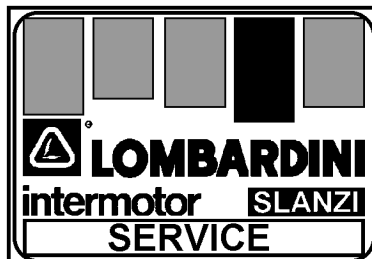



WORKSHOP MANUAL

Engines series LGA 226 cod. 1-5302- 527

LGA 226

1st Edition



COMPILER TECN. ATL <i>M. J. Imella</i>	REG. CODE 1-5302-527	MODEL N° 50804	DATE OF ISSUE 31.07.2001	REVISION 00	DATE 31.07.2001	ENDORSED <i>Mano...</i>		1
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PREFACE

Every attempt has been made to present within this service manual, accurate and up to date technical information. However, development on the Lombardini series is continuous. Therefore, the information within this manual is subject to change without notice and without obligation.

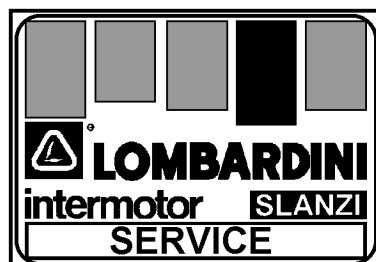
The information contained within this service manual is the sole property of Lombardini. As such, no reproduction or replication in whole or part is allowed without the express written permission of Lombardini.

Information presented within this manual assumes the following:

- 1- The person or persons performing service work on Lombardini series engines is properly trained and equipped to safely and professionally perform the subject operation;
- 2- The person or persons performing service work on Lombardini series engines possesses adequate hand and Lombardini special tools to safely and professionally perform the subject service operation;
- 3- The person or persons performing service work on Lombardini series engines has read the pertinent information regarding the subject service operations and fully understands the operation at hand.

GENERAL SERVICE MANUAL NOTES:

- 1- Use only genuine Lombardini repair parts. Failure to use genuine Lombardini parts could result in sub-standard performance and low longevity.
- 2- All data presented are in metric format. That is, dimensions are presented in millimeters (mm), torque is presented in Newton-meters (Nm), weight is presented in kilograms (Kg), volume is presented in liters or cubic centimeters (cc) and pressure is presented in barometric units (bar).



WARRANTY CERTIFICATE

Engine manufactured by Lombardini S.r.l., are warranted to be free of defects in workmanship or materials for 12 months from the date of delivery to the first purchaser or non more than two (2) years from date of engine delivery to the Original Equipment Manufacturer as defined by Lombardini invoicing, whichever occurs firsts, except as defined below.

Stationary applications, working at constant speed and/or slightly variable speeds, are excluded from the above terms. Stationary/fixed speed applications will be warranted to be free of material/workmanship defects for a maximum operational period of 1000 hours or 12months from the date of first purchase, whichever occurs first. The two (2) year limitation from date of Lombardini invoice will remain intact as described above.

Modification of Lombardini products by the Original Equipement Manufacturer or the end user with respect to cooling systems, filtration systems, induction systems, exhaust systems, lubrication system, fuel system, fuel system settings, etc., will require special written warranty agreements. A test certificate/approval by the R&D/Application engineering department of Lombardini or associated Lombardini companies concerning modified Lombardini products will entitle Warranty as defined above. Warranty will not be granted on any modified Lombardini product without special written approval by Lombardini.

Within the above stated periods Lombardini will replace and/or repair, at the option of Lombardini, any part or component that, upon examination by Lombardini or an authorized Lombardini agent, is found to be defective in workmanship or materials. Any other responsibility/obligation for different expenses, damages and direct/indirect losses deriving from the engine use or from both the total or partial impossibility of use, is excluded.


The repair or replacemnt of any component will not extend or renew the warranty period. Direct labor required to make repairs or to replace components found to be defective in materials or workmanship will be completed at no cost to the end user. Lombardini in not responsible however for indirect costs of removing/installing the engine assembly. Further, Lombardini is not responsible for the costs of transportation of the machine or components requiring repair or for service supplies such as lubricating oils and filters.

Lombardini Warranty obligations will be cancelled if:

- Lombardini engines are applied to a given machine causing working engine parameters outside Lombardini application guidelines.
- Lombardini engines are not serviced and maintained according to the "USE and MAINTENANCE" booklet.
- Any seal affixed to the engine by Lombardini has been tampered with or removed.
- Engines have been disassembled, repaired or altered by any party other than an authorized Lombardini agent.
- Spare parts used are not original Lombardini.
- Fuel injection system/component failures caused by the use of unauthorized fuel types or poor quality fuels are not covered under the Lombardini warranty policy.
- Electrical system failures due to the modification of Lombardini supplied harnesses, modification of Lombardini supplied control panels, OEM/end user supplied/installed relays, controls, etc. are not covered under warranty.

Following expiration of the above stated warranty period(s) and limitations, Lombardini will have no further responsibility for warranty and will consider our obligation for warranty complete.

The above warranty certificate will be in effect starting July 1, 1993 and cancels/replaces any and all explicit or implicit warranty policies on the part of Lombardini. The above warranty conditions can from this date forward be modified only in writing.

COMPILER TEC <i>M. Jimmella</i>	REG. CODE 1-5302-527	MODEL N° 50804	DATE OF ISSUE 31.07.2001	REVISION 00	DATE 31.07.2001	ENDORSED <i>Marco B...</i>		3
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This manual gives the main instructions on how to repair LOMBARDINI LGA 226 gasoline-fuelled engines, updated as of 31.07.2001.

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COMPILER TECOATL

Miguel Jimenez

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MODEL N°

50804

DATE OF ISSUE

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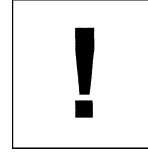
TROUBLE SHOOTING

Listed below are some of the possible causes of engine operating defects.
Carry out simple tests before proceeding with disassembly operations or making substitutions.

POSSIBLE CAUSES	TROUBLE											
	Does not start	Starts and stops	Lacks power	Noisy	White smoke	Dark smoke	Overheats	Consumes oil	Hunts	Does not accel.	Loses oil from breater	Spark plug fails to spark
Tank plug breather clogged		●										
Tap clogged		●	●						●			
Carburetor venting holes obstructed		●	●				●					
Fuel line clogged	●		●						●			
Fuel filter clogged		●	●				●		●			
Dirty carburetor			●			●	●					
Carburetor needle valve blocked		●	●							●		
Speed governor rod blocked							●			●		
Empty tank	●											
Grounded spark plug	●											●
Broken spark plug lead	●											●
Defective coil	●	●								●		
Clogged air filter		●	●									
Blocked valves	●	●	●						●			
Worn piston rings			●		●			●		●	●	
Excessive valve play			●	●						●		
Defective oil seals								●			●	
Worn valve guides			●	●		●				●		
Worn governor spring							●			●		
Piston seizure			●	●				●		●		
Loose head locking-nuts	●		●							●		
Low idling		●										

WARNING SIGNS**DANGER**

By not respecting these directions the user may place at risk persons and objects.

CAUTION


By not respecting these directions the user can cause technical damage to the unit and/or to the installation.

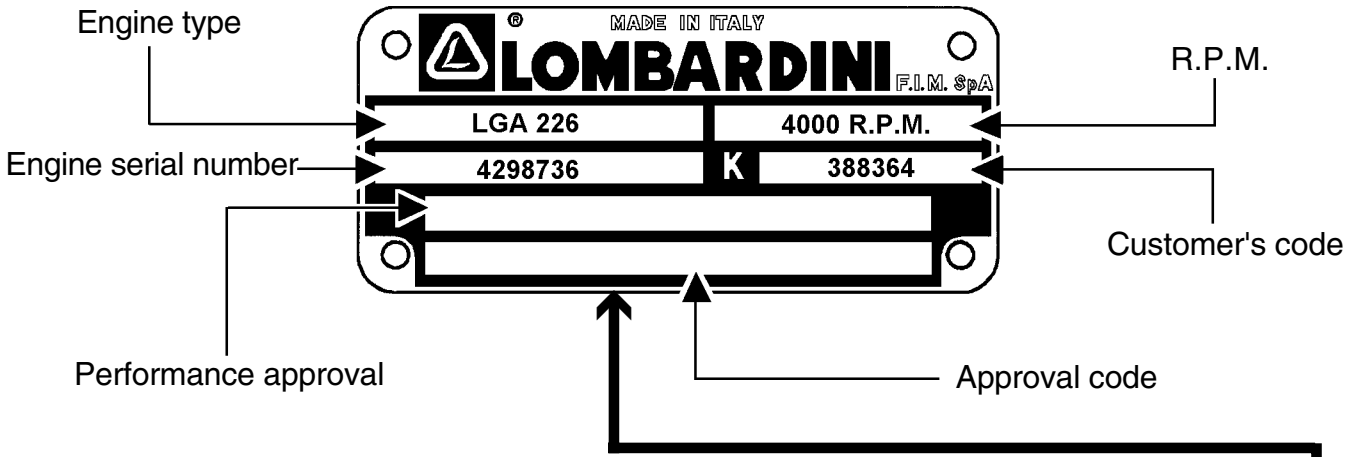
**SAFETY INSTRUCTIONS**

- Lombardini engines are built to provide safe and longlasting performances, but in order to obtain these results it is essential that the maintenance requirements described in the manual are observed along with the following safety recommendations.
- The engine has been built to the specifications of a machine manufacturer, and it is his responsibility to ensure that all necessary action is taken to meet the essential and legally prescribed health and safety requirements. Any use of the machine other than that described cannot be considered as complying with its intended purpose as specified by Lombardini, which therefore declines all responsibility for accidents caused by such operations.
- The following instructions are intended for the user of the machine in order to reduce or eliminate risks, especially those concerning the operation and standard maintenance of the engine.
- The user should read these instructions carefully and get to know the operations described. By not doing so he may place at risk his own health and safety and that of anyone else in the vicinity of the machine.
- The engine may be used or mounted on a machine only by personnel suitably trained in its operation and aware of the dangers involved. This is particularly true for standard and, above all, special maintenance work. For special maintenance contact personnel trained specifically by Lombardini. This work should be carried out in accordance with existing literature.
- Lombardini declines all responsibility for accidents or for failure to comply with the requirements of law if changes are made to the engine's functional parameters or to the fuel flow rate adjustments and speed of rotation, if seals are removed, or if parts not described in the operating and maintenance manual are removed and reassembled by unauthorized personnel.
- In addition to all other machine specifications, ensure that the engine is in a near horizontal position when starting. If starting manually, ensure that the necessary operations can be performed without any risk of striking against walls or dangerous objects. Rope starting (except for recoil rope starting) is not permitted even in emergencies.
- Check that the machine is stable so that there is no risk of it overturning.
- Get to know the engine speed adjustment and machine stop operations.
- Do not start the machine in closed or poorly ventilated environments. The internal combustion process generates carbon monoxide, an odourless and highly toxic gas, so spending too long a time in an environment where the engine discharges its exhaust products freely can lead to loss of consciousness and even death.
- The engine may not be used in environments containing flammable materials, explosive atmospheres or easily combustible powders, unless adequate and specific precautions have been taken and are clearly stated and certified for the machine.
- To prevent the risk of fire, keep the machine at a distance of at least one metre from buildings or other machines.
- Children and animals must be kept at a sufficient distance from the machine to prevent any danger resulting from its operation.

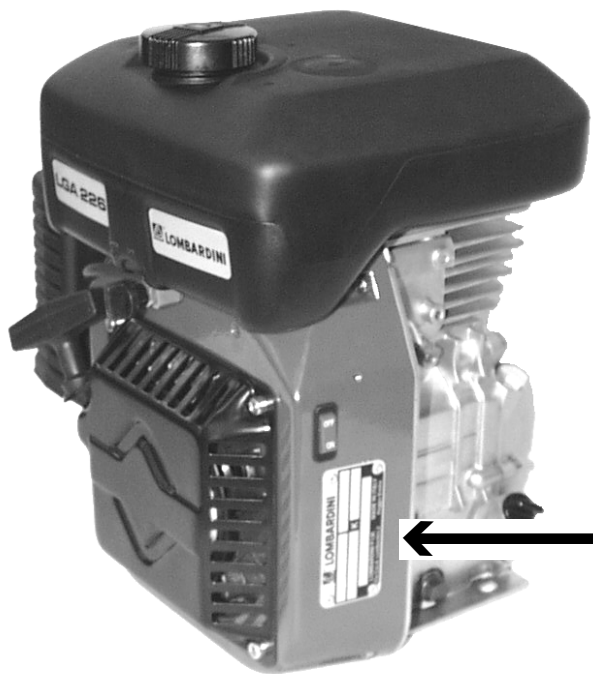


- Fuel is flammable, so the tank must be filled only when the engine is turned off. Dry carefully any fuel that may have spilled, remove the fuel container and any cloths soaked in fuel or oil, check that any sound-absorbing panels made of porous material are not soaked with fuel or oil, and make sure that the ground on which the machine is located has not absorbed fuel or oil.
- To start the engine follow the specific instructions provided in the engine and/or machine operating manual. Do not use auxiliary starting devices not originally installed on the machine (e.g. Startpilot systems which utilise ether etc.)
- Before starting, remove any tools that have been used for carrying out maintenance work to the engine and/or the machine and check that any guards removed have been replaced. In cold climates it is possible to mix kerosene with the diesel fuel to make the engine easier to start. The liquids must be mixed in the tank by pouring in first the kerosene and then the diesel fuel. Consult Lombardini technical office for mixture proportions. Petrol may not be used because of the risk of it forming flammable vapours.
- During operation the surface of the engine reaches temperatures that may be dangerous. Avoid in particular all contact with the exhaust system.
- Before carrying out any work on the engine, turn it off and allow it to cool down. Do not perform any operation while the engine is running.
- The liquid cooling circuit is under pressure. Do not carry out any checks before the engine has cooled down, and even then open the radiator cap or the expansion tank cautiously. Wear protective clothing and glasses. If there is an electric fan, do not approach the engine while it is still hot as the fan may come on even when the engine is not running. Clean the cooling system with the engine turned off.
- While cleaning the oil bath air filter, check that the oil is disposed of in such a way as not to harm the environment. Any filtering sponges in the oil bath air filter should not be soaked with oil. The cyclone pre-filter cup must not be filled with oil.
- Since the oil must be emptied out while the engine is still hot (approx. 80°C), particular care should be taken in order to avoid burns. In any case make sure that oil does not come into contact with your skin because of the health hazards involved.
- Check that the discharged oil, the oil filter and the oil contained in the oil filter are disposed of in such a way as not to harm the environment.
- Close the fuel tank filler cap carefully after each filling operation. Do not fill the tank right up to the top, but leave sufficient space to allow for any expansion of the fuel.
- Fuel vapours are highly toxic, so fill up only in the open air or in well ventilated environments.
- Do not smoke or use naked flames while filling.
- Take care when removing the oil filter as it may be hot.
- The operations of checking, filling up and replacing the cooling liquid must be carried out with the engine turned off and cold. Take particular care if liquids containing nitrites are mixed with others not containing these compounds as this may give rise to the formation of nitrosamines which are a health hazard. The cooling liquid is polluting, so dispose of in a manner that does not damage the environment.
- During operations which involve access to moving parts of the engine and/or removal of the rotary guards, disconnect and insulate the positive cable of the battery so as to prevent accidental short circuits and activation of the starter motor.
- Check the belt tension only when the engine is turned off.
- In order to move the engine use exclusively the eyebolts fitted for this purpose by Lombardini. These lifting points are however not suitable for the entire machine, so in this case use the eyebolts fitted by the manufacturer.

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Note : Performance approval and Exhaust approval are only stamped on Diesel engines

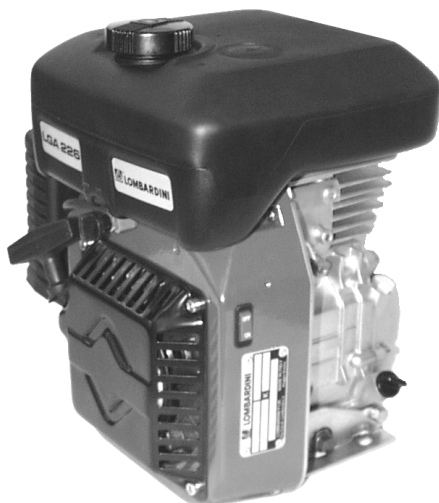


TECHNICAL FEATURES LGA 226

ENGINE TYPE		LGA 226
Cylinder	N.	1
Bore	mm	72
Stroke	mm	54
Displacement	Cm ³	220
Compression ratio		6.17 : 1
Standard R.P.M.		4000
Power kW/CV	N 80/1269/ECC - 88/195/ECC - ISO 1585	4.4 / 6
	NB 80/1269/ECC - ISO 1585	
	NA ISO 3946/1 - ICXN	3.6/4.9 @ 2200
Max torque	Kgm/Nm	1.13/11.1
No-load idling rate rpm		1200/1350
Max. tolerated slant for discontinuos service***		35° (40°)
Standard oil sump capacity	l	0,6
Tank capacity	l	3,1
Oil consumption (measured at NA power)**	g/kWh	0.011
Recommended battery	V/ah	12/36
Dry weight	Kg	17

** At NA power **CONTINUOUS RATING WITH OVERLOAD CAPACITY:** Continuous heavy duty with constant speed and constant load.

*** Depending on the application

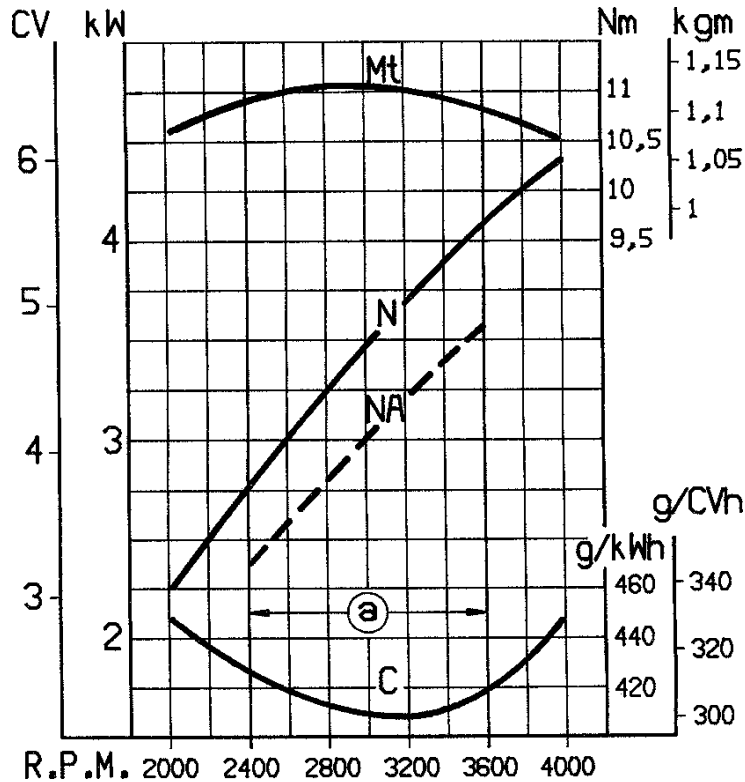


LGA 226



CHARACTERISTICS POWER, TORQUE AND SPECIFIC FUEL CONSUMPTION CURVES

LGA 226



N (80/1269/ECC - ISO 1585) AUTOMOTIVE RATING : Intermittent operation with variable speed and variable load.

NB (ISO 3046 - 1 IFN) RATING WITH NO OWERLOAD CAPABILITY: continuous lighth duty operation with constant speed and variable load.

NA (ISO 3046 - 1 ICXN) CONTINUOUS RATING WITH OVERLOAD CAPABILITY: continuous heavy duty with constant speed and constant load.

MN Torque at **N** power.

Mt (in **N** curve)

MA (in **NA** curve)

C Specific fuel consumption at **NB** power.

Cse Curve of specific consumption measured at **N** power

! When LGA 226 engines are being installed, remember that each variation to the exhaust or intake system will lead to a variation in the carburation.

The result should be checked out beforehand at the Lombardini test department. Lombardini's failure to approve the type of modification made relieves the same from all liability for any damage sustained by the engine.

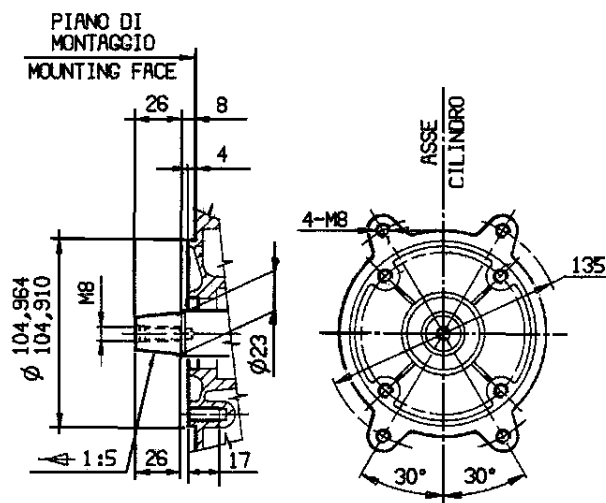
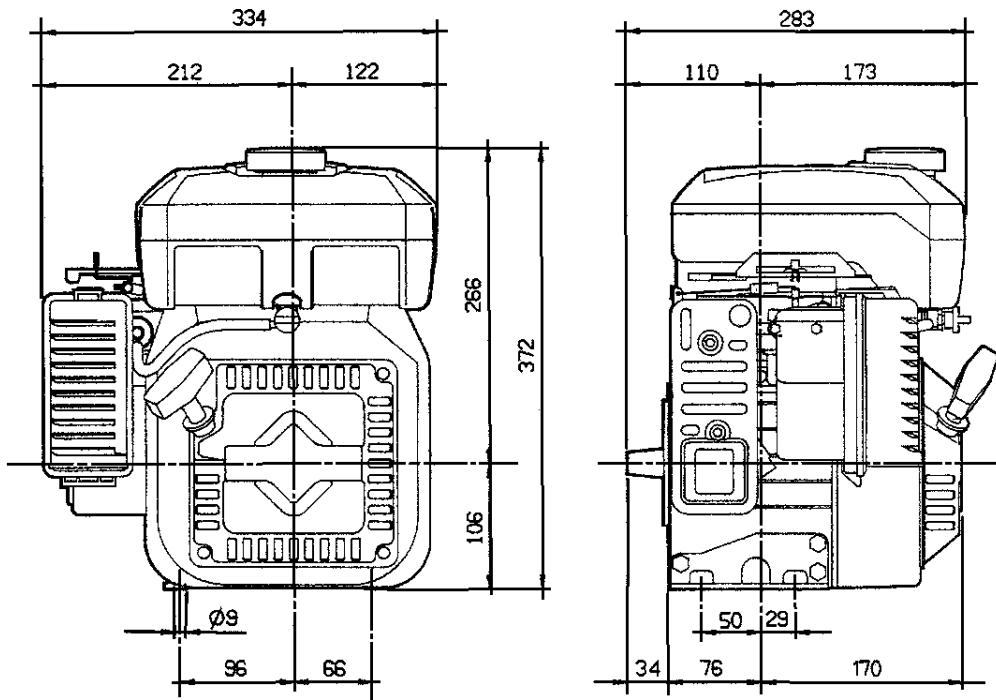
The above power values refer to an engine fitted with air cleaner and standard muffler, after testing and at the environmental conditions of 20°C and 1 bar.

Max. power tolerance is 5%.

Power decreases by approximately 1% every 100 m di altitude and by 2% every 5°C above 25°C.

Note: Consult LOMBARDINI for power, torque curves and specific consumptions at rates differing from those given above.

LGA 226



Note : The values are given in mm

VII

MAINTENANCE - RECOMMENDED OIL TYPE - REFILLING



Failure to carry out the operations described in the table may lead to technical damage to the machine and/or system

MAINTENANCE

OPERATION	COMPONENT	INTERVAL (HOURS)				
		8	50	100	300	
CHECK	HOUSING OIL LEVEL	●				
	DRY FILTER	●				
	OIL-COOLED FILTER	●				
	CLEAN COOLING SYSTEM		●			
	CLEAN FUEL FILTER			●		
	SPARK PLUG			●		
	CLEAN CYLINDER FINS			●		
	CLEAN CYLINDER HEAD FINS			●		
	CLEAN FUEL FILTER			●		
	VALVE CLEARANCE				●	
REPLACEMENT	AIR FILTER CARTRIDGE		●			
	HOUSING OIL		●			
	SPARK PLUG				●	

First replacement

(*) in very dusty places

(**) If the timing belt is removed, it must be replaced even when still in a serviceable condition.

(***) It is advisable to check the cylinders, piston rings, guides, springs, grind the valve housings, decarbonize the cylinder head and cylinders.

(****) Every two years or after every 1000 hours service.





The engine could be damaged if allowed to operate with insufficient oil. It is also dangerous to add too much oil as its combustion could sharply increase the rotation speed.

Use a suitable oil in order to protect the engine.

The lubrication oil influences the performances and life of the engine in an incredible way.

Use of an inferior type of oil or failure to regularly change the oil will increase the risk of piston seizure, may make the compression rings jam and will lead to rapid wear on the cylinder liner, the bearings and other moving parts. Engine life will also be notably reduced.

Oil viscosity must suit the ambient temperature in which the engine operates.



Old oil can cause skin cancer if repeatedly left in contact with the skin and for long periods of time. If contact with the oil is inevitable, you are advised to thoroughly wash your hands with soap and water as soon as possible.

Appropriate protective gloves etc should be worn during this operation.

Old oil is highly polluting and must be disposed of in the correct way. Do not litter.

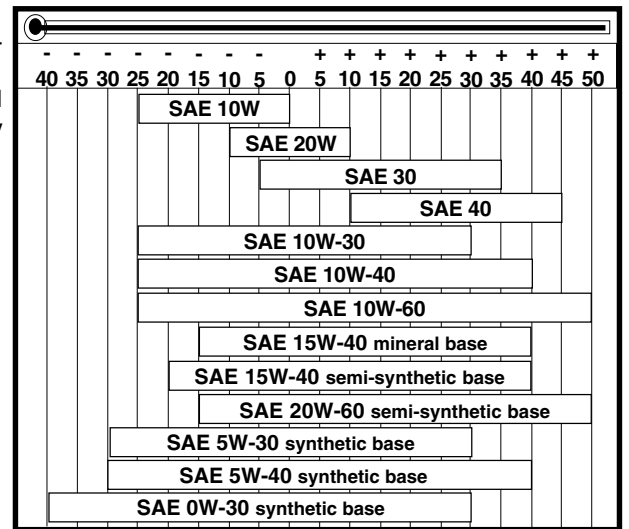
AGIP SINT 2000 5W40 specification API SJ/CF ACEA A3-96 B3-96 **GRADE**
MIL-L-46152 D/E.

ESSO ULTRA 10W40 specification API SJ/CF ACEA A3-96 MIL-L-46152 D/E.

In countries where AGIP and ESSO products are not available, use API SJ/CF oil for gasoline-fuelled engines or oil that complies with military specification MIL-L-46152 D/E.

OIL SUPPLY (liters) LGA 226
Standard oil sump

filter included 0,6



ACEA SEQUENCES

- A = Gasoline (Petrol)
- B = Light Diesel fuels
- E = Heavy Diesel fuels

Required levels :

- A1-96
- A2-96
- A3-96

- B1-96
- B2-96
- B3-96

- E1-96
- E2-96
- E3-96

DIESEL							BENZINA - ESSENCE - PETROL BENZIN - GASOLINA								
API	CF	CE	CD	CC	CB	CA	SA	SB	SC	SD	SE	SF	SG	SH	SJ
							CCMC G- 2							G- 4	
							CCMC G- 3							G- 5	
							CCMC PD - 1 / PD - 2								
			D- 4	CCMC D- 2											
			D- 5	CCMC D- 3											
							MIL - L - 2104 D								
							MIL - L - 2104 E								
							MIL - L - 46152 C								
							MIL - L - 46152 D/E								
							MB 226.1							MB 226.5	
							MB 227.1							MB 227.5	
			228.3	MB 228.1											
							VW 500.00								
							VW 501.01								
							VW 505.00								
							VOLVO VDS								
							MAN QC 13-017								

	NOTE
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WARNINGS!

During repair operations, when using compressed air, wear eye protection.

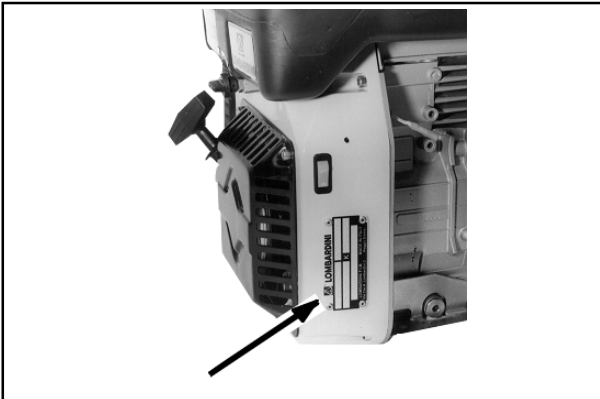
DISASSEMBLY AND REASSEMBLY

Besides disassembly and reassembly operations this chapter also includes checking and setting specifications, dimensions, repair and operating instructions. Always use original LOMBARDINI spare parts for repair operations.

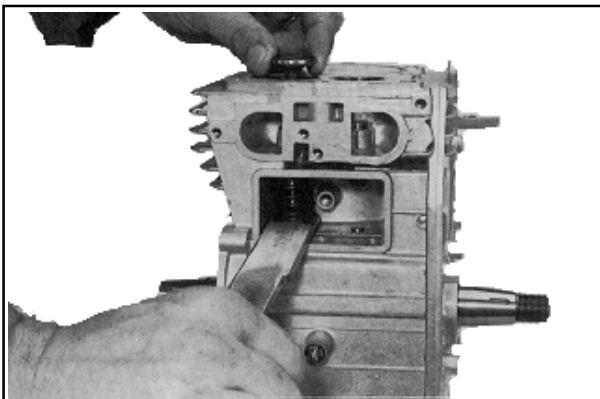
General information for correct repairs

In order to work quickly and safely, strictly observe the instructions in the manual and the following general rules:

- Lock the machine in position before disassembling the engine;
- Disconnect the battery cables (if the machine is equipped with electric starting);
- Always use suitable tools in order to avoid damaging engine parts;
- Use a plastic mallet to separate connected parts;
- When disassembling the engine, mark the parts that are not provided with reference marks in order to facilitate successive assembly operations;
- Clean disassembled parts with petrol and compressed air;
- Always replace gaskets, oil seals, washers and locknuts;
- Before re-assembling, lubricate moving parts and contact surfaces;
- Respect torque wrench settings when tightening screws.

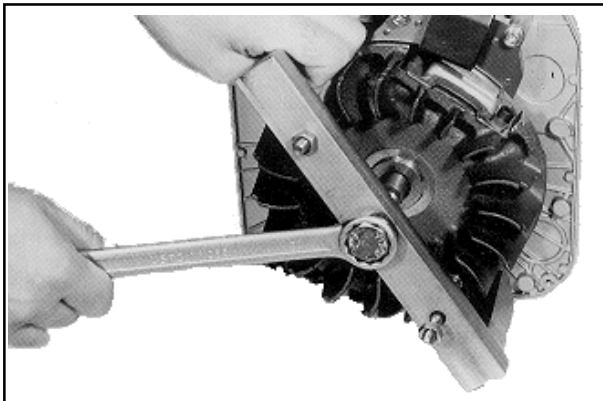
**ENGINE IDENTIFICATION**

The type of engine is indicated on the data plate affixed to the right-hand side of the shroud while the serial number is stamped on the crankcase.

**VALVES DISASSEMBLING**

After removing the cup containing the shims for valve clearance adjustment and after positioning the piston on the T.D.C., use the tool code 365110 page 42 as shown at fig. 2. Should it be difficult, turn the lower cap until the slot on such cap faces the inside (see fig. 44 on page 30).

2

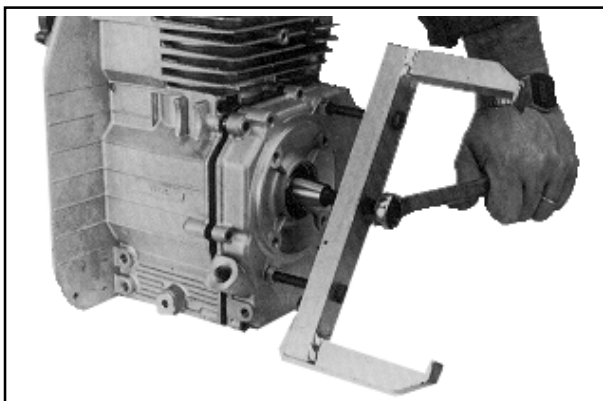


3

! During the demounting phases, pay particular attention to prevent the flywheel from dropping as this could seriously injure the operator.
Wear protective goggles when removing the flywheel ring.

FLYWHEEL REMOVAL

Use the puller code 365113 page 42, after removing nut, washer, pulley and guard (fig. 3).
On re-assembly, tighten the fixing bolt to a 137.2 Nm torque value.



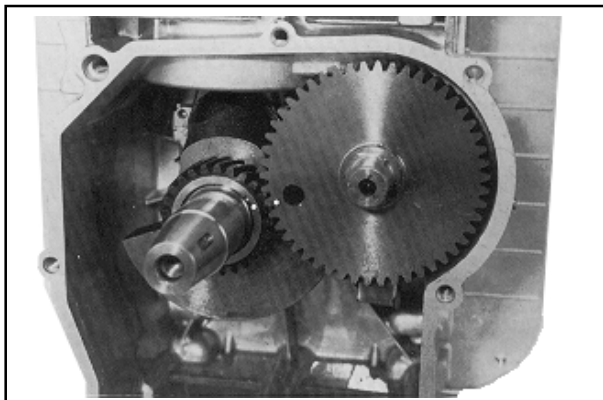
4

TIMING COVER REMOVAL

Use the puller code 365113 page 42, positioning the central screw on the opposite side to that used to pull the flywheel out and tightening the other two screws in the threaded holes on the cover

GOVERNOR GEAR

Remove the clamp and take out both pins of the flyweights; take the flyweights and the cap out of their seat. After removing the retaining ring, the gear can be taken out of the pivot.



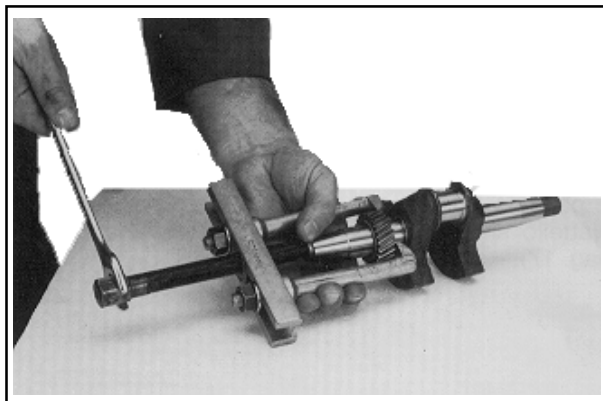
5

CAMSHAFT REMOVAL

Remove the cup with the shims for valve clearance adjustment and rotate the crankshaft until the marks on the camshaft gear and on the crankshaft gear are in correspondence

Remove the camshaft from its housing.

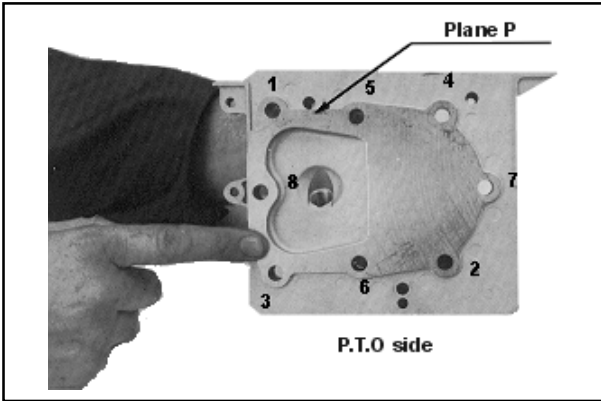
N.B.: The tappets will then release from their guides.



6

CRANKSHAFT GEAR REMOVAL

Use a universal puller with 2 or 3 fingers.



7



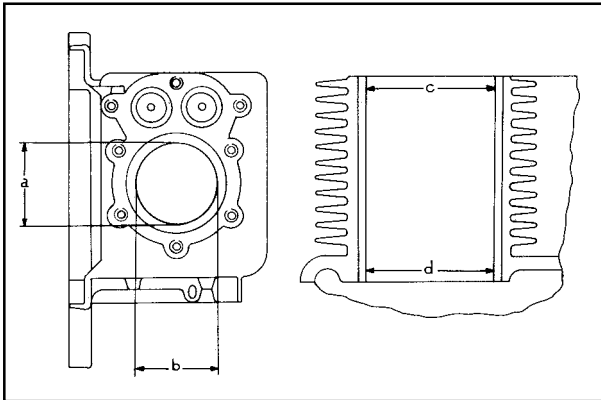
Do not demount and remount when hot to avoid deformations.

CYLINDER HEAD AND CYLINDER

The cylinder head is made of aluminium alloy and therefore the head should not be loosened when the engine is hot. Removal of a hot cylinder head can result in warping of the cylinder head. Any trouble occurring on plane **P** of the head (fig. 7), should be removed by milling the head surface.

Maximum flatness tolerance in between: 0.3 ± 0.5 mm.

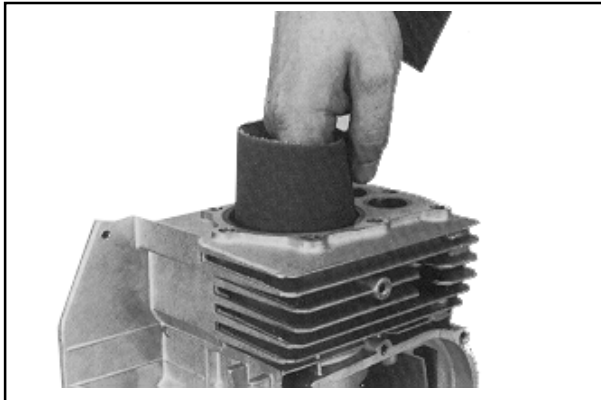
To obtain clean removal of carbon deposits, soak the head in gasoline (petrol) or Diesel fuel for three or four hours.



8

The cylinder sleeve is made of special cast iron (perlite) and is inserted into the engine block during pressure die casting. In dealing with cylinder wear, there are two oversize possibilities. Use comparators to check the two internal diameters (**a-b**) perpendicular to each other at three different heights (fig. 8). If the taper (**c-d**) and ovalization (**a-b**) exceed the 0.06 mm limit, rebore the cylinder as shown in the cylinder-piston oversize table on page 43.

NOTE: Comply with a +0 +0.020 machining tolerance when the cylinder is ground.

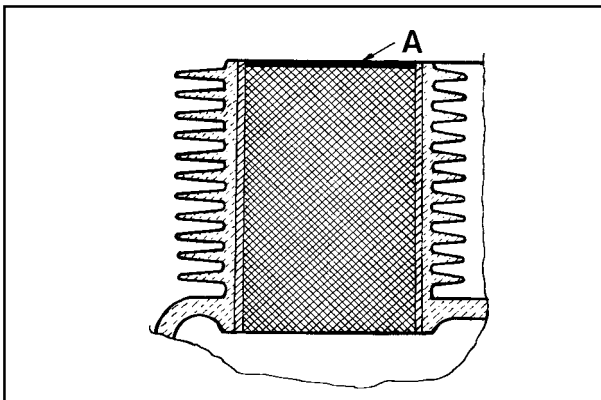


9

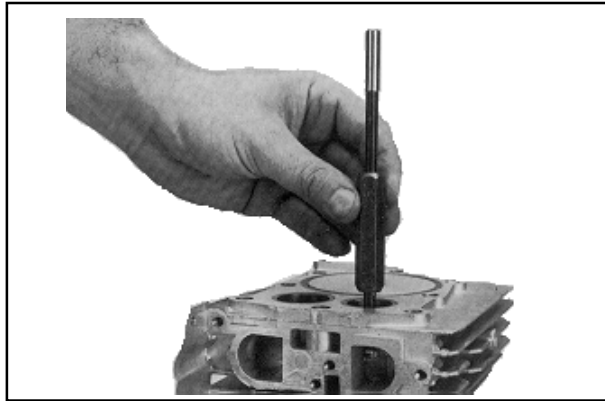
If the wear on the nominal diameter of the cylinder measured in the center of the liner is less than 0.06 mm, the taper and ovalization are less than the value given above and there is no scoring on the surface of the liner, just replace the piston rings. In this case, facilitate piston ring and cylinder adaptation by restoring the correct roughness to the liner. This is done by passing 80-100 grain emery cloth soaked in Diesel fuel and wound round the palm of the hand inside the liner with a crossed movement (fig. 9). The surface should look cross-hatched with a rough aspect as shown in fig. 10.

If the cylinder has a small ridge in zone **A** of fig. 10, smooth it down with honing stone in order to prevent the new piston rings from breaking.

Thoroughly flush out with Diesel fuel after these operations.



10

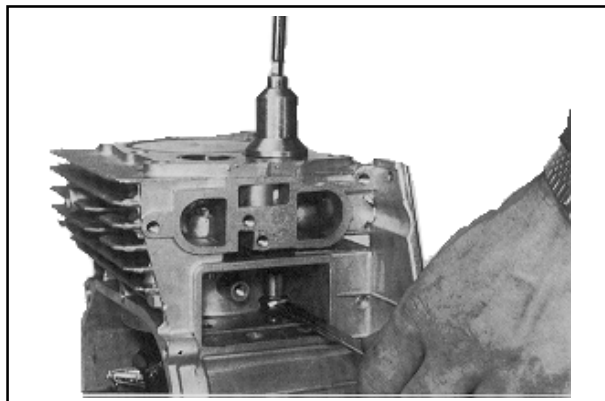
**VALVE GUIDES, VALVES SPRINGS AND TAPPETS**

Original as well as replacement valve guides are made of special perlitic cast iron (intake) and bronze (exhaust) and are inserted into the engine block. To check wear between valve and guide, use a go no-go internal gauge code 365048 page 42 (fig. 11).

Internal valve guides diameter after assembly in the engine:

min 7.015 ÷ max 7.025

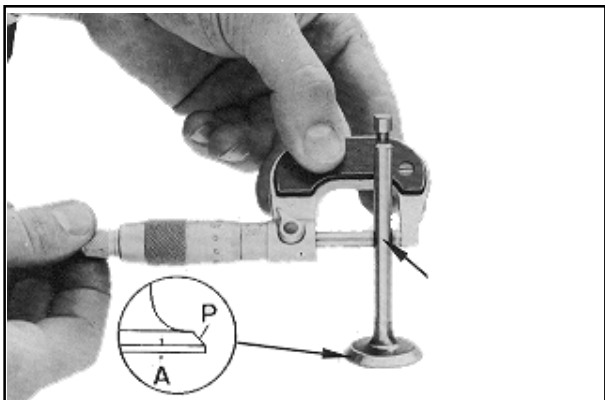
11



Plug diameter: 7.000 mm passes - 7.097 mm does not pass

Should clearance exceed, replace with new guides using puller CODE 365109 pag. 42 (fig. 12), after removing the lower split ring.

12

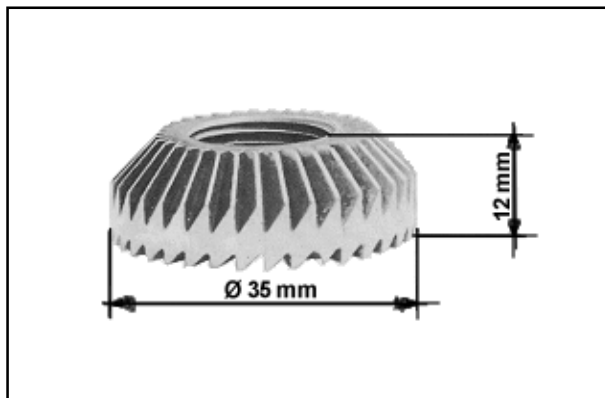


Valve condition is checked according to **A** and **B** values indicated in fig. 13.

With **A** not less than 0.5 mm (0.020 in) and **B** falling within the limits shown below, it is possible to repair the valve by grinding track **P** at 45°.

VALVES NOMINAL DIAMETERS B	
Intake valve	Exhaust valve
mm 7 - 0,03 mm 7 - 0,045	mm 7 - 0,03 mm 7 - 0,045

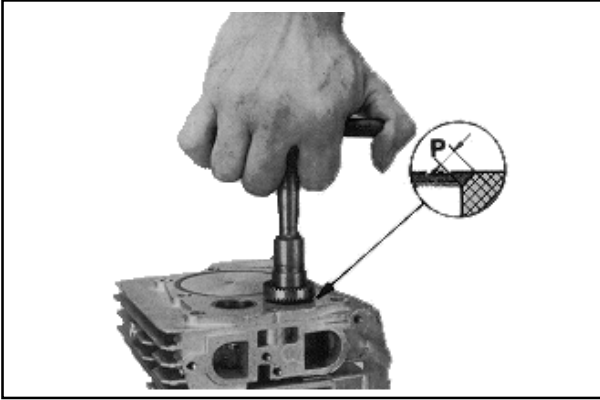
13



Valve seats are made of special cast iron of high nickel content to make them more heat resistant.

Seats are formed with an integral lip, which locks them permanently into the block during pressure die casting. To regrind use a conical 45° valve grinding tool (fig. 14).

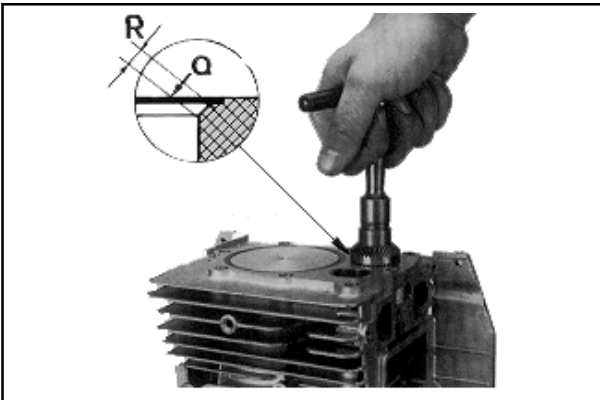
14



15

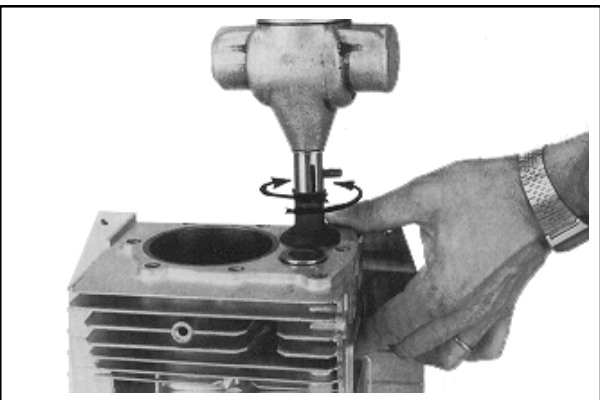
Due to prolonged use of the engine, tapping of valves on seats at high temperature hardnes track **P** (fig. 15) and makes hand grinding impossible.

It is therefore necessary to remove the hardened layer with a 45° grinding tool, employing a mechanical grinder. Final adaptation can be carried out by hand using the above grinder (fig. 14).



16

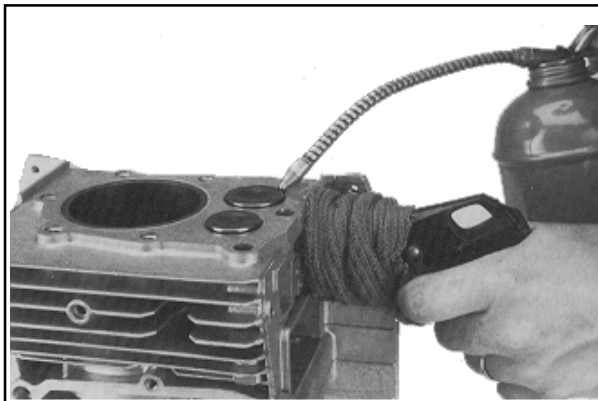
The final adjustment can be made by hand with the above illustrated hand grinder. Valve seat regrinding implies widening of track **P**. Should **P** be wider than 2 mm (0.079 in), lower plane **Q** (fig. 19) till **R** is from 1.2 to 1.3 mm (from 0.047 to 0.051 in).



17

Final adjustment of valves on the seats must be made by using fine grained emery paste and by rotating the valve with pressure, utilizing an alternate rotary movement, until a perfect "seating" is obtained between the two surfaces (fig. 17).

Next wash the valve and seat thoroughly with kerosene or gasoline to remove any lapping compound or swarf.



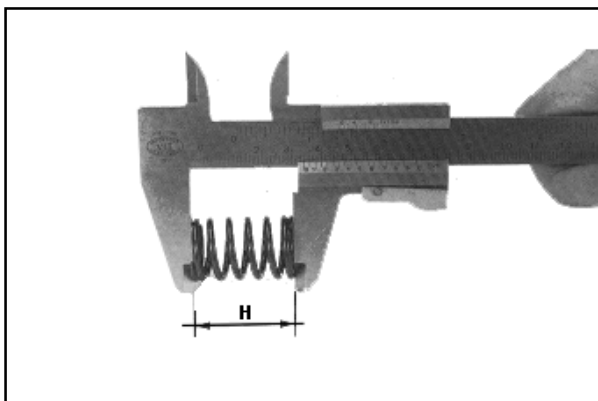
18

To check the seal between valve and seat after grinding, proceed as follow:

- 1) Mount the valve on the crankcase with spring and stop cap;
- 2) Pour some oil drops around the valve head.
- 3) Blow compressed air in the duct, making sure to plug the sides of the duct to avoid air leaks (fig. 18).

If air infiltration occurs in the form of bubbles between seat and valve, dismantle the valve and re-grind the seat.

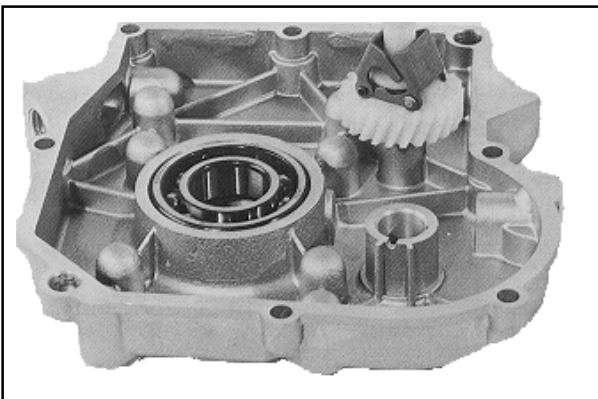
The seal can also be checked by pushing the valve upwards and letting it fall freely down on to its seat. If the rebound which takes place is considerable and uniform as the valve is rotated, it means that a good fit has been made. If not, continue to re-grind in order to achieve the conditions described.



19

Change spring if **H** is lower than 35 mm (1.37 in) is measurement of new spring (fig. 19).
replace if yielding exceeds the nominal value by 3 mm or more.

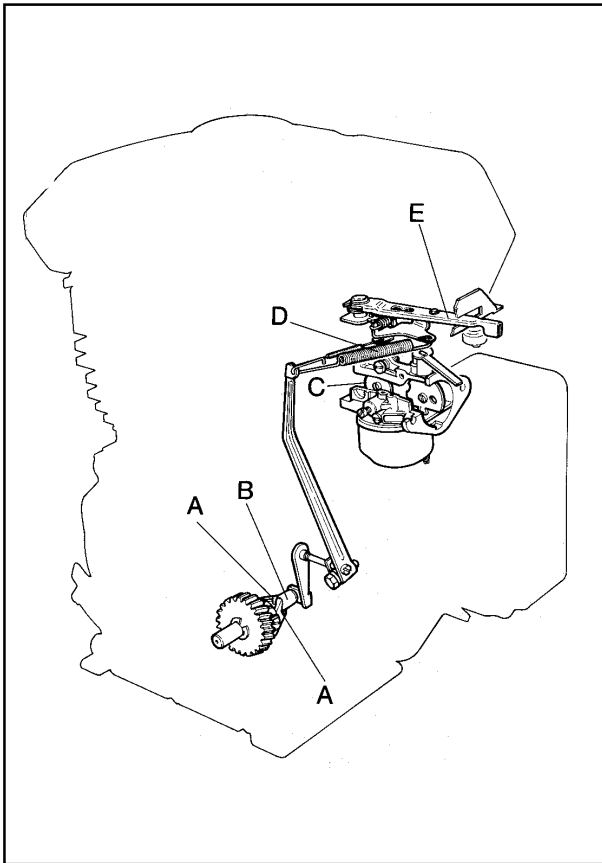
Make sure that the max play between tappet and guide is 0.037 mm and no scratches can be seen on the stem and on the head in touch with the camshaft. In the negative replace the tappets.



20

SPEED GOVERNOR

The speed governor is the centrifugal counterweight type (figs 20-21). Check that the gear rotates freely on the pin and that movement is not obstructed. Check that the counterweights expand freely and that the action provides continuity of movement to the cap.



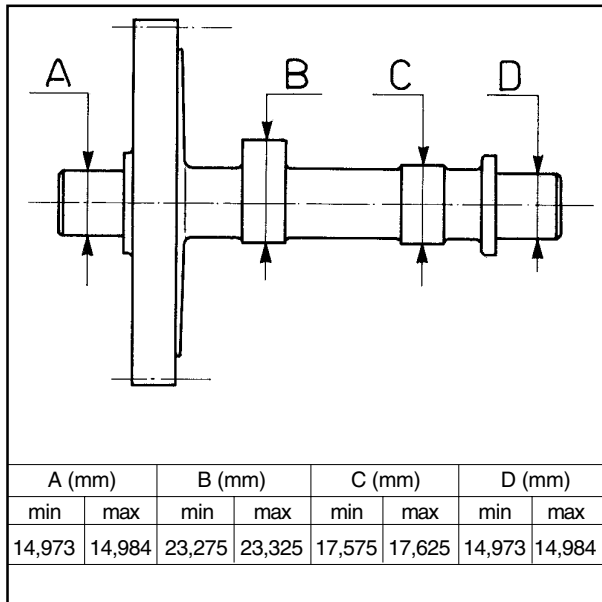
21

The two **A** flyweights, pulled outward by centrifugal force, push **B** cap axially and this cap by means of a series of levers opens the carburetor throttle plate **C**. The spring **D**, put under tension by the accelerator **E**, works against the action of the centrifugal force.

As the load decreases with the accelerator in position, the engine rate tends to increase and the counterweights shift cap **A** axially in the direction that tends to close carburetor throttle **C**, thus lowering the rpm rate. Since the centrifugal force that acts on the counterweights also diminishes, the action of spring **D** prevails and re-opens the throttle to such an extent that a balance is maintained between the two opposing forces.

Every position of the accelerator lever corresponds to a load variation on the spring and therefore to a situation of balance between the tension of the spring and the centrifugal force of the flyweights at different R.P.Ms. The cap plane on which the flyweights act should be smooth and orthogonal to the guide hole.

The play between the cap and its pivot should be: $0.17 \div 0.24$ mm
In case of excessive play replace cap.



22

CAMSHAFT

Make sure that the cam lobes, the pivots and the gear show no signs of wear or scratches. Any light marks or scratches can be trued by using some extremely fine grain files and finished by emery cloth of the same kind.

The value of the cam lobe and the journal dimensions of the camshaft are specified at table of fig. 22.

The gear is helical-toothed to reduce the noise and add strength.

The exhaust cam has a lobe which delays the closing of the valve at low R.P.M. and makes the engine start easier, thus eliminating any possible counterstroke.

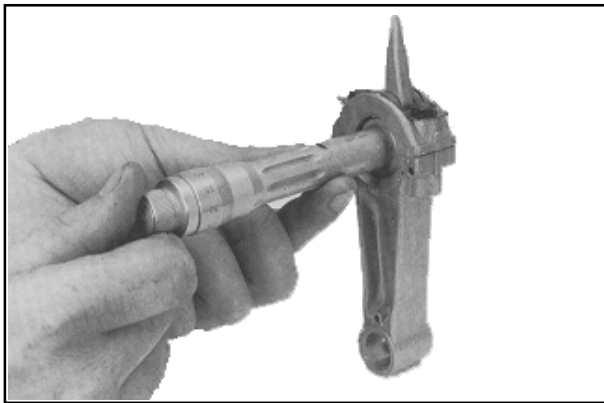
This device is standard on all engines, allowing the application of recoil starter also on those engines which originally were rope start, with no extra modification.

A (mm)		B (mm)		C (mm)		D (mm)	
min	max	min	max	min	max	min	max
14,973	14,984	23,275	23,325	17,575	17,625	14,973	14,984

OIL SEAL RINGS

Check the inner surface of the seal rings for hardening or scratches where the seal touches the crankshaft. If hardened or scratched, replace with new seals with the following dimensions:

OIL SEALS DIMENSIONS			
Flywheel side		Exhaust valve	
dimensions	code	dimensions	code
Ø 25x40x7	054126	Ø 25x40x7	054126

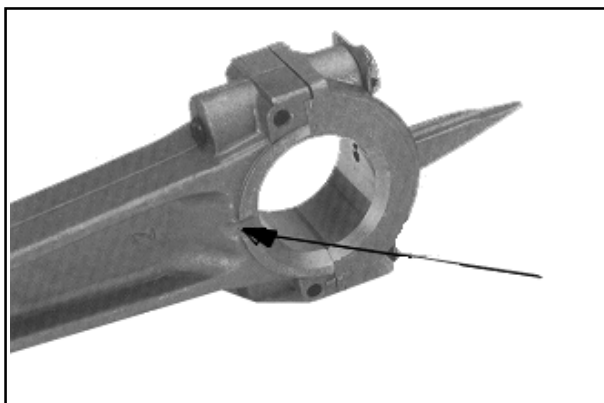


23

MAIN BEARINGS

The crankshaft is supported on both sides by ball bearings with the characteristics indicated in the following table:

FLYWHEEL & P.T.O. SIDE		
type	dimensions	code
sphere 6205	Ø 25x52x15	304102



24

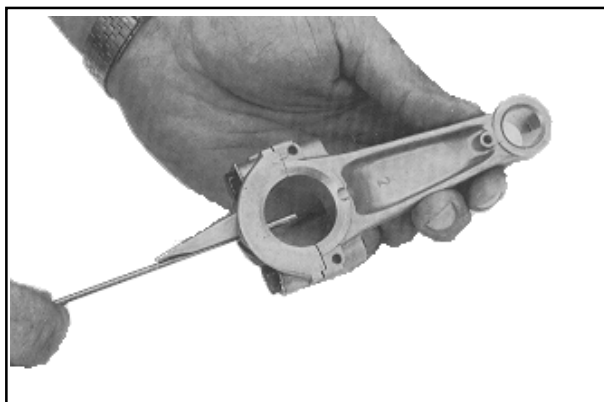
CONNECTING ROD

The connecting rod is made of a special die-cast aluminium alloy without "big end", and "small end" bearings. In case of wear or seizure, replace the whole connecting rod with another one with reduced head hole. Two reductions are allowed and, in case of crank journal grindings, consult the table page 43.

The maximum wear of the connecting rod "big end" hole is (fig. 23):

On the shoulders of the connecting rod "big end" there are grooves that assure a greater lubrication of the journal and the bearing (fig. 24). On the connecting rod cap there is a little scoop for the splash lubrication (fig. 25).

The fitting tolerance between "small end" hole and piston pin must be: 0,022 mm - min. 0,006 mm



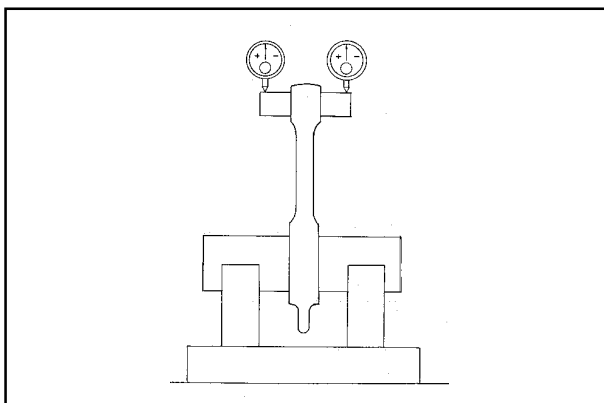
25

To check connecting rod axis, proceed as follows:

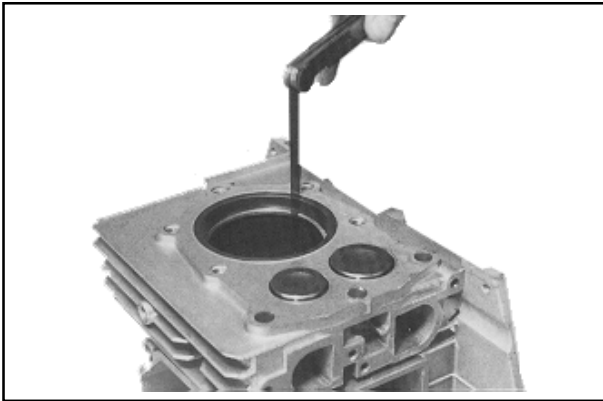
- 1) Fit pin in "small end" hole and a calibrated pin in "big end" hole.
- 2) Place big pin ends on two guage blocks laying on a surface plate (fig. 26).
- 3) Using a column gauge, be certain that the difference between the two pin ends does not exceed 0.05 mm (0.002 in). If in excess of 0.05 mm, square the connecting rod.

Should the connecting rod axis not be parallel, proceed as follows (using a small press);

- a) Place connecting rod on two blocks and make sure it is perfectly levelled with the press plane.
- b) Press gently on connecting rod stem until values coincide with those indicated under paragraph 3



26

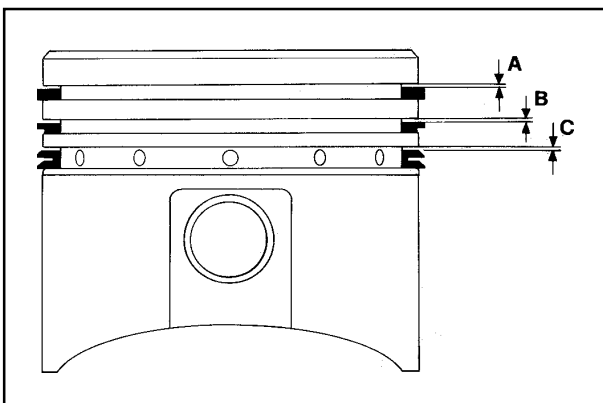


27

PISTON RINGS AND PISTON

To check the piston rings wear, insert the rings in the cylinder and gauge the gap between ring ends (fig. 27) which should be between:

Engine type LGA 226		Nominal distance	Initial distance	Limit distance
Compression rings	min	0,25 mm	0,25 mm	----
	max	0,45 mm	0,513 mm	1,15 mm
Scrapper rings	min	0,20 mm	0,20 mm	----
	max	0,35 mm	0,413 mm	2,0 mm

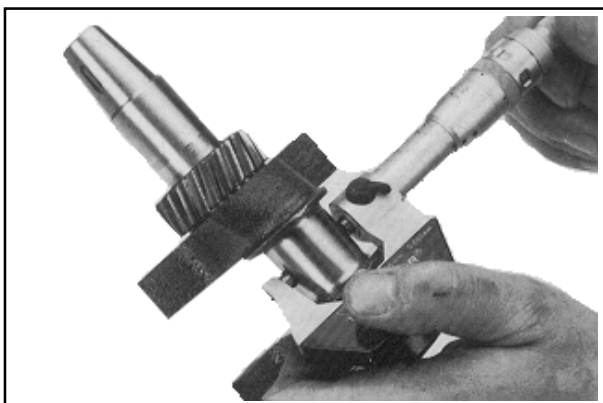


28

If the cylinder does not require reconditioning, replace the rings with others of the same type.

Make sure that the piston skirt shows no deep scratches and no seizure. Make sure that the pin hole has no ovalization exceeding 0.10 mm. If so, replace both piston and piston pin. After disassembling the piston rings and eliminating the carbon deposits, make sure that they run freely in the grooves and that their vertical clearance (fig. 28) is:

- 1st compression ring A = 0,05 mm (0.000197 in)
- 2nd compression ring B = 0,05 mm (0.000197 in)
- Scrapper ring C = 0,05 mm (0.000197 in)



29

CRANKSHAFT

Check that the main journals and the crank pin have no scratches or traces of any seizure.

Any possible light scratches or marks should be trued by means of a very fine grain file and finished by an emery cloth of the same kind. Cones, key seats and threads should not be warped and should show no marks.

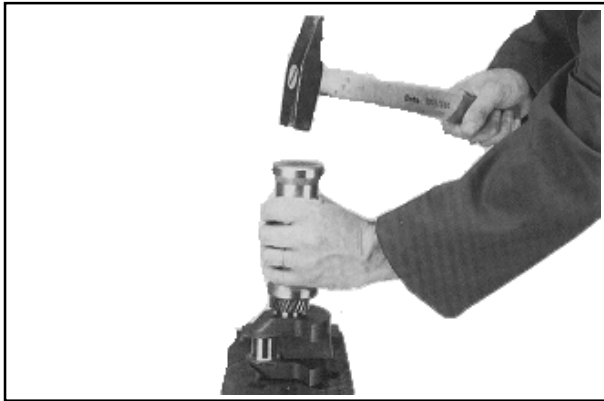
With the crankshaft perfectly clean, using a micrometer, check wear and ovality of the journals and of the crank pin, at two different positions, perpendicular to each other (fig. 29).

If wears exceed 0.05 mm (0.00197 in) grind the crank pin as table pag. 43.

Note: Comply with a 0.000±0.011 mm machining tolerance when the crank pin is ground

The diameter of the main journals should be: mm 25+0.002 +0.015 and it cannot be ground. Should the measured dimensions not correspond to the above, replace the crankshaft.

Make sure that there are no scratches in correspondance with the oil seal rings. If any, they should be eliminated with a very fine emery cloth.



30

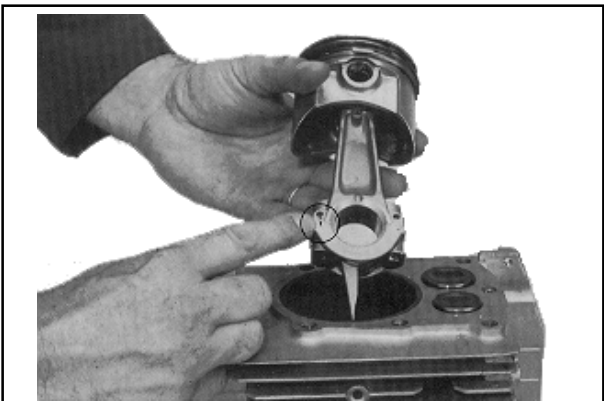
DRIVESHAFT

To assemble the driveshaft on the crankcase correctly, proceed as follows:

- a) Pre-heat crankcase and timing cover from 70° to 80°C (190°F to 210°F) and fit bearings in their casing.
- b) Pre-heat driveshaft gear by placing in oil bath 80° to 90°C (210 to 230°F) for a few minutes.
- c) Fit driveshaft in engine crankcase using a plastic hammer (fig. 31), placing a wedge between the two driveshaft counterweights in order to avoid damage to the driveshaft.
- e) Fit oil seals on both crankcase and timing cover; place protection cone on shaft end to prevent scratching or otherwise damaging oil seals.



31



32

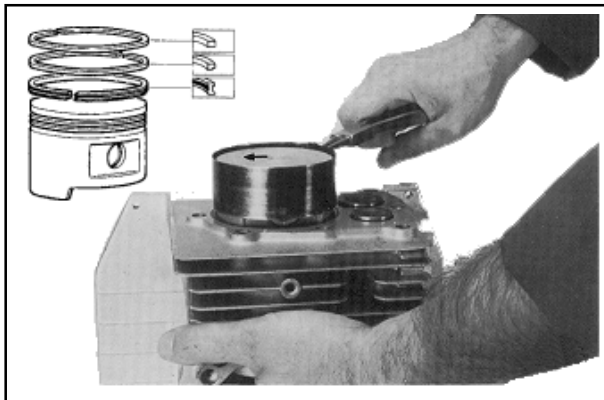
PISTON AND CONNECTING ROD

The piston and the connecting rod have to be mounted as follows; by keeping the arrow forged on top of the piston turned to the left, the connecting rod should be mounted with the reference notches on the connecting rod big end toward the assembler (fig. 32 and 33). The piston pin should be mounted without preheating the piston, but pressing it by hand. The lock it by the stop rings.

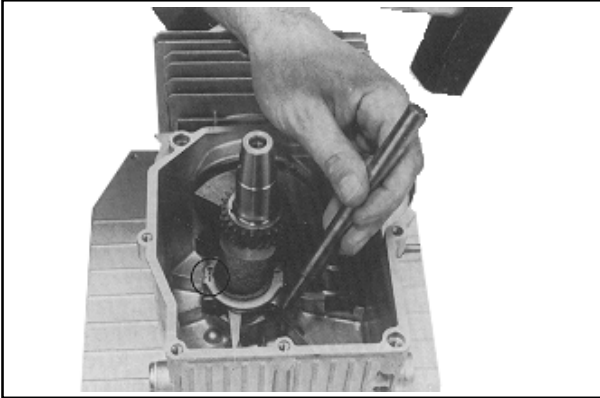
After inserting the rings into the proper grooves on the piston and before fitting piston into cylinder, equally place rings at 120° angle to one another 1/3 way each around piston circumference).

The scraper ring (the thicker ring with perforations) fits in the bottom groove and the two compression rings fit in middle and top grooves (fig. 33).

The installation of piston into cylinder is facilitated by using a ring compression tool.



33



34

CONNECTING ROD AND DRIVESHAFT CONNECTION

There is only one way to assemble connecting rod and cap (fig. 32). It is necessary that the two marks on connecting rod stem and cap correspond. When fitting connecting rod on crankshaft, the marks face toward timing cover.

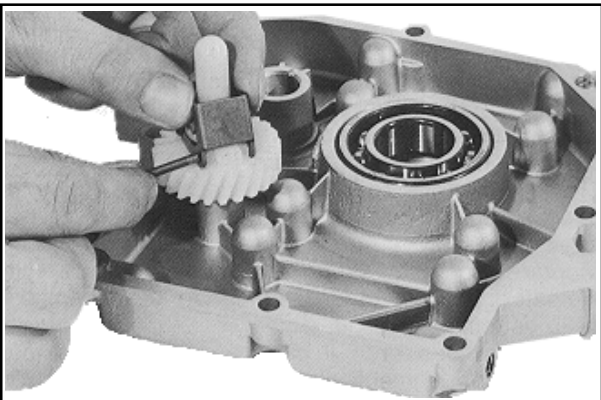
After assembling the connecting rod, tighten the screws, by using torque wrench to a value of: **11.8 Nm (1.2 Kgm)**
Bend locking tab washer at both cap screw heads (fig. 34).



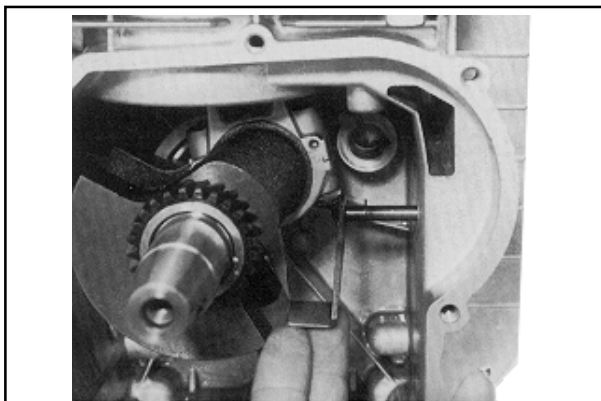
35

SPEED GOVERNOR

After assembling the gear on the pivot fixed to the timing cover, lock it by the retaining ring. Then assemble the push rod and the flyweights with their own pins, locking them by the clamp for engines up to serial No. 22931 (fig. 35). Starting from engine serial No. 22932, two tubular rivets are set at the place of flyweight pins; these rivets must be replaced whenever the gear and the flyweights have to be removed (fig. 36). Don't forget to upset rivets after gear and flyweights assembling. Insert the inner lever of the governor in the crankcase, locking it by the two retaining rings (fig. 37). For explanations as to governor operation, see page 22.



36

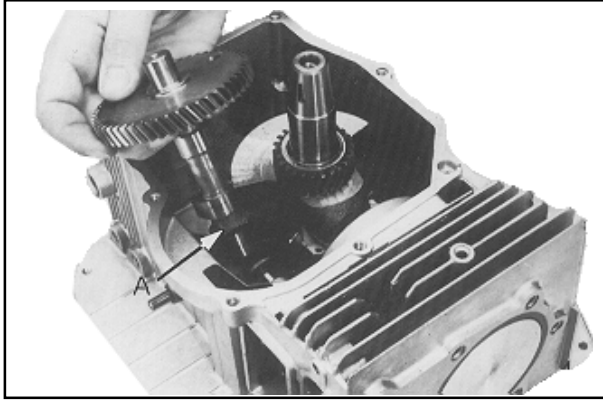


37

CAMSHAFT

To insert the camshaft in its seat in the engine block, proceed as follows:

- a) fit the tappets in their casings.



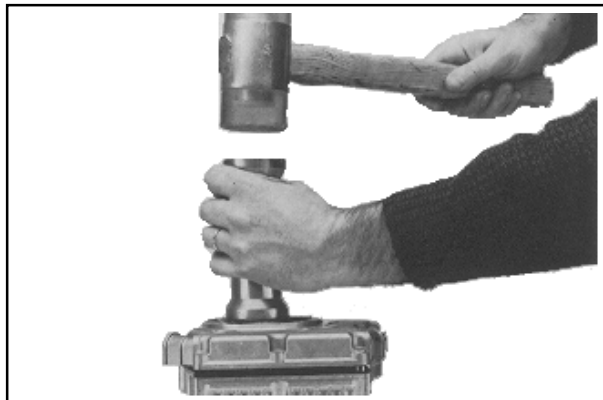
38

- b) fit the camshaft with bevel **A** (fig. 38) parallel to the tappets;
- c) rotate the crankshaft until the piston reaches the T.D.C. point, to make the marks stamped in the gears coincide (fig. 5 - page 18). In this way the timing will be correct.

TIMING COVER

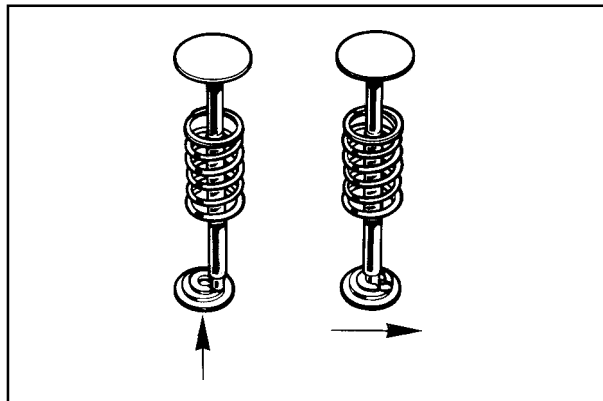
After assembling the gear and the governor units, as shown at page 27, proceed as follows:

- a) apply the protection code 365152 page 42 to the shaft end;
 - b) mount the timing cover, with the proper gasket between the surfaces (fig. 39).
- Torque the screws to a 11.8 Nm value on re-assembly.



39

N.B.: During the assembly, take care that the governor gear can couple with the camshaft gear correctly. Do not force the insertion of the cover if you are not sure that the coupling is correct, as the governor gear might be seriously damaged. The two longer screws have to be fitted to the upper right and to the lower left positions.



40

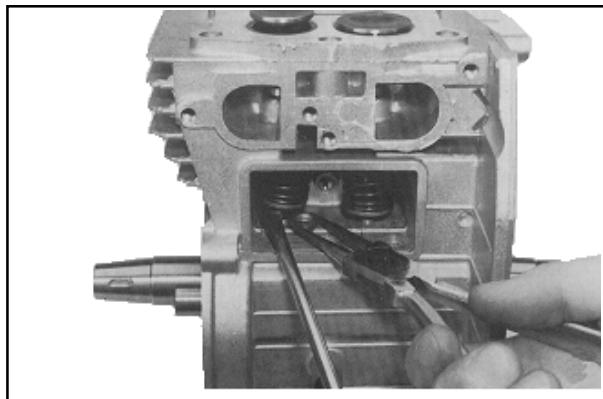
VALVES

Make sure that between the valve stem and the valve guide there is a play according to the following table:

INTAKE	0.020÷0.045 mm
EXHAUST	0.045÷0.070 mm

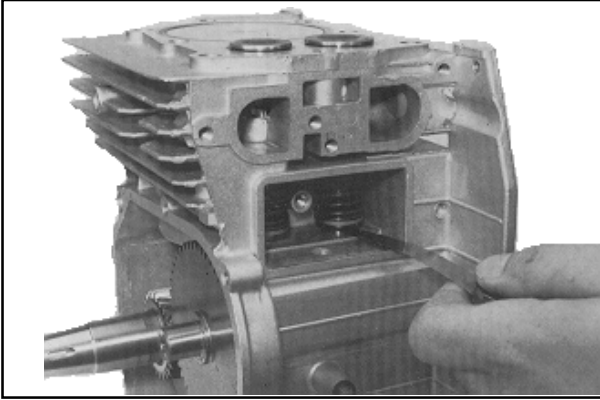
Mount the valves proceeding as follows:

- a) insert between the spring and the surface plane on the engine block the upper plate; insert the spring equipped with the lower plate for valve locking;
- b) insert the valves into their seats, by locking them in their lower part by the lower plates, using the tool code 365110 page 42 as indicated in the fig. 2 at 40;
- c) insert between the lower end of the valve stem and tappets the shim-holding cup for valve clearance adjustment (fig. 41).



41

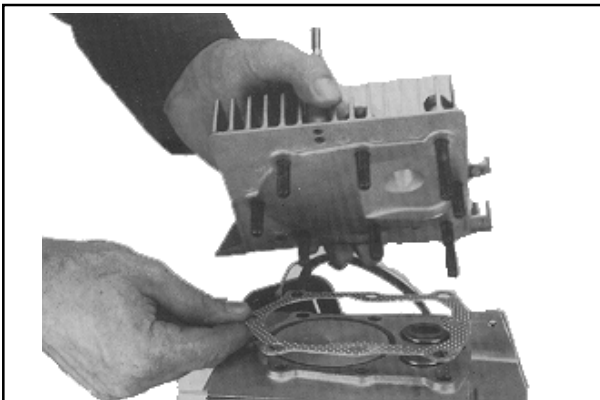
N.B.: The shims for valve clearance adjustment are available in two thicknesses: 0.1 mm and 0.2 mm



42

d) check that the valve clearance between valve and tappet is (piston at T.D.C.): 0.10 ± 0.15 mm

for both valves with cold engine (fig. 42). The clearance should be adjusted by varying the number of shims in the cup.

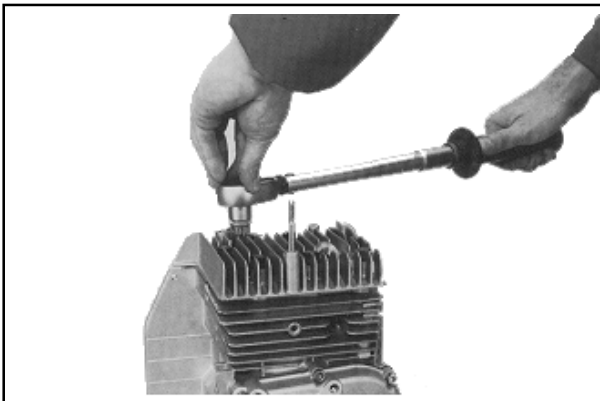


43

CYLINDER HEAD

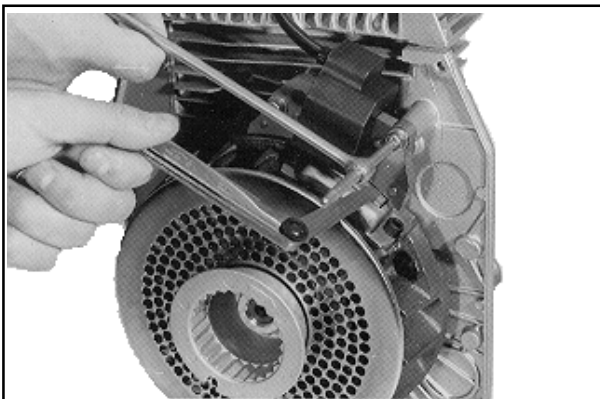
A head gasket must be fitted between the head and the cylinder (fig. 43).

Do not use sealer or gasket cement. Each head bolt should be tightened gradually and progressively in the order shown in fig. 7 page 19, by a torque wrench (fig. 44) at a value of: 24.5 Nm.



44

N.B.: The two longest screws should be mounted on the side of intake and exhaust ducts (pos. 1 and 3 fig. 7 page 19).



45

COIL AND MAGNETO

Proceed as follows:

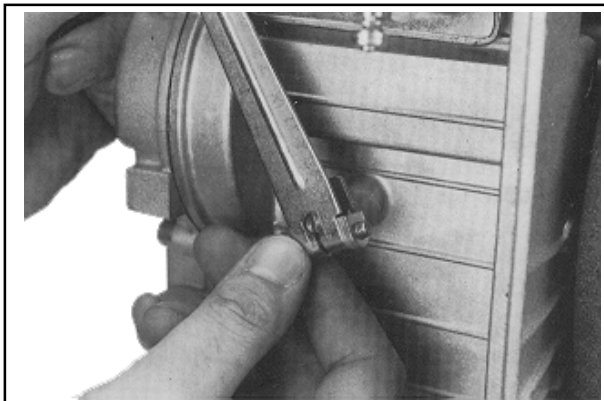
- mount the coil on the engine block without tightening the screws;
- mount the flywheel, after checking to make sure that the magneto is in a good condition and correctly fixed to the flywheel;
- use the feeler gauge positioned between the coil and the magneto to adjust the correct value of the air gap at 0.40 ± 0.45 mm (0.016-0.018 in), thus locking the coil in its definitive position (fig. 45)

Locking the coil by tightening the screws to a value of 11.8 Nm.

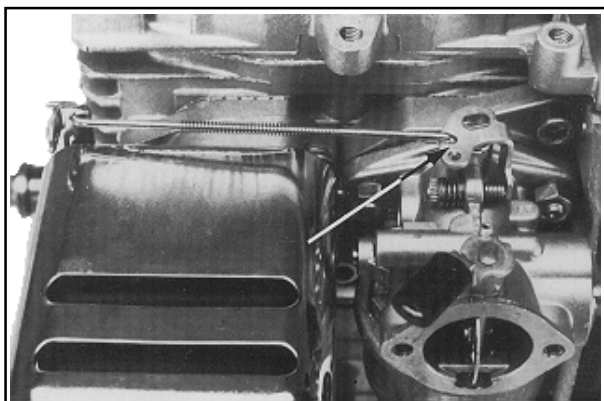
GOVERNOR LEVERS CONNECTIONS

Proceed as follows:

- a) connect the outer lever of the governor to the pivot of the inner lever coming out of the crankcase without tightening the locking screw completely (fig. 46);
- b) mount the carburetor on the crankcase, by inserting the spacer and both gaskets. Connect the outer lever of the governor to the throttle rod of the carburetor by means of the relevant tierod, to the ends of which the spring to take up slack is hooked; both the tie-rod and the spring to take up slack must be connected to the hole nearest the throttle rod (fig. 47). Hook the governor spring to the outer governor lever and to the lower accelerator lever using, for every type of spring, the hole shown at fig. 46. Three types of spring are available, according to the engine speed setting: 2400 - 3000 - 3600 R.P.M.



46

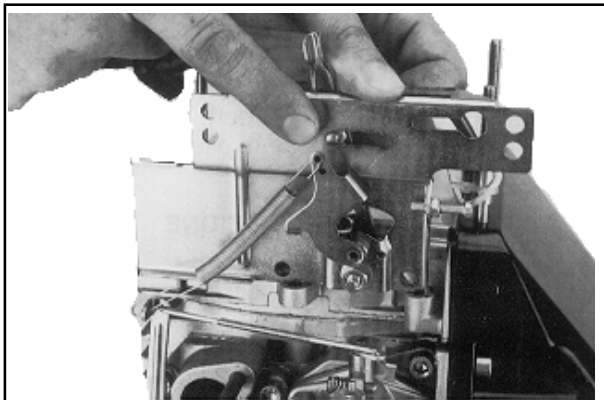


47

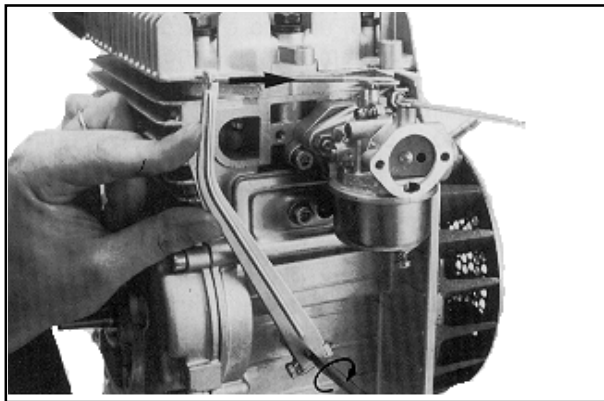
GOVERNING SYSTEM ADJUSTMENT

Proceed as follows:

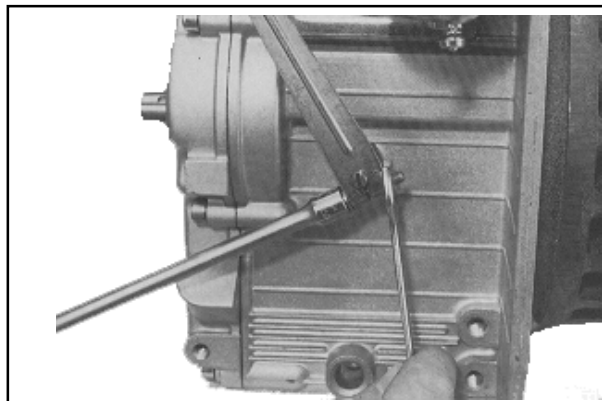
- a) Insert the top of a screw-driver in the notch on the head of the pivot of the inner lever of the governor, which comes out of the crankcase and rotate it clockwise, holding it in its position of end of stroke. At the same time, by the other hand position the accelerator throttle on its max. opening (fig. 49);
- b) by keeping the positions of the point a), tighten the locking screw of the outer lever of the governor on the pivot of the inner lever coming out of the crankcase (fig. 50).



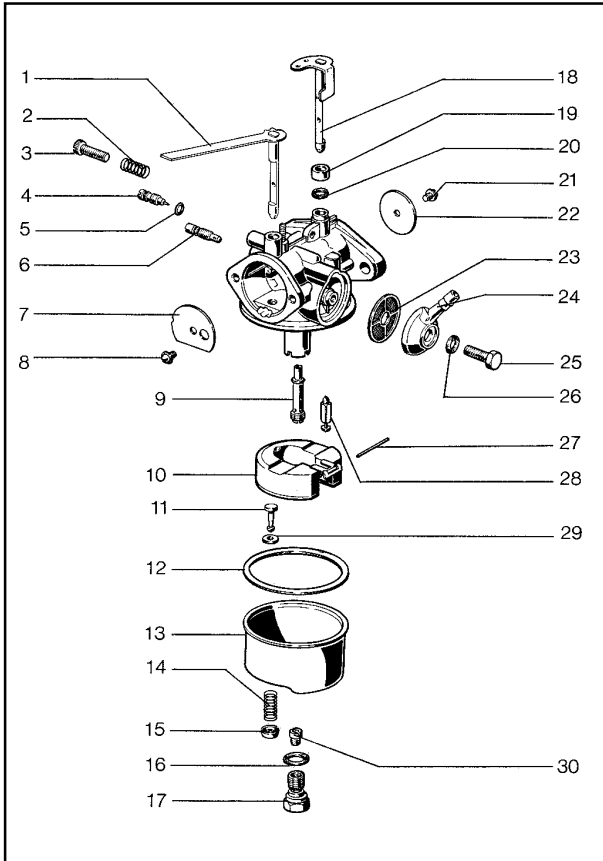
48



49



50



51

Carburetor

Parts

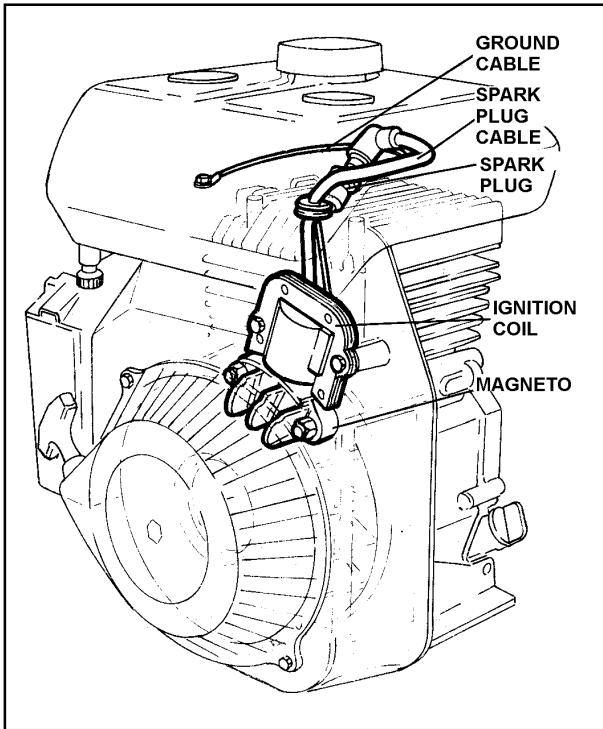
- | | |
|-----------------------------------|--------------------|
| 1) Lever | 16) Washer |
| 2) Spring | 17) Plug |
| 3) Idling rate adjusting screw | 18) Lever |
| 4) Idling mixture adjusting screw | 19) Cap |
| 5) Gasket | 20) Gasket |
| 6) Idle jet | 21) Screw |
| 7) Choke plate | 22) Throttle |
| 8) Screw | 23) Filter element |
| 9) Atomizer | 24) Eyelet |
| 10) Float | 25) Screw |
| 11) Push-button | 26) Washer |
| 12) Gasket | 27) Float pin |
| 13) Float chamber | 28) Needle valve |
| 14) Spring | 29) Gasket |
| 15) Drain push-button | 30) Main jet |

CARBURETOR CHARACTERISTICS (DRY AIR FILTER STD)

ENGINE (fuel feeding)	TYPE carburetor	dia. diff. mm	dia throttle	dia needle valve mm	Main jet	Idle jet	carburetor code
LGA 226	FHC20/16A	16	20	1,2	95	35	155192

To carry out any cleaning or checking, please proceed as follows:

- disassemble the carburetor completely and wash its components carefully, using gasoline or kerosene. Never use any metal points cleaning jets, holes or calibrated channels, but only compressed air;
- check the seal of the needle valve and see that it runs freely in its seat; replace it if not;
- make sure that the float is not damaged and that it moves freely;
- make sure that the throttle rod rotates freely in the whole area where it can be used, and that the play between the rod and its seat is not excessive, as it might let some air in;
- make sure that the choke plate is not worn and that its rotation is complete and free;
- make sure that the fuel filter and the atomizer are not damaged or dirty.



IGNITION

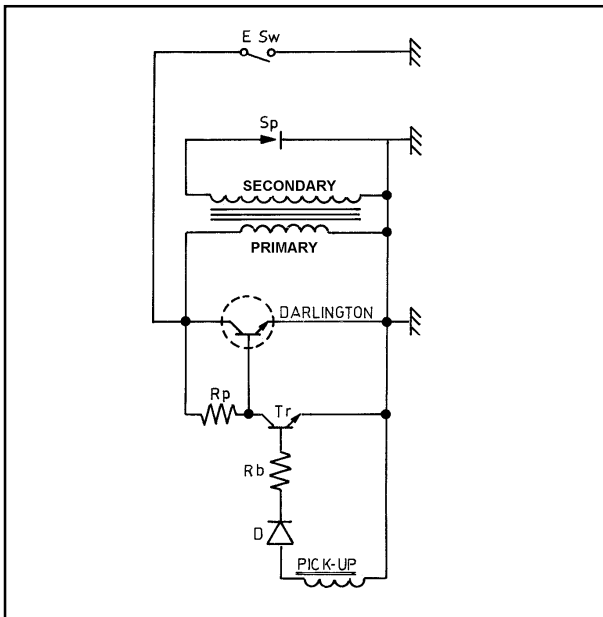
Inductive type electronic ignition with high performances which make engine starting much easier.

This system is designed for a higher degree of quality in each of the features listed below:

- no maintenance required as there are no moving parts;
- resistant to moisture, water and dust;
- high durability as there are no parts subject to deterioration due to mechanical wear;
- stable working and efficiency
- simple construction as the number of components in the ignition system has been considerably reduced.

The operating principles are described below (fig. 52-53).

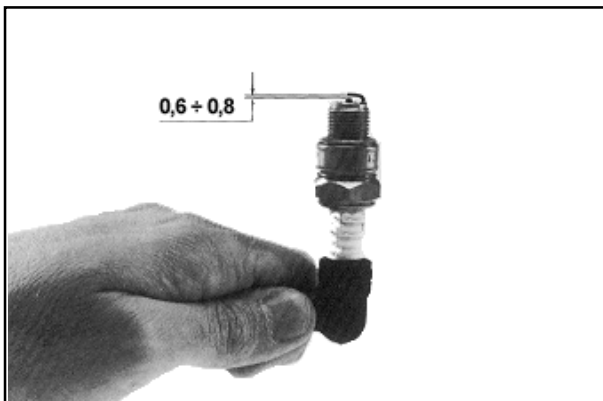
52



The inductive type electronic ignition reflects the operation of the breaker points system; however, in this case, the mobile contact interrupting the current in the primary winding is replaced by one or many transistors in "DARLINGTON" connection, which are usually closed (conduction) and are opened (lock) by a pick-up device followed by a small transistor. The "DARLINGTON" connection must open at peak current flow through the primary winding to have the highest efficiency, as it happens for the conventional breaker points ignition.

When a current is induced in the pick-up device, after being rectified by the diode **D**, it causes conduction in the transistor **Tr**, which takes to ground the "DARLINGTON" base, which is therefore interdicted, provoking a sudden variation of current circulating in the primary winding from peak to zero, with consequent extravoltage to the secondary winding, producing the spark in the **Sp** spark plug.

53



SPARK PLUG EQUIVALENTS

After having cleaned the area around the spark plug, demount it and check the distance between the electrodes, which must be 0.6-0.8 mm. If the electrodes are worn or the insulation is cracked, replace the spark plug with one of the same thermal rating (Lombardini code 2100.082). See the side table for specifications. (Thread mm 14x1.25 mm).

53a




54

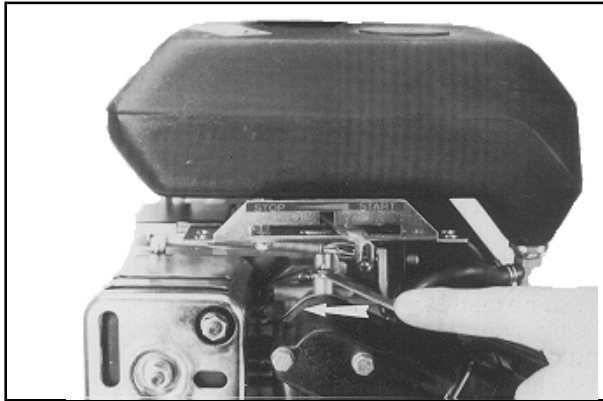
LUBRICATION

Lubrication of the internal engine parts is splash type. An oil jet is lifted and guided towards the piston crown by an oil dipper in the big end of the connecting rod. The oil reaches the tappets, valve springs, and caps in mist form, driven by upcoming air along the tappets at each stroke of the piston in the cylinder.

The diaphragm in the breather maintains the correct pressure inside the crankcase and prevents oil leakage and any dirt from getting in.

Before starting the engine, make sure that the sump is filled with clean oil per the table in fig. 15.

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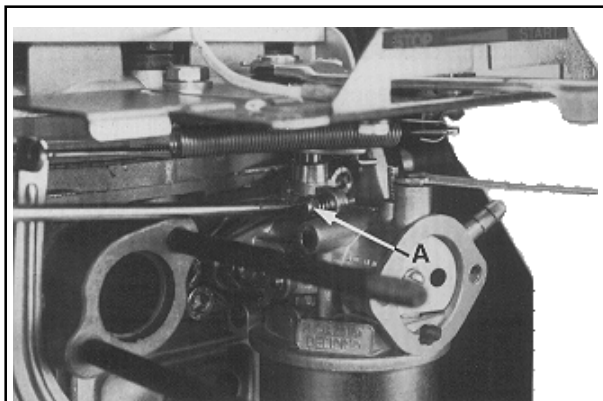
55

ENGINE TEST

Fix the engine on a base or on the machine. Check the oil level in the sump (and in the air filter if oil bath type) and the fuel level in the tank.

Rope or recoil starter

- a) Cold start.
Shut the starter throttle or move it to the intermediate position and set the accelerator to about the halfway mark. Pull in a decisive way after having wound the rope on to the pulley if a rope starter is installed. Open the starter once the engine has fired (fig. 57).
- b) When hot.
Without moving the starter throttle, set the accelerator to idling rate or the halfway mark. Pull in a decisive way after having wound the rope on to the pulley if a rope starter is installed.

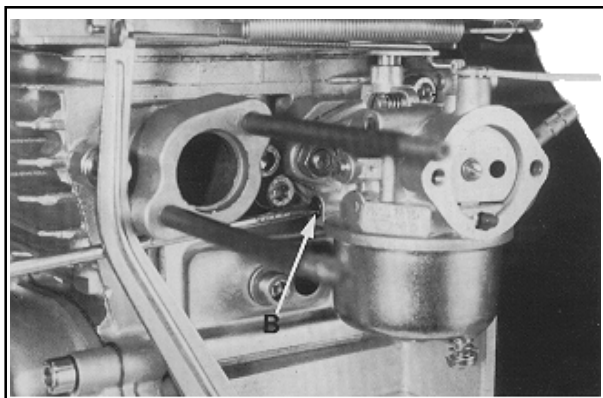


56

ELECTRIC STARTING

Before using the key or the push-button for starting, make sure that all connections are positive, especially those relevant to the rectifier with ground and battery. The rectifier can be damaged in a few seconds if it is not connected to the system (including battery), while engine is running.

As to the hot or cold starting procedures.



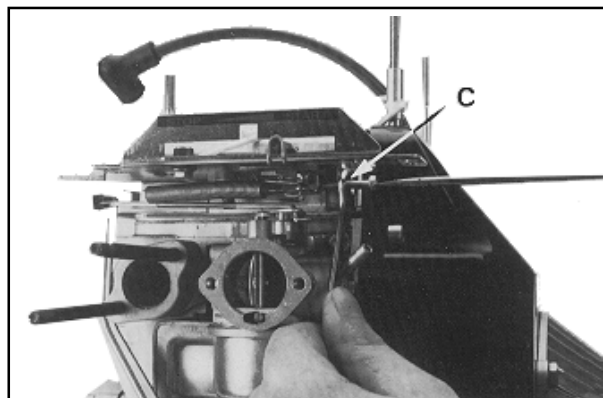
57

CARBURETOR AND SPEED ADJUSTMENTS

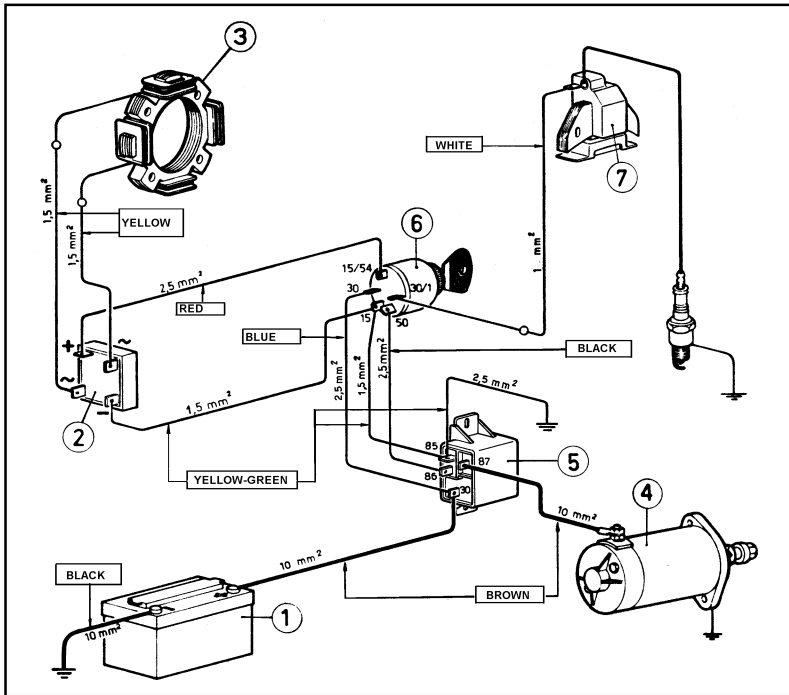
To carry out these operations, it is necessary to have a R.P.M. counter. Start the engine and let it run for some minutes at 2000 R.P.M. approx. Keep the engine at its slow running and fix it at 1000-1100 R. P. M., by turning the screw **A** (fig. 56).

Gently tighten the screw **B** and loosen it slowly of 1 1/2 turns (approx.), looking for the position where the engine working is most regular (fig. 57).

Such operation is particularly delicate and it is necessary to carry it out many times to be sure to have found the position of max. working evenness. Check the R.P.M. at slow running again, which should be 1000-1100 R.P.M. Then adjust the max. running depending on the different applications (2400/3000/3600 R.P.M.) by turning the screw **C** (end of stroke of the lower lever of the accelerator) remembering that the R.P.M. without load should be over 5% approx. as to ther R.P.M. at full load (fig. 58).



58



Electric starter by motor

Drawing of the plant

Parts of the system

- 1) Battery
- 2) Rectifier
- 3) Alternator
- 4) Starting motor
- 5) Remote control switch
- 6) Starting switch
- 7) Ignition coil

Characteristics

Alternator LOMBARDINI 12 V - 70 W
 Rectifier IR type 26 MB 20 A
 Starter SJCE PN1 12 V - 0.15 kW
 Remote control switch BOSCH 12 V
 Recommended battery: capacity 20 Ah.

59

Electrical system check

Check the cables, the insulation and the connections. Should the system no longer charge the battery, look for the following causes:

- stator windings bonding;
- magnetized ring, mounted on the flywheel, unmagnetized;
- defective rectifier;
- interruption in the battery ground;
- battery polarity inversion.

ALTERNATOR

Fixed armature type, mounted on the engine crankcase, with rotor in the flywheel.

Check the magnetization of the rotor.

The windings of the armature (stator) should not have any loose connections and traces of burning or wires bonding. Replace the stator if defective.

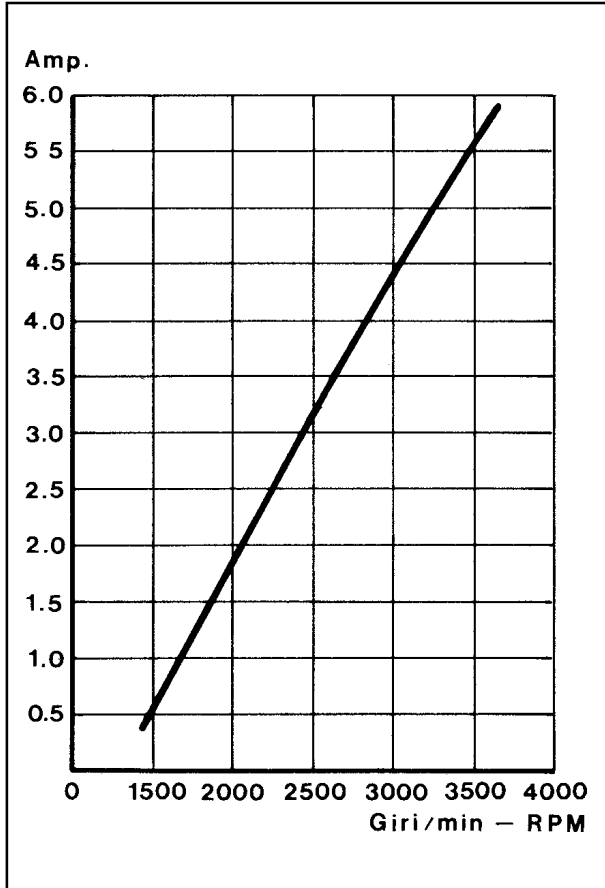
Check by an Ohmmeter that all wires are continuous and the ground insulated.

Check the efficiency of the alternator mounted as follows:

- disconnect the rectifier wires;
- connect a Voltmeter 10 to 30 Volts in alternated current or a tester between them;
- start the engine and check that the voltage reading on the Voltmeter or on the tester corresponds to that of the below indicated table:

R.P.M.	VOLTS (V)
2000	13,5 14,5
2500	17 18
3000	20,5 22
3600	25 26

Should the voltage reading be lower, It means that the rotor is no longer magnetized and must therefore be replaced.



RECTIFIER

The rectifier should be checked as follows:

- check the connections;
- connect an Ampmeter 10A between the positive pole of the battery and the positive terminal of the rectifier;
- connect between the battery poles a Voltmeter 20 V;
- decrease the battery voltage below 13 Volts. This can be done by starting the engine as many times as necessary (with the electric starter), to achieve the less than 13 Volts reading.

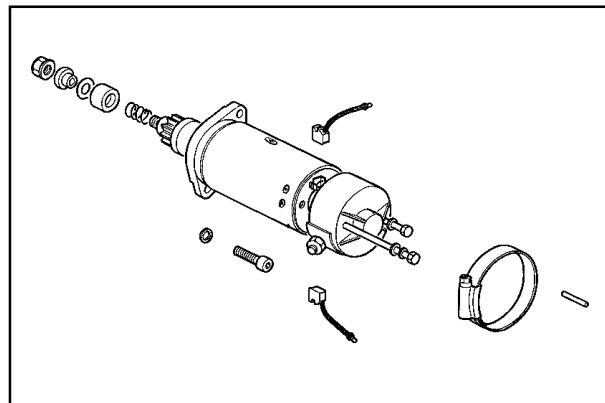
The diagram at fig. 62 shows the trend of the current intensity when the engine RPM varies, with constant voltage of the battery 12.5V and room temperature +25°C (+77°F).

If the charge current is zero with battery voltage 12.5V, replace the rectifier and check the charge.

Should the charge remain the same, check the alternator.

CAUTION: The rectifier can be damaged in a few seconds if it is not connect to the system, while engine is running.

60



STARTING MOTOR (STARTER)

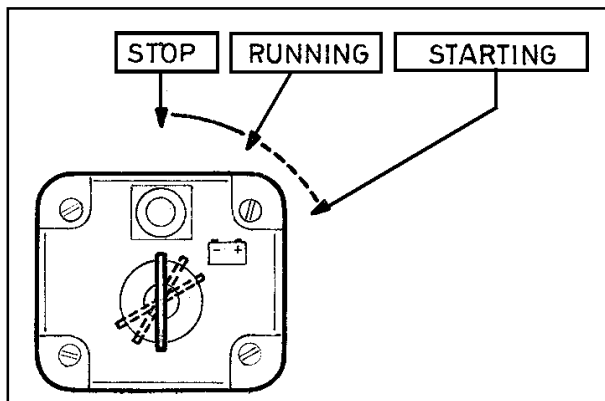
The starter is SJCE type PN1 12V-0.15 kW.

BATTERY

The recommended battery is 12V with a capacity of 20 Ah.

The battery capacity is according to the room temperature therefore, for low temperatures, batteries of higher capacity are required. The level of the liquid in the battery should be about 5 mm (0.20 in) above the plates.

61



STARTING PANEL

The following fig. 62 shows the various positions of the starting key. As to the connections of the wires to the panel, see the fig. 60.

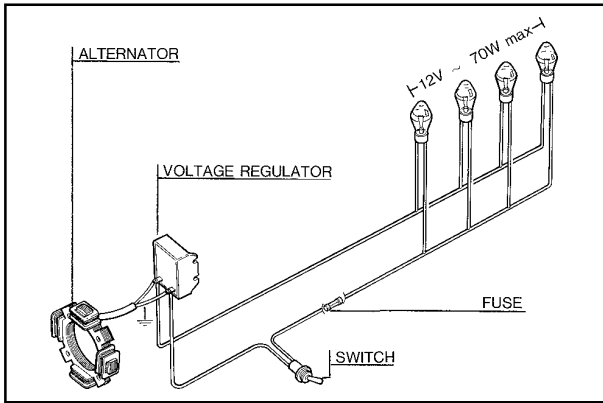
The first position of the key clockwise, activates the battery charging circuit, the second position activates the starter.

When the engine is running, the key has to be at its first position.

When the engine is not running, the key should be in rest position; if it is kept on its first position, the rectifier is damaged and the battery discharged.

The warning light of battery recharge is excluded by the key in its rest position; it has to be lighted when the engine runs and so the system works correctly. If it switches off, something is wrong in the battery charging system.

62



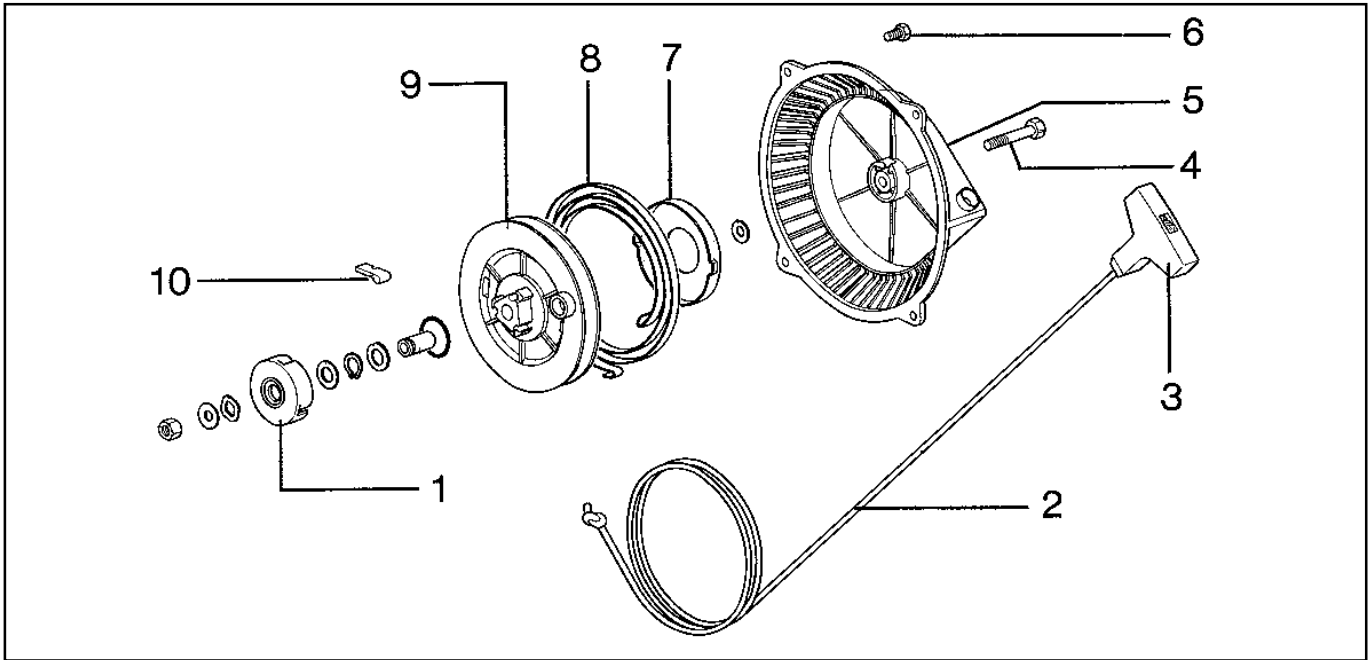
LIGHTING SYSTEM BY ALTERNATOR

System check

Apply a load by turning on lights for an absorption of 25 to 70 W, start the engine and bring it to the maximum speed (3600 RPM); the outler voltage should be approximately 12V.

Insert an Ampmeter with a scale of 5A between the positive pole of the voltage regulator and the switch. Should the charge be equal to zero, replace the voltage regulator and check the charge. Should it be unvaried, check the alternator.

63



64

RECOIL STARTER

Description

This is a manual starting device which rewinds the cable on a spring activated disc, after starting.

It can be mounted on all engines equipped with a standard pulley with inner toothing as specified at page 23.

Any breakage of the starting unit, will not compromise the engine starting. It can be started manually by a rope, just removing the complete recoil starter from the engine by loosening the screws holding it to the front of the engine (fig. 64).

Parts:

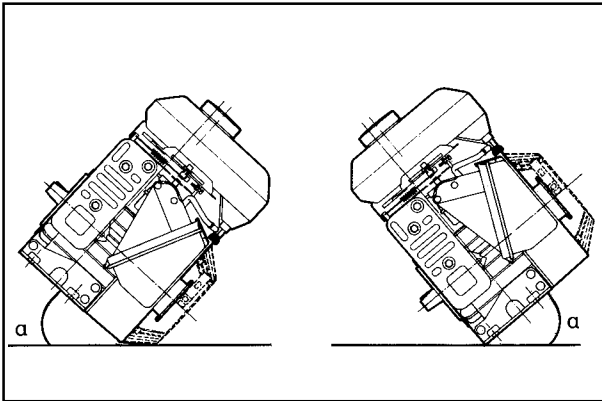
- 1) Dogs guide housing
- 2) Starting cable
- 3) Knob
- 4) Starter locking screw
- 5) Starter support
- 6) Screws M6 for starter fixing
- 7) Spring cover
- 8) Spiral spring
- 9) Cable rewind disk
- 10) Starter dogs

Disassembly, checking, overhaul

- Check the cable (2): should it be broken replace it.
- Check that the starter dogs (10) come out when starting.
- To replace the spiral spring (8) in case of breakage, it is supplied complete with cover (7) as an assembly, for simple replacement.

Mounting (or remounting) of recoil starting assembly

Install recoil assembly over starting pulley. Screw down the 4 screws that hold the assembly onto the engine, but do not tighten them. Grasp the starter handle and pull the cable approximately 150 mm (6 in), hold tension on the cable, then tighten the 4 screws. By performing this procedure, the starter assembly will be in perfect alignment with the center of the starting pulley.

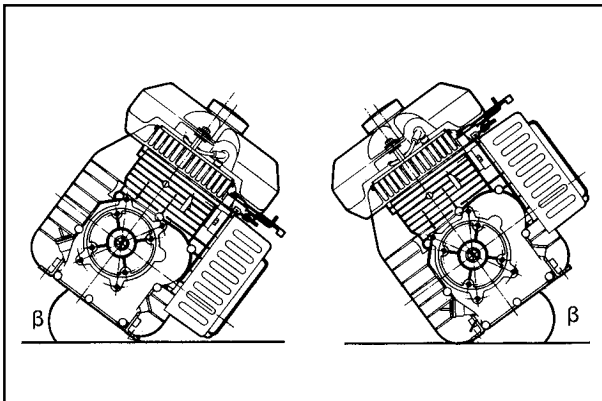


65

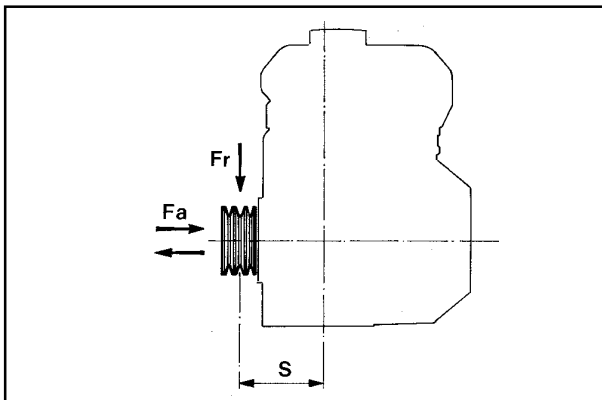
INSTALLATION

To install the engine correctly refer to the indicative data indicated below.

SLANT - LIMITS TO OPERATION (fig. 65-66)



66



67

AXIAL LOAD RADIAL LOAD AND MAXIMUM OVERHANG

The axial thrust in both senses F_a (fig. 67), must be less than 200 kg (441 Lb).

The maximum radial load F_r (fig. 67), for belt application, is 50 kg (110 Lb), with a max. overhang "S" from the cylinder axle of 135 mm (5.31 in).




Increasing the overhang "S", reduce the load F_r , so that the bending moment ($F_r \times S$) does not increase.

MAIN TORQUE SPECIFICATIONS

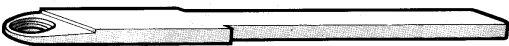


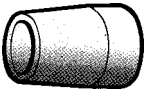
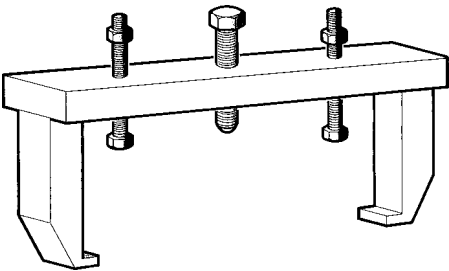
POSITION	Reference (Figure N° and page)	Diam. and picht (mm)	(Nm)
Timing cover	N° 39 - pag. 28	M 6	11,8
Big-end	N° 34 - pag. 27	M 6	11,8
Engine head	N° 44 - pag. 29	M 8	24,5
Fan cowl		M 6	9,8
Engine mount		M 8	15,7
Flywheel	N° 3 - pag. 17	M 18x1,5	137,2
Coil	N° 45 - pag. 29	M 6	11,8
Breather cover		M 6	6,9
Rocker arm block		M 8	24,5



STANDARD BOLT TORQUE SPECIFICATIONS

DESCRIPTION						
	R ≥ 800 N/mm ²		R ≥ 1000 N/mm ²		R ≥ 1200 N/mm ²	
Diameter x pitch (mm)						
4x0,70	3,6	0,37	5,1	0,52	6	0,62
5x0,80	7	0,72	9,9	1,01	11,9	1,22
6x1,00	12	1,23	17	1,73	20,4	2,08
7x1,00	19,8	2,02	27,8	2,84	33	3,40
8x1,25	29,6	3,02	41,6	4,25	50	5,10
9x1,25	38	3,88	53,4	5,45	64,2	6,55
10x1,50	52,5	5,36	73,8	7,54	88,7	9,05
13x1,75	89	9,09	125	12,80	150	15,30
14x2,00	135	13,80	190	19,40	228	23,30
16x2,00	205	21,00	289	29,50	347	35,40
18x2,50	257	26,30	362	37,00	435	44,40
20x2,50	358	36,60	504	51,50	605	61,80
22x2,50	435	44,40	611	62,40	734	74,90
24x3,00	557	56,90	784	80,00	940	96,00

SPECIAL TOOLS

	DESCRIPTION	TOOL NO.
	Valve spring extractor	365110
	Valve guide check tool	365048
	Valve guide puller	365109
	Oil seal installation cone	365152
	Engine flywheel and timing cover puller	365113

PISTON - CYLINDER OVERSIZE TABLE

Engine	Nominal	First re-boring	second re-boring
	Ø mm	Ø mm	Ø mm
LGA 280	+0,013 72 0	+0,013 72,5 0	+0,013 73 0

TOLERANCES OF CRANKSHAFT JOURNAL GRINDING

Nominal	first grinding	second grinding
Ø mm	Ø mm	Ø mm
Min 25,989	Min 25,739	Min 25,489
Max 26,000	Max 25,750	Max 25,500

CLEARANCES AND ADJUSTMENTS TABLE

Position	Min (mm)	Max (mm)
	Valve guide and stem	
INTAKE	0,020	0,045
EXHAUST	0,045	0,070
Pin and small end hole of connecting rod	0,006	0,022
Piston and pin (interference)	0,000	0,008
Connecting rod bearing and crankshaft journal	0,030	0,049
Valve clearance when cold	0,100	0,150
Gap between ignition coil and flywheel	0,400	0,450
Spark plug electrodes gap	0,600	0,800
Distance between ends of compression rings	0,250	0,450
Distance between ends of scaper ring (oil ring)	0,200	0,350



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