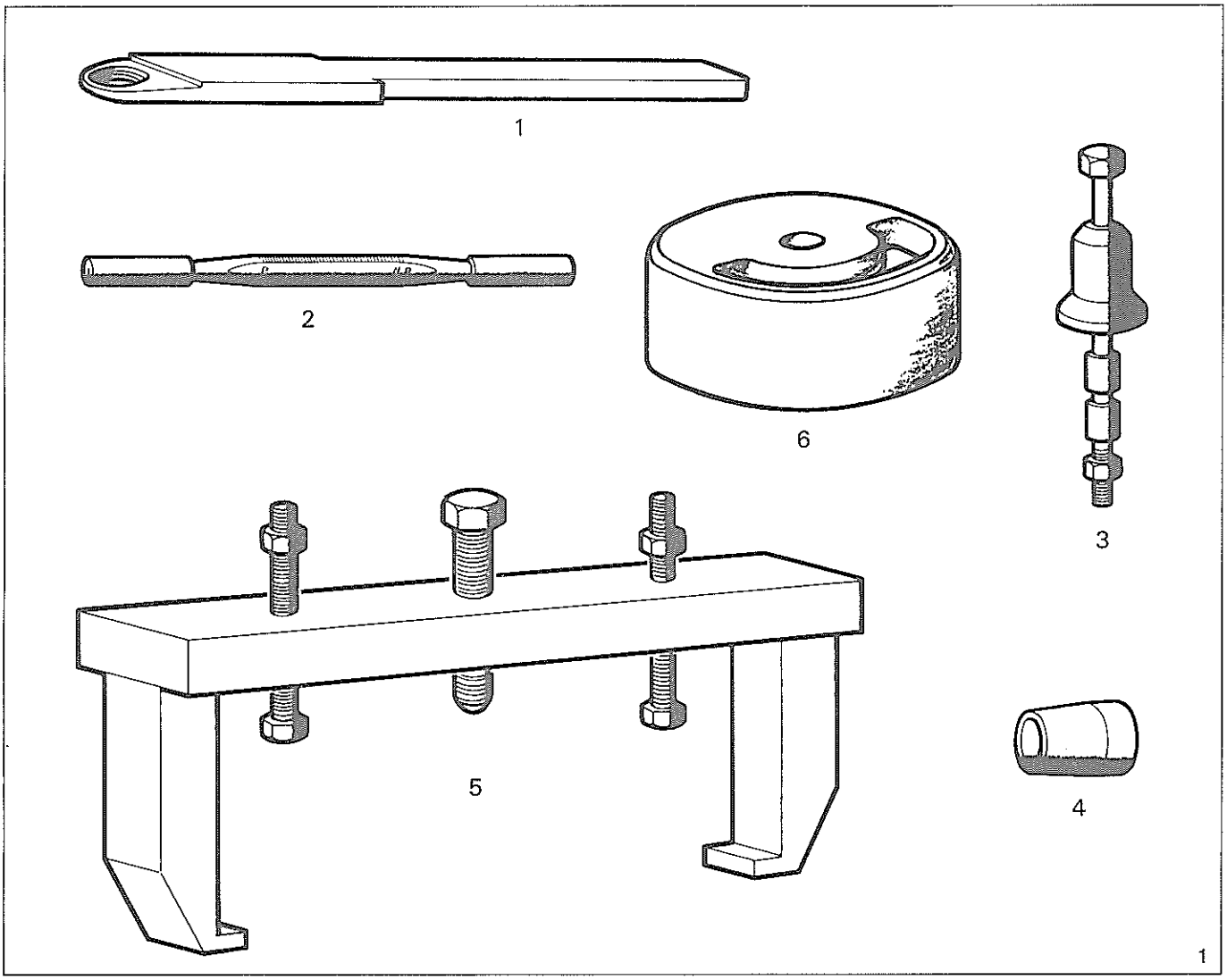
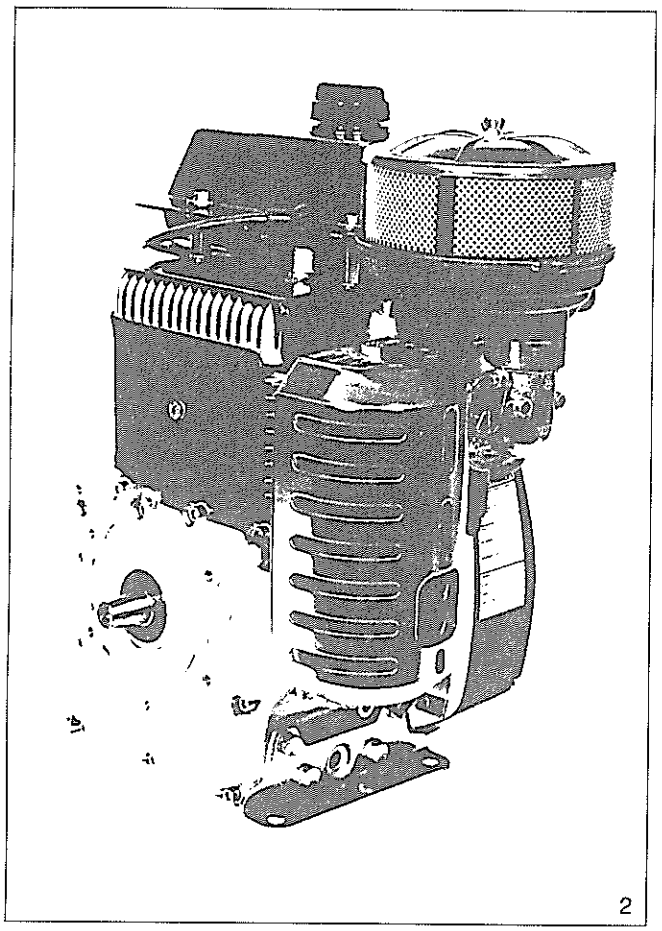
TABLE OF CONTENTS

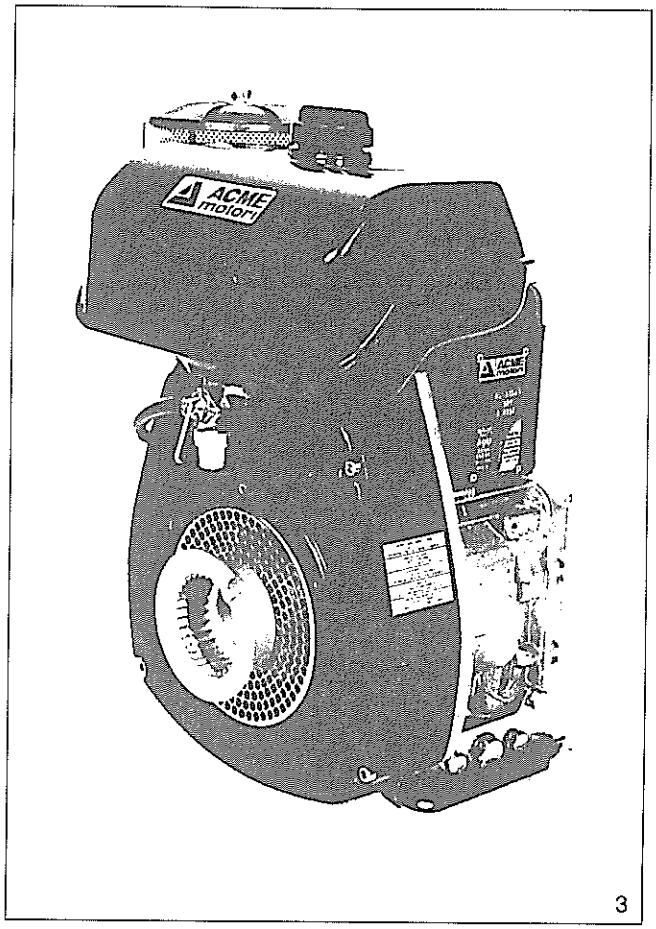


1 SPECIAL TOOLS

POS. NO.	TOOL NO.	DESCRIPTION
1	365110	VALVE SPRING EXTRACTOR
2	365048	VALVE GUIDE CHECK TOOL
3	365109	VALVE GUIDE PULLER
4	365152	OIL SEAL INSTALLATION CONE
5	365113	ENGINE FLYWHEEL AND TIMING COVER PULLER
6	365168	IGNITION COIL POSITIONING TOOL (up to serial No. A/425000)



2



3

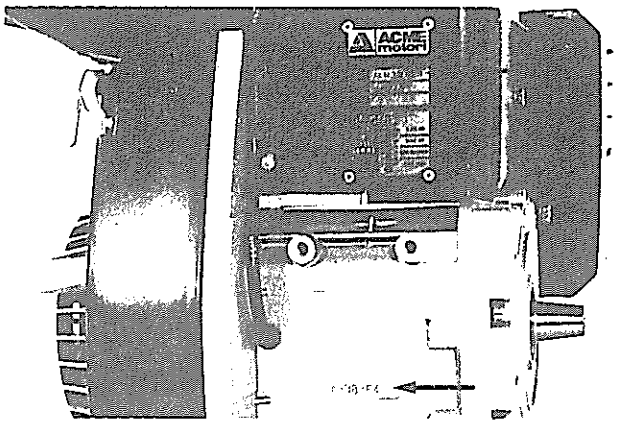
2 TECHNICAL FEATURES ALN 215W/290W/330W

ENGINE TYPE	Bore		Stroke		Displ.		Compression Ratio	Max. Standard RPM	Fuel
	mm	in	mm	in	cm³	Cu. in			
ALN 215 W B	65	2.56	65	2.56	215	13.12	5.5:1	3,600	gasoline
ALN 215 W P	65	2.56	65	2.56	215	13.12	4.6:1	3,600	kerosene
ALN 290 W B	75	2.95	65	2.56	287	17.51	5.7:1	3,600	gasoline
ALN 290 W P	75	2.95	65	2.56	287	17.51	4.5:1	3,600	kerosene
ALN 330 W B	80	3.15	65	2.56	327	19.95	5.9:1	3,600	gasoline
ALN 330 W P	80	3.15	65	2.56	327	19.95	4.5:1	3,600	kerosene

3 ENGINE DISMANTLING

3.1 ENGINE IDENTIFICATION

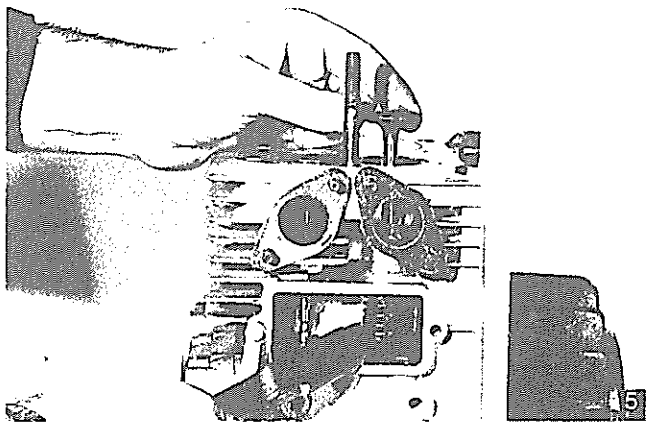
The engine type can be identified from the ACME engine plate fixed to the air cooling shroud on the right side of the engine as you face the engine from the starter or flywheel side; on the ACME plate the version code is also reported (starting from engine serial No. A/390031. The engine serial number is stamped into the block near the plate (fig. 4).



4

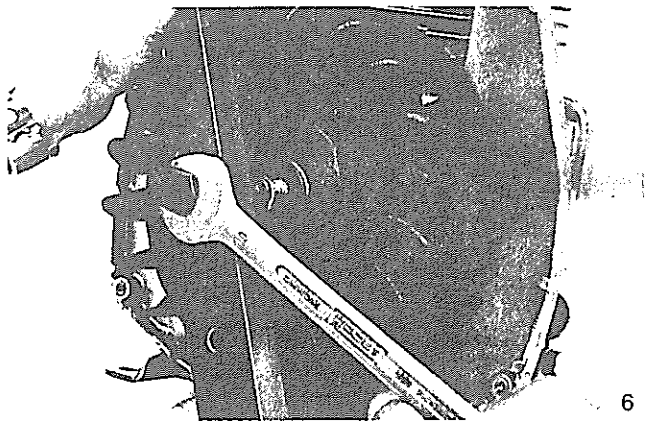
3.2 VALVES DISASSEMBLING

After removing the cup containing the shims for valves clearance adjustment and after positioning the piston on the T.D.C., use the tool no. 1 page 3 as shown at fig. 5. Should it be difficult, turn the lower cap until the slot on such cap faces the inside (see fig. 60 pag. 21).


5

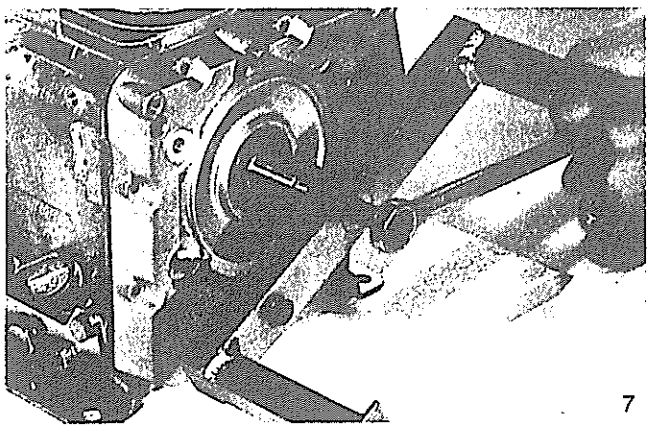
3.3 FLYWHEEL REMOVAL

Use the puller no. 5 page 3, after removing nut, washer, pulley and guard (fig. 6).


6

3.4 TIMING COVER REMOVAL

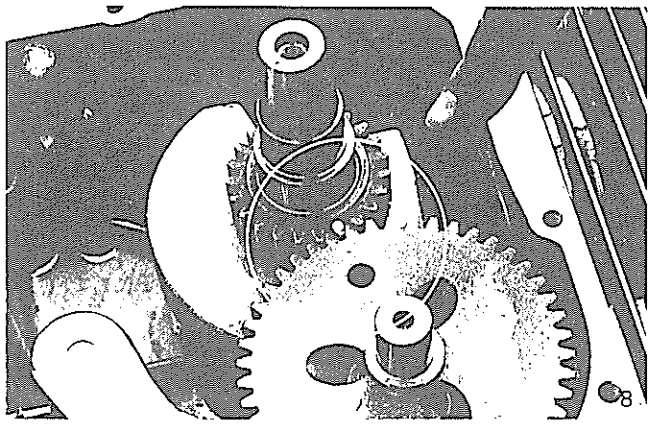
Use the puller no. 5 page 3, positioning the central screw on the opposite side to that used to pull the flywheel out and tightening the other two screws in the threaded holes on the cover (fig. 7).


7

3.5 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 (fig. 8).

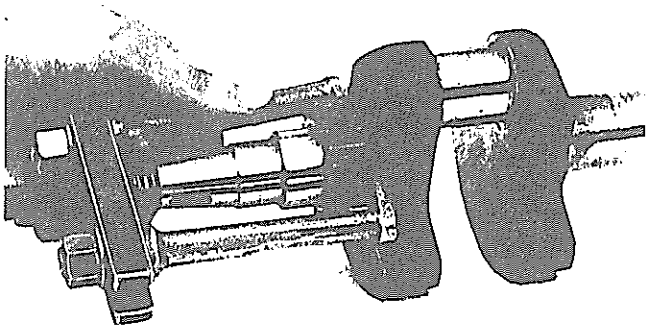
N.B.: The tappets will then release from their guides.



8

3.6 CRANKSHAFT GEAR REMOVAL

Use a universal puller with 2 or 3 fingers (fig. 9).



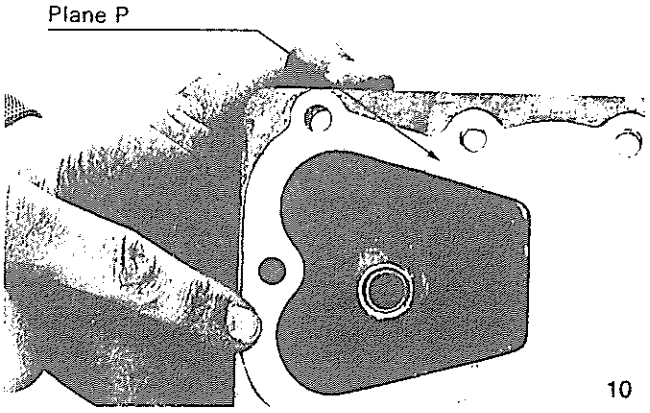
9

4 CHECKS AND OVERHAULS

4.1 CYLINDER HEAD AND CYLINDER

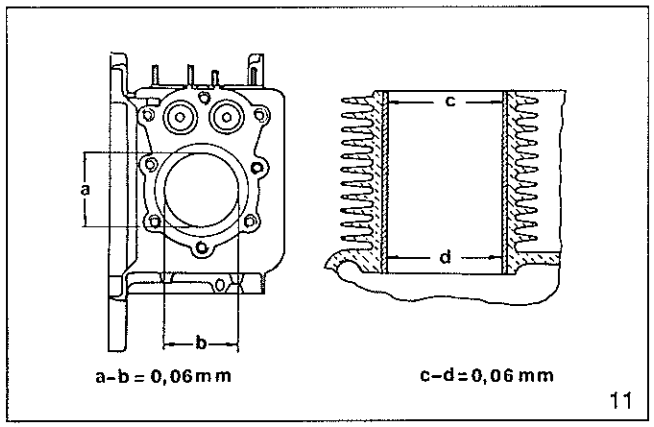
The cylinder head is made of aluminium alloy and therefore the head should not be loosened when the engine is hot. Removal of a hot cylinder head can result in warping of the cylinder head. Any trouble occurring on plane P of the head (fig. 10), should be removed by milling the head surface.
Maximum flatness tollerance in between:

0.3/0.5 mm	**0.012/0.020 inches**



10

To obtain clean removal of carbon deposits, soak the head in gasoline (petrol) or Diesel fuel for three or four hours.
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. Accurately gauge the extent of wear. Should the cylinder wear measure less than **0.06 mm (0.0024 inches)**, change piston rings (see table 11 page 39).



11

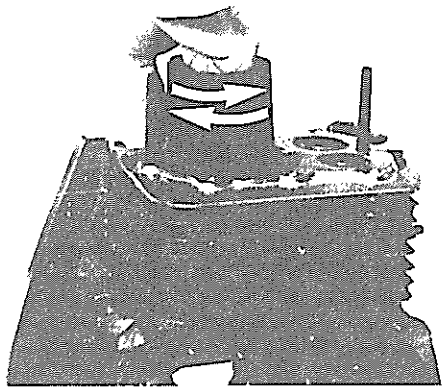
To facilitate quick and proper seating of the new piston rings, hand hone the cylinder with emery cloth (80-100 fine) soaked in Diesel fuel (fig. 12).
A rough surface should be obtained, as per fig. 13 below.

To avoid breakage of new piston rings, remove with sandpaper any ring groove which might have formed at the top of the cylinder (zone A, fig. 13).
After the above operations, wash thoroughly with kerosene or Diesel fuel.
Should maximum wear be over 0,06 mm and roundness an taper be in excess of indicated value, recondition cylinder as per Table 11 page 39.

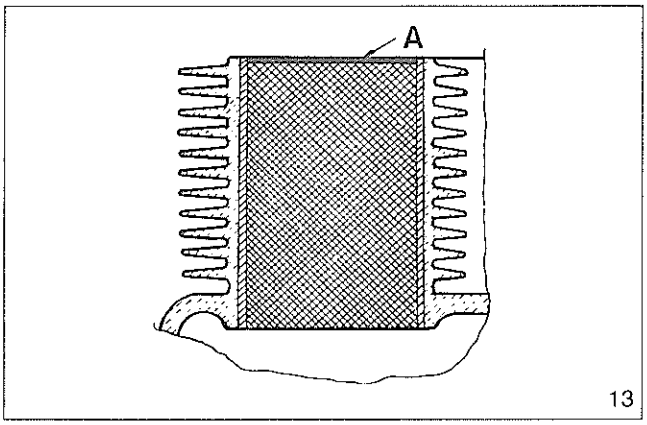
CAUTION: When grinding comply with working tolerance that should be or between:

mm	**+0.020 0**	**inches**	**+0.0008 0**

from nominal diameter of the cylinder bore.



12



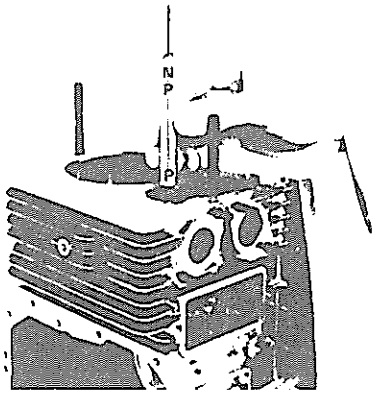
13

4.2 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 n. 2 page 3 (fig. 14).

Internal valve guides diameter after assembly in the engine:

min.	**7.015 mm**	**0.2762 in**
max.	**7.025 mm**	**0.2766 in**

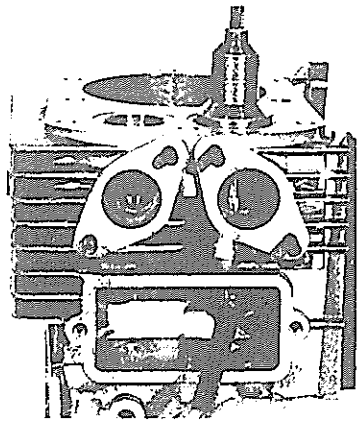


14

ACME valve guides gauge diameter:

go	**7.015 mm**	**0.2762 in**
no-go	**7.097 mm**	**0.2794 in**

Should clearance exceed, replace with new guides using puller no. 3 pag. 3 (fig. 15), after removing the lower split ring.

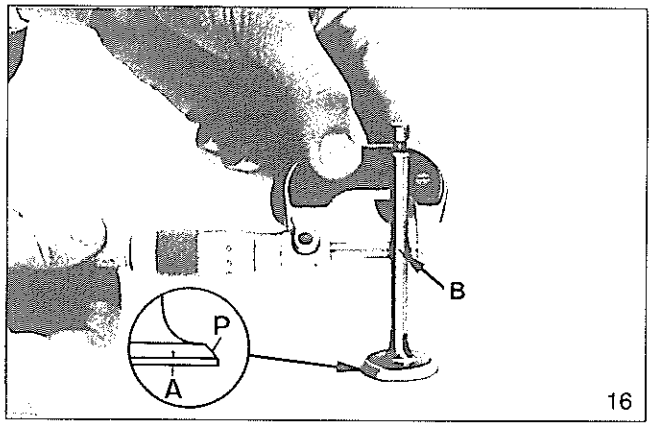


15

Valve condition is checked according to A and B values indicated in fig. 16.

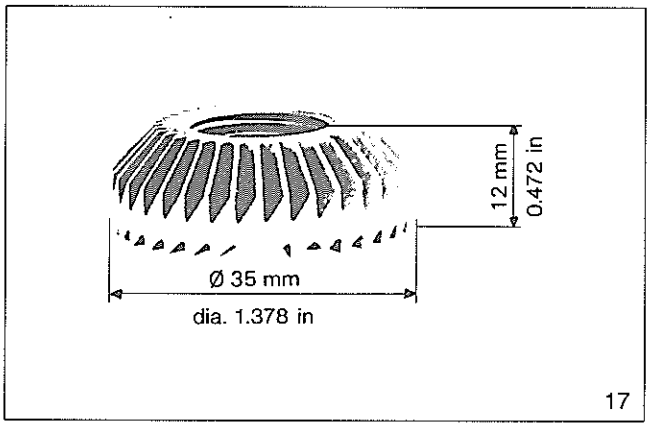
With A not less than **0.5 mm (0.020 in)** and B falling within the limits shown below, it is possible to repair the valve by grinding track P at 45°.

VALVES NOMINAL DIAMETERS B			
Exhaust valve		Inlet valve	
max.	6.970 mm (0.2744 in)	max.	6.987 mm (0.2751 in)
min	6.955 mm (0.2738 in)	min	6.965 mm (0.2742 in)



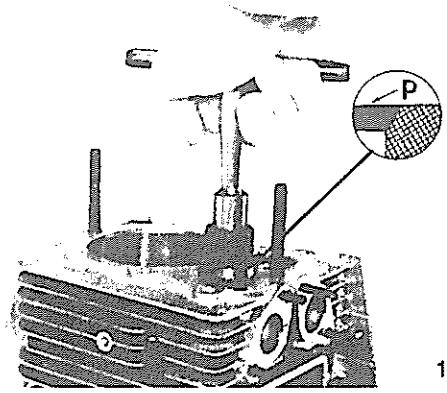
16

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. 17).



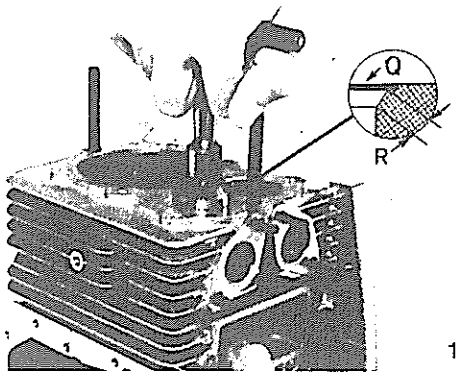
17

Due to prolonged use of the engine, tapping of valves on seats at high temperature hardnes track P (fig. 18) and makes hand grinding impossible.
It is therefore necessary to remove the hardened layer with a 45° grinding tool, employing a mechanical grinder.



18

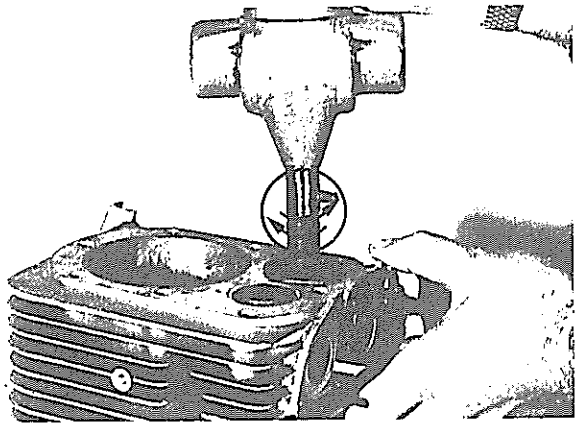
The final ajustment can be made by hand with the above illustrated hand grinder. Valve seat regrinding implies widening of track R. Should R be wider than 2 mm (0.079 in), lower plane Q (fig. 19) till R is **from 1.2 to 1.3 mm (from 0.047 to 0.051 in).**



19

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. 20).

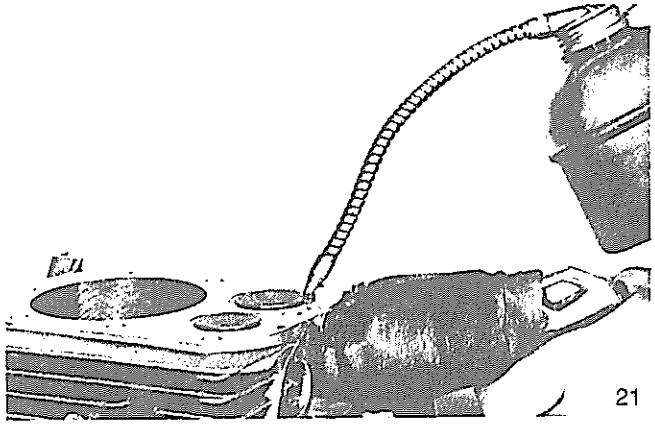
Next wash the valve and seat thoroughly with kerosene or gasoline to remove any lapping compound or swarf.



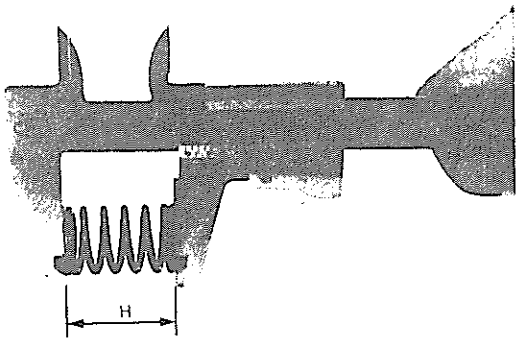
To check the seal between valve and seat after grinding, proceed as follows:

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. 21).

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 follows 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.
Change spring if H is lower than 32 mm (1.26 in); 35 mm (1.38 in) is measurement of new spring (fig. 22).
Make sure that the max play between tappet and guide is 0.043 mm (0.0017 in) and no scratches can be seen on the stem and on the head in touch with the camshaft. In the negative replace the tappets.



21



22

4.3 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 dimensions indicated on the side table.

OIL SEALS DIMENSIONS			
Flywheel side		P.T.O. side	
Dimensions mm (in)	Code	Dimensions mm (in)	Code
∅ 30 x 47 x 7 mm (dia. 1.18 x 1.85 x 0.28)	054016	⦸ 25 x 46 x 76 (dia. 0.98 x 1.81 x 0.28)	054027

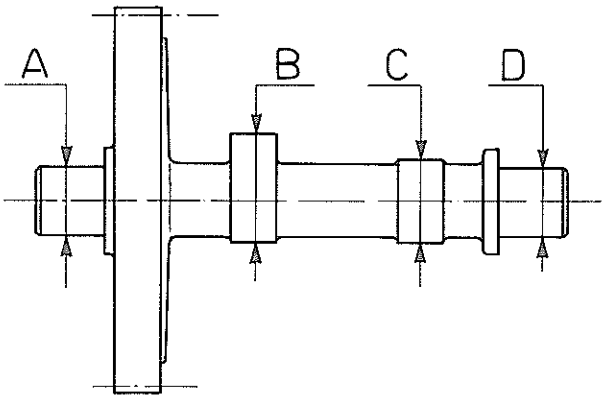
4.4 MAIN BEARINGS

The crankshaft is supported on both sides by ball bearings with the characteristics indicated on the side table.

MAIN BEARINGS		
FLYWHEEL & P.T.O. SIDE		
Type	Dimensions	Code
Balls 6206	∅ 30 x 62 x 16 mm (dia. 1.18 x 2.44 x 0.63 in)	304046

4.5 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. 23.
Starting from the engine serial No. A/396788, 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 (in)		B mm (in)		C mm (in)		D mm (in)	
min	max	min	max	min	max	min	max
15.973 (0.629)	15.984 (0.630)	26.540 (1.045)	26.570 (1.046)	19.975 (0.786)	20.025 (0.788)	15.973 (0.629)	15.984 (0.630)

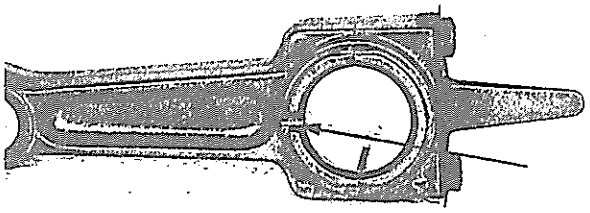
23

4.6 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 siezure, replace the whole connecting rod with another one with reduced head hole. Three reductions are allowed and, in case of crank journal grindings, consult the table 11 page 39.
The maximum wear of the connecting rod «big end» hole is:

mm 0.10	0.004 in

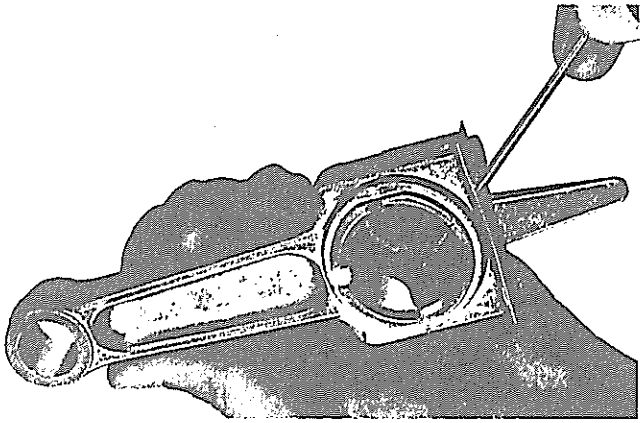
On the shoulders of the connecting rod «big end» there are grooves that assure a greater lubrication of the journal and the bearing (fig. 24). On the connecting rod cap there is a little scoop for the splash lubrication (fig. 25).



24

The fitting tolerance between «small end» hole and piston pin must be:

max 0.039 mm min 0.016 mm	max 0.0015 in min 0.0006 in



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, or replace it (fig. 26).

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.

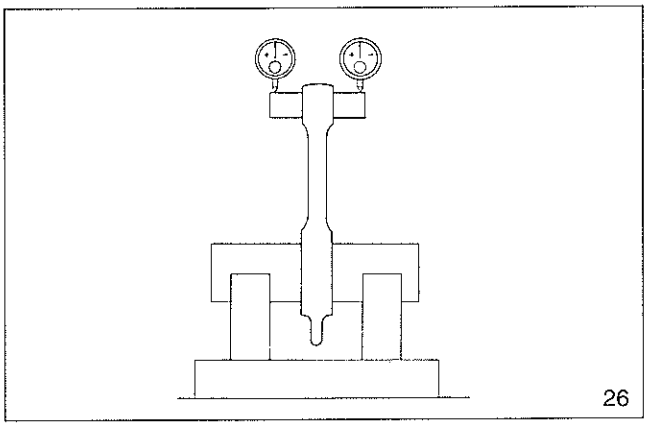
4.7 PISTON RINGS AND PISTON

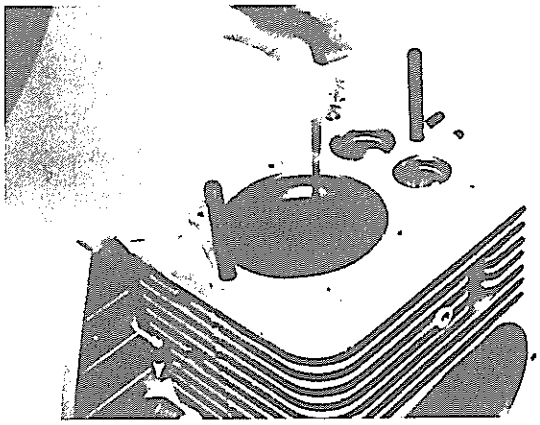
To check the piston rings wear, insert the rings in the cylinder and gauge the gap between ring ends (fig. 27) which should be between:

0.30/0.50 mm (0.0118/0.0197 in)	for compression rings
0.25/0.50 mm (0.0098/0.0197 in)	for scraper ring

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 (0.039 in). If so, replace both piston and piston pin. After disassemblying 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)
Scraper ring	C = 0.05 mm (0.000197 in)


26


27

4.8 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 11 pag. 39.

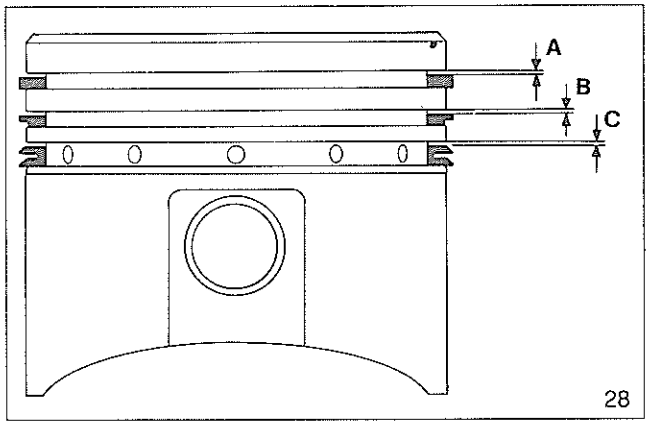
N.B.: When grinding the crank pin, keep a working tolerance of

max	mm	0.000	in	0.00000
min		—0.011		—0.00043

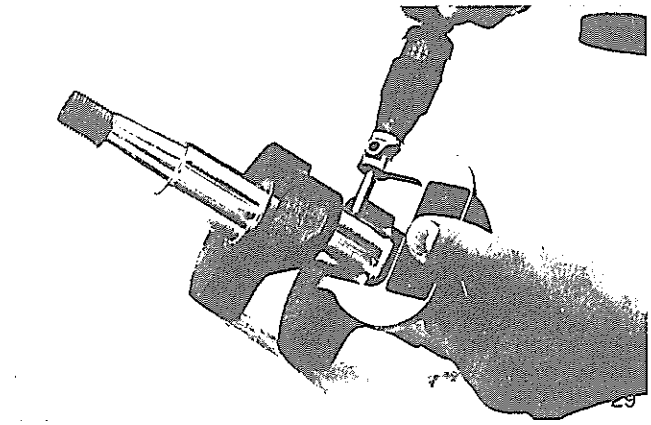
The diameter of the main journals should be

max	mm 30	+0.015	in 1.1811	+0.00059
min		+0.002		+0.00008

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.



28


29

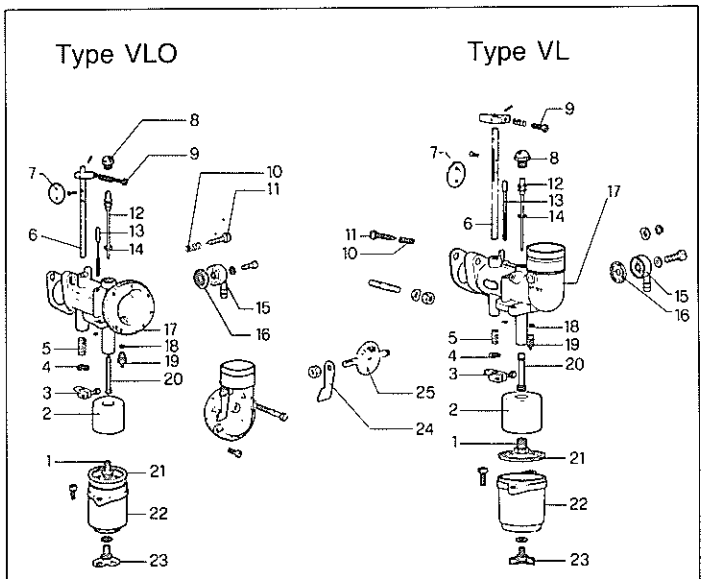
4.9 CARBURETORS ALN 215W/290W/330W

Parts shown at fig. 30
1) Main jet - 2) Float - 3) Clamp - 4) Circlip - 5) Spring - 6) Throttle rod - 7) Throttle - 8) Plug - 9) Screw - 10) Spring - 11) Screw - 12) Idle jet - 13) Primer push button - 14) Washer - 15) Eyelet - 16) Filter element - 17) Carburetor body - 18) Washer - 19) Needle valve - 20) Atomizer - 21) Gasket - 22) Float chamber - 23) Drain plug - 24) Choke lever - 25) Choke plate with valve - 26) Solid chocke plate - 27) Gasket.

CARBURETORS CHARACTERISTICS

(OLD TYPES: VL and VLO)
(with standard oil bath air cleaner).

ENGINE Model	Fuel	Carb. Type	Chocke ∅ mm	Throtl. ∅ mm	Needle hole mm	Main Jet	Idling Jet
ALN 215 WB	Gas.	VL22/16	16	22	2	75	50
ALN 215 WP	Ker.	VL22/16	16	22	2	80	50
ALN 290 WB	Gas.	VL25/20	20	25	2	95	50
ALN 290 WP	Ker.	VL25/18	18	25	2	100	50
ALN 330 WB	Gas.	VLO25	20	25	2	100	55
ALN 330 WP	Ker.	VLO25	18	25	2	105	55



Up to ALN 290 W serial No. 373728: type VL25.
Up to ALN 330 W serial No. 368920: type VLO25.

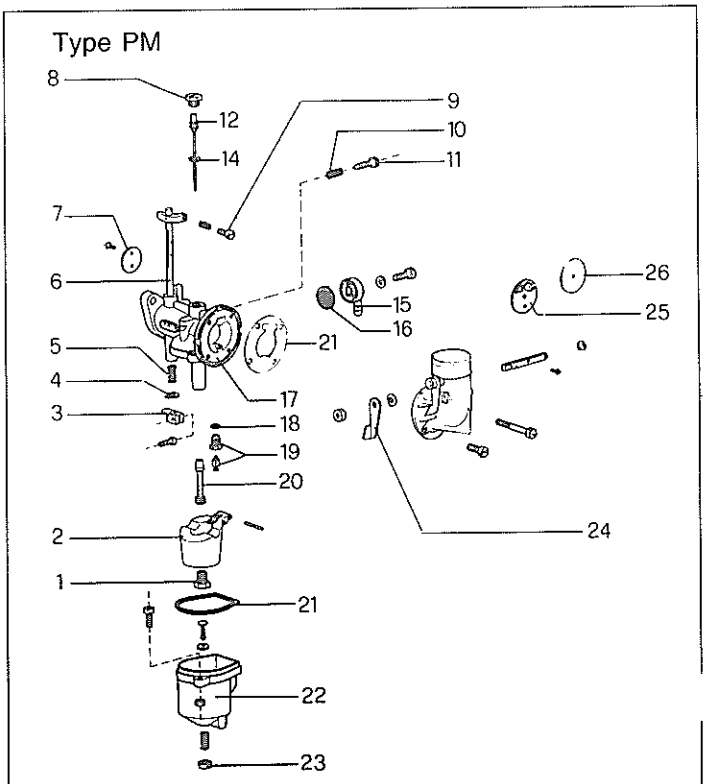
30/A

CARBURETOR CHARACTERISTICS

(NEW TYPES: PM)
(with standard oil bath air cleaner).

ENGINE Model	Fuel	Carb. Type	Chocke ∅ mm	Throtl. ∅ mm	Needle hole mm	Main Jet	Idling Jet
ALN 290 WB	Gas.	PM25/20	20	25	2	95	55
ALN 290 WP	Ker.	PM25/18	18	25	2	95	55
ALN 330 WB	Gas.	PM25/20	20	25	2	100	55
ALN 330 WP	Ker.	PM25/18	18	25	2	100	55

Note. For engines equipped with special air cleaners, see par. 10 pag. 38.



From ALN 290 W serial No. 373729: type PM 25.
From ALN 330 W serial No. 368921: type PM 25.

30/B

CARBURETOR CLEANING AND CHECK UP

The carburetor should be taken apart, washed with gasoline or Diesel fuel. Blow compressed air through each part to remove dirt particles.

CAUTION: Never use metal objects or abrasive on jets or jet holes (confine cleaning methods to use of compressed air and solvents only).

FUEL LEVEL CHECK

1) Fasten valve V to carburetor body and insert copper or fiber washers (between valve and seat) in order to obtain a measurement of (A) as shown in fig. 31:
   — for carburetors type VLO and VL:

mm 35 ± 0.2	in 1.38 ± 0.008

   — for carburetors type PM:

mm 37 ± 0.2	in 1.46 ± 0.008

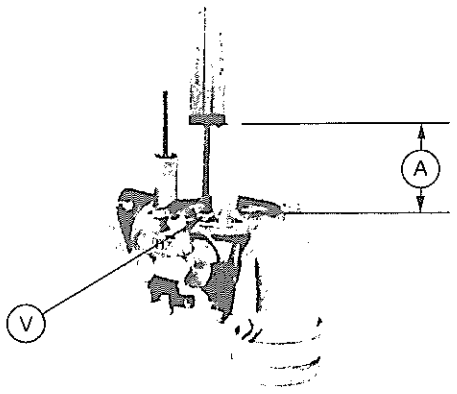
2) Complete carburetor assembling.
3) Connect carburetor with float chamber (in a vertical position) to the tank and open gas tap.
4) After a few seconds tap the float chamber lightly to simulate engine vibrations (fig. 32).
5) Close the shut off cock (vertical) and remove carburetor chamber without spilling content.
6) Keeping chamber in vertical position check the distance between carburetor bowl top and fuel level, which should be (fig. 33):
   — for carburetors type VLO and VL:

mm 30 ± 1	in 1.18 ± 0.04

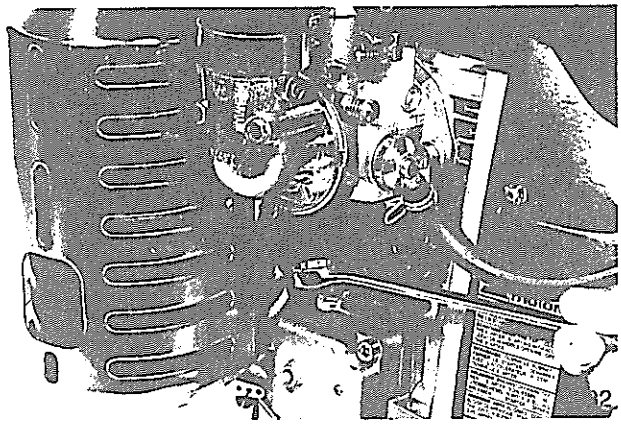
   — for carburetors type PM:

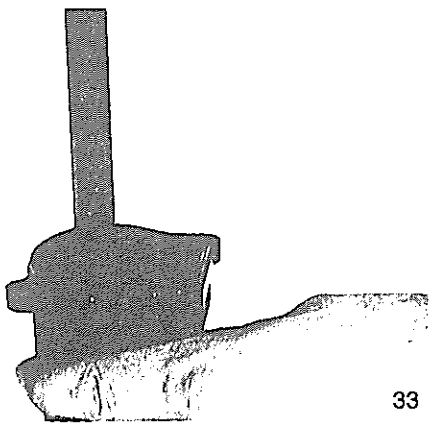
mm 26 ± 1	in 1.02 ± 0.04

   If those values are obtained, it indicates fuel level control valve is correct and carburetor can be mounted again; otherwise the needle valve V has to be replaced.



31

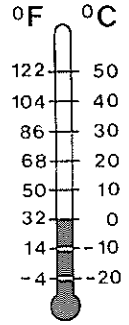

32


33

4.10 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 as per the table in fig. 34.
If the air filter is oil bath type, introduce into the sump the same lubricant used for the engine, in the quantity indicated by the level mark inside the filter sump.

Litres	0.750
Quarts	0.793



MIL - L - 2104B
API - SC - CC

SAE 40
SAE 30
SAE 20W/20
SAE 10W

34

4.11 BREACKER POINTS IGNITION

Up to the ALN 215W/290W/330W serial No. A/425000, ignition is magneto-flywheel type (fig. 35).

The ignition group is made up of an alternator/flywheel with a closed ring four pole continuous magnet, covered with special plastic material. Magnetic material is permanently charged before engine assembly.

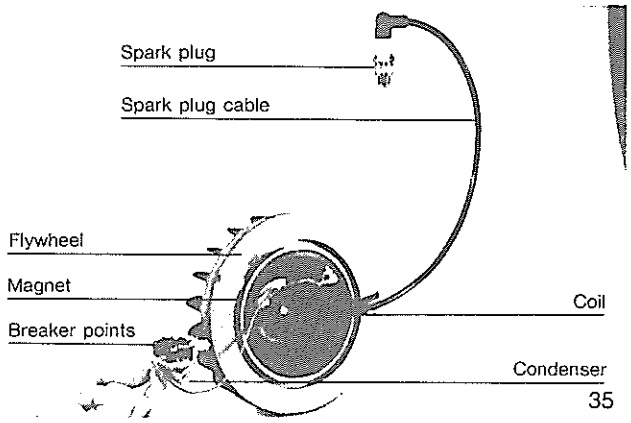
Although the flywheel might be disassembled, it is not necessary to remagnetize the magnet since the initial charge remains unchanged.
High voltage ignition coil is attached inside the flywheel and the gap between magnet and ignition coil must be (fig. 36):

mm 0,6/0,8	in 0.024/0.031

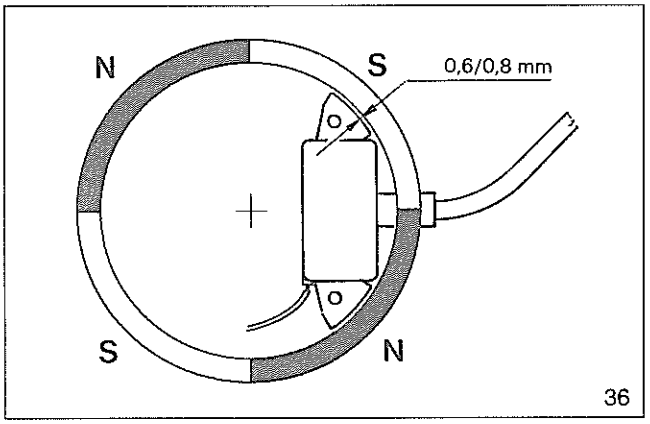
The breaker points are driven by a cam located on the camshaft and they are actuated by a smal push rod.

The condenser is also located in the points casing. Remove external cover to check and set points. The gap between points should be (Fig. 37) between:

mm 0.4/0.5	in 0.016/0,020



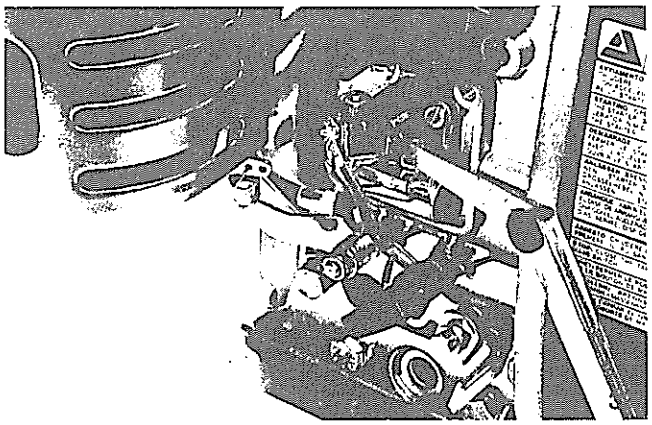
35



36

IGNITION CHECKING

Schould engine have been out of use for a long period, check that points are not oxidized. To clean points, use file and a small rag soaked in gasoline.
Should excessive sparking occur during engine operation, the condenser has to be replaced.



SPARK PLUGS

Different types of spark plugs must be used according to whether you are utilizing a gasoline engine or a kerosene engine. See the side table for specifications. (Thread 14 x 1,25 mm).

SPARK PLUG EQUIVALENTS

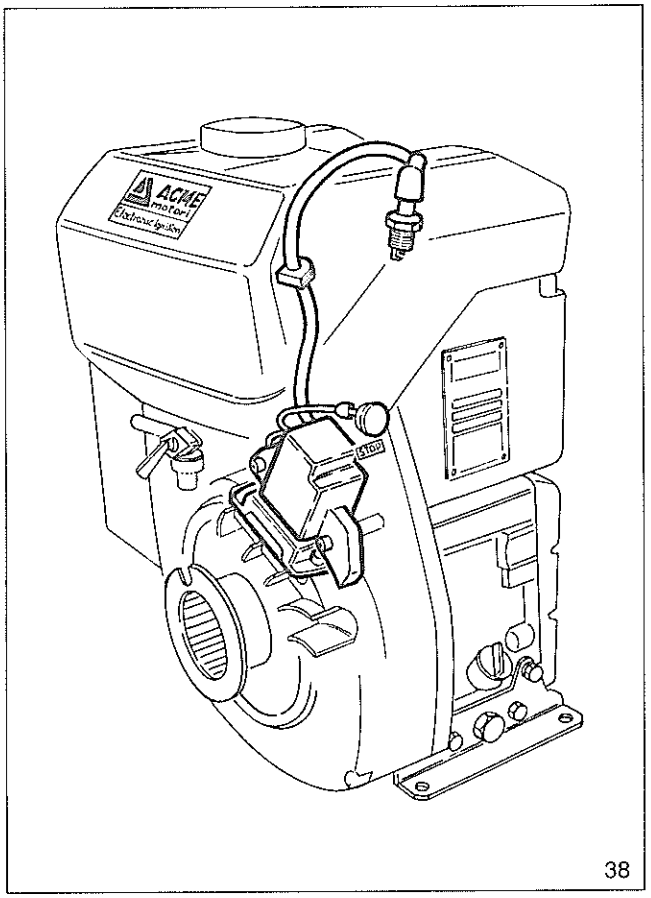
SPARK PLUG BRAND NAME	FEEDING	
	Kerosene	:Gasoline
CHAMPION	L90	L86
AC	C48	C47
BOSCH	W45T1	W95T1
MARELLI	CW2N	CW3N

4.12 ELECTRONIC IGNITION

Starting from the engine serial N° A/425001, an inductive type electronic ignition with high performances which make engine starting much easier is fitted.
This system is designed for a higher degree of quality in each of the features listed below:

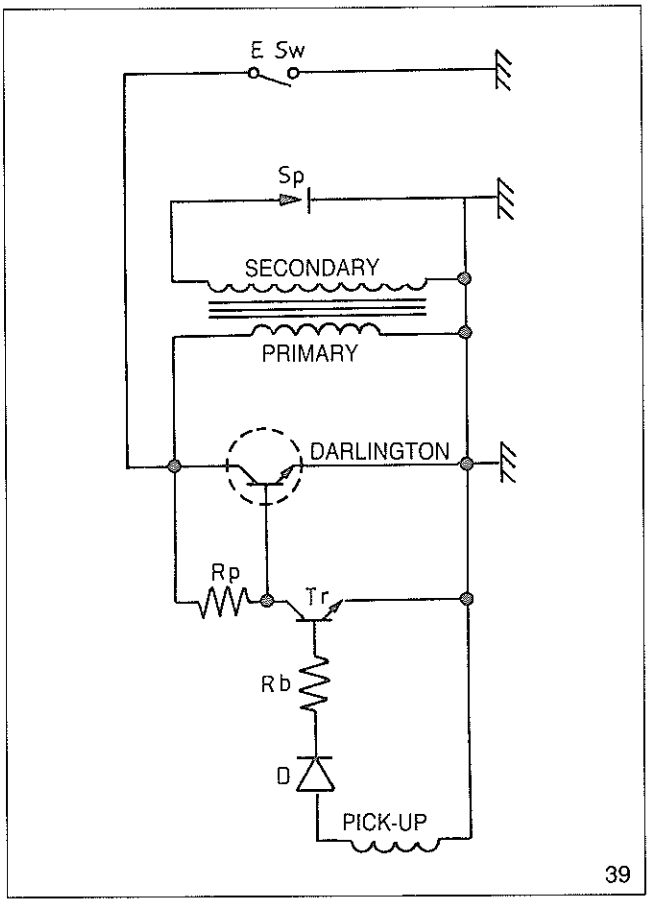
— no maintenance required as there are no moving parts;
— resistant to moisture, water and dust;
— high durabitily as there no parts subject to deterioration due to mechanical wear;
— stable working and efficiency;
— simple costruction as the number of components in the ignition system has been considerably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

Hereunder please find the operating principles of the ACME electronic ignition (fig. 38-39).



38

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, ad 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, provoking the spark in the Sp spark plug.



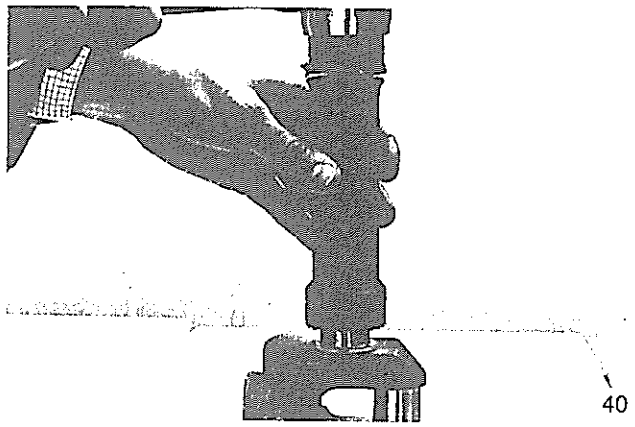
39

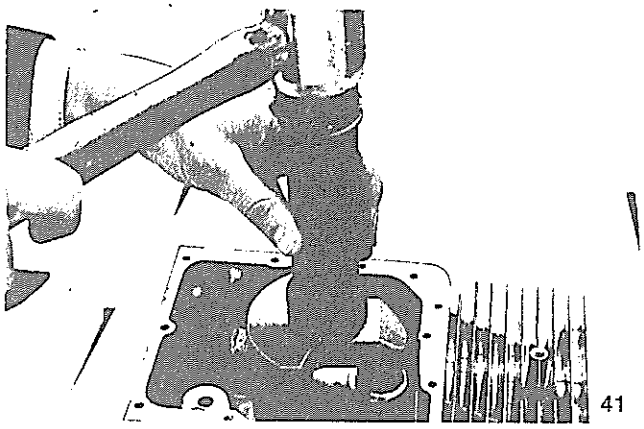
5 ENGINE ASSEMBLY

5.1 CRANKSHAFT

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

1) Pre-heat crankcase and timing cover from 70° to 80°C (190°F to 210°F) and fit bearings in their casing.
2) Pre-heat crankshaft gear by placing in oil bath 80° to 90°C (210 to 230°F) for a few minutes.
3) Fit gear key in crakshaft key-way and then place gear on shaft (fig. 40).
4) Fit crankshaft in engine crankcase using a plastic hammer (fig. 41), placing a wedge between the two crankshaft counterweights in order to avoid damage to the crankshaft.
5) Fit oil seals on both crankcase and timing cover; place protection cone on shaft end to prevent scratching or otherwise damaging oil seals.

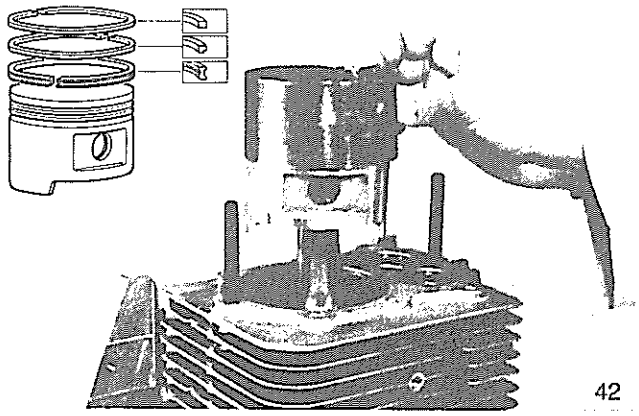

40


41

5.2 PISTON AND CONNECTING ROD

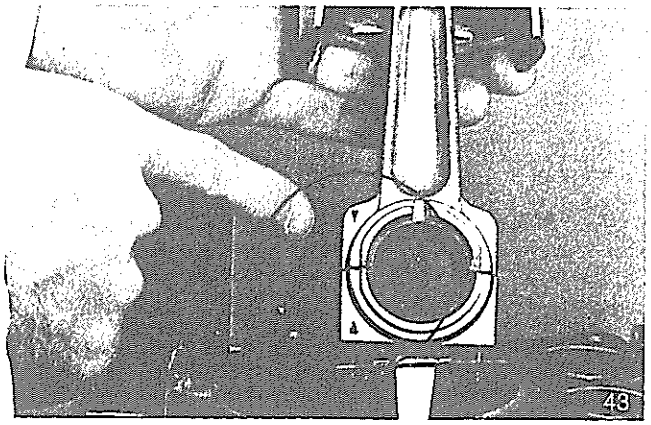
The piston can be coupled to the connecting rod on both senses, indifferently.

The piston pin should be mounted without preheating the piston, but pressing it by hand. Then 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. 42).
The installation of piston into cylinder is facilitated by using a ring compression tool.


42

5.3 CONNECTING ROD AND CRANKSHAFT CONNECTION

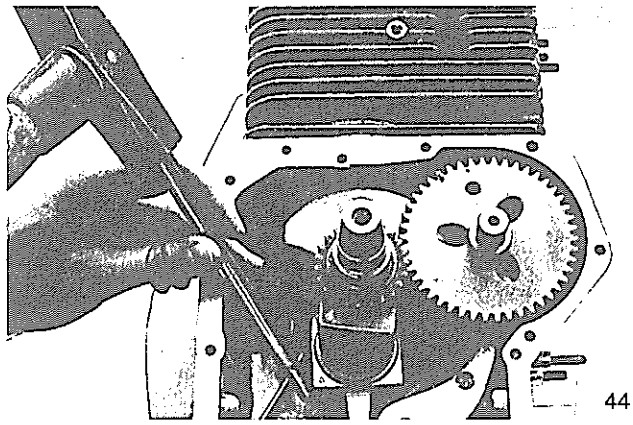
There is only one way to assemble connecting rod and cap (fig. 43). It is necessary that the two triangular notches on connecting rod and cap correspond. When fitting connecting rod on crankshaft, triangle shaped marks face toward timing cover and the oil pick up hole (fig. 25) must face toward the camshaft on clockwise rotation engine. The triangle shaped marks must face toward flywheel and the oil pick up hole must be opposite the camshaft in counter clockwise rotation engines (fig. 43).


43

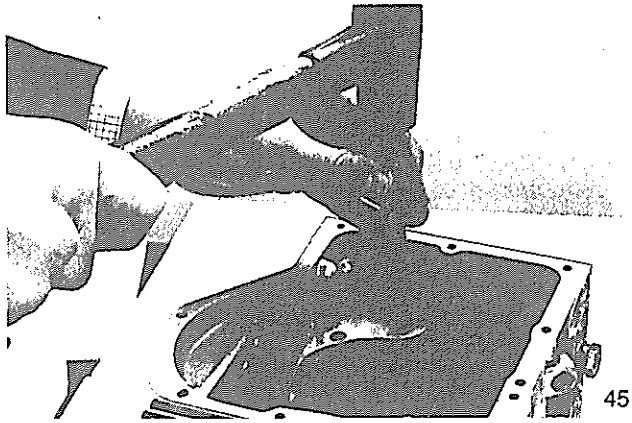
After assemblying the connecting rod, tighten the screws, by using torque wrench at a value of

16.7 Nm (1.7 Kgm) (12.4 ft-lbs)

Bend locking tab washer at both cap screw heads (fig. 44).


44

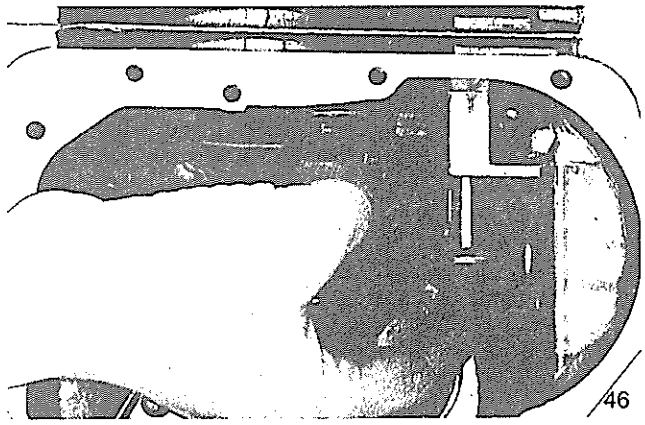
Check that the oil slinger trough is securely attached and does not touch the connecting rod (fig. 45).


45

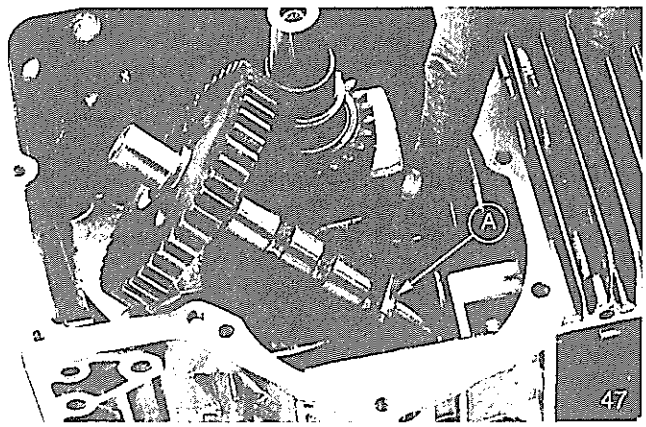
5.4 CAMSHAFT

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

a) fit the tappets in proper casings (fig. 46).


46

b) fit the camshaft with bevel A (fig. 47) placed 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. 8). In this way the timing will be correct.



47

5.5. INGNITION SYSTEM CHECKING (Up to engine serial No. A/425000)

1) Place piston at Top Dead Center TDC (marked PMS on the crankcase).
2) Rotate flywheel counterclockwise until the distance between the TDC mark on the flywheel and the PMS mark on the crankcase is obtained as per table reported below. This distance should correspond to point IA, marked on the flywheel Before Top Dead Center (fig. 48).

Ignition timing on the flywheel BTDC	Ignition timing degrees BTDC
36 mm 1.417 in	21°

3) After positioning the distance between Top Dead Center marks, check that points are just beginning to open.
4) Small adjustements of the ignition timing may be made by utilizing the Allen head screw on the points mounting plate.

CAUTION: The ignition timing must be checked at the beginning of points open that is from about 0.05 mm (0.002 in).

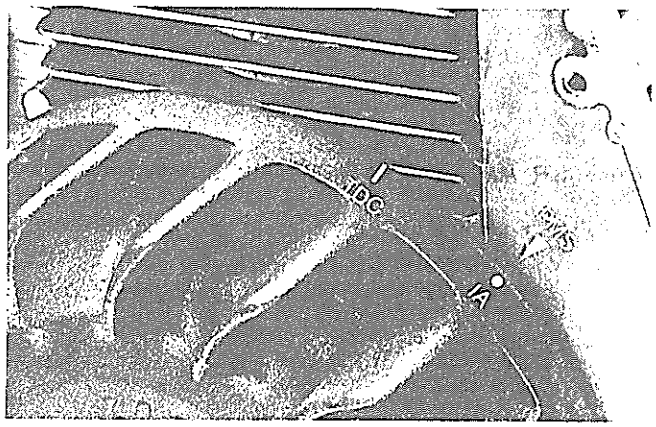
Maximum breaker points gap must not exceed:

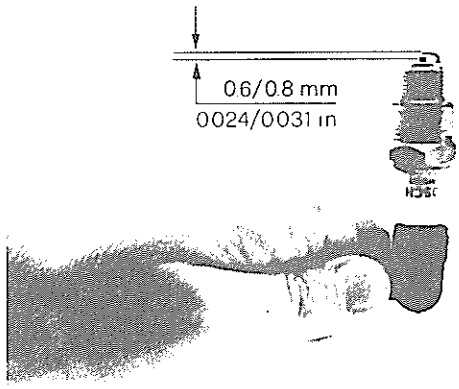
mm 0.5 **in 0.020**

Spark plug electrodes (fig. 49) should have a gap of between:

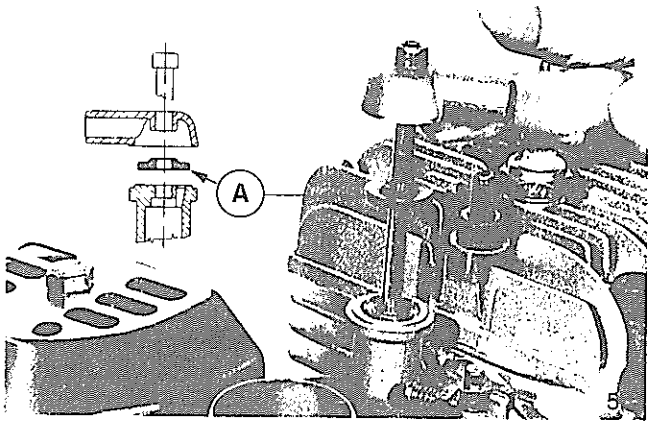
mm 0.6/0.8 **in 0.024/0.031**

On the engines equipped with electronic ignition (starting from the engine serial No. A/425001), the ignition timming is 21° BTDC and nonadjustable.





49



5.6 CRANKCASE BREATHER ASSEMBLY

The crankcase breather is fitted on the tappets cover; before assembling, check that rubber valve (A) and mounting gasket are not damaged.

CAUTION: Do not fit rubber valve (A) upside down, otherwise negative pressure needed inside crankcase does not develop and gaskets and crankshaft oil seal rings can be damage (fig. 50).

Starting from the engine serial No. A/425001, the breather of fig. 51 is fitted on the engines. Check the valve and gasket before mounting on the crankcase.

51

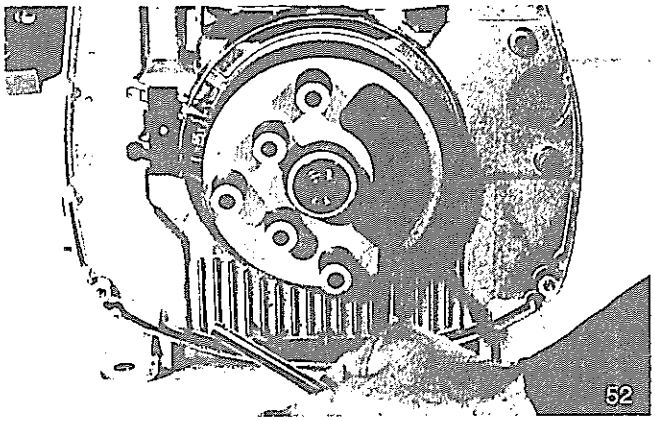
5.7 MAGNETO-FLYWHEEL FITTING (Up to engine serial No. A/425000)

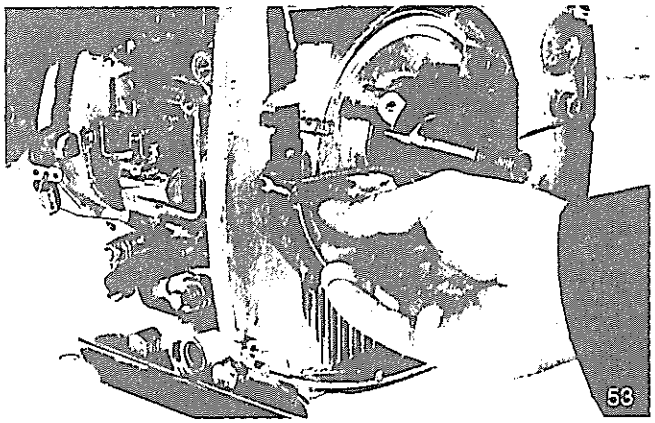
1) Fit ignition coil on the crankcase after having checked it by using an Ohmmeter.
   To fit correctly the coil on the inside of the flywheel, use the jig No. 6 pag. 3, as follows:
   — fit the coil on the crankcase without tightening completely the screws;
   — fit the jig on the engine as shown on fig. 52;
   — verify that the coil two pole shoes graze the jig internal surface;
   — tighten the coil fixing screws.

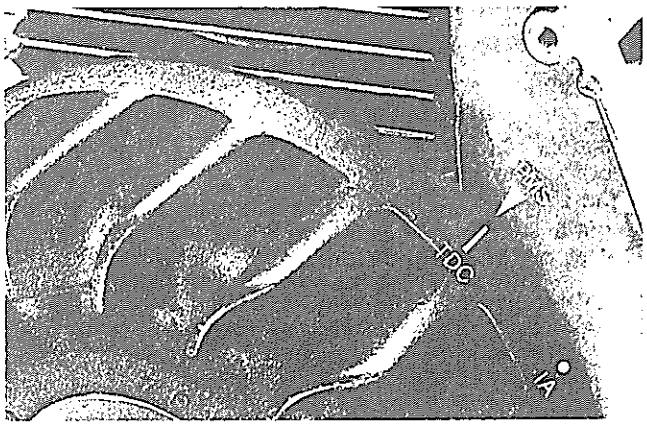
On that way, you may be sure of the correct value for the gap which has to be between

0.6/0.8 mm	0.024/0.031 in

2) Fit in position the following:
   a) points driving plunger
   b) condenser
   c) breaker points (fig. 53).
3) Fit engine flywheel making sure that magnetic ring is not damaged on inside surface.
4) Check piston position at Top Dead Center; it should correspond to the notch marked on flywheel (TDC) (fig. 54).







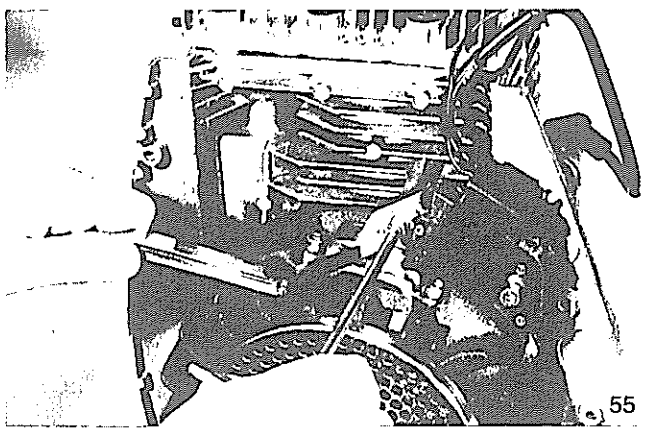
5.8 COIL AND MAGNETO (From the engine serial No. A/425001)

Proceed as follows:

a) mount the coil on the engine block without tightening the screws;
b) mount the flywheel, after checking the integrity of the magneto and the validity of its fixing on the flywheel;
c) use the feeler gauge positioned between the coil and the magneto to adjust the correct value of the air gap at **0.40 / 0.50 mm (0.016/0.020 in).** Then lock the coil by tightening the screws at a value of

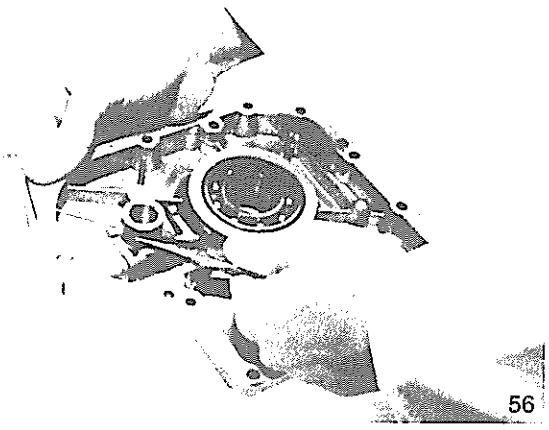
11.8 Nm (1.2 Kgm) (8.7 ft-lbs)

(fig. 55)

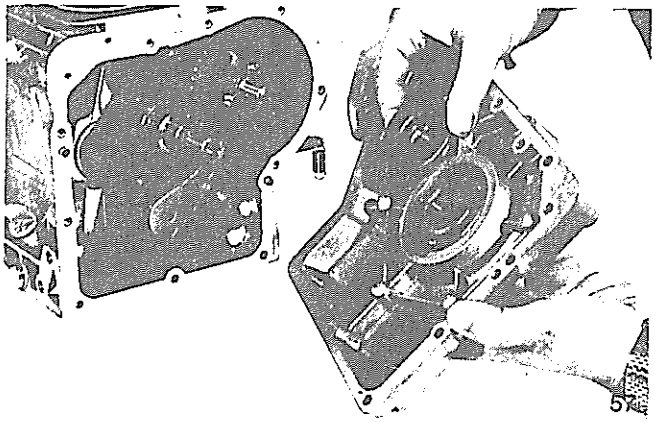


5.9 GOVERNOR ASSEMBLING

1) Insert governor lever into engine timing cover and fasten fork with elastic pin (fig. 56).

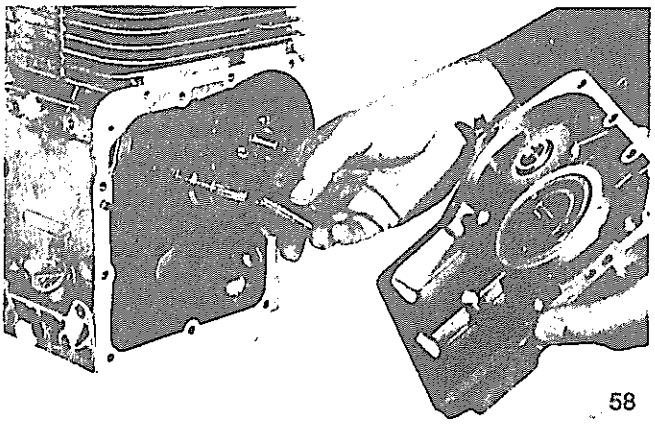

56

2) Insert governor plate with steel disc in casing on timing cover (fig. 57).


57

3) Fit governor balls in camshaft gear casing, using a light grease or heavy oil to hold them in place (fig. 58).

4) Apply protection cone to shaft end before fitting cover. Be certain to remove all foreign material from both case and cover.
Apply gasket shellac or gasket cement evenly on the metal surface and install gasket in careful alignment with holes (fig. 58 and 59).


58

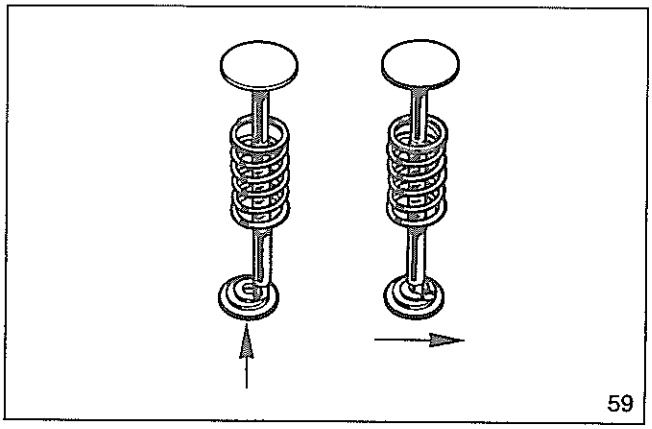
5.10 VALVES

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

INTAKE	0.013 / 0.057 mm (0.00051/0.00224 in)
EXHAUST	0.030 / 0.067 mm (0.00118/0.00264 in)

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;

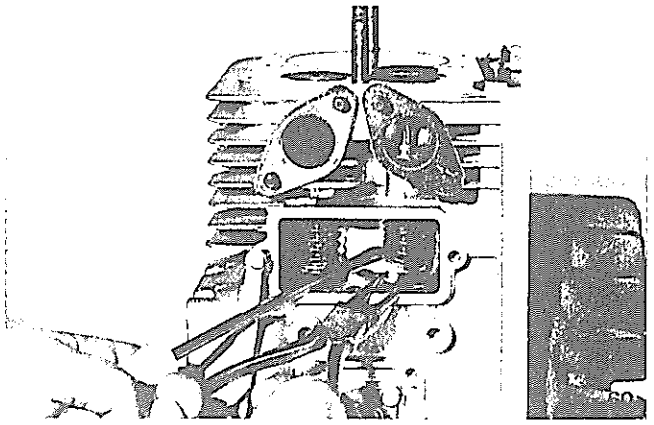

59

b) insert the valves into their seats, by locking them in their lower part by the lower plates, using the tool no. 1 page 3 as indicated in the fig. 59 and fig. 5;

c) insert between the lower end of the valve stem and tappet the shim-holding cup for valve clearance adjustment (fig. 60).

N.B.: The shims for valve clearance adjustment are available in two thicknesses:

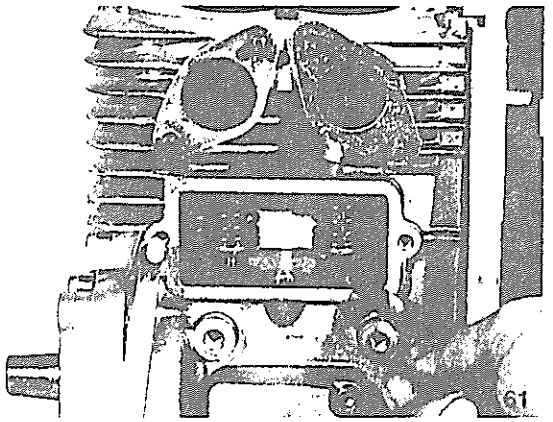
mm 0.1	**0.004 in**
mm 0.2	**0.008 in**



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

0.10 / 0.15 mm (0.004/0.006 in)

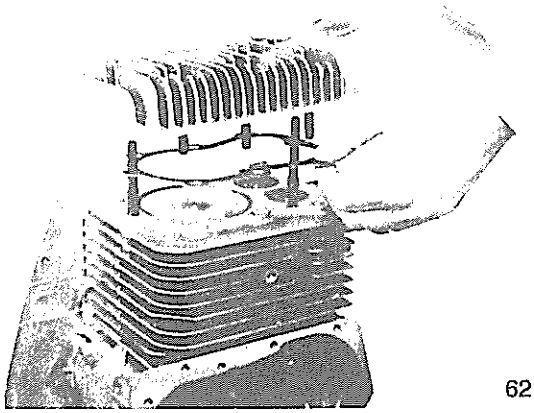
for both valves with cold engine (fig. 61).
The clearance should be adjusted by varying the number of shims in the cup.



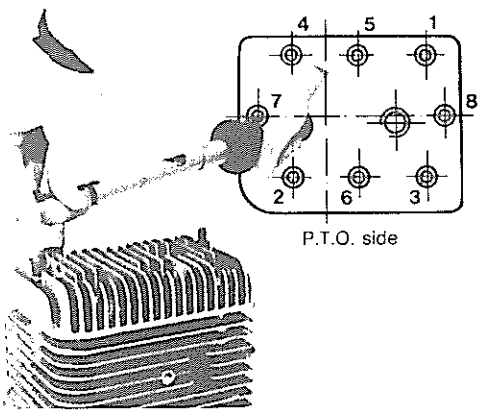
5.11 CYLINDER HEAD ASSEMBLING

A head gasket must be fitted between the head and the cylinder (fig. 62). Do not use sealer or gasket cement. Each head bolt should be tightened gradually and progressively in the order shown in fig. 63, by a torque wrench (fig. 63) at a value of

29.4 Nm (3.0 kgm) (21.7 Ft-lbs)



N.B.: The two longest screws should be mounted on the exhaust side (pos. 6 and 3 fig. 63).



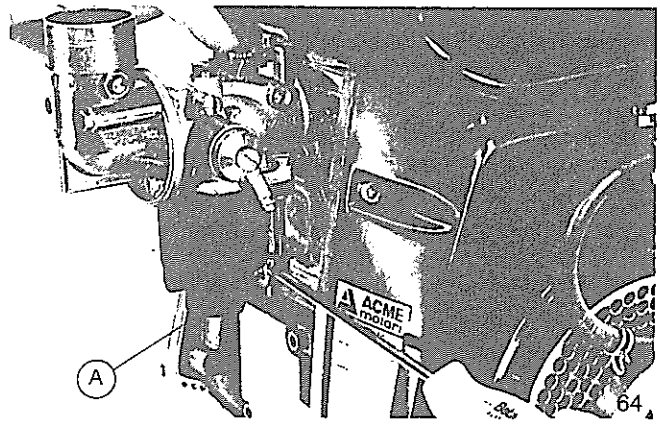
63

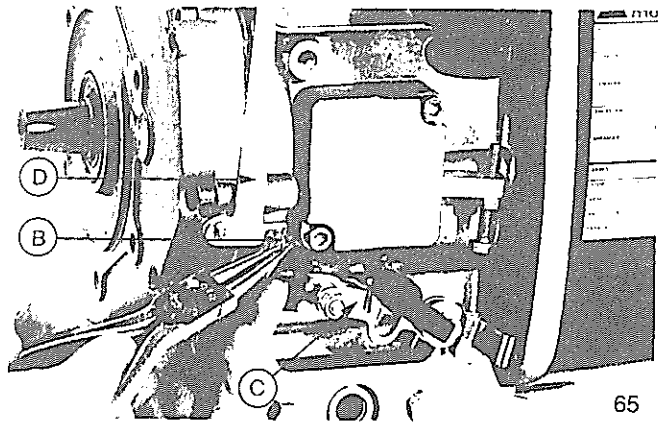
5.12 GOVERNOR LEVERS CONNECTIONS

Position the throttle valve on the intermediate position and lock the clamp A (fig. 64), on which the tie rod has been mounted with the outer governor lever, to permit the complete stroke of the throttle rod with no binding. Usually the correct locking position of the clamp is that with clamp perpendicular to the crankcase.

Hook the spring B to the accelerator lever C and join it for standar engine **(3,600 R.P.M.)** to the central hole of the outer governor lever D (fig. 65).

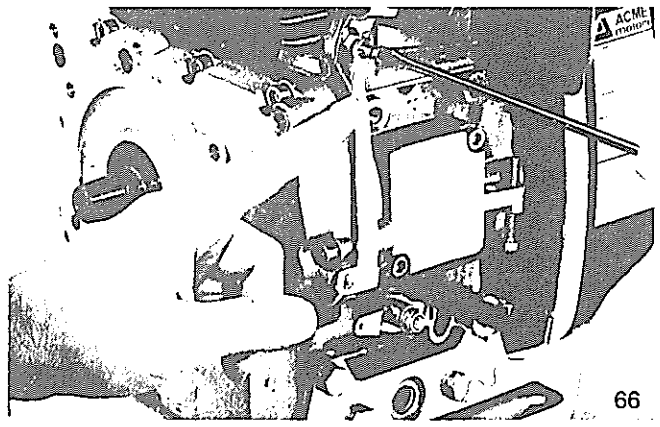
N.B. On the outer governor lever there are three holes: on the right one (fly wheel side) the spring has to be hooked when the engine is calibrated at 4,000 R.P.M. (for special purposes **ONLY**); it has to be hooked on the central hole when the engine runs at 3,600 R.P.M. and on the left one (P.T.O. side) when the engine runs at 3,000 R.P.M. For the engines running a 2,400 R.P.M., the spring has to be hooked always on the left one, but using a different spring.





5.13 GOVERNING SYSTEM ADJUSTMENT

Put accelerator lever in max acceleration position, make sure that the throttle is nearly completely open and then, pushing gently for 2 or 3 mm (0.08 or 0.12 in) on the outer governor lever to the direction of the carburetor, tighten the screw of locking clamp (fig. 66). Bringing accelerator lever to minimum, carburetor throttle should easily return to normal position.



6 ENGINE TEST

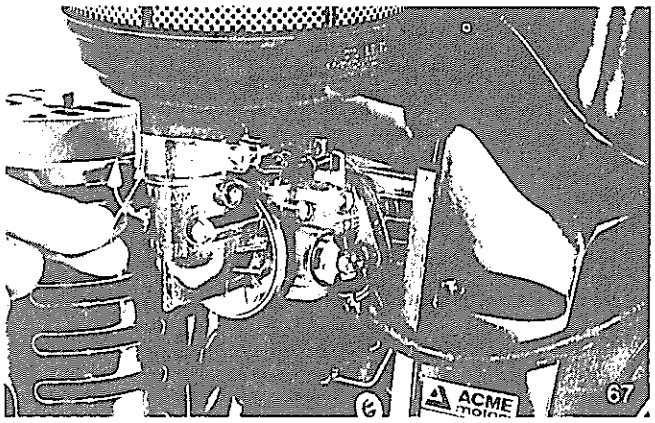
Fix the engine on a base or on the machine. Check the oil level in the sump (and in the air filter if oil bath type) and the fuel level in the tank.

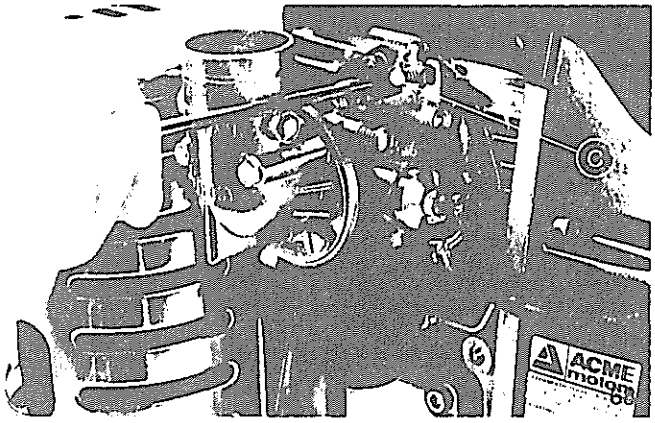
6.1 ROPE OR RECOIL STARTING

a) Cold.
Close the choke (fig. 67) and position the accelerator approx. at its half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting. As soon as the engine has started, open the choke.

N.B.: The engines working with kerosene feeding should be starded on gasoline, by turning the tap to the «gasoline» position. A few minutes after starting, the tap can then turned to the «kerosene» position.

b) Hot.
Do not touch the choke: simply position the accelerator at its minimum or half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting.



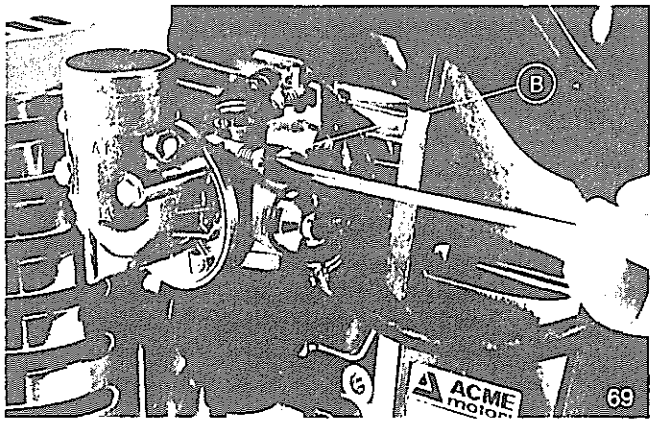


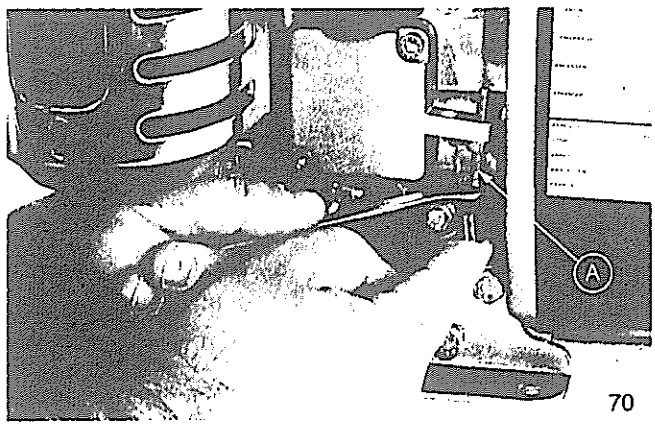
6.2 ELECTRIC STARTING

Before using the key or the push-button for starting, make sure that all connections are positive, expecially 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, see pos. 6.1.

6.3 CARBURETOR AND SPEED ADJUSTMENTS

1) Start engine and let it operate at idle speed for a few minutes. When starting a kerosene fed engine, gasoline must be used; change fuel only when the engine is hot.
2) With hand throttle control in extreme idle position, apply R.P.M. indicator to one end of the crankshaft and turn screw C — this is the idle speed control screw — until speed is about 1,000/1,100 R.P.M. (fig. 68).
3) Gently tighten screw B completely (fig. 69), taking care not to apply pressure beyond closed position (thus causing damage to screw and seat) and then slowly unscrew it 1 1/4 turns. An appropriate setting may be reached by turning the screw slightly in or out from the 1 1/4 turns position. This operation, being very delicate, should be repeated 2 or 3 times until the optimum setting is reached. When the engine is idling, R.P.M. should not be over 1,150. Otherwise, adjust screw C to obtain 1,000 to 1,100 R.P.M.
4) After having adjusted the idle speed, loose the nut of screw A (fig. 70), that acts as lim stop of the governor lever, and by tightening and loosening screw A bring the engine to the right maximum speed; then tighten the locking nut.





CAUTION: When making this adjustment, do not leave engine running at maximum speed for a long period of time.
The ALN 215W/290W/330W ACME gasoline and kerosene engines will normally reach a maximum of 3,600 R.P.M. Your conscientious care and regular periodic servicing of this superior ACME engine, will reward you with many «bonus» hours of dependable work.

NOTE: The Manufacturer will not be responsible for damage incurred by deliberate mis-use or neglected maintenance by User.

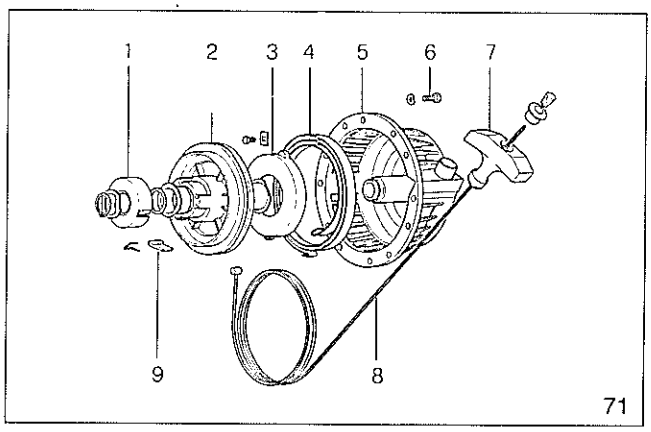
7 ACCESSORIES

7.1 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 pos. 4.3 page 10 for engines from serial No. A/396788.
For engines up to serial No. A/396787, was necessary to replace the standard camshaft with a special one equipped with centrifugal compression release (fig. 72).
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 (parts 6 of fig. 71).

Parts of fig. 71:
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.



71

Disassembly, checking, overhaul

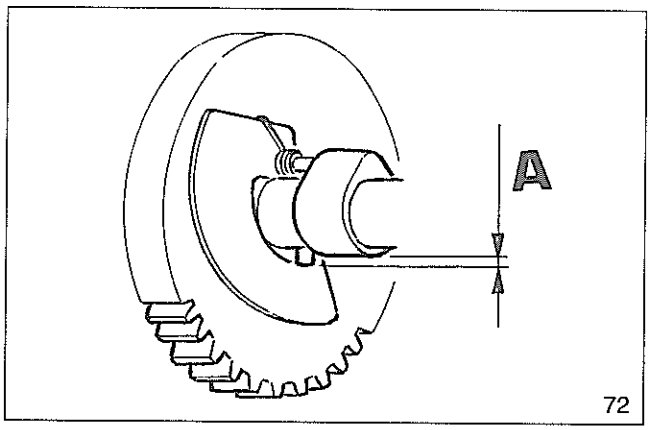
— Check the cable (8): should it be broken replace it.
— Check that the starter dogs come out when starting.
— To replace the spiral spring (4) when broken, it is supplied complete with cover (3) as an assembly, for simple replacement.

Mounting (or remounting) of recoil starting assembly on the engine

Install recoil assembly over front pulley. Replace the 6 bolts that hold the assembly onto the engine, but **do not tighten** bolts. Grasp the starter handle and pull the cable approximatley 150 mm (6 in), hold tension on the cable, then tighten the 6 bolts. By performing this procedure, the starter assembly will be in perfect alignment with the center of the starting pulley.

Camshaft with automatic compression release (engines up to serial No. A/396787).

A special camshaft with cetrifugal compression release, was mounted in the engines having electric starter or the recoil starter or both. This device makes starting easier, delaying the exhaust valve closing and it is disconnected automatically as soon as the engine starts. Check that the centrifugal mass glides properly, the spring is in the correct position and the projection A (fig. 72) of the rod on the cam is the following when the device is working.



72

ENGINE	PROJECTION A
ALN 215 W	0.5/0.6 mm 0.020/0.024 in
ALN 290 W ALN 330 W	0.8/0.9 mm 0.031/0.035 in

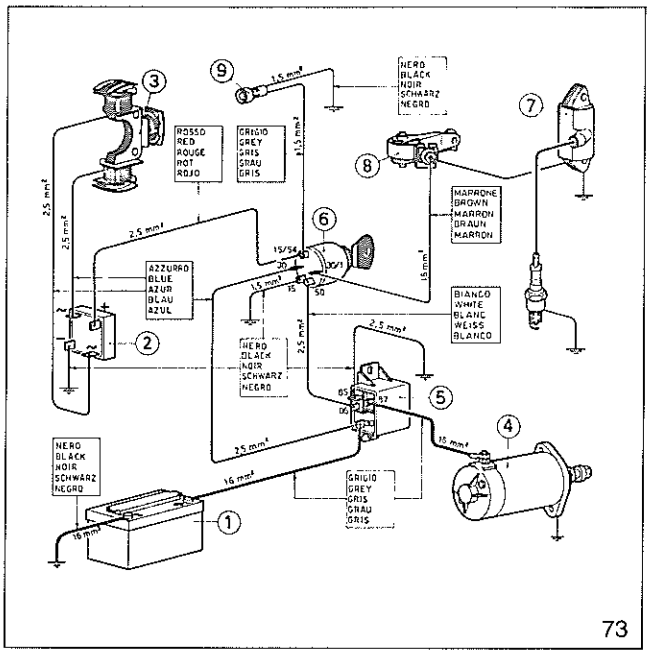
7.2 ELECTRIC STARTING BY MOTOR

Drawing of the plant for engines up to serial No. A/425000

Parts of the system of fig. 73:
1) Battery - 2) Rectifier - 3) Alternator (startor) - 4) Starting motor - 5) Remote control switch - 6) Starting switch - 7) Ignition coil - 8) Breaker points - 9) Warning light.

Characteristics

Alternator ACME 12V-40 W
Rectifier IR type 26 MB 20 A
Starter SJCE PN1 12 V - 0.15 kW
Remote control switch EFEL 12 V-75 A
Recommended battery: capacity 30 Ah.



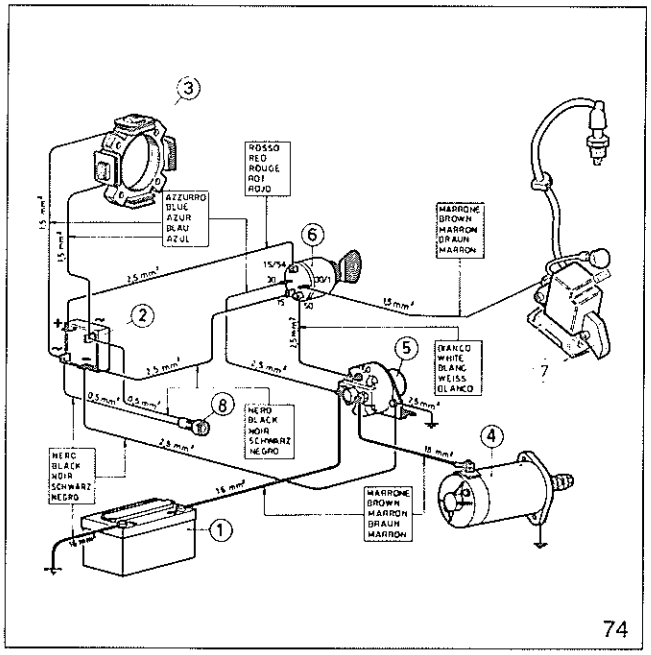
73

Drawing of the plant for engines from serial No. A/425001

Parts of the system of fig. 74:
1) Battery - 2) Rectifier - 3) Alternator (startor) - 4) Starting motor - 5) Remote control switch - 6) Starting switch - 7) Ignition coil - 8) Warning light.

Characteristics

Alternator ACME 12 V - 70 W
Rectifier IR type 26 MB 20 A
Starter SJCE PN1 12 V - 0.15 kW
Remote control switch EFEL 12 V - 75 A
Recommended battery: capacity 30 Ah.



74

Electrical system check

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

— 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 unsolded connections and traces of burning or wires bonding. Replace the coil 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 following tables:

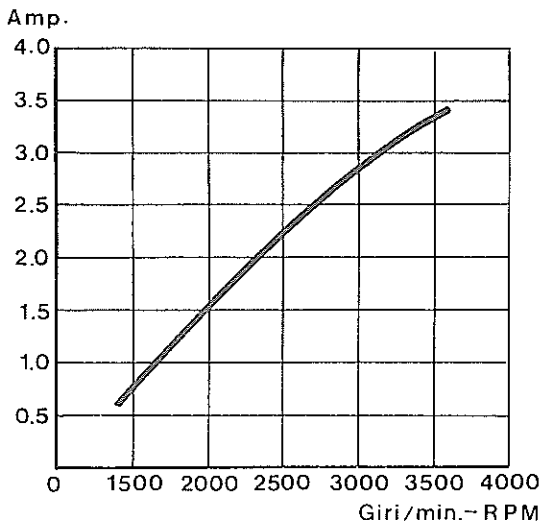
- engines up to serial No. A/425000

RPM	VOLTS (V)
2,400	20/22
2,800	23/25
3,200	26/28
3,600	29/30

- engines from serial No. A/425001

R.P.M.	VOLTS (V)
2,000	13.5 / 14.5
2,500	17 / 18
3,000	20.5 / 22
3,600	25 / 26

Should the voltage reading be lower, it means that the rotor is no longer magnetized and therefore it is necessary to replace it.



Engines up to serial No. A/425000

75

RECTIFIER

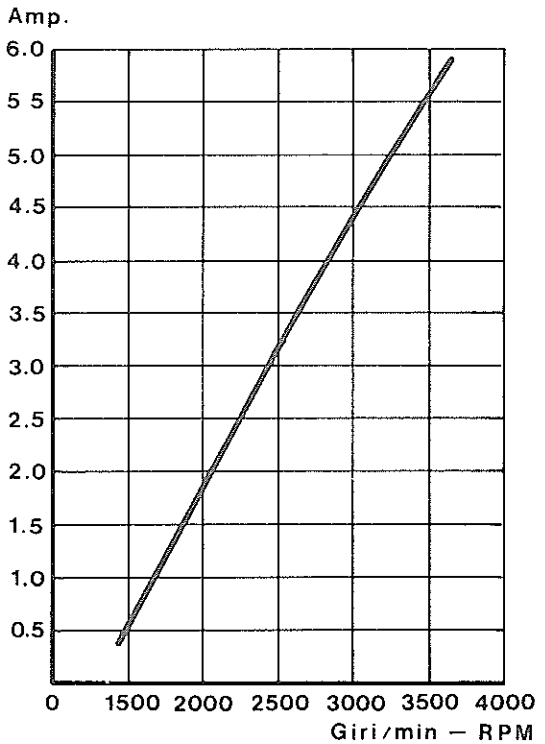
The rectifier should be cheked as follows:

- check the connections;
- connect an Ampmeter 10 A between the positive pole of the battery and the positive terminal of the rectifier;
- connect between the battery poles a Voltmeter 20V;
- 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 diagrams at fig. 75 and fig. 76 show the trends of the current intensities 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 connected to the system, while engine is running.



Engines from serial No A/425001

76

STARTING MOTOR (STARTER)

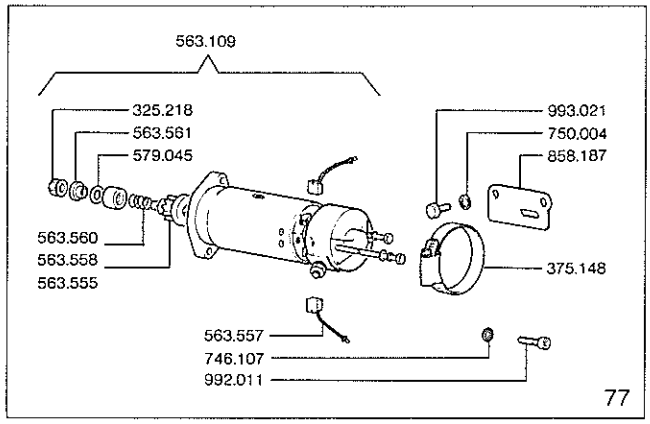
The starter is SJCE type PN1 12V-0.15 kW.
The fig. 72 shows the parts of the starter.
The ones with code numbers, are available as spare parts.

BATTERY

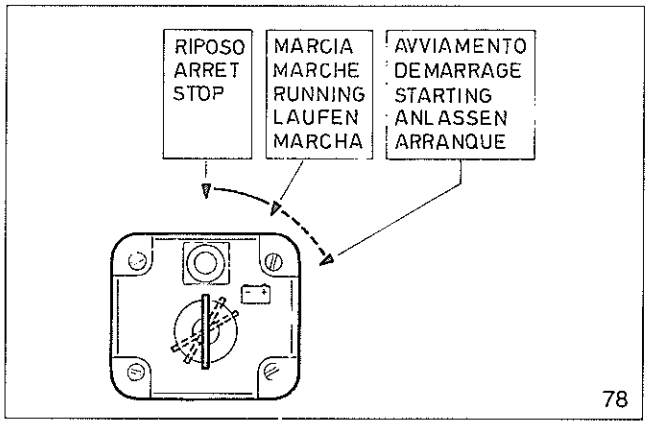
The recommended battery is 12V with a capacity of 20 Ah.
The battery capacity is according to the room temperature therefore, for low temperatures, batteries of higher capacity are required.
The level of the liquid in the battery should be about 5 mm (0.20 in) above the plates.

STARTING PANEL

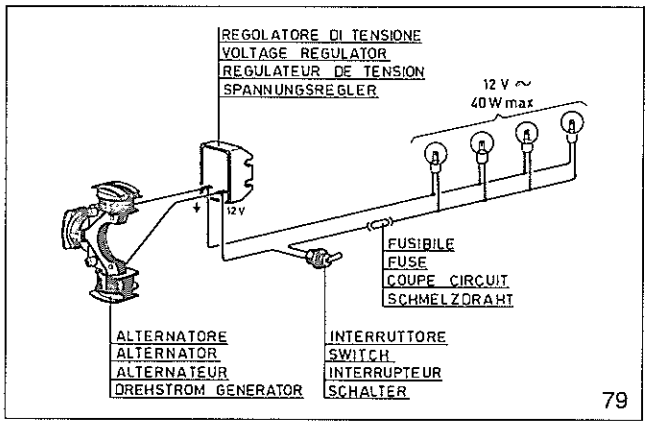
The fig. 78 shows the various positions of the starting key. As to the connections of the wires to the panel, see the fig. 73 and fig. 74.
The first position of the key clockwise, activates the battery charging circuit, the second position activates the starter.
When the engine is running, the key has 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 switchs off, sommething is wrong in the battery charging system.**



77



78



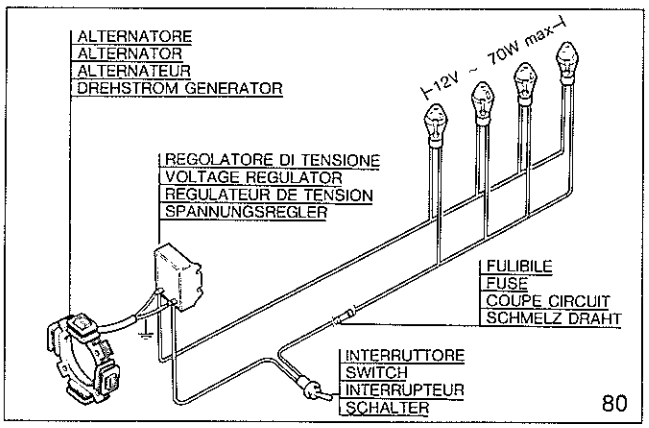
79

7.3 LIGHTING SYSTEM BY ALTERNATOR

Drawing of the plant:
fig. 79 for engines up to serial No. A/425000
fig. 80 for engines from serial No. A/425001

System check

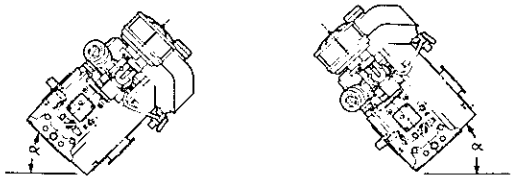
Apply a load by turning on lights for an absorption of
— 35/40W for engines up to serial No. A/425000
— 60/70W for engines from serial No. A/425001;
start the engine and bring it to the maximum speed (3,600 RPM); the outlet voltage should be approximately 12V.
Insert an Ampmeter with a scale of 5A between 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.



80

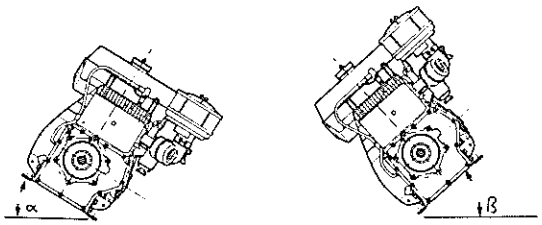
8 INSTALLATION

8.1 WORKING LIMIT BENDING (fig. 81-82)



LONGITUDINALLY	
Discontinuous service	α = 45°
Continuous service	α = 40°

81

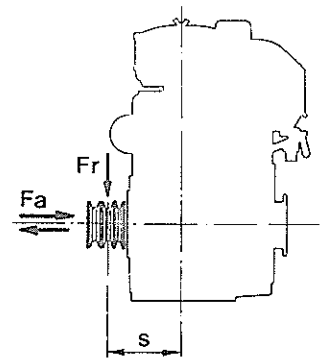


TRANSVERSALLY		
Discontinuous service	α = 35°	β = 45°
Continuous service	α = 30°	β = 40°

82

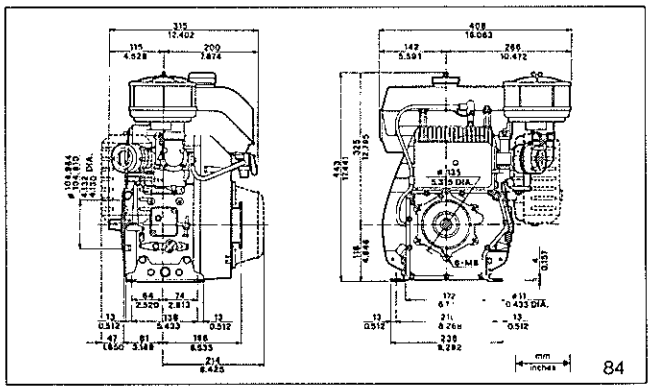
8.2 AXIAL LOAD RADIAL LOAD AND MAXIMUM OVERHANG

The axial thrust in both senses Fa (fig. 83), must be less than 250 kg (551 Lb).
The maximum radial load Fr (fig. 83), for belt application, is 80 kg (176 Lb), with a max. overhang «S» from the cylinder axle of 140 mm (5.51 in).
Increasing the overhang «S», reduce the load Fr, so that the bending moment (Fr × S) does not increase.



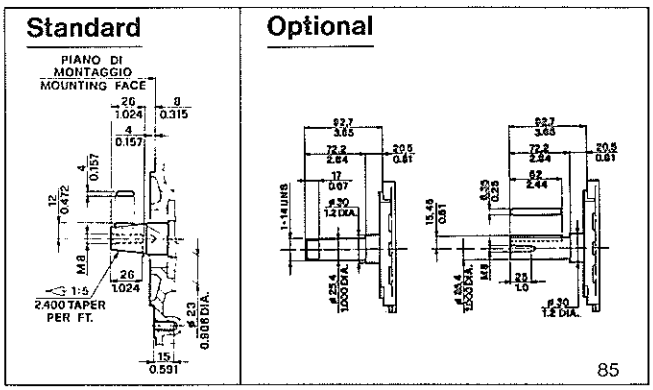
83

8.3 OVERALL DIMENSIONS (fig. 84)

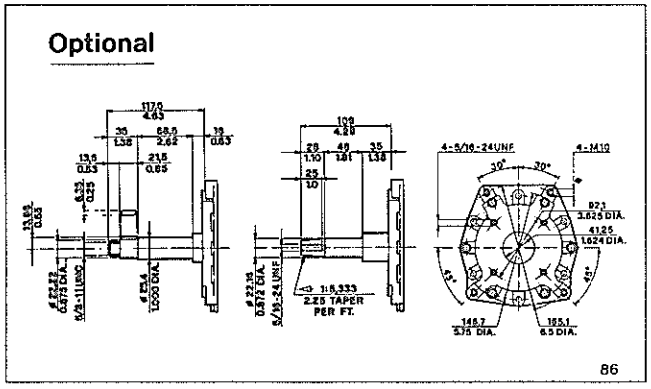


84

8.4 OPTIONAL PTOs AND FLANGES (fig. 85-86)

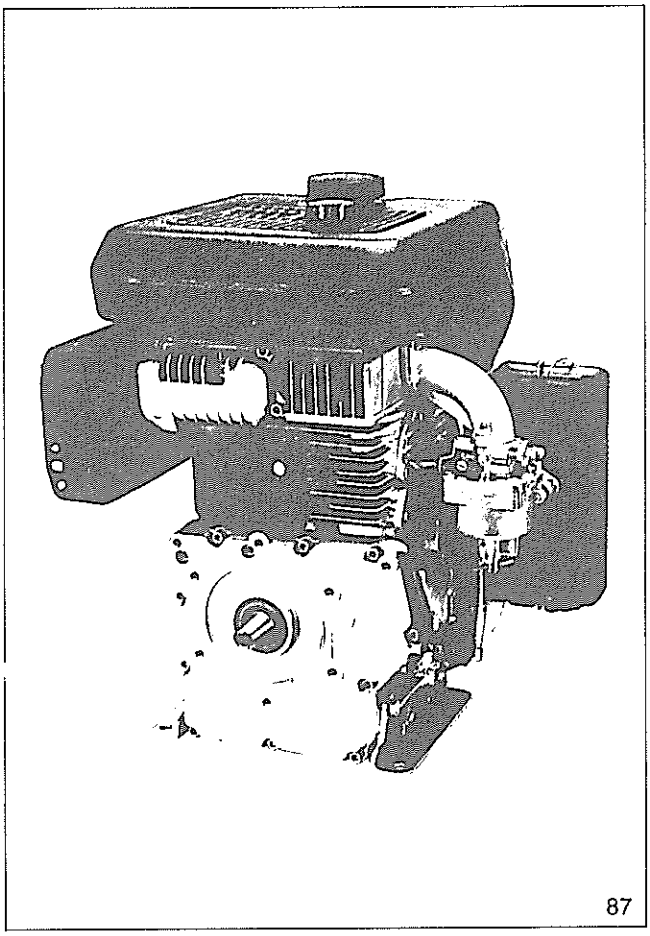


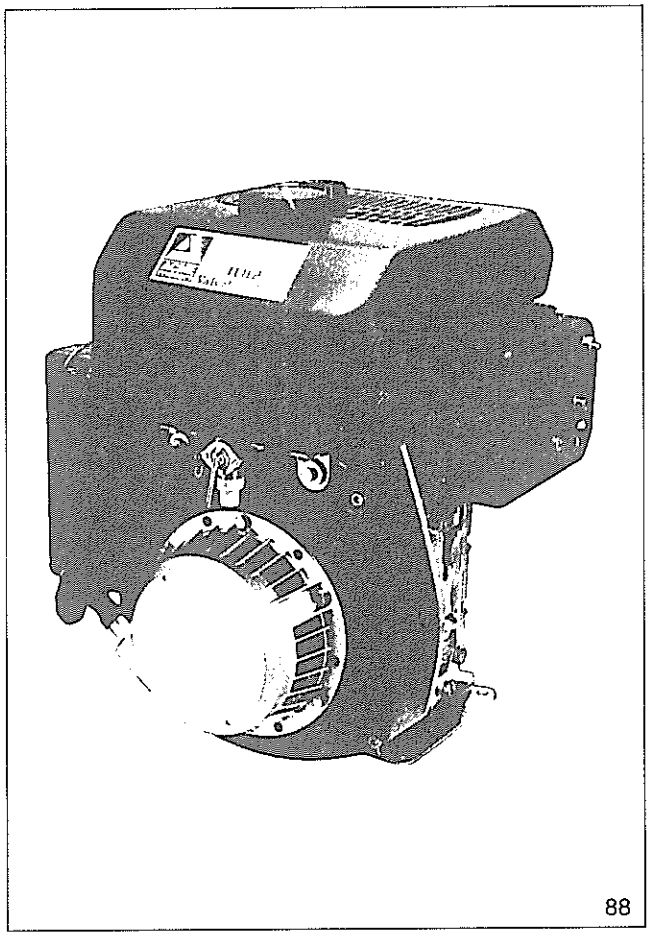
85



86

9 VARIATIONS FOR ENGINES TYPE AT 330 - OHV


87


88

9.1 TECHNICAL FEATURES AT 330 - OHV

ENGINE TYPE	DISPLACEMENT		BORE		STROKE		COMPRESSION RATIO	MAX STANDARD RPM	VALVES ARRENGEMENT
	cm^3	cu.in	mm	in	mm	in			
AT 330	327	19.95	80	3.15	65	2.56	7.5:1	3,600	OHV

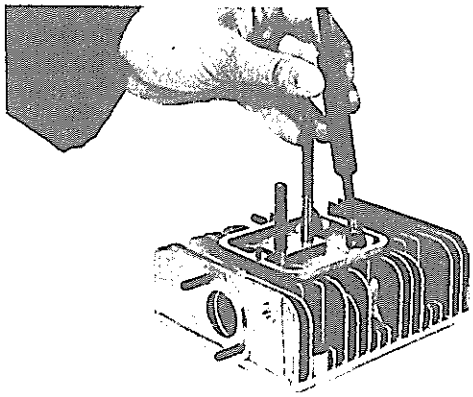
9.2 CYLINDER HEAD

It is made of aluminium alloy with inserted valve seats wich are made of special cast iron of high nickel content to make them more heat resistant.

Original as well as replacement valve guides are made of special perlitic cast iron (intake) and bronze (exhaust). To check wear between valve and guide, use a go no-go internal gauge n. 2 page 3 (fig. 89).

Internal valve guides diameter after assembly in the engine have the following values:

min.	**7.015 mm**	**0.2762 in**
max.	**7.015 mm**	**0.2762 in**

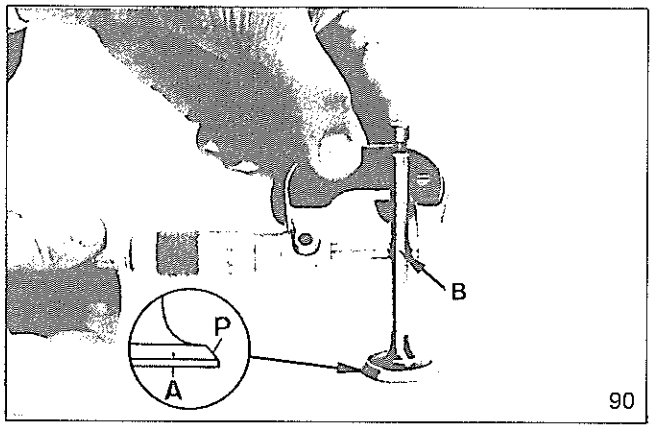


89

ACME valve guides gauge diameter:

go	**7.015 mm**	**0.2762 in**
no-go	**7.097 mm**	**0.2794 in**

Should clearance exceed, replace with new guides. The valve guides can be removed from the cylinder head by using a driver, after removing the retaining clips.

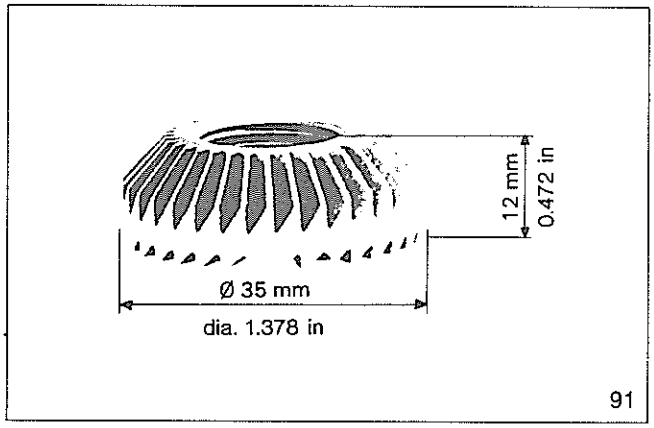


90

Valve condition is checked according to A and B values indicated in fig. 90.

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°.

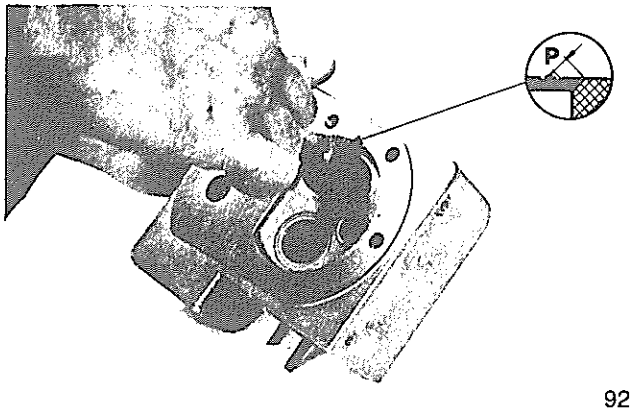
VALVES NOMINAL DIAMETERS B					
Exhaust valve			Inlet valve		
max.	6.970 mm	(0.2744 in)	max.	6.970 mm	(0.2744 in)
min.	6.955 mm	(0.2738 in)	min.	6.955 mm	(0.2738 in)



91

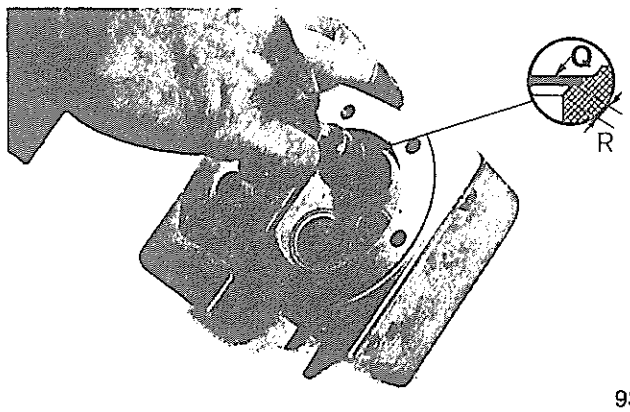
To regrind use a conical 45° valve grinding tool (fig. 91).

Due to prolonged use of the engine, tapping of valves on seats at high temperature hardnes track P (fig. 92) and makes hand grinding impossible.
It is therefore necessary to remove the hardened layer with a 45° grinding tool, employing a mechanical grinder.



92

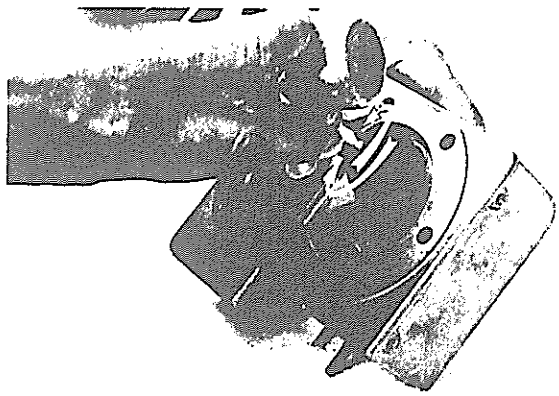
The final ajustment can be made by hand with the above illustreted hand grinder. Valves seat regrinding implies widening of track R. Should R be wider than 2 mm (0.079 in), lower plane Q (fig. 93) till R is **from 1.2 to 1.3 mm (from 0.047 to 0.051 in).**



93

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. 94).

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

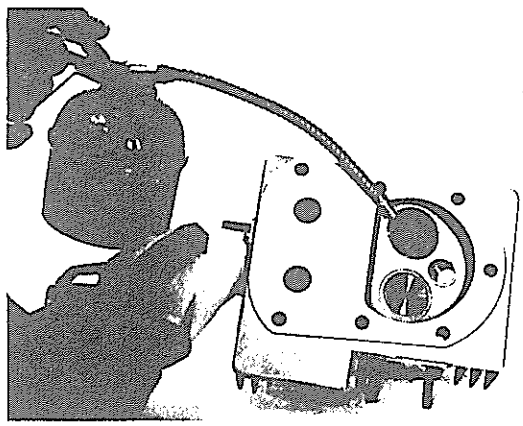


94

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

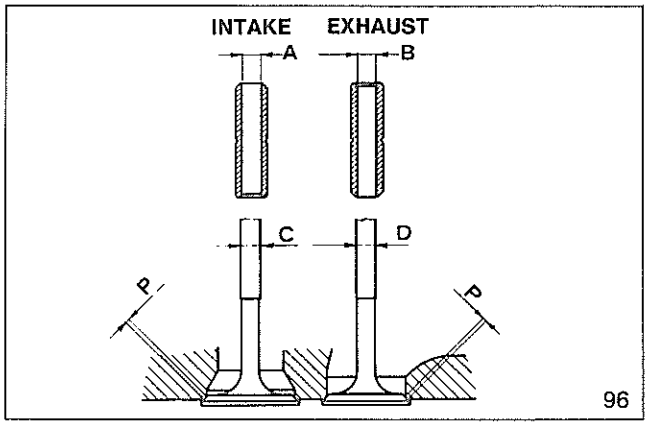
1) Mount the valve on the cylinder head with spring and stop cap.
2) Pour some oil drops around the valve head.
3) Blow compressed air in the duct, making sure to plug the sides of the duct to avoid air leaks (fig. 95).

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



95

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 follows 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.

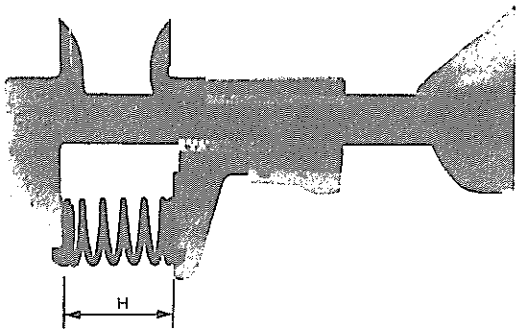


96

Valve guides and seats dimensions after assembly in the head (fig. 96).

DIMENSION	NOMINAL mm (in)	LIMIT mm (in)
A	7.0150 / 7.0250 (0.2762 / 0.2766)	7.0970 (0.2794)
B	7.0150 / 7.0250 (0.2762 / 0.2766)	7.0970 (0.2794)
C	6.9550 / 6.9700 (0.2738 / 0.2744)	— —
D	6.9550 / 6.9700 (0.2738 / 0.2744)	— —
P	1.2000 / 1.3000 (0.0472 / 0.0512)	2.0000 (0.0787)

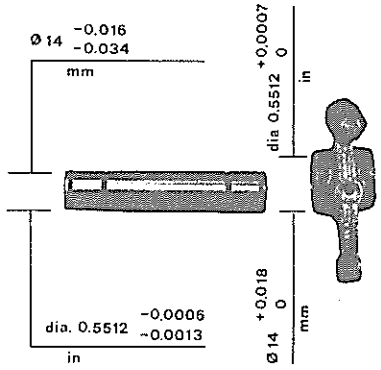
Change spring if H is lower than 35 mm (1.38 in); 37.5 mm (1.48 in) is the measurement of new spring (fig. 97). Make sure that the max play between tappet and guide is 0.045 mm (0.0018 in) and no scratches can be seen on the stem and on the head in touch with the camshaft. In the negative replace the tappets.



97

9.3 ROCKER ARMS

Check whether wear between rocker arms and pin is more than 0.15 mm (0.0059 in).
If it is, replace pin and rocker arms (fig. 98).



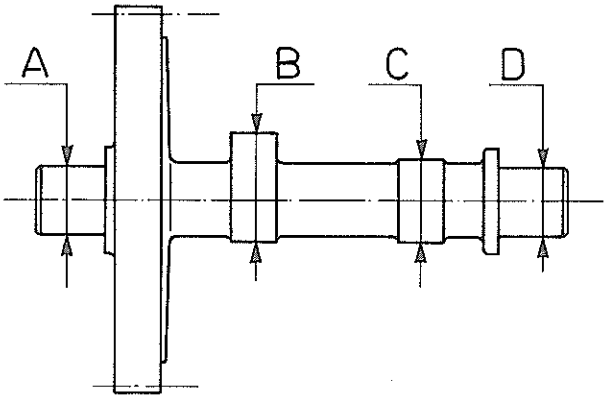
98

9.4 CAMSHAFT

Make sure that 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. 99.

A special camshaft, with centrifugal compression release, is mounted in the engines having electric starter or the recoil starter or both as indicated at pag. 24. This device makes starting easier, delaying the exhaust valve closing and it is disconnected automatically as soon as the engine starts. Check that the centrifugal mass glides properly, the spring is in the correct position and the projection A (fig. 72) of the rod on the cam is the following when the device is working:

0.5 / 0.6 mm	0.020 / 0.024 in



A mm (in)		B mm (in)		C mm (in)		D mm (in)	
min	max	min	max	min	max	min	max
15.973 (0.6289)	15.984 (0.6293)	26.290 (1.0350)	26.320 (1.0362)	19.590 (0.7713)	19.620 (0.7724)	15.973 (0.6289)	15.984 (0.6293)

99

9.5 CARBURETOR AT 330 - OHV

Parts shown at fig. 100

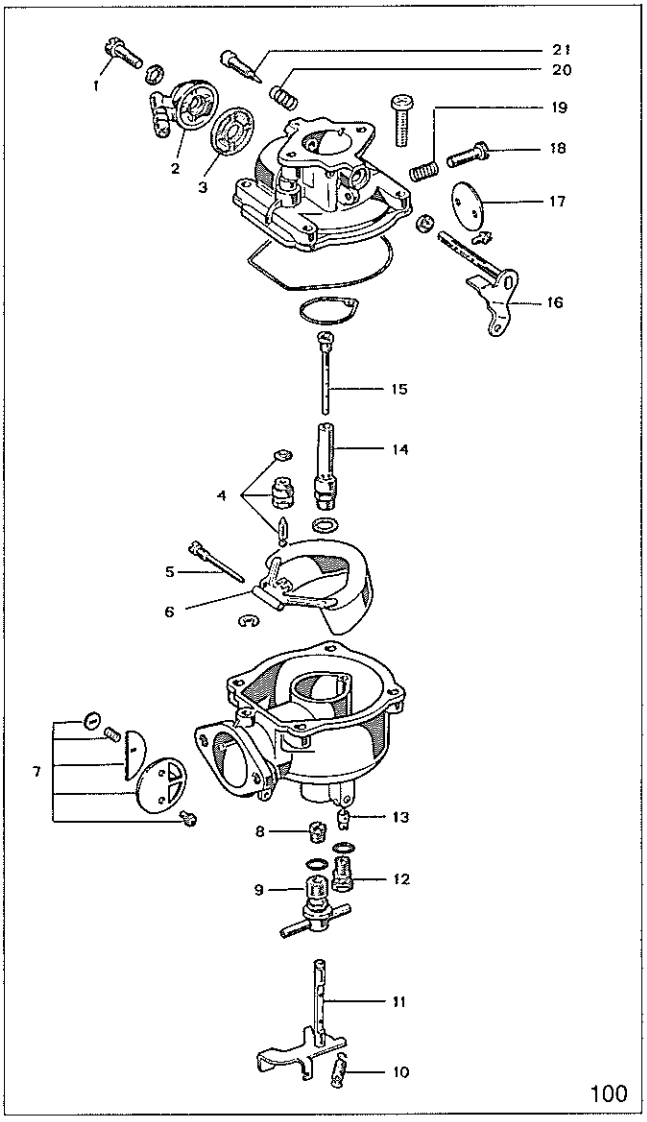
1) Screw - 2) Eyelet - 3) Filter element - 4) Needle valve - 5) Float pin - 6) Float - 7) Choke plate - 8) Main jet - 9) Main jet holder - 10) Choke spring - 11) Choke rod - 12) Idle jet holder - 13) Idle jet - 14) Atomizer holder - 15) Atomizer - 16) Throttle rod - 17) Throttle - 18) Screw - 19) Screw - 20) Spring - 21) Screw.

CARBURETOR CHARACTERISTICS

CARB. MOD.	DIA. DIFF. mm	DIA. THROTTLE mm	DIA. NEEDLE VELVE mm	MAIN JET	IDLE JET	CODE
FVCA 24-19	19	24	2	90	45	155.157

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 sur 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.



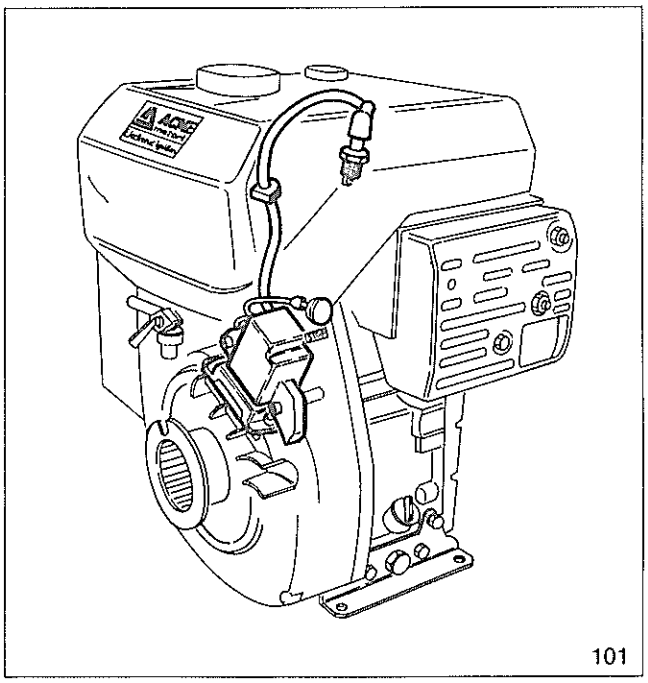
100

9.6 IGNITION

Inductive type electronic ignition (fig. 101) 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:

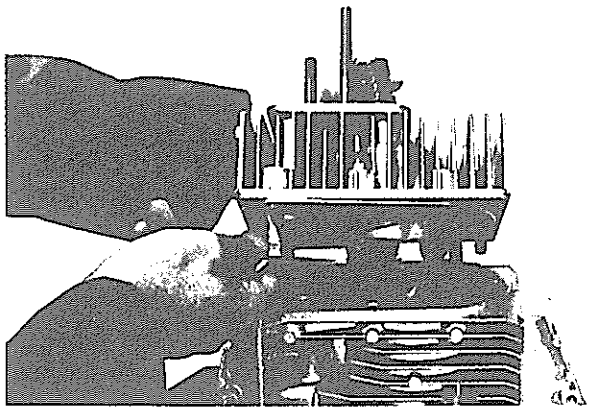
— no maintenance required as there are no moving parts;
— resistant to moisture, water and dust;
— high durability as there no parts subject to deterioration due to mechanical wear;
— stable working and efficiency;
— simple construction as the number of components in the ignition system has been considerably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

Ignition timing is 26° BTDC (44 mm or 1.732 in on the flywheel, see fig. 48 pag. 18) and nonadjustable. For further informations of the operating principles, see par. 4.12 pag. 15.


101

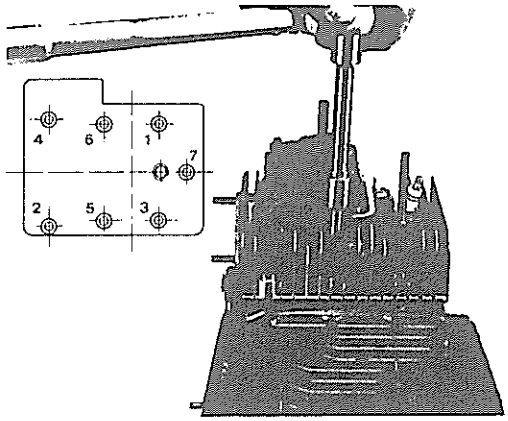
9.7 CYLINDER HEAD ASSEMBLING

A head gasket must be fitted between the head and the cylinder (fig. 102).



102

Each head bolt should be tightened graudally and progressively in the order shown in fig. 103.
About the torque setting, see Tab. 13 pag. 40.



103

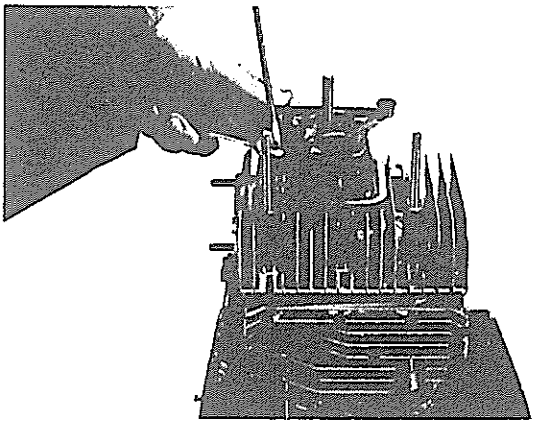
9.8 VALVE CLEARANCE

The clearance between valves and rocker arms with cold engine is:

Inlet	**0.10 mm 0.0039 in**

Exhaust:	**0,15 mm 0.0059 in**

The operation should be carried out with piston at Top Dead Center of compression stroke (fig. 104).



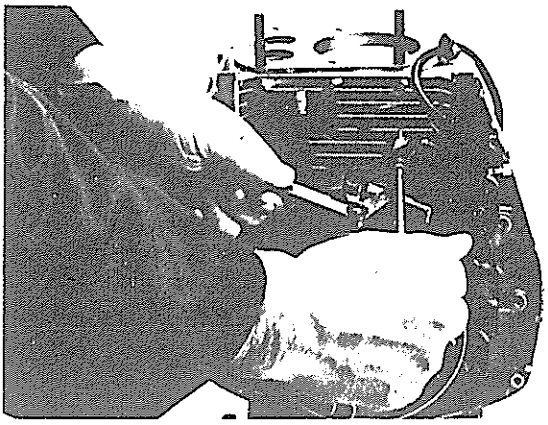
104

9.9 COIL AND MAGNETO

Proceed as follows:

a) mount the coil on the engine block without tightening the screws;
b) mount the flywheel, after checking the integrity of the magneto and the validity of its fixing on the flywheel;
c) use the feeler gauge positioned between the coil and the magneto to adjust the correct value of the air gap at **0.45 / 0.50 mm (0.018/0.020 in).** Then lock the coil by tightening the screws at a value of

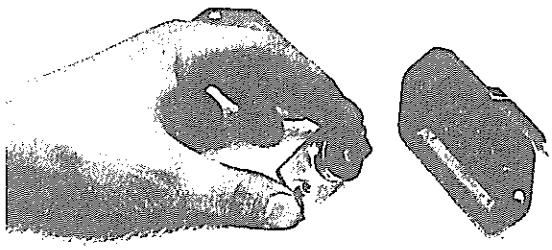
11.8 Nm (1.2 kgm) (8.7 ft-lbs) (fig. 105).



105

9.10 CRANKCASE BREATHER

The crankcase breather is located on the tappets cover. It is a small valve designed to maintain the pressure of the crankcase that assists lubrication. Check the valve and the gasket, before mounting on the crankcase (fig. 106).



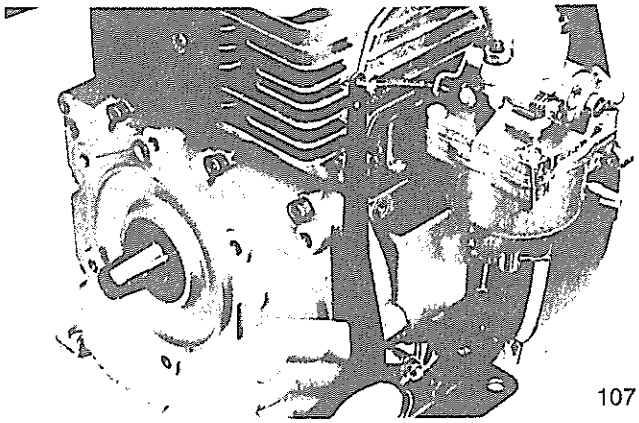
106

9.11 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 timing cover without tightening the locking screw completely (fig. 107);

b) mount the carburetor on the engine, by inserting the gasket. Connect the outher lever of the governor to the throttle rod of the carburetor by means of the relevant tie-rod, to the ends of which the spring to take up slack is hooked (fig. 107); hook the governor spring to the outer governor lever and to the accelerator lever, as shown in fig. 65 pag. 22.

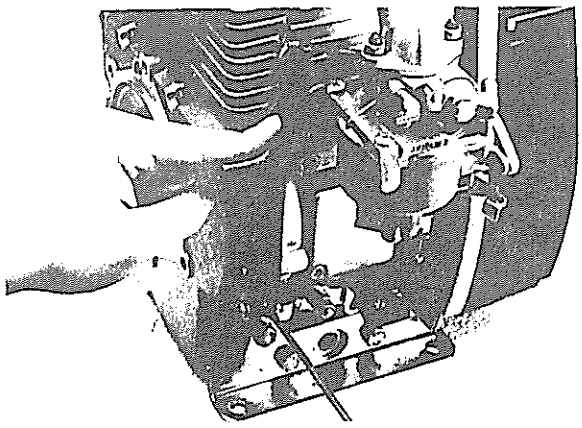


107

9.12 GOVERNING SYSTEM ADJUSTMENT

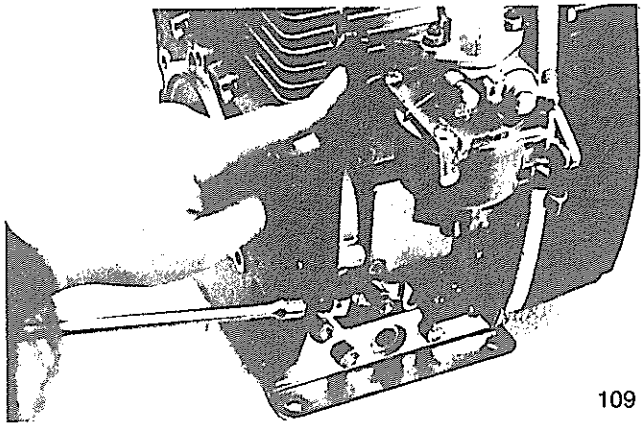
Proceed as follow:

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 timing cover and rotate it clockwise, holding it in its position of end of stroke. At same time, with the other hand position the accelerator throttle on its max. opening (fig. 108);



108

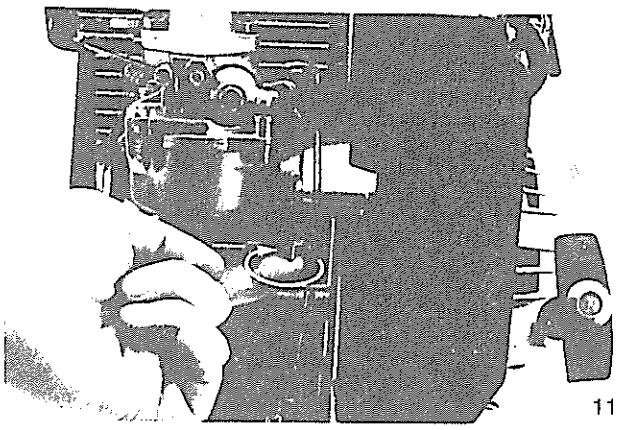
b) by keeping the positions of the point a), tighten the locking screw of the outer lever of the governor on the pivot of the inner lever coming out of the timing cover (fig. 109).



109

9.13 ENGINE TEST

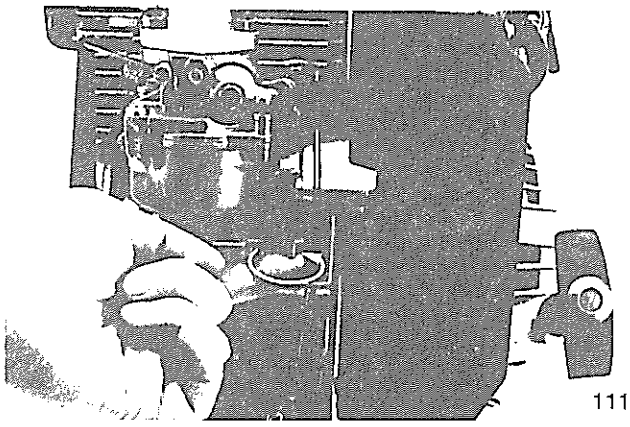
Fix the engine on a base or on the machine. Check the oil level in the sump (and in the air filter if oil bath type) and the fuel in the tank.


110

9.14 ROPE OR RECOIL STARTING

a) Cold.
Close the choke (fig. 110) and position the accelerator approx. at its half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting. As soon as the engine has started, open the choke (fig. 111).

b) Hot.
Do not touch the choke: simply position the accelerator at its minimum or half stroke. Give the rope a determined pull, after winding the rope on the pulley in case of rope starting.

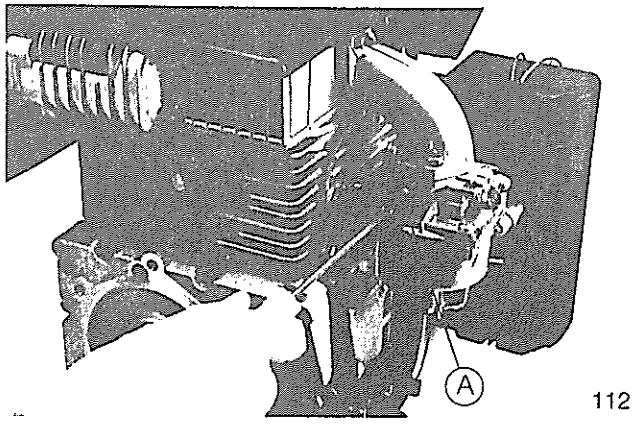

111

9.15 ELECTRIC STARTING

Before using the key or the push-button for starting, make sure that all connections are positive, expecially 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, proceed as above.

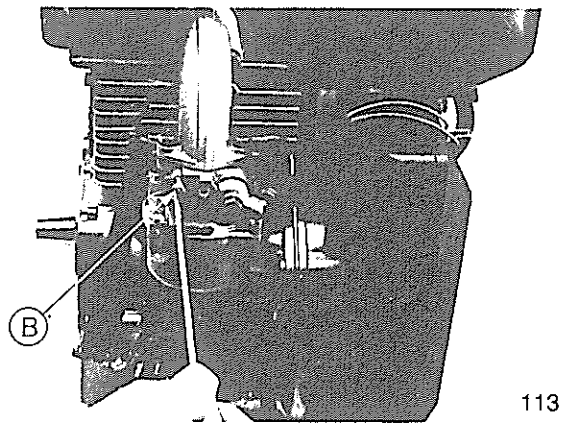
9.16 CARBURETOR AND SPEED ADJUSTMENTS

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 2,000 R.P.M. approx. Keep the engine at its slow running and fix it at 1,000/1,100 R.P.M., by turning the screw A (fig. 112).



112

Gently tighten the screw B and loosen it slowly of 1 ½ turns (approx.), looking for the position where the engine working is must regular (fig. 113). 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 1,000/1,100 R.P.M. Then adjust the max. running dipending on the different applications as shown on fig. 70 pag. 23.



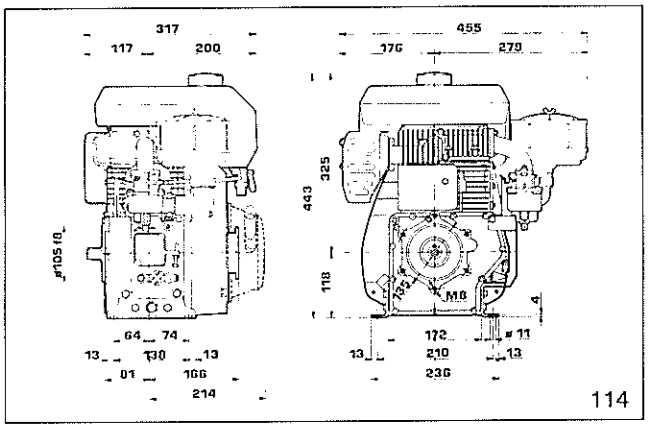
113

9.17 ELECTRIC STARTING BY MOTOR

For drawings and informations about characteristics and checkings, please refer to the system used on the engines series ALN from the engine serial No. A/425001 par. 7.2 pag. 25 (fig. 74-76-77-78).

9.18 LIGHTING SYSTEM BY ALTERNATOR

For drawing and checking, please refer to the system used on the engines series ALN from the engine serial No. A/425001 par. 7.3 pag. 27 (fig. 80).



9.19 OVERALL DIMENSIONS (fig. 114)

9.20 OPTIONAL PTOs AND FLANGES

see par. 8.4 pag. 29.

10 CARBURETORS CHARACTERISTICS

10.1 MAIN JETS AND CARBURETORS USED FOR VARIOUS AIR CLEANERS, STARTING FROM ENGINE SERIAL No. A/396788.

ENGINE TYPE	AIR CLEANER		CARBURETOR		IDLE JET		MAIN JET	
	Type	Part-No.	Type	Part-No.	Size	Part-No.	Size	Part-No.
ALN 290 WB ●	MORANDI MC 070	387.140	PM 25/20	155.150	55	431.102	95	431.007
	FBN 521	387.103	PM 25/20	155.152	55	431.102	110	431.118
	FBN 521 CP	387.111	PM 25/20	155.152	55	431.102	110	431.118
	DRY TYPE	387.143	PM 25/20	155.130	55	431.102	90	431.008
ALN 290 WB V ● ● ● ●	DRY TYPE	387.148	PM 25/20	155.151	55	431.102	100	431.010
ALN 290 WP ● ●	MORANDI MC 070	387.140	PM 25/18	155.145	55	431.102	95	431.007
	FBN 521	387.103	PM 25/18	155.148	55	431.102	105	431.103
	FBN 521 CP	387.111	PM 25/18	155.148	55	431.102	105	431.103
	DRY TYPE	387.143	PM 25/18	155.145	55	431.102	95	431.007
ALN 290 WGPL ● ● ●	MORANDI MC 070	387.140	PM 25/18	155.154	55	431.102	95	431.007
ALN 330 WB ●	MORANDI NM 040	387.141	PM 25/20	155.151	55	431.102	100	431.010
	MORANDI MC 070	387.140	PM 25/20	155.130	55	431.102	90	431.008
	FBN 521	387.103	PM 25/20	155.153	55	431.102	115	431.119
	FBN 521 CP	387.111	PM 25/20	155.153	55	431.102	115	431.119
	DRY TYPE	387.143	PM 25/20	155.150	55	431.102	95	431.007
ALN 330 WB V ● ● ● ●	DRY TYPE	387.148	PM 25/20	155.156	55	431.102	105	431.103
ALN 330 WP ● ●	MORANDI NM 040	387.141	PM 25/18	155.147	55	431.102	100	431.010
	MORANDI MC 070	387.140	PM 25/18	155.140	55	431.102	100	431.010
	FBN	387.103	PM 25/18	155.149	55	431.102	110	431.118
	FBN 521 CP	387.111	PM 25/18	155.149	55	431.102	110	431.118
	DRY TYPE	387.143	PM 25/18	155.147	55	431.102	100	431.010
ALN 330 WGPL ● ● ●	MORANDI NM 040	387.141	PM 25/20	155.155	55	431.102	100	431.010

On the engine equipped with PM 25 carburetors fed by gasoline or L.P.G. up to serial No. A/396787, the main jets were 0.05 mm smaller (F.E. size 95 instead of size 100).

10.2 MAIN JETS AND CARBURETORS USED FOR VARIOUS AIR CLEANERS, STARTING FROM ENGINE SERIAL No. A/425001.

ENGINE TYPE	AIR CLEANER		CARBURETOR		IDLE JET		MAIN JET	
	Type	Part-No.	Type	Part-No.	Size	Part-No.	Size	Part-No.
ALN 290 WB ●	MC 070	387.140	PM 25/20 N	155.159	55	431.102	90	431.113
	FBN 521	387.103	PM 25/20 N	155.170	55	431.102	115	431.119
	FBN 521 CP	387.111	PM 25/20 N	155.162	55	431.102	105	431.103
	DRY TYPE	387.143	PM 25/20 N	155.159	55	431.102	90	431.113
ALN 290 WB V ● ● ● ●	DRY TYPE	387.148	PM 25/20 N	155.161	55	431.102	100	431.010
ALN 290 WP ● ●	MC 070	387.140	PM 25/18 N	155.163	55	431.102	90	431.113
	FBN 521	387.103	PM 25/18 N	155.164	55	431.102	100	431.010
	FBN 521 CP	387.111	PM 25/18 N	155.164	55	431.102	100	431.010
	DRY TYPE	387.143	PM 25/18 N	155.163	55	431.102	90	431.113
ALN 290 WGPL ● ● ●	MC 070	387.140	PM 25/20 N	155.161	55	431.102	100	431.010
ALN 330 WB ●	MC 070	387.140	PM 25/20 N	155.160	55	431.102	95	431.007
	NM 040	387.141	PM 25/20 N	155.161	55	431.102	100	431.010
	FBN 521	387.103	PM 25/20 N	155.170	55	431.102	115	431.119
	FBN 521 CP	387.111	PM 25/20 N	155.162	55	431.102	105	431.103
	DRY TYPE	387.143	PM 25/20 N	155.179	55	431.102	92,5	431.114
ALN 330 WB V ● ● ● ●	DRY TYPE	387.148	PM 25/20 N	155.161	55	431.102	100	431.010
ALN 330 WP ● ●	NM 040	387.141	PM 25/18 N	155.163	55	431.102	90	431.113
	MC 070	387.140	PM 25/18 N	155.163	55	431.102	90	431.113
	FBN 521	387.103	PM 25/18 N	155.164	55	431.102	100	431.010
	FBN 521 CP	387.111	PM 25/18 N	155.164	55	431.102	100	431.010
	DRY TYPE	387.143	PM 25/18 N	155.163	55	431.102	90	431.113
ALN 330 WGPL ● ● ●	NM 040	387.141	PM 25/20 N	155.162	55	431.102	105	431.103

NOTE:
● Gasoline feeding engines
● ● Kerosene feeding engines
● ● ● L.P.G. feeding engines
● ● ● ● Vertical shaft engines

Engines manufactured in special version may not follow the previous listed data. In these cases, please contact the Service Departement.

11 PISTON-CYLINDER OVERSIZE TABLE

ENGINE	NOMINAL			FIRST RE-BORING			SECOND RE-BORING		
	Ø mm	dia. in	Piston code	Ø mm	dia in	Piston code	Ø mm	dia. in	Piston code
ALN 215 W	65 +0.013 0	2.56 +0.0005 0	A2016	65.5 +0.013 0	2.58 +0.0005 0	A2017	66 +0.013 0	2.60 +0.0005 0	A2018
ALN 290 W	75 +0.013 0	2.95 +0.0005 0	A2037	75.5 +0.013 0	2.97 +0.0005 0	A2038	76 +0.013 0	2.99 +0.0005 0	A2039
ALN 330 W AT 330	80 +0.013 0	3.15 +0.0005 0	A2406	80.5 +0.013 0	3.17 +0.0005 0	A2407	81 +0.013 0	3.19 +0.0005 0	A2408

ATTENTION: The code numbers indicated refer to pistons complete with rings and pin.

12 TOLERANCES OF CRANKSHAFT JOURNAL GRINDINGS

NOMINAL			FIRST GRINDING			SECOND GRINDING			THIRD GRINDING		
Ø mm	dia. in	Code	Ø mm	dia. in	Code	Ø mm	dia. in	Code	Ø mm	dia. in	Code
min. 29.985 max. 30.000	1.1805 1.1811	A2417	min. 29.735 max. 29.750	1.1707 1.1713	A2418	min. 29.485 max. 29.500	1.1608 1.1614	A2419	min. 29.235 max. 29.250	1.1510 1.1516	A2420

ATTENTION: Code (Parts) numbers refer to complete connecting rods.

13 CLEARANCES AND ADJUSTMENTS TABLE

POSITION		Min. (mm)	Max. (mm)	Min. (in)	Max. (in)
Valve guide and stem AT 330	Inlet and exhaust	0.045	0.070	0.0018	0.0028
Valve guide and stem ALN 215W/290W/330W	Inlet	0.013	0.057	0.0005	0.0022
	Exhaust	0.030	0.067	0.0012	0.0026
Piston and small end hole of connecting rod		0.016	0.039	0.0006	0.0015
Piston and pin		interference 0.005	0.005	interference 0.0002	0.0025
Connecting rod bearing and crankshaft journal		0.040	0.064	0.0016	0.0025
Cold valves clearance		0.100	0.150	0.0040	0.0060
Breaker points gap		0.400	0.500	0.0157	0.0197
Gap between ignition coil and flywheel (electronic ignition)		0.450	0.500	0.0177	0.0197
Spark plug electrodes gap		0.600	0.800	0.0240	0.0310
Distance between ends of compression rings		0.300	0.500	0.0118	0.0197
Distance between ends of scraper ring (oil ring)		0.250	0.500	0.0098	0.0197

14 TORQUE SETTING

POSITION	Bolt Size	Nm	Kgm	Ft-lbs
Timing cover	M6	14.7	1.5	10.9
Connecting rod cap	M6	16.7	1.7	12.3
Cylinder head	M8	29.4	3.0	21.8
Fan cowl	M6	9.8	1.0	7.3
Engine mount	M8	15.7	1.6	11.6
Flywheel	M18 x 1.5	157.0	16.8	115.8
Coil	M6	11.8	1.2	8.7
Breather cover (ALN electronic ignition and AT 330)	M6	2.9	0.3	2.2

15 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	Consumes oil	Overheats	Does not accel.	Hunts	Loses oil from breather	Spark plug fails to spark
Tank plug breather clogged		●										
Tap clogged		●	●						●			
Carburetor venting holes obstructed		●	●				●					
Fuel line plugged up	●		●						●			
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 valves play			●	●						●		
Defective oil seals								●			●	
Worn valve guides			●	●		●				●		
Worn governor spring							●			●		
Piston seizure			●		●			●		●		
Loose head locking-nuts	●		●							●		
Low idling		●										