuse**: 5A
4	4 - Under-panel controller	**Fuse**: 5A
5	5 - Socket 12v - 180w, helmet compartment lighting button, key switch contacts, saddle opener actuator, electric button opening.	**Fuse**: 15A
6	6 - Remote light control switch	**Fuse**: 10A



FUSE HOLDER B

	Specification	Desc./Quantity
1	7 - Light flash, fitting for accessories, horn	**Fuse**: 15A
2	8 - Brake lights, fitting for radio and anti-theft system, damper, under-key instrument panel.	**Fusibile**: 7,5A
3	9 - Light switch. Lamps for front and rear side/taillights, number plate light, indicators on the instrument panel.	**Fusibile**: 7,5A
4	10 - Immobilizer led, radio/intercom fitting, anti-theft system	**Fuse**: 7,5A



Sealed battery

Airtight battery start-up operations

If the vehicle is provided with an airtight battery, the only maintenance required is the check of its charge and recharging, if needed. These operations should be carried out before delivering the vehicle, and on a six-month basis for storage with open circuit. Besides upon pre-delivery it is therefore necessary to check the battery charge and recharge it, if required, before storing the vehicle and afterwards every six months.

INSTRUCTIONS FOR THE RENEWAL RECHARGE AFTER OPEN-CIRCUIT STORAGE

1) Voltage check

- Before installing the battery on the vehicle, perform an open-circuit voltage check using a

conventional tester.

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

2) Constant-voltage battery instructions

- - Constant voltage charge equal to 14.40-14.70V
- - Initial charge current equal to 0.3-0.5 x rated capacity
- - Charge time:
- Recommended 10-12 h Minimum 6 h Maximum 24 h

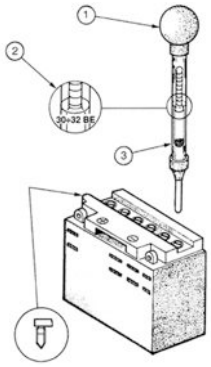
3) Constant-current battery instructions

- Charge current equal to 1/10 of the battery rated capacity

Dry-charge battery

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID; HENCE AVOID ANY CONTAC WITH EYES, SKIN OR CLOTHES. IF COMING INTO CONTACT WITH EYES OR SKIN, WASH ABUNDANTLY WITH WATER FOR APPROX. 15 MINS. AND SEEK IMMEDIATE MEDICAL ATTENTION.
IN THE EVENT OF ACCIDENTAL INGESTION OF THE LIQUID, IMMEDIATELY DRINK LARGE QUANTITIES OF MAGNESIUM MILK, BATTERED EGG OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF FREE FLAMES, SPARKS OR CIGARETTES; VENTILATE THE AREA WHEN RECHARGING INDOORS.
ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP CLEAR FROM THE REACH OF CHILDREN.



- Remove the short closed tube and its cap, then put sulphuric acid into the elements using a specific type for accumulators with a specific weight of 1.26, corresponding to 30 Bé at a minimum temperature of 15°C until the upper level is reached.
- Let stand for at least 2 hours, then restore the level with sulphuric acid.
- Within 24 hours, recharge using the specific battery charger (single) or (multiple) at an intensity of about 1/10 of the battery nominal capacity and until the acid density is about 1.27, corresponding to 31 Bé and such values become steady.

- After charging, level the acid (adding **distilled water**). Close and clean carefully.
- After performing the above operations, install the battery on the vehicle connecting as described at 3) of paragraph **Battery recharge**.

Specific tooling

020333Y Single battery charger

020334Y Multiple battery charger

1 Keep the pipe in vertical position
2 Inspect visually
3 The float must be freed

Checking the electrolyte level

The electrolyte level must be checked frequently and must reach the upper level. To restore such level, use only distilled water. If water topping is required too often, check the vehicle electric system: the battery works overcharged and is subject to quick wear.

Charging status check

After topping-up the electrolyte level, check its density using special density gauge.
With the battery charged, a density of 30 - 32 Bé, corresponding to a specific weight of 1.26 - 1.28, must be found at an ambient temperature not less than 15° C.
A density reading of less than 20° Bé indicates that the battery is completely flat and it must therefore be recharged.
If the vehicle is not used for a given time (1 month or more) it will be necessary to periodically recharge the battery.
Within three months the battery loses its charge completely. When refitting the battery onto the vehicle pay attention not to invert the cables, bearing in mind that the earth (**black**) wire marked with a (-) must be connected to the **negative** terminal whilst the other two **red** wires, marked with a (+) must be attached to the **positive**, + terminal.

Battery recharge

WARNING

BEFORE CHARGING THE BATTERY, REMOVE THE CAP FROM EACH CELL. KEEP FLAMES AND SPARKS AWAY FROM THE BATTERY WHEN CHARGING.

Remove the battery from the vehicle disconnecting the negative terminal first.
Normal bench charging must be performed using the specific battery charger (single) or (multiple),

setting the battery charge selector to the type of battery that requires recharging (i.e., at a current equal to 1/10 of the battery rated capacity). Connections to the power supply source must be implemented by connecting corresponding poles (+ to + and - to -).

Specific tooling

020333Y Single battery charger

020334Y Multiple battery charger

The battery should always be kept clean, especially on its top side, and the terminals should be coated with vaseline.

CAUTION

NEVER USE FUSES HAVING A CAPACITY GREATER THAN THE RECOMMENDED VALUE. THE USE OF A FUSE OF UNSUITABLE CAPACITY MAY RESULT IN SERIOUS DAMAGES TO THE WHOLE VEHICLE OR EVEN CULMINATE IN A FIRE.

CAUTION

DRINKING WATER CONTAINS MINERAL SALTS THAT CAN BE EXTREMELY HARMFUL TO THE BATTERY: ONLY USE DISTILLED WATER.

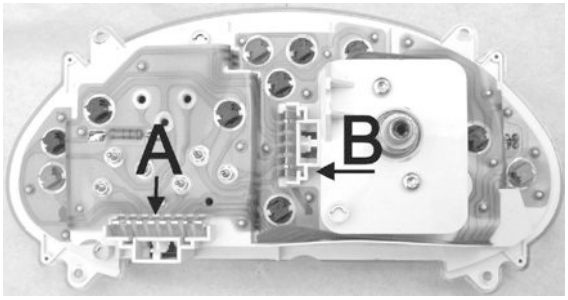
CAUTION

CHARGE THE BATTERY BEFORE USE TO ENSURE OPTIMUM PERFORMANCE. USING A POORLY CHARGED BATTERY CAUSES AN EARLY WEAR OF THE SAME.

Connectors

Dashboard

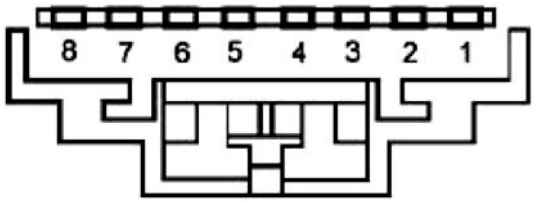
- The instrument unit is provided with two connectors (A with 8 PINS and B with 6 PINS) shown in the figure.



CONNECTOR A

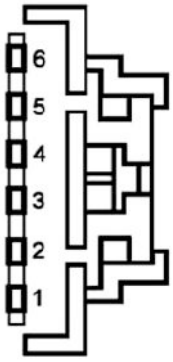
	Specification	Desc./Quantity
1	Left direction indicator light	
2	Battery negative	
3	Battery positive	
4	Water thermometer	

	Specification	Desc./Quantity
5	Right direction indicator light	
6	Preset indicator	
7	Fuel level gauge	
8	Low-fuel warning light	



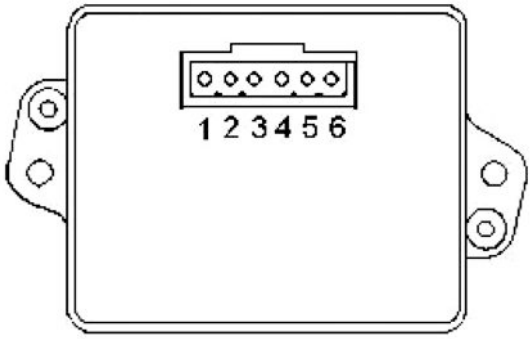
CONNECTOR B

	Specification	Desc./Quantity
1	High-beam lamp warning light	
2	Earth	
3	Engine control indicator	
4	Engine oil pressure indicator	
5	+ Under-key battery	
6	Dashboard illumination and headlamp warning light	



FUEL INDICATOR DAMPER

	Specification	Desc./Quantity
1	Fuel reserve indicator	
2	Fuel level indicator output	
3	Float input	
4	Test (not connected)	
5	Earth	
6	+ Under-key	

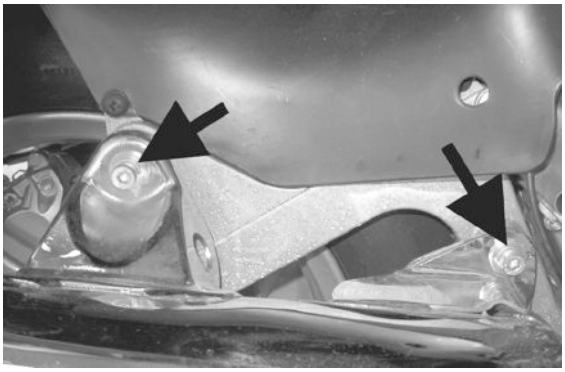

1 2 3 4 5 6

INDEX OF TOPICS

Exhaust assy. Removal

Unloose the two fixings of the exhaust manifold on the head.

- Unloose the 3 screws fixing the muffler to the supporting arm.
- Remove the muffler assembly.



Removal of the engine from the vehicle

- Disconnect the battery, remove the saddle and the sides and drain the cooling fluid.
- Remove the silencer and the relevant support and remove the rear wheel.
- Remove the oscillating arm and the accelerator control transmission.
- Remove the air filter sleeve and the engine earth cable.
- Disconnect the carburettor electrical devices and the starter motor power supply cable.
- Disconnect the fuel delivery and return pipes from the carburettor and the cooling system piping (outlet from the head and inlet to the thermostat).
- Disconnect the spark plug H.V. cable and the generator cables from the vehicle electric system.

WARNING

CARRY OUT THESE OPERATIONS WHEN THE ENGINE IS COLD.

WARNING

BE VERY CAREFUL WHEN HANDLING FUEL.

CAUTION

WHEN INSTALLING THE BATTERY, FIRST FIX THE POSITIVE CABLE AND THEN THE NEGATIVE CABLE.

Fitting the vehicle engine

- Perform the operations for removal in the reverse order according to the tightening torques indicated in Chapter «Characteristics».

Check that with valve in abutment against the register there is a small clearance.

- Check the engine oil level and top up using the recommended brand, if required.
- Fill the cooling circuit.
- Check that accelerator and electric devices are in good working order.

CAUTION

BE VERY CAREFUL TO ENSURE THAT THE GAS CONTROL TRANSMISSION IS IN PROPER POSITION.

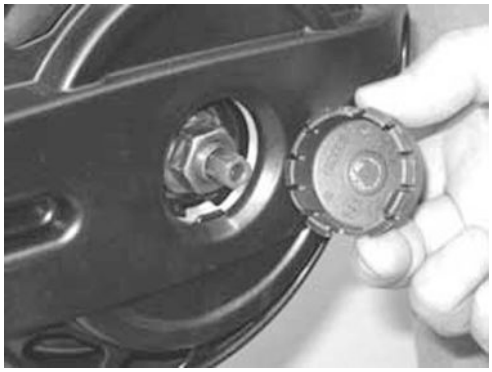
INDEX OF TOPICS

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

Automatic transmission

Transmission cover

- Using a screwdriver, remove the driven pulley axle cover by the bottom of the cap.



- Loosen the driven pulley shaft fastening nut using a misaligned wrench and prevent the pulley shaft rotation by a machine hexagon bush.
- Remove the nut and the two washers.

N.B.

DUE TO THE HIGH TIGHTENING TORQUE, USING DIFFERENT WRENCHES - SUCH AS A CONVENTIONAL POLYGONAL BUSH - MAY DAMAGE THE HEXAGON OBTAINED ON THE SHAFT OR BREAK THE BUSH ITSELF.

- Remove the six M6 screws.

- Remove the four M8 screws.
- Remove the transmission cover.
- Check that the bearing rotates freely, otherwise replace it.

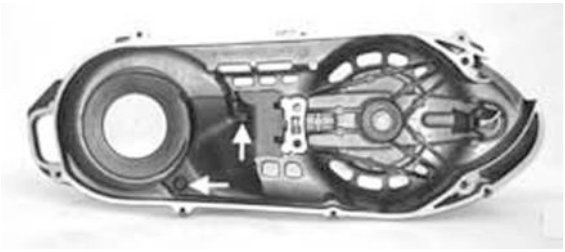
- Loosen the 4 fastening screws
- Extract the outside plastic transmission cover.

Air duct

- Remove the external transmission cover.
- Unscrew the 4 fastening screws shown in the figure to remove the external air conveyor.

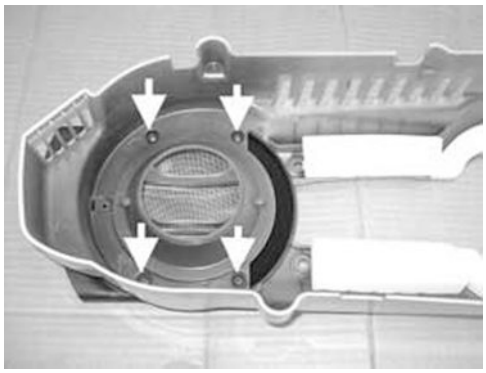
Locking torques (N*m)

Internal air conveyor screws 11 ÷ 12



- Remove the transmission cover.

- Unscrew the two screws shown in the figure to remove the air conveyor.



Air duct filter

- Remove the external air conveyor.
- Unscrew the 2 fastening screws shown in the figure to remove the conveyor filter.

Removing the driven pulley shaft bearing

- Remove the transmission cover.
- Remove the snap ring.

- Place transmission cover on a wood surface and use the specific tool so that it is adequately supported.
- Pull out the bearing by the specific tool.

N.B.

BELL MUST BE PLACED INTO THE TRANSMISSION COVER, CLOSE TO THE BEARING SEAT AND

THE WOODEN SURFACE, SINCE WITHOUT BELL THE ENTIRE COVER STRUCTURE WOULD BEND.

Specific tooling

001467Y002 Bell

020376Y Handle for punches

020375Y Adapter 28 x 30 mm

020439Y 17 mm guide

Refitting the driven pulley shaft bearing

- Heat the transmission cover interior by the thermal gun.

N.B.

BE CAREFUL NOT TO OVERHEAT THE COVER AS THIS WOULD DAMAGE THE OUTSIDE PAINTED SURFACE.

Specific tooling

020151Y Air heater "METABO HG 1500/2"

- Place the bearing onto the specific tool with a little grease to prevent it from coming out.
- Install the new bearing by the specific tool.

N.B.

PROPERLY SUPPORT THE OUTSIDE COVER TO PREVENT DAMAGING THE PAINTED SURFACE.

Specific tooling

020376Y Handle for punches

020358y 37 x40 adaptor

020439Y 17 mm guide

Baffle roller

Plastic roller

Belt anti-flapping roller

- Install the anti-flapping roller with the lip facing the engine crankcase.
- Tighten the central screw to the prescribed torque.

N.B.

SPIN THE DRIVEN AND/OR DRIVING PULLEY UNTIL A CORRECT TENSIONING OF THE BELT IS OBTAINED.

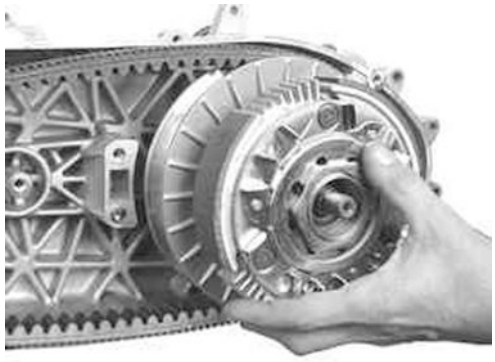
Locking torques (N*m)

Anti-flapping roller screw 16,7 ÷ 19,6

- Check that the roller is free from wear and that it rotates freely.
- Remove the fastening screw by a 13-mm wrench.
- Remove the roller and the bearing.

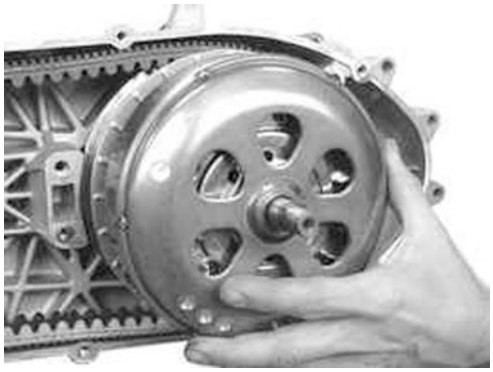
Removing the driven pulley

- Extract the driven pulley unit with the belt.



Inspecting the clutch drum

- Extract the clutch bell.



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

N.B.

CHECK THE ECCENTRICITY MEASURED, 0.2 MM MAX.

Characteristic

Max value:

160,5 mm

Standard value:

160,2 mm

Removing the clutch

- To remove the clutch with the driven pulley it is necessary to use the specific tool dwg;
- Arrange the tool with the mean pins screwed in position «**E**» on the inside;
- Install the driven pulley unit onto the tool inserting the pins into the ventilation holes;
- Move the rear stop screw in abutment against the fixed driven pulley as shown in the figure.

CAUTION

THE TOOL SHOULD BE STRICTLY SECURED IN A VICE USING THE SPECIAL TAIL. DO NOT TIGHTEN THE REAR SCREW TOO MUCH AS THIS COULD CAUSE AN IRREVERSIBLE TOOL DEFORMATION.
USING THE SPECIFIC 55-MM WRENCH, REMOVE THE FASTENING RING NUT.
LOOSEN THE TOOL SCREW AND DISASSEMBLE THE DRIVEN PULLEY UNIT, CLUTCH, SPRING WITH SHEATH.

Specific tooling

020444Y Driven half pulley spring compressor tool

Pin retaining collar

- Extract the collar using 2 screwdrivers.

- Remove the 4 guide pins.
- Extract the mobile driven half-pulley.

Removing the driven half-pulley bearing

- Check that the bushing is free from wear or damages; if so, replace the fixed driven half-pulley.
- Remove the lock ring using pliers.

- Using the specific tool inserted through the roller bearing, pull out the ball bearing.

N.B.

PROPERLY SUPPORT THE PULLEY TO PREVENT

DAMAGING THE THREADING.

Specific tooling

020376Y Handle for punches

020456Y Ø 24 mm adaptor

020363Y 20mm guide

N.B.

IF YOU NEED TO OVERHAUL THE BEARINGS ON AN ASSEMBLED DRIVEN PULLEY UNIT, IT IS NECESSARY TO SUPPORT THE UNIT BY THE BELL

Specific tooling

001467Y002 Bell

- Remove the roller bearing by the specific tool, supporting the fixed half-pulley with the bell.

Specific tooling

020376Y Handle for punches

020375Y Adapter 28 x 30 mm

020364Y 25 mm guide

001467Y002 Bell

Inspecting the driven fixed half-pulley

- Check that the belt contact surface is free from wear.
- Measure the pulley bushing outside diameter.

Characteristic

Minimum admissible diameter:

49,96 mm

Standard diameter:

49,965 mm

Inspecting the driven sliding half-pulley

- Check that the belt contact surface is free from wear.
- Remove the 2 inside sealing rings and the 2 outside O-rings.
- Measure the mobile half-pulley bushing inside diameter.

Characteristic

Maximum admissible diameter:

50,08 mm

Standard diameter:

50,085 mm

Refitting the driven half-pulley bearing

- Install a new roller bearing by the specific tool.

N.B.

PLACE THE BEARING WITH THE WRITINGS AND THE EMBEDDED OIL GUARD FACING OUTWARDS.

- Properly support the half-pulley to prevent damaging the threading.

If you are working on the driven pulley unit fully assembled, use tool.

Specific tooling

020478Y Punch for driven pulley roller casing

001467Y002 Bell

- Install a new ball bearing by the specific tool.

Specific tooling

020376Y Handle for punches

020477Y Adapter 37 mm

020363Y 20mm guide

- Insert the snap ring to lock.

Refitting the driven pulley

- Insert the new oil guards
- Insert the new O-rings

N.B.

O-RINGS ARE OF TWO SIZES. THE LARGE ONE IS INSTALLED ON THE MACHINING END RADIUS, AT THE BASE OF THE HALF-PULLEY.

- Install the half-pulley on the bushing being careful not to damage the top sealing ring during the introduction.
- Check that the pins and the collar are free from wear; install pins and collar.

- Using a bent beak greaser, lubricate the driven pulley unit with about 10 gr. of grease, this operation should be carried out through one of the two holes into the bushing to obtain the exit of the grease from the opposite hole. This operation is required to prevent the presence of grease beyond the O-rings.

Recommended products

TUTELA MRM 2 Grease for the phonic wheel turning ring

Molybdenum disulphide grease and lithium soap

Inspecting the clutch spring

- Measure the free length of the mobile driven half-pulley spring.

Characteristic

Standard length:

125,5 mm

Admissible limit after use:

120 mm

- Check the thickness of the clutch mass friction material.

Characteristic

Minimum allowable thickness:

1 mm

- The masses must exhibit no traces of lubricants;
in that case, check the driven pulley unit seals.

N.B.

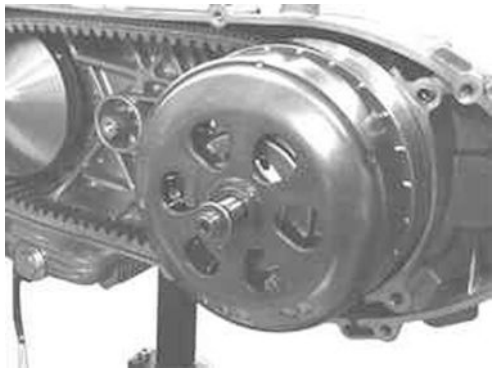
UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL CONTACT SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER. DIFFERENT CONDITIONS MAY CAUSE THE CLUTCH TEARING.

- Do not open the masses using tools to prevent a variation in the return spring load.

Refitting the clutch

Refitting bell

- Insert the bell and the spacer.



- Prepare the specific tool as for removal;
- Pre-assemble the driven pulley unit with the driving belt according to its direction of rotation;
- Insert the driven pulley unit, the spring with sheath and clutch into the tool.

Specific tooling

020444Y Driven half pulley spring compressor

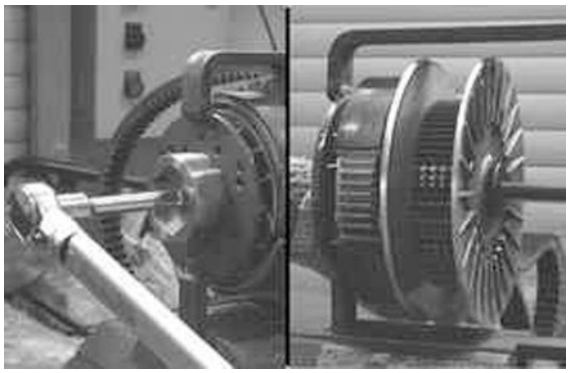
tool

- Compress the spring and insert the clutch on the driven pulley bushing.

N.B.

BE CAREFUL NOT TO DAMAGE THE SHEATH OR THE BUSHING THREADED END.

- Tighten the ring nut by hand and complete the tightening by the specific wrench at the prescribed torque.



Specific tooling

020444Y Driven half pulley spring compressor tool

Locking torques (N*m)

Clutch ring nut: 65 - 75

- To facilitate reassembly on the engine, turn the mobile driven pulley and insert the belt onto the smaller diameter.

Refitting the driven pulley

- Insert the driven pulley unit with the belt.

Drive-belt

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

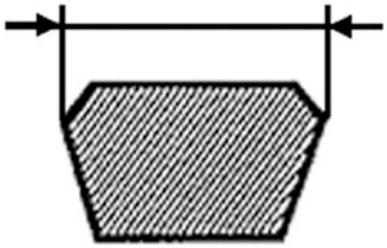
Characteristic

Minimum width:

25 mm

Standard width:

26,2 mm



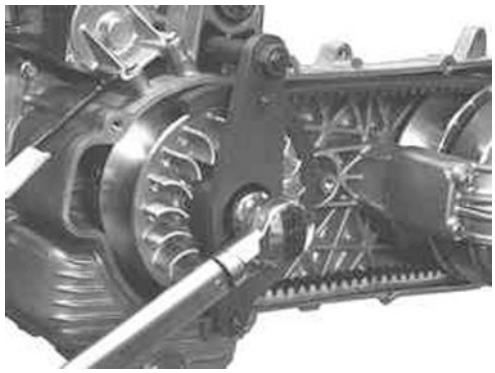
Removing the driving pulley

- Using a 27-mm wrench, turn the central pulley nut to horizontally align the central inside holes and install the specific tool.

Specific tooling

020474Y Driving pulley stop wrench

- Insert the retain band of the specific tool into the pulley first, so that the groove is fully abutted.
- Then, insert the tool so as to insert the stud bolts on the band into the holes obtained onto the tool itself.
- Tighten the two tool fastening nuts by hand.
- Loosen the central nut.
- Remove the spring washer and the flat washer.
- Remove the fixed driving half-pulley.
- Remove the bushing connection washer.



- Move the belt downwards.
- Suitable support the roller contrast and extract the mobile driving half-pulley with the relevant bushing and the rear washer, being careful not to make the rollers come out.

Inspecting the rollers case

- Check that the inside brasses shown in the figure are not worn and measure the inside diameter.

CAUTION

DO NOT LUBRICATE OR CLEAN THE BRASSES

Characteristic

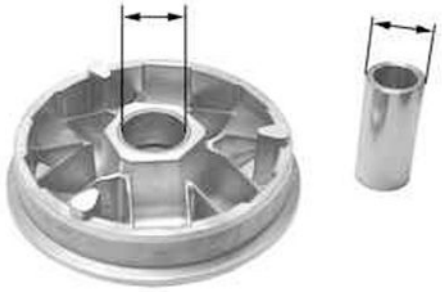
Maximum admissible diameter:

30,12 mm

Standard diameter:

30,021 mm

- Measure the pulley sliding bushing outside diameter shown in the figure.



Characteristic

Minimum admissible diameter:

Ø 29,95 mm

Standard diameter:

Ø 29,959 mm

Check that the rollers are not damaged or worn.

Characteristic

Minimum admissible diameter:

Ø 24,5 mm

Standard diameter:

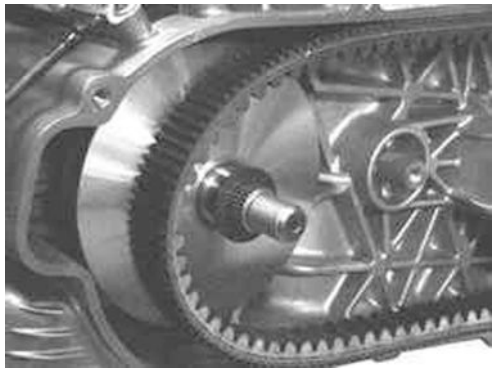
Ø 24,9 mm

- Check that the roller contrast plate slide blocks are not damaged.
- Check the wear of the roller housings and of the belt contact surfaces on both half-pulleys.

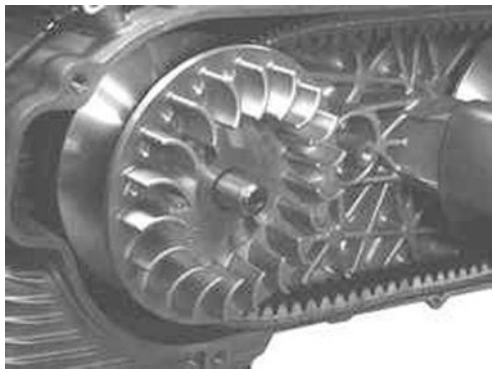
Refitting the driving pulley

Assembling the stationary drive semi-pulley

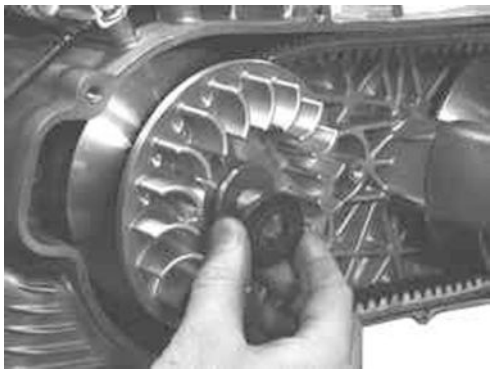
- Insert the spacer



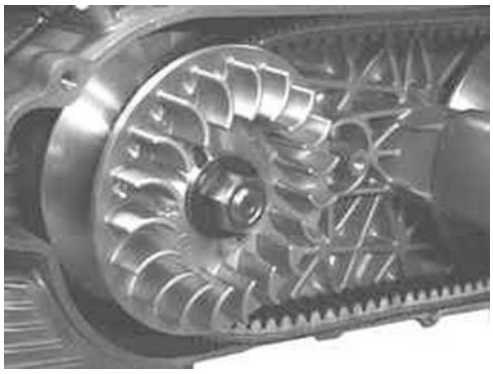
- Insert the fixed driving half-pulley and check that it is in contact with the spacer and with the mobile driving pulley sliding bushing.



- Remove the flat washer and the spring washer as shown in the figure.



- Insert the nut in the original position (nut side in contact with the spring washer).



- Turn the central pulley nut to horizontally align the holes and install the specific tool.

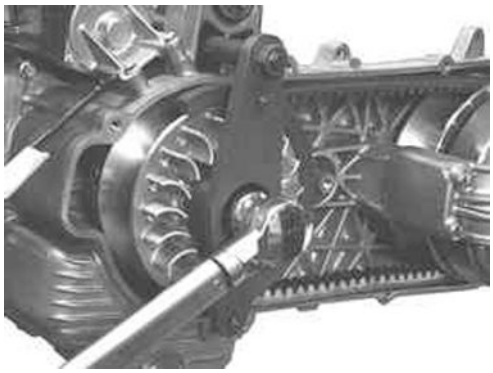
N.B.

CHECK THAT THE STOP WRENCH TOOL IS EASILY INSERTED INTO THE PULLEY AND IN THE ENGINE CRANKCASE.

Specific tooling

020474Y Driving pulley stop wrench

- Insert the retain band on the rear side, so that the groove is fully abutted.
- Finally install the tool by siding the nuts by hand and ensuring the tool is resting flatly.
- Tighten the driving pulley fastening nut at the prescribed torque
- Remove the specific tool.

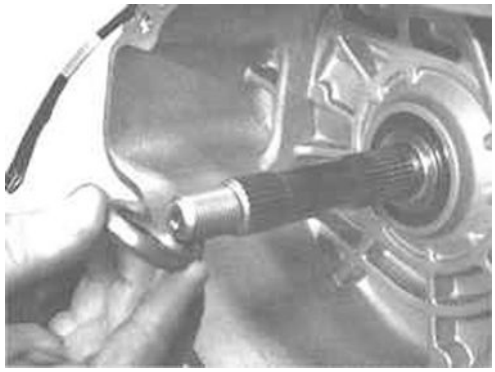


Locking torques (N*m)

Driven pulley shaft nut: 160 - 175

Assembling the belt anti-knock roller

- Insert the spacer with the inside chamfering facing the insertion side.



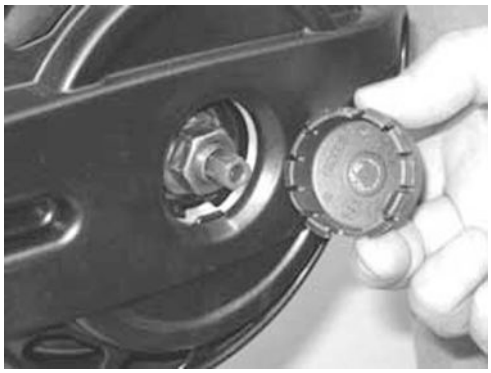
- Place the rollers into the half-pulley as shown in the figure.
- The covered side must rest onto the inside thrust side of the roller container.

- Assemble the half-pulley with the roller contrast and the sliding blocks.

- Insert the half-pulley on the driving shaft.
- Insert the spacer bushing.

Refitting the transmission cover

- Insert the driven pulley axle cap by placing the missing tooth in the low part at the reference on the transmission cover.



N.B.

CHECK THAT THE AIR INLET AND THE AIR OUTLETS ARE TOTALLY FREE.

- Insert the outside plastic transmission cover.
- Tighten the 4 fastening screws at the prescribed torque.

Locking torques (N*m)

Outside transmission cover screws: 7 ÷ 9

- Make sure that the 2 centering dowels are properly inserted into the crankcase.

- Insert the transmission cover with the bearing and install the relevant attachments.
- Lock the four M8 screws.

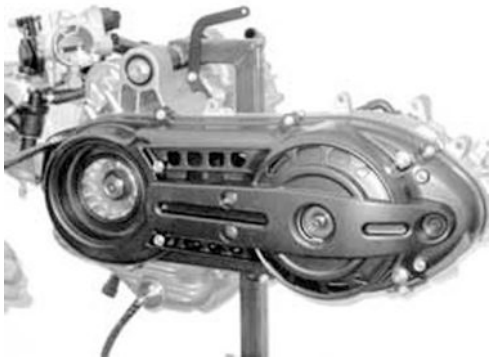
Locking torques (N*m)

M8 set screws for transmission cover 23 ÷ 26

- Lock the 7 M6 screws.

Locking torques (N*m)

M6 set screws 11 ÷ 13



- Insert the washers on the driven pulley shaft.

N.B.

INSERT THE SMALLER WASHER FIRST, THEN THE LARGER ONE.

- Insert the flanged nut.
- Prepare the dynamometric wrench for LH locking using a machine hexagon wrench.
- Tighten the driven pulley shaft fastening nut using a misaligned wrench.

N.B.

DUE TO THE HIGH TIGHTENING TORQUE, USING DIFFERENT WRENCHES - SUCH AS A CONVENTIONAL POLYGONAL BUSH - MAY DAMAGE THE HEXAGON OBTAINED ON THE SHAFT OR BREAK THE BUSH ITSELF.

Locking torques (N*m)

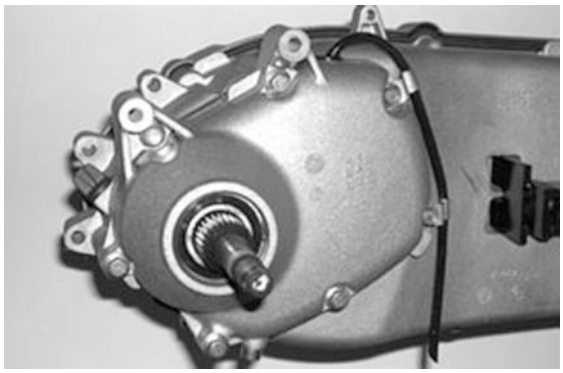
Driven pulley nut: 92 - 100

End gear

Removing the hub cover

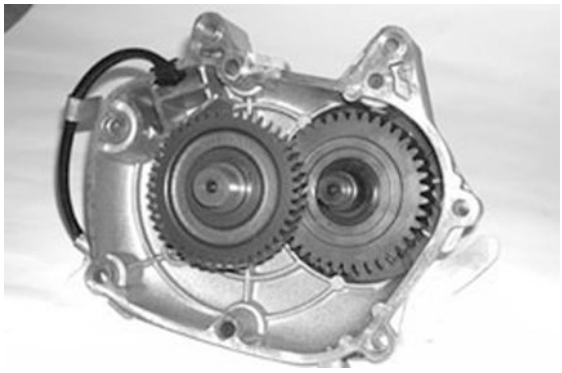
- Drain the rear hub oil through the oil drainage cap located under the Engine.
- Drain the rear hub oil through the oil drainage cap located under the Engine.

Remove the 7 fastening screws. Remove the hub cover and the relevant gasket.



Removing the wheel axle

- Remove the lay shaft.
- Remove the wheel axle with gear.



Removing the hub bearings

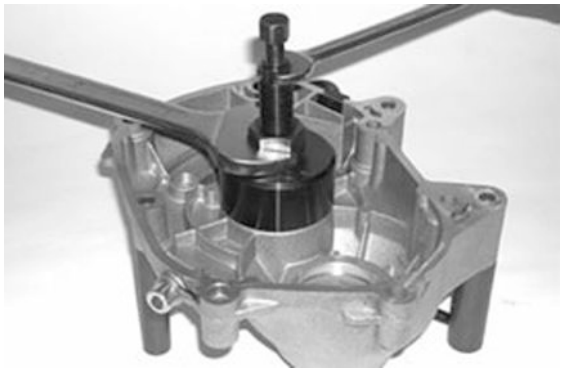
- Support the hub cover using the column kit.
- Extract the bearing by the specific tool.

Specific tooling

020476Y Column kit

001467Y006 20-mm pliers

001467Y007 Bell



- Check all bearings (wear, clearance and noise).

In case of anomalies, proceed as follows.

To remove the wheel axle bearing on the engine crankcase, use the following parts.

Specific tooling

001467Y014 15 mm pliers

001467y034 15-mm pliers

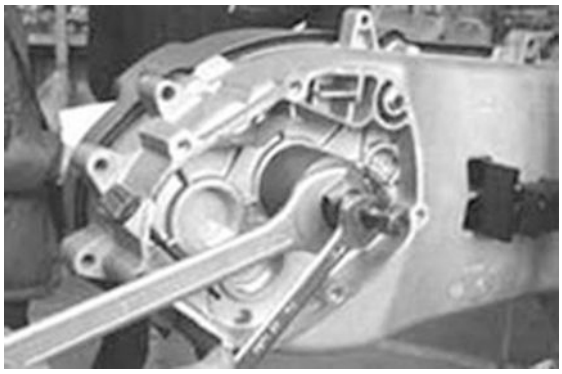
001467Y031 Bell

- Use the specific extractor to disassemble the bearing on the engine chassis of the countershaft.

Specific tooling

001467Y006 20-mm pliers

001467Y035 Bell



Removing the wheel axle bearings

- Remove the snap ring from the hub cover outside.

- Support the hub cover using the stud kit.
- Remove the bearing with the specific tool

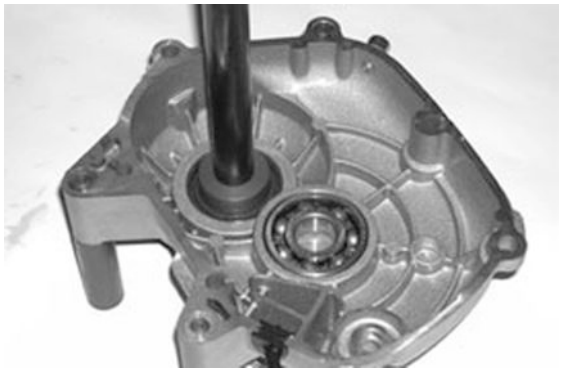
Specific tooling

020476Y Column kit

020376Y Handle for punches

020477Y Adapter 37 mm

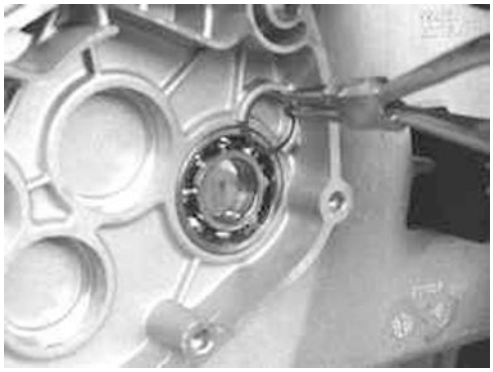
020483Y 30 mm guide



- Remove the oil guard by a screwdriver.

Removing the driven pulley shaft bearing

- If you have to remove the driven pulley shaft, the relevant bearing and the oil guard, remove the transmission cover and the clutch unit as described in the Automatic transmission chapter.
- Extract the driven pulley shaft from the bearing.
- Remove the oil guard by a screwdriver into the hub gear box.
- Remove the snap ring shown in the figure.



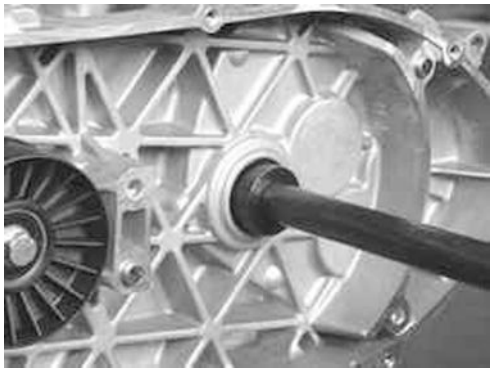
- Pull out the driven pulley shaft bearing from the engine crankcase using the specific tool.

Specific tooling

020376Y Handle for punches

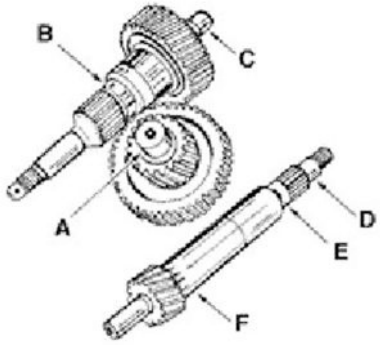
020358y 37 x40 adaptor

020364Y 25 mm guide



Inspecting the hub shaft

- Check that the 3 shafts exhibit no wear or deformation on the toothed surfaces, at the bearings and at the oil guards.
- In case of faults, replace the damaged parts.



Characteristic

Connection diameter for lay shaft:

A = Ø 20 - 0,01 -0,02 mm

Connection diameter for wheel axle:

B = Ø 30 - 0,010 -0,023 mm

C = Ø 15 - 0,01 -0,02 mm

Connection diameter for shaft driven pulley:

D = Ø 17 - 0,01 -0,02 mm

E = Ø 20 - 0,01 -0,02 mm
F = Ø 25 - 0,01 -0,02 mm

Inspecting the hub cover

- Check that the matching surface exhibits no deformations.

- Check the bearing capacity.

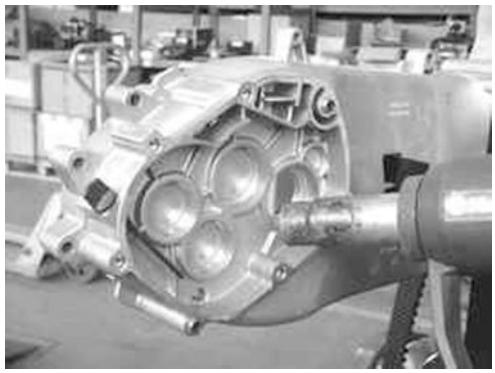
In case of faults, replace the hub cover.

Refitting the driven pulley shaft bearing

- Heat the crankcase by the thermal gun.

Specific tooling

020151Y Air heater "METABO HG 1500/2"



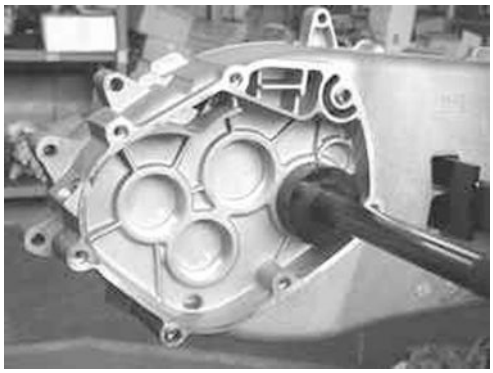
- Insert the driven pulley shaft bearing until it

abuts against the bottom of the seat using the

specific tool.

N.B.

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).



Specific tooling

020376Y Handle for punches

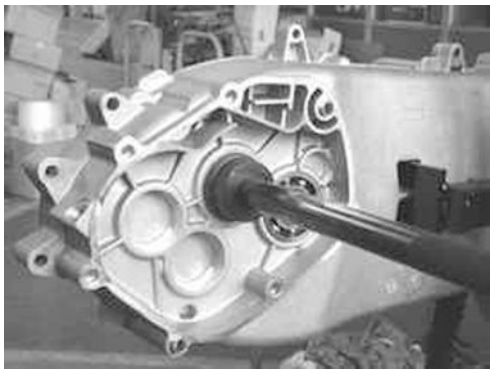
020360Y 52 x 55 mm adaptor

020364Y 25 mm guide

- Heat the intermediate gear bearing seat.
- Insert the intermediate shaft bearing by the specific tool.

N.B.

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).



Specific tooling

020376Y Handle for punches

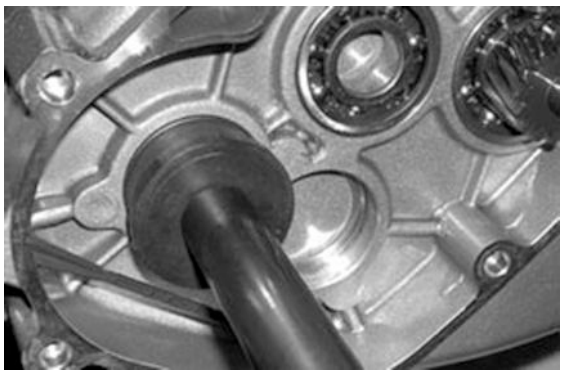
020359Y 42 x 47 mm hub bearing fitting adaptor

020363Y 20mm guide

- Heat the wheel axle bearing seat on the crankcase.
- Insert the wheel axle bearing in the upper crankcase seat by the specific tool.

N.B.

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).



Specific tooling

020376Y Handle for punches

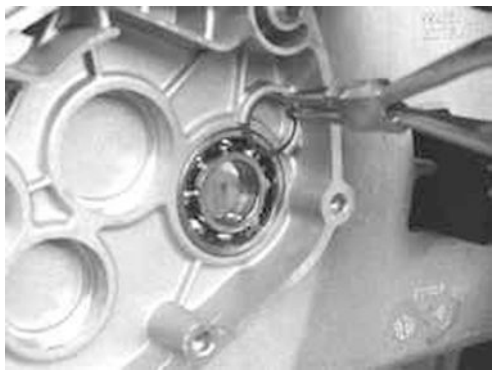
020359Y 42 x 47 mm hub bearing fitting adaptor

020412Y 15 mm guide

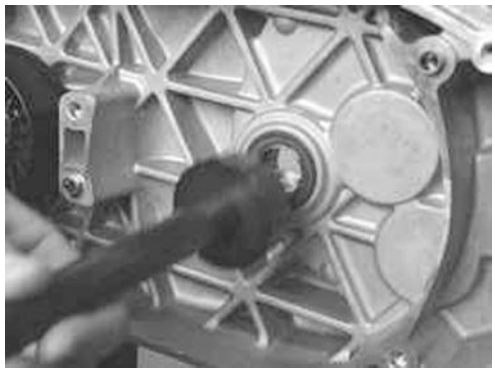
- Place the safety lock snap ring of the driven pulley shaft bearing.

N.B.

PLACE IT IN THE POSITION SHOWN IN THE FIGURE.



- Insert the pulley shaft oil guard on the transmission side.



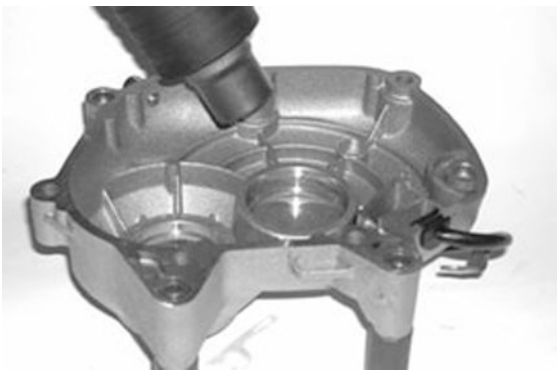
Refitting the hub cover bearings

- Heat the bearing seats on the cover using the thermal gun.
- Support the hub cover using the column kit.

Specific tooling

020151Y Air heater "METABO HG 1500/2"

020476Y Column kit

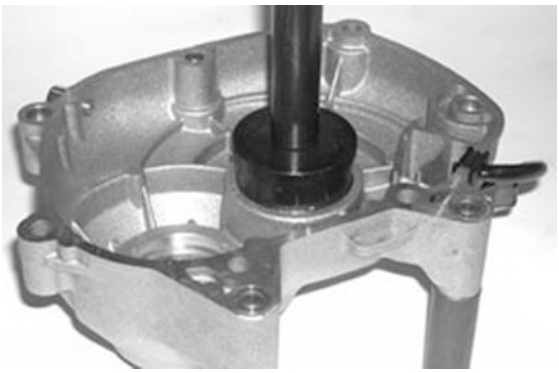


- Insert the intermediate shaft bearing on the cover by the specific tool.

N.B.

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

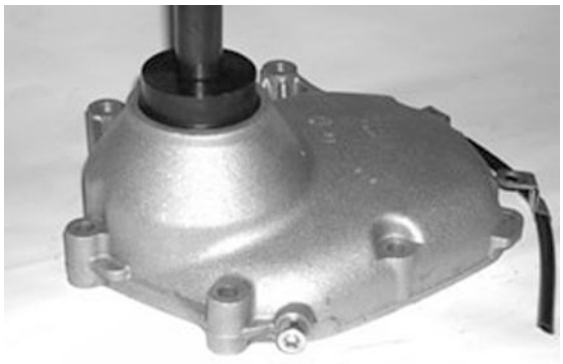


020376Y Handle for punches

020360Y 52 x 55 mm adaptor

020363Y 20mm guide

- Heat the wheel axle bearing seat from the cover outside.
- Insert the wheel axle bearing on the cover by the specific punch until abutment.



Specific tooling

020376Y Handle for punches

020360Y 52 x 55 mm adaptor

020483Y 30 mm guide

- Replace the snap ring

- Support the hub cover using the column kit.
- Insert the wheel axle oil guard with the sealing lip facing the inside of the cover.
- Place the oil guard flush with the crankcase.

Specific tooling

020376Y Handle for punches

020360Y 52 x 55 mm adaptor

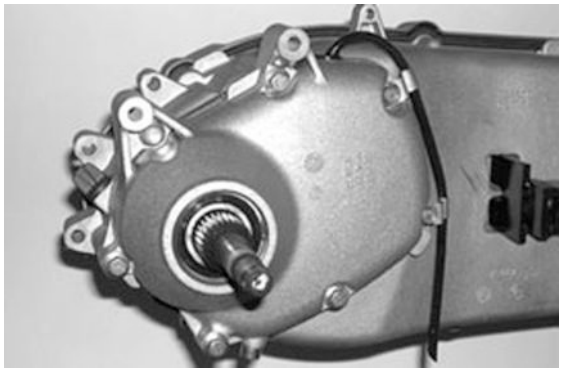
020476Y Column kit

Refitting the hub bearings

- Place the 3 shafts as shown in the figure.

Refitting the ub cover

- Check the proper position of the centering dowels.
- Install a new gasket.
- Install the cover checking the correct position of the vent pipe.



- Position the 7 set screws, tighten them to the prescribed torque, being careful of the position of the bands holding the vent tube, and the position of the 3 shortest screws as indicated in the figure.
- Refill with the prescribed oil to the Max. level.

Recommended products

TUTELA ZC 90 Rear hub oil

SAE 80W/90 Oil that passes API GL3 specifications

Characteristic

Quantity:

~ 250 cc

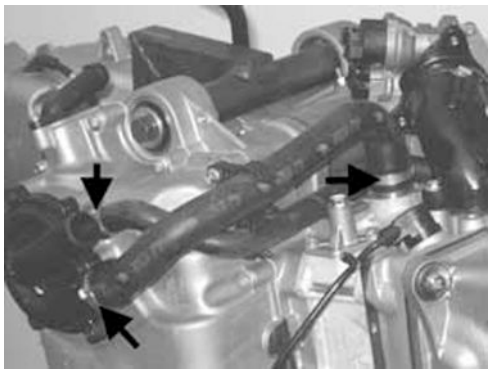
Locking torques (N*m)

Hub cover screws 24 ÷ 27

Flywheel cover

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the cylinder delivery sleeve and disconnect the

recirculation sleeve from the pump cover.



N.B.

THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.

Removing the hub cover

- Drain the engine oil by removing the drainage cap.
- Prepare a suitable container to collect the oil.

- Remove the pre-filter.

- Remove the oil filter using a filter tape or shaped cup wrench.

- Loosen the 14 fastening screws.

- Remove the flywheel cover with the relevant gasket and the cooling system sleeve support.

N.B.

THE SCREWS ARE OF 4 DIFFERENT LENGTHS. NOTE THE RELEVANT POSITIONS.

CAUTION

REMOVE THE COVER AVOIDING ANY POSSIBLE INTERFERENCES BETWEEN STATOR AND ROTOR.

CAUTION

BE CAREFUL TO PREVENT SLIPPAGE OF THE BY-PASS VALVE AND OF THE RELEVANT SPRING.

Removing the flywheel cover components

- Unscrew the 6 fixing screws and remove the water pump cover.

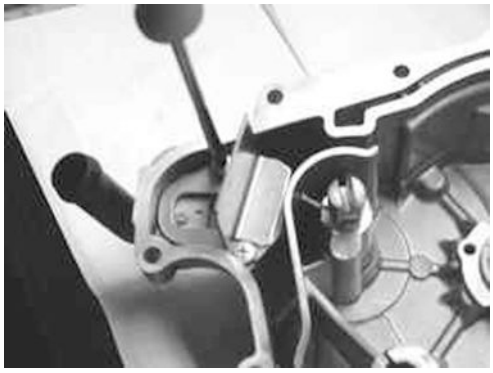
- Remove the by-pass and the relevant spring.
- Remove the sealing gasket.

Removing the stator

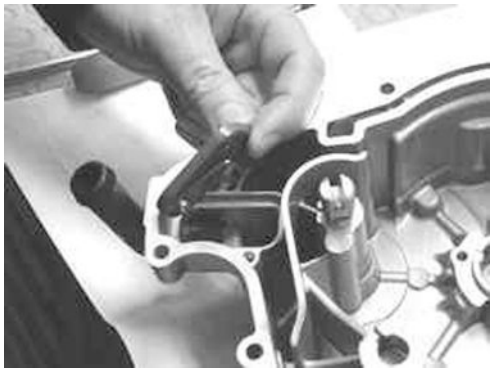
- Remove the 2 fastening screws and the wiring guide bracket.

- Unscrew the 3 fastening screws and remove stator and its wiring.

- Unscrew the 2 fastening screws and remove the reed valve support with head.



- Remove the blow-by reed valve with the relevant sealing gasket.

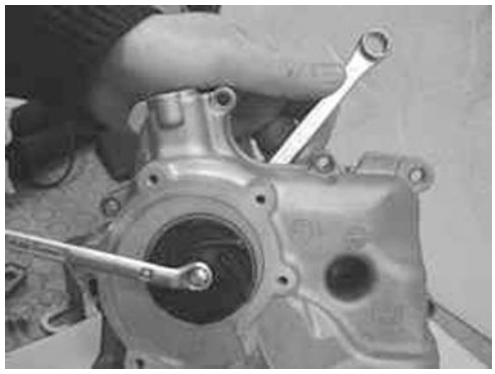


- Unscrew the fastening screw and remove the gas outlet union with the relevant O-ring.

- Remove the water pump impeller by unscrewing it from the relevant shaft.

N.B.

THE THREADING IS CLOCKWISE. IT IS ADVISABLE TO PREVENT THE SHAFT ROTATION BY INSERTING A 12-MM WRENCH INTO THE DRIVE.

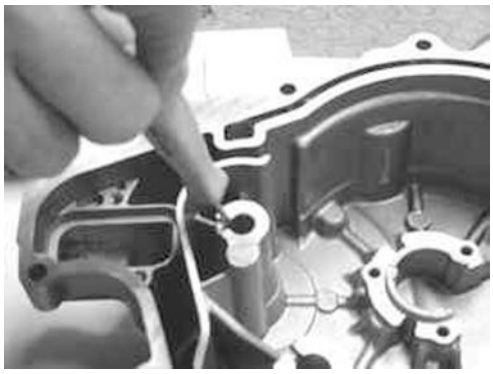


- Extract the shaft with the relevant abutment washer.

- Remove the sealing ring.

- Remove the ceramic ring and the relevant gasket.

- Remove the sealing ring for the pump shaft lubrication using a suitably shaped tool.



- Remove the engine oil filling cap/bar and the reference oil cap for the timing.
- Remove the minimum oil pressure sensor.

Inspecting the cover components

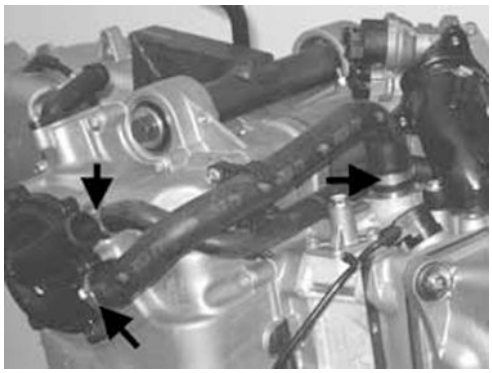
- Install a new oil filter, lubricate the sealing gasket, and tighten further at the prescribed torque.

Locking torques (N*m)

Oil filter: 12 - 16

- Install the cylinder delivery sleeve and connect

the recirculation sleeve to the pump cover using 3 new bands.



N.B.

LOCK THE BANDS WITH THE SPECIAL PLIERS BEING CAREFUL NOT TO CUT DEEPLY INTO THE SLEEVE AND PREVENTING INSUFFICIENT TIGHTENING.

- Install the pre-filter and the engine oil drainage cap and tighten at the prescribed torque.
- Refill the engine with the prescribed oil type.

Recommended products

SELENIA HI Scooter 4 Tech Engine oil

Synthetic oil SAE 5W/40 that passes the API SG specification.

Locking torques (N*m)

Engine oil drain plug 24 ÷ 30 N•m

- Check the integrity of the stator and of the relevant wiring.

- Check the continuity between the 3 phases.

N.B.

THE VALUES REFER TO AMBIENT TEMPERATURE. A CHECK WITH THE STATOR AT WORKING TEMPERATURE GIVES HIGHER VALUES.

Electric characteristic

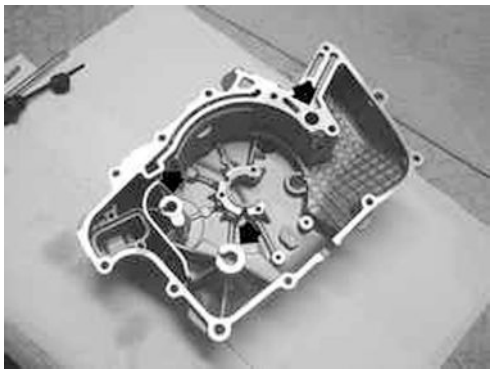
Resistance

0,2 ÷ 1 Ω

- Check the earth insulation of each phase.
- In case of irregularities, carefully check the wiring as this consists of 2 cables: stiff cables close to the stator and soft cables to the connector.

- Check that the winding is placed so as to not interfere with the fastening screw heads.

- Check that the crankcase matching surface exhibits no deformations or wear.
- Check that the by-pass valve seat, the torque limiter and the water pump shaft are free from wear.



Characteristic

By-pass housing hole diameter:

13,9 mm

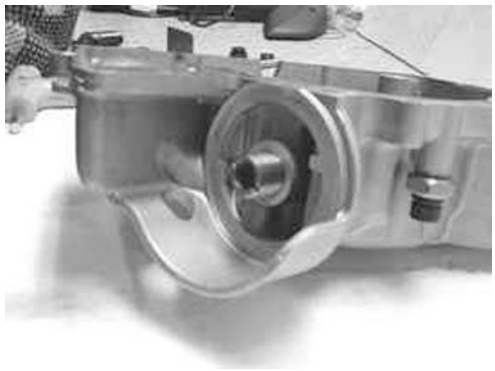
Connection diameter for start-up gear shaft:

12 mm

Connection diameter for pump shaft:

8 mm

- Check that the oil filter union and matching surface exhibit no deformations or wear.



Refitting the stator

- Install the stator with wiring, tightening the 3 screws at the prescribed torque.

N.B.

INSERT THE RUBBER WIRING SEALING GASKET INTO THE SPECIAL SEAT ON THE CRANKCASE.

Locking torques (N*m)

Stator fastening screws: 8 - 10

- Install the wiring guide bracket tightening the 2 screws at the prescribed torque.

Locking torques (N*m)

Wiring guide bracket fastening screws: 3 - 4

- Temporarily install the timing check hole cap and the engine oil filling cap/bar.
- Insert the blow-by recovery duct using a new O-ring.
- Tighten the screw at the prescribed torque.

Locking torques (N*m)

Blow-by recovery duct fastening screws: 3 - 4

- Insert the spring and the by-pass piston on the

flywheel cover.

N.B.

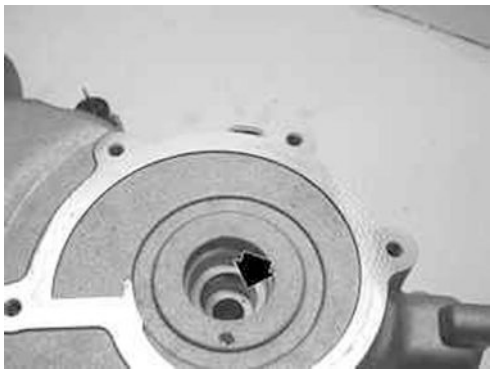
LUBRICATE THE BY-PASS VALVE.

Refitting the flywheel cover components

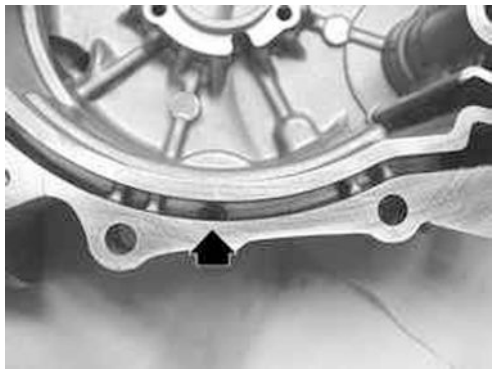
- Before reassembling, check that all components are perfectly clean.
- For the cover, carefully check all lubrication channels, in particular:
- The 3 by-pass channels.

- Oil feeding duct at the water pump shaft connection.

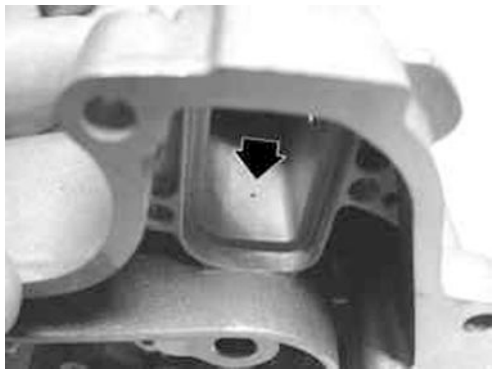
- Pump drainage duct.



- Oil pressure sensor feeding duct.



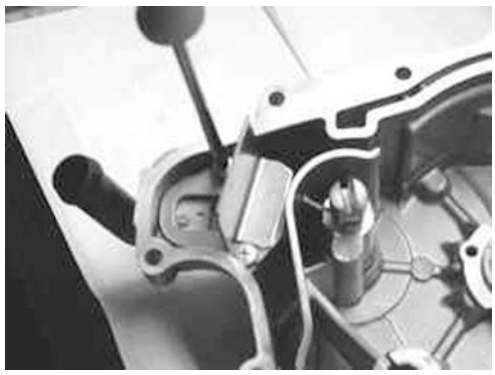
- Oil vapour decantation chamber



- Reinstall the blow-by reed valve using a new sealing gasket.
- Reinstall the support with head and tighten the screws at the prescribed torque.

Locking torques (N*m)

Support screws with head: 0,3 ÷ 0,4



- Install a new sealing ring for the pump shaft using the specific tool
- Install the oil minimum pressure sensor and tighten at the prescribed torque.

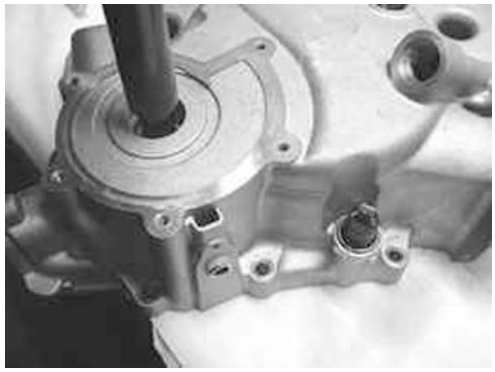
Specific tooling

020376Y Handle for punches

020412Y 15 mm guide

Locking torques (N*m)

Minimum oil pressure sensor 12 ÷ 14



- Pre-assemble the ceramic seal and the relevant gasket.

N.B.

PLACE THE CHAMFERING TOWARDS THE GASKET BEING CAREFUL NOT TO FOUL THE CERAMIC RING WITH OIL OR GREASE, WHICH WOULD IMPAIR THE SEAL.

- Insert the ceramic seal on the flywheel cover.

N.B.

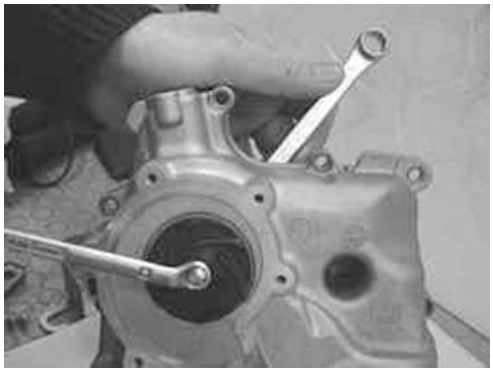
ASSEMBLE BY HAND TO PREVENT DAMAGES TO THE CERAMIC SEAL.

- Insert the water pump shaft after lubricating the flywheel cover seat.
- Insert the mechanical seal on the shaft up to the impeller abutment surface.

N.B.

THE FINAL INTRODUCTION DEPTH WILL BE DETERMINED BY THE IMPELLER.

- Screw the impeller and tighten at the prescribed torque.

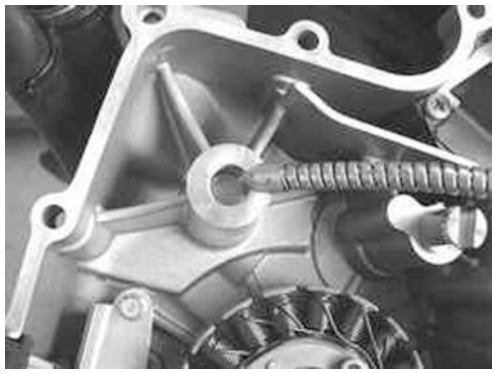


Locking torques (N*m)

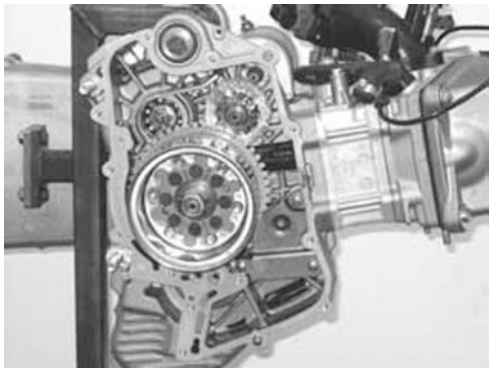
Water pump impeller: 4 ÷ 5

Refitting the flywheel cover

- Lubricate the intermediate gear seat with torque limiter on the flywheel cover.
- Align the water pump drive with a reference and install the flywheel cover as described in the Flywheel cover chapter.



- Install a new gasket on the engine crankcase.
- Check the presence of the 3 centering dowels.

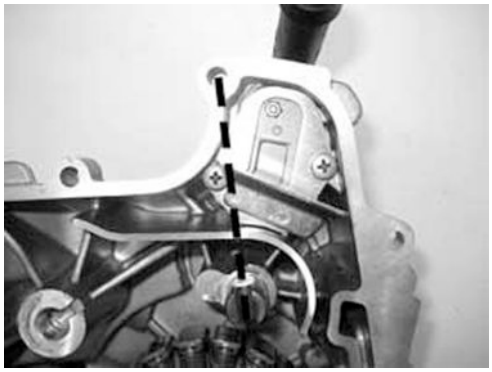


- Turn the driving shaft to align the counter-shaft drive with a reference on the crankcase (see figure).

- Repeat the alignment for the water pump shaft with the same reference on the cover.

N.B.

THESE ARRANGEMENTS ARE USEFUL ESPECIALLY WHEN WORKING WITH WATER PUMP COVER ALREADY ASSEMBLED.

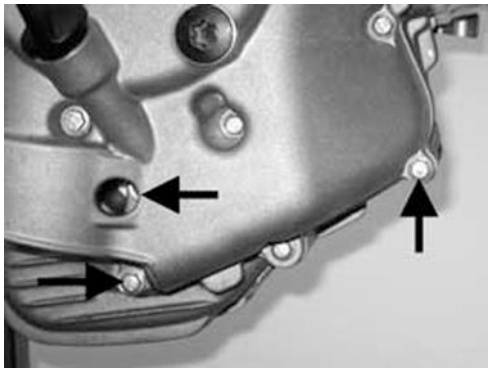


- Install the flywheel cover on the engine, being careful to prevent any possible interferences between stator and rotor.

WARNING

FAILURE TO OBSERVE THIS RULE CAN CAUSE THE BREAKAGE OF THE CERAMIC MAGNETS.

- Tighten the 14 cover fastening screws at the prescribed torque.

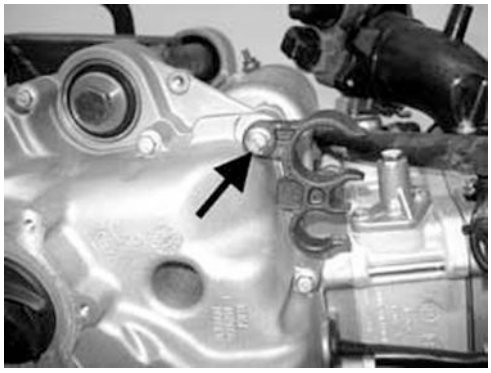


N.B.

THE SCREWS ARE OF 4 DIFFERENT LENGTHS:
- THE 3 SHORTER ONES ARE IN THE POSITION SHOWN IN THE FIGURE.
- THE LONGER ONE IS PLACED UNDER THE ENGINE OIL FILLING CAP.

N.B.

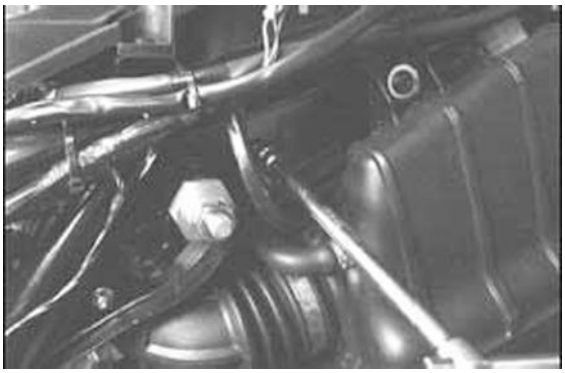
- THE INTERMEDIATE ONES ARE FOR THE REMAINING ATTACHMENTS, EXCEPT FOR THE SLEEVE SUPPORT FASTENING SCREW (HIGHLIGHTED IN THE FIGURE), WHICH IS SLIGHTLY LONGER.



Locking torques (N*m)

Flywheel cover screws 11 ÷ 13

Flywheel and starting



The starter is sold as a complete part.

Before deciding to replace it, carry out the following tests:

1 - **Battery**

Check the voltage after not running (a few hours):

Voltage >12.5V

Check the density of the electrolyte of each element:

Bé = 30- 32

Specific weight: 1,25 ÷ 1,26

YES go to 2 No go to 3

2 - Make sure the negative terminals (battery negative and starter negative) are correctly connected to each other and to the frame.

YES go to 4 NO go to 5

3 - Recharge and if necessary replace the battery.

4 - Connect the tester (see the "injection" chapter).

Connect the induction clamp of an ammeter to the positive power supply of the starter.

Remove the 10A fuse no. 12 (see «fuses» chapter).

Switch to «ON» with switch on «RUN» and side stand up.

Select the «PARAMETERS» function.

Start the engine (so that it cannot move) long enough to measure the rpm and starter absorption.

N.B.

THE DECLARED RPM VALUE IS THAT INDICATED BY THE TESTER, THE RPM READING IS NOT THE REAL ONE, BUT IS VALID FOR DIAGNOSTIC PURPOSES.

Specific tooling

020460Y Tester and scooter diagnosis

Electric characteristic

Absorption at drag speed:

80 ÷ 120 A

Revolution speed =

~300÷400 G/1'

YES go to 6 NO go to 7 NO go to 8 NO go to 9

5 - Restore the connections

6 - **The values are correct.**

Effect another confirmation, test the idle absorption.

Remove the starter motor (see the magneto and starter system).

Reconnect the earth and positive and perform the test.

Electric characteristic

Idle current absorption:

<40 A

YES go to 10 NO go to 11

7 - Low drag speed

High electrical absorption

Carry out a test of the engine rotation (example: possible melting of the bushes) and if no anomalies are found, replace the starter motor.

8 - **Low drag speed**

Low electrical absorption

Repeat the test bridging the starter contactor power terminals or replace.

Check the new values.

YES go to 12 NO go to 13

9 - **High drag speed**

Low electrical absorption

The engine turns too freely, check the compression end pressure.

If the values are not correct proceed as follows.

10 - The starter motor works properly.

11 - - Check the induced rotation.

12 - Replace the starter contactor.

13 - Test the battery again and if necessary replace the starter motor.

N.B.

IF THE DRAG SPEED OF THE ENGINE SHAFT IS LOW AND COMBINED WITH STRANGE NOISE, CHECK THE FREE WHEEL OF THE TORQUE LIMITER (SEE THE «MAGNETO AND STARTER SYSTEM» CHAPTER).

STARTER MOTOR

Specification	Desc./Quantity
Type	Mitsuba sm13d
Power	0,9 Kw

BATTERY

Specification	Desc./Quantity
Capacity	14 Ah
Starting current	125 A

STARTER CONTACTOR

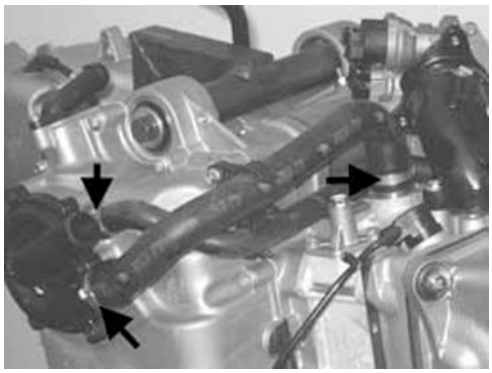
Specification	Desc./Quantity
Type	SEALED
Supply	150 A DC

STARTER TRANSMISSION

Specification	Desc./Quantity
Crown and free wheel coaxial to magneto	Intermediate gear with built-in torque limiter.

The starter system has a transmission between the motor armature and engine shaft equipped with free wheel coaxial to the magneto and torque limiter on the intermediate shaft.
The limiter is calibrated to 100 Kgm (100Nm); this component protects the structure of the engine and the starter kinematic mechanism in the event of incorrect starting with consequent inverse revolutions.
The free wheel is used for a sufficiently silent starting.
The starter command (energised contactor) is assisted by consensuses from the side stand and emergency OFF/RUN switch, which does not allow starting in dangerous conditions.
The starter commend circuit is not controlled by the immobilizer system, therefore before insisting on the starter system, check the consensus of the immobilizer.
As for checking the consensus circuit, see the «Electrical system» chapter, while for checking the engine shaft control transmission, follow what is described in the «Magneto and starter system» chapter.

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the cylinder delivery sleeve and disconnect the recirculation sleeve from the pump cover.



N.B.

THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.

Removing the starter motor

N.B.

THIS OPERATION MAY ALSO BE CARRIED OUT WITH FLYWHEEL COVER ASSEMBLED.

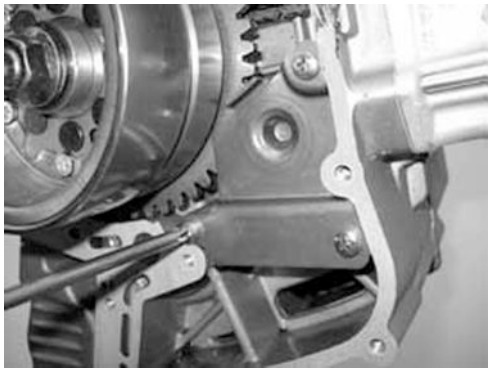
- Loosen the two fastening screws.
- Extract the complete starter motor.

Removing the flywheel magneto

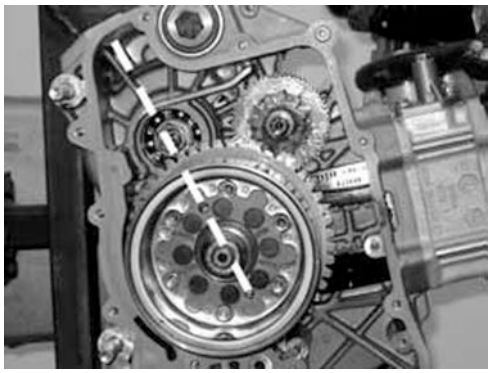
N.B.

IF YOU MUST REMOVE THE MAGNETO FLYWHEEL, IT IS NECESSARY TO REMOVE THE CHAIN GUIDE SLIDING BLOCK RETAIN PLATE FIRST.

- Unscrew the 3 fastening screws and remove the chain guide sliding block retain plate and the start-up rim.



- Align the holes obtained on the flywheel with the crankcase housing to allow the introduction of the specific tool.



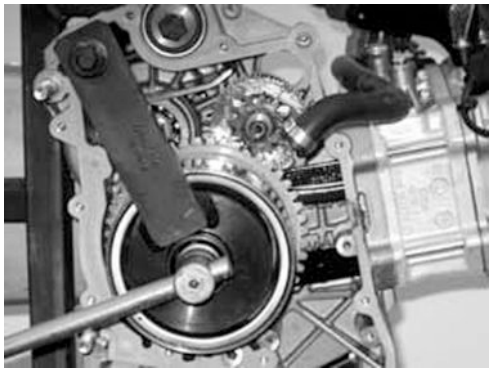
- Tighten the bushing of the flywheel lock tool on the removing tool threading..

Insert the specific tool as shown in the figure, making sure that the pins are perfectly inserted into the previously aligned holes and that it is perfectly abutted and almost flush with the flywheel.

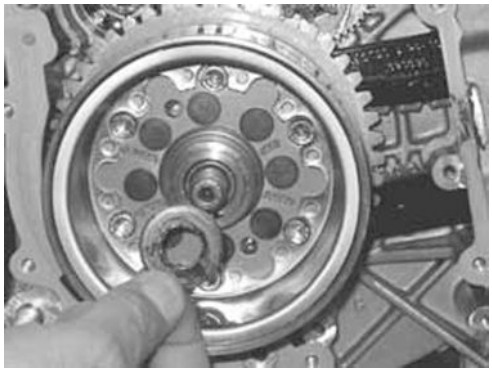
Specific tooling

020472Y Flywheel removing tool lock wrench

- Loosen the magneto flywheel fastening nut.
- Remove the specific tool and the fastening nut.



- Remove the washer.



- Insert the nut again so as to slightly uncover the shaft and free the space that was occupied by the washer.

CAUTION

THIS OPERATION IS REQUIRED AS THE FLY-WHEEL IS STRONGLY LOCKED; THE CONE DE-TACHMENT MAY THEREFORE CAUSE THE ROTOR SLIPPAGE, WITH THE CONSEQUENT BREAKAGE OF THE MAGNETS.

- Insert the specific removing tool.
- Using a 27-mm wrench and a 19-mm bushing, release the magneto flywheel.

Specific tooling

020467Y Flywheel extractor

- Remove the removing tool.
- Remove the nut and extract the magneto fly-wheel with the start-up rim.
- Remove the driving shaft key.

- To remove the start-up rim from the free wheel it is necessary to turn it clockwise and pull it out.

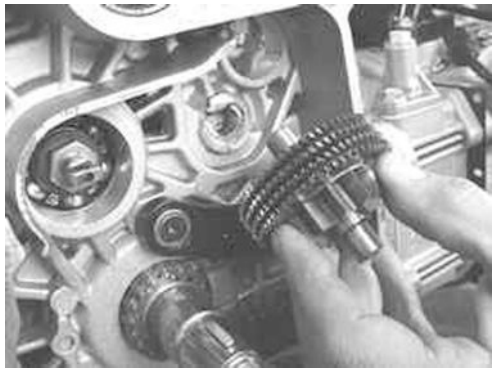
- Remove the free wheel from the magneto fly-wheel by loosening the 6 fastening screws.

CAUTION

SINCE THE FREE WHEEL MUST BE REMOVED, IT IS ADVISABLE TO LOOSEN THE 6 FASTENING SCREWS IN ADVANCE WITH THE FLYWHEEL STILL INSTALLED ON THE DRIVING SHAFT.

- The free wheel is coupled to the flywheel with high precision; if removal is difficult, use 2 screws as gripping points and as removing tools, if required.

- Extract the intermediate gear provided with torque limiter.

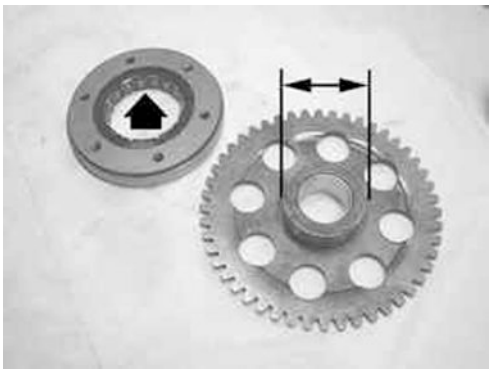


Inspecting the flywheel components

- Check the integrity of the magnets.
- Check that the magnet support cage is free from deformation or cracks.
- Check that the flywheel nailing exhibits no loosening.

Starter gear rim

- Check that the free wheel and the start-up rim hub surface are free from wear.
- Check the hub outside diameter.



Characteristic

Hub outside diameter:

Ø 45,665 + 0,008 +0,005 mm

- Check the start-up brass inside diameter.
- Check that the toothing is not worn.

Characteristic

Brass inside diameter:

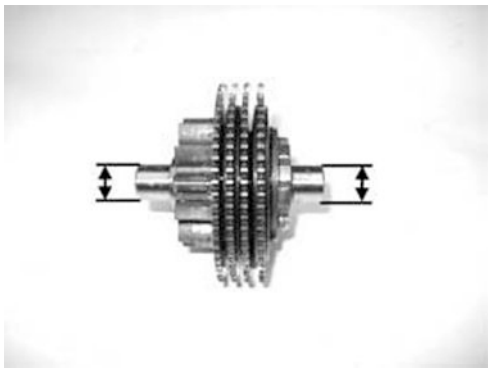
Ø 27 + 0,020 +0,041 mm

N.B.

IN THE EVENT OF FAILURES CONCERNING THE HUB, IT IS ADVISABLE TO REPLACE THE START-UP RIM AND THE FREE WHEEL.
IF ONLY THE BRASS IS WORN, IT IS POSSIBLE TO REPLACE ONLY THE COMPLETE START-UP RIM. IN THAT CASE, CHECK ALSO THE DIAMETER AND THE SURFACE OF THE CONNECTION ON THE DRIVING SHAFT. IN CASE OR IRREGULARITIES, REPLACE THE DRIVING SHAFT.

Intermediate gear

- Check that the toothing is not worn.
- Check the diameter of the two ends.



Characteristic

Gear connection diameter:

Ø 12 - 0 - 0,011 mm

Also check the capacity diameter on the flywheel cover and on the engine crankcase.

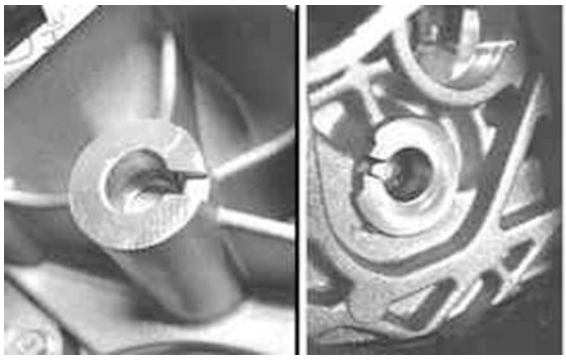
Characteristic

Flywheel cover connection diameter

Ø 12 + 0,034 -0,016 mm

Engine crankcase connectiondiameter:

Ø 12 + 0,034 -0,016 mm



N.B.

THE TORQUE LIMITER IS PROVIDED WITH 4 GEARS THAT HAVE THE FUNCTION OF CLUTCH DRIVING PLATES.

Driven plates consist of 4 Belleville washers provided with grooved profiles; this assembly allows transmitting torques lower than 10 kgm.
In case of incorrect start-up manoeuvres, the limiter prevents any kicks, with consequent reversal of direction of the driving shaft which would impair the engine structure.

The limiter assembly cannot be overhauled. In case of irregularities on the toothed discs, replace the assembly.

Refitting the free wheel

- Check that the free wheel contact surfaces are in good condition.
- Carefully clean the free wheel to remove any residues of LOCTITE.
- Degrease the threading of the holes on the free wheel and the fastening screws.
- Apply the recommended product to the ends of the screws.

Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

- Install the free wheel on the magneto flywheel,
with the rectified part in contact with the flywheel,
that is with visible wheel snap ring.
- Tighten the 6 fastening screws in a crossed se-

quence at the prescribed torque.

Locking torques (N*m)

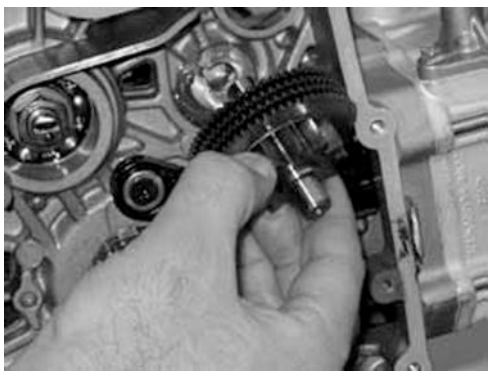
Free wheel fixing screws on the flywheel 13 - 15

- Lubricate the free wheel "rollers"

Refitting the intermediate gear

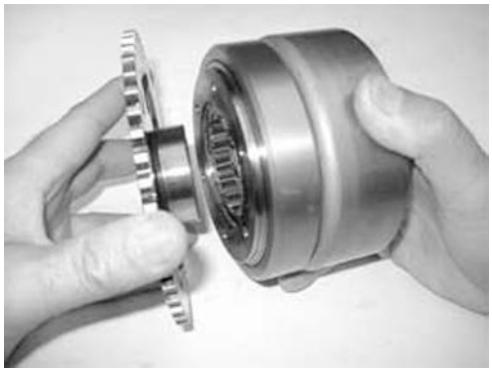
- Lubricate the gear housing on the engine crankcase.

- Insert the intermediate gear with torque limiter



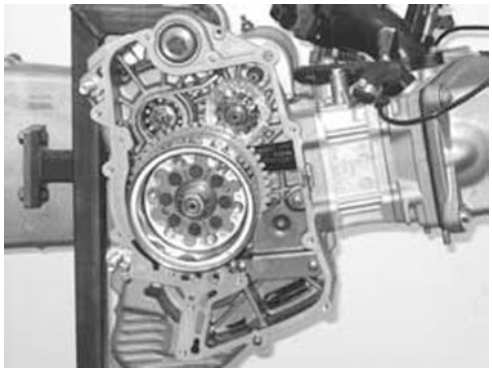
- Lubricate the inside brass and the start-up rim hub surface.

- Install the start-up rim on the flywheel turning it clockwise and inserting at the same time.



Refitting the flywheel magneto

- Insert the key on the driving shaft.
- Install the magneto flywheel checking the proper insertion of the key and engaging the torque limiter gear with the start-up rim.



- Insert washer and nut on the driving shaft.

- Tighten thoroughly the guide bushing of the flywheel lock tool and loosen by 1/4 turn.

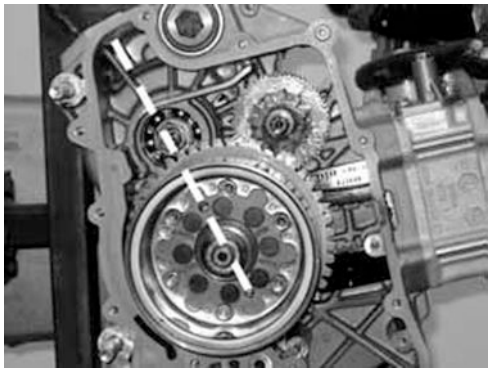
N.B.

FAILURE TO OBSERVE THIS RULE CAUSES THE LOCKING OF THE GUIDE ON THE FLYWHEEL.

Specific tooling

020472Y Flywheel removing tool lock wrench

- Align the 2 holes of the magneto flywheel with the case housing to allow the introduction of the specific tool.



- Insert the specific tool checking that the pins are perfectly introduced into the seat.

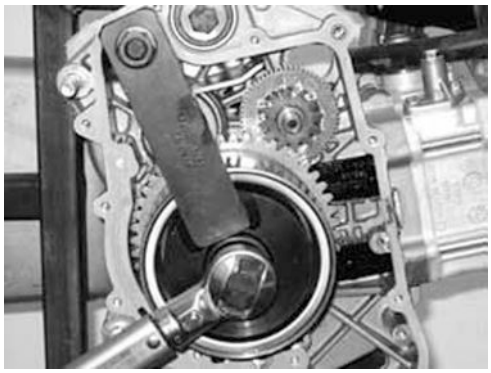
Specific tooling

020472Y Flywheel removing tool lock wrench

- Tighten the flywheel lock nut at the prescribed torque.

Locking torques (N*m)

Flywheel lock nut: 115 - 125



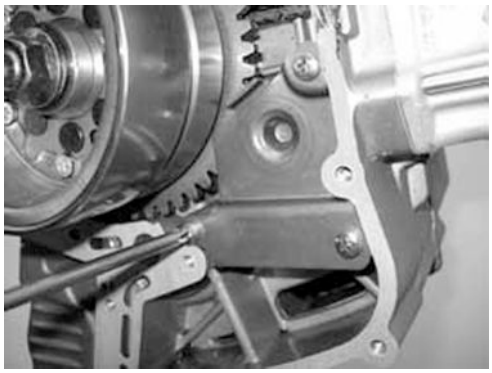
- Install the chain guide retain plate tightening the 3 screws at the prescribed torque.

N.B.

BEFORE TIGHTENING THE SCREWS, MOVE THE START-UP RIM IN CONTACT WITH THE CRANK-CASE AND CHECK THAT IT IS FREE TO ROTATE IN COUNTER-CLOCKWISE DIRECTION.

Locking torques (N*m)

Chain guide sliding block retain plate fastening screws: 3 ÷ 4



Refitting the starter motor

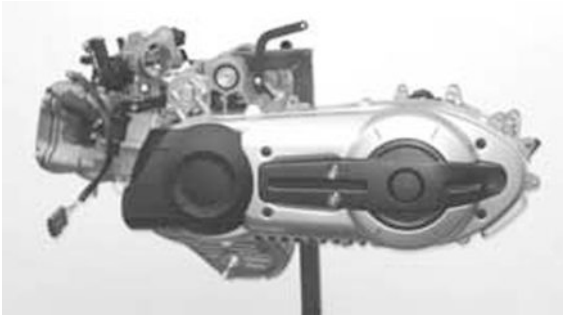
- Check that the O-ring is in good working order and lubricate it.
- Insert the starter motor.
- Tighten the 2 fastening screws at the prescribed torque.

Locking torques (N*m)

Starter motor screws 11 ÷ 13

Cylinder assy. and timing system

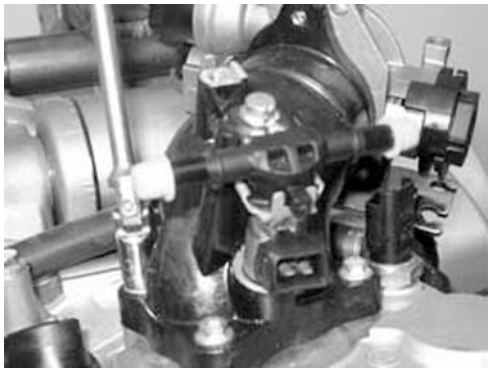
- Remove the external and internal transmission cover.



- Remove the magneto cover, magneto and torque limiter.

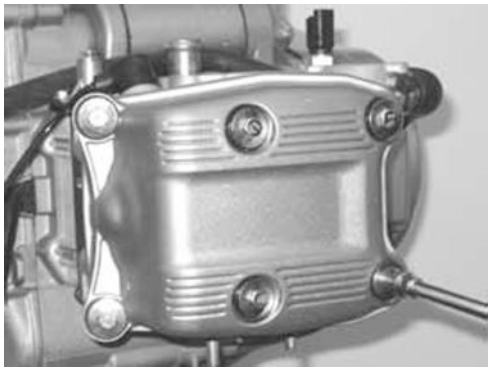
Removing the intake manifold

- Remove the 3 fixing screws.
- Remove the intake manifold unit.



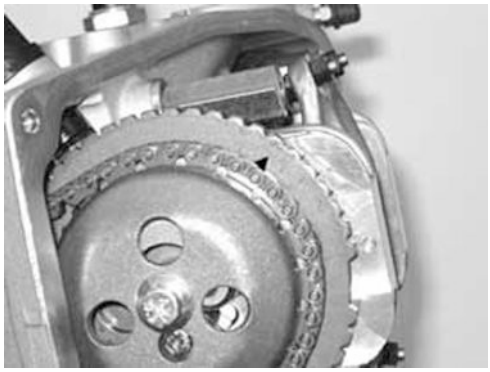
Removing the rocker-arms cover

- Loosen the 6 special screws with abutment and the relevant rubber gaskets.
- Remove the tappet cover with relevant gasket.



Removing the timing system drive

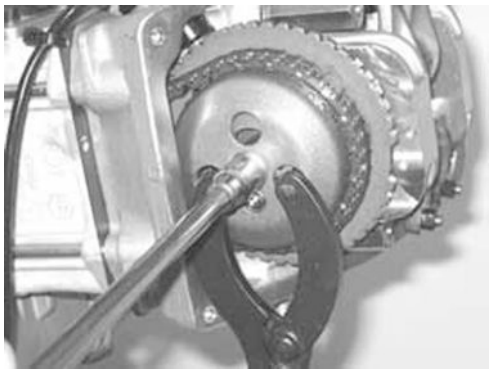
- Turn the engine to close the intake valves, i.e., moving the reference on the wheel speed sensor to the top, as shown in the figure.



- Remove the central screw and the valve lifting device mass stop bell using the specific tool.

Specific tooling

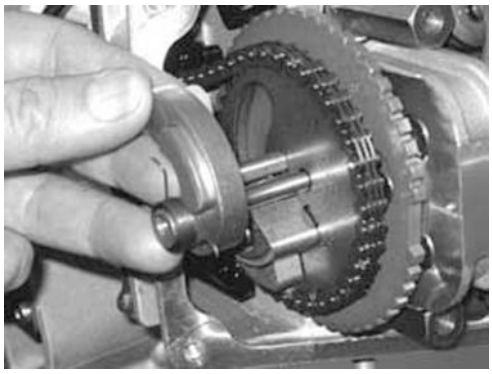
020565Y Compass flywheel stop spanner



- Remove the return spring and the valve lifting mass with relevant travel end washer.

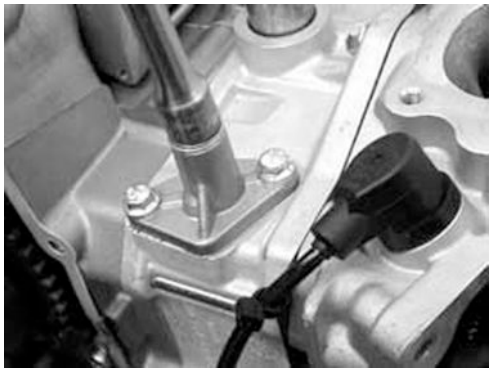
N.B.

BE CAREFUL NOT TO MAKE WASHER AND SPRING FALL INTO THE ENGINE THROUGH THE CHAIN COMPARTMENT.

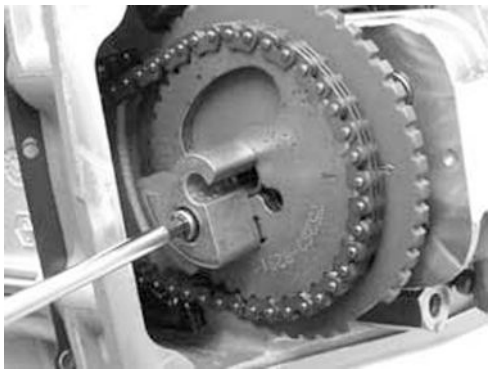


- Align the references located on the wheel speed sensor and on the head.

- Loosen the tightener central screw.
- Unscrew the 2 fastening screws and remove the tightener with relevant gasket.

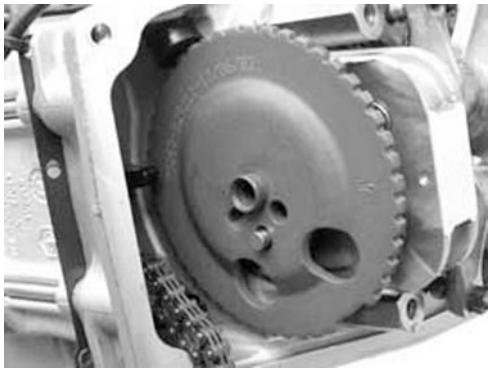


Remove the inside hexagon screw and the balance weight as shown in the figure.



- Remove the timing belt rim from the camshaft.
- Remove the timing belt rim.

- Remove the wheel speed sensor.



- Remove the engine stroke-revolution sensor and relevant O-ring by loosening the fastening screw and removing the fixing band from the special hole obtained on the head gasket.

N.B.

TO CHECK THIS COMPONENT, SEE THE INJECTION CHAPTER.

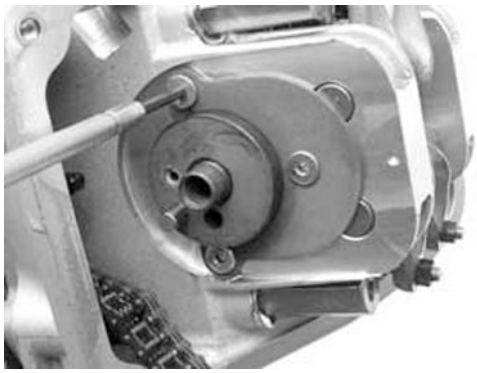
Removing the cam shaft

- Unscrew the 3 fastening screws and remove

camshaft retain bracket.

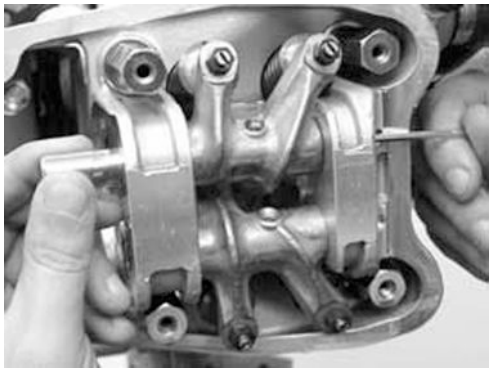
N.B.

REMOVING THE FASTENING SCREWS MAY BE DIFFICULT. BE CAREFUL NOT TO DAMAGE THE INSIDE HEXAGON. IN CASE OF NEED, SEPARATE THE THREADS IN ADVANCE.



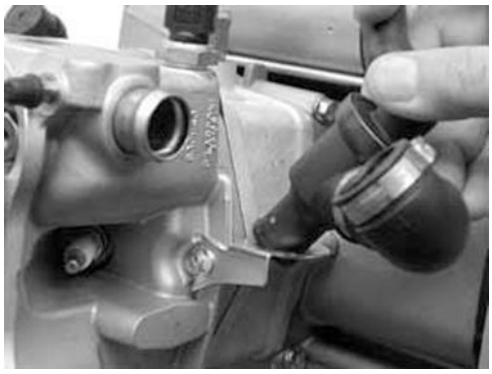
- Remove the camshaft.

- Remove pins and rockers by the transmission side holes.



Removing the cylinder head

- Remove the spark plug.
- Remove the cooling system outlet sleeve with thermostat.

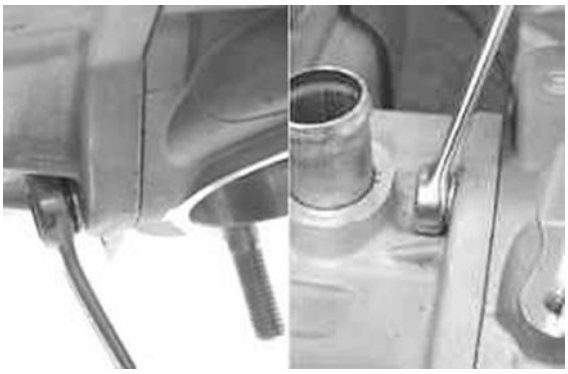


- Remove the cooling fluid temperature sensor.

N.B.

THE SENSOR CONTROLS BOTH INJECTION AND THE ANALOGUE INSTRUMENT ON THE PANEL. TO CHECK THIS COMPONENT, SEE THE INJECTION CHAPTER.

- Remove the 2 fastening nuts on the head, on the exhaust and on the intake side.



- Remove the two M6 screws into the distribution channel and the M6 screw on the spark plug side with the thermostat support.

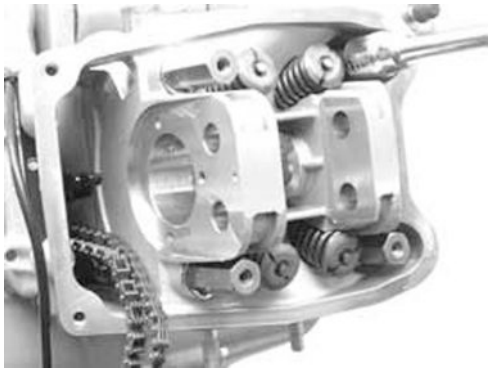
N.B.

IN CASE OF NEED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, PINS, ROCKERS AND FIXING BRACKET.

- Loosen the 4 head-cylinder fastening nuts in 2 or 3 times and in a crossed sequence.
- Remove the head, the 2 centering dowels, the gasket and the lower chain guide sliding block.

N.B.

DO NOT REMOVE THE DOWELS IF THEY ARE FORCED INTO THEIR SEAT.

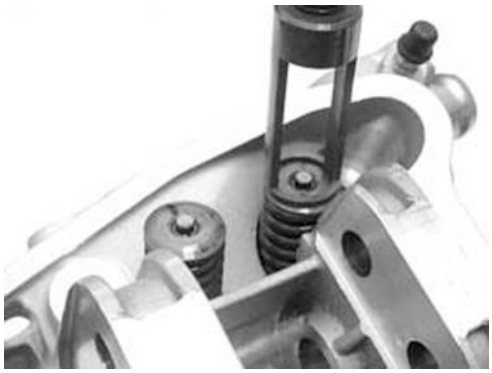


CAUTION

WHEN YOU HAVE TO REMOVE THE HEAD, PREPARE A SUITABLE CONTAINER SINCE THE THERMAL UNIT CONTAINS COOLING FLUID.

Removing the valves

- Using the specific tool with adapter, remove half-cones, plates, springs and valves.



Specific tooling

020382Y Tool for removing valve cotters equipped with part 012

020382Y012 bush (Valves removing tool)

CAUTION

ARRANGE THE VALVES SO AS TO RECOGNISE THE ORIGINAL POSITION ON THE HEAD (FLYWHEEL SIDE AND TRANSMISSION SIDE).

- Remove the oil guards by the specific tool.

Specific tooling

020431Y Valve oil seal extractor

- Remove the spring supports.

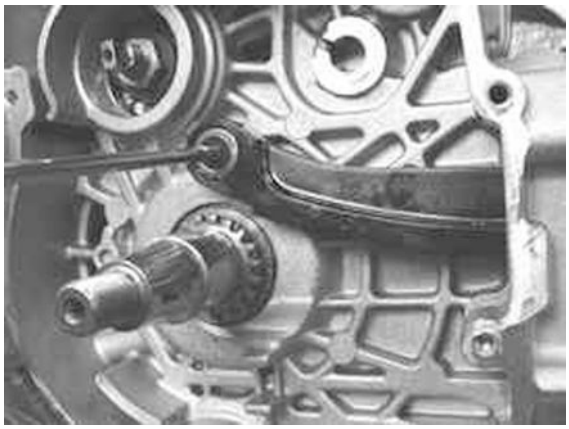
N.B.

BLOW THE SEATS WITH COMPRESSED AIR TO FACILITATE THE SPRING SUPPORT REMOVAL.

Removing the cylinder - piston assy.

- Remove the timing belt.

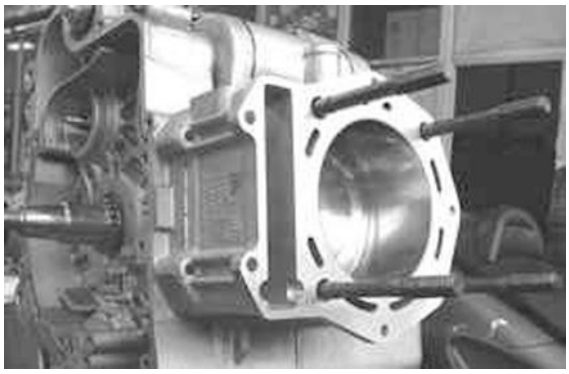
- Loosen the fastening screw and remove the spacer and the tightening sliding block.



N.B.

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

- Extract the cylinder with the relevant gasket and the centering dowel.



N.B.

THE SECOND CENTERING IS ENSURED BY A PIN SET INTO THE CYLINDER.

CAUTION

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

- Remove the 2 piston pin locking rings by the specific housings.
- Extract the pin and remove the piston.

N.B.

CLOSE THE CYLINDER HOUSING MOUTH ON THE CRANKCASE WITH PAPER OR WITH A CLOTH TO PREVENT SLIPPAGE OF ONE OF THE PIN LOCKING RINGS INTO THE CASE.

- Remove the piston sealing rings and the scraper ring.

CAUTION

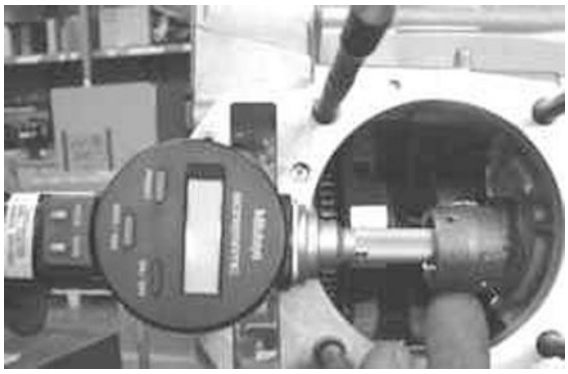
NOTE THE ASSEMBLY POSITIONS OF THE LININGS TO PREVENT INVERTING THE POSITION IN CASE OF REUSE.

N.B.

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.

Inspecting the small end

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



N.B.

IF THE CONNECTING ROD SMALL END DIAMETER EXCEEDS THE STANDARD DIAMETER, EXHIBITS WEAR OR OVERHEATING, PROCEED TO RE-PLACE THE DRIVING SHAFT AS DESCRIBED IN CHAPTER CRANKCASE AND DRIVING SHAFT.

Characteristic

Standard diameter:

22 + 0,025+0,015 mm

Inspecting the wrist pin

- Check the pin outside diameter by a micrometer.

Characteristic

Standard diameter:

22 0 -0,004 mm

- Calculate the coupling clearance between pin and connecting rod end.

Characteristic

Standard play:

0,015 ÷ 0,029 mm

- Measure the capacity diameter on the piston.

Characteristic

Standard diameter:

22 + 0,006 +0,001 mm

- Calculate the coupling clearance between pin and piston.

N.B.

THE PIN HOUSINGS ARE PROVIDED WITH 2 LUBRICATION CHANNELS. FOR THIS REASON, MEASUREMENT MUST BE MADE ACCORDING TO THE PISTON AXIS.

Characteristic

Standard play:

0,001 ÷ 0,010 mm

Inspecting the piston

- Measure the piston outside diameter according to a direction orthogonal to the pin axis.
- Take the measurement in the position shown in the figure.

Characteristic

A =

43,2 mm

Piston diameter:

92 mm

- Using a bore gauge, measure the cylinder inside diameter according to the directions shown in the figure at three different heights.

Characteristic

Standard diameter:

92 + 0,018 +0,010 mm

- Check that coating is free from flakes.
- Check that the head matching surface exhibits no deformations or wear.

Characteristic

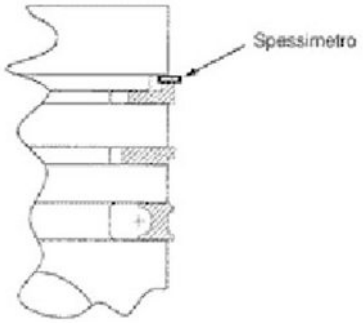
Maximum allowable runout:

0,05 mm

- Pistons and cylinders are classified into categories based on their diameter. Coupling is made in

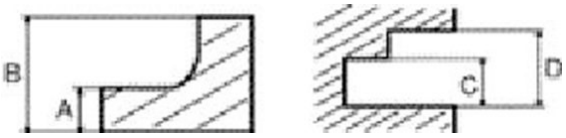
pairs (A-A, B-B, C-C, D-D).

- Carefully clean the sealing ring housings.
- Using suitable probes, measure the coupling clearance between sealing rings and piston housings, as shown in the figure.
- If higher clearance values than those reported in the table are measured, replace the piston.



N.B.

MEASURE THE CLEARANCE BY INSERTING THE BLADE OF THE THICKNESS GAUGE FROM THE SIDE OF THE SECOND GAS RING



Fitting clearance (Cylindrin/Pison)

Standard coupling play 1° compression lining A 0,9 - 0,005 -0,030mm B **1,5 - 0,005 - 0,03mm** **Admissible play after use** 1° compression lining C 0,9 + 0,03 +0,01mm D **2 + 0,05 +0,02mm** **Standard coupling play** 2° compression lining </> 12 - 0,005 mm </> **</>** **Admissible play after use** 2° compression lining </> 1,25 + 0,03 mm </> **</>** **Standard coupling play** Scraper ring lining </> 2,5 - 0,005 mm </> **</>** **Admissible play after use** Scraper ring lining </> 2,5 + 0,03 mm </> **</>**

Inspecting the piston rings

- Alternately insert the 3 sealing rings into the cylinder in the zone where it has the original diameter. Insert the rings in orthogonal position into the cylinder axle, using the piston.
- Measure the opening (see figure) of the sealing rings by a thickness gauge.
- If higher values than those prescribed are measured, replace the linings.

N.B.

BEFORE REPLACING THE PISTON RINGS ONLY, 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.

Fitting clearance (Cylindrin/Pison)

Compression lining Standard opening 0,15 ÷ 0,35 mm Max value 0,5 mm **</>** **Scraper ring lining** Standard opening 0,25 ÷ 0,50 mm Max value 0,65 mm **</>** **Scraper ring lining** Standard opening 0,25 ÷ 0,50 mm Max value 0,65 mm **</>**

Removing the piston

- Fit piston and pin on the connecting rod, placing the piston with the arrow towards the exhaust.

- Insert the locking ring into the specific tool, with the opening in the position indicated on the tool.
S = left
D= right

- Move the locking ring into position by the punch.

- Install the pin lock using the pin shown in the figure.

Specific tooling

020470Y Pin retainers installation tool

N.B.

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

CAUTION

USING A HAMMER MAY DAMAGE THE LOCK HOUSINGS

Choosing the gasket

- Temporarily install the cylinder on the piston without base gasket.
- Install a comparator on the specific tool using the short union, as shown in the figure.

Specific tooling

020475Y Driving pulley stop wrench

- Using an abutment plane, reset the comparator with a pre-load of a few millimetres.
- Finally fix the comparator.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the comparator position.
- Lock the tool by the original head fastening nuts.
- Turn the driving shaft to the TDC (point of reversal of the comparator rotation).
- Measure the deviation from the reset value.

- Identify the thickness of the cylinder base gasket to be used for re-assembly by the table below.

The proper identification of the cylinder base gasket thickness allows maintaining the correct compression ratio.

- Remove the specific 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.

Characteristic

Recess / Projection measured 1

- 0,185 ÷ - 0,10

Gasket thickness 1

0,4 ± 0,05

Recess / Projection measured 2

- 0,10 ÷ + 0,10

Gasket thickness 2

0,6 ± 0,05

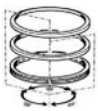
Recess / Projection measured 3

+ 0,10 ÷ + 0,185

Gasket thickness 3

0,8 ± 0,05

Refitting the piston rings



- Place the scraper ring lining spring on the piston.
- Install the scraper ring lining keeping the opening opposed to the spring junction and with the writing "top" facing upwards. In any case, the chamfering must be arranged towards the piston top.
- Fit the second lining with the identification letter or the writing "top" facing the piston top. In any case, the step must be facing opposite the piston top.
- 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 2 SEALING LININGS HAVE A CONICAL SURFACE OF CONTACT WITH THE CYLINDER. THIS IS TO ENSURE A BETTER ADAPTATION.

- Misalign the lining openings at 120° as shown in the figure.
- Lubricate the parts 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 and the band clamp, install the cylinder as shown in the figure.

N.B.

BEFORE INSTALLING THE CYLINDER, CAREFULLY BLOW THE LUBRICATION DUCT AND LUBRICATE THE CYLINDER LINER. CHECK THE PRESENCE OF THE TWO REFERENCE DOWELS.

Specific tooling

020468Y Band clamp

020512Y Cylinder piston fitting fork

Inspecting the cylinder head

- Using a rectified bar and a thickness gauge, check that the head surface exhibits no deformations or wear.

Characteristic

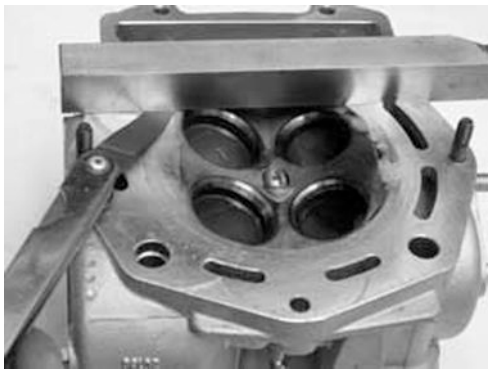
Maximum admissible out of plane:

0,1 mm

- In case of irregularities, replace the head.
- Check the sealing surfaces for the intake and

exhaust manifold.

- Check that the camshaft and the rocker pin capacities exhibit no wear.
- Check that the head cover surface is not worn.
- Check that the cooling fluid sealing pad exhibits no oxidation.



STANDARD DIAMETER

Specification	Desc./Quantity
A	13 + 0,018 0
B	20 + 0,021 0
C	42 + 0,025 0

- In case of irregularities, replace the head and check also the corresponding component.

Inspecting the timing system components

- Check that the guide sliding block and the tightening sliding block are not too worn.
- Check that the driving shaft pinion and the camshaft control timing rim unit exhibit no wear.

In case of wear of the sliding blocks, replace them. In case of wear of the chain or rim, replace the entire unit.

N.B.

IF THE CHAIN HAS DAMAGED THE PINION, REPLACE THE DRIVING SHAFT AS DESCRIBED IN CHAPTER CRANKCASE AND DRIVING SHAFT.

- Remove the central screw with the washer and the tightener spring. Check that the unidirectional gear is not worn.
- Check the integrity of the tightener spring.
- In case of wear, replace the entire assembly

Inspecting the valve sealings

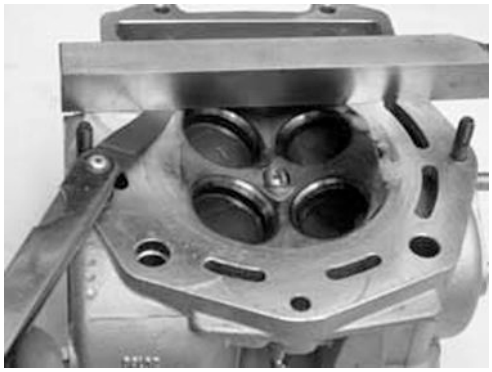
- Insert the valves into the head.
- Alternately test the intake and exhaust valves.
- The test should be carried out by filling the manifold with fuel and checking that the head does not bleed from the valves, when pressed by your fingers only.

- Visually inspect the valve sealing surface.

CAUTION

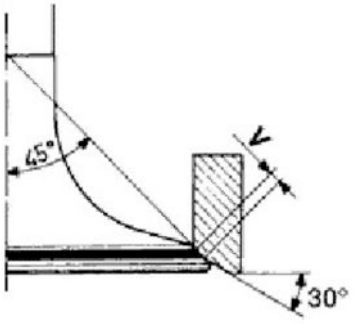
DO NOT CHANGE THE VALVE ASSEMBLY POSITION (RH-LH)

- If the valve sealing surface is interrupted in one or more points, or it is bent, replace the valve.



Inspecting the valve housings

- Clean the valve seats of any carbon residues.
- Using the Prussian blue, check the width of the impression on the valve seat «**V**».
- Measure the inside diameter of each valve guide.
- Measure according to the rocker thrust direction at three different heights.



Characteristic

Standard value:

1÷ 1,3 mm

Admissible limit:

1,6 mm

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

Inspecting the valves

-Check the valve stem diameter at the three points shown in the figure.

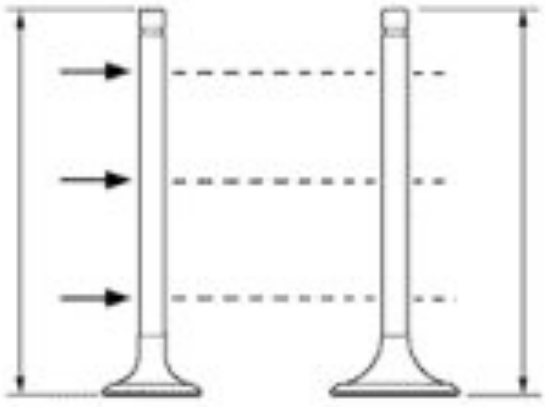
STANDARD DIAMETER

Specification	Desc./Quantity
Intake:	4,987 ÷ 4,972 mm
Exhaust:	4,975 ÷ 4,960 mm

MINIMUM ADMISSIBLE DIAMETER

Specification	Desc./Quantity
Intake:	4,96 mm
Exhaust:	4,945 mm

- Calculate the clearance between valve and valve guide.

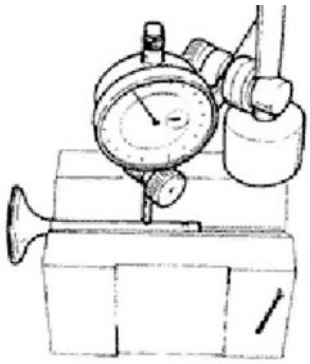


- Check the deviation of the valve stem by resting it on a «**V**» shaped abutment and measuring the extent of the deformation by a comparator.

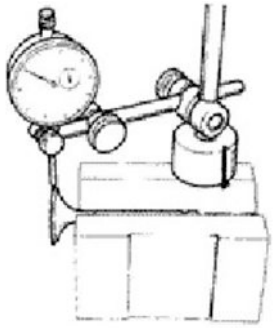
Characteristic

Admissible limit:

0,1 mm



- Check the concentricity of the valve head by arranging a comparator at right angle relative to the valve head and rotate it on a «**V**» shaped abutment.



Characteristic

Admissible limit:

0,03 mm

Inspecting the valve stem guide clearance

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

INTAKE

Specification	Desc./Quantity
Standard play:	0,013 ÷ 0,04 mm
Admissible limit:	0,08 mm

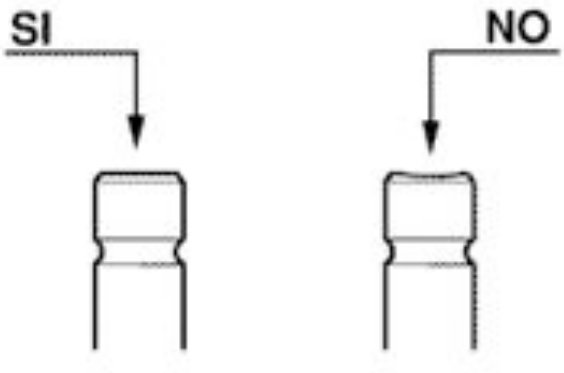
EXHAUST

Specification	Desc./Quantity
Standard play:	0,025 ÷ 0,052 mm
Admissible limit:	0,09 mm

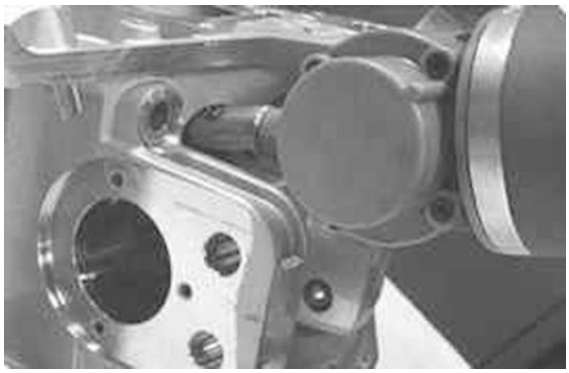
STANDARD VALVE LENGTH

Specification	Desc./Quantity
Intake:	95,0 ± 0,3 mm
Exhaust:	94,2 ± 0,3 mm

- Check that the contact surface with the articulated register terminal is free from wear.



- If the checks above give no failures, you can use the same valves. To obtain better sealing performance, grind the valve seats. Perform this operation carefully using fine grain emery paste. While grinding, keep the head with the valve axes in horizontal position to prevent the emery paste residues from penetrating into the valve guide stem coupling (see figure).



CAUTION

TO AVOID SCORING THE MATING SURFACE, DO NOT KEEP ROTATING 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 ASSEMBLY POSITION (RH-LH)

Inspecting the springs and half-cones

- Check that the spring upper support plates and half-cones are free from irregular wear.

- Measure the free length of the spring.

Characteristic

Standard length:

44,4 mm

Admissible limit after use:

42,4 mm

Refitting the valves

- Place the valve spring support plates on the head.
- Alternately insert the 4 oil guards by the specific tool.
- Lubricate the oil guards and the valve guides.

Specific tooling

020306Y Valve sealing ring drift

- Insert valves, springs and plates. Using the specific tool provided with the special adapter, compress the springs and insert the half-cones into the relevant seats.

Specific tooling

020382Y Tool for removing valve cotters

equipped with part 012

020382Y012 bush (Valves removing tool)

N.B.

DO NOT CHANGE THE VALVE ASSEMBLY POSITION. FIT THE VALVES WITH THE REFERENCE COLOUR ON THE HALF-CONES SIDE (LARGER STEP CURLS).

Inspecting the cam shaft

- Check that the camshaft ends exhibit no scratches or irregular wear.

- Using a micrometer, measure the camshaft capacity.

STANDARD DIAMETER

Specification	Desc./Quantity
Connection A Ø:	42 - 0,060 -0,085 mm
Connection B Ø:	20 - 0,020 -0,041 mm

MINIMUM DIAMETER ADMISSIBLE

Specification	Desc./Quantity
Connection A Ø:	41,910 mm
Connection B Ø:	19,940 mm

-Using a gauge, measure the cam height.

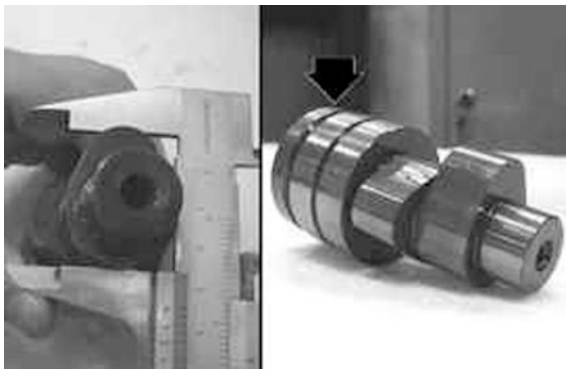
STANDARD HEIGHT

Specification	Desc./Quantity
Intake:	33,988 mm

Specification	Desc./Quantity
Exhaust:	33,417 mm

ADMISSIBLE LIMITS

Specification	Desc./Quantity
Intake:	33,740 mm
Exhaust:	33,170 mm
Standard axial clearance:	0 ÷ 0,22 mm
Maximum admissible axial clearance:	0,3 mm



- If different values or wear than those prescribed are found, replace the faulty parts.
- Check that the retain plate seat shown in the figure exhibit no wear.
- Check that the automatic valve lifting device cam, the travel end roller and the rubber abutment on the containment bell are free from wear.
- Check that the valve lifting spring has not yielded.
- In case of wear, replace the worn parts.

- Check that the rocker pins exhibit no scratches or wear.

Characteristic

Standard diameter:

Ø 13 - 0,010 -0,018 mm

- Measure the inside diameter of each rocker.

Characteristic

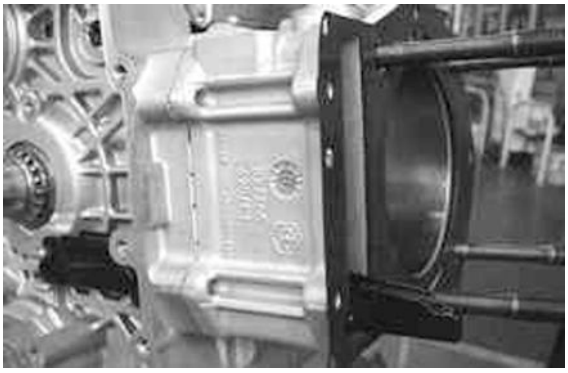
Standard diameter:

Ø 13 + 0,026 +0,015 mm

- Check that the cam contact sliding block and the articulated register plate is free from wear.
- In case of wear, replace the component.

Refitting the head and timing system components

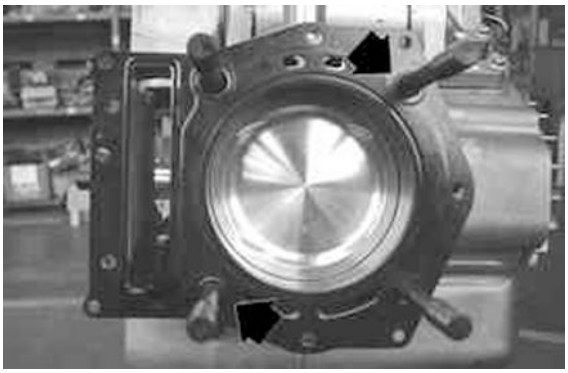
- Insert the chain guide sliding block.
- Insert the two centering dowels between head and cylinder.
- Install the head gasket.



N.B.

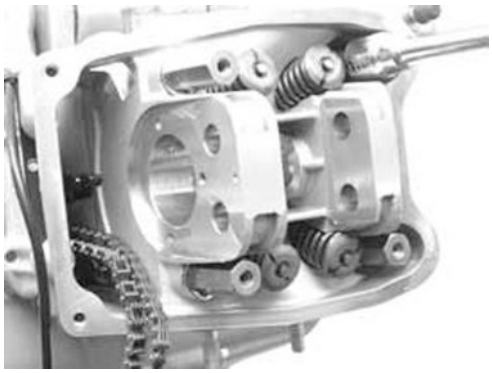
THE FIGURE SHOWS THE INSERTION POSITION OF THE TWO CENTERING DOWELS BETWEEN HEAD AND CYLINDER. THE DIRECTION OF INSTALLATION FOR THE GASKET IS FORCED BY THE DOWELS.

- The head gasket is made of steel and has a standard thickness.

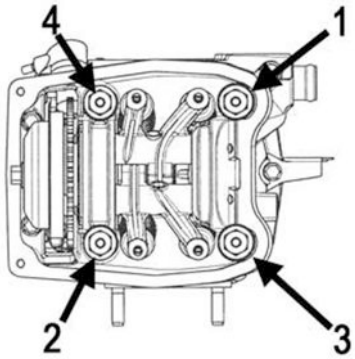


- Check that the head lubrication channel is perfectly clean. Clean with compressed air jets, if required.
- Insert the head.

- Lubricate the stud bolts and the 4 fastening columns.



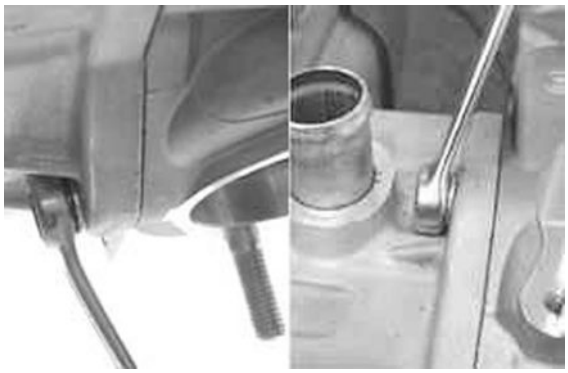
- Tighten the 4 fastening columns in a crossed sequence as shown in the figure, at a torque of 7 Nm.
- Tighten the 4 screws by 90° in the sequence shown in the figure.
- Further tighten by 90° in the sequence shown in the figure.



Locking torques (N*m)

Head fastening columns: *

- Tighten the fastening nuts on the exhaust and on the intake side at the prescribed torque.



Locking torques (N*m)

Exhaust / intake head fastening nuts: 10 - 12

- Tighten the 3 side screws at the prescribed torque.

Locking torques (N*m)

Head fastening screws: 10 - 12

- Install the cooling fluid temperature sensor with

the washer and tighten at the prescribed torque.

CAUTION

FAILURE TO OBSERVE THE TIGHTENING TORQUE CAN DAMAGE THE SENSOR.

Locking torques (N*m)

Cooling fluid temperature sensor: 10 - 12

- Install the spark plug and tighten at the prescribed torque.

Locking torques (N*m)

Spark plug 12÷14 Nm

- Insert the timing control belt on the driving shaft according to the initial direction of rotation.
- Apply the product to the set screws, also tightening the screws from the previous remaining locking threading.

Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

Locking torques (N*m)

Tightening sliding block fastening screw: 10 - 14

- Insert pins and rockers on the flywheel side.
- Lubricate the 2 rockers through the top holes.

- Clean the camshaft by blowing with little compressed air jets, especially the retaining plate housing.
- Lubricate the 2 connectors.

- Insert the camshaft into the head with the cams opposite the rockers.

- Remove any residues of LOCTITE from the camshaft retain bracket fastening screws by a brush.
- Tighten the earth set screws to the prescribed torque, using the recommended product.

Recommended products

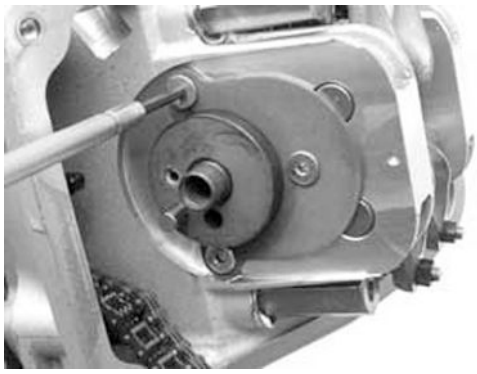
Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

- Insert the camshaft retain bracket with visible countersinks and tighten the 3 fastening screws at the prescribed torque, being careful not to damage the inside hexagon.

Locking torques (N*m)

Camshaft retaining bracket fastening screws: 4 ÷ 6



- Check that the toothing and the housing of the wheel speed sensor timing peg are free from deformations or dents.

- Insert the wheel speed sensor on the camshaft keeping the stroke reference visible.

- Install the engine stroke-revolution sensor using a new O-Ring, orientating it as shown in the figure. Tighten the 2 fastening screws at the prescribed torque.

N.B.

TO CHECK THIS COMPONENT, SEE CHAPTER «INJECTION».

Locking torques (N*m)

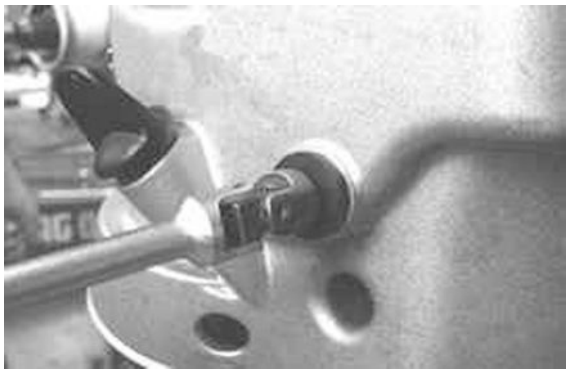
Stroke revolution sensor fastening screws: 3 - 4

- Install the intermediate gear with torque limiter, the flywheel and its cover, as described in Chapter «Flywheel and start-up system», and in Chapter «Flywheel cover».

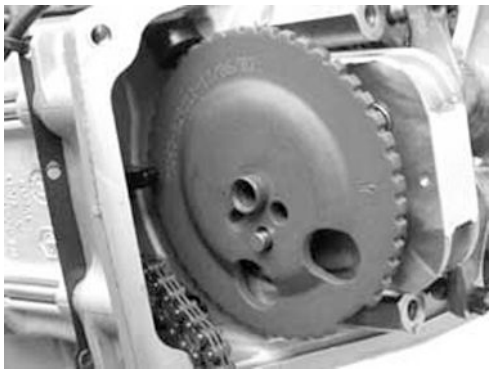
N.B.

FOR MORE CONVENIENCE, INSTALL THE FLYWHEEL COVER WITHOUT THE COOLING SYSTEM SLEEVES.

- Using the TORX wrench, remove the timing check cap



- Align the wheel speed sensor references with the head as shown in the figure.



- Keeping the belt slightly pulled, turn the driving shaft by the driving pulley to make the reference on the magnet support collimate with that on the flywheel cover.

- Insert the belt on the camshaft control timing rim.
- Insert the timing rim on the camshaft checking that the references are aligned.

N.B.

DURING THE STROKE CHECK, KEEP THE BELT TENSIONED BY PRESSING ON THE TIGHTENER COMPARTMENT SIDE.

- Install the balance weight mass.
- Centre using the bell fastening screw.
- Tighten the set screws to the prescribed torque, using the recommended product.

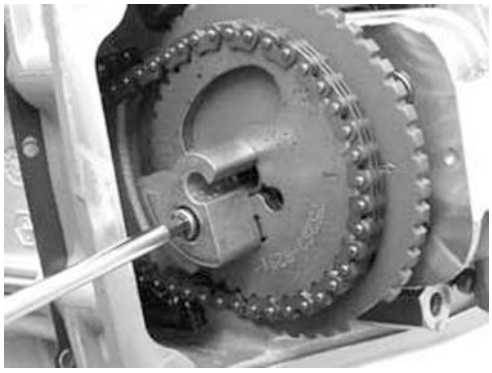
Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

Locking torques (N*m)

Balance weight screw 7÷8,5 Nm



- Remove the central screw.
- Install the valve lifting mass being careful to the proper positioning of the travel end ring.
- Lubricate the mass and de-compressor control pin.

- Install the return spring and load it by about 3/4 turn.

- Turn the engine to move the references to the top as shown in the figure (intake end).

- Insert the valve lifting device mass stop bell.
- Bloccare la vite di fissaggio alla coppia prescritta, utilizzando il prodotto consigliato.

N.B.

THE BELL TIMING IS ENSURED BY THE BALANCE WEIGHT MASS FASTENING SCREW HEAD.

Recommended products

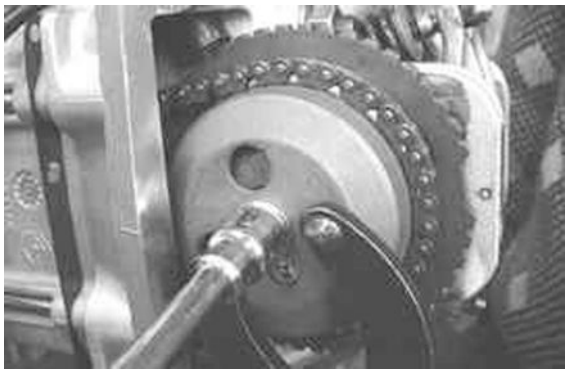
Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

- Check that the decompression mass is free and that it is pulled by the spring.

Locking torques (N*m)

Valve lifting device mass stop bell fastening screws: 30 - 35



- Place the engine with the valve clearance adjustment timing references aligned with the head.
- Check the clearance between valve and rocker using a thickness gauge.

PRESCRIBED CLEARANCE

Specification	Desc./Quantity
Intake	0,15 mm (with cold engine)
Exhaust	0,15 mm (with cold engine)

- In case of different values, adjust by loosening the lock nut and using a screwdriver for the adjuster, as shown in the figure.

Refitting the timing chain

This section describes the operations to carry out on the manifold components.

The ignition advance is electronically determined on the basis of the parameters recognised by the controller. For this reason it is not possible to declare the reference values based on the engine rpm. The ignition advance value is detectable any time by the diagnostic tester dwg. 020460Y.
Using the stroboscopic lamp dwg. it is possible to check whether the ignition advance determined by the injection system matches that actually started on the engine.

Specific tooling

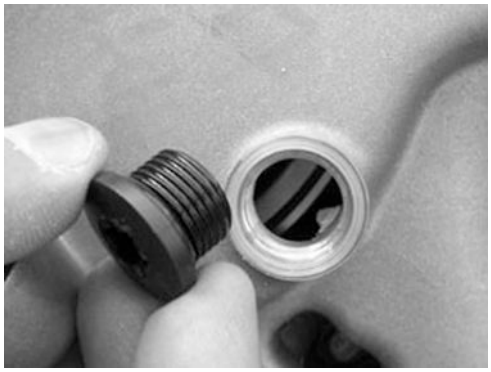
020460Y Tester and scooter diagnosis

020330Y Timing light for two- and four-stroke engines

Proceed as follows:

- Remove the transmission compartment cover as described in the automatic transmission chapter.

- Remove the TDC reference inspection cap between flywheel and cover housing. See the flywheel cover chapter.

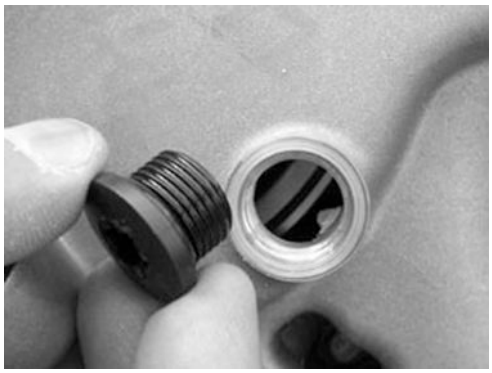


- By the driving pulley, turn the engine to find the alignment of the references to identify the TDC.

- Repeat for the reference between driving pulley and engine crankcase

- Replace the inspection cap on the flywheel side.
- Connect the diagnostic tester.

- Start the engine.
- Select the menu on the «parameters» function.
- Select the stroboscopic lamp control in the conventional 4-stroke engine position (1 spark 2 revolutions).
- Check that the real values of rpm and ignition advance match those measured by the diagnostic tester.



Specific tooling

020460Y Tester and scooter diagnosis

If the values do not match, check:

- timing
- stroke-revolution sensor
- injection controller

Inspecting the radial air gap

- Loosen a tooth of the wheel speed sensor with the stroke-revolution sensor.
- Check the air gap using a probe.

Characteristic

Standard air gap:

from 0,20 to 0,70 mm

- Repeat the check at 3 - 4 points.

- Place the tightener cursor in the rest position, keeping the retain tab pressed.

- Install a new tightener on the cylinder using a new gasket.
- Tighten the two fastening screws at the prescribed torque.

Locking torques (N*m)

Tightener fastening screws: 11 ÷ 13

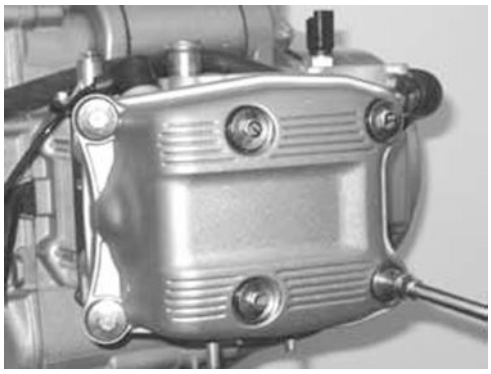
- Insert the spring with the central screw and the washer.
- Tighten the central screw at the prescribed torque.

Locking torques (N*m)

Tightener screw: 5 ÷ 6

Refitting the rocker-arms cover

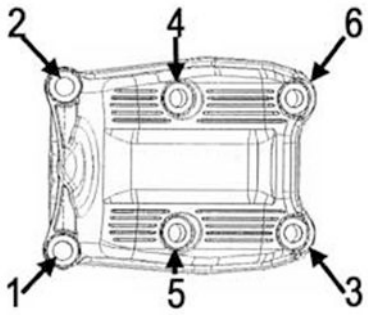
- Check that the gasket is in good working order.



- Tighten the two screws indicated in the figure

with «**1**» and «**2**» to limit the reciprocal sliding of the cover surface with the head surface.

- Tighten the remaining 4 screws in a crossed sequence (**3**, **4**, **5**, **6**).



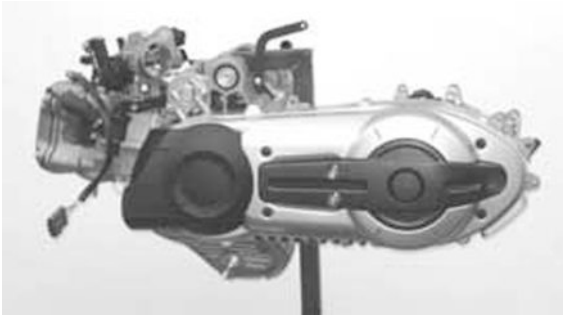
N.B.

CHECK THE PROPER POSITION OF THE GASKET.

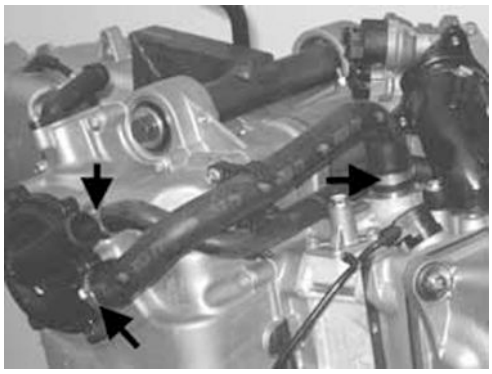
Locking torques (N*m)

Tappet cover fastening screws: 7 - 9

- Install the transmission cover and the relevant net filter and the outside transmission cover as described in the «Automatic transmission» chapter.

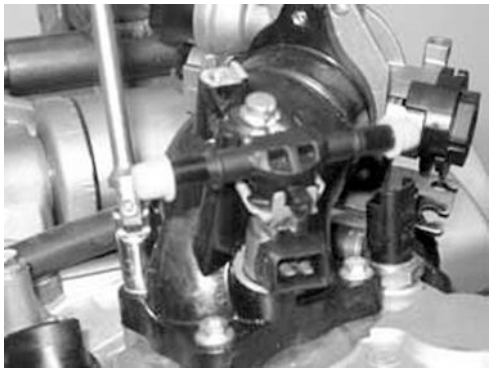


- Install the cooling system sleeves using new bands, as described in the «Flywheel cover» chapter.



Refitting the intake manifold

- Install the intake manifold on the engine.
- Insert the 3 fastening screws, one of which with a support band for the cooling system sleeve, and tighten at the prescribed torque.

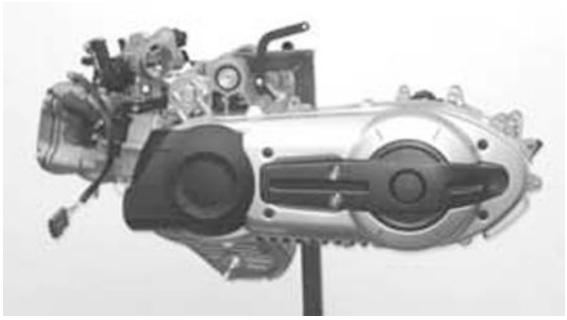


Locking torques (N*m)

Intake manifold screws 11 ÷ 13

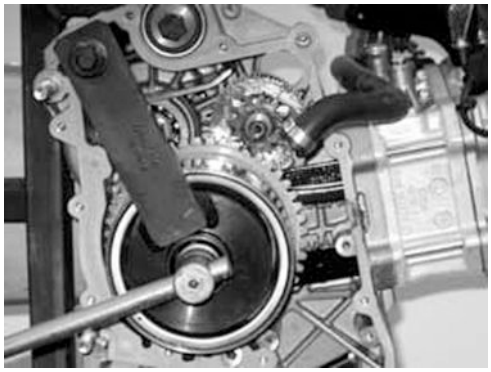
Crankcase - crankshaft

- Remove the outside and inside transmission cover and the complete driving pulley as described in «Automatic transmission».

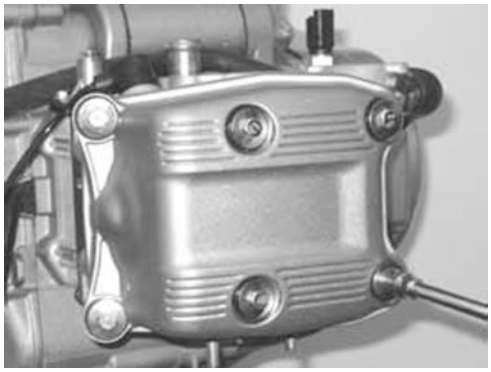


- Remove the flywheel cover with the cooling system sleeves, as described in the «Flywheel cover» chapter.

- Remove the flywheel magneto with the starting system following the instruction given in «Flywheel and Starting system».



- Remove the thermal unit (cylinder, head, piston) as described in the Thermal unit and timing system chapter.



- Before opening the engine crankcase, check the driving shaft axial clearance.

- To this purpose, use a plate (e.g. the specific tool) and a support with specific tool comparator.

Specific tooling

020262Y Crankcase detachment plate

020335Y Magnetic stand and comparator

Characteristic

Standard clearance:

0,10 ÷ 0,50 mm

Admissible increase limit after use:

0,60 mm

- Higher clearance denotes wear of the crankcase driving shaft rest surfaces.
- For a correct measurement, fully recover the clearance in both directions by operating between crankcase and engine.

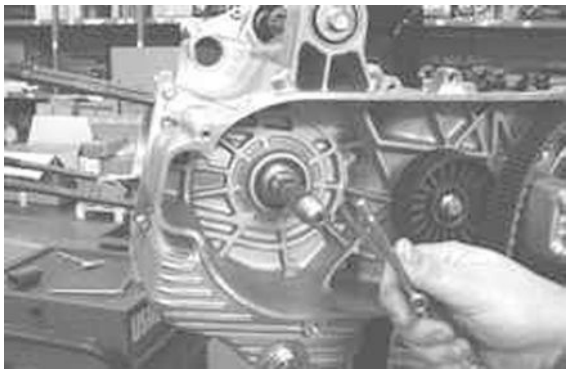
Splitting the crankcase halves

- Remove the engine support retain screw on the flywheel side half-crankcase.

- Remove the 14 crankcase coupling screws.

N.B.

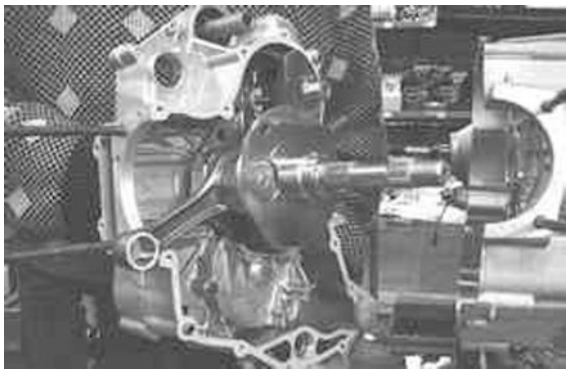
THE FASTENING SCREWS ARE OF 3 DIFFERENT LENGTHS. NOTE THEIR CORRECT POSITION.



- Split the crankcases while keeping the driving shaft inserted on the flywheel side half-crankcase.
- Remove the coupling gasket.

N.B.

THE BUSHING SUPPORT CAN BE LEFT IN THE FLYWHEEL SIDE HALF-CRANKCASE.



Removing the crankshaft

- Before removing the driving shaft, check the timing with the counter-shaft. To carry out this check, turn the driving shaft to align the two holes obtained on the driving shaft with the hole on the counter-shaft control gear.
This is an optimal position also to remove the driving shaft.

- Remove the driving shaft with the shim adjustment washer on the flywheel side.

CAUTION

WHILE OPENING THE CRANKCASE AND REMOVING THE DRIVING SHAFT, CHECK THAT THE SHAFT THREADED ENDS DO NOT INTERFERE WITH THE BENCH BRASSES. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE BENCH BRASS.

Removal of the oil pump and counter-shaft control gear.

- To remove the control gear, loosen the 4 fastening screws.

Remove the gear only if actually required.

CAUTION

THE SCREWS HAVE A COUNTERSUNK HEAD AND THEIR THREADING IS LOCKED BY LOCTITE. BE CAREFUL NOT TO DAMAGE THE CONTROL HEXAGON. TO OBTAIN BETTER RESULTS IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

Removing the countershaft

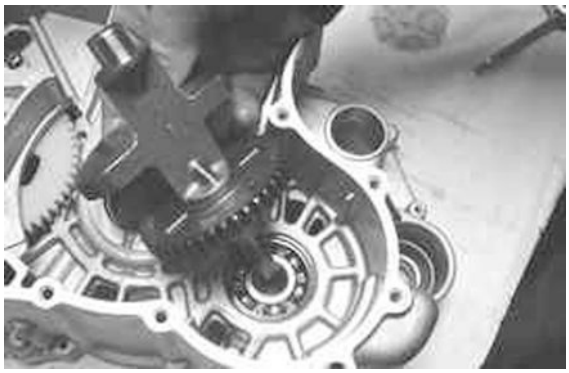
- Place the specific tool as shown in the figure.

Specific tooling

020479Y Counter-shaft lock wrench

- Remove the fastening nut with relevant washer.

- Remove the specific tool and extract the counter-shaft with the control gear.



Replacing the countershaft bearings

- Check that the bearings are free from irregular noise or clearance. Replace them, if necessary.

Flywheel-side half-crankcase

- Remove the inside snap ring.

- Upturn the half-crankcase.
- Remove the bearing from the flywheel side half-crankcase by the specific tool and a mallet.

Specific tooling

020376Y Handle for punches

020358y 37 x40 adaptor

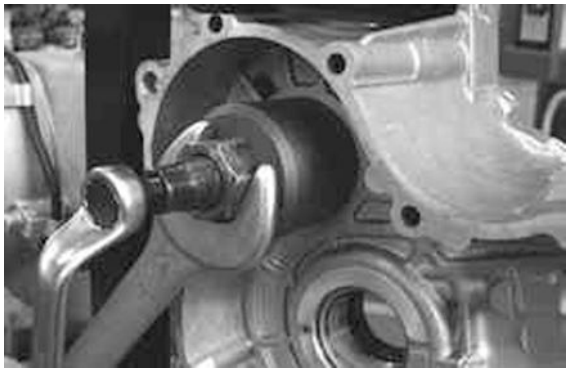
020439Y 17 mm guide

- Remove the bearing from the transmission side half-crankcase by the specific tool.

Specific tooling

001467y008 17 mm pliers (driven pulley bearings)

001467Y007 Bell



- Before installing a new bearing, heat the fly-wheel side half-crankcase by the specific tool.
- Place the half-crankcase on a wooden base.

Specific tooling

020151Y Air heater "METABO HG 1500/2"

- Insert a new bearing on the specific tool after greasing the guide seat.
- Install the new bearing on the half-crankcase by the specific tool.

N.B.

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANK-CASE INTERNAL SIDE.

Specific tooling

020376Y Handle for punches

020359Y 42 x 47 mm hub bearing fitting ad-aptor

020439Y 17 mm guide

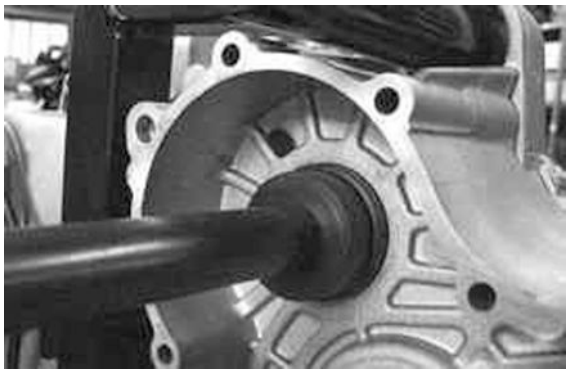
- Install the snap ring.

- Before installing the new bearing on the trans-mission side crankcase, heat the seat by the spe-cific tool.

Specific tooling

020151Y Air heater "METABO HG 1500/2"

- Insert a new bearing on the specific tool after greasing the guide seat.
- Install the new bearing on the engine crankcase by the specific tool.



N.B.

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANK-CASE INTERNAL SIDE.

Specific tooling

020376Y Handle for punches

020359Y 42 x 47 mm hub bearing fitting adaptor

020439Y 17 mm guide

Inspecting the crankshaft components

- Check the connecting rod axial clearance.

Characteristic

Standard clearance:

0,20 ÷ 0,40 mm

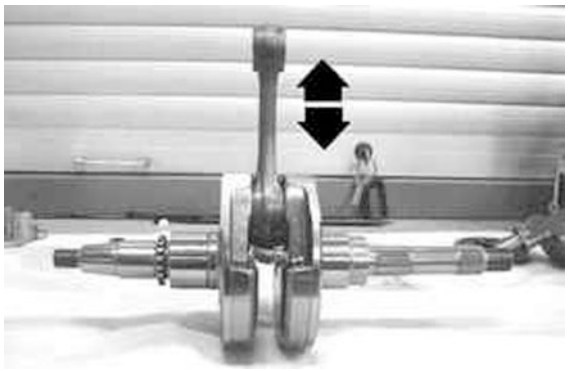
- Check the connecting rod diametrical clearance.

Characteristic

Standard clearance:

0,046 ÷ 0,076 mm

- Check that the axial clearance containment surfaces exhibit no scratches; using a gauge, check the driving shaft width as shown in the figure.



N.B.

BE CAREFUL NOT TO LET THE MEASUREMENT BE AFFECTED BY THE UNIONS WITH THE DRIVING SHAFT ENDS.

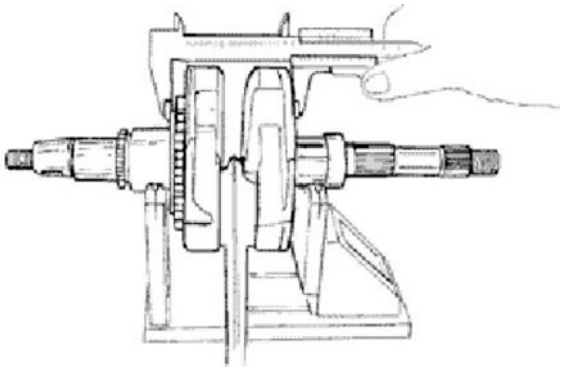
Characteristic

Stardard measure:

63,6 ÷ 63,45 mm

CAUTION

THE DRIVING SHAFT CAN BE REUSED WHEN THE WIDTH FALLS WITHIN THE STANDARD VALUES AND THE SURFACES ARE FREE FROM SCRATCHES.



Elevation

- Check the overall height of the driving shaft - shoulders - gear assembly.

Characteristic

Stardard shim:

71,804 ÷ 72,000 mm

- Check that shim adjustment is free from scratches.

N.B.

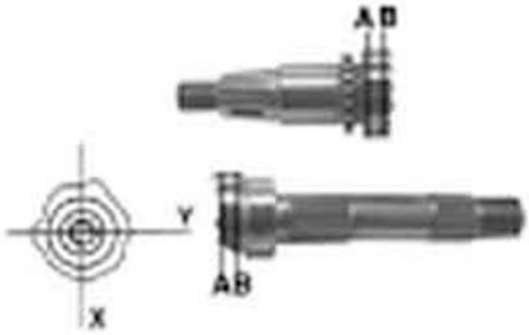
IN CASE OF NEW UTILIZATION, MAINTAIN THE FIRST POSITION OF ASSEMBLY.

Specific tooling

020074Y Crankshaft aligning tool

- If the driving shaft - crankcase axial clearance is higher than the standard value and the driving shaft exhibits no irregularity, the problem is caused by wear or by a wrong machining on the engine crankcase.

- Check the diameters of both the driving shaft ends according to the axes and planes shown in the figure. Half-shafts are classified into two categories, Cat. 1 and Cat. 2.



STANDARD DIAMETER

Specification	Desc./Quantity
Cat. 1	40,010 ÷ 40,016
Cat. 2	40,016 ÷ 40,022

Inspecting the crankshaft alignment

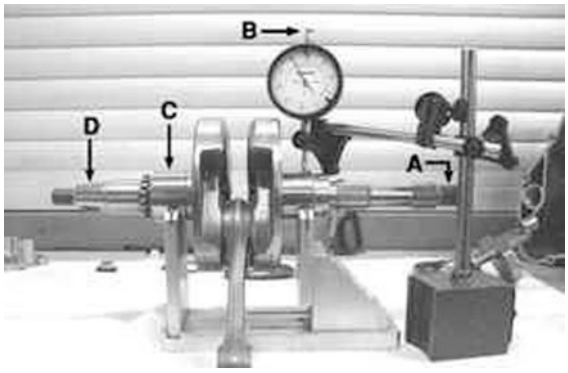
- Install the driving shaft on the support and measure the displacement at the 4 points shown in the figure.

Specific tooling

020074Y Crankshaft aligning tool

MAX ADMISSIBLE DISPLACEMENT:

Specification	Desc./Quantity
A	= 0,15 mm
B	= 0,01 mm
C	= 0,01 mm
D	= 0,10 mm



Check that the driving shaft cone, the tab seat, the oil guard connection and the threaded tangs are in good working order.

- In case of failures, replace the driving shaft.

N.B.

BENCH ENDS ARE NOT RECTIFIABLE.

The connecting rod cannot be replaced. To check the connecting rod small end diameter, see chapter «Thermal unit and timing system».

- When cleaning the driving shaft, be careful to prevent any impurity from entering into the shaft lubrication hole.

N.B.

IN CASE OF REPLACEMENT OF A DRIVING SHAFT CONSISTING OF TWO HALF-SHAFTS OF DIFFERENT CATEGORY, REPLACE THE TWO HALF-CRANKCASES AS WELL, COUPLING THE TWO COMPONENTS (SHAFT AND CRANKCASE) WITH THE SAME CATEGORY.

- To check the gear on the driving shaft, see chapter Thermal unit and timing system.Gruppo termico e Distribuzione.

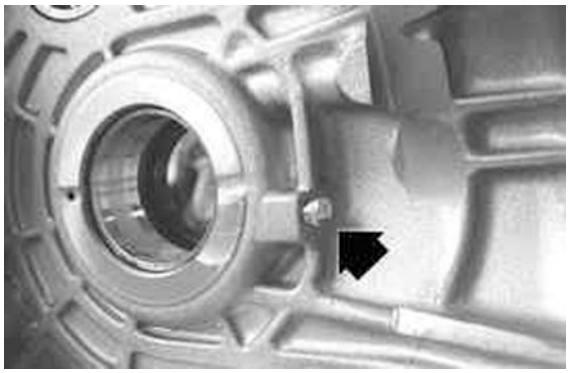
Inspecting the crankcase halves

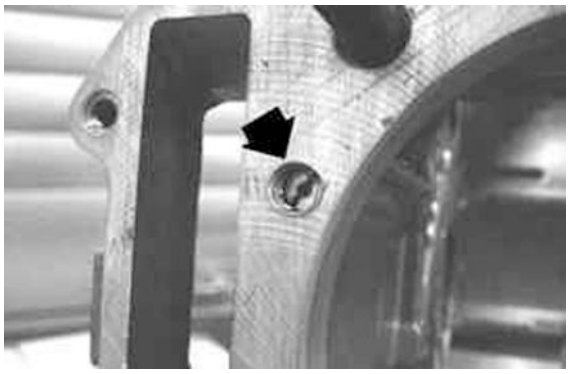
- Before checking the crankcase, carefully clean all lubrication channels and surfaces.
- For the transmission-side half-crankcase, special attention should be given to the brasses, to the cooling jet on the transmission side (see figure) and to the lubrication duct.

N.B.

THE JET IS FED THROUGH THE BENCH BRASSES. PROPER OPERATION OF THIS COMPONENT IMPROVES THE PISTON TOP COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAK CAN CONSIDERABLY DECREASE THE BENCH BRASS AND CONNECTING ROD LUBRICA-

TION PRESSURE.





- For the flywheel side half-crankcase, special attention should be given to the lubrication channels for the bench brasses and to the compartment and the channels for the oil pump, as well as to the duct for the by-pass located on the flywheel cover.

N.B.

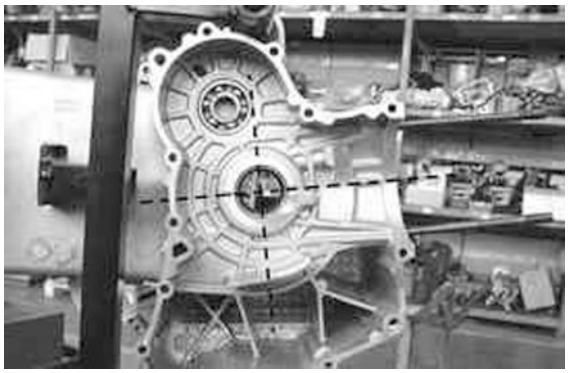
AS ALREADY DESCRIBED IN THE "LUBRICATION" CHAPTER, IT IS ESPECIALLY IMPORTANT THAT THE BY-PASS HOUSING ON THE FLYWHEEL COVER IS FREE FROM WEAR THAT MAY IMPAIR THE PROPER SEALING OF THE LUBRICATION PRESSURE ADJUSTMENT PISTON. THE HEAD LUBRICATION CHANNEL IS PROVIDED WITH A SHUTTER JET; THIS GIVES A "LOW 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 bench brass and connecting rod lubrication pressure.

- Check that the surfaces are free from dents or deformations, with special attention to the crankcase coupling and the crankcase-cylinder surfaces.
- Any defects in the crankcase gasket or matching surfaces (see Flywheel cover coupling) can cause pressurised oil leaks, thereby affecting the connecting rod and bench brass lubrication pressure.
- Check that the driving shaft axial clearance containment surfaces are free from wear. For the dimensional check, refer to the instructions relating to the axial clearance and dimensions check on the driving shaft

Inspecting the crankshaft plain bearings



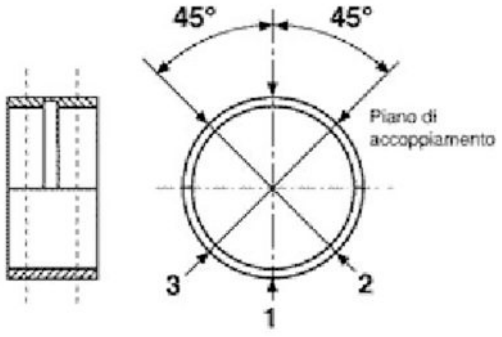
- In order to correctly lubricate the bearings, it is necessary to have both optimal lubricating pressure (4 bars) and oil mass flow; this implies that the bearings must be positioned correctly in order to have no partialised flow inside the oil supply ducts.
- The crankcase bearings comprise of 2 half-bearings, a monolithic one, and one in which lubrication holes are machined.

- 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 brass driving depth relative to the driving shaft axial clearance containment plane.

N.B.

TO KEEP SUCH POSITION OF THE BRASSES ON THE CRANKCASE, DRIVING IS FORCED ON CAST-IRON RINGS INSERTED IN THE CASTING OF BOTH HALF-CRANKCASES.

- Check the brass diameter in the 3 directions shown in the figure.
- Repeat the measurements for the other half of the brass. See figure.



N.B.

DO NOT TAKE THE MEASURE ON THE HALF-BEARING MATCHING SURFACE SINCE THE ENDS ARE RELEASED TO ALLOW DEFORMATION UPON INSERTION.

- The standard brass diameter after driving is variable on the basis of a coupling selection.
- The brass seats into the crankcases are classified into 2 categories as for the driving shaft Cat. 1 and Cat. 2.
- Brasses are divided into 3 categories according to their thickness. See the table below:

CHECK THE BENCH BUSH

Name	Description	Dimensions	Initials	Quantity
Type A - Red		1,982 ÷ 1,987		

Name	Description	Dimensions	Initials	Quantity
Type B - Blue		1,987 ÷ 1,992		
Type C - Yellow		1,992 ÷ 1,997		

Coupling chart

COUPLING THE SEMI-SHAFTS WITH THE SEMI-CHASSIS AND BUSHES

Name	Description	Dimensions	Initials	Quantity
Half-shaft category 1 - Brass category B			Spare crankcase setup FC1 - Dis. CM1033015001	
Half-shaft category 2 - Brass category C			Spare crankcase setup FC1 - Dis. CM1033015001	
Half-shaft category 1 - Brass category A			Spare crankcase setup FC2 - Dis. CM1033015002	
Half-shaft category 2 - Brass category B			Spare crankcase setup FC2 - Dis. CM1033015002	

N.B.

FOR OVERHAULING WITH SPARE PARTS, MATCH THE SHAFT WITH TWO SHOULDERS OF CATEGORY 1 TO CRANKCASE FC1 (OR CATEGORY 2 TO CRANKCASE FC2).

A spare crankcase cannot be combined with a driving shaft with mixed categories.

Spare shafts have half-shafts of the same category.

N.B.

TO REPLACE THE HALF-SHAFTS, REMOVE THE COUNTER-SHAFT BEARINGS AS DESCRIBED ABOVE. REMOVE THE COMPLETE DRIVEN PULLEY AND THE ANTI-FLAPPING ROLLER FROM THE TRANSMISSION SIDE HALF-CRANKCASE, AS DESCRIBED IN CHAPTER «AUTOMATIC TRANSMISSION», AND THE HUB COVER WITH THE RELEVANT GEARS AND BEARINGS AS DESCRIBED IN CHAPTER «FINAL REDUCTION».

Countershaft

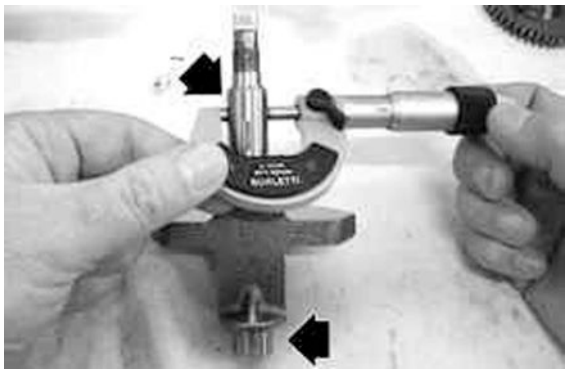
- Using a micrometer, measure the 2 capacities of

the counter-shaft as shown in the figure.

Characteristic

Standard diameter:

17 - 0,01 - 0,02 mm



- Check that the water pump drive is not worn.

Refitting the crankshaft

- Check that the oil pump and counter-shaft control gear are free from deformations or dents. Replace, if required.

N.B.

IF YOU HAVE TO REPLACE THE OIL PUMP AND COUNTER-SHAFT CONTROL GEAR IT IS NECESSARY TO REPLACE THE COUNTER-SHAFT GEAR AS WELL.

- Before installing the gear on the driving shaft, carefully clean the two matching surfaces removing any residues of LOCTITE from the holes by a brush.

Blow with compressed air and degrease the fixing holes on both surfaces to make the new LOCTITE grip.

Apply the recommended product to the holes again.

Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

- Repeat the same procedure for the 4 fastening screws.
- Insert the control gear on the driving shaft with the hole countersink visible.
- Tighten the 4 fastening screws at the prescribed torque.

N.B.

TO AVOID DAMAGING THE SCREW CONTROL HEXAGON, IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

Locking torques (N*m)

Gear fixing on driving shaft screws: 10 -12

- Lubricate the bench brass on the flywheel side half-crankcase.
- Lubricate the shim adjustment washer.
- Insert the shim adjustment washer on the driving shaft in its original position.
- Insert the specific timing tool in the hole on the counter-shaft.

Specific tooling

020471Y Pin for counter-shaft timing

- Insert the driving shaft on the pin and into the brass.
- Before inserting thoroughly, make the oil pump gear collimate with the control gear.
- Insert thoroughly and remove the specific tool.

N.B.

WHEN INSERTING THE SHAFT ON THE HALF-CRANKCASE, BE CAREFUL NOT TO DAMAGE THE BENCH BRASS WITH THE THREADED TANG OF THE DRIVING SHAFT AND WITH THE TIMING CONTROL TOOTHED PINION.

- Install the oil pump closing plate.
- Tighten the 2 flanged fastening screws at the prescribed torque.

Locking torques (N*m)

Closing plate fastening screws: 8 - 10

Refitting the crankcase halves

- Remove the oil guard from the transmission side half-crankcase by a screwdriver.

- Install a new oil guard after lubricating it, using the specific tool, arranging it at a 0.5 mm recess from the crankcase plane.

CAUTION

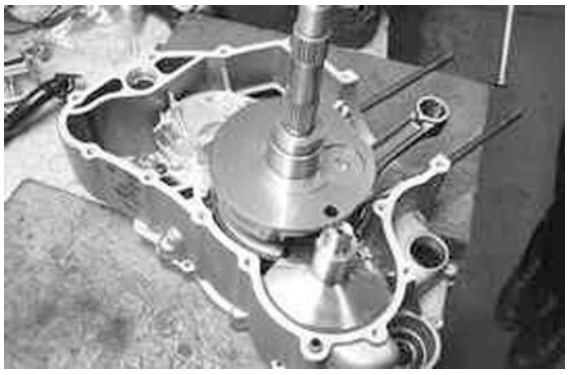
A WRONG POSITIONING OF THE OIL GUARD AFFECTS THE LUBRICATION OIL CIRCULATION.

Specific tooling

020360Y 52 x 55 mm adaptor

020376Y Handle for punches

- Insert the gasket on the flywheel side half-crankcase.



- Lubricate the bench brass on the transmission side half-crankcase.

- Couple the 2 half-crankcases being careful not to damage the brass on the transmission side half-crankcase with the threaded tang of the driving shaft.

- Insert the engine support retain screw on the fly-

wheel side half-crankcase without tightening.

- Insert the 14 fastening screws by arranging the single shorter screw «**A**» and the single longer screw «**B**» as shown in the figure.

- Tighten the screws thoroughly and tighten at the prescribed torque.
- Check that the driving shaft rotates freely.

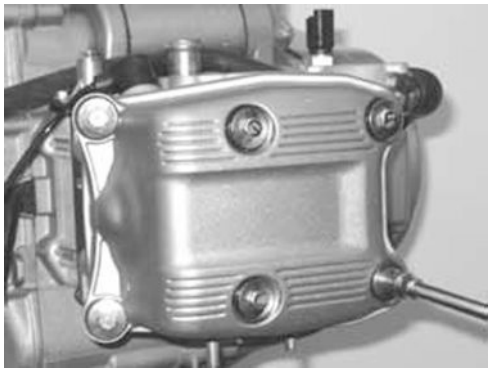
N.B.

REMOVE ANY EXCESS FROM THE CRANKCASE COUPLING GASKET ON THE CYLINDER PLANE, TO ENSURE BETTER SEALING PERFORMANCE.

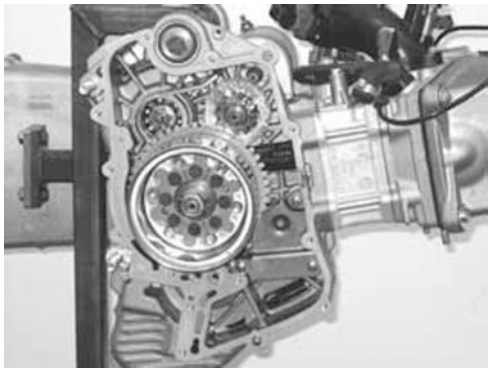
Locking torques (N*m)

Engine crankcase coupling screws 11 ÷ 13

- Install the thermal unit (cylinder, head, piston) as described in the Thermal unit and timing system chapter.Gruppo termico e Distribuzione.

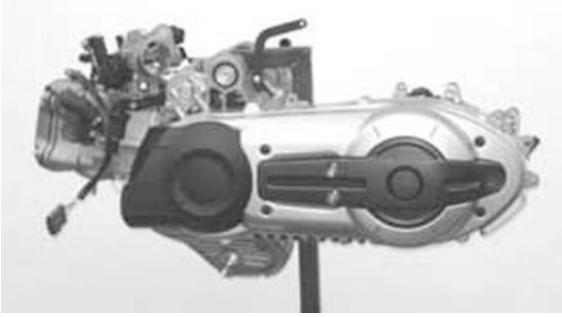


- Install the magneto flywheel with start-up control as described in the «Flywheel and start-up» chapter.



- Install the flywheel cover with the cooling system sleeves, as described in the «Flywheel cover chapter».

- Install the complete driving pulley, the transmission cover and the relevant net filter and the outside transmission cover as described in the «Automatic transmission chapter».



Lubrication

CHARACTERISTIC DATA

SUMP CAPACITY

Specification	Desc./Quantity
Overhaul	1,7 l
Oil and filter replacement	1,5 l

RECOMMENDED ENGINE OIL

Product	Description	Specifications
SELENIA HI Scooter 4 Tech	Engine oil	Synthetic oil SAE 5W/40 that passes the API SG specification.

OIL PUMP

Specification	Desc./Quantity
Type	Trochoidal
Rotor thickness	8 mm
Assembly clearances	Lobe ends 0.05-0.008 mm
Outside rotor radial clearance	0,05÷0,12 mm
Rotor axial clearance	0,025÷0,065 mm

BY-PASS

Specification	Desc./Quantity
Type	piston
Piston diameter	Ø 13,9 -0,039 -0,057 mm
Spring free length	62,5 mm
Calibration pressure	4 bar

PRE-FILTER

Specification	Desc./Quantity
Type	net, plastic

OIL FILTER

Specification	Desc./Quantity
Type	paper, with overpressure and anti-emptying by-pass

OIL MINIMUM PRESSURE INDICATOR LIGHT SWITCH

HEAD LUBRICATION CONTROL JET

Specification	Desc./Quantity
Diameter	Ø 1 ± 0,05 mm *

** Tightening torque 5÷7 N·m*

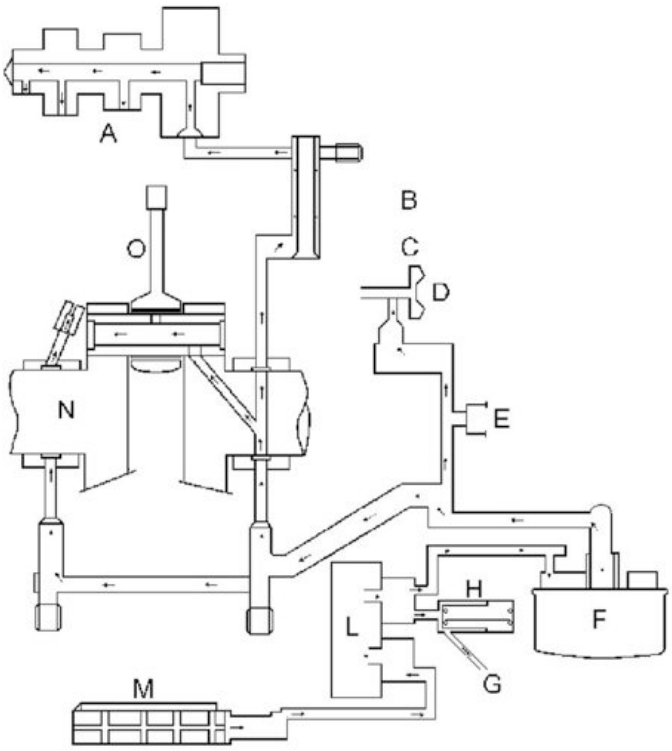
PISTON COOLING NOZZLE

Specification	Desc./Quantity
Diameter	Ø 0,8 ± 0,05 mm

BASE VENTILATION CHECK

Specification	Desc./Quantity
Device	decantation chamber and metal reed valve

Conceptual diagrams



CONCEPTUAL DIAGRAMS

Specification	Desc./Quantity
A	Camshaft

Specification	Desc./Quantity
B	Cylinder-head plane
C	Cylinder-crankcase plane
D	Water pump impeller
E	Minimum oil pressure sensor
F	Oil filter cartridge
G	To the oil sump
H	By-pass valve
L	Oil pump
M	Net pre-filter
N	Driving shaft
O	Connecting rod

General characteristics

The lubrication system is divided into two sections:

- high pressure

- low pressure

The high pressure section includes all components located on the engine crankcase, while the low pressure section only refers to the thermal unit.

The trochoidal pump is installed in the sump and is controlled by a pair of gears.

A pre-filter is used to ensure the pump integrity.

The pre-filter is of the extractable type and its cap also serves for engine oil drainage.

Delivery to the pump is controlled by a 4-bar calibrated piston by-pass. This is located before the cartridge filter, and both are installed on the flywheel cover, for this reason the gasket is subject to the system pressure.

The by-pass located before the cartridge filter improves the filter working conditions, especially with cold oil.

The filter is provided with an anti-emptying valve and with an overpressure valve; the latter trips when the filtering mass causes a pressure drop of more than 1 ± 0.2 bar.

Of course, these conditions are only reached with cold oil and engine at a high speed, or with a dirty filter.

The filtered oil is used to lubricate the water pump shaft and once the engine crankcase is reached, to lubricate the bench ends, the connecting rod head and the piston cooling nozzle, obtained on the transmission-side connection.

The transmission-side bench connection is provided with sealing oil guard and relevant drainage

duct.
The timing feeding duct is found at the flywheel side connection; delivery to the head is controlled by the specific jet started in the engine crankcase.
The timing components work with low pressure lubrication.
The camshaft ends are directly obtained in the head aluminium; the camshaft axial clearance is partly recovered by the oil sent to the connection with smaller diameter.
The camshaft lubricates the rockers through specific holes obtained in such position as to ensure that lubrication is maintained after the vehicle stops. This result is obtained thanks to the position taken by the camshaft with higher probabilities when the engine stops.
The oil used for head lubrication returns to the sump through the chain housing channel and therefore lubricates the chain as well.
A unidirectional valve and a decantation chamber are used to prevent the gases recovered from the base from carrying quantities of oil. The unidirectional valve is of the metal reed type; the decantation chamber is provided with a drainage hole. A failure of these components can cause the presence of oil in the engine air feeding duct.
An excess of oil vapours can cause clogging of the channels obtained on the throttle body.
A pressure switch located close to the filter output indicates the system minimum oil pressure.
The lubrication circuit doers not concern the counter-shaft, which is lubricated by the oil carried by the gears or by the oil centrifuged by the driving shaft.
The same occurs for the piston or pin, even though in this case the cooling nozzle is especially important.

Diagnosis guide

1 - Minimum oil pressure warning light on with hot engine.

AHEAD - go to 2

2 - Remove the minimum pressure switch electric connector.

Check that the warning light turns off.

YES - go to NO go to 11

3 - Check the actual oil pressure.

AHEAD - go to 4

4 - Remove the switch and install the specific tool with the relevant gasket.

Specific tooling

020193Y Oil pressure gauge

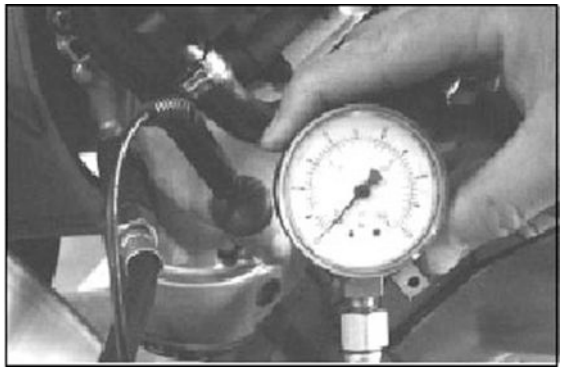
020434Y Oil pressure gauge connection

- Remove the bar with the oil loading cap and insert a cap with the temperature probe supplied with the specific tool. Insert the probe to feel contact with the case bottom and pull back a few millimetres.

Specific tooling

020331Y Digital multimeter

AHEAD - go to 5



5 - Measure pressure with cold and idling engine.

STANDARD VALUES

Specification	Desc./Quantity
20°C Temperature	
1400 rpm	

~ 4,5 bar

N.B.

RPM CAN BE MEASURED BOTH BY THE EXHAUST GAS ANALYSER AND BY THE DIAGNOSTIC TESTER

Specific tooling

020460Y Tester and scooter diagnosis

YES go to 6 NO go to 12

6 - Let the engine warm up and repeat the check with hot engine.

STANDARD VALUES

Specification	Desc./Quantity
80°C Temperature	
1400 rpm	

~ 1,5 bar

YES go to 7 NO go to 8

7 - Replace the oil minimum pressure switch.

8 - If pressure lower than 1.3 - 1.5 bar is measured.

AHEAD go to 9

9 - Replace the oil filter and repeat the pressure check with oil at 80°C..

YES go to 10 NO go to 13

10 - The failure was fixed.

It is recommended to respect the suggested number of kilometres covered.

11 - Check and restore the electric system.

12 - If pressure lower than 4 bar is measured.

AHEAD go to 9

13 - Remove the flywheel cover and check the by-pass and the cover sealing gasket efficiency towards the case internal side, as described in the «Flywheel cover» chapter.

YES go to 14 NO go to 15

14 - Check whether there is an irregular clearance on the driving shaft:

- axial clearance (see the "Crankcase and driving shaft" chapter)
- radial clearance, especially in the direction of the cylinder axis
- clearance according to the direction of rotation with the connecting rod in quadrature

YES go to 16 NO go to 17

15 - Replace the faulty components («Flywheel cover» chapter).

16 - Overhaul the engine («Crankcase and driving shaft» chapter).

17 - Open the engine crankcase and remove the oil pump, as described in the «Crankcase and driving shaft» chapter.

- Check the oil pump as described in the following pages.
- Check that the cooling nozzle and the timing feeding jet are properly installed.
- Visually inspect the driving shaft couplings and their size («Crankcase and driving shaft» chapter).

N.B.

ANY FAILURES OF THE COUPLINGS AND OF THE TIMING COMPONENTS CANNOT BE DETECTED BY THE INSPECTION OF THE LUBRICATION PRESSURE. THE FAILURES MAY BECOME EVIDENT BY AN INCREASE OF NOISE.

N.B.

IN CASE OF IRREGULAR PRESSURE ON THE BASE, CARRY OUT A VISUAL AND DIMENSIONAL INSPECTION OF THE TIMING COMPONENTS (SEE THERMAL UNIT AND TIMING SYSTEM CHAPTER).

Oil pressure check

1 - In case of oil leaks from the oil filter or from the flywheel cover coupling gasket, check the lubrication pressure.

AHEAD go to 2

2 - Install the specific tool.

Specific tooling

020193Y Oil pressure gauge

020434Y Oil pressure gauge connection

AHEAD go to 3

3 - Check the system pressure with cold engine and medium - high speed.

Standard pressure < 6 bar

YES go to 4 NO go to 5

4 - Replace the damaged components.

5 - Check the adjustment by-pass efficiency (see «Flywheel cover» chapter) and restore the proper sliding.

N.B.

STANDARD PRESSURES ARE OBTAINED USING OIL WITH THE PRESCRIBED VISCOSITY. A HIGHER VISCOSITY CAUSES AN INCREASE OF THE SYSTEM PRESSURE.

1 - If oil consumption is higher than 250 gr/1000 km on run-in engine, proceed as follows.

AHEAD go to 2

2 - Check the presence of oil at the recovery duct on the filter box.

YES go to 3 NO go to 4

3 - Check the unidirectional reed valve and the decantation chamber drainage hole.

YES go to 5 NO go to 4

4 - Check the thermal unit seals (piston rings, valve guides and oil guards), see "Thermal unit and timing system" chapter.

5 - Restore the valve or the drainage hole efficiency.

Oil pump

Removal

- Remove the oil pump compartment enclosure by removing the two set screws and washers.

- Remove the oil pump with gear, unscrewing the 2 set screws, through the slots in the gear.

- Remove the seal.

- Remove the two screws and the oil pump cover.

- Remove the inside rotor retaining snap ring turning it to move the opening at the shaft face.

- Remove the rotors and carefully wash them with

gasoline and compressed air.

- Extract the shaft with its gear and check that it is in good working order and free from wear.

- Reassemble the rotors with the pump body keeping the 2 references visible.
- Insert the shaft with the gear and install the lock ring; then, turn it with the opening opposed to the shaft face.
- Check any irregular clearance between shaft and pump body.

- Using a thickness gauge, check the distance between the rotors in the position shown in the figure.

Characteristic

Admissible limit clearance:

0,012 mm

- Check the distance between outside rotor and pump body; see figure.

Characteristic

Admissible limit clearance:

0,25 mm

- Check the rotor axial clearance using a rectified bar as reference plane, as shown in the figure.

Characteristic

Admissible limit:

0,1 mm

Inspection

- For tests on the oil pump, see the «Lubrication» chapter.

Refitting

- Make sure the gasket is in the correct position.

N.B.

THE TOOTH OF THE GASKET MUST BE IN ITS SEAT.

- Insert the oil pump with gear
- Insert the 2 set screws through the slots on the gear and tighten to the prescribed torque.

N.B.

THE ASSEMBLY POSITION OF THE PUMP IS FIXED BY INSTALLATION OF THE SCREWS.

Failure to observe the tightening torque may alter the coupling play of the rotors with the pump

body.

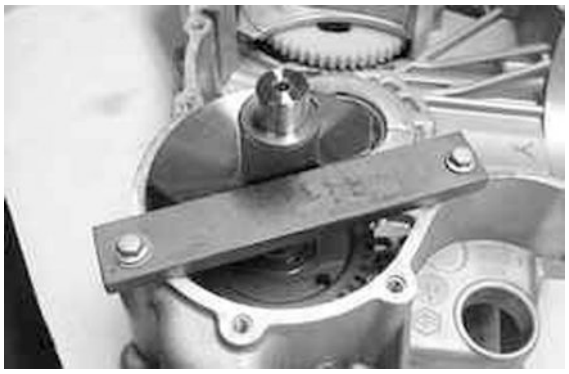
Locking torques (N*m)

Screws fixing the oil pump to the crankcase 5 ÷ 6

- Insert the countershaft with the gear on the magneto side semi-chassis.
- Install the specific device in the position shown in the figure.

Specific tooling

020479Y Counter-shaft lock wrench



- Keep the countershaft in position and insert the washer with the nut.
- Tighten the nut to the prescribed torque, using the recommended product.
- Remove the specific device.

Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

Locking torques (N*m)

Nut securing countershaft 25 - 29

- Lubricate the internal rotors.
- Make sure the pump cover is not worn or scratched..
- If non conforming values or scratches are found, replace it.
- Fit the pump cover in the position which aligns the holes for the screws securing it to the chassis.

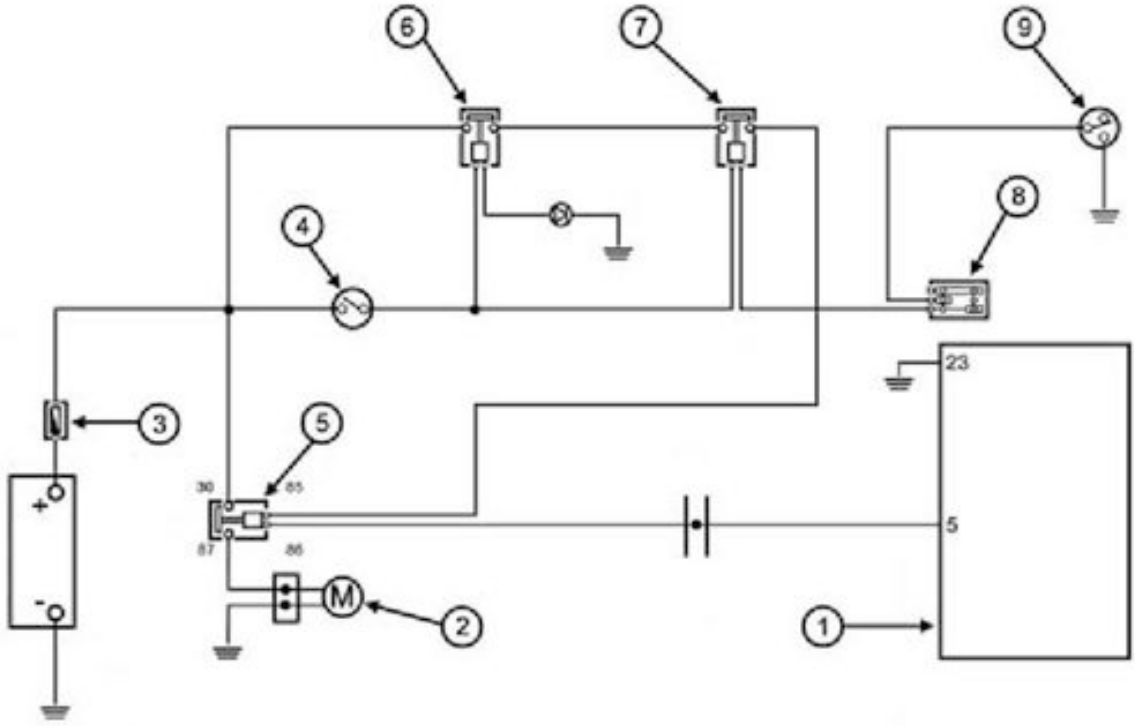
- Tighten the two set screws to the prescribed torque.

Locking torques (N*m)

Oil pump cover screws 0,7 ÷ 0,9

INDEX OF TOPICS

TERMINALS	CONDITIONS	STANDARD
5 - 23	Switch in "ON" position Switch on "RUN" Side stand up Electric fan off	Battery voltage



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Controller	
2	Electric fan	
3	Fuse	30A
4	Key-switch	
5	Electric fan contactor	

The electric fan system is supplied by a contactor connected under the panel and run by the injection cpu.

The injection cpu manages the control of the electric fan based on the measured engine temperature.

If the electric fan runs for a long time, before checking the electrical system, carefully check the following:

- level of the expansion chamber - drain from hose to engine
- drain of head outlet
- working order of thermostat
- working order of pump

For these tests see the cooling chapter.

To check the circuit, proceed as follows:

1 - Connect the tester. Switch to «ON» with switch on «RUN» and side stand up. Select the «ERRORS» function. Make sure the cpu has detected the fault on the electric fan control circuit.

YES go to 8 NO go to 2

2 - Select the «ENABLE DIAGNOSTICS» function on the menu. Activate the electric fan diagnostic function. Acoustically check the electric fan rotation. Wait for the tester outcome.

YES go to 3 NO go to 4

3 - Test completed successfully. The fan runs.

YES go to 5

4 - Test failed. The fan does not runs.

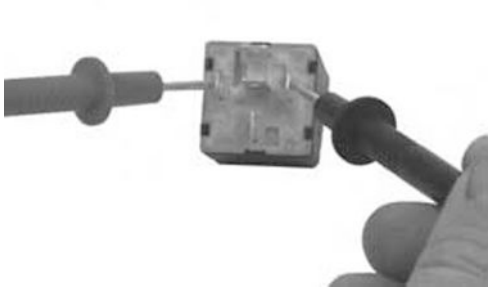
YES go to 8 NO go to 6

5 - The electric fan is in conformity

6 - Test completed successfully. The fan does not work.

YES go to 7

7 - The contactor control circuit works properly. Check the electric fan connector, the working order of the contactor contacts, the positive lines,



the negative line and the electric fan motor.

8 - Disconnect the electric fan control contactor.

Check the continuity of the excitation coil.

85 - 86 = 100 ± 50 Ω

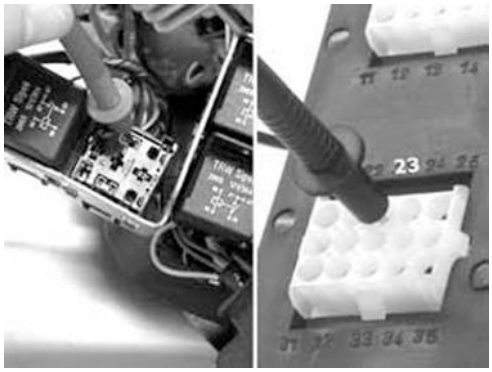
YES go to 10 NO go to 9

9 - Replace the contactor

YES go to 8

10 - Connect the specific tool between the cpu and system.. Do not connect the cpu

YES go to 11



11 - Check for positive battery voltage at pin 85 of the contactor connector.

85 (blue/grey) - 23 = battery voltage with switch on «ON»

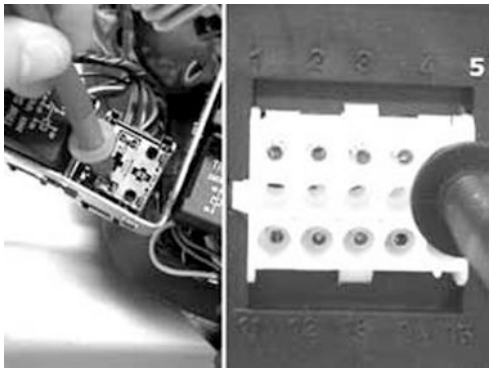
YES go to 13 NO go to 12

12 - Repair or replace the wiring

13 - Keeping the contactor disconnected, check the continuity between pin 86 of the contactor connector and pin 5 of the cpu.

86 (green/white) - 5 = 0Ω (continuity)

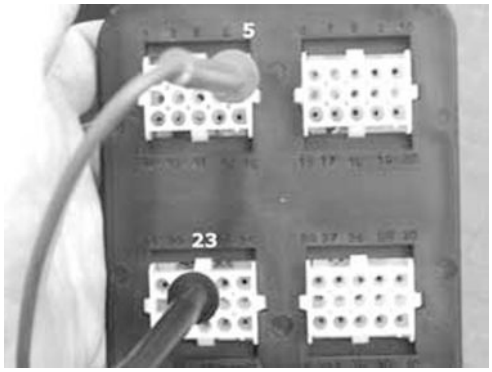
YES go to 14 NO go to 15



14 - Check the earth isolation.

5 - 23 > 1 MΩ (infinite)

YES go to 16 NO go to 15



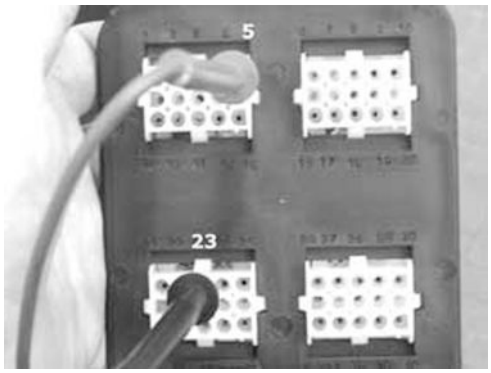
15 - Repair or replace the wiring

16 - Connect the contactor and check for battery

voltage between terminals 5 and 23 with the key-switch on «**ON**».

5 - 23 = battery voltage with switch on «**ON**»

YES go to 17



17 - Repeat the test with the cpu connected and engine cold.

5 - 23 = battery voltage with switch on «**ON**»

If the anomaly persists replace the cpu.

Make sure the entire exhaust system is sealed.

Remove the intake cap on the exhaust pipe, connect the dissipater and the extension pipe.

Warm-up the engine and use an exhaust analyser to check the carburation of the idle speed, if necessary, restore the correct setting using a scooter Tester, see «Adjusting idle carburation».

Specific tooling

020625Y Exhaust gases collecting kit

494929 Exhaust gas analyser

Connect the gas collection kit at the muffler outlet being careful to ensure that it is sealed and stable by making sure the band is correctly fitted.

Transfer the connection of the exhaust gas analyser from the manifold collection extension pipe to the extension pipe for the muffler outlet.

Use the exhaust collection kit for this connection.

Close the extension outlet for collection from the manifold to make sure air does not infiltrate.

Specific tooling

020623Y Gas collection kit for preliminary overhaul

Check the exhaust emissions from the muffler (after the catalytic converter) with the engine warm and idling.

STANDARD VALUES WITH THE ENGINE IDLING

Specification	Desc./Quantity
CO	= < di XXX %
CO2	= > di XXX %

Specification	Desc./Quantity
HC	= < di XXX ppm
O2	= XXX %
Lambda factor:	XX

If the values measured are the same as those obtained with what was collected from the exhaust pipe, increase the catalytic converter temperature keeping then engine at average rpm and repeat the idle test.

If the anomaly persists and the carburation setting was correct, replace the muffler with catalytic converter.

The injection system cpu is programmed to guarantee optimum carburation during on-road use.

Idle carburation requires fine tuning aimed at compensating productive tolerances and engine adjustments.

This adjustment is made by changing the opening time of the injector with the engine idling.

To make this adjustment, proceed as follows:

1 - Adjustment of the idle carburation must be effected with a well-tuned engine. First check:

- sparkplug
- cleanliness of air filter
- cleanliness of throttle body
- proper seal of suction system
- proper seal of exhaust system
- valve play
- fuel filter
- fuel pressure

N.B.

IDLE SPEED IS OBTAINED BY PRE-CALIBRATING THE THROTTLE BODY AND THE ACTIVITY OF THE STEPPER

Characteristic

Engine idle

1450 ± 50 g/min.

Make sure the throttle body has not been

tampered with.

YES go to 2

2- Warm-up and make sure the exhaust analyser

resets.

Remove the exhaust manifold cap and connect the extension with the inlet fitting for the analyser tube.

YES go to 3

3 - Connect the tester.

Switch to «**ON**» with switch on «**RUN**» and side stand up.

YES go to 4

4 - Select the «**ERRORS**» function on the menu. Check for any faults.

YES go to 6 NO go to 5

5 - Select the «**PARAMETERS**» function on the menu.

YES go to 7

6 - Repair according to the provided instructions.

YES go to 4

7 - Start the engine and let it warm up until obtaining the following conditions:

- coolant temperature = over 80°C
- suctioned air temperature = 25 - 30°C

YES go to 8

8 - Activate the exhaust analyser and check the following conditions:

- CO = 1.25±0.25%
- CO2 = 14.50±1%

YES go to 9 NO go to 10

9 - The adjustment is correct.

10- If non-conforming CO values are measured adjust the injection time to the minimum.

YES go to 11

11 - Select the «**CO CALIBRATION**» function on

the tester menu.

Activate the adjustment function.

YES go to 12

12 - The display shows the words «**TRIMMER VALUE**».

The numeric indication can be positive or negative.

YES go to 13

13 - To increase the CO the injection time needs to be increased.

To decrease the CO the injection time needs to be decreased.

Adjust the trimmer value according to the indications in the table:

YES go to 14

TRIMMER VALUE	INJECTION TIME	C O
+100	HIGH	INCREASE
+ 50	Ý	Ý
+ 10	LOW	ß
0	ß	DECREASE
- 10	MEDIUM	
- 50		
-100		

N.B.

THE TRIMMER VALUE 0 CORRESPONDS TO THE MEDIUM INJECTION TIME.
AFTER ADJUSTMENT THE ENGINES MAY HAVE EITHER POSITIVE OR NEGATIVE TRIMMER VALUES.
THIS IS DUE TO NORMAL PRODUCTION TOLERANCES.

14 - After having made a trimmer variation wait for the CO value to adjust.

When the adjustment is correct, press OK to save the value in the cpu.

YES go to 15

15 - Select «**PARAMETERS**» and «**ECU IN-**

FORMATION» to make sure the new trimmer variation has been memorised.

N.B.

WHEN THE CO PERCENTAGE IS CORRECT AND THE CO2 PERCENTAGE IS NOT WITHIN THE PRE-SCRIBED VALUES, THE LAMBDA FACTOR IS ALSO ALTERED. IN THIS CASE CAREFULLY CHECK THE SEAL ON THE EXHAUST SYSTEM.

When the CO percentage is correct and the HC (PPM) value is above the maximum allowed limit, check:

- sparkplug
- valve play
- distribution timing
- exhaust valve seal

If the cpu is replaced it is important to reset the TPS and pre-set the trimmer value of the original cpu (if available).

The CO value needs to be checked again.

N.B.

WHEN THE CO PERCENTAGE IS CORRECT AND THE CO2 PERCENTAGE IS NOT WITHIN THE PRE-SCRIBED VALUES, THE LAMBDA FACTOR IS ALSO ALTERED.

In this case carefully check the seal on the exhaust system.

When the CO percentage is correct and the HC (PPM) value is above the maximum allowed limit, check:

- sparkplug
- valve play
- distribution timing
- exhaust valve seal

If the cpu is replaced it is important to reset the TPS and pre-set the trimmer value of the original cpu (if available).

The CO value needs to be checked again.

EMS injection system

The injection system is of the integrated injection and ignition type.
Injection is indirect in the manifold through electronic injector.
Injection and ignition are timed on the 4-stroke cycle by a wheel speed sensor pivoted on the camshaft control and a reluctance variation sensor.
Carburetion and ignition are managed on the basis of the engine rpm and the gas valve opening.
Further corrections are made according to the following parameters:
- Cooling fluid temperature
- Sucked air temperature
- Ambient pressure

The system implements an idle feeding correction with cold engine through a stepper motor on a by-pass circuit of the gas valve. The controller manages the stepper motor and the injector opening time, thereby ensuring the idle steadiness and the proper carburetion.
In all working conditions, carburetion is managed by changing the injector opening time.
The fuel feeding pressure is kept constant based on the ambient pressure.

The feeding circuit consists of:
- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

Pump, filter and regulator are placed into the fuel tank by a single support.
The injector is connected by two pipes provided with quick couplings. This allows obtaining a continuous circulation, thereby avoiding the risk of fuel boiling. The pressure regulator is located at the end of the circuit.
The fuel pump is controlled by the EMS controller; this ensures the vehicle's safety

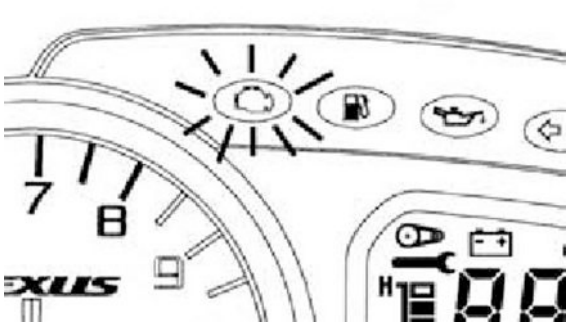
The ignition circuit consists of:
- H.V. coil
- H.V. cable
- Screened cap
- EMS controller
- Spark plug

The EMS controller manages the ignition with optimum advance, ensuring the timing on the 4-stroke cycle (ignition only during compression).
The EMS injection-ignition system manages the engine operation by a preset program.
Should any input signals fail, an acceptable working order of the engine is ensured to allow the user to reach a service station.

Of course, this cannot happen when the revolution-stroke signal is lacking, or when the failure concerns the control circuits:

- Fuel pump
- H.V. coil
- Injector

The controller is provided with an auto-diagnosis system connected to an indicator in the instrument panel.

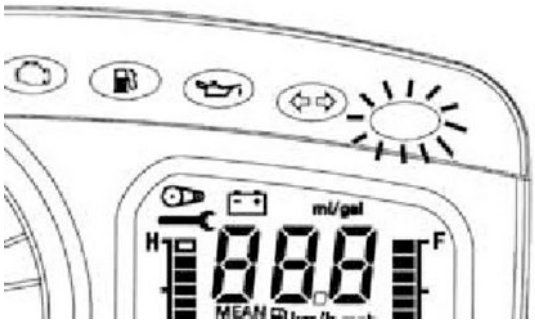


Failures are detected and restored by the diagnostic tester dwg. 020460Y.
In any case, when the fault has been fixed the stored value is automatically deleted after 16 usage cycles (cold start, running in temperature, stop).
The diagnostic tester is also required for adjusting the idle carburetion.

Specific tooling

020460Y Tester and scooter diagnosis

The EMS injection-ignition system has a control function over the rpm counter and on the radiator cooling electric fan.
EMS is connected to the immobilizer anti-theft system decoder.
In turn, the decoder is connected to a flashing diagnostic led that also serves as deterrent.



The EMS controller power supply is further controlled by the emergency switch and by the side

stand switch, to allow further safety of the vehicle.

Precautions

1. Before proceeding to fixing the injection system, check the presence of any faults.
Do not disconnect the battery before checking the fault.
2. The feeding system is pressurised at 300 Kpa (3 BAR). Before disconnecting the quick union of a pipe in the power supply system, check that there are no free flames, and do not smoke. Be careful to prevent sprays in your eyes.
3. When fixing electric components, leave the battery connected only if strictly necessary.
4. When carrying out functional checks, make sure that the battery voltage is more than 12V.
5. Before attempting start-up, make sure that the tank contains at least 2 litres of fuel. Failure to observe this regulation can damage the fuel pump.
6. If the vehicle is expected to remain unused for a long time, refill the tank to more than half the level. This ensures that the pump will remain immersed into the fuel.
7. When washing the vehicle, do not insist on electric wiring and components.
8. If ignition faults are detected, start the checks from the injection system and battery connections.
9. Before disconnecting the EMS controller connector, perform the following operations in the order shown:
- Set the switch to «OFF»
- Disconnect the battery
Failure to observe this rule can damage the controller.
10. When replacing the battery, be careful not to reverse the polarity.
11. In order to prevent damages, disconnect and reconnect the EMS system connectors only if actually required.
Before reconnecting, check that the connections are perfectly dry.
12. When carrying out electric inspections, do not force the tester prods into the connectors. Do not perform measures not prescribed in the manual.
13. At the end of every check carried out with the diagnostic tester, protect the system connector with

the specific cap. Failure to observe this rule can damage the EMS controller.

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

Terminals setup

Layout of the system-side connector and of the connector on controller.

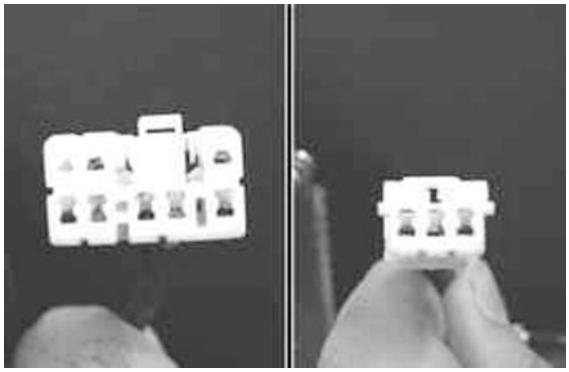
CONTROLLER SIDE

SYSTEM SIDE

EMS CONTROLLER

	Specification	Desc./Quantity
1	Throttle potentiometer power supply	+5 V
2	-	
3	Rpm counter / consumption counter	
4	Engine temperature	(+)
5	86 electric fan remote control switch	
6	Stepper motor	
7	Engine rpm sensor	(-)
8	-	
9	EMS diagnostic connector	
10	EMS diagnostic connector	
11	Throttle potentiometer signal	

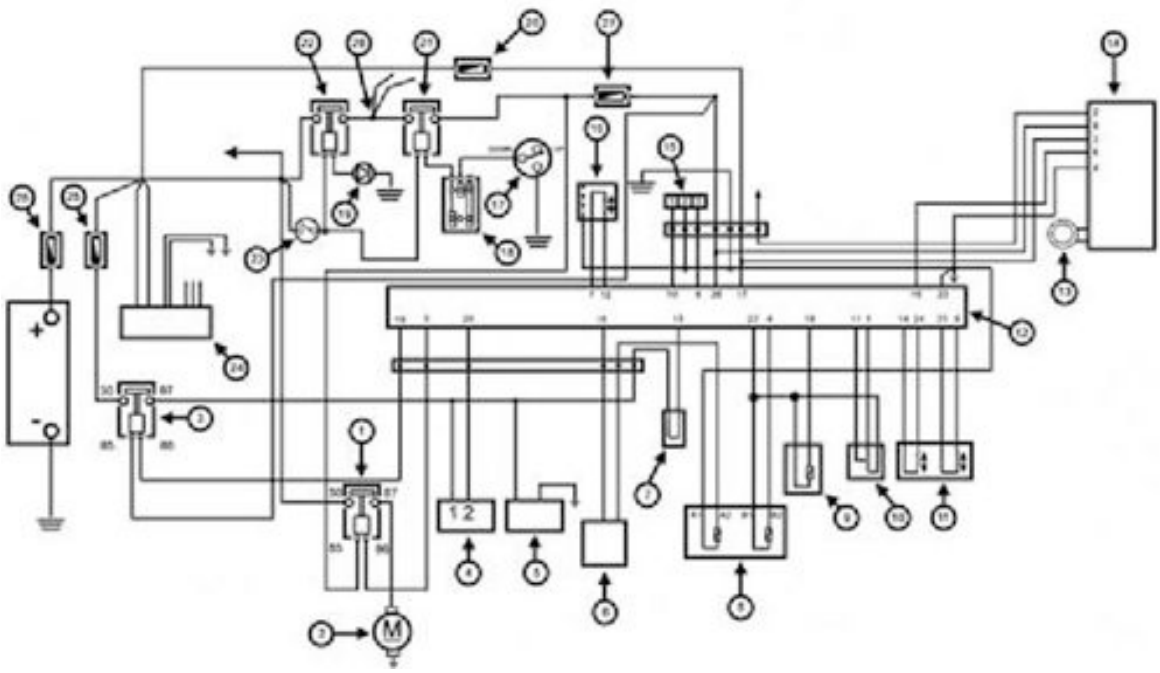
	Specification	Desc./Quantity
12	Engine rpm sensor	
13	Injector control	(negative)
14	Stepper motor	
15	Instrument unit (injection indicator - negative)	
16	Decoder (serial)	overturn sensor
17	Base power supply	(positive)
18	Air temperature sensor	(+)
19	85 remote control switch (pump - injector - h.v. coil)	(-)
20	H.V. coil	(negative control)
21	Stepper motor	
22	Sensor power supply	(-)
23	Controller negative	
24	Stepper motor	
25	-	
26	Under-panel power supply	(positive)



DECODER IMMOBILIZER

	Specification	Desc./Quantity
1	-	
2	Immobilizer led control	(negative)
3	Base power supply	(positive)
4	Negative	
5	-	
6	EMS controller	(serial)
7	-	
8	Under-panel power supply	(positive) Immobilizer antenna

EMS circuit diagram



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	Specification	Desc./Quantity
1	Electric fan remote control switch	
2	Electric fan	
3	Controller remote control switch	
4	H.V. coil	
5	Fuel pump	
6	Speedometer	
7	Injector	
8	Fluid temperature sensor	
9	Air temperature sensor	
10	Throttle potentiometer	
11	Stepper motor	
12	EMS controller	(serial)
13	Immobilizer antenna	
14	Decoder	
15	EMS diagnostic socket	
16	Stroke revolution sensor	
17	Stand switch	
18	Emergency stop switch	

	Specification	Desc./Quantity
19	Diode	2 A
20	Fuse	3 A
21	Headlight relay switch	
22	Master remote control switch	
23	Key switch	
24	Rectifier regulator	
25	Fuse	10A
26	Fuse	30 A
27	Fuse	5A
28	Utilities	

Troubleshooting procedure

This section provides troubleshooting guidance.

Engine does not start

ENGINE DOES NOT START EVEN IF ONLY DRAGGED

Possible Cause	Operation
Immobilizer signal	System not coded Inefficient system, fix according to the auto-diagnosis instructions
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor
Fuel feeding	Fuel in the tank Activation of the fuel pump Fuel pressure (low) Injector capacity (low)
Spark plug power supply	Sparkplug Cap shielded HT coil (secondary isolation).
Parameter reliability	Cooling fluid temperature Injection ignition timing Sucked air temperature
Compression end pressure	Compression end pressure
Parameter reliability	Cooling fluid temperature Injection ignition timing Sucked air temperature

Starting difficulties

DIFFICULT TO START ENGINE

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Start-up	Starter motor and remote control switch Battery Earth connections
Compression end pressure	Compression end pressure
Spark plug power supply	Spark plug Screened cap H.V. coil Stroke revolution sensor Ignition advance
Fuel feeding	Fuel pressure (low) Injector capacity (low) Injector seal (poor)
Parameter correctness	Cooling fluid temperature Sucked air temperature gas valve position stepper (effective steps and opening) Cleaning of the auxiliary air duct and of the gas valve air filter efficiency

Engine stops at idle

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

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Ignition efficiency	Spark plug Ignition timing
Parameter correctness	Gas valve position sensor Stepper Cooling fluid temperature sensor Sucked air temperature sensor

Possible Cause	Operation
Intake system cleaning	Air filter Gas valve and choke Stepper and additional air duct
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel feeding (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity
Exhaust gas analysis before catalytic converter	Trimmer value adjustment (CO% adjustment)

Engine does not rev down

ENGINE DOES NOT RUN AT IDLE/IDLE TOO HIGH

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Ignition efficiency	Ignition timing
Parameter correctness	Gas valve position sensor Stepper Cooling fluid temperature sensor Sucked air temperature sensor
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel feeding (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity
Exhaust gas analysis before catalytic converter	Trimmer value adjustment (CO% adjustment)

Exhaust backfires in deceleration

EXHAUST BACKFIRES WHEN DECELERATING

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Parameter correctness	Gas valve position sensor Stepper Cooling fluid temperature sensor Sucked air temperature sensor
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel feeding (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity
Exhaust system seal (infiltrations)	Manifold - head Manifold - silencer Analyzer socket Silencer welding
Exhaust gas analysis before catalytic converter	Trimmer value adjustment (CO% adjustment)

Engine revs irregularly

ENGINE RUNS IRREGULARLY WITH THROTTLE SLIGHTLY OPEN

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Intake system cleaning	Air filter Gas valve and choke Stepper and additional air duct
Intake system cleaning	Intake manifold Filter box
Ignition system	Spark plug wear check
Parameter reliability	Gas valve position signal Cooling fluid temperature signal

Possible Cause	Operation
	Sucked air temperature signal Ignition advance
TPS reset performed successfully	TPS reset performed successfully
Exhaust gas analysis before catalytic converter	Trimmer value adjustment (CO% adjustment)

Poor performance at full throttle

ENGINE POOR AT FULL POWER/ENGINE RUNS IRREGULARLY WHEN TIMED

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Spark plug power supply	Spark plug Screened cap H.V. cable H.V. coil
Intake system	Air filter Filter box (seal) Intake manifold (seal)
Parameter reliability	Gas valve position signal Cooling fluid temperature signal Sucked air temperature signal Ignition advance
Fuel feeding	Fuel level in the tank Fuel pressare Fuel filter Injector capacity

Engine knocking

KNOCKING (AT THE HEAD)

Possible Cause	Operation
Anomaly detected by autodiagnosis	Pump relay H.V. coil Injector Stroke revolution sensor Air temperature Cooling fluid temperature Atmospheric pressure
Ignition efficiency	Spark plug

Possible Cause	Operation
Parameter reliability	Gas valve position signal Cooling fluid temperature signal Sucked air temperature signal Ignition advance
Intake system cleaning	Intake manifold Filter box
TPS reset performed successfully	TPS reset performed successfully
Fuel feeding	Fuel pressure Fuel filter Injector capacity Injector capacity Fuel quality
Selection of the cylinder base gasket thickness	Selection of the cylinder base gasket thickness

Decoder master-box circuit

This section describes the operations to be carried out to check the power supply circuit.

Constant supply circuit check

Steady power supply circuit check

The decoder basic power supply is necessary for the deterrent flashing management. The injection controller power supply is necessary for the stepper motor management.

A power supply failure disables both ignition and injection.

In case of power supply faults, the diagnostic tester dwg. no. 020460Y gives the information «NO REPLY FROM THE CONTROLLER».

To carry out the check, proceed as follows:

Specific tooling

020460Y Tester and scooter diagnosis

1 - Check whether the immobilizer system led indicates switching to «ON» and whether the deterrent flashing is on.

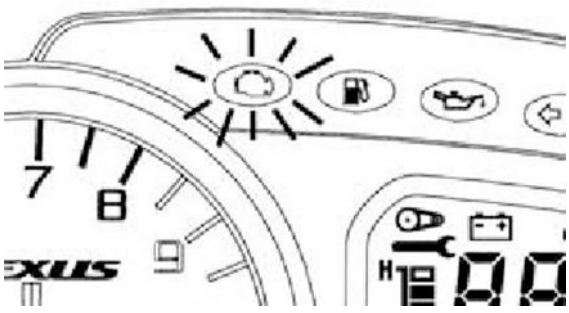
YES go to 2 NO go to 7

2 - The decoder is properly programmed.

YES go to 3

3 - Switch set to «**ON**» with side stand raised and emergency switch set to «**OFF**».

The injection indicator turns on for about 3

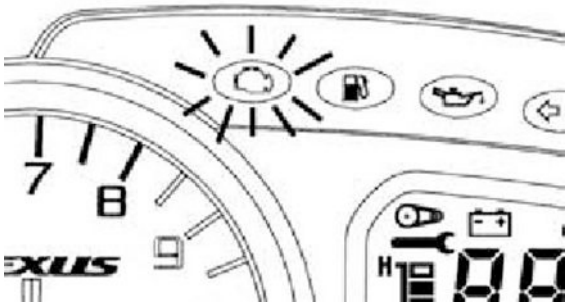


seconds.

YES go to 5 NO go to 4

4 - Check the instrument unit and its power supply.

YES go to 3



5 - Set the emergency switch to RUN.

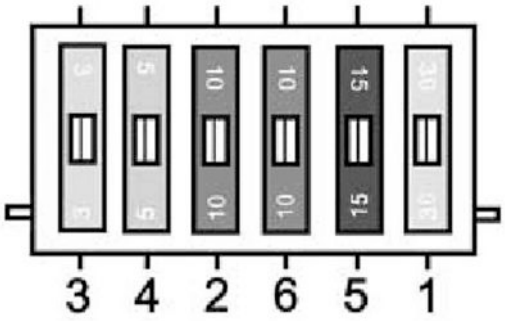
The injection indicator turns on for about 5 seconds.

YES go to 6 NO go to 7

6 - The injection controller is certainly powered.

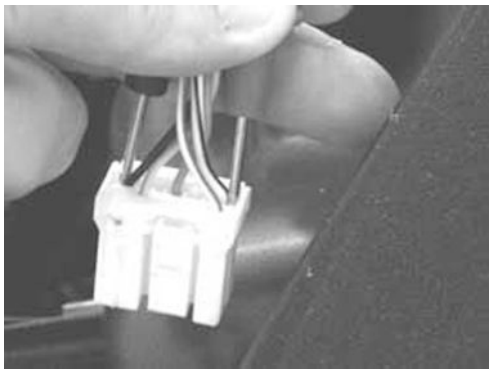
7 - Check the efficiency of the 3 A fuse no. 3 located in the fuse-holder under the right side.

YES go to 10 NO go to 8



8 - Fix any wiring short circuits and replace the fuse.

YES go to 1 NO go to 9



9 - Check any short circuit on decoder or controller and replace, if needed.

YES go to 1

10 - Place the specific tool between controller and power supply system.

Disconnect the main decoder connector and check the following conditions:

Terminal no. 3= battery positive

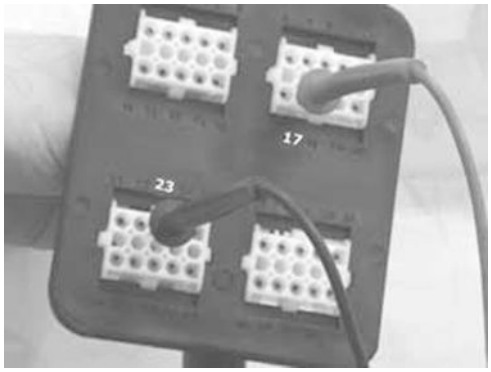
Terminal no. 4= battery negative

YES go to 11 NO go to 13

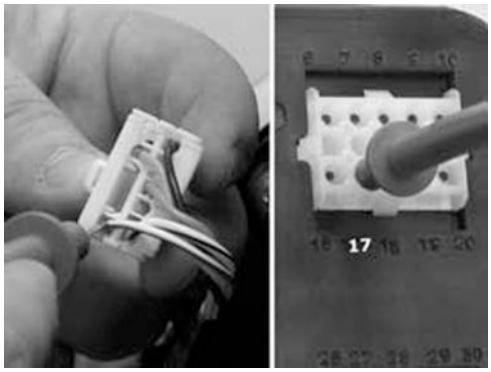
Specific tooling

020481Y Control unit interface wiring

11 - Decoder with proper base power supply.
Use the specific tool to check the controller power supply:
Pin 17 = battery positive
Pin 23 = battery negative
YES go to 12 NO go to 13



12 - Controller with proper base power supply.
13 - If the battery negative is not present, check continuity between Pin 23 of the specific tool and earth.
Detect the presence of the battery positive on Pin 17 of the specific tool and on pin 3 of the decoder connector.
YES go to 12 NO go to 14
YES go to 11



14 - Fix the wiring.

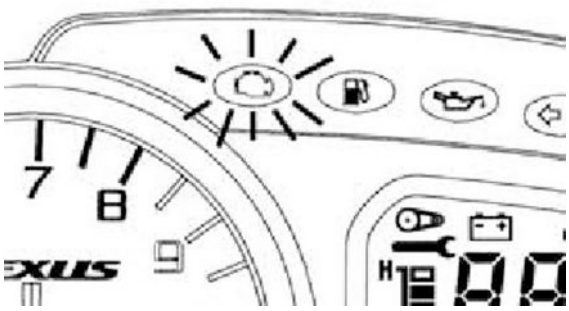
Key-switch power supply circuit check

- An under-panel power supply failure disables both ignition and injection functions. In case of power supply faults, the diagnostic tester gives the information «NO REPLY FROM THE CONTROLLER».

Specific tooling

020460Y Tester and scooter diagnosis

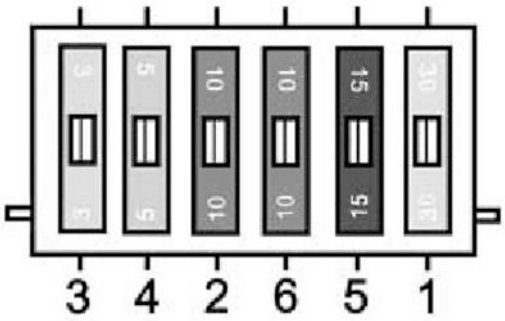
1 - Check whether the immobilizer system led indicates switching to «ON»
YES go to 2 NO go to 4
2 - Raise the side stand. Set the emergency switch to «**OFF**». Turn the key switch to «**ON**». Set the emergency switch to «**RUN**». Check whether the injection indicator turns on for 5 seconds
YES go to 3 NO go to 4



3 - Under-panel power supplies are regular

4 - Check the working order of the fuse no. 4 and 5 located in the fuse holder on the right side.

YES go to 5 NO go to 6



5 - Place the specific tool between controller and injection system.

YES go to 7

Specific tooling

020481Y Control unit interface wiring

6 - Fix any short circuits and replace the fuse.

Check decoder and controller, if necessary

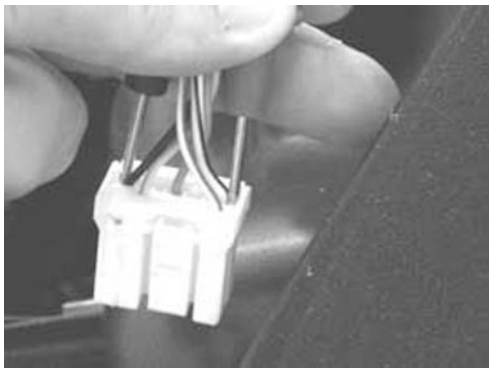
YES go to 1

7 - Disconnect the main decoder connector and check the following conditions: switch set to «**ON**», switch to «**RUN**» and side stand raised

Terminal no. 8 = battery positive

Terminal no. 4 = battery negative

YES go to 8 NO go to 10



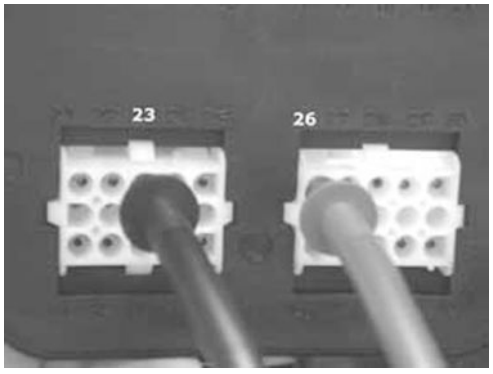
8 - Decoder with proper under-panel power supply.

Use the specific tool to check the controller under-panel power supply. Switch set to «**ON**», switch to «**RUN**» and side stand raised.

Pin 26 = battery positive

Pin 23 = battery negative

YES go to 9 NO go to 10



Specific tooling

020481Y Control unit interface wiring

9 - Controller with proper under-panel power supply.

10 - If only one component is not powered check the related connector.

If the problem involves both the decoder and cpu check the continuity of the decoder-cpu power supply line.

YES go to 12 NO go to 11

11 - Fix the wiring or the connection

YES go to 10

12 - Proper under-panel power supply

YES go to13

13 - Check the connector and the continuity of the key switch set to «**ON**»

Pin 1 - 2 = continuity

YES go to 14

14 - Check the engine stop remote control switch connector and the switch efficiency. The connector can be recognised by its larger section white lead.

NOTE: check the coil resistance

85 - 86 = ~ 70W

YES go to 15

N.B.

CHECK THE COIL RESISTANCE

15 - Check the signal circuit:

- emergency switch and connector
- side stand switch and connector

YES go to 16

16 - Check the wiring continuity. Check the utility control main remote control switch.

Disconnect the master remote control switch.

Check the diode installed on the earth connection of the main remote control switch pickup.

86 - earth = continuity with high resistance (connect the tester: positive with 86; negative with earth).

When the polarity is inverted there should be no continuity.

Diagnostic circuit

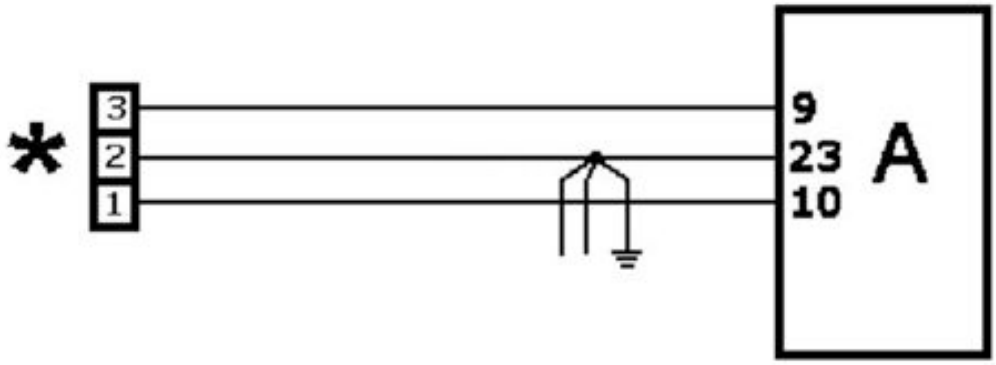
* CONNECTOR FOR DIAGNOSTIC TESTER

A = INJECTION CONTROLLER

Connect the diagnostic tester.

Specific tooling

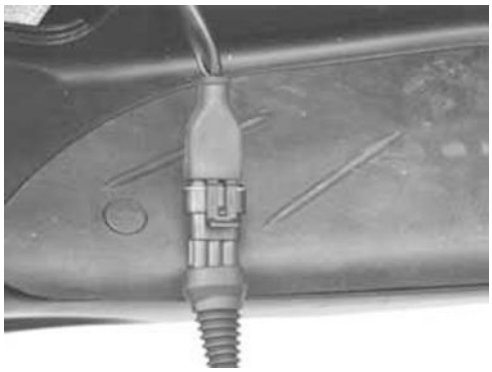
020460Y Tester and scooter diagnosis



If the diagnostic tester displays «No reply from the controller», disconnect the under-panel power supply for 10 seconds and switch to "ON" again; if the message is still displayed, proceed as follows:

1 - Check the diagnostic tester connections.

YES go to 2 NO go to 3



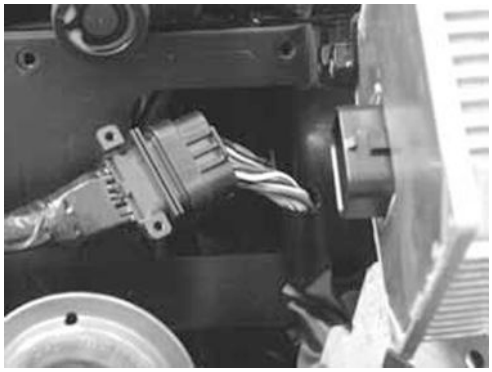
2 - Check the controller base and under-panel power supplies.

YES go to 4

3 - Restore

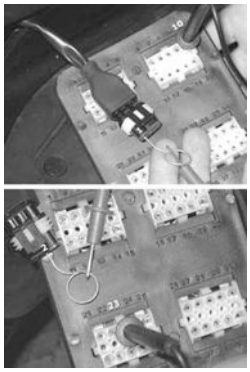
4 - Place the specific tool between controller and system. Keep the controller disconnected.

YES go to 5



Specific tooling

020481Y Control unit interface wiring



5 - Check the following conditions:

PIN 1 diagnostic socket - PIN 10 controller = continuity

PIN 2 diagnostic socket - PIN 23 controller = continuity with earth

PIN 3 diagnostic socket - PIN 9 controller = continuity

10 - 23 = insulation (>1 MΩ)

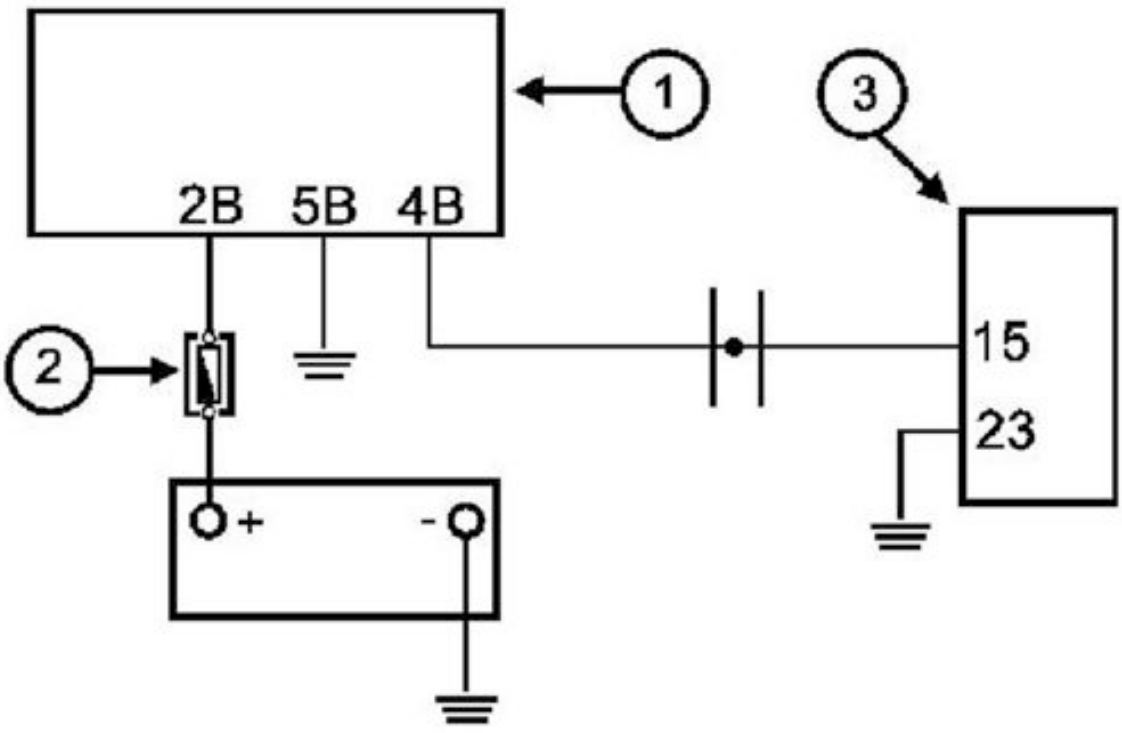
9 - 23 = insulation (>1 MΩ)

YES go to 6 NO go to 7

6 - The circuit is in good working order. Check the controller.

7 - Fix the interruption or short-circuit.

Injection warning light circuit



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	Specification	Desc./Quantity
1	Speedometer	
2	Fuses	7,5 A
3	Controller	

[P]

	Specification	Desc./Quantity
1	TERMINAL: 15 - 23	**CONDITIONS**: DURING THE CHECK - switch set to «**ON**» - side stand raised - switch to «**RUN**» **STANDARD VALUES**: O V
2	TERMINAL: 15 - 23	**CONDITIONS**: AFTER THE CHECK - switch set to «**ON**» - side stand raised - switch to «**RUN**» **STANDARD VALUES** : Battery voltage

The injection indicator light is controlled upon every switching to «**ON**» by the 3-second timing generated by the digital instrument. This step is normally interrupted by the injection controller control. The timing lasts 5 seconds.

The diagnostic tester is not programmed to check this circuit.

Proceed as follows:

Specific tooling

020460Y Tester and scooter diagnosis

1 - Put the switch in «ON» position Put the emergency switch on «RUN». Lift the side stand. Make sure the light goes on for 5 seconds.

YES go to 2 NO go to 3

2 - The system is working.

3 - Put the specific tool between the cpu and system..

YES go to 4

Specific tooling

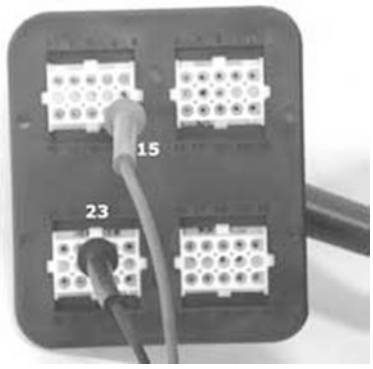
020481Y Control unit interface wiring

4 - Switch in «**ON**» position Emergency switch on «**RUN**».

Side stand up Wait more than 5 seconds.

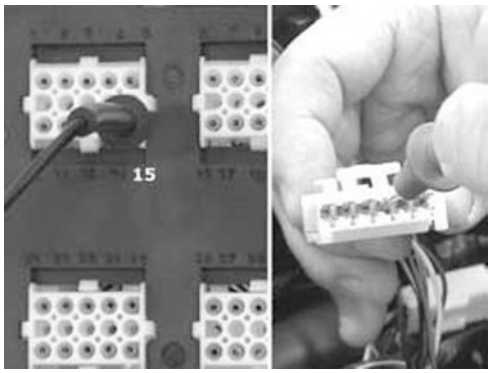
15 - 23 = battery voltage

YES go to 5 NO go to 6



5 - Check the cpu connector. Check the cpu.

6 - Check the continuity between pin 15 of the cpu and the brown-black wire of the 6 input connector of the instrument unit.



The injection cpu manages the negative of the light. The light must go off after the initial check. The light goes on again when the cpu autodiagnosis detects a fault. When the fault disappears the light goes back off, however, the related operating tests need to be carried out. The light can go on whether the engine is able to run or not.

Self-diagnosis system

The injection controller is provided with an auto-diagnosis function.

When a failure is detected, the controller:

- turns on the injection indicator (only when it is current).
- enables the engine management check according to the data entered in the controller (where possible).
- stores the failure (always).

In the event of intermittent failures, the indicator follows the failure trend and storage remains active. Stored data are automatically deleted when the failure does not occur for over 16 usage cycles of the vehicle (heating - use - cooling). The battery disconnection does not delete stored data.

Checking stored failures

Connect the diagnostic tester to the vehicle system. Select the menu on the «ERRORS» function.

Specific tooling

020460Y Tester and scooter diagnosis

The tester pages display the list of errors detectable by the auto-diagnosis. Errors detected by the auto-diagnosis are marked by one or two refer-

ence dots.

They are arranged on two lines:

Line A = current failures (present)

Line M = stored failures

Errors detectable by the auto-diagnosis may refer to the following system circuits or sectors of the controller:

- throttle valve position signal
- ambient pressure signal
- cooling fluid temperature signal
- sucked air temperature signal
- wrong battery voltage
- Injector and relevant circuit
- HV coil and relevant circuit
- Stepper and relevant circuit
- Pump relay circuit
- Electric fan relay circuit
- RAM memory
- ROM memory
- EEPROM
- Microprocessor
- Signals panel (stroke - revolution signal - unsteady cycle)

Underlined failures cause the engine to stop.

In the other cases, the engine works managed by the basic data.

Deleting stored failures

After fixing any failures, connect the diagnostic tester.

Select the menu on the «errors deleting» function.

Press «**OK**» and follow the instructions. Perform a trial cycle and check whether the failure occurs again.

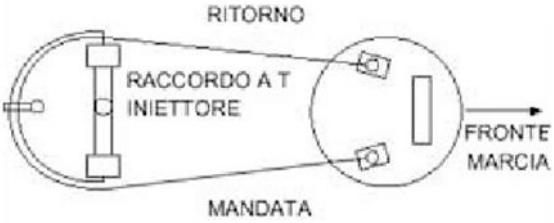
Specific tooling

020460Y Tester and scooter diagnosis

For troubleshooting for any faults see the related chapter sections.

Fuel supply system

Fuel is fed to the injector by a pump, a filter and a pressure regulator integrated with the fuel level indicator inside the tank.



The pump unit is connected to the injector by:

- 2 semi-flexible pipes
- 4 quick unions
- 1 T union with O-ring and retain bracket for the injector

The pipes are crossed and fixed to the intake manifold to prevent wear of the quick unions connected to the T union for the injector.

N.B.

BEFORE WORKING ON THE FEEDING SYSTEM, CAREFULLY CLEAN THE PARTS TO PREVENT DAMAGING THE QUICK UNION SEAL OR TO PREVENT INFILTRATIONS INTO THE DUCTS.

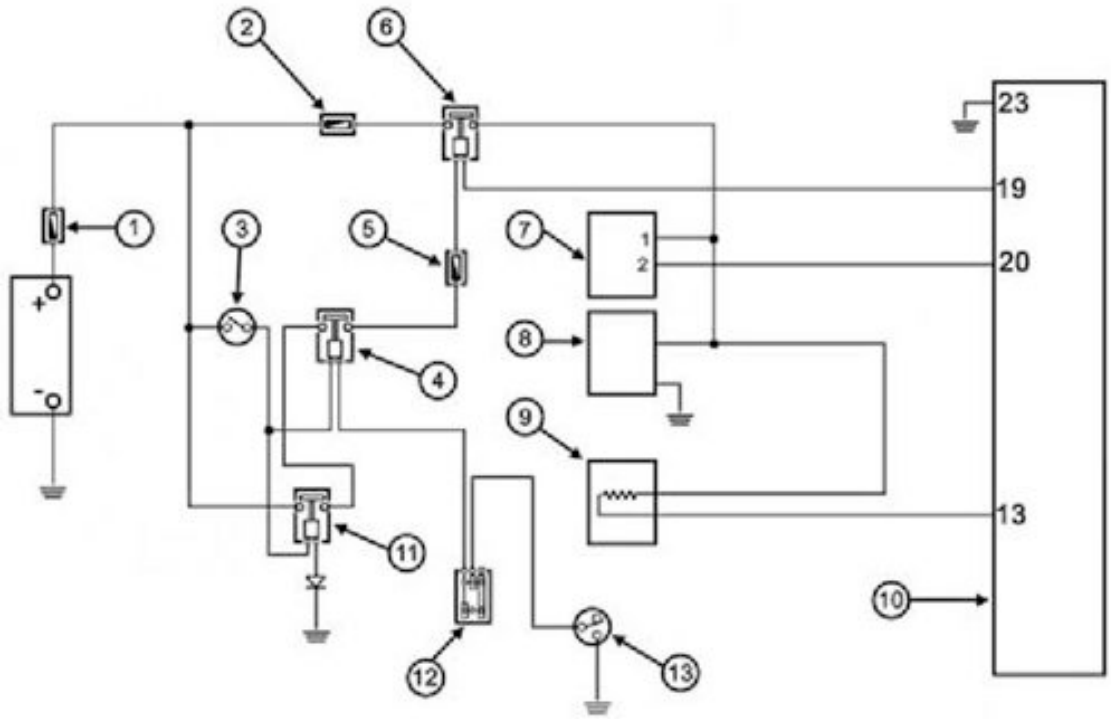
CAUTION

THE SYSTEM IS UNDER PRESSURE..
DO NOT SMOKE DURING THE INTERVENTIONS.
PREVENT ANY FUEL SPRAYING.

WARNING

- BEFORE STARTING THE ENGINE, CHECK THE PRESENCE OF FUEL INTO THE TANK.
- DO NOT USE THE VEHICLE IN RESERVE FOR A LONG TIME, UP TO THE POSSIBILITY OF RUNNING OUT OF FUEL.
- IF THE VEHICLE IS EXPECTED TO REMAIN UNUSED FOR A LONG TIME, REFILL THE TANK AT LEAST TO HALF THE LEVEL.
FAILURE TO OBSERVE THESE RULE CAN DAMAGE THE PUMP.

Circuit diagram



[P]

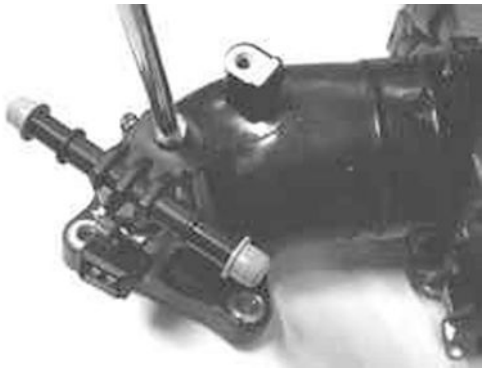
	Specification	Desc./Quantity
1	Fuse	30 A
2	Fuse	10A
3	Switch	
4	Headlight relay switch	
5	Fuse	5A
6	Controller remote control switch	
7	H.V. coil	
8	Fuel pump	
9	Injector	
10	Electronic injection controller	
11	Master remote control switch	
12	Engine stop deviator	
13	Stand switch	

Removing the injector

N.B.

ONLY REMOVE THE INJECTOR FROM THE MANIFOLD IN THE EVENT OF A PROVEN DEFECT. OPERATING TEST OF THE INJECTOR MUST BE PERFORMED WITH THE INJECTOR INSTALLED ON THE MANIFOLD (SEE «INJECTION»).

- To remove the injector, remove the central set screw of the «T» shunt acting as a support for the injector.



- Remove the injector from the manifold.

- Once the engine is repaired check the CO% value again while idling to make sure it is within the prescribed limits. If the CO% is not in conformity, proceed with calibration as described in the "Carburation adjustment" chapter.

Refitting the injector

Carefully check to make sure the components are clean.

- Fit new o-rings and grease them.
- Apply the recommended product to the set screws and tighten to the prescribed torque.

Recommended products

Loctite 243 Thread-Brake

Medium Loctite Thread-Brake 243

Locking torques (N*m)

Injector fixing screw 3 - 4

N.B.

ONCE THE ENGINE IS REPAIRED CHECK THE CO% VALUE WHILE IDLING TO MAKE SURE IT IS WITHIN THE PRESCRIBED LIMITS. IF THE CO% IS NOT IN CONFORMITY, PROCEED WITH CALIBRATION AS

DESCRIBED IN THE ADJUSTING IDLE CARBURATION PARAGRAPH.

Removing the butterfly valve

N.B.

THE THROTTLE BODY IS A PART WHICH INCLUDES VARIOUS COMPONENTS AND IS USUALLY SUPPLIED COMPLETE. TO TEST THESE COMPONENTS SEE THE «INJECTION» CHAPTER.

- Remove the 3 set screws indicated in the figure.

CAUTION

THE THROTTLE BODY COMES PRE-CALIBRATED. TAMPERING WITH THE THROTTLE STOP REGISTER IS TO BE ABSOLUTELY AVOIDED. THIS REGISTER HAS BEEN SEALED FOR THIS PURPOSE. FOR PROBLEMS WITH IDLING SEE THE «INJECTION» CHAPTER.

N.B.

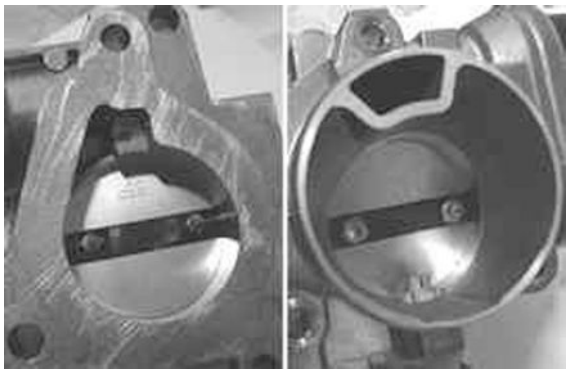
REMOVAL OF THE THROTTLE BODY CAN BE EFFECTED WITH THE MANIFOLD ON OR OFF THE ENGINE.

- Make sure the seal rims on the coupling surfaces between the manifold-throttle body and manifold-head are in good condition.

CAUTION

IF AIR GETS IN IT CAN JEOPARDISE THE OPERATION OF THE INJECTION SYSTEM, ESPECIALLY WHEN THE ENGINE IS IDLING.

- Make sure the gas valve and related conduit are clean.
- Make sure the supplementary air channel managed by the Stepper motor is clean.



N.B.

IF THE THROTTLE BODY IS REPLACED RESET THE T.P.S. AND ADJUST THE CO%.
ONCE THE ENGINE IS REPAIRED CHECK THE CO% VALUE WHILE IDLING TO MAKE SURE IT IS WITHIN THE PRESCRIBED VALUES.
IF THE CO% IS NOT IN CONFORMITY, PROCEED WITH CALIBRATION AS DESCRIBED IN THE ADJUSTING IDLE CARBURATION CHAPTER.

Throttle housing

From examinations of warranty components, we have found several throttle housings which have been erroneously replaced, following the smearing of the valve. The dirt which deposits on the valve, mainly on the inlet side, can be easily removed. After cleaning, the air flow through the throttle housing is identical to that of any new part. The smearing of the throttle valve is a phenomenon which manifests itself at different times, according to the level of use of the vehicle, environmental conditions, and idle adjustment. The build-up of the problem may be easily observed through a progressive decrement of the idle speed. A more accurate diagnosis may be carried out through the use of a scooter diagnostic tester, dwg. No. 020460y. Reference parameters, with the engine running at a temperature of at least 90°, are shown below:

	Standard	**Valve housing dirty**
Engine Rpm	1500±5	< 1400
Spark Advance	5°÷7°	10°
Valve Opening	5,24°	5,24°

The error menu shows the indication "signal frame" in memory status. This only occurs in the event that the engine has shut down with the ignition switch on the "on" position. An analysis of the exhaust gases will show an excessively rich carburetion at idle, which cannot be adjusted (CO > 4% - CO2< 12%). Collect the gases using tool no. 020625y. We also wish to stress that, with the exception of premature smearing, the cleaning operation must not be carried out within warranty. After cleaning the throttle housing, it is always advisable to check and, if necessary, adjust the c0 value. When these directions are combined with the activation of the injection warning light, or other errors or

faulty parameters, proceed with the inspections described in the manual. In these circumstances, a fault is evident.

Refitting the butterfly valve

- Carry out the operations in the reverse order of the disassembly, tighten the 3 set screws to the prescribed torque.

Locking torques (N*m)

Throttle body set screws 11 - 13

Pump supply circuit

The controller starts the pump in the following conditions:

- by setting the switch to «**ON**» with emergency switch to «**RUN**» and side stand raised. Pump supply for 2 seconds.
- when the stroke - revolution signal is on Continuous feeding.

The initial timing is useful to bleed the system especially after a stop with engine in temperature. In these conditions, the fuel altered by boiling will be mixed with that in the tank.

During use, the pump operation will be subject to the engine revolution.

Circuit check

Proceed as follow:

1 - Set the switch to «**ON**» with emergency switch to «**RUN**» and side stand raised. The pump rotates for 2 seconds

YES go to 2 NO go to 3

2 - Try to start up. Check that the engine revolution matches the pump rotation.

YES go to 4 NO go to 5

3 - The pump does not rotate, or it rotates uninterruptedly.

YES go to 5

4 - The pump power supply is conforming.

5 - Connect the diagnostic tester to the vehicle system.

YES go to 6

Specific tooling

020460Y Tester and scooter diagnosis

6 - Try to start up. Select the menu on the «ERRORS» function. Check whether there are any failures.

YES go to 7 YES go to 8 NO go to 30

7 - Pump control relay circuit failure.

YES go to 9

8 - Failure of:

- injector
- H.V. coil
- signals panel

YES go to 18

9 - The controller has detected a failure on the line of pin 19

YES go to 10 YES go to 11

10 - Line to earth. In this case, the pump is always in rotation when the under-panel voltage is on

YES go to 12

11 - Interrupted line. The relay cannot control the pump feeding

YES go to 13

12 - Check and restore the earth insulation of the controller line 19 and of the pump remote control switch line 85.

YES go to 14

13 - Install the specific tool between controller and the injection system.

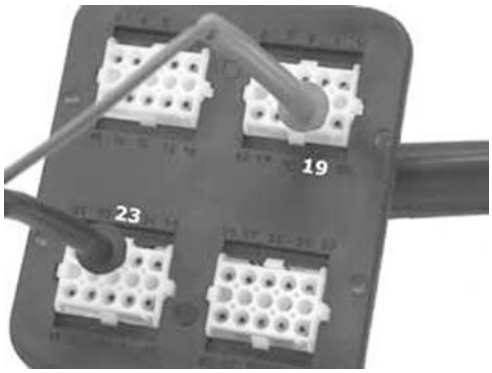
SI go to 15

Specific tooling

020481Y Control unit interface wiring

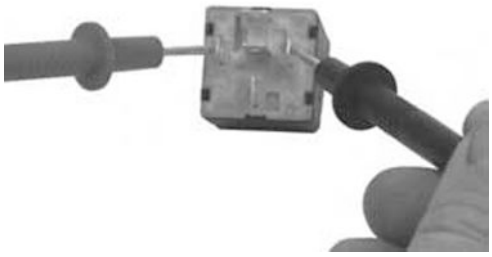
14 - Delete the code and check from the beginning.

15 - Set the switch to «**ON**» with switch to «**RUN**» and side stand raised. Wait more than two seconds and check the following conditions:
19 - 23 = battery voltage
YES go to 16 NO go to 17

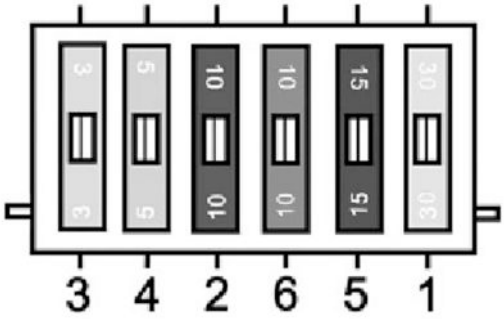


16 - Replace the controller

17 - Check the presence of voltage (+ batt.) between pin 86 of the pump remote control switch and pin 23 of the controller. Fix the wiring, if required. Check the relay coil continuity.
85 - 86 = 100 ± 50Ω

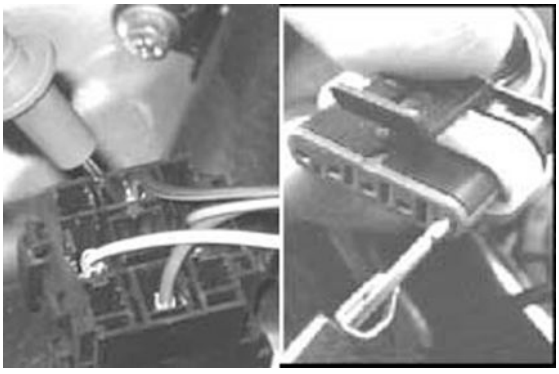


18 - Check the efficiency of the 10 A fuse no. 2
YES go to 20 NO go to 19



19 - Disconnect the following connectors: fuel pump, H.V. coil, injector
YES go to 22

20 - Check the efficiency of the pump remote control switch. Check the wiring continuity between remote control switch and pump.
87 (remote control switch) - green/black (pump) = continuity
NO go to 21

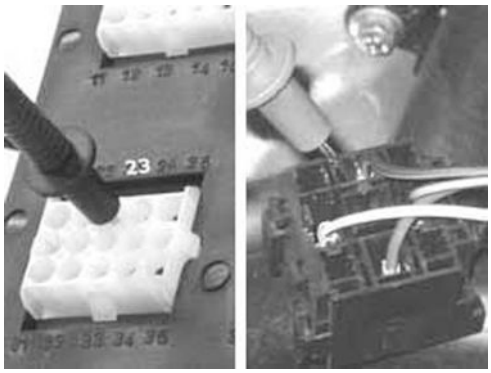


21 - Fix the wiring and repeat the check from the

beginning.

22 - Check the earth insulation of wiring 87 (pump remote control switch) - 23 = insulation (>1 MΩ)

YES go to 24 NO go to 23



23 - Restore the wiring insulation and replace the fuse.

24 - Check the earth insulation of the injector coil and of the HV coil primary.

YES go to 25

25 - Check the pump winding resistance: ~1.5Ω

YES go to 26 NO go to 27

26 - Replace the fuse and check the pump.

27 - Check the absorbed current.

28 - Select the diagnostic tester menu on the «ACTIVE DIAGNOSIS» function. Select the fuel pump simulation function. Enable the function with under-panel power supply on and engine off.

YES go to 29

Specific tooling

020460Y Tester and scooter diagnosis

29 - The tester prompts the controller to start the pump for 30 seconds

YES go to 30

30 - Acoustically check the following conditions:

- relay closure
- pump rotation
- relay opening

YES go to 31 NO go to 32

31 - The pump is fed. Perform a functional check of the pump.

32 - Check the efficiency of the pump connector..

YES go to 33 NO go to 34

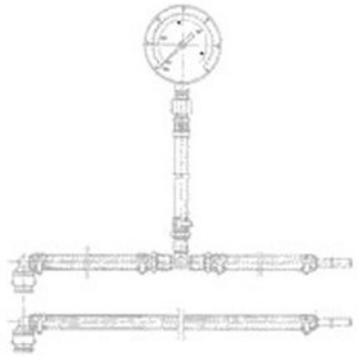
33 - Replace the fuel pump.

34 - Restore

The injection cpu manages the negative of the light. The light must go off after the initial check. The light goes on again when the cpu autodiagnosis detects a fault. When the fault disappears the light goes back off, however, the related operating tests need to be carried out. The light can go on whether the engine is able to run or not.

Hydraulics check and system maintenance

Before performing the checks concerning the system pressure, it is necessary to proceed by carefully cleaning all feeding system components.
To perform the inspections it is necessary to use the special tooling kit for fuel pressure check.



Specific tooling

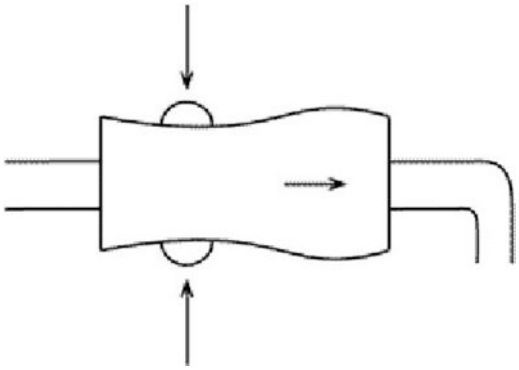
020480Y Fuel pressure check kit

Before disconnecting any fastener, reduce the system pressure.
Detach the electrical connector from the pump support with the engine running and wait for the shutdown.
The engine stops at approximately 1.5 bar.

CAUTION

CAREFULLY DETACH THE HOSE TERMINAL TO PREVENT POSSIBLE SPRAYS TO COME IN CONTACT WITH THE EYES.

The special tool is equipped with fast-release fittings, similar to those provided for the circuit.
In order to disconnect the female terminals (injector side), it is necessary to press the two extensions and draw them.



CAUTION

DO NOT FORCE THE TERMINAL IF THIS DOES NOT COME LOOSE; EVENTUALLY, TRY TWISTING IT. THE TERMINAL IS DESIGNED SO THAT AN INCRESE IN TENSION INCREASES THE LOCKING FORCE.

To detach male type terminals (pump side) it is necessary to press the coaxial rings towards the pump, and extract the terminals.

CAUTION

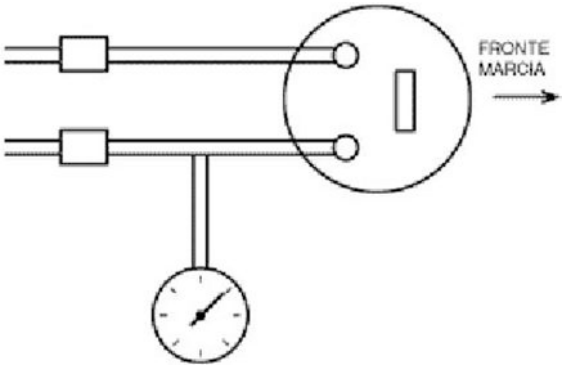
DO NOT FORCE THE TERMINAL IF THIS DOES NOT COME LOOSE; EVENTUALLY, TRY TWISTING IT. THE TERMINAL IS DESIGNED SO THAT AN IN-CRESE IN TENSION INCREASES THE LOCKING FORCE.

The system pressure check must be carried out, for practical reasons, by connecting on pump side.

Connect the manometer to the outlet duct (RHS) and the extension tube to the inlet duct (LHS).

CAUTION

BEFORE REASSEMBLYING CHECK THE TOOL DUCTS ARE CLEAN.



Pressure regulator check

1 - Connect the diagnostic tester

Specific tooling

020460Y Tester and scooter diagnosis

Select the menu on the «ACTIVE DIAGNOSIS» function.

Select the «PUMP DIAGNOSIS» function.

YES go to 2

2 - Enable the function with under-panel power supply on and engine off.

The controller starts the pump for 30 seconds

YES go to 3

3 - Let the system bleed for a few seconds.

Make sure that there are no external leaks.

Check the regulation pressure with pump power supply voltage higher than 12 V.

Regulation pressure = 300 - 320KPa (3 - 3.2 BAR)

YES go to 4 NO go to 5

4 - The pressure regulator is efficient.

5 - Pressure too high

Check that the return duct is not clogged or squashed

YES go to 6 NO go to 7

6 - Replace the pressure regulator.

7 - Pressure regulation too low

Start the pump rotation again.

Using pliers with flat and long tips, temporarily clamp the return duct by the extension of the specific tool (the serial pipe does not allow this operation).

fuel pressure = over 300 KPa (3 BAR)

YES go to 8 NO go to 9

8 - Replace the pressure regulator.

9 - Replace the fuel pump.

Fuel pump and filter check

This procedure is useful during maintenance to check the filter efficiency in delivery.

Connect the diagnostic tester.

Connect the fuel pressure check kit.

Specific tooling

020460Y Tester and scooter diagnosis

020480Y Fuel pressure check kit

1 - Select the diagnostic tester menu on the «ACTIVE DIAGNOSIS» function.
Select the «PUMP DIAGNOSIS» function.
The pump starts for 30 seconds.
YES go to 2

2 - Bleed for a few seconds.
Make sure that there are no leaks.
Using pliers with flat and long tips, temporarily clamp the return duct by the extension of the specific tool with pump power supply voltage higher than 12 V, check the system maximum pressure.
Maximum pressure = > 600 KPa (6 BAR)
YES go to 3 NO go to 4

Specific tooling

020480Y Fuel pressure check kit

3 - Check the system seal.
Start the pump for 30 seconds by the diagnostic tester.
When the pump stops, wait 3 minutes.
Check the system pressure.
Fuel pressure = over 200
KPa (2 BAR)
YES go to 5 NO go to 6

Specific tooling

020460Y Tester and scooter diagnosis

4 - If pressure is lower, carefully check the voltage with pump under stress.
If voltage is higher than 12 V, replace the pump.
5 - The system seal is efficient.
Check the free flow rate.

AHEAD go to 16

6 - Repeat the test. When the pump stops, use pliers with flat and long tips to temporarily clamp the return duct by the extension of the specific tool. This causes an increase of the fuel pressure.

AHEAD go to 7

7 - Check whether the pressure decreases with the same trend as the system when free from bottlenecks

AHEAD go to 8

8 - Pressure decreases much more slowly

YES go to 9 NO go to 10

9 - Replace the pressure regulator.

Check the system seal again.

10 - There occur trend variations

YES go to 11 NO go to 13

11 - Repeat the test clamping the pipe of the specific tool in the portion between the branch and the injector.

Check whether the pressure decreases with the same trend as the system when free.

Pressure decreases much more slowly

YES go to 12 NO go to 13

Specific tooling

020480Y Fuel pressure check kit

12 - Check and replace the injector, if required, due to an insufficient seal.

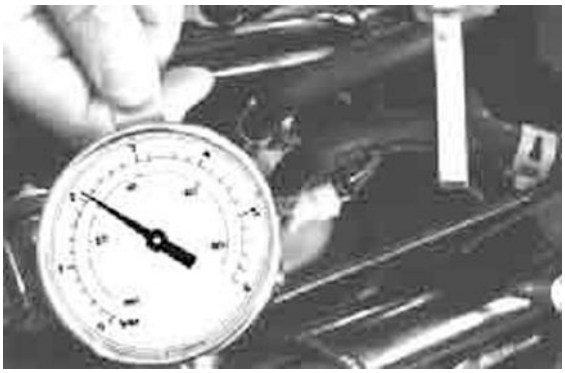
(see «THERMAL UNIT AND TIMING SYSTEM »)

13 - There are no trend variations

Repeat the test clamping the pipe of the specific tool in the portion between the branch and the

pump. Check whether pressure decreases much more slowly.

YES go to 14 NO go to 15



Specific tooling

020480Y Fuel pressure check kit

14 - The pump unidirectional valve is faulty. Replace the pump. (see Pump bracket overhaul)

15 - Check the pipe and the injector union seals more carefully.

Check the component seals again, if needed.

CAUTION

A POOR SYSTEM SEAL ONLY AFFECTS THE START-UP VELOCITY.

16 - Disconnect the pump connector, start the engine, wait until it stops and connect the connector again.

Disconnect the fuel return pipe from the pump support (left pipe).

AHEAD go to 17

17 - Introduce the return pipe into a graduated container.

Using the diagnostic tester,

start the fuel pump for 10 seconds.

Make sure that the power supply voltage is more than 12V.

Measure the amount of fuel delivered.

Pump free flow rate = 300 - 320 cc.

YES go to 18 NO go to 19

Specific tooling

020460Y Tester and scooter diagnosis

18 - The fuel filter is not clogged.

The vehicle can be used respecting the limit of 48000 Km.

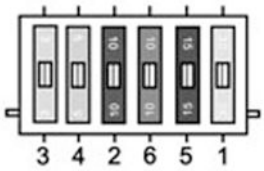
19 - The flow rate is less than 250 cc.

The fuel filter is dirty. Replace the pump support.

Pump electrics check

This section describes the operations to be carried out to perform electric checks on the pump.

Resistor check



Disconnect the connector from the pump support.

Using a tester, measure the pump winding resistance.

Connect the tester prods to the pump support pins as shown in the figure.

Electric characteristic

Resistance:

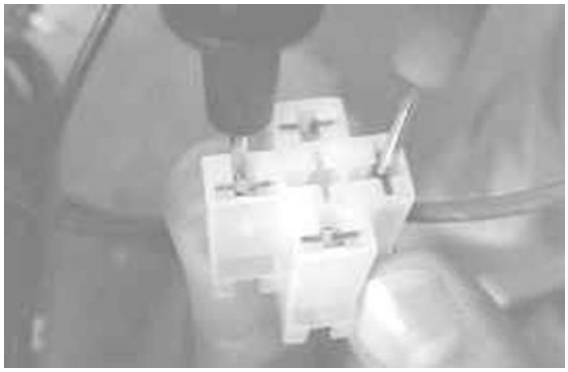
~1,5 Ω

In case of infinite resistance, replace the pump.

With infinite resistance, the pump does not rotate.

With resistance close to 0 W the pump absorbs too much, with the possibility of burning the 10-A fuse no. 2. Perform the following check.

Pump consumption check



The pump absorption may vary according to:

- power supply voltage
- pump running-in
- regulation pressure
- delivery filter cleaning

To check the absorbed current, proceed as follows

- disconnect the pump remote control switch connector.
- with key switch set to «**OFF**», connect the jumpers 30-87 on the connector using the tester prods

on amperometer function (see figure).

-check the pump rotation and absorption

N.B.

THIS ABSORPTION REFERS TO:
- POWER SUPPLY VOLTAGE = ~ 12 V
- PUMP RUN-IN
- SYSTEM PRESSURE = 300 KPA (3 BAR)
- FUEL FILTER CLEAN

Electric characteristic

Absorbed current:

~ 3,5 ÷ 4,2 A

The a dirty filter causes an increase of the absorption. If the overpressure valve opens, the pump absorbs ~ 6-7A.

In case of excessive absorption(5A), replace the filter. See pump support overhaul.

If the fault continues, replace the pump.

Fuel filter check

To check the fuel filter inspect the following:

- Free flow
- Current absorbed by the pump. A clogged filter causes:
- Poor performance especially at full power
- Pump absorption increase

N.B.

DO NOT BLOW THE FILTER WITH COMPRESSED AIR. A DAMAGED FILTER MAY CAUSE THE INJECTOR CLOGGING.

Pump bracket overhaul

To remove the pump support from the tank, proceed as follows:

- Disconnect the electric connector.
- Start the engine and wait for the spontaneous stop.
- Clean the tank and the pump support (wash and blow with compressed air, if needed).

- Disconnect the delivery and return pipes by the quick unions.

CAUTION

PREVENT ANY FUEL SPRAYING.

- Loosen the pump support fixing ring nut (RH threading).

- Remove the pump support and the sealing gasket.

N.B.

WHEN EXTRACTING, BE CAREFUL NOT TO DEFORM THE FLOAT ARM.

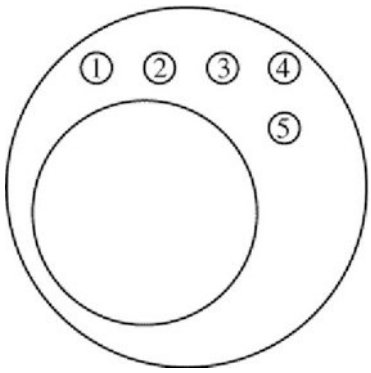
To replace the components, proceed as follows:

(**1**) Level indicators:

- Note the assembly position and the path of the two connecting wires.

pos 2 = wire connected to the circuit

pos 3 = wire connected to the mobile arm



Pass the wires through the hole obtained between filter and pressure regulator.

- Disconnect and extract the wires

- Using a screwdriver on the retain tab as shown in the figure, extract the level indicator from the support

- Level indicator check

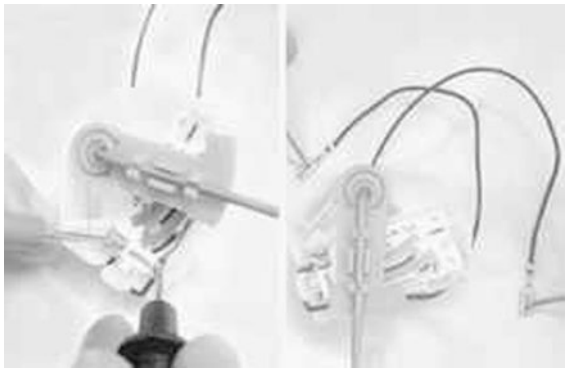
The check may also be carried out before removal from the support.

Measure the resistance between the two level indicator wires.

Moving the float arm, check that the resistance is subject to gradual variations according to the arm motion.

LIMIT VALUES

	Specification	Desc./Quantity
1	empty tank position:	95 ÷ 105 Ω
2	full tank position:	0 ÷ 9 Ω



- Repeat the operations in the reverse order for re-assembly.

(**2**) Pressure regulator:

- Remove the locking spring

- Extract the pressure regulator with sealing rings.

N.B.

TO OVERCOME THE RESISTANCE OF THE O-RINGS, LEVER WITH A SCREWDRIVER THROUGH THE OPENINGS OBTAINED ON THE STOP INSERTION SIDE.

- Lubricate the O-rings and repeat the operations

in the reverse order for re-assembly.

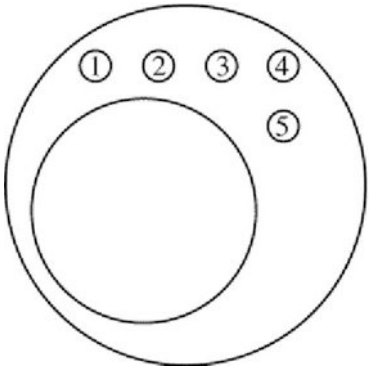
(**3**) Fuel pump

- Note the position of the power supply wires on the support

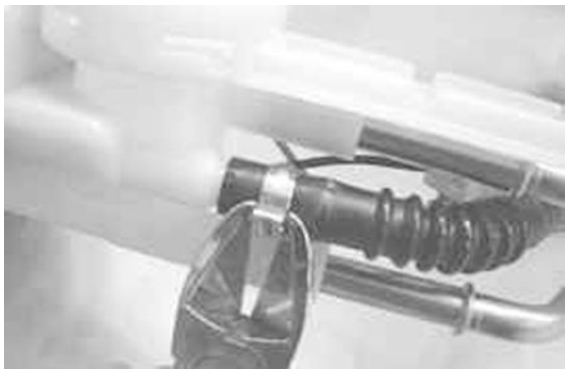
pos 1 = positive (red)

pos 4 = negative (black)

- Disconnect the power supply cables

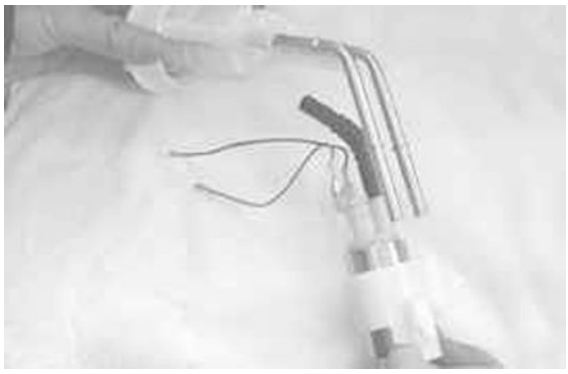


- Cut the delivery pipe fixing band on the support.

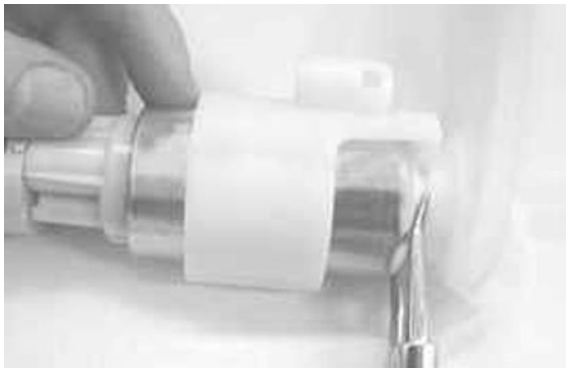


- Remove the pump fixing washer

- Remove the filter coupling pipe
- Remove the pump with annular support and pre-filter.



- If the pump requires replacement, remove the pre-filter and the annular support.
- For re-assembly, perform the removal operations in the reverse order using a new band for the delivery pipe and a new pump fixing washer.



N.B.

TO CLEAN THE PRE-FILTER, USE GASOLINE AND COMPRESSED AIR.

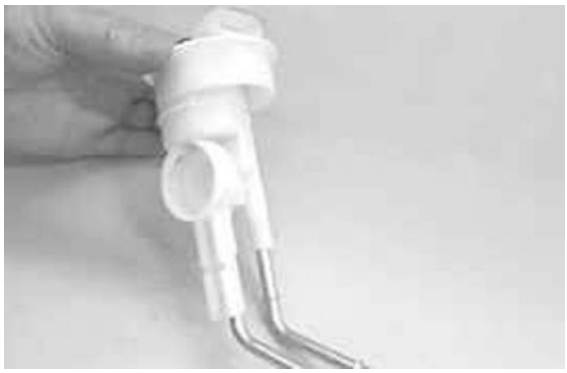
Orientate the pump properly.

(**4**) Fuel filter

The fuel filter is supplied already assembled with the pump support.

To replace the support, move the level indicator, the pressure regulator and the pump from the old to the new support.

For these operations, follows the instructions given above.



Pump bracket installation

- Before re-assembling, carefully check the tank cleaning.

In case of dirt or water, remove the tank.

- Install the sealing gasket on the pump support.
- Introduce the pump into the tank being careful not to deform the level indicator arm.

- Place the sealing gasket on the tank.
- Install the pump support onto the seat aligning the connector with the vehicle longitudinal axle.

N.B.

AN INCORRECT ORIENTATION MAY IMPAIR THE LEVEL INDICATOR PERFORMANCE.

- Screw the fixing ring nut and tighten thoroughly.

Locking torques (N*m)

Motor pump locking ring nut 20

- Connect the feeding circuit pipes again and check the proper introduction by pulling and turning upwards.
- Reconnect the electric connector.
- Recharge the system with at least 4÷5 timings (key switch «**OFF-ON**»)

N.B.

DO NOT START THE PUMP BEFORE REFILLING THE TANK. FAILURE TO OBSERVE THIS RULE CAN DAMAGE THE PUMP.

- Check that the feeding system quick couplings seal is efficient.

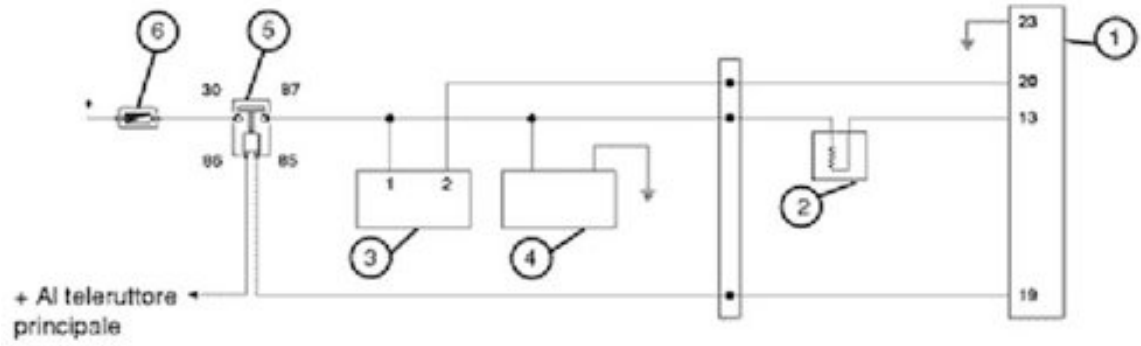
Inspecting the injector circuit

Electric characteristic

TERMINAL: 13 - 23

CONDITIONS : During the pump timing with engine off

STANDARD : battery voltage



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Electronic controller	
2	Injector	
3	H.V. coil	
4	Pump	
5	Controller remote control switch	
6	Fuse	10A

1 - Connect the diagnostic tester. Select the menu on the «ACTIVE DIAGNOSIS» function. Select the «INJECTOR» function.

YES go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - Enable the function with under-panel power supply on and engine off. The controller controls the fuel pump continuously and at the same time starts the injector opening. The injector openings are repeated for a few seconds.

YES go to 3

3 - Acoustically check the injector openings and wait for the tester results

YES go to 4 NO go to 5

4 - 5 injector openings detected. The injection tester displays «test successful».

YES go to 7

5 - No injector openings detected. The injection tester displays «test failed».

YES go to 9 NO go to 6

6 - No injector openings detected. The injection tester displays «test successful».

YES go to 8

7 - The injector control circuit is efficient. Perform the injector hydraulic check.

8 - The injector control circuit is efficient. Repeat the acoustic check and perform the injector hydraulic check for safety reasons.

9 - Select the menu on the «ERRORS» function. Check whether the injector failure message only is displayed.

YES go to 14 NO go to 10

10 - There are also fault messages for: pump relay

YES go to 13 NO go to 11

11 - There is also a fault message for the HV coil.

YES go to 12

12 - Check the power supply circuit with the 10A fuse and the remote control switch. Common feeding to the fuel pump.

13 - Check the pump relay control circuit

14 - Install the specific tool between the injection system and the controller.

YES go to 15

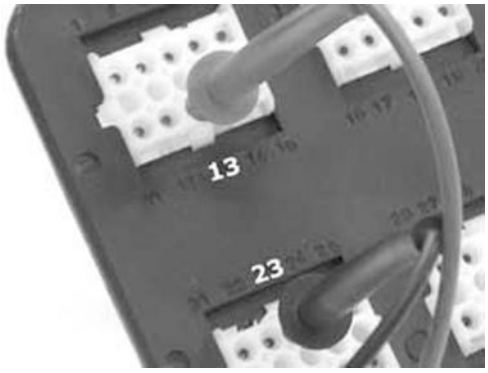
Specific tooling

020481Y Control unit interface wiring

15 - Arrange a multimeter with positive prod on pin 13 and negative prod on pin 23. Set the switch to «**ON**» with switch to «**RUN**» and side stand raised. Check the presence of battery voltage during the fuel pump timing.

13 - 23 = battery voltage for 2 seconds.

YES go to 16 NO go to 17

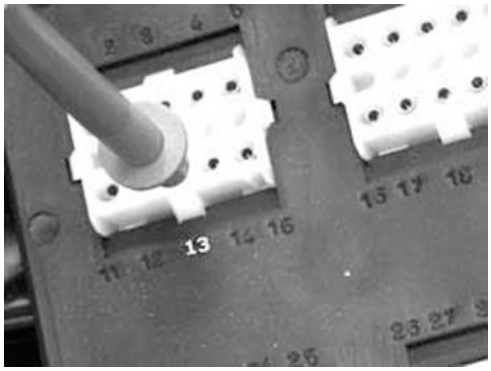


16 - The injector electric circuit is steady Repeat the checks. If the fault continues, check the controller connector. Replace the controller, if necessary.

17 - Repeat the test using the resistance multimeter.

13 - 23 = 14,5. ± 5% (injector resistance)

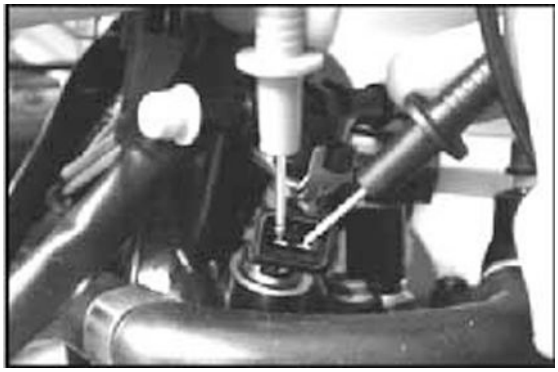
YES go to 19 NO go to 18



18 - No continuity. Disconnect the connector and repeat the resistive check directly at the injector terminals.

Resistance = 14.5 Ω ± 2%

YES go to 21 NO go to 22



19 - Check the earth insulation of the injector negative line. Disconnected controller and injector connectors.

13 - 23 = Ω infinity

NO go to 20

20 - Check the earth insulation of the injector negative line. Disconnected controller and injector connectors.

13-23 = Ω infinity. Fix the wiring, if required, or replace it

21 - Check the continuity between the injector power supply connector (red - yellow) and pin 13. Restore the continuity, if required, or replace the wiring

22 - Replace the injector.

Inspecting the injector hydraulics

To check the injector it is advisable to remove the intake manifold along with throttle body and injector.

The injector should be removed from the manifold only if necessary.

For these operations, see the «thermal unit amd timing system» chapter

1 - Connect the diagnostic tester. Use the socket in the under-saddle compartment.

Install the specific tool dwg. 020480Y fuel pressure check kit.

In this case, the injector can be connected directly to the tool quick couplings.

AHEAD go to 2

Specific tooling

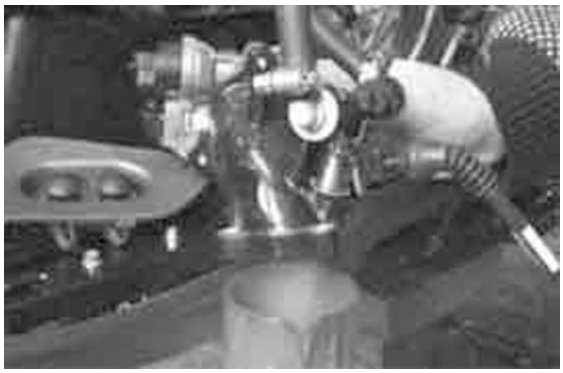
020460Y Tester and scooter diagnosis

020480Y Fuel pressure check kit

2 - Prepare a graduated container with minimum capacity of 100 cm3 and a resolution of 10-20 cm3

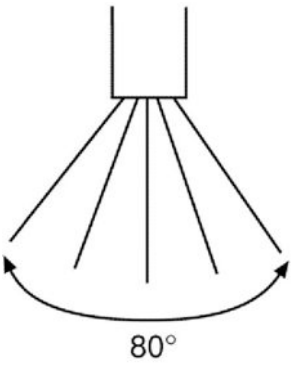
Connect the injector to the wire supplied with the

injection tester. The wire is provided with alligator clips for direct connection to the battery.
Prepare an auxiliary battery.
Set the switch to «**ON**» with switch to «**RUN**» and stand raised.
Select the «active diagnosis» function.
Start the pump diagnosis.
During the first 30 seconds of pump diagnosis, power the injector by the wire and the auxiliary battery for 15 seconds.
Collect the fuel delivered by the injector into the graduated container.
Power supply pressure = 300 KPa (3 BAR)
Quantity delivered = approx. 40 cm3
YES go to 3 NO go to 4



3 - Perform the injector sealing test.
Dry up the injector outlet by a compressed air jet.
Start the fuel pump. Wait a minute, check that there are no leaks from the injector outlet. A light bleeding is normal.
Limit value = 1 drop in 1 minute
YES go to 5 NO go to 6

4 - Higher quantities are not expected.
For lower quantities, replace the injector (THERMAL UNIT AND TIMING SYSTEM).
5 - The injector is conforming.
6 - Repeat the test. If the fault continues, replace the injector (THERMAL UNIT AND TIMING SYSTEM)
The injector atomisation cannot be checked by simple methods. The injector is provided with 5 holes whose angulation forms a jet with a taper of about 80°. The jet thus formed impinges both in-



take valves.

N.B.

- AN INJECTOR WITH LOW FLOW RATE AFFECTS THE MAXIMUM PERFORMANCE.
- AN INJECTOR WITH POOR SEAL AFFECTS IDLING AND THE START-UP FEATURES AFTER A SHORT STOP WITH HOT ENGINE.
- IN CASE OF CLOGGING OF THE INJECTOR, IT IS NECESSARY TO REPLACE IT, ALONG WITH THE FUEL FILTER CONTAINED IN THE TANK. CAREFULLY CLEAN THE SYSTEM AND THE TANK.

Troubleshooting

1 - A failure of the EMS system may depend on the connections rather than on the components.

Before searching the EMS system for failures, perform the following checks:

SUGGESTION FOR TROUBLESHOOTING

	Specification	Desc./Quantity
1	1. Power supply	- Battery voltage - Burnt fuse - Remote control switches - Connectors
2	2. Chassis earth	
3	3. Fuel feeding	- Faulty fuel pump - Dirty fuel filter
4	4. Ignition system	- Faulty spark plug - Faulty coil - Faulty screened cap
5	5. Intake circuit	- Dirty air filter - Dirty by-pass circuit - Faulty stepper motor
6	6. Other	- Wrong timing - Wrong idle carburetion - Wrong reset of the gas valve position sensor

2 - Failures to the EMS system may depend on loosened connectors. Make sure that all connections are properly implemented.

Check the connectors being careful of the following:

1. check that terminals are not bent.

2. check that connectors are properly engaged.

3. check whether the failure changes if the connector is slightly vibrated.

3 - Before replacing the EMS controller, check the whole system carefully.

If the fault is fixed by replacing the EMS controller, install the original controller again and check whether the fault occurs again.

4 - For troubleshooting, use a multimeter with an internal resistance of more than 10KW.

Improper instruments may damage the EMS controller.

The instruments to be preferred have a definition of more than 0.1V and 0.5Ω and an accuracy of more than ± 2%.

Immobiliser circuit

The EMS system is integrated with the immobilizer anti-theft device.

Its functions are:

- Start-up enabled by key recognition.
- Deterrent flashing.

System components

The system consists of:

-EMS system controller

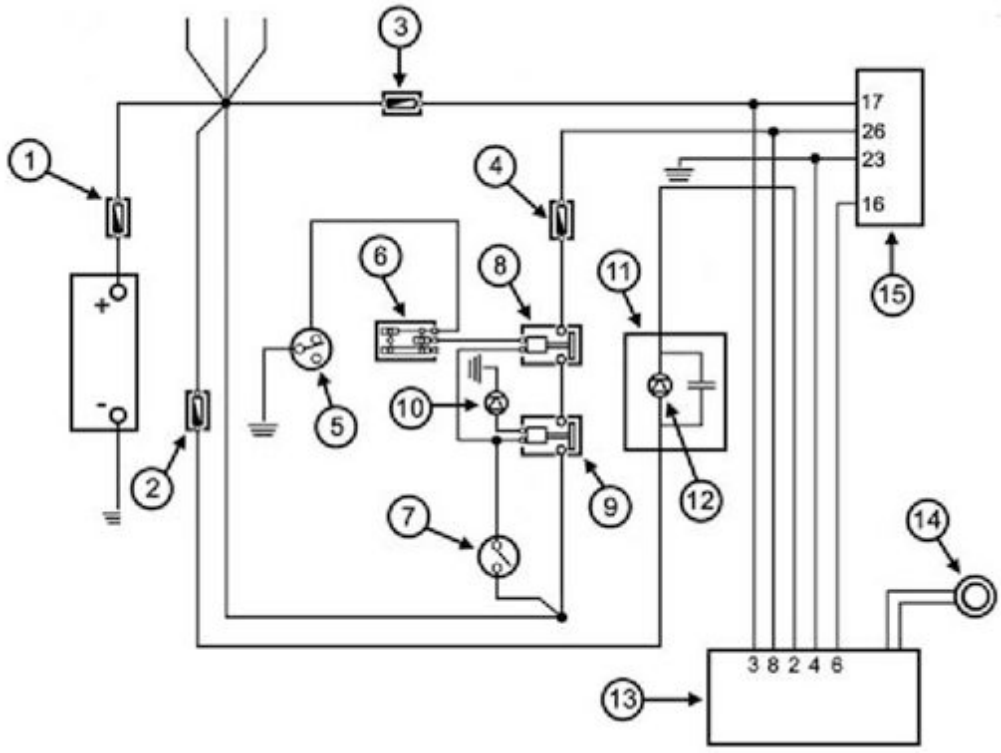
-decoder

-antenna

-master key (red-coloured)

-service key (black-coloured)

-Dissuader and diagnostics led



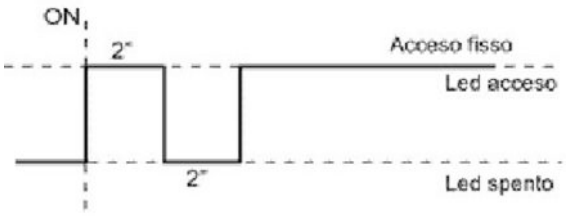
[P]

	Specification	Desc./Quantity
1	General fuse	30 A
2	Fuses	7,5 A
3	Fuse	3 A
4	Fuse	5A
5	Stand switch	
6	Emergency switch	
7	Key switch	
8	Headlight relay switch	
9	Master remote control switch	
10	Diode	2 A
11	Speedometer	
12	Immobilizer LED	
13	Decoder	
14	Immobilizer antenna	
15	Controller ECU	

Virgin circuit

When controller (ECU) and decoder are not programmed, the following conditions occur:
- Key switch set to «**OFF**». Deterrent flashing inactive.
- Key switch set to «**ON**». Ignition and injection disabled and led on with solid light.

When the key switch is set to «**ON**», the led switches on as shown in the figure.
The led is turned on by the decoder.
The controller data can be checked by the diagnostic tester.



Specific tooling

020460Y Tester and scooter diagnosis

To connect the diagnostic tester, open the spark plug inspection port and pull out the EMS diagnostic socket. Remove the protection cap and connect the tester terminal.

Power the diagnostic tester by connecting the terminals to the battery poles, or the specific connector to the socket inside the gloves compartment.

Set the switch to «**ON**» and select the diagnostic tester menu to the immobilizer function.
Scroll the pages to display the controller data.

N.B.

A BLANK SYSTEM CANNOT BE DETECTED UPON FIRST ASSEMBLY, OR IN CASE OF CONCURRENT REPLACEMENT OF DECODER AND CONTROLLER.

The information will be as follows:

Blank controller «**ON**»

Start-up disabled «**ON**»

Number of keys Zero > 250

Setting the circuit

The vehicle is supplied with two keys:

- Master key (red-coloured) with removable transponder

- Service key (black-coloured) with fixed transponder

The master and service keys musty be used to code the system as follows:

- Insert the master key, set to «ON» and keep this position for 2 seconds (limit values 1÷3 seconds).

- Insert the black key and set to «**ON**» for 2 seconds.

- If you have keys in two copies, repeat the operation for each key,

- Insert the master key again and set to «**ON**» for 2 seconds.

The maximum time to change keys is of 10 seconds.

Seven service keys (black coloured) can be programmed within the same storage operation.

Times and procedure must be strictly observed, or it will be necessary to repeat from the beginning.

Once the system has been programmed, master key transponder, decoder and controller are strictly matched.

This matching allows performing further service key programming in case of loss, replacement, etc.

Every programming deletes the previous one; to add or delete a key it is therefore necessary to repeat the procedure using all keys that you want to keep in use.

N.B.

AN ACCIDENTAL LOSS OF THE SERVICE KEY PROGRAMMING CAN ARISE FROM GENERAL FAULTS

OF THE IGNITION SYSTEM. IN THIS CASE, CHECK THE H.V. LINE SHIELDING.

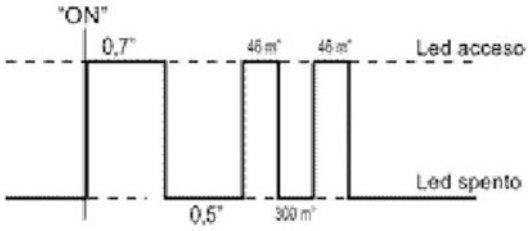
In any case it is advisable to use resistive spark plugs.

LED signals

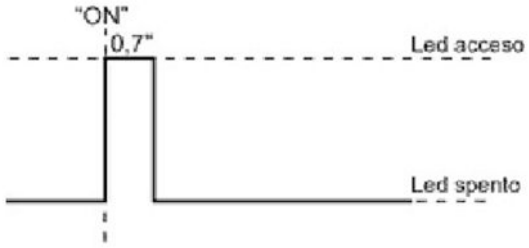
When the key switch is set to «**ON**» and programming is performed normally, the led switches on as shown in the figure.

WITH MASTER KEY

After the confirmation flash when switching to «**ON**», a number of flashes are emitted, equal to the number of keys used for programming.



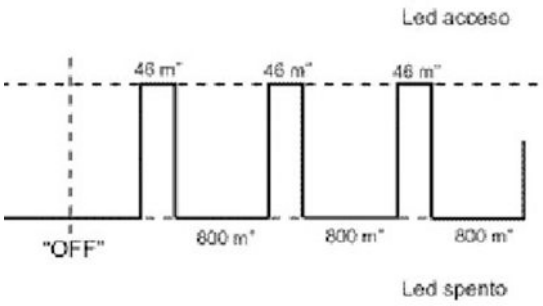
WITH SERVICE KEYS



Deterring blink

Switching from «**ON**» to «**OFF**» with programmed system causes the intermittent switching on of the led, with an anti-theft effect.

This occurs with any key used for programming.



If the vehicle is not used, the deterrent light stops automatically after 48 hours to prevent discharging the battery. A new 48-h cycle starts by switching from «**OFF**» to «**ON**» and «**OFF**» again.

Checking master-box data

Connect the diagnostic tester.

Set to «**ON**» and select the immobilizer function.

Scroll the pages the find the data.

Specific tooling

020460Y Tester and scooter diagnosis

The information will be as follows:

- Blank controller «**OFF**»

- Start-up disabled «**OFF**»

- Number of keys 2*

*The number denotes how many keys have been used for programming, master key included.

Resetting the circuit

1 Replacing the small cylinder

- Remove the original master key transponder and install it on the master key of the new cylinder.

- Program the system again as described above.

2 Decoder replacement

When the decoder is replaced it is necessary to program the system again.

Programming is indispensable for the engine start-up. (see System programming).

3 Controller replacement

Programming is indispensable when the controller is replaced to enable the engine start-up.

In this case it is sufficient to switch to «**ON**» using the master key.

N.B.

- THE SERVICE KEY (BLACK-COLOURED) IS NOT USED FOR PROGRAMMING.
- WHEN NOT PROGRAMMED, THE CONTROLLER ALLOWS NO FUNCTIONAL DIAGNOSIS ON THE ENGINE.

4 Replacing or duplicating service keys

Keys can be duplicated using the preforms and the original master key.

A copy may also be requested using the vehicle's CODE CARD.

Program the system again using the master key and all service keys (see System programming).

N.B.

THE CODE CARD CAN ONLY BE USED WHEN THE ORIGINAL MASTER KEY IS AVAILABLE.

Diagnostic codes

The led indication is divided into 3 steps:

1st step: A flash: «**ON**» switching recognition

2nd step: Series of flashes: diagnostic code indication

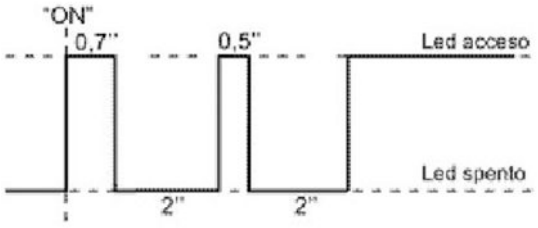
3rd step: Solid light on or off:

on = start-up disabled

off = start-up enabled

Code 1

Code 1 indicates a non-programmed system.
If the code is still displayed after having carried out the programming procedure, repeat the procedure carefully observing the «**ON**» times of each key.



If the code is still displayed, proceed as follows:

- Disconnect the battery negative.
- Remove the controller connector.
- Connect the specific tool between the injection system and the controller.
- Remove the main decoder connector.

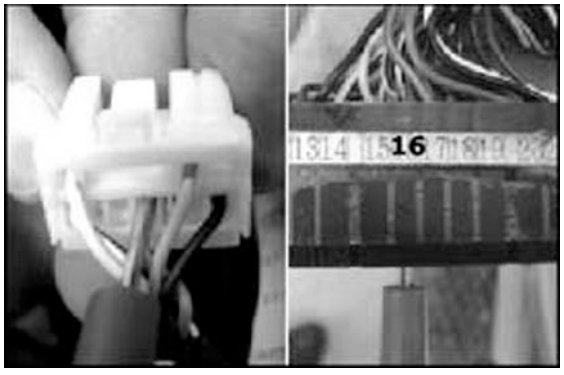
N.B.

TO ACCESS THE COMPONENTS, SEE THE COMPONENTS LAYOUT CHAPTER.

Specific tooling

020481Y Control unit interface wiring

1 - Using a multimeter, check the continuity between pin 16 of the controller and pin 6 of the decoder connector.
YES go to 3 NO go to 2



2 - Replace or fix the wiring.

3 - Check the connections carefully

YES go to 5 NO go to 4

4 - Restore

5 - Replace the decoder. Connect the battery.

Repeat the programming.

YES go to 7 NO go to 6

6 - Disconnect the battery, replace the controller, connect the battery.

Repeat the programming.

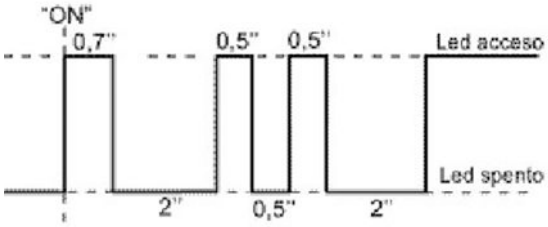
7 - The system is OK

Code 2

Code no. 2 denotes a system where the decoder does not perceive the transponder's signal.

- Start-up disabled
- Injection light on, solid

In this case, proceed as follows:



1 - Check whether the code is repeated using the second key.

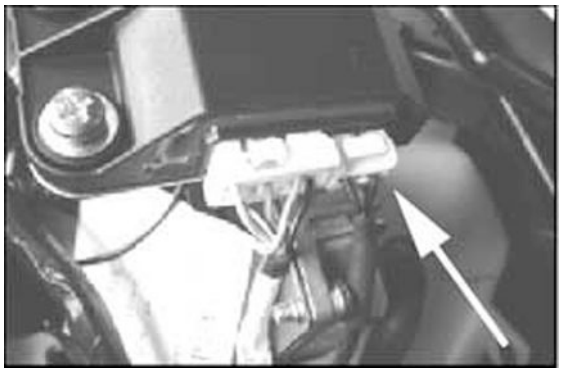
YES go to 3 NO go to 2

2 - Failure detected with the service key Replace and program again. Failure detected with the master key.

Replace the transponder using one from the new cylinder kit.

Replace decoder and controller.

Program again.



3 - Check the proper connection of the antenna connector.

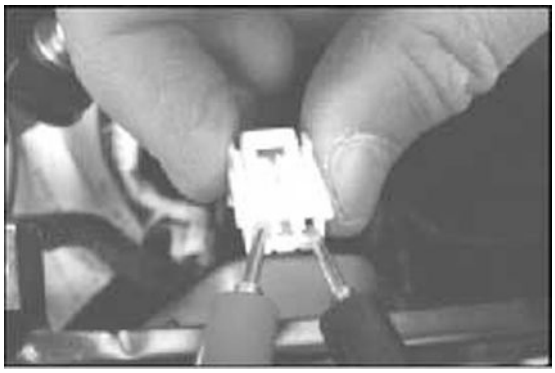
YES go to 5 NO go to 4

4 - Restore the connection and check the pres-

ence of the code

5 - Disconnect the antenna connector and check continuity (8 ± 2 W).

YES go to 7 NO go to 6



6 - Replace the antenna

7 - Check the proper position of the antenna.

YES go to 9 NO go to 8

8 - Place it in proper position

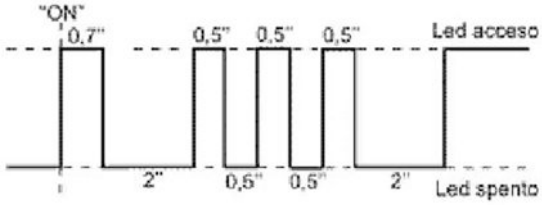
9 - Replace the decoder and check the presence of the code

Code 3

Code no. 3 denotes a system where the decoder perceives a transponder not provided for by programming.

Start-up disabled

Injection light on, solid



1- Check whether the code is still displayed using the master key

YES go to 3 NO go to2

2 - Program again using all service keys

3 - Check that all components (keys - decoder - controller) are properly matched.

YES go to 5 NO go to 4

4 - Restore

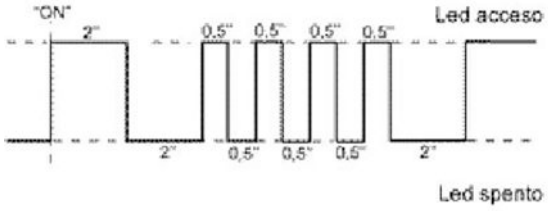
5 - Replace decoders and controller. Program the components again.

Code 4

Code no. 4 denotes a system where the decoder is blank and the controller is programmed. The key is recognised by the controller.

- Start-up disabled

- Indicator light

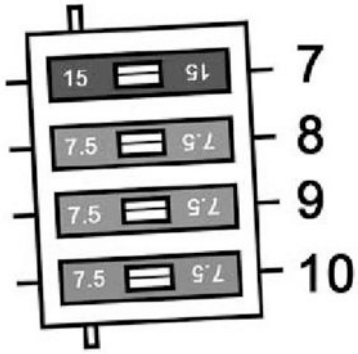


N.B.

REPEAT THE KEY PROGRAMMING PROCEDURE USING THE ORIGINAL MASTER KEY.

Diagnosis guide

Immobilizer LED switching on failure

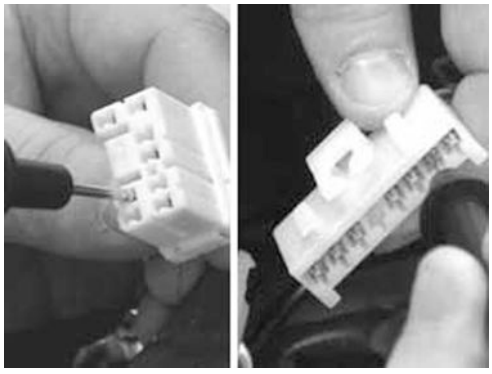


1 - Check whether the injection indicator turns on for 5 sec. after switching to ON

YES go to 2 NO go to 14

2 - Check the function of the 7.5A fuse no. 8 in the under-saddle compartment.

YES go to 5 NO go to 3



3 - Check for any short circuits on the instrument unit power supply line, check that the instrument unit has not short-circuited

YES go to 4

4 - Restore the wiring fixing the short circuits.

5 - Connect pin no. 2 of the decoder (red/green wire) to earth and check whether the led turns on

YES go to 6 NO go to 7

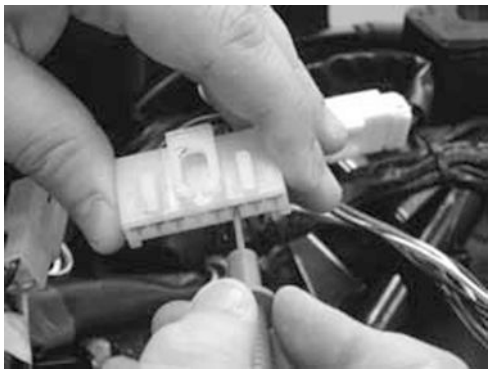
6 - Replace the decoder and program again.

7 - Check the continuity of the red/green wire measuring between PIN 6 of the 12-way connector of the digital instrument and PIN 2 of the decoder.

YES go to 9 NO go to 12

8 - Check for positive battery voltage at the red-black wire of the instrument unit 8 way connector.

YES go to 9 NO go to 10



9 - Defective LED, replace the instrument unit.

10 - Refit or replace the wiring.

11 - If the injection light does not go on, check the decoder and cpu power circuit.

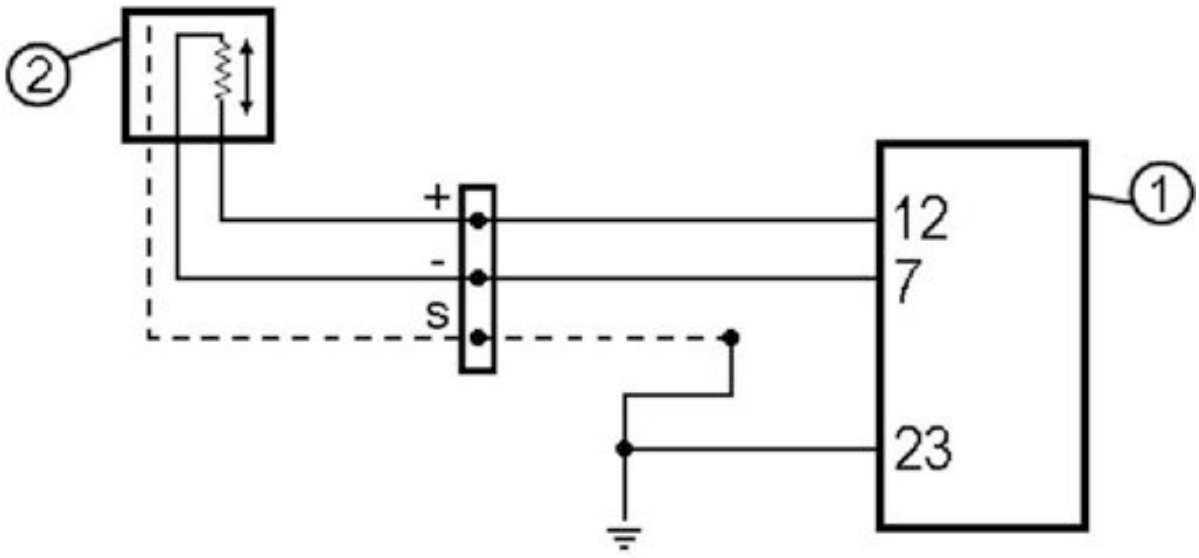
Tachometer

Electric characteristic

TERMINAL: 7 - 12

CONDITIONS : Start-up

STANDARD: 0,8 ÷ 4,5 V~



CIRCUIT LAYOUT

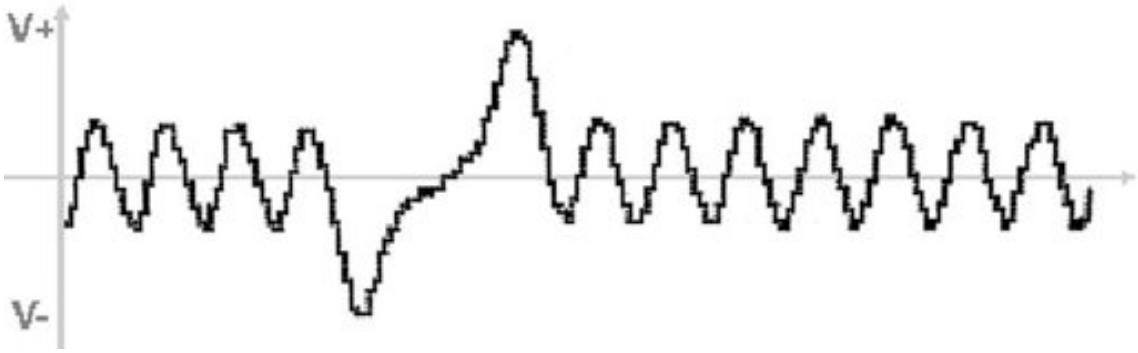
	Specification	Desc./Quantity
1	Controller	
2	Engine rpm sensor	

The sensor allows recognising the revolutions and the angular position of the driving shaft referred to the TDC. Since the wheel speed sensor is pivoted on the camshaft it is also possible to recognise the

4-stroke cycle. Such solution allows controlling the injector and the spark plug every two revolutions of the driving shaft.

The sensor is of the reluctance variation type and is therefore comparable to an alternate current generator that powers the controller.

The signal frequency is interrupted by the vacuum generated by the two missing teeth on the wheel speed sensor.

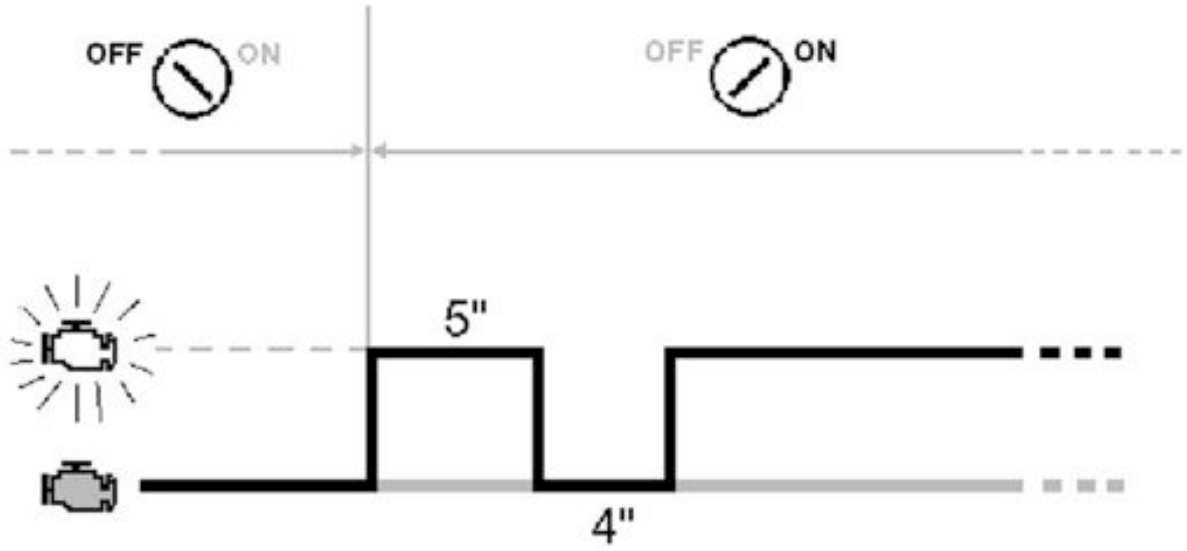


The sensor signal is fundamental for obtaining starting of the engine.

The cpu autodiagnosis is enabled on this circuit in 2 different ways based on use conditions.

Right after turning to «**ON**» (Power under the panel present in the cpu), the continuity and isolation of the sensor and related circuit are checked.

Any faults discovered in this phase are signaled via the injection light.



The fault continues to be signaled, but the circuit is only checked when turning to «**ON**».

Therefore faults which occur or disappear after turning to «**ON**» are not acknowledged.

During and after the start phase, the autodiagnosis checks the alternating current produced by the sensor (synchronisation of the signal panel).

If a signal panel is detected which is not perfectly synchronised, corrective interventions are applied used to reconstruct the cycle. In this case the autodiagnosis records the number of lost synchronisations and signals the fault via the injection light.
The light remains on during the period the cycle is reconstructed.
If the rpm-timing signal is completely missing due to mechanical faults or lack of magnetic activity, it will be impossible to start the engine (or it will stop while driving) and the autodiagnosis will not be able to record any faults.
To check the sensor and related circuit, proceed as follows:

1 - Connect the scooter tester.
Select the «**ERRORS**» function on the menu.
Check for any faults on the «Signal panel».
YES point 2 NO point 3

Specific tooling

020460Y Tester and scooter diagnosis

2 THE FAULT HAS BEEN RECORDED IN MEMORISED STATUS:

The signal panel may be synchronised with possibility of starting. The fault is probably occasional.

N.B.

A NON-CONFORMING SIGNAL PANEL FAULT MAY ALSO BE DETECTED IF THE ENGINE STOPS AFTER A FAULT INVOLVING IDLING.

2 THE FAULT HAS BEEN RECORDED IN CURRENT STATUS:

The control circuit gave a negative result when switching to «**ON**».
AHEAD go to 8

3 Select the «**PARAMETERS**» function on the menu.
Check the number of «lost synchronisations»:
1 TOOTH and > 1 TOOTH
YES go to 4 NO go to 5

4 THE INDICATION INCREASES PROGRESSIVELY OVER TIME WITH THE ROTATION OF THE ENGINE.

AHEAD «point» 8

5 INDICATION = 1-3

THE RPM-TIMING CIRCUIT IS IN CONFORMANCE.

Make an attempt to start and use the parameters function to check for the «rpm engine» indication.

YES go to 6 NO go to 7

6 The signal panel is in conformance.

7 CHECK THE AIR GAP AND MAGNETIC ACTIVITY OF THE SENSOR.

See engine mechanics.

8 Check the sensor and related connection circuit with the cpu.

AHEAD go to 9

9 Install the connection wiring between the cpu and injection system. Do not make the connection with the cpu.

AHEAD go to 10

Specific tooling

020481Y Control unit interface wiring

10 Install the connection connector between the rpm timing sensor and injection system.

Measure the sensor resistance by connecting a multimeter between the terminals marked + and - (see the «Electrical system» chapter).

RESISTANCE OF THE RPM TIMING SENSOR: (AT 25°C)

	Specification	Desc./Quantity
1	Model with 1 clamp:	860 Ω ± 130 Ω
2	Model with 2 clamps:	680 Ω ± 100 Ω

YES go to 11 NO go to 12

11 - Check the earth isolation between a pole and the shielding.

(see the «Electrical system» chapter).

Electric characteristic

S - + =

infinite (>MΩ)

SI punto 13 NO punto 12

---

12 - Replace the revolution sensor.

13 - Reconnect the stroke revolution sensor connector.

Repeat the resistance check through the injection wiring pin 7 pin 12.

Electric characteristic

7-12 =

680 Ω ± 100 Ω (Model with 2 clamps)

7-12 =

890 Ω ± 130 Ω (Model with 1 clamp)

The value should be very close to that detected directly by the sensor.

YES go to 17 NO go to 14

14 - Higher or infinite resistance.

YES go to 15 NO go to 16

15 - Check the connectors carefully. Disconnect and check the continuity between connector and pin 7-12

Electric characteristic

Connector - 7 =

continuity

Connector - 12 =

continuity

Fix the connectors or replace the wiring.

16

Electric characteristic

Resistance

0

Replace or fix the injection wiring (short circuit)

17 - Check the earth insulation again.

Electric characteristic

7-23 =

infinite (>1MΩ)

YES go to 19 NO go to 18

18 - Check the sensor and controller connectors.

Replace or fix the injection wiring

19 - Measure the alternated voltage between pins 7 and 12 with engine at start-up speed.

Electric characteristic

7-12 =

0,8÷4,5 V~eff

Revolution speed =

~300÷400 G/1'

YES go to 20 NO go to 21

20 The sensor circuit is in conformance.

Use the parameter function to check if the engine rpm indication is present when trying to start.

If not, carefully check the cpu connection connector and replace it if necessary.

21 Check the air gap and magnetic activity of the sensor.

See the «Combustion unit and distribution» chapter.

If there is no magnetic activity replace the sensor.

N.B.

-THE SENSOR CABLE MUST BE PROPERLY INSTALLED FOR SERVICING.
-DO NOT FORCE THE CABLE.
-A POOR CABLE SHIELDING CAN IMPAIR THE ENGINE PERFORMANCE AT HIGH SPEED.

HT coil

This section describes the ignition system operation.

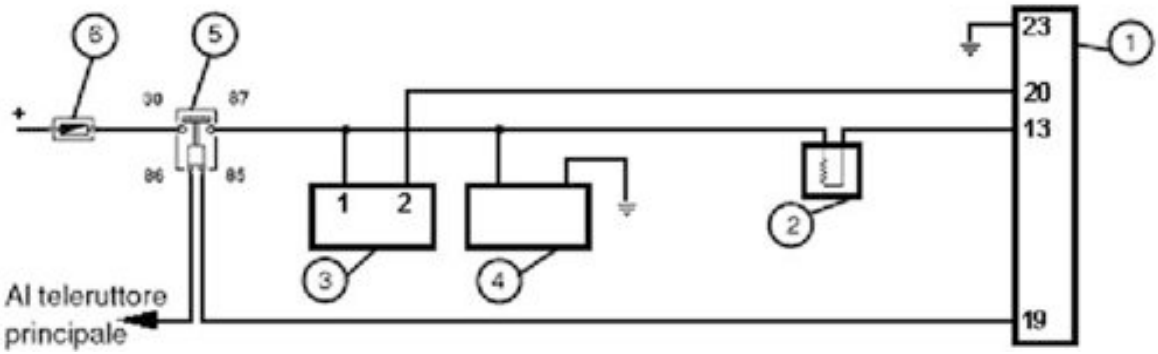
Circuit diagram

Electric characteristic

TERMINALS: 20 - 23

CONDITIONS : During the pump timing with engine off .

STANDARD: Battery voltage



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Electronic controller	
2	Injector	
3	H.V. coil	
4	Pump	
5	Controller remote control switch	
6	Fuse	10A

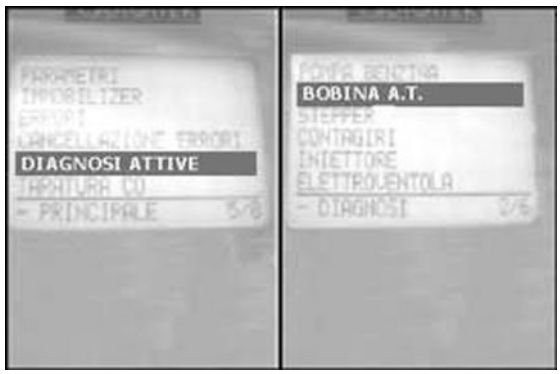
The ignition system is integrated with the injection and is of the inductive high efficiency type.

The controller manages two important parameters:

- Ignition advance

This is optimised according to the engine rpm, to the 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 controller. The ignition power is increased during the engine start-up.

The injection system recognises the 4-stroke cycle and therefore, ignition is only controlled during compression.

To check the ignition circuit, proceed as follows:

1 - Connect the diagnostic tester. Select the menu on the «ACTIVE DIAGNOSIS» function. Start the HV coil check with switch set to «**ON**», switch to «**RUN**» and side stand raised. Wait for the tester to display: «TEST SUCCESSFUL»

YES go to 3 NO go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - The tester displays: «TEST FAILED». Repeat the test and wait for the tester to display: «TEST SUCCESSFUL»

YES go to 3 NO go to 4

3 - Select the menu on the «ERRORS» function. Check the presence of current or stored errors relating to the H.V. coil.

YES go to 6 NO go to 5

4 - Test failed

YES go to 6

5 - The coil control circuit is efficient.

Check the H.V. coil secondary, the cable and the screened cap

6 - Install the specific tool between the injection system and the controller.

Measure voltage between pins 20 and 23 of the specific tool during the fuel pump timing step.

To start the timing, set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

Electric characteristic

20-23 =

battery voltage (coupled to the pump rotation -2 seconds).

If you want to increase the test time, enable the «pump relay diagnosis» function

(30 seconds)

YES go to 7 NO go to 8

7 - The coil primary control circuit is efficient.

Carefully check the connectors to the controller and to the coil.

Replace the controller, if necessary.

8 - Disconnect the connector to the H.V. coil primary.

Repeat the voltage check between the black-green wire and earth.

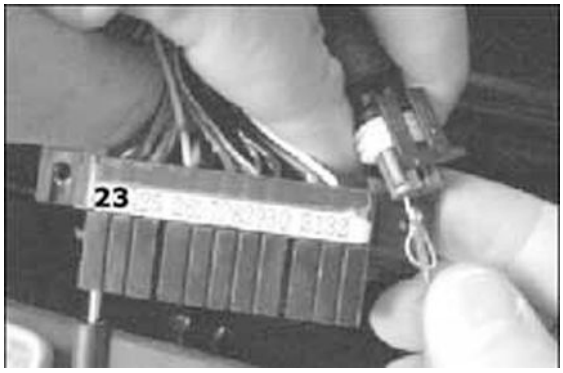
Electric characteristic

Black-green-23 =

battery voltage

(coupled to the pump rotation-2 seconds).

YES go to 10 NO go to 9



9 - Check the black-green wire continuity.

Replace or fix the wiring.

N.B.

A FAILURE OF THE REMOTE CONTROL SWITCH WOULD CAUSE THE PUMP ROTATION FAILURE

10 - The positive power supply is conforming. Check the continuity between the pink-black wire of the connector and pin 20.

Electric characteristic

Pink-black-20 =

Continuity

YES go to 12 NO go to 11

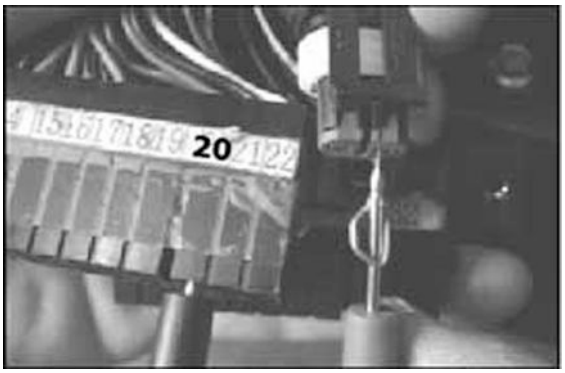
11 - Check the continuity of the punk-black wire in the two systems.

Electric characteristic

Pink-black (coil connector)-20 =

Continuity

YES go to 12 NO go to 13



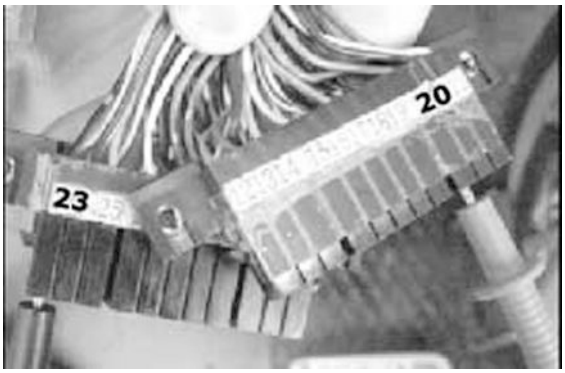
12 - Check the earth insulation of the negative line.

Electric characteristic

20-23 =

Ω infinite (>1MΩ)

YES go to 15 NO go to 14



13 - Replace or fix the faulty system. Repeat the check with the menu on «ACTIVE DIAGNOSIS».

14 - Repeat the earth insulation check in the two sections. Replace or fix the wiring. Repeat the check with the menu on «ACTIVE DIAGNOSIS» H.V. coil control simulation. Delete the errors stored in memory.

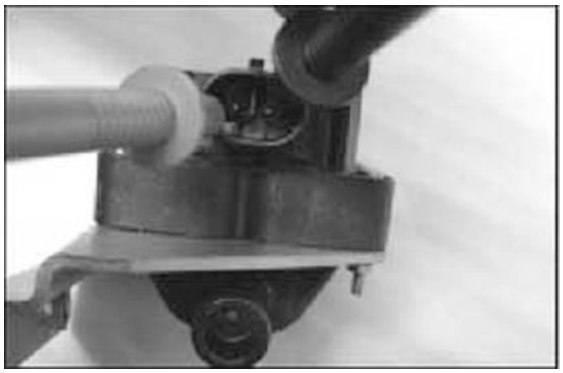
15 - Check the continuity of the H.V. coil primary. See figure.

Electric characteristic

Primary resistance =

0,5± 8%

YES go to 16 NO go to 19



16 - Check the earth insulation of the primary circuit

Measure between one of the primary terminals and earth.

Electric characteristic

Primary-earth =

Ω infinite (>1MΩ)

YES go to 17 NO go to 19

17 - Check the secondary resistance.

Measure the resistance between one of the primary terminals and the spark plug cable output

Electric characteristic

Primary-HV cable output =

3,1KΩ ± 9%

YES go to 18 NO go to 19

18 - The coil is conforming.

19 - Replace the coil

Inspecting the spark plug shielded cap

Measure the screened cap resistance.

Electric characteristic

Resistance:

5 KΩ

If different values are measured (<1; >20KΩ), replace the screened cap.

N.B.

AN UNSCREENED CAP OR SPARK PLUG CAN AFFECT THE INJECTION SYSTEM.
FOR INFORMATION ON THE SPARKPLUG, SEE THE "SPECIFICATIONS" AND "MAINTENANCE" CHAPTERS.

Spark advance

The ignition advance is electronically determined on the basis of the parameters recognised by the controller. For this reason it is not possible to declare the reference values based on the engine rpm. The ignition advance value is detectable any time by the diagnostic tester.
Using the stroboscopic lamp it is possible to check whether the ignition advance determined by the injection system matches that actually started on the engine.

Specific tooling

020460Y Tester and scooter diagnosis

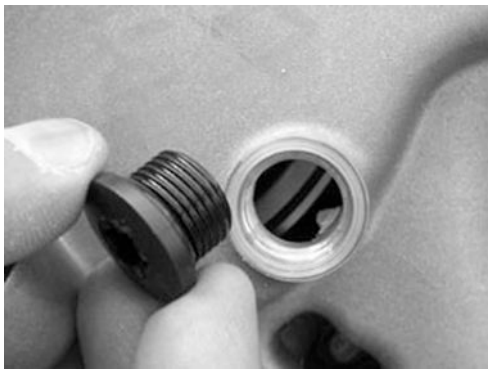
020330Y Timing light for two- and four-stroke engines

Proceed as follows:

- Remove the transmission compartment cover as described in the «automatic transmission»

chapter.

- Remove the TDC reference inspection cap between flywheel and cover housing. See the «flywheel cover» chapter



- By the driving pulley, turn the engine to find the alignment of the references to identify the TDC.

- Repeat for the reference between driving pulley and engine crankcase.

- Replace the inspection cap on the flywheel side.
- Connect the diagnostic tester.
- Start the engine.

- Select the menu on the «parameters» function.
- Select the stroboscopic lamp control in the conventional 4-stroke engine position (1 spark 2 revolutions).
- Check that the real values of rpm and ignition advance match those measured by the diagnostic tester.

If the values do not match, check:

· Timing

· stroke-revolution sensor

· injection controlle

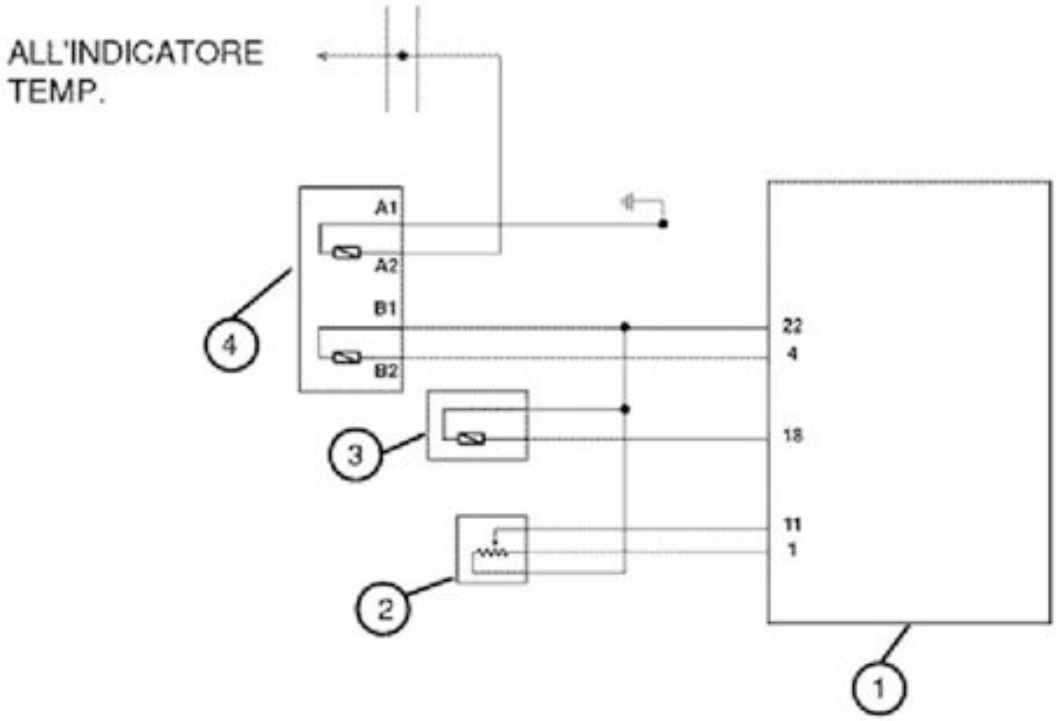
Coolant temperature sensor

Electric characteristic

TERMINALS: 4 - 22

CONDITIONS : cooling fluid temperature

STANDARD:
With connected sensor :
20° = 2500 ± 100 Ω
80° = 308 ± 6 Ω



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Controller	
2	Valve position sensor	
3	Air temperature sensor	
4	Fluid temperature sensor	

The cooling fluid temperature sensor is installed on the engine head and provides the indications for the digital instrument and for the injection.

It is realised with two electrically different sections.

The injection section is realised with an NTC sensor connected to a 5V powered circuit. The resistance variation causes a variation of the circuit voltage. Such voltage is combined with a temperature value.

By this value, the controller can manage the engine operation, optimising it for all temperatures.

A failure of this circuit causes the switching on of the injection indicator and the tripping of the safeties (among which the electric fan continuous start). In these conditions, the engine works, even though not in an optimum way, always safeguarding the catalytic converter integrity.

A false temperature value that falls within the range of possible temperatures is a failure very difficult to manage. This can cause a failure of the safeties and an improper management of the carburetion.

Such failure is more easily detected upon the engine start-up.

To check the sensor and the relevant circuit, proceed as follows:

1 - Connect the injection diagnostic tester and select the menu on the «errors» function.

Check whether there are any indications regarding the cooling fluid temperature sensor.

YES go to 3 NO go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - The EMS system has received no indications of temperatures out of the range of possible temperatures.

If you suspect a wrong temperature indication, proceed to perform the following check.

N.B.

A WRONG TEMPERATURE SIGNAL CAN BE DETECTED BY COUPLING THE ANALOGUE INSTRUMENT INDICATION WITH THE ELECTRIC FAN START.
IN ANY CASE, BEFORE CHECKING THE SENSOR, CHECK THE FILLING AND BLEEDING OF THE COOLING SYSTEM

3 - Before checking the sensor and the relevant circuit, wait until the engine has cooled down and the vehicle has set to the working area temperature.

YES go to 4

4 - Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

Select the menu on the "parameters" function.

Do not start the engine.

YES go to 5

5 - Check the following values:

cooling fluid temperature

sucked air temperature

ambient temperature

The three indications are equal or they are slightly different (e.g. 1° C).

YES go to 6 NO go to 7

6 - The temperature sensor is providing an incorrect information.

Check at ~80° C.

7 - Install the specific tool.

WARNING

DO NOT CONNECT THE CONTROLLER CONNECTOR.

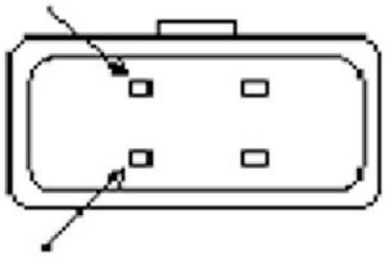
Specific tooling

020481Y Control unit interface wiring

YES go to 8

8 - Disconnect the cooling fluid temperature sensor connector. Measure the sensor resistance between the terminals shown in the figure.

Check that the resistance matches the values declared according to the temperature.



Electric characteristic

TEMPERATURE RESISTANCE

9,6KW. -10° C

5,975KW. 0
3,81KW. +10° C .
2,5KW. +20° C
1,68KW. +30° C
0,3KW. +80° C

YES go to 10 NO go to 9

9 - Replace the sensor.

10 - Connect the sensor connector and repeat the resistive check at terminals 4 and 22;

Electric characteristic

4-22 =

Resistance equal to the value directly detected at the sensor.

YES go to 13 NO go to 11

11 - If slightly higher values are detected, check the connectors.

If infinite resistance is detected (>1MW) check the continuity between the two lines with disconnected connectors.

Electric characteristic

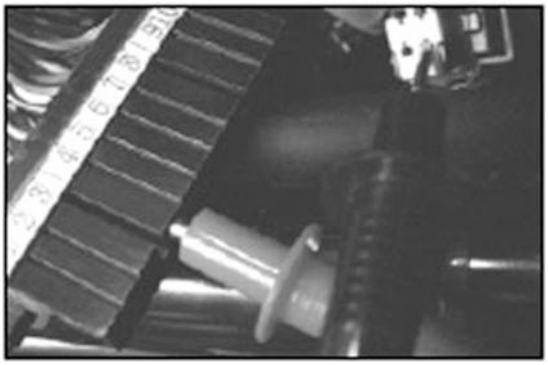
Blue-white -4 =

0W . (continuity)

Light blue-green-22 =

0W . (continuity)

YES go to 12



12 - Replace or fix the wiring.

YES go to 10

13 - Check that the sensor circuit is earth insulated.

Electric characteristic

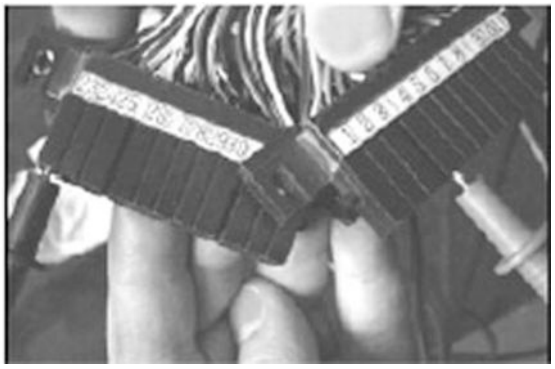
4-23 =

W infinite (>1MW.)

22-23 =

W infinite (>1MW.)

YES go to 15 NO go to 14



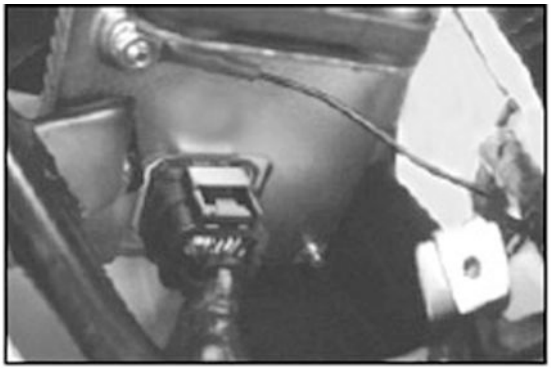
14 - Replace or fix the wiring.

YES go to 13

15 - Connect the specific tool to the controller.

Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

YES go to16



Specific tooling

020481Y Control unit interface wiring

16 - Measure voltage at terminals 4 and 22;

TEMPERATURE VOLTAGE

	Specification	Desc./Quantity
1	X V	-10° C
2	X V	0
3	X V	+10° C
4	X V	+20° C
5	X V	+30° C
6	X V	+80° C

YES go to 21 NO go to 17

17

Electric characteristic

Measured value =

5±0,2 V

Repeat the wiring and sensor continuity checks.

YES go to 18

18

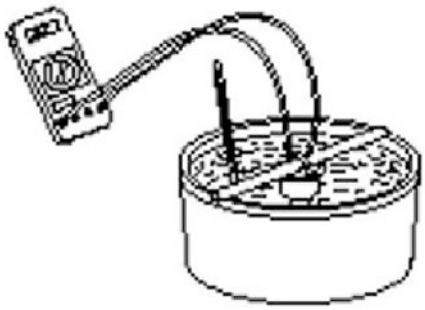
Electric characteristic

Measured value =

0 V

Repeat the sensor and circuit earth insulation check.

YES go to 19 NO go to 20



19 - Check the controller connection connector.

Check the controller power supply.

Replace the controller, if necessary.

20 - Replace or fix the wiring..

21 - Start the engine and check that voltage decreases gradually according to the temperature increase as per table.

YES go to 22 NO go to 23

22 - The temperature signal is conforming.

23 - Replace the temperature sensor.

N.B.

FOR A MORE ACCURATE CHECK OF THE SENSOR, REMOVE IT FROM THE ENGINE AND

CHECK ITS RESISTANCE AT CONTROLLED TEMPERATURE.
USING A SUITABLE CONTAINER, IMMERSE THE METAL PORTION OF THE SENSOR IN WATER, HEAT GRADUALLY AND READ THE TEMPERATURE AND RESISTANCE VALUES.
CHECK THE MATCHING AS PER TABLE

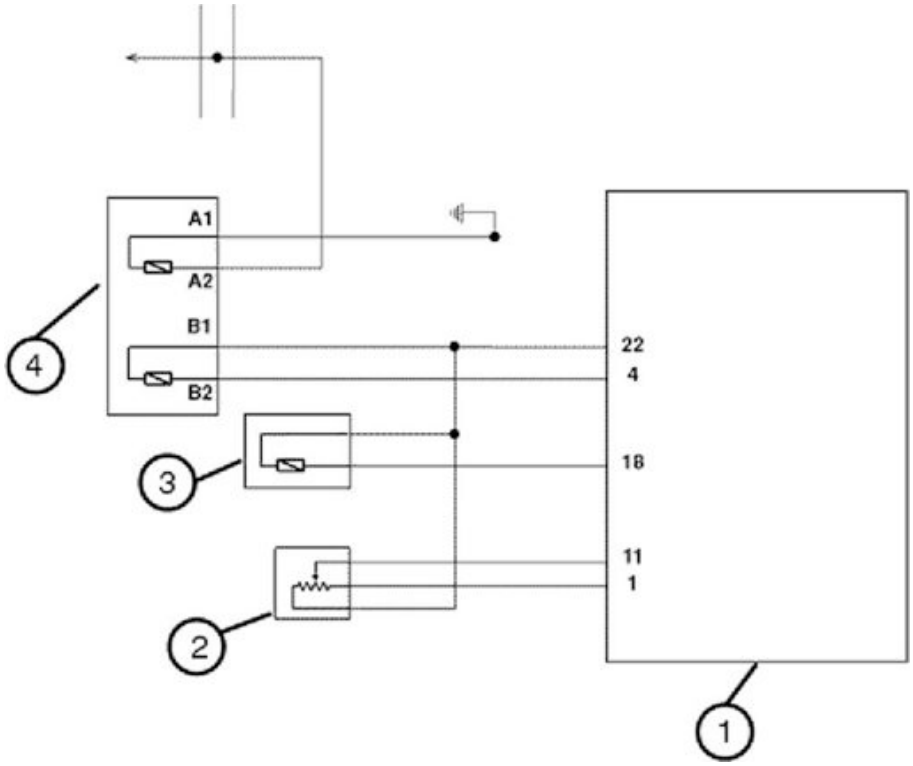
Intake air temperature sensor

Electric characteristic

TERMINALS: 18 - 22

CONDITIONS : Sucked air temperature 20°

STANDARD: With connected sensor: 3750 ± 200 Ω



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Controller	
2	Valve position sensor	
3	Air temperature sensor	
4	Fluid temperature sensor	

The sucked air temperature sensor is installed in

the bottom side of the throttle body on the filter

box side.

The sensor is an NTC and has the same functional layout as the cooling fluid temperature sensor. This signal is used to optimise the engine performance. Anyway, this data is less important than the cooling fluid temperature signal.

A failure of this circuit causes the controller to turn on the injection indicator starts the safety control, thereby ensuring the engine operation.

To check the sensor and the relevant circuit, proceed as follows:

1 - Connect the diagnostic tester.

Select the menu on the «ERRORS» function.

Check whether there are any indications regarding the sucked air temperature sensor.

YES go to 3 NO go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - The EMS system has received no indications of temperatures out of the range of possible values. If you suspect a wrong temperature indication, check as follows.

3 - Before checking the sensor and the relevant circuit, wait until the engine has cooled down and the vehicle has set to the working area temperature.

YES go to 4

4 - Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

On the diagnostic tester, select the «parameters» menu.

YES go to 5

5 - Check the following values:

cooling fluid temperature

sucked air temperature

ambient temperature indicated by the digital instrument.

The three indications are equal or they are slightly different (e.g. 1° C).

YES go to 6 NO go to 7

6 - The sucked air temperature sensor is providing an incorrect information.

7 - Install the specific tool. Do not connect the controller connector.

YES go to 8

Specific tooling

020481Y Control unit interface wiring

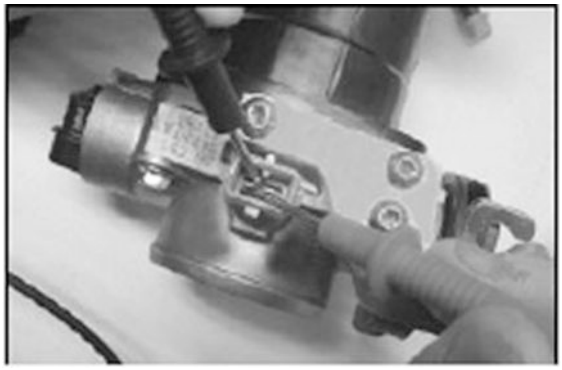
8 - Disconnect the sucked air temperature sensor connector.

Measure the resistance between the sensor terminals. Check that the resistance matches the values declared according to the temperature.

TEMPERATURE RESISTANCE

	Specification	Desc./Quantity
1	9,6 KW	-10° C
2	5,975 KW	0
3	3,81 KW	+10° C
4	2,5 KW	+20° C
5	1,68 KW	+30° C

YES go to 10 NO go to 9



9 - Replace the sensor.

10 - Connect the sensor connector and repeat the resistive check at terminals 18 and 22.

Electric characteristic

18-22 =

Resistance equal to the value directly detected at the sensor.

YES go to 13 NO go to 11

11 - If slightly higher values are detected, check the connectors.

If infinite resistance is detected (>1MΩ) check the continuity between the two lines with.

Electric characteristic

Grey-white-18 =

0 W (continuity)

Light blue-green-22 =

0 W (continuity)

YES point 12

12 - Replace or fix the wiring

YES go to 10

13 - Check that the sensor circuit is earth insulated.

Electric characteristic

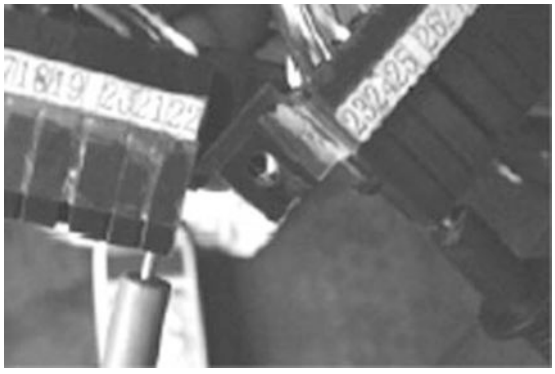
18-23 =

Winfinite (>1MW)

22-23 =

Winfinite (>1MW)

YES go to 15 NO go to 14



14 - Replace or fix the wiring.

Check the valve position and the fluid temp. lines.

YES go to 13

15 - Connect the specific tool to the controller.

Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

YES go to 16

Specific tooling

020481Y Control unit interface wiring

16 - Measure voltage at terminals 18 and 22.

Electric characteristic

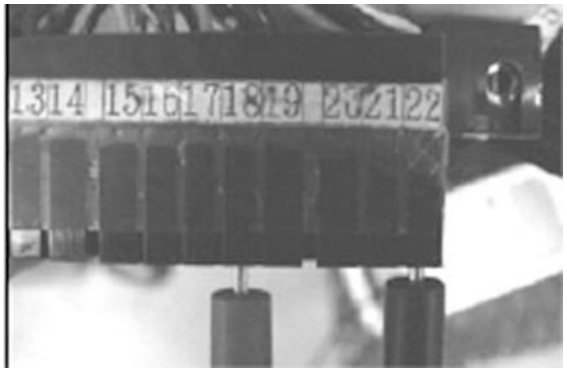
18-22 =

V as per table.

TEMPERATURE VOLTAGE

	Specification	Desc./Quantity
1	X V	-10° C
2	X V	0
3	X V	+10° C
4	X V	+20° C
5	X V	+30° C
6	X V	+80° C

YES go to 21 NO go to 17



17

Electric characteristic

Measured value =

5±0,2 V

Repeat the wiring and sensor continuity checks.

YES go to 18

18

Electric characteristic

Measured value =

0 V

Repeat the sensor circuit earth insulation check.

YES go to 19 NO go to 20

19 - Check the controller connection connector.

Check the controller power supply.

Replace the controller, if necessary.

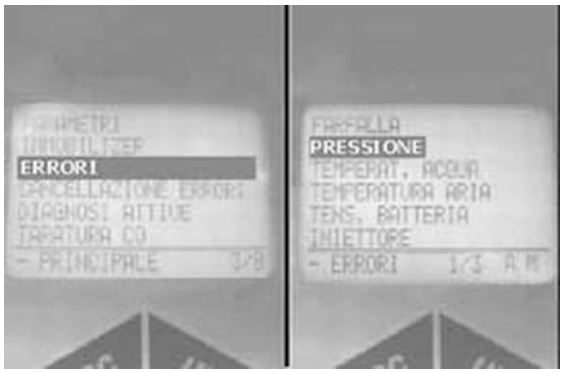
20 - Replace or fix the wiring.

21 - Start the engine and check that voltage decreases gradually according to the air filter box temperature increase.

N.B.

WITH MILD WEATHER, 30° C CAN BE EASILY REACHED AFTER A FEW MINUTES OF STOP WITH IDLE ENGINE.

Pressure sensor



This sensor does not have a system since it is directly installed into the controller.

The sensor allows the controller to optimise the engine performance based on altimetric variations.

To check the sensor, proceed as follows:

1 - Connect the diagnostic tester.

Select the menu on the «ERRORS» function.

Check whether there are any indications regarding the pressure sensor.

YES go to 2 NO go to 3

Specific tooling

020460Y Tester and scooter diagnosis

2 - Replace the injection controller.

3 - Select the menu on the «parameters» function.

Check that the pressure value in mm/Hg matches that of another vehicle or of an external barometer.

Electric characteristic

Max error:

± 20 mmHg

YES go to 4 NO go to 5

4 - The ambient pressure signal is correct.

5 - Replace the injection controller.

Throttle valve opening sensor

Throttle position sensor (t.p.s.)

Electric characteristic

TERMINALS: 1 - 22

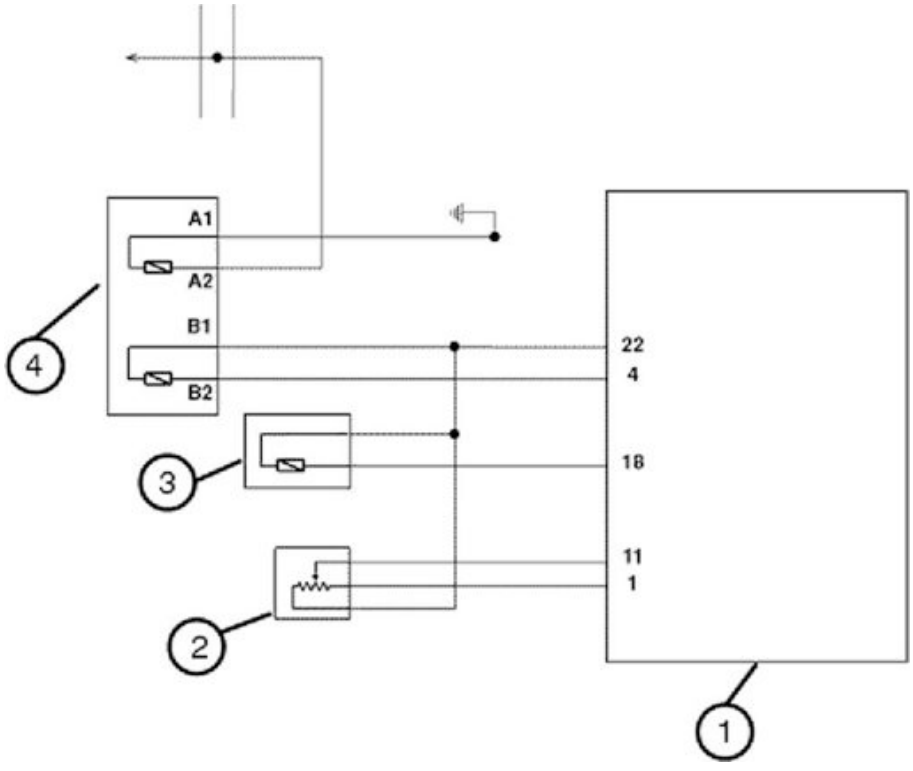
CONDITIONS : Switch set to «ON»

STANDARD: 5 V

TERMINALS: 11 - 22

CONDITIONS : Opening the gas gradually

STANDARD: Volt= Progressive increase



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Controller	
2	Valve position sensor	
3	Air temperature sensor	
4	Fluid temperature sensor	

The gas valve position sensor is not removable and is installed on the throttle body.

This sensor receives a 5-V power supply from the controller and transmit a gradually increasing voltage to the same, with an increase of the gas valve opening. The controller converts this voltage at an angular position of the valve.

The engine rpm and the gas valve position are the two basic signals for the engine management.

A failure of this circuit causes the switching on of the injection indicator and the tripping of the safeties. In these conditions, the engine works, even though not in an optimum way, always safeguarding the catalytic converter integrity.

The gas valve position signal is especially important at the small valve openings. These areas are also where the sensor works more frequently, and therefore they require more frequent checks after a high number of kilometres run.

To check the sensor and the relevant circuit, proceed as follows:

1 - Connect the diagnostic tester.

Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

Select the tester menu on the «ERRORS» function.

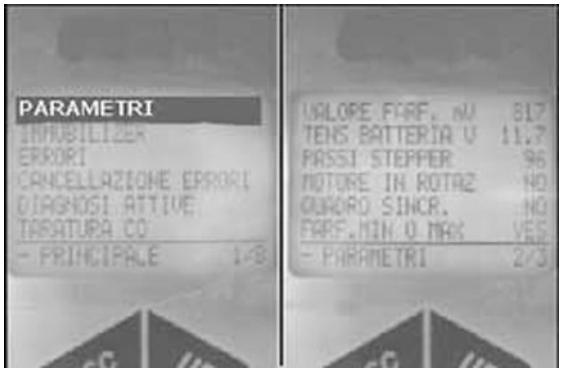
Check whether the controller has detected any failures relating to the gas valve position signal.

YES go to 6 NO go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - Select the diagnostic tester menu on the «**PARAMETERS**» function.
Check whether the controller recognises the extreme positions:
gas valve to minimum
gas valve to maximum
YES go to 4 NO go to 3



3 - Check the adjustment of the gas valve control flexible transmissions. Fix or replace, if required.
YES go to 2
4 - Gradually open the throttle valve, check that the mV value increases progressively and proportionally with the opening variation.
YES go to 5 NO go to 6
5 - The gas valve position signal is conforming.
6 - Connect the specific tool to the injection system.
Do not connect the tool to the controller.
Disconnect the gas valve position sensor connector.
Check the continuity between the connector's
terminals and the relevant pins on the controller.

Specific tooling

020481Y Control unit interface wiring

Electric characteristic

Light blue-green-22 =

0 Ω (continuity)

Brown-yellow-1 =

0 Ω (continuity)

Orange-light blue-11 =

0 Ω (continuity)

YES go to 8 NO go to 7

7 - Replace or fix the injection wiring.

YES go to 6

8 - Check the earth insulation of the three circuit lines.

Electric characteristic

22-23 =

Ω infinite (>1M)

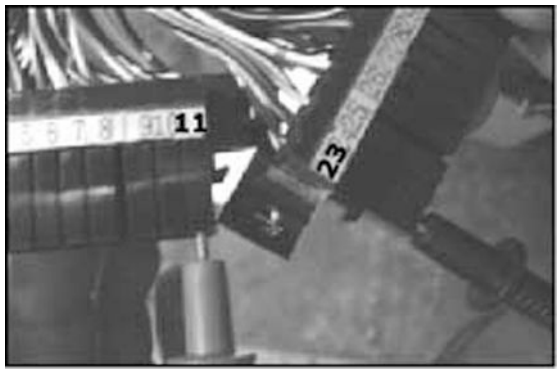
1-23 =

Ω infinite (>1M)

11-23 =

Ω infinite (>1M)

YES go to 10 NO go to 9



9 - Replace or fix the injection wiring

YES go to 8

10 - Connect the specific tool to the controller.

Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

Measure voltage between terminals 1 and 22

of the specific tool.

Specific tooling

020481Y Control unit interface wiring

Electric characteristic

1-22 =

5±0,2 V

YES go to 12 NO go to 11

11 - Check the controller connection connector.

Replace the controller, if necessary.

YES go to 10

12 - Connect the gas valve position sensor connector.

Repeat the voltage measurement between terminals 1 and 22 of the specific tool.

Electric characteristic

1-22 =

5±0,2 V

YES go to 13 NO go to 14

13 - Measure voltage between terminals 11 and 22. Gradually open the throttle valve and check that the voltage value increases progressively.

N.B.

BY WAY OF AN INDICATION, VOLTAGE MAY VARY FROM ~700MV AT MINIMUM, AND ABOVE 4V AT MAXIMUM.

Electric characteristic

11-22 =

V (progressive variation)

The possible variations of the limit values are

caused by the sensor installation tolerances.

YES go to 15 NO go to 14

14 - Replace the throttle body along with sensors

and stepper.

YES go to 12

15 - Check that the voltage measured at pins 11 and 22 matches that indicated by the diagnostic tester set to «**PARAMETERS**».

YES go to 16 NO go to 17

16 - The gas valve position sensor and relevant circuit are conforming.

17 - Replace the controller.

Zeroing the throttle

Throttle position sensor reset (T.P.S. reset)

The throttle body is supplied with gas valve position sensor and is pre-calibrated.

Pre-calibration consists in the adjustment of the minimum gas valve opening, to obtain a fixed air capacity in predetermined reference conditions.

Pre-calibration allows an optimum air rate for idle management.

This adjustment must not be changed.

The injection system will complete the idle management by the stepper and the ignition advance variation.

After pre-calibration, the throttle body has the valve open with an angle that may vary according to the valve and duct working tolerances.

In turn, the valve position sensor may take different installation positions. For these reasons, the mV of the sensor with valve at minimum value may vary for different throttle bodies.

For optimum carburetion, especially with small openings of the gas valve, it is necessary to match the throttle body with the controller according to the procedure called TPS.

This operation allows setting the mV value in the controller as starting point corresponding to the pre-calibration position. The controller will recognise such value as angle 5.24°.

To reset, proceed as follows:

Connect the diagnostic tester.

Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.

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

Specific tooling

020460Y Tester and scooter diagnosis

-Check that the gas valve has the control abutted against the abutment screw.

-In this position, confirm the TPS reset procedure.

-Select the «**PARAMETERS**» function and check that the TPS reset «**YES**» is displayed.

Reset should be performed in the following cases:

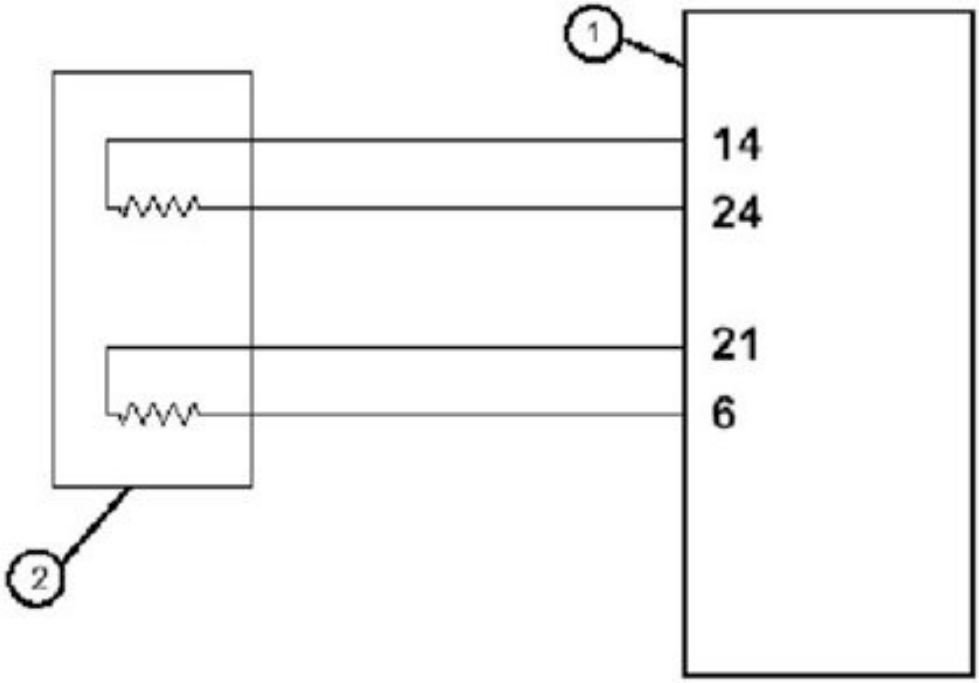
- upon the first assembly
- in case of replacement of the throttle body

- in case of replacement of injection controller.

N.B.

THE TPS RESET PROCEDURE MUST NOT BE CARRIED OUT WITH OLD THROTTLE BODIES SINCE THE POSSIBLE VALVE AND ABUTMENT WEAR MAKE THE AIR FLOW RATE DIFFERENT FROM THAT OF PRE-CALIBRATION.

Step motor



CIRCUIT LAYOUT

	Specification	Desc./Quantity
1	Controller	
2	Stepper motor	

The throttle body is provided with an auxiliary air circuit. This is enabled by a piston valve controlled by a stepper motor.

The stepper is powered by the controller only when the opening must be changed.

The revolution is divided into portions called «steps».

By changing the opening «steps» it is possible to properly feed the engine to facilitate the start-up procedure and adjust the air feeding with cold en-

gine.
When the engine reached the working temperature, the stepper partly closes again.
To prevent wear of the adjustment piston, operation at full speed is obtained with a minimum opening of 43 ÷ 45 «steps».
To recover possible adjustments, every switching to «**OFF**» causes the piston to close up to end of travel and to open up again by a fixed number of steps (self-reset).
When the controller changes the stepper opening «steps» it also changes the injection time to ensure proper carburetion.
Idling speed stabilises at 1450-50 G/1'. After a hot start-up step you can perceive the first increase in the revolutions and the subsequent closing of the stepper to stabilise the speed.
In case of irregular speed, before carrying out electric checks inspect the gas valve and the auxiliary air circuit cleaning.
To check the stepper and the relevant circuit, proceed as follows:
1 - Connect the diagnostic tester.
Set the switch to «**ON**» with switch to «**RUN**» and side stand raised.
Lift the vehicle on the central stand. Select the menu on the «**ERRORS**» function.
Check whether the controller has detected any failures relating to the stepper circuit.
YES go to 8 NO go to 2

Specific tooling

020460Y Tester and scooter diagnosis

2 - Select the menu on the «**PARAMETERS**» function. Check the number of «steps» programmed by the controller to obtain start-up. This setting is a function of the engine temperature.

Electric characteristic

20° C =

~ 135 ÷ 140 steps

YES go to 3 NO go to 4

3 - Start the engine and let it warm up.

With a cooling fluid temperature of more than 70°C, the controller must control the stepper with about 20 «steps».

YES go to 5 NO go to 4

4 - Check the cooling fluid temperature sensor signal. Check the controller, if necessary.

5 - Select the menu on the «**ACTIVE DIAGNOSIS**» function. Select «**STEPPER**» diagnosis. Start the diagnosis with idle engine at the working temperature. Check whether the stepper commands some revolution variations and wait for the diagnostic tester response.

N.B.

THE CPU ENABLES THE DIAGNOSIS ONLY WHEN THE IDLE SPEED IS WITHIN THE SPECIFICATIONS.

YES go to 6 NO go to 8

6 - Test successful. Variations of revolutions perceived.

YES go to 7 NO go to 9

7 - Stepper and relevant circuit efficient.

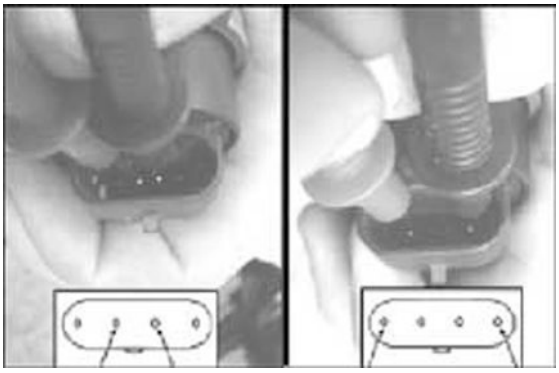
8- Test failed. No change in the rpm, check the stepper circuit. Disconnect the stepper connector. Check the resistance of the stepper circuits by connecting the tester as indicated in the figure. The two measurements must have the same value.

Electric characteristic

Resistance =

~ 51 Ω

YES go to 11 NO go to 10



9 - Test successful.

No variations of revolutions.

Remove the throttle body.

Check the auxiliary air circuit cleaning.

Switch from «**ON**» to «**OFF**» and again to «**ON**» and check whether the piston valve moves. If the valve does not move, replace the throttle body.

10 - Replace the throttle body

11 - Connect the specific tool.

For these checks, do not connect the specific tool to the controller. Check the continuity of the 4 power supply lines of the stepper.

Specific tooling

020481Y Control unit interface wiring

Electric characteristic

A Light blue-red-14 =

0 Ω (continuity)

B Orange-blue-6 =

0 Ω (continuity)

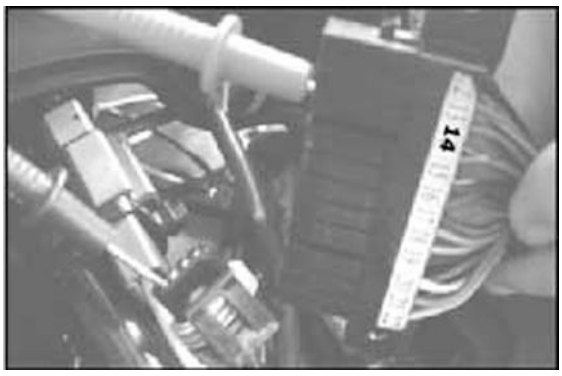
C Light blue-yellow-21 =

0 Ω (continuity)

D Light blue-black-24 =

0 Ω (continuity)

YES go to 12 NO go to 13



12 - Check the earth insulation of the 4 stepper lines.

Electric characteristic

14-23 =

>1MΩ (infinite)

6-23 =

>1 MΩ (infinite)

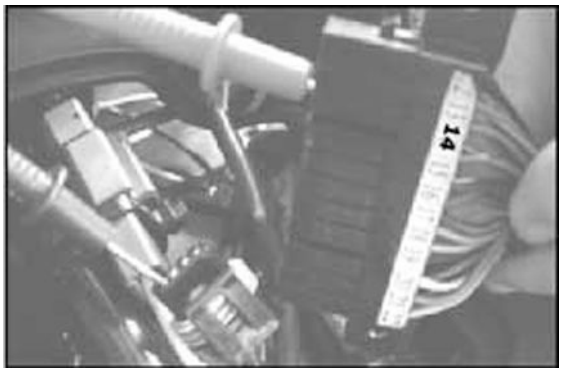
21-23 =

>1 MΩ (infinite)

24-23 =

>1 MΩ (infinite)

YES go to 14 NO go to 13



13 - Replace or fix the wiring.

YES go to 11

14 - Connect the stepper connector.

Repeat the continuity check with the tool pins.

Electric characteristic

14-24 =

~ 51 Ω

6-21 =

~ 51 Ω

YES go to 16 NO go to 15

15 - Check wiring and connectors more carefully.

16 - Connect the controller connector.

Set the switch to «**ON**» with switch to «RUN» and side stand raised. Repeat the «**ON**» «**OFF**» «**ON**» switching.

Check the presence of voltage pulses on the stepper command lines.

Setup for direct voltage measurements.

N.B.

PULSES ARE USED TO CHANGE THE STEPPER POSITION.

Electric characteristic

14-24 =

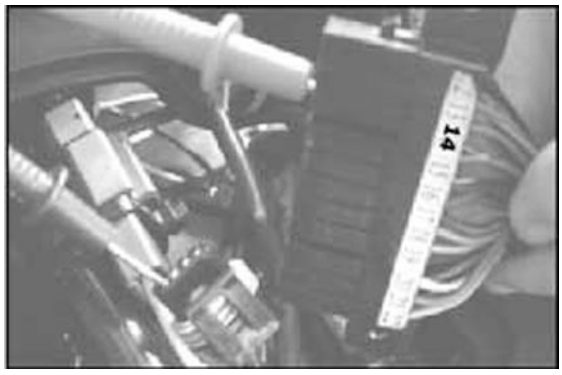
V (pulses for a few seconds)

6-21 =

V (pulses for a few seconds)

After reaching the optimum position, the power supply voltage becomes null.

YES go to 17 NO go to 18



17 - The stepper circuit is efficient.

18 - Check the controller connection connector. Replace the controller if needed.

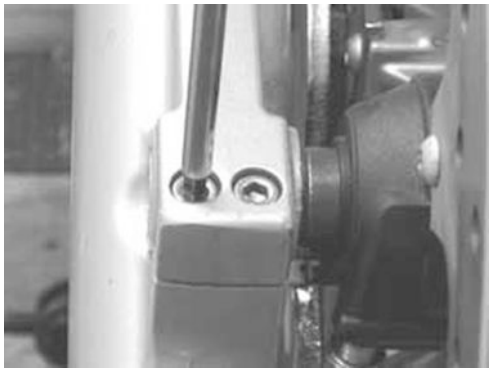
INDEX OF TOPICS

This section provides information on the operations that may be carried out on the suspensions.

Front

Removing the front wheel

- Loosen the two wheel axle fastening screws shown in the figure.



- Remove the wheel axle locking nut
- Extract the wheel axle and remove the wheel
- Be careful not to damage the odometer motion drive during removal
- Check that the wheel axle is free from wear or deformations. Replace them, if necessary.

Locking torques (N*m)

Wheel axle fixing screws: 6 ÷ 7 N·m Front wheel spindle nut 45 ÷ 50

Front wheel hub overhaul

Check that the wheel bearings are free from wear.

If you have to replace the wheel bearings, proceed as follows:

- Remove the 2 bearings on the odometer motion drive side using pliers 14 or 34 and bell 9.

- Remove the inside spacer.

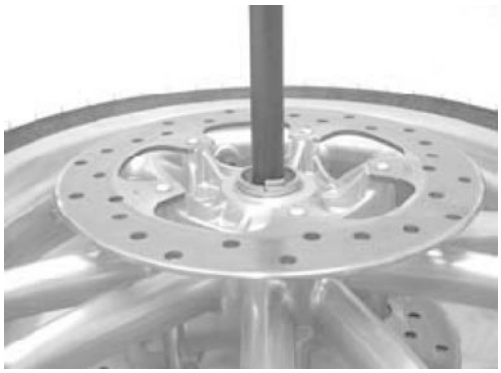
Specific tooling

001467y034 15-mm pliers

001467Y014 15 mm pliers

001467Y009 Bell for bearings external Ø 50 mm

- Support the front wheel with two wooden shims to prevent scratches in case of contact with the rim.
- Insert the punch consisting of the adapter handle, adapter and 15-mm guide on the odometer motion drive side to allow removing the LH bearing and the spacer bushing.



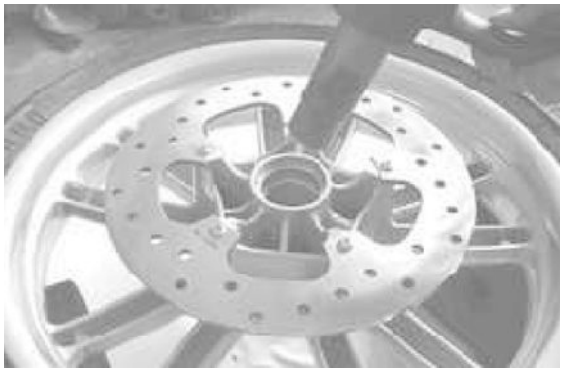
Specific tooling

020376Y Handle for punches

020456Y Ø 24 mm adaptor

020412Y 15 mm guide

- Heat the LH bearing seat using the thermal gun.



- Insert the bearing by the punch consisting of adapter handle, adapter 42x47 mm and 15-mm guide to abutment.

- Reinsert the spacer bushing on the brake disc side by the specific tool and move it to abutment.

Specific tooling

020376Y Handle for punches

020359Y 42 x 47 mm hub bearing fitting adaptor

020412Y 15 mm guide

020201Y Spacer bushing driving tube

- Upturn the wheel and insert the inside spacer with the portion provided with snap ring facing the LH bearing installed before.
- Heat the bearing seat on the odometer motion drive side using the thermal gun.

- Insert the 2 bearings by the punch consisting of adapter handle, adapter 32x35 mm and 15-mm guide to abutment.

Specific tooling

020376Y Handle for punches

020357Y 32 x 35 mm adaptor

020412Y 15 mm guide

Refitting the front wheel

- For re-assembly, perform the operations for removal in the reverse order according to the prescribed torques.
- Place the odometer motion drive in advance to insert the reference into its seat.

Locking torques (N*m)

Side stand nut 45 ÷ 50 Safety screw on leg 6 ÷ 7

Front fork

Removal

- Remove the front wheel
- Remove the front mudguard
- Remove the front brake
- Remove the front and rear handlebar cover.
- Remove the pin fixing the handlebar to the steering wheel tube.
- Remove the handlebar and rest it on the counter-shield.

- Using the specific tool, loosen and remove the upper ring nut, the spacer washer and the counter-ring nut.
- Extract the fork.

N.B.

TAKE CARE TO SUPPORT THE FORK SO AS TO PREVENT IT FROM COMING OFF ABRUPTLY

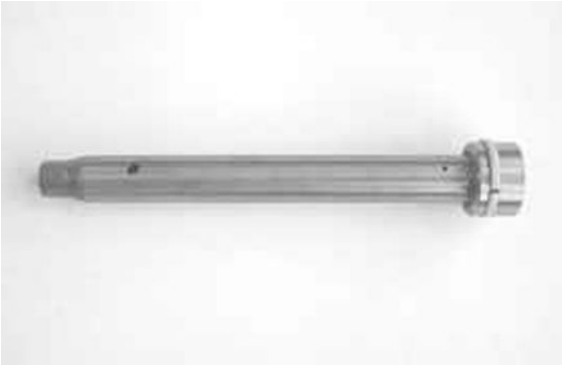
Specific tooling

020055Y Steering tube ring nut spanner

Overhaul

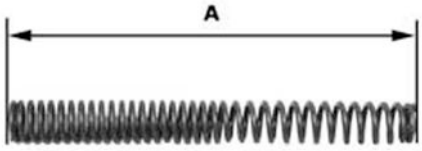
Check pump unit

- Check that the oil holes on the pumping are free from clogging.
- Check that the sealing snap ring is not damaged.



Check spring length

- Check the spring length «**A**».



Characteristic

Spring standard length:

291,6 mm

Servicing tapered bearing seats

- Check that the seats and the conical bearings exhibit no scratches or wear.

N.B.

THE CONICAL BEARING SEATS SHOULD BE REMOVED ONLY IF STRICTLY NECESSARY.

In case of replacement, proceed as follows:

- Using a bearing removal punch, inserted from the bottom, remove the top seat on the steering head.

Then, remove the bottom seat of the conical bearing inserting the punch from the top of the steering head.

Specific tooling

020004Y Drift for removing thrust rings from steering head tube

Overhaul of steering tube rods

- Using an inside 17 mm hexagonal wrench, loosen the top stem closing cap.

- Loosen the stem support clamp and remove fork leg and stem.

- Remove the spring.
- Drain the oil.
- Remove the screw with copper washer shown in the figure. To prevent the pumping member rotation, insert an inside 22 mm hexagon wrench into the stem.
- Remove the pumping member.

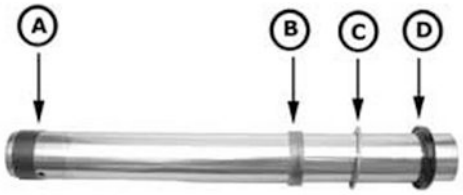
- Remove the dust guard ring by a screwdriver as shown in the figure.

N.B.

BE CAREFUL NOT TO DAMAGE THE DUST GUARD AND THE STEM.

- Remove the oil guard safety lock by a screw-driver.
- Repeatedly actuate the stem to remove it from the leg.

- Extract the oil guard «**D**», the abutment washer «**C**» and the top brass «**B**».
- Widen and remove the bottom brass «**A**».

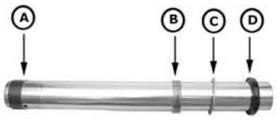


Refitting

Rod reassembly on jambs

Preassemble the stem as indicated:
- Install the brass from the bottom of the stem

- Insert the following from the top of the stem:



1 brass «**B**»
2 Abutment washer «**C**»
3 oil guard «**D**»

- Insert the pumping member guiding bush-

ing at the bottom end of the stem.

- Insert the stem into the casing being careful not to let the guiding bushing come out of the stem.
- Move the oil guard in abutment using a tube.

TUBE SIZE

Specification	Desc./Quantity
Inside:	44 mm
Outside:	51 mm
Height:	~ 105 mm

- Insert the contrast spring into the pumping ember.
- Insert the pumping member into the stem.
- Insert the stem into the fork leg being careful not to let the guiding bushing come out of the stem.
- Insert and tighten the pumping member screw with a new copper washer and tighten at the prescribed torque.

CAUTION

TO PREVENT THE PUMPING MEMBER ROTATION, INSERT AN INSIDE 22 MM HEXAGON WRENCH INTO THE STEM.

Locking torques (N*m)

Pumping fastening screw 25 ÷ 35

- Pour recommended oil into the stem.

Recommended products

SELENIA FORK0 10 W Oil for front staple

Hydraulic oil SAE 10 W

Characteristic

Amount oil:

195 ± 3 cc

- Insert the spring with the thickest turns at the bottom.
- Insert the stem into the fork clamp.
- Tighten the clamp to screw the top stem closing cap.
- Check that the sealing ring on the cap is in good working order, then tighten the cap on the stem at the pre-scribed torque.

Locking torques (N*m)

Stem upper cap 35 ÷ 55

- Loosen the fork clamp screws and move the stem closing cap in abutment with the

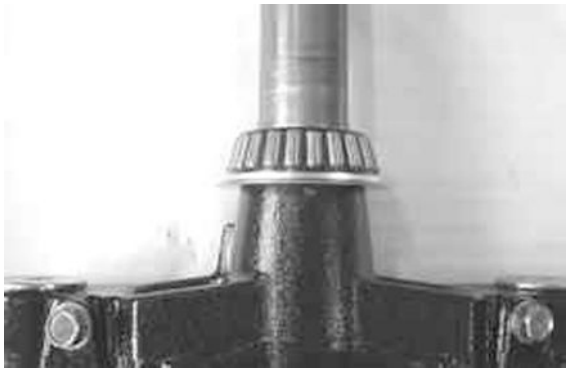
clamp.

- Tighten the clamp screws at the pre-scribed torque.

Locking torques (N*m)

Fork clamp screws 20 ÷ 25

- Grease by applying the specific product to the tapered bearing.



Recommended products

TUTELA ZETA 2 Grease for steering, seats of pin and swing arm

Lithium soap and zinc oxide grease NLG12

- Insert the fork in the steering tube.
- Insert the tapered bearing after having applied the specific product.

Recommended products

TUTELA ZETA 2 Grease for steering, seats of pin and swing arm

Lithium soap and zinc oxide grease NLG12

- Use the specific tool to tighten the first ring nut in the steering tube with an adjustment torque, then completely loosen.

Locking torques (N*m)

Lower ring nut settling torque 20 ÷ 25 *

Tighten at a recommended torque

Locking torques (N*m)

Steering lower ring nut 10 ÷ 13 **

- Fit the spacer washer.
- Use the specific tool to tighten the second ring nut in the steering tube and tighten it to the pre-

scribed torque.

Locking torques (N*m)

Steering wheel upper ring nut: 36 ÷ 39

- Reinstall the steering wheel on the tube and centre it by collimating the groove on the handlebar with that on the steering tube, as shown in the figure.

- Tighten the fastening screw on the steering tube at the prescribed torque.
- Reinstall the front and rear handlebar covers as described in the "Body" chapter.
- Reinstall the front mudguard.
- Reinstall the front wheel.
- Reinstall the front brake caliper.
- Tighten the screws fixing the brake caliper to the support.

Specific tooling

020055Y Steering tube ring nut spanner

Locking torques (N*m)

Screw securing handlebar to steering tube 45 ÷ 50 Lower ring nut settling torque 20 ÷ 25 * Steering wheel upper ring nut: 36 ÷ 39 Steering lower ring nut 10 ÷ 13 ** Front brake caliper fixing on fork 20 ÷ 25 Brake disc fastening screw 11 ÷ 13 Plastic protection fixing screw 5 ÷ 6

Steering bearing

Removal

Overhaul of tapered bearing on fork

- Check that the conical bearing on the fork exhibits no deformations or wear.

CAUTION

THE BEARING SHOULD BE REMOVED ONLY IF STRICTLY NECESSARY.

In case of replacement, proceed as follows:

- Support the fork in a vice.

- Insert the contrast plate in the upper end of the steering tube

- Insert the specific tool as shown in the figure.

- Insert the retaining band of the two half-rings.

- Using a 19 mm hexagonal wrench, extract the roller bearing.

Specific tooling

020458Y Steering tube lower bearing extractor

Refitting

Reassembly of steering tapered bearing seats

Using the specific tool, reassemble the conical bearing housings on the head as described below:

- Place a new top housing on the head and a new bearing seat on the bottom side.
- Insert the screw of the specific tool setup with the adapters for inserting bearing and seat, into the steering head, as shown in the figure.
- Using two 24 mm wrenches, tighten the screw to move the two seats in abutment.

N.B.

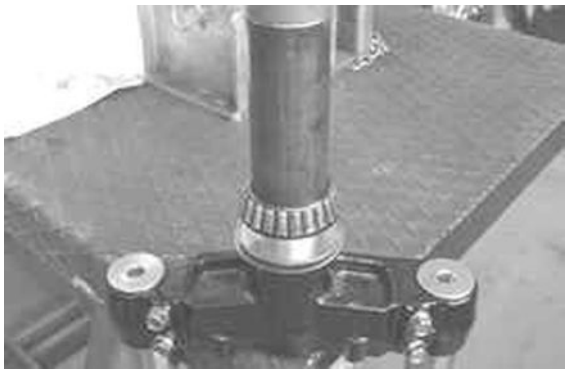
ALWAYS USE A NEW BEARING AND A NEW HOUSING.

Specific tooling

001330Y Steering seat installer, to be fitted with parts: 001330Y009-For lower seat, 001330Y013-For upper seat

Reassembly of tapered bearing in steering tube

- Insert the a new plate and a new dust guard in the steering tube
- Insert the a new conical bearing in the steering tube
- Using the specific tool and a mallet to move the dust guard and the bearing in abutment.



Specific tooling

006029y Drift for fitting thrust ring seats on steering tube

Rear

Removing the rear wheel

- Remove the silencer support arm

- Remove the spacer on the wheel axle.

- Loosen the five wheel axle fastening nuts by the rear brake.

Refitting the rear wheel

- For reassembly, perform the previous operations in the reverse order

Locking torques (N*m)

Wheel fastening screws 33 ÷ 37

Swing-arm

Removal

- Extract the left bearing by the specific tool.

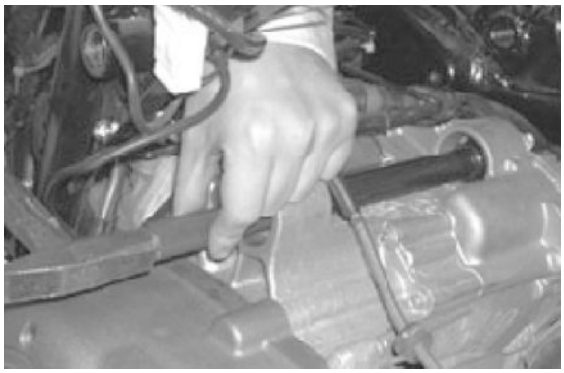
Specific tooling

001467Y006 20-mm pliers

001467Y031 Bell

- Extract the right bearing by the modu-

lar punch through the left bearing seat (removed before).



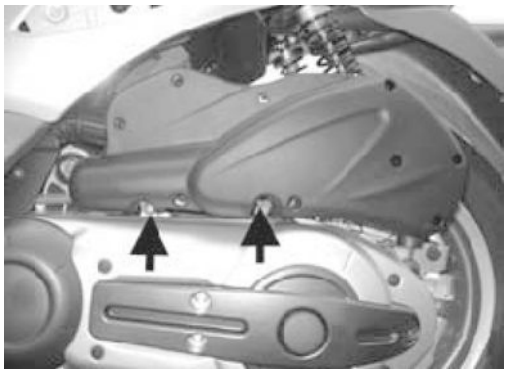
Specific tooling

020363Y 20mm guide

020375Y Adapter 28 x 30 mm

020376Y Handle for punches

- Remove the helmet compartment.
- Remove the air filter.
- Remove the rear mudguard.

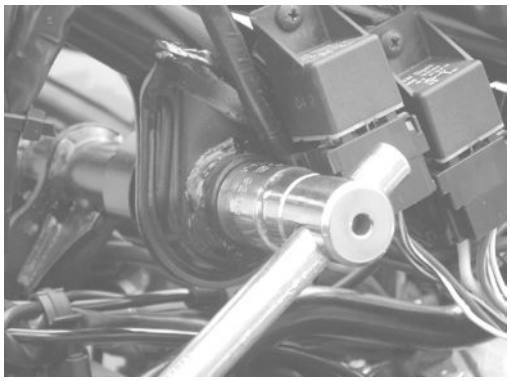


- Remove the nut and the washer fixing the oscillating arm/engine pin and tie rod.

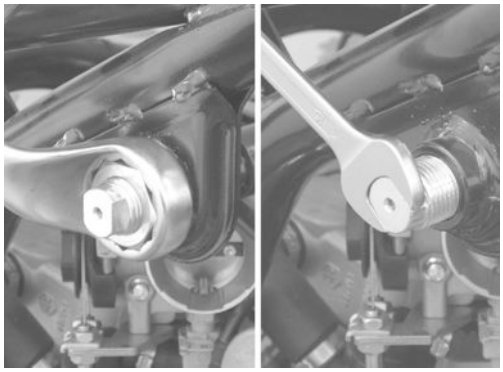
- Remove the locking nut, the washer and the tie rod pad.

- Suitably support the engine by a jack under the oil sump.

- Remove the nut of the pin fixing the oscillating arm to the chassis.

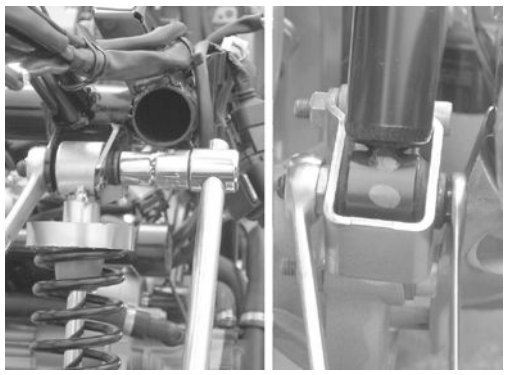


- Remove the lock nut, then using a 15-mm fork spanner, loosen the pin fixing the oscillating arm to the chassis.



- Remove the oscillating arm from the chassis and remove the shaped washer.

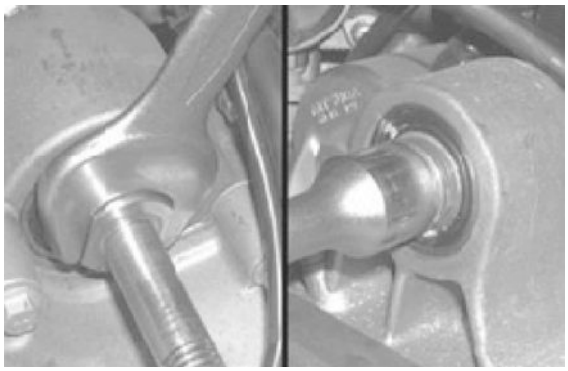
- Loosen the rear shock absorber fixing bolts.



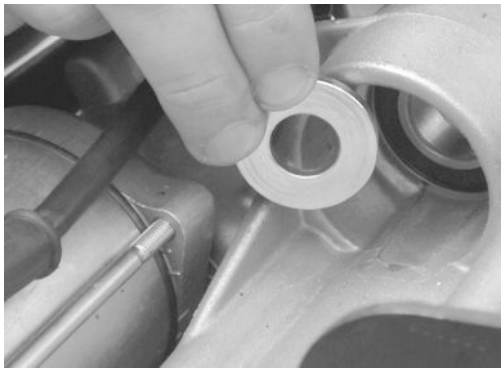
- Move the engine backwards as much as piping and transmissions allow, at

the same time move the front of the engine leftwards to allow removing the tie rod (with washer and pad) from the chassis and from the pin fixing the oscillating arm to the engine.

- Prevent the rotation of the pin connecting the oscillating arm to the engine by a 19-mm fork spanner.
- Remove the nut and the washer from the vehicle left side.



- Pull out the pin from the right side and remove the oscillating arm with the washer on the right.



N.B.

CHECK THAT THE OSCILLATING ARM DOES NOT INTERFERE WITH THE THROTTLE BODY COMPONENTS IF PULLED BY THE SPACER BUSHING.

N.B.

REMOVE THE CABLE UNIT SUPPORT BRACKET FIXING SCREW.

- Remove the bushing from the bearing on the engine left support.

Check that the following components are not worn or dented:

- Engine crankcase supports
- Ball bearing with bushing on oscillating arm
- Roller bearing on oscillating arm

Check that the chassis connecting pin exhibits no wear or dents on the roller bearing connection: In case of irregularities, replace the pin and the roller bearing.

- Check that the pin connecting the oscillating arm to the engine exhibits no wear at the right bearing housing connection:

Characteristic

Bolt diameter at bearing location:

Ø18 -0,034 mm

Bolt diameter:

Ø20 -0,041 mm

Overhaul

- Properly support the oscillating arm in the vice.
- Remove the snap ring.

- Remove the ball bearing bushing.

- Extract the ball bearing by the specific tool.

Specific tooling

001467y017 Bell

001467y034 15-mm pliers

- Extract the roller bearing by the specific tool.

N.B.

POSITION THE PLIERS FOR EXTRACTING UNDER THE UPPER EDGE OF THE ROLLER BEARING.

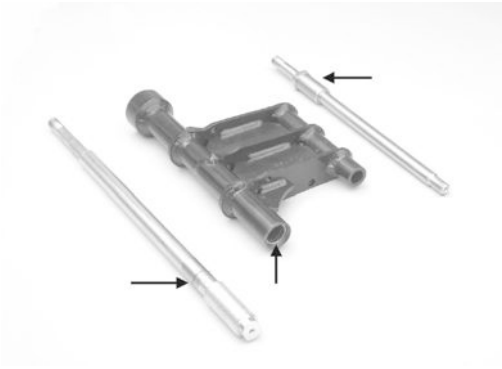
Specific tooling

001467y010 Bell

001467y019 18 mm pincer

Refitting

- Lubricate the inside tracks of the bearings on the crankcase.
- Lubricate the roller bearing into the oscillating arm.
- Lubricate the bearing connection on the oscillating arm/engine pin.

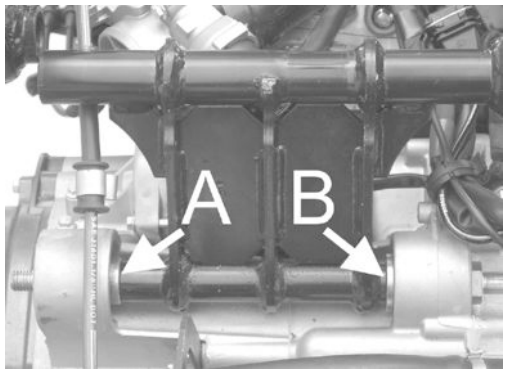


Lubricate the roller bearing connection on the oscillating arm/chassis pin.

- Insert the spacer bushing in the left bearing «A».
- Assemble the engine connecting pin with the washer «B» and the oscillating arm.
- Install the washer and the flanged nut

and move them close without tightening.

- Check that the tie rod silent block is free from wear; if not, replace the complete tie rod.
- Check that the 2 tie rod spring pads are in good working order.



- Assemble the tie rod with the washer and a pad.
- Install the tie rod inserting it on the oscillating arm/engine pin and into the bracket welded to the chassis.

N.B.

FOR THIS OPERATION, MOVE THE ENGINE ON THE VEHICLE LONGITUDINAL AXIS.

N.B.

IF YOU REMOVE THE ELECTRIC SYSTEM SUPPORT BRACKET, REINSTALL IT BEFORE INSERTING THE TIE ROD.

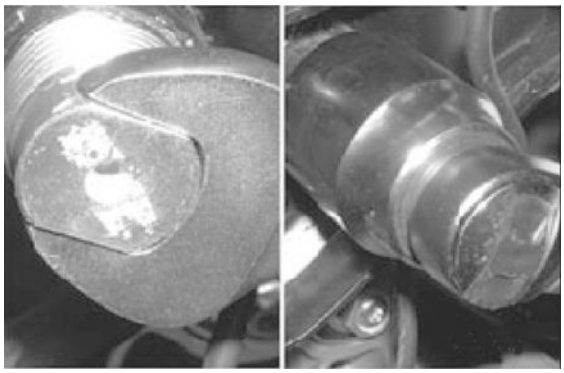
- Apply the rubber pad and the washer to the tie rod and lock it.

Locking torques (N*m)

Upper tie fixing: 33÷41 Nm

- Lubricate the shaped washer and place it onto the bearing.
- Insert the chassis fixing pin.
- Restore the axial clearance between oscillating arm and chassis tightening the pin at the prescribed torque.

- Tighten the lock nut at the prescribed torque.



Locking torques (N*m)

Bolt securing swing-arm to engine 14 - 17
Counter-nut: 40÷50 Nm

- Tighten the right end of the chassis connecting pin at the prescribed torque, using a new nut.

Locking torques (N*m)

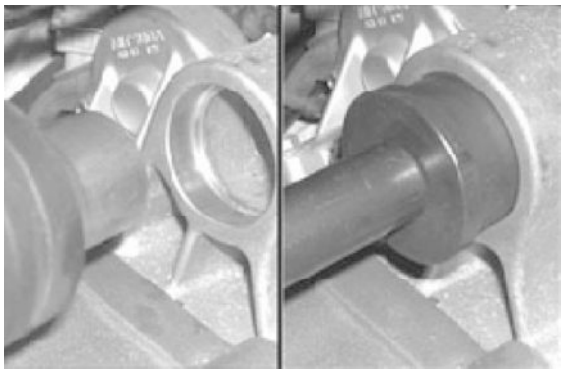
RH chassis pin nut: 66 ÷ 73 Nm

- Use a 19-mm fork wrench to prevent the rotation of the pin connecting the oscillating arm to the engine and tighten the right nut (with washer) and the left nut at the prescribed torque.

Locking torques (N*m)

Transmission-side nut: 100 ÷ 120 Nm Silencer-side nut: 56 ÷ 70 Nm

- Heat the connections on the engine crankcase and insert the bearings to abutment by the modular punch.
- To install the right bearing, lower the engine.



N.B.

WHEN HEATING THE LEFT SEAT MOVE THE HOSE FOR OIL TO THE BRAKE CLAMP AWAY FROM THE ENGINE CHASSIS. FOR THE RIGHT PART REMOVE AND MOVE AWAY THE BRACKET SUPPORTING

THE WIRING.

Specific tooling

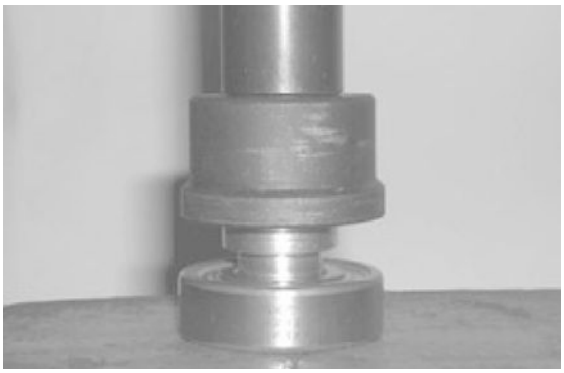
020151Y Air heater "METABO HG 1500/2"

020359Y 42 x 47 mm hub bearing fitting adaptor

020363Y 20mm guide

020376Y Handle for punches

- Insert the spacer on the ball bearing by the specific tool.



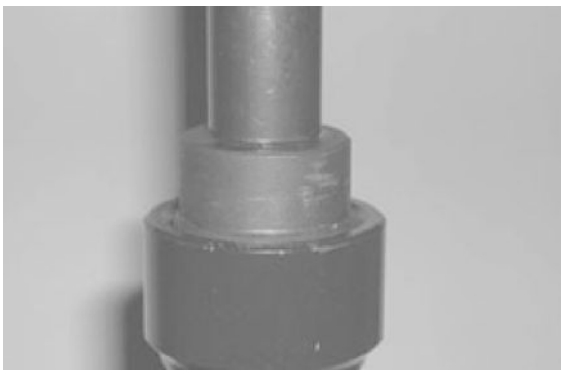
Specific tooling

020357Y 32 x 35 mm adaptor

020362y 12 mm guide

020376Y Handle for punches

- Heat the bearing seat on the oscillating arm.
- Insert the bearing to abutment by the specific tool.



N.B.

THE BEARING SPACER MUST BE INSERTED FROM THE INSIDE OF THE OSCILLATING ARM.

N.B.

DO NOT DETERIORATE THE PAINTED SURFACE WHILE WARMING THE OSCILLATING ARM.

Specific tooling

020151Y Air heater "METABO HG 1500/2"

020376Y Handle for punches

020362y 12 mm guide

020357Y 32 x 35 mm adaptor

- Install the snap ring.

- Install the roller bearing by the specific tool.

Specific tooling

020083y Punch

Shock absorbers

Removal

Proceed as follows:

- Rest the vehicle on the central stand;
- Remove the sides according to the removal sequence described in Chapter "Body".

- Slightly raise the engine by a jack to free both shock absorbers;
- Remove the silencer;

- Loosen the shock absorber spring unit fastening screw from the support fixed to the engine and from that fixed to the

silencer support;

- Loosen the two top nuts (one by side) fixing the shock absorber spring unit to the chassis and remove the shock absorbers.

See also

Side fairings

Refitting

Perform the above operations in the reverse order.

Locking torques (N*m)

Shock absorber bottom fixing 33 ÷ 41 Shock absorber top fixing 33 ÷ 41

Centre-stand

- Remove the 2 stand return springs.
- Loosen the fastening nuts.
- Remove the stand.
- Upon reassembly, tighten the nut at the prescribed torque

Locking torques (N*m)

Central stand fixing 25 ÷ 30

Side stand

- Release the springs.
- Loosen the nut.
- Extract the screw.

ASSEMBLY

- For reassembly, perform the previous operations in the reverse order

Locking torques (N*m)

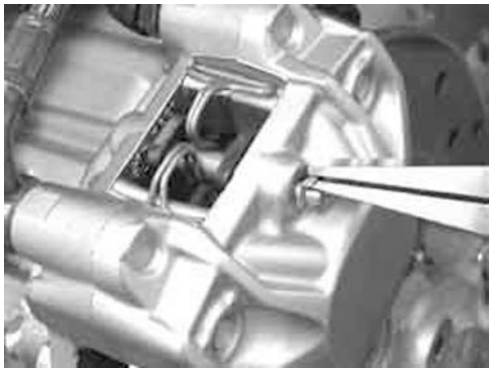
Side stand fastening bolt 40 ÷ 45 Nm

INDEX OF TOPICS

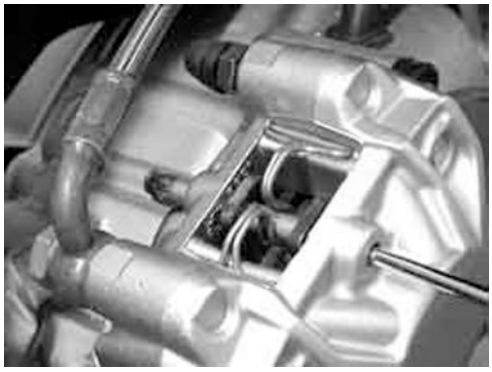
Rear brake calliper

Removal

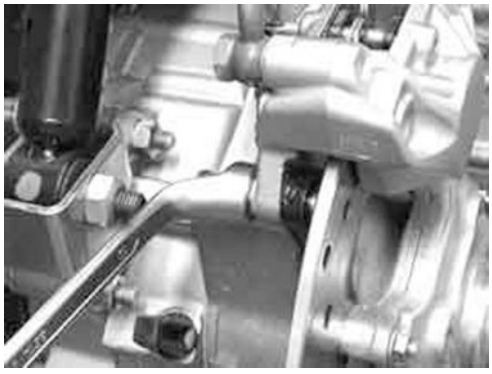
- Remove the rear wheel.
- Remove the pads retain pin lock ring.



- Using a peg, partly pull out the pads retain pin to release the snap ring.



- Remove the two screws fixing the brake caliper to the bracket, then remove the brake caliper with pipe.



- Fully extract the pads retain pin, spring and pads.

N.B.

IF THE BRAKE CALIPER REQUIRES OVERHAULING OR REPLACEMENT, LOOSEN THE OIL UNION FIXING BEFORE REMOVING THE CALIPER ATTACHMENTS TO THE SUPPORT BRACKET.

Overhaul

- Remove the rear brake caliper
- Properly support the brake caliper in vice.
- Remove the two caliper coupling screws as shown in the figure.

- Remove the two pistons from the caliper body with the aid of small compressed air jets through the brake fluid feeding holes.
- Remove the dust guard ring and the sealing ring of each half-caliper.
- Remove the two sealing rings in the right half-caliper.

N.B.

DO NOT SCRATCH THE HALF-CALIPER SEATS WHILE REMOVING THE RINGS.

- Check that the pistons and relevant seats exhibit no scratches.
- Wash and carefully blow all components.
- Fit new sealing rings and dust guards.
- Replace the pistons into their seats and lubricate with brake fluid.

- Couple the half-caliper and tighten the two screws at the prescribed torque.

N.B.

TO AVOID DAMAGES TO THE GASKETS, WASH THE PLIERS COMPONENTS ONLY WITH ALCOHOL. DO NOT USE FUEL OR DERIVATIVES

Locking torques (N*m)

Brake caliper coupling 20 ÷ 24

Refitting

- The rear brake caliper is recognisable by the pistons Ø 34 mm and the bleeding as shown in the figure.

- Insert the brake pads into the page according to the arrow that indicates the direction of rotation of the brake disc, as shown in the figure

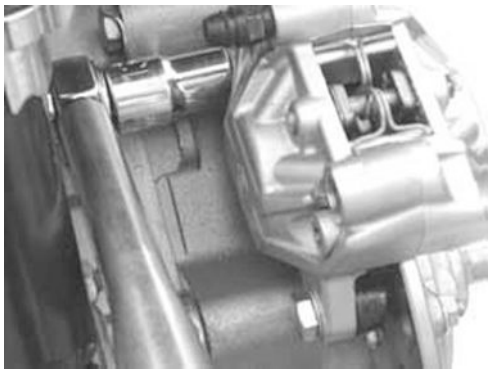
- Insert the pad fixing pin and the retain spring arranging its ends facing the bleed screw as shown in the figure.

- Insert the spring ring on the pad fixing pin.

N.B.

A WRONG POSITIONING OF THE PADS ACCORDING TO THE DIRECTION OF ROTATION CAN IMPAIR THE BRAKE PERFORMANCE AND NOISELESSNESS.

- Keep the pads in contact with the pistons and insert the caliper into the brake disc.
- Fasten the caliper to the support by the two screws with spring washer, as shown in the figure



- Fasten the brake pipe union to the caliper and tighten at the prescribed torque
- Bleed the system and replace the rear wheel

N.B.

IF THE REAR BRAKE CALIPER SUPPORT PLATE IS REMOVED, FOR REASSEMBLY BEND THE WASHER EDGES ON THE HEAD OF THE FASTENING SCREW

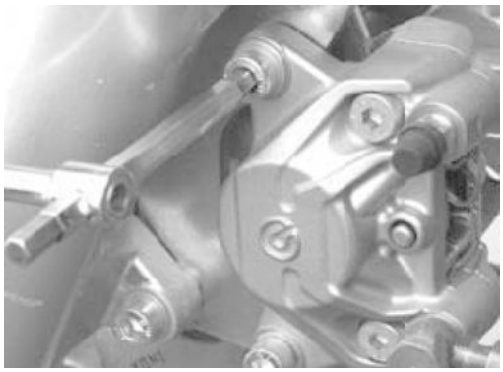
Locking torques (N*m)

Tube union / brake caliper: 20 ÷ 25 Crankcase caliper support fixing screws: 20 ÷ 25

Front brake calliper

Removal

- Remove the two front brake caliper attachments from the support plate as shown in the figure



N.B.

IF THE CALIPER NEEDS OVERHAULING OR REPLACEMENT. LOOSEN THE PIPE UNION FROM THE BRAKE CALIPER IN ADVANCE.

Overhaul

- Remove the rear brake caliper
- Properly support the brake caliper in vice.
- Remove the two caliper coupling screws as shown in the figure.

- Remove the two pistons from the caliper body with the aid of small compressed air jets through the brake fluid feeding holes.
- Remove the dust guard ring and the sealing ring of each half-caliper.
- Remove the two sealing rings in the right half-caliper.

N.B.

DO NOT SCRATCH THE HALF-CALIPER SEATS WHILE REMOVING THE RINGS.

- Check that the pistons and relevant seats exhibit no scratches.
- Wash and carefully blow all components.
- Fit new sealing rings and dust guards.
- Replace the pistons into their seats and lubricate with brake fluid.
- Couple the half-caliper and tighten the two screws at the prescribed torque.

Locking torques (N*m)

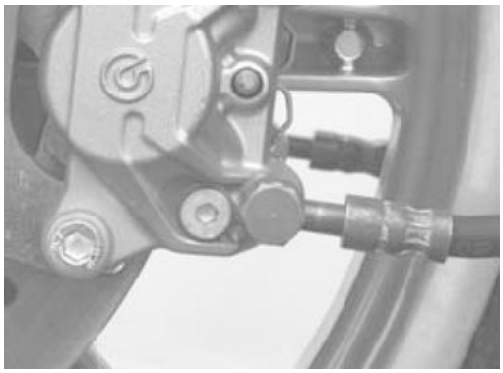
Caliper coupling screws: 20÷25 N•m

Refitting

- The front left brake caliper is recognisable by the pistons Ø 32 mm whereas the front right caliper is recognisable by the pistons Ø 34 mm
- Fasten the caliper to the support

bracket by the two screws with spring washer, as shown in the figure

- Fasten the brake pipe union to the caliper and tighten at the prescribed torque, orientating the union parallel to the horizontal axis, as shown in the figure



Locking torques (N*m)

Brake caliper fastening screws: 20÷25 N•m
Brake cooling fluid pipe union 20÷25 N·m

Rear brake disc

Removal

- Remove the rear brake caliper
- Remove the wheel axle and the brake disc with hub.
- To remove the brake disc from the hub, support the unit in a vice and tighten the 5 fastening bolts with self-locking nuts.

Refitting

- To re-assemble 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 opposed the wheel keying
- Follow the direction of rotation shown by the ar-

row and tighten at the prescribed torque.

-Lubricate the wheel axle grooved profile using advise grease

N.B.

APPLYING AN EXCESSIVE QUANTITY OF GREASE MAY IMPAIR THE BRAKE PERFORMANCE

Recommended products

TUTELA ZETA 2 Grease for steering, seats of pin and swing arm

Lithium soap and zinc oxide grease NLG12

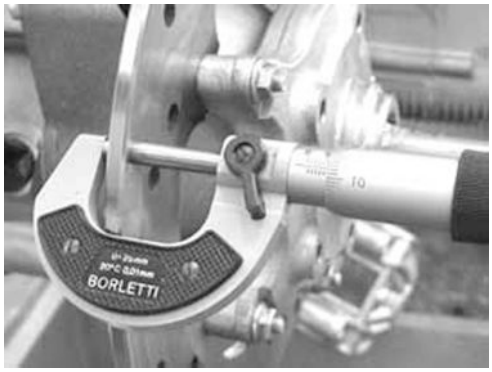
- Insert the hub - disc assembly in the wheel axle.

Locking torques (N*m)

Rear brake disc set screw 11 ÷ 13

Disc Inspection

- Remove the rear brake caliper
- Using a micrometer, check the disc thickness as shown in the figure.

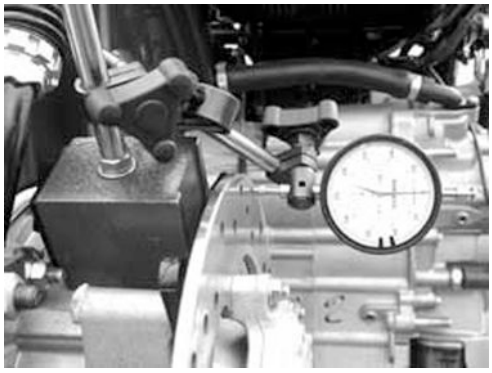


Characteristic

Standard thickness:

5 +02 -01mm

- Repeat the measurement in at least 6 points of the disc.
- Check that the measurements do not give deviations higher than 0.1 mm
- Check that the brake disc unit rotates regularly using the specific tool fixed on the brake caliper support as shown in the figure.
- Suitably fasten the flange on the wheel axle by a nut and the original spacer, and a bearing Ø 17mm



N.B.

TO AVOID WRONG MEASURES IT IS PREFERABLE TO GENERATE THE DISC ROTATION BY ROTATING THE DRIVEN PULLEY AXLE.

Specific tooling

020335Y Magnetic stand and comparator

Characteristic

Max admissible deviation:

0,1 mm

- In case of irregular values, replace the disc. If the fault continues, replace the hub.

Front brake disc

Removal

- Remove the front wheel.
- Suitably support the front wheel by the 5 screws as shown in the figure

Refitting

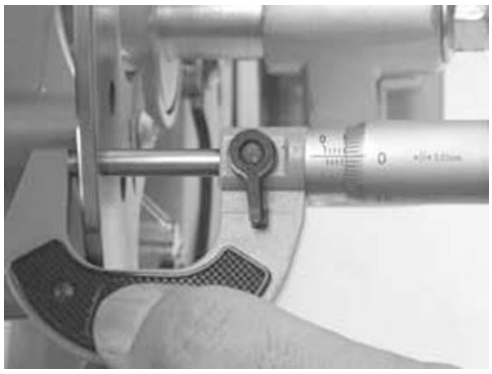
- Perform the removal operations in the reverse order according to the direction of rotation of the disc, as shown by the arrow on the disc.
- Tighten the 5 screws at the prescribed torque.

Locking torques (N*m)

Brake disc tightening torque 11÷13 N·m

Disc Inspection

- Using a micrometer, check the disc thickness as shown in the figure.



Characteristic

Standard thickness

4 +02 -01mm

- Repeat the measurement in at least 6 points of the disc.
- Check that the measurements do not give deviations higher than 0.1 mm
- Remove the front brake caliper
- Place the magnetic base with comparator on the brake caliper support bracket as shown in the figure
- Place the comparator on the disc outside edge
- Lift the front wheel, make it rotate and

Specific tooling

020335Y Magnetic stand and comparator

Characteristic

Max admissible deviation:

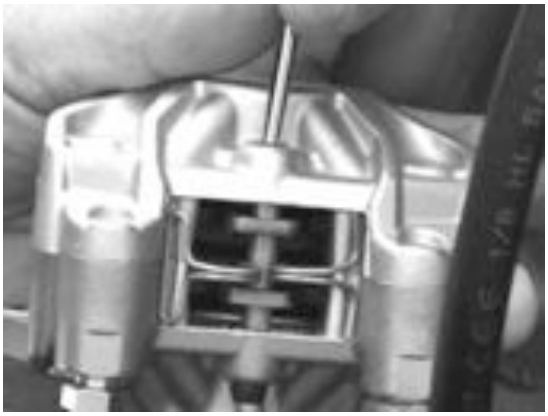
0,1 mm

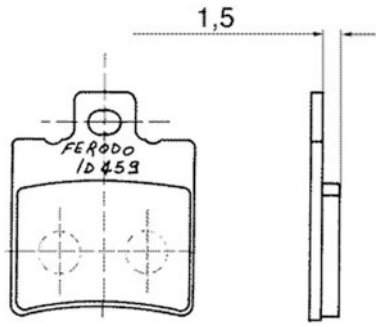
Front brake pads

Removal

- Remove the front brake caliper
- Remove the pads retain pin snap ring as shown in the figure.

- Using a plug, remove the pad retain pin, then remove the pads.
- Check that there are no deformations or wear. Replace them, if necessary
- Check that the thickness of the friction material is more than 1.5 mm. Replace them, if necessary





Refitting

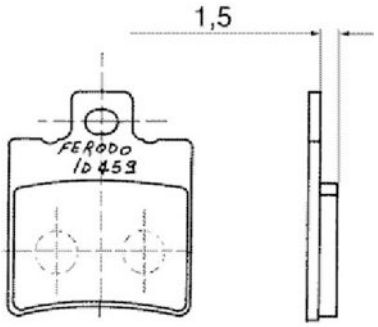
- Insert the brake pads in the caliper as shown in the figure.
- Insert the pad fixing pin and the retain spring arranging its ends facing the bleed screw as shown in the figure
- Insert the spring ring on the pad fixing pin.
- Keep the pads in contact with the pis-

tons and insert the caliper into the brake disc.

Rear brake pads

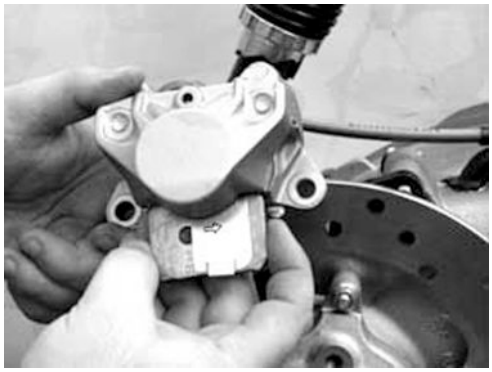
Removal

- Remove the rear brake caliper
- Remove the brake pads and check that there are no deformations or wear. Replace them, if necessary
- Check that the thickness of the friction material is more than 1.5 mm. Replace them, if necessary



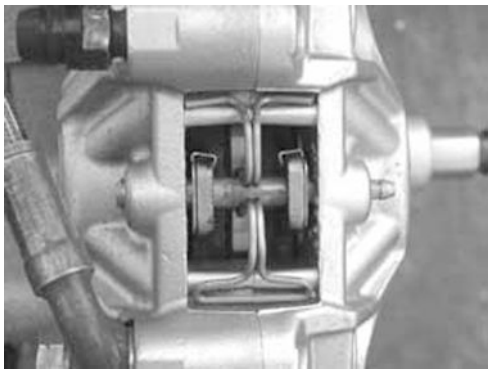
Refitting

- Insert the brake pads according to the direction of rotation of the brake disc, as indicated by the arrow on the anti-vibration pad.
- Insert the pad fixing pin and the retain spring with its ends facing the bleed screw as shown in the figure.
- Insert the retaining ring on the pin
- Fasten the rear brake caliper to the bracket and tighten the 2 screws at the prescribed torque.



Locking torques (N*m)

Rear brake fixing screws 20 ÷ 25 Nm



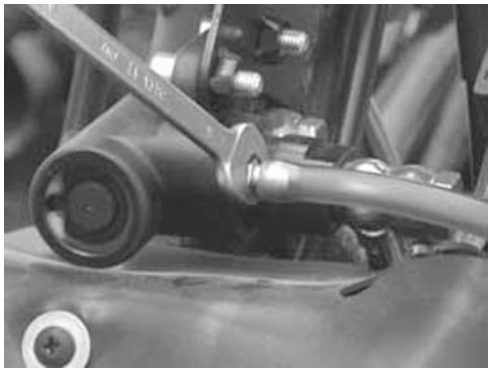
Fill

Rear - combined

To bleed the integral system, start by bleeding the rear brake caliper.

- Remove the rubber cap from the bleeding screw and insert a rubber pipe to recover the brake fluid.

- Move the LH brake lever to load the system and put it under pressure.
- Keep the LH brake lever actuated and loosen the bleeding screw to allow the exit of the inside air. Tighten the bleeding screw



- Then, repeat the bleeding operations for both the adjustment valve and the RH front caliper
- Repeat the operation until only brake fluid comes out of the rubber pipe.

- To access the adjustment valve, remove the front shield
- Restore the brake fluid level in the tank.

N.B.

DURING BLEEDING, AVOID ANY CONTACT BETWEEN THE BRAKE FLUID AND THE BODY TO PREVENT DAMAGES. ALSO, WHILE BLEEDING THE BRAKE CALIPER AVOID ANY CONTACT BETWEEN THE FLUID AND THE BRAKE DISCS OR PADS. FAILURE TO OBSERVE THIS PRECAUTION AFFECTS THE BRAKING SYSTEM PERFORMANCE.

It is possible to bleed by a specific vacuum pump, if required.

Specific tooling

020329Y Pump MITYVAC

Locking torques (N*m)

System bleed pliers union 12 ÷ 16

Front

- Remove the rubber cap from the bleeding screw.
- Insert a rubber pipe in the bleeding screw to allow recovering the brake fluid.

- Move the RH brake lever to load the system and put it under pressure.
- While operating the right lever, loosen the bleeder screw of the left clamp to bleed the air in the system. then tighten the bleeder screw.
- Repeat the operation until only brake fluid comes out of the rubber pipe.
- Remove the fluid recovery pipe and fit the rubber cap on the bleeding screw.

- Restore the brake fluid level in the tank.

N.B.

DURING BLEEDING, AVOID ANY CONTACT BETWEEN THE BRAKE FLUID AND THE BODY TO PREVENT DAMAGES. ALSO, WHILE BLEEDING THE BRAKE CALIPER AVOID ANY CONTACT BETWEEN THE FLUID AND THE BRAKE DISCS OR PADS. FAILURE TO OBSERVE THIS PRECAUTION AFFECTS THE BRAKING SYSTEM PERFORMANCE.

It is possible to bleed by a specific vacuum pump, if required.

Specific tooling

020329Y Pump MITYVAC

Locking torques (N*m)

System bleed pliers union 12 ÷ 16

Brake fluid level check

- Rest the vehicle on a flat ground and on the central stand.
- Remove the brake pump cover as shown in the figure

- Check the fluid level by the portholes on the pumps.

N.B.

THE LEVEL TENDS TO DROP AS THE BRAKE PADS GET WORN, A MINIMUM LEVEL SHOULD NOT BE REACHED. IF THE LEVEL IS TOO LOW, CHECK AND FIX THE SYSTEM SEALS, IF REQUIRED.TOP UP THE PUMP TANK, IF REQUIRED, CONSIDERING THAT THE «MAX» LEVEL MUST ONLY BE OBTAINED WITH NEW PADS.

For re-assembly, perform the operations for removal in the reverse order according to the tightening torques of the tank cover screws.

Top-up

CAUTION

USE ONLY DOT 4 BRAKE FLUID.

Proceed as follows:

- Rest the vehicle on a flat ground and on the central stand.
- Remove the brake pump cover as shown in figure .
- Remove the tank cap by loosening its two screws indicated in figure remove the gasket and top up the level, using only the prescribed fluid without exceeding the maximum level.

CAUTION

KEEP THE BRAKE FLUID AWAY FROM THE SKIN, THE EYES AND CLOTHING. IN CASE OF CONTACT, RINSE GENEROUSLY WITH WATER.

WARNING

THE BRAKING CIRCUIT FLUID HAS A STRONG CORROSIVE POWER: DO NOT LET IT COME INTO CONTACT WITH THE PAINTED PARTS.

Recommended products

TUTELA TOP 4 Brake fluid

Synthetic fluid SAE J1703, NHTSA 116 DOT 4, ISO 4925

Front brake pump

Removal

- Remove the front handlebar cover
- Remove the two screws fixing the brake pump to the handlebar, as shown in the figure.

- Remove the oil piping union from the pump by the screw shown in the figure.
- Remove the connector from the parking light switch

BRAKE PUMP TECHNICAL DATA

Specification	Desc./Quantity
RH pump piston diameter:	Ø 12
LH pump piston diameter:	Ø 14

Refitting

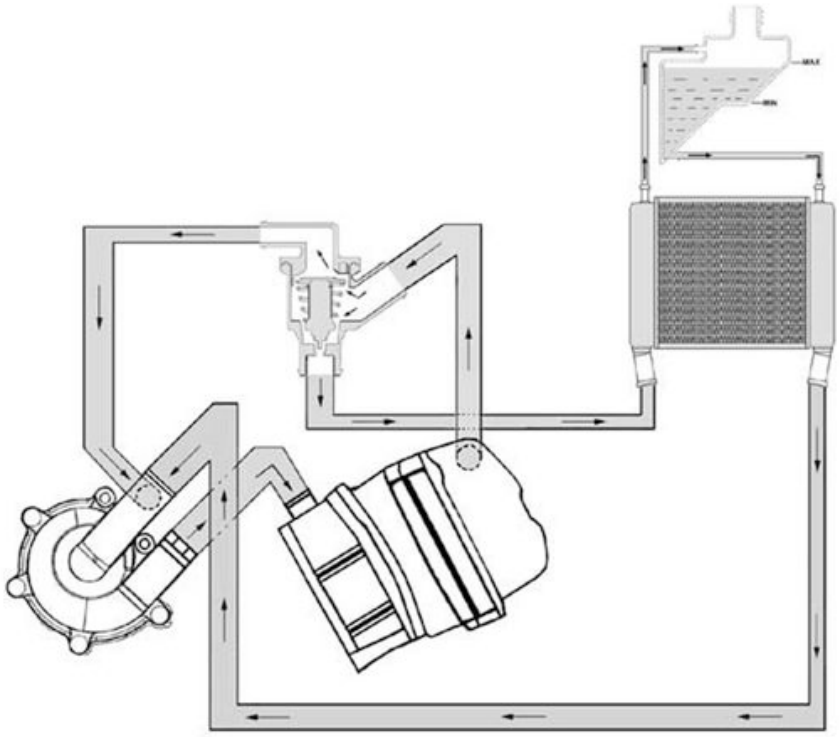
For re-assembly, perform the operations for removal in the reverse order according to the tightening torques.

Locking torques (N*m)

Handlebar to pump 7 ÷ 10 Oil piping union to pump: 20÷25

INDEX OF TOPICS

Circuit diagram



The cooling system is of the forced circulation type, with continuous venting and air pressurisation.

Circulation takes places by a centrifugal pump driven by the countershaft.

The pump delivers the cooling fluid to the thermal unit.

The two-way thermostat support is connected in output to the head. One way is connected to the pump and the other to the radiator (of the horizontal circulation type).

The radiator output is directly connected to the pump.

The expansion tank is connected in parallel to the radiator.

The radiator hot box is connected to the upper side of the expansion tank (in air).

The radiator cold box is connected to the lower side of the expansion tank (in the fluid).

When the engine is cold, the thermostat output to the radiator is closed, even though there is still a little flow for de-aeration obtained by a hole into the closing plate.

In this case, the circulation into the thermal unit is active to ensure an even heating.

Once the working temperature has been reached, the main circulation on radiator and expansion tank starts.

With the small openings in the thermostat there is a flow overlapping (recirculation and main one).

When the temperature is higher, the thermostat allows excluding the recirculation to favour the main circulation.

In this case, the flow is consistent in the expansion tank as well, and this ensures a continuous auto-

matic venting.

For the system venting during the circuit filling step, there is a specific union at the top of the head (see filling rules).

To ensure cooling in case of poor dynamic ventilation, there is an electric fan controlled by the injection system.

TECHNICAL SPECIFICATIONS

Specification	Desc./Quantity
Cooling system capacity	1,7 l
Prescribed fluid	Mixture of 50% water and fluid for sealed circuits (PARAFLU 11 FE)
Sealing pressure	Cap calibrated at 0.9 bar

THERMOSTAT

Specification	Desc./Quantity
Type	Wax, with deviator
Starts opening	82 ± 2°C

ELECTRIC VENTILATION

Specification	Desc./Quantity
Type	With piston
Electric ventilation start	107°C
Electric ventilation end	103°C

WATER PUMP

Specification	Desc./Quantity
Type	Centrifugal
Control	Coaxial at the countershaft

RADIATOR

Specification	Desc./Quantity
Type	Aluminium, with horizontal circulation

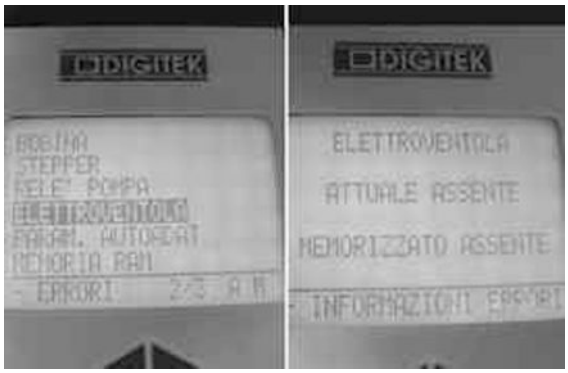
EXPANSION TANK

Specification	Desc./Quantity
Calibration	Automatic venting, in parallel with the radiator

Electric fan check

- Connect the injection diagnostic tester and select the menu on the «ERRORS» function.

- Check any failures in the electric fan control circuit (see "Injection" chapter)



Specific tooling

020460Y Tester and scooter diagnosis

- Select the menu on the «ACTIVE DIAGNOSIS» function and start the electric fan operation simulation (see «Injection» chapter).
- If the electric fan is certainly efficient, check the ventilation start and end temperature.

- Select the menu on the «PARAMETERS» function to display the cooling fluid temperature.
- If non-conforming values are detected, replace the injection controller (see "Injection" chapter).
- If the analogue instrument temperature is close to the red zone, but the degrees indicated by the diagnostic tester is below the electric ventilation temperature, check the temperature sensor on the head and the relevant injection circuit (see Injection chapter);

N.B.

THE ELECTRIC VENTILATION TEMPERATURE AT 106° C CAN ONLY BE MANAGED WITH A SYSTEM SUPPLIED WITH A 50% MIXTURE AND PRESSURISED AT 0.9 BAR.

Characteristic

Electric fan start

106°C

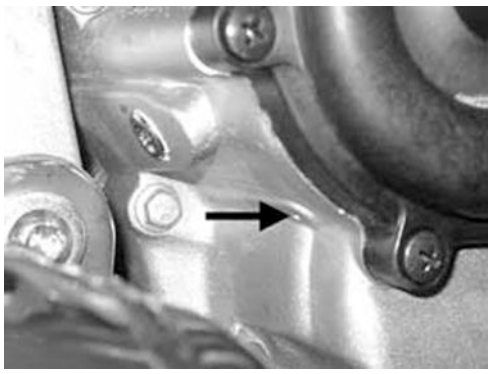
Electric fan stop

98°C

- Avoid starting the engine without pressurisation since it may reach the boiling temperature before the electric ventilation starts.
- In case of increase of the electric ventilation time, check the thermostat opening temperature and check that the cooling fluid density is correct. The optimum density is obtained with a 50% water and cooling circuit fluid mixture.

System sealing check

- Check the proper circuit sealing when it is in pressure and at the temperature.
- For a more accurate check, wait until the system has cooled down since small leaks may not be visible due to evaporation
- The water pump is provided with a drainage hole in case of leaks from the cooling system mechanical seal, or from the shaft sealing oil guard.



- If cooling fluid or oil leaks are detected, inspect the pump (see Flywheel cover chapter).

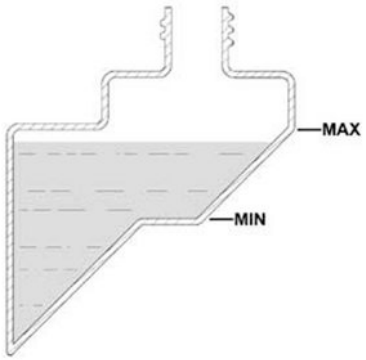
N.B.

DO NOT USE OILS OR GREASES WHILE FIXING THE COOLING SYSTEM. FAILURE TO OBSERVE THIS REGULATION CAN CAUSE IRREVERSIBLE DEFORMATION TO THE SEALING GASKETS.

Coolant replacement

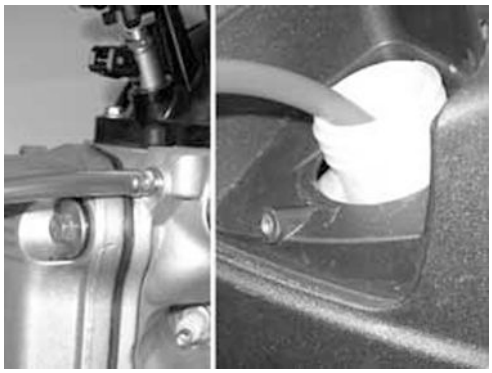
System top-up rules

- Prepare the mixture of 50% water and cooling fluid.
- Fill the system to reach a level ranging between the MIX and MAX levels indicated in the expansion tank filler.
- Do not close the expansion tank with the cap.



- Use a transparent hose to connect the venting union with the expansion tank filler.

- Loosen the vent and start the engine.

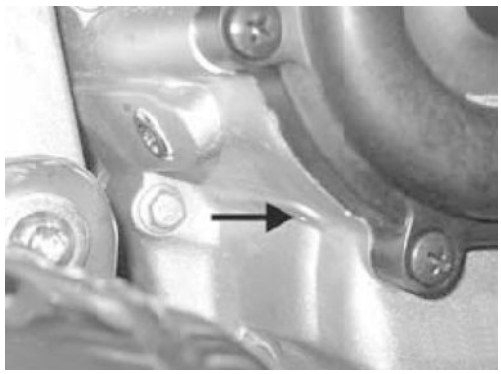


- Keep it open until the air has been fully vented.
- Close the venting screw.
- Stop the engine.
- Restore the level into the expansion tank and tighten the cap.
- Start the engine and let it warm up to reach the electric ventilation temperature.
- Stop the engine.
- Restore the level with cold engine.

CAUTION

ELECTRIC VENTILATION IS CONTROLLED BY THE TEMPERATURE MEASURED AT THE HEAD.
THE ELECTRIC VENTILATION START DOES NOT MEAN THAT THE VENTING HAS BEEN COMPLETED.
VENTING IS COMPLETE WHEN THE EXPANSION TANK TEMPERATURE RISES.

Water pump - overhaul



In case of noise or fluid leaks from the water pump drainage hole, inspect the pump as described in the "Flywheel cover" chapter.
Proceed to carry out a few preliminary operations as described below:

- Rest the vehicle on the central stand and on a flat ground.
- Remove the right footboard as described in the "Body" chapter.
- Remove the silencer to access the flywheel cover, as described in the «Engine» chapter.
- Empty the cooling system, removing

the hoses located on the water pump cover and the loading cap located on the expansion tank.

CAUTION

THIS OPERATION SHOULD BE CARRIED OUT ON COLD ENGINE.

- Remove the water pump cover shown in the figure by loosening the 6 fastening screws.
- Follow the instructions provided in the "Engine" chapter to partly discharge the system and to inspect the pump.
- Once the fault has been fixed and all components have been replaced, fill and drain the system again.

N.B.

TO REPLACE THE COOLING FLUID, SEE THE «COOLING» CHARTER.

Characteristic

Cooling system fluid

~1,7 liter

Water pump ceramic seal

Our Leader, Quasar, and Master liquid cooled engines are equipped with water pumps fitted with the ceramic seal in the subject. Such component must guarantee the seal around the pump shaft. This is achieved via two special ceramics, a static one and a spinning one, kept in contact by the thrust of a spring, coaxially mounted onto the pump shaft. The efficiency of this system is guaranteed by the accurate machining and cleaning of the components as they are fitted; in any case, ceramic seals are subjected to a running in period. During this period (1,000 ± 1,500 Km), there may be small leakages through draining holes, which remain visible on the aluminium crankcase. This phenomenon is particularly visible there where the hole is more exposed (Quasar and Master). In these cases, it is suggested that the crankcase be cleaned and the sealing be checked after 1,500 Km. Following persisting leaks, it is possible to replace the ceramic seal. For these operations, attain to the tools and instructions given in the relevant service station manuals.

Note: The ceramic seal may be overhauled according to the following couplings:

- Coupling "A": seal ring no. 485084 with ceramic seal no. 486216
- Coupling "B": seal ring no. 841329 with ceramic seal no. 841330

The couplings above may be selected according to their availability, as they are interchangeable.

See also

Engine
Flywheel cover

Thermostat

Check

Before proceeding to disassembly, carry out a few checks:

- Connect the diagnostic tester and select the «PARAMETERS» function (see «Injection» chapter);
- Start the cold engine and let it warm up.
- Make sure that there is a sudden increase of temperature.

N.B.

THERE SHOULD BE A SLIGHT AND GRADUAL HEATING CAUSED BY A SMALL PASSAGE ON THE THERMOSTAT TO THE OFF POSITION.

Specific tooling

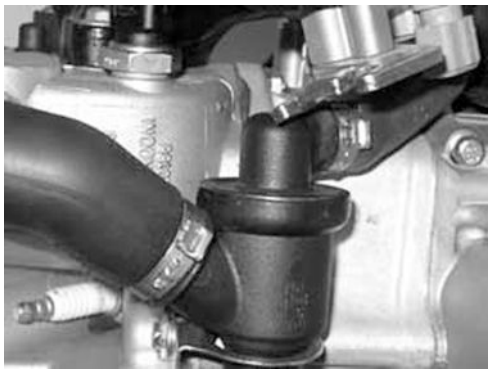
020460Y Tester and scooter diagnosis

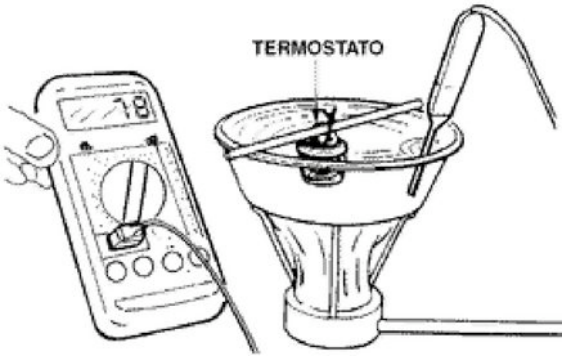
- Check the temperature read by the diagnostic tester.
- If opening occurs at different temperatures, check the thermostat.
- Remove the thermostat as described in the flywheel cover paragraph.

Characteristic

Thermostart opening start

~82±2°C





- Visually check that the thermostat exhibits no mechanical faults.
- Prepare a metal container with ~ 1 litre of water.
- Immerse the thermostat keeping it in the middle of the container.
- Immerse the multimeter thermometer probe close to the thermostat.
- Heat the container by the thermal gun.
- Heat the water and periodically pull the thermostat out until its opening becomes visible.
- Insert a thin copper wire between the seat and the thermostat closing plate.
- Keep the wire into position until locking up is perceived.
- Let water and thermostat cool down.
- Progressively heat the water keeping the thermostat immersed by the wire.
- Check the opening temperature when the thermostat releases from the wire.

Specific tooling

020331Y Digital multimeter

020151Y Air heater "METABO HG 1500/2"

- Heat to obtain the thermostat full opening
- If incorrect values are detected, replace the thermostat.
- Repeat the filling and venting procedure.

N.B.

HEATING SHOULD BE GRADUAL.

N.B.

AVOID CONTACT BETWEEN THERMOSTAT AND CONTAINER FOR A CORRECT TEST PERFORMANCE.

diagnosis

Excessive system pressure

1 - Check the expansion tank cap efficiency.

N.B.

THE CAP IS PROVIDED WITH AN OVERPRESSURE VALVE CALIBRATED AT 0.9 BAR.

There is also a valve that must allow air inlet during the cooling step.

YES go to 2 NO go to 3

2 - Check the head gasket seal (see «Thermal unit and timing system» chapter)

3 - Replace the cap.

Cooling fluid consumption

1 - Check the system outside seals as described above.

YES go to 2 NO go to 3

2 - Check the head gasket seal (see «Thermal unit and timing system» chapter)- If water leaks are detected in the engine oil, inspect the pad on the head cooling circuit.

3 - Fix any damaged seals.

Oil in the fluid

1 - Oil into the cooling fluid.

YES go to 2

2 - Check the head gasket seal (see «Thermal unit and timing system» chapter)

INDEX OF TOPICS

Seat

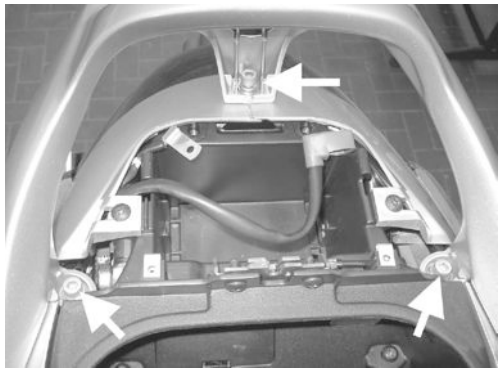
- To remove the saddle, loosen the three screws shown in the figure.

Side fairings

- Remove side bumpers by removing the fixing screws shown in the figure (one on each side).

Rear rack

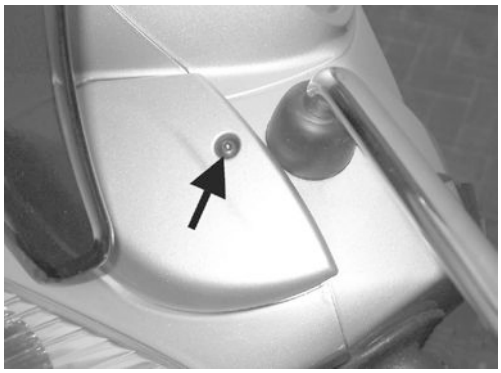
- Loosen the two fixing screws and remove the battery cover.
- Remove the snap-on plastic cover from the carrier.
- Loosen the three Allen screws shown in the figure and remove the carrier.



Rear handlebar cover

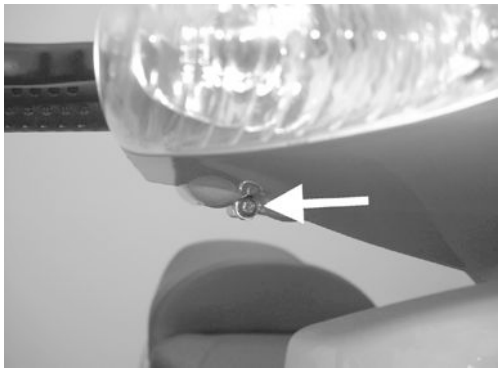
- Remove the brake tank covers by the screw shown in the figure.

- Remove the rear-view mirrors and the windscreen.

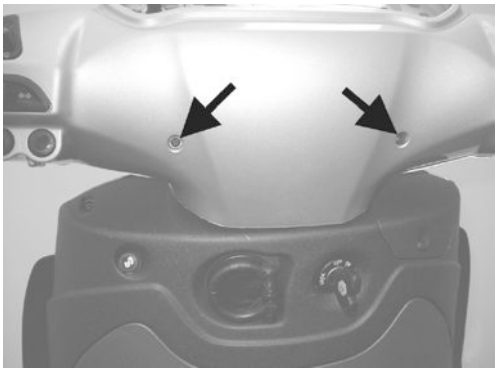


- Remove the upper coupling screws.

- Remove the two lower fixing screws.

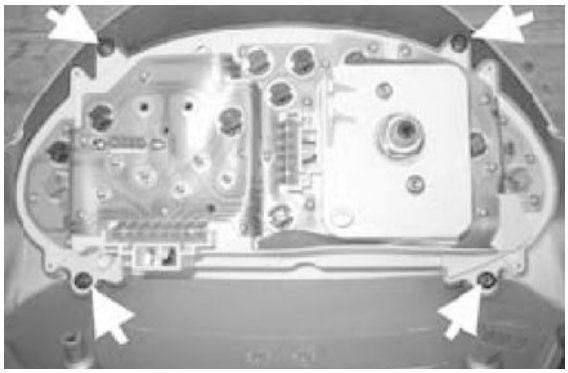


- Remove the two rear handlebar cover screws.
- Disconnect the electric wiring and remove the rear handlebar cover with instrument unit.



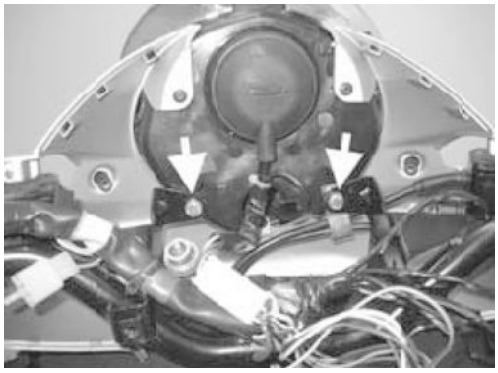
Instrument panel

- Remove the rear handlebar cover.
- Unscrew the four screws shown in the figure to separate the rear handlebar cover from the instrument unit.



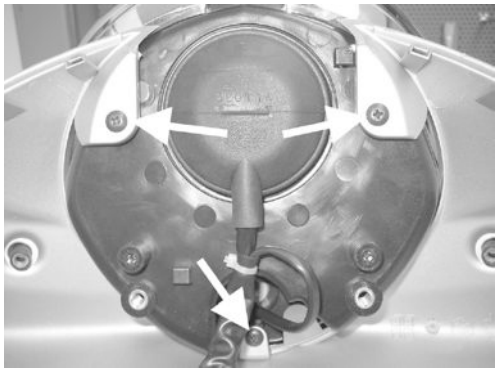
Front handlebar cover

- Remove the rear handlebar cover.
- Unscrew the two fixing screws shown in the figure and remove the front handlebar cover with headlight.



Headlight assy.

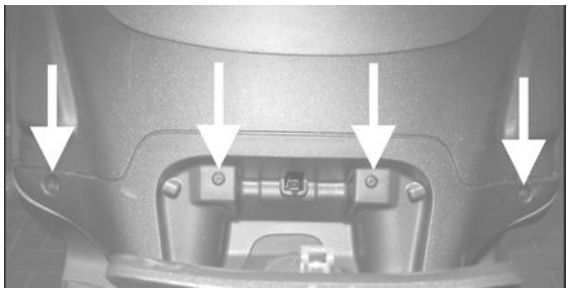
- Remove the front handlebar cover.
- Unscrew the three fixing screws shown in the figure to separate the headlight from the front handlebar cover.



Frame central cover

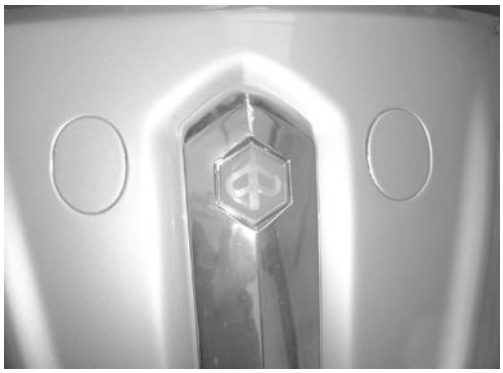
- Open the fuel tank access port.
- Loosen the 4 screws shown in the figure.
- Temporarily remove the fuel tank cap and the underlying rubber mat.

- Remove the chassis central cover by sliding it from the rear side of the vehicle and disconnecting it from the door opening transmission.

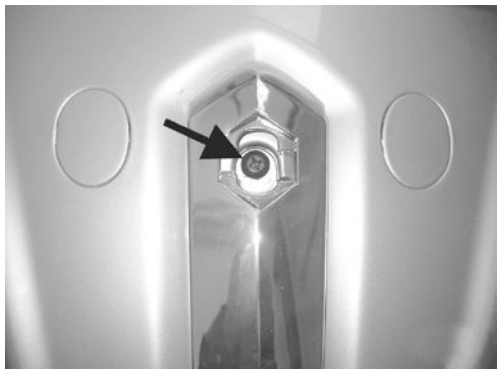


Legshield

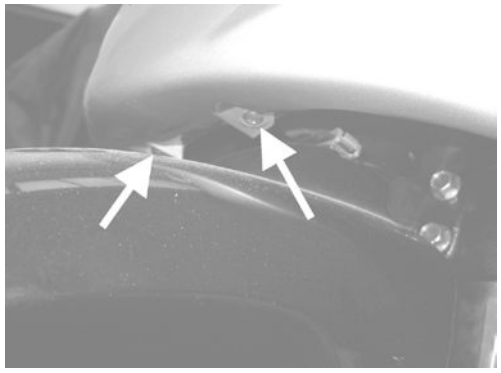
- Remove the Piaggio logo by a screwdriver carefully, without damaging the front shield.



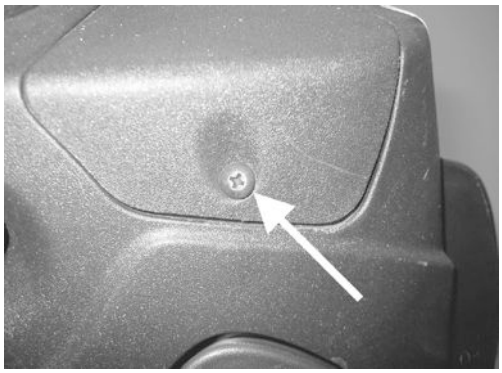
- Remove the screw shown in the figure.



- Remove the two lower fixing screws shown in the figure.



- Remove the expansion tank access port.

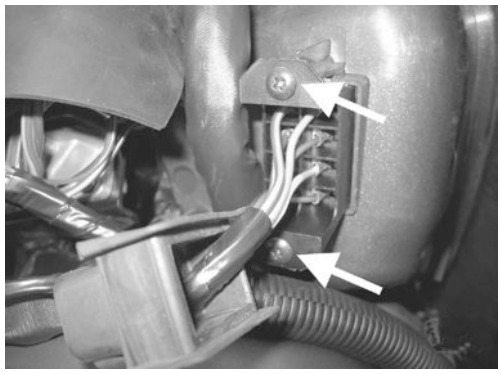


- Remove the fixing screw shown in the figure.

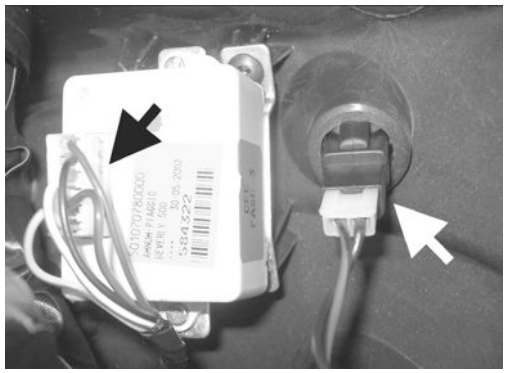
- Remove the central cover.
- Remove the two lower attachments shown in the figure.
- Remove the complete front shield.

Knee-guard

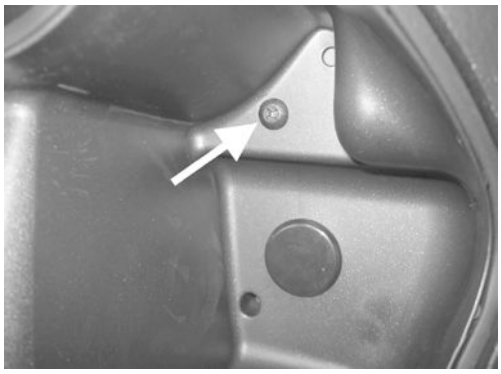
- Remove the front shield.
- Disengage the fuse holder rubber cap and loosen the two screws shown in the figure to remove the fuse holder.



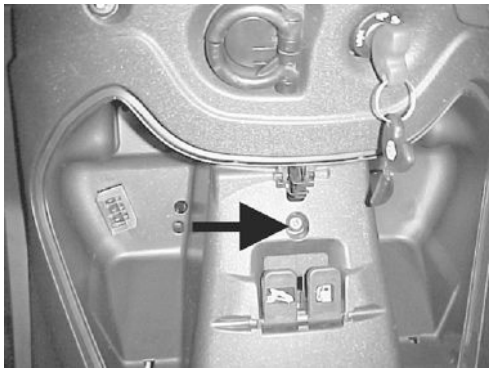
- Disconnect the connectors of the saddle opening button and of the fuel level damper device.



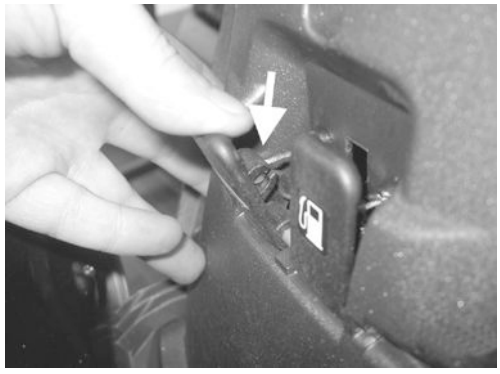
- Remove the expansion tank fixing screw located into the trunk.



- Remove the central fixing screw of the counter-shield.



- Remove the two transmissions (saddle opening and fuel port opening) from the relevant lever.

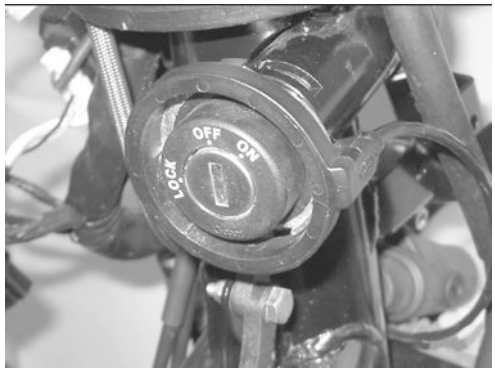


- Remove the rubber gasket and cap of the expansion tank filler.

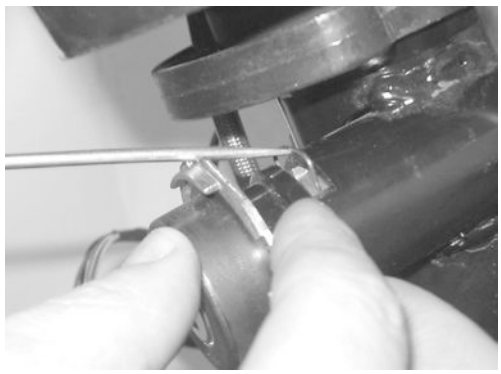
- Remove the counter-shields and disengage the expansion tank filler from the hole on the counter-shield.
- Remove the counter-shield.

Removing the ignition key-switch when on *off*

- Remove the rear shield.
- Remove the immobilizer antenna shown in the figure.



- Slightly push the cylinder and extract the stop from the threading shown in the figure.
- Pull out the cylinder fitted with lock body.



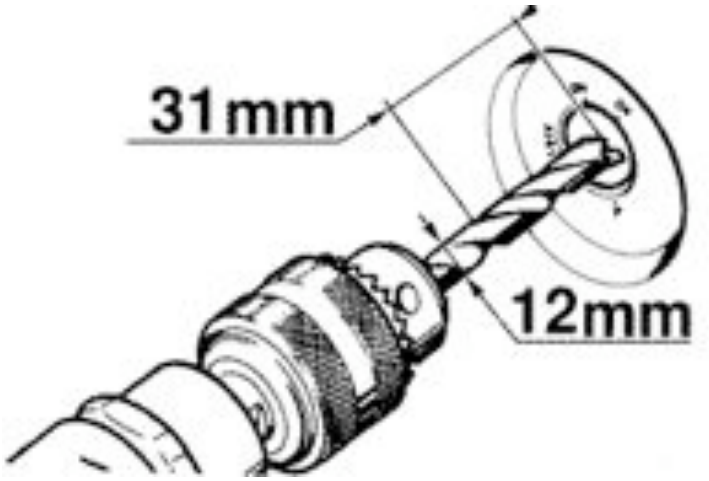
- To reinstall, introduce the clip into the RH hole.
- Insert the cylinder and the lock body and move the locking clip in abutment using a wrench.

Removing the ignition key-switch when on *lock*

In «**Lock**» and «**ON**» position, the cylinder locking clip cannot be accessed. Drill the clip as shown in the figure to eject the lock cylinder.

N.B.

FOR RE-ASSEMBLY FROM THIS POSITION, RELEASE THE STEERING WHEEL AND SET THE LOCK BODY (INSIDE AND OUTSIDE PART) TO "OFF". THEN, PROCEED AS DESCRIBED IN PARAGRAPH RE-MOVAL, LOCK IN OFF POSITION.



See also

Removing the ignition key-switch when on *off*

Taillight assy.

- Remove the two side bumpers.
- Remove the two side fixing screws of the light group shown in the figure.

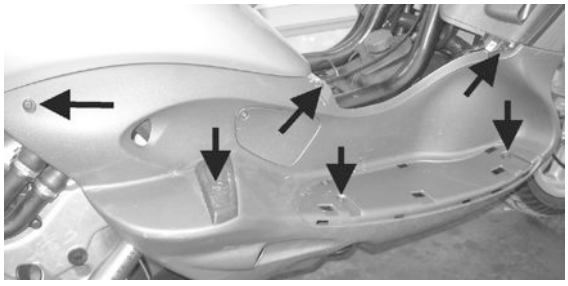
- Remove the plastic cover of the rear trunk rack by removing the two side screws from the lower side of the rack.

- Remove the upper fixing screw through the special hole on the trunk rack.

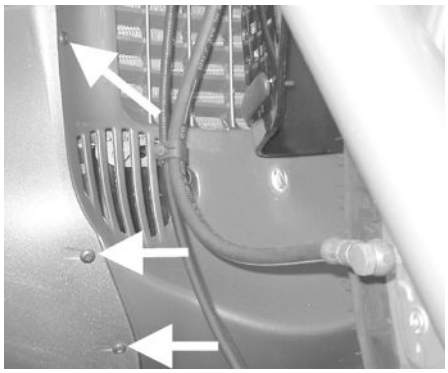
- Remove the rear light group and disconnect the electric connector.

Footrest

- Remove the central cover.
- Remove the six screws shown in the figure.



- Remove the three attachments shown in the figure.



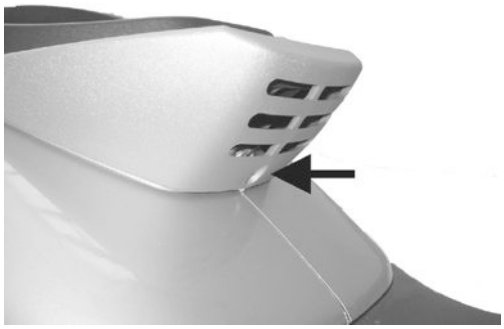
- Remove the diagnostics socket (RH footboard only) from the side engine inspection port

and remove the complete footboard.

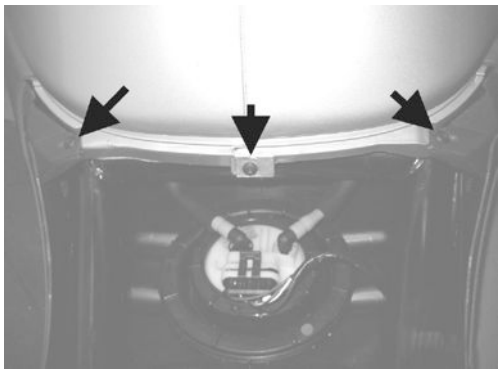
Side fairings

Remove the saddle.

- Remove the under-saddle cover by loosening the fixing screw shown in the figure.
- Remove the central cover.
- Remove the rear light group. - Remove the rear trunk rack.

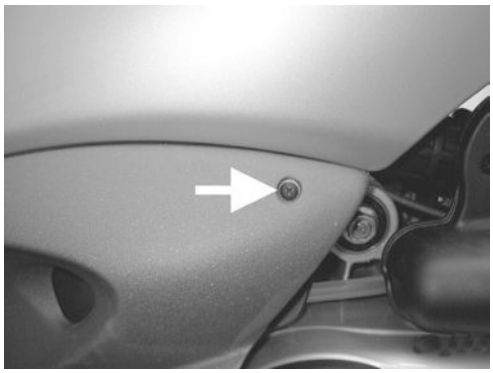


- Remove the three front side fixing screws shown in the figure.

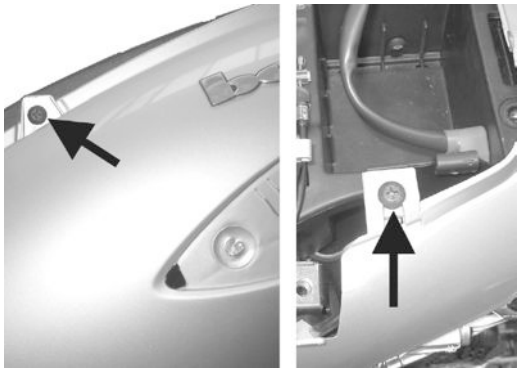


- Remove the rear side fixing screw shown in the figure.

- Remove the screw shown in the figure.



- Remove the two side fixing screws shown in the figure.



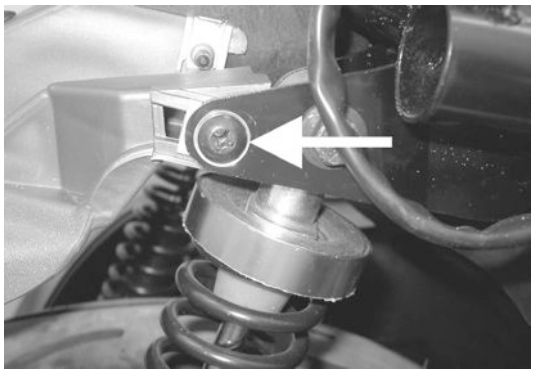
CAUTION

THE TWO SCREWS SHOWN IN THE FIGURE HAVE DIFFERENT LENGTH.
USE THE SHORTER SCREW FOR SIDE FIXING SINCE THE LONGER ONE WOULD DAMAGE THE UNDER-SADDLE COMPARTMENT INSIDE WALL.

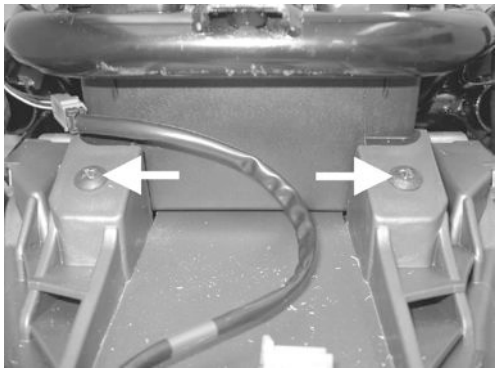
- Remove the plastic parts of the footboards and the sides.

License plate holder

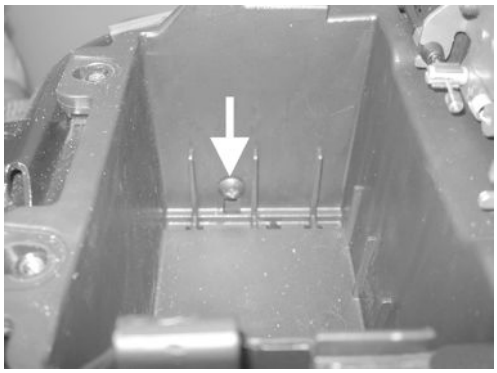
- Remove the sides.
- Remove the side attachments of the number plate holder highlighted in the figure.



- Remove the two upper attachments highlighted in the figure.



- Remove the two attachments inside the battery compartment.
- Disconnect the wiring.
- Remove the complete number plate holder support.

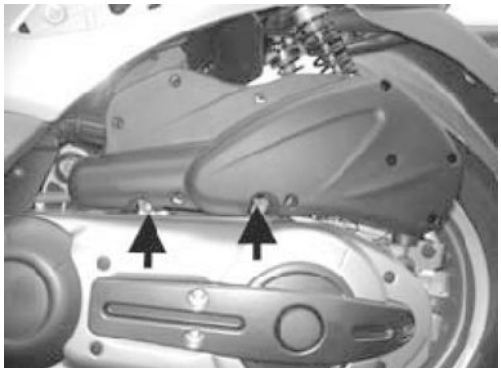


Air filter

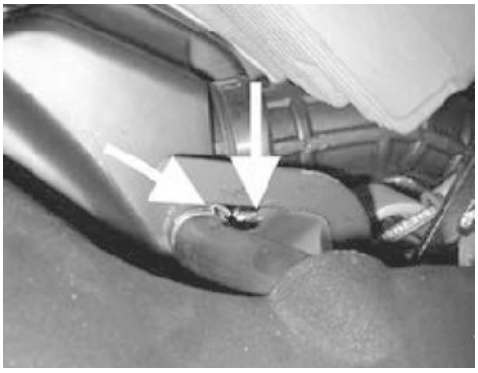
- Remove the two fixing screws shown in the figure.

CAUTION

UPON RE-ASSEMBLY, THE SHORTER SCREW MUST BE INSERTED INTO THE REAR SIDE.

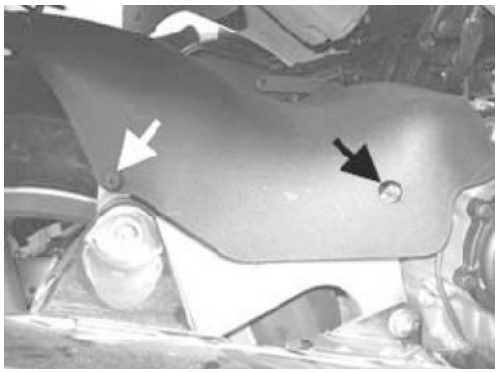


- Remove the blow-by and condensate exhaust pipe cap.
- Loosen the intake hose screw band.
- Loosen the blow-by pipe band.
- Pull out the complete air filter box.



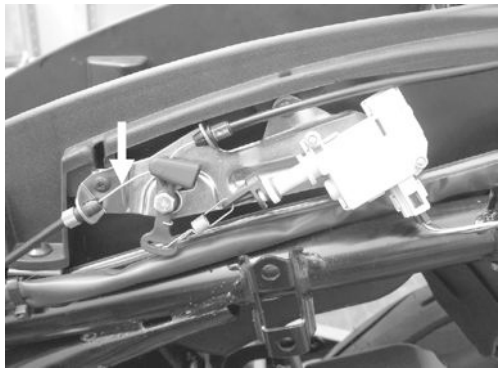
Rear mudguard

- Remove the air filter box.
- Disconnect the rear brake pipe retain strap.
- Remove the two attachments shown in the figure.
- Remove the mudguard from the vehicle right side.

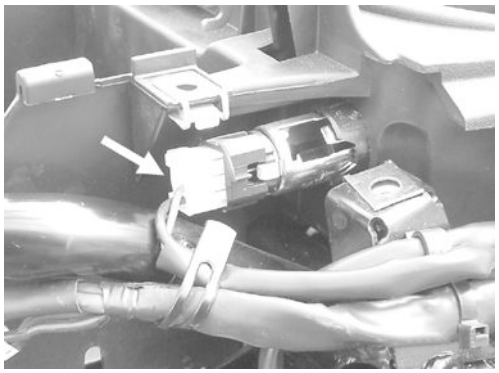


Helmet bay

- Remove the sides.
- Remove the number plate holder support.
- Remove the primary saddle opening transmission.
- Remove the glass bowl.
- Remove the saddle light button connections.

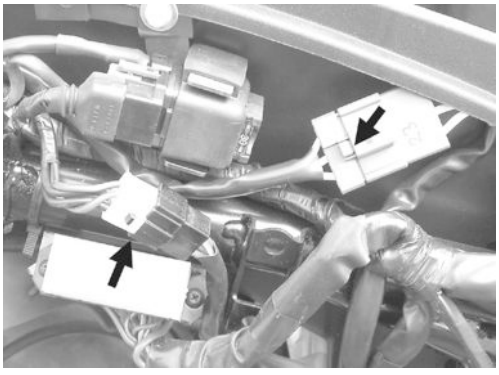


- Remove the current socket connection.
- Remove the start-up remote control switch fixing screw.



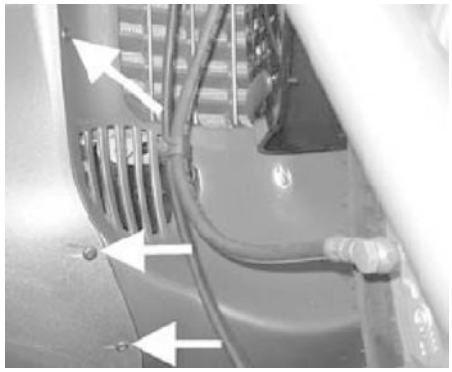
- Disconnect the two connectors (alternated and direct three-phase) of the voltage regulator, remove the chassis / system strap and the cable stop on the three-phase.

Through the six attachments, remove the helmet compartment with voltage regulator.



spoiler

- Pull out the front fork with wheel and mudguard.
- Remove the attachments between board and footboard shown in the figure.



- Remove the upper screw and the two spoiler fixing lower screws.

Fuel tank

- Remove the front shield.
- Remove the footboard.
- Remove the upper and the two lower attachments of the spoiler.

N.B.

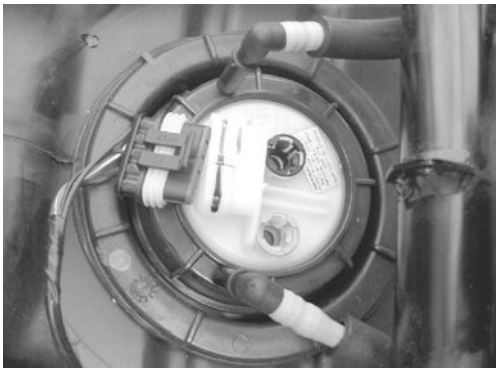
THIS OPERATION IS PREFERBLY TO BE CARRIED WITH THE FUEL TANK EMPTY.

- Protect mudguard and radiator to prevent scratches and/or damages, then mover the spoiler towards the mudguard and turn the steering wheel fully rightwards or leftwards to access the part under the tank.

- Disconnect the electric connection on the pump and the fuel delivery and inlet piping.

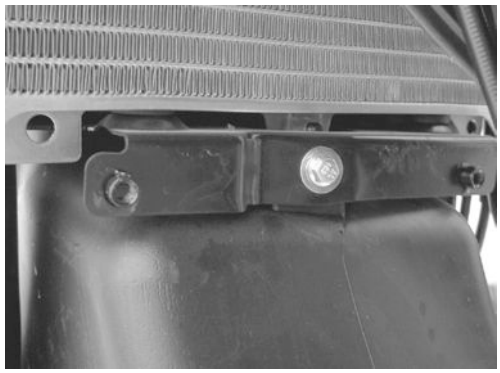
N.B.

BE VERY CAREFUL WHEN PULLING OUT THE CARBURETTOR PIPING SINCE AN EXCESSIVE FORCE MAY DAMAGE THE PLASTIC INSERTS ON THE PUMP BODY. UPON RE-ASSEMBLY, IT IS THEREFORE NECESSARY TO SLIGHTLY PRESS THE PIPING AND THE RETAIN RIM TOWARDS THE PUMP, THEN KEEP THE RIM PRESSED AND PULL THE UNION UPWARDS.



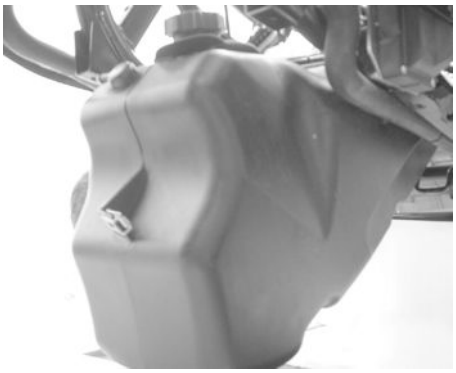
- Remove the two lower chassis cross-members: for the front one, which is fixed by 4 screws, it is necessary to release the cooling fluid delivery and return pipes from the bands placed on the cross-member; the rear one is provided with two attachments only.

- Remove the front screw.



- Remove the rear attachment.

- Move the tank backward and pull out the front side downwards, then release the rear side.



For re-assembly, perform the operations in the reverse order according to the following tightening torques:

Locking torques (N*m)

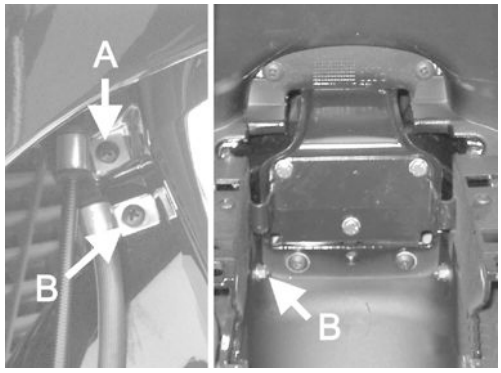
Chassis cross-member lower screws 16 ? Chassis front cross-member upper screws: 6 ÷ 10,5 N·m

Rear central cover

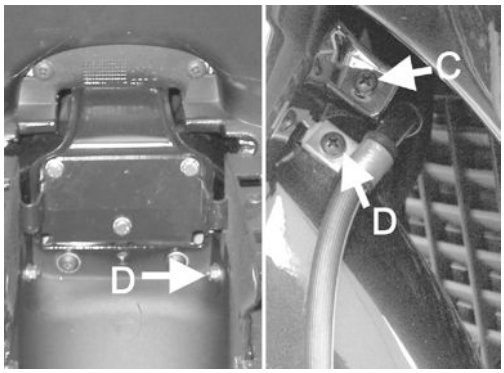
- Remove the saddle.
- Remove the 2 fixing screws shown in the figure.

Front mudguard

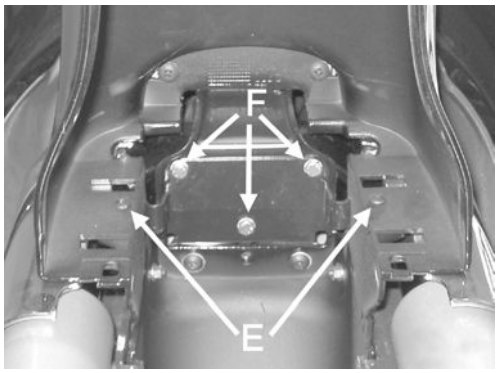
- Remove the front wheel.
- Remove the attachment «A» of the odometer transmission to the mudguard and of the right fork leg cover.
- Remove the attachment «B» of the front right brake piping.



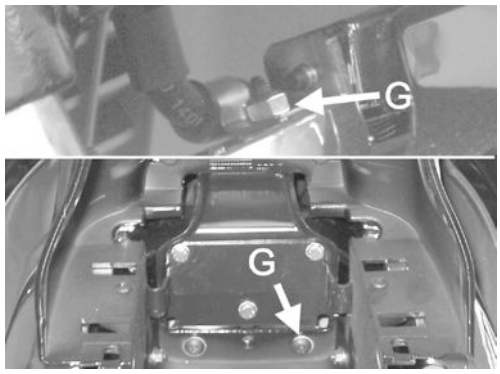
- Remove the attachment «C» of the left fork leg cover.
- Remove the attachment «D» of the front left brake piping.



- Remove the two lower attachments «E» of the fork leg covers.
- Remove the three attachments «F».

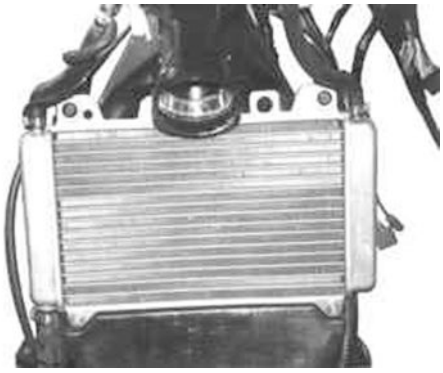


- Lower the mudguard and remove the attachment «G» of the front left brake piping.
- Remove the mudguard with plate.



Radiator fan

- Remove the front wheel housing.
- Prepare a container for the coolant.
- Remove the expansion tank outlet and return pipes.
- Remove the coolant supply and return pipes from the radiator.
- Loosen the screw fixing the radiator to the frame.
- Disengage the radiator and the electric fan.



See also

Front wheel housing

INDEX OF TOPICS

Carry out the listed tests before delivering the vehicle.

WARNING

BE VERY CAREFUL WHEN HANDLING FUEL.

Aesthetic inspection

Predelivery checks:

- Paintwork
- Mating of plastics
- Scratches
- Dirt

Tightening torques inspection

Check locking devices

- Safety locks

SAFETY LOCKS:

Name	Torque in Nm
Shock absorber set screws behind the frame	38 ÷ 46
Side stand nut	45 ÷ 50
Rear wheel axle	104 ÷ 126
Rear brake disc set screw	11 ÷ 13
Engine - frame pin	100 ÷ 120
Screw securing handlebar to steering tube	45 ÷ 50
Steering wheel upper ring nut:	36 ÷ 39
Steering lower ring nut	10 ÷ 13 **

*** tighten and loosen by 90°*

- Cover set screws

Electrical system

Electric System:

- Master switch
- Headlights: upper beams, dipped beams, side/taillights (front and rear) and relevant light indicators
- Headlight setting according to the regulations in force
- Front and rear brake light buttons and relevant lamp

- Direction indicators and relevant lights
- Instrument panel lights
- Instruments. fuel and temperature indicator
- Instrument unit indicator lights
- Horn
- Electric start-up
- Engine stop by emergency stop switch and side stand
- Saddle electric opening button

CAUTION

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

CAUTION

WHEN INSTALLING THE BATTERY, CONNECT THE POSITIVE CABLE BEFORE CONNECTING THE NEGATIVE ONE, AND PERFORM THE REVERSE OPERATION UPON REMOVAL.

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AND CAUSES SEVERE BURNS AS IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH THE EYES, THE SKIN AND CLOTHING.
IN CASE OF CONTACT WITH THE EYES OR THE SKIN, RINSE GENEROUSLY WITH WATER FOR ABOUT 15 MINUTES AND IMMEDIATELY SEEK MEDICAL ATTENTION.
IN CASE OF INGESTION, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. IMMEDIATELY SEEK MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES. KEEP THEM AWAY FROM OPEN FLAMES, SPARKS AND CIGARETTES. IF THE BATTERY IS CHARGED IN A CLOSED PLACE, TAKE CARE TO ENSURE ADEQUATE VENTILATION. ALWAYS PROTECT THE EYES WHEN WORKING CLOSE TO BATTERIES.
KEEP OUT OF REACH OF CHILDREN

CAUTION

NEVER USE FUSES HAVING A CAPACITY GREATER THAN THE RECOMMENDED VALUE. THE USE OF A FUSE OF UNSUITABLE CAPACITY MAY RESULT IN SERIOUS DAMAGES TO THE WHOLE VEHICLE OR EVEN CULMINATE IN A FIRE.

Levels check

Level check:

Fuel level in the tank.

Hydraulic braking system fluid level

Rear hub oil level

Engine oil level

Engine coolant level

Road test

Road test:

- Cold starting
- Operation of instruments
- Operation of throttle control
- Stability during acceleration and braking
- Operation of front and rear brakes
- Operation of front and rear suspensions
- Abnormal noise from vehicle

Static test

Static test after road test:

- Restarting when warmed up

Starter operation

Minimum hold (turning the handlebar)

- Uniform rotation of the steering wheel
- Any leaks
- Operation of the radiator electric fan

Functional inspection

Operating test:

- Hydraulic brake system
- Lever travel
- Clutch - check correct operation
- Engine - Check correct general operation and make sure there is no unusual noise
- Other
- Check documents:

Check chassis n° and engine n°.

- Check tool kit
- License plate assembly
- Check locks
- Check tire pressure
- Check assembly of mirrors and other accessories

CAUTION

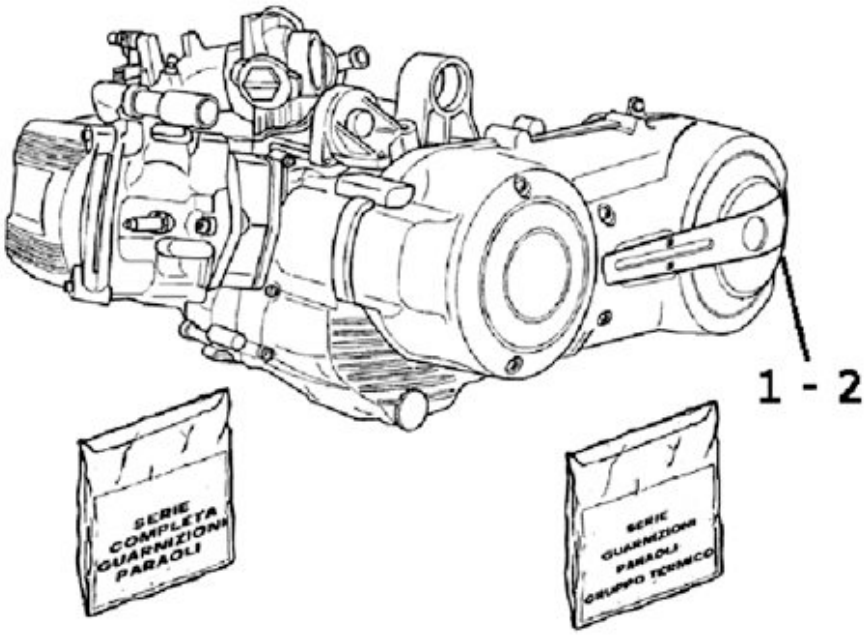
NOT EXCEED THE RECOMMENDED INFLATING PRESSURES AS THE TYRES MAY BURST.

CAUTION

CHECK THE INFLATING PRESSURES WHEN THE TYRES ARE AT AMBIENT TEMPERATURE.

INDEX OF TOPICS

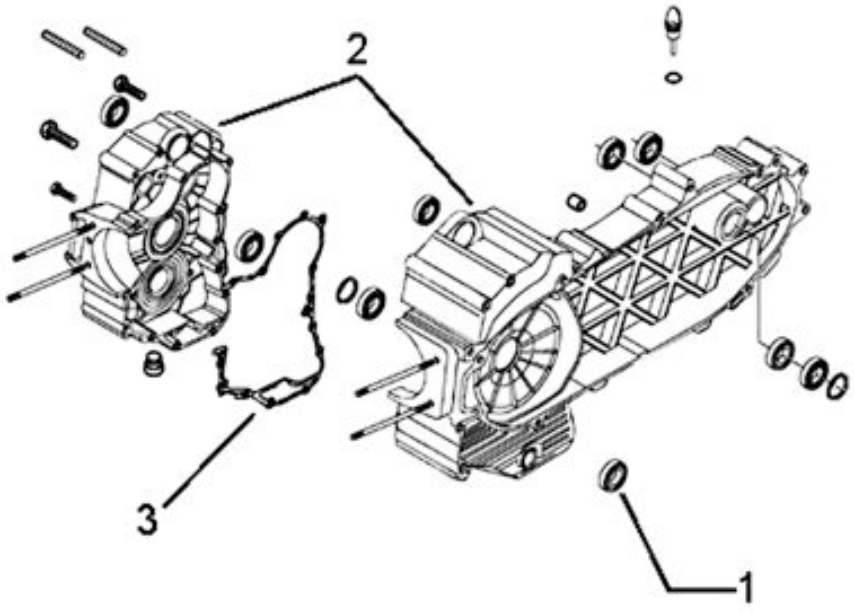
Engine



ENGINE

	Code	Action	Duration
1	001001	Engine from chassis - Removal and reinstallation	
2	003057	Engine attachment - Nuts tightening	

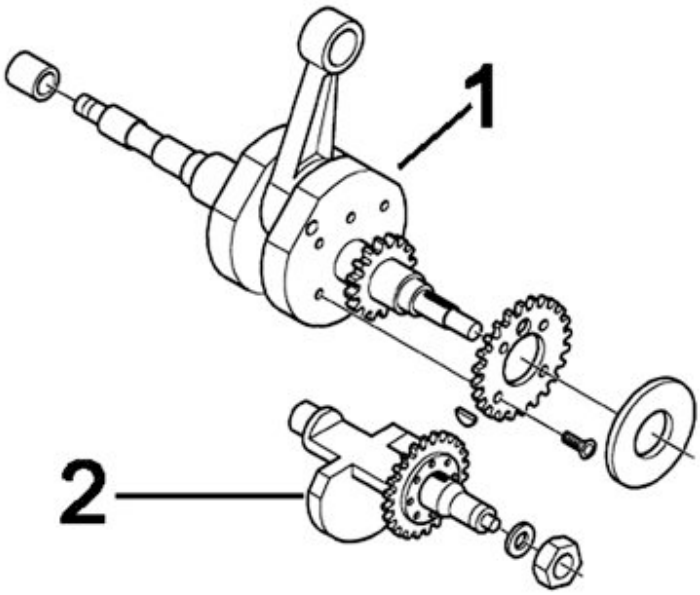
Crankcase



CRANKCASE

	Code	Action	Duration
1	001100	Oil seal, clutch side - Replacement	
2	001133	Engine crankcase - Replacement	
3	001153	Half crankcase gasket - Replacement	

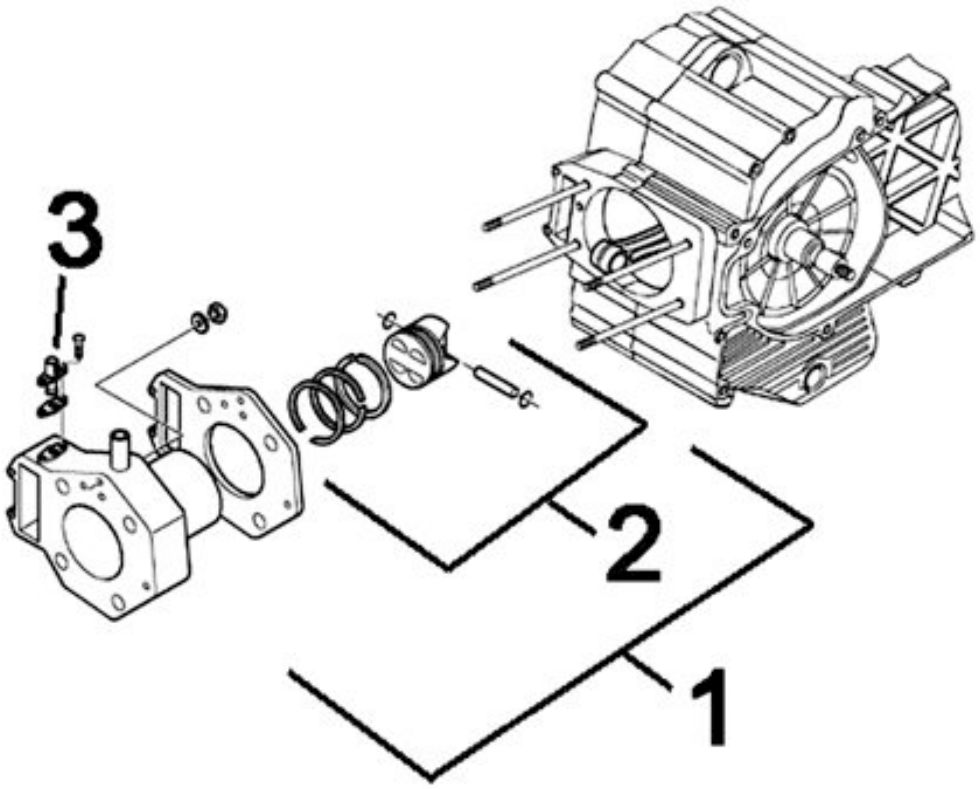
Crankshaft



CRANKSHAFT

	Code	Action	Duration
1	001117	Driving shaft - Replacement	
2	001098	Countershaft - Replacement	

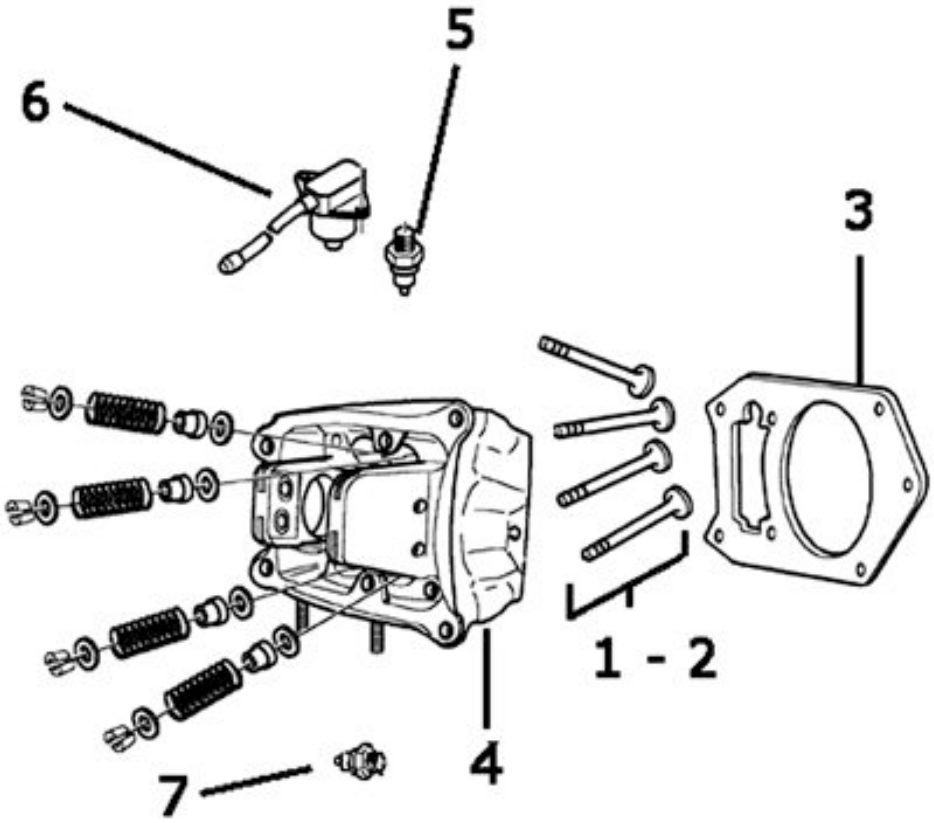
Cylinder assy.



CYLINDER ASSY.

	Code	Action	Duration
1	001002	Cylinder / Piston - Replacement	
2	001154	Pin ring piston unit - Overhaul	
3	001129	Chain tightener - Replacement	

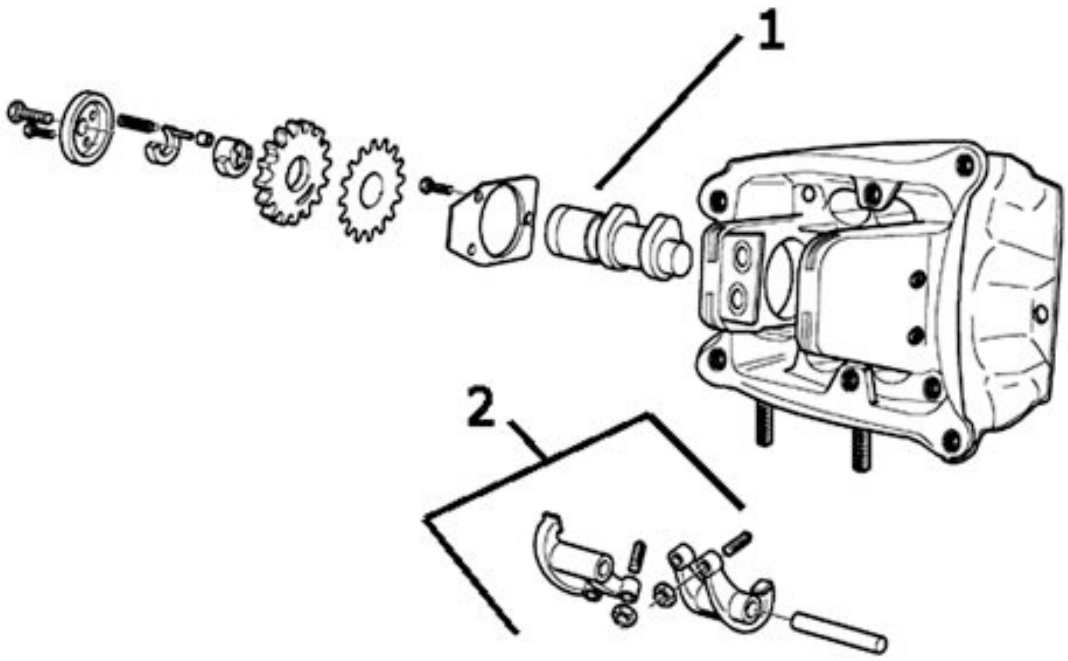
Cylinder head assy.



HEAD UNIT

	Code	Action	Duration
1	001045	Valves - Replacement	
2	001049	Valves - Adjustment	
3	001056	Head gasket - Replacement	
4	001126	Head - Replacement	
5	005081	Temperature sensor - Replacement	
6	005116	Stroke revolution sensor - Replacement	
7	007012	Coolant bleed valve - replacement	

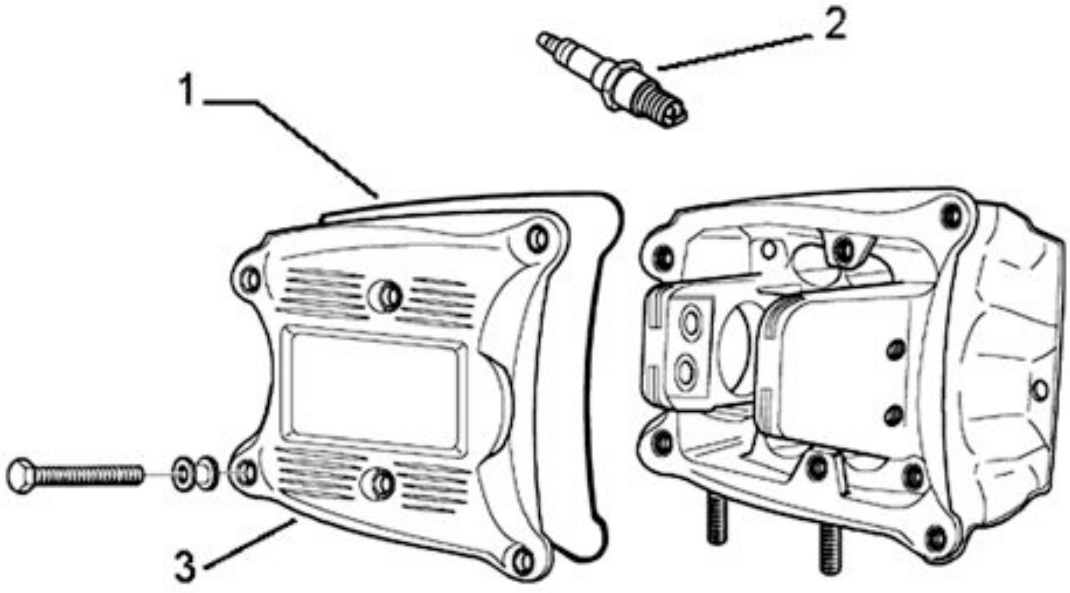
Rocker arms support assy.



ROCKER ARMS SUPPORT ASSY.

	Code	Action	Duration
1	001044	Camshaft - Replacement	
2	001148	Valve rockers - Replacement	

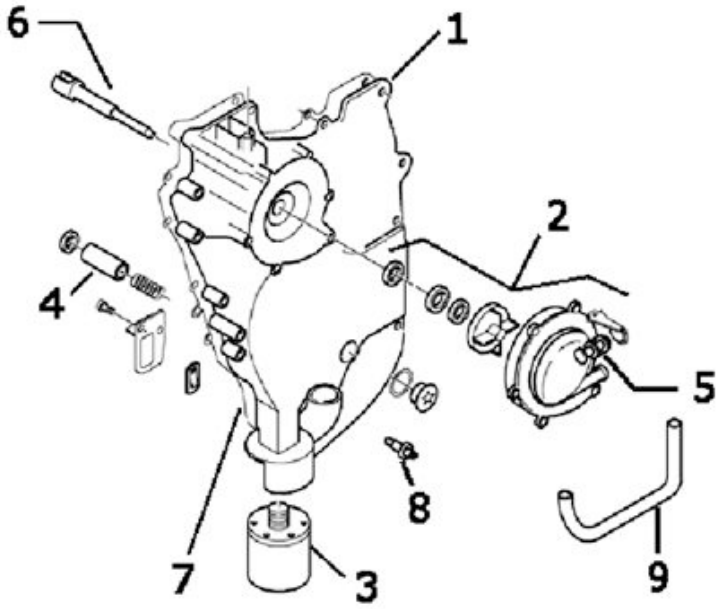
Cylinder head cover



CYLINDER HEAD COVER

	Code	Action	Duration
1	001089	Head cover - Replacement	
2	001093	Spark plug - Replacement	
3	001088	Head cover gasket - Replacement	

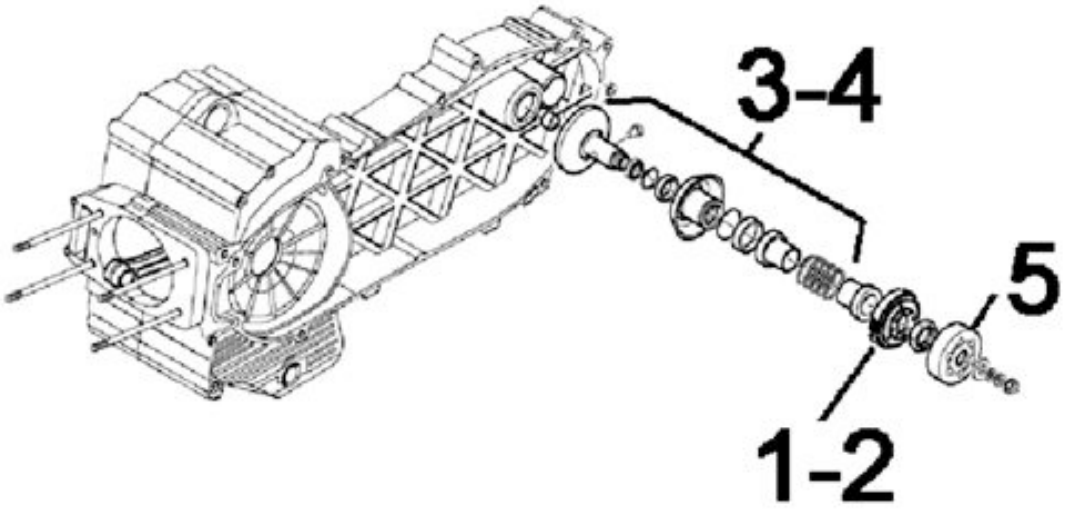
Flywheel cover



FLYWHEEL COVER

	Code	Action	Duration
1	001087	Flywheel cover - Replacement	
2	001113	Water pump - Replacement	
3	001123	Oil filter - Replacement	
4	001124	By-pass valve - Replacement	
5	001057	Thermostat - Replacement	
6	001062	Water pump control shaft - Replacement	
7	001150	Flywheel cover gasket - Replacement	
8	001160	Minimum oil pressure sensor -Replacement	
9	007011	By-pass - thermostat - drain valve bellow - Replacement	

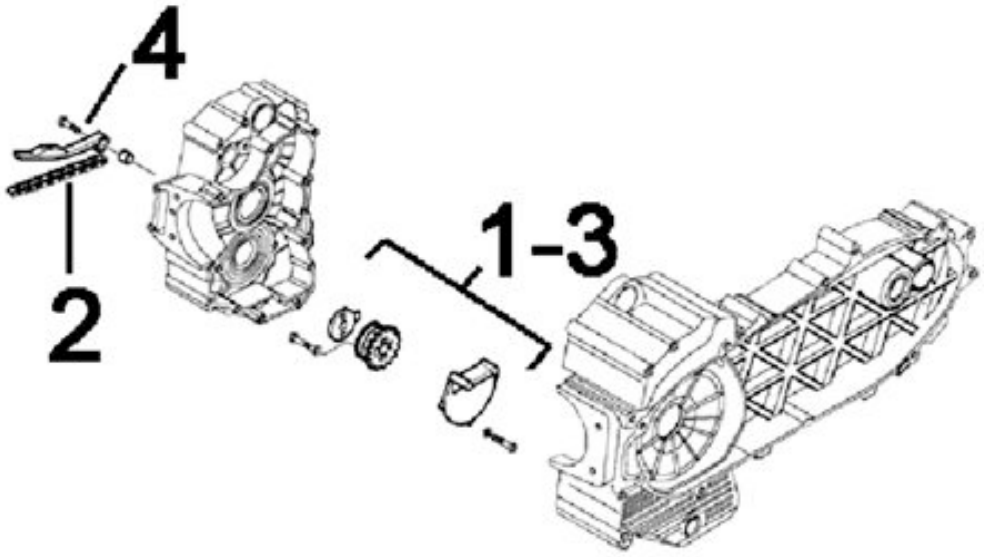
Driven pulley



DRIVEN PULLEY

	Code	Action	Duration
1	001022	Clutch - Replacement	
2	003072	Clutch assembly - Wear check	
3	001012	Driven pulley - Overhaul	
4	001110	Driven pulley - Replacement	
5	001155	Clutch bell housing - Replacement	

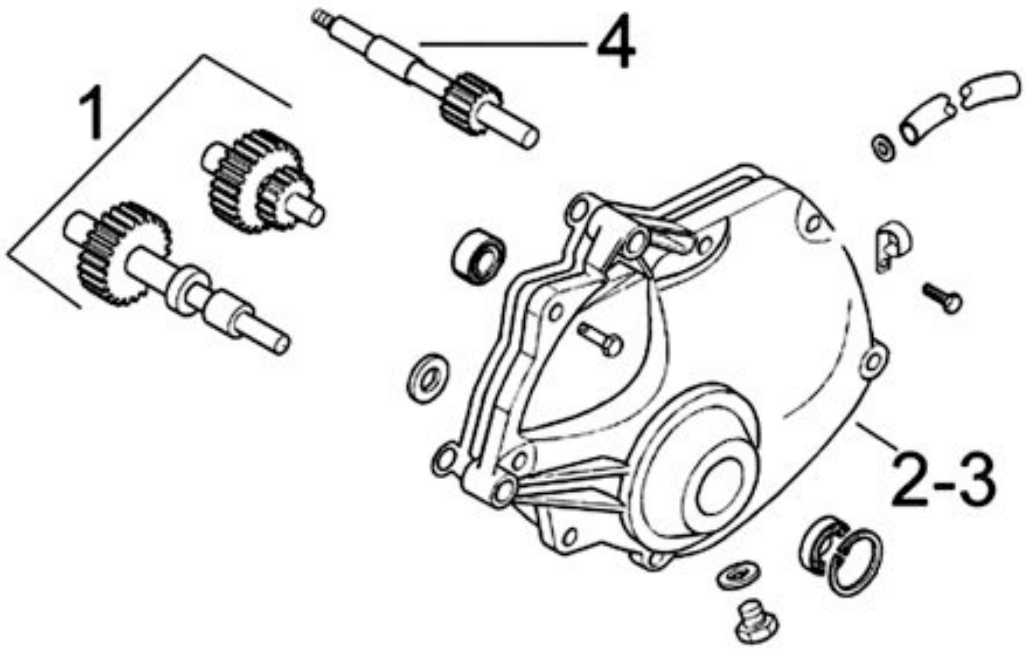
Oil pump



OIL PUMP

	Code	Action	Duration
1	001042	Oil pump - Overhaul	
2	001051	Belt/Timing chain - Replacement	
3	001112	Oil pump - Replacement	
4	001125	Chain guide pads - Replacement	

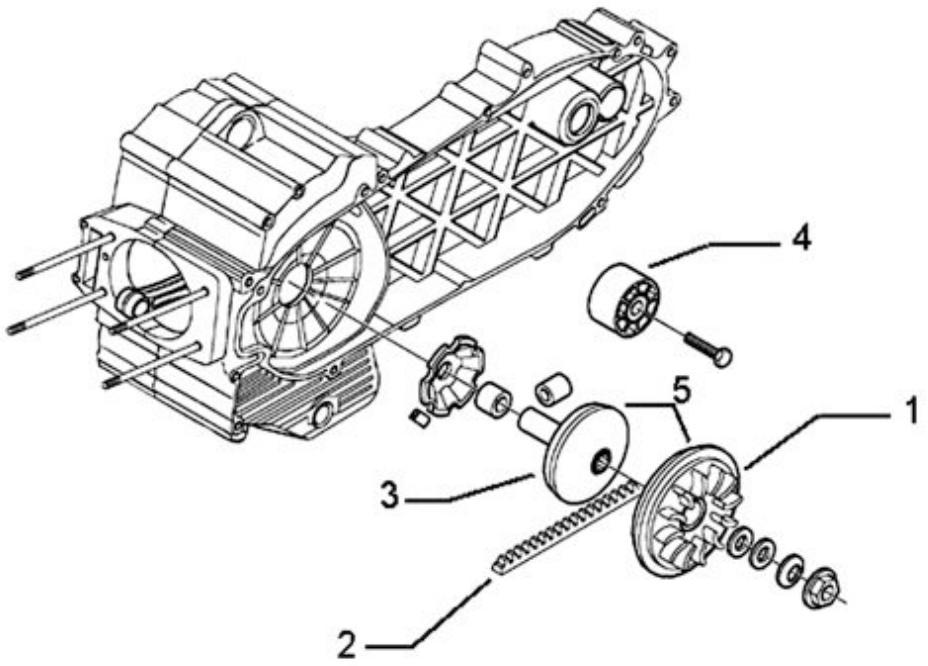
Final gear assy.



FINAL GEAR ASSY.

	Code	Action	Duration
1	001010	Geared reduction unit - Overhaul	
2	001156	Geared reduction unit cover - Replacement	
3	003065	Gear box oil - Renewal	
4	004125	Rear wheel axle - Replacement	

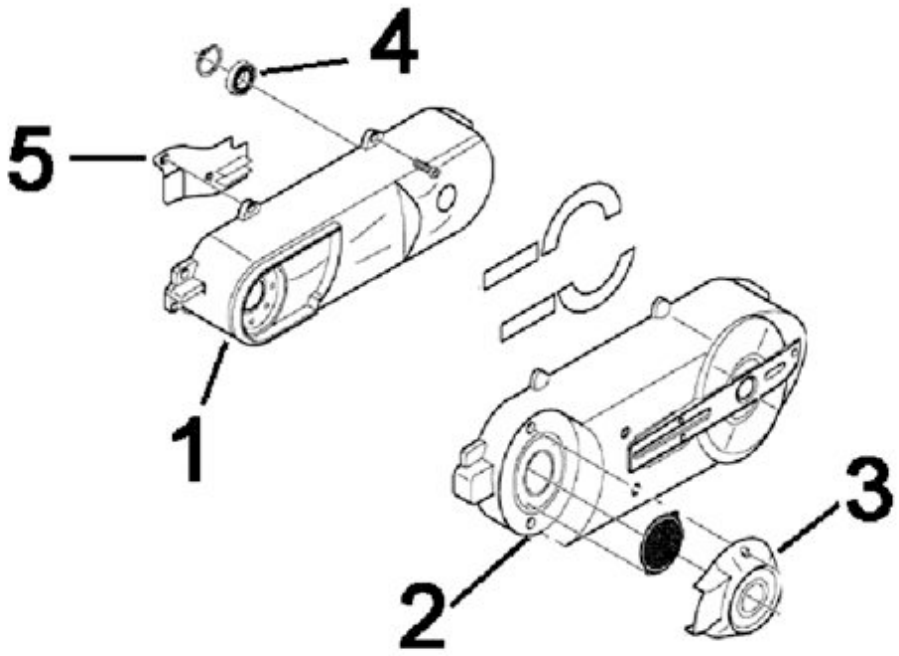
Driving pulley



DRIVING PULLEY

	Code	Action	Duration
1	001086	Driving half-pulley - Replacement	
2	001011	Driving belt - Replacement	
3	001006	Driving pulley - Overhaul	
4	001141	Belt anti-flapping roller - Replacement	
5	001066	Driving pulley - Replacement	

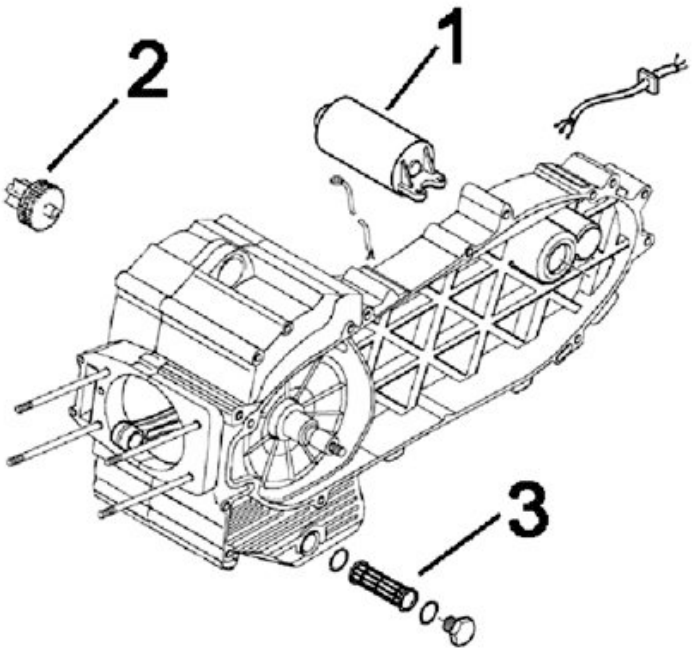
Transmission cover



TRANSMISSION COVER

	Code	Action	Duration
1	001065	Transmission cover - Replacement	
2	001096	Transmission crankcase cover - Replacement	
3	001131	Transmission air intake - Replacement	
4	001135	Transmission cover bearing - Replacement	
5	001170	Cooling air duct - Replacement	

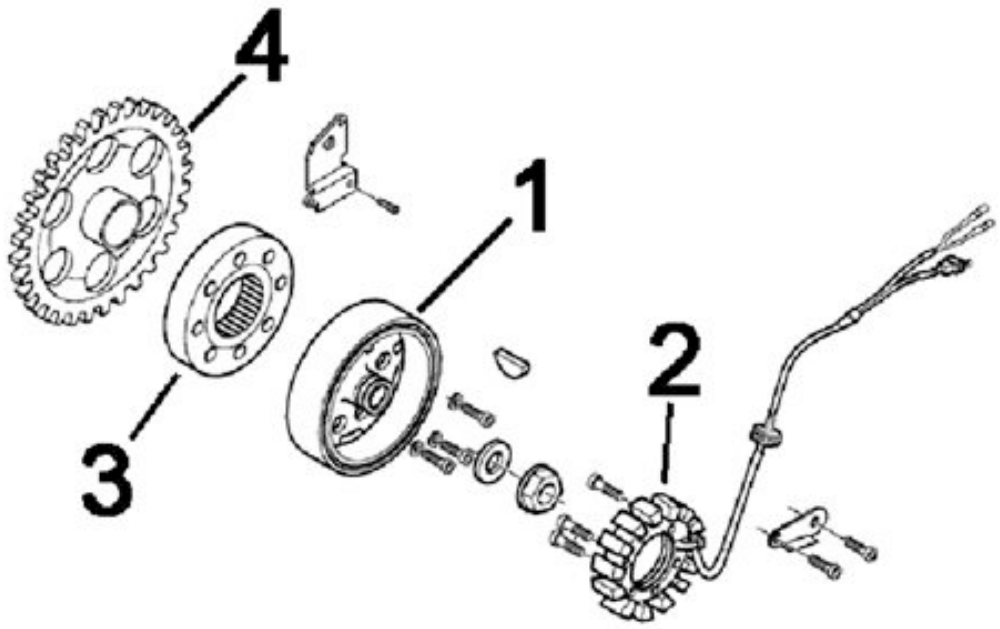
Starter motor



STARTER MOTOR

	Code	Action	Duration
1	001020	Starter motor - Replacement	
2	001017	Starter pinion - Replacement	
3	003064	Engine oil - Replacement	

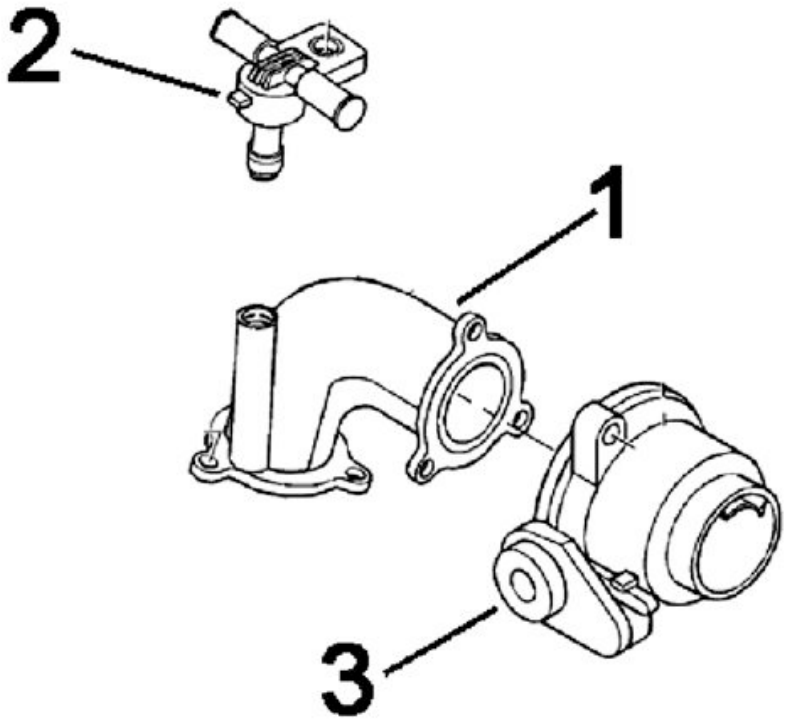
Flywheel magneto



MAGNETO FLYWHEEL

	Code	Action	Duration
1	001058	Flywheel - Replacement	
2	001067	Stator - Replacement	
3	001104	Start-up free wheel - Replacement	
4	001151	Starter drive gear - Replacement	

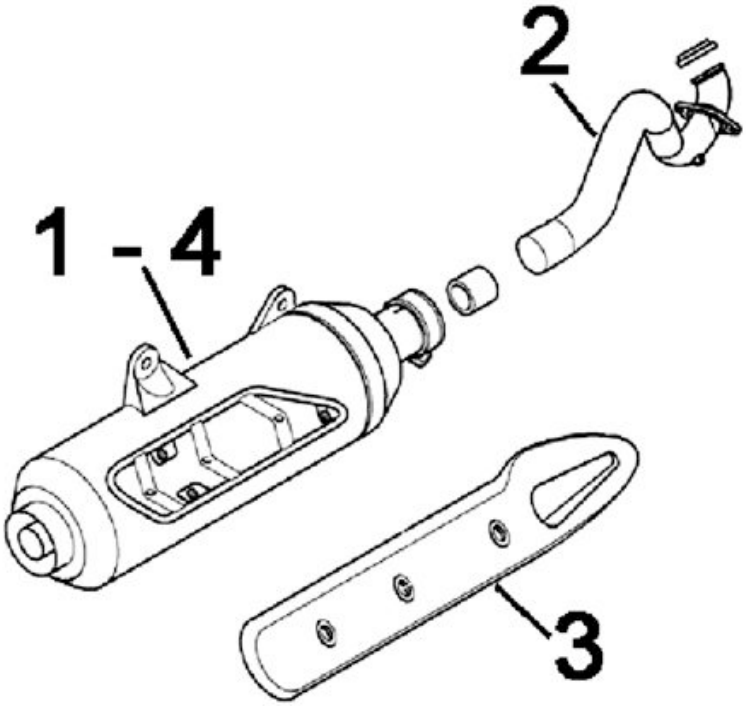
Butterfly valve



THROTTLE BODY

	Code	Action	Duration
1	001013	Intake manifold - Replacement	
2	001047	Injector - Replacement	
3	001166	Throttle body - Replacement	

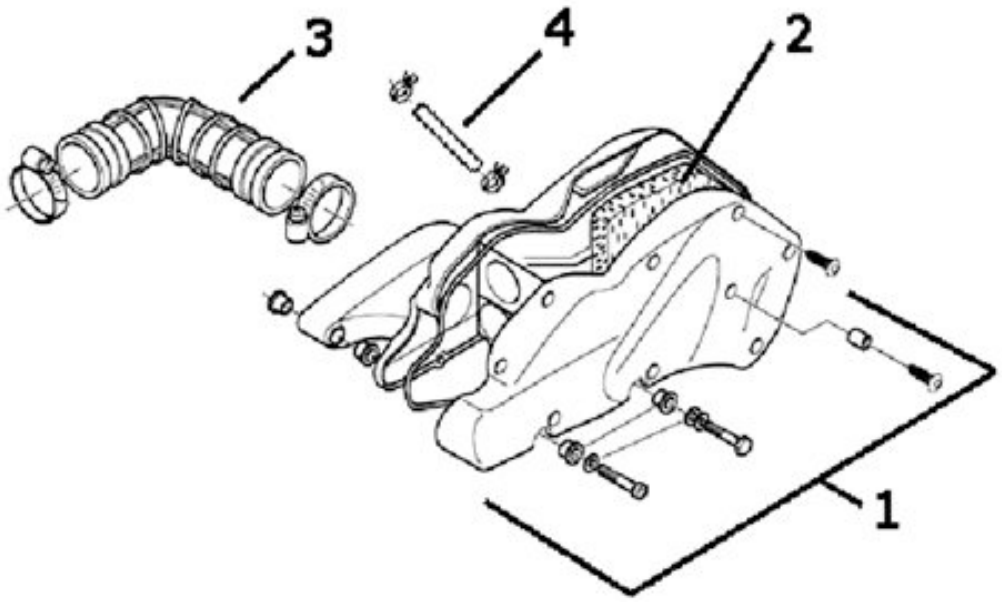
Exhaust pipe



SILENCER

	Code	Action	Duration
1	001009	Silencer - Replacement	
2	001092	Exhaust manifold - Replacement	
3	001095	Silencer guard - Replacement	
4	001136	Exhaust emissions - Adjustment	

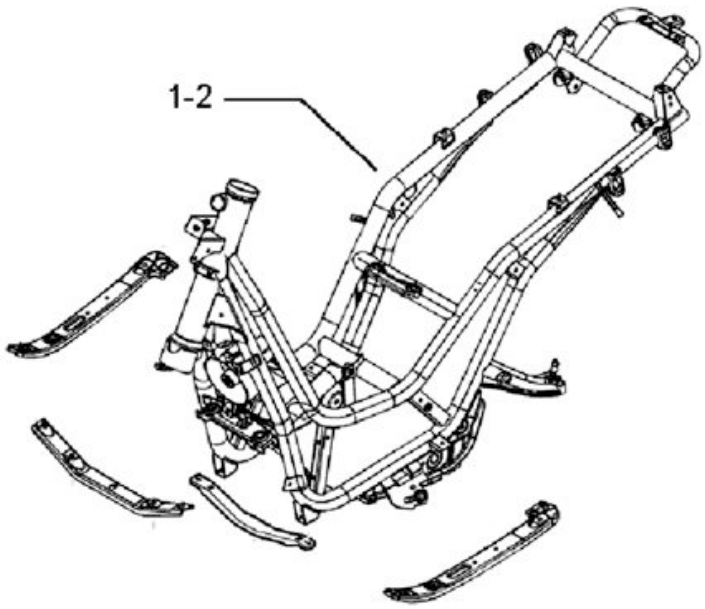
Air cleaner



AIR CLEANER

	Code	Action	Duration
1	001015	Air filter box - Replacement	
2	001014	Air Filter - Replacement/Clean-ing	
3	004122	Cleaner / Throttle body union - Replacement	
4	001074	Oil vapour recovery pipe - Replacement	

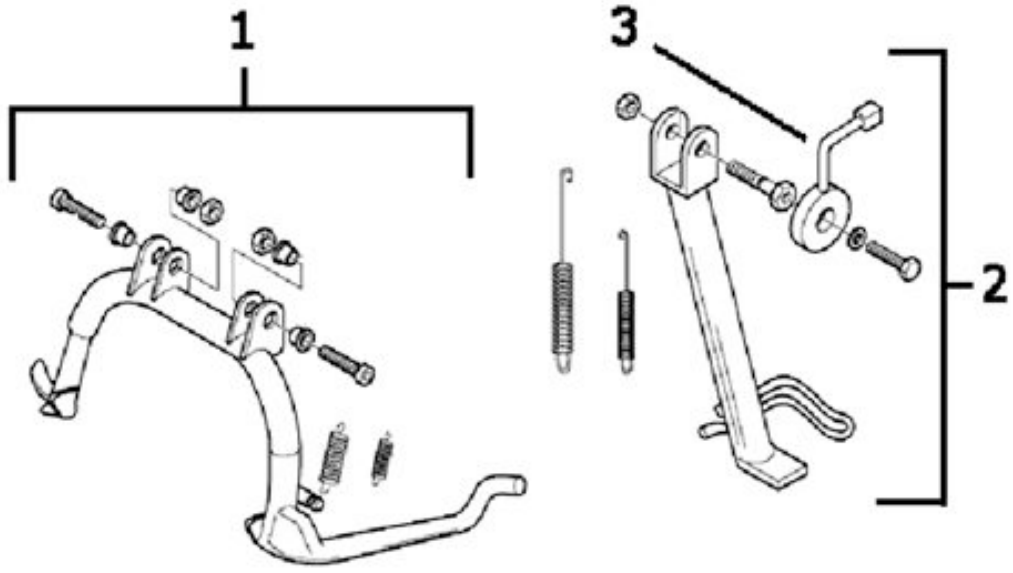
Frame



CHASSIS

	Code	Action	Duration
1	004001	Chassis - Replacement	
2	006001	Chassis - Painting	

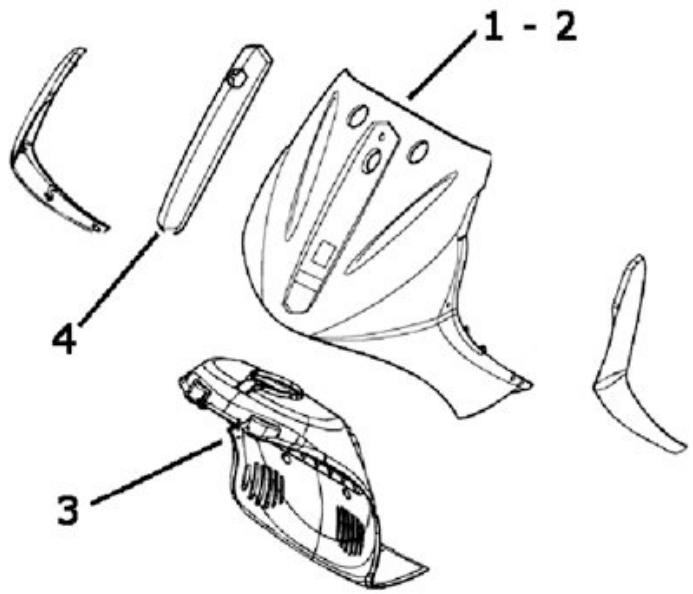
Centre-stand



SIDE CENTRAL STAND

	Code	Action	Duration
1	004004	Stand - Replacement	
2	004102	Side stand - Replacement	
3	005079	Stand switch - Replacement	

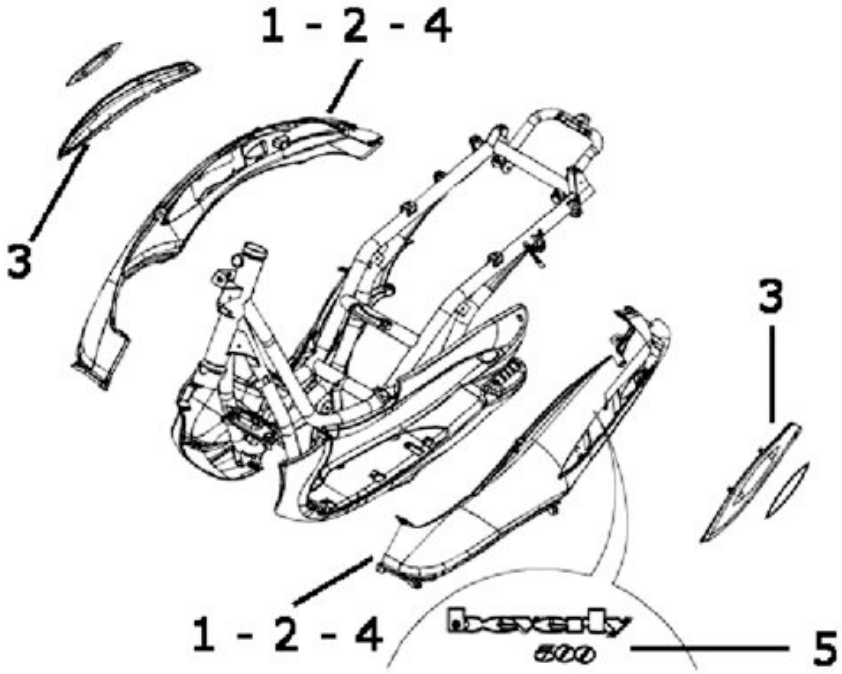
Legshield spoiler



SPOILER FRONT SHIELD

	Code	Action	Duration
1	004064	Front side front shield - Replacement	
2	006012	Steering tube cover - Painting	
3	004053	Spoiler - Replacement	
4	004149	Front shield cover - Replacement	

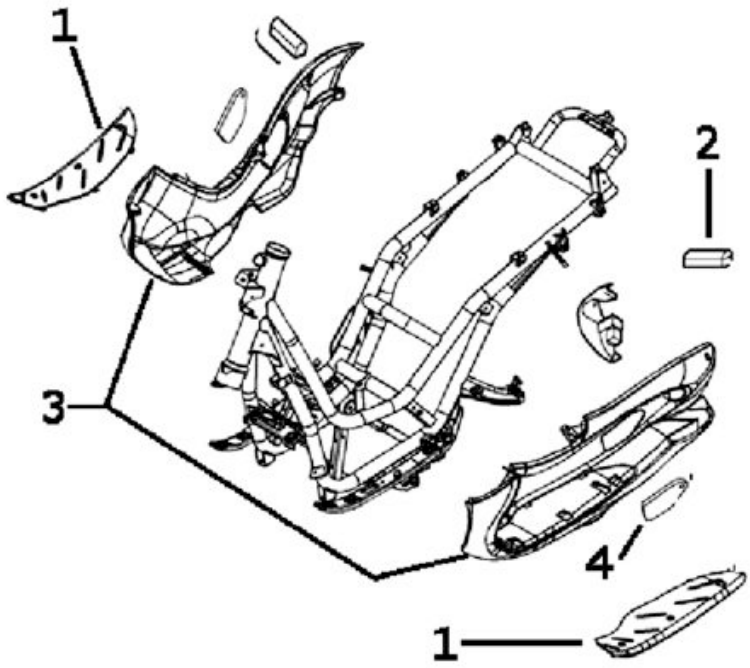
Side fairings



SIDE COVERS

	Code	Action	Duration
1	004085	Side panel (1) - Replacement	
2	006005	Side covers - Painting	
3	004129	Side bumpers - Replacement	
4	004012	Sides (2) - Replacement	
5	004159	Plates / Stickers - Replacement	

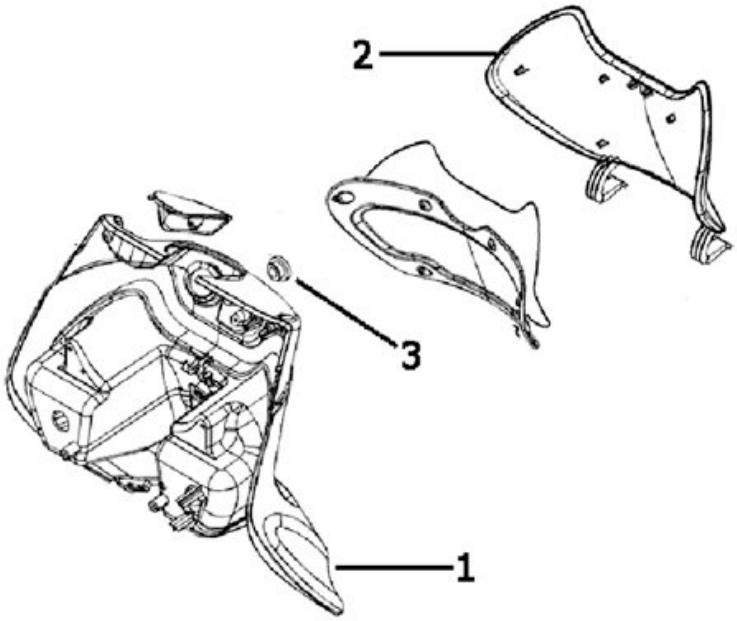
Footrests



COVER MATS

	Code	Action	Duration
1	004075	One front mat - Replacement	
2	004079	Rear footrest (1) - Replacement	
3	004015	Footboards - Replacement	
4	004059	Spark plug inspection flap - Replacement	

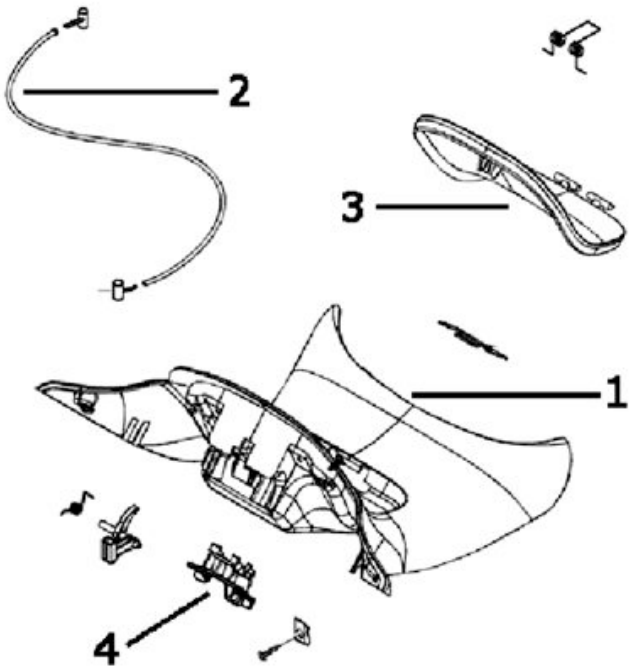
Rear cover



REAR SHIELD

	Code	Action	Duration
1	004065	Counter-shield - Replacement	
2	004081	Glove comparment door - Replacement	
3	005121	Seat opening button - Replacement	

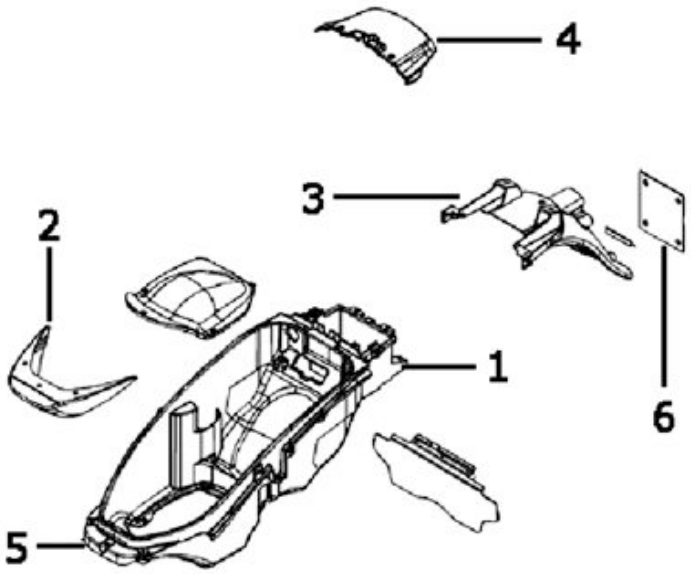
Central cover



CENTRAL COVER

	Code	Action	Duration
1	004011	Chassis central cover - Replacement	
2	002082	Fuel tank door opening cable - Replacement	
3	004135	Fuel tank port - Replacement	
4	004157	Fuel port coupling - Replacement	

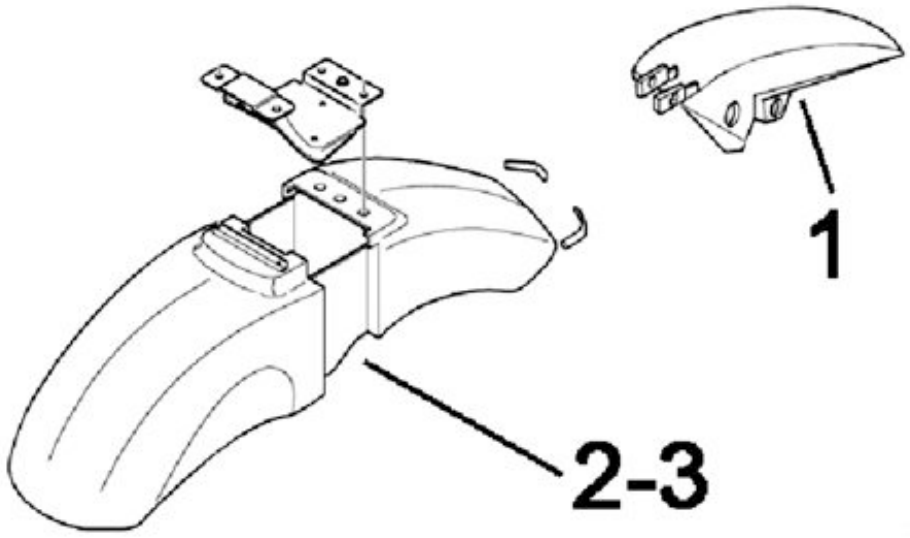
Underseat compartment



SADDLE

	Code	Action	Duration
1	004016	Helmet compartment - Replacement	
2	004106	Undersaddle band - Replacement	
3	004136	License plate holder - Replacement	
4	005046	Battery cover - Replacement	
5	005033	Under-saddle light button - Replacement	
6	005048	Number plate holder - Replacement	

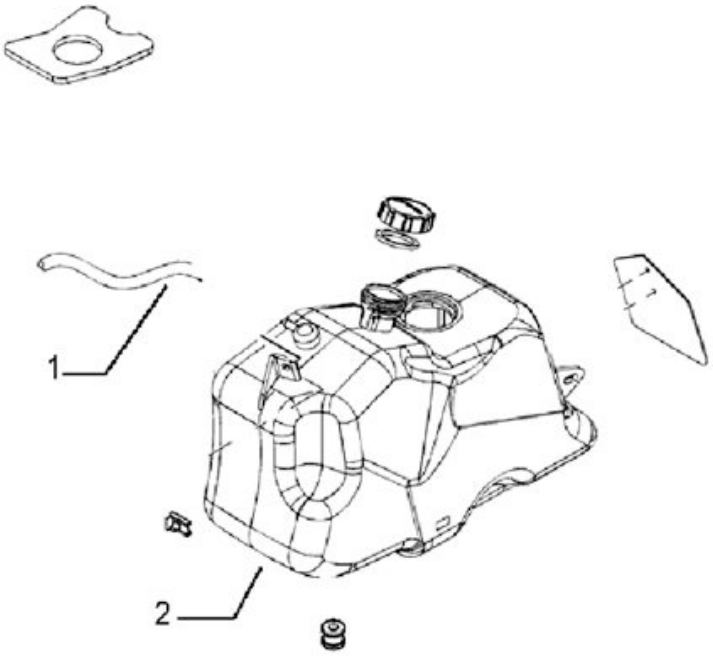
Mudguard



MUDGUARD

	Code	Action	Duration
1	004009	Rear mudguard - Replacement	
2	004002	Front mudguard - Replacement	
3	006003	Mudguard - Painting	

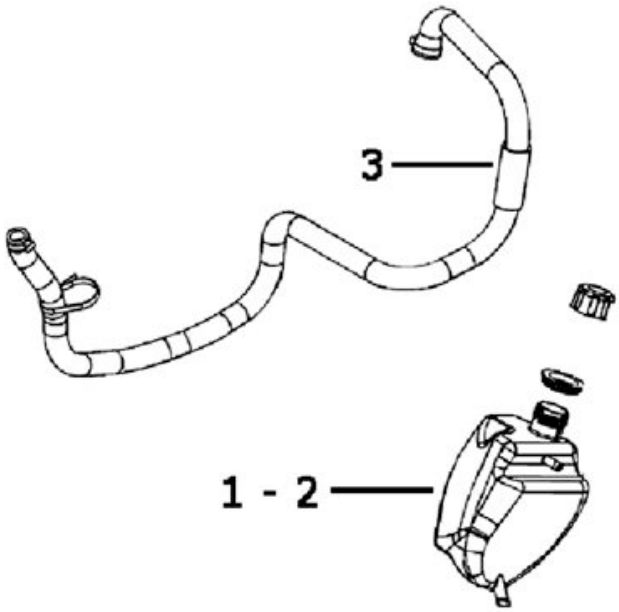
Fuel tank



FUEL TANK

	Code	Action	Duration
1	004109	Fuel tank breather - Replacement	
2	004005	Fuel tank - Replacement	

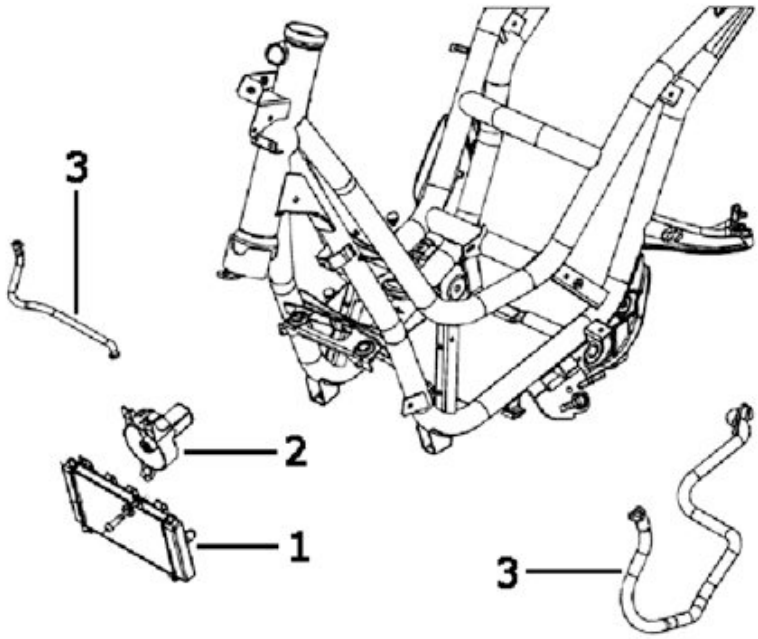
Expansion tank



EXPANSION TANK

	Code	Action	Duration
1	007001	Expansion tank - Replacement	
2	001052	Coolant and air vent - Replacement	
3	007013	Expansion tank/radiator connection pipe - Replacement	

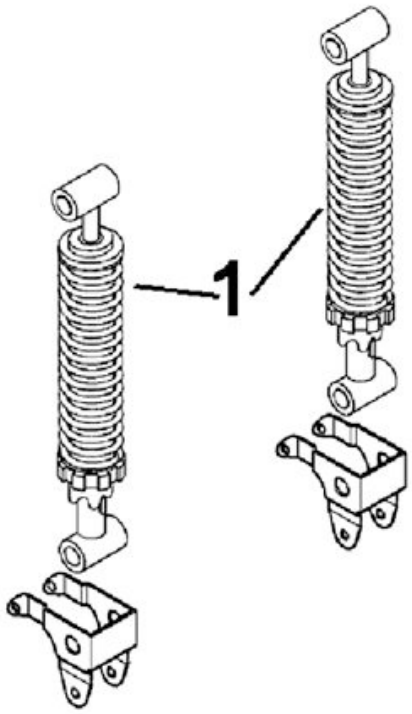
Radiator



RADIATOR

	Code	Action	Duration
1	007002	Water radiator - Replacement	
2	007016	Fan complete with support - Repl.	
3	007003	Coolant delivery and return pipe - Repl.	

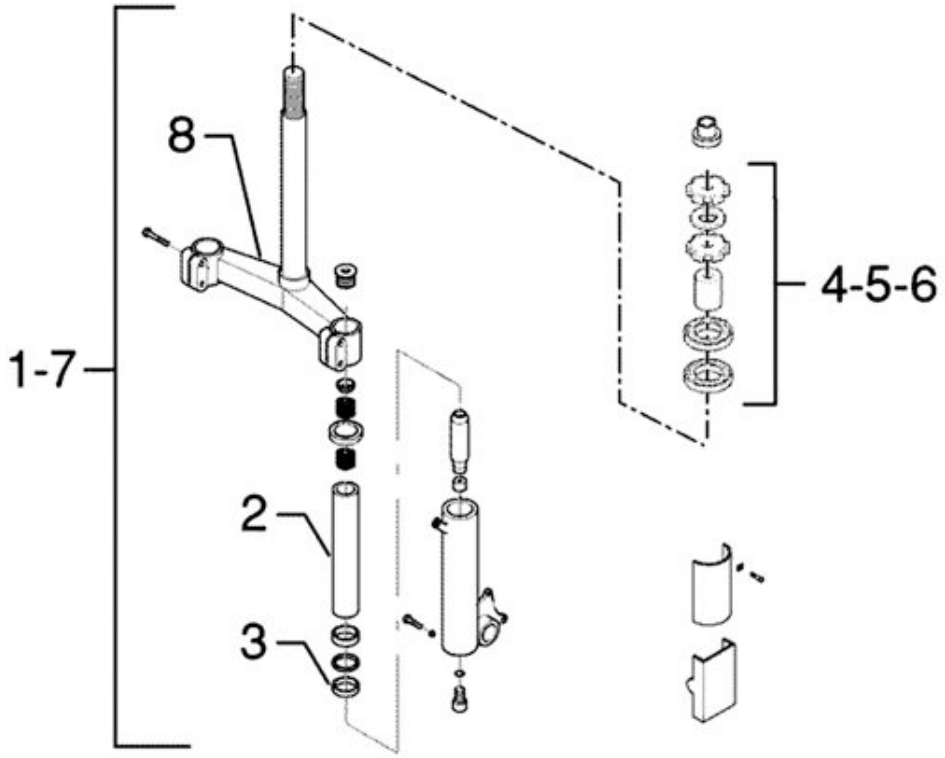
Rear shock-absorber



REAR SHOCK ABSORBER

	Code	Action	Duration
1	003007	Rear shock absorbers - Replacement	

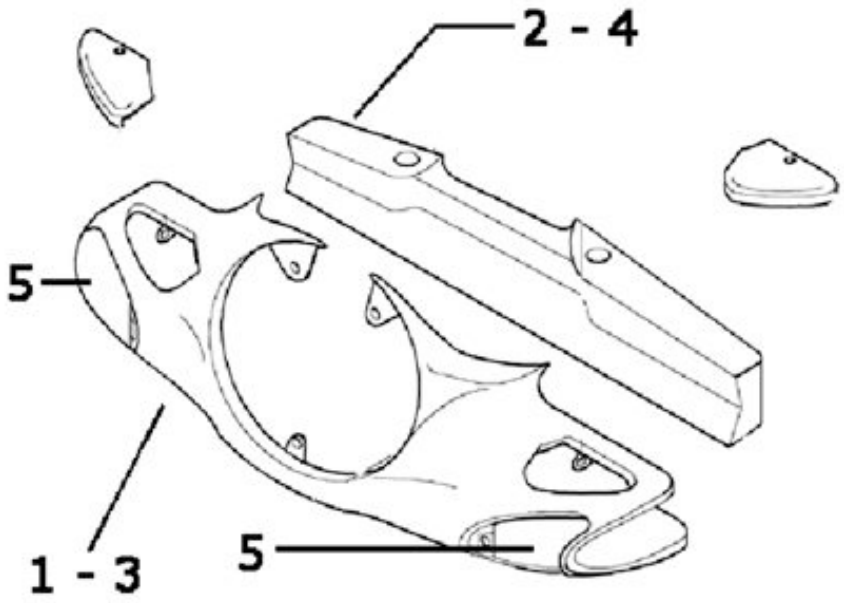
Steering column bearings



STEERING THRUST BEARINGS

	Code	Action	Duration
1	003051	Fork assembly - Replacement	
2	003079	Fork rod - Replacement	
3	003048	Fork oil seal - Replacement	
4	004119	Steering upper thrust ring/ bearing - Replace.	
5	003002	Steering thrust rings - Replacement	
6	003073	Steering play - Adjustment	
7	003010	Front suspension - Overhaul	
8	003050	Fork lower plate - Replacement	

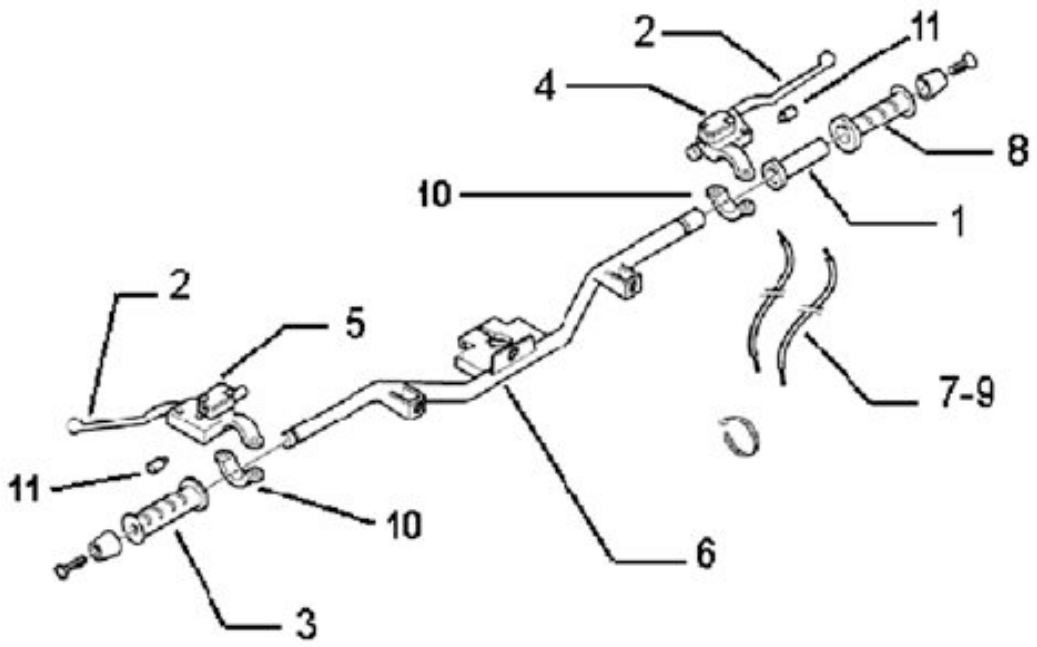
Handlebar covers



HANDLEBAR COMPONENTS

	Code	Action	Duration
1	004018	Handlebar front section - Replacement	
2	004019	Handlebar rear part - Replacement	
3	006013	Handlebar front part - Painting	
4	006014	Handlebar rear part - Painting	
5	005091	Direction indicators plastic cover - Replacement	

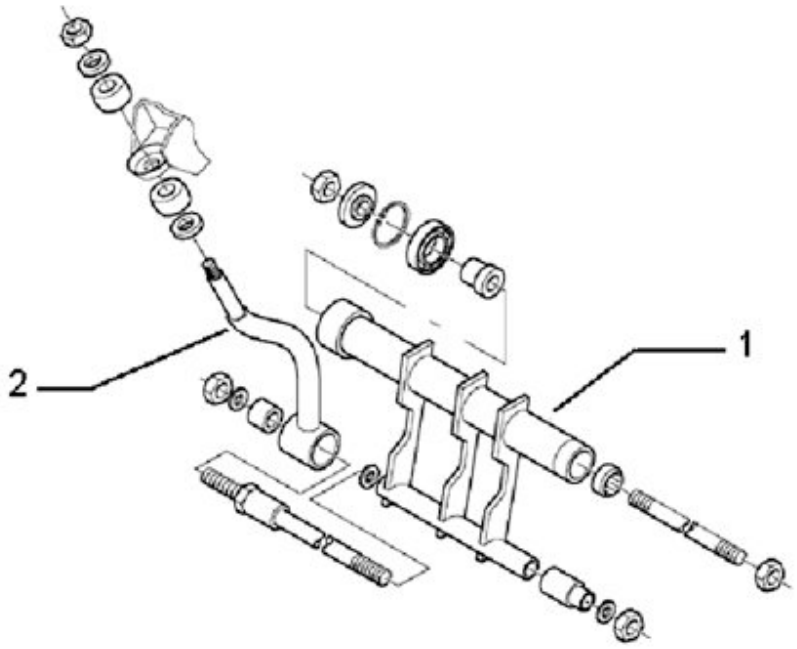
Handlebar components



HANDLEBAR COMPONENTS

	Code	Action	Duration
1	002060	Gas control - Replacement	
2	002037	Complete gas control - Replacement	
3	002071	Left knob - Replacement	
4	002024	Front brake pump - Replacement	
5	002088	Integral brake pump - Replacement	
6	003001	Handlebar - Removal and refitting	
7	002063	Gas control transmission - Replacement	
8	002059	Right knob - Replacement	
9	003061	Throttle cable - Adjustment	
10	004162	Mirror U-bolt and/or brake pump fitting - Replacement	
11	005017	Stop light switch - Replacement	

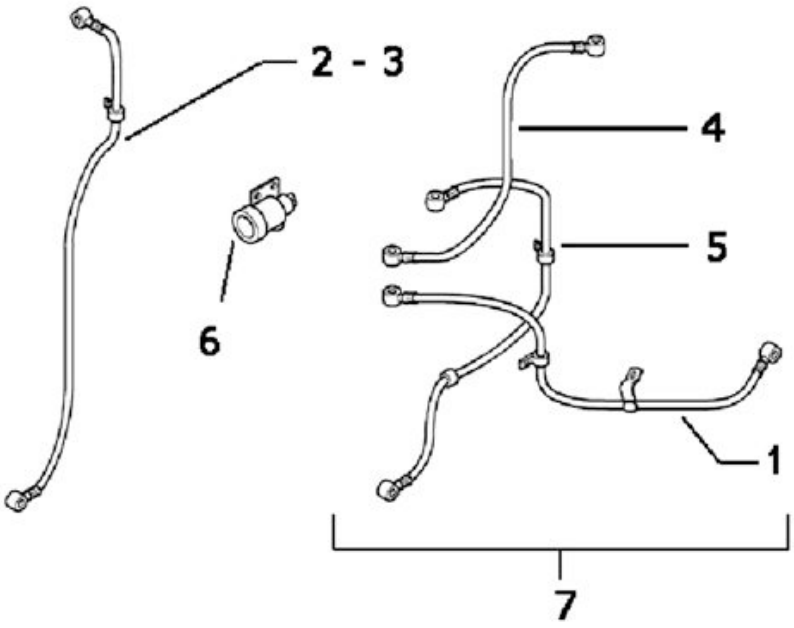
Swing-arm



OSCILLATING ARM

	Code	Action	Duration
1	001072	Engine-frame connection swing arm - Replacement	
2	003082	Damper arm - Replacement	

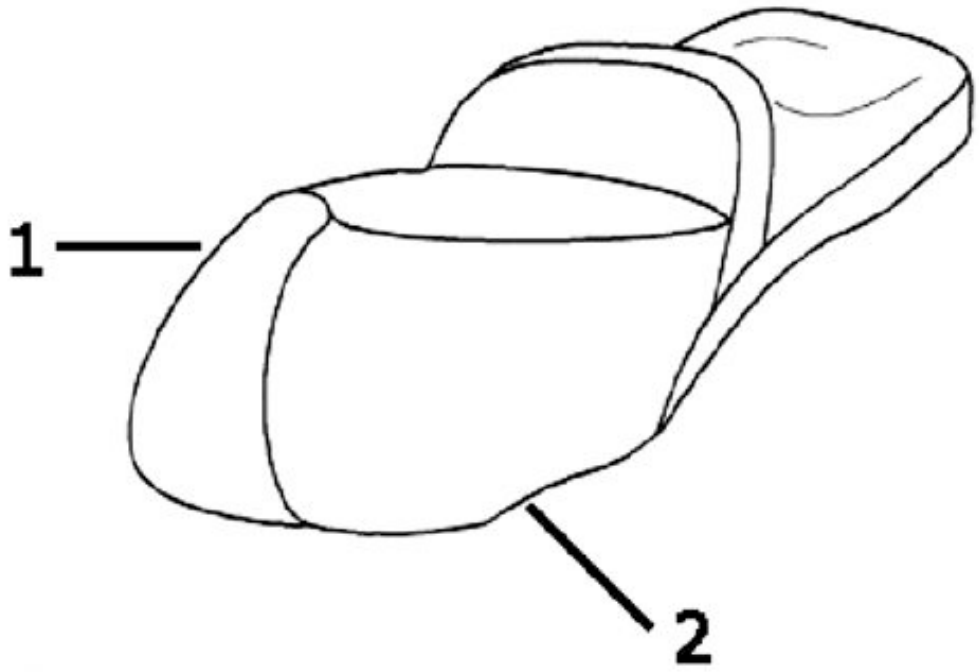
Brake hoses



BRAKE PIPING

	Code	Action	Duration
1	002020	Rear brake piping - Replacement	
2	002021	Front brake line - Removal and refitting	
3	002047	Front brake liquid and circuit bleeding - Replacement	
4	002084	Device / two-wheel brake pump piping - Replacement	
5	002085	Two-wheel brake front piping	
6	002089	Two-wheel braking device - Replacement	
7	002090	Bleed circuit and all brake oil - Replace	

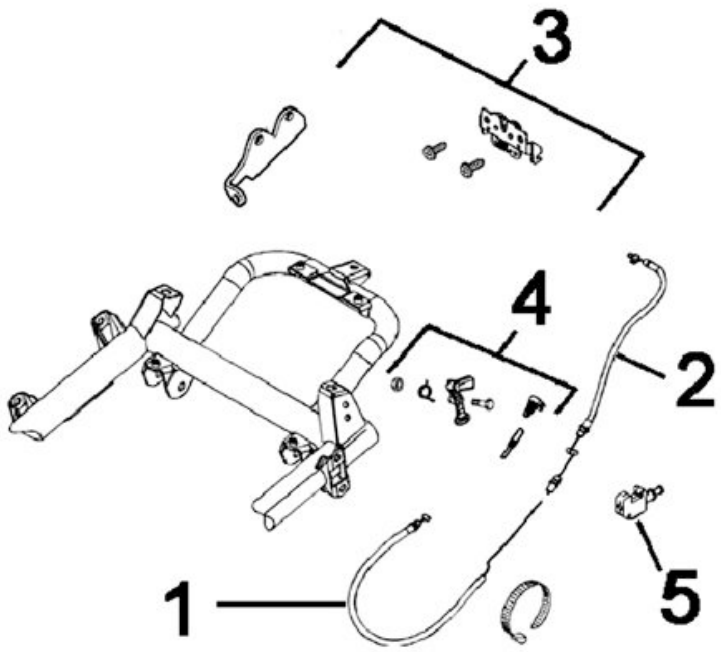
Seat



SADDLE

	Code	Action	Duration
1	004003	Saddle - Replacement	
2	004144	Saddle cover - Replacement	

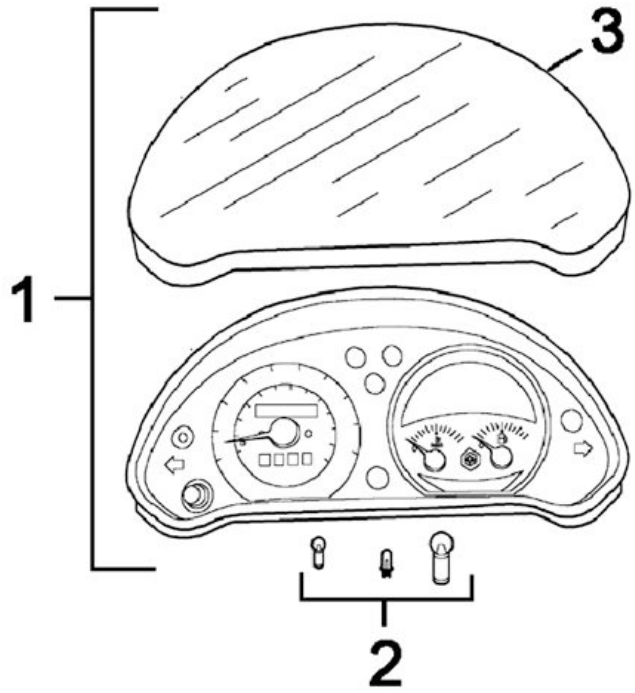
Seat lock



SADDLE CLOSURE

	Code	Action	Duration
1	002083	Seat opening cable - Replacement	
2	002092	Splitter/seat lock cable - Replacement	
3	004054	Saddle catch - Replacement	
4	004158	Splitter for saddle opening - Replacement	
5	005099	Saddle electric opening device - Replacement	

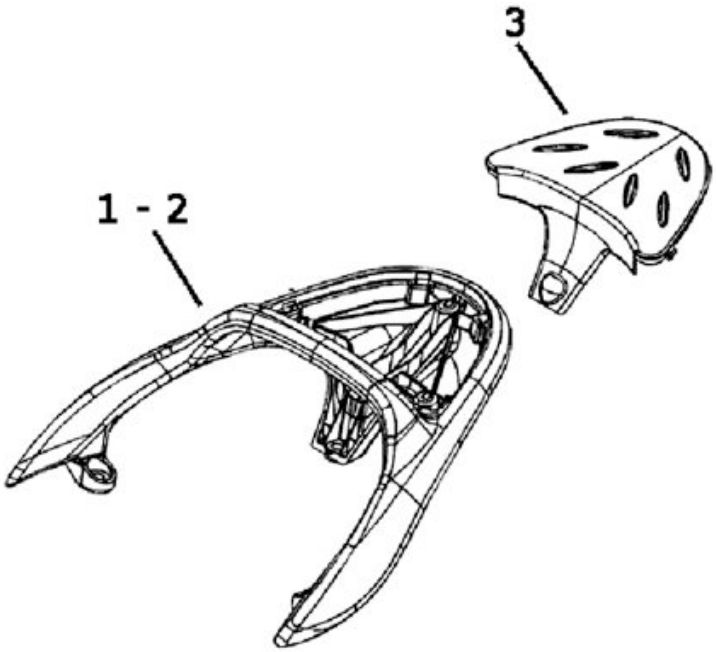
Instrument panel



LIGHT ASSEMBLY

	Code	Action	Duration
1	005014	Instrument unit - Replacement	
2	005038	Dashboard warning lights - Replacement	
3	005078	Odometer plastic cover - Replacement	

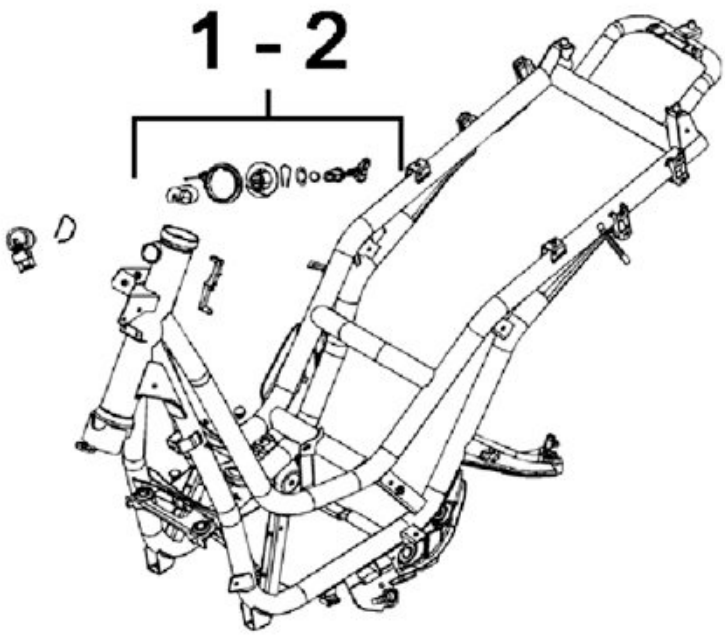
Rear rack



TRUNK RACK

	Code	Action	Duration
1	004008	Trunk rack - replacement	
2	006002	Trunk rack - Painting	
3	004062	Rear rack cover - Replacement	

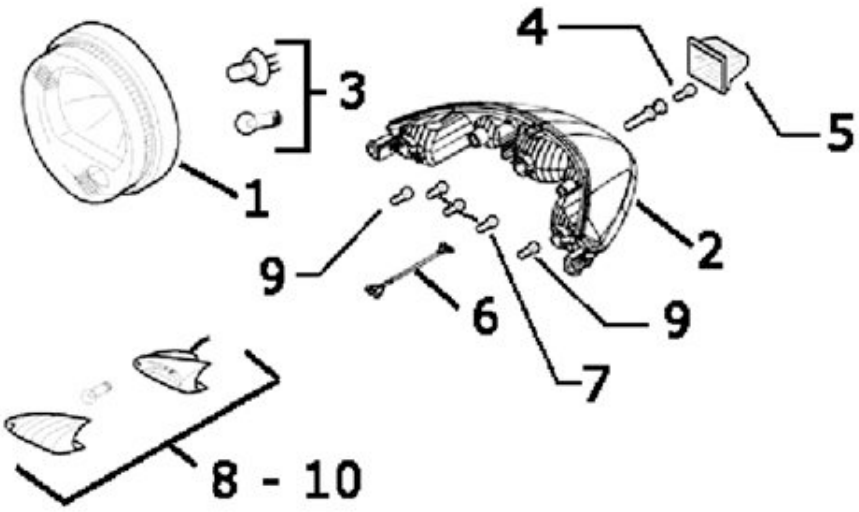
Locks



LOCKS

	Code	Action	Duration
1	005016	Ignition switch - Replacement	
2	004010	Antitheft lock - Replacement	

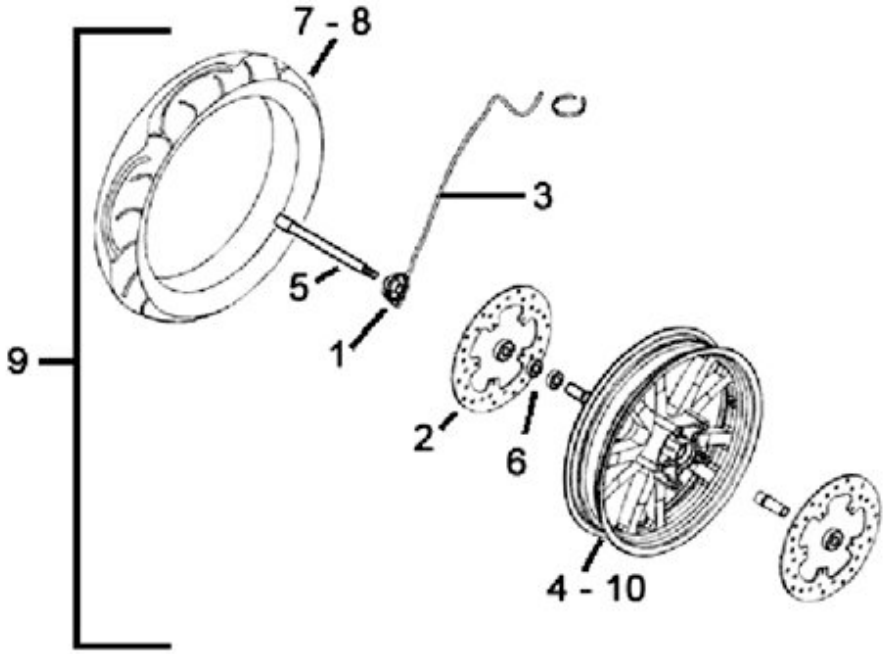
Turn signal lights



DIRECTION INDICATOR HEADLIGHTS

	Code	Action	Duration
1	005002	Headlight - Replacement	
2	005005	Rear light - Replacement	
3	005008	Front headlights - Replacement	
4	005031	Number plate light bulb - Replacement	
5	005032	Number plate light cover - Replacement	
6	005044	Cable harness - Replacement	
7	005066	Rear light bulbs - Replacement	
8	005067	Front direction indicator bulb - Replacement	
9	005068	Rear turn indicator bulb - Replacement	
10	005012	Front turn signal light - Replacement	

Front wheel



FRONT WHEEL

	Code	Action	Duration
1	002011	Odometer drive gear - Replacement	
2	002041	Brake disc - Replacement	
3	002051	Odometer transmissions assembly - Replacement	
4	003037	Front wheel rim - Replacement	
5	003038	Front wheel axle - Replacement	
6	003040	Front wheel bearings - Replacement	
7	003047	Front tyre - Replacement	
8	003063	Tyre pressure - Check	
9	004123	Front wheel - Replacement	
10	006018	Wheel rim - Painting	

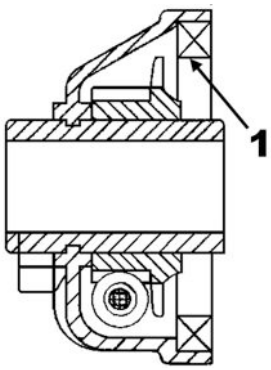
Encoder/speedometer transmission greasing

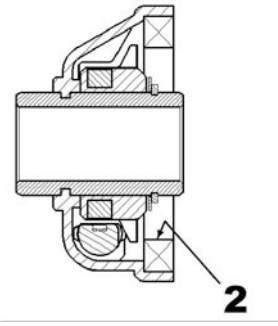
Please take note that the code has been intro-

duced:

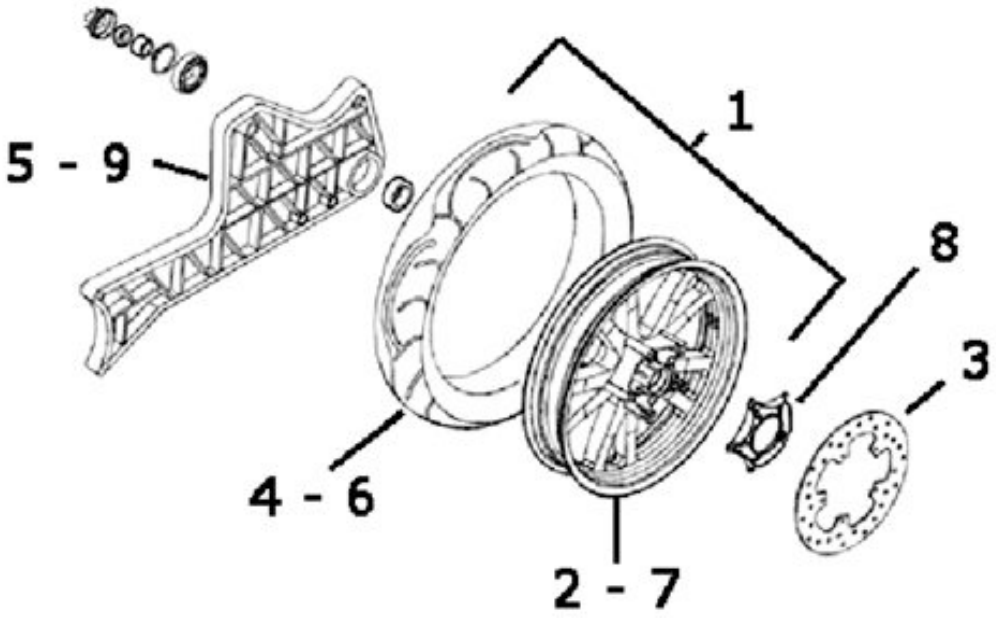
900001 - encoder/speedometer transmission

greasing - 15'.
It is recommended not to use erroneously the codes 002011 (speedometer transmission replacement) and 005089 (encoder replacement) in the event of noise of the indicated components.
The grease recommended is TUTELA MRM 2 (molybdenum bisulphide grease and lithium soap).
The following is to show, by means of an arrow, the area that has to be ingreased (1 - Speedometer transmission, 2 - Encoder).





Rear wheel

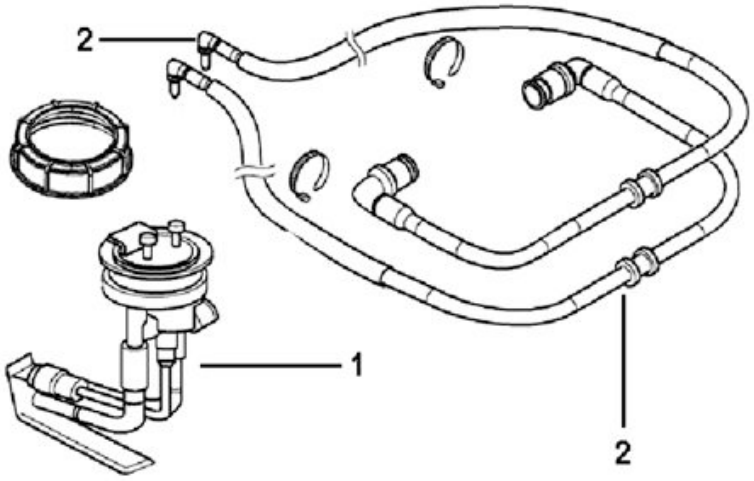


REAR WHEEL

	Code	Action	Duration
1	001016	Rear wheel - Replacement	

	Code	Action	Duration
2	001071	Rear wheel rim - Removal and refitting	
3	002070	Rear brake disc - Replacement	
4	003063	Tyre pressure - Check	
5	003077	Silencer/rear shock absorber support arm - Overhaul	
6	004126	Rear tyre - Replacement	
7	006018	Wheel rim - Painting	
8	002028	Rear wheel hub - Replacement	
9	003014	Rear suspension arm - Replacement	

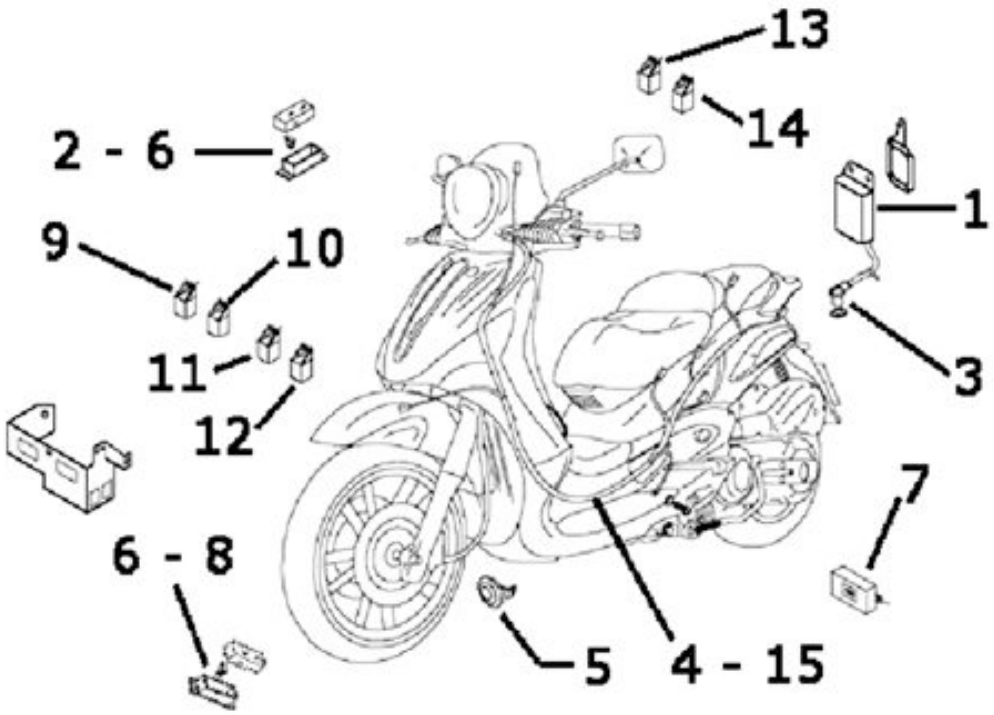
Fuel pump



FUEL PUMP

	Code	Action	Duration
1	004073	Fuel pump - Replacement	
2	004137	Injector pump pipe - Replacement	

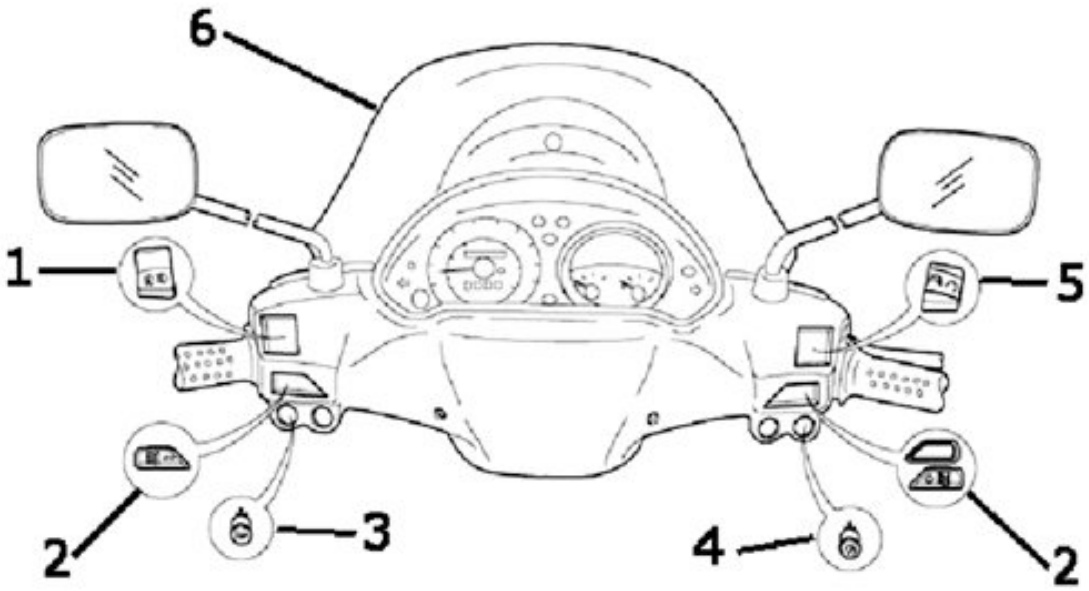
Electric devices



ELECTRIC DEVICES

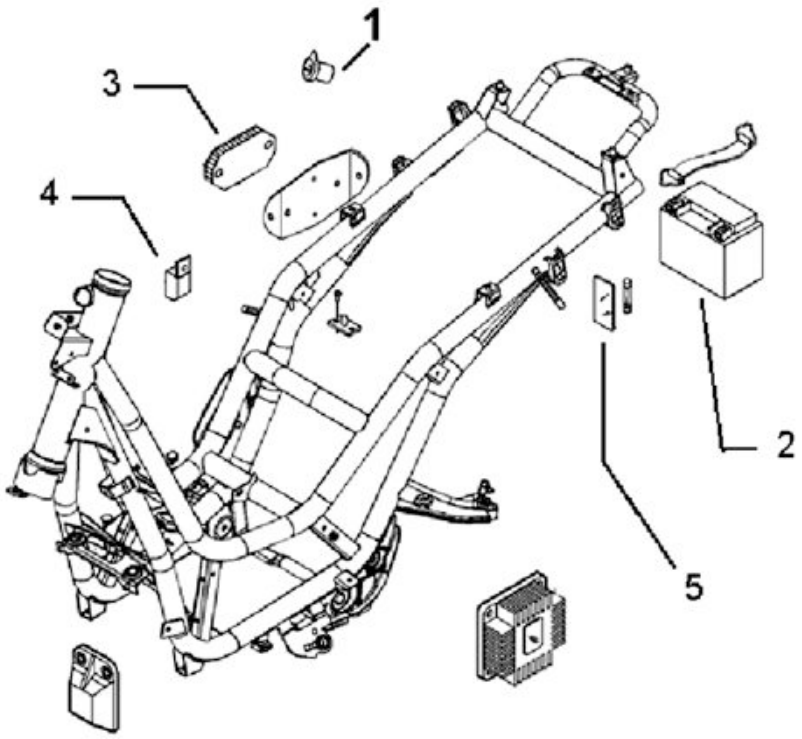
	Code	Action	Duration
1	001069	H.T. coil - Replacement	
2	005054	Fuse holders - Replacement	
3	001094	Spark plug cap - Replacement	
4	005001	Electric circuit - Replacement	
5	005003	Electric horn - Replacement	
6	005052	Fuse (1) - Replacement	
7	005115	Electronic fuel level damper - Repl.	
8	005080	Front fuse-holder - Replacement	
9	005035	Headlight relay - Replacement	
10	005117	Electric fan remote control switch - Replacement	
11	005118	Direction indicators rem. control switch - Replacement	
12	005096	Injection components remote control switch - Replacement	

	Code	Action	Duration
13	005119	Fuel pump rem. control switch - Repl	
14	005120	Control unit power rem. control switch - Replacement	
15	005114	Electric circuit - Overhaul	



ELECTRIC DEVICES

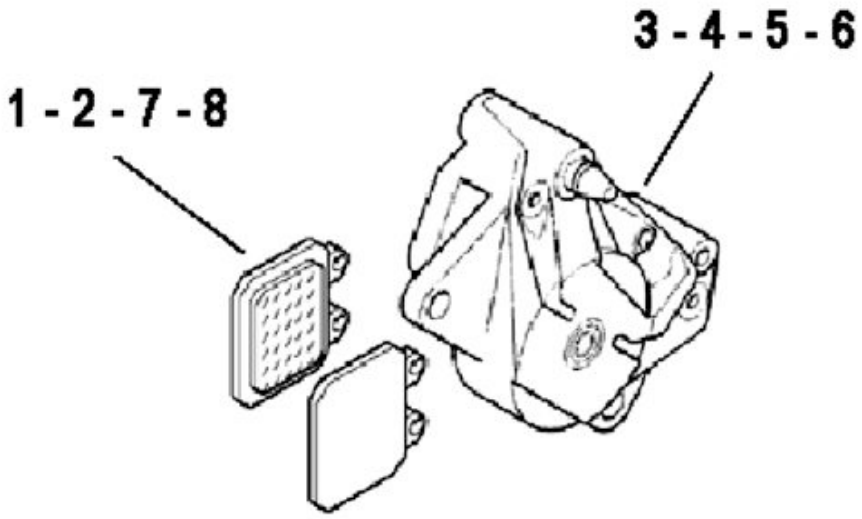
	Code	Action	Duration
1	005039	Light switch - Replacement	
2	005006	Lights or flashlights switch - Replacement	
3	005040	Horn button - Replacement	
4	005041	Starter button - Replacement	
5	005047	Emergency stop switch - Repl.	
6	004117	Cap - Replacement	



ELECTRIC DEVICES

	Code	Action	Duration
1	004142	Outlet - Replacement	
2	005007	Battery - Replacement	
3	005009	Voltage regulator - Replacement	
4	005011	Start-up remote control switch - Replacement	
5	005026	Helmet compartment bulb - Replacement	
6	005027	Helmet compartment lamp support - Replacement	
7	005073	Decoder immobilizer - Replacement	
8	001023	Controller - Replacement	

Brake callipers



FRONT BRAKE CALIPERS

	Code	Action	Duration
1	002002	Rear brake pads - Replacement	
2	002007	Front brake pads - replacement	
3	002039	Brake caliper - Removal and refitting	
4	002040	Front brake caliper - Overhaul	
5	002048	Rear brake caliper - Replacement	
6	002068	Rear brake caliper - Overhaul	
7	003070	Front brake pads - wear check	
8	003071	Rear brake pads - Wear check	