

Vespa

Grand Turismo



# WORKSHOP MANUAL

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# **1 Vespa GT 200**

This manual has been prepared by Piaggio USA, Inc., a subsidiary of Piaggio & C. S.p.A., for use in the workshops of authorized Piaggio® dealers and sub-agents

It is assumed that the person utilizing this manual for servicing or repairing Piaggio® vehicles has a knowledge of the principles of mechanics and standard procedures required for general vehicle repair, therefore information regarding routine procedures has been deliberately omitted. Any relevant changes concerning the vehicle characteristics or specific repair operations will be divulged in the form of updates to this manual.

Satisfactory repair or service cannot be achieved without the necessary equipment and tools. Refer to the pages of this manual concerning specific tools and equipment and the special tools catalogue.



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## 2 Characteristics

This section describes the general characteristics of the vehicle.

### 2.1 Various

#### 2.1.1 Workshop Safety

For tests performed with the engine running ensure the work is carried out in a well-ventilated place and, if necessary, using appropriate extractors. Never run the engine in an enclosed space; exhaust gases are toxic.

Some types of battery use sulphuric acid as an electrolyte. Protect eyes, clothing and skin. Sulphuric acid is highly corrosive; if it comes into contact with the eyes or the skin, rinse thoroughly with water and seek immediate medical attention.

The battery produces hydrogen gas, which is extremely explosive. Do not smoke and do not allow flames or sparks near the battery, especially whilst it is being recharged.

Gasoline is extremely flammable and, under certain conditions, explosive. Do not smoke and do not allow flames or sparks in the work area.

Cleaning of brake shoes, drums and pads should be done in a well-ventilated area, aiming compressed air so as to avoid inhaling the dust produced by wear in the friction material. Even the dust from asbestos-free linings can damage the health.

#### 2.1.2 Service Recommendations

Use genuine Piaggio® spare parts and recommended lubricants. Use of non-genuine spare parts may damage the vehicle.

For operations requiring special tools, use only those designed specifically for this engine.

Always replace seals, gaskets and split pins with new ones, during reassembly.

After removing components, clean them with a non-flammable or high flash-point solvent. Lubricate all contacting surfaces, inspect for taper fit couplings, before reassembling.

Check all components have been correctly fitted and test that they work properly after reassembly.

Use only Metric-sized tools for removing, repairing and refitting operations. Metric screw fasteners, nuts and bolts are not interchangeable or compatible with Imperial-sized fasteners. Use of Imperial-sized tools or fasteners can damage the vehicle.

For repairs that involve disconnecting the vehicle's electrics, test the connections after reassembly, especially those to ground and to the battery.

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## 2.2 Vehicle Identification

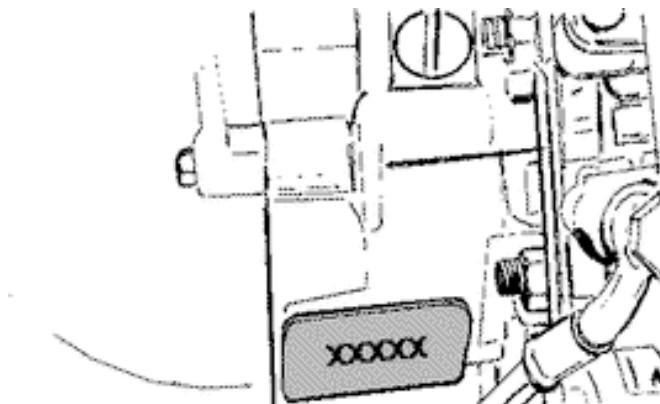
### 2.2.1 Frame No.

Vehicle	Frame prefix
Granturismo 200 cc	ZAPM3120000001001



### 2.2.2 Engine No.

Vehicle	Engine prefix
Granturismo 200 cc	M312M1001

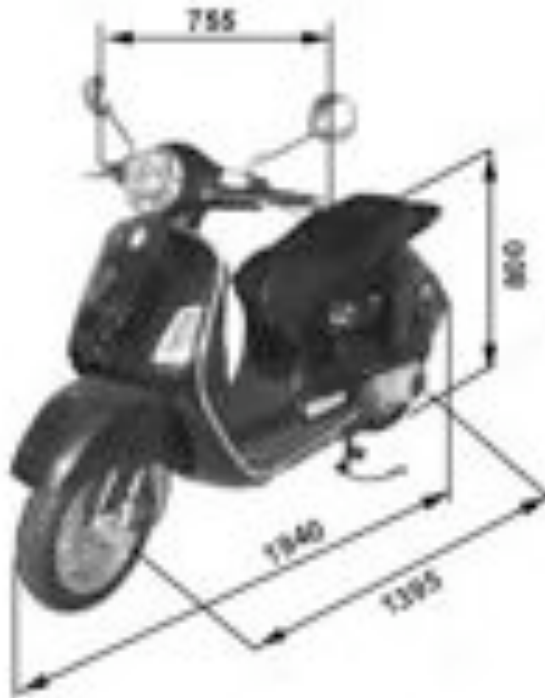


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## 2.3 Technical Specifications

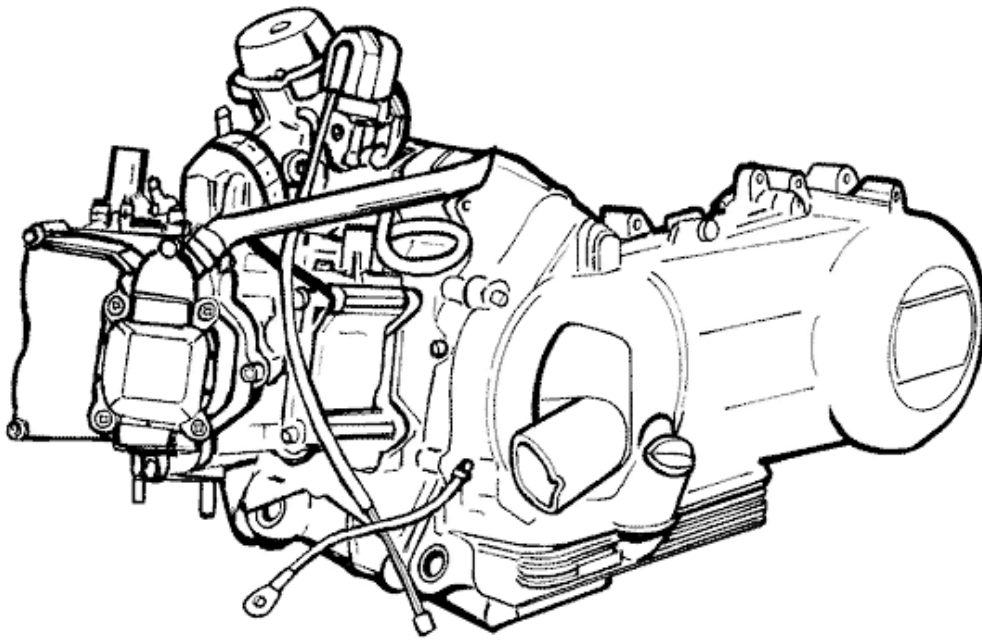
### 2.3.1 Weight and Dimensions

Characteristics	Descriptions
Dry weight	308 lbs. (140 Kg)
Width (at handgrips)	2.48 ft. (755 mm)
Length	6.36 ft. (1,940 mm)
Wheel base	4.58 ft. (1,395 mm)
Saddle height	2.62 ft. (800 mm)



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## 2.4 Engine



2.4.1 General	
Characteristics	Descriptions
Type	Single-cylinder, four-stroke, four-valve, liquid-cooled
Timing system	Single overhead camshaft driven by chain on L.H., 3-arm rockers with threaded adjuster
Bore	2.83 in. (72.0 mm)
Stroke	1.91 in. (48.6 mm)
Piston displacement	12.06 cu. in. (197.775 cm <sup>3</sup> )
Compression ratio	11-12: 1
Walbro carburetor	WVF-7P
Keihin carburetor	CVK 30
Engine idle	1650±50 rpm
CO value	3.8±0.7%
Air filter	Sponge air filter, soaked in fuel-oil mixture (50% gasoline - 50% oil)
Starter system	Electric starter motor with torque limiter



Lubrication	By chain driven lobe pump in crankcase, mesh strainer and cartridge filter
Fuel system	Gasoline supplied by carburetor with vacuum pump
Max power (shaft)	21 hp (15.4 kW) @ 8,500 rpm
Max speed	75 mph (120 km/h)
<b>2.4.2 Walbro carburetor</b>	
<b>Characteristics</b>	<b>Descriptions</b>
Vacuum type	WVF- 7P*
Printing on body	7P
CUT-OFF device	Present
Max jet	95
Slow running jet	33
Main air jet	120
Idling air jet	55
Throttle valve spring	0.264 lbs (1.18 N)
Initial opening of idle speed mixture adjusting screw	2±½
Conical needle	495
Notches from top of conical needle	2
Diffuser nozzle	Ø 0.106 in (2.7 mm)
Fuel inlet hole	Ø 0.059 in (1.5 mm)
Starting air jet	200
Starting diffuser jet	110
Starter jet	45
Starter pin diameter	Ø 0.070 in (1.78 mm)
Starter device resistance	~40 Ω
Venturi tube	Ø 1.142 in (29.0 mm) - (30.3×27.0 mm)
Throttle valve	Ø 1.299 in (33.0 mm)
Tube maximum choke	Ø 1.890 in (48.0 mm)

<b>2.4.3 Kehin carburetor</b>	
<b>Characteristics</b>	<b>Descriptions</b>
Vacuum type	CVK 30
Printing on body	CVK
CUT-OFF device	present
Max jet	92
Slow running jet	38
Main air jet	70
Idling air jet	115
Throttle valve spring	0.330–0.551 lbs (1.47–2.45 N)
Initial opening of idle speed mixture adjusting screw	2¼±¼
Conical needle	NDAA
Notches from top of conical needle	Single-notch needle
Diffuser nozzle	Ø 1.969 in (5.0 mm)
Fuel inlet hole	Ø 0.059 in (1.5 mm)
Starting air jet	-
Starting diffuser jet	-
Starter jet	42
Choke pin diameter	-
Choke device resistance	~ 20 Ω
Venturi tube	Ø 1.142 in (29.0 mm) (47×30.9 mm)
Throttle valve	Ø 1.201 in (30.5 mm)
Tube maximum choke	-

\*The identification letter may vary every time the carburetor is updated.

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## 2.5 Transmission

Characteristics	Descriptions
Transmission	By automatic variator, with expanding pulleys, torque converter, V-belt, automatic clutch, gear reducer and transmission compartment cooled by forced air circulation

## 2.6 Capacities

Characteristics	Descriptions
Engine oil	~1.06 quarts ( $\sim 1,000\text{ cm}^3$ ) (recommended oil: Selenia HI Scooter 4 Tech)
Fuel tank (including reserve ~0.5 gal)	~2.5 gallons ( $\sim 9.5\text{ liters}$ )
Rear hub	~0.16 quarts ( $\sim 150\text{ cm}^3$ ) (recommended oil: TUTELA ZC 90)
Cooling system fluid	~0.55-0.57 gallons ( $\sim 2.10\text{--}2.15\text{ liters}$ ) (recommended: PARAFLU 11FE (diluted))

## 2.7 Electrical Components

Characteristics	Descriptions
Ignition type	Electronic ignition by capacitive discharge, with variable advance and separate H.T. coil
Variable ignition advance (before T.D.C.)	From $10^\circ \pm 1^\circ$ @ 2,000 rpm to $32^\circ \pm 1^\circ$ @ 6,500 rpm
Spark plug	Champion RG 6 YC
Battery	12V-12Ah
Fuses	1×15A, 1×10A, 3×7.5A, 2×5A
Generator	In alternating current (AC)

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## 2.8 Frame, Suspensions, Brakes and Tires

2.8.1 Frame and Suspension	
Characteristics	Descriptions
Type	Pressed steel, mono-coque type
Front suspension	Single-arm suspension equipped with dual-effect hydraulic shock absorber with coaxial spring
Front shock absorber travel	3.4 in (86.5 mm)
Rear suspension	Engine mounted on oscillating fork pivoted to the frame by means of an arm with 2 degrees of freedom. Pair of dual effect hydraulic shock absorbers and coaxial springs with 3 preload adjustment positions
Rear shock absorber travel	3.52 in (89.5 mm)
2.8.2 Brakes	
Characteristics	Descriptions
Front	Ø 8.66 in (220 mm) disc and hydraulically operated floating caliper (via RH lever) with two Ø 0.98 in (25 mm) pistons
Rear	Ø 8.66 in (220 mm) disc and hydraulically operated floating caliper (via LH lever) with two Ø 1.18 in (30 mm) pistons
2.8.3 Wheels and Tires	
Characteristics	Descriptions
Aluminum alloy rims	Front: 3.00×12" Rear: 3.00×12"
Tires	Front: 120/70-12" Tubeless Rear: 130/70-12" Tubeless
Tire pressure (when cold):	Front: 26.1 psi (1.8 bars) Rear (rider only): 29.0 psi (2.0 bars) Rear (rider + passenger): 31.9 psi (2.2 bars)
<b>Note:</b> The tire inflation pressure should be checked and adjusted when the tires are at ambient temperature. Pressure should be adjusted according to the weight of the driver, accessories, and/or passenger.	

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### 3 Tightening Torques

<b>3.1 Steering Unit</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (<i>N·m</i>)]</b>
Steering upper ring nut	1	22.1–29.5 (30–40)
Steering lower ring nut	1	5.9–7.4 (8–10)
Handlebar clamping screw (*)	1	33.1–36.8 (45–50)
Handlebar control unit U-bolts fixing screws	2	5.1–7.4 (7–10)
<b>3.2 Frame</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (<i>N·m</i>)]</b>
Swing arm-engine pivot nut	1	47.1–53.0 (64–72)
Swing arm-frame pivot nut	1	56.0–61.1 (76–83)
Frame –engine link nut	1	24.3–30.2 (33–41)
Silent-block support plate bolt	2	30.9–38.3 (42–52)
Center stand bolt	1	18.4–22.1 (25–30)
<b>3.3 Front Suspension</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (<i>N·m</i>)]</b>
Shock absorber plate–caliper fixing screw	2	14.7–19.9 (20–27)
Wheel axle nut	1	55.2–66.3 (75–90)
Wheel screw	5	14.7–18.4 (20–25)
Mudguard–fork fixing screw	3	3.7–4.8 (5–6.5)

<b>3.4 Front Brake</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Pump-oil tube connection	1	13.7–18.4 (20–25)
Caliper-oil tube connection	1	13.7–18.4 (20–25)
Caliper-shock absorber plate fixing screw	2	13.7–18.4 (20–25)
Disk clamping screw (°)	6	4.4 (6)
Oil bleeder screw	1	8.8–11.8 (12–16)
Pad clamping pin	2	13.6–18.4 (19.6–25)
Brake pump basin screw	2	9.6–13.7 (15–20)
<b>3.5 Rear Suspension</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
L.H. side shock absorber support plate-crankcase fixing screw	2	13.7–18.4 (20–25)
Shock absorber top fastening	2	13.7–18.4 (20–25)
Shock absorber bottom fastening	2	24.3–30.2 (33–41)
Rear wheel axle	1	76.5–92.6 (104–126)
Wheel-hub fixing screw	5	13.7–18.4 (20–25)
Silencer-shock absorber support arm screws on engine (*)	2	13.7–18.4 (20–25)

<b>3.6 Rear Brake</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Pipe-oil tube connection	1	13.7–18.4 (20–25)
Caliper–oil tube connection	2	13.7–18.4 (20–25)
Rear disk clamping screw (°)	6	8.1–9.6 (11–13)
Oil bleeder screw	1	8.8–11.8 (12–16)
Caliper–engine fixing screw	2	13.7–18.4 (20–25)
Brake pump basin screw	2	11.0–14.7 (15–20)
Caliper coupling screw	2	22.1–24.3 (30–33)
<b>3.7 Silencer</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Silencer heat shield fixing screw	4	3.7–4.4 (5–6)
Exhaust gas inlet screw	1	9.6–11.0 (13–15)
Silencer–support arm fixing screw	3	13.7–18.4 (20–25)
<b>3.8 Hydraulic Components</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Hub oil bleeder cap	1	11.0–12.5 (15–17)
Oil filter–crankcase fixing screw	1	19.9–24.3 (27–33)
Engine oil–net filter bleeder cap	1	17.7–22.1 (24–30)

Oil filter	1	5.9–7.4 (8–10)
Oil pump cover screw	2	5.2–6.6 (7–9)
Oil pump–crankcase fixing screw	2	3.7–4.4 (5–6)
Oil pump control rim screw	1	7.4–10.3 (10–14)
Oil pump cover plate screws	2	2.9–4.4 (4–6)
Oil sump screw	7	7.4–10.3 (10–14)
Minimum oil pressure sensor	1	8.8–10.3 (12–14)
<b>3.9 Cylinder Head</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Spark plug	1	8.8–10.3 (12–14)
Head cover screw	5	4.4–5.2 (6–7)
Head-cylinder fixing nut (*) ( <sup>§</sup> )	4	5.2±0.7 +½ rotation (7±1 +180°)
Head fixing side screw	2	8.1–9.6 (11–13)
Start up mass screw	1	5.2–6.3 (7–8.5)
Adjustment tappet lock-nut	2	4.4–5.9 (6–8)
Intake manifold screw	2	8.1–9.6 (11–13)
Timing chain tightening sliding block screw	1	7.4–10.3 (10–14)
Start up mass bell screw	1	8.1–11.0 (11–15)
Timing belt tightening support screw	2	8.1–9.6 (11–13)



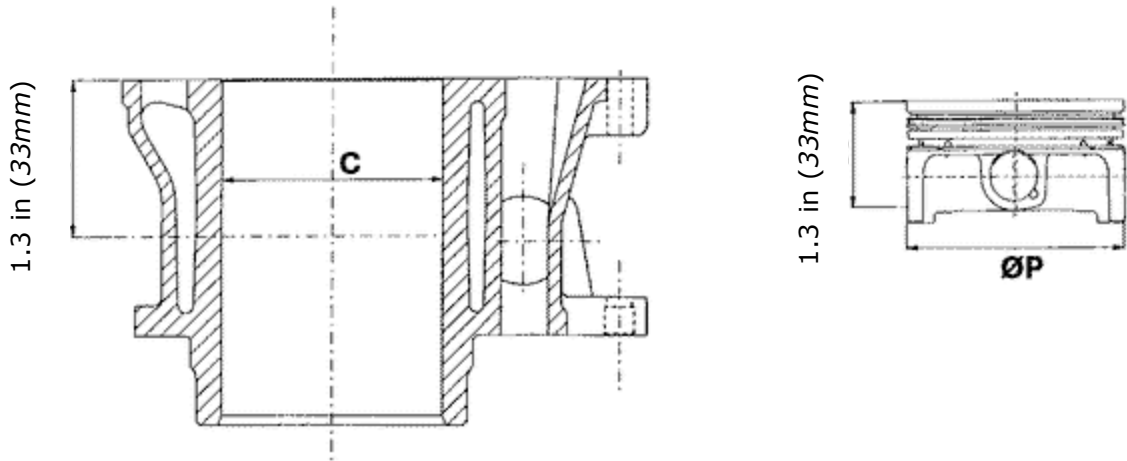
Timing belt tightening central screw	1	3.7-4.4 (5-6)
Camshaft retain plate screw	2	2.9-4.4 (4-6)
<b>3.10 Transmission</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Belt support roller screw	1	8.1-9.6 (11-13)
Clutch assy. nut	1	40.5-44.2 (55-60)
Driving pulley nut	1	55.2-61.1 (75-83)
Transmission cover screw	13	8.1-9.6 (11-13)
Driven pulley axle nut	1	39.8-44.4 (54-60)
Rear hub cover screw	7	17.7-19.9 (24-27)
<b>3.11 Flywheel</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Flywheel cover fixing screw	4	3.7-4.4 (5-6)
Stator unit screw (°)	2	2.2-2.9 (3-4)
Flywheel nut	1	38.3-42.7 (52-58)
Pick-up fixing screw	2	2.2-2.9 (3-4)
<b>3.12 Engine Crankcase and Shaft</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (N·m)]</b>
Engine crankcase inside head screws (transmission side half shaft)	2	2.9-4.4 (4-6)
Engine crankcase coupling screws	11	8.1-9.6 (11-13)

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Starter motor screws	2	8.1–9.6 (11–13)
Crankcase timing chain cover screw (°)	3	2.5–3.2 (3.5–4.5)
<b>3.13 Cooling</b>		
<b>Component</b>	<b>Qty</b>	<b>Torque [lbs·ft (<i>N·m</i>)]</b>
Water pump impeller cover	3	2.2–2.9 (3–4)
Water pump impeller driving joint screws	3	2.2–2.9 (3–4)
Thermostat cover screws	2	2.2–2.9 (3–4)

## 4 Assembly Clearances

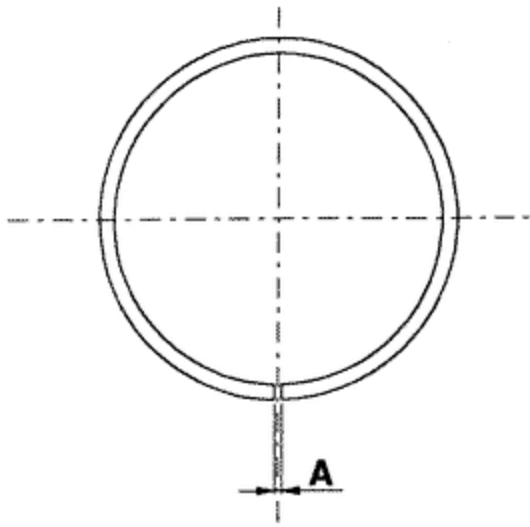
### 4.1 Piston–Cylinder Mating



[in (mm)]

Part	Dimensions	Coupling Classes			Assembly Clearance
		Class	Cylinder	Piston	
Cylinder	$2.835 \begin{smallmatrix} +0.0007 \\ -0.0003 \end{smallmatrix}$ $(72.00 \begin{smallmatrix} +0.018 \\ -0.010 \end{smallmatrix})$	A	2.8342–2.8345 (71.990–71.997)	2.8327–2.8330 (71.953–71.960)	0.00118–0.00173 (0.030–0.044)
		B	2.8345–2.8347 (71.997–72.004)	2.8330–2.8333 (71.960–71.967)	
Piston	$2.833 \pm 0.0005$ $(71.97 \pm 0.014)$	C	2.8347–2.8350 (72.004–72.011)	2.8333–2.8336 (71.967–71.974)	
		D	2.8350–2.8353 (72.011–72.018)	2.8336–2.8338 (71.974–71.981)	

## 4.2 O Rings

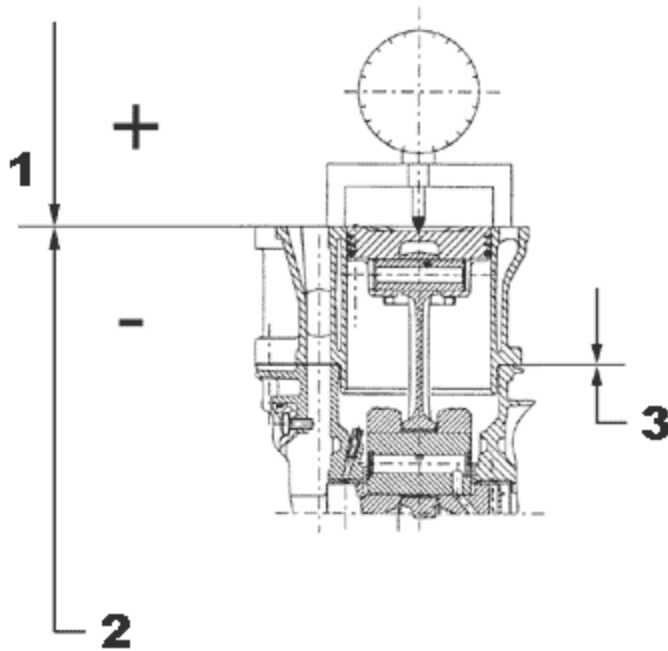


[in (mm)]

Part	Dimensions	Clearance Class	Assembly Clearance
Compression ring	2.834×0.059 (72.0×1.5)	A	0.005–0.011 (0.15–0.30)
Scraper ring	2.834×0.039 (72.0×1.0)	A	0.007–0.015 (0.20–0.40)
Scraper ring	2.834×0.098 (72.0×2.5)	A	0.007–0.015 (0.20–0.40)

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### 4.3 Compression Ratio Limiting Shimming System: (11-12:1)



1. Measure «A» (with piston at T.D.C.).

**Note:** Measure «A» must be taken without any gasket installed between the crankcase and the cylinder and after resetting the comparator, complete with support, on a rectified surface.

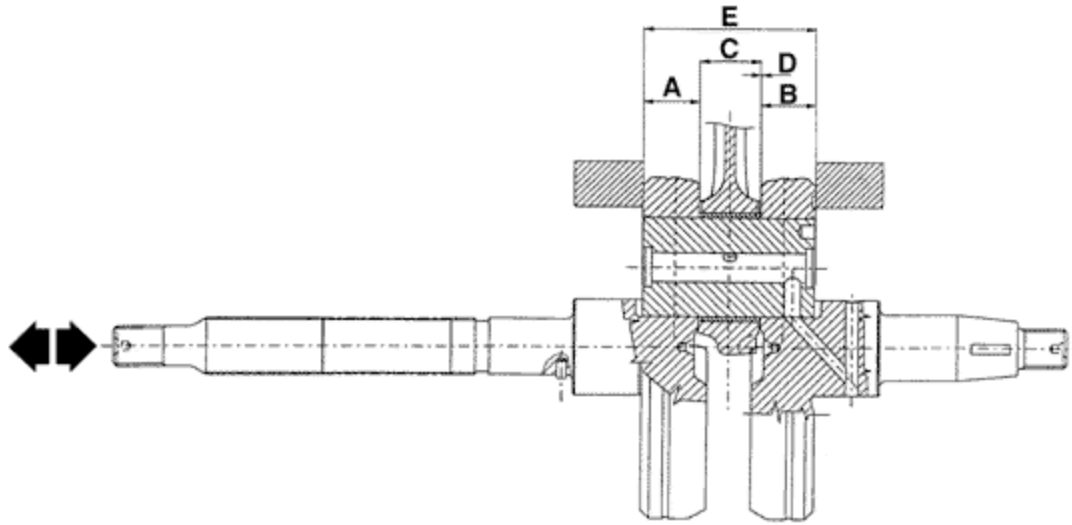
2. Install according to the measure «A» taken.

**Note:** The «A» value to be measured is referred to the piston recess. It indicates the amount by which the surface formed by the piston crown lowers, compared to the surface formed by the cylinder upper part. The more the piston descends into the cylinder, the less the base gasket to be applied (to recover the compression ratio) will be and vice versa.

[in (mm)]

Measure «A»	Gasket thickness
(1.7-1.6)	$0.015 \pm 0.0019$ ( $0.4 \pm 0.05$ )
(1.6-1.4)	$0.023 \pm 0.0019$ ( $0.6 \pm 0.05$ )
(1.4-1.3)	$0.031 \pm 0.0019$ ( $0.8 \pm 0.05$ )

## 4.4 Crankshaft End-Play



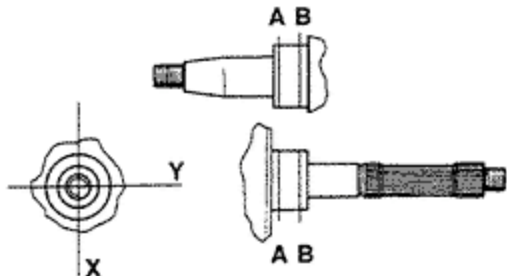
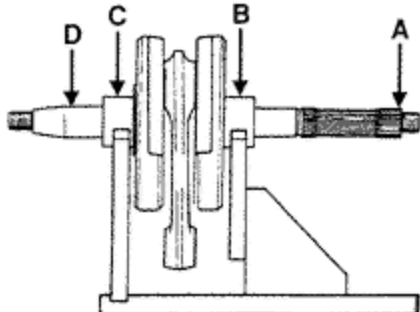
### Standard clearance:

Crankshaft/crankcase axial clearance (engine cold) 0.005-0.015 in  
(0.15-0.40 mm)

[in (mm)]

Part	Dimensions	Clearance Class	Assembly Clearance
Half-shaft transmission side	$0.653 \begin{smallmatrix} +0.0000 \\ -0.0019 \end{smallmatrix}$ $(16.60 \begin{smallmatrix} +0.000 \\ -0.050 \end{smallmatrix})$	A	D= 0.007-0.019 (0.20-0.50)
Half-shaft flywheel side	$0.653 \begin{smallmatrix} +0.0000 \\ -0.0019 \end{smallmatrix}$ $(16.60 \begin{smallmatrix} +0.000 \\ -0.050 \end{smallmatrix})$	B	
Connecting rod	$0.708 \begin{smallmatrix} -0.0059 \\ -0.0040 \end{smallmatrix}$ $(18.00 \begin{smallmatrix} -0.150 \\ -0.100 \end{smallmatrix})$	C	
Spacing tool	$2.023 \begin{smallmatrix} +0.0010 \\ -0.0000 \end{smallmatrix}$ $(18.00 \begin{smallmatrix} -0.150 \\ -0.100 \end{smallmatrix})$	D	

## 4.5 Crankshaft Alignment

Measure the diameters on both X and Y axes				
<b>Class</b>	<b>Standard diameter (mm)</b>			
1	1.1416–1.1418 (28.998-29.004)			
2	1.1418–1.1421 (29.004-29.010)			
<b>Maximum allowable misalignment:</b>  <b>A</b> = 0.15 mm  <b>B</b> = 0.01 mm  <b>C</b> = 0.01 mm  <b>D</b> = 0.10 mm  <b>Specific tools and equipment:</b> Support and comparator 020335Y Crankshaft aligning tool 020074Y				
<b>Crankcase – Crankshaft – Half crankshaft bearings</b>				
<b>Crankcase</b>	<b>Class 1</b>	<b>Class 2</b>		
	1.2973–1.2978 (32.953–32.963)			
<b>Half crankshaft bearing</b>	<b>A type - Red</b>	<b>B type - Blue</b>	<b>C type - Yellow</b>	
	0.0776–0.0777 (1.970–1.973)	0.0777–0.0778 (1.973–1.976)	0.0778–0.779 (1.976–1.979)	
<b>Note:</b> Spare crankcases are selected with half-crankcases of the same category and mounted with category B bearings (blue colored). Match the shaft with two category 1 shoulders with category 1 crankcase (or cat. 2 with cat. 2). A spare crankcase cannot be combined with a crankshaft with mixed categories. Spare shafts have half-shafts of the same category.		<b>Half-crankcase</b>	<b>Half crankshaft</b>	<b>Bearing</b>
		Cat. 1	Cat. 1	B
		Cat. 2	Cat. 2	B
		Cat. 1	Cat. 2	A
		Cat. 2	Cat. 1	C

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## 5 Recommended Lubricants

Use	Characteristics	Recommended Product
Rear hub	SAE 80W/90 oil, exceeding API GL3 specifications	TUTELA ZC 90
Air filter sponge	Mineral oil with specific additives to increase adhesion ISO VG 150	SELENIA Air Filter Oil
Brake levers, throttle handgrip	Complex calcium soap grease NLGI 1-2	SYSTEM TW 249 AREXONS
Engine oil	SAE 5W/40 synthetic oil, exceeding API SJ specifications	SELENIA HI Scooter 4 Tech
Brake fluid	Synthetic fluid SAE J1703, NHTSA 116 DOT 4, ISO 4925	TUTELA TOP 4
Coolant	Monoethylene glycol-based anti-freezer, CUNA NC 956-16	PARAFU 11 FE (Diluted)
Grease for driven pulley shaft compensating ring and moveable driven pulley sliding seat	Molybdenum disulphide grease	MONTBLANC MOLYBDENUM GREASE (498345)
Grease for wheel bearings, pivot housings and swing arm	Lithium soap and zinc oxide grease NLG12 for the oscillating arm	TUTELA ZETA 2



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## 6 Special Tools

### 6.1 Steering Bearing Seat Installer – 001330Y

	Description	Notes	Part No.
	Steering bearing seat installer; to be fitted with parts:  001330Y009- For bottom housing  001330Y010- For top housing	NECESSARY	001330Y

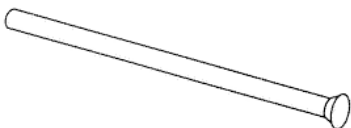
### 6.2 Pliers – 001467Y014

	Description	Notes	Part No.
	0.59 in (15mm) Pliers	NECESSARY	001467Y 014

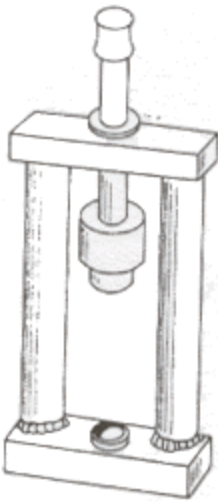
### 6.3 Bell – 001467Y017

	Description	Notes	Part No.
	Bell	NECESSARY	001467Y 017

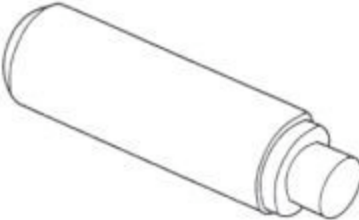
### 6.4 Steering Column Ball-Cage Bearing Removing Punch – 020004Y

	Description	Notes	Part No.
	Punch for removing steering column ball-cage bearings from steering head	RECOMMENDED	020004Y

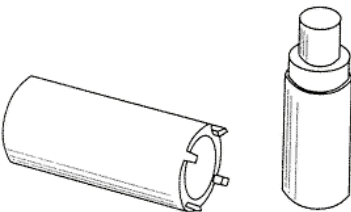
## 6.5 Front Suspension Overhaul Tool – 020021Y

	Description	Notes	Part No.
	Front suspension overhaul tool	NECESSARY	020021Y

## 6.6 Punch – 020036Y

	Description	Notes	Part No.
	Punch	NECESSARY	020036Y

## 6.7 Punch - 020038Y

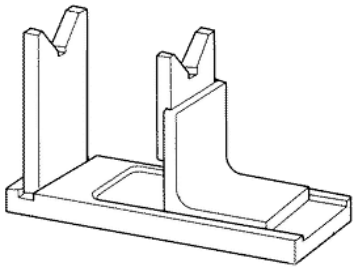
	Description	Notes	Part No.
	Punch	NECESSARY	020038Y

## 6.8 Ring Nut Spanner - 020055Y

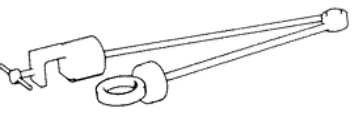
	Description	Notes	Part No.
	Steering column ring nut spanner	NECESSARY	020055Y

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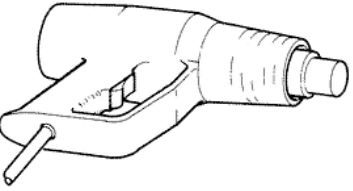
## 6.9 Crankshaft Aligner - 020074Y

	Description	Notes	Part No.
	Crankshaft aligning tool	RECOMMENDED	020074Y

## 6.10 Heat Gun Support - 020150Y

	Description	Notes	Part No.
	"Metabo hg 1500/2" hot air gun support	RECOMMENDED	020150Y

## 6.11 Heat Gun - 020151Y

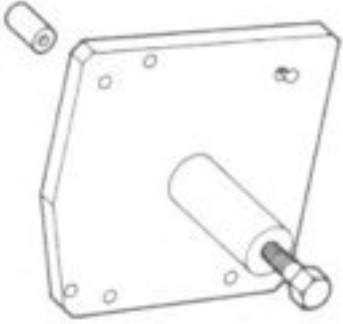
	Description	Notes	Part No.
	"Metabo hg 1500/2" hot air gun	RECOMMENDED	020151Y

## 6.12 Oil Pressure Gauge - 020193Y


	Description	Notes	Part No.
	Oil pressure gauge	NECESSARY	020193Y

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### 6.13 Crankcase Detacher - 020262Y

	Description	Notes	Part No.
	Crankcase detachment plate	RECOMMENDED	020262Y

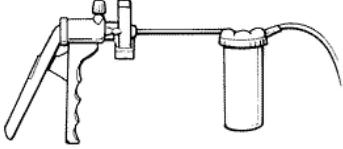
### 6.14 Half-Pulley Assembler - 020263Y

	Description	Notes	Part No.
	Half pulley assembly sheath	NECESSARY	020263Y

### 6.15 Fitting Punch - 020306Y

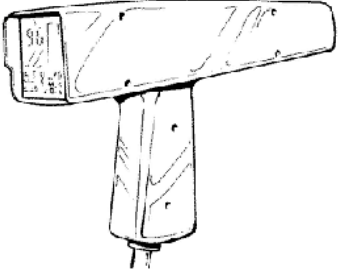
	Description	Notes	Part No.
	Retaining ring fitting punch	NECESSARY	020306Y

### 6.16 Vacuum Pump - 020329Y

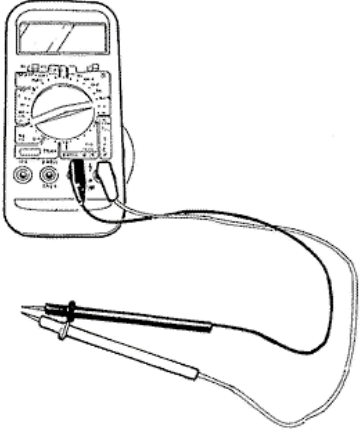
	Description	Notes	Part No.
	Mitivac-like vacuum pump	RECOMMENDED	020329Y

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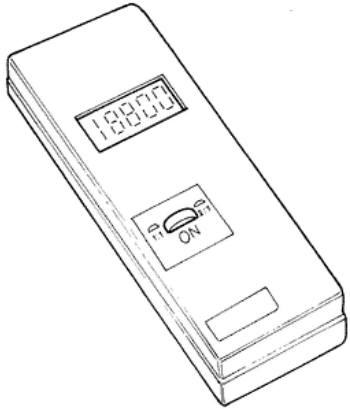
### 6.17 Timing Light - 020330Y

	Description	Notes	Part No.
	Timing light for two and four-stroke engines	RECOMMENDED	020330Y

### 6.18 Digital Multimeter - 020331Y

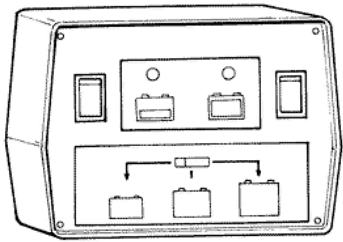
	Description	Notes	Part No.
	Digital multimeter	RECOMMENDED	020331Y

### 6.19 Digital Tachometer - 020332Y

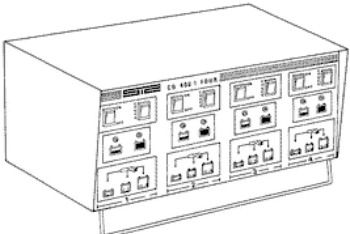
	Description	Notes	Part No.
	Digital tachometer	RECOMMENDED	020332Y

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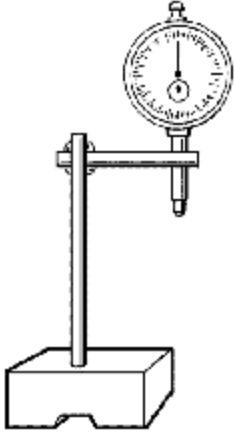
### 6.20 Single Battery Charger - 020333Y

	Description	Notes	Part No.
	Single battery charger	RECOMMENDED	020333Y

### 6.21 Multiple Battery Charger - 020334Y

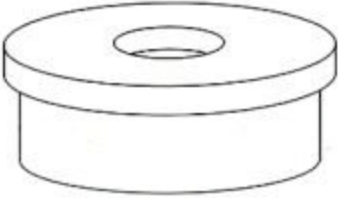
	Description	Notes	Part No.
	Multiple battery charger	RECOMMENDED	020334Y

### 6.22 Dial Gauge - 020335Y

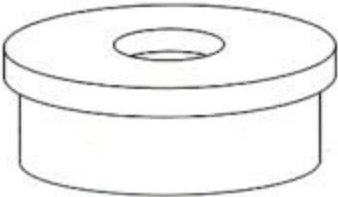
	Description	Notes	Part No.
	Dial gauge (0.001 mm) with magnetic stand	RECOMMENDED	020335Y

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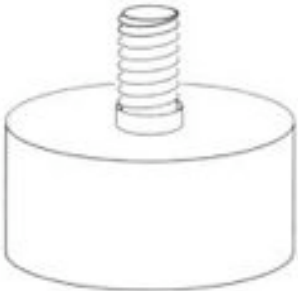
**6.23 Adapter (42×47 mm) - 020359Y**

	Description	Notes	Part No.
	42×47 mm Adapter	NECESSARY	020359Y

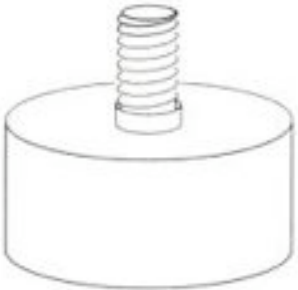
**6.24 Adapter (52×55 mm) - 020360Y**

	Description	Notes	Part No.
	52×55 mm Adapter	NECESSARY	020360Y

**6.25 Guide (20 mm) - 020363Y**

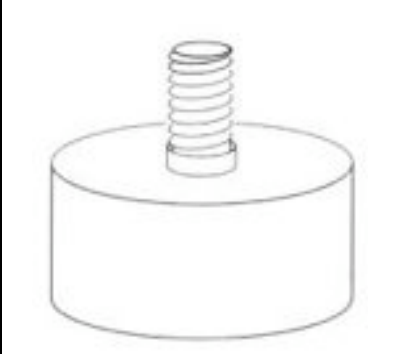
	Description	Notes	Part No.
	20 mm guide	NECESSARY	020363Y

**6.26 Guide (25mm) - 020364Y**


	Description	Notes	Part No.
	25 mm guide	NECESSARY	020364Y

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**6.27 Guide (22 mm) - 020365Y**

	Description	Notes	Part No.
	22 mm guide	NECESSARY	020365Y

**6.28 Adapter (28×30 mm) - 020375Y**

	Description	Notes	Part No.
	28×30 mm adapter	NECESSARY	020375Y

**6.29 Handle - 020376Y**

	Description	Notes	Part No.
	Handle for adapters	NECESSARY	020376Y

**6.30 Valve Half-Cone Remover - 020382Y**

	Description	Notes	Part No.
	Tool for valve half-cone removal	NECESSARY	020382Y


**6.31 Bushing - 020382Y011**

	Description	Notes	Part No.
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	Bushing (for valve removal)	NECESSARY	020382Y 011
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### 6.32 Piston Assembly Band - 020393Y


	Description	Notes	Part No.
	Piston assembly band	NECESSARY	020393Y

### 6.33 Multimeter Adapter - 020409Y


	Description	Notes	Part No.
	Multimeter adapter (peak voltage measurement)	RECOMMENDED	020409Y

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### 6.34 Guide (15 mm) - 020412Y

	Description	Notes	Part No.
	15 mm guide	NECESSARY	020412Y

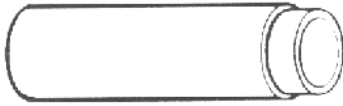
### 6.35 Clutch Drum Lock Wrench - 020423Y

	Description	Notes	Part No.
	Clutch drum lock wrench	NECESSARY	020423Y

### 6.36 Punch - 020424Y


	Description	Notes	Part No.
	Driven pulley-roller housing installing punch	NECESSARY	020424Y

### 6.37 Punch - 020425Y


	Description	Notes	Part No.
	Oil seal (flywheel-side) punch	NECESSARY	020425Y

---


### 6.38 Piston Fitting Fork - 020426Y

	Description	Notes	Part No.
	Piston fitting fork	NECESSARY	020426Y


### 6.39 Piston Support - 020428Y

	Description	Notes	Part No.
	Piston projection support	NECESSARY	020428Y

### 6.40 Valve O-Ring Remover - 020431Y


	Description	Notes	Part No.
	Valve o-ring removing tool	NECESSARY	020431Y

### 6.41 Oil Pressure Gauge - 020434Y


	Description	Notes	Part No.
	Oil pressure gauge	NECESSARY	020434Y

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**6.42 Guide (17 mm) - 020439Y**

	Description	Notes	Part No.
	17 mm guide for shock absorber support bearing assembly	NECESSARY	020439Y


**6.43 Water Pump Overhaul Tool - 020440Y**

	Description	Notes	Part No.
	Water pump overhaul tool	NECESSARY	020440Y

**6.44 Adapter (26×28 mm) - 020441Y**


	Description	Notes	Part No.
	26×28 mm adapter	NECESSARY	020441Y

**6.45 Stop Wrench - 020442Y**


	Description	Notes	Part No.
	Driving pulley wrench	NECESSARY	020442Y

---


**6.46 Driven Pulley Spring Tool - 020444Y**

	Description	Notes	Part No.
	Driven pulley spring compressing tool	NECESSARY	020444Y


**6.47 Guide (30 mm) - 020483Y**

	Description	Notes	Part No.
	30 mm guide for hub bearing assembly	NECESSARY	020483Y

**6.48 Pivot Retainers Installer - 020488Y**

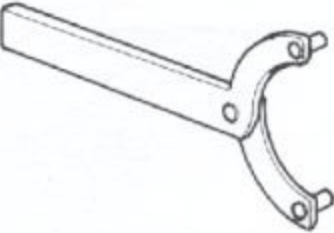
	Description	Notes	Part No.
	Pivot retainers installation tool	NECESSARY	020488Y

**6.49 Hub Cover support - 020489Y**

	Description	Notes	Part No.
	Hub cover support tool kit	NECESSARY	020489Y

---

### 6.50 Flywheel Wrench - 020565Y

	Description	Notes	Part No.
	Adjustable wrench for flywheel fixing	NECESSARY	020565Y

### 6.51 Engine Support - 002095Y

	Description	Notes	Part No.
	Engine support; to be fitted with parts:  002095Y015 – Tube 002095Y022 – Cross member 002095Y023 – Nut 002095Y044 – Plate 002095Y046 – Clamp	RECOMMENDED	002095Y

### 6.52 Pliers - 002465Y


	Description	Notes	Part No.
	Snap-ring pliers	RECOMMENDED	002465Y

### 6.53 Punch - 06029Y


	Description	Notes	Part No.
	Steering column ball-cage bearing installing punch	RECOMMENDED	006029Y

---

### 6.54 Flywheel Extractor - 08564Y

	Description	Notes	Part No.
	Flywheel removing tool	NECESSARY	008564Y

### 6.55 Gas Analyzer - 494929

	Description	Notes	Part No.
	Exhaust gas analyzer	RECOMMENDED	494929

## 7 Maintenance

This section provides information on periodical maintenance.

### 7.1 Maintenance Schedule

×625 miles (×1,000 km)	1	6	12	18	24	30	36	42	48	54	60	66	72
Months	4	12	24	36	-	-	-	-	-	-	-	-	-
<b>Check: V</b>													
<b>Replacement: S</b>													
Engine oil - Check level/Top up	V	Every 1,875 mile (3,000 km)											
Engine oil - Replace	S	S	S	S	S	S	S	S	S	S	S	S	S
Hub oil level - Check/Replace	S	V	V	V	S	V	V	V	S	V	V	V	S
Spark plug/Electrodes distance - Check/Replace		V	S	V	S	V	S	V	S	V	S	V	S
Air filter - Clean		V	V	V	V	V	V	V	V	V	V	V	V
Secondary air filter (external internal) - Clean	Every 2 years												
Oil filter - Replace	S	S	S	S	S	S	S	S	S	S	S	S	S
Valve clearance - Check		V		V			V			V			V
Idle speed (*) - Adjust	V		V		V		V		V		V		V
Gas control - Adjust	V		V		V		V		V		V		V
Variator rollers - Check/Replace		V	V	V	V	V	V	V	V	V	V	V	V
Driving belt - Check/Replace		V	S	V	S	V	S	V	S	V	S	V	S
Cooling fluid level - Check		V	V	V	V	V	V	V	V	V	V	V	V
Cooling fluid - Replace	Every 2 years												
Radiator - Clean exterior/Check				V			V			V			V
Steering - Adjust	V		V		V		V		V		V		V
Brake levers - Lubricate	V		V		V		V		V		V		V
Brake pads - Check condition and wear	V	V	V	V	V	V	V	V	V	V	V	V	V
Brake fluid piping - Replace							S						S
Brake fluid level - Check	V	V	V	V	V	V	V	V	V	V	V	V	V
Brake fluid - Replace	Every 2 years												



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Transmissions - Lubricate			V		V		V		V		V		V
Safety locks – Check	V		V		V		V		V		V		V
Suspensions – Check			V		V		V		V		V		V
Electrical system and Battery - Check	V	V	V	V	V	V	V	V	V	V	V	V	V
Headlight - Check/Adjust			V		V		V		V		V		V
Tires pressure and wear - Check		V	V	V	V	V	V	V	V	V	V	V	V
Vehicle and braking system performance - Road test	V	V	V	V	V	V	V	V	V	V	V	V	V
<b>Labor time</b>	<b>70'</b>	<b>130'</b>	<b>135'</b>	<b>140'</b>	<b>150'</b>	<b>90'</b>	<b>245'</b>	<b>90'</b>	<b>150'</b>	<b>140'</b>	<b>135'</b>	<b>90'</b>	<b>260'</b>

Safety tightenings: refer to the chapter “Pre-delivery Operations”.

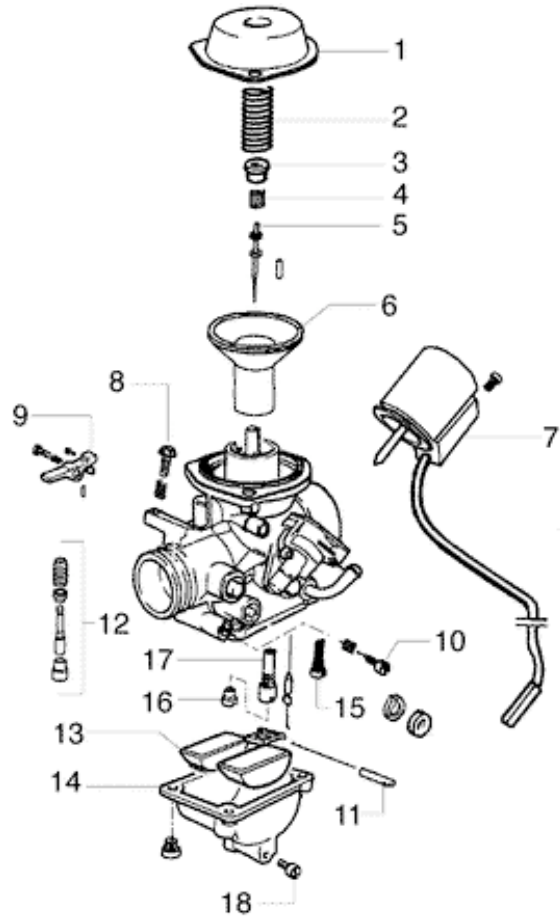
(\*) See rules

## 7.2 Carburetor

- Disassemble all carburetor components, accurately wash them in solvent, and then dry them with compressed air. To ensure thorough cleaning, pay particular attention to the passages in the carburetor body.
- Carefully check the conditions of each component.
- The throttle valve must slide freely into the chamber; in case of excessive play due to wear, replace the valve.
- Replace the carburetor if the chamber shows excessive signs of wear as to preclude the valve's regular seal or free sliding (even if new).
- Gaskets should be replaced every time the carburetor is reassembled.

**Warning** - Fuel is highly explosive. Always replace gaskets to prevent leakage.

**1.** Diaphragm cover - **2.** Throttle valve spring - **3.** Conical needle support - **4.** Conical needle spring - **5.** Conical needle - **6.** Throttle valve diaphragm - **7.** Automatic choke - **8.** Idle speed adjusting screw - **9.** Return valve rockers - **10.** Idle mixture adjusting screw - **11.** Float pin - **12.** Return pump unit - **13.** Float - **14.** Float chamber - **15.** Idling jet - **16.** Main jet - **17.** Diffuser - **18.** Float chamber drain screw.



### 7.3 Checking and Replacing the Spark Plug

**Warning** – Remove the spark plug when the engine is cold. Replace the spark plug every 7,500 miles (12,000 km). The use of non-conforming ignition controllers, and spark plugs other than those prescribed can seriously damage the engine.

**Recommended spark plug:**

Champion RG6YC

- Rest the vehicle on the central stand
- Open the saddle and extract the helmet compartment
- Disconnect the spark plug H.T. cable cap.
- Unscrew the spark plug, using the spanner provided.
- Inspect the spark plug, to ensure that the insulator is in good conditions and no signs of cracks are visible. Also check the condition of the seal washer and make sure that the electrodes are not worn out or excessively sooty.
- Measure the spark gap with a suitable thickness gauge

**Standard dimension:**

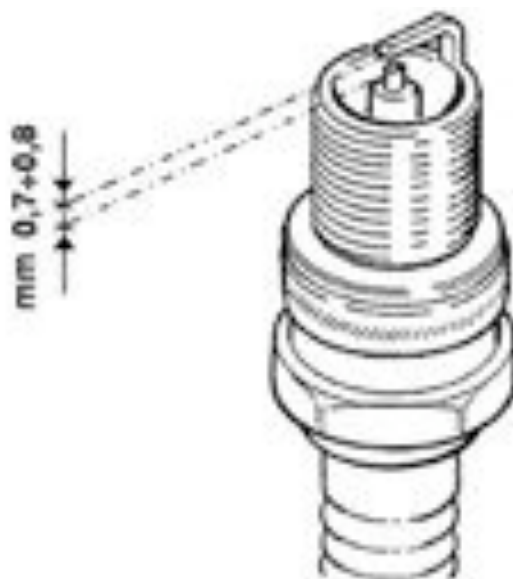
Spark gap 0.028-0.031 in.  
(0.7-0.8 mm)

- If necessary adjust the spark gap by carefully bending the side electrode.
- If the spark plug shows any of the defects mentioned above, replace it with a plug of the recommended type.
- Insert the spark plug with the proper inclination, and screw it thoroughly by hand, then tighten it using the supplied spanner.

**Tightening torque:**

Spark plug 8.9-10.3 lbs·ft  
(12-14 N·m)

Insert the cap over the spark plug thoroughly and proceed to the reassembly



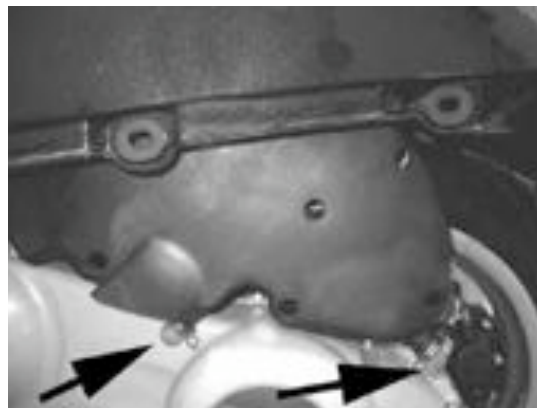
## 7.4 Air Filter

**Note:** Every 3,726 miles (6,000 km) it is necessary to check the air filter and blow it, if required. The jet should be directed from the inside outwards of the filter (i.e., opposite to the air flow direction during normal engine operation).

- Remove the left hand-side fairing by releasing the two screws, as shown in the figure
- Remove the helmet compartment
- Remove the three fastening screws that can be reached after the removal of the helmet compartment, from inside the frame
- Remove the five fixing screws shown in the figure
- Remove the filtering element.
- Replace the air filter with a new one.



**Note:** Every 3,726 miles (6,000 km), during servicing, it is necessary to remove the stops and the rubber caps located below the filter box, as shown in the figure, and drain any oil accumulation.



**Cleaning (Every 7,452 miles, or 12,000 km):**

Wash with water and shampoo.

Dry with light jets of compressed air and wipe with a clean cloth.

Soak with a 50% fuel-oil mixture (use SELENIA AIR FILTER OIL).

Let the filtering element drip and squeeze it with hands without wringing.

Replace the filtering element.

**Caution** – If the vehicle is mostly used on dusty roads, the air filter must be cleaned more frequently than what indicated in the scheduled maintenance table.

**Caution** – Never let the engine run without air filter. This would cause an excessive wear of cylinder and piston and would damage the carburetor.

---

## 7.5 Engine Oil

Engine oil is used in 4-stroke engines to lubricate the valve gear components, the crankshaft bearings and the power plant. **An insufficient quantity of oil can cause serious damage to the engine itself.**

In all 4-stroke engines, oil deterioration and consumption are, to some extent, normal, especially during running-in. Consumption partly depends on the riding style (e.g.: when riding constantly at full throttle, oil consumption increases).

### 7.5.1 Checking the Engine Oil Level

Perform the following operations when the engine is cold:

- Rest the vehicle on the central stand and on a flat surface.
- Unscrew dipstick «A», dry it with a clean cloth and reinsert it, by screwing it completely.
- Remove the dipstick again and check that the level is between the MAX and MIN levels; top up, if required.

The MAX level mark means that in the engine there is an oil quantity of approximately 1.164 quarts ( $1,100\text{ cm}^3$ ).

**Note:** The level will be lower if checked after using the vehicle (i.e. when the engine is hot). To obtain a correct indication of the oil level, wait at least 10 minutes after switching off the engine.



### 7.5.2 Topping-Up the Engine Oil

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

Restoring the level between **MIN** and **MAX** requires a quantity of oil of  $\sim 0.4$  quarts ( $\sim 400\text{ cm}^3$ ).

#### Oil pressure warning light

The vehicle is equipped with a warning light on the instrument panel which comes on when the ignition key is turned to the "ON" position. However, this light should switch off once the engine has started.

**Note:** Should the light turn on while braking, idling or cornering, check the oil level and the lubrication system as soon as possible.



### 7.5.3 Replacing the Oil and Oil Filter

- Oil and filter should be replaced every 3,726 mi (6,000 km). The engine should be emptied by draining the oil from the pre-filter drainage tap «B» of the net pre-filter on the flywheel side. To facilitate the oil drainage, loosen dipstick «A». Once the oil has been drained from the drainage tap, loosen the oil filter cartridge «C» and remove it as described below.
- Check that the O-rings of the pre-filter and drainage cap are not worn out and in good conditions.



- Lubricate the O-rings and replace net filter and oil drainage cap; tighten at the prescribed torque.
- Install the new cartridge filter after lubricating the O-ring.
- Fill with fresh engine oil.
- Since a certain quantity of oil still remains in the circuit, the fill-up should be carried out with about 0.64 quarts ( $600-650\text{ cm}^3$ ) of oil from cap «A». Subsequently, start up the engine, let it idle for a few minutes and then switch it off. After about 5 minutes, check the level and top up if necessary **without ever exceeding the MAX mark**. The cartridge filter must be replaced every time the oil is changed. For top ups and replacements, use fresh **Selenia HI Scooter 4 Tech** oil.

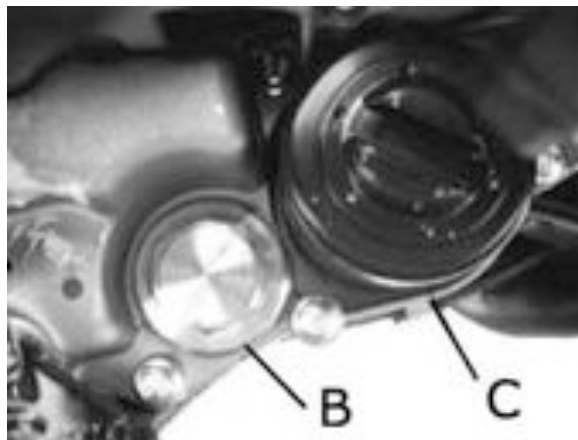
**Note:** Engine oil should be replaced when the engine is hot.

**Tightening torque:**

Engine oil drainage cap	17.6-22.1 lbs·ft (24-30 N·m)
-------------------------	---------------------------------

**Recommended oil:**

Selenia HI Scooter 4 Tech



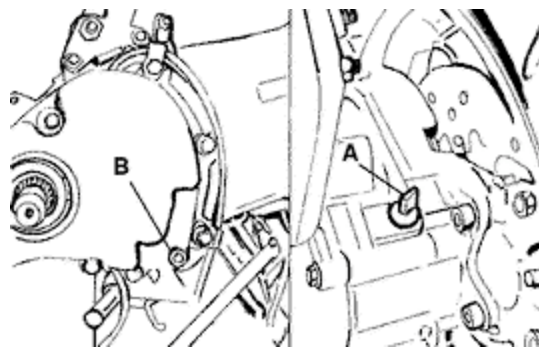
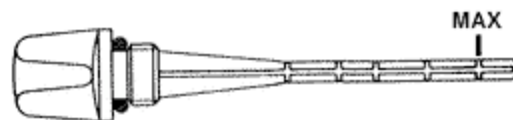


## 7.6 Hub Oil

### 7.6.1 Checking the Hub Oil Level

- Position the vehicle on its central stand on a flat surface
- Unscrew the oil dipstick «A», dry it with a clean cloth and reinsert it, screwing it in completely.
- Pull out the dipstick and check that the oil level reaches the lower notch (see figure); if the level is below the MAX mark, restore the proper amount of oil in the hub.
- Reinsert the dipstick and screw it tightly.

The notches on the hub oil dipstick, with the exception of the **MAX** mark, refer to other PIAGGIO models and have no specific function as far as this vehicle is concerned.



### 7.6.2 Replacing the Hub Oil

- Remove oil filler cap «A».
- Unscrew oil drain cap «B» and let the oil drain out completely.
- Retighten the oil drain cap and then fill the hub with fresh oil

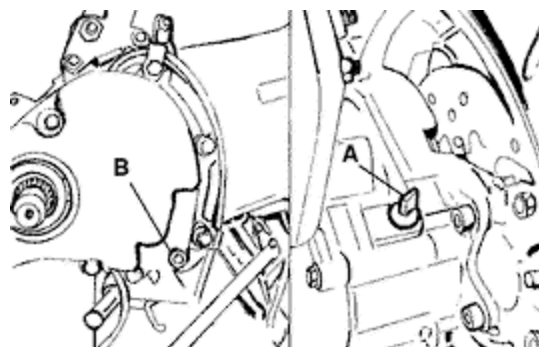
Recommended oil: TUTELA ZC 90

**Oil capacity:**

Rear hub ~0.16 quarts  
(~150 cm<sup>3</sup>)

**Tightening torques:**

Hub oil draining screw 11.0-12.5 lbs·ft  
(15-17 N·m)



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## 7.7 Topping-Up the Engine Cooling Liquid

**Note:** The liquid level inspection should be carried out every 3,726 mi. (6,000 km) when the engine is cold. The following steps should be followed:

- Rest the vehicle on its central stand level ground.
- Loosen the screw shown in the figure and remove the plastic flap on the right hand side of the vehicle's leg-shield, in order to access the cooling liquid expansion tank
- Remove the expansion tank cap and top up, if the coolant level is below or near the MIN level in the expansion tank. The fluid level should always be between the MIN and MAX marks.
- The coolant consists of a 50% mixture of demineralized water and antifreeze solution with a base of ethylene glycol and corrosion inhibitors.

**Warning** – To prevent leaks of the cooling fluid from the expansion tank during the use of the vehicle, never exceed the MAX mark upon filling.



---

## 7.8 Brake Fluid

### 7.8.1 Checking the Brake Fluid Level

The front and rear brake fluid reservoirs are located on the pumps installed on the handlebar.

In order to check the brake fluid level in the reservoirs, follow these steps:

- Rest the vehicle on its central stand on level ground and turn the handlebar to the central position.
- Remove the brake pump cover.
- Check the fluid level through the sight shown in the figure.

**Note:** A certain decrease in the level of the fluid occurs as a result of pad wear.



## 7.8.2 Topping-Up the Brake Fluid Level

**Caution** - Only use brake fluid classified as DOT 4.

- If the level is below minimum, loosen the two screws shown in the figure.
- Remove the reservoir cap, remove the gasket and top up, only using the prescribed fluid and without exceeding the maximum level.

**Recommended brake fluid:**  
TUTELA TOP 4

**Warning** - Keep the brake fluid away from the skin, the eyes and clothing. In case of contact, rinse thoroughly with water.

**Warning** - The brake fluid is highly corrosive. Do not let it come into contact with the paintworks.

**Warning** - The brake fluid is hygroscopic, i.e. it absorbs humidity from the surrounding air. If the concentration of humidity in the fluid exceeds a certain value, the braking action becomes insufficient.

**Warning** - Never use braking fluid drawn from open or partly empty containers.

In normal climatic conditions, the fluid should be replaced every 12,420 mi (20,000 km) or in any case every 2 years.

**Note:** Change brake fluid and bleed system as described in chapter "Braking System".

### **Tightening torque**




Reservoir screws: 11.0-14.7 lbs·ft  
(15-20 N·m)



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## 7.9 Removing the Steering Lock

### 7.9.1 Removing the Steering Lock when on «OFF» Position

<ul style="list-style-type: none"><li>- Remove the leg-shield as described in chapter "Bodywork".</li><li>- Remove the immobilizer antenna shown in the figure.</li></ul>	
<ul style="list-style-type: none"><li>- Disconnect the wiring.</li></ul>	
<ul style="list-style-type: none"><li>- Pull out the retaining spring shown in the figure and remove the ignition switch.</li></ul>	

- Push the bolt lightly and extract the retainer from the milled part shown in the figure.
- Extract the bolt assembly from the lock body.
- To refit, follow the reverse procedure.

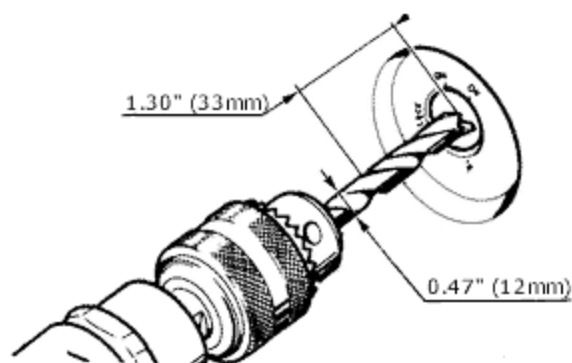


### 7.9.2 Removing the Steering Lock when on «LOCK» Position

The bolt retaining spring is not accessible in the «LOCK» position. It is then necessary to drill the bolt as shown in the figure to eject it.

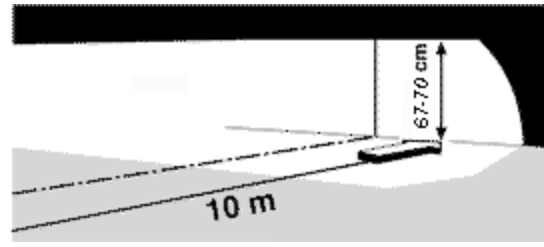
**Note:** To refit the bolt from this position, first disengage the steering lock by putting the lock body (inner and outer part) in the OFF position.

To refit, proceed as described in the previous paragraph.



## 7.10 Headlight Adjustment

- Place the unloaded vehicle on a flat surface, 32.8 ft (10 m) from a half lit white screen, with the tires inflated to the prescribed pressure. Ensure that the axis of the vehicle is perpendicular to the screen.
- Trace a horizontal line on the screen 27.2-28.3 in (67-70 cm) above ground.
- Remove the steering cover by loosening the screw shown in the figure.
- Switch on the headlight, turn on the low beam and check that the horizontal line, which separates the lighted area from the dark area, is not above the line previously drawn on the screen. To shift the headlight, operate on the adjusting screw immediately below the headlight, as shown in the figure.



## 7.11 Checking the Spark Advance

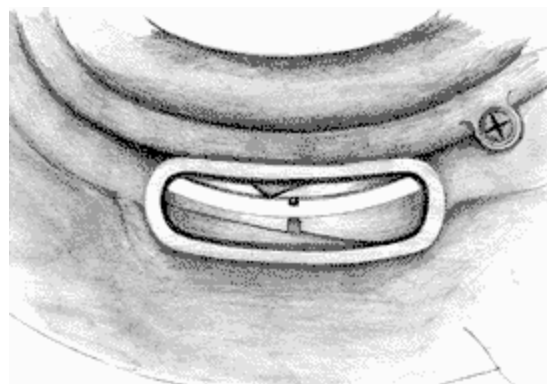
- To check the spark advance, use the stroboscopic light with the induction clamp connected to the spark plug feeder cable.
- Connect the induction clamp paying attention to the polarity (the arrow on the clamp must be facing the spark plug).
- Set the lamp selector to the central position (1 spark = 1 crankshaft revolution as in 2 stroke engines).
- Start the engine and check that the lamp works properly and that the revolution counter can also read high engine speeds (e.g. 8,000 rpm).
- If flashing or rpm reading instabilities are noted, increase the resistive load on the spark plug feeder cable (10-15 kΩ in series with the H.T. cable).
- Remove the plastic cover from the slotted hole on the flywheel cover.
- Using the lamp flash phase shift corrector, align the reference mark on the flywheel cover with the level on the water pump drive. Read the degrees of advance on the stroboscopic light.
- Check the revolving speed corresponding to the degrees of advance in the tables below.
- If any discrepancy is found, check the pick-up and the control unit feeders (positive-negative). If necessary, replace the control unit.
- An un-programmed control unit prevents the engine from exceeding 2,000 rpm.
- A programmed control unit allows the engine to revolve within the prescribed limits.

### Spark advance:

from 10°±1° @ 2,000 rpm  
to 32°±1° @ 6,000 rpm

### Specific tools and equipment:

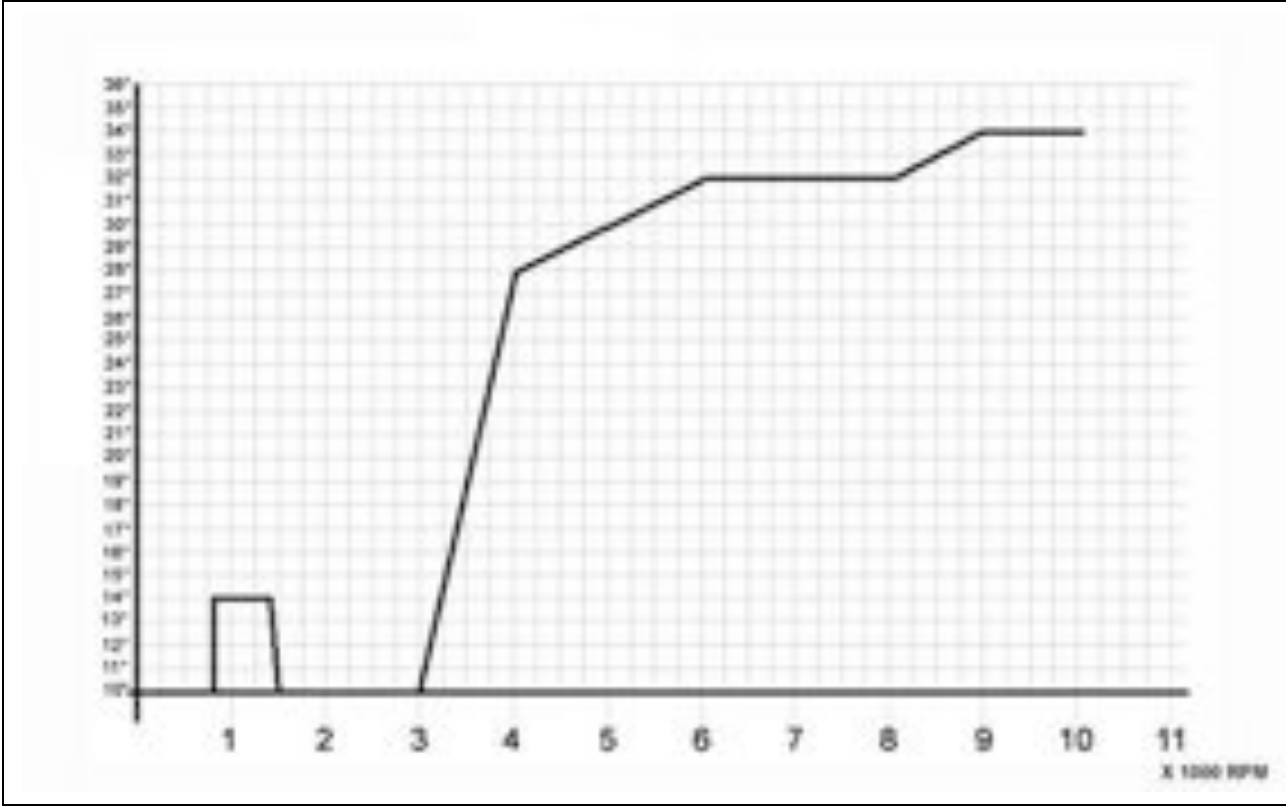
Timing Light 020330Y





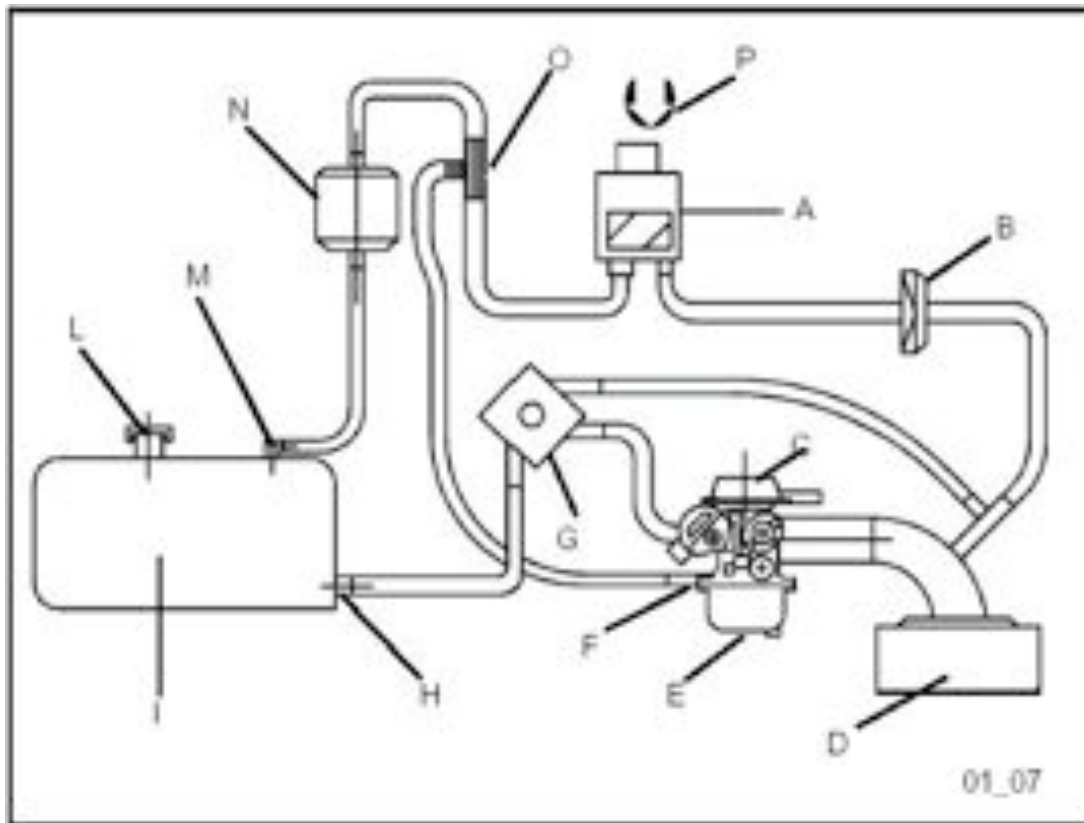
7.12 Spark Advance Variation Curve

	Rev limiter	
	First threshold	First threshold
Tripping threshold	9,900±50 rpm	9,900±50 rpm
Restore threshold	9,800±50 rpm	9,800±50 rpm
Spark suppression	1 spark out of 7	2 sparks out of 3



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## 7.13 Evaporative emission system



- A** = Canister
- B** = Uni-directional valve
- C** = Air intake membrane
- D** = Cylinder head
- E** = Carburetor
- F** = Air intake float chamber
- G** = Pump
- H** = Fuel output
- I** = Fuel tank
- L** = Plug
- M** = Fuel breather pipe

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**N** = Roll-over valve


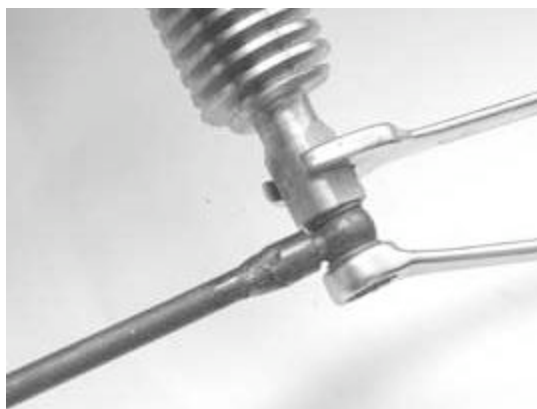

**O** = Union "T"

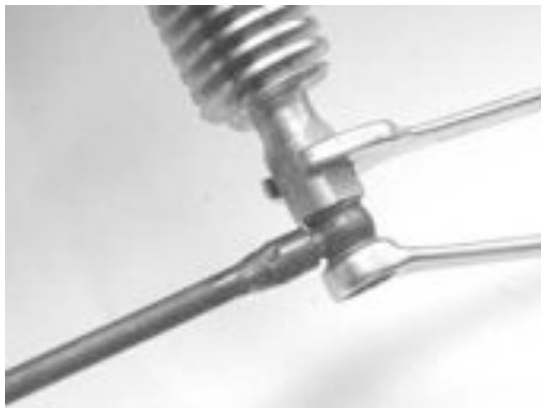
**P** = Environment



## Checking the CO Concentration

This test may be required when engine operation is irregular or while adjusting the idle.

The test must be carried out after washing all carburetor components and making sure that the air filter is clean and the spark plug is in good condition.

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>- Remove the side fairing and then the transmission cooling air inlet duct so as to easily reach the flow adjustment screw.</li><li>- Remove the gas cap on the exhaust.</li><li>- Using the original washer, install the exhaust gas collection kit onto the exhaust.</li></ul> |   |
| <ul style="list-style-type: none"><li>- Suitably orientate all the components.</li><li>- Close the gas outlet terminal of the tool.</li><li>- Start the engine and let it warm up until the electric fan activates.</li><li>- Stop the engine.</li></ul>   |  |
| <ul style="list-style-type: none"><li>- Disconnect the SAS (Secondary Air System) check valve vacuum pipe from the 'T' connection shown in the figure.</li></ul>   |  |



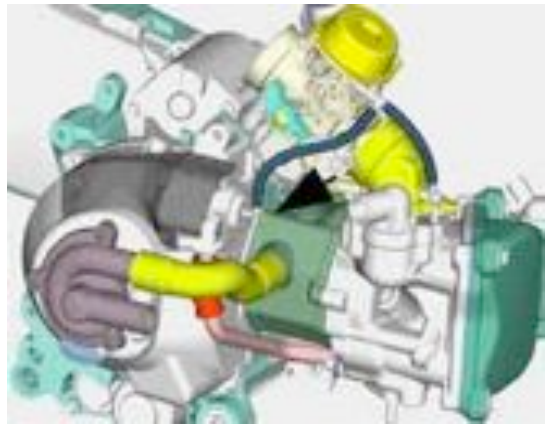
<ul style="list-style-type: none"> <li>- Seal the connection using a cap or a pipe portion with conical a cap.</li> <li>- Connect the Mitivac vacuum pump to the control pipe and to the SAS valve.</li> </ul>							
<ul style="list-style-type: none"> <li>- Start the vacuum pump up to a pressure of <math>-8.7 \div -11.6</math> psi (<math>-0.6 \div -0.8</math> bar) so as to close the valve and cut off the SAS system.</li> </ul>							
<p>Remove the exhaust gas collection kit closing cap and connect the analyzer properly pre-heated.</p> <p>Check the conditions displayed by the analyzer and the engine rpm and adjust the <b>CO value</b> to:  <b><math>3.8 \pm 0.7</math> @ <math>1,650 \pm 50</math> rpm</b></p> <p><b>Special equipment and tools:</b></p> <table> <tbody> <tr> <td>Mityvac-like vacuum pump</td><td>020329Y</td></tr> <tr> <td>Digital tachometer</td><td>020332Y</td></tr> <tr> <td>Exhaust gas analyzer</td><td>494929Y</td></tr> </tbody> </table>		Mityvac-like vacuum pump	020329Y	Digital tachometer	020332Y	Exhaust gas analyzer	494929Y
Mityvac-like vacuum pump	020329Y						
Digital tachometer	020332Y						
Exhaust gas analyzer	494929Y						
<p><b>Note:</b> Check that the result is obtained with the gas valve in the closest position.</p> <p>Also check that the carburetion adjustment is obtained with the flow screw open by 2 to 4 turns.</p> <p>If not, check the fuel level adjustment in the basin and check the fuel circuit.</p> <p>In case of unsteady CO, check the carburetor cleaning, the feeding system efficiency and the vacuum seals.</p> <p>In case of unburnt hydrocarbons (HC) &gt; of 1,000 p.p.m., check the ignition system, the timing, the valve clearance and the drainage valve seal.</p>							

## 7.14 SAS (Secondary Air System)

### 7.14.1 General

The Secondary Air System (SAS) on the 200cc L.E.A.D.E.R. engines is similar, in principle, to the SAS employed on PIAGGIO's 2-stroke engines.

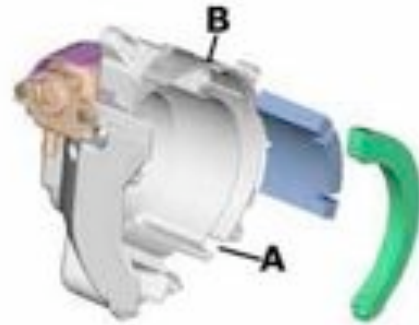
Here, however, the secondary air enters directly into the exhaust duct from the head.



The bleed valve found on the 2-stroke engine is here replaced by a membrane. The unit, indicated by an arrow in the figure, is provided with a cut-off connected to the vacuum inlet on the intake manifold to shut the air inlet during deceleration, to prevent explosions in the silencer.

### 7.14.2 Description

Air is sucked through hole «A» and flows through the first filter into hole «B».

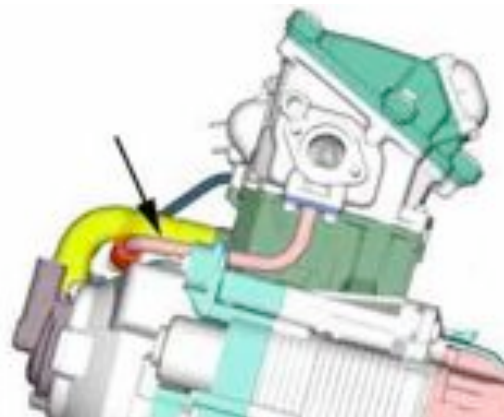


Passing through the hole indicated in the figure, air reaches the second filter «B».

At this point, the filtered air enters into the membrane device to be channeled towards the head.



Flowing through a stiff duct, flanged to the head, the secondary air reaches the exhaust duct thus providing oxygen addition to the unburnt gases just before they enter the catalytic converter. The efficiency of the catalyzing process is therefore increased.



### 7.14.3 Removing the SAS

**Warning** – This operation must be performed with the engine cold.

Remove the silencer.

Remove the R.H. fairing.

Loosen the clamps and remove the cooling fluid inlet and outlet sleeves from the pump cover and drain the cooling system.



Remove the top strip fixing the SAS valve connection sleeve to the drainage as shown in the figure.



Remove the 2 fixing screws, the gasket and the pipe connecting the SAS valve to the head. Then, remove the pipe.



Release the electric wiring fixing from the flywheel cover as shown in the figure



Disconnect the vacuum pipe from the SAS valve







Remove the pump support bracket and the fuel filter

Remove the flywheel cover with the SAS valve by releasing the 4 hexagon screws as shown in the figure





<p>Remove the two SAS valve fixing screws and remove the valve with the O-ring from the support</p>	
<p>Remove the plastic support with the gasket</p>	
<p>Check that the secondary air box valve plastic support is free from cracks and deformations</p> <p>Check the integrity of the gasket</p> <p><b>Warning</b> - An impaired seal between secondary air box valve and flywheel cover causes an increase of noise of the system.</p>	
<p>Carefully clean the internal and external filter. If they exhibit damages or abnormal deformations, proceed to the replacement.</p> <p>Check that the sleeve connecting the secondary air to the head exhibits no cracks or deformations. Replace them, if necessary. Check that the metal duct is free from cracks.</p> <p>For re-assembly, perform the operations for removal in the reverse order respecting the orientation of the rubber sleeve connecting the SAS valve to the exhaust system.</p>	



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## 8 Troubleshooting

This section provides troubleshooting guidance. All faults are provided with a list of possible causes and remedies.

### 8.1 Engine

#### 8.1.1 Poor Performance

Symptom	Possible Cause	Operation
Poor performance	Carburetor dirty. Fuel pump or one-way valve faulty	Remove, wash with solvent and dry with compressed air, or replace
	Timing failure or timing system parts worn	Reset timing phase or replace any worn parts
	Exhaust blocked	Replace
	Air filter clogged or dirty	Remove the sponge, wash it in water and shampoo, and then soak it in a 50% mixture of fuel and oil (recommended: Selenia Air Filter Oil). Squeeze the sponge without twisting, allow it to drip and then replace it
	Automatic choke failure	Check the mechanical sliding and the electrical connection and ensure that power is supplied. Replace if necessary
	Clutch slipping	Check and if necessary replace the clutch assembly and/or the clutch drum housing
	Automatic transmission faulty	Check correct pulley sliding and rollers. Replace any faulty components and lubricate the movable driven pulley guide with Montblanc Molybdenum Grease
	Worn driving belt	Replace
	Low compression: piston rings, cylinder, valves and valve seats worn	Replace any worn parts
	Engine oil level exceeding MAX mark	Find out the cause and adjust the oil level

---

### 8.1.2 Rear Wheel Spins at Idle

Symptom	Possible Cause	Operation
Rear wheel spins at idle	Idle speed too high	Adjust the engine idle speed and, if necessary, the CO concentration
	Faulty clutch	Check clutch springs/weights

### 8.1.3 Rich Mixture

Symptom	Possible Cause	Operation
Rich mixture	Calibrated air holes on carburetor clogged or obstructed	Remove, wash in solvent and dry with compressed air.
	Float valve faulty	Check the proper sliding of the float and the operation of the valve.
	Level in float bowl too high	Restore the level in the float chamber by bending the fuel inlet needle thrust blade on the float so that the float is parallel to the chamber surface when the carburetor is in an upside-down position.
	Automatic choke remains activated	Check the correct sliding of the mechanical component and the electrical connection and ensure that power is supplied. If necessary replace.
	Air filter clogged or dirty	Remove the sponge, wash it in water and shampoo, and then soak it in a 50% mixture of fuel and oil (recommended: Selenia Air Filter Oil). Squeeze the sponge without twisting, allow it to drip and then replace it.

---

#### 8.1.4 Weak Mixture

Symptom	Possible Cause	Operation
Weak mixture	Carburetor jets clogged	Remove, wash in solvent and dry with compressed air.
	Float valve faulty	Check the proper sliding of the float and the operation of the valve.
	Level in float bowl too low	Restore the level in the float bowl bending the fuel inlet needle thrust blade on the float so that the float is parallel to the chamber surface when the carburetor is in an up-side down position.
	Tank breather clogged	Restore proper tank aeration.
	Feed pipes choked or throttle	Restore proper fuel flow.
	Intake manifold cracked or clamps poorly tightened	Replace the intake connection and check for any abnormal air leakage.

#### 8.1.5 Low Compression

Symptom	Possible Cause	Operation
Low compression	Incorrect valve adjustment	Adjust valve clearance
	Valves overheated	Remove the cylinder head and the valves, then grind or replace the valves
	Valve seat deformed/worn	Replace the head assembly
	Cylinder worn; piston rings worn or broken	Replace cylinder-piston assembly or piston rings

---

### 8.1.6 Starting Problems

Symptom	Possible Cause	Operation
Starting problems	Flat battery	Check the battery charge level. If the battery shows any sign of sulphation, replace it with a new one
	Carburetor dirty or fuel pump faulty	Remove, wash with solvent and dry with compressed air, or replace
	Spark plug faulty or spark advance incorrect	Replace the spark plug or check the ignition circuit components
	Air filter clogged or dirty	Remove the sponge, wash it in water and shampoo, and then soak it in a 50% mixture of fuel and oil (recommended: Selenia Air Filter Oil). Squeeze the sponge without twisting, allow it to drip and then replace it
	Automatic choke failure	Check the mechanical sliding and the electrical connection and ensure that power is supplied. Replace if necessary
	Engine flooded	Open the throttle wide and try to start the engine. If the engine does not start, remove the spark plug, dry it and, before replacing it, crank the engine to expel the excess of fuel, keeping the cap connected to the spark plug and the latter to earth. If the fuel has run out, refuel and then start the engine
	Incorrect valve seal or wrong valve adjustment	Inspect the head and/or set the correct clearance
	Starting speed too low or starting system and motor faulty	Check starter motor, starting system and torque limiter
	Altered fuel characteristics	Drain worn fuel and refuel

---

### 8.1.7 Excessive Oil Consumption/Excessive Smoke from Exhaust

Symptom	Possible Cause	Operation
Excessive oil consumption/excessive smoke from exhaust	Piston rings worn or broken or improperly fitted	Replace cylinder-piston assembly or piston rings
	Oil leaks from joints or gaskets	Check and replace the gaskets or restore the joint seal
	Oil retainer worn	Replace valve oil retainer
	Valve guides worn	Check and, if necessary, replace the head assembly

### 8.1.8 Insufficient Lubrication Pressure

Symptom	Possible Cause	Operation
Insufficient lubrication pressure	Oil level too low	Restore to the required level by topping up with fresh oil (recommended oil: Selenia HI Scooter 4 Tech)
	Oil filter excessively dirty	Replace the cartridge filter
	Oil pump play excessive	Perform dimensional checks on the oil pump components
	By-pass remains open.	Check the by-pass and replace if required. Carefully clean the by-pass area

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### 8.1.9 Engine Tends to Cut Out at Full Throttle

Symptom	Possible Cause	Operation
Engine tends to cut out at full throttle	Main jet dirty; lean carburetion	Wash the jet in solvent and dry with compressed air
	Water in carburetor	Empty the float chamber by using the drain screw
	Float level incorrect	Restore the level in the float chamber by bending the fuel inlet needle thrust blade on the float so that the float is parallel to the chamber surface when the carburetor is in an up-side down position
	Fuel supply circuit faulty	Check and, if necessary, replace the fuel pump. Check the vacuum intake and the duct seal

### 8.1.10 Engine Tends to Stop at Idle

Symptom	Possible Cause	Operation
Engine tends to stop at idle	Idling jet dirty	Wash in solvent and dry with compressed air
	Choke device remains activated	Check: electrical connections, circuit continuity, mechanical sliding and power supply; replace if required
	Spark plug faulty or spark advance incorrect	Replace the spark plug or check the ignition circuit components
	Compression end pressure too low	Check thermal unit seals and replace worn components
	Idle adjustment incorrect	Adjust using a rev counter
	Cut-off device faulty	Check the operation of the valve, membrane and spring; check if the air adjusters and the sponge filter are clean
	Incorrect timing	Restore correct timing and check timing system components

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### 8.1.11 Excessive Fuel Consumption

Symptom	Possible Cause	Operation
Excessive fuel consumption	Air filter clogged or dirty	Remove the sponge, wash it in water and shampoo, and then soak it in a 50% mixture of fuel and oil (recommended: Selenia Air Filter Oil). Squeeze the sponge without twisting, allow it to drip and then replace it.
	Automatic choke device faulty	Check electrical connections, circuit continuity, mechanical sliding, and power supply
	Fuel pump faulty	Check vacuum duct seal
	Jets loose	Check that the main and idling jets are securely seated
	Float level	Restore the level in the float chamber by bending the fuel inlet needle thrust blade on the float so that the float is parallel to the chamber surface when the carburetor is in an up-side down position

## 8.2 Transmission and Brakes

### 8.2.1 Irregular Clutch Operation or Grapping

Symptom	Possible Cause	Operation
Clutch irregular operation or grapping	Faulty clutch	<p>Check that the clutch weights are free from grease</p> <p>Check that the contact surface of the clutch weights with the drum housing is mainly at the centre and equivalent for the three weights</p> <p>Check that the drum housing exhibits no abnormal wear or scratches</p>

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### 8.2.2 Poor Braking Performance

Symptom	Possible Cause	Operation
Poor braking performance	Pads or disk excessively worn; brake fluid quantity insufficient or hydraulic system faulty	Check the pads wear; <b>MIN allowable dimension:</b> Brake pads wear 0.06 in (1.5 mm)  Ensure that the brake disks are not worn, scratched or deformed  Check the brake fluid level in the pumps and, if necessary, replace the brake fluid  Check that there is no air in the circuit and bleed as necessary  Check that the front brake caliper moves correctly along the front disk axis
	Brake disk loose or distorted	Check the tightening of the brake disk screws. Using a comparator and with the wheel mounted onto the vehicle, measure the disk's axial deviation
	Brake fluid leakage from the hydraulic system	Replace faulty flexible connections, piston, or brake pump gaskets as necessary

### 8.2.3 Brakes Overheating

Symptom	Possible Cause	Operation
Brakes overheating	Defective piston sliding	Check caliper and replace any damaged parts
	Brake disk loose or distorted	Check the tightening of the brake disk screws. Using a comparator and with the wheel mounted onto the vehicle, measure the disk's axial deviation
	Pump compensation holes clogged	Clean thoroughly and blow with compressed air
	Rubber gaskets swollen or sealed	Replace gaskets



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## 8.3 Electrical System

### 8.3.1 Battery

Symptom	Possible Cause	Operation
Battery	The battery requires regular maintenance.  If the vehicle is not used for long periods (1 month or more), the battery must be charged from time to time. Over a period of disuse of 3 months, the battery will discharge completely. When installing the battery, make sure the black ground lead is connected to the negative terminal and the red lead to the positive terminal	

### 8.3.2 Turn Signal Lights Not Working

Symptom	Possible Cause	Operation
Turn signal lights not working	Electronic control unit faulty	With the ignition switch set to «ON», jumper contacts 1 (Blue-Black) and 5 (Red-Blue) on the electronic control unit connector. If turn indicators do not light up and stay lit when the related switch is operated, replace the regulator, otherwise check the wiring and the switch

## 8.4 Steering Controls and Suspension

### 8.4.1 Excessive Steering Stiffness

Symptom	Possible Cause	Operation
Excessive steering stiffness	Irregular tightening	Check the tightening of the upper and lower ring nuts. If steering rotation is still uneven, check the bearing ball rolling seats. Replace if the seats appear to be recessed or if the balls are flattened

### 8.4.2 Excessive Steering Play

Symptom	Possible Cause	Operation
Excessive steering play	Irregular tightening.	As above

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### 8.4.3 Noisy Suspension

Symptom	Possible Cause	Operation
Noisy suspension	Anomalies in the suspension system	<p>If the front suspension is noisy, check the operation of the front shock absorber, the condition of the ball bearings and of the related locknuts, the rubber stops and the sliding bushes</p> <p>Also check the tightening torques of the wheel hub, the brake caliper, the disk and the shock absorber on the hub and steering column connections</p>

### 8.4.4 Suspension Oil Leaking

Symptom	Possible Cause	Operation
Suspension oil leaking	Faulty seal	<p>Replace the shock absorber</p> <p>Check the wear of the steering caps and adjusters</p>

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## 9 Electrical System

<b>1</b>	Front left-hand side turn signal light (with 2 bulbs)
<b>2</b>	Rear brake light switch
<b>3</b>	Headlight switch
<b>4</b>	Turn signal lights switch
<b>5</b>	Horn button
<b>6</b>	Radio-intercom fitting
<b>7</b>	Saddle opener button
<b>8</b>	Thermostat
<b>9</b>	Electric fan
<b>10</b>	Saddle opening actuator
<b>11</b>	Voltage regulator
<b>12</b>	Rear left-hand side turn signal light (with bulb)
<b>13</b>	Number plate light (with bulb)
<b>14</b>	Complete tail light (with low beam bulb and 6 brake light bulbs)
<b>15</b>	Rear right-hand side turn signal light (with bulb)
<b>16</b>	Fuel level transmitter
<b>17</b>	Engine earth
<b>18</b>	Starter motor
<b>19</b>	Oil pressure sensor
<b>20</b>	Magneto flywheel
<b>21</b>	Automatic choke device
<b>22</b>	Thermostat
<b>23</b>	H.T. coil
<b>24</b>	Starting relay
<b>25</b>	Fuse holder with 2 fuses

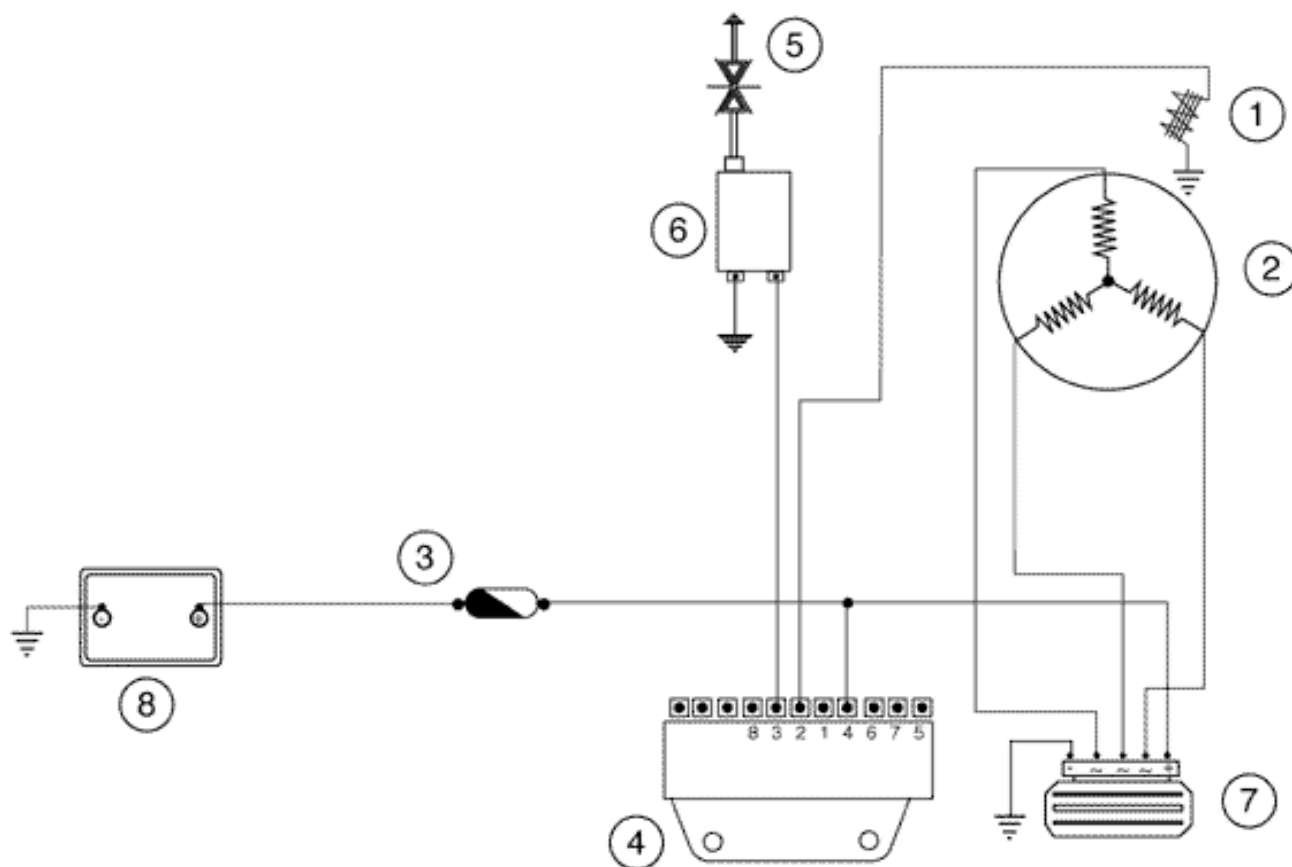
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<b>26</b>	Battery 12V 12Ah
<b>27</b>	Anti-theft alarm fitting
<b>28</b>	Immobilizer antenna
<b>29</b>	Key switch
<b>30</b>	Start-up button
<b>31</b>	Horn
<b>32</b>	Front right-hand side turn signal light (with 2 bulbs)
<b>33</b>	Analogue instrument panel with 9 bulbs, warning lights, fuel reserve warning light, oil pressure warning light, upper beam indicator, RH turn signal light indicator, LH turn signal light indicator, LED for immobilizer, 3 bulbs for instrument illumination
<b>34</b>	Relay switch
<b>35</b>	Complete right or left-hand asymmetric headlight with bulb for headlight and 1 bulb for position
<b>36</b>	Fuse holder box
<b>37</b>	Anti-theft alarm fitting
<b>38</b>	Electronic ignition device (CDI)
<b>39</b>	Engine stop deviator
<b>40</b>	L.H. lever brake light switch

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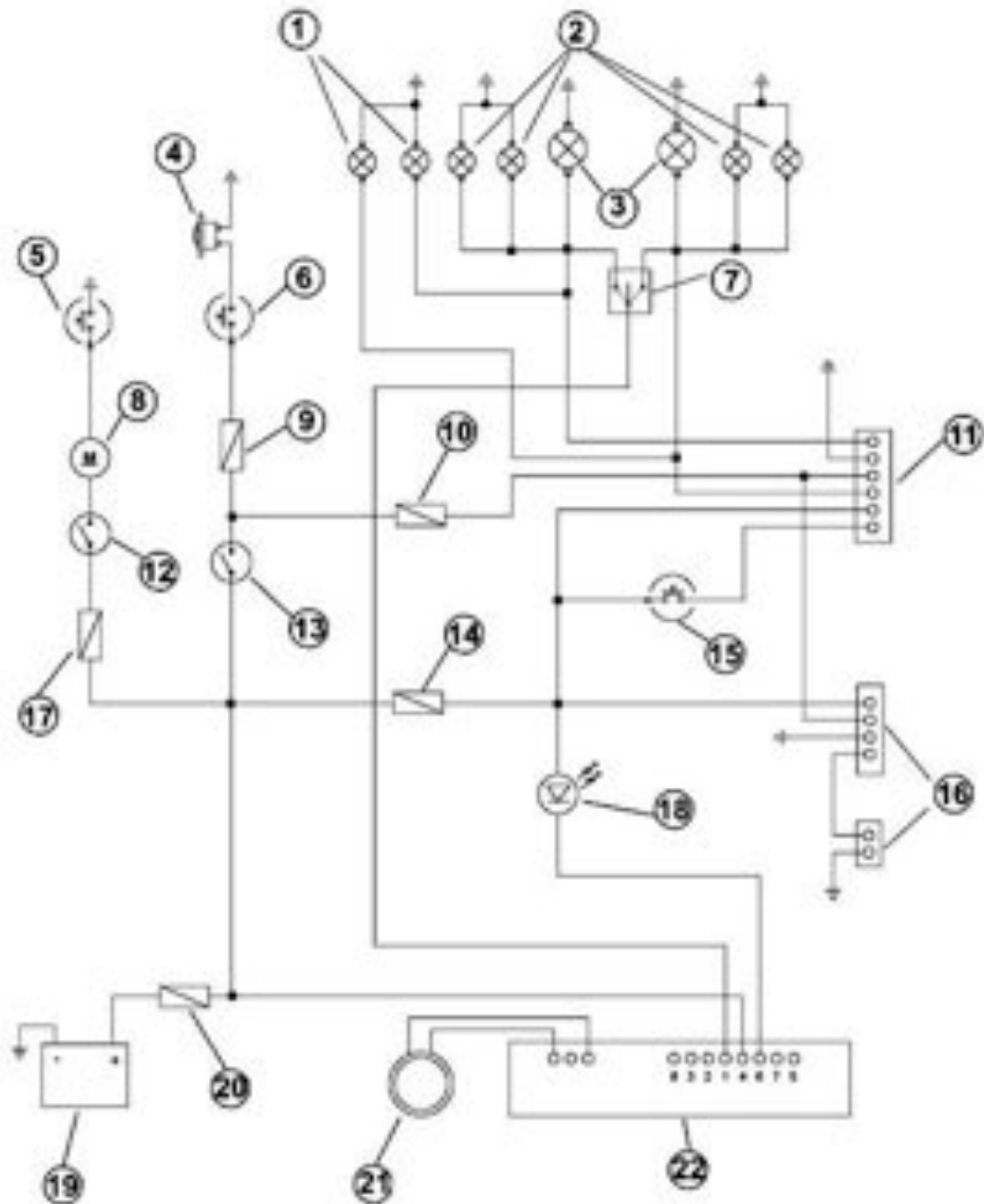
## 9.1 Electrical Diagrams

### 9.1.1 Ignition Section



<b>1</b>	Pick-up	<b>5</b>	Spark plug
<b>2</b>	Flywheel magneto	<b>6</b>	H.T. coil
<b>3</b>	15A Fuse (No. 7)	<b>7</b>	Voltage regulator
<b>4</b>	Electronic ignition device (CDI)	<b>8</b>	12V-12Ah Battery

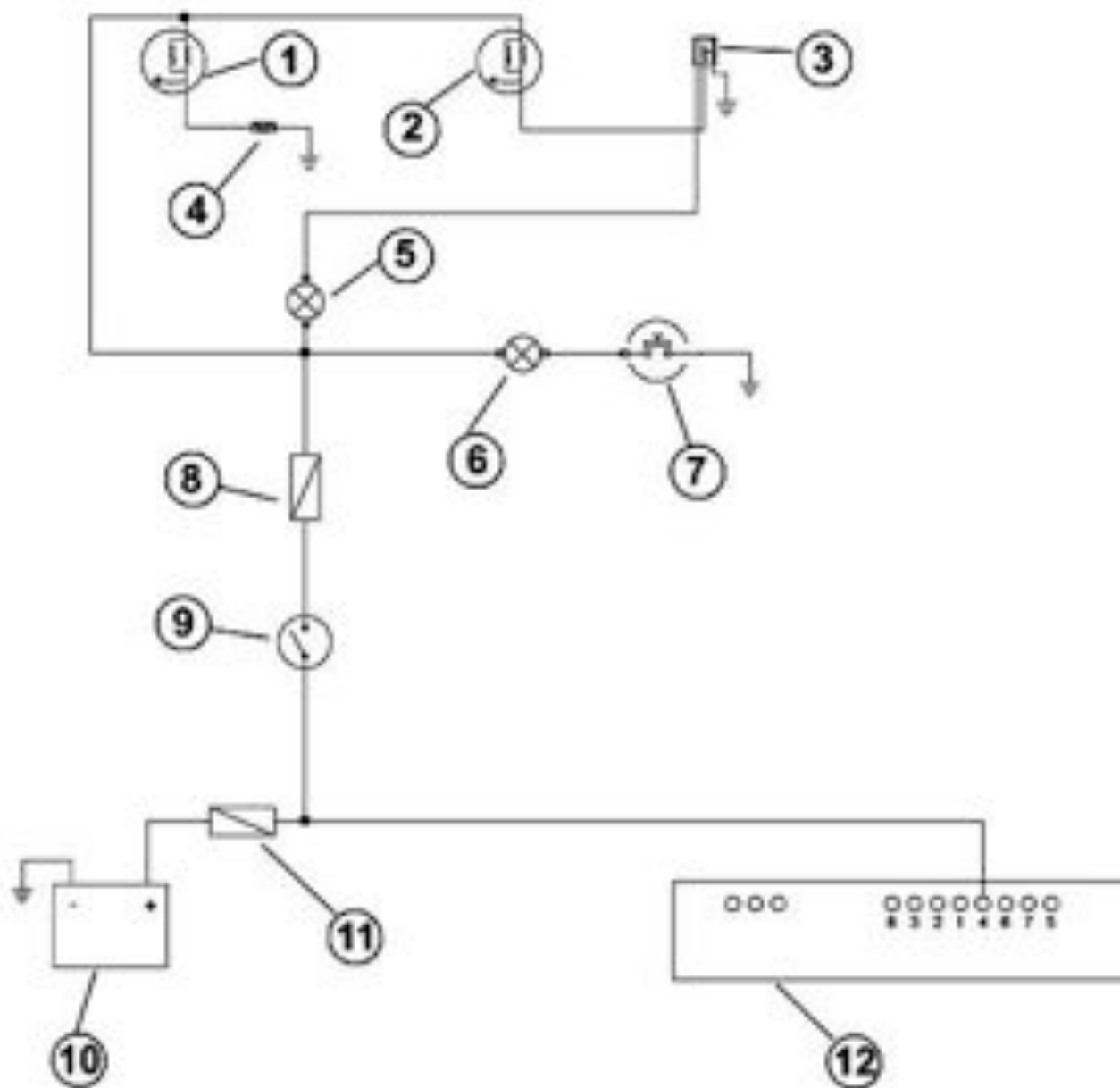
### 9.1.2 Turn Signal Lights, Horn, Services and Accessory Pre-Wiring



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<b>1</b>	Direction indicators 12V-2W	<b>12</b>	Ignition switch contact
<b>2</b>	No. 4 Front turn signal light bulbs 12V-5W	<b>13</b>	Ignition switch contact
<b>3</b>	No. 2 Rear turn signal light bulbs 12V-10W	<b>14</b>	7.5A Fuse
<b>4</b>	Horn 12V	<b>15</b>	Anti-theft alarm pre-wiring
<b>5</b>	Saddle opening button	<b>16</b>	Radio-intercom pre-wiring
<b>6</b>	Horn button	<b>17</b>	10A Fuse
<b>7</b>	Turn signal lights switch	<b>18</b>	Immobilizer LED
<b>8</b>	Saddle opening actuator	<b>19</b>	Battery (12V-12Ah)
<b>9</b>	7.5A Fuse	<b>20</b>	15A Fuse
<b>10</b>	7.5A Fuse	<b>21</b>	Immobilizer antenna
<b>11</b>	Anti-theft alarm pre-wiring	<b>22</b>	Electronic ignition device (CDI)

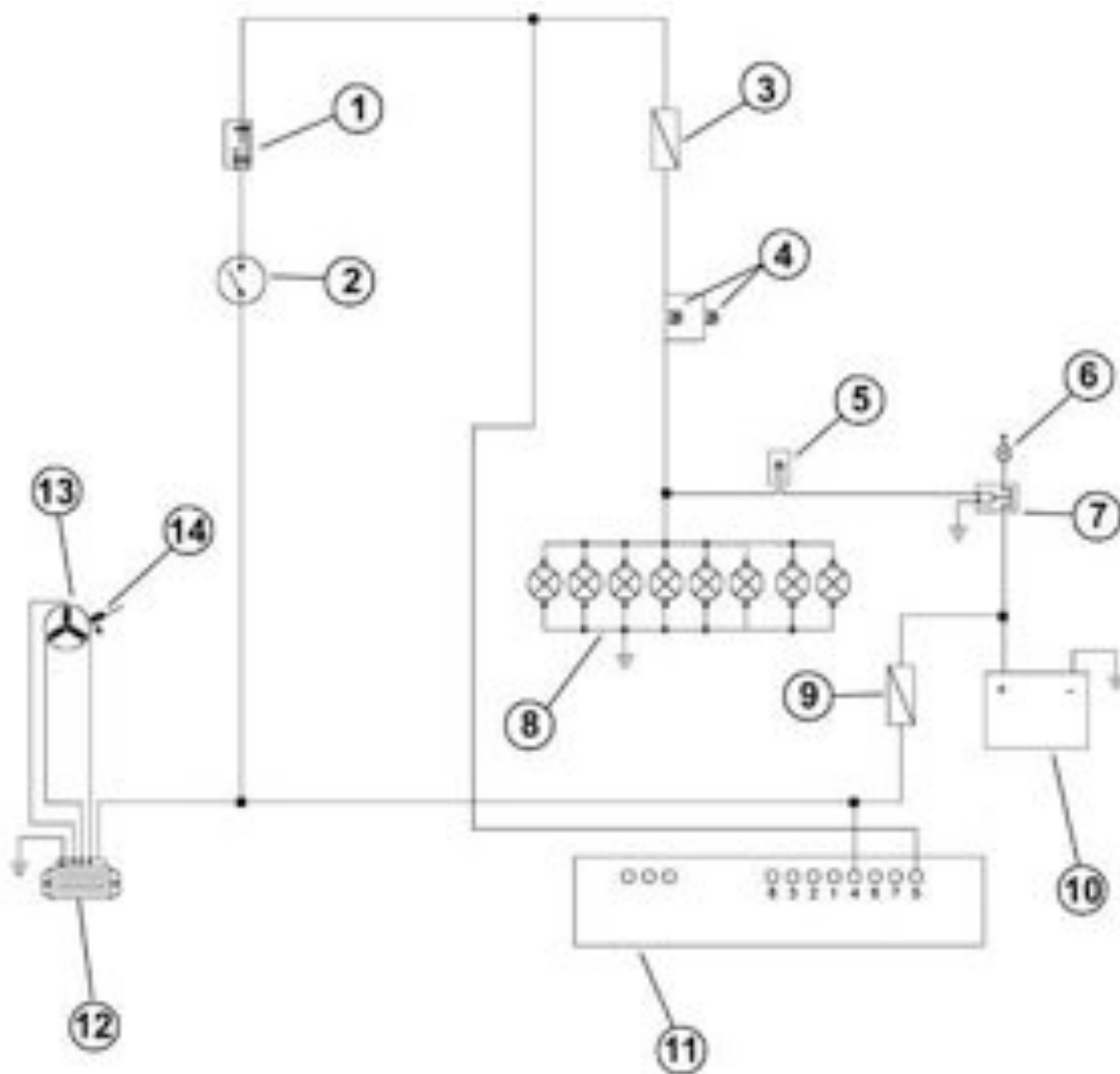
### 9.1.3 Level Indicators and Safety Switches



<b>1</b>	Cooling fluid temperature indicator	<b>7</b>	Oil pressure sensor
<b>2</b>	Fuel level indicator	<b>8</b>	Fuse 7.5A
<b>3</b>	Fuel level transmitter	<b>9</b>	Key switch contacts
<b>4</b>	Thermostat	<b>10</b>	Battery 12V-12Ah
<b>5</b>	Fuel indicator 12V-1.2W	<b>11</b>	Fuse 15A
<b>6</b>	Oil pressure indicator 12V-1.2W	<b>12</b>	Electronic ignition device

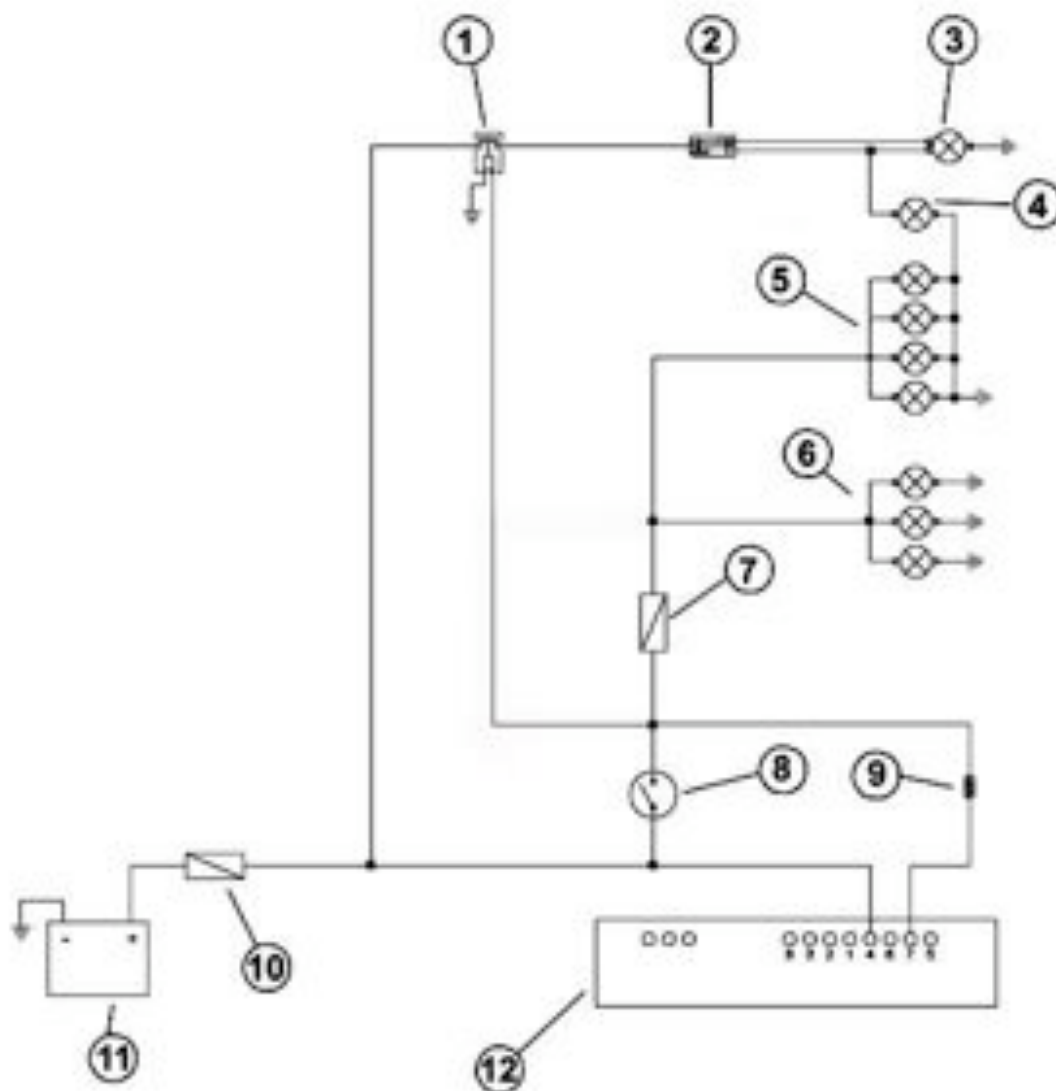


### 9.1.4 Battery Recharge and Starting Section



<b>1</b>	Engine stop deviator	<b>8</b>	No. 8 bulbs for stop light 12V–2.3W
<b>2</b>	Key switch contacts	<b>9</b>	Fuse 15A
<b>3</b>	Fuse 5A	<b>10</b>	Battery 12V / 12Ah
<b>4</b>	Stop buttons	<b>11</b>	Electronic ignition device
<b>5</b>	Start-up button	<b>12</b>	Voltage regulator
<b>6</b>	Starter motor	<b>13</b>	Magneto flywheel
<b>7</b>	Starting relay	<b>14</b>	Pick-up

### 9.1.5 Headlight and Automatic Choke Section



<b>1</b>	Starting relay	<b>7</b>	Fuse 8A
<b>2</b>	Light switch	<b>8</b>	Key switch contacts
<b>3</b>	Dipped beam/upper bulb 12V-55/60W	<b>9</b>	Automatic starter
<b>4</b>	Upper beam indicator 12V-1.2W	<b>10</b>	Fuse 15A
<b>5</b>	No. 3 bulbs for instrument lighting + side/taillights indicator 12V-2W	<b>11</b>	Battery 12V-12Ah
<b>6</b>	No. 3 number plate position bulbs 12V-5W	<b>12</b>	Electronic ignition device

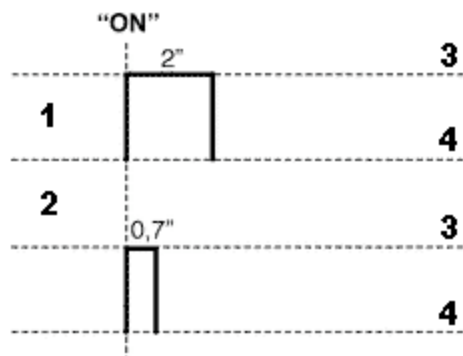
## 9.2 Electrical Equipment

### 9.2.1 Electronic Ignition (Immobilizer System)

The electronic ignition system is DC-fed and is equipped with an immobilizer antitheft system built into the electronic control unit.

The ignition system consists of:

- Electronic control unit (CDI)
- Immobilizer antenna
- Master and service key with built-in transponder
- H.T. coil
- Diagnostic LED



1 = Un-programmed control unit

2 = Programmed control unit

3 = LED on

4 = LED off

**Note:** The diagnostic LED also works as a deterring blinker. This function is activated every time the ignition switch is turned to the «OFF» position, or the emergency cut-off switch is set to «OFF». It remains activated for 48 hours in order not to affect the battery charge.

When the ignition switch is turned to the «ON» position the deterring blinker function is deactivated. Subsequently, a flash confirms the switching to the «ON» status.

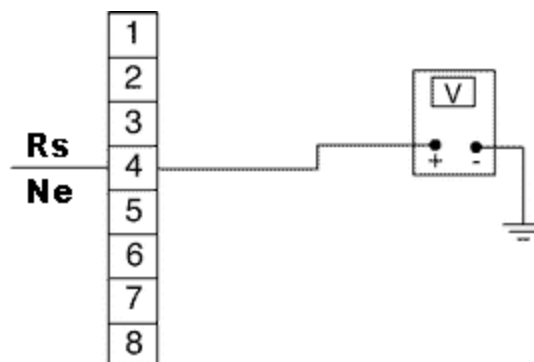
This duration of the flash depends on the programming of the electronic control unit prog (see figure above).

If the LED is off and stays off even when the ignition switch is turned to «ON», check if:

- Battery voltage is present, i.e. the battery is not flat
- The fuses are in working order; main fuse 15A (no. 7)

If both battery and fuses are working properly and the deterring LED still remains off, disconnect the electronic control unit connector and follow these steps to check that power is supplied to the electronic control unit:

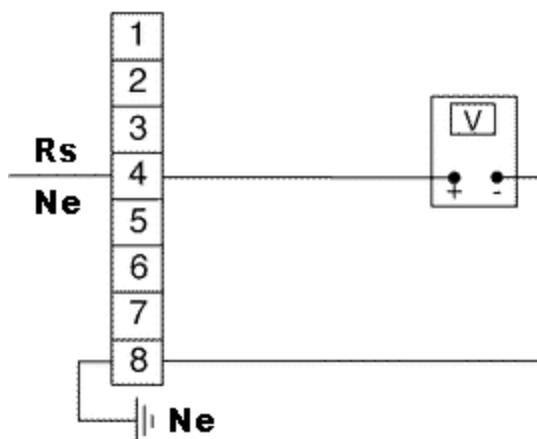
- Ensure that the potential difference between terminal no. 4 (red/black) and ground (see figure) is equal to the battery voltage



Rs = Red

Ne = Black

- Check that battery voltage is present between terminals no. 4 (red/black) and no. 8 (black), as shown in the figure



Rs = Red

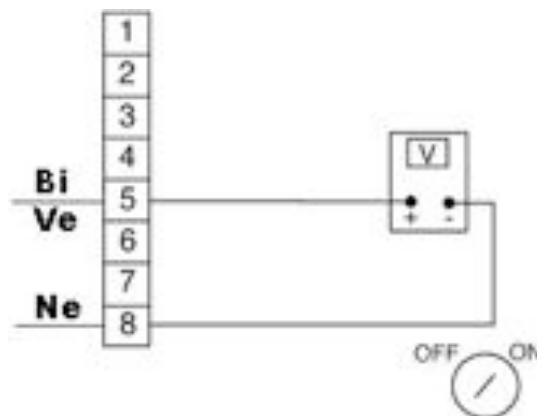
Ne = Black

- Check that battery voltage is present between terminals no. 5 (green/white) and no. 8 (black) with the ignition switch turned to the «ON» position and the emergency cut-off switch set to «RUN» (see figure).

If no faults are found, replace the control unit; otherwise, check the wiring and the following components:

If no malfunction is found, replace the control unit and, otherwise check the wiring and the following components:

- Engine stop relay switch
- Emergency cut-off switch
- Ignition switch contacts



Bi = White

Ve = Green

Ne = Black

### 9.2.2 Un-Coded Electronic Ignition System

When the ignition system is not coded, the engine can be run at a maximum speed of 2,000 rpm. Any attempt to rev up causes the engine to misfire.

To code the system, set the emergency cut-off switch to the «RUN» position and use the MASTER (brown) and SERVICE (black) keys as follows:

- Insert the MASTER key; turn the ignition switch to the «ON» position for approximately 2 seconds (strictly between 1 and 3 seconds) and then turn it back to the «OFF» position
- Insert all the SERVICE keys available in succession, each time turning the ignition switch to «ON» for 2 seconds
- Insert the MASTER key again and turn it to «ON» for 2 seconds

**Note:** The time needed to change keys must not exceed 10 seconds.

**Note:** A maximum of three SERVICE keys can be programmed within the same coding session.

It is essential to observe the sequence and time limits as described above. If at any time during the programming session these are not observed, the procedure will have to be restarted from the beginning.

Once the control unit has been coded, an unbreakable relation is created between the control unit and the MASTER key transponder.

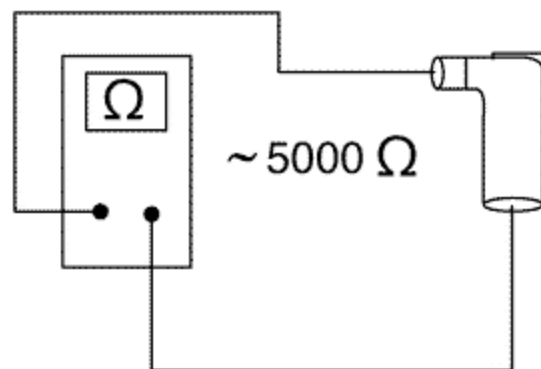
This relation allows new SERVICE keys to be coded in case of loss, replacement, etc. Each new storing operation cancels the previous one.

Should the SERVICE keys lose the data stored in them it is essential to carefully check the shielding of the high-voltage system:

**Standard resistance:**

Shielded cap ~5 kO

The use of resistive spark plugs is recommended (see figure).



### 9.2.3 Diagnostic Codes

After the flash that denotes the switching to the «ON» status, the system may output a number of malfunction codes.

The LED stays initially off for 2 seconds, and then the diagnostic codes are displayed in the form of 0.5-second flashes.

Once the malfunction code has been displayed, the LED turns on to indicate that ignition is impossible (see graph below).

#### 2-Flash code

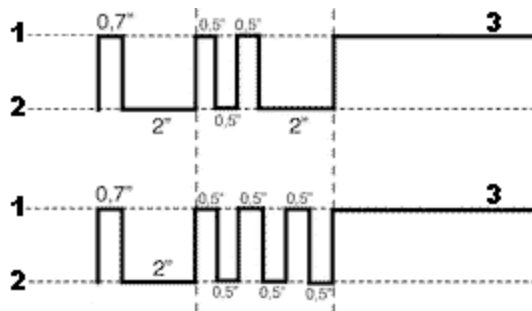
Example – electronic control unit programmed, transponder absent and/or antenna malfunctioning.

**Ignition disabled** – Vehicle immobilized

#### 3-Flash code

Example – electronic control unit programmed, aerial in working conditions and transponder code unknown.

**Ignition disabled** – Vehicle immobilized



1 = LED on  
2 = LED off  
3 = LED remains lit

### 9.2.4 2-Flash Diagnostic Code

If the 2-flash diagnostic code is displayed, check if the malfunction persists when the key (including the MASTER key) is changed. If the anomaly persists with any key, detach the control unit aerial connector and check the continuity of the antenna by using the recommended multimeter 020331Y.

#### Standard resistance:

Immobilizer antenna ~ 7-9 Ω

If the value is not as specified, replace the antenna.

If no anomaly is found, replace the control unit.

**Warning** – Before performing the storing procedure on the new control unit, check that no malfunction code is signaled. This precaution is needed to avoid wasting a new control unit.

### 9.2.5 3-Flash Diagnostic Code

If the 3-flash diagnostic code is displayed, check if the anomaly persists even after inserting the MASTER key into the ignition switch.

If the malfunction disappears when the MASTER key is used, proceed to a new coding of the SERVICE (black) keys.

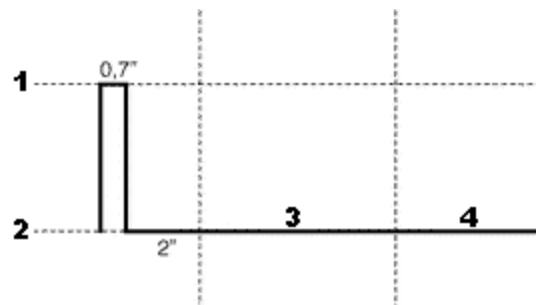
If the anomaly persists, then the MASTER key and the control unit are not matched. In that case, replace the control unit and proceed to code the keys.

The immobilizer system is in working order when, after turning the ignition switch to «ON», a single 0.7-second flash is emitted (see graph below).

In that case, ignition is possible.

Example – electronic control unit programmed, transponder present key programmed and aerial in working order.

**Ignition enabled**  
(standard operating conditions)



### 9.2.6 Ignition System

Once the immobilizer system has been enabled, it is possible to obtain a spark at the plug through the H.T. coil and the signals coming from the pick-up.

The basic power supply is represented by the battery. The system is calibrated in such a way that any voltage drops in the battery are detected by the starting system and is therefore virtually harmless to the ignition system.

The pick-up is connected to the control unit by a single wire. As a result, the pick-up ground is connected to the control unit through the frame and the earth wire from the engine.

To avoid hampering the ignition system during the starting process, it is important that the engine/frame ground connection is as efficient as possible.

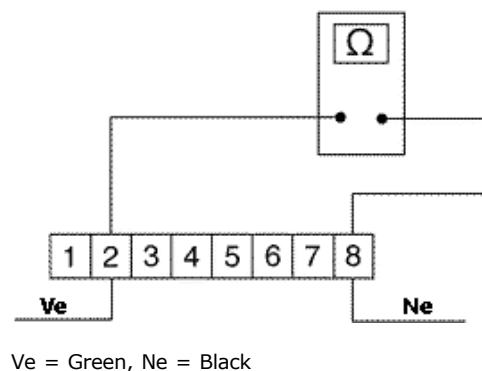
## 9.2.7 Spark Plug Power Supply Failure

If no power is supplied to the spark plug and the LED signals that ignition is possible, follow these steps:

- **Run a pick-up check:** detach the control unit connector and check continuity between terminals no. 2 (green) and no. 8 (black). This check involves the pick up and its supply:

### Standard resistance:

Pick-Up 105-124  $\Omega$



If the circuit is interrupted, repeat the check between the flywheel connector and the engine ground (see engine manual). If the measured values are not as specified, replace the pick-up, otherwise repair the wiring.

If, on the other hand, the values are as specified, try replacing the control unit (without programming it) and ensure that the problem has been solved by checking that a spark is produced at the plug, then proceed to program the control unit.

### H.T. coil primary circuit check

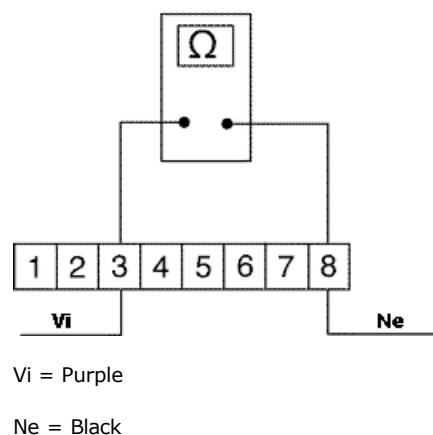
Detach the control unit connector and check continuity between terminals no. 3 and no. 8 (see figure).

### Standard resistance:

H.T. coil secondary circuit 0.4-0.50

If the resistance is not as specified, repeat the check directly on the positive and negative terminals of the H.T. coil primary circuit.

If the measured resistance is as specified, proceed by repairing the wiring or restoring the connections, otherwise replace the H.T. coil.



### H.T. coil secondary circuit check

Disconnect the spark plug cap from the H.T. cable and measure the resistance between the end of the H.T. cable and the negative terminal of the H.T. coil (see figure).

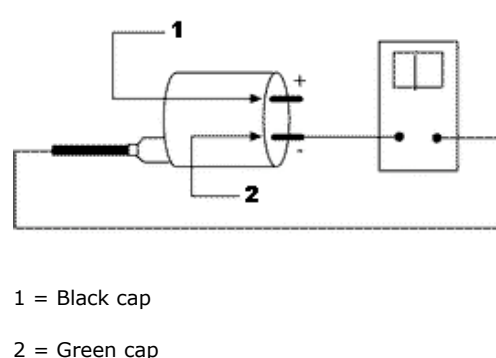
### Standard resistance:

H.T. coil secondary circuit  $\sim 3,000 \pm 300 \Omega$

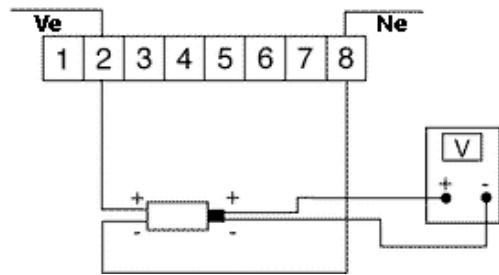
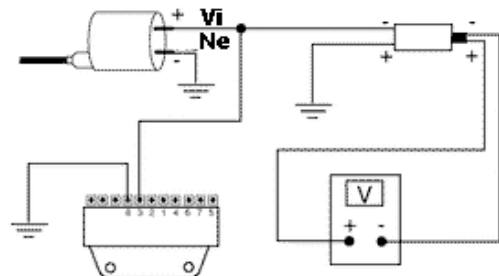
If the measured values are not as specified, replace the H.T. coil. To obtain a more accurate diagnosis proceed to verify the peak voltage using the multimeter adaptor.

### Specific equipment and tools:

Multimeter adaptor 020409Y





<p><b>Pick-Up</b></p> <p>Detach the control unit connector and connect the positive terminal to connector no. 2 and the negative terminal to connector no. 8 (see figure).</p> <p>Crank the engine by operating the starter motor and measure the voltage produced by the pick-up.</p> <p><b>Standard voltage:</b> Pick-up <span style="float: right;">&gt;2V</span></p> <p>If the voltage is not as specified, replace the pick-up.</p> <p><b>Note:</b> The output is in DC; hence the multimeter must be set on DC in order to carry out the measurements.</p>	 <p>Ve = Green Ne = Black</p>
<p><b>H.T. coil</b></p> <p>With control unit and H.T. coil normally connected, measure the voltage of the coil primary circuit during the starting test using the peak voltage adaptor and connecting the positive terminal to earth and the negative terminal to the coil positive connector</p> <p>Standard voltage: H.T. coil <span style="float: right;">&gt;100V</span></p> <p>If the voltage is not as specified, replace the control unit.</p> <p><b>Note:</b> The positive terminal of the H.T. coil primary circuit is black, while the negative terminal is green.</p>	 <p>Vi = Purple Ne = Black</p>

### 9.2.8 Battery Charging System

The battery recharge system consists of a three-phase generator and a permanent-magnet flywheel. The generator is directly connected to the voltage regulator. The latter is in turn directly connected to earth and to the battery positive terminal via the 15A protection fuse. The system is therefore not connected to the ignition switch. The system allows considerable recharging power, and at low rpm offers a good compromise between supplied power and idle speed stability. For this reason, it is essential that the slow running speed is adjusted as specified.

## 9.2.9 Checking the Voltage Regulator

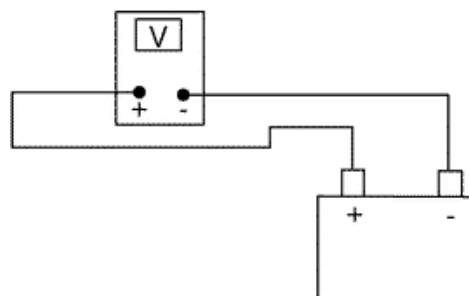
With a fully charged battery and all lights off, measure the voltage at the battery terminals (see figure) with the engine running at high speed.

**Standard voltage:**

Voltage regulator <15.2V

If a higher voltage is detected, replace the regulator.

If the voltage is less than 14 V, check the stator and its wiring.

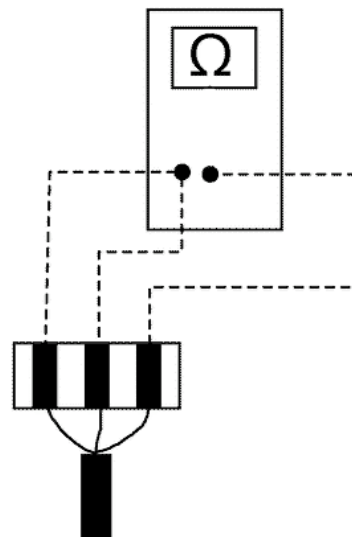


## 9.2.10 Stator check

Disconnect the voltage regulator connector and check for continuity between each one of the three yellow wires and the other two.

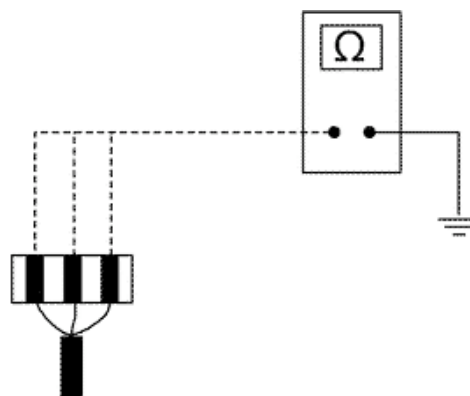
**Standard resistance:**

Stator 0.7-0.90



Also check that each yellow wire is insulated from earth.

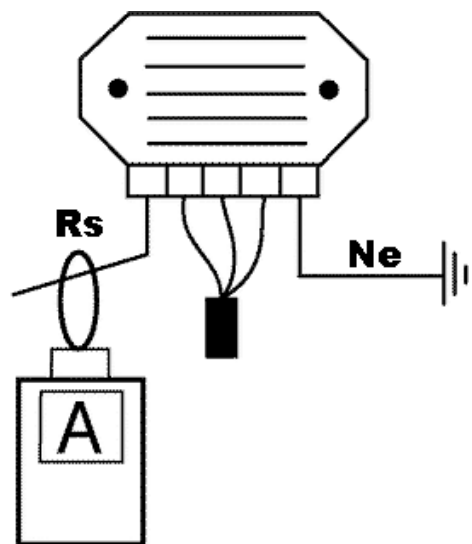
If any of the measured values are not as specified, repeat the check directly on the stator. If incorrect values are still found, replace the stator, otherwise repair the wiring.



### 9.2.11 Checking the Regulator

Connect the induction nippers of an ammeter to the positive cable of the voltage regulator. Measure the battery voltage and, after turning the lights on without starting the engine, wait until voltage reading settles at about 12V. Start the engine and measure the current supplied by the system with the lights on and the engine running at high speed.

If the supplied current is less than 10A, repeat the test using a new regulator and/or stator.



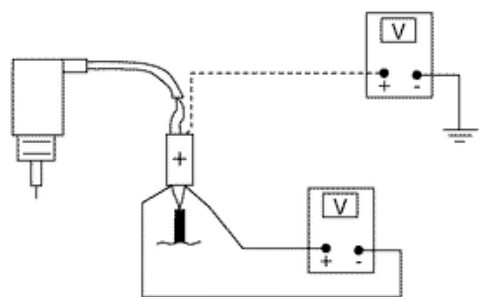
Rs = Red, Ne = Black

### 9.2.12 Checking the Automatic Choke Section

For information on how to carry out the functional and resistive check of the component, refer the engine section of this manual. Regarding the automatic choke device power supply, keep the system connector attached and check that battery voltage is present between the two terminals, **while the engine is running** (see figure).

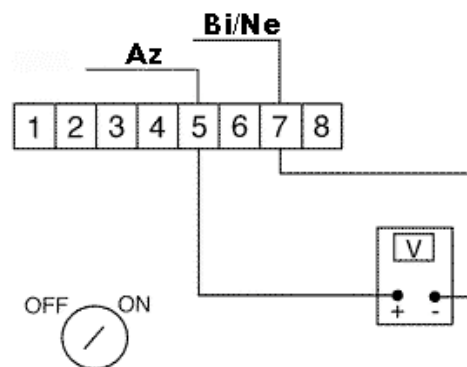
If there is no voltage, connect the multimeter negative terminal to ground and the positive terminal to the orange wire on the automatic choke device. With the ignition switch turned onto the «ON» position, check for the presence of battery voltage. If no voltage is detected, check the wiring connected with the ignition switch and the two fuses 15A (no. 8).

If voltage is present, repeat the check from the ignition control unit connector.



After disconnecting the choke device, start the engine and keep it idling. Check for the presence of voltage by connecting the multimeter positive terminal to the terminal no. 5 (light blue) and its negative terminal to terminal no. 7 (white/black) (see figure).

If no voltage is detected, replace the control unit after verifying the integrity of the fuses, otherwise check the wiring between the choke and the electronic control unit, and if necessary proceed by replacing the choke device.



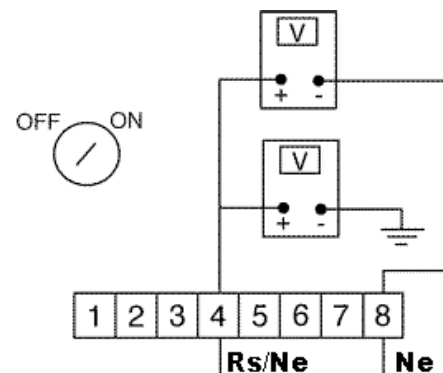
Bi/Ne = White/Black

Az = Light blue

### 9.2.13 Turn Signal Lights Fail to Operate

If the turn signal lights fail to operate, proceed as follows:

- Detach the control unit connector and check for potential difference at terminal no. 4 (red/black) with respect to ground (p.d. must be equal to battery voltage).
- Check that the same p.d. (battery voltage) is present between terminals no. 4 and no. 8 (black).
- Repeat the same check between terminals no. 5 (light blue) and no. 8 (black) with the ignition switch turned to the «ON» position, and the emergency cut-off switch in the «RUN» position.

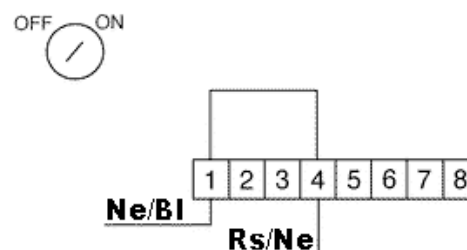


Rs/Ne = Red/Black

Ne = Black

If no voltage is detected, check the wiring, the connections and the integrity of the main 15A fuse; otherwise proceed as follows:

- Jumper terminals no. 1 (black/blue) and no. 4 (red/black) as shown in the figure. Acting on the turn signal switch, ensure that the turn signal lights come on
- If so, the control the control unit is defective and must be replaced. Otherwise check the wiring between the control unit and the turn signal switch, and then repeat the test
- If the wiring is intact and the turn signal lights still fail to operate correctly, replace the turn signal switch.



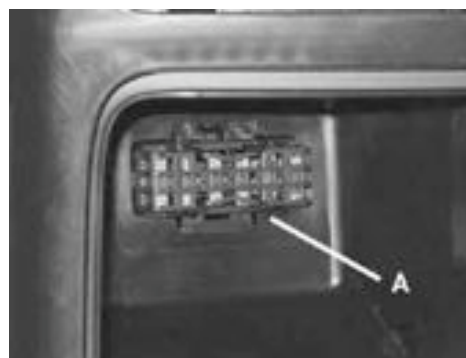
Ne/BI = Black/Blue

Rs/Ne = Red/Black

## 9.2.14 Fuses

The electrical equipment is protected by:

1. Six fuses (marked as «A» in the picture on the right) located inside the glove-box, on the left hand-side
2. One 15A fuse («B» in the picture below) placed underneath the helmet compartment bucket



**Warning** - Before replacing a blown fuse, always trace and eliminate the fault that caused the blowing. Never try to replace a fuse using different material (e.g. a piece of electric wire) or a fuse having greater amperage than prescribed.

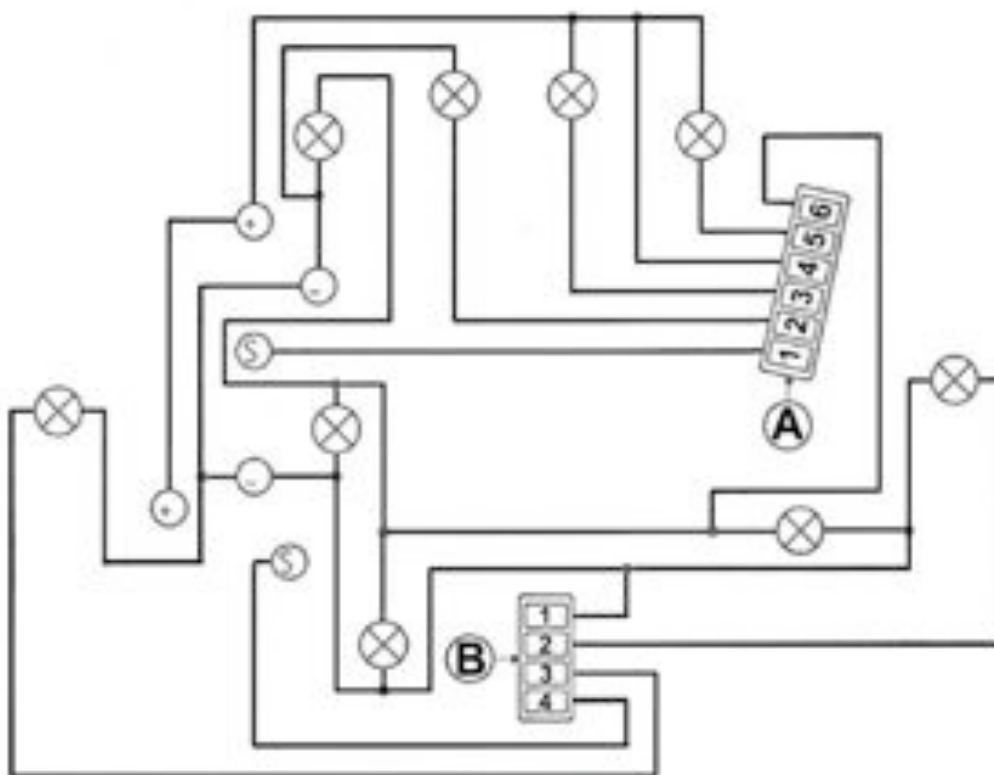
The following table shows the positions and specifications of the fuses installed on the vehicle.



Fuse no.	Amperage	Protected circuits
1	5A	Taillight bulb, number plate bulb, instrument lighting and instrument light indicator.
2	5A	Brake-light bulb, starting relay switch inhibitor
3	7.5A	Radio-intercom pre-wiring, antitheft alarm pre-wiring, cooling liquid temperature indicator, fuel reserve indicator, oil pressure warning light and fuel reserve warning light
4	7.5A	Horn
5	7.5A	Radio-intercom pre-wiring, antitheft alarm pre-wiring, diagnostic LED
6	10A	Electric saddle opener, headlight (high/low beam), full headlight indication light
7	15A	General

## 9.2.15 Instrument Panel

- A** = Digital clock with calendar  
**B** = Coolant temperature  
**C** = RH direction indicator switch  
**D** = Fuel level indicator  
**E** = Light indicator  
**F** = Upper beam indicator  
**G** = Low oil pressure indicator  
**H** = Fuel reserve indicator  
**I** = Speedometer  
**L** = Odometer  
**M** = Left turn signal indicator  
**N** = Immobilizer LED



'A' connector

- 1- Fuel level indicator signal
- 2- Upper beam indicator
- 3- Oil indicator
- 4- Power supply (+)
- 5- Reserve light
- 6- Lighting

'B' connector

- 1- Ground (-)
- 2- LH turn signal indicator
- 3- RH turn signal indicator
- 4- Temperature signal

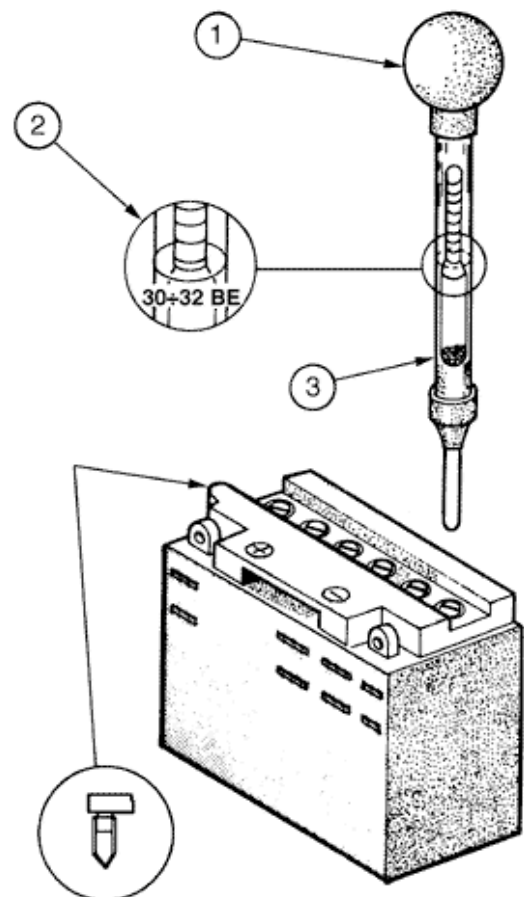
## 9.2.16 Battery

### 9.2.16.1 Preparing the Battery

- Remove the cap from the bleeder, shown in the figure, and then carefully pour sulphuric acid into each element.

**Note:** the acid must have a density of  $78.7 \text{ lbs}\cdot\text{ft}^{-3}$  ( $1,260 \text{ kg}\cdot\text{m}^{-3}$ ), equivalent to 30 BE at a minimum temperature of  $59^{\circ}\text{F}$  ( $15^{\circ}\text{C}$ ) until the upper level is reached.

- Let the battery rest at least 2 hours, and then restore the level by pouring additional sulphuric acid as required.
- Recharge the battery using the recommended battery charger 020333Y (single) or 020334Y (multiple) at an intensity of about 1/10 of the battery's nominal capacity and until the acid density is about  $79.3 \text{ lbs}\cdot\text{ft}^{-3}$  ( $1,270 \text{ kg}\cdot\text{m}^{-3}$ ), corresponding to 31 BE and such values become steady.
- After charging, level the acid (adding **distilled water**). Close and clean carefully.
- After performing the above operations, install the battery on the vehicle following the steps described in "Battery recharge" section of this manual.



### 9.2.16.2 Checking the Electrolyte Level

The electrolyte level must be checked frequently and must reach the upper mark. If the level is too low, it can be restored only by using distilled water. If water toppings are required too often, check the vehicle electrical system as this inconvenient is usually a symptom that the battery is working over-charged and is subject to quick wear.

### 9.2.16.3 Checking the Electrolyte Density

After restoring the electrolyte level, check its density by using the density gauge.

When the battery is charged, density should be equal to  $30\div 32$  BE, corresponding to a specific weight of  $78.7\text{--}79.9 \text{ lbs}\cdot\text{ft}^{-3}$  ( $12.4\text{--}12.6 \text{ kN}\cdot\text{m}^{-3}$ ) at a minimum temperature of  $59^{\circ}\text{F}$  ( $15^{\circ}\text{C}$ ).

If density is below 20 BE, the battery is fully discharged and it is therefore necessary to recharge it.

If the vehicle is not used for a certain period (1 month or more), the battery must be

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periodically recharged. Within a period of inactivity of approximately three months, at standard atmospheric conditions, the battery should be completely discharged. When reinstalling the battery on the vehicle, pay attention not to invert the connections, considering that the ground wire (black and marked with a (-) sign) must be connected to the negative terminal, whereas the two red wires, marked as (+), must be connected to the positive terminal.

#### 9.2.16.4 Checking the Battery Charge Level

**Warning** – Before recharging the battery, remove the plugs from each element. Keep sparks and free flames away from the battery while recharging.

Remove the battery from the vehicle by disconnecting the negative terminal first.

Normal bench charging must be performed using the recommended battery charger 020333Y (single) or 020334Y (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 normal capacity). Connections to the power supply source must be implemented by connecting the corresponding poles (+ to + and - to -).

#### 9.2.16.5 Cleaning the Battery

Keep the battery clean, especially the top; coat the terminals with Vaseline.

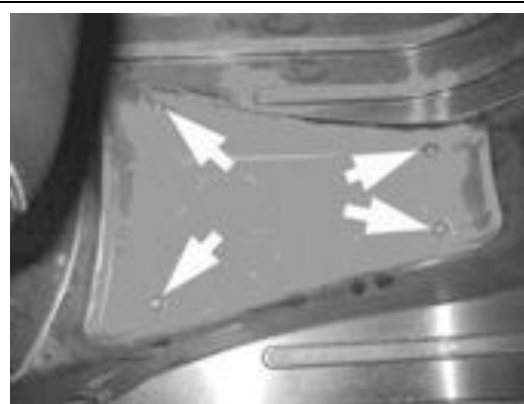
**Warning** – Never use fuses having a greater capacity than the recommended value. The use of a fuse of unsuitable capacity may result in serious damages to the whole vehicle or even culminate in a fire.

**Warning** – Drinking water contains mineral salts that can be extremely harmful to the battery: only use distilled water.

**Warning** – To ensure maximum performance the battery must be charged before using the vehicle. Insufficient battery charge or low electrolyte level, when first used, will result in premature battery failure.

#### 9.2.16.6 Installing the Battery

- Remove the battery cover by removing the four screws securing the central cover to the footrest, as shown in the picture.





- Remove the battery fixing clamp.

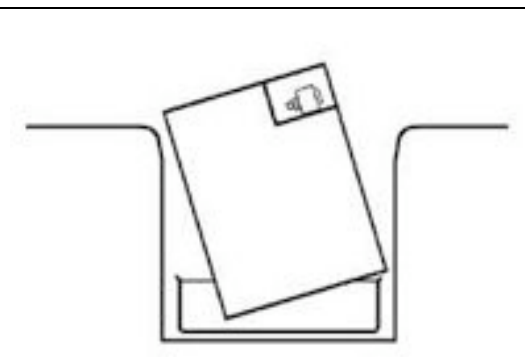


- Use the hole shown in the figure to insert the battery bleed tube



- Place the battery onto the tray as shown in the figure, so to attach the wires to the terminals.

**Note:** In order to correctly connect the wires to the battery terminals, pay attention when placing the battery onto the tray and ensure that there are no interferences between the wires and the frame (due to a possible misplacement of the battery) since these might seriously affect the wiring integrity (see sketch).



- With the aid of a screwdriver fix the wires to the battery terminals placing the supplied beveled washer between the screw head and the wire terminal.

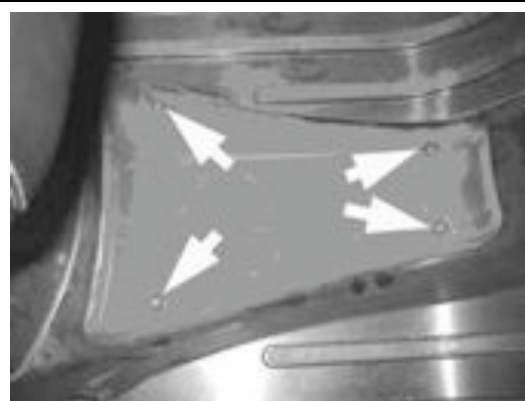
**Note:** Do not use a wrench to tighten the screws.



- Once the wires are securely fastened, proceed by correctly placing the battery onto the tray.
- Replace the battery fixing clamp.



- Replace the battery cover.

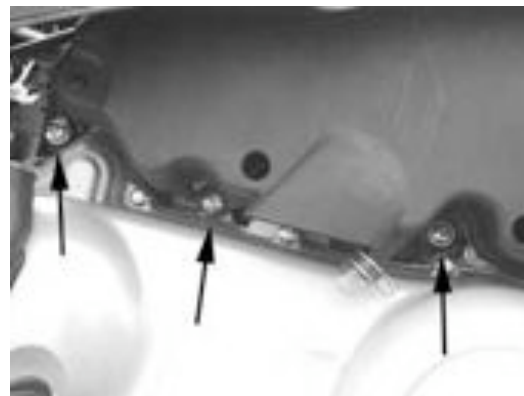


## 10 Engine

### 10.1 Disassembling the Engine from the Frame

**Caution** – The following operations must be performed with the engine cold.

- Disconnect the battery.
- Remove the helmet compartment.
- Remove the side fairings.
- Disassemble the silencer.
- Release the three screws fixing the air filter to the crankcase.



- Remove the clip from the blow-by pipe



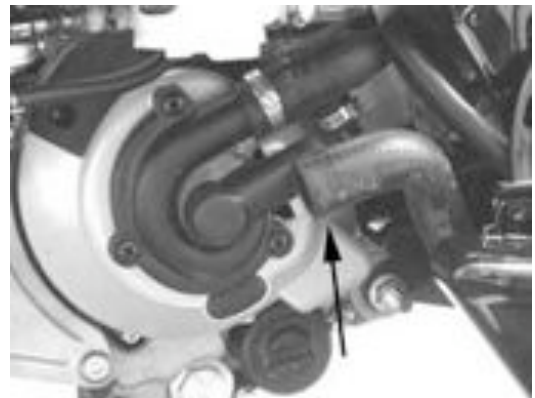
- Disconnect the carburetor bellows. Then remove the air filter.



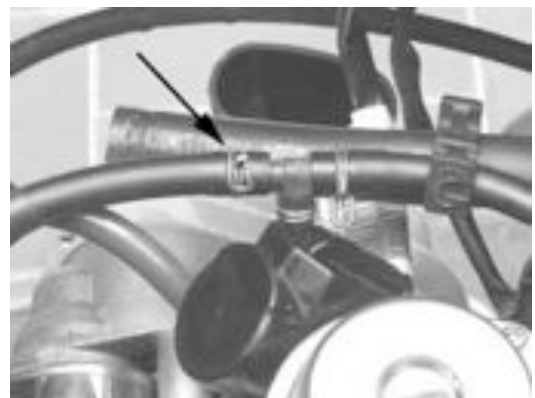
- Remove the air intake bellows to the transmission compartment by releasing the two screws shown in the figure and removing the plastic clip.



- Remove the cooling fluid inlet piping from the pump as shown in the figure.



- Remove the fuel tap vacuum pipe from the «T» union shown in the figure.



- Remove the fuel feeding pipe from the carburetor.



- Remove the cooling fluid outlet piping from the engine.



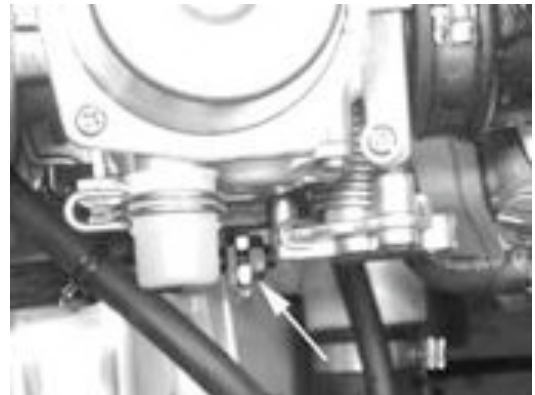
- Also remove the bleeding piping shown in the figure.



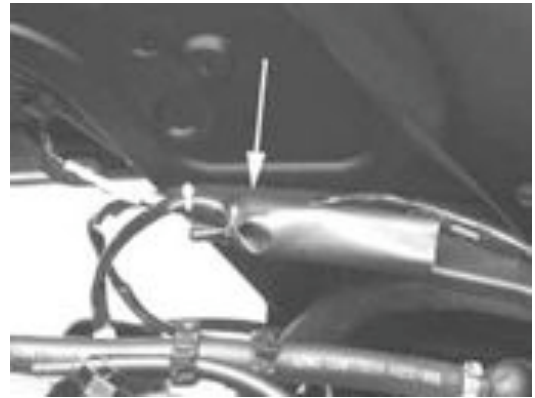
- Remove the spark plug cap.
- Remove the cooling fluid temperature sensor connector shown in the figure.



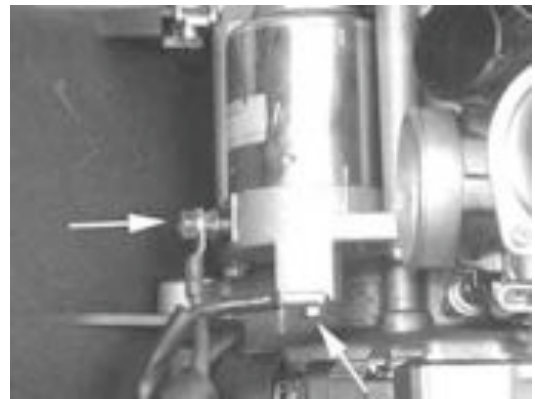
- Remove the gas control cable from the carburetor by releasing the nut shown in the figure.



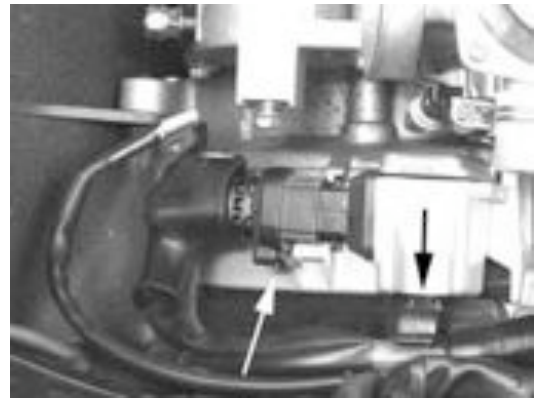
- Remove the automatic connector from the system located inside the protective sheath shown in the figure.



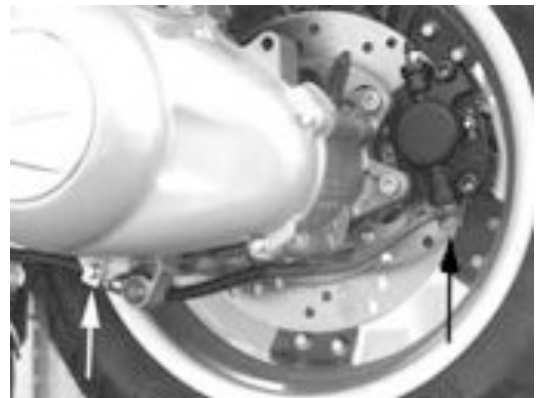
- Remove the positive and negative wirings from the starter motor as shown in the figure.



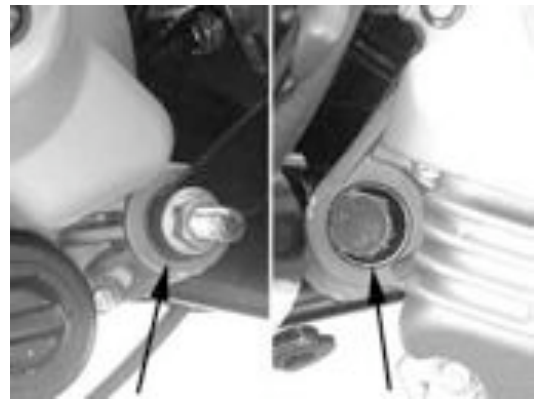
- Remove the flywheel wiring connector shown in the figure.
- Remove the cable from the flywheel cover retain clip.



- Remove the rear shock absorbers.
- Remove the hydraulic piping from the rear brake caliper by loosening the screw shown in the figure. Then, remove the pipe attachments to the engine crankcase shown in the figure.



- Suitably support the vehicle by the jack. Remove the engine-swing arm assembly by loosening the nut and the pin head shown in the figure.
- The engine can now be removed.





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## 10.2 Removing the Silencer

- 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.



## 10.3 Refitting the Engine onto the Frame

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

**Warning** – Be very careful in ensuring that the throttle cable is in the proper position.

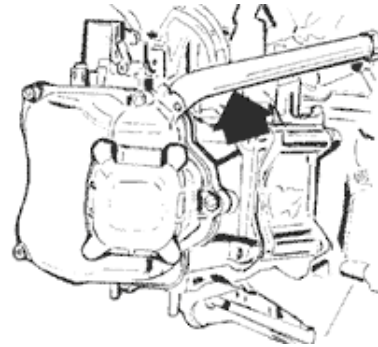
- Check that with valve in abutment against the register there is a small clearance.
- Check the engine oil level and top up using the recommended brand, if required.
- Fill the cooling circuit.
- Check that accelerator and electric devices are in good working order.



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## 10.4 Removing the Rocker Cover

- Remove the five rocker cover screws and the pipe shown in the figure, after removing the relative strip; remove the tappet cover with decanter and automatic valve.
- Remove the sealing gasket.
- Check that the unidirectional valve is in good working order.



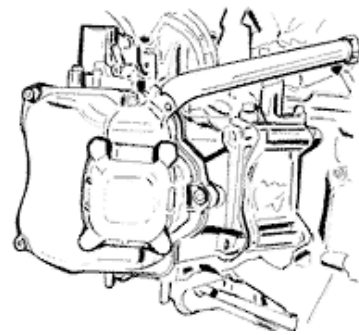
## 10.5 Refitting the Rocker Cover

Perform the operations for removal in the reverse order and tighten the five screws at the proper torque.

**Note:** Install a new O-ring gasket on the tappet cover.

**Tightening torque:**

Rocker cover screws                      8.1-9.6 lbs·ft  
(11-13 N·m)



## 10.6 Checking the Compression

- Remove the spark plug cap with cold engine.
- Remove the ignition spark plug.
- Fit a compression test gauge into the spark plug seat using a 10mm spark plug joint and tighten to the prescribed torque.
- Let the engine run by the starter and with the carburetor in fully open position as long as the gauge value is steady. If pressure is higher than 9 bar, remove the tool and proceed in the reverse order of removal.

If the pressure is below the indicated values, check the engine test speed; if the engine speed is less than 450 rpm, check the starting system; if the value is within the prescribed limits or slightly higher, check the timing. If no faults are detected:

- Ensure that the cylinder base gasket was properly selected.
- Check the sealing on the cylinder-piston assembly (piston rings-valves).

**Tightening torque:**

Spark plug                      8.8-10.3 lbs·ft (12-14 N·m)

---

## 10.7 Transmission

### 10.7.1 Removing the Transmission Cover

**Note:** To remove the transmission cover it is necessary to remove the plastic cover first, using a screwdriver on the special guides. Using the clutch drum lock wrench shown in the figure, remove the driven pulley axle locking nut and washer.

**Specific equipment and tools:**

Driven pulley locking wrench

020423Y



- Remove engine oil dipstick.
- Remove the 10 screws from the transmission cover.
- Remove the transmission cover.

**Note:** If this operation is performed without dismantling the engine from the vehicle, it is necessary to remove the transmission cooling air sleeve first.



### 10.7.2 Removing the Fan Case

- Remove the 5 screws shown in the figure.



### 10.7.3 Removing the Transmission Cooling Intake

- To remove the transmission cover intake, it is sufficient to remove the 2 screws indicated in the figure.

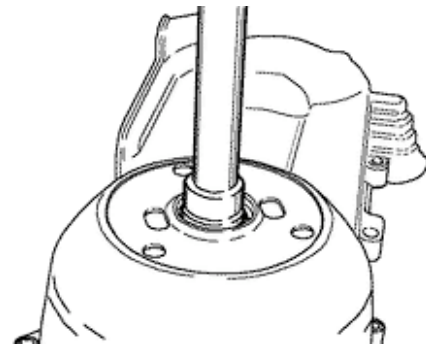


### 10.7.4 Removing the Driven Pulley Shaft Bearing

- Remove the snap ring from the inside of the transmission cover.
- Remove the bearing from the case, using the recommended tools listed below.

**Specific equipment and tools:**

Handle	020376Y
Adapter (28×30mm)	020375Y
15mm Guide	020412Y

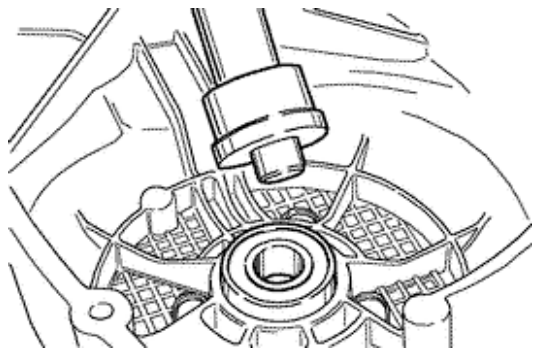


### 10.7.5 Fitting the Driven Pulley Shaft Bearing

- Heat the inside of the transmission cover in order to prevent the paint on the outer surface.
- Install the bearing onto its seat.
- Replace the snap ring.

**Specific equipment and tools:**

Handle	020376Y
Adapter (32×35mm)	020357Y
15mm Guide	020412Y



**Warning** – Ensure to use an appropriate rest surface to avoid damaging the transmission cover.

**Warning** – Always replace the bearing when reassembling the component.

### 10.7.6 Removing the Belt Support Roller

- Check that the roller is free from wear and that it rotates freely.
- Remove the special fastening screw and the roller, complete with bearing.



- Remove the elastic ring and eject the bearing using the following tools.

**Specific equipment and tools:**

Handle	020376Y
25mm Guide	020364Y



### 10.7.7 Refitting the Belt Support Roller

- Heat the roller and install the bearing using the following tools.

**Specific equipment and tools:**

Heat gun	020151Y
Heat gun support	020364Y
Handle	020376Y
Adapter (32×35mm)	020357Y
10mm Guide	020455Y



- Reposition the roller using the specific screw.
- Tighten at the prescribed torque.

**Tightening torque:**

Anti-flapping roller	8.1-9.6 lbs·ft (11-13 N·m)
----------------------	-------------------------------

- Replace the intake with the O-ring, pan sealing gasket and fan case.



### 10.7.8 Removing the Driving Pulley

- With the pulley stop wrench correctly inserted into the apposite slits, remove the lock nut.

**Note:** The nut has an 'in-built' spring washer.

**Specific equipment and tools:**

Driving pulley stop wrench 020442Y



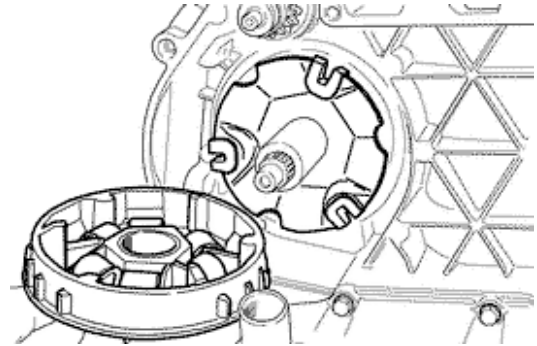
- Remove the starting rim assembly.
- Remove the driving fixed half-pulley, together with the O-ring and the steel washer on the bushing.



- Remove the belt and extract the moving half-pulley with the relevant bushing

**Note:** The rollers are freely placed onto the slides inside the pulley. Ensure that they don't fall when the pulley is being removed.

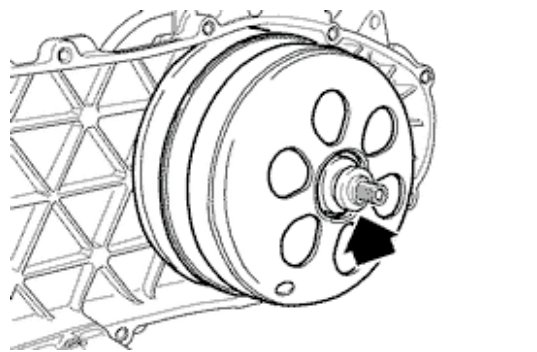
- Remove the roller contrast plate with the relevant guide sliding blocks



### 10.7.9 Removing the Driven Pulley

- Remove the spacer, the clutch drum and the entire driven pulley assembly.

**Note:** This operation may be performed without removing the driving pulley assembly.



### 10.7.10 Inspecting the Clutch Drum

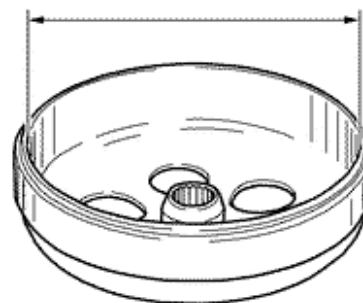
- Check that the clutch drum is not worn or damaged.
- Measure the internal diameter, as shown in the figure.

**Standard dimension:**

Clutch drum  $\varnothing$  5.283 in  
(134.2 mm)

**Max. allowable dimension:**

Clutch drum  $\varnothing$  5.295 in  
(134.5 mm)



### 10.7.11 Checking the Clutch Drum Surface Eccentricity

- Install the drum on a driven pulley shaft using two bearings (internal diameter 15 and 17mm).
- Use the original spacer nut to lock the drum/shaft assembly.
- Place the drum/shaft assembly on the support (020074Y) to check the driving shaft alignment.



- Using a feeler pin comparator and the magnetic base, measure the drum eccentricity.
- Repeat the measurement on three surfaces (central, internal and external).



### 10.7.12 Removing the Clutch

- Prepare the driven pulley spring compressor (020444Y) with the medium length pins in position «C» tightened on the inside of the tool.
- Introduce the adapter ring no. 11 with the chamfering facing the inside of the tool.
- Install the driven pulley assembly onto the tool inserting the three pins into the ventilation holes on the mass holding support.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to release and tighten the clutch nut.
- Using the specific 46×55mm wrench remove the clutch fixing nut.
- Separate the components of the driven pulley (clutch and spring with plastic rest).

**Specific equipment and tools:**

Driven pulley spring compressor	020444Y
Wrench (46×55mm)	020444Y009
Adapter ring	020444Y011

**Caution** – The toll must be tightly fixed in the vice and the central screw must be moved in abutment with the tool. An excessive torque may deform the specific tool.



### 10.7.13 Disassembling the Fixed Driven Half-Pulley Bearings

- Check for any noise and/or signs of wear. If the bearings are worn or noisy, replace them.
- Remove the retaining ring using two flat screwdrivers.
- Use a suitable wooden surface to support the bushing from the threaded side.
- Using a pin and a mallet, remove the bearing, as shown in the figure.





- Rotate the pulley assembly up-side-down, as shown in the figure, and ensure the pulley is suitably supported.
- Remove the roller bearing using the modular punch.

**Specific equipment and tools:**

Handle	020376Y
Adapter (24mm)	020456Y
Guide (20mm)	020363Y
Bell (no. 35)	001467Y035



### 10.7.14 Checking the Fixed Driven Half-Pulley

- Measure the external diameter of the bushing; see figure.

**Standard dimension:**

Bushing diameter  $\varnothing$  1.598 in  
(40.985mm)

**Min. allowable dimension:**

Bushing diameter  $\varnothing$  1.597 in  
(40.960mm)

- Ensure that the working surface (in contact with the belt) is free from abnormal wear.
- Check the riveting.



- Check the planarity of the working surface.

**Wear limit:**

Fixed Driven pulley planarity 0.0012 in  
(0.03mm)





### 10.7.15 Checking the Moving Driven Half-Pulley

- Remove the two inner sealing rings and the two O-rings.
- Measure the internal diameter of the bushing, as shown in the figure.

**Standard dimension:**

Bushing diameter  $\varnothing$  1.599-1.600 in  
(41.000-41.035mm)

**Min. allowable dimension:**

Bushing diameter  $\varnothing$  1.602 in  
(41.080mm)

- Ensure that the working surface (in contact with the belt) is free from abnormal wear.
- Check the riveting.



- Check the planarity of the working surface.

**Wear limit:**

Fixed Driven pulley planarity 0.0012 in  
(0.03mm)



### 10.7.16 Fitting the Fixed Driven Half-Pulley Bearings

- Ensure the pulley bushing is suitably supported from the threaded side on a wooden surface.
- Install the new roller casing as shown in the figure, ensuring that the inscription is facing outwards.

**Specific equipment and tools:**

Punch for roller casing 020424Y



- To install the new ball bearing, proceed as shown in the figure using the modular punch.

**Note:** Install the bearing

**Specific equipment and tools:**

Handle 020376Y  
1.1×1.2 in. (28×30mm) adapter 020375Y



### 10.7.17 Refitting the Driven Pulley

**Note:** Before proceeding with the assembly ensure the working surface is in good conditions, and shows no signs of abnormal or wear, as described in the previous section.

- Insert the new oil seals and O-rings on the moving half-pulley.
- Carefully grease the O-ring (marked as «A» in the figure).



- Install the half-pulley on the bushing using the specific tool.

**Specific equipment and tools:**

Protective sheath 020263Y

- Ensure that the pins and the collar are not worn and then refit them, using the apposite slits.



- Using a curved-spout grease dispenser, lubricate the driven pulley assembly with approximately  $\frac{1}{4}$  oz. (7 g) of TUTELA MRM2 grease. Apply grease to one of the holes in the bushing until it comes out through the hole on the opposite side.

**Note:** This operation is necessary to avoid the presence of grease beyond the O-rings.

**Recommended grease:**  
TUTELA MRM2



**Note:** The lubrication of the servo-system can be carried either with the bearings installed or during their replacement. It may be easier to proceed with the lubrication during overhaul.

### 10.7.18 Checking the Moving Driven Half-Pulley Spring

- Measure the length of the moving driven half-pulley spring, as shown in the figure.

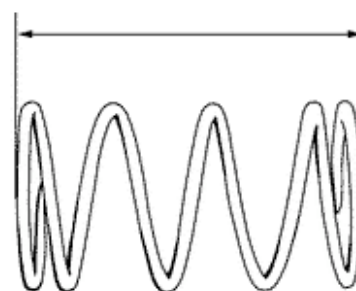
**Note:** The spring must be unloaded.

**Standard dimension:**

Spring length 4.84 in  
(123mm)

**Min. allowable dimension:**

Spring length 4.65 in  
(118mm)



### 10.7.19 Checking the Drive Belt

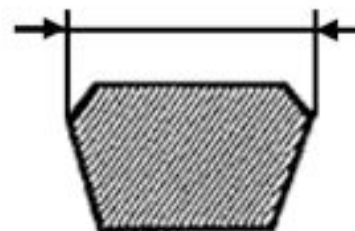
- Ensure the drive belt shows no external signs of damage, i.e. no cracks.
- Measure the belt width as shown in the figure.

**Standard dimension:**

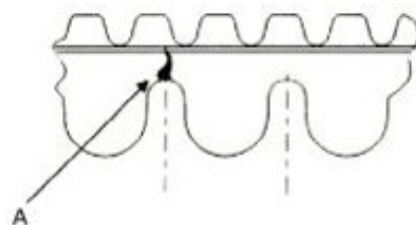
Belt width  $0.8071 \pm 0.0078$  in  
( $20.50 \pm 0.20$  mm)

**Min. allowable dimension:**

Belt width 0.7600 in  
(19.5 mm)



**Note:** During the wear check (to be performed according to the maintenance table shown at pp. 57-58 of this manual), it is necessary to thoroughly check the bottom of the tooth groove for cracks (see example «A» shown in figure). If cracks are detected the belt must be replaced. Also ensure that no deformations are present.



### 10.7.20 Checking the Clutch Friction Material

- Measure the thickness of the clutch shoes friction material.

**Min. allowable dimension:**

Clutch shoe thickness 0.04 in  
(1 mm)

**Note:** Ensure that the clutch shoes bear no traces of lubricant. If they do, check the seal of the driven pulley assembly.

**Note:** Upon the running-in period, the clutch shoes must have a central contact surface and must not differ from one another, otherwise the clutch may slip.

**Warning** – Do not use a tool to open the shoes as this may affect the return spring load.



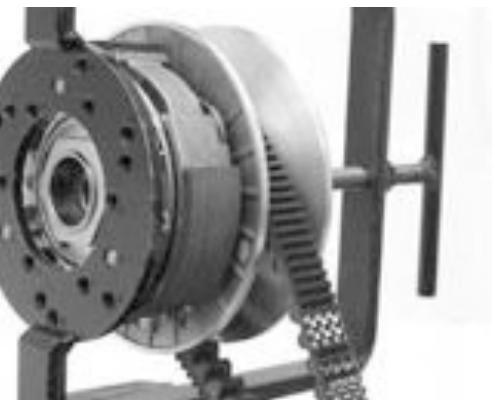
### 10.7.21 Fitting the Clutch

- Place the driven pulley onto the compressor tool, as shown in the figure, so that the control screw is in a vertical position.
- Prepare the tool with the medium length pins screwed in position «C» on the inside.
- Introduce the adapter ring no. 11 with the chamfering facing upwards.
- Insert the clutch on the adapter ring.
- Lubricate the end of the spring that abuts against the servo-system closing collar.



**Note:** An excessive amount could impair the clutch functions.

- Insert the spring with relevant plastic support in contact with the clutch.
- Insert the driving belt into the pulley unit according to their direction of rotation.
- Insert the pulley unit with the belt into the tool.
- Slightly pre-load the spring.
- Make sure that the clutch is perfectly inserted



### 10.7.22 Checking the Moving Driving Half-Pulley

Check that the bearing shown in the figure is not worn and measure the internal diameter.

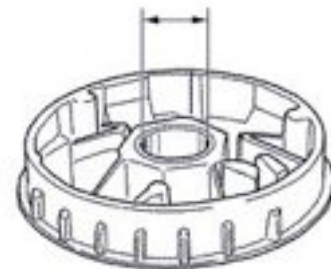
**Standard dimension:**

Internal bearing diameter  $\varnothing$  1.0140-1.0148 in  
(26.000-26.021 mm)

**Max. allowable dimension:**

Internal bearing diameter  $\varnothing$  1.0283 in  
(26.12 mm)

**Warning** - Do not lubricate or clean the bushes.



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




**Standard dimension:**

Bushing external diameter  $\varnothing$  1.0220-1.0228 in  
(25.959-25.980 mm)


**Min. allowable dimension:**

Bushing external diameter  $\varnothing$  1.0217 in  
(25.950 mm)

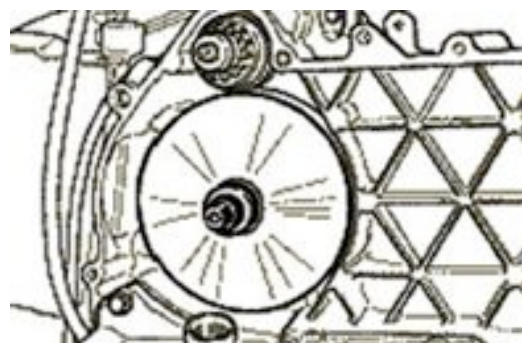


<ul style="list-style-type: none"> <li>- Check that the rollers are not damaged or worn.</li> </ul> <p><b>Standard dimension:</b> Ø 0.807-0.815 in (20.5-20.7 mm) Roller diameter</p> <p><b>Min. allowable dimension:</b> Ø 0.787 in (20.0 mm) Roller diameter</p>	
<ul style="list-style-type: none"> <li>- Check that the roller contrast plate slide blocks are not damaged.</li> <li>- Check the wear of the roller housings and of the belt contact surfaces on both half-pulleys.</li> </ul>	
<ul style="list-style-type: none"> <li>- Check that the fixed driving pulley exhibits no abnormal wear on the grooved profile and on the belt contact surface.</li> <li>- Check that the O-Ring is not deformed.</li> </ul>	

### 10.7.23 Fitting the Fixed Driving Half-Pulley and Bushing Assembly

<ul style="list-style-type: none"> <li>- Pre-assemble the mobile half-pulley with the roller contrast plate, placing the rollers in the specific slits with the larger matching surface in contact with the pulley according to the direction of rotation. Check that the O-Ring is not deformed.</li> <li>- Check that the roller contact plate exhibits no anomalies or damages on the grooved profile.</li> </ul>	
--	--

- Install the group with the bushing on the driving shaft.

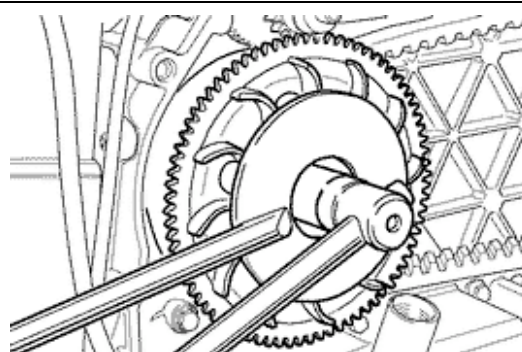


- Install the driven pulley/clutch/belt assembly on the engine.



### 10.7.24 Fitting the Moving Half-Pulley Assembly

- Properly reinstall the bendix into its seat, if removed.
- Install the steel shim in contact with the bushing and the fixed driving half-pulley with the O.R. on the external end of the ventilation blades.
- Install the start-up rim assembly with torque limiter.
- Prevent the half-pulley rotation using the specific lock wrench.
- Insert the torque limiter on the driving shaft so as to ensure the alignment of the references obtained on the start-up rim and on the fixed driving half-pulley. If this is not possible, choose the position where the references are closest to one another.
- Failure to comply with this rule can impair the cooling fan efficiency.



**Warning** - It is very important to install the fixed driving half-pulley with the belt totally free to prevent a false locking of the driving half-pulley.



**Note:** Always replace the nut with a new one upon any reassembly.

- Turn the engine by hand to obtain a minimum tension of the belt.

**Tightening torque:**

Driving pulley screw: 55.3-61.2 lbs·ft  
(75-83 N·m)

**Specific equipment and tools:**

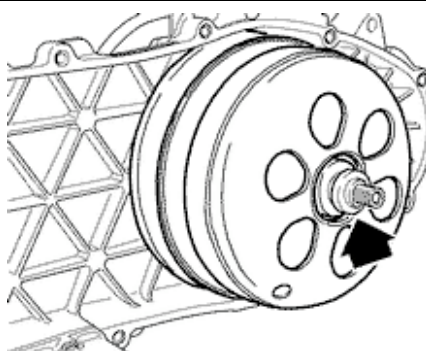
Lock wrench: 020368Y

- The torque limiter is calibrated at 71.7 lbs·ft (100 N·m).
- The lock wrench works on the starting rim.
- If the torque limiter is worn, it is possible to detect the fault when locking of the nut on the driving shaft.
- The torque limiter cannot be overhauled.
- In case of anomalies, replace the start-up rim with the limiter.



### 10.7.25 Fitting the Clutch Drum

- Fit the clutch drum and the spacer.





### 10.7.26 Fitting the Transmission Cover

- Check that the locating dowels and the oil seal in the sump are in place.
- Fit the transmission cover and tighten the ten screws to the specified torque
- Attach the ground cable to the first screw above the oil sump.
- Fit the oil dipstick
- Fit the steel washer and the driven pulley shaft nut.
- Apply Loctite Super Rapid 242E thread locking compound to the threads and tighten the driven pulley shaft nut to the specified tightening torque, using the lock wrench specific tool.
- Re-fit the plastic cover.

**Specific equipment and tools:**

Lock wrench: 020423Y

**Tightening torques:**

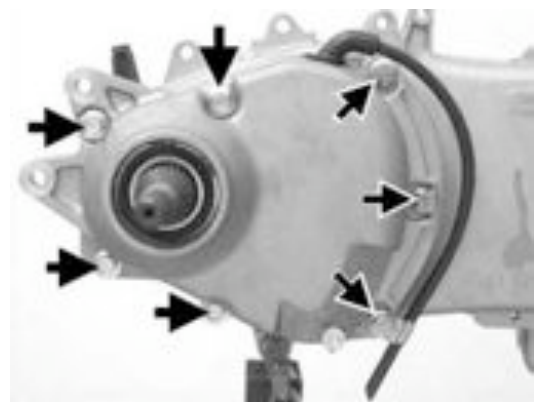
Transmission cover screws: 8.1-9.6 lbs·ft  
(11-13 N·m)

Driven pulley axis: 39.8-44.2 lbs·ft  
(54-60 N·m)



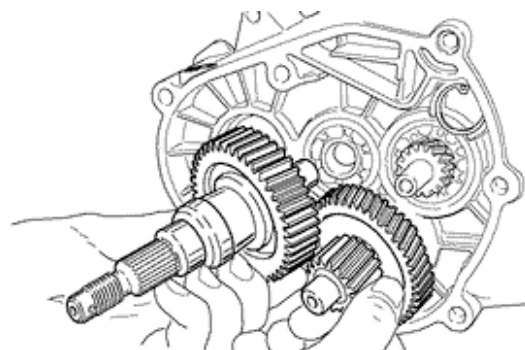
### 10.7.27 Removing the Rear Hub Cover

- Remove the oil drain plug and thus drain the hub.
- Remove the seven flanged screws shown in the figure.
- Remove the hub cover and the related gasket.



### 10.7.28 Removing the Rear Wheel Axle

- Remove the wheel axle with the related gear.
- Remove the reduction gear.



### 10.7.29 Checking the Hub Casing Bearings

- Check the condition of the hub casing bearings (wear, play, noise). If any anomalies are found, proceed as described below.
- Remove the three 0.585 in (15mm) bearings (two on the crankcase and one on the hub cover) using the specific extractor.

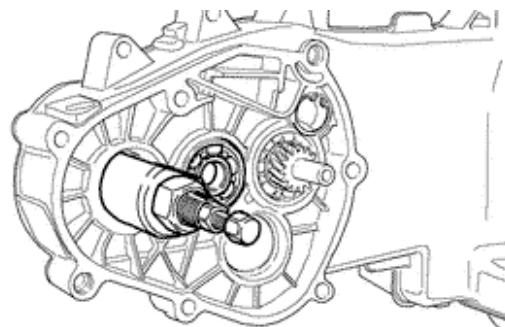
#### Specific equipment and tools:

0.585 in (15mm) Pliers


Bell

001467Y013

001467Y009

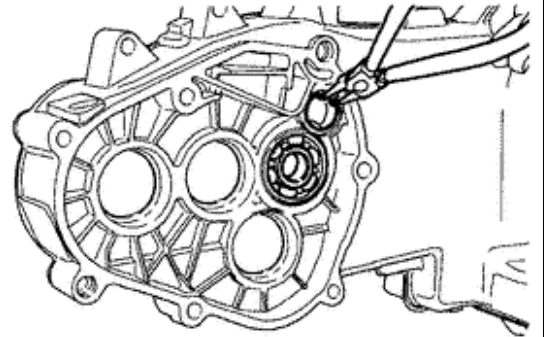


### 10.7.30 Removing the Wheel Axle Bearing from the Cover

<ul style="list-style-type: none"><li>- Remove the Snap ring from the outside of the hub cover.</li></ul>									
<ul style="list-style-type: none"><li>- Support the hub cover as shown in the figure.</li><li>- Remove the bearings using the specific tools.</li></ul> <p><b>Specific equipment and tools:</b></p> <table><tr><td>Column kit</td><td>020489Y</td></tr><tr><td>Handle</td><td>020376Y</td></tr><tr><td>1.46 in (37mm) adapter</td><td>020477Y</td></tr><tr><td>1.18 in (30mm) guide</td><td>020483Y</td></tr></table>	Column kit	020489Y	Handle	020376Y	1.46 in (37mm) adapter	020477Y	1.18 in (30mm) guide	020483Y	
Column kit	020489Y								
Handle	020376Y								
1.46 in (37mm) adapter	020477Y								
1.18 in (30mm) guide	020483Y								
<ul style="list-style-type: none"><li>- Using the specific tools, remove the oil seal as shown in the figure.</li></ul> <p><b>Specific equipment and tools:</b></p> <table><tr><td>Handle</td><td>020376Y</td></tr><tr><td>(42×47mm) adapter</td><td>020359Y</td></tr></table>	Handle	020376Y	(42×47mm) adapter	020359Y					
Handle	020376Y								
(42×47mm) adapter	020359Y								

### 10.7.31 Removing the Driven Pulley Shaft

- In order to remove the driven pulley shaft, its bearing and oil seal, it is necessary to remove the transmission cover and the clutch assembly as previously described.
- Pull the driven pulley shaft off the bearing.
- Remove the oil seal from inside the bearing and expel it on the transmission side taking care not to damage its seat.
- Remove the Snap ring shown in the figure.



- Using the modular punch, remove the driven pulley shaft bearing.

#### Specific equipment and tools:

Handle	020376Y
1.10×1.18 in (28×30mm) adapter	020375Y
0.78 in (20mm) guide	020363Y



### 10.7.32 Checking the Hub Cover

- Ensure that the mating surface is not dented or distorted.
- Check that the bearing housing shows no signs of wear or cracks.
- If any defects are found, replace the hub cover.


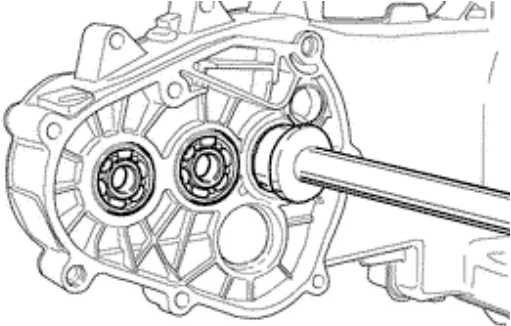
### 10.7.33 Fitting the Hub Casing Bearings

- Heat the engine crankcase and the hub cover using the specific hot air gun.


#### Specific equipment and tools:

Hot air gun support	020150Y
Hot air gun	020151Y



<ul style="list-style-type: none"> <li>- Install the three 15mm bearings using the specific tools.</li> </ul> <p><b>Specific equipment and tools:</b></p> <table border="0"> <tr> <td>Handle</td> <td>020376Y</td> </tr> <tr> <td>(42×47mm) adapter</td> <td>020359Y</td> </tr> <tr> <td>0.585 in (15mm) guide</td> <td>020412Y</td> </tr> </table> <p><b>Note:</b> The 42mm side of adapter 020359Y must face the bearing.</p>	Handle	020376Y	(42×47mm) adapter	020359Y	0.585 in (15mm) guide	020412Y	
Handle	020376Y						
(42×47mm) adapter	020359Y						
0.585 in (15mm) guide	020412Y						
<p><b>Note:</b> Before installing the bearings onto the cover, ensure that this is suitably supported by means of the recommended column kit.</p> <p><b>Specific equipment and tools:</b></p> <table border="0"> <tr> <td>Column kit</td> <td>020489Y</td> </tr> </table>		Column kit	020489Y				
Column kit	020489Y						
<ul style="list-style-type: none"> <li>- Replace the driven pulley axle bearing using the modular punch as shown in the figure.</li> </ul> <p><b>Note:</b> If the bearing is of the asymmetric ball containment type, place it as shown in the figure.</p> <p><b>Specific equipment and tools:</b></p> <table border="0"> <tr> <td>Handle</td> <td>020376Y</td> </tr> <tr> <td>(42×47mm) adapter</td> <td>020359Y</td> </tr> <tr> <td>0.787 in (20mm) guide</td> <td>020363Y</td> </tr> </table> <ul style="list-style-type: none"> <li>- Replace the Snap ring.</li> </ul>	Handle	020376Y	(42×47mm) adapter	020359Y	0.787 in (20mm) guide	020363Y	
Handle	020376Y						
(42×47mm) adapter	020359Y						
0.787 in (20mm) guide	020363Y						
<p><b>Note:</b> To install the bearings onto the engine crankcase it is necessary to ensure that the crankcase is supported in such a way to allow the bearings to be placed vertically.</p>							

#### 10.7.34 Fitting the Wheel Axle Bearing on the Cover

<ul style="list-style-type: none"> <li>- Place the hub cover on an appropriate wooden surface.</li> <li>- Heat the cover using the hot air gun.</li> <li>- Fit the wheel axle bearing onto the cover using the specific tools.</li> </ul> <p><b>Specific equipment and tools:</b></p> <table border="0"> <tr> <td>Hot air gun support</td> <td>020150Y</td> </tr> <tr> <td>Hot air gun</td> <td>020151Y</td> </tr> <tr> <td>Handle</td> <td>020376Y</td> </tr> <tr> <td>2.047×2.165 in (52×55mm) adapter</td> <td>020360Y</td> </tr> <tr> <td>1.181 in (30mm) guide</td> <td>020483Y</td> </tr> </table>	Hot air gun support	020150Y	Hot air gun	020151Y	Handle	020376Y	2.047×2.165 in (52×55mm) adapter	020360Y	1.181 in (30mm) guide	020483Y	
Hot air gun support	020150Y										
Hot air gun	020151Y										
Handle	020376Y										
2.047×2.165 in (52×55mm) adapter	020360Y										
1.181 in (30mm) guide	020483Y										

- Install the Snap ring, as shown in the figure.



- Install the oil seal with the sealing lip facing the inside of the hub and aligned to the edge of the seat.

**Specific equipment and tools:**

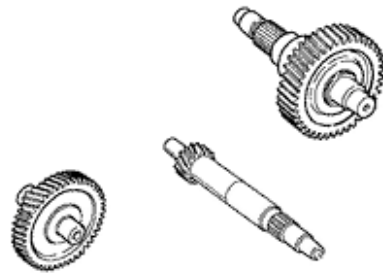
Handle 020376Y  
 2.047×2.165 in (52×55mm) adapter 020360Y

**Note:** The 2.047 in (52mm) side of adapter 020360Y must face the bearing.



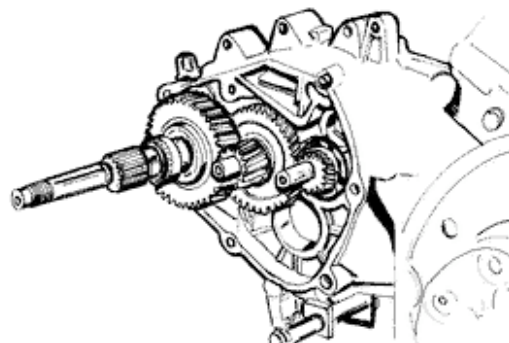
### 10.7.35 Checking the Hub Shafts

- Ensure that the three shafts exhibit no signs of wear or deformation, especially at the toothed surfaces, and at the bearing and oil seal housings
- Replace any damaged parts.



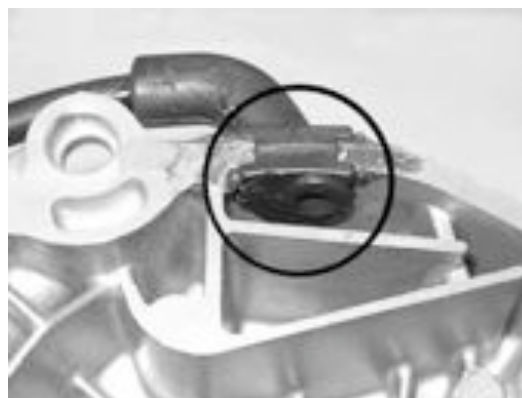
### 10.7.36 Fitting the Hub Gears

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



### 10.7.37 Fitting the Hub Cover

- Install a new gasket with centering dowels.
- Carefully seal the vent pipe gasket using black silicone sealant.



- Install the cover ensuring that the breather pipe is correctly positioned.
- Place the three shorter screws, which are different in color, and the pipe support plate in as shown in the figure.
- Position the remaining four screws and then tighten all the seven screws with the prescribed torque.

### Tightening torques:

Hub cover screws

17.6-19.9 lbs·ft  
(24-27 N·m)








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## 10.8 Flywheel

### 10.8.1 Removing the Flywheel Cover Assembly

<ul style="list-style-type: none"><li>- Remove the two clamps and sleeves shown in the figure and then drain the cooling system.</li></ul>	
<ul style="list-style-type: none"><li>- Remove the two clamps fixing the SAS valve connection sleeve to the drainage pipe.</li></ul>	
<ul style="list-style-type: none"><li>- Remove the two fastening screws, the secondary air connection pipe and the relevant copper gasket.</li></ul>	



**Note:** If needed, it is possible to remove the complete flywheel cover by releasing the four hexagonal-head screws shown in the figure.



- Remove the two screws fixing the SAS valve to the flywheel cover.



- Remove the SAS valve, complete with the gasket



- Remove the three screws fixing the SAS valve support to the flywheel cover as shown in the figure.



- Remove the SAS valve support complete with its gasket



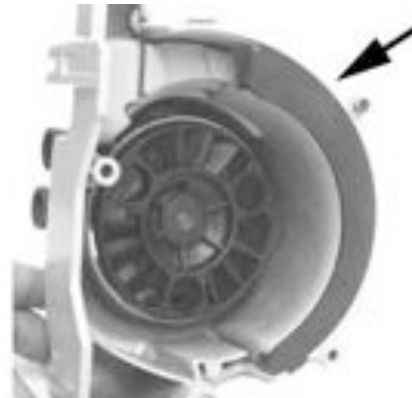
- Remove the external filter shown in the figure.



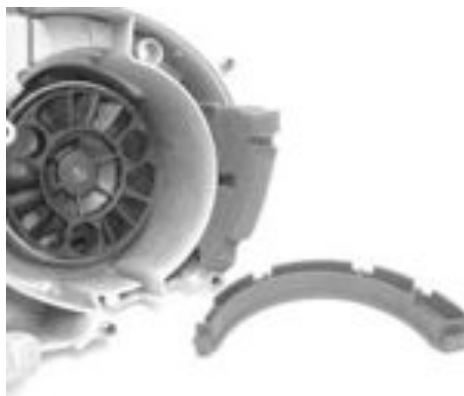
- Remove the flywheel cover with the two centering dowels as shown in the figure.



- Remove the inside filter cover shown in the figure.



- Remove the inside filter shown in the figure.



- Check that the two internal and external sponge filters are clean and efficient.
- Check that the plastic support for the secondary air box is free from cracks and deformations.
- Check the integrity of the gasket.

**Warning** - an impaired seal between secondary air box valve and flywheel cover may cause an increase of noise.

- Check that the sleeve connecting the secondary air to the head exhibits no cracks or deformations. Replace them, if necessary.
- Check that the metal duct is free from cracks.

## 10.8.2 Removing the Flywheel

- Using the adjustable spanner, hold the flywheel in position; see figure.

### **Specific tools and equipment:**

Adjustable wrench 020565Y

- Loosen and remove the lock nut.

**Warning** - Using a different adjustable wrench could damage the stator coils.



- Using the specific extractor, remove the flywheel.

**Specific tools and equipment:**

Flywheel extractor

008564Y



### 10.8.3 Removing the Stator

- Removing the electric terminal of the low oil pressure switch.
- Remove the two pick-up screws (indicated by two black arrows in the figure), the wiring clip screw and the two stator fixing screws (white arrows).
- Remove the stator and the related wiring.



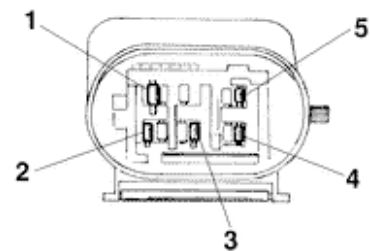
### 10.8.4 Checking the Stator

- Using a multimeter, check for continuity between connections 5-3 and 5-1.
- Check ground insulation on the three stator phases: 5-ground, 3-ground, 1-ground.

**Standard resistance:**

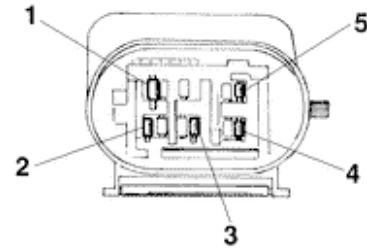
For each phase

0.5-1.0 Ω



### 10.8.5 Checking the Low Oil Pressure Switch

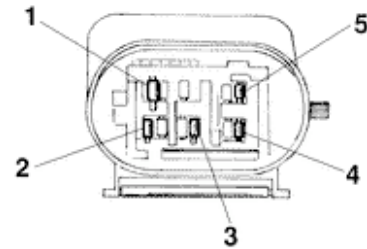
- Using a multimeter, check for continuity between connector 4 and ground (with engine off).



### 10.8.6 Checking the Pick-Up

- Check that the resistance between connection 2 and ground is approximately 105-124  $\Omega$  at 68°F (20°C).
- If the measured resistance is not as specified, replace the faulty parts.

**Note:** Resistance values are rated for measurements taken at, or near, the indicated temperature. Checks carried out with the stator at operating temperature give higher resistances than the rated values.



### 10.8.7 Checking the Flywheel

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

### 10.8.8 Fitting the Stator Assembly

- Fit the stator and the flywheel by following the removing procedure in the reverse order. Tighten the fastenings with the prescribed torque.
- Position the wiring as shown in the figure.

**Tightening torques:**

Stator and pick-up screws 2.2-2.9 lbs·ft  
(3-4 N·m)

**Note:** The pick-up wire must be placed between the upper screw and the dowel bolt, as shown here.



---

### 10.8.9 Fitting the Flywheel

- Fit the flywheel taking care to correctly insert the woodruff key.
- Tighten the flywheel lock-nut with the prescribed torque.

**Tightening torques:**

Flywheel fixing nut 38.2-42.6 lbs·ft  
(52-58 N·m)



- Check that the pick-up clearance gap ranges between 0.013-0.029 in (0.34-0.76mm).
- No adjustment of the clearance gap is necessary when fitting the pick-up.
- Different values are the result of deformations of the pick-up support.

**Note:** A variation of the clearance gap changes the minimum supply speed if the ignition system.







### 10.8.10 Fitting the Flywheel Cover Assembly

- Position the flywheel so that the TDC reference mark is aligned with the mark on the crankcase.





<ul style="list-style-type: none"> <li>- Prepare the flywheel cover by aligning the reference marks between the drive and the cover casing.</li> <li>- Fit the cover on the engine. Insert the three studs in the water pump drive.</li> <li>- Follow the operations for the removal in the reverse order.</li> </ul> <p><b>Warning</b> – Take care to properly position the flywheel connector. Make sure of the presence of the two dowel bolts.</p>	
<ul style="list-style-type: none"> <li>- Replace the plastic support for the secondary air box valve and tighten with the prescribed torque.</li> </ul> <p><b>Tightening torques:</b>  Flywheel fixing nut <span style="float: right;">2.2-2.9 lbs·ft (3-4 N·m)</span></p>	
<ul style="list-style-type: none"> <li>- Replace the secondary air box valve with its gasket and tighten with the prescribed torque.</li> </ul> <p><b>Tightening torques:</b>  Secondary air box valve screw <span style="float: right;">2.2±0.4 lbs·ft (3±0.5 N·m)</span></p>	
<ul style="list-style-type: none"> <li>- Replace the rubber sleeve and the metal pipe connecting the SAS valve to the exhaust.</li> <li>- Check the correct orientation by aligning the two references, on the rubber and on the plastic support, as shown in the figure.</li> </ul>	

- Tighten the two SAS piping screws at the prescribed torque.

**Tightening torques:**

SAS piping screw  $7.4 \pm 8.8 \text{ lbs}\cdot\text{ft}$   
 $(10 \pm 12 \text{ N}\cdot\text{m})$



## 10.9 Checking the Secondary Air Box Valve

- Remove the SAS valve.
- Temporarily install the rubber sleeve at the outlet of the SAS valve ensuring its seal.
- Connect the mityvac vacuum pump to the rubber sleeve as shown in the figure.
- Set the pump onto vacuum mode.
- Open the pump slowly.
- Check that the one-way valve allows the passage of air; this should generate a small vibration.

**Note:** The absence of vibration indicates a poor sealing.

- Switch the pump onto pressure mode.
- Open the pump and check that there is an increase in pressure. Small leaks are normal.

**Note:** The incorrect operation of the one-way valve can cause the overheating of the rubber sleeve and filters.

- Replace in case of faults.

**Specific tools and equipment:**

Mityvac pump 020329Y





### 10.9.1 Checking the One-Way Valve

- Remove the SAS valve.
- Connect the mityvac vacuum pump to cut-off valve vacuum inlet as shown in the figure.
- Set the pump onto vacuum mode.
- Operate the pump until a vacuum pressure of 0.5 bar is reached.
- Check that this value is maintained does not decrease with time.
- If the value is not maintained, proceed by replacing the component.

**Note:** Besides impairing the functionality of the cut-off, an incorrect seal of the cut-off valve membrane affects the engine operation at idle.



- Using a «T» branch and rubber hoses, implement a parallel connection between the rubber sleeve and the vacuum inlet of the cut-off valve.
- Connect the branch to the mityvac pump, as shown in the figure.



- Set the pump in vacuum position.
- Using pliers with flat tips clamp the rubber hose in the proximity of the valve.
- Operate the pump until a vacuum pressure of over 0.5 bar is reached.
- Release the hose and check the valve response.



- In standard operating conditions, the pressure undergoes a drop and then settles.
- A slow and gradual gain of pressure, up to about 0.4 bar, then occurs.
- At this point, the valve opens and vacuum suddenly resets.
- A seal failure or an opening at inconsistent pressure values is not to be considered as acceptable. Replace the component.

**Note:** A seal failure of the cut-off valve causes exhaust noises (explosions in the silencer). A wrong calibration of the cut-off valve can impair the correct functionality of the catalytic converter.

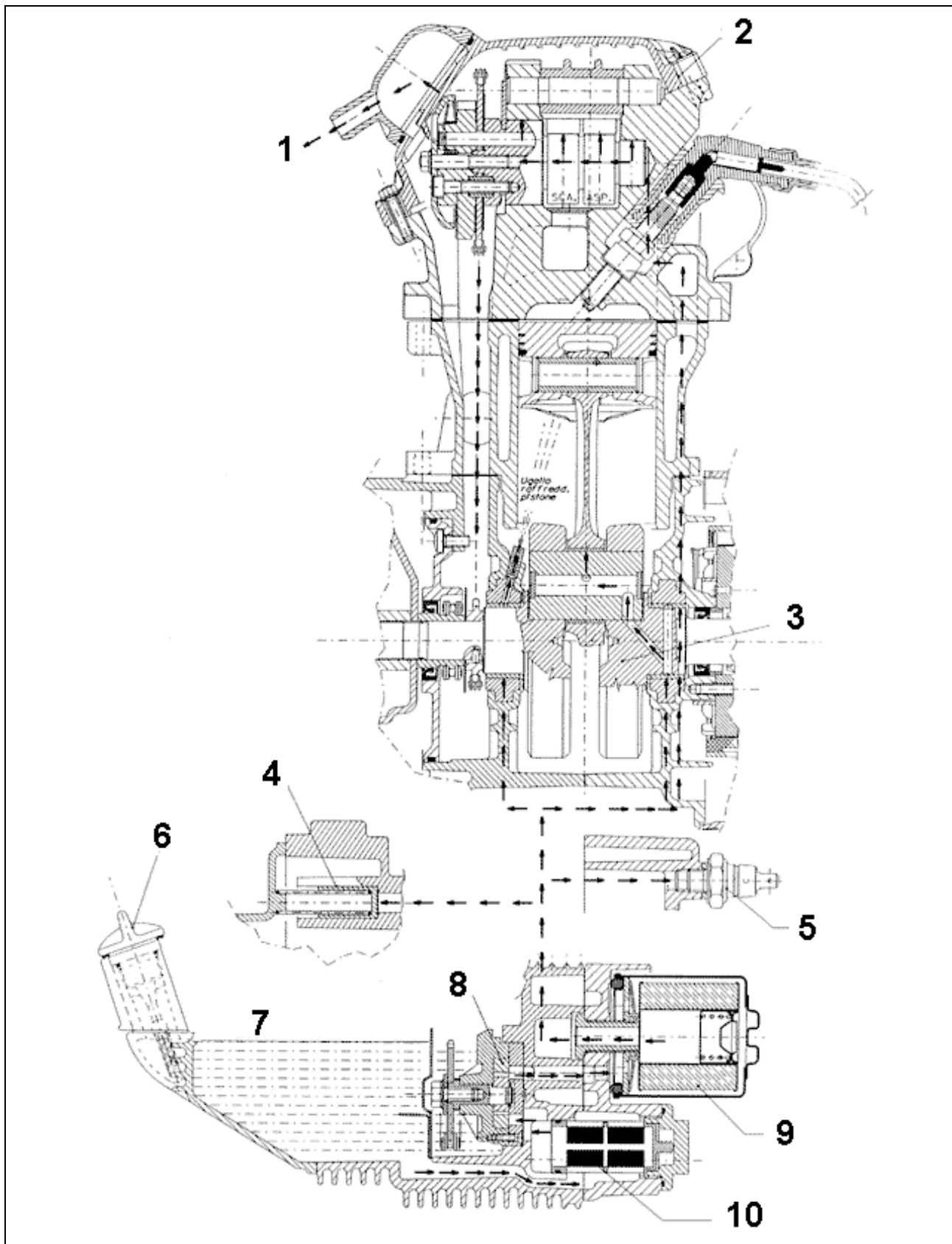
**Specific tools and equipment:**

Mityvac pump

020329Y



## 10.10 Lubrication Circuit



1	Oil vapors to the air filter	6	Oil filler
2	Rocker cover	7	Oil level in sump
3	Crankshaft	8	Oil pump
4	Oil blow-by valve	9	Oil filter cartridge
5	Low oil pressure sensor	10	Net oil filter

### 10.10.1 Checking the Oil Pressure

- After removing the flywheel cover as described in the "Flywheel" chapter (p. 141), detach the electrical connection of the oil low pressure switch and remove the switch.
- With the engine idling at 1,650 rpm and the engine oil at temperature of  $\sim 194^{\circ}\text{F}$  ( $\sim 90^{\circ}\text{C}$ ), check that the oil pressure is in the range 0.5-1.2 atm.
- With the engine running at 6,000 rpm and the engine oil at a temperature of.  $\sim 194^{\circ}\text{F}$  ( $\sim 90^{\circ}\text{C}$ ), check that the oil pressure is in the range 3.2-4.2 atm.
- After completing the check, remove the specific tools fitted to the engine, refit the low oil pressure switch, with its washer, and tighten it with the prescribed torque. Then fit the flywheel cover.
- If abnormal pressures are found, check in the following order, the oil filter, the by-pass, the oil pump and the crankshaft seals.

#### Specific tools and equipment:

Oil pressure gauge	020193Y
Pressure gauge connection	020434Y
Multimeter with temperature probe	020331Y

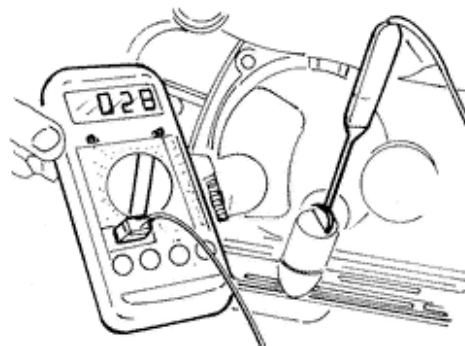
**Note:** Before carrying out the check, ensure that the oil is at the right level and that the oil filter is in good condition.

#### Min. allowable pressure:

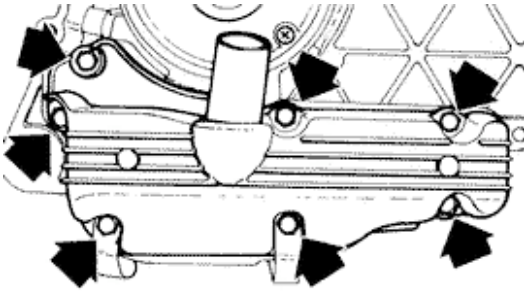
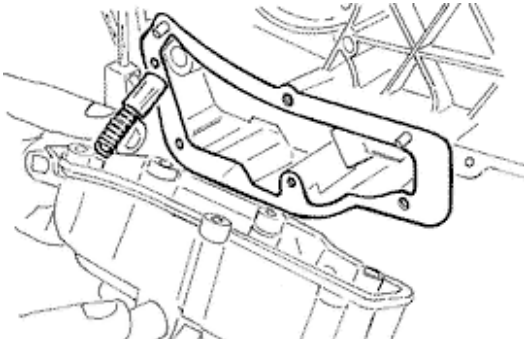
Oil pressure 3.2 atm @ 6,000rpm

#### Tightening torques:

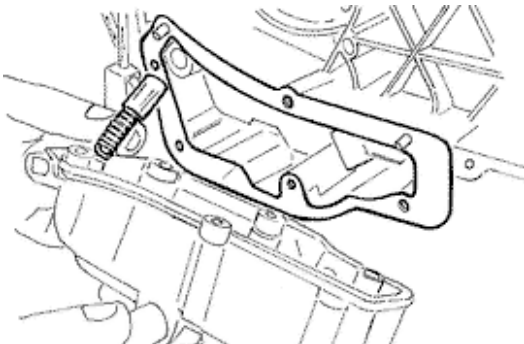
(Also applies to inspection joint) 8.8-10.3 lbs·ft  
(12-14 N·m)



### 10.10.2 Removing the Oil Sump and Pressure Adjusting By-Pass Valve

<ul style="list-style-type: none"><li>- Remove the oil filler cap, the transmission cover, the driving pulley assembly (with belt), and the pinion as described in chapter "Transmission".</li><li>- Drain the oil from the sump as previously described.</li><li>- Remove the seven screws shown in the figure with the two rear brake fluid pipe clamps.</li></ul>	
<ul style="list-style-type: none"><li>- Remove the spring, the by-pass piston, the gasket and the centering dowels shown in the figure.</li></ul>	

### 10.10.3 Checking the By-Pass Valve

<ul style="list-style-type: none"><li>- Check the unloaded length of the spring.</li></ul> <p><b>Standard dimension:</b></p> <table><tr><td>By-pass valve spring length</td><td>2.11 in (54.2 mm)</td></tr></table> <ul style="list-style-type: none"><li>- Check that the piston exhibits no signs of superficial defects.</li><li>- Ensure that it slides freely on the crankcase and that it provides sufficient seal.</li><li>- If not remove any dirt or replace any defective parts.</li></ul>	By-pass valve spring length	2.11 in (54.2 mm)	
By-pass valve spring length	2.11 in (54.2 mm)		

#### 10.10.4 Removing the Oil Pump

- Remove the chain transmission cover and the complete driving pulley assembly.



- Install the base of the specific tool on the oil guard, using the supplied screws.

**Specific equipment and tools:**

Transmission-side oil seal punch

020662Y

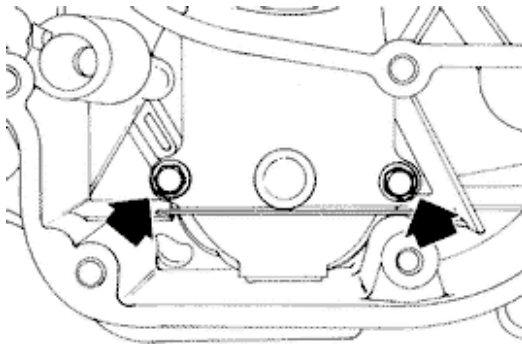


- Screw the threaded bar at the base of the tool and remove the oil seal.

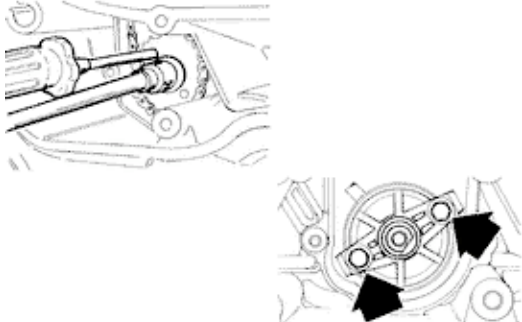


- Remove the pump control rim cover by loosening the two screws shown in the figure.


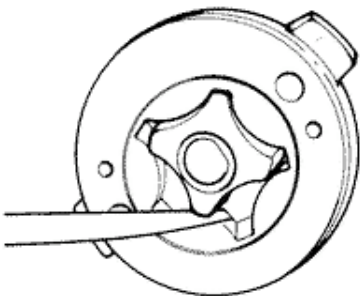
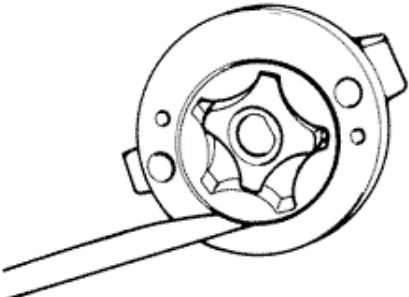
- Hold the oil pump control pulley in place, and thus preventing it from rotating, by inserting a screwdriver through one of the holes.





<ul style="list-style-type: none"> <li>- Remove the central screw with the Belleville washer; see figure.</li> <li>- Remove the chain with its pulley.</li> <li>- Remove the control pinion with the O-ring.</li> <li>- After loosening the two fastening screws, shown in the figure, remove the oil pump.</li> <li>- Remove the seal.</li> </ul>	
<p><b>Note:</b> The chain should be suitably marked in order to ensure that the original direction of rotations is maintained when refitted.</p>	

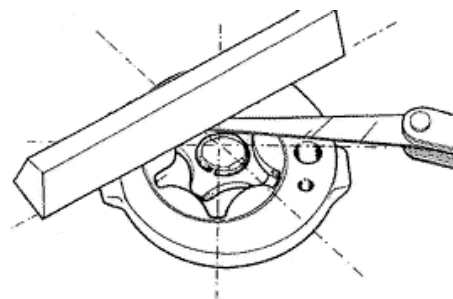
### 10.10.5 Checking the Oil Pump

<ul style="list-style-type: none"> <li>- Remove the two screws and the oil pump cover.</li> <li>- Remove the inner rotor circlip.</li> <li>- Remove the rotors and carefully clean them with gasoline and compressed air.</li> <li>- Reassemble the rotor with the pump body, leaving the reference marks visible. Re-fit the snap ring.</li> </ul>	
<ul style="list-style-type: none"> <li>- Using a thickness gauge check the distance between the rotors in the position shown in the figure.</li> </ul> <p><b>Max. allowable clearance:</b> Rotor clearance 0.0040 in (0.12 mm)</p>	
<ul style="list-style-type: none"> <li>- Measure the distance between the outer rotor and the pump body; see figure.</li> </ul> <p><b>Max. allowable clearance:</b> Rotor-body clearance 0.0078 in (0.20 mm)</p>	

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

**Max. allowable clearance:**

Rotor axial clearance 0.0035 in  
(0.09 mm)



### 10.10.6 Fitting the Oil Pump

- Check that the pump shaft body is not worn.
- Check that the pump cover exhibits no wear or superficial imperfections.
- If any measurement does not comply with the limits previously specified or if any part is scored or worn, replace the part or, if necessary, the assembly.
- Fit the pump cover in a position such to allow the alignment of the holes for the screws fastening the pump to the crankcase.
- Tighten the fastening screws with specified torque.

**Tightening torques:**

Oil pump-crankcase fixing screws 0.51-0.66 lbs·ft  
(0.7-0.9 N·m)

- Ensure that the gasket is correctly positioned and then fit the pump to the crankcase. The pump can only be fitted in one position. Tighten the screws with the prescribed torque.

**Tightening torques:**

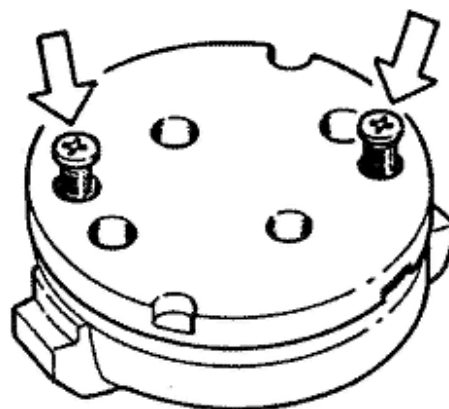
Oil pump fastening screws 3.7-4.4 lbs·ft  
(5-6 N·m)

- Fit the pinion with a new O-ring.
- Fit the chain.
- Fit the pulley, the central screw, and the Belleville washer. Tighten with the prescribed torque.

**Tightening torques:**

Central screw 7.4-10.3 lbs·ft  
(10-14 N·m)

- Fit the pump cover and tighten the two screws





with the prescribed torque.

**Tightening torques:**

Oil pump cover screw 0.5-0.6 lbs·ft  
(0.7-0.9 N·m)

**Note:** Fit the Belleville washer so that its outer rim is in contact with the pulley. Ensure that the pump can rotate freely.

### 10.10.7 Fitting the Chain Cover Oil Seal

- Check that the chain tightening shoe is not worn.
- If so, replace it or fit it the other way round to make it work on the other side.
- Using the specific tools listed below, remove the oil seal.

**Specific tools and equipment:**

Handle 020376Y  
(32×35mm) adapter 020357Y

- Prepare the new oil seal carefully lubricating the sealing lip.

**Warning** – Do not lubricate the surface keyed onto the engine crankcase.

- Pre-assemble the oil seal with the specific tool, by slightly tightening the screws.



- Insert the sheath onto the crankshaft.



- Insert the tool, with the oil seal onto the crankshaft, and make it slide until it is in contact with the crankcase.

**Warning** – Orientate the oil seal by positioning the chain housing channel facing downwards. When the seal is in place, do not pull it back outwards. Failure to comply with this rule can cause a wrong positioning of the oil seal sheath.



- Finally, place the oil seal installing the bracket from the specific tool kit



- Screw the threaded bar onto the crankshaft.



- Using the nut at the base of the tool, position the oil seal at its position.
- Carefully remove all the tooling



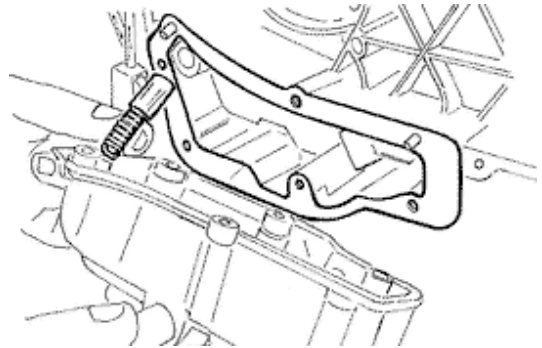
- Place the cover onto the engine crankcase and, by tightening the three screws (with copper washers) with the prescribed torque, fix the cover to its seat.

### Tightening torques:

Chain cover fixing screw	2.6-3.3 lbs·ft (3.5-4.5 N·m)
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### 10.10.8 Fitting the By-Pass and the Oil Sump

- Fit the by-pass piston in its seat.
- Insert the adjusting spring.
- Fit a new sump gasket.
- Fit the two dowel bolts.
- Install the sump taking care to insert the spring into the projection in the sump.
- Fit the screws and the rear brake pipe clamps by following the removing procedure in the reverse order.
- Tighten the screws with the prescribed torque.



### Tightening torques:

Oil sump screws	7.4-10.3 lbs·ft (10-14 N·m)
-----------------	--------------------------------

- Fit the driving pulley assembly, the belt, the pinion and the transmission cover as described in the chapter "Transmission".
- Regarding the checks relating to the lubrication of the connecting rod assembly, refer to the chapter "Crankcase and Crankshaft".

### 10.10.9 Removing the Intake Manifold

- Remove the flywheel cover assembly.
- Loosen the three screws and remove the intake manifold.



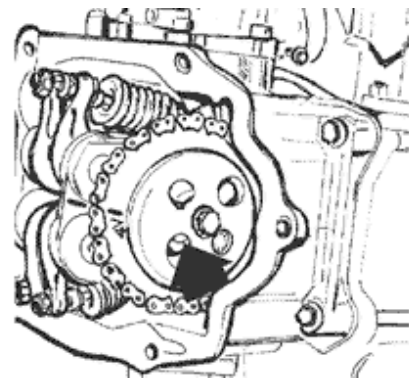
### 10.10.10 Thermostat Removal

- Loosen the two screws shown in the figure and remove the thermostat cover.
- Remove the thermostat and its gasket.



### 10.10.11 Removing the Timing Chain Sprockets

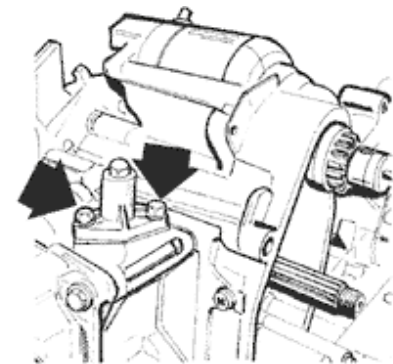
- Before removing the cylinder head, it is necessary to remove all of the following components: transmission cover, driving pulley (and belt), starter Bendix, oil sump with spring and blow-by piston, lower oil pump sprocket cover, O-ring on crankshaft and oil pump sprockets-timing chain disk.
- Remove the rocker cover.

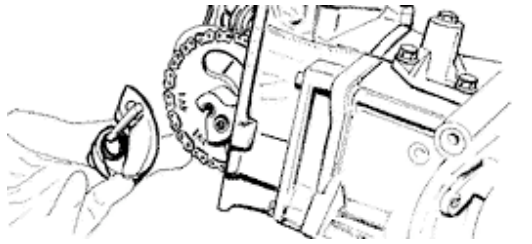
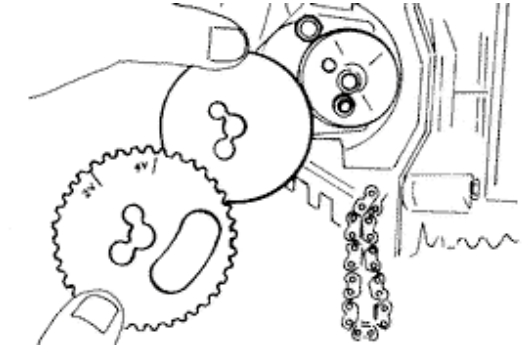
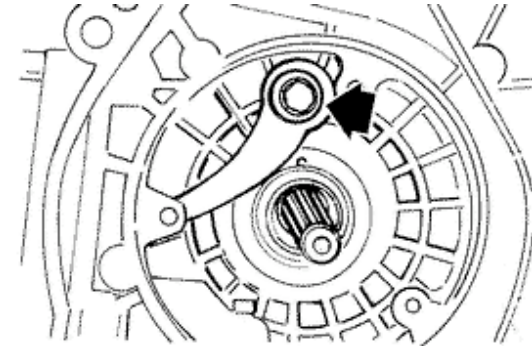


- Remove the central screw fastener and the automatic valve-lifter retaining cover.
- Remove the automatic valve-lifter cam, together with its end-stop ring.

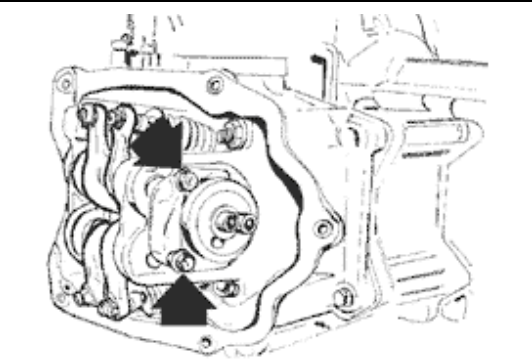


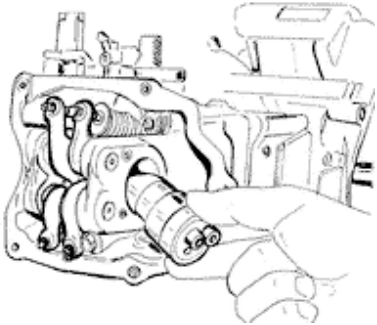
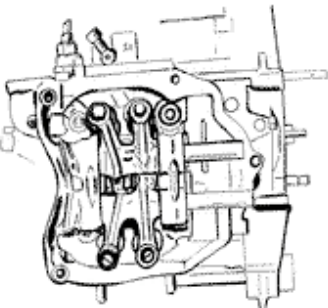
- Loosen the central screw on the chain tensioner.
- Remove the two screw fasteners shown in the figure.



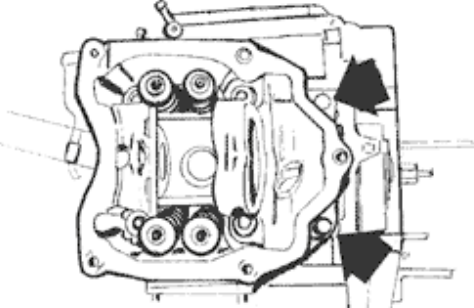
<ul style="list-style-type: none"> <li>- Remove the Allen screw, shown in the figure, and the counterweight.</li> </ul>	
<ul style="list-style-type: none"> <li>- Remove the timing chain sprocket and associated washer from the camshaft.</li> <li>- Remove the timing chain drive sprocket from the camshaft.</li> </ul>	
<ul style="list-style-type: none"> <li>- Remove the screw fastener indicated by the arrow in the figure, the stator and the chain guide.</li> </ul> <p><b>Note:</b> Mark the chain in order to replace it with the same direction of rotation. The chain tensioning pad must be removed from the transmission side. The chain guide can only be removed following the removal of the cylinder head.</p>	

#### 10.10.12 Removing the Camshaft and Rockers

<ul style="list-style-type: none"> <li>- Remove the two screw fasteners and the camshaft retainer shown in the figure.</li> </ul>	
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<ul style="list-style-type: none"> <li>- Remove the camshaft.</li> </ul>	
<ul style="list-style-type: none"> <li>- Remove the rocker pin by pushing it through from the flywheel side.</li> <li>- Remove the rockers, together with their spring washers.</li> </ul> <p><b>Note:</b> Mark the position of the rockers in order to prevent the reversal of the inlet and outlet rockers on reassembly.</p>	

### 10.10.13 Removing the Cylinder Head

<ul style="list-style-type: none"> <li>- Remove the spark plug.</li> <li>- Remove the two screw fasteners on the outside of the cylinder head, shown in the figure.</li> <li>- Loosen the four cylinder head securing nuts in two or three stages, following a diagonal crosswise sequence.</li> <li>- Remove the cylinder head, the two locating dowels and the cylinder head gasket.</li> </ul> <p><b>Note:</b> If necessary, the cylinder head can be removed as a complete assembly, together with camshaft, rocker pin and camshaft support. Furthermore, the cylinder head can be removed without completely removing the timing chain, together with the tensioner.</p>	
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### 10.10.14 Removing the Valves

- Using the appropriate special tool, fitted with the adapter shown in the figure, remove the split cones, the valve spring retainer caps, the valve springs and the valves themselves.

**Special tools and equipment:**

Valve removing tool 020382Y

Adapter 020382/11Y

**Warning** – Place the valves so as to recognize their original position on the head.



- Remove the valve seals with the appropriate special tool.

**Special tools and equipment:**

Oil seals removing tool 020431Y

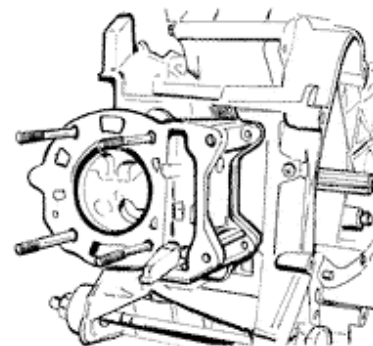
- Remove the spring seats.



### 10.10.15 Removing the Cylinder and Piston Assembly

- Remove the chain guide.
- Remove the cylinder base gasket.

**Warning** – Ensure the piston is well-supported whilst removing the cylinder, in order to avoid damaging it.



- Remove the two wrist pin spring clips, the wrist pin and the piston.
- Remove the piston rings.

**Note:** Take care to avoid damaging the piston rings whilst removing them.



#### 10.10.16 Inspecting the Small End

- Measure the internal diameter of the small end using an internal micrometer.

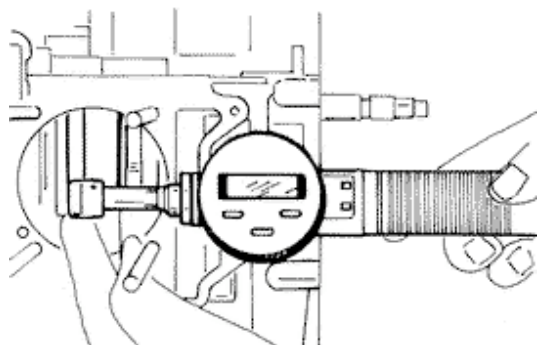
**Standard dimension:**

Small end diameter  $\varnothing$  0.5911-0.5915 in  
(15.015-15.025 mm)

**Max. allowable dimension:**

Small end diameter  $\varnothing$  0.5917 in  
(15.030 mm)

**Note:** Whenever the small end exceeds the wear limit, or shows signs of wear or overheating, replace the crankshaft with a new one, as described in the following pages.





### 10.10.17 Inspecting the Wrist Pin Diameter

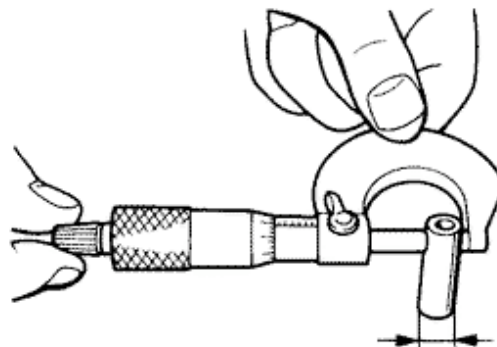
- Measure the external diameter of the wrist pin.

**Standard dimension:**

Wrist pin diameter  $\varnothing$  0.5904-0.5906 in  
(14.996-15.000 mm)

**Min. allowable diameter:**

Wrist pin diameter  $\varnothing$  0.5903 in  
(14.994 mm)

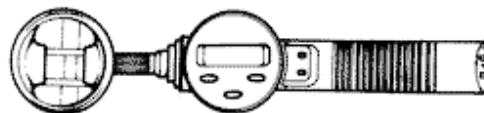


- Estimate the clearance between the wrist pin and piston.

**Standard clearance:**

Piston/wrist pin 0.00003-0.00025 in  
(0.001-0.010 mm)

**Note:** The wrist pin housing has two lubrication channels so, in order to get a true reading of the internal diameter, the measurement must be taken parallel to the axis of the piston.



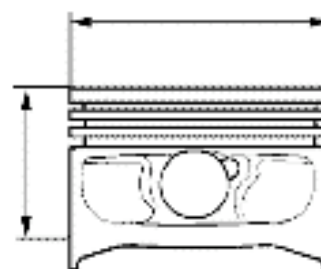
### 10.10.18 Inspecting the Piston and Cylinder Diameters

- Measure the outside diameter of the piston, perpendicular to the wrist pin axis.
- Take this measurement 0.197 in (5 mm) from the base of the piston, as shown in the figure.

**Standard diameter:**

Piston diameter  $\varnothing$  2.8328-2.8339 in  
(71.953-71.981 mm)

**Note:** The wrist pin housing has two lubrication channels so, in order to get a true reading of the internal diameter, the measurement must be taken parallel to the axis of the piston.



200 cc

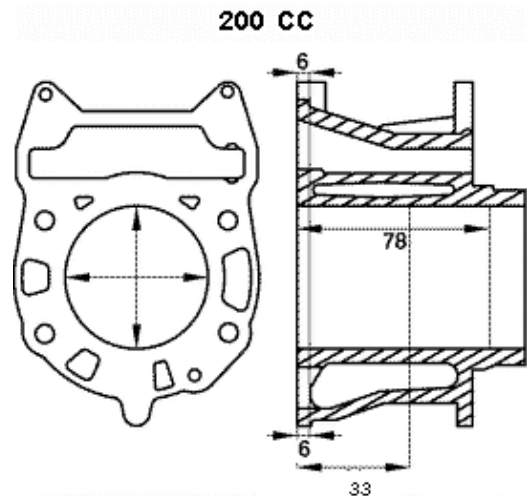
- Using a bore measuring instrument, measure the cylinder bore, in different directions and at different heights, as shown in the figure.

- Check that there is no wear or deformation on the surface of the cylinder that mates with the cylinder head.

**Max. allowable out-of-plane:**

Cylinder/cylinder head 0.0020 in  
(0.050 mm)

- Pistons and cylinders are classified according to the diameter. Pistons should be matched with cylinders of the same classification (A-A, B-B, C-C, D-D).

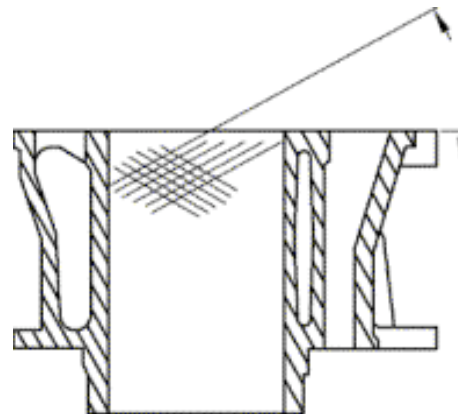


- Cylinder re-bores must be carried out respecting the original matching angle on the bored surface of the cylinder.

- The surface roughness of the bored surface of the cylinder should be 0.00004 in (0.9  $\mu$ m).

- This is imperative to ensure proper bedding-in of the piston rings, and hence reduced oil consumption and optimum performance.

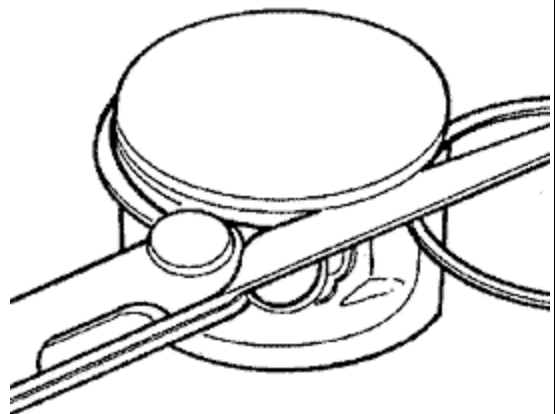
- 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> over-size pistons are available as spare parts, for re-bored cylinders, corresponding to 0.2, 0.4 and 0.6 mm over-sizes, respectively. There are four categories for matching oversize cylinders (A-A, B-B, C-C, D-D).



### 10.10.19 Inspecting the Piston

- Clean the piston ring grooves thoroughly.
- Measure the clearance between piston rings and the grooves using feeler gauges, as shown in the figure.
- If the clearances exceed the limits specified in the table below, the piston should be replaced by a new one.

**Note:** Measure the clearance by inserting the thickness gauge in the second groove.



	Standard Clearance	Wear limit: max. clearance
Top ring	0.0006-0.0024 in (0.015-0.060 mm)	0.0028 in (0.070 mm)
Middle ring	0.0006-0.0024 in (0.015-0.060 mm)	0.0028 in (0.070 mm)
Oil scraper ring	0.0006-0.0024 in (0.015-0.060 mm)	0.0028 in (0.070 mm)

### 10.10.20 Checking the Piston Ring Gap

- Insert each of the three piston rings in turn, in a part of the cylinder that still maintains its original diameter, making sure they are square to the axis of the cylinder.
- Measure the piston ring gap using feeler gauges.
- Replace piston rings exhibiting a gap exceeding the specified limit.

**Note:** Before replacing the piston rings alone, on the original piston, check the piston ring to groove clearance and the piston to cylinder clearances are within the specified limits. The new rings may sit differently than the old ones, which had bedded-in, when fitted on a used cylinder.



	Standard gap	Maximum gap
Top ring	0.0059-0.0118 in (0.15-0.30 mm)	0.0157 in (0.040 mm)
Middle ring	0.0078-0.0157 in (0.20-0.40 mm)	0.0197 in (0.50 mm)
Oil scraper ring	0.0078-0.0157 in (0.20-0.40 mm)	0.0197 in (0.50 mm)

### 10.10.21 Fitting the Piston

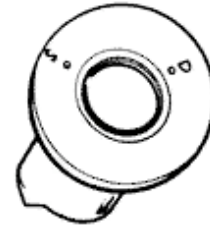
- Assemble the piston and wrist pin onto the connecting rod, with the arrow in the piston crown pointing towards the exhaust port.
- Insert the wrist pin spring clips, using the appropriate special three-part tool, as described below. With the opening in the position shown on the tool.

**Specific tools and equipment:**

Pin retainer installer 020488Y

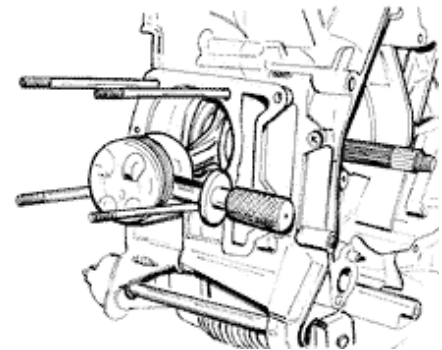
**Note:** The letter 'S' stamped onto the tool stands for left, while the letter 'D' stands for right.

**Note:** The tool must be used exclusively by hand.



- Place the circlip on the hollow tool, with the opening over the arrow stamped on the tool. Insert the longer of the two drifts into the hollow part of the tool and push home, to the circlip into the correct position on the hollow tool.
- Insert the shorter of the two drifts into the hollow part of the tool, offer up the couple to the circlip groove and push the shorter drift home, to push the circlip into its groove on the piston.

**Warning** – Using a mallet to fit the circlip can damage the circlip grooves.



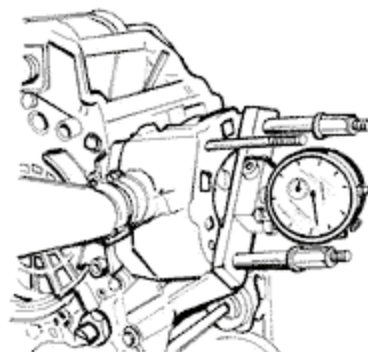
### 10.10.22 Choosing the Base Gasket Thickness

- Fit the cylinder without the base gasket.
- Fit a dial gauge to the appropriate special tool.

**Specific tools and equipment:**

Piston positioning support 020428Y

- Rest the dial gauge and support on a datum surface and take an arbitrary zero reading.
- Place the bracket, together with the dial gauge, on top of the cylinder, fastening it with two nuts to the studs (use a tightening torque not superior to 8.1 lbs·ft (11 N·m)).
- Rotate the crankshaft to the TDC, by acting onto the flywheel.



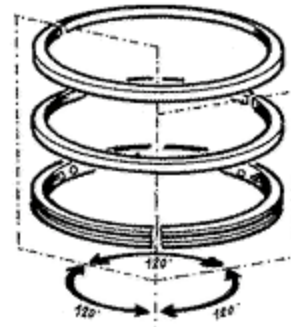
<ul style="list-style-type: none"> <li>- Choose the base gasket thickness according to the difference between the two dial gauge readings obtained, referring to the table below. Choosing the correct base gasket thickness will give the correct compression ratio.</li> <li>- Remove the dial gauge and support from the cylinder.</li> </ul> <p><b>Warning</b> – Using a mallet to fit the circlip can damage the circlip grooves.</p>	
<b>With fiber gasket</b> (thickness 0.0433 in (1.1 mm))	
Measured recess	Gasket thickness
0.0197-0.0236 in (0.5-0.6 mm)	0.0157±0.0020 in (0.4±0.05 mm)
0.0236-0.0315 in (0.6-0.8 mm)	0.0236±0.0020 in (0.6±0.05 mm)
0.0315-0.0354 in (0.8-0.9 mm)	0.0315±0.0020 in (0.8±0.05 mm)
<b>With metal gasket</b> (thickness 0.0118 in (0.3 mm))	
Measured recess	Gasket thickness
- 0.0118 - -0.0078 in (- 0.3 - - 0.2 mm)	0.0157±0.0020 in (0.4±0.05 mm)
- 0.0078 - 0.000 in (- 0.2 - 0.0 mm)	0.0236±0.0020 in (0.6±0.05 mm)
0.0000 - +0.0039 in (0.0 - +0.1 mm)	0.0315±0.0020 in (0.8±0.05 mm)

### 10.10.23 Fitting the Piston Rings

- Place the oil scraper ring spring on the piston.
- Install the scraper ring keeping the opening opposed to the spring junction and with the word "TOP" facing upwards. In any case, the chamfering must be arranged towards the piston.
- Fit the middle piston ring with the identification letter facing the crown of the piston. The tapered side of the middle piston ring should always be facing the crown of the piston.
- The top piston ring with the word "TOP" or the reference mark facing the crown of the piston.

**Note:** In order to improve the bedding in of the rings, the surfaces on the top two piston rings are angled to give a conical section of contact.

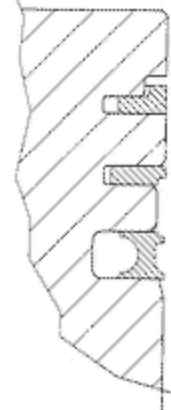
**Note:** Offset the piston ring gaps on the three rings by 120° to each other, and lubricate the components with engine oil.



125 cc.



200 cc.



### 10.10.24 Fitting the Cylinder

- Fit the base gasket of the chosen thickness, previously determined.
- Using the fork support and the piston ring retaining band. Install the cylinder as shown in the figure.

**Specific tools and equipment:**

Piston fitting fork	020426Y
Piston ring retaining band	020393Y



**Note:** Before installing the cylinder blow out the lubrication ducts thoroughly and lubricate the bore of the cylinder with engine oil.

**Warning** – Always use a new base gasket.

### 10.10.25 Inspecting the Cylinder Head

- Using a bar with a ground flat surface, check the surface of the cylinder head that mates with the cylinder is not worn.

**Max. allowable out-of-plane:** 0.0020 in  
(0.050 mm)

- Inspect the working surfaces of the camshaft and the rocker pin for signs of wear.
- Inspect the flat surfaces on the cylinder head cover, the inlet manifold and the exhaust manifold.



Hole	Standard diameter
A	0.4724-0.4731 in (12.000–12.018 mm)
B	0.7874-0.7882 in (20.000–20.021 mm)
C	1.4567-1.4577 in (37.000–37.025 mm)



### 10.10.26 Checking the Valve Seals

- Measure the width of the sealing surfaces on the valve heads.

**Standard dimension:**  
Valve sealing width (intake) 0.0390 in  
(0.99 mm)

**Standard dimension:**  
Valve sealing width (exhaust) 0.0500 in  
(1.27 mm)

**Max. allowable dimension:**  
Valve sealing width (intake) 0.0630 in  
(1.60 mm)

**Max. allowable dimension:**  
Valve sealing width (exhaust) 0.0630 in  
(1.60 mm)



- If the valve sealing surface is wider than the prescribed limit, interrupted in one or more points, or bent, replace the valve.

**Warning** – Do not change the valve assembly position.

### 10.10.27 Inspecting the Valve Seats

- Clean any carbon build-up from the valve guides.
- Measure the internal diameter of each valve guide.
- Take the above measurement at three different heights, according to the direction of the thrust of the valves.

**Standard dimension:**

Valve seat diameter (intake)  $\varnothing$  0.1969-0.1973 in  
(5.000-5.012 mm)

**Standard dimension:**

Valve seat diameter (exhaust)  $\varnothing$  0.1969-0.1973 in  
(5.000-5.012 mm)

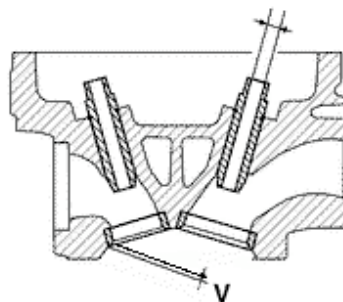
**Max. allowable dimension:**

Valve seat diameter (intake)  $\varnothing$  0.1977 in  
(5.022 mm)

**Max. allowable dimension:**

Valve seat diameter (exhaust)  $\varnothing$  0.1977 in  
(5.022 mm)

- Check the width of the wear on the valve seat (indicate by "V" in the figure) does not exceed a width of 0.063 in (1.6 mm). If the wear exceeds this limit, replace the cylinder head with a new one.



### 10.10.28 Inspecting the Valves

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

**Standard dimension:**

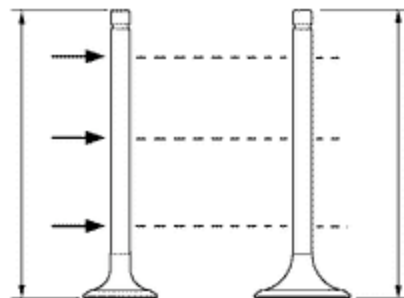
Valve stem diameter (intake)  $\varnothing$  0.1957-0.1963 in  
(4.972-4.987 mm)

**Standard dimension:**

Valve stem diameter (exhaust)  $\varnothing$  0.1953-0.1959 in  
(4.960-4.975 mm)

**Min. allowable dimension:**

Valve stem diameter (intake)  $\varnothing$  0.1953 in  
(4.960 mm)

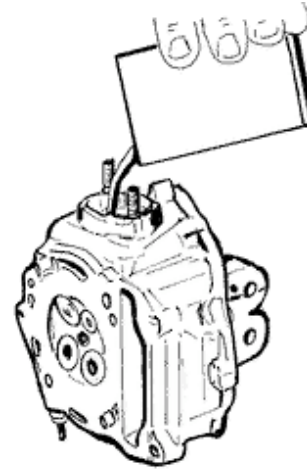




<p>(4.960 mm)</p> <p><b>Min. allowable dimension:</b> Valve stem diameter (exhaust)      <math>\varnothing</math> 0.1949 in (4.950 mm)</p> <p>- Estimate the clearance between valve stem and valve guide.</p> <p><b>Standard clearance:</b> Valve stem-guide (intake)      0.0005 -0.0016 in (0.013-0.040 mm)</p> <p><b>Standard clearance:</b> Valve stem-guide (exhaust)      0.0010-0.0020 in (0.025-0.052 mm)</p> <p><b>Max. allowable clearance:</b> Valve stem-guide (intake)      0.0024 in (0.062 mm)</p> <p><b>Max. allowable clearance:</b> Valve stem-guide (exhaust)      0.0028 in (0.072 mm)</p>	
<p>- Check the wear on the surfaces on the ends of the valve stems, in contact with the tappets, is not excessive.</p> <p>- Measure the length of the valve.</p> <p><b>Standard dimension:</b> Valve length (intake)      3.724 in (94.6 mm)</p> <p><b>Standard dimension:</b> Valve length (exhaust)      3.717 in (94.4 mm)</p> <p>- If any of the sealing surface of the valve does not conform to the specified wear limits, or is damaged or curved, replace the valve with a new one.</p>	<div data-bbox="966 861 1380 1123"> </div> <p>1 = YES 2 = NO</p>
<p>- It is advisable to grind the valve seats, which should be done using a fine grade grinding paste. During the grinding operation hold the cylinder in such a position as to keep the valve axis horizontal. This will avoid grinding paste residues penetrating the seal between the valve guide and stem; see figure.</p> <p><b>Warning</b> – In order to avoid scoring the sealing surfaces, do not continue rotating the valve after the grinding paste has run out. Thoroughly clean the cylinder head and valves with a suitable product according to the grinding paste used.</p> <p><b>Note:</b> Do not change the valve assembly position.</p>	

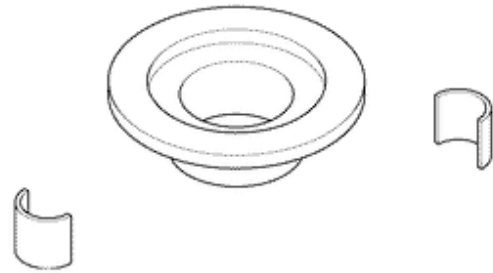
### 10.10.29 Testing the Valve Seals

- Fit each of the valves, alternatively, into the head.
- For each valve, fill the appropriate manifold chamber with fuel and check that no petrol leaks out, whilst holding the valve shut with just the force of a finger.



### 10.10.30 Checking the Valve Spring Plates and Half-cones

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



### 10.10.31 Fitting the Valves

- Lubricate the valve guides with engine oil.
- Place the valve spring seats on the cylinder head.
- Using the special drift fit the four valve seals.

**Specific tools and equipment:**

Oil seals installing punch

020306Y



- Fit the valves, the springs and the spring retaining caps. Using the appropriate special tool and adapter, compress the spring and insert the split cones in their seats.

**Specific tools and equipment:**

Valve installation tool

020382Y

Adapter

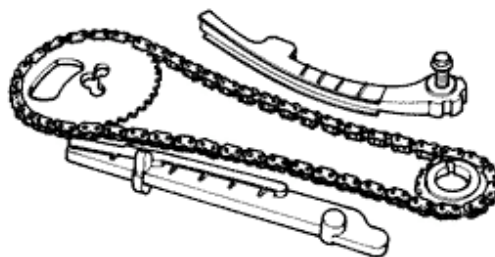
020382/11Y

**Note:** Do not change the valve assembly position. Fit the valves with the reference color on the half-cones side.

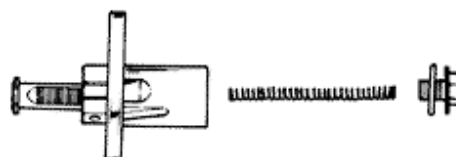


### 10.10.32 Inspecting the Timing Components

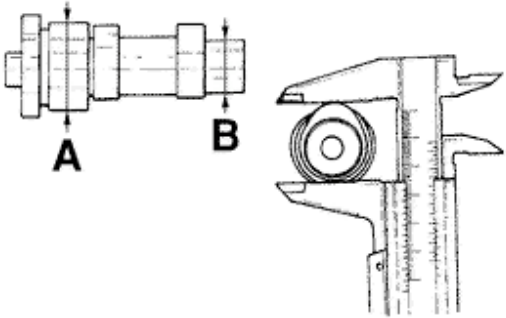
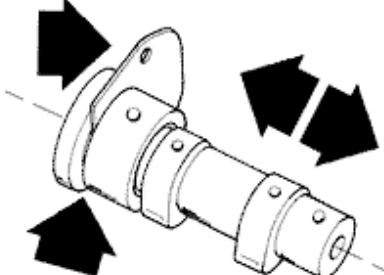
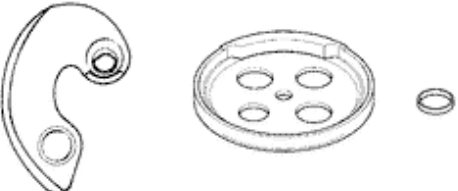
- Inspect the chain guide and the chain tensioner for signs of excessive wear.
- Check there is not excessive wear on the timing chain, the camshaft sprocket and the timing chain sprocket on the crankshaft.
- Replace worn components, as necessary, and in the case of wear on the timing chain or sprockets, replace all three components as a group.



- Remove the chain tensioning screw with the associated washer and spring. Check there is no wear on the one-way valve mechanism.
- Check the tensioning is in good condition.
- If any of the chain tensioner components is defective, replace the complete chain tensioner assembly with a new one.



### 10.10.33 Inspecting the Camshaft

<ul style="list-style-type: none"> <li>- Inspect the camshaft for signs of abnormal wear on the cams.</li> <li>- Measure the diameter of the two bearing surfaces ("A" and "B" in the figure) and the height of the height of the intake and exhaust cams.</li> </ul> <p><b>Standard dimension:</b> Diameter (A) <math>\varnothing</math> 1.4547-1.4557 in (36.950-36.975 mm)</p> <p><b>Standard dimension:</b> Diameter (B) <math>\varnothing</math> 0.7858-0.7866 in (19.959-19.980 mm)</p> <p><b>Min. allowable dimension:</b> Dimension (A) <math>\varnothing</math> 1.4543 in (36.940 mm)</p> <p><b>Min. allowable dimension:</b> Diameter (B) <math>\varnothing</math> 0.7854 in (19.950 mm)</p> <p><b>Standard dimension:</b> Cam height (intake) 1.1923in (30.285 mm)</p> <p><b>Standard dimension:</b> Cam height (exhaust) 1.1500 in (29.209 mm)</p>	
<ul style="list-style-type: none"> <li>- Check there is no wear on the camshaft retaining plate and its associated groove on the camshaft.</li> </ul> <p><b>Max. allowable clearance:</b> Camshaft retaining plate 0.020 in (0.42 mm)</p> <ul style="list-style-type: none"> <li>- If any of the above dimensions are outside the specified limits, or there are signs of excessive wear, replace the defective components with new ones.</li> </ul>	
<ul style="list-style-type: none"> <li>- Check there are no signs of wear on the automatic valve-lifter cam, or the end-stop ring, or the rubber buffer on the automatic valve-lifter retaining cover.</li> <li>- Check the automatic valve-lifter return spring is not reformed by over-stretching.</li> <li>- Replace any defective or worn components.</li> </ul>	

- Check the rocker pin for excessive wear or scoring.

**Standard dimension:**

Rocker pin diameter  $\varnothing$  0.4715-0.4719 in  
(11.977-11.985 mm)

- Measure the internal diameter of both rockers.

**Standard dimension:**

Rocker diameter  $\varnothing$  0.4724-0.4729 in  
(12.000-12.011 mm)

- Check there are no signs of wear on the cam followers or the tappets.
- Check there are no signs of wear on the spring washers that can take up the axial play between the rockers. Replace any defective components with the new ones.

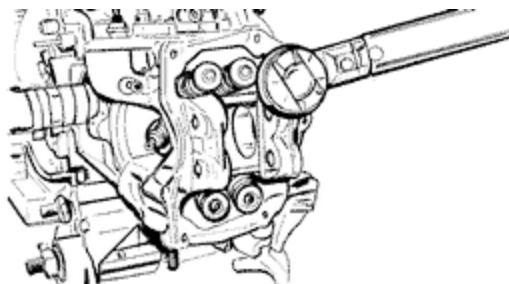


### 10.10.34 Fitting the Cylinder Head

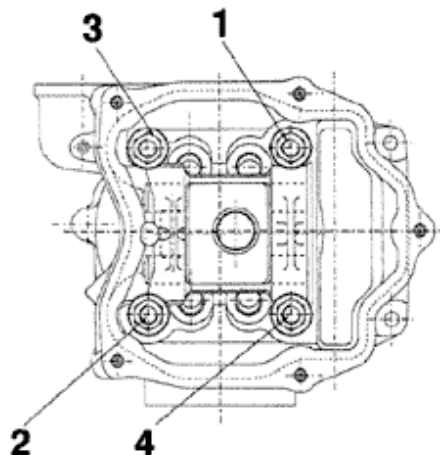
- Fit the timing chain guide.
- Insert the centering dowels between head and cylinder. Install the head gasket and then place the head onto the cylinder.
- Lubricate the stud threading.
- Fit the cylinder head nut fasteners and tighten them in a crosswise sequence, in two or three stages, to the specified tightening torque.

**Tightening torque:**

Cylinder head nuts 4.4-5.9lbs·ft+180°  
(preliminary) (6-8 N·m+180°)



- Tighten the nuts by following the sequence shown in figure.



- Fit the two screw fasteners on the outside of the timing chain side of the cylinder head and tighten them to the specified tightening torque.

**Tightening torque:**

Timing side screws 8.1-9.6 lbs·ft  
(11-13 N·m)

**Note:** Before fitting the cylinder head, check the lubricating channels are clean, using compressed air, if necessary, to remove any residues.



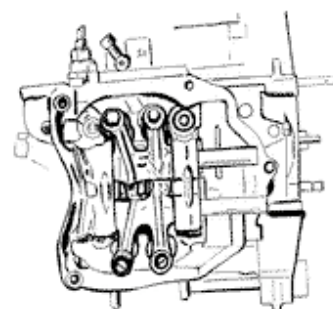
### 10.10.35 Fitting the Timing Components

- Fit the lower timing chain sprocket on the crankshaft, with the chamfer innermost.
- Loop the timing chain around the sprocket on the crankshaft.
- Fit the chain tensioner guide to the cylinder head.
- Fit the spacer and the fastening screw, and tighten the screw at the prescribed torque.

**Tightening torque:**

Tensioner screw 7.4-10.3 lbs·ft  
(10-14 N·m)

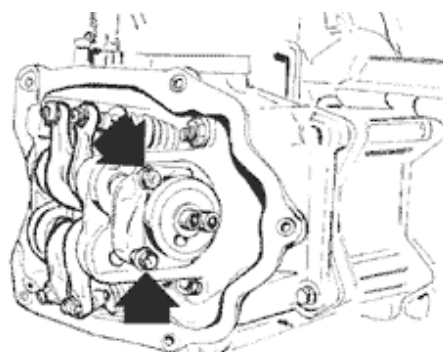
- Fit the rocker pin, the exhaust rocker, the spring washer and the inlet washer.
- Lubricate the rockers via the holes on top.
- Lubricate the cam surfaces and insert the camshaft in the support, making sure the cams correspond to the rockers.

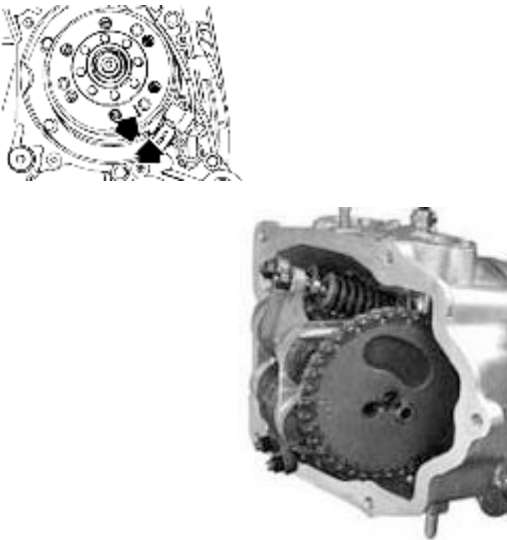

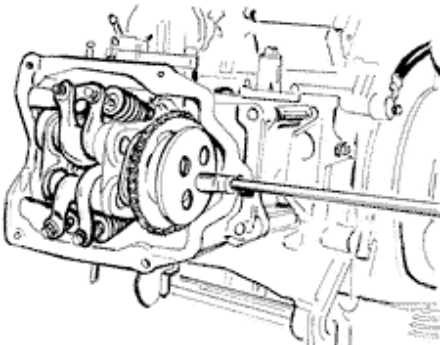



- Fit the camshaft retaining plate and fit the two screw fasteners, shown in the figure, to the specified torque.


**Tightening torque:**

Camshaft retaining screws 3.0-4.4 lbs·ft  
(4-6 N·m)



<ul style="list-style-type: none"> <li>- Fit the spacer on the camshaft.</li> <li>- Rotate the engine so that piston is at TDC, using the reference marks on the flywheel and the crankcase.</li> <li>- Holding the engine in this position, loop the chain over the camshaft timing chain sprocket, making sure the reference mark "4V" on the sprocket corresponds to the reference mark machined on the cylinder head.</li> <li>- Fit the pulley on the camshaft.</li> <li>- Fit the counterweight and tighten the screw to the specified tightening torque.</li> </ul> <p><b>Tightening torque:</b> Counterweight screw</p>	 <p>The top part of the image is a technical diagram showing the camshaft timing chain sprocket and its alignment with the cylinder head. The bottom part is a photograph of the same assembly, showing the sprocket and the timing chain being installed.</p>
<ul style="list-style-type: none"> <li>- Fit the end-stop ring on the automatic valve-lifter cam and fit the automatic valve-lifter cam to the camshaft.</li> </ul> <p><b>Note:</b> Lubricate the end-stop ring with grease, in order to avoid it from coming loose accidentally and falling inside the engine.</p> <ul style="list-style-type: none"> <li>- Fit the automatic valve-lifter return spring, pre-loading it by a 180° rotation.</li> </ul>	 <p>A close-up photograph showing the automatic valve-lifter cam and the end-stop ring being fitted onto the camshaft.</p>
<ul style="list-style-type: none"> <li>- Fit the automatic valve-lifter retaining dish, using the counterweight fastening screw as a reference.</li> <li>- Tighten the screw to the specified tightening torque.</li> </ul> <p><b>Tightening torque:</b> Retaining dish screw</p>	 <p>A technical diagram showing the automatic valve-lifter retaining dish being fitted onto the camshaft, with the counterweight fastening screw used as a reference point.</p>
<ul style="list-style-type: none"> <li>- With the tensioning screw screwed right out, fit the chain tensioner on the cylinder, using a new gasket, and tight the two screws to the specified torque.</li> </ul> <p><b>Tightening torque:</b> Tensioner screw</p> <ul style="list-style-type: none"> <li>- Insert the chain tensioning screw, together with the spring and washer, tightening it to the specified tightening torque.</li> </ul>	 <p>A technical diagram showing the chain tensioner being fitted onto the cylinder, with the tensioning screw, spring, and washer being inserted and tightened.</p>



<p><b>Tightening torque:</b> Tensioner cap 3.7-4.4 lbs·ft (5-6 N·m)</p> <ul style="list-style-type: none"> <li>- Adjust the valve clearances according to the instructions given in the previous chapters.</li> <li>- Fit the spark-plug.</li> </ul> <p><b>Tightening torque:</b> Spark plug 8.9-10.3 lbs·ft (12-14 N·m)</p> <p><b>Recommended spark plug:</b> Champion RG 6YC</p>	
<ul style="list-style-type: none"> <li>- Fit the rocker cover gasket. The projections on the timing chain side provide a reference for its orientation.</li> <li>- Fit the head cover and tighten the five screws at the prescribed torque. Check the proper position of the gasket.</li> </ul> <p><b>Tightening torque:</b> Rocker cover screw 4.4-5.1 lbs·ft (6-7 N·m)</p> <ul style="list-style-type: none"> <li>- Fit the flywheel cover as already described in the "Flywheel" chapter.</li> <li>- Fit the oil pump drive, the oil pump cover, the oil blow-by valve and the sump (see "Lubrication" chapter).</li> <li>- Fit the driving pulley, the drive belt and the transmission cover (see "Transmission").</li> </ul>	



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### 10.10.36 Fitting the Thermostat

- Place the thermostat with the drainage hole in the highest point.
- Check that the rubber gasket is properly positioned.
- Install the thermostat cover with the carburetor heating connection facing the flywheel.
- Tighten the two screws at the prescribed torque.

**Tightening torque:**

Thermostat screw	2.1-2.8 lbs·ft (3-4 N·m)
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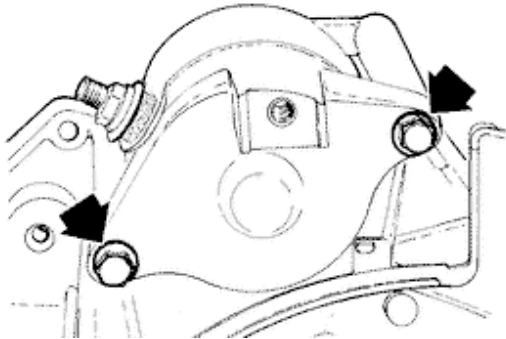
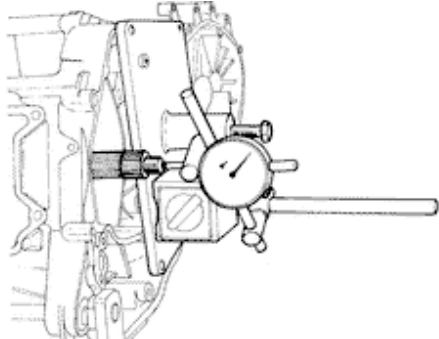
### 10.10.37 Fitting the Intake Manifold

- Install the intake manifold and tighten the three fastening screws.



## 10.11 Crankshaft

### 10.11.1 Preparing the Engine for Crankcase Separation

<ul style="list-style-type: none"><li>- Following the instructions previously described, remove the following components/assemblies:  Transmission cover, driving pulley, drive belt, driven pulley, reduction gearbox cover, gears bearings and oil seals ("Transmission" chapter).  Oil sump, oil blow-by valve, oil pump and cover ("Lubrication" chapter).  Flywheel cover, water pump, flywheel and stator ("Flywheel" chapter).</li><li>- Remove the oil filter and the oil low pressure sender.</li><li>- Remove the cylinder-head and cylinder-piston assembly (see the previous chapter).</li><li>- Remove the two screws shown in the figure and the starter motor.</li></ul>	 A technical line drawing of an engine block. Two black arrows point to specific screws on the side of the block, indicating where they should be removed.						
<ul style="list-style-type: none"><li>- Before separating the crankcase halves, it is worthwhile to measure the end-float on the crankshaft. Use a dial gauge and support attached to the crankcase separating plate.</li></ul> <p><b>Recommended tools and equipment:</b></p> <table><tr><td>Crankcase detachment plate</td><td>020262Y</td></tr><tr><td>Dial gauge with magnetic base</td><td>020335Y</td></tr></table> <p><b>Standard clearance:</b></p> <table><tr><td>Crankshaft</td><td>0.0059-0.0157 in (0.15-0.40 mm)</td></tr></table>	Crankcase detachment plate	020262Y	Dial gauge with magnetic base	020335Y	Crankshaft	0.0059-0.0157 in (0.15-0.40 mm)	 A technical line drawing showing a dial gauge with a magnetic base. The gauge is positioned to measure the end-float of a crankshaft. The dial face is visible, and the gauge is mounted on a support structure.
Crankcase detachment plate	020262Y						
Dial gauge with magnetic base	020335Y						
Crankshaft	0.0059-0.0157 in (0.15-0.40 mm)						

### 10.11.2 Separating the Crankcase Halves

- Remove the eleven screw fasteners securing the crankcase halves together.
- Separate the crankcase halves, taking care to leave the crankshaft supported by one of the two halves.

**Warning** – Failing to observe this rule can lead to damage of the crankshaft.

- Remove the crankshaft from whichever crankcase half it sits, following separation of the crankcase halves.

**Warning** – During separation of the crankcase halves and removal of the crankshaft, take care that the threaded ends of the crankshaft do not damage the main bearings.

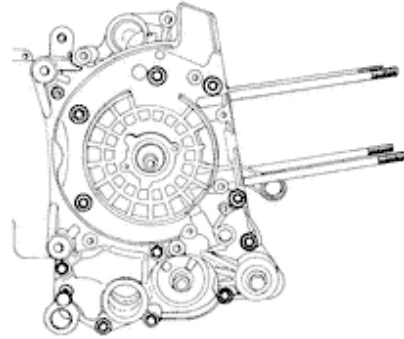
**Note:** The crankshaft is installed with two steel shim adjusting washers. Make a note of the fitting position.

**Recommended tools and equipment:**

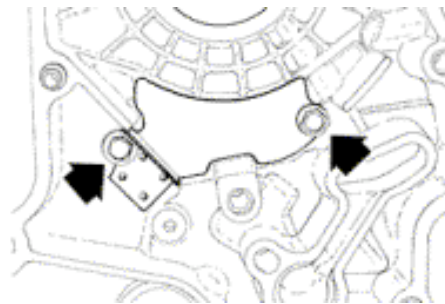
Crankcase detachment plate 020262Y  
Dial gauge with magnetic base 020335Y

**Standard clearance:**

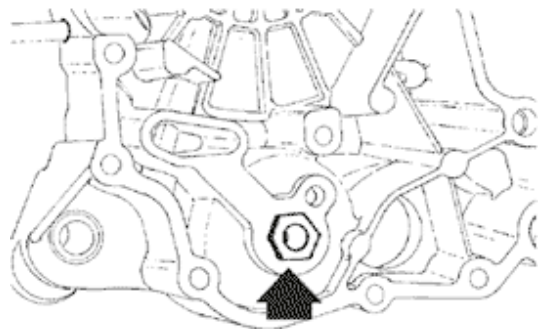
Crankcase 0.0059-0.0157 in  
(0.15-0.40 mm)



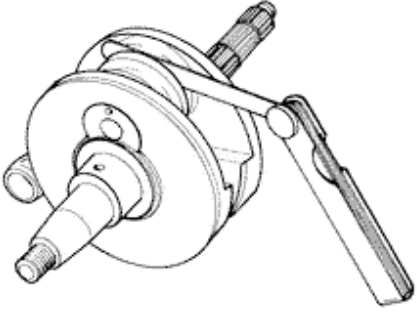
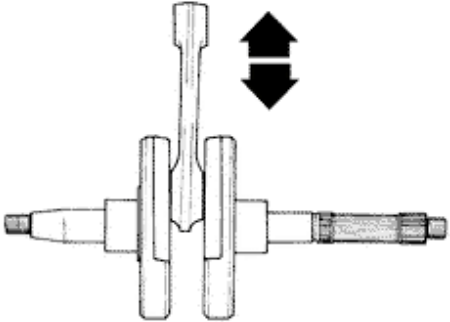
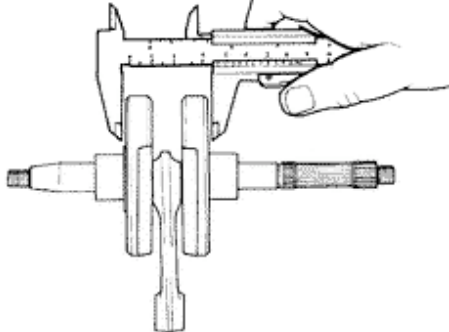
- Remove the crankcase gasket.
- Remove the two screws and the internal cover shown in the figure.



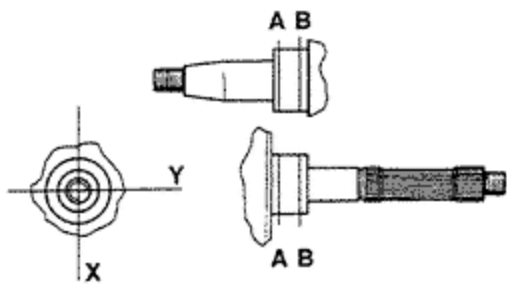
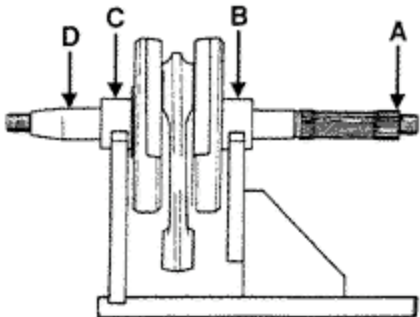
- Remove the oil seal on the flywheel side.
- Remove the oil filter union shown in the figure.



### 10.11.3 Checking the Crankshaft

<ul style="list-style-type: none"> <li>- Check the connecting rod axial clearance, before removal.</li> </ul> <p><b>Standard clearance:</b> Connecting rod (axial) 0.008-0.020 in (0.20-0.50 mm)</p>	
<ul style="list-style-type: none"> <li>- Check the radial clearance on the connecting rod.</li> </ul> <p><b>Standard clearance:</b> Connecting rod (radial) 0.0014-0.0021 in (0.036-0.054 mm)</p>	
<ul style="list-style-type: none"> <li>- Check that the surfaces that limit the axial free-play are not scored and measure the width, as shown in the figure.</li> </ul> <p><b>Note:</b> Make sure the ends of the caliper do not go into the machined corner of the crankshaft, as the curvature in the corner may cause inaccurate readings.</p> <p><b>Standard dimension:</b> with shim adjusting washers 2.024-2.026 in (51.40-51.45 mm)</p> <p><b>Standard dimension:</b> with integral washers 2.192-2.199 in (55.67-55.85 mm)</p>	
<p><b>Warning</b> – The crankshaft can be re-used as long as its width is within the specified limits and shows no signs of scoring.</p> <ul style="list-style-type: none"> <li>- If present, check that the shim adjusting washers show no signs of superficial imperfections, such as scratches or crack initiations, and measure their thickness.</li> </ul> <p><b>Standard dimension:</b> Shim adjusters thickness 0.0856-0.0876 in (2.175-2.225 mm)</p> <p><b>Note:</b> If the shim adjusting washers are to be reused, ensure to keep the initial assembly position.</p>	

**Note:** Provided none of the specified crankshaft tolerances are exceeded, any non-acceptable axial play found on the crankshaft must be due to either excessive wear or wrong machining on the crankcase.

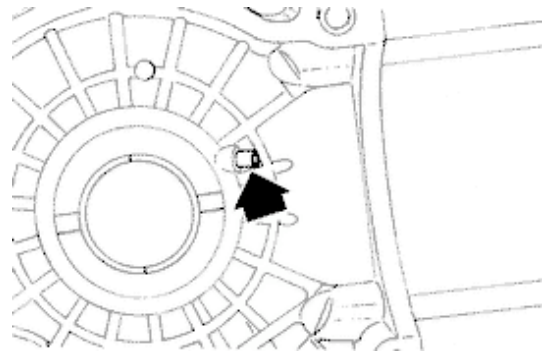
Measure the diameters on both X and Y axes				
<b>Class</b>	<b>Standard diameter (mm)</b>			
1	1.1416–1.1418 (28.998-29.004)			
2	1.1418–1.1421 (29.004-29.010)			
<b>Maximum allowable misalignment:</b> <b>A</b> = 0.0060 in (0.15 mm) <b>B</b> = 0.0004 in (0.01 mm) <b>C</b> = 0.0004 in (0.01 mm) <b>D</b> = 0.0039 in (0.10 mm)				
<b>Specific tools and equipment:</b> Support and dial gauge 020335Y Crankshaft aligning tool 020074Y				
<b>Crankcase – Crankshaft – Half crankshaft bearings</b>				
<b>Crankcase</b>	<b>Class 1</b>		<b>Class 2</b>	
	1.2973–1.2978 (32.953–32.963)			
<b>Half crankshaft bearing</b>	<b>A type - Red</b>	<b>B type - Blue</b>	<b>C type - Yellow</b>	
	0.0776–0.0777 (1.970–1.973)	0.0777–0.0778 (1.973–1.976)	0.0778–0.779 (1.976–1.979)	
<b>Note:</b> Spare crankcases are selected with half-crankcases of the same category and mounted with category B bearings (blue colored). Match the shaft with two category 1 shoulders with category 1 crankcase (or cat. 2 with cat. 2). A spare crankcase cannot be combined with a crankshaft with mixed categories. Spare shafts have half-shafts of the same category.		<b>Half-crankcase</b>	<b>Half crankshaft</b>	<b>Bearing</b>
		Cat. 1	Cat. 1	B
		Cat. 2	Cat. 2	B
		Cat. 1	Cat. 2	A
		Cat. 2	Cat. 1	C

#### 10.11.4 Checking the Crankcase Halves

- Before proceeding to check the crankcase halves, thoroughly clean all the surfaces and oil ducts.
- On the transmission side crankcase half, take particular care cleaning the housing and oil ducts for the following components: the oil pump, the oil blow-by valve, the main bearings and the cooling jet on the transmission side, see picture.

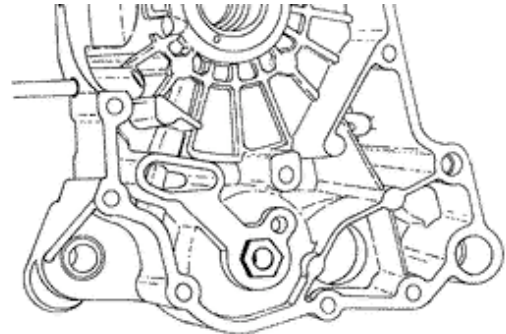
**Note:** The cooling jet is fed via the main bearings. When working correctly, it improves the cooling of the crown of the piston. Blockage of this jet will increase piston temperature and the ensuing damage would require major repairs. A missing or unseated cooling jet can cause a serious reduction in the oil pressure lubricating the main bearing and connecting rod.

As mentioned in the "Lubrication" chapter, it is essential that the by-pass housing shows no signs of wear capable of affecting the seal of the lubrication pressure adjusting piston.

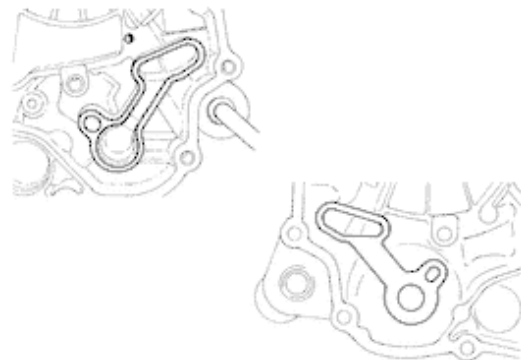


- On the flywheel side crankcase half, take particular care in cleaning the oil ducts for the main bearings, the oil duct for the jet that lubricates the cylinder head and the oil drainage duct at the flywheel side oil seal.

**Note:** The oil duct for lubrication of the cylinder head is fitted with a vaporizer jet that provides so-called 'low pressure lubrication', designed to keep the oil temperature in the sump at an acceptable level. Blockage of this jet will prevent proper lubrication of the cylinder head and timing components. A missing or unseated jet can cause a serious reduction in the oil pressure lubricating the main bearing and connecting rod.



- Inspect the mating surfaces on the crankcase halves for scratches or deformations, taking particular care with the surfaces that mate with the cylinder and the mating surfaces between the crankcase halves.
- Defects in the gasket between the crankcase halves, or the mating surfaces shown in the figure, can cause a reduction in the oil pressure lubricating the main bearing and connecting rod.
- Check the main bearing seats that limit axial play in the crankshaft show no signs of wear. The dimension between these seats is measured



following the procedure previously described for measuring the crankshaft axial play and dimensions.

### 10.11.5 Checking the Main Bearings

- Proper lubrication of the main bearings depends on them being seated correctly in their housings, which will avoid obstructing the lubrication ducts. Not only will this ensure proper flow of oil, but also proper oil pressure values 58 psi (4 bar), on which lubrication of the main bearings depends.
- The main bearings comprise two half-bearings, one containing holes and channels for lubrication and the other solid.
- The solid half-bearing bears the load due to combustion and is, therefore, located at the far side from the cylinder.
- In order to avoid obstructing the passage of oil, the plane of the coupling between the two half-bearings must be absolutely perpendicular to the axis of the cylinder, as shown in the figure.
- The depth to which the half-bearings are driven, in relation to the surface that limits the axial play of the crankshaft, can also affect the alignment of the oil ducts.

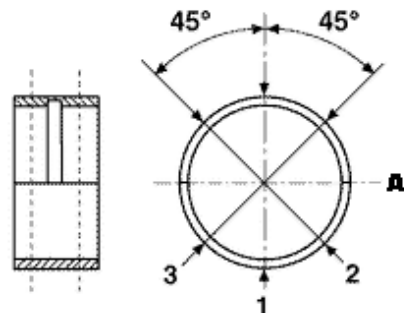
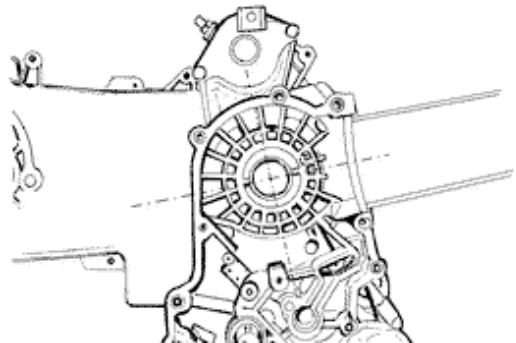
#### Standard dimension:

Main bearing bedding-in depth      0.053-0.063 in  
(1.35-1.60 mm)

**Note:** The main bearings are driven into steel rings located by interference fit inside both the crankcase castings, in order to maintain the position described above.

- Check the internal diameter of the main bearings in the three directions indicated in the figure.
- Repeat these measurements on the other side of the lubrication channel in the bearing (see figure).

**Note:** Avoid measuring the main bearings internal diameter on the mating surface of the two half shells as the ends are relieved to allow distortion



during the bedding.	A = Matching surface
---------------------	----------------------

- The main bearings are chosen from a selection of standard sizes that give certain internal diameters once driven into the bearing housings in the crankcase, so as to obtain a match with the crankshaft.
- Bearing housings are available in two categories as are the crankshafts (cat. 1 and cat. 2)
- The crankcase is available in one class only. And can either be fitted with red, blue or yellow bearings.

**Standard dimension:**  $\varnothing$  1.2974-1.2978 in  
Crankcase bearing housing (32.953-32.963 mm)

- Main half-bearings are divided into three categories according to their thickness; see table in the previous page for details.

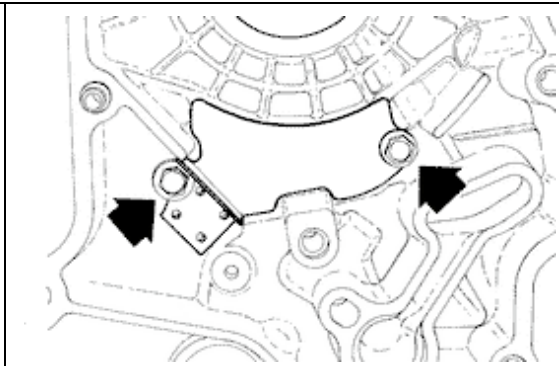
Bearing category	Half-crankcase category	Bearing internal diameter as assembled	Mating option
A	1	1.1427-1.1433 in (29.025-29.040 mm)	Original
B	1	1.1425-1.1431 in (29.025-29.040 mm)	Original and spare
	2	1.1428-1.1434 in (29.028-29.043 mm)	
C	2	1.1426-1.1432 in (29.022-29.037 mm)	Original

### 10.11.6 Assembling the Crankcase Halves

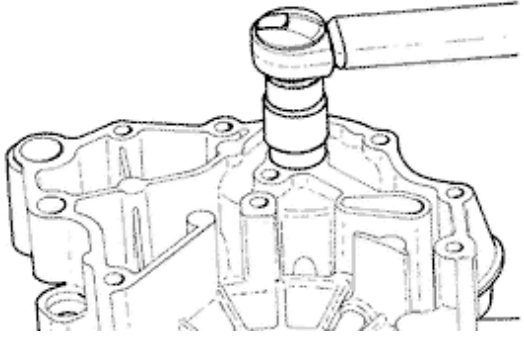
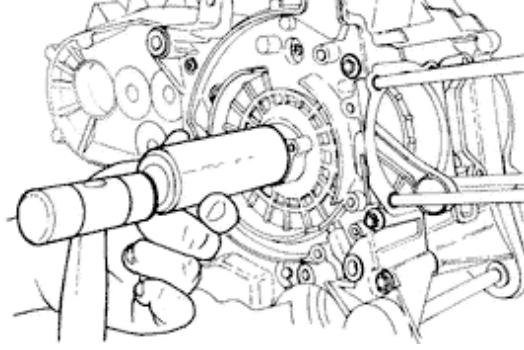
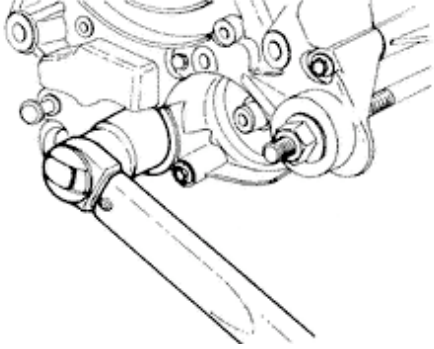
- Fit the internal cover shown in the diagram and tighten the two screw fasteners to the specified tightening torque.

**Tightening torque:**  
Internal cover screws

2.9-4.4 lbs·ft  
(4-6 N·m)





<ul style="list-style-type: none"> <li>- Fit the oil filter union and tighten it to the specified tightening torque.</li> </ul> <p><b>Tightening torque:</b> Oil filter union 19.9-24.3 lbs·ft (27-33 N·m)</p> <ul style="list-style-type: none"> <li>- Place a new gasket on one of the crankcase halves, preferably on the transmission side, together with the locating dowels.</li> </ul>	
<ul style="list-style-type: none"> <li>- Lubricate the main bearings and insert the crankshaft in the transmission side crankcase half.</li> <li>- Re-assemble the two crankcase halves.</li> </ul> <p><b>Note:</b> Take care that the threaded end of the crankshaft does not damage the main bearing.</p> <ul style="list-style-type: none"> <li>- Place the shim adjusting washers in their original position.</li> <li>- Fit the eleven screws and tighten them to the prescribed torque.</li> </ul> <p><b>Tightening torque:</b> Half crankcase coupling screws 8.1-9.6 lbs·ft (11-13 N·m)</p>	
<p><b>Note:</b> Remove any remains of the old gasket from the crankcase and cylinder mating surfaces in order to ensure proper seals.</p> <ul style="list-style-type: none"> <li>- Lubricate the flywheel-side oil seal.</li> <li>- Using the appropriate special tool, fit the oil seal.</li> </ul> <p><b>Recommended tools and equipment:</b> Punch for oil seal 020425Y</p> <p><b>Note:</b> Not using the special tool can lead to the oil seal being fitted at the wrong depth, thereby preventing it from working properly.</p>	
<ul style="list-style-type: none"> <li>- Fit a new O-ring on the oil sieve and lubricate it.</li> <li>- Re-fit the oil seal to the engine with the oil drain plug and tighten to the specified tightening torque.</li> </ul>	

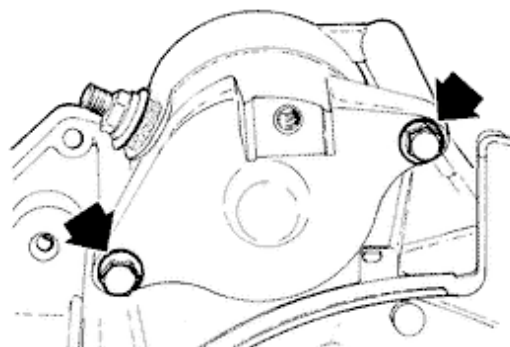
### 10.11.7 Fitting the Starter Motor

- Fit a new O-ring on the starter motor and lubricate it.
- Fit the starter motor to the crankcase and tighten the two screw fasteners to the specified tightening torque.

**Tightening torque:**

Half crankcase coupling screws      8.1-9.6 lbs·ft  
(11-13 N·m)

**Note:** Re-fit the remaining engine components as described in the previous pages.



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## 10.11.8 Removing the Carburetor

### 10.11.8.1 Kehin CVK 30 Carburetor

- To disconnect the carburetor from the engine, it is necessary to move the air filter and remove the throttle cable, the automatic choke connection, the clamps fastening the carburetor to the filter box and the intake manifold, the pipe supplying air to the membrane, and the inlet connection.
- Pull off the carburetor and rotate it to remove the screw with the water connection complete with pipes.

**Note:** This operation is necessary to avoid emptying the cooling system. It is also necessary to disconnect the cut-off vacuum supply pipe.



- Remove the protection, the clamp and the automatic choke device after loosening the two screws shown in the figure.



- Remove the two screws and the automatic choke device support with its gasket.



- Remove the clamp and the cap with the membrane chamber filter.



- Remove the four fixing screws shown in the figure and the vacuum chamber cover.



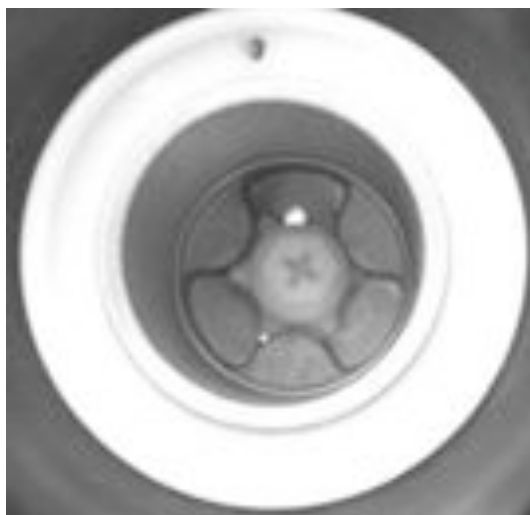
- **Caution** - The spring can suddenly jump out during the operation of removal. Take care to contain it.



- Remove the vacuum valve with the membrane.



- Turn the coupling by ? turn and remove it. Remove the spring and the vacuum valve pin.



- Remove the four screws shown in the figure.



- Remove the float bowl, the accelerator pump and its gasket.



- Remove the sealing gasket.
- Remove the accelerator pump inlet and outlet valves from the bowl.

**Note:** Pay particular attention when handling the valves, since they consist of nozzles, springs and metallic spheres.

**Note:** Do not remove the accelerator pump piston and control.



- Using a hammer, and with the carburetor suitably supported, remove the float pin from the throttle valve side.
- Remove the float.



- Remove the main jet.



- Loosen the emulsion jet.



- Tilt the carburetor and remove the emulsion jet.



- Remove the atomizer.

**Note:** This operation is necessary to avoid loosing the atomizer while cleaning the carburetor body. If the atomizer is jammed in its housing, do not attempt to remove it, or it may get damaged.



- Remove the idling jet.



- Remove the idle-speed flow screw and spring.



**Warning** - Do not attempt to remove components pressed into the carburetor body. These include the fuel feed duct, the needle valve seat, the starter jet, the emulsion tube plug, the accelerator jet, the air adjuster (minimum and maximum), the butterfly valve and the butterfly valve control arm. The screw fasteners have been crimped after fitting and removing them will damage the arm.



### 10.11.8.2 Walbro WVF-7P Carburetor

- To disconnect the carburetor from the engine, it is necessary to move the air filter and remove the throttle cable, the automatic choke connection, the clamps fastening the carburetor to the filter box and the intake manifold, the pipe supplying air to the membrane, and the inlet connection.
- Pull off the carburetor and rotate it to remove the screw with the water connection complete with pipes.

**Note:** This operation is necessary to avoid emptying the cooling system. It is also necessary to disconnect the cut-off vacuum supply pipe.



- Remove the protection, the clamp and the automatic choke device after releasing the screw shown in the figure.



- Remove the clamp and the cap with the membrane chamber filter.



- Remove the four fixing screws shown in the figure and the vacuum chamber cover.



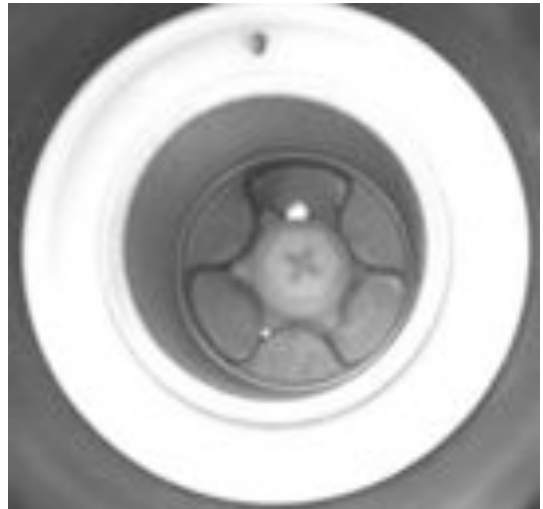
**Caution** - The spring can suddenly jump out during the operation of removal. Take care to contain it.



- Remove the vacuum valve with the membrane.



- Turn the coupling by ? turn and remove it. Remove the spring and the vacuum valve pin.



- Remove the four screws shown in the figure.



- Remove the float bowl, the accelerator pump and its gasket.



- Remove the sealing gasket.
- Remove the accelerator pump inlet and outlet valves from the bowl.

**Note:** Pay particular attention when handling the valves, since they consist of nozzles, springs and metallic spheres.

**Note:** Do not remove the accelerator pump piston and control.



- Using a hammer, and with the carburetor suitably supported, remove the float pin from the throttle valve side.
- Remove the float.



- Remove the cap conveying fuel to the starting jet, shown in the figure.



- Remove the main jet.



- Loosen the emulsion jet.



- Remove the atomizer.

**Note:** This operation is necessary to avoid loosing the atomizer while cleaning the carburetor body. If the atomizer is jammed in its housing, do not attempt to remove it, or it may get damaged.



- Remove the idling jet.



- 
- Remove the idle-speed flow screw with O-ring, washer and spring.
  - Remove the two fixing screws, the cover, the spring and the cut-off device membrane.



**Warning** - Do not attempt to remove components pressed into the carburetor body. These include the fuel feed duct, the needle valve seat, the starter jet, the emulsion tube plug, the accelerator jet, the air adjuster (minimum and maximum), the butterfly valve and the butterfly valve control arm. The screw fasteners have been crimped after fitting and removing them will damage the arm.

## 10.11.9 Re-assembling the carburetor

### 10.11.9.1 Kehin CVK 30 Carburetor

- Clean the carburetor thoroughly before reassembly, using petrol and compressed air.
- Take particular care in cleaning the fuel feed duct and the float valve seat.



- Clean the main air jet shown in the figure.



- Carefully clean the slow-running circuit, concentrating in the following points: the air screw, the passage within the slow-running screw mechanism and the auxiliary channel openings around the butterfly valve.



- For the starter circuit, concentrate on the jet duct, as the housing blocks the calibrated holes, making them inaccessible.
- Thoroughly blow out the accelerator pump jet.

**Note:** The jet outlet is extremely small and directed towards the butterfly valve. Proper atomization will be prevented, if this jet is directed otherwise.



- Check that on the carburetor there are five ball bearing seals pressed into the holes machined in the carburetor body.
- Check that the two mating surfaces, between the float bowl and the diaphragm, are unblemished.
- Check the butterfly valve and control arm.
- Check that the float valve housing channel shows no signs of scoring.
- Check that the valve seat shows no signs of abnormal or excessive wear.
- If any of the above defects are observed, replace the carburetor with a new one.

**Note:** Do not insert metal tools or instruments into the calibrated jets as these can cause damage and alter the carburetion.

- Thoroughly clean and blow the slow-running jet and re-fit it.



- Thoroughly clean and blow the main supply circuit components, the atomizer, the emulsion jet and the main jet.
- Insert the atomizer into the carburetor body with the shorter, cylindrical part facing the emulsifier.
- Re-fit the emulsion jet, ensuring the atomizer is correctly located, and tighten.
- Re-fit the main jet.



- Check there are no signs of wear on the sealing surface of the float needle, the softened pin or the return spring.
- If there are any signs of wear, replace the needle with a new one.



- Check that the float shows no signs of wear on the hinge, or the metal tab in contact with the float needle and check that fuel has not infiltrated the float.
- If there are any defects, replace the float with a new one.
- Re-fit the float, together with the needle, inserting the pin from the fuel inlet side.

**Note:** Ensure the return spring on the float tab is in the correct position.

#### 10.11.9.2 Walbro WFV-7P Carburetor

- Before reassembling the carburetor, carefully clean the carburetor body using fuel and compressed air.
- Take particular care in cleaning the fuel feed duct and the float valve seat.

- In the Venturi tube check the air calibration, shown in the figure.



- Carefully clean the air holes shown in the figure.



- Carefully clean the slow-running circuit, concentrating in the following points: the air screw, the passage within the slow-running screw mechanism and the auxiliary channel openings around the butterfly valve.

**Note:** The slow-running is controlled by two calibrations. That of the cut-off is obtained directly in the carburetor.

- For the starter circuit, concentrate on the jet duct, as the housing blocks the calibrated holes, making them inaccessible.
- Thoroughly blow out the accelerator pump jet.

**Note:** The jet outlet is extremely small and directed towards the butterfly valve. Proper atomization will be prevented, if this jet is directed otherwise.



- Check that on the carburetor there are five ball bearing seals pressed into the holes machined in the carburetor body.
- Check that the two mating surfaces, between the float bowl and the diaphragm, are unblemished.
- Check the butterfly valve and control arm.
- Check that the float valve housing channel shows no signs of scoring.
- Check that the valve seat shows no signs of abnormal or excessive wear.
- If any of the above defects are observed, replace the carburetor with a new one.

**Note:** Do not insert metal tools or instruments into the calibrated jets as these can cause damage and alter the carburetion.

- Thoroughly clean and blow the slow-running jet and re-fit it.
- Thoroughly clean and blow the main supply circuit components, the atomizer, the emulsion jet and the main jet.
- Insert the atomizer into the carburetor body with the shorter, cylindrical part facing the

emulsifier.

- Re-fit the emulsion jet, ensuring the atomizer is correctly located, and tighten.
- Re-fit the main jet.

- Check there are no signs of wear on the sealing surface of the float needle, the softened pin or the return spring.
- If there are any signs of wear, replace the needle with a new one.



- Check that the float shows no signs of wear on the hinge, or the metal tab in contact with the float needle and check that fuel has not infiltrated the float.
- If there are any defects, replace the float with a new one.
- Re-fit the float, together with the needle, inserting the pin from the fuel inlet side.

**Note:** Ensure the return spring on the float tab is in the correct position.





### 10.11.10 Checking the Float Height

#### 10.11.10.1 Kehin CVK 30 Carburetor

- Holding the carburetor upside-down, check that the float is parallel to the plane of the bowl.
- If found to be out of alignment, adjust by bending the metal tab that controls the needle, until corrected.
- When making adjustments to the metal tab, ensure it remains parallel to the pin on which the float hinges.



- Remove the float bowl drainage screw and then thoroughly clean and blow out the bowl, paying particular attention in cleaning the accelerator pump ducts.
- Repeatedly actuate the accelerator pump piston and blow with compressed air.

<ul style="list-style-type: none"> <li>- Replace the accelerator pump valves in the following sequences:</li> </ul> <p><b>Intake valve (A):</b> Spring Sphere Nozzle</p> <p><b>Delivery valve (M):</b> Sphere Spring Nozzle</p> <p><b>Note:</b> The delivery valve nozzle is provided with a milling.</p>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p><b>A</b></p>  </div> <div style="text-align: center;"> <p><b>M</b></p>  </div> </div>
<ul style="list-style-type: none"> <li>- Check the seal on the screw by introducing a small amount of fuel into the float bowl.</li> <li>- Re-fit the float bowl to the carburetor body, using a new gasket and tightening the four screws to the specified torque.</li> <li>- Check that the throttle rocker arm rotates freely onto its seat.</li> </ul> <p><b>Note:</b> Check that the gasket is inserted properly.</p> <p><b>Note:</b> Avoid excessively loading the accelerator pump rocker arm control.</p>	
<ul style="list-style-type: none"> <li>- Clean and blow the idle-speed flow screw.</li> <li>- Check that the screw is free from oxidation and/or deformations.</li> <li>- Fit the spring onto the screw, as shown in the picture.</li> </ul>	
<ul style="list-style-type: none"> <li>- Tighten the flow screw onto the carburetor body and adjust its final position by carrying out an exhaust gas analysis.</li> <li>- Prepare the carburetor for adjustment with the screw loosened by two turns from its closing position.</li> </ul>	

#### 10.11.10.2 Walbro WVF-7P Carburetor

- Holding the carburetor upside-down, check that the float is parallel to the plane of the bowl.
- If found to be out of alignment, adjust by bending the metal tab that controls the needle, until corrected.
- When making adjustments to the metal tab, ensure it remains parallel to the pin on which the float hinges.

**Note:** With the carburetor tilted upside-down, the float must not overcome the load of the float pin spring. If the float remains in position, check that it is not burdened with fuel infiltrations. Replace the float and/or pin as necessary.







- Thoroughly clean and blow the fuel conveying cap and insert it onto the starter jet.

**Note:** Failure to install this component results in worse cold starting performance, since the starter jet draws old fuel from the bottom of the bowl.

- Remove the float bowl drainage screw and then thoroughly clean and blow out the bowl, paying particular attention in cleaning the accelerator pump ducts.
- Repeatedly actuate the accelerator pump piston and blow with compressed air.
- Check that the accelerator pump piston and seat are free from wear. If worn, replace.
- Check that the accelerator pump piston spring is not worn.
- Install a new O-ring and gasket; hence replace the piston unit on the bowl.
- Install a new O-ring on the drainage screw and tighten it.





<ul style="list-style-type: none"> <li>- Check the seal on the screw by introducing a small amount of fuel into the float bowl.</li> <li>- Re-fit the float bowl to the carburetor body, using a new gasket and tightening the four screws to the specified torque.</li> <li>- Check that the throttle rocker arm rotates freely onto its seat.</li> </ul> <p><b>Note:</b> Check that the gasket is inserted properly.</p> <p><b>Note:</b> Avoid excessively loading the accelerator pump rocker arm control.</p>	
<ul style="list-style-type: none"> <li>- Clean and blow the idle-speed flow screw.</li> <li>- Check that the screw is free from oxidation and/or deformations.</li> <li>- Fit the spring onto the screw, as shown in the picture.</li> </ul>	
<ul style="list-style-type: none"> <li>- Tighten the flow screw onto the carburetor body and adjust its final position by carrying out an exhaust gas analysis.</li> <li>- Prepare the carburetor for adjustment with the screw loosened by two turns from its closing position.</li> </ul>	
<ul style="list-style-type: none"> <li>- Check that the accelerator pump control rocker is free from abnormal wear.</li> <li>- Check that the rocker travel end screw protrudes by 0.126 in (3.2 mm).</li> </ul>	

<ul style="list-style-type: none"> <li>- Check that the rocker arm return spring is not slackened.</li> </ul> <p>Pre-assemble the spring and the rocker as shown in the figure.</p> <p>Install the rocker on the carburetor keeping the throttle valve open.</p> <p>Tighten the rocker fixing screw.</p> <ul style="list-style-type: none"> <li>- Make sure that the gear works properly.</li> </ul>	
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### 10.11.11 Checking the Vacuum Valve and the Needle

#### 10.11.11.1 Kehin CVK 30 Carburetor

<ul style="list-style-type: none"> <li>- Ensure the vacuum valve float pin is free from wear.</li> <li>- Check that the vacuum valve exhibits no scratched on the surface.</li> <li>- Ensure that the vacuum feeding hole is not clogged.</li> </ul>	
<ul style="list-style-type: none"> <li>- Check that the membrane is not broken or hardened, if not so, replace the entire valve.</li> <li>- Insert the float pin into the vacuum valve seat.</li> <li>- Replace the vacuum throttle valve on the carburetor paying attention in inserting the pinto into the atomizer.</li> </ul> <p><b>Note:</b> The valve can only be inserted in one position.</p>	



- Fit the spring with the pin lock.
- After ensuring that the spring is properly positioned into the housing, fit the vacuum chamber cover.



- Clean and blow the ambient pressure inlet filter sponge.



- Fit the filter and its clamp as shown in the figure.



- Clean and blow out the choke device support.
- Install a new gasket onto the carburetor body and tighten the two fixing screws.



#### 10.11.11.2 Walbro WVF-7P Carburetor

- Ensure the vacuum valve float pin is free from wear and the lock is positioned at the third notch.
- Check that the vacuum valve exhibits no scratched on the surface.
- Ensure that the two vacuum feeding holes are not clogged.

**Note:** The two holes have different diameters.



- Check that the membrane is not broken or hardened, if not so, replace the entire valve.
- Insert the float pin into the vacuum valve seat.
- Replace the vacuum throttle valve on the carburetor paying attention in inserting the pinto into the atomizer.

**Note:** The valve can only be inserted in one position.

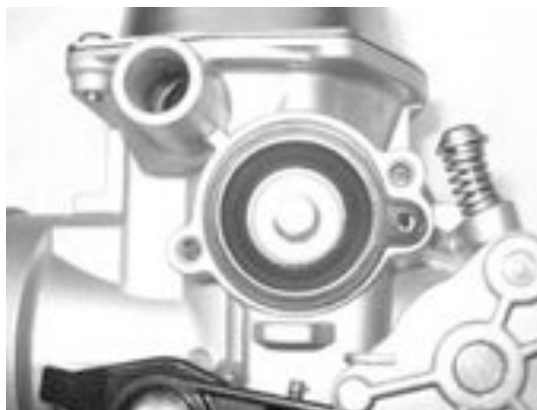


- Fit the spring with the pin lock.
- After ensuring that the spring is properly positioned into the housing, fit the vacuum chamber cover.
- Clean and blow the ambient pressure inlet filter sponge.

- Check that the cut-off valve is in good condition and that the membrane is not broken or hardened.
- Check the unloaded length of the spring.

**Standard dimension:**

Spring 0.945 in  
(24 mm)



- Fit the membrane with the metal pin positioned on the valve.
- Fit the spring and the cover. The cover must have the vacuum inlet facing upwards.

## 10.11.12 Checking the Automatic Choke Device

### 10.11.12.1 Kehin CVK 30 Carburetor

- Check that the piston (picture) exhibits no scratches or oxidation and that it slides freely into the seat.
- Check the unloaded length of the spring.
- Check that the piston sealing gasket exhibits no deformations.



- 

Piston length @ 68°F (20°C) XX-XX in  
(XX-XX mm)



- 

## Choke resistance @ 68°F (20°C) ~20 Ω

- Note:** When performing this check do not generate any short-circuits. It is therefore necessary to use a cable with suitable terminals.

-

### 10.11.12.2 Walbro WVF-7P Carburetor

<ul style="list-style-type: none"><li>- Check that the piston (picture) exhibits no scratches or oxidation and that it slides freely into the seat.</li><li>- Check the unloaded length of the spring.</li><li>- Check that the piston sealing gasket exhibits no deformations.</li><li>- Measure the projection of the piston as shown in the figure, and check the corresponding value.</li><li>- Ensure that the starter settles at ambient temperature.</li></ul> <p><b>Standard dimension:</b> Piston length @ 68°F (20°C) 0.492-0.512 in (12.5-13.0 mm)</p>	
<ul style="list-style-type: none"><li>- The choke should gradually disengage as it is being heated electrically.</li><li>- Check the choke resistance at ambient temperature.</li></ul> <p><b>Standard resistance:</b> Choke resistance @ 68°F (20°C) ~40 Ω</p>	
<ul style="list-style-type: none"><li>- Using a 12V battery, power the automatic choke and check that the piston reaches its maximum protrusion.</li></ul> <p><b>Note:</b> When performing this check do not generate any short-circuits. It is therefore necessary to use a cable with suitable terminals.</p> <ul style="list-style-type: none"><li>- The effective heating time depends on the ambient temperature.</li><li>- If measured projection, resistance or time values are inconsistent with the prescribed ones, replace the automatic choke assembly.</li></ul>	

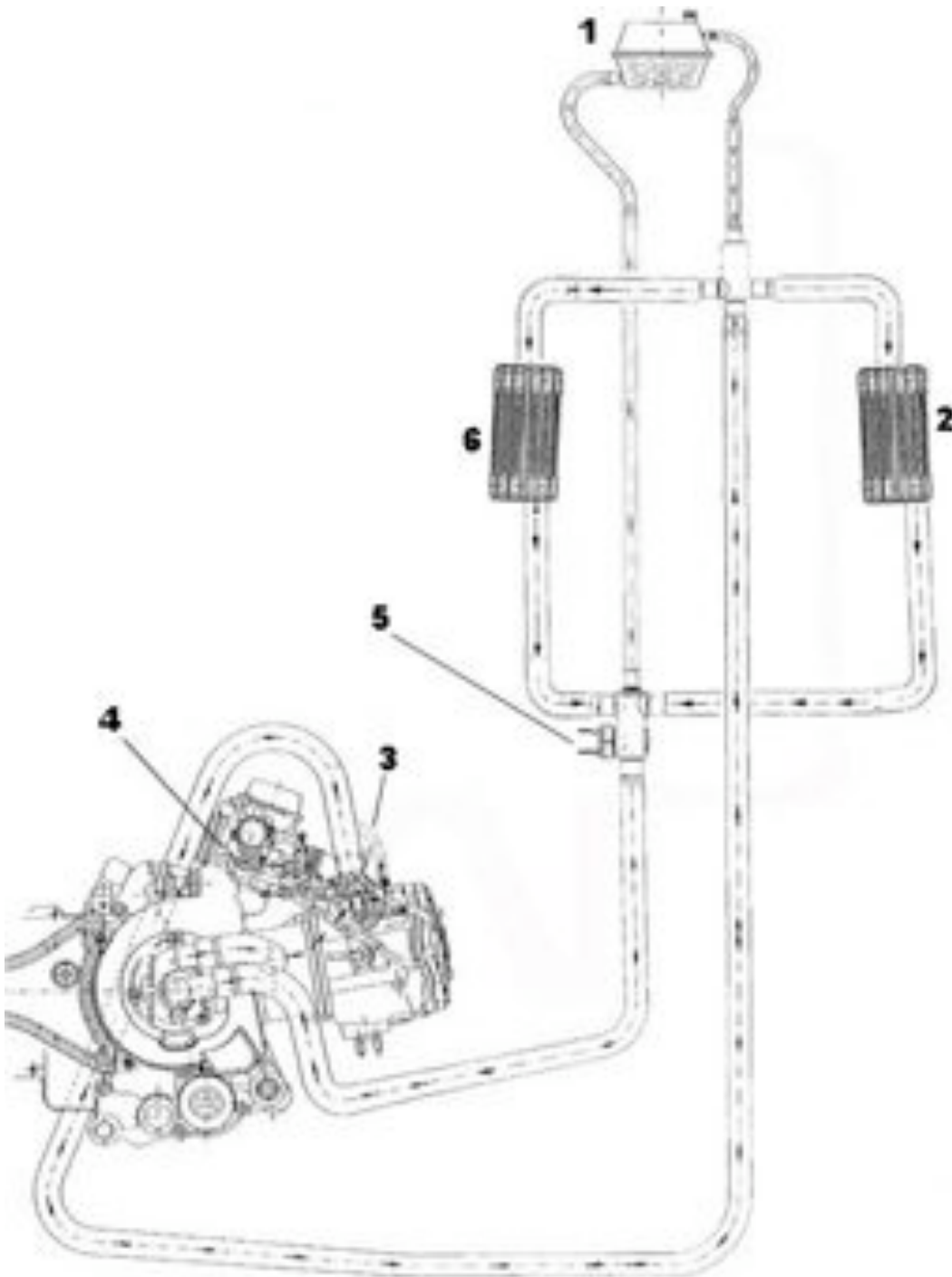
- Install the choke onto the carburetor checking the proper positioning of the O- Ring, insert the plate with the knurling resting against the choke and tighten the fixing screw.
- Orientate the choke device as shown in the figure.
- Install the safety casing



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## 10.12 Cooling System

### 10.12.1 Cooling Circuit



1 = Expansion tank

4 = Carburetor heating circuit

2 = LH radiator with electric fan

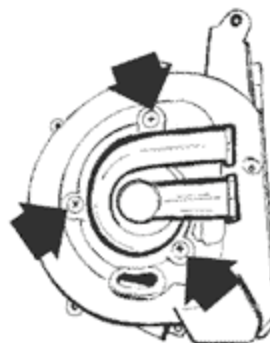
5 = Electric fan switch

3 = Thermostat with by-pass

6 = RH radiator

### 10.12.2 Removing the Water Pump

- If the bearings are noisy or any liquid leaks from the drain hole inside the cover, proceed to overhaul the water pump.
- Remove the flywheel cover with the water pump from the engine.
- Remove the impeller cover after unscrewing the three fastenings shown in the figure.



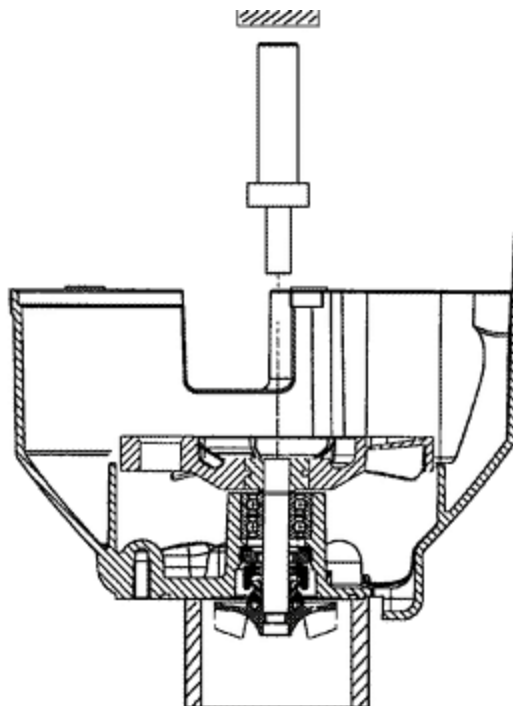
- Position the flywheel cover on the ring-shaped base that is part of tool part no. 020440Y.

#### **Specific tools and equipment:**

Ring base 020440Y

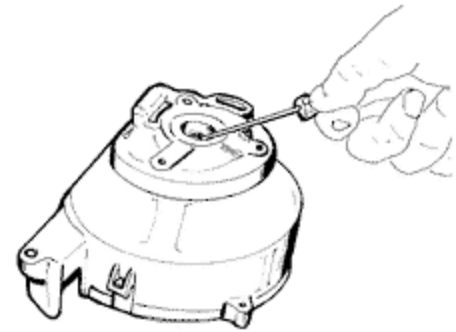
**Note:** To prevent damage to the cover surface designed to ensure coolant tightness, use the ring-shaped base with the accurately machined surface facing the flywheel cover.

- Using a press and the drift that is part of tool no. 020440Y, eject the shaft complete with the impeller from the drive and the bearing.

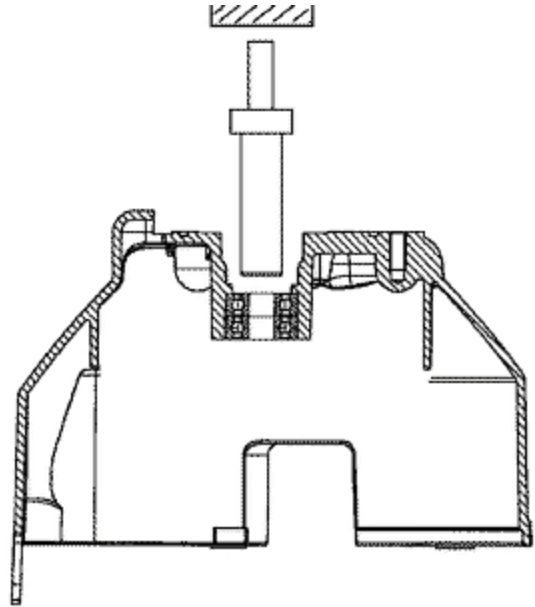




- With the aid of a flat screwdriver, carefully remove the static part of the ceramic seal from the flywheel body.



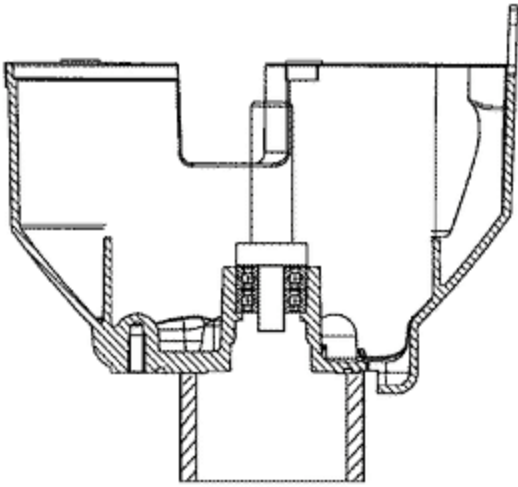

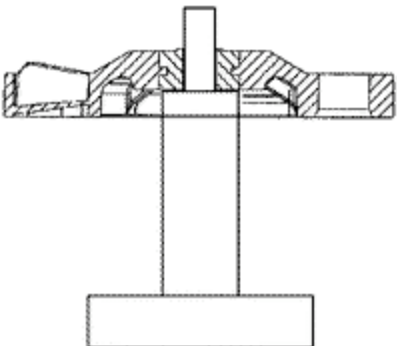
- Place the flywheel cover under the press. Ensure that the cover is perfectly horizontal.
- Using the drift in inverted position, eject the two ball bearings.



### 10.12.3 Checking the Components

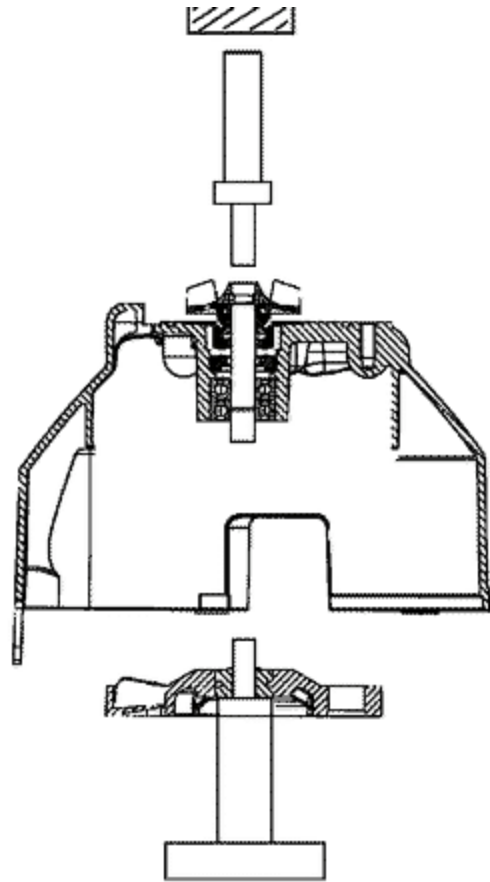
- Check that the impeller is not cracked or worn.
- Check that the impeller shaft is not oxidized.
- Check that no oxidation is present on the ceramic seal and bearing housings.
- Ensure that the drive is not cracked and that it is perfectly joined to the steel hub.

#### 10.12.4 Fitting the Water Pump

<ul style="list-style-type: none"> <li>- Using the hot air gun, heat the flywheel cover from the inside.</li> </ul> <p><b>Specific tools and equipment:</b> Hot air gun 020151Y</p> <p><b>Note:</b> To prevent damage to the painted surface, avoid overheating the cover.</p> <ul style="list-style-type: none"> <li>- Place the flywheel cover on the ring-shaped base as during the pump removal.</li> <li>- Position the bearing pair on the specific drift.</li> </ul> <p><b>Note:</b> Always use new bearings. Use grease to keep bearings on the specific tool.</p> <ul style="list-style-type: none"> <li>- Drive the bearing fully home into the crankcase using a plastic mallet.</li> </ul>	
<ul style="list-style-type: none"> <li>- Assemble the ceramic ring with the rubber gasket. The ceramic ring bevel must face the gasket.</li> <li>- Lubricate the rubber gasket and fit the assembly to the flywheel cover.</li> <li>- If necessary, use the drift from 020440Y only by hand.</li> </ul> <p><b>Note:</b> Always use new ceramic rings and gaskets. Failure to manually install the ceramic ring may damage the ring.</p>	
<ul style="list-style-type: none"> <li>- Insert the drive on the guiding pin of the support base of the specific tool no. 020440Y. Ensure that the convex side faces upwards.</li> </ul> <p><b>Specific tools and equipment:</b> Punch 020440Y</p>	

- Fit the flywheel cover, complete with bearings, onto the specific tool.
- Fit the shaft, complete with the mechanical seal, on the bearings.
- Using the specific drift and the press, insert the shaft into the bearings and the drive until the specific tool is felt to have reached its abutting end.

**Note:** Carefully center the punch onto the impeller. Apply force to the shaft and check that the flywheel cover rotates horizontally. Failure to observe this rule may result in damage to the drive.

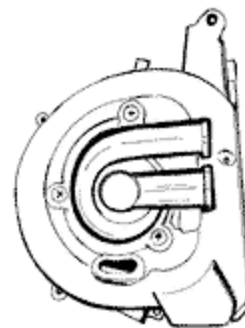


- Refit the impeller cover using a new O-ring.
- Tighten the three fixing screws at the prescribed torque.

**Tightening torque:**

Impeller cover fixing screws      2.2-2.9 lbs·ft  
(3-4 N·m)

**Note:** Do not lubricate the O-ring. Failure to observe this rule results in distortion to the ring.



### 10.12.5 Checking the Thermostat

- Visually check that the thermostat is not damaged.
- Prepare a metal container with  $\sim\frac{1}{4}$  gallon (1 liter) of water.
- Immerse the thermostat and keep at the center of the container.
- Dip the thermometer probe next to the thermostat.

**Specific tools and equipment:**

Digital multimeter 020331Y

- Heat the container by using the hot air gun.

**Specific tools and equipment:**

Hot air gun 020151Y

- Measure the temperature at which the thermostat begins to open.

**Standard temperature:**

Thermostat opening 157.1-162.5°F  
(69.5-72.5°C)

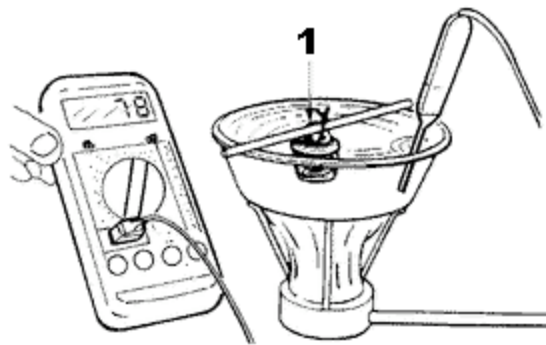
- Heat until the thermostat opens completely.

**Standard dimension:**

Thermostat opening 0.136 in  
travel at 176°F (80°C) (3.5 mm)

**Warning** - To properly conduct the test, avoid direct contact between thermostat and container, and between thermometer and container.

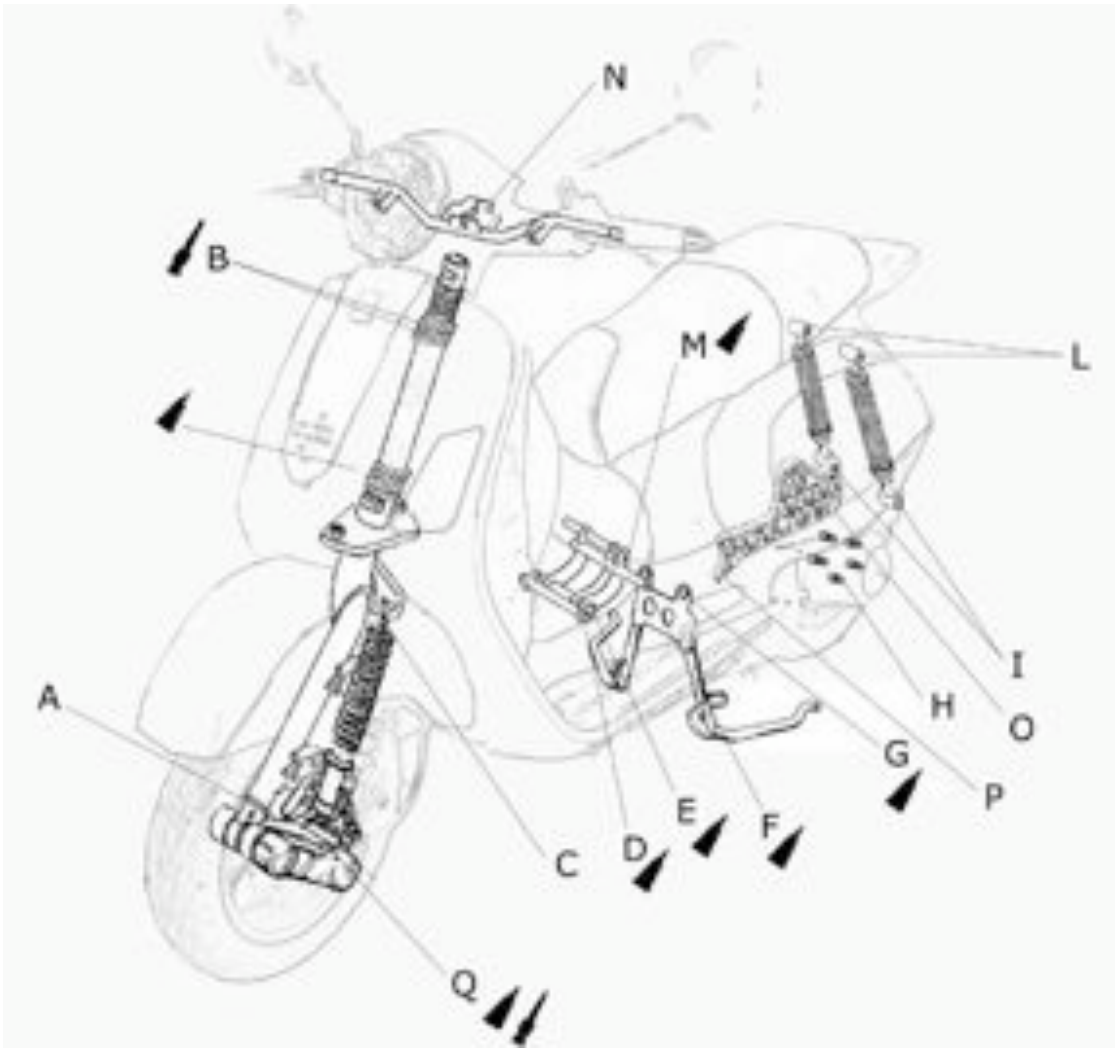
- Replace the thermostat in case of malfunction.









1 = Thermostat

# 11 Suspensions

This section provides information on the operations that may be carried out on the suspensions.



 Lubricate with oil				 Clean carefully			
 Lubricate with grease				 Caution: handle with care			
 Apply product				 Always replace			
	A	B	C	D	E	F	G
<b>Qty</b>	5	2	1	1	1	1	2
<b>Torque lbs·ft (N·m)</b>				73-88 104-126	63-77 90-110		18-21 25-30

H	I	L	M	N	O	P	Q
5	2	2	1	1	1	2	1

### 11.1 Removing and Refitting the Front Wheel

- Remove the five Allen screws shown in the figure, fastening the wheel to the hub.
- For re-assembly, properly place the wheel onto the front hub, and tighten the five screws at the prescribed torque.

**Tightening torque:**

Wheel fixing screws 14.0-17.5 lbs·ft  
(20-25 N·m)



### 11.2 Removing and Refitting the Rear Wheel

- Remove the silencer-rear shock absorber bracket.
- Remove the five Allen screws shown in the figure.
- For refitting, tighten the five screws at the prescribed torque and reassemble the bracket.

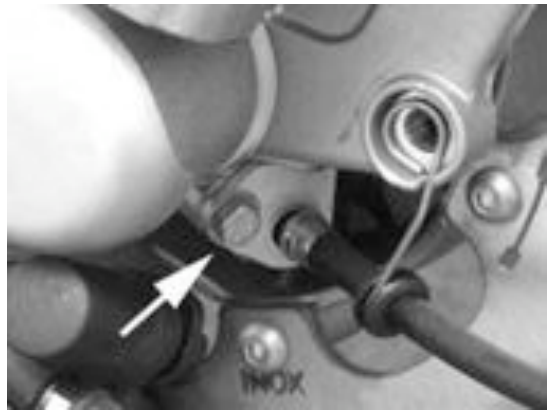
**Tightening torque:**

Wheel fixing screws 14.0-17.5 lbs·ft  
(20-25 N·m)



### 11.3 Removing the Steering Column

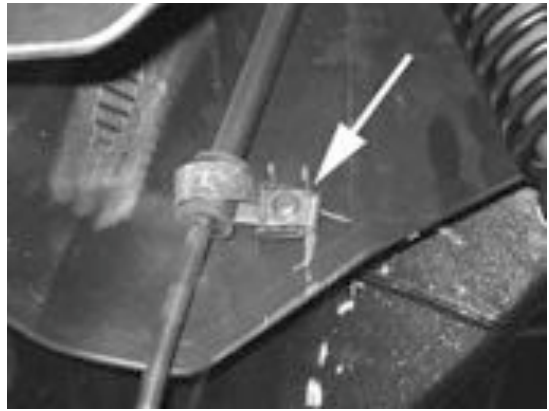
- Remove the front wheel.
- Remove the front caliper.
- Loosen the odometer fixing plate screw to remove the cable.



- Remove the suspension arm cover by releasing the three screws shown in the figure.



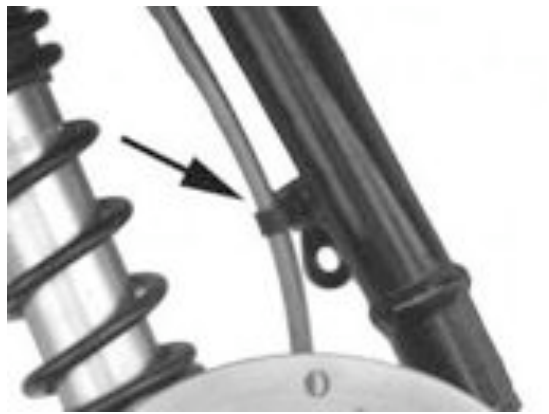
- Remove the odometer cable clamp from the front mudguard, as shown in the figure.



- Remove the brake tube clamp from the top plate of the shock absorber.






- Remove the brake tube fixing from the suspension arm.



- Pre-loosen the three nuts fixing the mudguard to the front suspension bracket.





<ul style="list-style-type: none"> <li>- Remove the rear handlebar cover.</li> <li>- Remove the screw fixing the handlebar to the steering column.</li> <li>- Carefully rest the rear handlebar cover against the leg-shield, paying attention not to scratch any plastic parts.</li> </ul>							
<ul style="list-style-type: none"> <li>- Remove the steering column ring nut cover.</li> </ul>							
<ul style="list-style-type: none"> <li>- Remove the counter ring nut, the spacing washer and the top steering column ball-cage bearing seat ring nut.</li> <li>- Extract the steering column and remove the mudguard from the suspension.</li> </ul> <p><b>Specific tools and equipment:</b> Steering column ring nut spanner 020055Y</p>							
<ul style="list-style-type: none"> <li>- For re-assembly, follow the operations for removal in the reverse order, carefully applying grease on the steering column ball-cage bearing seats and tightening at the prescribed torques.</li> </ul> <p><b>Tightening torques:</b></p> <table> <tr> <td>Upper ring nut</td><td>21-28 lbs·ft (30-40 N·m)</td></tr> <tr> <td>Lower ring nut</td><td>6-7 lbs·ft (8-10 N·m)</td></tr> <tr> <td>Handlebar-steering column</td><td>32-35 lbs·ft (45-50 N·m)</td></tr> </table>		Upper ring nut	21-28 lbs·ft (30-40 N·m)	Lower ring nut	6-7 lbs·ft (8-10 N·m)	Handlebar-steering column	32-35 lbs·ft (45-50 N·m)
Upper ring nut	21-28 lbs·ft (30-40 N·m)						
Lower ring nut	6-7 lbs·ft (8-10 N·m)						
Handlebar-steering column	32-35 lbs·ft (45-50 N·m)						

## 11.4 Removing the Front Wheel Hub

- Remove the front wheel.
- Remove the front brake caliper.
- Remove the split pin and the wheel axle nut cap shown in the figure.



- Remove the wheel axle nut.
- Extract the wheel hub, complete with brake disk, from its axle.



- For re-fitting, perform the operations for removal in the reverse order.





### **Tightening torque:**

Wheel axle nut                      53-63 lbs·ft  
(75-90 N·m)

## 11.5 Front Wheel Hub Overhaul

- Remove the snap ring shown in the figure.



<ul style="list-style-type: none"> <li>- Using the specific tool, remove the ball bearing.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>15mm pliers 001467Y014 Bell 001467Y017</p>	
<ul style="list-style-type: none"> <li>- Using a flat screwdriver, remove the oil seal on the roller bearing side.</li> </ul>	
<ul style="list-style-type: none"> <li>- Using the specific tool, remove the roller bearing.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>Handle 020376Y Adapter 020456Y 0.787 in (20mm) guide 020363Y</p>	
<ul style="list-style-type: none"> <li>- With the aid of the hot air gun, heat the roller bearing seat.</li> <li>- Using the specific tool, insert the bearing with the screened side facing outwards and push it home.</li> <li>- Refit the snap ring.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>Handle 020376Y 1.7×1.8 in (42×47 mm) adapter 020359Y 0.591 in (15 mm) guide 020412Y Hot air gun 020151Y</p>	

- Using the specific tool, insert the roller case and push it home.
- Refit the oil seal on the roller bearing side.
- Apply grease JOTA 3 FS between ball and roller bearings.

**Specific tools and equipment:**

Punch

020038Y



## 11.6 Removing the Front Brake Caliper-Shock Absorber Bracket

- Remove the wheel hub and the brake disk.
- Remove the front shock absorber lower fixing screw.



- Remove the bracket lock snap ring.
- Extract the bracket.



- Before replacing the bracket into the wheel axle, place the O-ring as shown in the figure, in order to keep it properly positioned after the bracket assembly.
- Refit the washer and the snap ring.
- Replace the screws fixing the shock absorber to the bracket and tighten at the prescribed torque.

**Tightening torque:**

Shock absorber lower fixing screw      14-19 lbs·ft  
(20-27 N·m)



## 11.7 Front Brake Caliper-Shock Absorber Bracket Overhaul

- The caliper-shock absorber fixing bracket is provided with two roller bearings spaced from one another as shown in the figure.




- Remove the two roller bearings from the bracket using the specific tool from the shock absorber coupling side, as shown in the figure.

**Specific tools and equipment:**

Handle      020376Y  
1.0×1.1 in (26×28 mm) adapter      020441Y  
0.866 in (22 mm) guide      020365Y



<ul style="list-style-type: none"> <li>- Remove the oil guard on the wheel hub side using a screwdriver, as shown in the figure.</li> </ul>	
<ul style="list-style-type: none"> <li>- Suitably support the shock absorber-brake caliper bracket.</li> <li>- Using the specific tool, install a new oil seal and push it home.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>Handle 020376Y 2.0×2.2 in (52×55 mm) adapter 020360Y</p>	
<ul style="list-style-type: none"> <li>- Using the specific tool, install a new roller bearing on the shock absorber side and push it home.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>Punch 020036Y</p>	
<ul style="list-style-type: none"> <li>- Suitably support the shock absorber-brake caliper bracket.</li> <li>- Using the specific tool, install a new roller bearing on the wheel hub side and push it home.</li> </ul> <p><b>Specific tools and equipment:</b></p> <p>Punch 020037Y</p>	

## 11.8 Removing the Front Shock Absorber

- Remove the steering column.
- Remove the shock absorber lower fixing screws.
- Remove the top shock absorber attachments.



- For re-assembly, perform the operations for removal in the reverse order and tighten at the specified torque.

### **Tightening torque:**

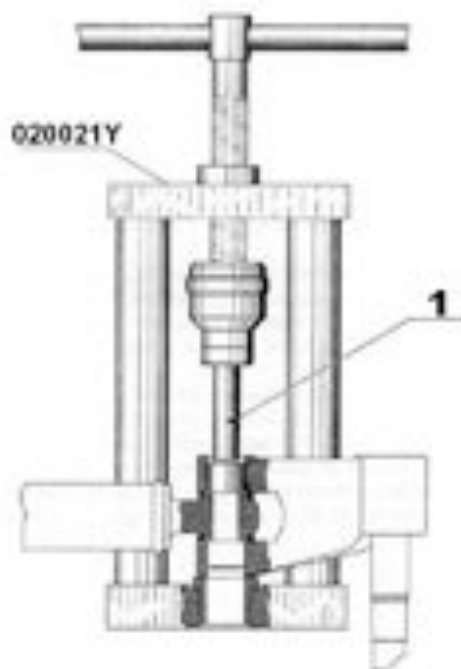
Shock absorber top fixing screw	14-21 lbs·ft (20-30 N·m)
Shock absorber lower fixing screw	14-19 lbs·ft (20-27 N·m)

## 11.9 Front Swing Arm Overhaul

- Remove the steering column.
- Remove the shock absorber- brake caliper bracket.
- Using the special tool, fitted with part 1, as shown in the figure, remove pin and roller cage from their seat.
- To remove the second roller cage, fit the tool with part 2, on the opposite side to that shown in the figure.

### **Specific tools and equipment:**

Front swing arm overhaul tool	020021Y
-------------------------------	---------



1 = Part 1

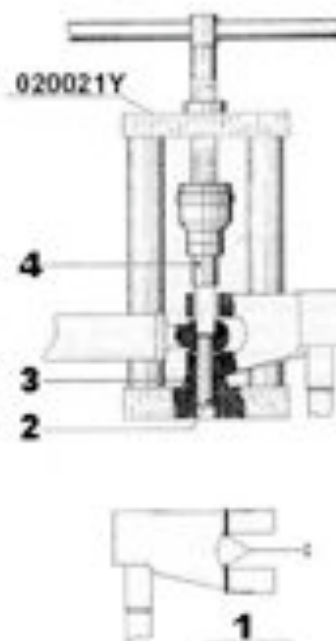


**Warning** - Reassemble with new roller cases, pins, oil seals and dust covers.

- Install the two dust covers «C» on the oscillating hub as shown in detail "A".
- Connect the oscillating hub to the steering column using the guide pin indicated as part 5.
- Fit the specific tool with the bearing, part 3, onto the shaft and part 4 at its base.
- Grease the pin with Z2 grease and insert it onto the oscillating arm. Operate the tool handle until part 3 comes into contact with the steering column.
- After fitting the pin insert the two spacers, part 17, using a mallet. C

**Specific tools and equipment:**

Front swing arm overhaul tool 020021Y



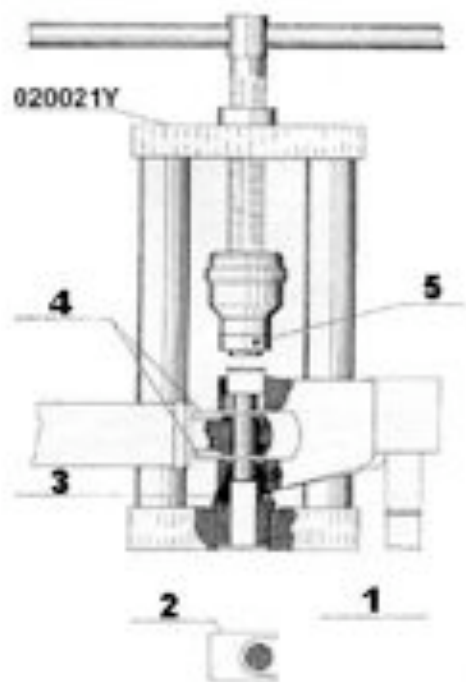
1=Detail "A"; 2=Part 5; 3=Part 4; 4=Part 3.

- Lubricate the oil seals with mineral oil and half-fill the needle casings with the recommended grease type Z2.
- Introduce the sealing ring on the pin and, at the same time, the roller bushing with wedging washer.
- Remove the specific tool, then part 5 (guide), which was partially expelled in the preceding fitting operation, while leaving part 4 fitted.
- Replace part 3 with part 16 on the shaft.
- Operating on the tool handle push the wedging washer-needle casing-oil seal assembly until part 16 is brought into contact with the oscillating hub.
- For the fitting of the second wedging washer-needle casing-oil seal assembly, repeat the above operation with the tool still bearing part 16 and with part 22\* instead of part 4 on the side opposite to that shown in the figure.

**Recommended tools and equipment:**

Front swing arm overhaul tool 020021Y

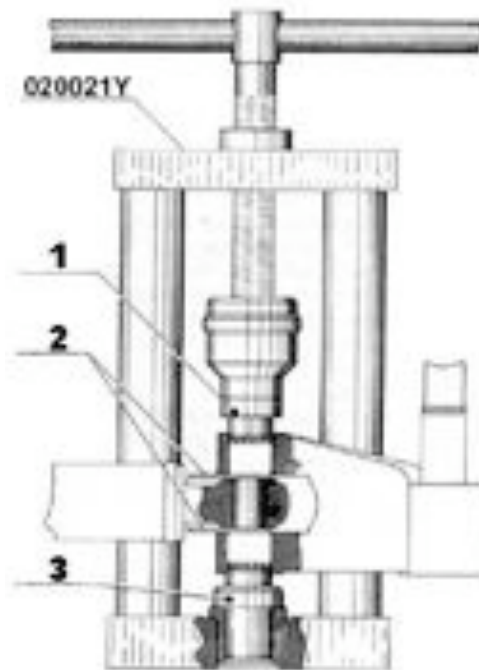
(\*) supplied with tool 020021Y.



1=Detail "B"; 2=Part 17; 3=Part 4; 4=Part 17; 5=Part 16



- Use the tool fitted with parts 20 and 21 on its shaft, as shown in the figure.
- Using the handle exert pressure until the bottom of the two needle casings is brought into contact with the pin end.
- Use the tool fitted with parts 3 and 4, as for fitting the pin, and operate the handle to exert pressure until the washers are wedged onto the oscillating hub.
- Remove the spacers (part 17); fill the gap between the steering column and the oscillating hub with Z2 grease, then place the dust covers in that space.



1=Part 20; 2=Part 17; 3=Part 21

### 11.10 Steering Column Ball-Cage Bearings Overhaul

**Note:** This operation should be carried out exclusively in the case of extreme necessity and new components must always be used during re-assembly.

- Remove the steering column.
- Using the specific tool, remove the top steering column bearing seat from underneath the steering head, as shown in the figure. Then, from the top, remove the lower steering bearing seat.

**Specific tools and equipment:**

Steering bearing removing punch

020004Y



- Using the specific tool, remove the steering column ball-cage bearing seat and the dust cover on the steering column, as shown in the figure. Use a mallet.

**Specific tools and equipment:**

Steering bearing removing punch

020004Y



- Using the specific tool, replace the dust cover and the steering column ball-cage bearing seat on the steering tube to abutment.

**Specific tools and equipment:**

Steering bearing removing punch 006029Y



- Using the specific tool, install the steering column ball-cage bearing seats on the head as shown in the figure.

**Specific tools and equipment:**

Steering bearing seat installer 001330Y



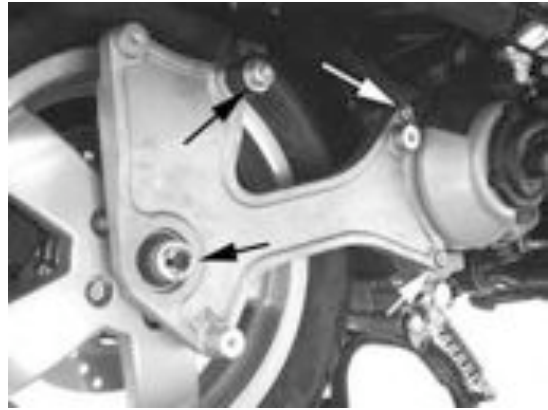
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## 11.11 Removing the Rear Shock Absorber-Silencer Bracket

- Remove the silencer.
- Remove the two screws fixing the bracket to the engine crankcase.
- Remove the split pin, the key cap, and the rear wheel axle fixing nut with spacer.
- Remove the lower shock absorber fixing.
- For re-assembly, perform the operations for removal in the reverse order, tightening each fastener at the specified torque value.

### **Tightening torques:**

Bracket-crankcase fixing screw	14-18 lbs·ft (20-25 N·m)
Shock absorber lower fixing screw	23-29 lbs·ft (33-41 N·m)
Wheel axle nut	73-88 lbs·ft (104-126 N·m)

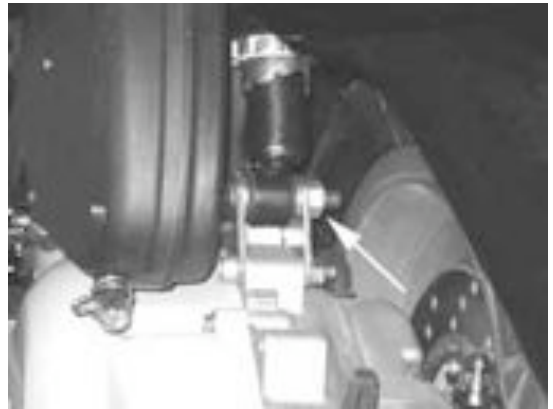


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## 11.12 Rear Shock Absorbers

### 11.12.1 Removing the Rear Shock Absorbers

- Rest the vehicle on its central stand.
- Remove the rear rack.
- Using a jack, slightly lift the engine off the ground so to unload the rear suspensions.
- Remove the silencer.
- Loosen both lower shock absorber fastening bolts (on crankcase and crankcase-silencer bracket).
- Loosen the two top shock absorber fastening screws (top picture on the right) and remove both shock absorbers.



---

### 11.12.2 Refitting the Rear Shock Absorbers

- Perform the operations for removal in the reverse order, and tighten all fasteners according to the prescribed tightening torques.

**Tightening torques:**

Shock absorber lower fixing bolt	23-29 lbs·ft (33-41 N·m)
Shock absorber top fixing screw	14-18 lbs·ft (20-25 N·m)

### 11.13 Central Stand

- Suitably support the vehicle with a jack.
- Remove the two stand-return springs.
- Loosen the nut indicated in the figure.
- Remove the RH pin.
- Remove the central stand.
- Upon reassembly, tighten the nut at the prescribed torque.

**Tightening torques:**

Central stand fastening bolt	18-21 lbs·ft (25-30 N·m)
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### 11.14 Inspecting the Rear Swing Arm

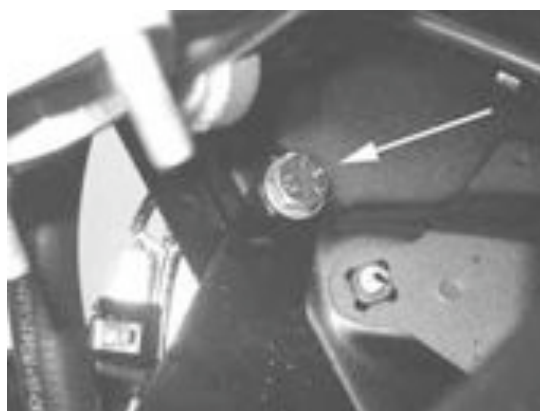
- Rest the vehicle on its central stand.
- Remove the air cleaner box.
- Remove the screw fixing the oscillating arm to the engine as shown in the figure.
- Push the engine backwards.



- Remove the spring anchoring the swing arm to the frame, as shown in the figure.



- Remove the two screws fixing the pad support bracket to the frame.



- Remove the RH and LH caps located under the footrest to access the pin fixing the swing arm to the body.



- Carefully inspect the whole of the swing assembly.





- Carefully inspect centering bushes, rubber pads, and silent block.
- Replace worn components found to exhibit excessive play, resulting in unsatisfactory riding characteristics.
- For reassembly, perform these operations in the reverse order.
- Apply TUTELA Z2 grease on all bearings and revolving components.
- Complete the assembly tightening the nuts onto the relevant pins at the correct tightening torques.

**Tightening torques:**

Swing arm bolt, engine side	45-50 lbs·ft (64-72 N·m)
Swing arm bolt, frame side	53-58 lbs·ft (76-83 N·m)
Silent-block - frame bracket screw	29-36 lbs·ft (42-52 N·m)
Swing arm bolt, engine and frame side	23-29 lbs·ft (33-41 N·m)

## 11.15 Swing Arm Overhaul

- Check that the silent-block is not broken. Replace if necessary.
- Remove the snap ring shown in the figure.



- Remove the bracket and the silent-block.
- Remove the silent-block ring shown in the figure.



- Suitably support the bracket and the silent-block in a vice.
- Using the specific tool, extract the silent-block from the bracket on the frame side. This is to ensure that the tool is centered with respect to the support.






- Install a new silent-block ensuring the alignment with the reference tooth.
- Fit the silent-block by properly matching the silent-block chamfering with that of the bracket.






- Using the specific tool, install the silent-block as shown in the figure.



## 11.16 Silent-Block Overhaul

<ul style="list-style-type: none"><li>- Check that there are no dents on the joint connecting the swing arm on the engine side to the swing arm on the frame side.</li><li>- Check the axial clearance between the two swing arms using a thickness gauge.</li></ul> <p><b>Standard clearance:</b> 0.016-0.024 in (0.40-0.60 mm)</p> <p><b>Max. allowable clearance:</b> 0.059 in (1.50 mm)</p>	
<ul style="list-style-type: none"><li>- To check the clearance on the frame-side arm, prepare the assembly using the frame-side bolt and the two spacers from tool no. 020229Y. Alternatively, use two standard washers for Ø 0.472 in (12 mm) bolts and minimum external diameter and thickness of Ø 1.181 in (30 mm) and 0.157 in (4 mm).</li></ul>	
<ul style="list-style-type: none"><li>- Check that the rotation is smooth.</li><li>- Check the axial of the swing arm on the frame-side.</li></ul> <p><b>Standard clearance:</b> 0.016-0.024 in (0.40-0.60 mm)</p> <p><b>Max. allowable clearance:</b> 0.059 in (1.50 mm)</p>	

<ul style="list-style-type: none"> <li>- Separate the swing arm on the engine-side from the swing on the frame-side.</li> <li>- Remove the plastic bushes and the internal spacer shown in the figure.</li> </ul>					
<ul style="list-style-type: none"> <li>- Using a suitable pin, remove the roller cases as shown in the figure.</li> </ul>					
<ul style="list-style-type: none"> <li>- Using the specific tool, fit new cases being careful to position bearings with sealing rings facing outwards.</li> </ul> <p><b>Specific tools and equipment:</b></p> <table border="0"> <tr> <td>Ø 0.59 in (15 mm) punch for engine-side swing arm cases</td> <td>020244Y</td> </tr> <tr> <td>Ø 0.71 in (18 mm) punch for engine-side swing arm cases</td> <td>020115Y</td> </tr> </table>	Ø 0.59 in (15 mm) punch for engine-side swing arm cases	020244Y	Ø 0.71 in (18 mm) punch for engine-side swing arm cases	020115Y	
Ø 0.59 in (15 mm) punch for engine-side swing arm cases	020244Y				
Ø 0.71 in (18 mm) punch for engine-side swing arm cases	020115Y				

**Standard dimensions:**

Engine-side swing arm tube length	$6.902 \frac{+0.008}{0.000}$	$(175.3 \frac{+0.20}{-0.00})$
Engine-side internal swing arm spacer length	$7.210 \frac{0.000}{-0.008}$	$(183 \frac{0.00}{-0.20})$
Engine-side swing arm plastic bushes diameter	$0.138 \pm 0.002$	$(3.5 \pm 0.05)$
Frame-side swing arm tube length	$11.142 \pm 0.004$	$(283 \pm 0.1)$
Frame-side internal swing arm spacer length	$11.417 \pm 0.004$	$(290 \pm 0.1)$
Frame-side swing arm plastic bushes diameter	$0.138 \pm 0.002$	$(3.5 \pm 0.05)$

- Use TUTELA Z2 to grease the roller cases and the plastic bushes.
- Insert the spacers.
- Assemble the two arms with the relevant bolt in the position shown in the figure.
- Orientate the bolt as shown in the figure.
- Place the swing arm on the frame-side with the most protruding part facing the silent-block as shown in the figure.



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## 12 Bodywork

### 12.1 Removing the Seat

- Remove the helmet compartment.
- Loosen the two screws shown in the picture.
- Remove the seat.



### 12.2 Removing the Steering Column Cover


- Remove the "PIAGGIO" badge.
- Loosen the screw shown in the picture.
- Carefully pull the cover.



### 12.3 Removing the Front Handlebar Cover


- Remove the steering column cover.
- Loosen the screw shown in the picture.



- 
- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>- Loosen the two screws shown in the figure.</li><li>- Remove the front handlebar cover.</li><li>- Carefully detach the headlight connections.</li></ul> |  |
|--|--|

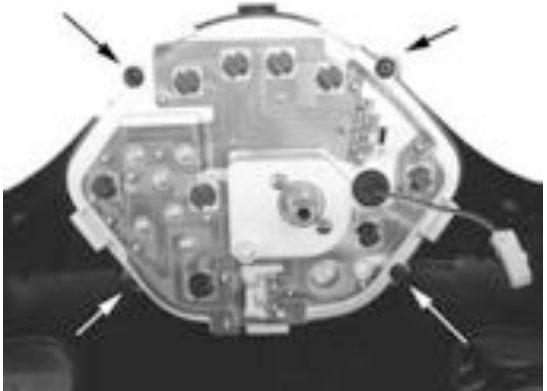


## 12.4 Removing the Rear Handlebar Cover

- |   |   |
|---|---|
| <ul style="list-style-type: none"><li>- Remove the front handlebar cover.</li><li>- Loosen the four screws shown in the picture.</li><li>- Detach the speedometer cable.</li><li>- Detach all electrical connections and remove the rear handlebar cover.</li></ul> |  |
|---|---|



## 12.5 Removing the Instrument Panel

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>- Remove the rear handlebar cover.</li><li>- Loosen the four screws shown in the picture.</li><li>- Remove the instrument panel.</li></ul> |  |
|--|--|



## 12.6 Removing the Glove-box Panel

- Remove the rear handlebar cover.
- Loosen the two screws shown in the picture, from the front leg-shield.



- Remove the expansion tank cover and its cap.
- Loosen the screw shown in the picture, positioned inside the glove-box compartment.



- Loosen the two screws shown in the picture, positioned underneath the two side covers.





- Loosen the four screws shown in the picture, positioned at the bottom of the glove-box panel.



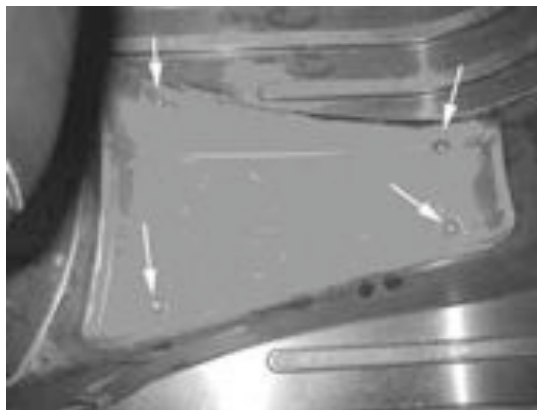
- Detach the seat opening electrical connection, the fuse holder, and the seat opening cable.



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## 12.7 Removing the Battery Compartment Cover

- Loosen the four screws shown in the picture.



## 12.8 Removing the Side Fairings

- Loosen the two screws shown in the picture and remove the fairing. Follow the same operation for both left and right hand-side.



## 12.9 Removing the Footrest

- Remove the glove-box panel.
- Remove the battery compartment cover.
- Remove the side fairings.
- Loosen the screw shown in the picture, positioned in the battery compartment.



- Remove both pillion pegs by loosening the two screws (on each side) shown in the picture.



- Loosen the two (LH and RH) footrest fixing screws.



- Remove the two (LH and RH) lower plastic covers by loosening the screw as shown in the picture.



- Remove the screws positioned underneath the rubber mat, as shown in the picture.



## 12.10 Removing the Luggage Carrier

- Remove the helmet compartment.
- Loosen the two screws shown in the picture and remove the luggage carrier cover.



- Loosen the six fixing screws shown in the figures and remove the luggage carrier.



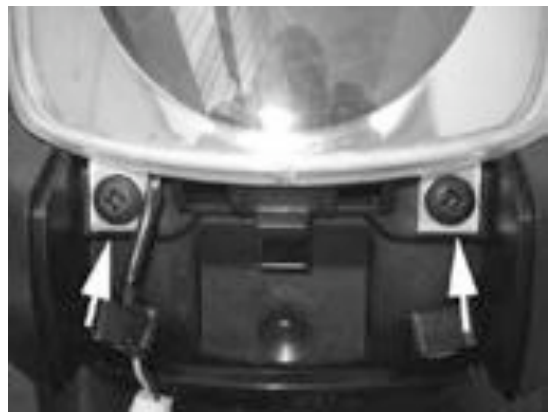
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### 12.11 Removing the Taillight

- Loosen the two license plate light fixing screws shown in the figure, and remove the plastic flap.



- Loosen the two fixing screws shown in the picture and remove the taillight.



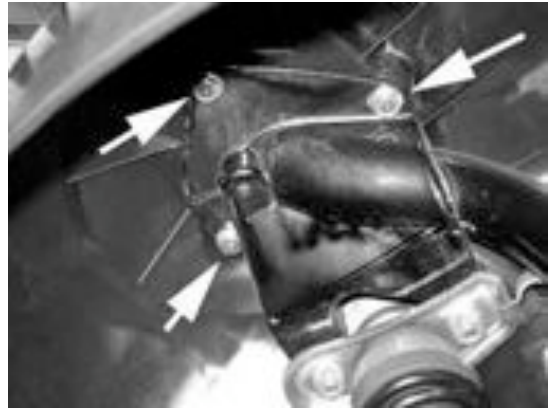
### 12.12 Removing the Helmet Compartment

- Open the seat and lift the helmet compartment bay.



### 12.13 Removing the Front Fender

- In order to remove the front fender, it is necessary to remove the steering column and disconnect the front brake tube from the caliper.
- The fender can then be removed by loosening the three fixing screws shown in the picture.



### 12.14 Removing the Fuel Tank

- Remove the helmet compartment.
  - Remove the right hand-side plastic fairing.
  - Remove the exhaust pipe.
  - Remove the luggage carrier.
  - Remove the top shock absorber fixing screws.
  - Loosen the two fuel tank fixing screws, shown in the figure, from the frame.
- 
- Detach the fuel level indicator cable, shown in the figure.



- After removing the taillight, loosen the fuel tank-frame fixing screw shown in the figure.



- Remove the fuel tap clamps shown in the figure.
- Remove the rear turn signal lights.

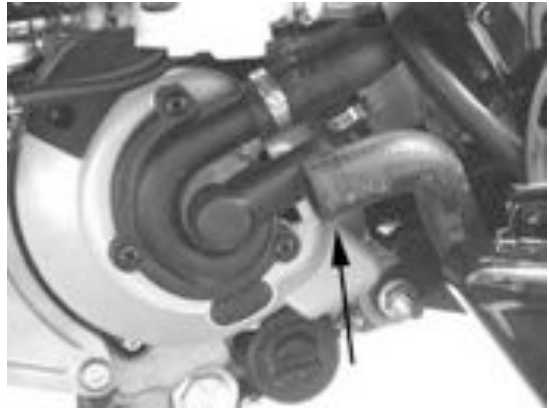


- Lift the vehicle in order to obtain enough clearance between frame and engine such to remove the fuel tank from underneath the frame.
- To reassemble the fuel tank, follow the above operations in the reverse order.



## 12.15 Removing the Radiators and the Cooling Fan

- Before acting on the radiators, drain the cooling circuit by disconnecting the liquid inlet tube from the pump.



- Remove the glove-box panel.
- Disconnect the inlet and outlet tubes from the RH radiator.
- Loosen the radiator fixing screws shown in the figure.
- Remove the radiator.



- Detach the cooling liquid tube from the plastic air conveying vent. Hence remove the conveying vent.





- Follow the same procedure for the LH radiator, although, in this case, it is necessary to remove the electric fan by loosening the three screws shown in the figure.



- When reassembling the radiators, follow the operations described above in the reverse order, paying particular attention in using new clamps for all the cooling liquid piping connections and in properly refilling the cooling circuit.

## 12.16 Removing the Rear Mudguard

- Remove the air filter.
- Loosen the fixing screw shown in the picture.
- Remove the mudguard.



## 12.17 Removing the Turn Signal Lights

- Loosen the screw shown in the figure and remove the front turn signal light.



- Loosen the screw shown in the figure and remove the rear turn signal light.



### 12.18 Removing the Electrical Opening Seat System

- Remove the helmet compartment.
- Loosen the two nuts shown in the figure.



- Detach the electrical cable from the clamps shown in the figure.



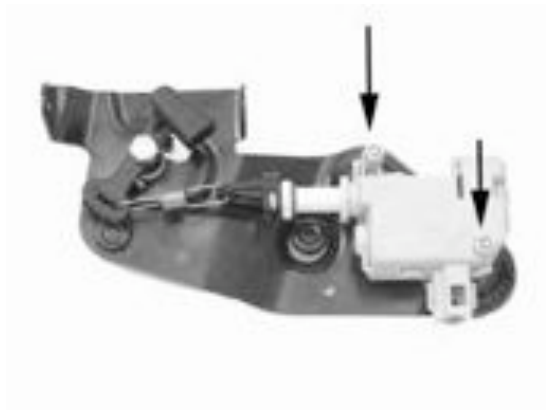
- Remove the seat opening cable.
- Remove the seat opening cable manual control.



- Detach the electrical connector from the seat opening actuator.



- Loosen the two screws shown in the figure.
- Remove the return spring.
- Remove the actuator from the support bracket.



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## 13 Pre-Delivery Inspections

Before delivering the vehicle, carry out the following checks:

**Caution** – Handle gasoline with the utmost care.

### 13.1 Checking the Vehicle Appearance

Paintwork

Plastic fairing joins

Scratches or dents

Dirtiness

### 13.2 Checking the Tightening Torques

Check all tightening torques

Check external fairing screws

### 13.3 Checking the Electrical Circuit

Charge the battery with a suitable battery charger

Ignition switch

Lights: headlight (high/low beam), taillight, and warning lights on instrument panel

Brake light and brake light switches (front and rear)

Turn signal lights (front and rear), and warning lights on instrument panel

Instrument panel light, fuel and cooling liquid temperature indicators

Horn

Electric starter

Emergency engine cut-off switch

Electrical seat opening button

**Warning** – The battery must be charged before use to ensure optimal performance. An inadequate electrolyte level will result in a premature failure of the battery.

**Warning** – When installing the battery on the vehicle connect the positive lead before the negative lead.

**Caution** – Battery electrolyte contains sulphuric acid. Battery electrolyte is poisonous and causes severe burns. Avoid contact with the eyes, skin, and clothes.

In case of contact with the eyes and/or skin, abundantly wash the affected area with clean water for about 15 minutes and seek immediate medical attention.

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In case of ingestion of electrolyte, drink water or vegetable oil and seek immediate medical attention.

Batteries produce explosive gases; keep the battery well away from open flames, sparks or cigarettes.

Ensure there is adequate ventilation when charging batteries in closed areas.

Protect the eyes when working with batteries or in their immediate vicinity.

KEEP BATTERIES AWAY FROM CHILDREN

**Warning** – Never use a fuse with a higher rating than the prescribed value. The use of unsuitably rated fuses can result in widespread damage to the vehicle, including fire.

### **13.4 Checking the Levels**

Brake fluid

Rear hub

Engine oil

Cooling liquid

### **13.5 Road Test**

Cold start

Instruments

Throttle response

Vehicle stability in acceleration and braking

Front and rear brake efficiency

Front and rear suspension efficiency

Anomalous noises

### **13.6 Static Test**

Restart with engine warm

Automatic choke device

Idle

Correct and smooth steering

Leaks

Electric fan

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## 13.7 Functional Check

Brake lever travel and braking circuit

Clutch

Engine

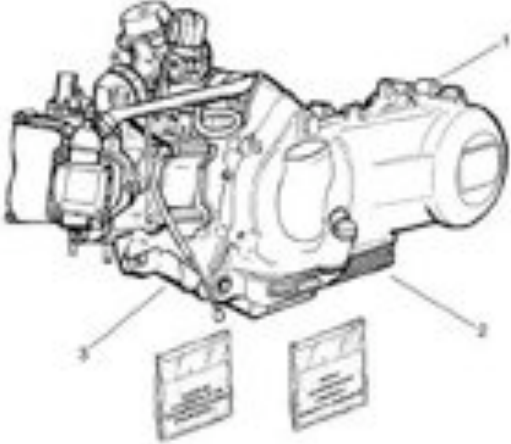
Other: documents inspection, toolkit, license plate, locks, tires inflation pressure, mirrors and accessories

**Warning** – Check and adjust the tire inflation pressure only when the tires are at ambient temperature.

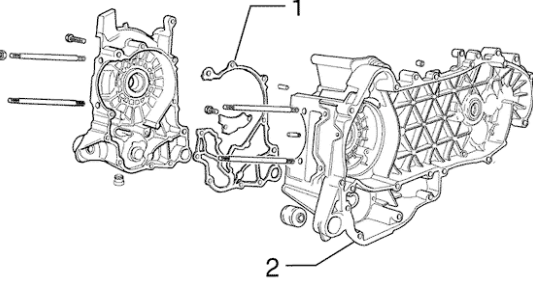
**Warning** – Over-inflated tires can burst. Never exceed the prescribed inflation pressure.

## 14 Time Sheets

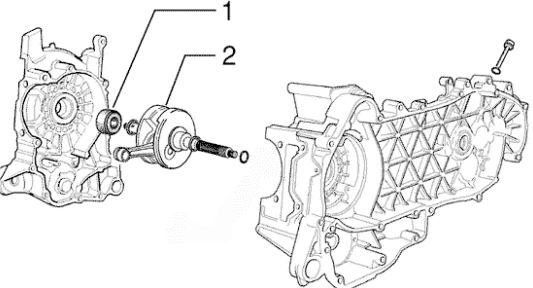
### 14.1 Engine

	Description	Op.	Code	Time
	Engine from the frame - Dismantling and Reassembling	1	001001	80'
	Engine oil - Replacement	2	003064	10'
	Engine fixing - Nut tightening	3	003057	10'

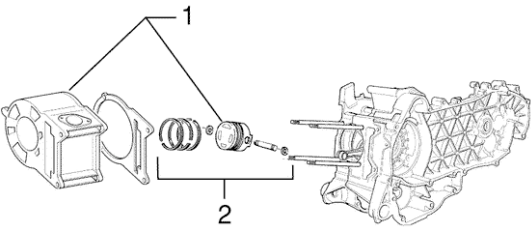
### 14.2 Crankcase

	Description	Op.	Code	Time
	Half crankcase gasket - Replacement	1	001153	140'
	Engine crankcase - Replacement	2	001133	200'

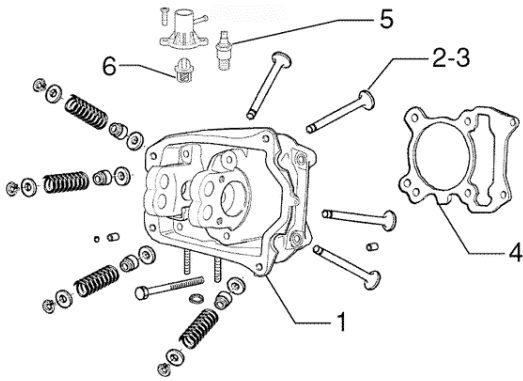
### 14.3 Crankshaft

	Description	Op.	Code	Time
	Flywheel-side oil seal - Replacement	1	001099	40'
	Engine crankshaft - Replacement	2	001117	160'

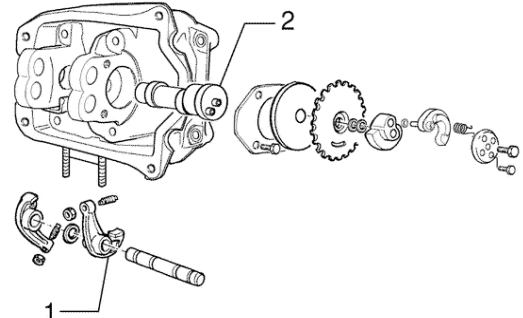
## 14.4 Piston-Cylinder Assembly

	Description	Op.	Code	Time
	Piston-cylinder assy. - Replacement	1	001002	130'
	Piston-Rings-Wrist Pin Assembly - Overhaul	2	001154	130'

## 14.5 Cylinder Head and Valves

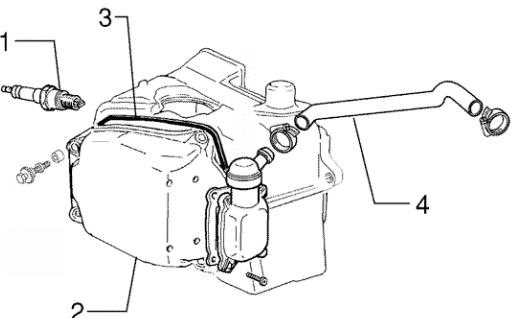
	Description	Op.	Code	Time
	Cylinder Head Assembly - Replacement	1	001126	130'
	Valves - Replacement	2	001045	130'
	Valves - Adjustment	3	001049	40'
	Head Gasket - Replacement	4	001056	120'
	Thermistore - Replacement	5	001083	15'
	Thermostat - Replacement	6	001057	20'

## 14.6 Camshaft

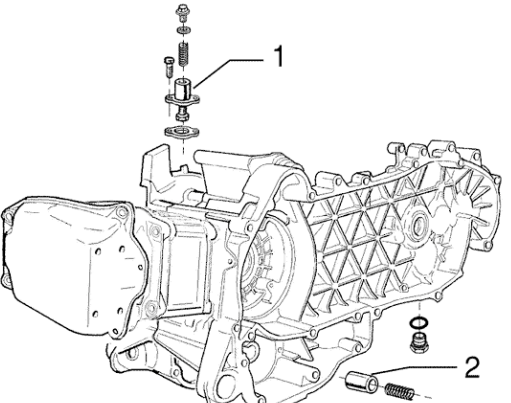
	Description	Op.	Code	Time
	Valve rockers - Replacement	1	001148	120'
	Camshaft - Replacement	2	001044	120'



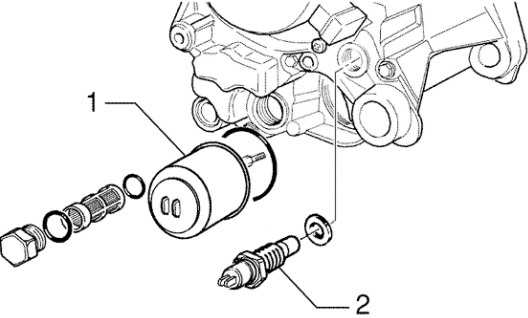
## 14.7 Valve Cover

	Description	Op.	Code	Time
	Spark plug - Replacement	1	001093	15'
	Head cover - Replacement	2	001089	40'
	Head cover gasket - Replacement	3	001088	40'
	Oil vapor recovery pipe - Replacement	4	001074	10'

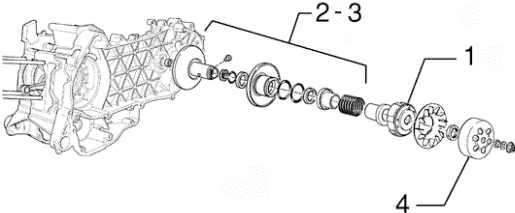
## 14.8 Chain Tensioner - By-Pass Valve

	Description	Op.	Code	Time
	Chain tensioner - Overhaul and Replacement	1	001129	10'
	Lubrication by-pass valve - Replacement	2	001124	30'

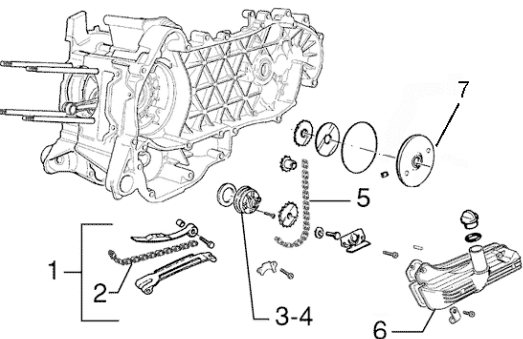
## 14.9 Oil Filter

	Description	Op.	Code	Time
	Oil filter - Replacement	1	001123	10'
	Oil pressure sensor - Replacement	2	001160	40'

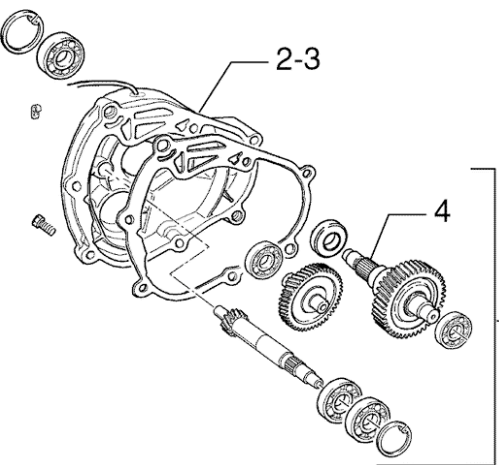
## 14.10 Driven Pulley

	Description	Op.	Code	Time
	Clutch - Replacement	1	001022	30'
	Driven pulley - Overhaul	2	001012	45'
	Driven pulley - Replacement	3	001110	30'
	Clutch drum - Replacement	4	001155	20'

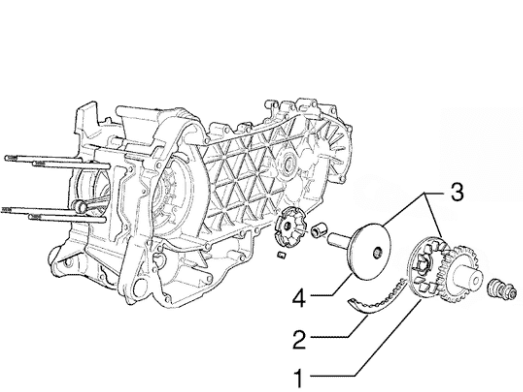
## 14.11 Pump Assembly - Oil Sump

	Description	Op.	Code	Time
	Chain guide shoe - Replacement	1	001125	140'
	Timing belt/chain - Replacement	2	001051	140'
	Oil pump - Overhaul	3	001042	70'
	Oil pump - Replacement	4	001112	60'
	Oil pump chain - Replacement	5	001122	60'
	Oil sump - Replacement	6	001130	30'
	Chain cover port - Replacement	7	001172	30'

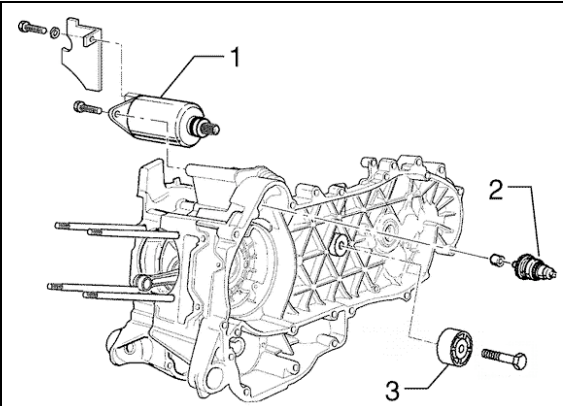
## 14.12 Rear Wheel Axle

	Description	Op.	Code	Time
	Reduction gear assy. - Overhaul	1	001010	85'
	Reduction gear cover - Replacement	2	001156	60'
	Gearbox oil - Replacement	3	003065	15'
	Rear wheel axle - Replacement	4	004125	45'

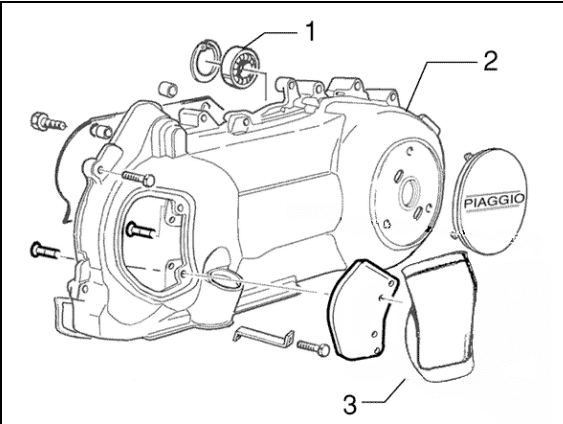
## 14.13 Driving Pulley

	Description	Op.	Code	Time
	Driving half-pulley - Replacement	1	001086	25'
	Driving belt - Replacement	2	001011	25'
	Driving pulley - Removal and reassembly	3	001066	25'
	Driving pulley - Overhaul	4	001006	25'

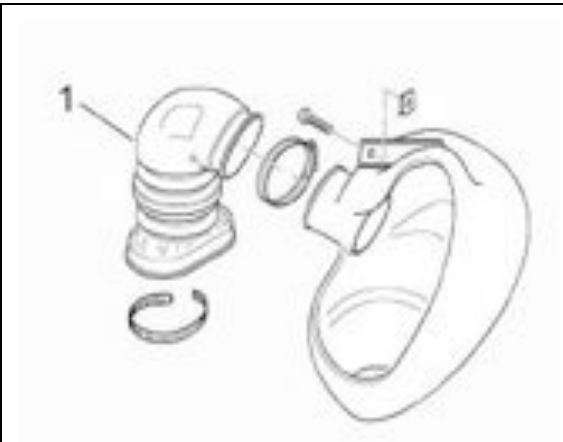
## 14.14 Electric Starter

	Description	Op.	Code	Time
	Starter motor - Replacement	1	001020	30'
	Starter pinion - Replacement	2	001017	25'
	Belt support roller - Replacement	3	001141	20'

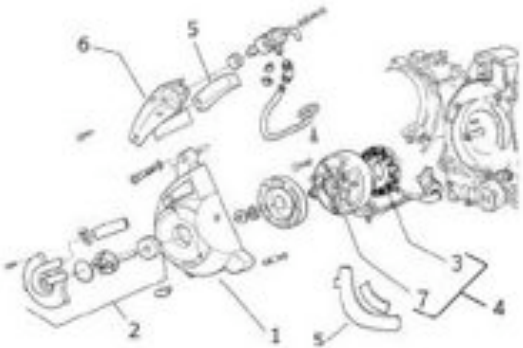
## 14.15 Kick-Starter, Transmission Cover, and Transmission Cooling

	Description	Op.	Code	Time
	Transmission cover bearing - Replacement	1	001135	25'
	Transmission cover - Replacement	2	001096	20'
	Transmission air inlet - Replacement	3	001131	20'

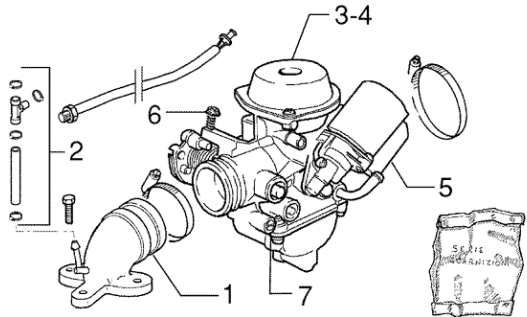
## 14.16 Transmission Cooling Air Inlet

	Description	Op.	Code	Time
	Transmission air inlet pipe - Replacement	1	001132	10'

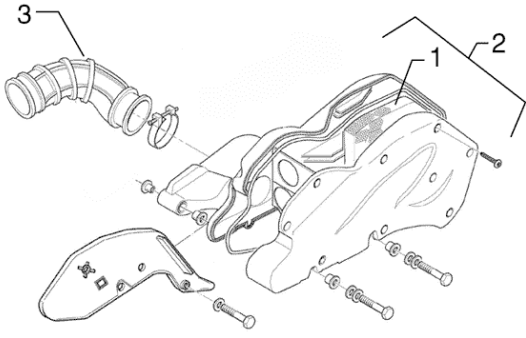
## 14.17 Flywheel Magneto

	Description	Op.	Code	Time
	Flywheel cover - Replacement	1	001087	60'
	Water pump, pump impeller - Replacement	2	001113	50'
	Stator - Removal and reassembly	3	001067	45'
	Complete flywheel - Replacement	4	001058	45'
	Secondary air filter - Replacement	5	001161	30'
	Secondary air filter box - Replacement	6	001162	30'
	Rotor - Replacement	7	001173	45'

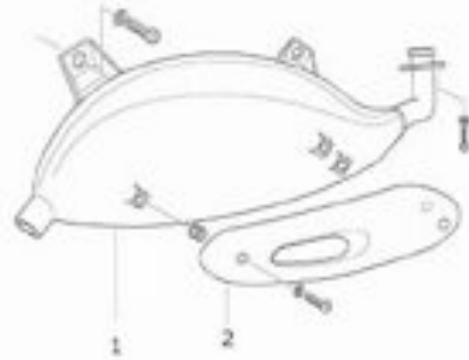
## 14.18 Carburetor

	Description	Op.	Code	Time
	Intake manifold - Replacement	1	001013	10'
	Carburetor heating pipes - Replacement	2	007020	20'
	Carburetor - Overhaul	3	001008	30'
	Carburetor - Replacement	4	001063	20'
	Automatic choke - Replacement	5	001081	15'
	Carburetor - Adjustment	6	003058	10'
	Exhaust emissions - Adjustment	7	001136	20'

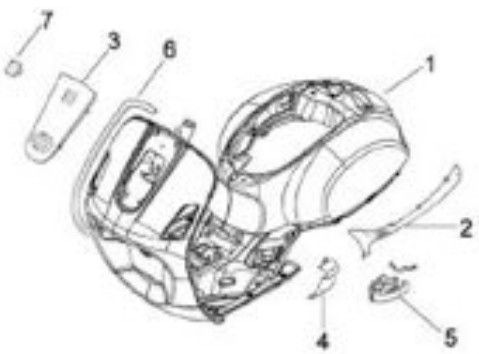
## 14.19 Air Filter

	Description	Op.	Code	Time
	Air filter - Replacement/Cleaning	1	001014	20'
	Air filter box - Replacement	2	001015	15'
	Carburetor-air box bellow - Replacement	3	004122	20'

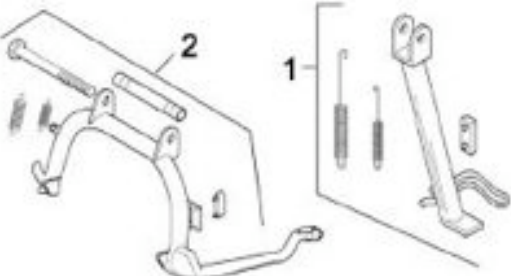
## 14.20 Silencer

	Description	Op.	Code	Time
	Silencer - Replacement	1	001009	15'
	Silencer protection- Replacement	2	001095	10'

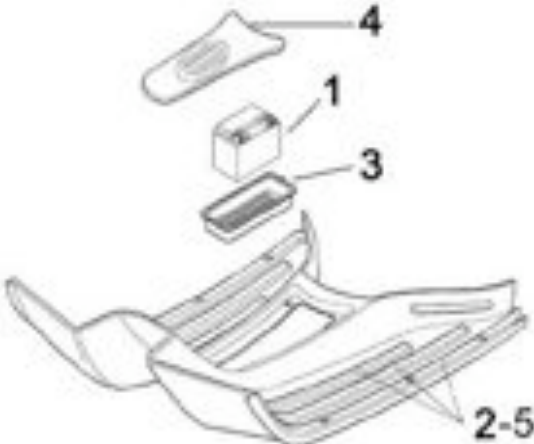
## 14.21 Frame

	Description	Op.	Code	Time
	Frame - Replacement	1	004001	240'
	Fairing (1) - Replacement	2	004085	5'
	Horn - Replacement	3	004149	5'
	Spoiler - Replacement	4	004053	5'
	Passenger footrest - Removal and reassembly	5	004015	5'
	Shield edge - Replacement	6	004023	45'
	Badges - Replacement	7	004159	10'


## 14.22 Central Stand

	Description	Op.	Code	Time
	Side stand - Replacement (non-US)	1		
	Central stand - Replacement	2	004004	10'

## 14.23 Footrest and Battery

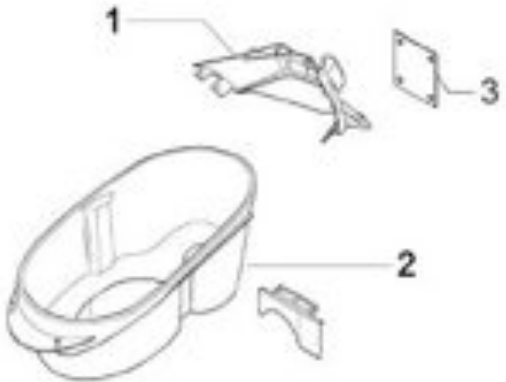
	Description	Op.	Code	Time
	Battery - Replacement	1	005007	20'
	Footrest - Replacement	2	004079	40'
	Battery compartment - Replacement	3	004071	10'
	Battery cover - Replacement	4	005046	5'
	Footrest rubber - Replacement	5	004078	5'

## 14.24 Glove-Box

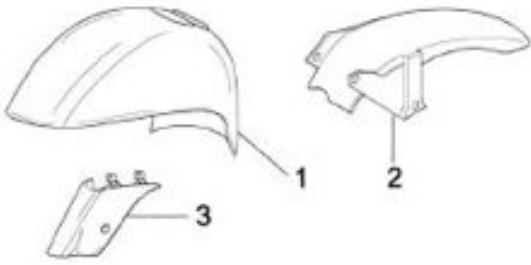
	Description	Op.	Code	Time
	Glove-box - Replacement	1	004083	25'
	Glove-box flap - Replacement	2	004081	25'



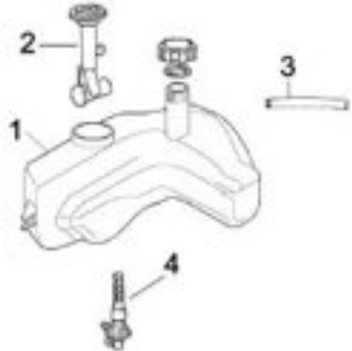
## 14.25 Helmet Compartment and Rear Fender

	Description	Op.	Code	Time
	Rear fender - Replacement	1	004136	15'
	Helmet compartment - Removal and reassembly	2	004016	5'
	Plate holder - Replacement	3	005048	10'

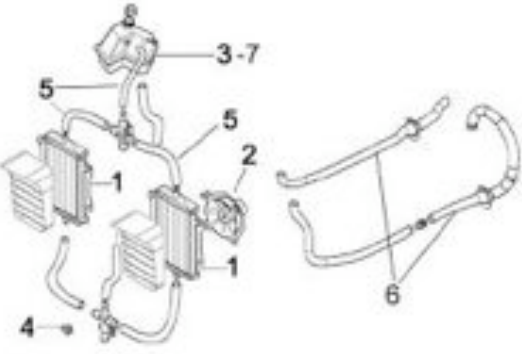
## 14.26 Front Fender and Rear Mudguard

	Description	Op.	Code	Time
	Front fender - Replacement	1	004002	45'
	Rear mudguard - Replacement	2	004009	20'
	Front suspension cover - Replacement	3	003044	10'


## 14.27 Fuel Tank

	Description	Op.	Code	Time
	Fuel tank - Replacement	1	004005	50'
	Tank float - Replacement	2	005010	45'
	Fuel tank bleed - Replacement	3	004109	10'
	Fuel tap - Replacement	4	004007	10'

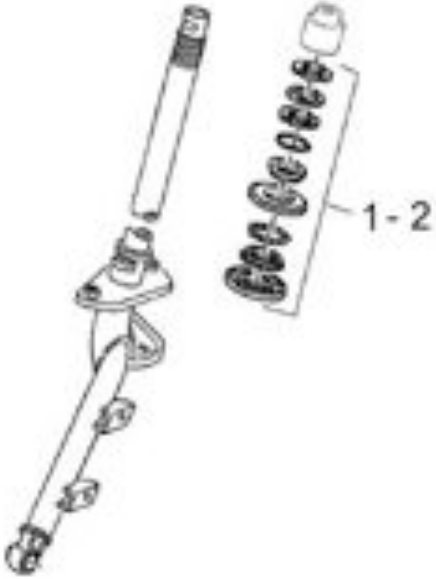
## 14.28 Cooling System

	Description	Op.	Code	Time
	Radiator - Replacement	1	007002	35'
	Fan with support - Replacement	2	007016	30'
	Expansion tank - Replacement	3	007001	40'
	Thermo-switch - Replacement	4	007014	55'
	Tank-radiator pipe - Replacement	5	007013	40'
	Coolant pipe - Replacement	6	007003	60'
	Coolant and air vent - Replacement	7	001052	20'

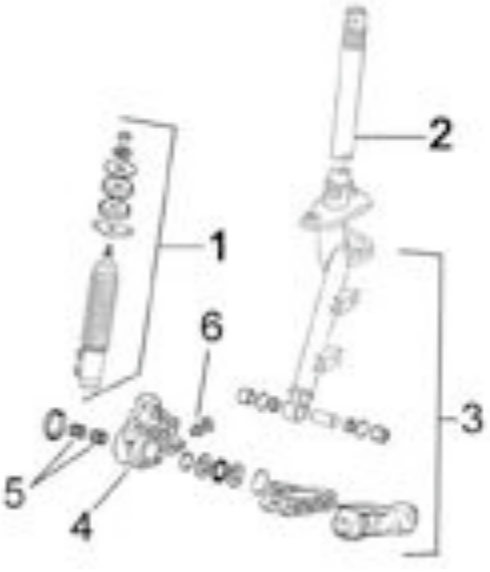
## 14.29 Fuel Pump

	Description	Op.	Code	Time
	Fuel pump - Replacement	1	004073	15'
	Fuel pump-tank tube - Replacement	2	004089	10'
	Fuel filter- Replacement	3	004072	10'
	Vacuum fuel pump tube - Replacement	4	004086	10'
	Pump-carburetor tube - Replacement	5	004086	10'

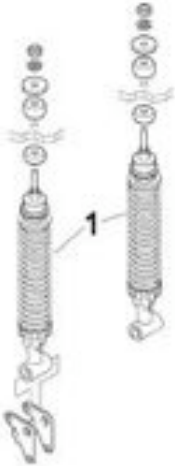
### 14.30 Steering Column

	Description	Op.	Code	Time
	Steering column ball-cage bearings - Replacement	1	003002	60'
	Steering column play - Adjustment	2	003073	25'

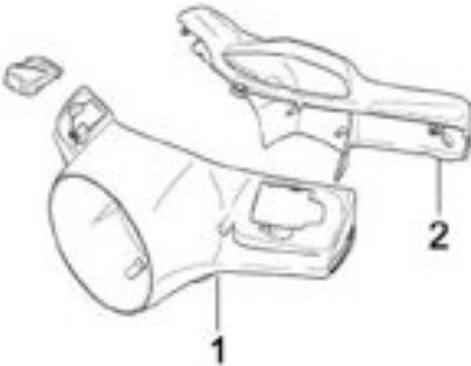
### 14.31 Front Suspension

	Description	Op.	Code	Time
	Front shock absorber - Removal and reassembly	1	003011	20'
	Steering column - Replacement	2	003045	60'
	Front suspension - Overhaul	3	003010	100'
	Brake caliper/suspension bracket - Replacement	4	003035	25'
	Front wheel hub bearings - Replacement	5	003034	40'
	Odometer reel - Replacement	6	001064	15'

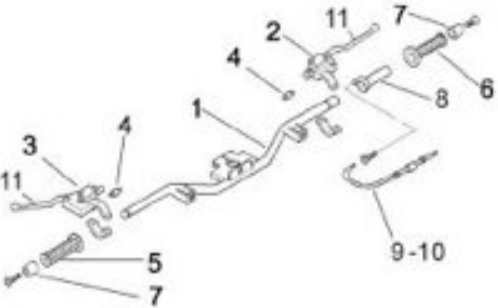
### 14.32 Rear suspension

	Description	Op.	Code	Time
	Rear shock absorber - Removal and reassembly	1	003007	20'

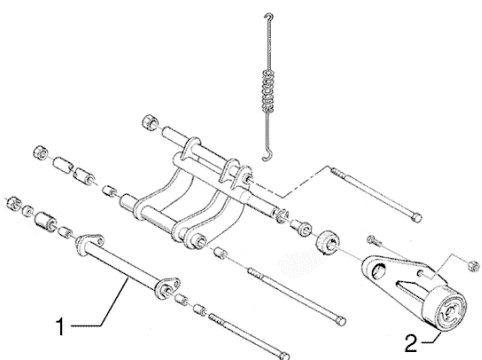
### 14.33 Handlebar Covers

	Description	Op.	Code	Time
	Handlebar cover, front side - Replacement	1	004018	15'
	Handlebar cover, back side - Replacement	2	004019	20'

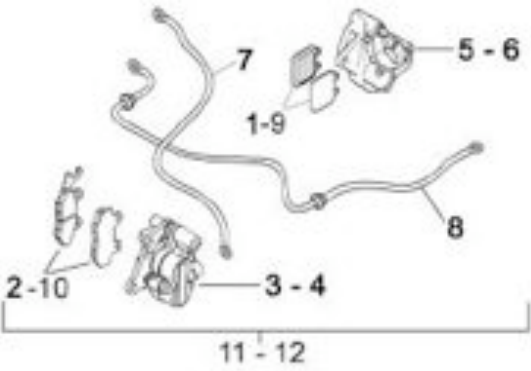
## 14.34 Handlebar, and Brake and Throttle Controls

	Description	Op.	Code	Time
	Handlebar - Removal and reassembly	1	003001	45'
	Front brake pump - Replacement	2	002024	35'
	Rear brake pump - Replacement	3	002024	35'
	Brake light switch - Replacement	4	005017	20'
	LH handgrip - Replacement	5	002059	10'
	RH handgrip - Replacement	6	002071	10'
	Counterweight - Replacement	7	003059	5'
	Throttle sleeve - Replacement	8	002060	30'
	Complete throttle cable - Replacement	9	002063	50'
	Throttle cable - Adjustment	10	003061	10'
	Brake lever - Replacement	11	002037	15'

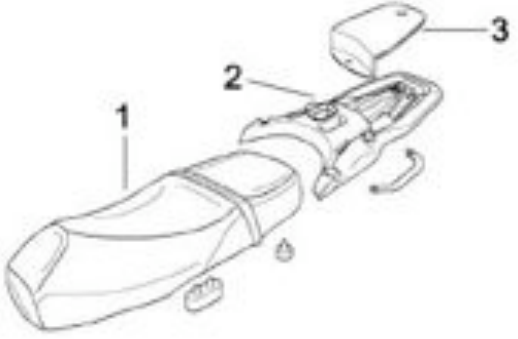
## 14.35 Swing Arm

	Description	Op.	Code	Time
	Engine/Frame swing arm - Replacement	1	001072	50'
	Silent-block - Replacement	2	004058	60'

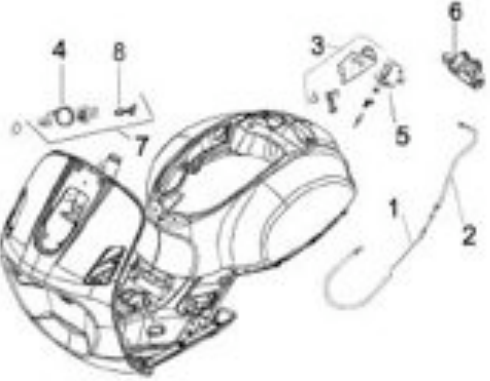
## 14.36 Brakes

	Description	Op.	Code	Time
	Rear brake pads - Wear check	1	003071	5'
	Front brake pads - Wear check	2	003070	5'
	Front brake caliper - Overhaul	3	002040	60'
	Front brake caliper - Removal and reassembly	4	020039	20'
	Rear brake caliper - Removal and reassembly	5	002048	35'
	Rear brake caliper - Overhaul	6	002068	50'
	Front brake tube - Removal and reassembly	7	002021	45'
	Rear brake tube - Removal and reassembly	8	002020	50'
	Rear brake pads - Removal and reassembly	9	002002	30'
	Front brake pads - Removal and reassembly	10	002007	15'
	Front brake fluid - Replacement	11	002047	15'
	Rear brake fluid - Replacement	12	002080	15'

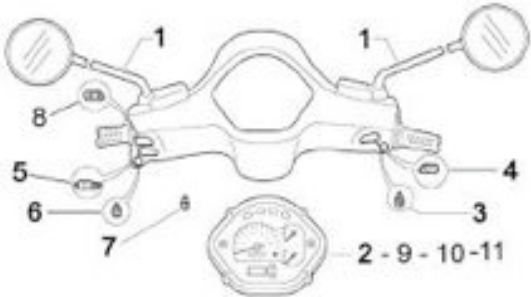
### 14.37 Saddle and Rear Rack

	Description	Op.	Code	Time
	Saddle - Replacement	1	004003	10'
	Rack - Replacement	2	004008	10'
	Rack cover - Replacement	3	004062	5'

### 14.38 Locks and Immobilizer

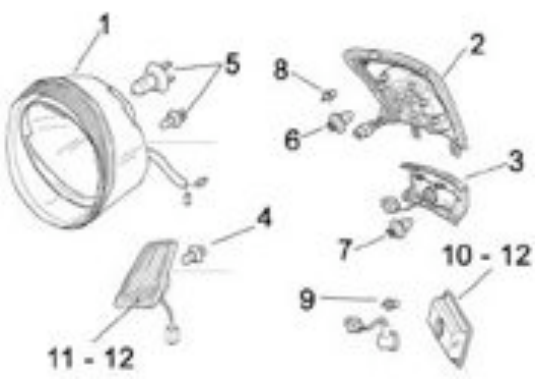
	Description	Op.	Code	Time
	Saddle opening cable - Replacement	1	002083	45'
	Lock cable for saddle opening - Replacement	2	002092	20'
	Lock for saddle opening - Replacement	3	004158	20'
	Immobilizer antenna - Replacement	4	005072	30'
	Electric device for saddle opening - replacement	5	005099	20'
	Saddle lock - Replacement	6	004054	10'
	Steering lock - Replacement	7	004010	35'
	Ignition switch - Replacement	8	005016	35'

### 14.39 Mirrors, Electric Controls, and Instrument Panel

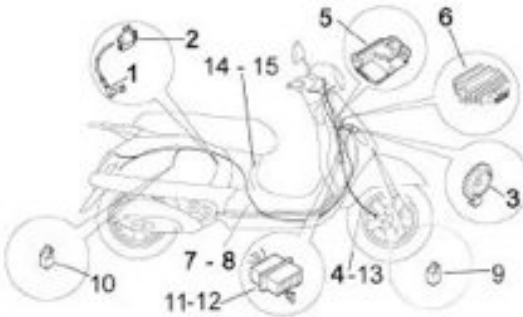
 <p>The diagram shows a top-down view of a motorcycle's handlebars and instrument panel. Numbered callouts point to various components: 1 points to the rearview mirrors; 2 points to the instrument panel; 3 points to the start button; 4 points to the engine cut-off switch; 5 points to the turn signal switch; 6 points to the horn button; 7 points to the saddle opening button; 8 points to the ignition switch; 9 points to the lights switch; 10 points to the panel warning lights; and 11 points to the clock/battery unit. A group of callouts 2, 9, 10, and 11 are clustered near the instrument panel.</p>	Description	Op.	Code	Time
	Rearview mirror - Replacement	1	004066	5'
	Instrument panel - Replacement	2	005014	20'
	Start button - Replacement	3	005041	20'
	Engine cut-off switch - Replacement	4	005077	20'
	Turn signal switch - replacement	5	005006	20
	Horn button - Replacement	6	005040	20'
	Saddle opening button - Replacement	7	005121	25'
	Ignition switch - Replacement	8	005039	20'
	Lights switch - Replacement	9	005078	25'
	Panel warning lights - Replacement	10	005038	10'
	Clock/battery - Replacement	11	005076	15'



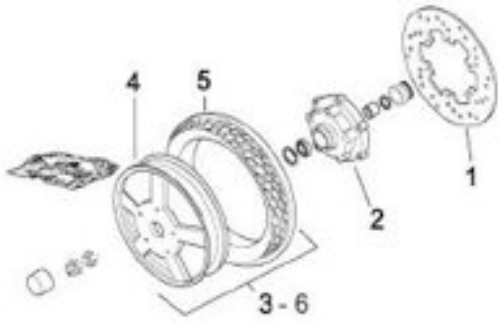
## 14.40 Lights

	Description	Op.	Code	Time
	Headlight - Replacement	1	005002	15'
	Taillight - Replacement	2	005005	10'
	License plate light - Replacement	3	005032	10'
	Front turn signal bulb - Replacement	4	005067	5'
	Headlight bulb - Replacement	5	005008	10'
	Taillight bulb - Replacement	6	005066	10'
	Plate light bulb - Replacement	7	005031	10'
	Brake light bulb - Replacement	8	005090	10'
	Rear turn signal bulb - Replacement	9	005068	5'
	Rear turn signal light - Replacement	10	005022	5'
	Front turn signal light - Replacement	11	005012	5'
	Turn signal lens - Replacement	12	005091	5'

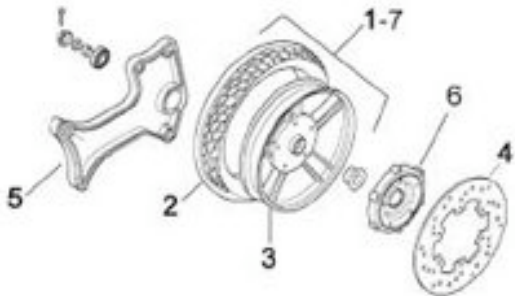
## 14.41 Electrical Devices

	Description	Op.	Code	Time
	Spark plug cap - Replacement	1	001094	10'
	H.T. coil - Replacement	2	001069	15'
	Horn - Replacement	3	005003	10'
	Odometer/Speedometer cable - Replacement	4	002049	20'
	Electronic ignition device - Replacement	5	001023	40'
	Voltage regulator - Replacement	6	005009	20'
	Electrical circuit - Replacement	7	005001	120'
	Electrical circuit - Overhaul	8	005114	30'
	Headlight relay - Replacement	9	005035	15'
	Starting relay - Replacement	10	005011	15'
	Fuse holder - Replacement	11	005054	25'
	Fuse holder board - Replacement	12	005019	25'
	Complete odo/speedometer cable - Replacement	13	002051	40'
	Battery fuse - Replacement	14	005024	10'
	Battery fuse holder - Replacement	15	002025	10'

## 14.42 Front Wheel

	Description	Op.	Code	Time
	Front brake disk - Replacement	1	002041	25'
	Front wheel hub - Replacement	2	003033	25'
	Front wheel - Replacement	3	004123	10'
	Front wheel rim - Removal and reassembly	4	003037	15'
	Front tire - Replacement	5	003047	15'
	Front tire - Check	6	003063	5'

## 14.43 Rear Wheel

	Description	Op.	Code	Time
	Rear wheel - Replacement	1	001016	20'
	Rear tire - Replacement	2	004126	25'
	Rear wheel rim - Removal and reassembly	3	001071	25'
	Rear brake disk - Replacement	4	002070	35'
	Silencer-suspension support bracket - Replacement	5	003077	25'
	Rear wheel hub - Replacement	6	002028	35'
	Rear tire pressure - Check	7	003063	5'