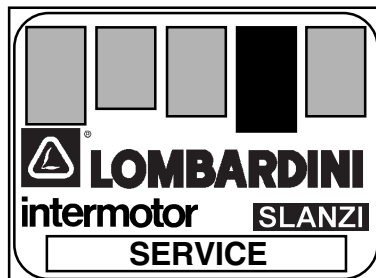



# WORK SHOP MANUAL

LGA 280-340 OHC Series engines,code 1-5302- 528

## LGA 280 OHC LGA 340 OHC

1st Edition



COMPILER TECNICI <i>M. J. Cimella</i>	REG. CODE 1-5302-528	MODEL N° 50805	DATE OF ISSUE 31.07.2001	REVISION 00	DATE 31.07.2001	ENDORSED <i>Marco Biondi</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.

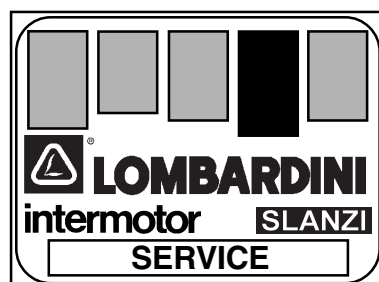
The information contained within this service manual is the sole property of Lombardini. As such, no reproduction or replication in whole or part is allowed without the express written permission of Lombardini.

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.


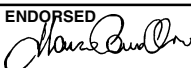

The repair or replacemnt of any component will not extend or renew the warranty period. Direct labor required to make repairs or to replace components found to be defective in materials or workmanship will be completed at no cost to the end user. Lombardini in not responsible however for indirect costs 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.

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This manual gives the main instructions on how to repair LOMBARDINI LGA 280-340 OHC gasoline-fuelled engines, updated as of 31.07.2001.

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**NOTE**

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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	No power	Noisy	Light or white smoke	Dark or black smoke	Hunts	Consumes oil	Overheats	Does not accel.	Spark plug fails to spark
Tank plug breather clogged		●									
Tap clogged		●	●					●			
Fuel filter clogged		●									
Dirty carburetor			●			●	●				
Carburetor needle valve blocked		●	●							●	
Speed governor rod blocked							●			●	
Grounded spark plug	●										●
Broken spark plug lead	●										●
Defective coil	●	●								●	●
Clogged air filter	●	●									●
Low oil level (oil watch alerted)		●									
Air filter choked		●	●								
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 rate		●									
Driving belt broken	●										

**WARNING SIGNS****DANGER**

**Failure to comply with these instructions may result in damages to persons and property.**

**CAUTION**

**Failure to comply with these instructions can lead to technical damage to the machine and/or installation.**


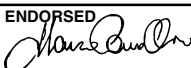

**SAFETY INSTRUCTIONS**

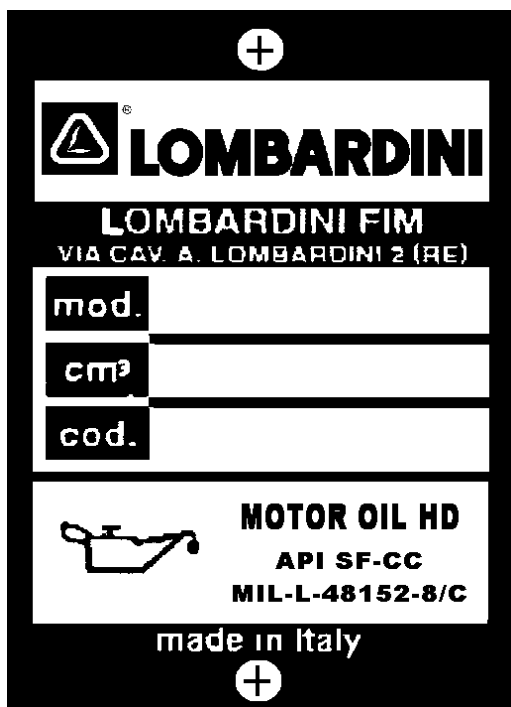
- Lombardini engines are built to provide safe and longlasting performances, but in order to obtain these results it is essential that the maintenance requirements described in the manual are observed along with the following safety recommendations.
- The engine has been built to the specifications of 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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← LOMBARDINI

← ENGINE TYPE

← SWEPT VOLUME

← CUSTOMER CODE



ENGINE IDENTIFICATION NUMBER

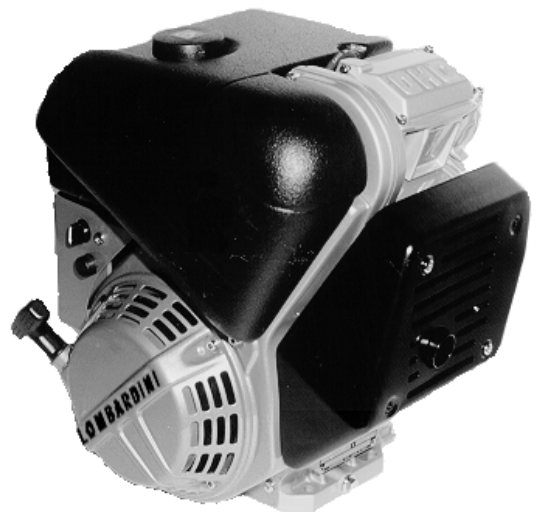
TECHNICAL FEATURES LGA 280-340 OHC

ENGINE TYPE		LGA 280	LGA 340	
Cylinder	N.	1	1	
Bore	mm	74	82	
Stroke	mm	64	64	
Swept volume	cc.	275	338	
Compression ratio		8.5 - 1	8.5 - 1	
Standard R.P.M.	RPM	3000 - 3800	3000 - 3800	
Rating kW	N DIN 70020	kW/HP	6.0/8.1 - 6.6/9.0	7.4/10 - 8.1/11
	NB DIN 6271 ISO 3046	kW/HP	5.6/7.6 - 6.3/8.5	6.9/9.4 - 7.7/10.4
	NA DIN 6271 ISO 3046	kW/HP	5.2/7.1 - 5.9/8.0	6.6/8.9 - 7.3/9.9
Max torque	Nm-Kgm	19 - 1.94	23.7 - 2.4	
Specific fuel consumption	g/kW h - g/HP h	329 - 242	342 - 251	
Tank capacity	l.	6	6	
Housing oil capacity	l.	1.2	1.2	
Dry weight	Kg.	30	30	
Spark plug		112-2100-067	112-2100-067	
Ignition system		Electronic	Electronic	
Cooling system		Forced air	Forced air	
Type of engine		4-stroke integral camshaft	4-strokes integral camshaft	



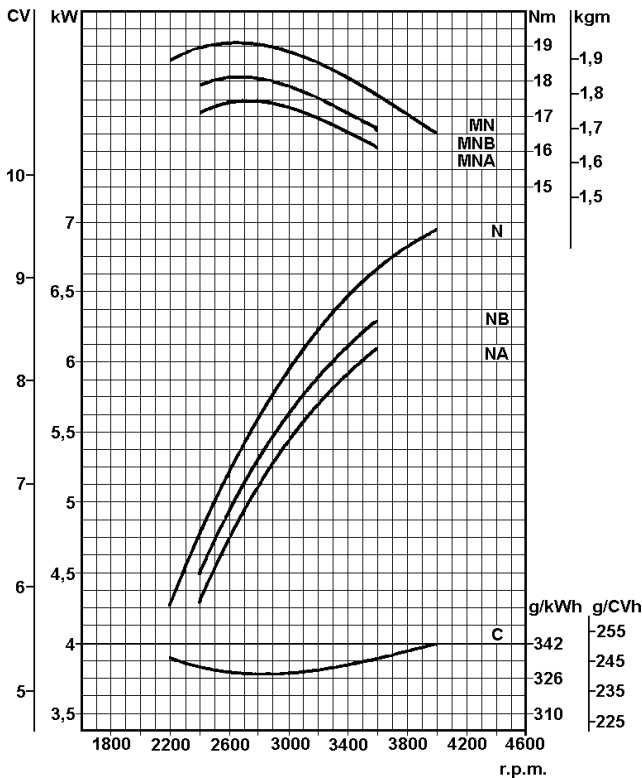
**LGA 280**

**LGA 340**

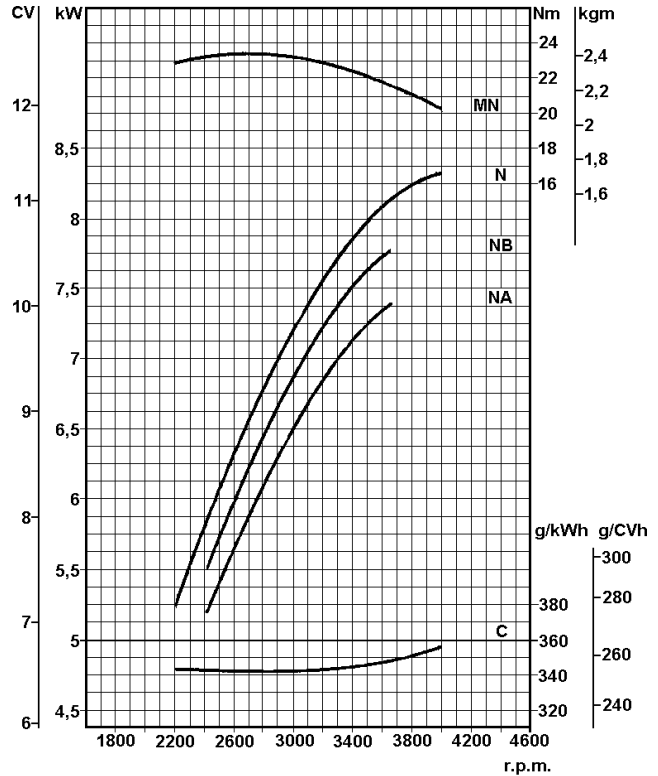


CHARACTERISTICS POWER, TORQUE AND SPECIFIC FUEL CONSUMPTION CURVES

LGA 280



LGA 340



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

**NB (ISO 3046 - 1 IFN) RATING WITH NO OVERLOAD CAPABILITY**: continuous light 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 curve (at N power).

**MB** (in NB curve)

**MA** (in NA curve)

**C** Curve of specific fuel consumption measured at power N.

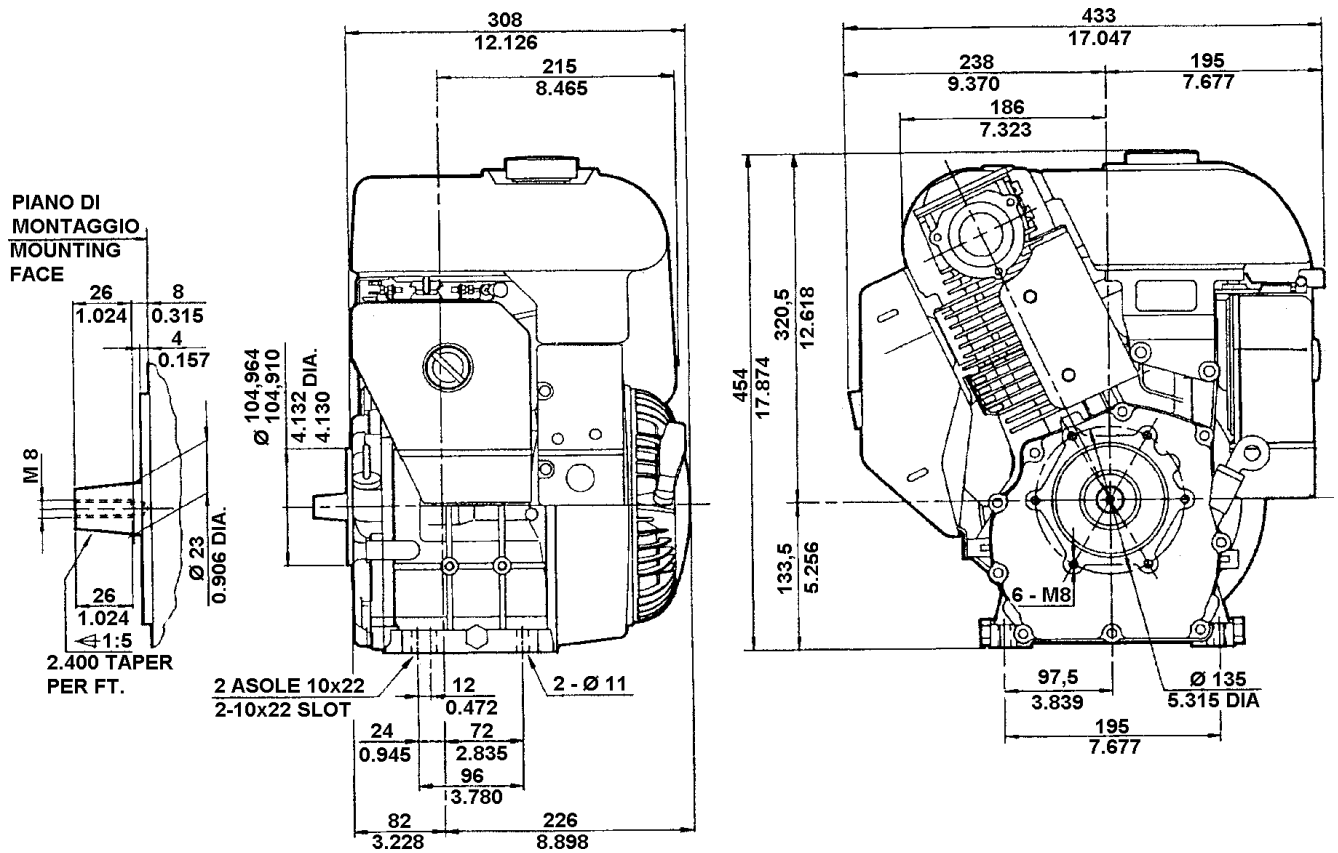
The above power values refer to an engine fitted with air cleaner and standard muffler, after testing and at the environmental conditions of 20°C and 1 bar.

Max. power tolerance is 5%.

Power decreases by approximately 1% every 100 m di altitude and by 2% every 5°C above 20°C.

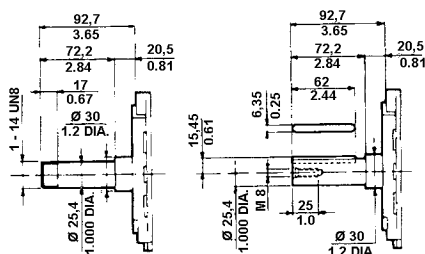
**Note:** Consult LOMBARDINI for power, torque curves and specific consumptions at rates differing from those given above.

OVERALL DIMENSIONS

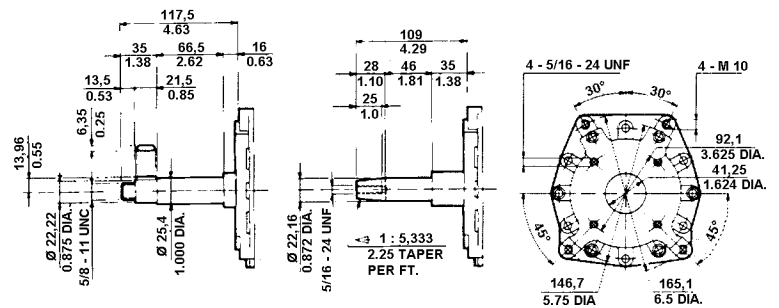


POWER TAKEOFFS AND SPECIAL FLANGING

Optional



Optional




Note: The values are given in mm



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)									
		10	20	25	50	100	300	500	1000	2500	
CLEANING	Air filter cartridge		•								
	Fuel filter				•						
	Cylinder and head fins					•					
INSPECTION	Oil level in housing		•								
	Distance of glow plug electrodes					•					
	Valve play						•				
	Timing belt							•			
REPLACEMENT	Oil in housing			•							
	Paper cartridge of air filter					•					
	Timing belt									•	

-  To avoid explosions or fire outbreaks, do not smoke or use naked flames during the operations.  
 Fuel vapours are highly toxic. Only carry out the operations outdoors or in a well-ventilated place.  
 Keep your face well away from the plug to prevent harmful vapours from being inhaled. Dispose of fuel in the correct way and do not litter as it is highly polluting.

## FUEL

When refuelling, it is advisable to use a funnel to prevent fuel from spilling out. The fuel should also be filtered to prevent dust or dirt from entering the tank.

Use PREMIUM gasoline or UNLEADED PREMIUM gasoline of the type used in cars. Use of other types of fuel could damage the engine.

The octane rating of the fuel must be higher than 95 to prevent difficult starting.

Do not use old, dirty gasoline or oil-gasoline, water-gasoline mixtures since this would cause serious engine faults.

The tank capacity is: 6 l.



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 quality 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 all 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 wore during this operation.

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

**Engine oil fuelling**

Set the engine on a flat surface, then pour in oil up to the max. level mark on the plug dipstick.

If the engine has an oil-cooled filter, check the oil level in the filter sump and if necessary, top up with the same type of oil as used to lubricate the engine.

**RECOMMENDED OIL**

AGIP SINT 2000 5W40 specification API SJ/CF ACEA A3-96 B3-96 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 280 - LGA 340**

Standard oil sump                    lt 1.2

**ACEA SEQUENCES**

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

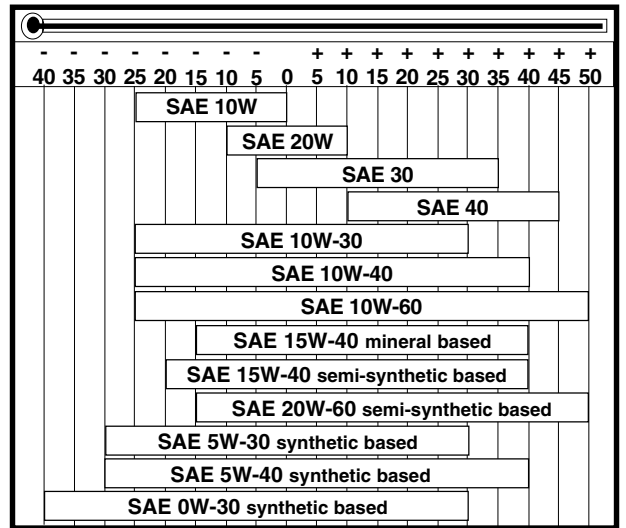
Required levels :

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

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

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

**GRADE**



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**



*M. J. Imella*

*Manuel B. B. B.*



**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**

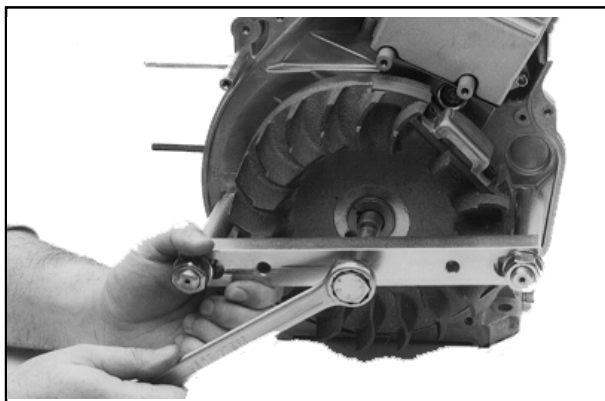
- In order to work quickly and safely, strictly observe the instructions in the manual and the following general rules:
- Lock the machine in position before disassembling the engine.
- Disconnect the battery cables (if the engine is equipped with electric starting).
- Always use suitable tools in order 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.
- Use always LOMBARDINI original spare parts.

**ENGINE DISASSEMBLY**

If the engine is mechanically worn-out but the outside parts are still in good condition (tank, casing, flywheel, coil, carburetor, air filter, exhaust, fan cowl, cylinder head), the use of a "Short-Blocks" is advised (composed of crankcase, crankshaft, connecting rod, piston, timing cover) already enclosed and prepared to be completed by the outside parts. Once assembly operations have been completed, proceed with setting up.

**ENGINE PREPARATION**

After having drained off the oil from the engine and emptied the fuel tank, place the engine on a work bench and disassemble the outside parts: tank, exhaust, air filter, carburetor, casing, recoil starter and fan cowl.



1



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 EXTRACTION**

Loosen the flywheel locknut (remember that the thread is RIGHT HANDED), remove the washer and pulley belt. Using the puller CODE 3595.048 on page 42, remove the flywheel (fig. 1).

**HEAD DISASSEMBLY**

Do not disassemble when hot to avoid deformation.

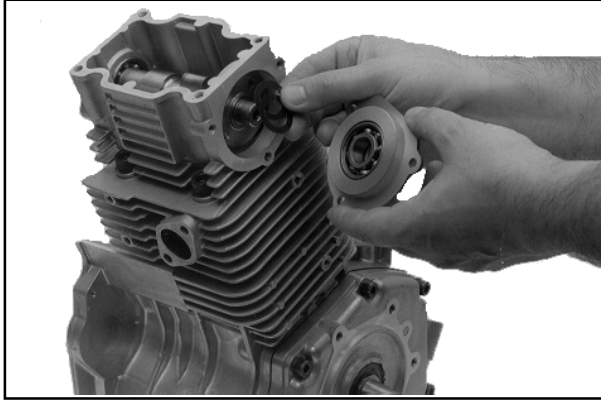
Remove the belt cover casing, loosen the tightener and timing belt, remove the timing pulley loosening the screw that fixes it to the camshaft, and the relative key, remove the toothed belt internal protective casing.

Using a allen wrench, loosen the 4 screws M 10 that fix the casing to the engine.

**WARNING:** it is advised to replace the timing belt after removal, even if this means anticipating the expiry term.

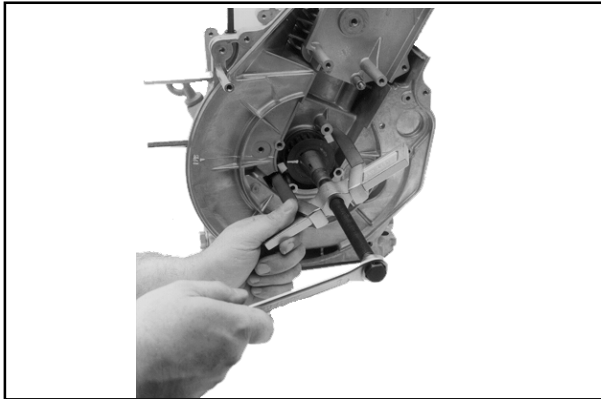
(See tab. pag. 14)

COMPILER TECN. ATL <i>M. J. Imola</i>	REG. CODE 1-5302-528	MODEL N° 50805	DATE OF ISSUE 31.07.2001	REVISION 00	DATE 31.07.2001	ENDORSED <i>Marco Bui</i>		17
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**DISASSEMBLY OF CAMSHAFT - TAPPETS VALVES**

Remove the tappet cover, rotate the camshaft so that the cams face upward, remove the side support, extract the camshaft (fig.2). Remove the tappets and, with tool CODE 1460.113 on page 42, remove the valve cotters; then extract the valves from the valve guides.

2

**TIMING PULLEY REMOVAL**

Use extractor CODE 1460.114 on page 42 and remove the timing pulley as shown in fig. 3.

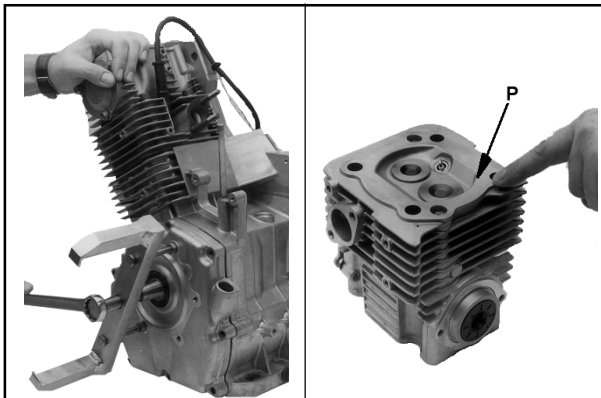
3

**TIMING COVER REMOVAL**

Loosen the M 8 screws that fix the timing cover to the crankcase, using puller CODE 3595.048 on page 42, position the central screw on the opposite side from that used to extract the flywheel, tighten the two screws in the threaded holes on the timing cover (fig. 4a).

**DRIVE SHAFT EXTRACTION**

After the completion of operations, loosen the connecting rod screws, slide out the piston and extract the drive shaft.



4a

4b

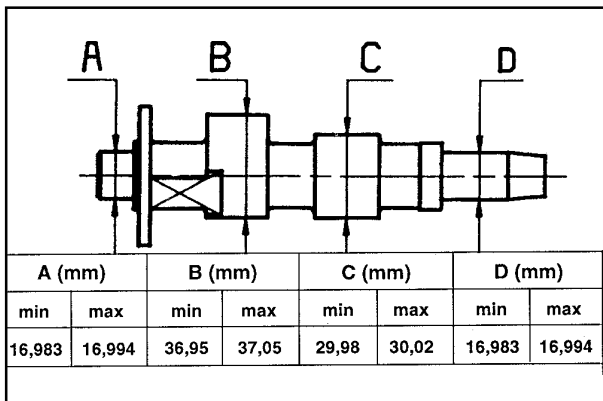


Do not demount and remount when hot to avoid deformations.

**CYLINDER HEAD**

Made in die-cast aluminium alloy with inserted valve seats which are made of special cast iron of high nickel-chromium content. They are introduced with negative allowance into the relative seats on the head.

The valve guides are inserted and replaceable; special cast iron for the intake valve and bronze for the exhaust valve. Clean all carbon deposits from the head and check that the head face **P** fig. 4b is not deformed. If deformed, grind the working face by removing not more than **0.25 mm**.



**CAMSHAFT**

Check that the cams and pins are not worn or scored. Slight indentations or scoring can be taken up using a fine file and finished with the same type of emery cloth. The pin diameter values and other main camshaft dimensions are shown in the table in fig. 5.

All engines are fitted with centrifugal compression release; check the smoothness of the counter-weight and the correct position of the spring (fig.6).

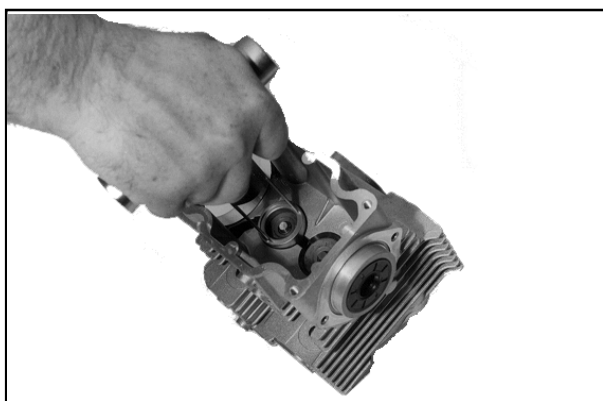
The protusion of the pin from the cam contour must be between 0.50 ÷ 0.60 mm with the device engaged.

N.B.: up to serial No. 11276 the protusion of the pin from the cam was 0.65-0.75 mm. Camshaft with protusion of the pin between 0.50-0.60 mm will be delivered as spare parts.

5



6



**VALVES - GUIDES - SEATS - VALVE SPRINGS - TAPPETS**

After disassembly and cleaning with a metal brush, check that the valves heads are not deformed, burned or worn in the seats: replace the valves if damaged.

If the general condition is good, reset the face track **P** in the seat with a grinding of:

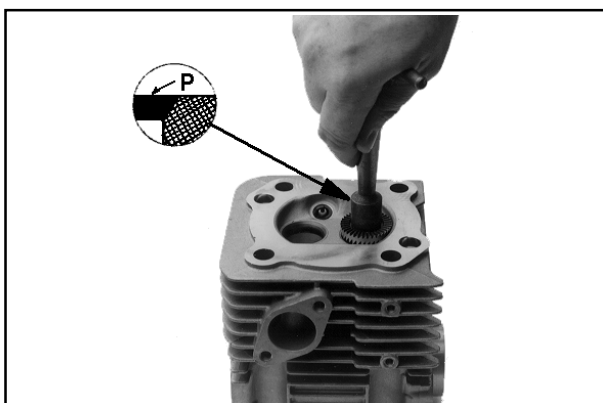
- 90° exhaust - 90° intake for engine LGA 280 OHC
- 90° exhaust - 121° intake for engine LGA 340 OHC

Check the guides, valves, seats after assembly.

N.B.: Valve seats with angles of 90° (exhaust) and 121° (intake) will be used in the LGA 280 OHC too.

Please check technical informative sheet for introduction date

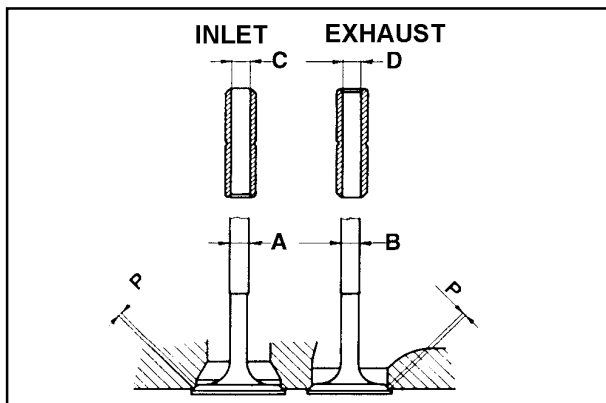
7



**Valves and valve-guides dimensions after assembly in the head.**

	nominal D. (mm)
A Inlet valve	7 -0.013 -0.035
B Exhaust valve	7 -0.030 -0.045
C Inlet valve-guide	7 -0.025 +0.015
D Exhaust valve-guide	7 +0.025 +0.015

8



## Valves and valve-guides gap

	NOMINAL	LIMIT
C - A	0.028 - 0.070	0.14
D - B	0.045 - 0.080	0.14

9



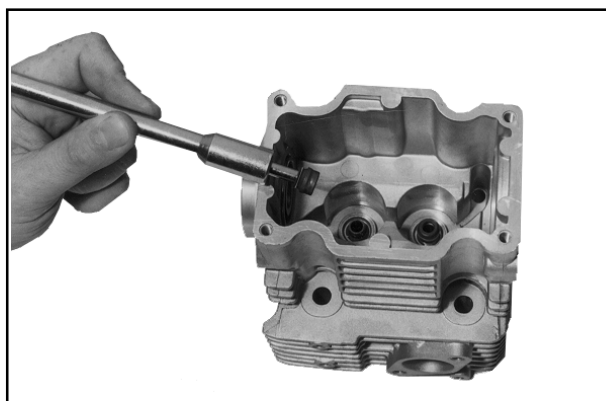
## VALVE GUIDES

Check that the valve guides are not scored, show signs of seizing or carbon deposits. Cheeking of the valve guides wear (fig. 10) can be carried out using a plug go-no-go gauge with pitch code 1460.103 on page 42.

Internal valve-guides diameter after assembly in the head:  
 min 7.015 mm - max 7.025 mm  
 valve-guides gauge diameter:  
 7.010 mm passes - 7.097 mm does not pass

If the diameter of the guide exceeds the plug diameter, replace the guide. In order to extract the valve guide from the seat, use puller code 1460.104 on page 42, after having removed the safety ring.

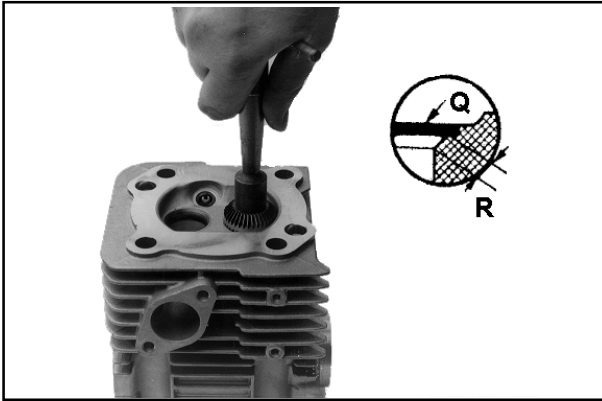
10



## OIL SEAL RING ON VALVE GUIDE:

Check that the rings are intact and still sufficiently elastic before re-assembling. It is advised to replace these parts. For the assembling, (fig. 11) use the tool code 1460.108 on pag. 42.

11



12

**VALVE SEATS**

The special high nickel-chromium alloy content cast iron valve seats are particularly resistant to the heat caused by combustion. For grinding, use a tapered milling cutter:

88° exhaust - 88° intake for engine LGA 280 OHC  
88° exhaust- 120° intake for engine LGA 340 OHC

N.B.: Valve seats with angles of 90° (exhaust) and 120° (intake) will be used in the LGA 280 OHC too. Please check technical informative sheet for introduction date.

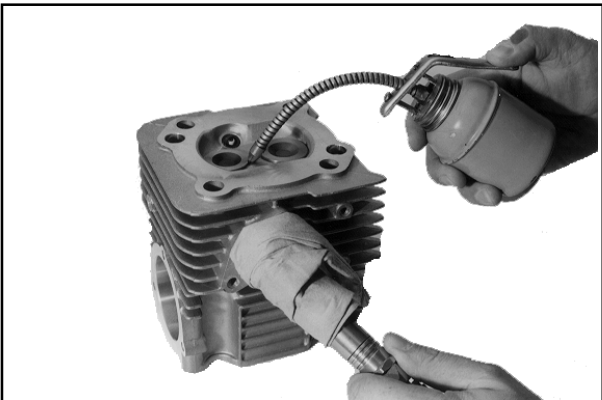
Following prolonged engine operation, the hammering of the valves on the seats, at high temperatures, hardens the track **P** (fig.8) making manual grinding impossible. The hardened surface must be removed using a grinder fitted on a seat refacer. The final accommodation may be carried out with a manual cutter, as previously described (fig.8).

Valve seat grinding will lead to the enlarging of trace **R** that faces the valve on the seat. If **R** is wider than **2 mm**, using an inverted cutter, lower the face **Q** (fig. 12) until the **R** measurement is between: 1.3-1.5 mm



13

The final accommodation of the valve in the seat should be carried out by spreading a layer of fine grain lapping paste in the seat and rotating the valve, using slight pressure and an alternating movement, until the surfaces are perfectly set (fig. 13).



14

Wash the valve and seat thoroughly with oil or petrol to eliminate all traces of lapping paste or shavings.

To check the efficiency of the seal between the valve and seat, once lapping is terminated, proceed as follows:

- 1) Fit the valve on the head with the spring and cotters.
- 2) Pour a few drops of diesel fuel or oil around the edge of the valve head.
- 3) Direct compressed air inside the duct (intake/exhaust), taking care to plug the edges of the duct in order to avoid air leakage (fig.14).

If air infiltration causes bubbles to form between the seat and the valve, disassemble the valve and correct the seat grinding.

The test can also be carried out by pushing the valve upward in the seat and then allowing it to return freely. If the recoil is both substantial and uniform, even when manually rotating the valve, this means that the accommodation is satisfactory. If not, continue the lapping operation until the aforementioned conditions have been achieved.

If the seat needs to be replaced, proceed as follows:

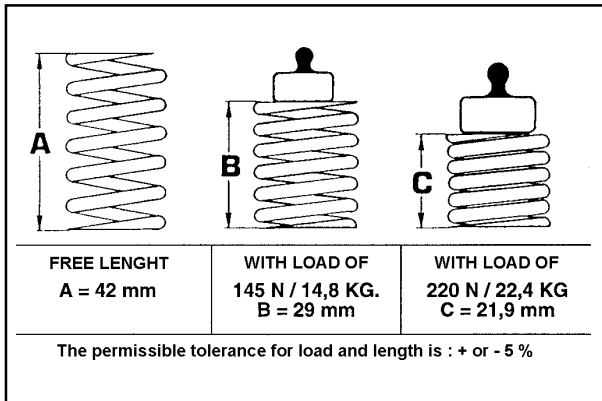
- 1) Using a 2-3 mm drill bit, drill holes on the seat, completing the cut with a chisel, without damaging the housing.
- 2) Extract the seat.
- 3) Heat the head to a temperature of between 160°-180° degrees C.
- 4) Introduce the new seat using the press.

It is advised that this type of operation is carried out at specialized workshops.

## VALVE SPRINGS

Check the general conditions of the valve springs, replacing them if they are damaged or their original characteristics are compromised. Check that the lengths under load corresponds to the values indicated in fig.

If these values are not achieved, change the spring.



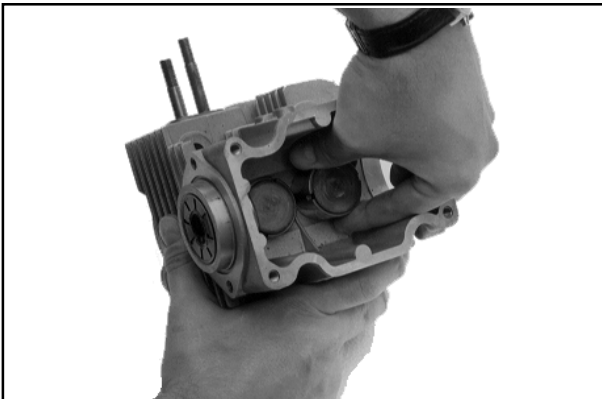
15

## TAPPETS

Check the general conditions, if the side surfaces of the cylinders are scored, replace the tappets

## BREATHER VALVE

Clean any deposits that have formed on the valve and check the valve movement, replace the rubber gasket if damaged.



16

**!** It is forbidden to lap the inner surface of the cylinder with emery cloth.

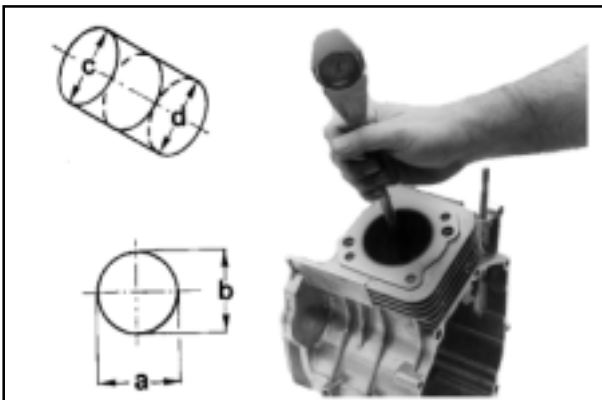
## CYLINDER

Using a dial gauge, check two internal diameters (a-b) perpendicular each other at three different heights (fig.17). If the taper (c-d) and ovalization (a-b) exceed the limit of 0.06 mm, the cylinder has to be rebored.

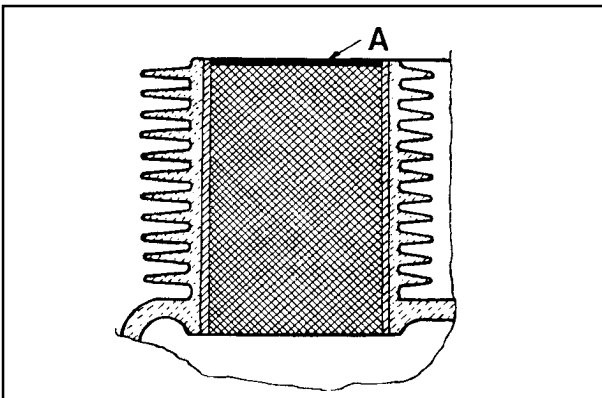
The oversizes are shown on page 36 . If the cylinder is rebored, observe a machining allowance of: +0.020 + 0

If the taper (c-d) and ovalization (a-b) do not exceed the 0.06 mm limit, and the cylinder shows no sign of scoring, simply replace the rings. In this case, in order to facilitate rapid accommodation between the ring and the cylinder , reset the correct roughness of the liner on all of the contact surface with the ring, using the plateau method.

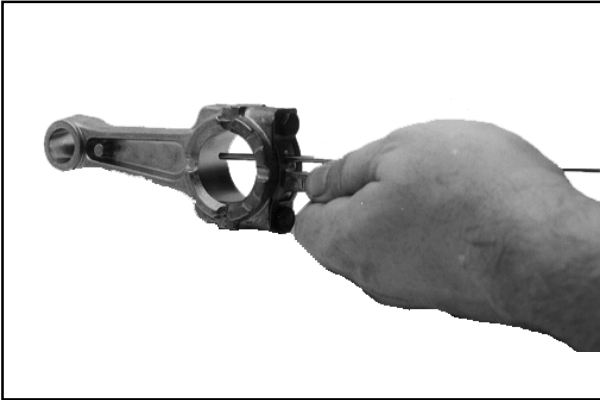
Do not true the inside surface of the cylinder by hand using emery cloth. If there is a slight step in the cylinder in zone A (fig.18), eliminate the difference using a lapping stone, in order to avoid ring damage. On completion, wash abundantly with petrol or diesel fuel.



17



18



19

**CONNECTING ROD**

Made in special aluminium alloy, with out inserted bearings and available in two undersizes. If replaced because of wear or seizing, it is advised to regrind the crank pin and to fit a connecting rod with a reduced size big-end hole.

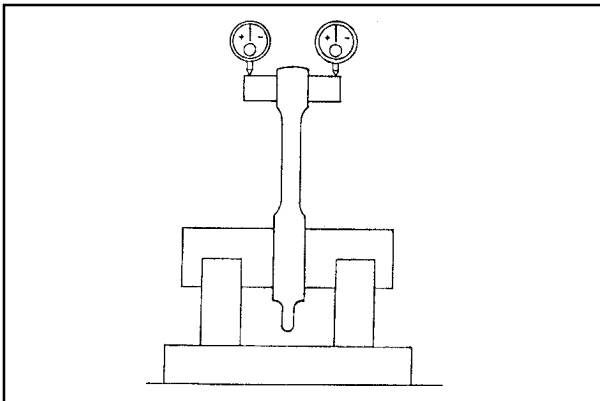
For undersizes see table page 43.

A hole on the connecting rod cap allows lubrication between the big-end and crank pin to be carried out (fig. 19).

The allowance between the small end and piston pin must be:

<b>min 0.032</b>	<b>max 0.016</b>	<b>limit 0.060</b>
------------------	------------------	--------------------

In order to correctly control the parallelism of the axes between the big-end and the small end, proceed as follows (fig. 25).



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- 1) Insert the pin in the hole at the small end and a calibrated pin in the big-end hole.
- 2) Rest the two ends of the pin on two drill blocks positioned on a level surface.
- 3) Using a column dial gauge, check that the difference between the two ends of the pin does is not more than 0.05 mm, if this value is exceeded the connecting rod will require squaring.

The squaring operation can be carried out using a small mechanical press:

- a) Position the connecting rod on two shims, making sure that it is perfectly horizontal with the press surface.
- b) Using the press, apply pressure in jolts on the rod on the opposite side from where the error was detected, until the parallelism returns within the values noted in point 3.



21

**PISTON AND RINGS**

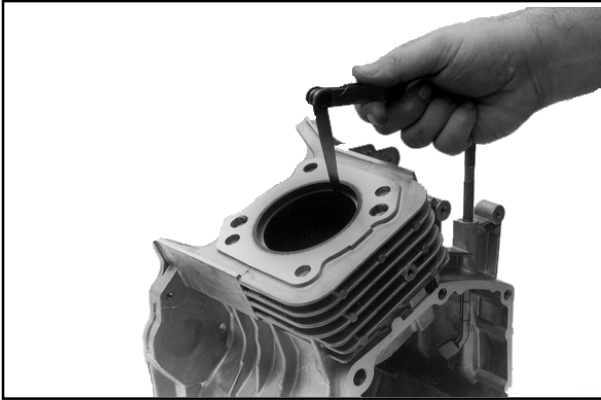
Check that the piston shows no scoring or signs of seizing, check the wear by measuring the piston diameter on the skirt, 10 mm from the base, perpendicular to the axis of the pin (fig.21). The skirt wear should not exceed 0.05 mm.

Engine type	Nominal diameter of piston
<b>LGA 280 OHC</b>	<b>73.945 - 73.955</b>
<b>LGA 340 OHC</b>	<b>81.945 - 81.955</b>

If the clearance between the cylinder/piston exceeds 0.23 mm, rebore the cylinder and fit new piston and rings (see tab. pag. 43).

The machining allowance for the cylinder is: 0.02 mm

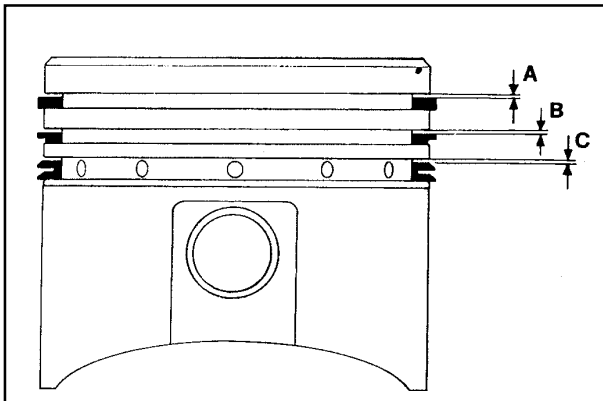
Check that the ovalization on the piston pin hole is not more than 0.10 mm; if this value is exceeded replace the piston and pin.



Disassemble the rings and remove any deposit; check the wear by measuring the gap between the two free ends, after positioning the ring in the middle of the cylinder (fig. 22). This distance should be:

Engine type LGA 280 OHC	Nominal end gap mm		Initial end gap mm		Max limit end gap mm
	min	max	min	max	limit
compress. ring	0.20	0.40	0.20	0.463	1
scraper ring	0.20	0.40	0.20	0.463	1
Engine type LGA 340 OHC	Nominal end gap mm		Initial end gap mm		Max limit end gap mm
	min	max	min	max	limit
compress. ring	0.25	0.50	0.25	0.563	1.2
scraper ring	0.25	0.50	0.25	0.563	1.2

22

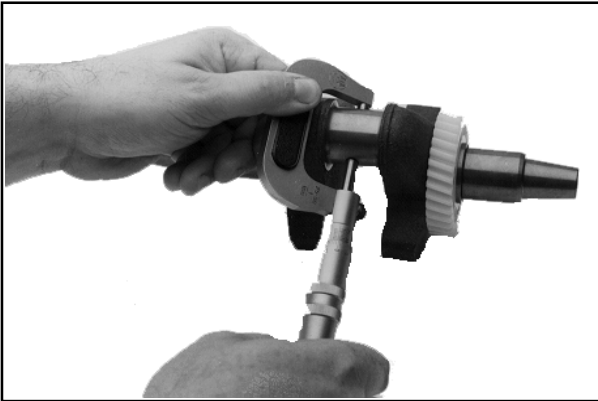


If the gap exceeds the values shown above and the cylinder does not require reboring, replace the rings with others of the same type. Check that the rings slide freely in the slots and that the vertical clearance is:

Engine type	LGA 280 OHC	LGA 340 OHC
a) compression ring	0.030-0.065	0.025-0.070
b) compression ring (second slot)	0.030-0.065	0.025-0.070
c) scraper ring	0.030-0.065	0.025-0.070

23





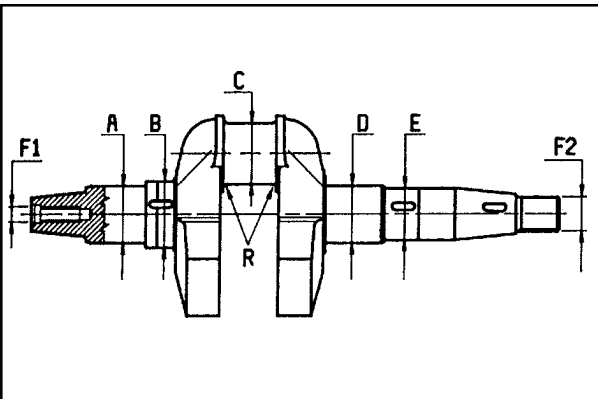
24

**DRIVESHAFT**

Check that the main journal and crank pin are not scored and show no signs of seizing. Slight scores or notches can be taken up using a fine file and finished with the same type of emery cloth.

Check that the cones, keys and end threads are not deformed and free of notches.

Take a measurement, using a micrometer, according to two perpendicular diameters, to check wear and ovalization of the crank pin and main journal. The maximum permitted wear limit of the crank pin is: 0.05 mm



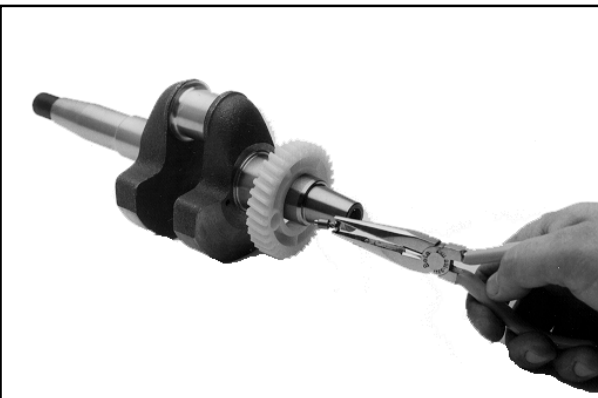
25

**PIN DIAMETERS - THREADS - RADII (mm)**

<b>A</b> = 28.993 - 29.980	<b>F1</b> : M 8
<b>B</b> = 34.991 - 34.975	<b>F2</b> : M 18 X 1.5
<b>C</b> = 32.000 - 31.989	<b>R</b> = 2.7-3
<b>D</b> = 28.993 - 29.980	
<b>E</b> = 27.035 - 27.048	

If wear exceeds this value, grind the crank pin according to the data shown in table on page 43. When grinding, the allowance for the crank pin is: 0.0000-0.011 (mm). The surface must be finished without scoring, to a roughness of 0.4 µm Ra.

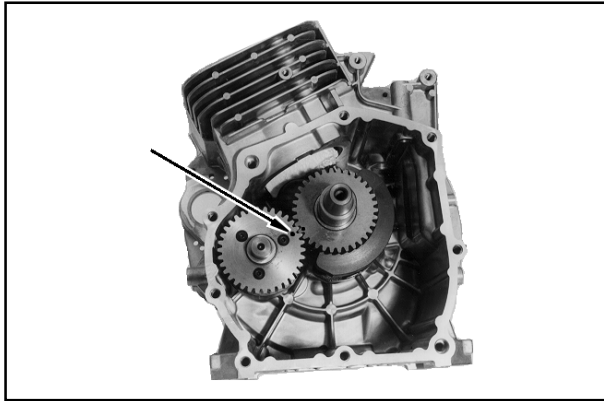
- NOTE: 1) When grinding the crank pin restore the radius value to original specification (2.7 - 3.0 mm).  
 2) The main journals must not be ground.



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**GOVERNOR AND BALANCING SHAFT GEAR COMMAND**

Check that the governor gear teeth are not worn or damaged, if necessary replace the gear proceeding in the manner noted below. The gear, made in plastic material, is attached to the shaft by means of two self-tapping rivets ; in order to remove these rivets the gear mechanism must be broken and the rivets extracted with pliers. A new gear can then be replaced and fixed in position with another two rivets. If the engine is fitted with a balancing shaft, the gear is made in steel. In this case disassembly operation requires the use of a normal puller. When reassembling, the gear must be heated to a temperature of between 150 - 180 degrees C and then inserted on the engine shaft.

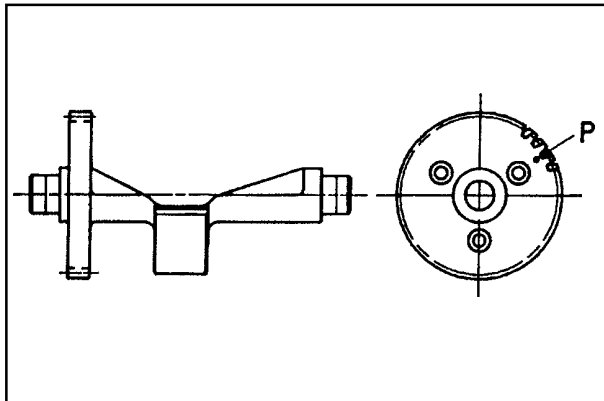


27a

**BALANCING SHAFT** (optional) (fig. 27b)

This shaft is mounted on two ball bearings, one in the crankcase, the other in the timing cover.

For assembling the balancing shaft, position the crankshaft as in fig 27a in order that the reference marks of the balancing shaft gear are in correspondence with the ones of the crankshaft gear.



27b



28

**SPEED GOVERNOR**

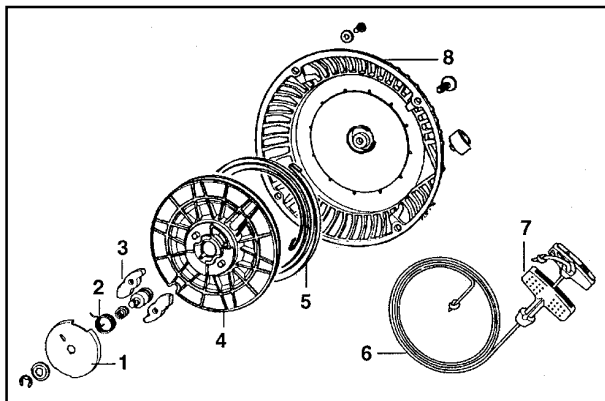
The speed governor is of centrifugal counterweight type (fig. 28). Check that the gear rotates freely on the pin and that movement is not obstructed. Check that the counterweights expand freely and that the action provides continuity of movement to the cap, through to total opening.

**BEARINGS**

The crankshaft is supported on ball bearings; these bearings must be replaced if they become noisy or present too much radial play.

**CRANKCASE AND TIMING COVER**

Check the condition of the face surface and the bearing housing.



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**RECOIL STARTER**

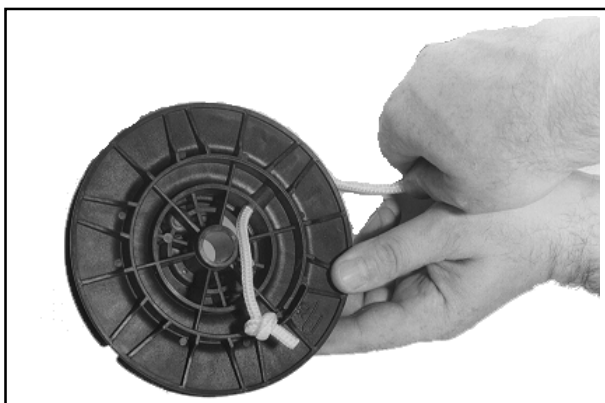
This is a manual starting device that, with the use of a spring, rewinds the rope on a disk after starting.

The starter components are listed below:

- |                       |                       |
|-----------------------|-----------------------|
| 1) Dogs guide housing | 5) Rope return spring |
| 2) Spring             | 6) Rope               |
| 3) Starter dogs       | 7) Handle             |
| 4) Starter disk       | 8) Starter support    |

**OVERHAUL**

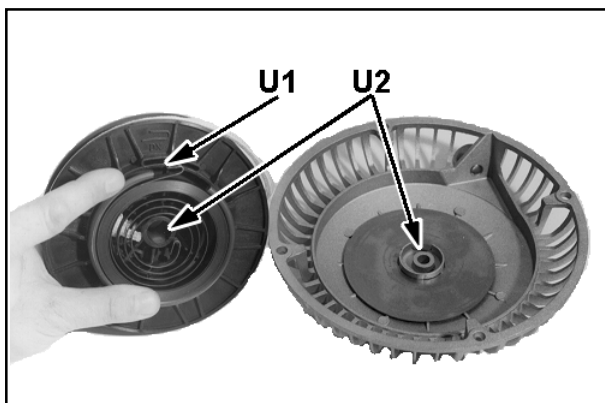
- 1) Check the condition of the rope.
- 2) Check that the starter dogs come out during the starting phase.



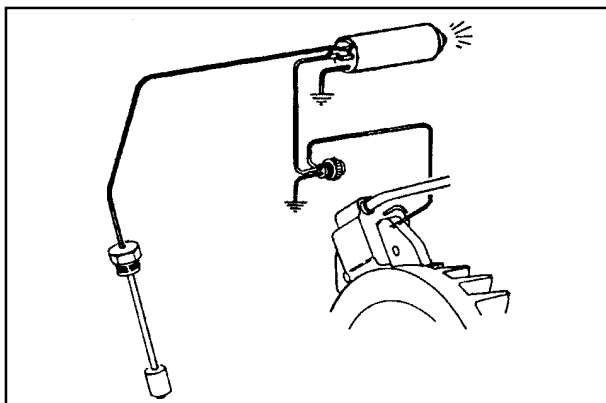
30

**ROPE AND RETURN SPRING REPLACEMENT**

- 1) remove the snap ring, the dogs guide housing, the dogs return spring and the thrust bearing spring;
- 2) remove the disk, taking care that the disk return spring is extracted from its seat;
- 3) extract the old rope and insert a new one, tie a knot and wind the rope round the disk (fig. 31);
- 4) when replacing the self-winding disk return spring: remove the old spring and insert the new spring, taking care that the direction of rotation is correct (the clockwise engine rotation position **DX** is stamped on the self-winding disk); the replacement spring is supplied closed with clips, therefore insert the outside **U1** shaped eyelet in the starter disk seat and position the spring, removing the clips one at a time (fig.32);
- 5) assemble the disk complete with spring and rope in the seat, the inside **U2** shaped eyelet of the spring should be hooked inside the seat of the self-winding housing (fig. 32);
- 6) fit the dogs, the axial thrust spring and the dogs seal spring on the cap cover;
- 7) in order to insert the dogs cap in its seat, rotate it by half a turn in an anti-clockwise direction, this will load the dogs seal spring;
- 8) rotate the self-winding disk by one-one and a half turns (in an anti-clockwise direction) so that the internal return spring is loaded, pass the rope out of the rope guide bushing and attach the handle by tying a knot on the end of the rope;
- 9) check the self-winding operation by pulling the rope a few times, making sure that the starter dogs come out when starting.



31



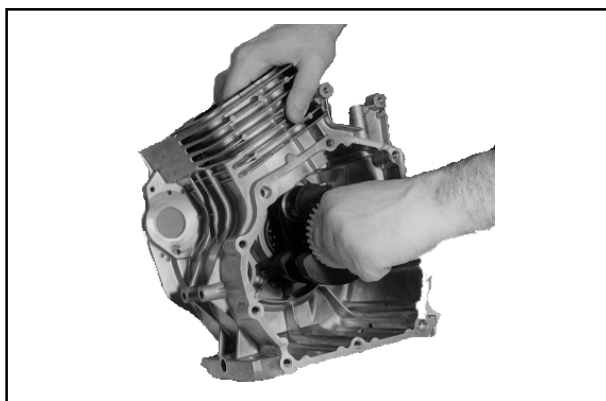
32a

**OIL WATCH DEVICE (optional)**

This is a protection system that activates by switching off the engine when the oil drops below the required level during operation. The OIL WATCH device activates in the following cases:

- 1) insufficient oil;
- 2) low oil level.

In the first case, the engine fails to start while in the second, the engine starts but stops immediately afterwards. In both cases, OIL WATCH signals its activation by means of an indicator light. If the device activates, add oil to the max level mark on the plug dipstick then start the engine again.



32b

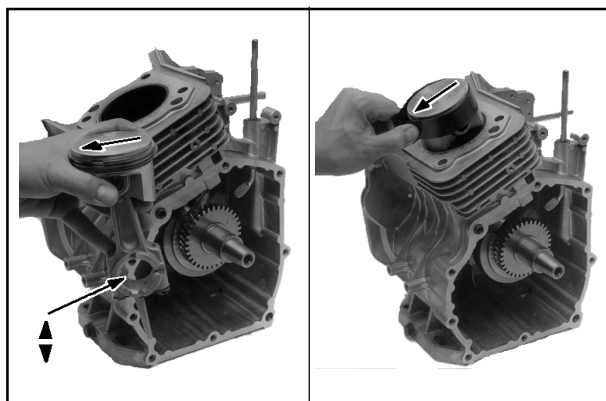
**CRANKSHAFT AND OIL SEAL RINGS**

After having positioned the ball bearings in the seat on the engine casing, insert the crankshaft in the crankcase.

Fit the oil seal ring on the engine crankcase and timing cover, using the proper tool, code 1460.112 on pag. 42.

Fit the protective bushing code 1460.105 side flywheel and 1460.106 side P.T.O.

NOTE: a damaged oil seal ring may let air to come inside the crankcase, causing breather problems.



33a

33b

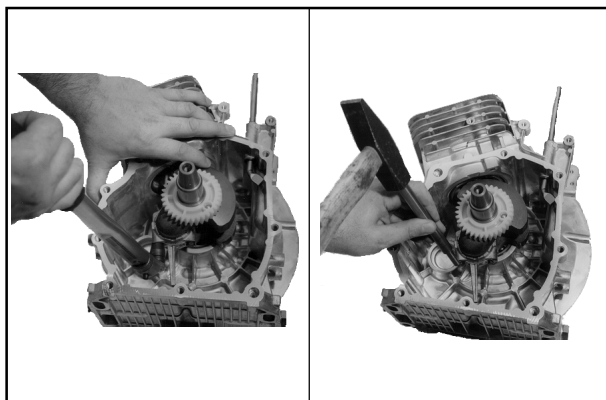


Before mounting, oil: the pin, the piston, the cylinder and the big-end bush.

**PISTON AND CONNECTING RODS**

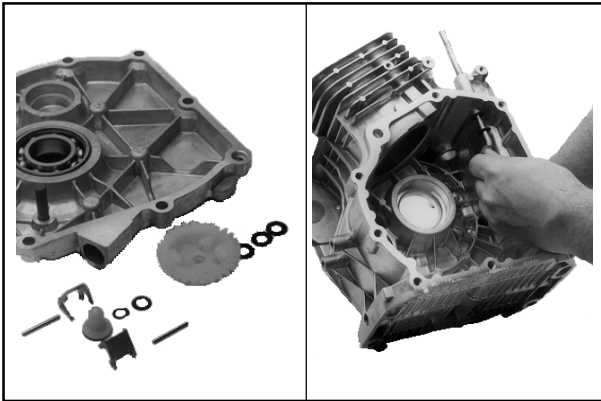
The piston and the connecting rod must be assembled in a particular manner. For correct assembly operations proceed as follows:

- the connecting rod must be fitted using the triangular reference marks on the big end facing the fitter in the same position, the piston must be assembled with the arrows facing in the left direction (exhaust side) (fig. 33-a)
- fit the piston pin without pre-heating the piston, pressing into place manually. Lock in position using the stop rings.
- fit the rings on the piston with the **top** mark facing upward, tilt the ends of the rings so that they are staggered by 120°.
- oil the cylinder liner and the piston, introduce the piston with the arrow positioned above the piston crown facing towards the exhaust. Use a normal ring tightening band (commercially available) to tighten the piston rings (fig. 33-b).
- oil the crankshaft and the connecting rod big end, fit the cap on the connecting rod (the two triangular notches must face outward), tighten the connecting rod screws with a torque wrench at a torque of: 15.7 Nm - 1.6 Kgm
- lock the screws in position with the safety plate (fig.34-b).



34a

34b

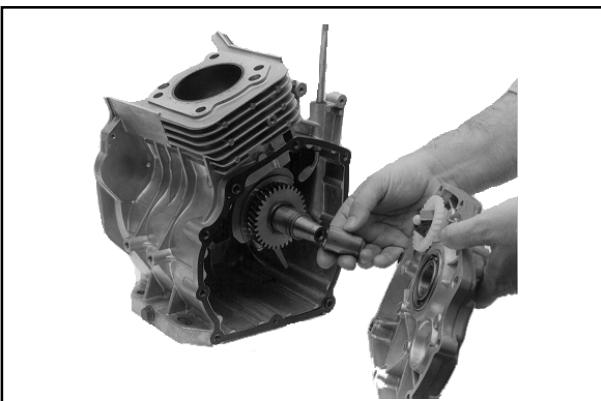


35a

35b

**SPEED GOVERNOR**

Fit the governor gear on the pin attached to the timing cover and lock it in position with the circlip, then fit the cap and the counter weight. The two counter weights are fixed to the governor gear by means of two holed rivets; these rivets must be replaced in case of disassembling of the counterweights or gear (fig.35a). Remember to hammer the rivets after fitting the gear mechanism or the counterweights. Insert the inside lever of the governor into the block and lock in position with the two circlips (fig.35b).



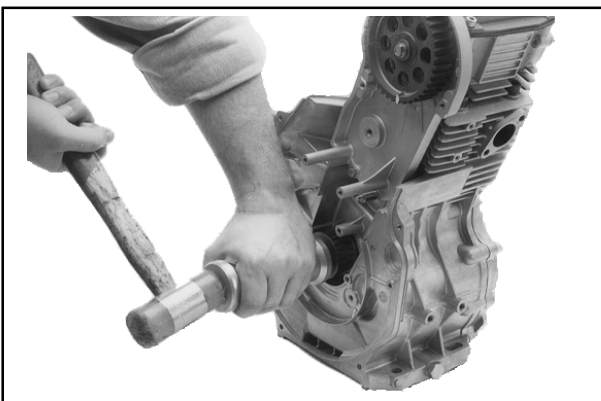
36

**TIMING COVER**

After having fitted the governor unit, as shown in paragraph 7.3, proceed as follows:

- fit the protective bushing code 1460.106 on page 42 to the conical end of the crankshaft.
- fit the timing cover, remembering to position the gasket between the two surfaces (fig. 36) and torque the screws to a 23.5 Nm value.

**N.B.:** care should be taken when mating the governor gear with the crankshaft gear. Do not force the cover if the mating has not been carried out correctly, as this action may result in serious damage to the governor gear.

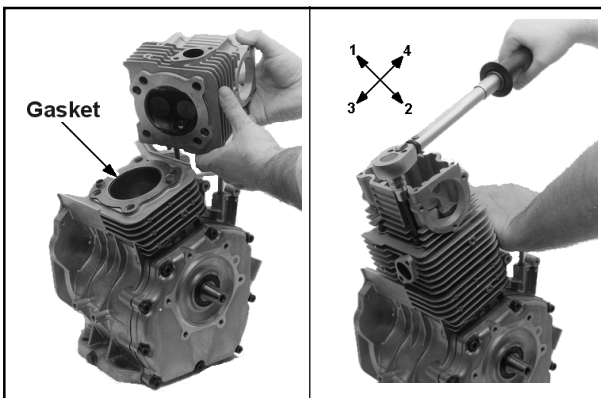


37

**TIMING PULLEY ASSEMBLY**

Pre-heat the pulley to 150 - 180° C for a few minutes, position the key in its seat on the drive shaft, insert the pulley with its flat surface pointing towards the engine housing so that the timing point is visible.

Use tool code 1460.112 on page 42 (fig. 37) to position the pulley.



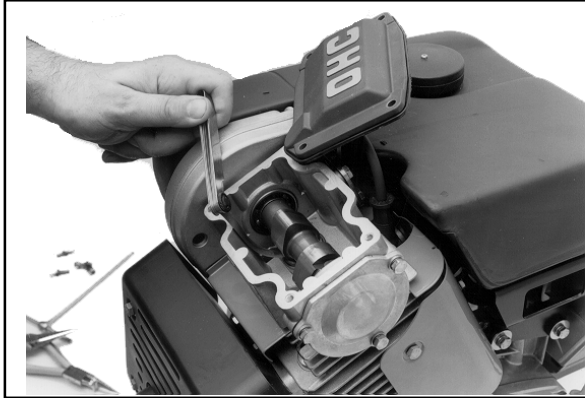
38a

38b

**CYLINDER HEAD ASSEMBLY**

Insert the head gasket (fig. 38a) between the head and the cylinder. Tighten the screws alternatively from opposite sides, following the diagram in fig. 38b.

Use a torque wrench to tighten the screws to a 39.2 Nm - 4 Kgm torque value.



39

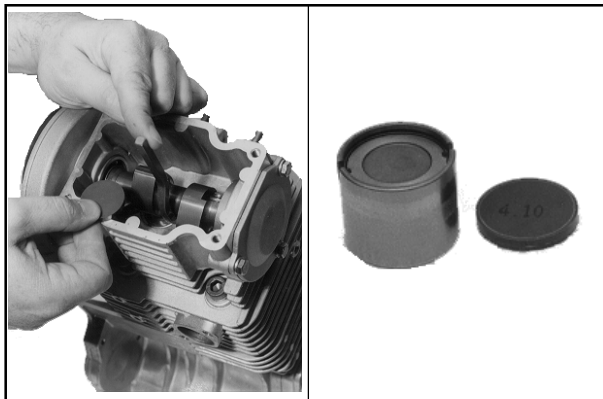
**CAMSHAFT ASSEMBLY AND VALVE CLEARANCE ADJUSTMENT**

Oil the tappet seats and insert the tappets into the housing.  
Fit the camshaft and fix the side support in position.

Fit the belt tensioner support casing and the camshaft pulley, tighten the pulley retaining screw to a 11.8 Nm - 1.2 Kgm torque value.

turn the cam shaft until the cam is facing upward, clearance adjustment will be facilitated in this position. Using a feeler gauge, check that the clearance is between: 0.10 - 0.15 mm for both valves when the engine is cold (fig.39).

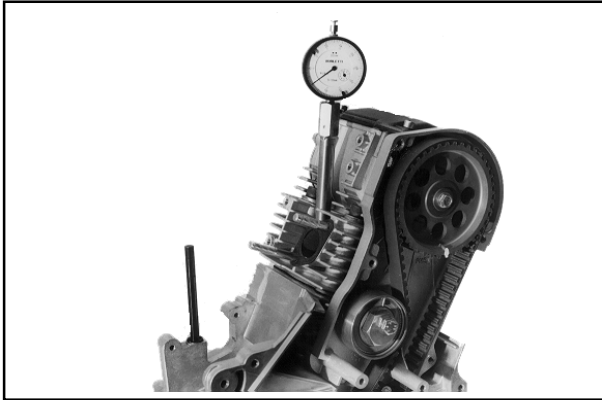
In order to replace the shims, use tool code 1460.109 on page 42, lower the tappets and raise the shims, then replace with a piece of the same size (fig. 40-a / 40-b).



40a

40b

N.B.: shims are available in various thicknesses with a difference of 0.05 mm between each size.

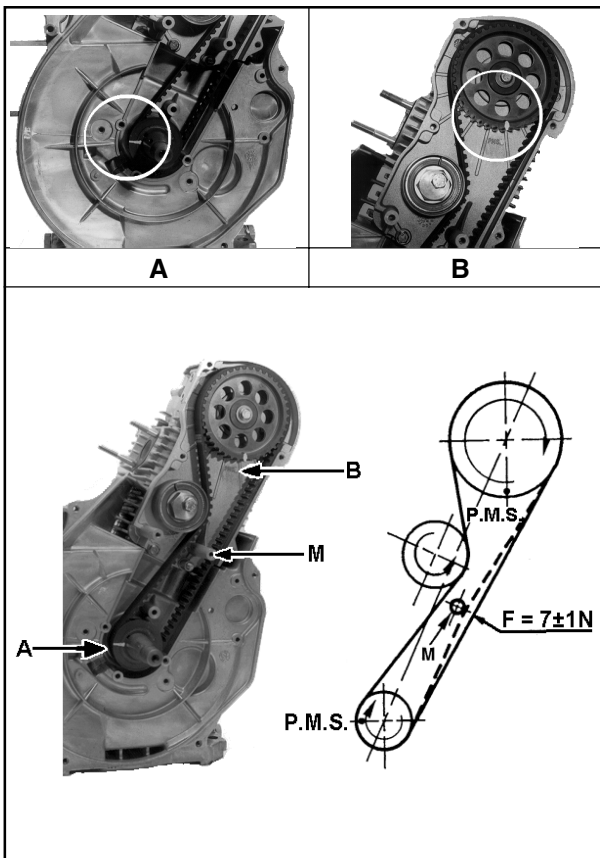


41a

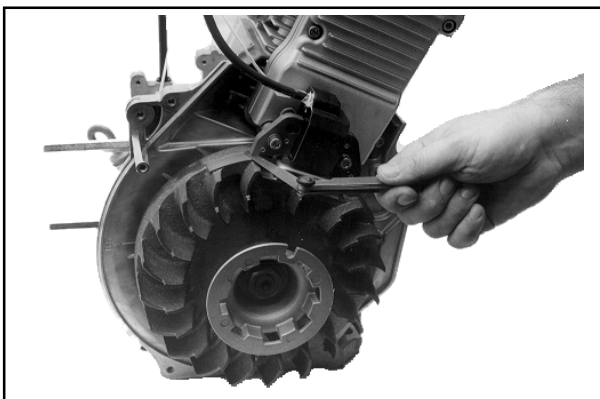
### TIMING ADJUSTEMENT AND ASSEMBLING OF THE TOOTHED BELT

In order to fit the toothed belt and adjust the timing, proceed as follows:

- 1) turn the timing pulley until the mark on the pulley coincides with the mark on the crankcase (fig.41-b) (otherwise use tool code 1460.115 on page 42 which should be inserted into the plug hole in order to find the TDC);
- 2) turn the camshaft pulley until the reference marks coincide, as shown in fig.41-b;
- 3) insert the timing belt, taking care to respect the position of the reference marks;
- 4) by means of the tightener, tighten the belt. With a dynamometer push the belt until it grazes the support **M** (fig. 41-b). The belt tension is correct when the dynamometer value is  $7 \pm 1$  N;
- 5) to check the timing, use the flywheel, make a few complete turns and check that the reference marks stamped on the crankcase and cylinder head match those on the pulleys. If not, loosen the tightener and repeat the entire operation.
- 6) if timing is correct, tight the tightener nut at a torque of: 23.5 NM - 2.4 Kgm.



41b



42

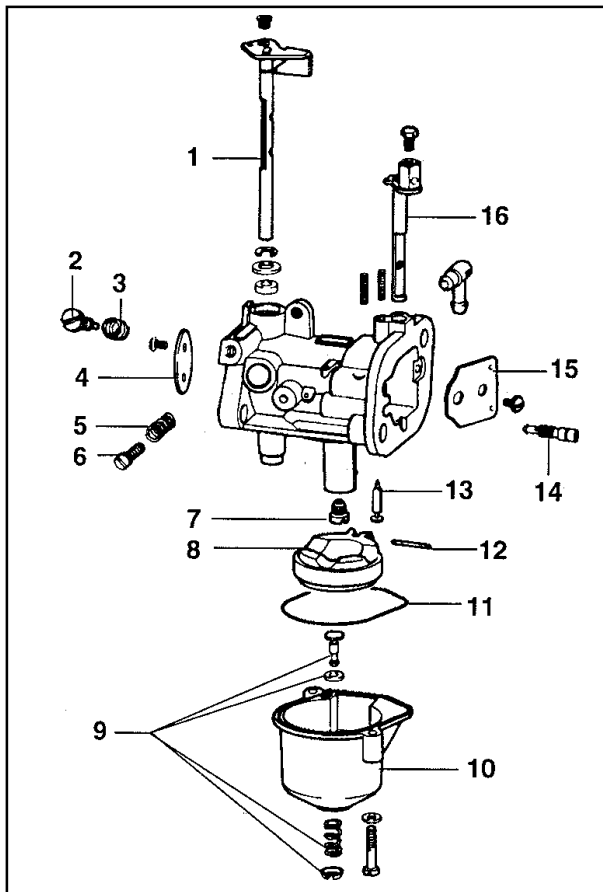
### FLYWHEEL ASSEMBLY AND COIL GAP ADJUSTMENT

Fit the alternator on the engine crankcase (if provided), check the condition of the stator cables, insert the cables into the housing and check that they are held in position by the steel plate.

Assemble the flywheel, after having checked the condition of the magnet and that it is securely attached to the flywheel Tighten the flywheel with at a torque wrench at a torque of: 137.2 Nm - 14 Kgm .

Fit the coil on the supports with out tightening the screws. Using a feeler gauge (fig. 42), positioned between the coil and the magnet, check the correct value of the gap, which should be between: 0.45 - 0.55 mm

Lock the coil screws in the definitive position with a 11.8 Nm - 1.2 Kgm torque value.

**Carburetor**

## Details

- 1) throttle rod
- 2) air adjustment screw
- 3) spring
- 4) throttle
- 5) spring
- 6) screw
- 7) main jet
- 8) float
- 9) drain valve
- 10) float chamber
- 11) gasket
- 12) floating pin
- 13) needle valve
- 14) idle jet
- 15) choke plate
- 16) choke plate command rod

**CARBURETOR CHARACTERISTICS**  
 for standard engines with dry air filter

engine type	carburetor type	needle main	main jet	idle jet
LGA 280	FHBC25-21	1.5	86	45
LGA 340	FHBC25-21	1.5	88	45

43

For cleaning and checks, proceed as follows:

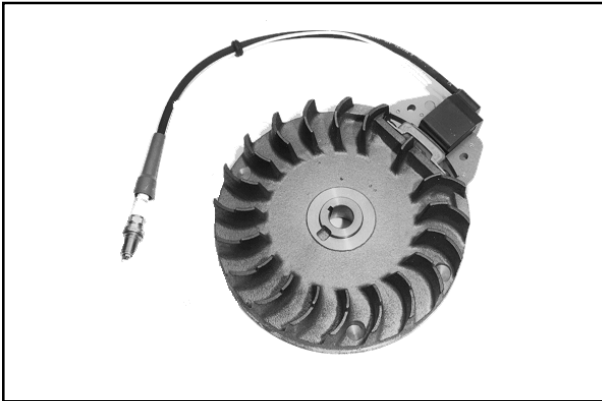
- Totally disassemble the carburetor and carefully wash all parts with petrol or diesel fuel. Never use metal points when cleaning the jets and calibrated channels.
- Check the needle valve seal and sliding movement in the seat. Replace if necessary.
- Check the condition and free movement of the float.
- Check that the throttle rod is free to rotate throughout its field of action, and that there is not excessive clearance between the rod and the seat allowing air infiltration.
- Check that the choke plate is not worn and that it rotates freely.

**LUBRICATION**

Lubrication of internal moving parts is by means of oil, taken from an oil dipper fitted on the rod cap, and centrifuged by the rotation of the crankshaft. Lubrication of the camshaft, tappets, springs and valves is by means of an ascending flow of sprayed oil, in the form of emulsion and vapor, that is directed from the lower part of the crankcase towards the head through special passages; movement is forced by the piston movement. The breather pipe maintains the correct pressure inside the engine casing and prevents oil leaking out and impurities entering. Before starting the engine, make sure that the sump contains the correct type and quality of oil, as indicated at table page 15.







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**ELECTRONIC IGNITION**

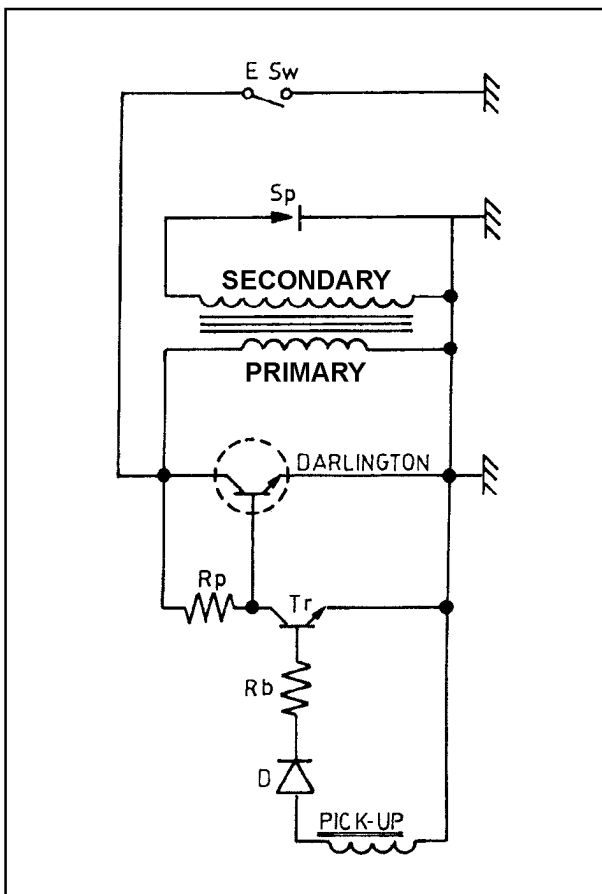
Inductive discharge electronic ignition with variable spark advance (fig. 45); The spark advance prevents any type of kik-back during starting, making this operation simple and safe both for the operator and the mechanical parts.

**SPARKPLUG**

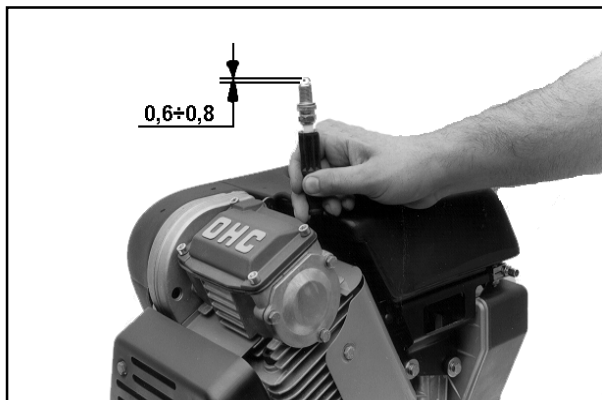
Clean the electrodes with a metal brush and compressed air, check that the gap between electrodes (fig. 46) is between: 0.6-0.8 mm

If the isolating material is splintered or the electrodes are worn, replace with a spark plug with appropriate thermal rating, as shown in the table:

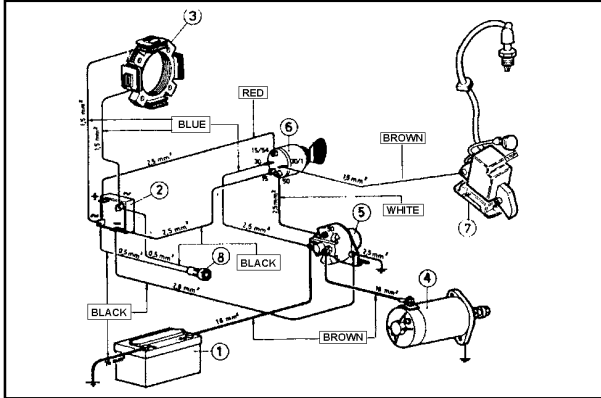
SPARK PLUG BRAND
BOSCH FR 8 DC
CHAMPION RC 12 YC
NGK BC PR 7 ER



45



46



**Electric starting**

- 1) Battery
- 2) Rectifier
- 3) Alternator
- 4) Starting motor
- 5) Remote control switch
- 6) Switch with key
- 7) Ignition coil
- 8) Indicator light

**Electrical start system standard**

Alternator 12 v - 70w  
 Rectifier IR type 26 MB 20A  
 Starting motor SYCE PN1 12V - 0,15 KW  
 Remote control switch EFEL 12V - 75A  
 Battery 30 Ah

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**SYSTEM CHECKS**

Check the condition of the cables, isolation and connections.  
 If the system does not recharge the battery, the cause may be one of the following:

- stator winding grounded
- magnetized ring on flywheel demagnetized
- faulty rectifier
- battery ground interrupted
- battery polarity inverted.

**ALTERNATOR**

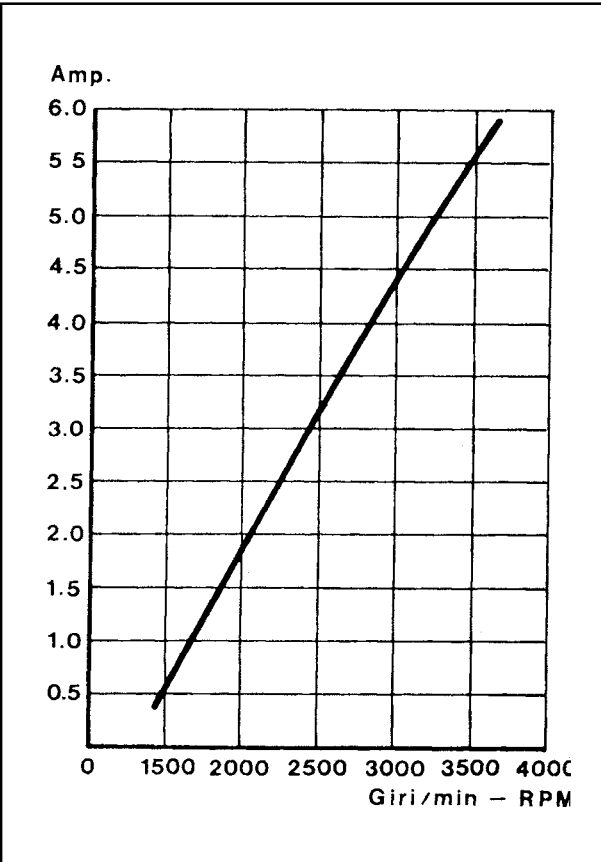
Special type with armature (stator), fitted on the engine crankcase, and rotating inductor, housed in the flywheel. Check the inductor magnetization and that the connections on the stator are correctly welded, not burned or with grounded wires. Replace the inductor if faulty. Check the continuity between the cables and the ground isolation using an ohmmeter.

Check the efficiency of the alternator as follows:

- disconnect the rectifier wires;
- connect a 10/20 V.a.c. Voltmeter or a tester between the wires;
- start the engine and check that the voltage reading on the voltmeter or tester corresponds to the values in the following table:

RPM	Volts
2000	13.5 -14.5
2500	17 - 18
3000	20.5 - 22
3600	25 - 26

If the voltage reading is less than these values, the rotating inductor is partially demagnetized and will need to be replaced.



48

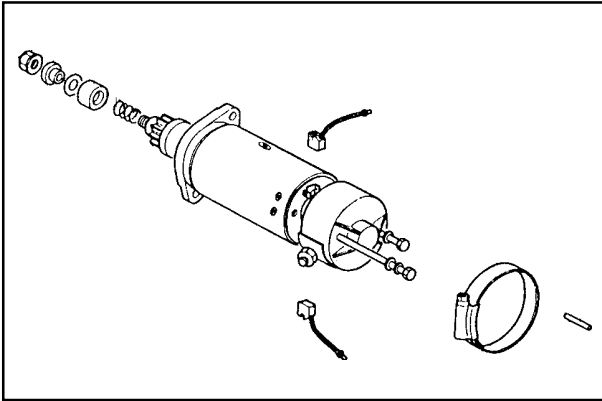
**RECTIFIER**

The rectifier should be checked in the following manner:

- check the efficiency of the connections
- connect a 10 A amperometer between the positive pole of the battery and the positive terminal of the rectifier
- connect a 20 V voltmeter between the battery poles
- allow the battery voltage to drop below 13 V, starting the engine a few times.

In the diagram in fig. 48 the current intensity flow is shown in relation to the variation of the engine r.p.m., with constant battery voltage of 12.5 V and ambient temperature of +250 C. If the charge is zero with 12.5 V battery tension, replace the rectifier and check the charge conditions. If the charge conditions remain unchanged, check the condition of the alternator.

**IMPORTANT:** The rectifier requires only a few seconds to be damaged if allowed to function when disconnected from the battery.



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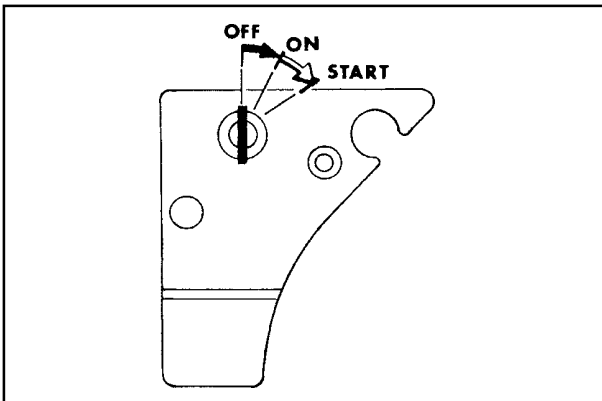
**STARTER MOTOR**

The starter motor is of the SYCE PN1 12 v - 0.15 KW type.

**BATTERY**

The battery (not supplied by LOMBARDINI) must provide a voltage of 12 V and a capacity of not less than 30 Ah.

**N.B.:** The battery capacity functions according to ambient temperature, therefore batteries with greater capacities are required for particularly low temperatures.

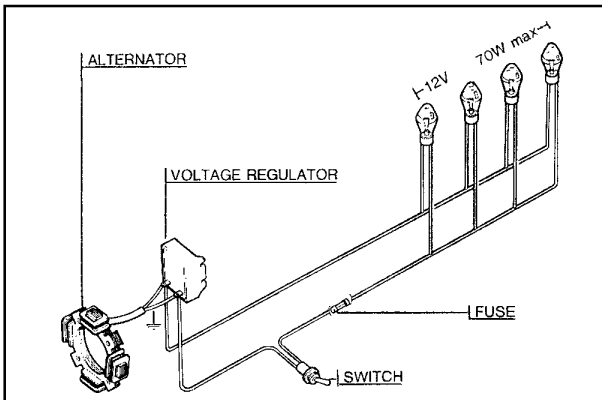


50

**STARTING PANEL**

Shows the various positions of the starting key. The first position, in the clockwise direction, inserts the battery charging circuit; the second position activates the starting motor. Whilst the engine is running the key should be placed in the first position. When the engine is stopped the key should be in the resting position; if left in the first position, the rectifier will be damaged and the battery will be discharged.

The panel electric wiring diagram is shown in fig. 47.



51

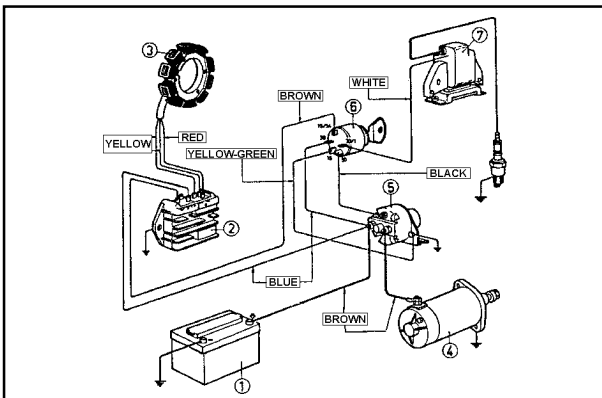
**LIGHTING SYSTEM WITH ALTERNATOR**

**System checks**

Apply a charge (lamp) with an absorption of 60 - 70 W, start the engine and set at the maximum power speed (3800 r.p.m.) the voltage should be approximately 12 V at utilization.

Insert an amperometer (5 A bottom scale) between the 12 V pole of the voltage regulator and the switch.

If the current is zero, replace the regulator and re-check the current absorption; if the current remains at zero, check the alternator condition again.

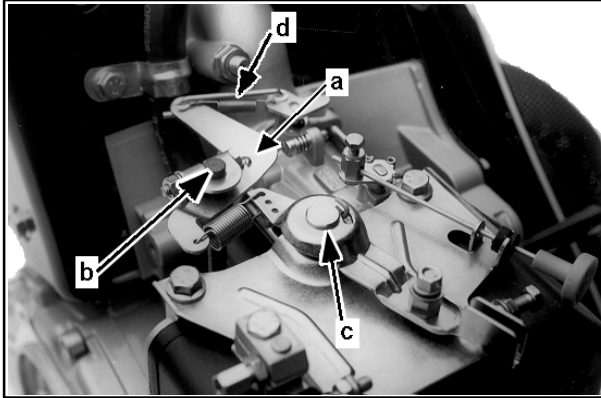


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**CHARACTERISTICS WITH ALTERNATOR 180 W (optional)**

- Alternator 12 V - 180 w
- Electronic rectifier with diode controlled type
- Starting motor SYCE PN1 12 v - 0.15 KW
- Remote control switch EFEL 12 V - 75 A
- Battery: 30 Ah capacity

- |                         |                          |
|-------------------------|--------------------------|
| 1) Battery              | 5) Remote control switch |
| 2) Electronic rectifier | 6) Switch with key       |
| 3) Alternator           | 7) Ignition coil         |
| 4) Starting motor       |                          |



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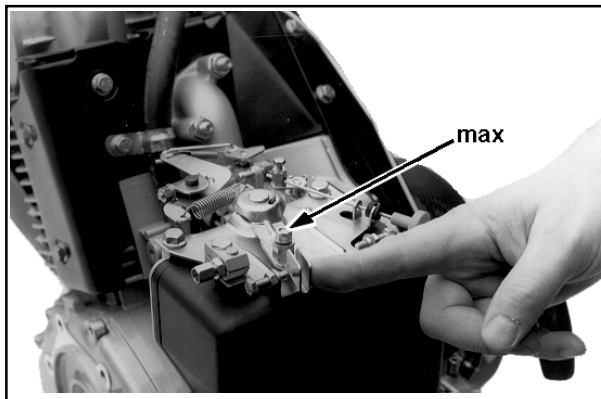
**ENGINE ASSEMBLY**

**BREATHER VALVE:** clean the breather valve with petrol and check the condition; before assembly check that the rubber gasket is not damaged.

**FAN COWL AND COOLING AIR DUCTS:** check that are not damaged and tighten the screws at a torque of: 9.8 Nm - 1 Kgm.

**INTAKE MANIFOLD AND CARBURETOR:** fit the intake manifold on the engine and, after having positioned the gaskets, fit the carburetor.

**CONTROL PLATE ASSEMBLY:** fit the controls plate to the air filter support, insert the choke command rod, insert the breather pipe on the air filter support union.



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**GOVERNOR LEVER ADJUSTMENT**

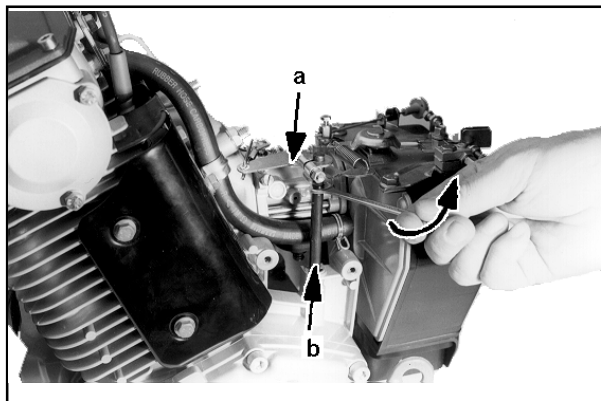
Insert the governor lever (a) on the governor rod (b) (fig.53), fit the governor spring between the governor lever (a) and the accelerator lever (c) fitted on the controls plate.

The governor spring should always be fixed to the external hole on the accelerator lever.

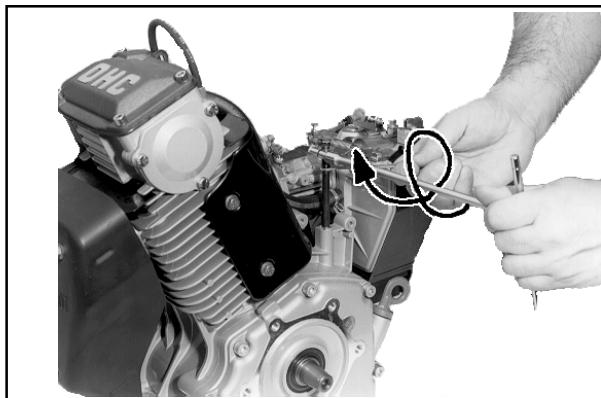
Fit the tie-rod (d) between the governor lever and the carburetor throttle command rod, fit the take up spring.

Adjustment should be carried out as follows:

- 1) Move the accelerator to the max. position, with the carburetor throttle fully open (fig.54).
- 2) Rotate the governor rod (b) anti-clockwise (fig.56) until it stop and the governor is fully closed.
- 3) Lock the governor lever clamp on the governor rod.
- 4) Complete the engine assembly.



55



56

**ENGINE TEST**

Attach the engine to a base or to the machine.

Check the oil level in the engine sump (and in the air filter if it is an oil bath model). Fill up the tank with fuel. Open the fuel cock.

If the carburetor has been replaced or overhauled, carry out an initial adjustment by fully tightening the air adjustment screw and then loosening it by approximately two turns.

Close the choke and place the accelerator at the max. The engine is ready to be started.



57

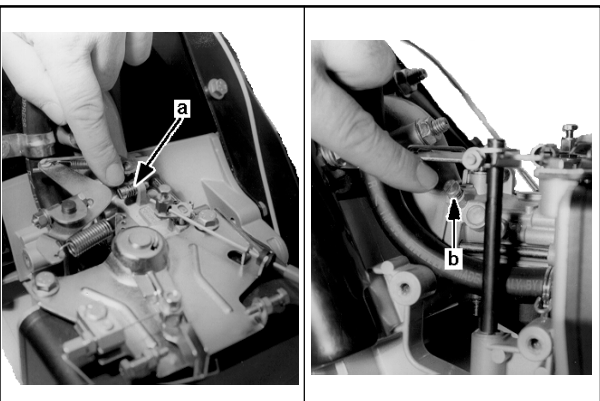
**STARTING WITH THE RECOIL STARTER**

After having carried out the operations noted above, pull the rope sharply (fig. 57) and allow the engine to turn over for a few seconds before opening the starter.

**ELECTRIC STARTING**

Before turning the starter key, make sure that all connections are in order, especially the rectifier and the battery ground connections. Operating with the battery disconnected will cause rectifier breakdown after a few seconds. Starting procedures are the same as those of paragraph.

**CARBURETOR AND R.P.M. ADJUSTMENT**

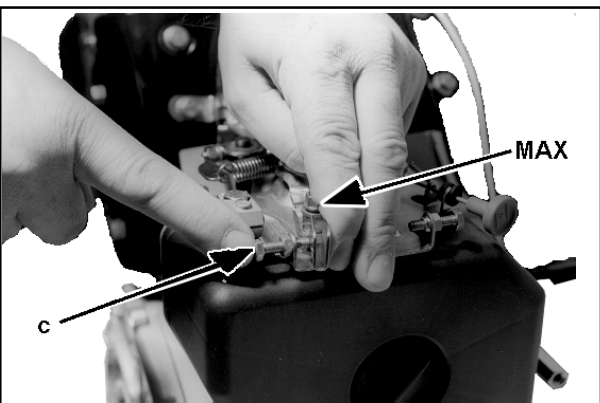


58a

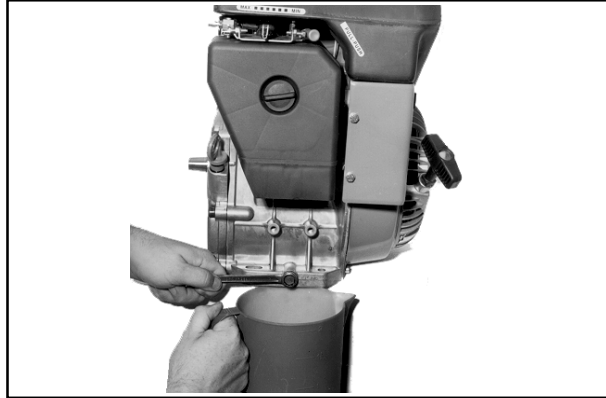
58b

- 1) Start the engine and leave running for a few minutes.
- 2) Attach an r.p.m. counter to the end of the crankshaft. Using screw **a** in fig.58a, adjust the minimum speed to the value of 1300 - 1350 r.p.m.
- 3) Fully tighten the air adjustment screw **b** in fig.58b, and then loosen slowly until it is in the normal functioning position (usually approximately two turns). Check that the minimum speed is maintained at the values noted in point 2.
- 4) Move the accelerator lever to the max (fig. 59). position and check the r.p.m. (unloaded) using the r.p.m. counter, this value should be:
  - for generating set models 3200 r.p.m.
  - for all other models 3800 r.p.m.

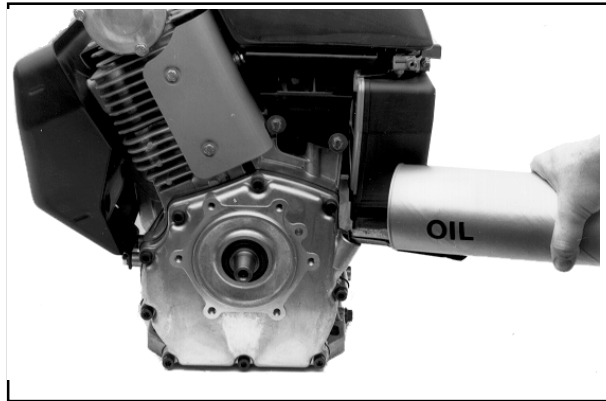
NOTE: different governor springs are provided for different speeds. Adjust the max. speed using the screw **c** on the controls plate; once adjustments are completed tighten the locknut.



59



60



61



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## STORAGE

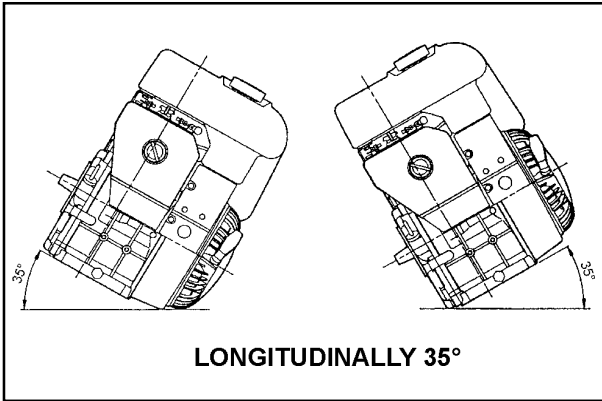
### TEMPORARY INACTIVITY

If the engine has to remain temporarily unused, it is advised to carry out the following operations:

- allow the engine to turn over for ten minutes, drain off the oil from the crankcase when the engine is hot (fig 60);
- replace the oil drain plug and fill up with new oil (fig.61) of the type described on page 15;
- empty the fuel tank by removing the feed pipe and empty the carburetor using the drain button, positioned under the carburetor bowl;
- clean the fins on the cylinder and head;
- remove the spark plug and pour-in a spoonful of engine oil, allow the engine to turn over in order to distribute the oil on the cylinder, then replace the spark plug;
- close the exhaust and intake holes of the air filter using adhesive tape;
- cover the engine and store in a dry place (fig. 62).

### PREPARATION FOR STARTING

- Remove the protection and the adhesive tape from the air filter exhaust;
- clean the main and idle jets;
- for starting, follow the instructions noted in the use and maintenance manual that is provided with all engines.



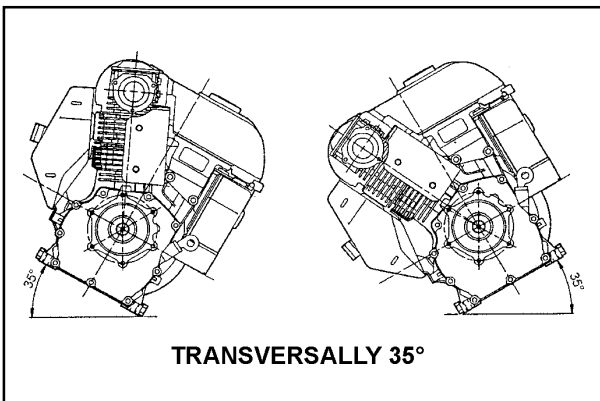
**63**

**INSTALLATION**

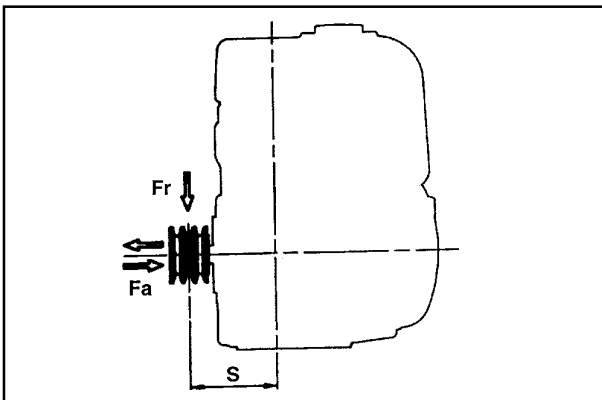
**INCLINATION LIMITS OF OPERATION (fig. 63-64)**

**AXIAL LOAD - RADIAL LOAD AND MAXIMUM OVERHANG**

The axial thrust in both directions **F<sub>a</sub>** (fig. 65) must not exceed 250 Kg.  
 The maximum radial load **F<sub>r</sub>** (fig. 65) for belt transmission is 80 Kg with a maximum overhang (**S**) of the cylinder axis of 140 mm.  
 When increasing the overhang (**S**) reduce the load **F<sub>r</sub>** so that at the bending moment **F<sub>r</sub> x S** does not increase.



**64**



**65**

## MAIN TORQUE SETTINGS




POSITION	Ref. (fig. N°)	Bolt size (mm)	(Nm)
Cylinder head	38 b - page 29	M 10	39.2
Connecting rod cap	34 a - page 28	M 6	15.7
Flywheel	42 - page 31	M 18 x 1.5	137.2
Coil	42 - page 31	M 6	11.8
Camshaft pulley	39 - page 30	M 6	11.8
Belt stretcher	41 b - page 31	M 8	23.5
Timing cover	36 - page 29	M 8	23.5
Fan cowl		M 6	11.8
Breather cover	39 - page 30	M 6	11.8

Note: Comply with the following general regulations for the nuts and bolts not indicated in the table:















**M6 -> 10 Nm - M8 -> 25 Nm - M10 -> 45 Nm material A 8.8**





STANDARD BOLT TORQUE SPECIFICATIONS						
DESCRIPTION	 8.8		 10.9		 12.9	
	Diameter per pitch (mm)	R ≥ 800 N/mm <sup>2</sup>		R ≥ 1000 N/mm <sup>2</sup>		R ≥ 1200 N/mm <sup>2</sup>
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	CODE
	Valve guide check tool	1460.103
	Tool for insertion and removal valve guides	1460.104
	Flywheel and timing cover puller	1460.119
	Oil seal installation cone flywhell side	1460.105
	Oil seal installation cone P.T.O. side	1460.106
	Belt stretcher tool	1460.107
	Valve stem oil seal assembly tool	1460.108
	Valve clearance shim disassembly tool	1460.109
	Camshaft bearing assembly tool	1460.110
	Head oil seal ring assembly tool	1460.111
	Assembly tool for bearing, oil seal rings and pulley	1460.112
	Valve retainer assembly tool	1460.113
	Crankshaft pulley disassembly tool	1460.114
	T.D.C. check tool	1460.115

**PISTON- CYLINDER OVERSIZE TABLE**

Engine	Nominal	First re-boring	Second re-boring
	Liner diam.	Liner diam.	Liner diam.
LGA 280	+0.02 74 0	+0.02 74.5 0	+0.02 74.5 0
LGA 340	+0.02 82 0	+0.02 82.5 0	+0.02 82.5 0

ATTENTION: the part-numbers indicated refer to piston complete with rings and pin.

**TOLERANCES OF CRANKSHAFT JOURNAL AND CONNECTING ROD GRINDINGS**

Nominal	First grindings	Second grinding
D. mm	D. mm	D. mm
Min 32.000	Min 31.750	Min 31.500
Max 31.989	Max 31.739	Max 31.489

**CLEARANCES AND ADJUSTMENTS TABLE**

Position		Min (mm)	Max (mm)
Valve guide and stem	INTAKE	0.028	0.060
	EXHAUST	0.045	0.070
Piston pin and small end hole of connecting rod		0.016	0.032
Piston and pin		-0.002	0.006
Connecting rod bearing and crankshaft journal		0.040	0.060
Valve clearance when cold		0.10	0.15
Gap between ignition coil and flywheel		0.45	0.50
Spark plug electrode gap		0.60	0.80
Distance between ends of compression rings LGA 280		0.20	0.40
Distance between ends of scraper ring LGA 280		0.20	0.40
Distance between ends of compression rings LGA 340		0.25	0.50
Distance between ends of scraper ring LGA 340		0.25	0.50
Timing belt tension		7 ± 1 N	
Belt replacement		2500 h	




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