

Villiers Mark 15 Four Stroke Engine Manual (Fitted to Rotary Hoes)

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OPERATING INSTRUCTIONS
AND
SPARE PARTS LIST



MARK 15

Specification 450 A

FOUR-STROKE ENGINE

Fitted to the
ROTARY HOBS

'Bantam'

THE VILLIERS ENGINEERING CO. LTD.
WOLVERHAMPTON, ENGLAND

September, 1956

VEC 65



*The Power and the Heart
of a fine machine*

Printed in England by Clutton Printing Co. Ltd., Clutton Heath, Sussex.
L. & C. R.

ENGINE DATA

Engine	...	...	...	Villiers Mack 15, Specification 460A
Bore	...	...	...	63 mm.
Stroke	...	...	...	47 mm.
Total swept volume	...	...	...	147 c.c.
B.H.P.	...	...	...	2.9 @ 1,000 r.p.m.
Cooling System	...	...	...	Air Cooled
Magneto	...	...	...	Villiers Drybed type
Coilant Breaker Point Gap	...	...	...	.012" ± .015"
Carburettor	...	...	...	Villiers Jetson
Finger Needle	...	...	...	No. 23
Finger Needle Setting	...	...	...	29/32"
Spark plug	...	...	...	Edge type C-14, Gap .018" ± .025"
Fuel tank capacity	...	...	...	1 gallon
Lubricating oil pump capacity	...	...	...	1 pint
Recommended rocker clearance (cold)	...	...	...	Intake .013", Exhaust .016"
Ignition timing	...	...	...	1° B.T.D.C.

BEFORE STARTING THIS ENGINE FOR THE
FIRST TIME CAREFULLY READ PAGES 2 AND 3

ENGINE DATA

Engine	...	...	...	Villiers Mark 5, Specification 460A
Bore	...	...	...	63 mm.
Stroke	...	...	...	47 mm.
Total swept volume	...	...	...	147 c.c.
R.P.M.	...	...	...	2.1 x 3,000 r.p.m.
Cooling System	...	...	...	Air Cooled
Magneto	...	...	...	Villiers flywheel type
Contact Breaker Point Gap	...	...	...	.012" (.015")
Carburettor	...	...	...	Villiers Junior
Taper Needle	...	...	...	No. 37
Taper Needle Setting	...	...	...	28/32"
Spark Plug	...	...	...	Leads Type C.14, Gap .018" (.025")
Fuel tank capacity	...	...	...	1 gallon
Lubricating oil sump capacity	...	...	...	1 pint
Recommended rocker clearance (cold)003", Exhaus. .006"
Ignition timing	1° B.T.D.C.

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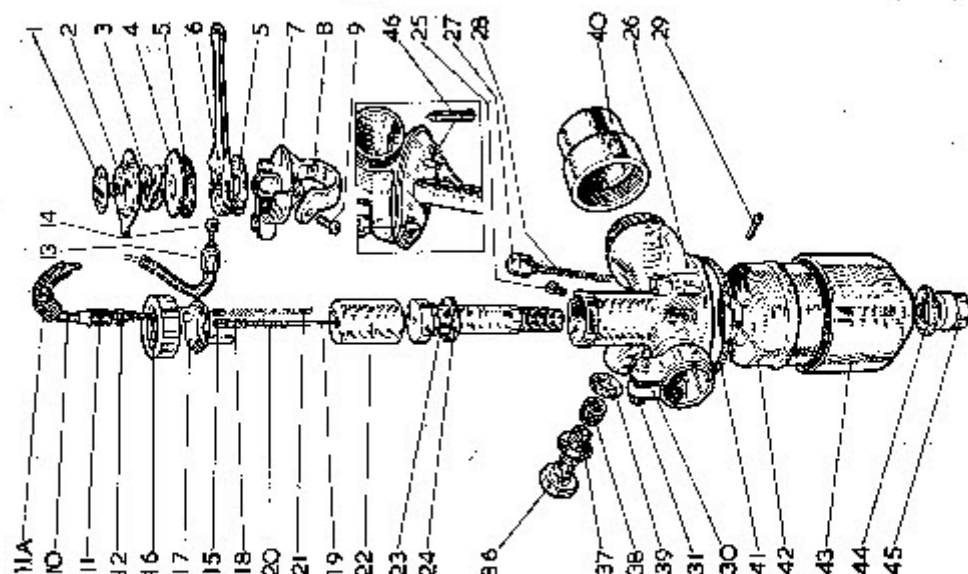
BEFORE STARTING THIS ENGINE FOR THE
FIRST TIME CAREFULLY READ PAGES 2 AND 3

SPARE PARTS LIST FOR VILLIERS Mk. 15 ENGINE

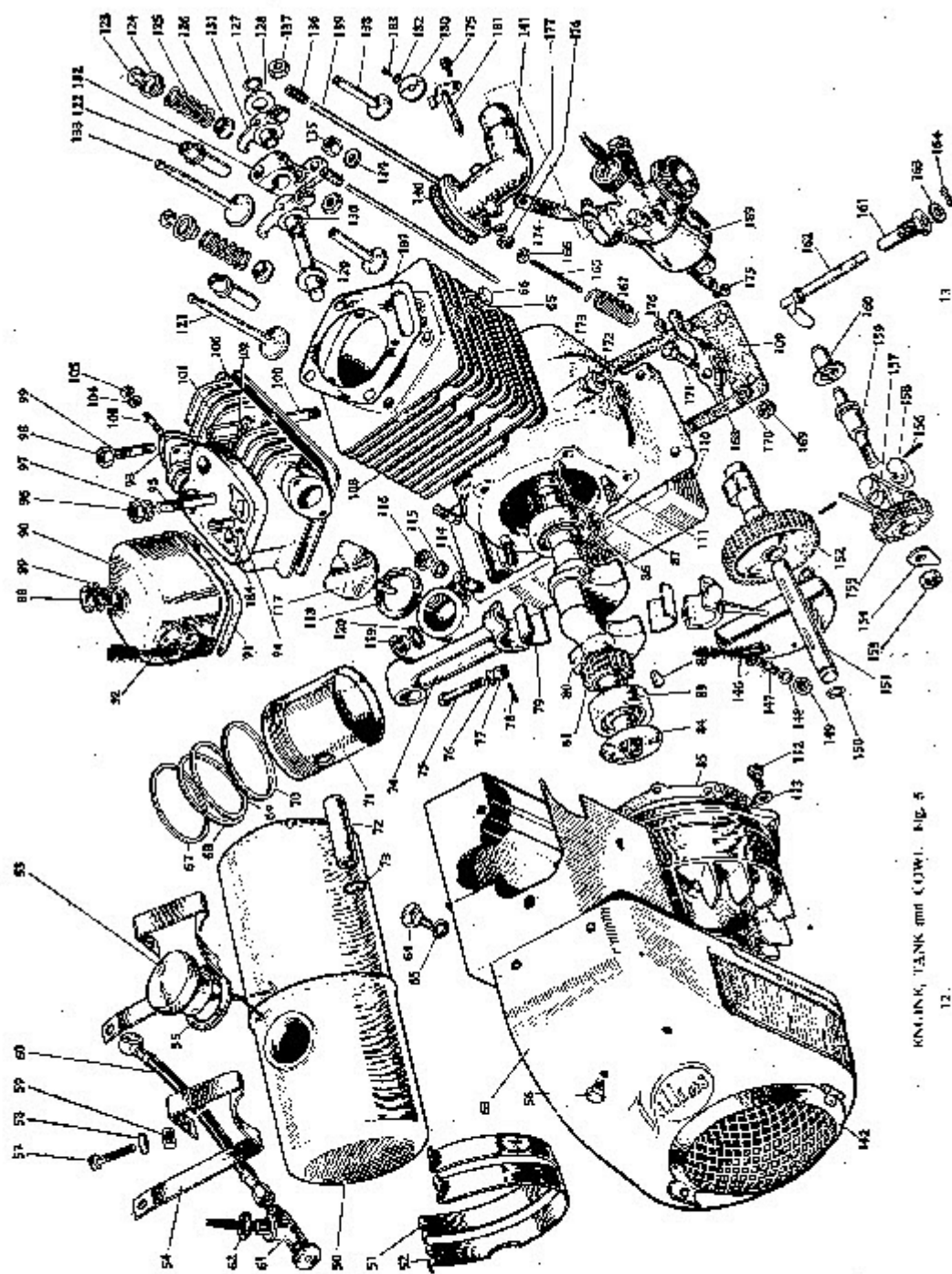
Note: When ordering replacement parts it is important that the engine number is quoted. This will be found on the name plate fixed to the fan casing. Always quote the part number and description, and the illustration number.

CARBURETTOR Fig. 4

ILLU. NO.	PART NO.	DESCRIPTION	NO. OF
1	V-117-SE	Slide, control top cover plate	1
2	V-387	Washer, spring	1
3	V-142-11E	Plate, piston	1
4	V-429K	Washer, piston, floor	1
5	V-142-11E	Lever, carburettor control	1
6	V-406K	Body, carburettor control	1
7	V-406K	Clip, carburettor control body	1
8	V-142-11E	Slide, carburettor control body	1
9	V-142-11E	Slide, carburettor control body	1
10	V-234H-5V	Slide, carburettor control body	1
11	V-108-1E	Adjuster, control cable	1
12	V-162-1E	Spring, cable projector	1
13	V-108-1E	Locking, cable projector	1
14	V-108-1E	Sleeve, control cable	1
15	V-123-15E	Slide, cable, control end	1
16	V-142-11E	Slide, cable, carburettor end	1
17	V-387E	Ring, carburettor top	1
18	V-406E	Disc, carburettor top with guide peg	1
19	V-413E	Adjuster, taper needle	1
20	V-107-7E	Needle, taper No. 25	1
21	V-387E	Slide, taper needle	1
22	V-387E	Slide, taper needle	1
23	V-406E	Slide, taper needle	1
24	V-107-3E	Quarrel, with jet No. 1.120	1
25	V-406E	Washer, filter, counterpoise	1
26	V-424E	Body, counterpoise	1
27	V-406E	Body, carburettor, with fuel needle lever and body	1
28	V-207K	Slide, 103 in.	1
29	V-111-2K	Pin, 3/16	1
30	V-320K	Cap, carburettor body	1
31	V-387E	Slide, carburettor body, clip	1
32	V-387E	Slide, carburettor body, clip	1
33	V-114-4K	Washer, filter, 103 in.	1
34	V-387E	Filter, petrol, in main meter	1
35	V-387E	Washer, filter, 103 in.	1
36	V-387E	Adjuster, carburettor body	1
37	V-107-2E	Washer, filter, front cap joint	1
38	V-107-2E	Cap, fuel	1
39	V-107-2E	Washer, filter, bottom rear	1
40	V-107-2E	Washer, filter, bottom rear	1
41	V-107-2E	Washer, filter, bottom rear	1
42	V-107-2E	Washer, filter, bottom rear	1
43	V-107-2E	Washer, filter, bottom rear	1
44	V-107-2E	Washer, filter, bottom rear	1
45	V-107-2E	Washer, filter, bottom rear	1
46	V-355E	Needle, fuel	1



CARBURETTOR Fig. 4



ENGINE, TANK and COVER. FIG. 5

ENGINE, COWL AND TANK FIG. 5

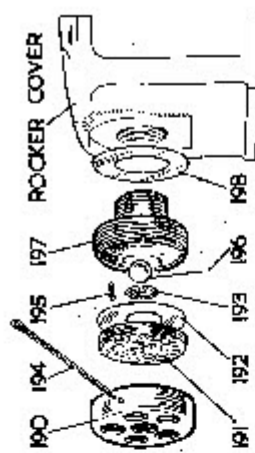
ILLUS. NO.	PART NO.	DESCRIPTION	NO. REQ.
50	CM.1970	Tank, fuel, with filler cap	1
51	FM.1542	Stop, fuel tank	1
52	FM.1715	Stop, petrol tank (with out-let pipe)	1
53	FM.1707	Cap, petrol tank, with sealant FM.1870	1
54	FM.1702	Washer, fuel tank, top	1
55	FM.1870	Washer, petrol tank, top	1
56	FM.1575	Washer, petrol tank, top	1
57	FM.1574	Washer, petrol tank, top	1
58	FM.1570	Washer, petrol tank, top	1
59	FM.1570	Washer, petrol tank, top	1
60	FM.1570	Washer, petrol tank, top	1
61	FM.1570	Washer, petrol tank, top	1
62	FM.1570	Washer, petrol tank, top	1
63	FM.1570	Washer, petrol tank, top	1
64	FM.1570	Washer, petrol tank, top	1
65	FM.1570	Washer, petrol tank, top	1
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80	FM.1570	Washer, petrol tank, top	1
81	FM.1570	Washer, petrol tank, top	1
82	FM.1570	Washer, petrol tank, top	1
83	FM.1570	Washer, petrol tank, top	1
84	FM.1570	Washer, petrol tank, top	1
85	FM.1570	Washer, petrol tank, top	1
86	FM.1570	Washer, petrol tank, top	1
87	FM.1570	Washer, petrol tank, top	1
88	FM.1570	Washer, petrol tank, top	1
89	FM.1570	Washer, petrol tank, top	1
90	FM.1570	Washer, petrol tank, top	1
91	FM.1570	Washer, petrol tank, top	1
92	FM.1570	Washer, petrol tank, top	1
93	FM.1570	Washer, petrol tank, top	1
94	FM.1570	Washer, petrol tank, top	1
95	FM.1570	Washer, petrol tank, top	1

FIG. 5

ILLUS. NO.	PART NO.	DESCRIPTION	NO. REQ.
96	FM.1197	Nut, rocker bracket clamping	1
97	FM.1030	Washer, spring	1
98	FM.1574	Nut, cylinder head	1
99	FM.1559	Stud, roller, cylinder head	1
100	FM.1568	Stud, roller, cylinder head	1
101	FM.1572	Nut, roller, cylinder head	1
102	FM.1567	Washer, roller, cylinder head	1
103	FM.1567	Washer, roller, cylinder head	1
104	FM.1567	Washer, roller, cylinder head	1
105	FM.1565	Nut, roller, cylinder head	1
106	FM.1565	Nut, roller, cylinder head	1
107	FM.1565	Nut, roller, cylinder head	1
108	FM.1565	Nut, roller, cylinder head	1
109	FM.1565	Nut, roller, cylinder head	1
110	FM.1565	Nut, roller, cylinder head	1
111	FM.1565	Nut, roller, cylinder head	1
112	FM.1565	Nut, roller, cylinder head	1
113	FM.1565	Nut, roller, cylinder head	1
114	FM.1565	Nut, roller, cylinder head	1
115	FM.1565	Nut, roller, cylinder head	1
116	FM.1565	Nut, roller, cylinder head	1
117	FM.1565	Nut, roller, cylinder head	1
118	FM.1565	Nut, roller, cylinder head	1
119	FM.1565	Nut, roller, cylinder head	1
120	FM.1565	Nut, roller, cylinder head	1
121	FM.1565	Nut, roller, cylinder head	1
122	FM.1565	Nut, roller, cylinder head	1
123	FM.1565	Nut, roller, cylinder head	1
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141	FM.1565	Nut, roller, cylinder head	1
142	FM.1565	Nut, roller, cylinder head	1
143	FM.1565	Nut, roller, cylinder head	1
144	FM.1565	Nut, roller, cylinder head	1
145	FM.1565	Nut, roller, cylinder head	1
146	FM.1565	Nut, roller, cylinder head	1
147	FM.1565	Nut, roller, cylinder head	1
148	FM.1565	Nut, roller, cylinder head	1
149	FM.1565	Nut, roller, cylinder head	1
150	FM.1565	Nut, roller, cylinder head	1

These items are listed separately and can only be used together

BREATHER VALVE ASSEMBLY FIG. 6



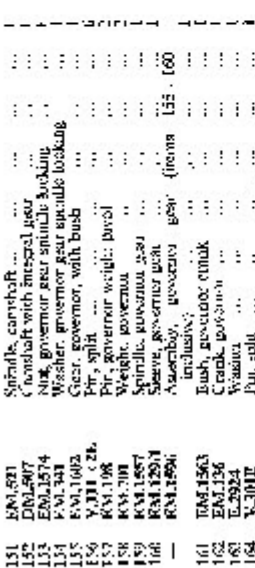
ILLUS. NO.	PART NO.	DESCRIPTION	QTY
190	EN4 1551	Washer, steel used only with EN4 1553	1
191	EN4 1552	Washer, steel used only with EN4 1553	1
192	EN4 1553	Washer, steel used only with EN4 1553	1
193	EN4 1554	Washer, steel used only with EN4 1553	1
194	EN4 1555	Washer, steel used only with EN4 1553	1
195	EN4 1556	Washer, steel used only with EN4 1553	1
196	EN4 1557	Washer, steel used only with EN4 1553	1
197	EN4 1558	Washer, steel used only with EN4 1553	1
198	EN4 1559	Washer, steel used only with EN4 1553	1

MAGNETO FIG. 7

ILLUS. NO.	PART NO.	DESCRIPTION	QTY
200	EN4 1561	Washer, steel used only with EN4 1563	1
201	EN4 1562	Washer, steel used only with EN4 1563	1
202	EN4 1563	Washer, steel used only with EN4 1563	1
203	EN4 1564	Washer, steel used only with EN4 1563	1
204	EN4 1565	Washer, steel used only with EN4 1563	1
205	EN4 1566	Washer, steel used only with EN4 1563	1
206	EN4 1567	Washer, steel used only with EN4 1563	1

(continued on page 18)

BREATHER VALVE ASSEMBLY FIG. 6



ILLUS. NO.	PART NO.	DESCRIPTION	QTY
190	EN4 1551	Washer, steel used only with EN4 1553	1
191	EN4 1552	Washer, steel used only with EN4 1553	1
192	EN4 1553	Washer, steel used only with EN4 1553	1
193	EN4 1554	Washer, steel used only with EN4 1553	1
194	EN4 1555	Washer, steel used only with EN4 1553	1
195	EN4 1556	Washer, steel used only with EN4 1553	1
196	EN4 1557	Washer, steel used only with EN4 1553	1
197	EN4 1558	Washer, steel used only with EN4 1553	1
198	EN4 1559	Washer, steel used only with EN4 1553	1

The following four components, which bearing part of the Engine Unit, are supplied by the Manufacturer of the engine, to whom application should be made for replacement: —

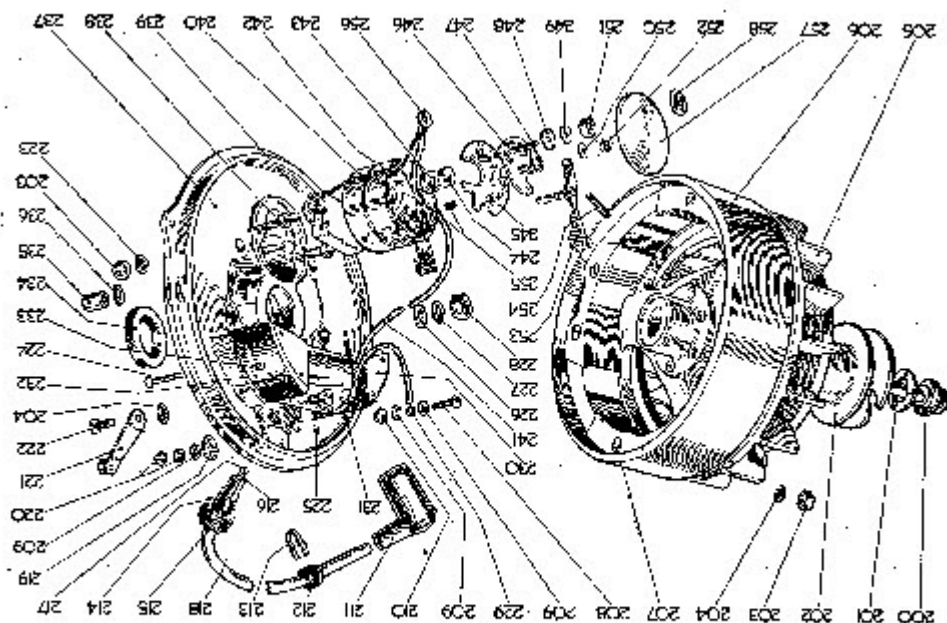
ILLUS. NO.	PART NO.	DESCRIPTION	QTY
200	EN4 1561	Washer, steel used only with EN4 1563	1
201	EN4 1562	Washer, steel used only with EN4 1563	1
202	EN4 1563	Washer, steel used only with EN4 1563	1
203	EN4 1564	Washer, steel used only with EN4 1563	1
204	EN4 1565	Washer, steel used only with EN4 1563	1
205	EN4 1566	Washer, steel used only with EN4 1563	1
206	EN4 1567	Washer, steel used only with EN4 1563	1

TOOLING, etc.

ILLUS. NO.	PART NO.	DESCRIPTION	QTY
200	EN4 1561	Washer, steel used only with EN4 1563	1
201	EN4 1562	Washer, steel used only with EN4 1563	1
202	EN4 1563	Washer, steel used only with EN4 1563	1
203	EN4 1564	Washer, steel used only with EN4 1563	1
204	EN4 1565	Washer, steel used only with EN4 1563	1
205	EN4 1566	Washer, steel used only with EN4 1563	1
206	EN4 1567	Washer, steel used only with EN4 1563	1

207	M1707K	Screw, pole piece and fan fixing
208	M1609B	Screw, air-out contact
209	L113 x 5/8	Washer, air-out contact
210	L013 x 1/4	Bush, air-out contact, insulation
211	Lodge M.14	Plug, cover and clamp screw
212	M-7860L	Grounded, H.T. cable
213	L20071	Clamp, H.T. cable
214	F360	Washer, felt H.T. terminal
215	L124 x 9/16	Terminal, H.T.
216	L001 x 1/16	Spring, H.T. terminal pad
217	M1790JC	Screw, spring fixing (not lubricated)
218	L046 x 1/16	Washer, H.T. terminal
219	M1603Z	Washer, H.T. 114" cut piece (see plug cover, clip and previous)
220	M-1001	Washer, insulating, cut-out contact
221	L086 x 3/8	Nut, cut-out terminal screw
222	L089 x 3/8	Switch, ignition cut-out
223	L002 x 1/16	Screw, cut-out switch
224	M1709A	Washer, spring
225	L081 x 1/16	Screw, coil cover fixing
226	L081 x 1/16	Screw, condenser plate/crankcase
227	L081 x 1/16	Washer, plain, armature fixing stud
228	L081 x 1/16	Washer, spring, armature fixing stud
229	L081 x 1/16	Nut, spring to plate fixing
230	L081 x 1/16	Lead, L.T. (not to cut-out switch)
231	L081 x 1/16	Clamp, left-hand, lamp coil
232	L081 x 1/16	Clamp, right-hand, lamp coil
233	L081 x 1/16	Clamp, right-hand, lamp coil
234	L081 x 1/16	Screw, prob, terminal cut fixing
235	L081 x 1/16	Seal, oil
236	M1742E	Nut, cap, condenser box fixing
237	M-171	Washer, trapez
238	L081 x 1/16	Armature plate assembly with oil and condenser box
239	L081 x 1/16	Nut, condenser box fixing
240	M1750E	Condenser
241	M1750E	Condenser box with condenser
242	M1750E	Condenser box complete (temp 238-239 included)
243	M1750E	Lead, coil to contact breaker
244	M1750E	Bush, lead fixing
245	M1750E	Bush, cam insulating
246	M1750E	Cam, point breaker adjusting
247	M1750E	Plate, adjusting
248	M1750E	Point breaker
249	M1750E	Stud, coil, bracket and cover fixing
250	M1750E	Washer, insulating
251	M1750E	Washer
252	M1750E	Nut, point bracket fixing
253	M1750E	Nut, L.T. and condenser lead fixing
254	M1750E	Reorder pin with point and pad
255	M1750E	Spring, rocker arm
256	M1750E	Bush, point bracket and lead insulating
257	M1750E	Terminal, L.T. and condenser lead
258	M1750E	Corner, condenser box
259	M1750E	Nut, condenser box cover

MAGNETO Fig. 7



Running the MARK 15 ENGINE

INSTALLATION

The engine must be securely fixed in place and be reasonably level, otherwise proper lubrication and the operation of the carburetor are liable to be adversely affected.

BEFORE STARTING (see also "ROUTINE ATTENTION," page 4)

Fill the sump (see Fig. 1) with the recommended grade of oil up to the shoulder of the filler hole. This is level with the shoulder of the dipstick fixed in the filler plug.

The bottom end of the dipstick represents the danger level, and the sump must be replenished before the oil reaches this point.

RECOMMENDED GRADES OF OIL

Engine

For temperatures above 90°F.: Castrol XXL S.A.T.40.

For temperatures 65°F. to 90°F.: Castrol XL S.A.T.30.

For temperatures below 65°F.: Castrolite S.A.T.20.

FUEL

The fuel tank must be filled with good quality petrol.

NOTE:—Do not mix oil and petrol. The lubrication system of this engine is separate from the fuel supply system.

STARTING

When the engine is cold—Open the petrol tap.

Close the vent valve, which is fitted in the air filter.

Set throttle lever 1/3 open.

In very cold weather it may be necessary to flood the carburetor by depressing the tickler cup projecting above the top of the float chamber.

Turn the pulley guard and wheel in starting rope around the starting pulley in a clockwise direction. One end of the rope is placed in the notch provided in the pulley; the knob at the other end of the rope being held in the hand. Give a brisk pull to rotate the engine, pulling the rope clear of the starting pulley.

After starting, open the strainer gradually as the engine warms up, and adjust throttle to give steady tick-over.

Close pulley guard as soon as engine is running.

NOTE:—At extremely low temperatures it is essential that the lighter grade of oil recommended is used. This will enable the engine to rotate quickly enough to start, and also ensure proper circulation of the oil.

It may also be helpful to inject petrol through the squaring plug hole before starting.

When the engine is hot:—Rotate the engine. Do not flood or strangle.

STOPPING

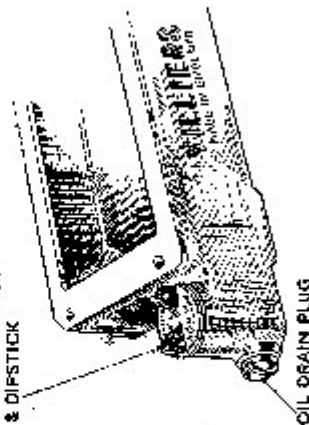
Effect:

Closing the fuel tap will shut off the fuel supply, and the engine will stop as soon as the carburetor float chamber is empty.

Or:—

The ignition system can be switched off by operating the small switch on the back of the acoustic plate, at the rear of the fan casing. Press the small button at the end of the spring strip against the contact stud until the engine has stopped rotating.

OIL FILLER PLUG
& DIPSTICK



OIL DRAIN PLUG

Fig. 1

TRACING TROUBLES

FUEL SYSTEM

Fault	Remedy
No petrol in tank.	Refill.
Petrol pipes choked.	Clean.
Fuel gauge choked.	Clean.
Fuel pump not working.	Remove obstruction by blowing out. WIRE MUST NOT BE USED.
Carburettor flooding.	Clear needle seating in float chamber. bush.
Exhaust too close to engine.	See steering instructions.
Air cleaner choked.	Clean. (See instructions in Machine Handbook).

IGNITION SYSTEM

No spark at plug.	Clean and adjust. If still faulty or new plug.
Faulty ignition cable.	Examine for faulty insulation or loose connections and if necessary renew cable.
Contact points dirty or out of adjustment.	Clean and set points between .012 to .015 gap.
Timing slipped.	Re-align in accordance with instructions on page 6.

LACK OF COMPRESSION

Exhaust head joint leak.	Tighten top cylinder head nuts if slack and/or renew gasket.
Valves not seating due to:—	Adjust rocker clearance.
(a) Fouled or stuck valves.	Remove valve and clean off gum or carbon.
(b) Valve stem sticking in guide.	Remove valve and clean.
(c) Carbon on valve seat.	Remove and clean off carbon.
Leakage past piston due to:—	Replace.
(a) Piston rings sticking.	Return cylinder for re-bore.
(b) Broken piston rings.	
(c) Worn cylinder bore.	

VILLIERS SERVICE REPLACEMENT AND REPAIR ORGANISATION

To enable users to obtain speedy servicing of Villiers Engine Units the following assemblies are obtainable:—

- (1) Engine Unit complete with magnet and carburettor.
- (2) Magnet complete with flywheel.
- (3) Carburettor (see sheet 11002).
- (4) Rebuilt cylinder with oversize piston complete. (The cylinder presented for exchange must be suitable for re-boring to our maximum oversize of .030").
- (5) Genuine Villiers Spare Parts.

Prices and delivery details of replacement assemblies can be obtained from your nearest Dealer, or Villiers Service Dept. or direct from Villiers Service Department, Wolverhampton.

Should it be inconvenient for you to obtain your requirements from your Dealer or Villiers Service Dept. we are prepared to accept complete Engine Unit and Sub-assemblies for repair or replacement. In this event pages 22, 23, should be carefully noted.

TERMS OF BUSINESS

ESTIMATES

If requested at the time of dispatch, we are prepared to give an estimate before proceeding with any repair. This entails a return of labor in dispatching in accordance with our terms will be required, and therefore, in the case of any estimate not being accepted, a charge is made for our mechanic's time in taking down the engine for repair and the re-building, and repair carriage costs.

Estimates must be treated as approximate only. We reserve the right to exclude additional parts should these be found, on further examination or on bench test, or, in the necessary, to make the repair satisfactory.

We do not undertake to fit to engines sent to us for overhaul, such parts as specified by the customer if we consider that extra parts are necessary to make an efficient repair. In such cases, we are prepared to supply the customer's requirements in spare, but we do not undertake to fit them.

IMPORTANT

1.—In correspondence, and when ordering replacement assemblies or parts, always quote the Engine Specification and Serial Number stamped on the plate attached to the engine cowling.

The Engine number is comprised of two parts, the first being the SPECIFICATION Number which is the key to the component parts fitted, and the second being the Engine Serial Number by which the date of manufacture, etc., can be determined, e.g. 4695A/12345.

The Magneto also bears a SPECIFICATION Number (example: R.301A/79), but no Serial Number. The "R" (Rotor or Flywheel), and "A" (Armature Plate) Number is stamped on the base of the Flywheel.

The Carburettor bears no identification marks.

2.—When sending parts for replacement, repair, or set pattern, the name and address of the sender should always be securely attached, and full instructions explaining what is required must also be sent separately by post. In no circumstances should instructions be sent only with the parts as they are liable to be lost or damaged in unpacking.

3.—If an engine is sent for repair, it should be well packed in a strong wooden box. Cracked or a sick is insufficient, and engines so packed are liable to get seriously damaged in transit. Packing cases are not returnable unless specially asked for by the owner at the time of sending to us.

4.—All goods must be consigned to us carriage paid, addressed to "Service Dept." Goods returned by rail are consigned carriage paid.

5.—As we are not manufacturers of complete vehicles or other machines, only the engine, magneto and carburettor should be sent to us. If machines are forwarded an extra charge will be made for dismantling the engine from the machine and returning the components that are not of our manufacture. We cannot undertake to re-fit engines to machines.

6.—We prefer to bench test every repaired engine before returning it to its owner. It is, therefore, always advisable to send the engine complete with its magneto, trucking plate and carburettor.

7.—When forwarding a flywheel magneto for overhaul, send the complete plate and the flywheel complete.

8.—Any engine or sub-assembly sent to our Works for repair and not paid for within 12 months from the date of our estimate will from the date the owner is notified of completion of repair, will be dealt with under The Deposit of Unclaimed Goods Act, 1932.

9.—An extra amount must always be included in remittances to cover the cost of postage or carriage and packing on spare parts. This is 5% extra up to £10 value. Minimum extra is 1/- Stamps cannot be accepted for items over 1/- (one shilling) in value.

10.—When making remittances by telegraphic money order, the name and address of the sender must be included in the space provided on the Post Office Remittance Form for a private message form remitter to payee. To lose this a loss, the Post Office does not give this information upon the telegram.

* Look on
GENTLENESS
Villiers SPARKS

GUARANTEE

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We do not undertake to add or bear the cost of replacement or refitting any new part. We guarantee, subject to the conditions mentioned below, to make good or any time within six months any defects in these pumps. As a condition of sale, the pump and accessories are liable to disengagement 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 engine or accessories, it must be sent to us or carrier paid and accompanied by an indemnity from the tender that he desires to have it replaced 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 any claim that may arise, but, such articles will be here at the risk of the tender, and this guarantee or any implied guarantee shall not be enforceable.

THE TRADE "AGENT" is used in a complimentary sense only, and those firms whom we select as agents are not authorized to acknowledge, incur any debt, or transact any business whatsoever on our account other than the sale of goods which they may purchase from us, nor are they authorized 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.

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ROUTINE ATTENTION

OIL LEVEL

DO NOT REMOVE FILLER PLUG WHILE ENGINE IS RUNNING.

After every eight running hours, the level of oil in the engine sump must be checked, and if necessary topped up with the recommended grade of oil.

The sump must be level when checking and topping up, otherwise an incorrect amount of oil may be put in.

CHANGING THE OIL

After every 100 hours operation, drain all the old oil from the sump by removing the small vented plug fitted at the side. (See Fig. 1).

This is best done when the engine is warm, so the oil will then run out freely. Refill the sump with clean new oil of the correct grade.

NOTES—If the above operation is not carried out at the proper intervals, the running of the engine may be affected, due to excessive wear and the formation of large deposits of carbon.

AIR FILTER

Regular attention to the air filter is required, especially when the engine is operating under dusty conditions. It is important to see that the filter does not become choked, or the engine will lose power and the fuel consumption become excessive.

If the engine runs better without the filter, then the filter needs cleaning.

CLEANING THE BREATHER VALVE

We show on page 17 an illustration of the breather valve assembly which is screwed into the rocker box. After approximately 250 hours running, or more often in severe dusty conditions, the breather valve and cap should be unscrewed in an anti-clockwise direction, and the felt pad taken out and cleaned in petrol. When doing this it is also advisable to clean the pad in the fingers before this is replaced.

Take care to replace the felt retaining washer and split pin. The breather valve body is painted to its rocker cover, and need not be removed. The breather valve ball can be removed after taking out the retaining washers.

Carmen Engines have a grease filter in place of the felt pad, and in this case the steel washer is not fitted. The grease should be cleaned in petrol or paraffin.

MAINTENANCE AND REPAIRS

PETROL FILTER

Occasional examination and cleaning of the filter gauge is desirable. This filter is accessible by unscrewing the brass bolt illus. 3a, fig. 4. There is also a filter incorporated in the petrol tap (illus. 6a, fig. 5).

SPARKING PLUG

Check and re-set the points 3000 rev after each 100 hours operation. Adjustment of the gap should be done by moving the points attached to the outer body of the plug. NEVER ADJUST THE CENTRE PIN. Keep the outside of the plug metal free from water and dirt. When screwing the plug in the cylinder head, similar dry running surfaces be encountered, do not use force but rotate the flywheels for any particles of dirt or carbon which may be present. These must be removed, otherwise the threads in the cylinder head may be damaged. It is a good plan to smear a trace of graphite grease on the plug threads before replacing.

CONTACT BREAKER

The contact breaker points should be checked occasionally to see that they are clean, that the gap with the points is open is between 0.12 and 0.15" and that they open and close properly. Access is obtainable after the starter pulley and camshaft cover have been removed. The small box spring, screwdriver and feeler gauge supplied should be used to check the gap. The points should be positioned so that the contact points are in the fully open position before adjustment is made. Adjust by slackening nut illus. 2b, fig. 7, and move point bracket by means of the eccentric arm (illus. 2a, fig. 7).

DECARBONISING

This will be necessary at intervals, varying according to the type of service the engine has to perform, but generally about every 200-300 hours operation. If the engine "knocks" at normal loads, and when the load is released, it is usually an indication that there is an excessive amount of carbon on the piston and the inside of the cylinder head. It is inevitable to have very cylinder head and rocker cover gaskets available for replacement in the event of the originals being damaged.

VALVE GRINDING

While the engine is being decarbonised, since the valves are inspected the condition of the seats to see whether they require regrounding. When the valve spindles are compressed, the loose stone collars which hold the spring seat in place can be removed, thus allowing the valves to be taken out of the cylinder head. All traces of grinding compound must be removed before reassembly of the valves. A suitable grade of valve grinding compound is Carborundum No. 180 Fine. Inlet and exhaust valves are marked on the head, and are not interchangeable.

VALVE CLEARANCE

When the valves are in the closed position there must be clearance between the valve stem and the valve rocker. In the case of the exhaust valve the clearance should be .006" and for the intake valve .005". These clearances refer to a cold engine.

To reset the valve clearance the valve rocker adjusting screw (illus. 17, Lar. 5) should be turned in the required direction until the lock nut has been retightened. Make sure that the lock nut is retightened after adjustment.

MAGNETO TIMING

The magnet is timed so that the contact breaker points are timed to open when the piston is $\frac{1}{2}$ " before top dead center. Accurate timing can only be done with the piston visible, therefore the cylinder head must first be removed.

The cam operating the contact breaker lever is adjusted to the flywheel, which is driven by a rope on the crankshaft, and if adjustment to magnet timing is necessary, the flywheel must be rotated by unscrewing the centre nut with the hex. spanner provided in the tool kit. This nut is a right-hand thread, is impervious to the weather and should be reversed until the flywheel is just free to revolve on the crankshaft. With the piston in its normal position (1" H.T.D.C.), the contact should be moved round in a clockwise direction until the points are just open. Tighten up the centre nut firmly and recheck the timing. Always set the contact breaker points to .007-.012" gap before timing the magnet, because any adjustment to the point gap affects the ignition timing. The cam will then be tightly locked by fitting with a hammer on the end of the timing bar of the magnet the light brass spanner.

The cam and contact breaker fingers must be clean and slightly oiled with clean oil.

Secure a little H.M.P. (High Meeting Point) Grease on the cam profile and on the felt pad which bears on the cam.

GOVERNOR

This is carefully set before delivery to give the specified maximum engine speed. An adjusting nut is fitted above the spring so that a different maximum speed may be obtained when this is really necessary. NO ADJUSTMENT can be made by altering the position of the governor lever on the governor arm.

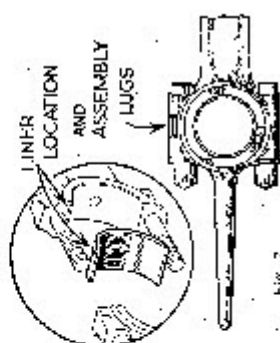
It is essential that the Governor Linkage Weight Flap should be quite free, so any stiffness in the linkage will prevent the Governor from operating satisfactorily when the specified maximum engine speed has been reached, thus causing the engine to over-speed with possible damage. Engine speeds before the specified maximum are controlled entirely by the hand throttle control, and at such speeds the governor will appear to be entirely inoperative.

TO RE-SET GOVERNOR

Connect up the linkage to the inlet pipe properly and slacken off the governor lever clamp bolt. Turn both the governor crank and the governor lever as far as possible in a clockwise direction (this being the fully open position of the inlet pipe solenoid), and securely tighten the clamp bolt. Provided that no adjustment has been made to the setting of the governor spring adjusters and the inlet governor spring is being set, it should not be necessary to increase the maximum engine speed, which is 3,000 r.p.m.

CONNECTING ROD

This is fitted with detachable wrist pins and lugs which can be replaced when necessary without firing or reworking. It is essential that the assembly lugs are extremely fitted up as shown in fig. 2. Always replace connecting rod with assembly lugs (provided the crankshaft).



COOLING SYSTEM

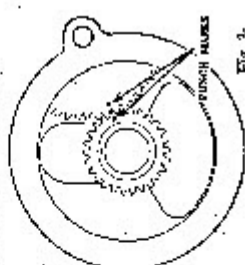
The fan attached to the flywheel must be removed and it is vital that the cowling should be in position when the engine is running.

OIL LEAKS

The outside of the engine should be kept clean. If oil leaks develop check the tightness of the rocker cover and the cylinder nuts. Examine oil level. This should not be appreciable higher than the shoulder on the dipstick. If, after these precautions, oil still leaks from the crankcase, bearing or governor shaft, it would be advisable to examine the condition of the piston rings. These must be free in their grooves and the rubbing surfaces clean and bright. Remove any carbon from the grooves and replace any damaged lugs. Check the breather valve for cleanliness. (See page 4).

VALVE TIMING

Correct timing will only be obtained by assembling the cam shaft and crankshaft parts so that the timing marks on each gear are together and in line (see fig. 2).



CRANKSHAFT AND CRANKSHAFT

Unless it is absolutely essential we do not recommend that the crankshaft or crankshaft be removed.

In some cases when removing the crankshaft the ball race may come away with the shaft instead of being left in the housing. This will prevent the shaft being withdrawn completely with the crankshaft still in position as the ball race will ride up the gear teeth on the crankshaft.

The method of removal therefore is to withdraw the crankshaft spindle which will allow the crankshaft to be lifted out of the crankcase after the crankshaft has been withdrawn sufficiently to permit the gear to be between the two crank webs.

With the crankshaft lying in its furthest point from the crankshaft, the whole crankshaft can then be rolled around the crankshaft itself and lifted clear. In doing this it is desirable that the crankshaft should be protected by insulating wire or similar protection in order to prevent it being bruised by the crankshaft gear during this operation.

PISTON RINGS

Three compression and one scraper ring are fitted to the piston in the following order:

Top Compression Ring: Chromium plated stepped ring. Fit with rollers - BTM - towards bottom of piston.

Second Compression Ring: A taper faced ring. Fit with rollers - BTM - towards top of piston.

Third Compression Ring: A symmetrical ring, can be fitted either way.

Scraper Ring: Can be fitted either way.

Fitted Ring gaps are as follows: -

Angle cut gap: .007" to .011"

Square cut gap: .011" to .015"

The above figures are for new components fitted in a new cylinder bore. When the piston ring gap exceeds .030", the ring should be changed, or cylinder enlarged for excessive wear.

The stepped top compression ring has only recently been introduced, and earlier engines were fitted with a top compression ring identical with the third compression ring (see Photo 105). It is suggested, however, that when replacing the top compression ring, the chromium plated stepped ring is used.

CARBURETTER

The function of the Carburettor is to supply a mixture of petrol and air in correct proportions under all conditions. In the Vauxhall Junior Carburettor the float chamber surrounds the jet and emulsion, and the fuel level is maintained by a needle valve in the carburettor body. The cable operated throttle is fitted with an adjustable lever (needle wheel) extends below the throttle and into the carburettor. A variable compensation of jet size, needle position and taper will give a correct mixture strength at all throttle openings.

The taper needle is set to give optimum results during bench testing before the engine leaves the factory, but it may be necessary to make slight adjustments to suit the normal working conditions, and whilst the needle setting given on page 1 is satisfactory for the majority of engines, slight adjustment without aid of this figure may be desirable.

Adjustment of the taper needle is carried out by means of a screw situated in the top of the throttle. Clockwise rotation of the screw will weaken the mixture and vice versa.

To change the Taper Needle

1. Remove the top ring and remove the throttle, complete with cable and top disc, etc., from the Carburettor body. With the throttle open to the fully closed position the throttle can be moved away from the guide peg, thus making the taper needle adjusting screw accessible. The screw should be removed, followed by the taper needle and spring. The spring should be carefully replaced on the taper needle, the taper needle inserted in the throttle and the screw adjusted to give an average taper needle length. It would be adjusting screw in case, the tapered pointing may be easily reset again.

To remove the emulsion and fuel needle

The jets and taper needle having been removed from the carburettor body, the bottom nut and three washers holding the float chamber in position should be removed. The float chamber and float are now free to fall away from the carburettor, leaving the fuel needle lever and fuel needle still in position. The small screw at the side of the Carburettor body must now be loosened, thus releasing the emulsion. The jet requires only to be unscrewed through the Carburettor body, the fuel needle lever moved to one end and the fuel needle removed. Care should be taken not to distort the fuel needle lever as it will affect the jet level in the float chamber.

To reassemble the Carburettor

Clean the various components and make sure that the vent hole in the needle jet is clear. Place the fuel needle into the Carburettor body and note, the fuel needle lever into position. Insert the emulsion, with three washers in position under the jet, and replace the jet screw. Replace float, float cup washer and float arm, followed by the bottom nut washer and bottom nut. Do not over-tighten the bottom nut as this may cause distortion of the Carburettor body or damage to the threaded portion of the carburettor. Replace the throttle in the Carburettor body, pushing the taper needle into the jet opening. Locate the top disc and screw down the top ring.

If the Carburettor has been removed from the engine, make sure that the body is pushed on in the inlet pipe as far as possible.

If the inlet pipe does not extend past the end of the jets in the Carburettor body, it will be sealed in, thus causing hard starting and erratic running. When replacing the jetted plug, check that the filter and rope fibre washers are correctly positioned on the jet hole, and that the bolt is securely tightened.

THE



Type S12 CARBURETTOR

OPERATING INSTRUCTIONS

(See over for illustration references.)

STARTING FROM COLD.

Turn on petrol and pull strangle knob (3a) up to close strangle slide (29).

Open throttle fully and start the engine by the means provided. Open strangle fully as engine warms up and adjust throttle to give required throttle speed.

In cold weather it may also be necessary to "soak" the carburettor by means of the heater (34).

STARTING FROM HOT.

Turn on petrol, open throttle 1/3 and start engine. If engine has stopped through shortage of petrol it may be necessary to close the strangle, but it should be opened fully as soon as the engine starts.

AIR FILTER.

The oil-wetted air filter (32) should be removed from the carburettor for cleaning at frequent intervals. Wash in petrol or paraffin and then dry in petrol and allow to drain before refilling.

Oil both air filters about once a week as necessary to maintain correct oil level. Clean out bowl and refill with new oil according to instructions on filter. After frequent cleaning with the "expander" under very dirty conditions.

If the engine runs rich, the filter probably requires cleaning as above.

PETROL FILTER.

A petrol filter (38) is fitted to the petrol inlet body bolt on which (25) of 40. Remove filter occasionally and clean by dipping in petrol. Make sure the gaskets are in good condition before replacing petrol filter or hand strings. Do not over tighten.

FLOODING OF CARBURETTOR.

The carburettor can be flooded by means of the filler (25). But under normal running conditions the petrol level in the float chamber is controlled by the float and fuel needle assembly. If flooding of the carburettor occurs when the float is not depressed, if hand of the expander corrects when the float is not depressed, turn off petrol, remove carburettor from engine and unscrew the float chamber (25) allowing float (21) to be removed. Check float for leaks.

Remove and replace float chamber by hand. Do not use spanner, etc. If float is satisfactory, the fuel needle (20) and fuel bush (15) can be unscrewed for further inspection after pin (13) and lever (14) have been removed. If flooding still persists, the fuel needle can be loosened in the body by turning lightly on the screw end of the fuel needle. If needle is worn, replace with new component.

(See over for illustration)

When re-assembling carburettor, ensure that the float is clear of the tickler wire. Fuel needle lever is fully raised and that the float chamber is fully closed. (19) has already in the petrol in the carburettor body.

MAIN, NEEDLE AND AIR COMPENSATING JET.

The main jet (22) is screwed into the bottom of the float chamber, and is easily removed for cleaning.

The air compensating jet (26) screws into the carburettor body inside the air filter assembly. A fuel jet filter is correctly maintained, should not require cleaning.

The needle jet (17) screws into the jet orifice body, a special tool being required for this operation. The jet may be cleaned by blowing compressed air through the bottom of the jet orifice stem of the carburettor body after float assembly and throttle have been removed. (The type pump if air flow is not available) To clean the air compensating passage, place the finger over the hole in the top of the jet orifice body and continue blowing from the bottom of the carburettor.

ADJUSTING CARBURETTOR.

The main air compensating and needle jets, and the jet orifice body, as well as the jet orifice body, have been selected to give optimum results for each particular engine and, therefore, it is recommended that adjustments to the jet orifice body and air compensating jet are carried out by the jet orifice body and air compensating jet.

The jet orifice body screw enables the mixture to be adjusted, before the float is fitted, to the position of the throttle. Screw in to richen mixture, and screw out to leanen mixture.

The jet orifice body (23) position governs the mixture strength between 1 and 2 throttle. The mixture position is with the needle locating clip (2) in groove No. 3. Groove No. 1 is the richest position. The speed of the mixture can be adjusted by the screw (44). In cold weather, the fuel needle may be set one groove "richer" than normal (up to 10) (See instructions).

FITTING OF REPLACEMENT PARTS.

As stated above, certain components are selected to give the best performance for each particular engine application. Therefore, the correct replacement parts must be fitted.

The carburettor body is made with two check screws, as shown in the parts list. By turning the engine number and/or the number appearing on the component you will obtain the correct replacement parts.

The Term and Conditions of Guarantee apply to the Villiers Carburettor as applicable to the S12 Carburettor and its component parts.

THE VILLIERS ENGINEERING CO. LTD.
WOLVERHAMPTON, ENGLAND.

TEL: 2209 (20 lines)
FAX: 1997

SPARE PARTS LIST

Part No.	DESCRIPTION	QTY.
1 V-1646E	Cover, cable	1
2 V-1400B	Screw, tap cap	1
3 V-1485 X 24	Wash, cable adjuster locking	1
4 V-1517K	Con. adjusting lever	1
5 V-1491H/1	Pin, cable, needle locking	1
6 V-1509R	Spring, thumb	1
7 V-1605-27 IE	Pin, adjusting screw	1
8 V-145 X 16C	Needle, cable, thumb end	1
9 V-1440U	Ball, carburetor body clip	1
10 V-1436B	Clip	1
11 V-1436B	Nut	1
12 V-1543B	Ball, head mounting	1
13	Ball, head, needle	1
14 V-1247H	Body, armature, 1/2" stroke	1
15 V-1248C	Body, armature, 1/2" stroke	1
16 V-1180U	Needle, fuel	1
17 V-1179E	Lever, fuel needle	1
18 V-1396E	Pin, lever spring	1
19 V-1377E	Washer, lever chamber sealing	1
20 V-1396E	Crash, needle	1
21 V-1509K	Pin	1
22 V-1419R	Flat, rain	1
23 V-1156D	Chamber, fuel	1
24 V-1601P	Spring, needle	1
25 V-1398E	Pin, air compensating	1
26	Pin, air compensating	1
27 V-1388E	Pin, air compensating	1
28 V-1349D	Pin, air compensating	1
29 V-1377E	Washer, armature	1
30 V-1508E	Washer, armature screw	1
31 V-1624E	Pin, armature plate	1
32 V-1363D	Screw, armature plate	1
33 V-1609E	Pin, armature	1
34 V-1604E	Screw, air intake	1
35 V-1396E	Washer, air intake	1
36 V-1396E	Washer, air intake	1
37 V-1341E	Pin, air intake	1
38 V-1357E	Pin, air intake	1
39 V-1342E	Pin, air intake	1
40 V-1601P	Spring, needle	1
41 V-1401E	Screw, air adjustment	1
42 V-1248D	Pin, needle	1
43 V-1605 X 18	Pin, needle	1
44	Pin, needle	1
45	Pin, needle	1
46	Pin, needle	1
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