



WORKSHOP MANUAL

633234



X9 Evolution 500



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WORKSHOP MANUAL

X9 Evolution 500

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. Important information in this manual is marked as follows.

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.



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CHARACTERISTICS

CHAR

This section describes the general specifications of the vehicle.

Rules

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

Safety rules

- 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 run in an enclosed area. Exhaust fumes are toxic.
 - The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with abundant water and seek immediate medical attention.
 - The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
 - Fuel is highly flammable, and in some conditions it can be explosive. Do not smoke in the working area, and avoid open flames or sparks.
 - Clean the brake pads in a well ventilated environment, directing the compressed air jet so as to not inhale the dust produced by the wear of the friction material. Even though the latter contains no asbestos, dust inhalation is harmful.
-

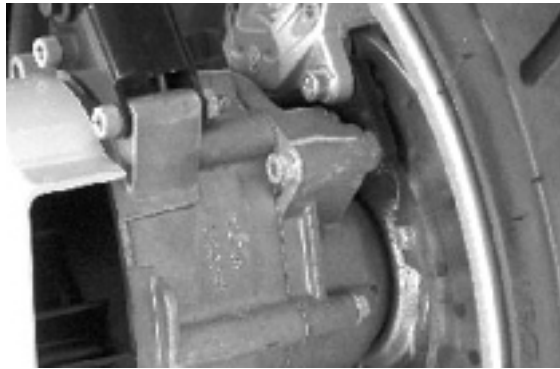
Maintenance rules

- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spares may damage the vehicle.
 - Use only the special tools designed for this scooter.
 - 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 the work surfaces except the tapered couplings before refitting.
 - 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 unsuitable coupling members and tools may damage the scooter.
 - Should any interventions to the scooter electrical system be required, check that the electrical connections - especially earth and battery connections - have been implemented properly.
-

Vehicle identification

VEHICLE IDENTIFICATION

Specification	Desc./Quantity
Chassis prefix	ZAPM 27000 ÷ 4000001
Engine prefix	M271M ÷ 1001



Dimensions and mass

WEIGHT AND DIMENSIONS

Specification	Desc./Quantity
Total dry weight	206 Kg
Width (at the mirrors)	910 mm
Wheel base	2130 mm
Length	1530 mm
Height (at the saddle)	780 mm
Height at the windscreen (high position)	1450 mm



Engine

ENGINE

Specification	Desc./Quantity
Engine	Single-cylinder, four-stroke
Bore	92 mm
Stroke	69 mm
Cubic capacity	460 cm ³
Compression ratio	10.5: 1
Timing system	Single overhead camshaft with integrated tone wheel, control from flywheel side chain, 4 valves and automatic start-up valve lifting device.
Valve clearance: intake	0.15 mm (when cold)
Valve clearance: discharge	0.15 mm (when cold)
Valve clearance adjustment	By threaded adjuster on the rockers
Engine idle speed	1500 ± 50 rpm
Air filter	Dry paper filter.
CO % value (measured at the intake manifold)	1 - 1.5%
Starting system	Electric starter system with freewheel.
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
Fuel supply	Electronic injection system with electric fuel pump, Ø 38 mm throttle body and single injector.
Max. power (at crankshaft)	29.5 kW at 7500 rpm
Max. torque (at crankshaft)	43 Nm at 5500 rpm
Cooling system	Fluid circulation through a motor-driven pump, 3-way thermostat and electric fan.

Transmission

TRANSMISSIONS

Specification	Desc./Quantity
Transmission	With automatic expandable pulley variator with torque server, V belt, automatic clutch, gear reduction unit and transmission housing with forced air circulation cooling.

Capacities

CAPACITIES

Specification	Desc./Quantity
Cooling system	approx. 1.8 l
Fuel tank (including reserve ~ 2.5 l)	~ 14,5 l
Rear hub	~ 250 cc
Engine oil (empty)	1.7 lt.
Engine oil (at oil and filter change)	1.5 lt.

Electrical system

ELECTRICAL COMPONENTS

	Specification	Desc./Quantity
1	Ignition type	Inductive, high efficiency, integrated with injection, variable advance and separate HV coil.
2	Spark advance (before TDC)	Variable, controlled by the injection controller
3	Spark plug	CHAMPION RG6YC; NGK CR7EKB
4	Battery	12V-14Ah
5	Fuses	n.1 70A_n.1 30A_n.2 15A_n.3 10A_n.4 7,5A_n.2 5A_n.1 3A
6	Generator	in three-phase alternating current

Frame and suspensions

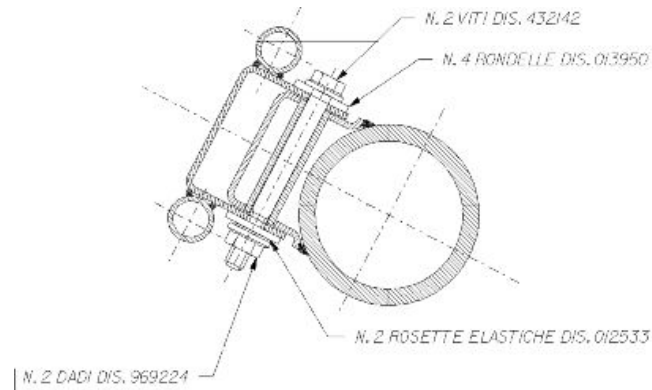
FRAME AND SUSPENSIONS

Specification	Desc./Quantity
Type	Welded structure consisting of steel pipes with asymmetrical trestle structure, front crosspieces and union members made of sheet steel.
Front suspension	Hydraulic telescopic fork with dual effect, Ø 40 mm stems and back pin with couplongs for dual brake calipers.
Front fork stroke	104 mm
Rear suspension	Engine based on oscillating fork pivoted to the chassis by 2-freedom degree oscillating arm and pair of dual effect hydraulic shock absorbers with 4-position preload adjustment
Rear suspension range	76.6 mm (minimum spring preload)

X9 Evolution 125-250-500:

Please take note that, starting from chassis serial number ZAPM2300003509521, the front small chassis fixing system has changed in order to improve its locking to the chassis. Therefore we have introduced:

- N°2 screws drawing 432142
- N°2 4x11x0 external teeth spring washers drawing 012533
- N°2 nuts drawing 968224



Front fork

This is to inform you that, starting from frame no. ZAPM2700004008122, the front fork has been replaced to improve comfort. The new suspension differs from the previous one for a different stiffness of the springs and a higher quantity of oil: from 268 cc to **273 cc ± 2 cc of Selenia Fork 7.5 W**

Brakes

BRAKES

Specification	Desc./Quantity
Front	Disc brake Ø 260 (vehicle RH side), with hydraulic command activated from handlebars with right-hand lever and 2 piston floating caliper.
Combined	With dual disc brake, Ø 260 front LH with 2 piston floating caliper and Ø 240 rear, with 2 opposed piston floating caliper. Hydraulic command activated from handlebars with left-hand lever. The system is interlocked with a pressure distribution valve.

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Light alloy rims (Front):	3,50x14"
Light alloy rims (rear):	4,50x14"
Tyre pressure (when cold): front	2,2 bar
Tyre pressure (when cold): rear	2,4 bar (2,6 bar with passenger or optional trunk on)
Front Tyre	Michelin Gold Standard 120/70-14' M/C reinforced TL 55 S
Manufacturer / Model / Size	Pirelli GTS 23 120/70_14'M/C TL 55 S
Rear Tyre	Michelin Gold Standard 150/70-14' M/C TL 66 S
Manufacturer / Model / Size	Pirelli GTS 24 150/70_14' M/C TL 66 S

CAUTION



IT IS MANDATORY TO ADOPT EXCLUSIVELY "S" CLASS TYRES, WHICH GUARANTEE CORRECT VEHICLE PERFORMANCE AT THE DIFFERENT SCOOTER SPEEDS. USING ANY OTHER TYRE MAY RESULT IN VEHICLE INSTABILITY. IT IS ADVISABLE TO USE TYRE TYPES RECOMMENDED BY PIAGGIO.

Tightening Torques

STEERING UNIT

Name	Torque in Nm
Steering wheel upper ring nut	36 ÷ 39
Steering wheel lower ring nut	10 ÷ 13 then loosen by 90° (see "Steering wheel ring nut locking")
Handlebar fixing screw (*)	43 ÷ 47

STEERING WHEEL LOCKING RING NUT

- 1) Apply to the lower ring nut a setting torque of **20±25 Nm** then loosen it.
- 2) Tighten the ring nut again at a torque of **10±13 Nm**.
- 3) Loosen the lower ring nut by **90°**.
- 4) Insert the spacer.
- 5) Lock the upper ring nut at a torque of **36 ± 39 Nm**

CHASSIS UNIT

Name	Torque in Nm
Oscillating arm pin right nut - Engine	100 ÷ 120
Oscillating arm pin left nut - Engine	56 ÷ 70
Oscillating arm-chassis pin	14 ÷ 17
Oscillating arm-chassis pin lock nut	40 ÷ 50
Oscillating arm pin right nut - Chassis	66 ÷ 73
Side stand support fixing bolt	33 ÷ 41
Bolt fixing the centre stand to the frame	25 ÷ 30
Hydraulic actuator fixing screw to chassis	20 ÷ 25
Side stand screw	35 ÷ 40
Side stand switch screw	5 ÷ 7
Side stand nut	40 ÷ 45
Oscillating arm damper bar nut	33 ÷ 41
Damper pad support plate nut	33 ÷ 41

FRONT SUSPENSION

Name	Torque in Nm
Fork leg tightening clamp screw	20 ÷ 25
Front wheel axle	45 ÷ 50
Wheel axle tightening clamp screw	6 ÷ 7
Front mudguard fixing screw	5 ÷ 6,5
Pumping fixing screw to fork leg	45 ÷ 50

FRONT BRAKE

Name	Torque in Nm
Screw for fixing the caliper support to the fork	42 ÷ 62
Brake fluid pump-hose fitting	16 ÷ 20
Brake fluid pipe-calliper fitting	16 ÷ 20
Disc tightening screw (°)	5 ÷ 6
Oil drainage screw	12 ÷ 16

REAR SUSPENSION

Name	Torque in Nm
Right and left shock absorber support fixing	20 ÷ 25
Shock absorbers fixing to chassis	33 ÷ 41
Shock absorbers fixing to lower supports	33 ÷ 41
Rear wheel axle	104 ÷ 126
Rear wheel rim screws	33 ÷ 37
Silencer support arm fixing to engine	33 ÷ 42

COMBINED BRAKE

Name	Torque in Nm
Oil pipe union on combined brake pump	16 ÷ 20
Combined brake pipe union on front calipers	16 ÷ 20
Combined brake pipe union on rear calipers	16 ÷ 20
Front brake caliper pipe union on combined braking device	20 ÷ 25
Rear brake caliper pipe union on combined braking device	20 ÷ 25
Brake caliper fixing screw to supports	20 ÷ 25
Rear disc tightening screw (°)	14 ÷ 17
Oil bleed screw	12 - 16
Rear brake caliper fastening screw to engine	20 ÷ 25
Rear brake piping support fixing screw to engine	5 ÷ 6,5
Rear brake piping support fixing screw to chassis	9 ÷ 11

SILENCER

Name	Torque in Nm
Manifold fixing screw to silencer	16 ÷ 18
Silencer support bracket fixing screw to engine	33 ÷ 41
Silencer heat guard fixing screw	3 ÷ 4
Exhaust gas inlet screw	22 ÷ 26

ENGINE UNIT

Name	Torque in Nm
Clutch locking nut	65 ÷ 75
Driven pulley shaft support fixing screw	23 ÷ 26
Belt anti-flapping roller fixing screw	17 ÷ 20
Driving pulley nut (°)	160 ÷ 175
Flywheel nut (°)	115 ÷ 125
Driven pulley nut	92 ÷ 100
Half-crankcase union screw	11 ÷ 13
Head cover screws	11 ÷ 13
Head nuts (°) (§) (*)	38 ÷ 42
Cylinder stud bolts	44 ÷ 46
Camshaft bell screw (#)	30 ÷ 35
Camshaft plate fixing screw (#)	4 ÷ 6
Valve clearance adjustment lock nut	6 ÷ 8
Water pump impeller	4 ÷ 6
Starter motor fastening screw	11 ÷ 13
Ignition spark plug	12 ÷ 14
Hub oil drainage cap	15 ÷ 17
Rear hub cap screw	24 ÷ 27
Transmission cover screw	11 ÷ 13
Oil pump head screw	8 ÷ 10
Engine oil drainage cap	24 ÷ 30
Water pump cover screw	3 ÷ 4
Screw fixing the oil pump to the crankcase	5 ÷ 6
Stator fastening screw	8 ÷ 10
Screw fixing the start-up free wheel to the flywheel (#)	13 ÷ 15
Flywheel cover screw	11 ÷ 13
Head intake manifold screw	11 ÷ 13
Screw fixing the throttle body to the manifold	11 ÷ 13
Chain tightener sliding block screw (#)	10 ÷ 14
Timing chain tensioner central screw	5 - 6
Timing chain tensioner support screw	11 ÷ 13
Counter-rotating shaft fixing nut (#)	25 ÷ 29
Screw fixing the silencer to the support arm	20 ÷ 25
Exhaust manifold - cylinder nuts	27 ÷ 33
Screw fixing the rear brake caliper support bracket to the engine	20 ÷ 25
Driving shaft timing cap	3,5 ÷ 4,5
Head water outlet cover screw	3 ÷ 4
Calibrated dowel	5 ÷ 7
Oil cap with level bar	1,5 ÷ 2,5
Oil filter	12 ÷ 16
Oil filter engagement union	18 ÷ 22

Name	Torque in Nm
Oil vent pipe fixing	3 ÷ 4
Minimum oil pressure sensor	12 ÷ 14
Fairlead bracket fixing	3 ÷ 4
Head/Cylinder/Crankcase fixing	10 ÷ 12
Revolution timing sensor fixing screw	3 ÷ 4
Coolant temperature sensor	10 ÷ 12
Pressure reducer counterweight retainer	7 ÷ 8.5
Counter shaft gear fixing on driving shaft (#)	10 ÷ 12
Thermostat cover	1,5 ÷ 2
Start-up rim counter shaft plate fixing	3 ÷ 4
Injector support fixing (#)	3 ÷ 4
Head lubrication control jet	5 - 7

(°)Lubricate parts before fitting.

(^) Apply LOCTITE for surfaces type 510.

(#) Apply thread-holding LOCTITE medium type 242.

(§) 1st locking: 20 N-m crossed, locking at torque 38 - 42 N-m crossed, crossed loosening.

(*) 2nd tightening: 20 N-m crossed, locking at torque 38 - 42 N-m crossed.

N.B.

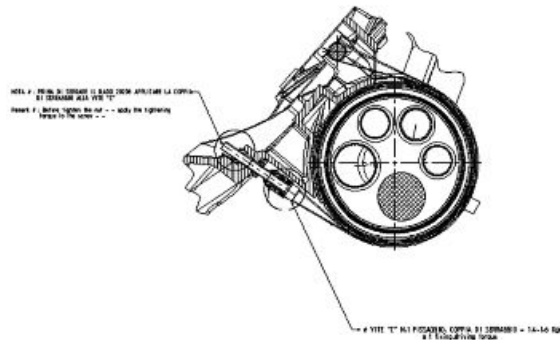
LUBRICATE THE THREADS.

NOTICE OF TECHNICAL SERVICING

For correct tightening, the expansion tank cap locking torque has been standardised to **2.5 Nm**

Please take note that we have normalized to **17 - 20 Nm** the temperature sensor locking torque, in order to guarantee a correct locking

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.

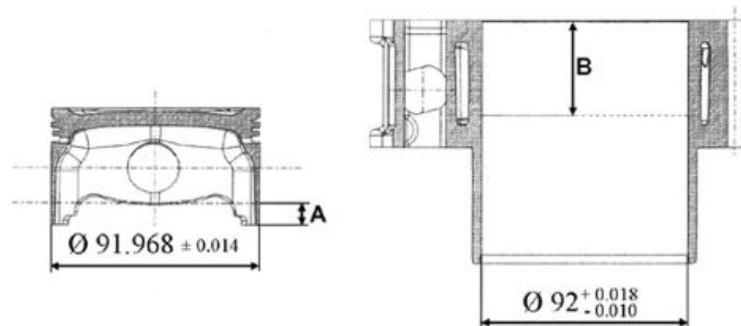


Overhaul data

This section provides the main information for scooter servicing.

Assembly clearances

Cylinder - piston assy.



(Values in mm)

HEIGHT AT WHICH THE DIAMETER SHOULD BE MEASURED

Specification	Desc./Quantity
A:	10 mm
B:	43 mm

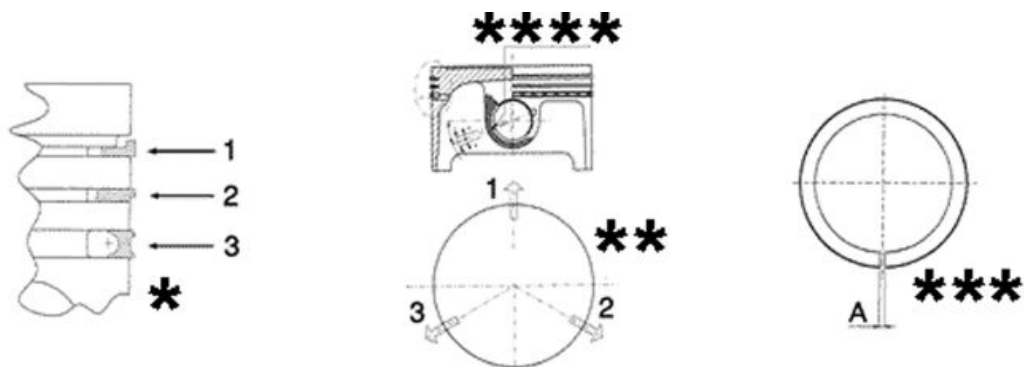
CATEGORIES OF COUPLING

Name	Initials	Cylinder	Piston	Play on fitting
Cylinder Piston	A	91.990 - 91.997	91.954 - 91.961	0.029 - 0.043
Cylinder Piston	B	91.997 - 92.004	91.961 - 91.968	0.029 - 0.043
Cylinder Piston	C	92.004 - 92.011	91.968 - 91.975	0.029 - 0.043
Cylinder Piston	D	92.011 - 92.018	91.975 - 91.982	0.029 - 0.043

N.B.

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

Piston rings



* Fit rings «2» and «3» with the word «TOP» facing upwards.

** Position the openings in the rings as shown here.

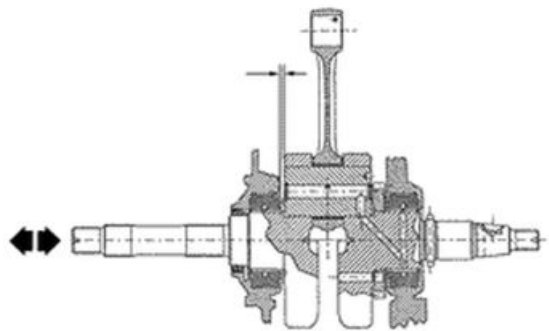
*** Value «A» of sealing ring inside the cylinder

**** Ring opening

SEALING RINGS

Name	Initials	Cylinder	Piston	Play on fitting
1st Compression ring	A	0.15 ÷ 0.35	0.5	</>
Middle piston ring	A	0.25 ÷ 0.50	0.65	</>
Oil scraper ring	A	0.25 ÷ 0.50	0.65	</>

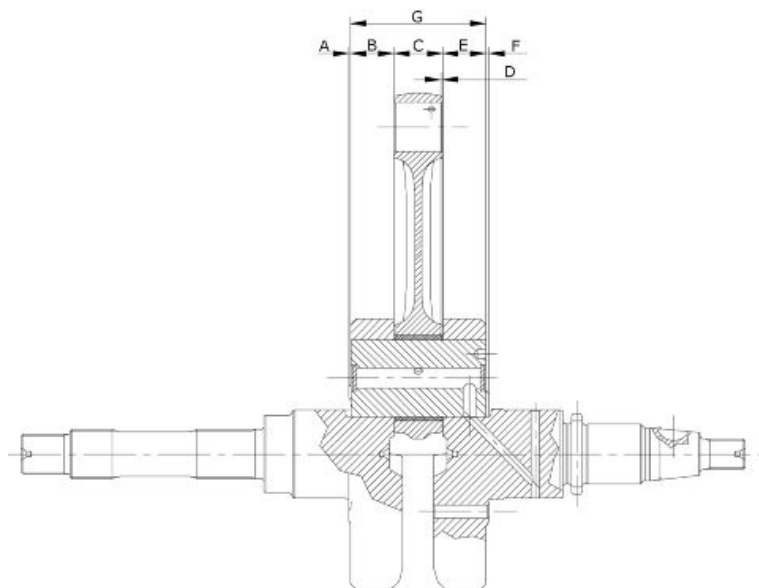
Crankcase - crankshaft - connecting rod



Characteristic

Drive shaft / crankcase axial clearance:

0.1 - 0.5 mm (when cold)

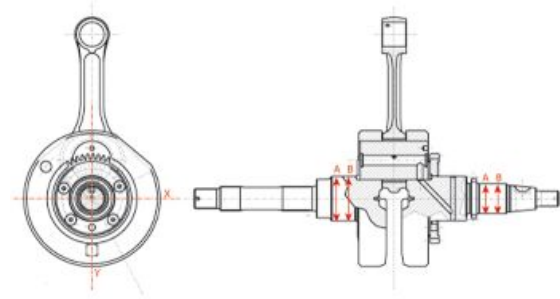


AXIAL CLEARANCE BETWEEN CRANKSHAFT AND CONNECTING ROD

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 drive shaft		63.5+0.1-0.05	G	D= 0.20 - 0.40

Diameter of crankshaft bearings.

Measure the capacity on both axes x-y.



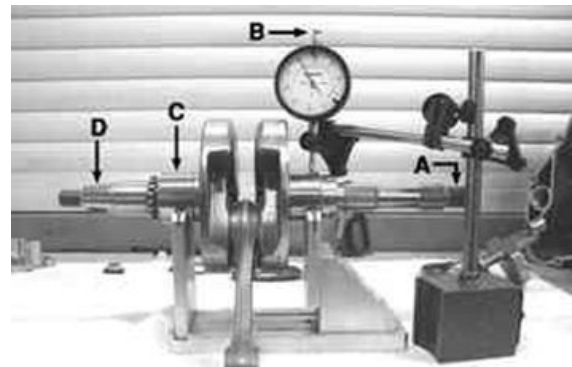
CRANKSHAFT

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 support for dial gauge



MAX. ADMISSIBLE DISPLACEMENT

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

Crankcase / countershaft coupling

Besides considering it should match the crankshaft, the crankcase is chosen according to the centre to centre distance between the seat of the crankshaft and that of the contra-rotating shaft.

Both the centre to centre distance and the pair of gears driving the contra-rotating shaft are divided into two types (A and B) to be matched (**A with A and B with B**).

This selection is useful to keep the difference between the working distance of the gears and their distance without clearance at a given value in order to avoid abnormal noise.

TYPE A

Specification	Desc./Quantity
Centre to centre distance of the gears without clearance	76.937 ÷ 76.867
Centre to centre distance on the crankcase	77.022 ÷ 76.992

TYPE B

Specification	Desc./Quantity
Centre to centre distance of the gears without clearance	76.907 ÷ 76.837

Specification	Desc./Quantity
Centre to centre distance on the crankcase	76.992 ÷ 76.962

The gears with centre to centre distance without clearance between 76.867 and 76.907 are considered universal and can be fitted to either crankcase type.

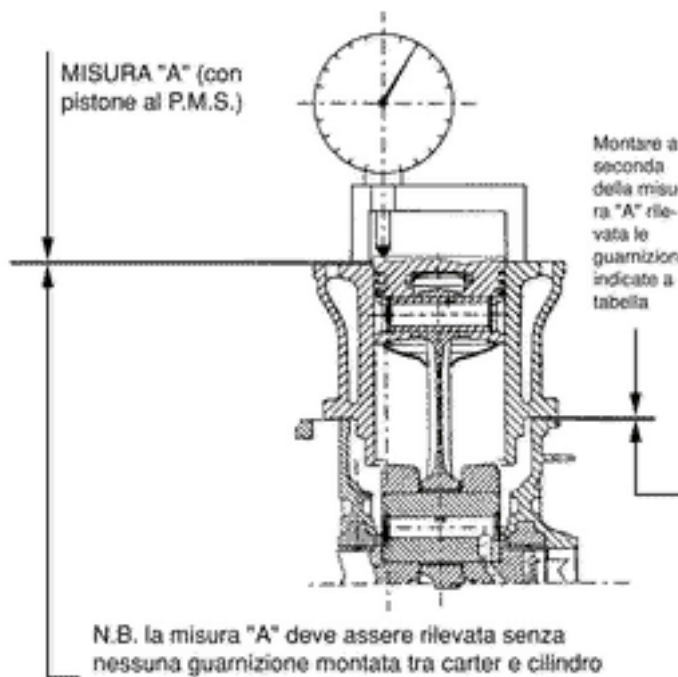
Either the pair of gears or the crankcase is identified with the letter referring to the type (on the crankcase, this mark is found at the cylinder mouth, flywheel side).

Slot packing system

Shimming system for limiting the compression ratio $R_c = 10.5 : 1$

DISTANCE "A" IS A PROJECTION OR RECESS VALUE OF THE PISTON TOP FROM THE CYLINDER PLANE.

DISTANCE "A" ALLOWS THE THICKNESS OF THE GASKET TO BE DETERMINED THAT HAS TO BE FITTED TO THE CYLINDER HEAD IN ORDER TO RESTORE THE COMPRESSION RATIO. THE BASE GASKET MUST BE THICKER, THE MORE THE PLANE FORMED BY THE PISTON TOP PROTRUDES FROM THE PLANE FORMED BY THE CYLINDER HEAD. 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
«A» MEASURE TAKEN	- 0.185 - - 0.10	0.4 ± 0.05
«A» MEASURE TAKEN	- 0.10 - + 0.10	0.6 ± 0.05
«A» MEASURE TAKEN	+ 0.10 ÷ + 0.185	0.8 ± 0.05

N.B.

VALUES INDICATED WITH «-» REFER TO PISTON CROWN RECESSES WITH RESPECT TO THE CYLINDER PLANE.

Products

PRODOTTI

Product	Description	Specifications
AGIP ROTRA 80W-90	Rear hub oil	SAE 80W/90 Oil that exceeds the requirements of API GL3 specifications
AGIP FILTER OIL	Oil for air filter sponge	Mineral oil with specific additives for increased adhesiveness
AGIP CITY HI TEC 4T	Engine oil	SAE 5W-40, API SL, ACEA A3, JASO MA Synthetic oil
AGIP BRAKE 4	Brake fluid	FMVSS DOT 4 Synthetic fluid
SPECIAL AGIP PERMANENT fluid	coolant	Monoethylene glycol-based antifreeze fluid, CUNA NC 956-16
AUTOSOL METAL POLISH	Muffler cleaning paste	special product for cleaning and polishing stainless steel muffler
AGIP GP 330	Grease for brake levers, throttle	White calcium complex soap-based spray grease with NLGI 2; ISO-L-XBCIB2
AGIP CITY TEC 2T	Mixer oil	synthetic oil for 2-stroke engines: JASO FC, ISO-L-EGD
ARNICA 46	Electro-hydraulic centre-stand	Highly viscous oil for hydraulic controls


INDEX OF TOPICS

TOOLING

TOOL

SPECIFIC TOOLING

Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y002	Driver for OD 73 mm bearing	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Driver for OD 54-mm bearings	
001467Y008	Pliers to extract 17 mm ø bearings	
001467Y017	Driver for OD 36 mm bearings	

Stores code	Description	
001467Y031	Bell	


001467Y034 Pliers to extract ø 15-mm bearings



001467Y035	Belle for OD 47-mm bearings	
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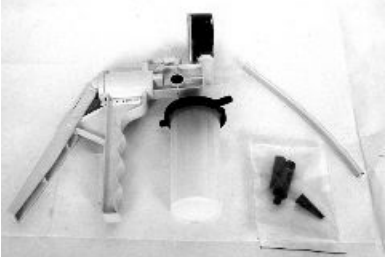
002465Y Pliers for circlips



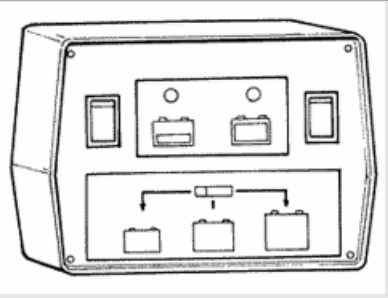





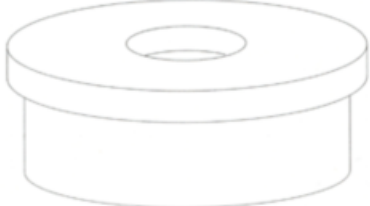




020004Y	Punch for removing fifth wheels from headstock	
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020055Y Wrench for steering tube ring nut



Stores code	Description	
020074Y	Support base for checking crankshaft alignment	
020150Y	Air heater support	
020151Y	Air heater	
020193Y	Oil pressure gauge	
020306Y	Punch for assembling valve seal rings	
020329Y	MityVac vacuum-operated pump	

Stores code	Description	
020330Y	Stroboscopic light to check timing	
020331Y	Digital multimeter	
020333Y	Single battery charger	
020334Y	Multiple battery charger	
020335Y	Magnetic support for dial gauge	
020358Y	37x40-mm adaptor	

Stores code	Description	
020359Y	42x47-mm adaptor	
020360Y	Adaptor 52 x 55 mm	
020363Y	20 mm guide	
020364Y	25-mm guide	
020375Y	Adaptor 28 x 30 mm	
020376Y	Adaptor handle	
020382Y012	bush (valve removing tool)	

Stores code

Description

020412Y

15 mm guide



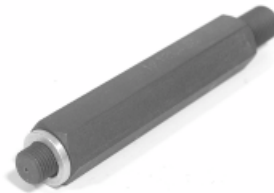
020431Y

Valve oil seal extractor



020434Y

Oil pressure control fitting



020439Y






17 mm guide



020444Y

Tool for fitting/ removing the driven pulley clutch



Stores code	Description	
020444Y009	46x55 Wrench	
020456Y	Ø 24 mm adaptor	
020458Y	Puller for lower bearing on steering tube	
020459Y	Punch for fitting bearing on steering tube	
020460Y	Scooter diagnosis and tester	

Stores code	Description
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020467Y

Flywheel extractor



020468Y

Piston fitting band



020469Y

Reprogramming kit for scooter diagnosis tester



020470Y



Pin retainers installation tool









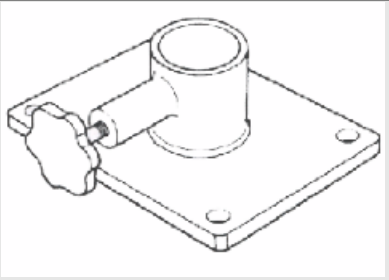

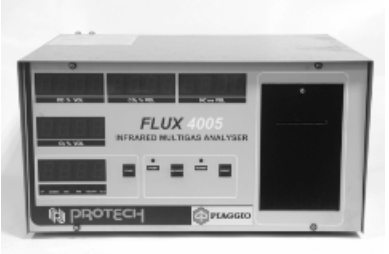
020471Y

Pin for countershaft timing



Stores code	Description	
020472Y	Flywheel lock wrench	 A black metal tool consisting of a circular ring with a handle and a smaller cylindrical component.
020474Y	Driving pulley lock wrench	 A black metal tool with a curved handle and a central opening.
020475Y	Piston position checking tool	 A black metal tool with a circular base and several vertical pins.
020476Y	Stud bolt set	 Three black metal bolts of varying lengths.
020477Y	Adaptor 37 mm	 A black metal cylindrical adaptor with a central hole.
020478Y	Punch for driven pulley roller casing	 A black metal cylindrical punch with a tapered end.

Stores code	Description	
020479Y	Countershaft lock wrench	
020480Y	Petrol pressure check set	
020481Y	Control unit interface wiring	
020482Y	Engine support	
020483Y	30 mm guide	
020512Y	Piston fitting fork	

Stores code	Description	
020527Y	Engine support base	
020565Y	Flywheel lock calliper spanner	
020604Y011	Fitting adapter	
494929Y	Exhaust fumes analyser	

INDEX OF TOPICS

MAINTENANCE

MAIN



Maintenance chart

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

To this end, a series of checks and maintenance operations (at the owner's expense) have been suggested, which are included in the summary table on the following page. Any minor faults should be reported without delay to an **Authorised Service Centre or Dealer** without waiting until the next scheduled service to solve it.

All scheduled maintenance services must be carried out at the specified intervals, even if the stated mileage has not yet been reached. Punctual scooter servicing is essential to ensure your warranty remains valid. For any further information concerning Warranty procedures and "Scheduled Maintenance", please refer to the "Warranty Booklet".

EVERY 2 YEARS

60'

Action

Coolant - change
Brake fluid - change

EVERY 3,000 KM

Action

Engine oil - level check/ top-up
Brake pads - check condition and wear

AFTER 1,000 KM OR 4 MONTHS

90'

Action

Engine oil - replacement
Hub oil - change
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Steering - adjustment
Brake control levers - greasing
Brake fluid level - check
Safety locks - check
Electrical system and battery - check
Vehicle and brake test - road test

AFTER 6,000 KM OR 12 MONTHS

80'

Action

Engine oil - replacement
Hub oil - level check
Spark plug / electrode gap - check
Air filter - cleaning
Engine oil - change
Valve clearance - check
Base vent - check
Variable speed rollers - replacement
Driving belt - checking
Coolant level - check
Brake fluid level - check
Electrical system and battery - check
Tyre inflation and wear - Check
Vehicle and brake test - road test

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

205'

Action

Engine oil - replacement
Hub oil - level check
Spark plug/electrode gap - replacement
Air filter - clean
Engine oil - change
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Variable speed rollers - replacement
Roller support sliding blocks - check/change
Driving belt - replacement
Coolant level - check
Steering - adjustment
Brake control levers - greasing
Transmission elements - lubrication
Brake fluid level - check
Safety locks - check
Suspensions - check
Electrical system and battery - check
Headlight - adjustment
Tyre pressure and wear - check
Vehicle and brake test - road test

AFTER 18,000 KM AND AFTER 54,000 KM

150'

Action

Engine oil - replacement
Hub oil - level check
Spark plug / electrode gap - check
Air filter - change
Engine oil - change
Valve clearance - check
Base vent - check
Variable speed rollers - replacement
Driving belt - checking
Coolant level - check
Radiator - external cleaning/ check
Brake fluid level - check
Electrical system and battery - check
Tyre inflation and wear - Check
Vehicle and brake test - road test

AFTER 24,000 KM

255'

Action
Engine oil - replacement
Hub oil - change
Spark plug / electrode gap - replacement
Air filter - clean
Engine oil - change
Fuel filter - check
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Variable speed rollers - replacement
Roller support sliding blocks - check/change
Driven pulley bushing - check / grease
Driving belt - replacement
Coolant level - check
Steering - adjustment
Brake control levers - greasing
Transmission elements - lubrication
Brake fluid level - check
Safety locks - check
Suspensions - check
Electrical system and battery - check
Headlight - adjustment
Tyre inflation and wear - Check
Vehicle and brake test - road test

AFTER 30,000 KM, 42,000 KM AND 66,000 KM

80'

Action
Engine oil - replacement
Hub oil - level check
Spark plug / electrode gap - check
Air filter - cleaning
Engine oil - change
Base vent - check
Variable speed rollers - replacement
Driving belt - checking
Coolant level - check
Brake fluid level - check
Electrical system and battery - check
Tyre inflation and wear - Check
Vehicle and brake test - road test

AFTER 36,000 KM

365'

Action
Engine oil - replacement
Hub oil - level check
Spark plug/electrode gap - replacement
Air filter - change
Engine oil - change
Valve clearance - check
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Variable speed rollers - replacement
Roller support sliding blocks - check/change
Driving belt - replacement
Coolant level - check
Radiator - external cleaning/ check
Steering - adjustment

Action

Brake control levers - greasing
Brake fluid hoses - replacement
Transmission elements - lubrication
Brake fluid level - check
Safety locks - check
Suspensions - check
Electrical system and battery - check
Headlight - adjustment
Tyre inflation and wear - Check
Vehicle and brake test - road test

AFTER 48,000 KM

255'

Action

Engine oil - replacement
Hub oil - change
Spark plug / electrode gap - replacement
Air filter - clean
Engine oil - change
Fuel filter - replacement
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Variable speed rollers - replacement
Roller support sliding blocks - check/change
Driven pulley bushing - check / grease
Driving belt - replacement
Coolant level - check
Steering - adjustment
Brake control levers - greasing
Transmission elements - lubrication
Brake fluid level - check
Safety locks - check
Suspensions - check
Electrical system and battery - check
Headlight - adjustment
Tyre inflation and wear - Check
Vehicle and brake test - road test

AFTER 72,000 KM

405'

Action

Engine oil - replacement
Hub oil - change
Spark plug / electrode gap - check / replacement
Air filter - change
Engine oil - change
Fuel filter - check
Valve clearance - check
Carburetion - check/adjust
Seals/injection system hoses - visual check
Base vent - check
Variable speed rollers - replacement
Roller support sliding blocks - check/change
Driven pulley bushing - check / grease
Driving belt - replacement
Coolant level - check
Radiator - external cleaning/ check
Steering - adjustment
Brake control levers - greasing
Brake fluid hoses - replacement
Brake fluid level - check
Safety locks - check
Suspensions - check

Action

Electrical system and battery - check
Headlight - adjustment
Tyre inflation and wear - Check
Vehicle and brake test - road test
Transmission elements - lubrication

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 CONTROL UNITS AND SPARK PLUGS OTHER THAN THOSE PRESCRIBED CAN SERIOUSLY DAMAGE THE ENGINE.

Characteristic

Recommended spark plugs:

CHAMPION RG6YC - NGK CR 7 EKB

- Position the scooter on centre 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 spark plug cap
- Unscrew the spark plug.
- Check the conditions of the spark plug, 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 the appropriate feeler gauge.



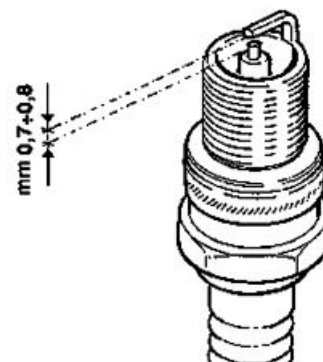
Characteristic

Electrode gap

0.7-0.8 mm

Adjust the gap if necessary, carefully bending the earth electrode. In the event of irregularity, replace the spark plug with a recommended type.

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



Locking torques (N*m)

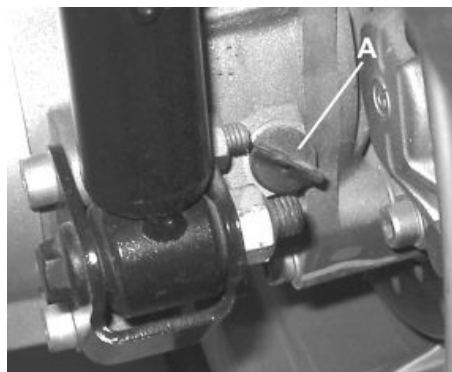
Spark plug 12 ÷ 14

- 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.



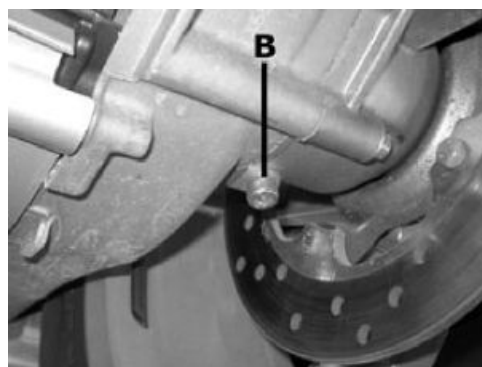
N.B.

THE NOTCHES ON THE HUB OIL LEVEL BAR, WITH THE EXCEPTION OF THOSE INDICATING THE MAX AND MIN LEVEL, REFER TO SOME OF THE MANUFACTURER'S OTHER MODELS AND HAVE NO SPECIFIC FUNCTION AS FAR AS REGARDS THIS VEHICLE.



Replacement

- Prepare a suitable container.
- Remove the oil drainage cap «**B**» and let the oil drain out completely.
- Tighten the drainage cap again and fill the hub with oil.



Recommended products

AGIP ROTRA 80W-90 rear oil hub

SAE 80W/90 Oil that exceeds the requirements of API GL3 specifications

Characteristic

Rear hub oil

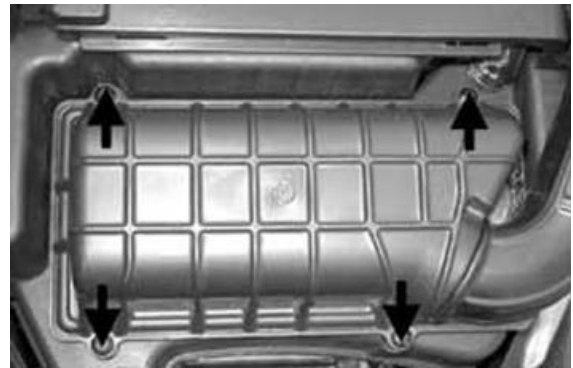
250 cc

Air filter

- Raise the saddle.
- Remove the piston ring and the battery cover.



- Loosen the 4 mounting screws shown in the figure.



- Loosen the mounting screw located under the intake manifold.



- Replace the air filter and reassemble the various components, reversing the removal procedure.



- An inspection and possible cleaning (with compressed air) of the air filter is scheduled every 6000 km in any case.
- The air jet must be directed from the inside to the outside of the filter (i.e. opposite the direction of the air flow during normal operation of the engine).
- Any deposits of condensate out of the engine oil caused by blow-by can be removed via the pipe shown in the figure.

**N.B.**

FAILURE TO OBSERVE THE RULES REGARDING CLEANING OF THE FILTER ELEMENT CAN LEAD TO IMPROPER LUBRICATION OF THE ELEMENT. POOR LUBRICATION AFFECTS THE FILTERING CAPACITY. EXCESSIVE LUBRICATION AS WITH A SOILED FILTER CAUSES AN EXCESSIVELY RICH FUEL/AIR MIXTURE.

CAUTION

WHEN TRAVELLING ON DUSTY ROADS, THE AIR FILTER MUST BE CLEANED MORE OFTEN THAN SHOWN IN THE SCHEDULED MAINTENANCE CHART.

WARNING

DO NOT RUN THE ENGINE IF THE AIR FILTER IS NOT IN PLACE THIS WILL RESULT IN EXCESSIVE WEAR TO ALL THE PARTS OF THE COOLING SYSTEM.

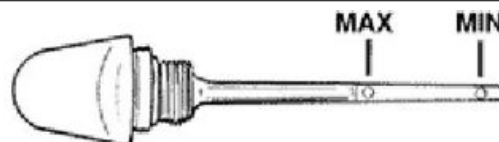
Engine oil

In 4T engines, the engine oil is used to lubricate the distribution elements, the bench bearings and the thermal group. **An insufficient quantity of oil can cause serious damage to the engine.**

In all 4T engines, the deterioration of the oil characteristics, or a certain consumption should be considered normal, especially if during the run-in period. Consumption levels in particular can be influenced by the conditions of use (e.g.: oil consumption increases when driving at "full throttle").

Check

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



- 1) Rest the vehicle on the central stand and on a flat ground.
- 2) Unscrew the cap/dipstick "A", dry it with a clean cloth and reinsert it, **screwing it thoroughly.**
- 3) Remove the cap/dipstick 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 1700 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 implies a quantity of oil **of approx. 400 cc.**

Engine oil filter

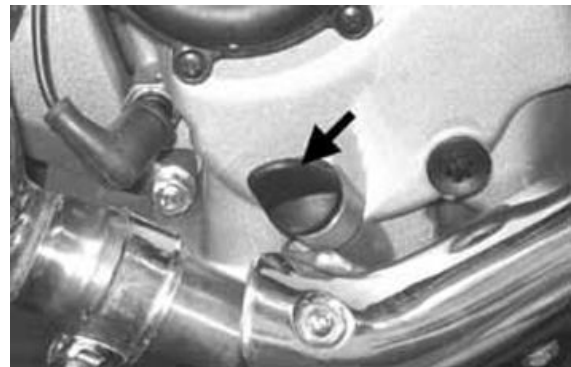
CAUTION

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

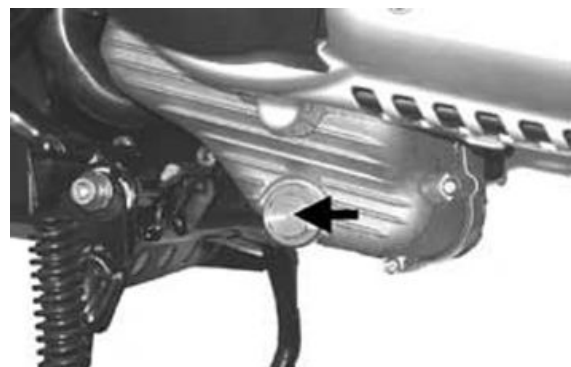
WARNING

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

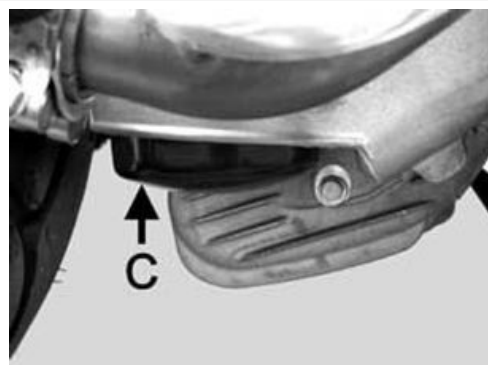
- Remove the muffler.
- Remove the filler plug.



- 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 pre-filter 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 necessary, **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:

1700 cm³

Locking torques (N*m)

Engine oil drainage plug 24 ÷ 30 Engine oil filter 12 - 16

Oil pressure warning light

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 ignition timing

- Using a TORX wrench, remove the timing check cap located on the flywheel cover.
 - Remove the transmission cover to access the driving pulley fastening nut that allows the driving shaft rotation.
 - Remove the head cover as described in the Thermal unit and timing system chapter.
 - Turn the driving shaft to make the reference located on the magnet support collimate with that on the flywheel cover (TDC).
 - Make sure that the reference on the wheel speed sensor is aligned with that obtained on the head.
- If the reference is located opposed to the index



obtained on the head, make the driving shaft perform a further revolution.

- Check that the two references match perfectly; if not, remove the timing belt and install it again.



See also

[Cylinder assy. and timing system](#)

Checking the valve clearance

- To check the clearance in the valves collimate the references between the cam shaft control pulley and head.
- Use a feeler to make sure the clearance between the valve and register screw correspond to the indicated values. If the clearance does not correspond, adjust it by loosening the lock nut using a screwdriver on the set screw as shown in the figure.



Characteristic

Valve clearance: intake

0.15 mm (when cold)

Valve clearance: discharge

0.15 mm (when cold)

Cooling system

Engine cooling fluid 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.
- 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 have an indication of the fluid level, refer to a notch made in a cylindrical insert, coaxial to the filler and visible inside it once you remove the loading cap.

The top side of the notch indicates the **MAX** level while the lower one indicates the **MIN** level.

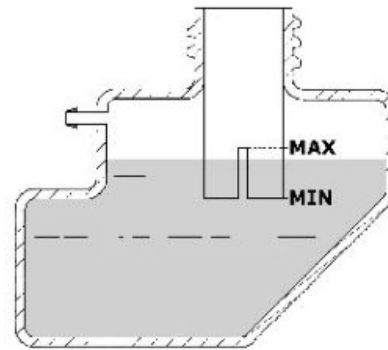
The cooling fluid consists of a mixture of 50% demineralised water and ethylene glycol and corrosion inhibitors based anti-freeze solution.

WARNING

TO CHECK THE PRESENCE OF AIR IN THE CIRCUIT, PROCEED AS DESCRIBED IN THE «COOLING» CHAPTER

CAUTION

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



Characteristic

Cooling system

approx. 1.8 l

See also

[Cooling system](#)

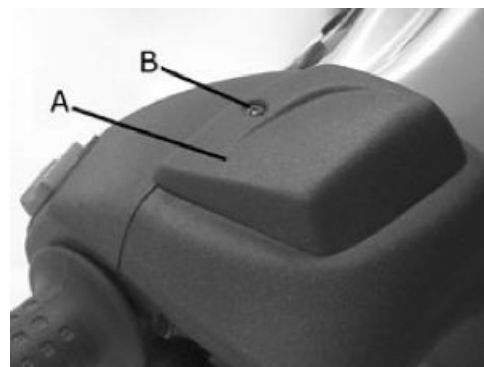
Level check

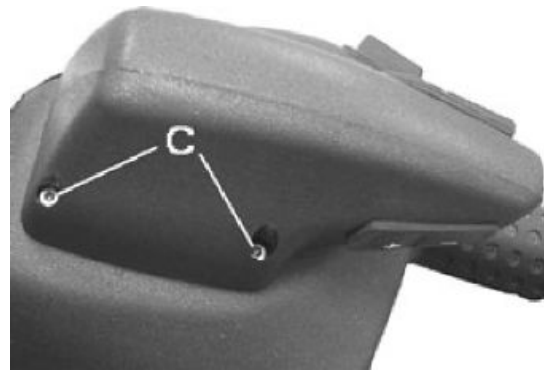
The front and rear brake fluid tanks can be accessed removing the cover located on the right side of the handlebar cover and the display PICS on the left side.

To check the level proceed as follows:

- rest the vehicle on the central stand with the handlebars in a central position;
- remove cover «A» loosening the fixing screw «B» and check the front brake fluid level;
- remove screws «C» fixing the display PICS and check the combined brake fluid level;

The level will go down to a certain extent due to lining wear.





Braking system

Level check

- Rest the scooter 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 RE-

REQUIRED. TOP UP THE PUMP TANK, IF REQUIRED, CONSIDERING THAT THE "MAX." LEVEL MUST ONLY BE OBTAINED WITH NEW PADS.

Top-up

To top up the fluid proceed as follows:

Remove the right cover and/or the PICS display, then remove the tank cap loosening the relevant two screws, remove the intermediate rubber membrane and restore the level using the prescribed fluid without exceeding the max level.

CAUTION

ONLY USE DOT 4-CLASSIFIED BRAKE FLUID.

Recommended products

AGIP BRAKE 4 Brake fluid

FMVSS DOT 4 Synthetic fluid



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

Never use braking fluid from containers that have already been opened, or partially used.

CAUTION

THE BRAKE FLUID IS HYGROSCOPIC, THAT IS, IT ABSORBS MOISTURE FROM THE SURROUNDING AIR. IF THE LEVEL OF HUMIDITY IN THE BRAKE FLUID EXCEEDS A GIVEN VALUE, BRAKING EFFICIENCY WILL BE REDUCED.

CAUTION



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

WARNING

BRAKE CIRCUIT FLUID IS VERY CORROSIVE; DO NOT LET IT COME INTO CONTACT WITH PAINTED PARTS.

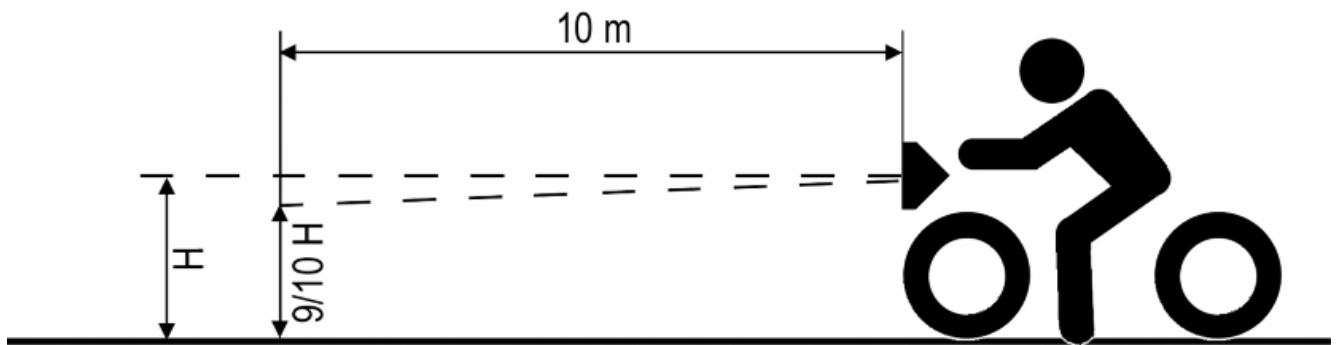
N.B.

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



Headlight adjustment

- Place the vehicle in use conditions, with no load, with tyres inflated at the prescribed pressure on flat ground at 10 m from a white screen placed in dim light, making sure that the vehicle's axle is perpendicular to the screen.
- Trace a horizontal line on the screen at 70 - 73 cm above ground level.



- Turn the headlight on, switch on the dipped beam and check that the horizontal limit line between the dark zone and the illuminated zone does not fall above the horizontal line traced on the screen.
- Adjust the screw located under the front shield to change the headlight inclination and the light beam height.



Checking the end compression pressure

- With the engine cold remove the sparkplug cap.
- Remove the sparkplug.
- Fit a compression testing pressure gauge in the sparkplug seat with a 10 mm sparkplug fitting tightened to the correct torque.
- With the switch on "ON" wait a few seconds and then disconnect the rpm-timing sensor to disable operation of the injector and sparkplug.
- Run the engine using the starter motor and with the throttle body fully open, until the reading on the pressure gauge is stable.
- If the pressure is greater than XX - XX, remove the device and reassemble the vehicle.
- If pressure values lower than those indicated are measured, check the engine rpm used for the test; if under 450 rpm, check the starter system.

When the compression end pressure is under the norm, remove the fitting from the pressure gauge and pour a few cc of oil in the combustion chamber, rotate the engine (preferably by hand) to lubricate the cylinder.

Repeat the pressure test:

if the new values are still low check the valve seals.

Higher pressure values of a new engine indicate poor sealing of the parts.

Locking torques (N*m)

Spark plug 12 ÷ 14

INDEX OF TOPICS

TROUBLESHOOTING

TROUBL

Transmission and brakes

Clutch grabbing or performing inadequately

IRREGULAR CLUTCH PERFORMANCE OR SLIPPAGE

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

Insufficient braking

INSUFFICIENT BRAKING

Possible Cause	Operation
Inefficient braking system	Check the pad wear (1.5 min). Check that the brake discs are not worn, scored or warped. Check the correct level of fluid in the pumps and change brake fluid if necessary. Check there is no air in the circuits; if necessary, bleed the air. Check that the front brake calliper moves in axis with the disc.
Fluid leakage in hydraulic braking system	Failing elastic fittings, plunger or brake pump seals, replace

Brakes overheating

BRAKES OVERHEATING

Possible Cause	Operation
Rubber gaskets swollen or stuck	Replace gaskets.
Compensation holes on the pump clogged	Clean carefully and blast with compressed air
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the vehicle to measure the axial shift of the disc.
Defective piston sliding	Check calliper and replace any damaged part.

Braking vibrations or noise

VIBRATIONS OR NOISE WHEN BRAKING

Possible Cause	Operation
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the vehicle to measure the axial shift of the disc.

Electrical system

Battery

BATTERY

Possible Cause	Operation
Battery	This is the device in the system that requires the most frequent attention and the most thorough maintenance. If the vehicle is not used for some time (1 month or more) the battery needs to be recharged periodically. The battery runs down completely in the course of 3 months. If the battery is fitted on a motorcycle, be careful not to invert the connections, keeping in mind that the black ground wire is connected to the negative terminal while the red wire is connected to the terminal marked+.

Turn signal lights malfunction

TURN INDICATOR NOT WORKING

Possible Cause	Operation
Electronic ignition device failure	With the key switch set to "ON" jump the contacts 1 (Blue - Black) and 5 (Red/Blue) on the control unit connector. If by operating the turn indicator control the lights are not steadily on, replace the control unit; otherwise, check the cable harness and the switch.

Steering and suspensions

Controls

STEERING CONTROLS AND SUSPENSIONS

Possible Cause	Operation
Torque not conforming	Check the tightening of the top and bottom ring nuts. If irregularities in turning the steering continue even after making the above adjustments, check the seats on which the ball bearings rotate: replace them if they are recessed or if the balls are flattened.
Steering hardening	Check the tightening of the top and bottom ring nuts. If irregularities in turning the steering continue even after making the above adjustments, check the seats on which the ball bearings rotate: replace them if they are recessed or if the balls are flattened.
Malfunions in the suspension system	If the front suspension is noisy, check: the efficiency of the front shock absorbers; the condition of the ball bearings and relevant lock-nuts, the limit switch rubber buffers and the movement bushings. In conclusion, check the tightening torque of the wheel hub, the brake calliper, the shock absorber disk in the attachment to the hub and the steering tube.
Seal fault or breakage	Replace the shock absorber Check the condition of wear of the steering covers and the adjustments.

Heavy steering

STEERING HARDENING

Possible Cause	Operation
Torque not conforming	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: replace if they are recessed.

Excessive steering play

EXCESSIVE STEERING CLEARANCE

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

Noisy suspension

NOISY SUSPENSION

Possible Cause	Operation
NOISY SUSPENSION	If the front suspension is noisy, check: the efficiency of the front shock absorbers; the condition of the ball bearings and relevant lock-nuts, the limit switch rubber buffers and the movement bushings.

Suspension oil leakage

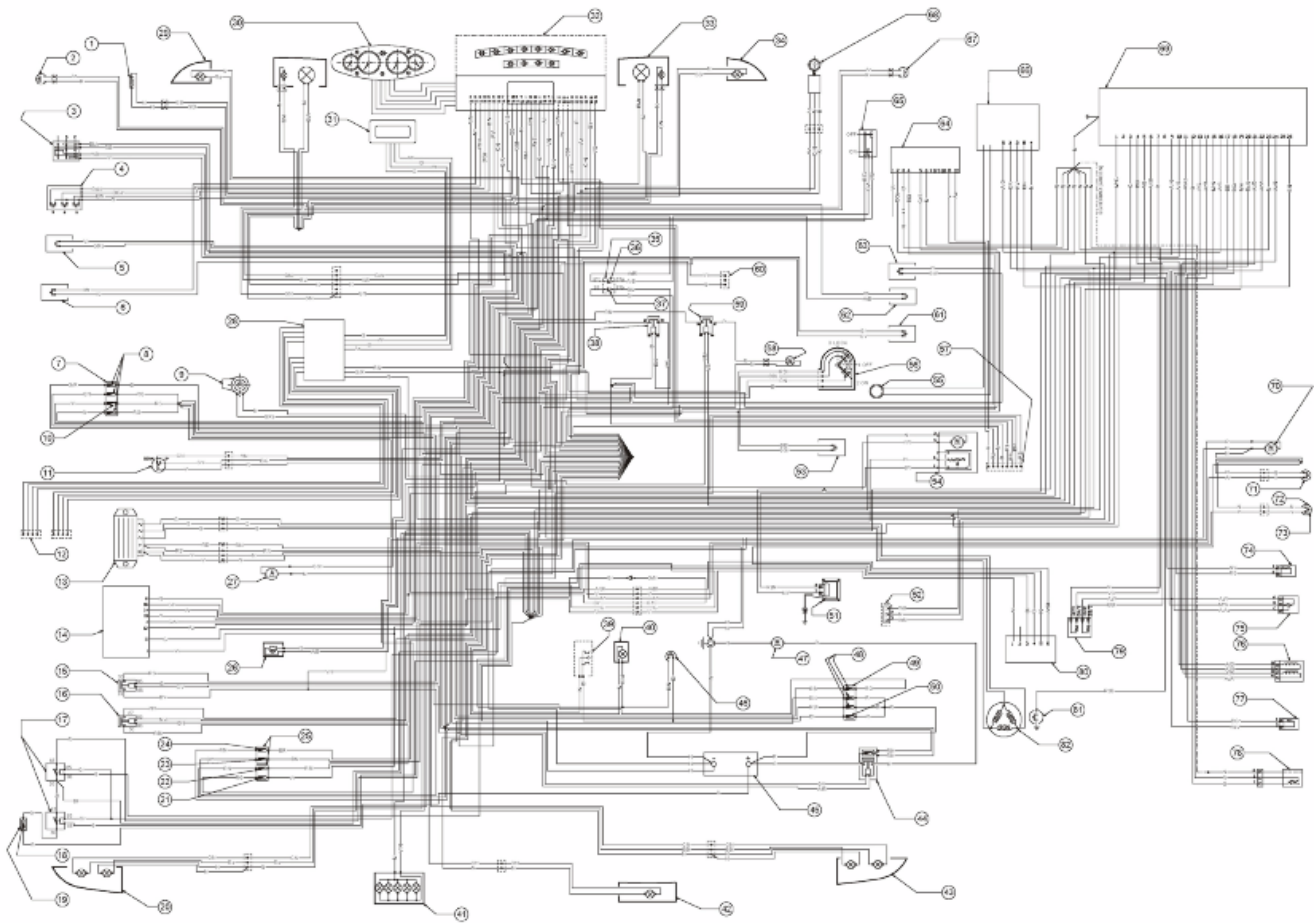
OIL LEAKAGE FROM SUSPENSION

Possible Cause	Operation
Oil leakage from suspension	Service the pumping members and check the sleeves and sealing rings are in good conditions. Replace the damaged parts

INDEX OF TOPICS

ELECTRICAL SYSTEM

ELE SYS



ELECTRICAL SYSTEM

	Specification	Desc./Quantity
1	Outside temperature sensor	
2	Rear brake stop button	
3	Light switch with flash	
4	Indicators switch	
5	Horn button	
6	Emergency flashing button	
7	Front fuse holder box	
8	Fuse no.3 7,5A	
9	Horn	
10	Fuse 15A	
11	Side stand switch	
12	Intercom connectors	
13	Voltage regulator	
14	Electric side stand control unit	
15	Engine stop remote control switch 30A	
16	Remote electronic controller switch 30A	
17	No. 2 side stand pump remote control switches	
18	Fuse 70A	
19	Fuse holder box with side stand pump base	
20	LH taillight with sidelights bulb and flashing light bulb	
21	Fuse 7,5A	
22	Fuse	10A
23	Fuse 5A	
24	Fuse 3A	
25	No. 2 rear fuse holder boxes for control unit	
26	Anti-tilting sensor	
27	Saddle opening actuator	
28	Intercom control unit	

	Specification	Desc./Quantity
29	Front left-hand direction indicator with bulb	
30	Analogue instrument unit (5 bulbs)	
31	Radio display	
32	Digital instrument unit with no. 11 LED indicators	
33	Front headlight	
34	Front right-hand direction indicator with bulb	
35	Diode unit	
36	Diode 6A	
37	Diode 1A	
38	Main remote control switch 30A	
39	Socket 12V	
40	Helmet compartment glass bowl with lamp	
41	Rear brake light with no. 5 bulbs	
42	Number plate light with bulb	
43	RH taillight with sidelights bulb and flashing light bulb	
44	Start-up remote control switch	
45	Battery 12V-14Ah	
46	Helmet compartment light button	
47	Starter motor	
48	No. 3 7.5A fuses	
49	Fuse holder box	
50	Fuse	15A
51	HV coil	
52	Connector cap	
53	Saddle opening button	
54	Fuel level indicator with pump	
55	Immobilizer aerial	
56	Key switch	
57	Anti-theft alarm fitting	
58	Electric fan	
59	Electric fan remote control switch 30A	
60	Fitting for accessories	
61	Side stand button	
62	Start up button	
63	Reset button	
64	Actuators control unit	
65	Engine stop switch	
66	Decoder	
67	Front brake stop button	
68	Wheel rpm sensor	
69	Injection ECU	
70	Side stand pump motor	
71	End of stroke button	
72	Enable button	
73	No. 2 buttons with clamp	
74	Fuel injector	
75	Throttle potentiometer	
76	Idle adjustment motor	
77	Engine rpm sensor	
78	Engine rpm sensor	
79	Engine water temperature sensor	
80	Stuck relay indicator	
81	Engine oil pressure sensor	
82	Magneto flywheel	

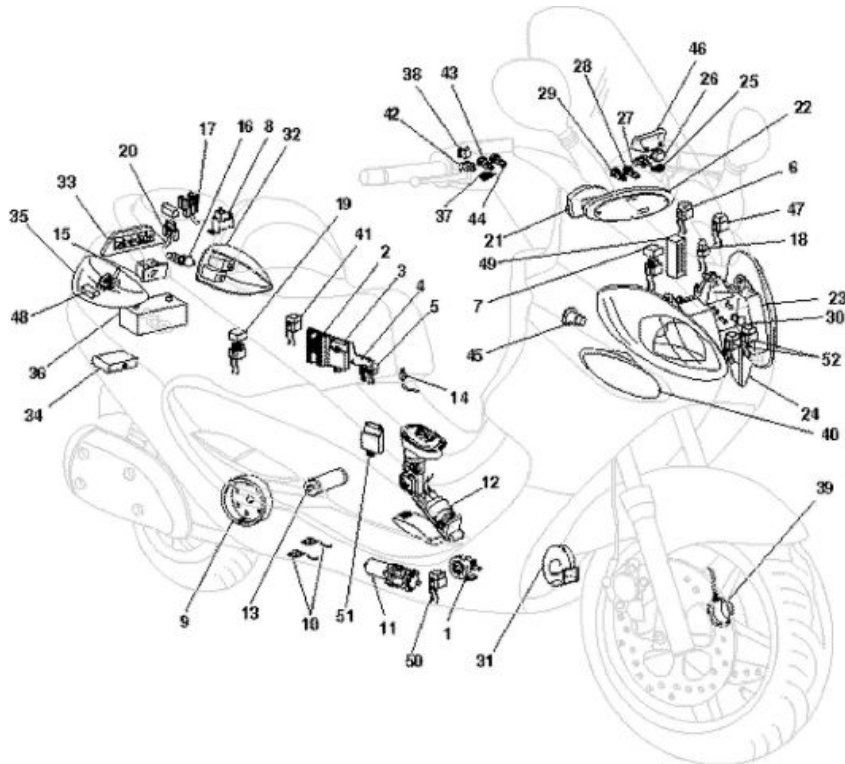
WIRING COLOUR CHART:

B = White - **BI** = Blue - **G** = Yellow - **Mr** = Brown - **N** = Black - **BV** = White - Green - **GN** = Yellow - Black - **G** = Grey - **Rs** Pink - **R** = Red - **Vi** = Purple - **V** = Green - **VN** = Green - Black - **BN** = White - Black - **BBI** = White - Blue - **GV** = Yellow - Green - **Ar** = Orange - **Az** = Light blue - **GrBI** = Grey - Blue - **GrN** = Grey - Black.

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



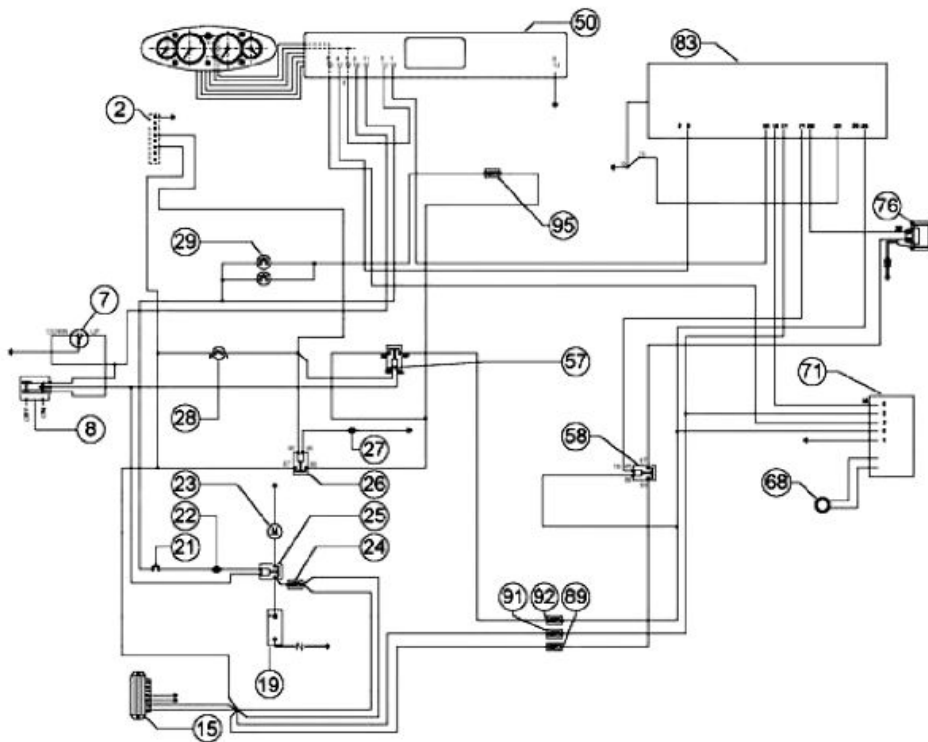
COMPONENTS LOCATION

	Specification	Desc./Quantity
1	Side stand switch	
2	Voltage regulator	
3	Side stand control unit	
4	Electronic control unit remote control switch	
5	Engine stop remote control switch	
6	Service remote control switch	
7	Fuse holder box (n.3 7.5A, n.1 15A)	
8	No. 2 start-up remote control switches	
9	Magneto flywheel 373W	
10	No. 2 buttons for side stand	
11	Side stand pump motor	
12	Pump unit with level indicator	
13	Starter motor	
14	Helmet compartment lighting button	
15	Helmet compartment glass bowl	
16	Socket 12V	
17	No. 2 rear fuse holder boxes for control unit (n.1 3A, n.1 5A, n.1 10A, n.1 3A)	
18	(Diode holder box (n. 2 6A and 2A diodes)	
19	Fuse holder box (n.2 7.5A, n.1 15A and 5A)	
20	Fuse holder box with base for stand pump remote control switch (n.1 70A)	
21	Digital instrument unit (11 indicators and led)	
22	Analogue instrument unit (5 bulbs)	
23	Headlight with n. 2 position bulbs and n.2 high/low beam bulbs 55W	
24	Front LH direction indicator with 10W bulb	
25	Rear brake stop button	

	Specification	Desc./Quantity
26	Light switch with flash	
27	Indicators switch	
28	Horn button	
29	Emergency flashing button	
30	Reset button	
31	Horn	
32	LH taillight with sidelights bulb 5W and flashing light bulb 10W	
33	Rear tail light with 5 2.3W bulbs	
34	Number plate light bulb 12V-5W	
35	Rh taillight with sidelights bulb 5W and flashing light bulb 10W	
36	Battery 12V-14Ah	
37	Front brake stop button	
38	Engine stop switch	
39	Wheel rpm sensor	
40	Front RH direction indicator with 10W bulb	
41	Main remote control switch	
42	Light switch	
43	Start up button	
44	Side stand button	
45	Key switch	
46	Radio display	
47	Electric fan remote control	
48	30A fuse with start-up remote control switch	
49	Radio/intercom/handsfree control unit	
50	No. 2 pump remote control switches	
51	Stuck relay indicator	
52	No. 2 headlight remote control switches	

Conceptual diagrams

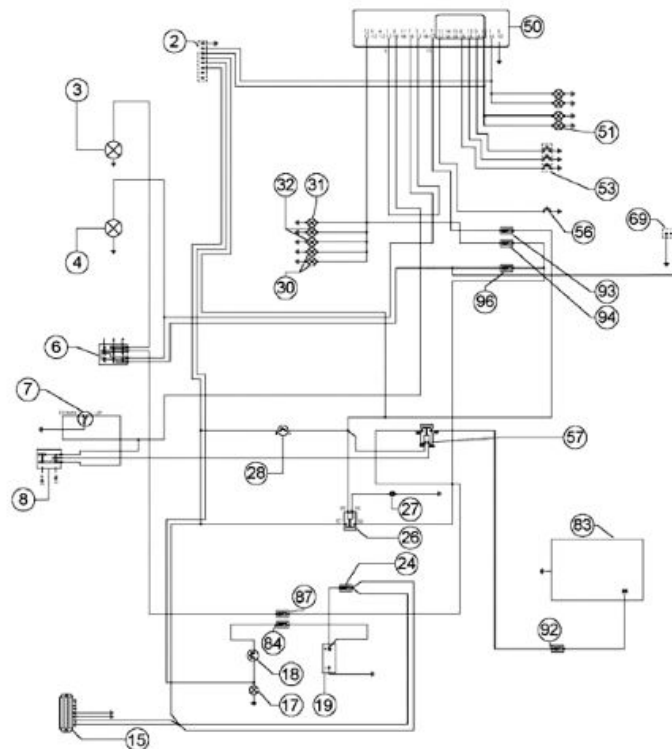
Ignition



IGNITION SECTION

	Specification	Desc./Quantity
1	Anti-theft alarm fitting	
2	Side stand switch	
3	Engine stop switch	
4	Voltage regulator	
5	Battery	12V - 4Ah
6	Start up button	
7	Diode	6A
8	Starter motor	
9	Fuse no. 13	30 A
10	Remote starter switch	
11	Main remote control switch	
12	Diode	2 A
13	Key switch contacts	
14	Two brake light buttons	
15	Digital instrument unit	
16	Engine stop remote control switch	
17	Electronic control unit remote control switch	
18	Immobilizer aerial	
19	Decoder	
20	HV coil	
21	Start-up/injection electronic control unit	
22	Fuse	no. 2 10 A
23	Fuse	no. 3 3A
24	Fuse	no. 10 7,5A

Headlights and automatic starter section

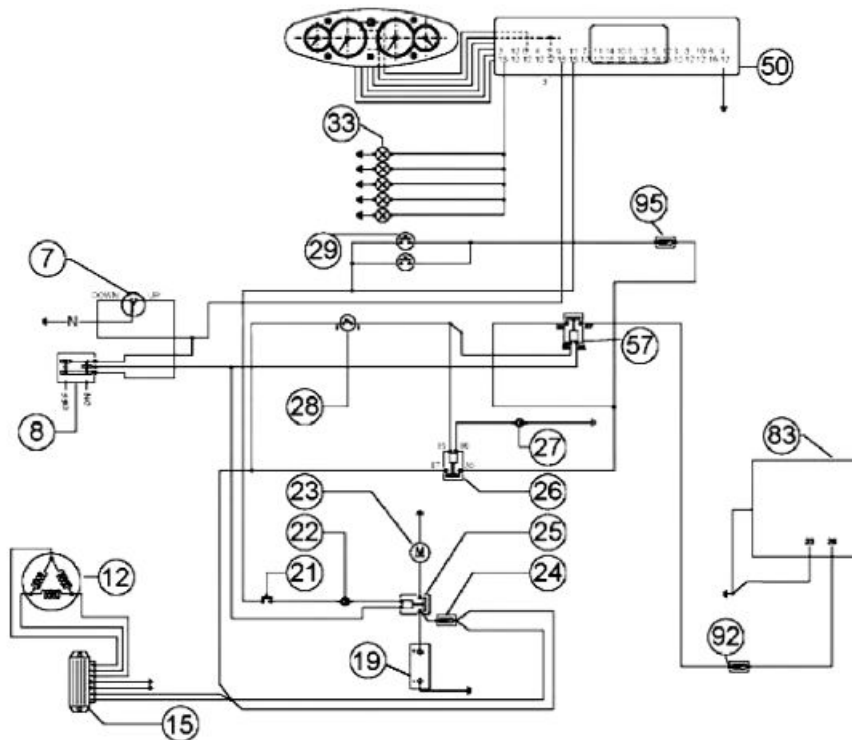


HEADLIGHTS AND AUTOMATIC STARTER SECTION

	Specification	Desc./Quantity
1	Anti-theft alarm fitting	
2	Bulb for upper beams	12V - 55W
3	Bulb for lowerbeams	12V - 55W

	Specification	Desc./Quantity
4	Light switch	
5	Side stand switch	
6	Engine stop switch	
7	Voltage regulator	
8	Roof lamp for box helmet illumination with lamp	
9	Helmet compartment lighting button	
10	Battery	12V - 14 Ah
11	Fuse no. 13	30 A
12	Main remote control switch	
13	Diode	2 A
14	Key switch contacts	
15	No. 2 bulbs for front sidelight	12V-3W
16	License plate light bulb	12V - 5W
17	Two (2) taillight bulbs	12V - 5W
18	Digital instrument unit	
19	4 Turn indicator bulbs	12V-10W
20	Indicators switch	
21	Emergency flashing light button (4 direction indicators)	
22	Engine stop remote control switch	
23	Connettore per predisposizione accessori	
24	Start-up/injection electronic control unit	
25	Fuse	no. 5 15 A
26	Fuse	no. 8 7,5 A
27	Fuse	no. 4 5 A
28	Fuse	no. 12 7,5 A
29	Fuse	no. 11 7,5 A
30	Fuse	no. 9 15 A

Battery recharge and starting

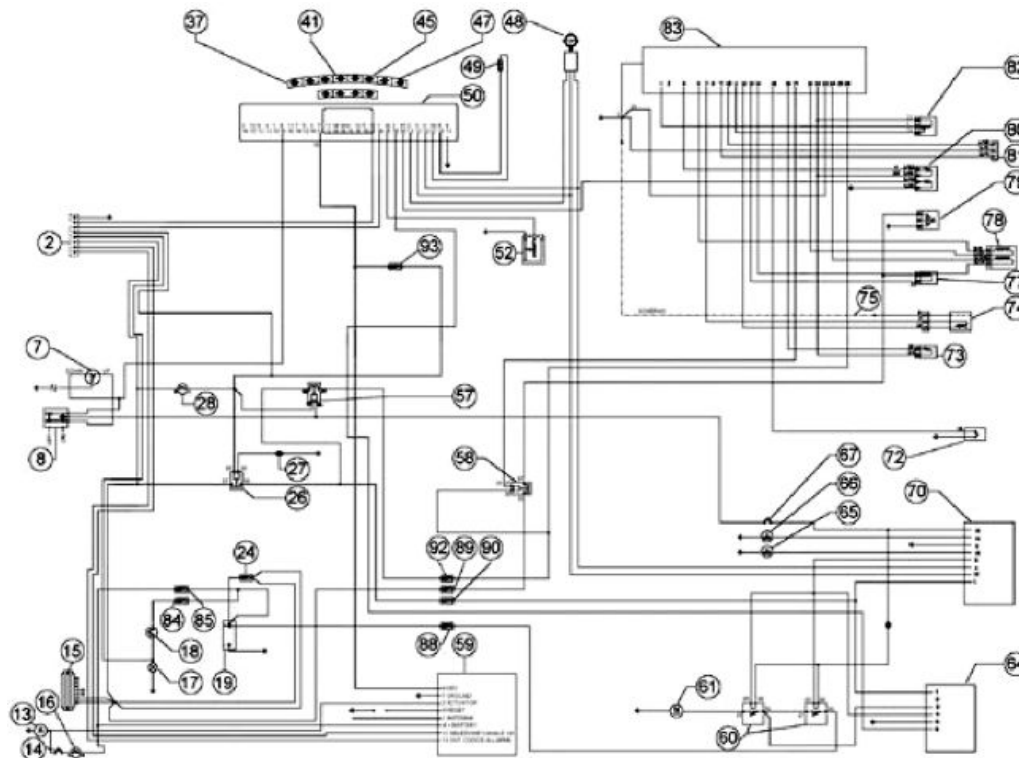


BATTERY RECHARGE AND START-UP SECTION

	Specification	Desc./Quantity
1	Side stand switch	
2	Engine stop switch	
3	Magneto flywheel	

	Specification	Desc./Quantity
4	Voltage regulator	
5	Battery	12V - 4Ah
6	Start up button	
7	Diode	6A
8	Starter motor	
9	Fuse no. 13	30 A
10	Remote starter switch	
11	Main remote control switch	
12	Diode	2 A
13	Key switch contacts	
14	Two brake light buttons	
15	No. 5 bulbs for brake light	12V-2,3W
16	Digital instrument unit	
17	Control unit power supply remote control switch (engine stop)	
18	Start-up/injection electronic control unit	
19	Fuse	no. 4 5 A
20	Fuse	no. 10 7,5A

Level indicators and enable signals section



LEVEL INDICATORS AND ENABLE SIGNALS SECTION

	Specification	Desc./Quantity
1	Anti-theft alarm fitting	
2	Side stand switch	
3	Engine stop switch	
4	Saddle opener actuator	
5	Saddle opening button	
6	Voltage regulator	
7	Key switch contacts	
8	Roof lamp for box helmet illumination with lamp	
9	Helmet compartment lighting button	
10	Battery	12V - 4Ah
11	Fuse no. 13	30 A
12	Main remote control switch	

	Specification	Desc./Quantity
13	Diode	2 A
14	Key switch contacts	
15	Engine warning indicator	
16	Engine not enable indicator	
17	Low fuel warning light	
18	High-beam warning light	
19	Wheel RPM sensor	
20	Outside temperature sensor	
21	Digital instrument unit	
22	Fuel level sender	
23	Control unit power supply remote control switch (engine stop)	
24	Electronic control unit components remote control switch	
25	Saddle opener receiver	
26	Pump remote control switches	
27	Side stand pump motor	
28	Stuck relay indicator	
29	Side stand out enable button	
30	Side stand in enable button	
31	Electro-hydraulic side stand actuation button	
32	Side stand control unit	
33	Tilting sensor	
34	Air temperature sensor	
35	Engine rpm sensor	
36	Double wire screened cable	
37	Fuel injector	
38	Idle adjustment motor	
39	Fuel pump	
40	Engine temperature sensor	
41	Diagnostics socket connector	
42	Throttle potentiometer	
43	Start-up/injection electronic control unit	
44	Fuse	no. 5 15A
45	Fuse	no. 6 10A
46	Fuse	no. 14 70A
47	Fuse	no. 2 10A
48	Fuse	no. 1 5A
49	Fuse	no. 4 5 A
50	Fuse	no. 12 7,5 A

Checks and inspections

Battery recharge circuit

The recharge system is provided with a three phase alternator with permanent flywheel.

The alternator is directly connected to the voltage regulator.

This, in its turn, is connected directly to the ground and the battery positive terminal passing through the 30A protective fuse.

This system therefore requires no connection to the key switch.

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

Stator check

Stator winding check-up

WARNING

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

- 1) Remove the door in the saddle compartment.
- 2) Disconnect the connector between the stator and regulator with the three yellow wires.
- 3) Measure the resistance between each of the yellow terminals and the other two.

Electric characteristic

Resistance:

0.2 - 1 Ω

- 4) Check that there is insulation between the each yellow cable and the ground.
- 5) If values are incorrect, replace the stator.

Recharge system voltage check

Look for any leakage

- 1) Check that the battery does not show signs of leaking fluid before checking the output voltage.
- 2) Turn the ignition key to OFF and connect the multimeter leads between the battery negative pole (-) and the Black cable.
- 3) With the multimeter leads connected, disconnect the Black cable from the battery negative pole (-).
- 4) With the ignition key always at OFF, the reading indicated by the ammeter must be ≤ 0.5 mA.

Maximum current output check.

- With engine off and panel set to "ON" turn on the lights and let the battery voltage set to 12V.
 - Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
 - Keep the lights on and start the engine, bring it to normal speed and read the values on the ammeter.
- With an efficient battery a value must be detected: > 20 A

Check the charging current

WARNING

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

- 1) Place the vehicle on its centre stand
- 2) With the battery correctly connected to the circuit, place the tester terminals between the battery terminals..
- 3) Start the engine, ensure that the lights are all out, increase the engine speed and at the same time measure the voltage.

Electric characteristic

Voltage ranging between 14.0 and 15.0V at 5000 rpm.

VOLTAGE REGULATOR/RECTIFIER

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

Lights list

LIGHTS LIST

	Specification	Desc./Quantity
1	Dipped beam light	N° 1, 12V-55W, halogen
2	Upper beam light	N° 1, 12V-55W, halogen
3	Front position lights	N° 2, 12V-3W, all glass
4	Front direction indicator lights	N° 2, 12V-10W, spherical
5	Rear position lights	N° 2, 12V-5W, spherical
6	Stop lights	N° 5, 12V-2,3W, spherical
7	Rear turn indicator bulbs	Two, 12V-10W, spherical
8	Instrument panel lights	N° 5, 12V-2W, all glass
9	Helmet compartment light	N° 1, 12V-5W, cylindrical
10	Number plate lights	N° 1, 12V-5W, cylindrical

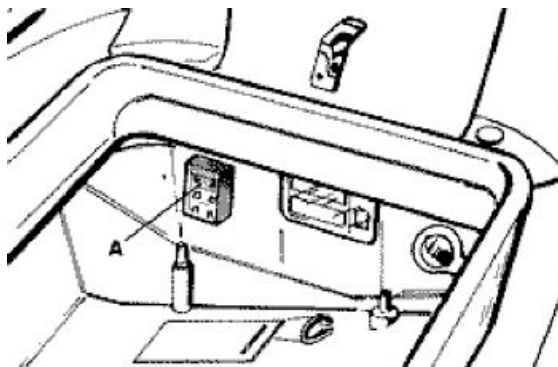
Fuses

The electric system is equipped with:

- four fuses «A» into the under saddle compartment.

FUSE

	Specification	Desc./Quantity
1	N.1	Capacity: 15 A Protected Circuits : Socket 12V for users- Under saddle compartment light
2	N.1	Capacity: 10 A Protected Circuits : Saddle opening by button
3	N.1	Capacity: 10 A Protected Circuits : PICS device
4	N.1	Capacity: 7,5 A Protected Circuits : Dipped and high beam bulb

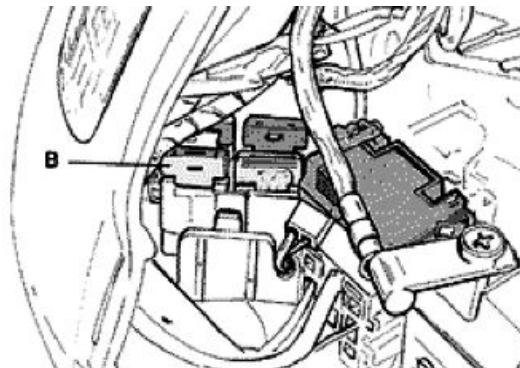


- five fuses «B» next to the battery, on the left side.

FUSE

	Specification	Desc./Quantity
1	N.1	Capacity: 70 A Protected Circuits : Electro-hydraulic stand
2	N.1	Capacity: 5 A Protected Circuits : Electro-hydraulic stand
3	N.1	Capacity: 10 A Protected Circuits : Fuel pump - Injector - H.V. coil
4	N.1	Capacity: 3 A Protected circuits: Immobilizer (Decoder and EMS engine management control unit)

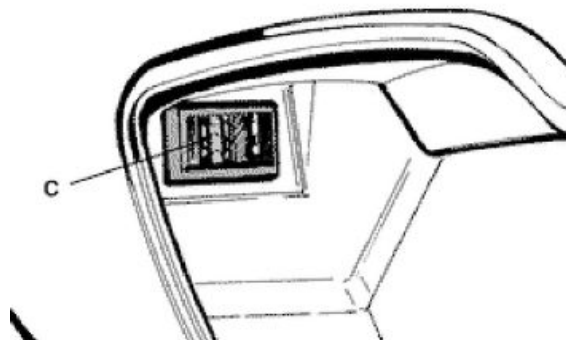
	Specification	Desc./Quantity
5	N.1	Capacity: 5 A Protected circuits: Diagnostic outlet - Decoder and control unit enable signal



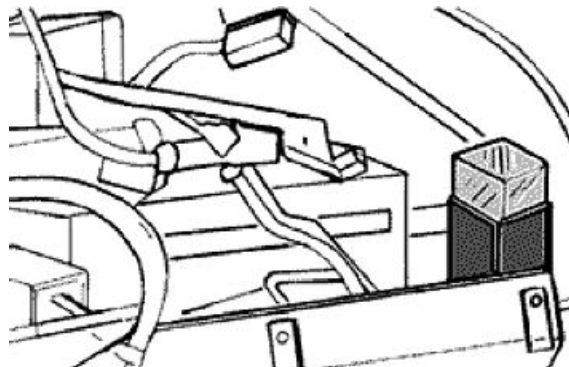
3. four fuses «C» into the trunk on the left side.

FUSE

	Specification	Desc./Quantity
1	N.1	Capacity: 15 A Protected circuits: Horn - High beam bulb - Accessories
2	N.1	Capacity: 7,5 A Protected circuits: Start-up enable signal - Brake light lamp
3	N.1	Capacity: 7,5 A Protected circuits: Front and rear position light - Number plate light
4	N.1	Capacity: 7,5 A Protected circuits: PICS - Saddle opening by remote control



4. a 30A fuse (main fuse), located next to the battery on the right side and on the start-up remote control switch; a spare fuse is provided below it.



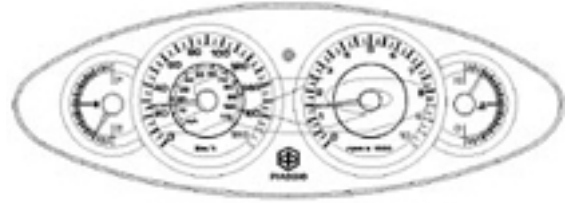
Dashboard

Vehicle X9 is provided with an instrument panel divided into 2 sections: the analogue section is fixed into the cap while the digital section is integral to the handlebar.

The analogue section includes:

- Tachometer with dual scale (MPH/KMH) controlled by the fifth wheel by the digital section;
- RPM counter controlled by the signal sent by the injection control unit;
- Fuel level indicator controlled by a resistive sensor (into the tank)
- Cooling fluid temperature indicator controlled by a resistive sensor (on the head)

These instruments are electrical and managed by stepping motors.



The digital section has the following indications:

- Fuel reserve: amber coloured;
- Position and dipped beam lights: green coloured;
- Upper or passing beams: blue coloured;
- Left direction indicator: green coloured;
- Right direction indicator: green coloured;
- Emergency lights (four direction indicators): red coloured;
- Engine disabled: red coloured;
- ABS system failure (optional): red coloured;
- Oil pressure: red coloured;
- Injection warning: amber coloured;
- ALARM (electro-hydraulic stand): red coloured.



The fuel reserve, direction indicators and emergency flashing functions are activated by the instrument electronics. For example, the fuel reserve indicator light only turns on when the reserve indication coming from the engine lasts at least 13.5 seconds. This prevents the intermitting turning on of the reserve light indicator.

- The intermitting function is built in the instrument electronics: this allows operating the emergency lights with switch in position "OFF" and control switch off. The control switch is only active when the instrument panel is on.

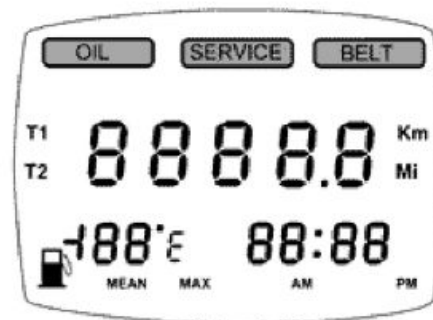
To ensure safety while riding, the "direction indicators control" function is connected to the odometer. If the indicator is left on, it automatically stops after 1 kilometre travelled.

- The "engine disabled" indicator is activated by the side stand switch and by the emergency switch on the right side of the handlebar.
- The LCD display gives a 5 digit indication for the total kilometres covered by the vehicle. It can be expressed in kilometres or in miles: of course, this indication cannot be reset. **To select the indication, press "Trip" and "M" at the same time, then turn the key switch to "ON"; keep these 2 buttons pressed for more than 3" to display "SET" on the display, then the display switches from miles to kilometres, or vice versa.**

The instrument panel digital section is completed by a liquid crystal display and 4 control buttons.

The display has 3 icons:

- Oil
- Service
- Belt



- The "Oil" icon warns the user of the need of replacing the engine oil.
- The "Service" icon warns the user of the need of servicing the vehicle.
- The "Belt" icon warns the user of the need of replacing the driving belt.

After servicing by the authorised workshop, the icon message must be reset by the "Reset" button located in the front side of the vehicle under the headlight upper cover. The "Reset" button allows resetting the kilometres covered and, in the case of "OIL" and "BELT" and "SERVICE", also the year count. This count remains active even if the battery is disconnected for a short time.

To reset one of the icons, press the "Reset" button for less than a second, then on the icon before that to be reset press "Reset" for at least 3" so as to display:

- **The selectionj of the desired icon through the relevant solid light.**
- **The flashing of this light confirms the reset.**
- For example, to reset the "Service" icon, go to "Oil" and press the "Reset" button for at least 3". To reset "Oil", repeat the above procedure going to "Belt".

This procedure must be repeated since the selection of the icon and its reset are operations to be made at the same time (it is not possible to view the desired function and reset by two different button pressures since in this way the next icon would be reset).

Data check function

The date must be adjusted upon the vehicle delivery to the customer. This is because the clock starts counting the year for the «Service» function. If the clock has already been started, reset the functions

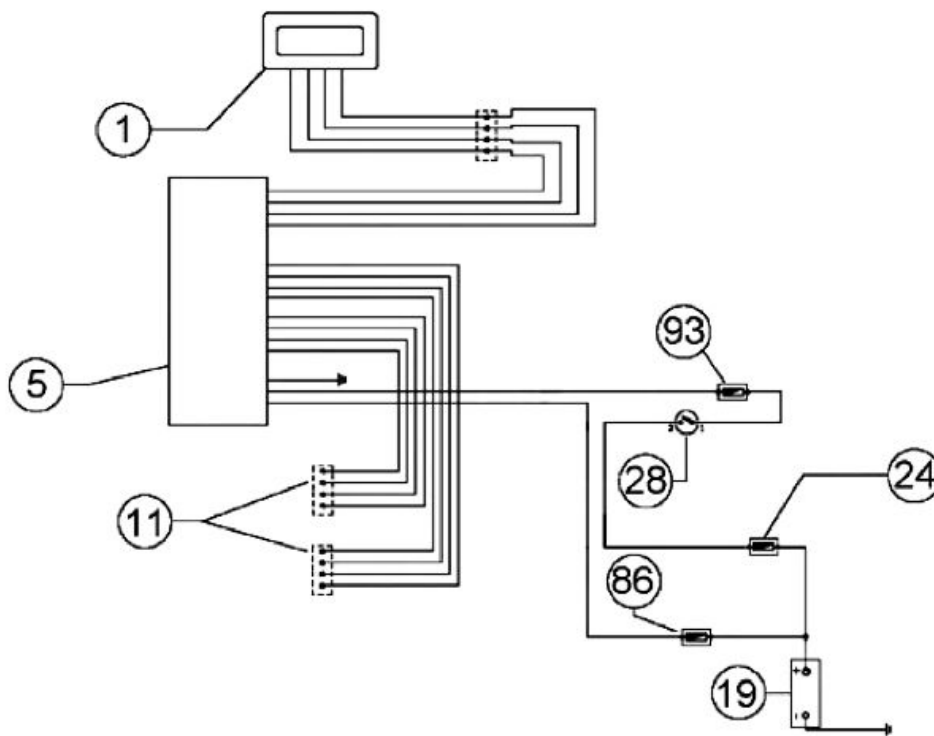
«Oil», «Service» and «Belt». The calendar is programmed from 2000 to 2050, to adjust the date and time use the two buttons «Clock» and «Set».

To guarantee the vehicle safety, every time the key switch is set to «ON», all of the digital indications are checked.

The digital section also has a functional check of the 4 analogue instruments and of the flashing light control. **To start this check, keep buttons «Clock» and «Set» pressed and set the key switch to «ON».** Within 4 seconds, the software version is displayed, the instruments indicate the scale bottom and the direction indicators turn on.

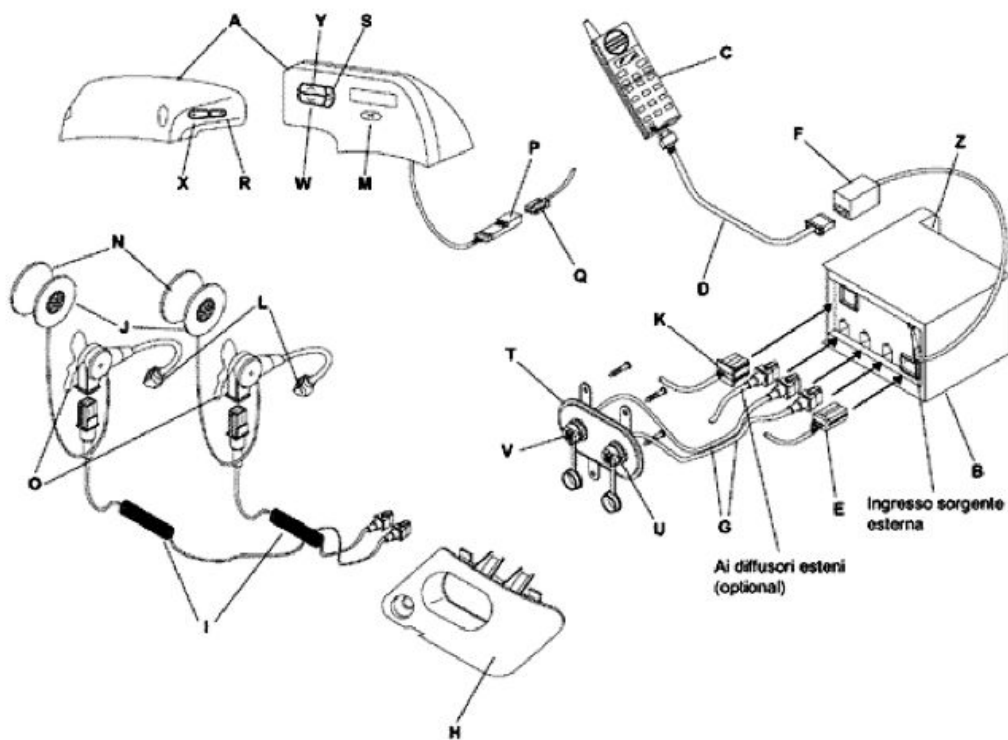
At the end of the above procedure, there is the normal check of the indicator lights.

pics



PICS SECTION

	Specification	Desc./Quantity
1	Display pics	
2	Intercom Controller	
3	Intercom connectors	
4	Battery	12V - 4Ah
5	Fuse no. 13	30 A
6	Key switch contacts	
7	Fuse	no. 7 10A
8	Fuse	no. 12 7,5 A



Captions

- A** = Satellite
- D** = Mobile phone cable
- F** = Telephone connector
- H** = Spark plug inspection port
- J** = Loudspeaker
- L** = Microphone
- O** = Headset clip
- R** = Volume button-
- U** = Passenger connection
- X** = Volume button +
- B** = Control unit
- E** = Control unit power supply connector
- K** = Vehicle control unit connector
- M** = MODE button
- P** = Satellite connector
- S** = Selection button
- V** = Pilot connection
- Y** = UP button
- C** = Mobile phone
- G** = Control unit audio connection cables

- I = Headset cables
- N = Loudspeaker
- Q = Vehicle satellite connector
- T = Cable support plate
- W = DOWN button
- Z = Fixing of control unit to chassis

The control unit PICS X9 (B) combines in a single product the traditional function of intercom for motor-riders and that of handsfree kit for mobile phones and RDS radios.

The voice activation of the intercom function allows eliminating the ground noise caused by the wind. It can be enabled both in automatic and manual mode selecting the two available levels high/low.

Without passenger, the control unit can be used by the pilot as telephone handsfree and/or to listen to the radio or to the external audio source.

The phone talk sets automatically to the pilot when the call signal is detected, but it can be switched to the passenger and/or vice versa by the button (Y) located on the satellite.

The listening volume is adjusted by hand using buttons (R) and (X) for the two loudspeakers; this adjustment affects the audio, intercom and telephone.

The control unit is provided with an auxiliary audio socket for a portable CD or cassette reader.

During the telephone conversation, the external source is disconnected from the conversation channel and is restored at the end of the same.

The control unit is adapted to specific mobile phones by the telephone cable (D) (supplied separately).

N.B.

THE MOBILE PHONE-CONTROL UNIT INTERFACE CABLE IS AVAILABLE FOR MOST MOBILE PHONES AVAILABLE ON THE MARKET. CHECK THE AVAILABILITY OF THE INTERFACE CABLE FOR YOUR SPECIFIC MOBILE PHONE AT THE CONCESSIONAIRE'S.

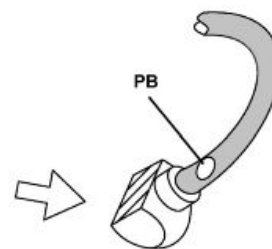
The microphone stem is provided with an elastic metal clip to fix it to the bottom edge of the helmet, on the right side.

The loudspeaker (J) is fixed inside the helmet, at the ear height, by an attachment velcro (N).

To optimise the intercom communication quality:

- For crash helmets, bend the microphone stem so that the capsule is fully seated into the helmet, with the white identification spot (see figure 2) facing the mouth.

- For open helmets, bend the microphone stem so that the capsule sensitive part is as close as possible to the mouth, using the white identification spot (see figure).



WARNING

DON'T REMOVE THE MICROPHONE CAPSULE PROTECTION.

Insert both headsets into the connectors; the pilot's is the front one, the passenger's is the rear one. Move the ignition key to ON and the intercom will start automatically, at the low level (LOW); the intercom can be started in manual mode too.

Adjust the volume using buttons (X) (R).

The voice activation level can be switched to two levels (high; low).

In automatic mode, the intercom starts automatically when the pilot or the passenger talk, and it remains active for 20 seconds at the end of the talk (be careful to the level set).

To switch it to the high level (HIGH), press button (M) and then button (S) when the radio function is displayed.

A mobile phone can be connected to the device using the special cable (D) (see Piaggio accessories); when a call is received, a tone is heard by both the passenger and the pilot; after the tone, the call is switched to the pilot, with the possibility of switching it to the passenger by button (Y). The call can be temporarily interrupted by button (W) to switch to the intercom, and then resumed pressing the same button.

In any case, when the call is received, the control unit emits a short sound on both loudspeakers, optionally with the phone's tone, if the phone model has one.

When the vehicle is stopped, if a call is in progress the control unit remains on until the conversation is ended.

The mobile phone should be set to the automatic answer function to prevent having to press a key to start the conversation.

For the models not provided with this function: you can select the answer by any key option.

The conversation volume can only be set by the mobile phone.

The volume should be set to maximum.

It is possible to connect a scatterer (2.5 W max) by the external scatterer socket (see figure 1). Besides the radio, intercom and handsfree kit functions, it is possible to connect the control unit to a portable CD reader or a walkman by a cable with stereo jack termination 3.5 mm. Adjust the external source volume so that it can be heard correctly without having to adjust the intercom volume.

During a conversation in intercom mode, the audio from the radio or from the external source remains in background at a lower volume.

N.B.

ALWAYS REFER TO THE USE MANUAL OF YOUR MOBILE PHONE TO SET UP THE FUNCTIONS DESCRIBED ABOVE.

N.B.

THE USERS OF MOTOROLA 8700, STARTAC 130™ CD920 CD930 AND BOSCH M-COM 506 MUST CONNECT THEIR MOBILE TO THE CONTROL UNIT WITH PHONE OFF: THE PHONE WILL SWITCH ON AUTOMATICALLY.

STARTING (USING THE VEHICLE KEY)

Specification	Desc./Quantity
No helmet inserted - Logo X9	Tuner - source - Speakerphone with external speakers
Driver headphone inserted - Driver/passenger helmet - passenger crossed out	Tuner - source - Speakerphone
Passenger headphone inserted - Driver/passenger helmet - driver crossed out	Tuner - source - Speakerphone
Driver and passenger headphones inserted - Driver and passenger helmets	Tuner - source - Speakerphone - Intercom

N.B.

EVERY TIME THE KEY SWITCH IS SET TO "ON" THE PICS SYSTEM DISPLAY CHECKS ALL AVAILABLE ICONS.

TURNING ON/OFF THE DEVICE (VEHICLE RUNNING)

Specification	Desc./Quantity
Turn off - M	> 4 sec.
Turn on - M	> 4 sec.

N.B.

WHEN THE VEHICLE IS STARTED, IF THE DEVICE HAD BEEN TURNED OFF THE ICON CHECK WILL BE DISPLAYED AND AT THE END OF THIS STEP IT WILL RETURN TO THE PREVIOUS POSITION (OFF). TO RESTART, PRESS "M" FOR MORE THAN 4 SEC.

MANUAL INTERCOM

Specification	Desc./Quantity
Activation - M two times	Short
Deactivation - M two times	Short

N.B.

AFTER MANUAL DISABLING, THE INTERCOM SWITCHES TO AUTOMATIC MODE WITH LESS SENSITIVE ENABLE LEVEL (LOW).

TUNER/SOURCE

Specification	Desc./Quantity
Radio on - S	Short
Radio off - S	Short
Source on - M go after S	Short, > 2 sec.
Source off -M go after S	short, > 2 sec
Manual tuning UP - M go after ^	Short, Continuous
Manual tuning DOWN -M go after ^	short, continuous
Automatic tuning UP - M go after ^	Short, Continuous
Automatic tuning DOWN -M go after ^	short, short
Memory scanning UP - ^	Short
Memory scanning DOWN - v	Short
AUTOSTORE memorization - ^	> 2 sec.
RDS - M go after vol + (AF - TA - PTY)	Short, Short
PTY functions (can only be selected after enabling PTY) - Vol.	Short
-	-
Manual station memorization - Select station* go after S** go after ^ o V (select station) and after S (to confirm)	> 4 sec., short, short

* By automatic or manual tuning described above

** Press until the display flashes

N.B.

THE BUTTONS MUST BE PRESSED IN A SEQUENCE NOT AT THE SAME TIME.

RDS Radio Data System

Several functions are provided but few of them are used correctly. Basic functions as the AF (alternative frequencies), that allow listening to a fixed radio station on most of the territory during a journey, are not always used properly. The same also applies to traffic news.

AF Alternative Frequencies

This allows the receiver to automatically tune on an alternative frequency stronger than the currently listened by relating to the same station.

TA Traffic Announcement identification

When the traffic news are on air, the function starts and interrupts any other radio stations to listen to the traffic news. You must be tuned on the station that transmits the news.

PTY Program Type

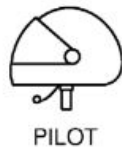
This allows identifying different types of music programs, to listen to the news, etc. There will be: News, Affairs, Info, Sport ecc.

SPEAKERPHONE TELEPHONE

Specification	Desc./Quantity
Driver-passenger conversation passage - ^	Short
Intercom-telephone passage - v	Short

Volume adjustme

icon



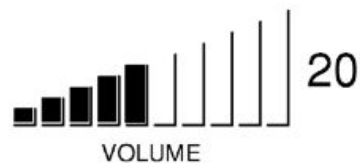
Headphone inser

icon



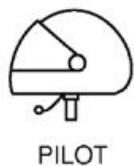
Passenger headp

not inserted icon

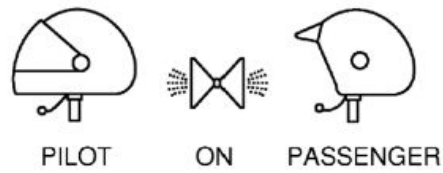


Driver headphon

inserted icon



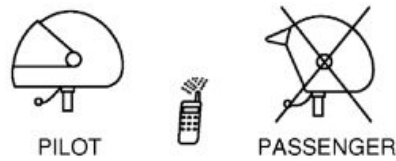
Intercom on icon



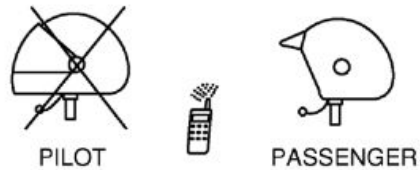
Manual intercom



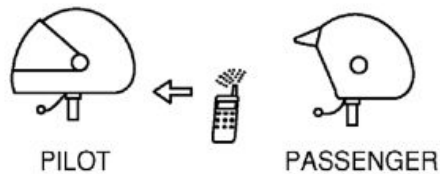
Incoming call icon



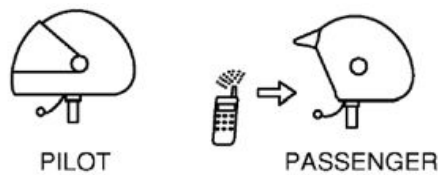
Incoming call icon with driver headp inserted.



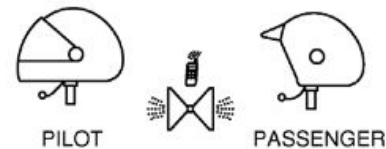
Incoming call icon with passenger h phone inserted.



Telephone call w driver icon



Telephone call wi passenger icon



Telephone conversation intercom icon

SPECIFICHE TECNICHE

	Specification	Desc./Quantity
1	Power	10.5V ÷ 16V 1.4 A max

	Specification	Desc./Quantity
2	Key	10.5V ÷ 16V 1.5 mA max
3	Maximum output power	500 mW per channel
4	Power consumption	vehicle off ~0 mA in stand-by ~280 mA at maximum power ~500 mA
5	Frequency response	audio 200 Hz - 20 kHz ± 3 dB intercom 200 Hz - 5 kHz ± 3 dB
6	Microphones	-69 dB ± 3 dB one-way
7	Frequency response:	audio 200 Hz ÷ 20 kHz ± 3 dB
8	Loudspeakers	8 Ω - 0.5 mΩ

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
 - Minimum 6 h
 - Maximum 24 h

Constant-current battery instructions

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

WARNING

WHEN THE BATTERY IS REALLY FLAT (WELL BELOW 12.6V) IT MIGHT OCCUR THAT 5 HOURS OF RECHARGING ARE NOT ENOUGH TO ACHIEVE OPTIMAL PERFORMANCE. GIVEN THESE CONDITIONS IT IS HOWEVER ESSENTIAL NOT TO EXCEED 8 HOURS OF CONTINUOUS RECHARGING SO AS NOT TO DAMAGE THE BATTERY ITSELF.

Recharging the battery

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

Cleaning the battery

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

CAUTION

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

CAUTION

CHARGE THE BATTERY BEFORE USE TO ENSURE OPTIMUM PERFORMANCE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS THE LIFE OF THE BATTERY.

If the scooter is not used for a given time (1 month or more) it will be necessary to periodically recharge the battery.

The battery runs down completely in the course of three months. If it is necessary to refit the battery in the vehicle, be careful not to reverse the connections, remembering that the ground wire (**black**) marked (-) must be connected to the **negative** clamp while the other two **red** wires marked (+) must be connected to the clamp marked with the + **positive** sign.

Dry-charge battery

- BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH EYES, SKIN AND CLOTHING.

IN CASE OF CONTACT WITH EYES OR SKIN, RINSE WITH ABUNDANT WATER FOR ABOUT 15 MINUTES AND SEEK MEDICAL ATTENTION AT ONCE.

IF IT IS SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.

THE BATTERIES PRODUCE EXPLOSIVE GAS; KEEP THEM AWAY FROM NAKED FLAMES, SPARKS AND CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS.

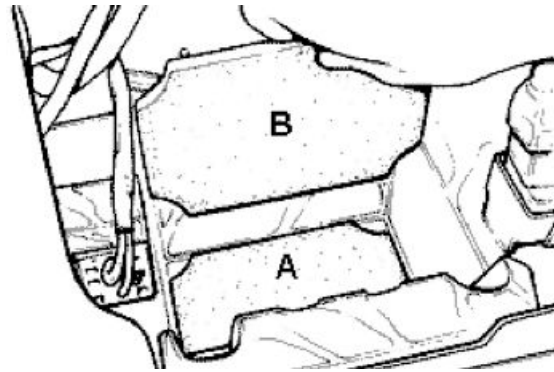
ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.

KEEP OUT OF THE REACH OF CHILDREN

- Lift the seat.
- Remove the two screws and the seat lock cover.
- Loosen the two Allen screws, pull the rear cover upwards and detach the stop light wiring.
- Remove the securing belt and the plastic cover.
- Remove the battery by detaching the negative (-) terminal first, followed by the positive one (+).



- Insert the lower panel at the bottom of the battery compartment (A).
- Insert the front element (B).



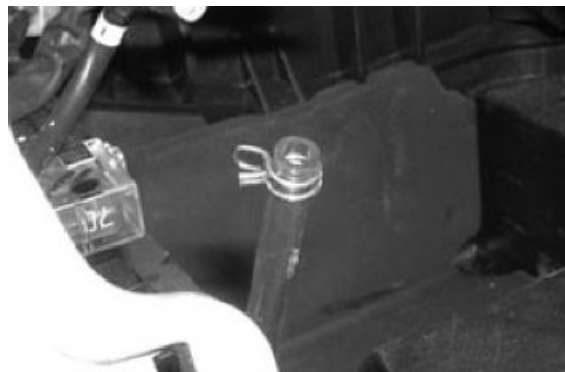
- Place the battery fixing the vent pipe by the retaining clip.

N.B.

THE VENT PIPE WITH THE RETAINING CLIP ARE ALREADY MOUNTED ON THE VEHICLE.

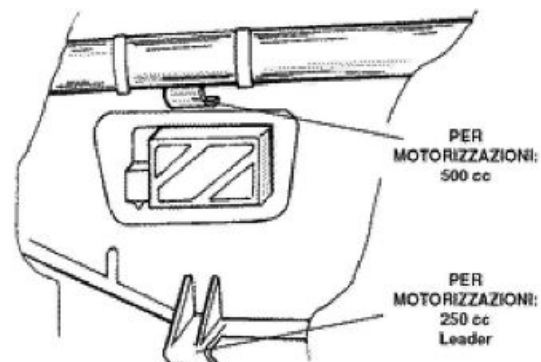
N.B.

AFTER RECHARGING AND BEFORE INSTALLING, ENSURE THAT THE BATTERY ELECTROLYTE DOES NOT EXCEED THE MAX LEVEL.



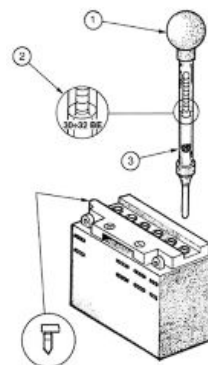
The figure shows two front hooks for the battery retaining belt:

The top one, obtained in the chassis metal cross-piece, must be used for version 500 cc.



- Position the battery and fit the plastic cap, then lock by the plastic belt.
- Connect the wires to the battery terminals.

- Remove the short closed tube and the caps, then pour sulphuric acid into the cells using the type specified for batteries with a specific gravity of 1.26, corresponding to 30 Bé at a minimum temperature of 15°C until the upper level is reached.
- Allow to stand for at least 2 hours, then top up the level with sulphuric acid.
- Within 24 hours, recharge using the special battery charger (single) or (multiple) at an intensity of about 1/10 of the battery nominal capacity and until



the acid gravity is about 1.27, corresponding to 31 Bé and such values become steady.

- After charging, top up the acid (adding **distilled water**). Close and clean carefully.

- After carrying out the operations above, install the battery on the scooter, observing the connections described in point 3) of paragraph "**Battery re-charge**".

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. Only use distilled water, to restore this level. If it is necessary to add water too frequently, check the vehicle's electrical 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.

When the battery is charged, you should detect a density of 30 to 32 Bé corresponding to a specific weight of 1.26 to 1.28 at a temperature of no lower 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 scooter is not used for a given time (1 month or more) it will be necessary to periodically recharge the battery.

The battery runs down completely in the course of three months. When refitting the battery onto the scooter 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 RECHARGING THE BATTERY, REMOVE THE PLUGS OF EACH CELL. KEEP SPARKS AND NAKED FLAMES AWAY FROM THE BATTERY WHILE RECHARGING.

Remove the battery from the vehicle removing the negative clamp first.

Normal bench charging must be performed using the special 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 WITH A CAPACITY HIGHER THAN THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

CAUTION

ORDINARY AND DRINKING WATER CONTAINS MINERAL SALTS THAT ARE HARMFUL FOR THE BATTERY. FOR THIS REASON, YOU MUST ONLY USE DISTILLED WATER.

CAUTION

CHARGE THE BATTERY BEFORE USE TO ENSURE OPTIMUM PERFORMANCE. FAILURE TO CHARGE THE BATTERY ADEQUATELY BEFORE BEING PUT INTO OPERATION WILL LEAD TO A PREMATURE FAILURE OF THE BATTERY.

Phonic wheel

- Ensure that the tone wheel is correctly installed on the scooter and connected to the electrical system.
- Turn the key switch to "**ON**".
- Access the tone wheel connector on the **system side**.
- Carry out the following measurements using the special tool.

Specific tooling

020331Y Digital multimeter

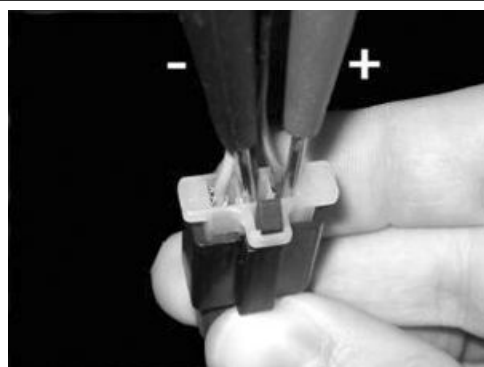
Check the supply voltage.

Keeping the connector in the position shown in the photo, check for battery voltage (12 V) with the polarity shown.

If incorrect values are measured, check the electrical system and the digital instrument.

N.B.

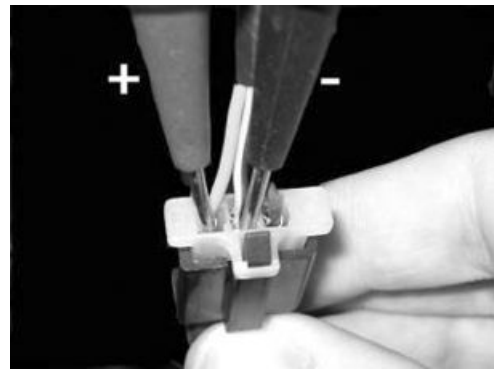
A DROP IN VOLTAGE OF 1 V IN RELATION TO THE BATTERY VOLTAGE CAN BE CONSIDERED NORMAL.



Check the signal

Move the positive rod to the position shown in the photo. Turn the front wheel very slowly and check that the measured voltage is 0 V or battery voltage, depending on the position taken up.

This condition should be repeated 16 times during a complete revolution of the wheel.



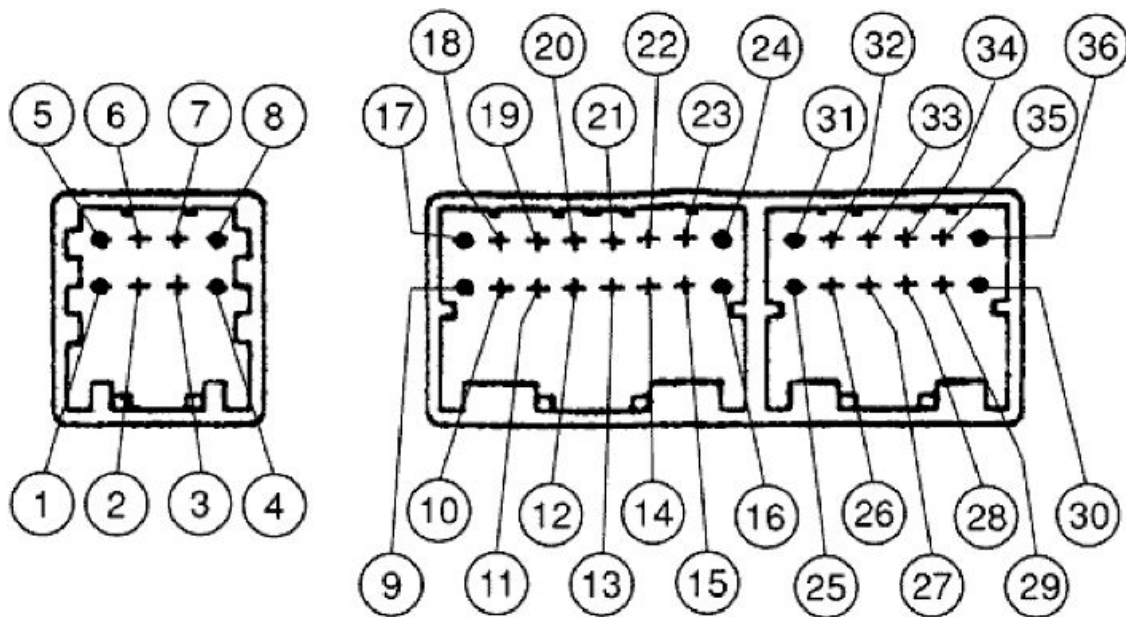
N.B.

THE DIGITAL MULTIMETER IS NOT ABLE TO DISPLAY THE VOLTAGE WHEN THE WHEEL IS ROTATED FAST.

If other voltages are measured or there is no alternation, replace the tone wheel.

Connectors

ECU

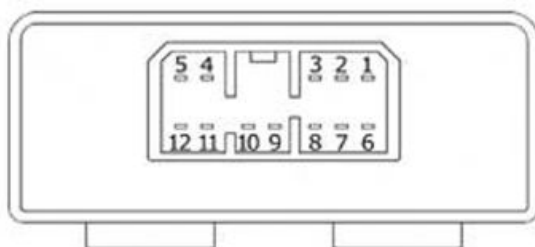


DIGITAL DASHBOARD CONNECTOR AND WIRING

	Specification	Desc./Quantity
1	Analogue card negative	
2	Battery positive (+30) for analogue card	
3	Analogue card serial clock output	
4	Antitheft led output	
5	Analogue card serial data output	
6	Lights on output	
7	(Not connected)	
8	(Not connected)	
9	Warning light input	
10	Stuck relay alarm light input	
11	Abs indicator input (not connected)	
12	RH direction indicator output	
13	RH direction indicator button input	
14	LH direction indicator button input	

	Specification	Desc./Quantity
15	Upper beam indicator input	
16	Air temperature sensor input	
17	Engine not actuable input	
18	Oil pressure indicator input	
19	(Not connected)	
20	LH direction indicator output	
21	Direction indicator stop button input	
22	Reset service management button input	
23	Water temperature sensor input	
24	Fuel level sensor input	
25	Battery positive (+30)	
26	Tachometer sensor power supply	
27	Tachometer sensor return to ground	
28	Rpm sensor input	
29	Battery positive (+30)	
30	Antitheft led	
31	Key positive (+15)	
32	Tachometer sensor input	
33	Negative	
34	Air temperature sensor return to ground	
35	Emergency light button input (hazard)	
36	Lights on input	

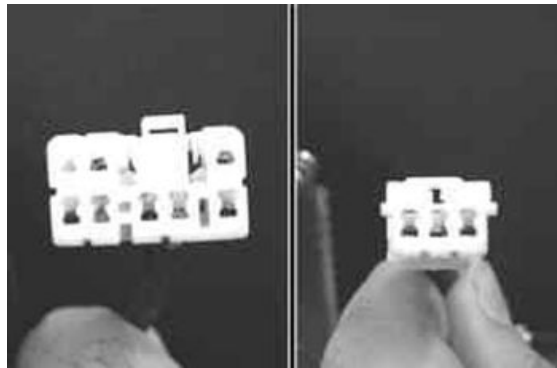
Seat opening receiver



RECEIVER CONTROL UNIT FOR SADDLE OPENER

	Specification	Desc./Quantity
1	Radio aerial	
2	Actuator positive output 1	
3	Reset / Input clearing	
4	Battery positive	
5	(Not connected)	
6	Live positive lead	
7	Ground lead	
8	(Not connected)	
9	(Not connected)	
10	Selection input CH1 / CH3	
11	Positive output actuator 1	
12	Data for alarm output	

Immobiliser decoder



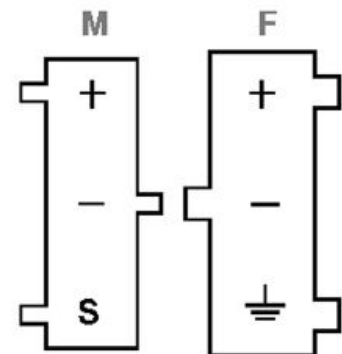
IMMOBILIZER DECODER

	Specification	Desc./Quantity
1	-	
2	Immobilizer LED control	(negative)
3	Base power supply	(positive)
4	Negative	
5	-	
6	Electronic control unit EMS	(serial)
7	-	
8	Continuous power supply (positive)	Immobilizer aerial

Engine rev. sensor

REV SENSOR

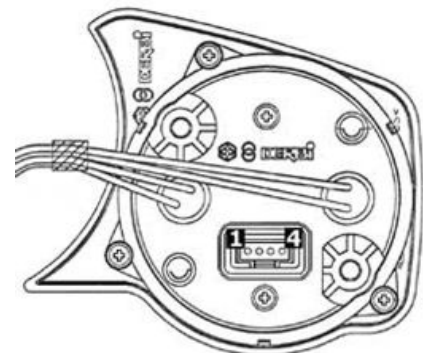
	Specification	Desc./Quantity
1	M:	Male
2	F:	Female
3	S:	Shielding



Analogue odometer

ANALOGUE ODOMETER

	Specification	Desc./Quantity
1		STEPPER MOTOR A
2		STEPPER MOTOR B
3		STEPPER MOTOR C
4		STEPPER MOTOR D



Remote seat opening

The vehicle is equipped with a remote control to open the saddle.

This remote control is supplied together with the keys and at the manufacturing stage, it has been programmed to work together with the ECU that control the opening device.

If the remote control is lost, a new one can be requested and reprogram it by resetting the ECU memory and following the same steps as per programming the immobilizer system in the keys.

Battery replacement

To separate the two half-shells of the remote control, insert a blade or a very thin tip of a screwdriver into a point of the outside edge, then let it slide along the entire circumference.

- Access the printed circuit and remove the two batteries from the contact reed.

- Place the new batteries with the positive pole facing the contact reed.



Characteristic

Batteries used:

CR1616

- Replace the card on the rear half-shell with the button and the led facing outwards.
- Install the pressure rubber on the button (the direction of installation is only one)
- Make the other half engage snap-wise.



Zeroing

- Remove the metal terminal by pliers and connect it to earth or to terminal 7 (black), for at least 10 seconds.

- This operation clears all remote controls stored in the control unit.

N.B.

THE CONTROL UNIT CAN PROGRAMME UP TO 7 REMOTE CONTROLS.



Programming

- Remove the front shield to access the saddle opening reception/control unit.
- In the wiring cover you can see the metal terminal of the white wire protruding from Pin 3 of the control unit.



- To program, the remote controls, set the key switch to «ON» for 1 to 3 seconds, then set it to «OFF».
 - Within 10 seconds, reset the switch to «ON» and within 3 seconds, press the remote control button, then set to «OFF» again.
 - If the saddle opens with this last operation, the programming was successful.
 - You can program up to 7 remote controls by the above procedure.
-

INDEX OF TOPICS

ENGINE FROM VEHICLE

ENG VE

Exhaust assy. Removal

- Loosen the two fasteners of the exhaust manifold from the head.



- Loosen the 3 screws fixing the silencer to the supporting arm.
- Remove the complete silencer.



N.B.

TO ENSURE THE SEAL OF THE SILENCER-EXHAUST MANFOLD GROUP, YOU MUST REPLACE THE GRAPHITE COUPLING GASKET EVERY TIME THESE COMPONENTS ARE DETACHED. MOREOVER, UPON REASSEMBLY, PREVENT THE EXHAUST PIPE FROM DAMAGING THE NEW GASKET. CHECK THE JOINT SEAL WITH ENGINE ON TO PREVENT FURTHER TROUBLES.

Removal of the engine from the vehicle

Removal of engine

WARNING

CARRY OUT THESE OPERATIONS WHEN THE ENGINE IS COLD.

- Disconnect the battery
- Remove the underseat compartment.
- Drain the coolant.
- Remove the complete muffler assembly.
- Remove the rear wheel.
- Remove the swinging arm.
- Remove the throttle control transmission.
- Remove the air filter coupling and the collector.
- Disconnect the ground cable from the engine.
- 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).

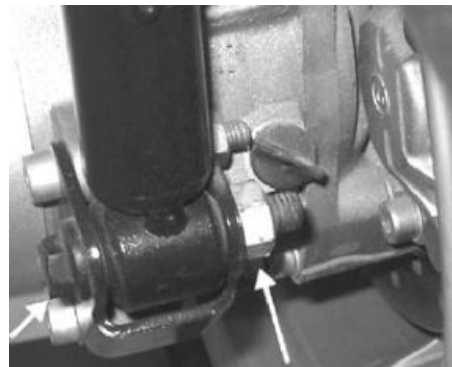
- Disconnect the HV cable from the spark plug.
- Disconnect the alternator cable from the electrical system of the scooter.

WARNING**BE VERY CAREFUL WHEN HANDLING FUEL.****CAUTION****WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE LEAD.****Removing the support arm**

- Release the lower fixing bolt of the right shock absorber from the support arm.
- Loosen the 2 screws fixing the arm to the engine.
- Remove the shim adjustment and release the wheel axle nut; to prevent rotation, use the integral brake keeping the LH lever pulled.
- Remove the support arm.

**Removal of the lower bolt from LHS shock-absorber**

- Remove the bolt shown in the figure.

N.B.**TO REMOVE THE SHOCK ABSORBER SUPPORT, REMOVE THE TWO NUTS FROM THE BRAKE CALIPER SIDE AND EXTRACT THE SCREWS.****Engine - swing-arm bolt removal**

- Suitably support the engine.
- Remove the nut shown in the figure.
- Extract the pin.
- The engine can now be removed.



- Perform the operations for removal in the reverse order according to the proper tightening torques.

CAUTION**BE VERY CAREFUL NOT TO REVERSE THE TWO ACCELERATOR CONTROL TRANSMISSIONS. CHECK THAT WITH VALVE IN ABUTMENT AGAINST THE REGISTER THERE IS A SMALL CLEARANCE.****N.B.**

CAREFULLY CLEAN THE INJECTOR «T» BRANCH BEFORE REPLACING THE QUICK COUPLINGS.

- Orientate the injector so as to prevent interferences of the electric wiring with the cooling fluid and fuel pipes.
 - 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.
-

INDEX OF TOPICS

ENGINE

ENG

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



Automatic transmission

Transmission cover

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



- Loosen the driven pulley shaft fastening nut using a misaligned wrench and prevent the pulley shaft rotation using 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.

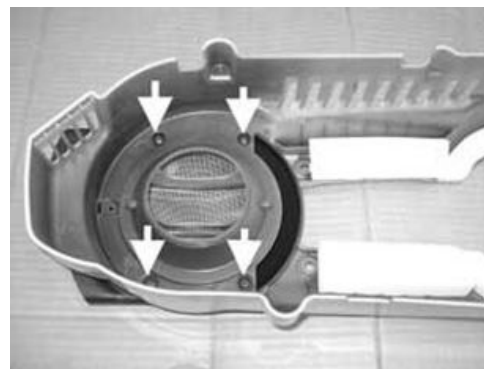


- Loosen the 4 fastening screws
- Extract the outside plastic transmission cover.

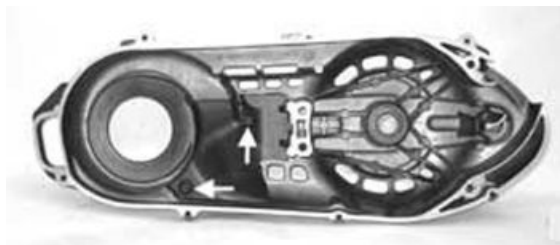


Air duct

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



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



Locking torques (N*m)

Air conveyor screws 11 ÷ 12

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 Seeger ring.



- Place transmission cover on a wood surface and use the special tool so that it is adequately supported.
- Pull out the bearing using the special 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. NOT ONLY IN THE AREA OF MAXIMUM STURDINESS.



Specific tooling

001467Y002 Driver for OD 73 mm bearing

020376Y Adaptor handle

020375Y Adaptor 28 x 30 mm

020439Y 17 mm guide

Refitting the driven pulley shaft bearing

- Heat the transmission cover interior using the heat gun.

N.B.

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

Specific tooling

020151Y Air heater



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

N.B.

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

Specific tooling

020376Y Adaptor handle

020358Y 37x40-mm adaptor

020439Y 17 mm guide



Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Loosen the retaining bolt using a 13 mm spanner.
- Remove the complete roller with bearing.

N.B.

IF THE ROLLER DOES NOT ROTATE FREELY, REPLACE THE COMPLETE ROLLER.



Installation of belt anti-vibration roller

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

N.B.

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

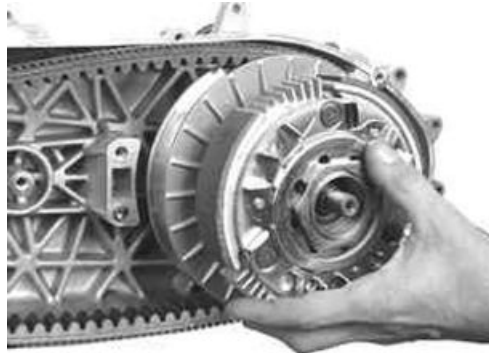
Locking torques (N*m)

Anti-vibration roller screw 16.7 ÷ 19.6



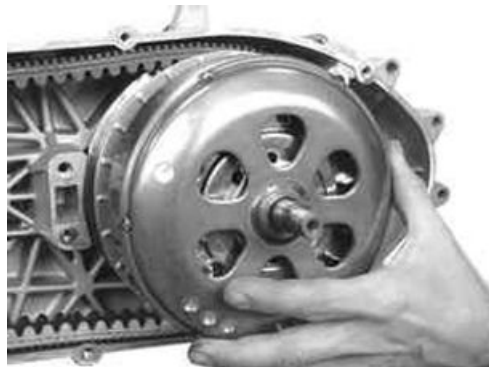
Removing the driven pulley

- Remove the driven pulley assembly with the belt.



Inspecting the clutch drum

- Remove 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 special tool;
- 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 FIRMLY SECURED IN A VICE USING THE SPECIAL TOOL. DO NOT TIGHTEN THE REAR SCREW TOO MUCH AS THIS COULD CAUSE AN IRREVERSIBLE TOOL DEFORMATION.

USING THE SPECIAL 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 Tool for fitting/ removing the driven pulley clutch

Pin retaining collar

- Extract the collar using 2 screwdrivers.



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



Removing the driven half-pulley bearing

- Check that the bushing is free from wear and damage; otherwise replace the fixed driven half-pulley.
- Remove the lock ring using pliers.



- Using the special 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 Adaptor handle

020456Y Ø 24 mm adaptor

020363Y 20 mm 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 Driver for OD 73 mm bearing



- Remove the roller bearing using the special tool, supporting the fixed half-pulley with the bell.

Specific tooling

020376Y Adaptor handle

020375Y Adaptor 28 x 30 mm

020364Y 25-mm guide

001467Y002 Driver for OD 73 mm bearing



Inspecting the driven fixed half-pulley

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

Characteristic

Minimum admissible diameter

49.91 mm

Standard diameter:

50.00 -0.015 -0.035 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 movable half-pulley bushing inside diameter.

Characteristic

Maximum admissible diameter:

50.05 mm

Standard diameter:

50.00 +0.035 0.00 mm



Refitting the driven half-pulley bearing

- Install a new roller bearing using the special 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 the special tool.

Specific tooling

020478Y Punch for driven pulley roller casing

001467Y002 Driver for OD 73 mm bearing



- Install a new ball bearing using the special tool.

Specific tooling

020376Y Adaptor handle

020477Y Adaptor 37 mm

020363Y 20 mm guide



- Insert the Seeger lock ring.

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.

- Make sure the pins and collar are not worn, re-assemble the 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 necessary to avoid the presence of grease beyond the O-rings.

Recommended products

AGIP GREASE SM 2 Grease for the tone wheel revolving ring

Soap-based lithium grease containing NLGI 2 Molybdenum disulphide; ISO-L-XBCHB2, DIN KF2K-20

Inspecting the clutch spring

- Measure the length of the spring, while it is relaxed.

Characteristic

Standard length:

125.5 mm

Admissible limit after use:

120 mm



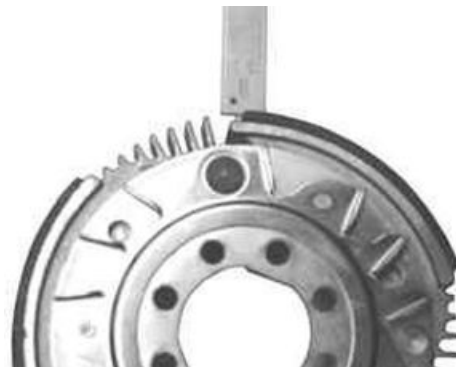
- Check the thickness of the clutch mass friction material.

Characteristic

Minimum thickness permitted:

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. VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

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

Refitting the clutch

- Prepare the special tool as for removal;
- Preassemble the driven pulley unit with the drive belt according to its direction of rotation;
- Insert the driven pulley unit, the spring with sheath and clutch into the tool.



Specific tooling

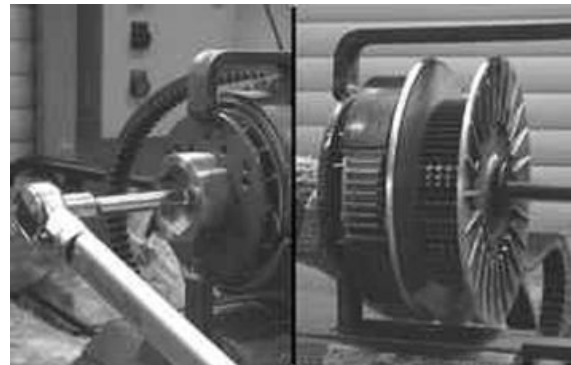
020444Y Tool for fitting/ removing the driven pulley clutch

- 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 using the special wrench to the prescribed torque.



Specific tooling

020444Y Tool for fitting/ removing the driven pulley clutch

Locking torques (N*m)

Clutch ring nut 65 - 75

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

Bell assembly

- Install the bell and the spacer.



Refitting the driven pulley

- Install the driven pulley assembly with belt.



Drive-belt

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

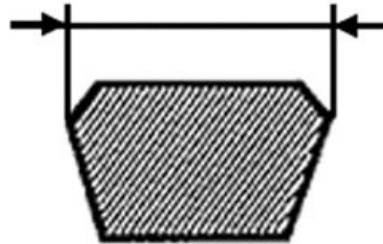
Characteristic

Minimum width:

25 mm

Standard width:

26.2 mm



Removing the driving pulley

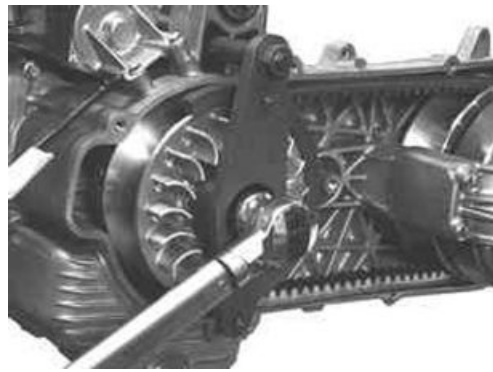
- Using a 27 mm wrench, turn the central pulley nut to horizontally align the central inside holes and install the special tool.

Specific tooling

020474Y Driving pulley lock wrench



-
- First install the lock ring of the special tool onto the pulley so that the splines are completely engaged.
 - Then, insert the tool so as to insert the stud bolts on the ring into the holes obtained onto the tool itself.
 - Tighten the two tool fastening nuts, also 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 bushings shown in the figure exhibit no signs of abnormal wear and measure the inside diameter.

CAUTION

DO NOT LUBRICATE OR CLEAN THE BUSHINGS

Characteristic

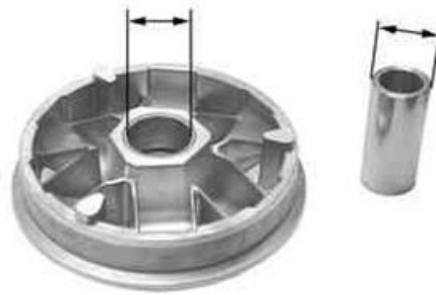
Maximum admissible diameter:

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

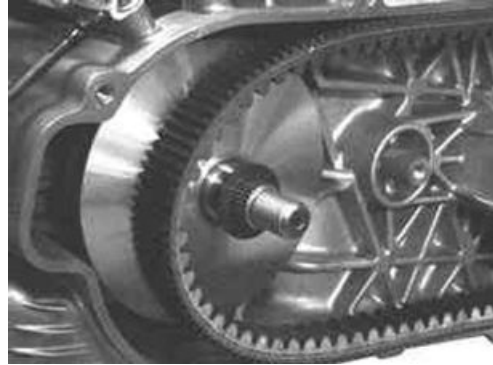
- Check the guide shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt contact surfaces on both pulley halves.



Refitting the driving pulley

Installing the fixed driving half-pulley

- Insert the spacer.



- Install the fixed driving half-pulley and check that it is in contact with the spacer and with the guide bushing of the moving driving pulley.



- 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 belleville washer).



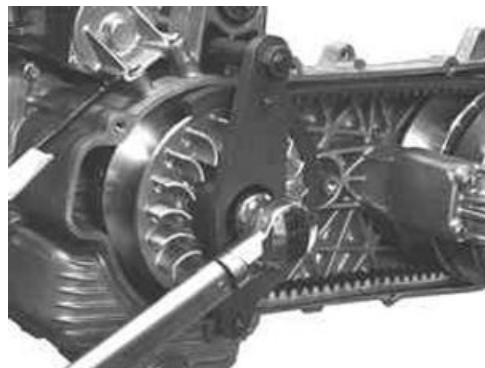
- Turn the central pulley nut to horizontally align the holes and install the special tool.

N.B.

CHECK THAT THE STOP WRENCH TOOL IS EASILY INSERTED INTO THE PULLEY AND IN THE ENGINE CRANK-CASE.

Specific tooling**020474Y Driving pulley lock wrench**

- Install the lock ring from the rear so that the splines are completely engaged.
- Finally install the tool by sliding the nuts by hand and ensuring the tool is resting flatly.
- Tighten the driving pulley fastening nut to the prescribed torque
- Remove the special tool.

**Locking torques (N*m)****Driving pulley nut 160 - 175****Installing the roller container**

- Install the spacer with the internal chamfer facing towards the inside.



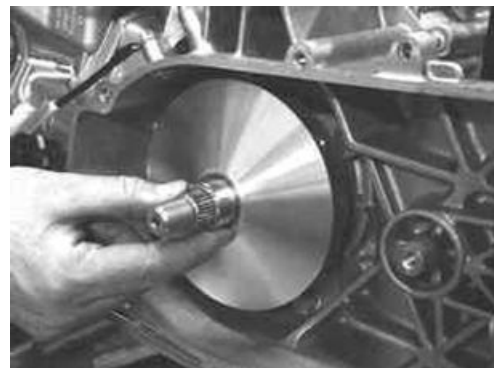
- Position the rollers on the half-pulley as shown in the figure.
- The closed side must rest on the inside thrust face of the roller container.



- Assembly the half-pulley with the roller contrast plate and sliding blocks.



- Insert the half-pulley on the crankshaft.
- Insert the spacer bushing.



Refitting the transmission cover

- Install the driving pulley shaft cover, positioning the tooth gap on the lower part with the reference mark on the transmission crankcase.



N.B.

ENSURE THAT THE AIR INTAKE AND EXHAUST OPENINGS ARE COMPLETELY FREE.

- Install the outside plastic transmission cover.
- Tighten the 4 fastening screws to the prescribed torque.

Locking torques (N*m)

External transmission cover screws 7 ÷ 9



- Ensure the correct installation on the crankcase of the 2 centring dowels.



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

Locking torques (N*m)

M8 retainers for transmission cover 23 ÷ 26



- Lock the 7 M6 retainers.

Locking torques (N*m)

M6 retainer 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 torque wrench for LHS locking using a machine hexagon wrench.
- Tighten the driven pulley shaft fastening nut using an offset 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

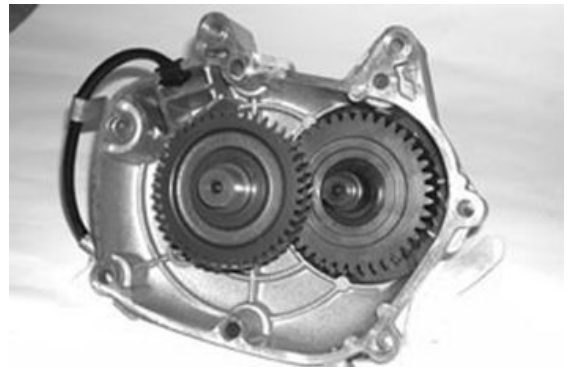
Removing the hub cover

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



Removing the hub bearings

- Check all bearings (wear, clearance and noise). In case of anomalies, proceed as follows. To remove the gear shaft bearing on the engine crankcase, use the following parts.

Specific tooling

001467Y014 Pliers to extract \varnothing 15-mm bearings

001467Y034 Pliers to extract \varnothing 15-mm bearings

001467Y031 Bell

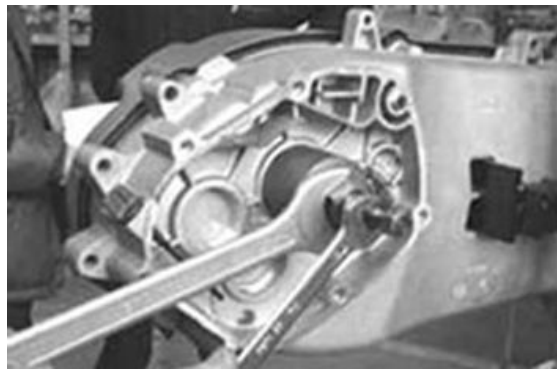


- Use the special extractor to disassemble the bearing on the engine chassis of the countershaft.

Specific tooling

001467Y006 Pliers to extract 20 mm bearings

001467Y035 Belle for OD 47-mm bearings



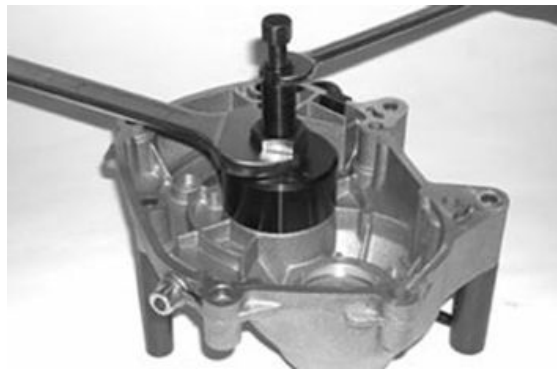
- Support the hub cover using the column kit.
- Pull out the bearing using the special tool.

Specific tooling

020476Y Stud bolt set

001467Y006 Pliers to extract 20 mm bearings

001467Y007 Driver for OD 54-mm bearings



Removing the wheel axle bearings

- Take out the clip on the outside of the gearbox cover.



- Support the hub cover using the column kit.
- Pull out the bearing using the special tool.

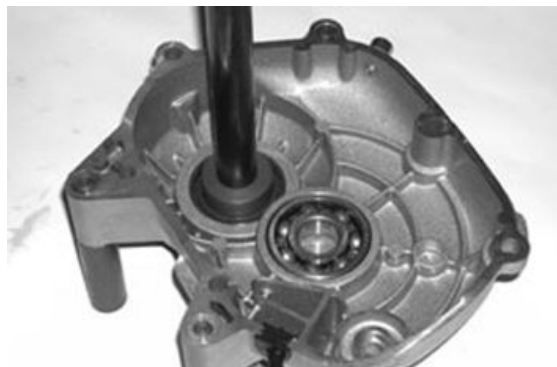
Specific tooling

020476Y Stud bolt set

020376Y Adaptor handle

020477Y Adaptor 37 mm

020483Y 30 mm guide



- Remove the oil guard using 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 its bearing.
- Remove the oil guard using a screwdriver into the hub gear box.
- Remove the Seeger ring shown in the figure.



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



Specific tooling

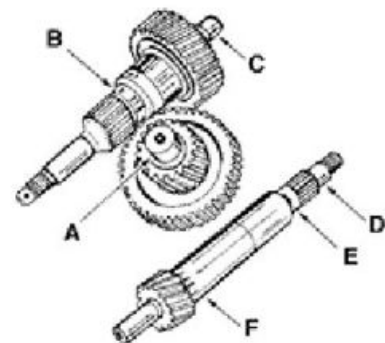
020376Y Adaptor handle

020358Y 37x40-mm adaptor

020364Y 25-mm guide

Inspecting the hub shaft

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



Characteristic

Connection diameter for countershaft:

A = diameter 20 - 0.01 -0.02 mm

Connection diameter for wheel shaft:

B = diameter 30 - 0.010 -0.023 mm

C = diameter 15 - 0.01 -0.02 mm

Bearing diameter for driven pulley shaft:

D = diameter 17 - 0.01 -0.02 mm

E = diameter 20 - 0.01 -0.02 mm

F = diameter 25 - 0.01 -0.02 mm

Inspecting the hub cover

- Check that the mounting surface is not damaged or deformed.
- Check the bearing bearings.

In case of faults, replace the hub cover.

Refitting the driven pulley shaft bearing

- Heat the crankcase using the heat gun.

Specific tooling

020151Y Air heater



- Insert the driven pulley shaft bearing until it abuts against the bottom of the seat using the special tool.

N.B.

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

Specific tooling

020376Y Adaptor handle

020360Y Adaptor 52 x 55 mm

020364Y 25-mm guide



- Heat the intermediate gear bearing seat.
- Insert the intermediate shaft bearing using the special tool.

N.B.

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

Specific tooling

020376Y Adaptor handle

020359Y 42x47-mm adaptor

020363Y 20 mm guide



- Heat the gear shaft bearing seat on the crankcase.
- Insert the gear shaft bearing in the upper crankcase seat using the special tool.

N.B.

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

Specific tooling

020376Y Adaptor handle

020359Y 42x47-mm adaptor

020412Y 15 mm guide



- Place the safety lock Seeger 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.



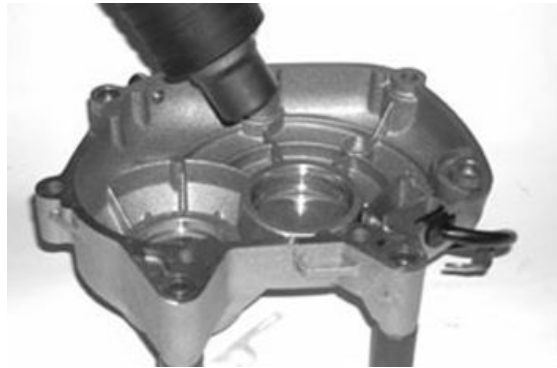
Refitting the hub cover bearings

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

Specific tooling

020151Y Air heater

020476Y Stud bolt set



- Insert the intermediate shaft bearing on the cover using the special tool.

N.B.

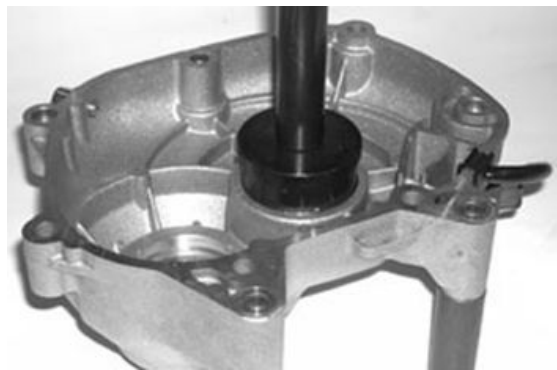
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adaptor handle

020360Y Adaptor 52 x 55 mm

020363Y 20 mm guide



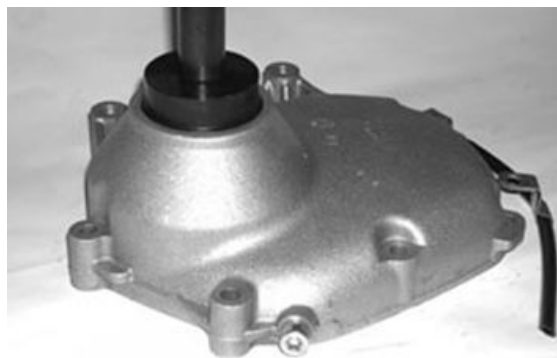
- Heat the gear shaft bearing seat from the cover outside.
- Insert the gear shaft bearing on the cover using the special punch until abutment.

Specific tooling

020376Y Adaptor handle

020360Y Adaptor 52 x 55 mm

020483Y 30 mm guide



- Replace the snap ring



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



Specific tooling

020376Y Adaptor handle

020360Y Adaptor 52 x 55 mm

020476Y Stud bolt set

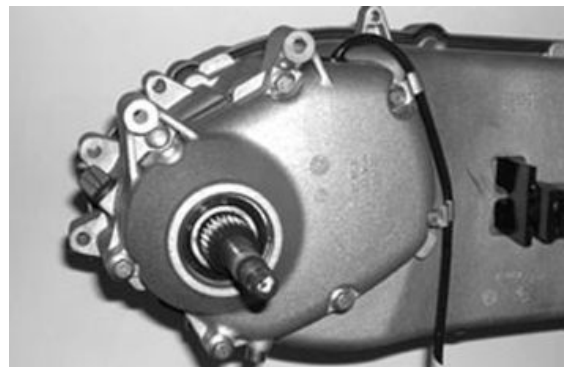
Refitting the hub bearings

- Place the 3 shafts as shown in the figure.



Refitting the hub cover

- Check the proper position of the centring dowels.
- Install a new gasket.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.



- 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

AGIP ROTRA 80W-90 rear oil hub

SAE 80W/90 Oil that exceeds the requirements of API GL3 specifications

Characteristic

Quantity:

approx. 250 cc

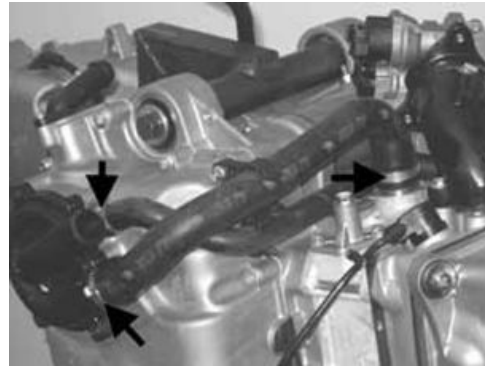
Locking torques (N*m)**Rear hub cover screws 24 ÷ 27**

Flywheel cover

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose 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 INTERFERENCE 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

-
- Loosen the six mounting screws and remove the water pump cover.



- Remove the by-pass and the relevant spring.
- Remove the oil pump seal.



Removing the stator

- Remove the two retaining screws and the cable guide bracket.



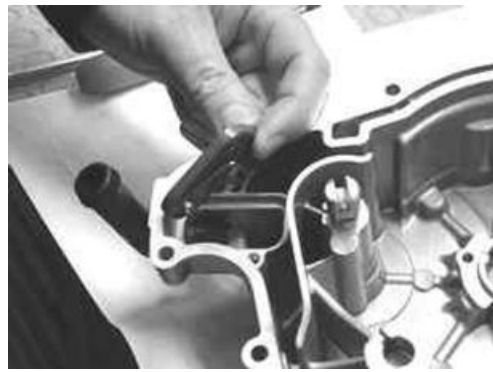
- Unscrew the 3 fastening screws and remove stator and its wiring.



- Loosen the two retaining screws and remove the reed valve support with bulkhead.



-
- 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.



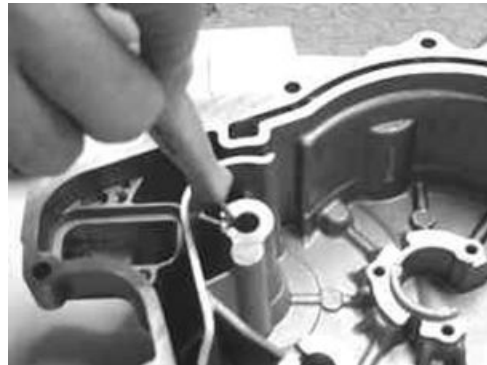
- Remove the sealing ring.



- Remove the ceramic ring and the relevant gasket.



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

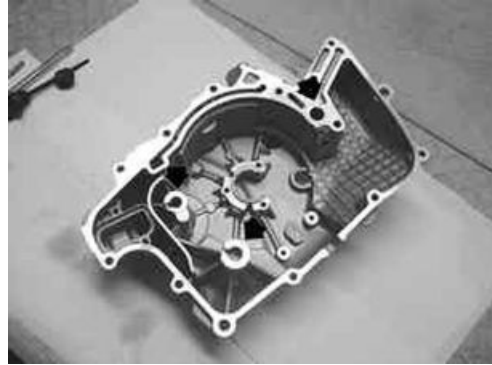


- Remove the engine oil filling cap/dipstick and the check hole cover for the distribution timing.
- Remove the minimum oil pressure sensor.



Inspecting the cover components

- Check that the mounting surface of the crankcase is not worn or deformed.
- 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

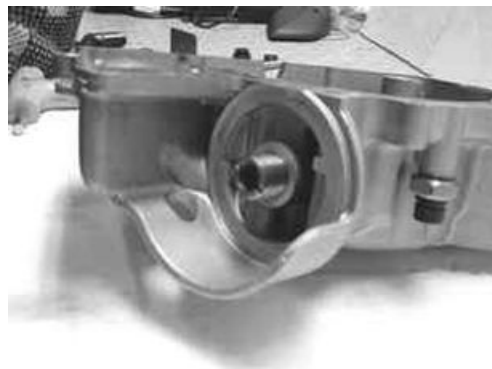
Connection diameter for start-up gear shaft:

12 mm

Connection diameter for pump shaft:

8 mm

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



- Check the condition of the stator and of the respective cable harness.



-
- Check the continuity between the 3 phases.

N.B.

VALUES ARE STATED AT AMBIENT TEMPERATURE. A CHECK WITH THE STATOR AT OPERATING TEMPERATURE MAY RESULT IN VALUES HIGHER THAN THOSE STATED.

Electric characteristic**Resistance:**

0.2 - 1 Ω



-
- Check the ground insulation of each phase.
 - If a fault is found, carry out a thorough check of the cable harness that contains two types of cable: Rigid cables close to the stator and flexible cables close to the connector.



-
- Check that the winding is positioned so as not to interfere with the heads of the retaining screws.



-
- Install a new oil filter, lubricate the gasket, screw on and finally tighten to the prescribed torque.

Locking torques (N*m)

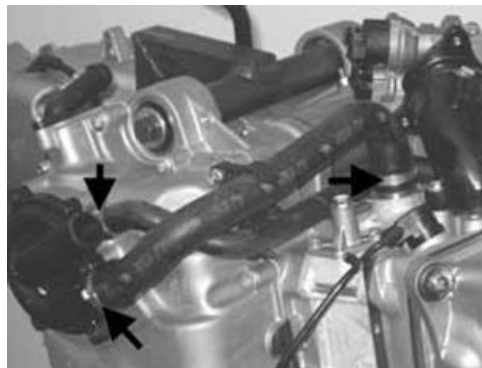
Engine oil filter 12 - 16



- Install the supply hose to the cylinder and connect the return hose to the pump cover using 3 new clamps.

N.B.

TIGHTEN THE CLAMPS USING APPROPRIATE PLIERS, PAYING ATTENTION NOT TO CONSTRICT THE HOSES BUT ALSO TAKING CARE TO TIGHTEN THE CLAMPS SUFFICIENTLY.



- Install the pre-filter again and insert the engine oil drain plug, tightening to the prescribed torque.
- Refill the engine with the prescribed type of oil.

Recommended products**AGIP CITY HI TEC 4T Engine oil**

SAE 5W-40, API SL, ACEA A3, JASO MA Synthetic oil

Locking torques (N*m)

Engine oil drainage plug 24 ÷ 30

**Refitting the stator**

- Install the stator assembly together with the wiring harness, tightening the 3 screws to the prescribed torque.

N.B.

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

Locking torques (N*m)

Stator retainers 8 - 10



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

Locking torques (N*m)

Stator cable harness guide bracket screws 3 - 4



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

Locking torques (N*m)

Blow-by recovery duct fixing 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

- Correctly fit a new O-ring, do not allow it to come into contact with grease or oil.

FAILURE TO OBSERVE THIS ADVICE CAN IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

Locking torques (N*m)

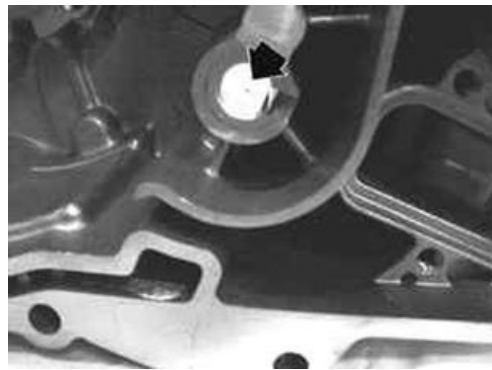
Pump cover fixing screws: 3 ÷ 4



- 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.



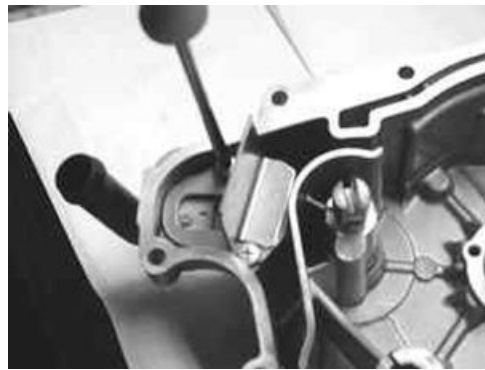
- Oil vapour decantation chamber



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

Locking torques (N*m)

Supporting screws with bulkhead 0.3 - 0.4



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

Specific tooling

020376Y Adaptor handle

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 to the prescribed torque.

Locking torques (N*m)**Water pump impeller 4 ÷ 5**

Refitting the flywheel cover

- Install a new gasket on the engine crankcase.
- Check the presence of the three centring dowels.



- Turn the crankshaft in order to align the counter-shaft movement sensor with a reference point on the crankcase (see figure).



- Repeat the alignment for the water pump crankshaft using the same reference point on the engine.

N.B.

THIS PREPARATION IS USEFUL PARTICULARLY IN THE EVENT OF REPAIRS WITH THE WATER PUMP COVER INSTALLED.



- Install the flywheel cover on the engine, paying attention to avoid interference between the stator and rotor.

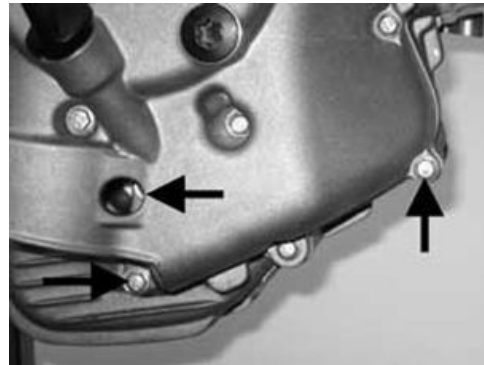
WARNING

FAILURE TO OBSERVE THIS INSTRUCTION MAY RESULT IN DESTRUCTION OF THE CERAMIC MAGNETS.

- Tighten the 14 retaining bolts of the cover to the prescribed torque.

N.B.**THE BOLTS HAVE FOUR LENGTHS:**

- THE 3 SHORTEST ARE INSERTED AS SHOWN IN THE FIGURE.
- THE LONGEST IS INSERTED UNDER THE ENGINE OIL FILLER PLUG.

**N.B.**

- THE INTERMEDIATE BOLTS FOR THE REMAINING MOUNTING POINTS WITH THE EXCEPTION OF THE BOLT FOR THE MANIFOLD SUPPORT (SHOWN IN THE FIGURE) ARE SLIGHTLY LONGER.

Locking torques (N*m)

Flywheel cover screws 11 - 13



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



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 cell:

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 diagnostic tester (see chapter "Injection system").

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

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

Switch in position "ON" with interrupt switch in position "RUN" and side stand raised.

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 Scooter diagnosis and tester

Electric characteristic

Absorption at trailing speed:

80 - 120 A

Revolution speed =

approx. 300-400 rpm

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.

Finally carry out a check of the power consumption at idle speed.

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

Reconnect the earth and positive and perform the test.

Electric characteristic

Current consumption at idle speed:

<40 A

YES go to 10 NO go to 11

7- Low trailing 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 trailing speed

Low electrical absorption

Repeat the test, bridging the power terminals of the starter remote control switch or even better replacing them.

Check the new values.

YES go to 12 NO go to 13

9 - High trailing 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 rotation of the armature.

12 - Replace the starter remote control switch.

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

N.B.

IF THE TRAILING SPEED OF THE CRANKSHAFT IS LOW AND COMBINED WITH STRANGE NOISE, CHECK THE FREEWHEEL OF THE TORQUE LIMITER (SEE THE "FLYWHEEL 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

START-UP REMOTE CONTROL SWITCH

Specification	Desc./Quantity
Type	SEALED
Maximum load	150 A continuous

STARTER TRANSMISSION

Specification	Desc./Quantity
Ring gear and freewheel coaxial to the flywheel.	Intermediate gear with built-in torque limiter.

The starter system has a transmission between the motor armature and engine shaft equipped with freewheel coaxial to the flywheel and torque limiter on the intermediate shaft.

The limiter is calibrated to 10 kgm (100 Nm); this component protects the structure of the engine and the starter kinematic mechanism in the event of incorrect starting with consequent inverse rotations.

The freewheel is used for a sufficiently silent starting.

The starter control (energised remote control) is slaved to enabling signals by the side stand and the emergency OFF/RUN switch, which does not allow starting given dangerous conditions.

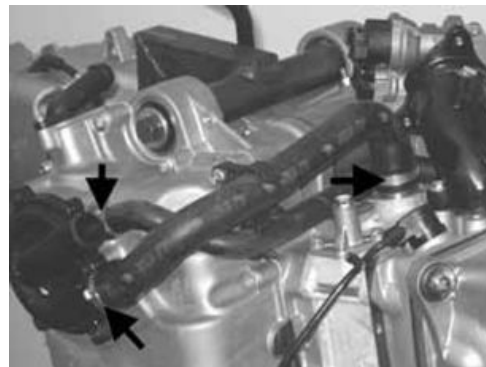
The starter control circuit is not controlled by the immobilizer system, therefore before insisting on the starter system, check the consensus of the immobilizer.

In order to check the enabling switches circuit, see the «Electrical system» chapter, whereas to check the engine shaft control transmission, follow what is described in the «Flywheel and starter system» chapter.

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose 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

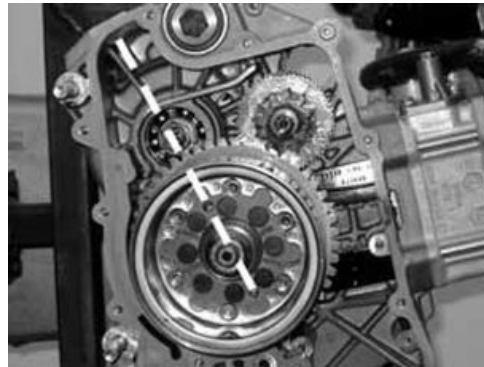
N.B.

IF YOU MUST REMOVE THE 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 special tool.



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



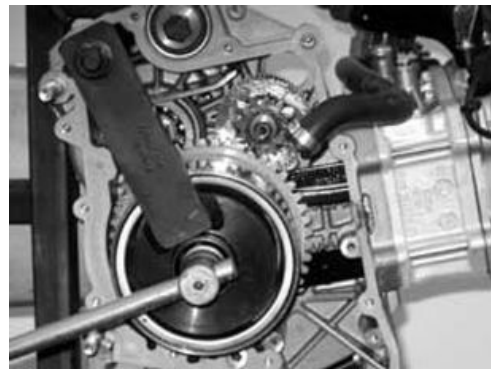
- Insert the special tool as shown in the figure, making sure that the pins are perfectly inserted into the previously aligned holes and that it is perfectly abutted and almost flush with the flywheel.

Specific tooling

020472Y Flywheel lock wrench



- Loosen the magneto flywheel fastening nut.
- Remove the special 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 FLYWHEEL IS STRONGLY LOCKED; THE CONE DETACHMENT MAY THEREFORE CAUSE THE ROTOR SLIPPAGE, WITH THE CONSEQUENT BREAKAGE OF THE MAGNETS.



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

Specific tooling

020467Y Flywheel extractor



- Remove the extractor.
- Remove the nut and extract the flywheel with the start-up rim.
- Remove the crankshaft key.



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



- Remove the freewheel from the flywheel by loosening the 6 fastening screws.

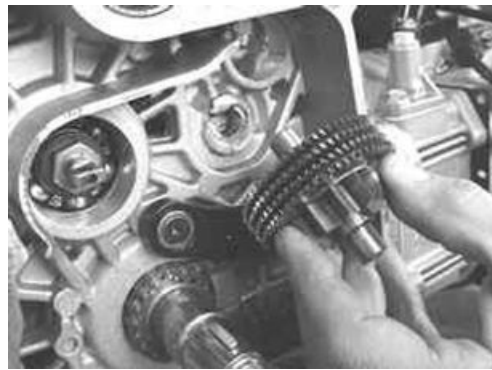
SINCE THE FREEWHEEL MUST BE REMOVED, IT IS ADVISABLE TO LOOSEN THE 6 FASTENING SCREWS IN ADVANCE WITH THE FLYWHEEL STILL INSTALLED ON THE CRANKSHAFT.



- The freewheel 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.



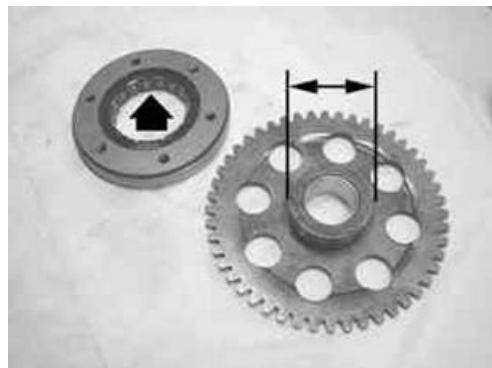
Inspecting the flywheel components

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



Starter gear rim

- Check that there is no wear or abnormal impressions on the "rollers" of the freewheel and on the surface of the starter ring gear hub.
- Check the hub outside diameter.



Characteristic

Hub outside diameter:

Diameter $45.665 + 0.008 + 0.005$ mm

- Check the inside diameter of the bushing of the starter gearing.
- Check that the tothing is not worn.



Characteristic

Inside diameter of the bushing:

Diameter $27 + 0.020 + 0.041$ mm

N.B.

IF THE FAULTS DISCOVERED AFFECT THE HUB, REPLACE THE STARTER RING GEAR AND FREEWHEEL.

IF ONLY THE BUSHING 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 CRANKSHAFT. IN CASE OF IRREGULARITIES, REPLACE THE CRANKSHAFT.

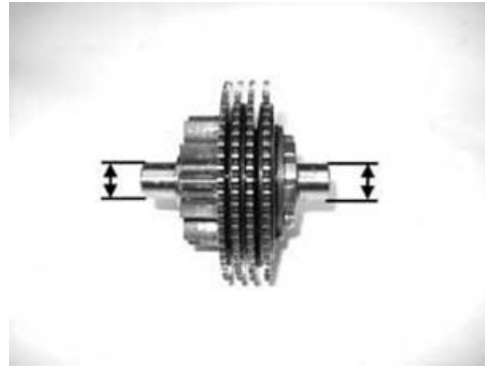
Intermediate gear

- Check that the tothing is not worn.
- Check the diameter of the two bearings.

Characteristic

Gear bearing diameter:

12 - 0 0.011 mm



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

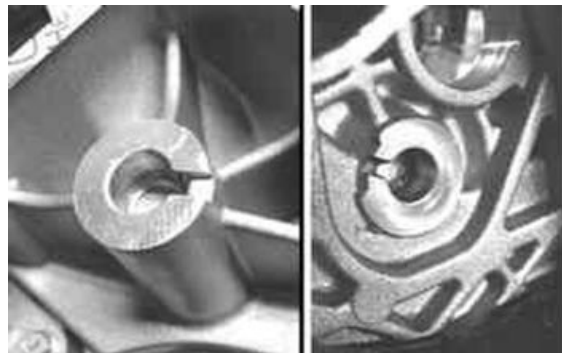
Characteristic

Bearing diameter on the flywheel cover

12 + 0.034 -0.016 mm

Bearing diameter on the engine crankcase:

12 + 0.034 -0.016 mm



N.B.

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

Driven plates consist of 4 Belleville springs provided with grooved profiles; this assembly allows transmitting torque lower than 10 kgm.

In case of incorrect start-up manoeuvres, the limiter prevents any kicks, with consequent reversal of direction of the crankshaft 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

- Make sure the freewheel faying surfaces are in good condition.
- Thoroughly clean the free wheel to remove LOCTITE residue.

- Degrease the threading of the holes in the free wheel and the clamping screws.
- Apply the recommended product to the end of the screws.

Recommended products

Loctite 243 Medium strength threadlock

Loctite 243 medium-strength threadlock

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



Locking torques (N*m)

Screw fixing freewheel to flywheel 13 ÷ 15

- Oil the free wheel "rollers".

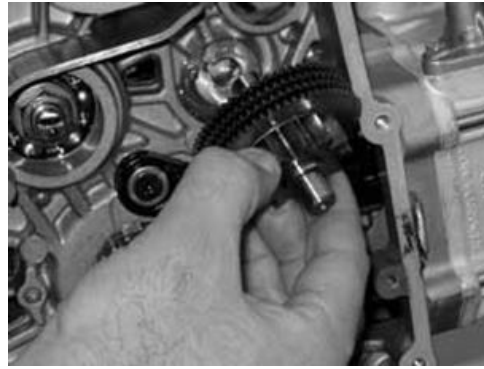


Refitting the intermediate gear

- Lubricate the gear housing on the engine crankcase.



-
- Insert the intermediate gear with torque limiter



-
- Lubricate the inside bushing and the starter ring gear 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 crankshaft.
 - Install the 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 crankshaft.



-
- 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 lock wrench



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



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

Specific tooling

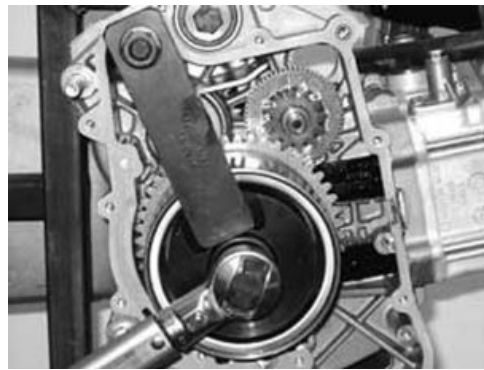
020472Y Flywheel lock wrench



- Tighten the flywheel lock nut to the prescribed torque.

Locking torques (N*m)

Flywheel fixing nut 115 - 125



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

N.B.

BEFORE TIGHTENING THE SCREWS, MOVE THE START-UP RIM IN CONTACT WITH THE CRANKCASE AND CHECK THAT IT IS FREE TO ROTATE IN ANTICLOCKWISE 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 to 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 flywheel cover, the flywheel and the torque limiter.



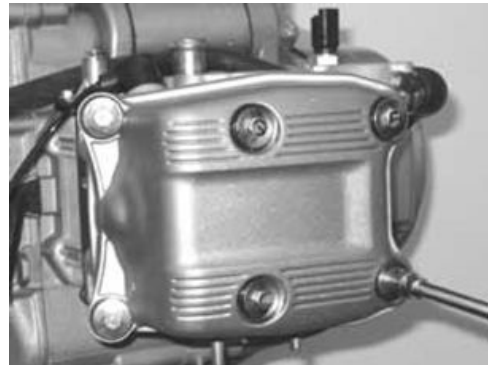
Removing the intake manifold

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



Removing the rocker-arms cover

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



Removing the timing system drive

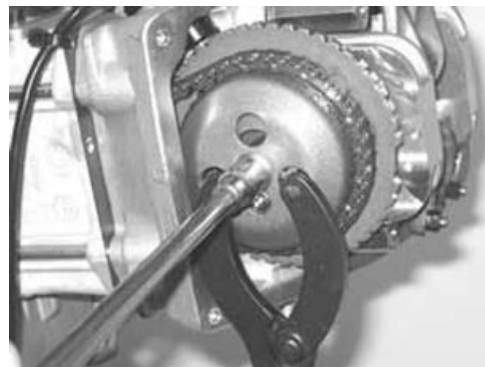
- Turn the engine to close the intake valves, i.e., moving the reference on the tone wheel to the top, as shown in the figure.



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

Specific tooling

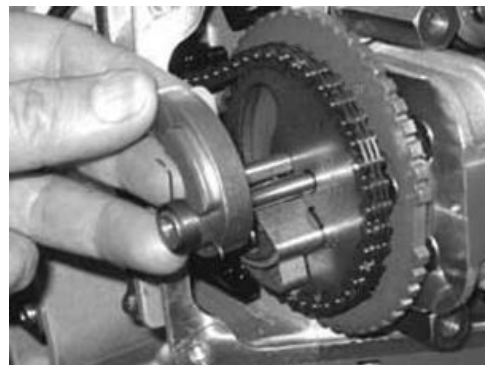
020565Y Flywheel lock calliper spanner



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

N.B.

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



- Align the references located on the tone wheel and on the head.



-
- Loosen the central screw on the tensioner first.
 - Unscrew the 2 fastening screws and remove the tensioner with relevant gasket.



Remove the inside hexagon screw and the counterweight as shown in the figure.



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



-
- Remove the tone wheel.



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

N.B.

TO CHECK THIS COMPONENT, SEE THE INJECTION CHAPTER.

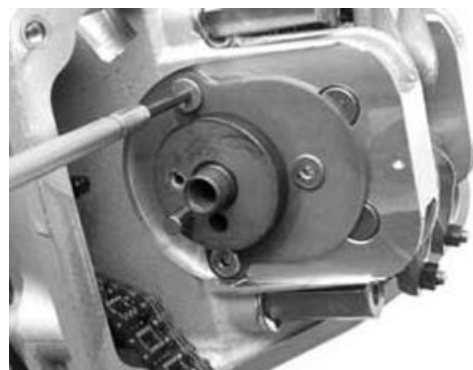


Removing the cam shaft

-
- Unscrew the 3 fastening screws and remove camshaft retaining bracket.

N.B.

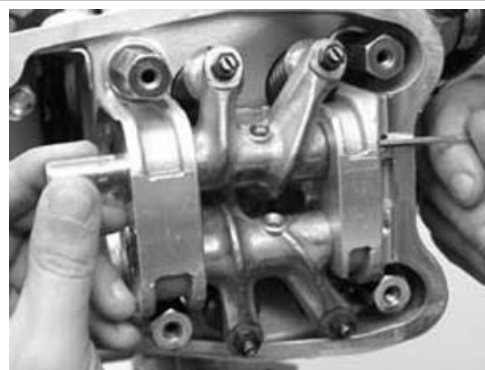
REMOVING THE FASTENING SCREWS MAY BE DIFFICULT. BE CAREFUL NOT TO DAMAGE THE INSIDE HEXAGON. IF NECESSARY, SEPARATE THE THREADS IN ADVANCE.



-
- Remove the cam shaft.

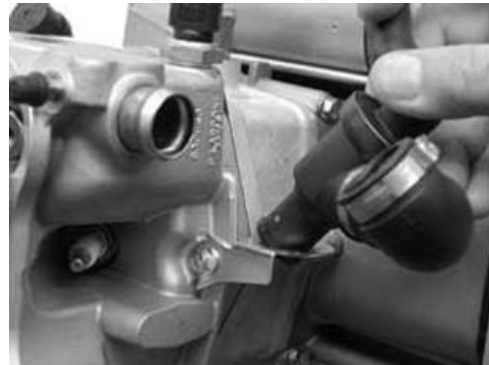


-
- Remove pins and rocking levers by the transmission side holes.



Removing the cylinder head

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



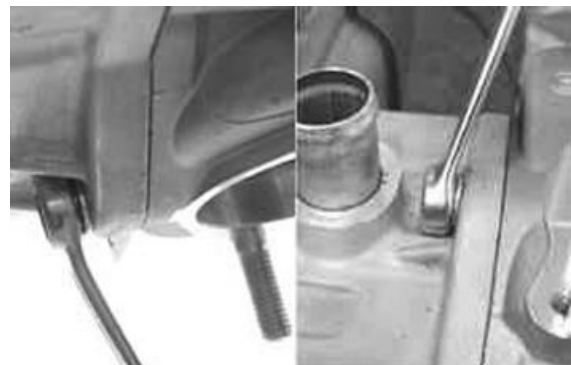
- Remove the coolant temperature sensor.

N.B.

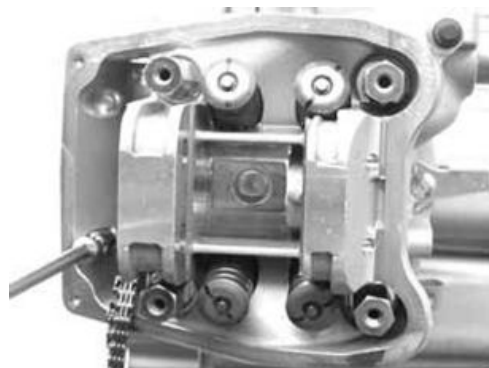
THE SENSOR CONTROLS BOTH INJECTION AND THE ANALOGUE INSTRUMENT ON THE PANEL. TO CHECK THIS COMPONENT, SEE THE INJECTION CHAPTER.



- 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.**

THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKING LEVER PINS AND FITTING BRACKET IF NECESSARY.

- Loosen the 4 head-cylinder fastening nuts in 2 or 3 times and in a crossed sequence.
- Remove the head, the 2 centring 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 GROUP CONTAINS COOLANT.

Removing the valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.

Specific tooling

020382Y Valve cotters equipped with part 012 removal tool

020382Y012 bush (valve removing tool)

**CAUTION**

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

- Remove the oil guards using the special 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 chain.
- 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.



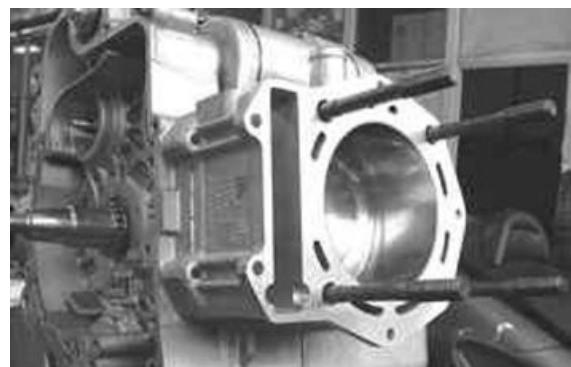
- Extract the cylinder with the relevant gasket and the centring dowel.

N.B.

THE SECOND CENTRING 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.

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



- Remove the piston sealing rings and the oil scraper.

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 REPLACE THE CRANKSHAFT AS DESCRIBED IN THE CRANKCASE AND CRANKSHAFT CHAPTER.

Characteristic**Standard diameter:**

$22 + 0.025 + 0.015$ mm



Inspecting the wrist pin

- Check the pin outside diameter using a micrometer.

Characteristic**Standard diameter:**

$22.0 - 0.004$ mm

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

Characteristic**Standard clearance:**

$0.015 \div 0.029$ mm



- Measure the diameter of the bearings on the piston.

Characteristic**Standard diameter:**

$22 + 0.006 + 0.001$ mm

- Calculate the piston pin coupling clearance.

N.B.

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

Characteristic

Standard clearance:

0.001 ÷ 0.010 mm

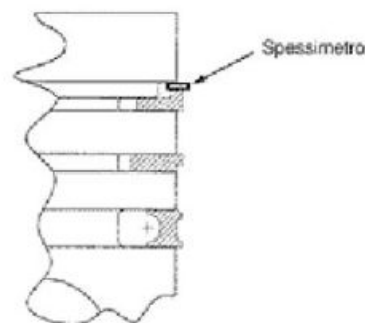


Inspecting the piston

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

N.B.

MEASURE THE CLEARANCE BY INSERTING THE BLADE OF THE FEELER THICKNESS GAUGE FROM THE SECOND SEAL SIDE.



Fitting clearance (Cylindrin/Pison)

Standard coupling clearance A 0.9 - 0.005 -0.030mm B 1.5 - 0.005 -0.03mm **Maximum permissible clearance after use** C 0.9 + 0.03 +0.01mm D 2 + 0.05 +0.02mm **Standard coupling clearance** </> 1.2 - 0.005 mm </> </> **Maximum permissible clearance after use** </> 1.25 + 0.03 mm </> </> **Standard coupling clearance** </> 2.5 - 0.005 mm </> </> **Maximum permissible clearance after use** </> 2.5 + 0.03 mm </> </>

- Measure the outside diameter of the piston, perpendicular to the gudgeon pin axis.
- Take the measurement in the position shown in the figure.

Characteristic

A =

43.2 mm

Piston diameter:

92 mm



- Using a bore meter, measure the inner cylinder diameter at three different points according to the directions shown in the figure.

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 run-out:

0.05 mm

- Pistons and cylinders are classified into categories based on their diameter. The coupling is carried out in pairs (A-A, B-B, C-C, D-D).

Inspecting the piston rings

- Alternately insert the three sealing rings into the cylinder, in the area where it retains its original diameter. Using the piston, insert the rings perpendicularly to the cylinder axis.
- Measure the opening (see figure) of the sealing rings using a feeler gauge.
- If higher values than those prescribed are measured, replace the linings.



N.B.

BEFORE REPLACING ONLY THE PISTON RINGS, ENSURE THAT THE CLEARANCE BETWEEN THE PISTON RINGS AND THE PISTON RING GROOVES, AND BETWEEN THE PISTON AND THE CYLINDER, IS AS SPECIFIED. IN ANY CASE, NEW PISTON RINGS USED IN COMBINATION WITH A USED CYLINDER MAY HAVE DIFFERENT BEDDING CONDITIONS THAN THE STANDARD.

Fitting clearance (Cylindrin/Pison)

Compression ring 0.15 ÷ 0.35 mm Max. value. 0.5 mm </> **Oil scraper ring** 0.25 ÷ 0.50 mm Max. value. 0.65 mm </> **Oil scraper ring** 0.25 ÷ 0.50 mm Max. value. 0.65 mm </>

Removing the piston

- Install piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.



- Insert the locking ring into the special tool, with the opening in the position indicated on the tool.

S = left

D= right



- Place the wrist pin stop ring into position using a punch



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

Specific tooling

020470Y Pin retainers installation tool



N.B.

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

CAUTION

USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

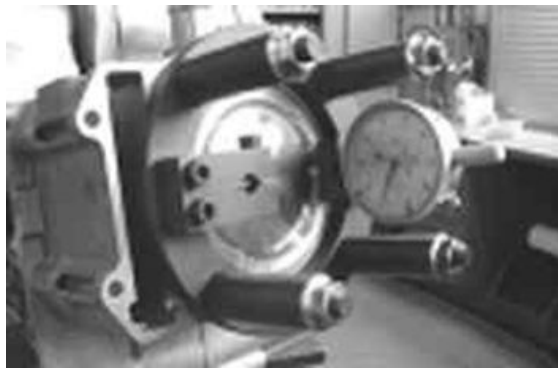
Choosing the gasket

- Provisionally fit the piston into the cylinder, without any base gasket.
- Install a comparator on the special tool using the short union, as shown in the figure.

Specific tooling

020475Y Piston position checking tool

- Using an abutment plane, reset the comparator with a preload 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 using the original head fixing nuts.
- Rotate the crankshaft up to the TDC (the inversion point of the dial gauge rotation)
- Measure the deviation from the reset value.



- Identify the thickness of the cylinder base gasket to be used for reassembly by the table below. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.

N.B.

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

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