

**USER'S
HANDBOOK**

Villiers

LIGHTWEIGHT RANGE

50 c.c. 75 c.c. 125 c.c. 150 c.c.

HORIZONTAL SHAFT

AND

150 c.c.

VERTICAL SHAFT

FOUR - STROKE ENGINES

THE VILLIERS ENGINEERING COMPANY LTD

Marston Road

Wolverhampton

IMPORTANT

Prior to despatch all engines are fully tested and the carburation and engine speed are set to suit the particular machine in which it will be used; therefore no subsequent adjustments should be made, in fact, efficiency of operation will be impaired if maker's settings are interfered with.

Always use fresh petrol of a good grade. Never fill up with petrol which has been standing in a can for several months as gum may form and clog carburetter filters and jets.

Introduction

THE engines dealt with in this book, like all Villiers products, are precision built; every part conforming rigidly to standards of the highest quality. Provided proper care and attention is given to the simple routine maintenance suggested in these pages, your engine, which is the heart of the machine in which it is installed, will give many years efficient and trouble-free service.

Keep this book handy for consultation when required.

Because of the fine limits to which these engines are made and assembled you are advised to entrust major overhauling to your nearest Official Service Depot* or to the Manufacturer of your machine, both of whom have the full facilities of Villiers Service Organisation at their disposal.

Important

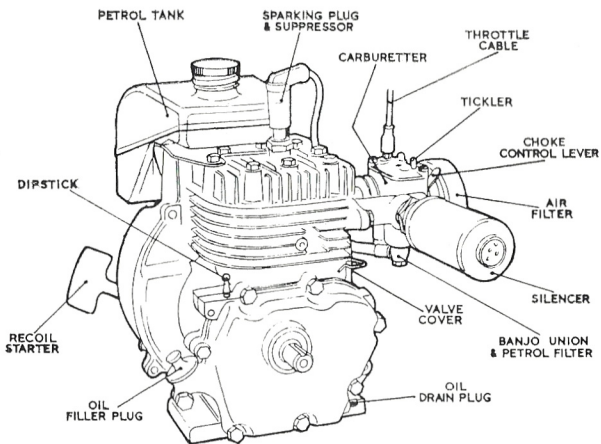
The serial numbers stamped on the engine should always be quoted when enquiries are made to either Official Service Depots or Villiers Service Department.

** The name and address of your nearest Service Depot will be advised upon application to us.*

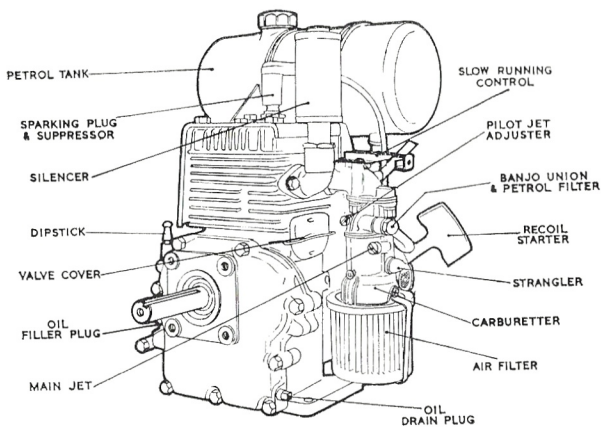
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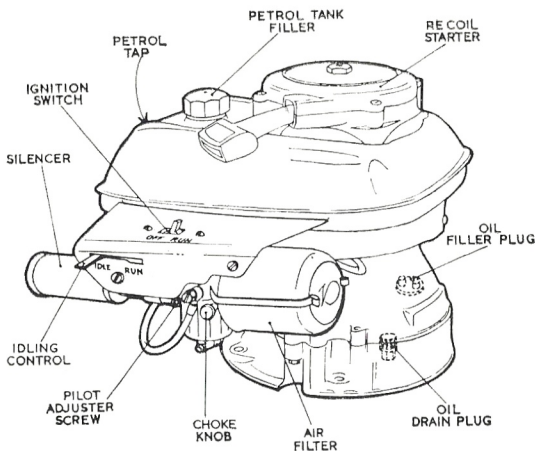
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VILLIERS, WOLVERHAMPTON



50 c.c. or 75 c.c. Engine



125 c.c. or 150 c.c. Horizontal Shaft Engine



150 c.c. Vertical Shaft Engine

LIGHTWEIGHT ENGINE RANGE

Before Starting

Remove filler plug from sump and pour in oil, Castrol XL (SAE30) until it reaches *bottom* of filler orifice thread. Where dipstick is fitted fill to notch. *Do not overfill.* Replace filler plug. The four horizontal shaft engines have a rubber plug made secure by the use of a hidden expander ring; therefore, before removing the plug, the knurled knob must be unscrewed and pressed in to release the ring and allow the plug to be removed effortlessly. To replace the plug, hold squarely over orifice and, with a twisting motion, gently press it home. **PULL UP** the knurled knob to engage the expander ring and screw firmly. It is most important, if excessive wear is to be avoided, that no dust or abrasive foreign matter enters the engine, therefore, keep the filler plug and orifice clean and use only clean containers to hold the lubricating oil.

The engine must be reasonably level (horizontal) when filling or checking oil level to avoid a false indication of the amount of oil it contains.

Starting

Open the petrol tap and close the air strangler (or choke) by operating the lever or knob, as the case may be, on the side of the carburettor body.

If carburetter has a hand throttle control open the throttle one third of the full travel of the lever. If idling control is fitted move lever to "RUN" position. If an ignition switch is provided move to "ON" or "RUN" before operating the starter.

Pull the handle of the re-coil starter until engine is just over one compression—allow rope to return fully then pull handle once more until the ratchet pawl is felt to be in engagement—now rest the free hand on the engine, well clear of the starter, so as to have solid support, and give a brisk pull to provide sufficient impetus for engine to start. Keep the handle of the starter under control and allow rope to rewind—if suddenly released damage can be caused.

As engine warms up gradually open the choke to its full extent. Adjust the throttle lever to give the required speed on ungoverned engines.

The S.10 carburetter has a "tickler" fitted to the top cover in order to flood the float-chamber thus giving a very rich mixture for starting under extremely cold conditions. When re-starting an engine, still hot from previous running, the carburetter must not be flooded, by operating the "tickler", and it is normally unwise to use the "choke" except perhaps momentarily on governed engines where the throttle fully opens as the engine comes to rest. If idling control is fitted set in "idle" position to start.

Failure to Start

Should the engine fail to start after a reasonable number of attempts the cause of the trouble should be ascertained by a systematic check. Refer to "Fault Finding Guide" on page 13.

Difficulty in starting the vertical shaft engine may be due to the drag of the cutter in long grass—this can be avoided by starting the engine on a portion of grass that has already been cut.

Stopping

The engine is stopped by switching ignition off, on engines possessing a switch, otherwise by fully closing the throttle. Turn off petrol tap to prevent possibility of petrol wastage if engine is to be left unattended.

Recommended Grades of Oil

When air temperature is below 16°F. use Wakefield Castrolite (S.A.E. 20).

Between 16°F. and 90°F. use Castrol XL (S.A.E. 30).

Above 90°F. use Castrol XXL (S.A.E. 40).

ROUTINE ATTENTION

Lubrication

Frequently check the oil level and top up when found to be below end of dipstick (where fitted) or below bottom of filler orifice. After the first 5 hours running drain out the old oil and replace with new, thereafter change oil at intervals of 25 hours operation; this operation is more readily and efficiently carried out when the engine is warm, directly after a run, when the oil will flow freely from the drain in the sump. Ensure that the drain plug washer, on engines fitted with this, is in good condition so that an oil-tight joint is made when the plug is replaced and sump filled with new engine oil.

Air Filter

Either a paper element or oil wetted steel gauze type is used. The *paper filter* may be removed at intervals and dust or grit on the outside blown off. Under no circumstances should any attempt be made to wash the paper element. If engine runs better without the filter then a new element is due—do not, however, operate the engine without a filter otherwise air drawn in through the carburetter will deposit abrasive dust and other foreign matter on the cylinder wall and result in rapid wear.

The oil wetted *steel gauze filter* should be unclipped from the carburetter at regular intervals and washed in petrol or paraffin. After washing shake out the cleaning fluid and immerse filter in engine oil. Allow excessive oil to drain and wipe clean before replacing air filter on carburetter body.

Cooling System

Cooling air is drawn through a rotating gauze which must be kept free from grass cuttings or any matter which might impede the flow of air. Cylinder fin surfaces must be kept clean and free from foreign matter to ensure adequate cooling.

Petrol Filters

Two gauze filters are fitted—one on the tap, inside the petrol tank, and one in the “banjo” connection between the pipe and the carburetter.

The filter inside the “banjo” union can be examined by removing the securing bolt after the petrol tap has been turned off, but the filter on the tap is visible only when the tap itself is removed. This is best done when tank is empty so that any residue left in the tank can be swilled out.

Sparking Plug

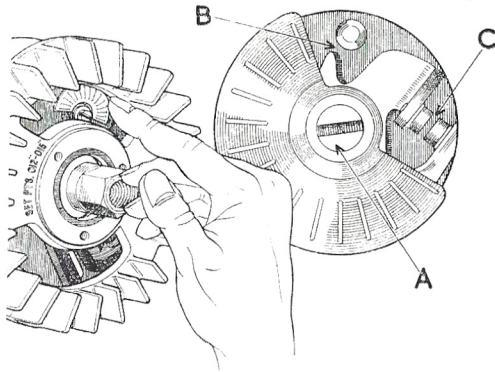
Keep the outside of the plug clean by occasional wiping with a dry rag. After each 100 hours operation unscrew the plug, clean off all deposits of carbon and re-set the point gap to $\cdot 020''$. Do not allow the plug thread to be damaged in any way and ensure that it is clean before replacing plug into cylinder head.

If the thread is in good condition and is clean, the plug can be screwed right up without the use of much force, but any grit on the thread may cause it to seize—therefore any stiffness felt when screwing in should be investigated.

Contact Breaker

Check the points for cleanliness and for correct clearance when in fully open position. Access is possible through one of the apertures in the flywheel after the recoil starter if fitted and auxiliary pulley are removed.

The cover over the points can be revolved with a screwdriver blade to fully expose the mechanism illustrated below.



Turn flywheel clockwise until the heel of the rocker arm is on top of the profile of the cam attached to the flywheel boss. Should point gap be less than $\cdot 012''$ or more than $\cdot 015''$ release screw "A" about $\frac{1}{8}$ th of a turn and with the blade of a screwdriver placed between the point bracket and dimple at "B" close or open the gap "C" until a feeler gauge can just be inserted without force.

Ignition Timing

The contact breaker points are timed to commence opening when the piston is slightly before top dead centre, the correct measurement for each engine being shown in the Data on page 15. However, when each engine is built at the manufacturers an arrow is stamped on the rim of the flywheel to line up with a small "vee" shaped rib cast on the underside of the horizontal flange of the cowl backplate when the piston is at top dead centre, thus making it possible to time the ignition correctly when replacing the flywheel if for any reason it has been taken off. The cam operating the rocker arm is part of the flywheel centre which is secured to a taper on the crankshaft, the flywheel centre nut making a tight fixture.

Should it be necessary to fit a new flywheel which has no markings to give top dead centre, then it will be necessary to first set the piston at its correct timing position. The flywheel is then placed on the taper of the crankshaft and moved clockwise without turning the shaft until the contact breaker points just begin to break. At this point the centre nut must be firmly tightened, the correct torque being 480 lb. ins. After tightening re-check the timing to ensure that the points just begin to break when the piston is in its correct position. Note that the centre nut is imprisoned in the flywheel, thus the action of unscrewing it, turning anti-clockwise, causes the flywheel itself to be withdrawn from the shaft.

Caution:—Always set contact breaker points $\cdot 012''/\cdot 015''$ gap before timing because any variance of gap will affect the timing.

Clean and lightly oil the crankshaft taper before assembly. Occasionally smear a little oil on the cam profile and oil the felt pad which wipes the cam.

Decarbonising

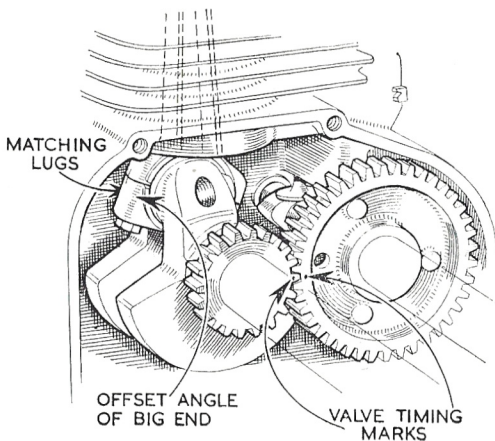
After a long period of use, say 200/300 hours, varying according to conditions and the type of service engine has to perform, a general reduction in efficiency will indicate that a "top overhaul" is due.

This operation involves the removal of the cylinder head, cleaning of piston top, inside cylinder head, valve ports, silencer, valves, valve seats and, possibly, re-grinding of valve seats. Both valves are interchangeable but it is advisable to mark them when dismantling so that they can be returned to the original position in which they have been working. Where special bronze coloured bolts are fitted ensure that they are replaced in original position. Ensure that the clearances between valve stems and tappets are not less than $\cdot 002''$ when engine is re-assembled. Fit a new cylinder head gasket and firmly tighten the bolts, 60 lb. ins. being the correct loading for each bolt on 50 and 75 c.c. and 120 lb. ins. on 125 and 150 c.c. engines.

N.B. The petrol tank and the cylinder head cowl must be removed to allow access to the cylinder. Do not, under any circumstances, unscrew the barrel nut on the air vane adjuster as this has been set by the makers. Unhook the tension spring if it is necessary to disconnect. If, in order to gain access to the tension spring, the engine cowl has to be removed, there is no need to dismantle the recoil starter—this can be taken off with the cowl.

Valve Timing

The crankshaft and camshaft gears of all engines are marked with dots, indicating the correct assembly for valve timing. The illustration below is of the 125 and 150 c.c. engines.



Oil Leaks

The outside of the engine should be kept clean and needs only an occasional wipe over with a rag. If oil leaks develop see that oil level is not too high, check tightness of all nuts and ensure that the valve cover plate joint is oil tight. Some oil will inevitably appear around the “breather valve” but should this develop into a leak it may be necessary to remove the valve pad and ball for cleaning. The “breather valve” is situated inside the valve chest, but it is retained by the cowl backplate and access for cleaning this component is only possible after dismantling. Oil sealing rings are fitted to each end of the crankshaft; therefore if leaks do appear at these points the serviceability of the rings must be suspected after ensuring that oil level in sump is not too high.

Piston Rings

Two compression and one scraper rings are fitted, the gap of a new ring in an unworn cylinder being $.007"/.012"$ for 125 and 150 c.c. and $.006"/.010"$ for the smaller engines. Fit new rings when gaps exceed $.030"$.

The 50 c.c. engine has a taper faced ring fitted in the second groove with the marking 'T' or 'Top' facing the cylinder head.

Connecting Rod

When re-fitting ensure that assembly lugs on big-end are correctly mated and, on the horizontal shaft engines that the "dipper" plate is replaced. The illustration on page 8 shows the correct assembly on 125 and 150 c.c. engines. The loading on each bolt is 24—28 lb. ins. for 50 c.c. and 75 c.c. and 60—70 lb. ins. for 125 and 150 c.c. engines—do not exceed or damage can be caused—a special washer is fitted under the head of each bolt to prevent them from loosening in service. Neither big-end nor small-end is bushed, therefore, if after long service excessive wear is detected the connecting rod must be renewed.

Speed Regulator—Air Vane

This is fitted as standard on 125 and 150 c.c. vertical and horizontal shaft engines. On these engines a control is provided to override the governor and reduce engine revolutions to an idling speed during periods when machine is not actually being operated. Apart from ensuring that the pivot and all joints are free no maintenance is necessary.

Recoil Starter

This must be removed to gain access to the flywheel magneto for contact breaker examination and adjustment if necessary. The vertical shaft engine differs from the other models in the means of securing the starter; in this engine, the backplate is separately mounted and when the cover plate screws are removed, allowing the plate to be taken off, the initial tension on the rope return spring is lost. When replacing the starter the tension on the rope must be restored; this is simply done by gripping the starter firmly and after fully winding the rope on the pulley *anti-clockwise*, turn the pulley by means of the rope handle about $1\frac{1}{2}$ turns and holding the rope at the point of exit from the cover replace the unit on to the backplate.

CARBURETTERS

Type S.10/2—50 c.c. and 75 c.c. Engines (also alternative on 125 c.c. and 150 c.c. Engines)

No external adjustments are provided except to the cable. After loosening the locknut on carburetter top cover the cable adjuster can be screwed in or out to decrease or increase engine idling speed when the control lever is in the shut off position. The cable adjuster and locknut are protected by a moulded rubber water-proof sleeve.

An air cleaner is clipped to the intake of the body; servicing instructions being given on page 5.

At base of carburetter is a domed nut covering the main jet. Very fine deposits of dust may collect here, therefore the nut may be removed on occasions and cleaned. Erratic running could possibly be caused by a blocked main jet; this can be cured by blowing through with compressed air, but do not risk enlarging the jet by trying to pass a wire through it.

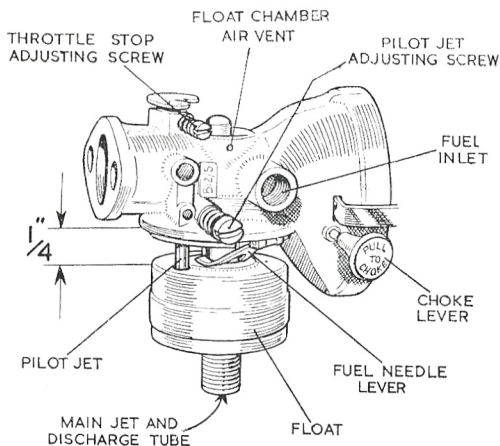
The other attachment to the carburetter base is a banjo union containing a fine wire gauze. The hexagon nut above the union is the seating to the fuel needle which does not need to be removed except for replacement purposes. The fuel needle clipped to the float is extracted from the base of the seating by gently pressing downwards after the carburetter top cover is removed. To replace the fuel needle hold a $\frac{1}{8}$ " pin against the head and gently press the float until the clip springs into the groove provided in the needle.

The throttle cable terminates in a nipple located in a slot in the throttle barrel. The throttle can be removed by closing the lever and by pressing the barrel against the spring so that the cable nipple projects from its location and can be moved sideways into a clearance hole. The taper needle (No. 7) is retained in the throttle by means of an offset grooved plate located in the second notch from top of needle, the grooved plate being held in position by a circlip. As the taper needle operates in the needle jet it follows that the amount of fuel which can pass the jet increases as the throttle is opened, in fact the mixture of air and petrol is governed by the needle between $\frac{1}{4}$ and $\frac{3}{4}$ full throttle opening. Setting the grooved plate into a higher notch in the needle will result in a weaker mixture whilst setting in a lower notch will give a richer mixture over the above mentioned range. A slight adjustment is possible by reversing the plate in the same notch as the plate is dished.

When replacing the top cover care must be taken to see that the taper needle enters the needle jet and the fuel needle into its bush in the cover. The throttle barrel has a slot on one side which passes over a key cast into the body ensuring correct location.

Type B.12/5—150 c.c. Vertical Shaft Engine

The butterfly throttle in this carburetter is connected by lever and linkwork to the air-vane governor. When engine is not running the throttle is wide open, but as it begins to run the pressure of the air, forced by the fan, bears on the vane and progressively closes the throttle as speed increases until the driven load and engine power balance one another. Adjustment of the spring tension to slightly vary governed engine speed is provided by means of a slotted barrel nut. Apart from the choke the only manual control provided is the "IDLE"—"RUN" lever to override the governor and close the throttle to reduce engine revolutions to idling speed—a useful feature when engine is not actually required to drive. A knurled spring-loaded screw on the right-hand side of the carburetter enables mixture adjustments to be made when engine is idling—it should be screwed in or out, not more than $\frac{1}{4}$ turn for each adjustment, until engine revolutions increase to their maximum for this particular throttle position with the smoothest possible running. The initial position for the screw is one complete turn out from the fully closed position. A stop is provided against which the throttle spindle lever rests at idling speed; adjustment, made in conjunction with pilot jet mixture alterations, is by means of a screw threaded into the stop.



TYPE B.12/5 WITH
FLOTT CHAMBER
REMOVED

The float chamber is screwed on the carburetter body, a circular washer making a tight joint. In addition to the float, one end of which is marked "BOTTOM" for correct assembly, the chamber encloses the discharge tube, main jet, pilot jet and fuel needle. The needle operates in a bush, screwed into the body, and a lever held by a hinge pin is set in such a way that the required fuel level is maintained in the carburetter. The figure on preceeding page illustrates the setting of the lever when the float is held gently against it.

The main jet, pilot jet and discharge tube together with the air jet, the latter being screwed into the body behind the strangler plate, can be removed for cleaning. Blocked jets are best cleared by compressed air rather than by means of a wire which may enlarge and thus ruin the jet. Remove and replace the float chamber by hand as undue force exerted by a spanner or pliers will distort the body.

Type B.10/1—125 c.c. and 150 c.c. Horizontal Shaft Engines

Two spring-loaded screws provide the only adjustments to this carburetter, i.e., the throttle stop and the pilot jet adjusting screws. (see illustration in front of book).

The engine speed is governed by an air vane mechanism as in the vertical shaft engine, and when not required to drive, idling speed may be set by an override lever which closes the throttle lever against the adjustable stop screw. The knurled pilot jet adjuster screw, on front of the top half of carburetter, is the means of correcting the petrol-air mixture at slow running. The initial setting for the pilot adjusting screw is two complete turns from the fully screwed-in position; move in or out one quarter of a turn at any one time until engine, when warm, slow runs evenly. If engine "hunts" when off load, try slight adjustments of this screw. Any tendency for engine to fade when load is applied can be counteracted by slightly richening the mixture, i.e., by screwing pilot adjuster screw inwards.

The lower half of the carburetter contains the float, fuel needle, main and pilot jets. The fuel needle is merely held by a spring clip in the float. When assembling, see that the needle locates correctly in the fuel bush at the top and in the guide at base of the carburetter; ensure, also, that the joint washer is replaced between top and bottom halves of body. The main jet is accessible without any dismantling: thus, if suspected of being the cause of "rough" running, it may be removed for examination by unscrewing from the right-hand side of the bottom half of carburetter.

FAULT FINDING GUIDE

Engine will not start

1. Ensure that there is petrol in tank.
2. If petrol is present, filters may be choked.
3. Fuel needle sticking; remove float chamber to gain access.
4. Main jet may be choked—clean by blowing out, but do not use wire as this may enlarge jet.
5. When the engine is warm the mixture can easily be made too rich by incorrect use of strangler causing difficult starting. Float may be punctured or air cleaner choked.
6. Check sparking plug. With lead attached hold plug on top of engine to see if spark is visible when engine is rotated. Clean and adjust point gap to $\cdot 020''$.
7. If no spark can be obtained hold lead about $\frac{3}{8}''$ from cowling. Insulation of lead may be faulty or contact breaker points dirty. Clean contact points and adjust $\cdot 012''/\cdot 015''$ —renew if badly pitted. Condenser or ignition coil or their connections may be faulty. Ignition Switch faulty.

Lack of power

1. Faulty or unsuitable sparking plug.
2. Loss of compression due to:—
 - (i) Leak through cylinder head joint. Slightly tighten bolts or nuts. but take care not to overtighten.
 - (ii) Valves not seating due to insufficient tappet clearance.
 - (iii) Valve sticking in guide. Remove valve and clean off gum or carbon from stem.
 - (iv) Valves not seating correctly. Remove and clean off carbon. Renew valve if seat is badly pitted.
 - (v) Leakage past piston. Piston rings broken or sticking. Remove piston and replace rings or clean ring grooves. Renew piston and/or cylinder if worn.
3. Excessive carbon deposit. Remove cylinder head and scrape off carbon from head and piston. Silencer should also be cleaned.
4. Valve timing incorrect. Check, particularly after overhaul.
5. Ignition timing incorrect. Contact breaker points must commence opening a little before piston reaches top dead centre as stated in Data on page 15.

TEMPORARY STORAGE

Before storing away for the winter or if the engine is not required for a considerable period, the following action should be taken to lessen the risk of corrosion and ensure that engine will start and operate efficiently when next needed :—

1. Turn off petrol tap whilst engine is running so as to completely empty carburetter.
2. Drain all fuel from tank and replace filler cap.
3. Remove sparking plug and squirt a small amount of engine oil into cylinder. Turn engine a few times to ensure a film of oil covers the cylinder wall and replace plug.
4. Cover engine and store in a dry place.

Always Insist on

Genuine  Spares

D A T A

| ENGINE TYPES | Horizontal Shaft | | | Vertical Shaft |
|----------------------------------|--|---------------------------------|---------------------------------|--------------------------------------|
| | 50 c.c. | 75 c.c. | 125 c.c. | |
| BORE and STROKE (mm) | 43 x 34 | 52 x 34 | 58 x 47 | 63 x 47 |
| IGNITION TIMING Before T.D.C. | $\cdot 094''$ ($27\frac{1}{2}^\circ$) | $\cdot 050''$ (20°) | $\cdot 042''$ (15°) | $\cdot 022''$ (11°) |
| CARBURETTER | S.10/2 | | | B.10/1 (or S.10/2) B.12/5 |
| FUEL TANK (pints) | 1 | | | 4 3 $\frac{1}{2}$ |
| OIL SUMP (fl. ozs.) | 10 ($\frac{1}{2}$ pint) | | | 15 ($\frac{3}{4}$ pint) 20 (1 pint) |

Tappet Clearance— $\cdot 002''$ / $\cdot 006''$

Contact Breaker Gap— $\cdot 012''$ / $\cdot 015''$

Air Filters—Oil Wetted Steel Gauze or Paper Element

Sparking Plug—Lodge CN or Champion L.10

Sparking Plug Gap— $\cdot 020''$

GUARANTEE

WE give the following guarantee with VILLIERS Engines and Accessories in place of any implied guarantee by statute or otherwise, all such guarantees being in all cases excluded. No statement or representation contained in this catalogue shall be construed as enlarging or varying this guarantee. In the case of engines and accessories which have been used for "hiring out" purposes, or from which our trade mark, name, or manufacturing number has been removed, no guarantee of any kind is given or is to be implied.

We guarantee subject to the conditions mentioned below, that all precautions which are usual and reasonable have been taken by us to secure excellence of materials and workmanship, but this guarantee is to extend and to be in force for six months only from the date the engines or accessories are purchased by the first owner user, and the damages for which we make ourselves responsible under this guarantee are limited to the replacement of a part manufactured by us which may have proved defective. We cannot accept responsibility for the replacement of any proprietary articles or parts not manufactured by us, unless the makers of these parts agree to replacement. We do not undertake to refit or bear the cost of replacement or refitting such new part.

We guarantee, subject to the conditions mentioned below, to make good at any time within six months any defects in these respects. As VILLIERS Engines and accessories are liable to derangement by neglect or misuse, this guarantee does not apply to defects caused by wear and tear, misuse and neglect.

CONDITIONS OF GUARANTEE

If a defective part should be found in our engines or accessories, it must be sent to us carriage paid and accompanied by an intimation from the sender that he desires to have it repaired free of charge, under our guarantee, and he must also furnish us at the same time with the number of the engine, and full particulars of purchase. Failing compliance with the above, no notice will be taken of anything that may arrive, but such articles will lie here at the risk of the sender, and this guarantee or any implied guarantee shall not be enforceable.

THE TERM "AGENT" is used in a complimentary sense only, and those firms whom we style our agents are not authorised to advertise, incur any debts, or transact any business whatsoever on our account other than the sale of goods which they may purchase from us, nor are they authorised to give any warranty or make any representations on our behalf or sell subject to or with any conditions other than those contained in the above guarantee.

The guarantee becomes void if any parts not made or supplied by THE VILLIERS ENGINEERING COMPANY LTD., are fitted to a VILLIERS engine. To safeguard his own interests, the owner should always insist upon genuine VILLIERS parts.

Villiers

*The Power and the Heart
of a fine machine*