SVM-7735

scorpion inc.

Service Manual

For

JLO Axial-Fan Twin Cylinder Engine Model LR-440/2 (2F-440-3)

- 2-CYCLE ENGINE FUNDAMENTALS
- ENGINE BREAK-IN
- EXHAUST SYSTEMS
- DISASSEMBLY AND ASSEMBLY INSTRUCTIONS OF BASIC ENGINE INCLUDING RECOIL STARTER
- ELECTRIC STARTER MOUNTING INSTRUCTIONS
- IGNITION TIMING PROCEDURE
- SPARE PARTS LIST; SERVICE TOOLS

2-Cycle Engine Fundamentals

The 2-cycle, air-cooled gasoline engine has become very popular today for snowmobiles, ATV's and other recreational vehicles. It is uniquely qualified for these applications because of its relatively high power output, light weight, and ease of lubrication, with fewer moving parts than conventional 4-cycle engines.

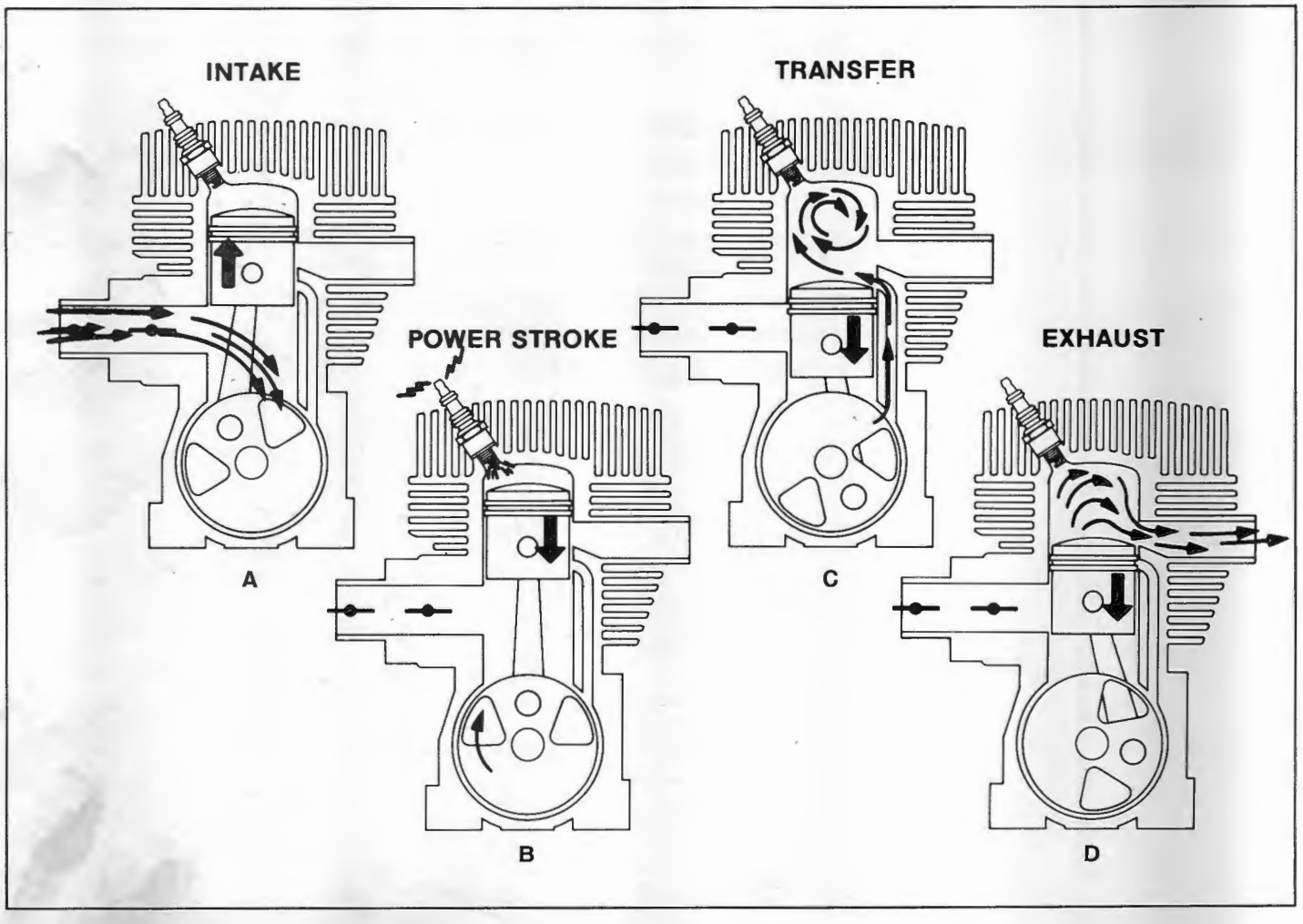
However, in order to get the best possible use, and assure that it retains its high degree of dependability and endurance, it must receive proper care and maintenance. Since the life expectancy of any 2-cycle gasoline engine depends to a great degree on the level of maintenance it receives, it is necessary for us to know something about the basic fundamentals of an engine and how it functions in order to determine and apply, the correct amount of maintenance.

Operation

The JLO 2-cycle engine is of the loop-scavenged, 3rd-port design type . . . the most widely used design today. It uses a mixture of gasoline and oil for combustion, lubrication and cooling. It fires on every stroke of each piston. There are two *power strokes* for every revolution of the crankshaft.

As the piston moves upward in the cylinder (Illustration A), it draws the fuel/air mixture into the lower crankcase while at the same time compressing the fuel already in the compression chamber above. As the piston nears T.D.C., the spark plug ignites the compressed fuel and the burning fuel expands and forces the piston downward on its second, or power stroke (Illustration B). In this downward stroke the piston not only turns the crankshaft but compresses a new charge of fuel in the crankcase while continuing downward clearing the exhaust ports (Illustration C) in the cylinder wall to release the burned gasses through the ports and out into the exhaust system. The piston continues downward to uncover the transfer port and release the compressed fuel charge into the cylinder where it displaces the remaining burned gasses and forces them out through the exhaust ports (Illustration D).

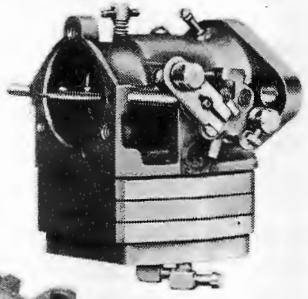
Because lubrication of 2-cycle engines depends on mixing predetermined amounts of oil and fuel, it is extremely important that good quality oil be thoroughly mixed with fuel and in proper proportions. While there are different engines, as well as different oils, requiring different fuel mixtures, the correct oil-fuel ratio required for Rockwell-JLO engines is 20 to 1. Use of little oil may cause engine over-heating, piston or cylinder scoring and eventual engine seizure or failure. Too much oil, on the other hand, leads to incomplete combustion, carbon fouling of plugs and piston overload.



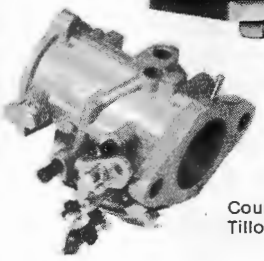
Carburetion

In order to atomize the oil-fuel mixture and mix it with proper proportions of air flowing to the intake port or intake manifold, it is necessary to utilize a carburetor. Carburetor design is based on the venturi principle whereby a gas or liquid flowing through a restricted or necked-down passage increases in velocity and decreases in pressure as compared to the velocity and pressure in the full size section of the passage.

There are various types of carburetors classified by method of delivery of fuel to the carburetor: float, suction lift and diaphragm type. JLO Engines mainly use diaphragm type carburetors, therefore, future references herein will be limited to this type of carburetor.



Courtesy of Walbro Carburetor Corp.



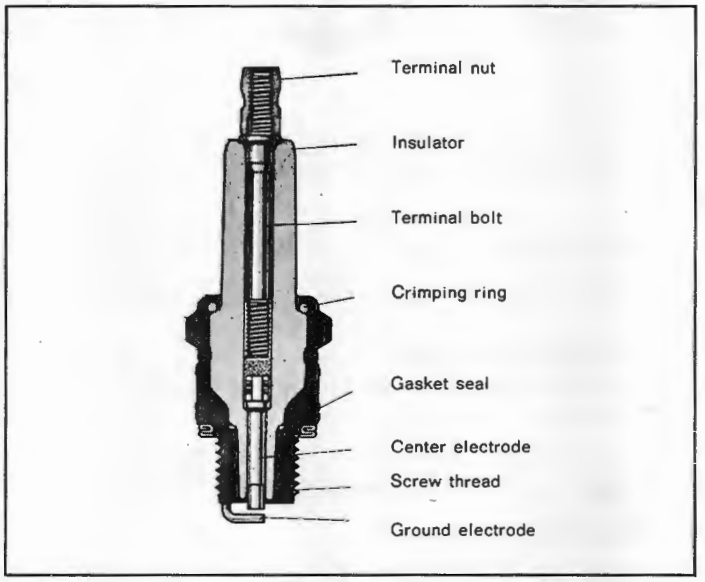
Courtesy of Tillotson Mfg. Co.

Ignition

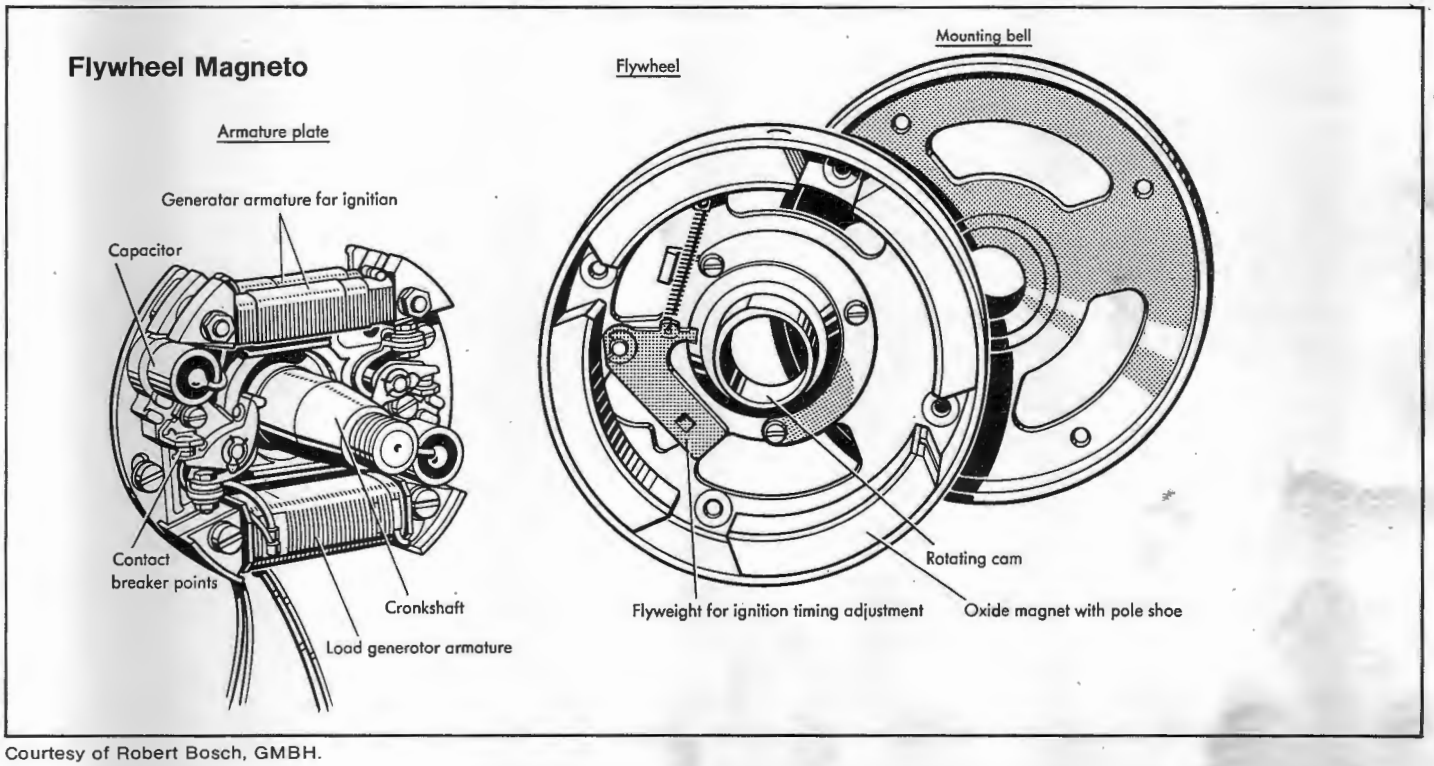
The ignition system provides the high voltage electrical energy which flows across the spark plug electrode gap to create ignition spark. Most small engines are equipped with magneto type ignition. The magneto ignition system generates and transforms electrical energy into high voltage, delivering it at the proper time for ignition spark.

Spark Plug

The spark plug provides the electric spark necessary for ignition of the compressed fuel-air mixture in the cylinder. There are many types and sizes of spark plugs, depending on engine design and operating characteristics. Most single cylinder, 2-cycle engines use the "short reach" type spark plug, while the newer, angled-head single and twin cylinder engines use the "long reach" type spark plug. The most commonly used thread sizes are 10 mm., 14 mm. and 18 mm. Spark plugs tip temperatures are also extremely important in proper engine operation, therefore, they should be selected according to engine design and type of service



Courtesy of Robert Bosch, GMBH.



Courtesy of Robert Bosch, GMBH.

Starting, Stopping, Fuel Mixture

Starting Procedure

1. Turn switch to "on" position.
2. Close choke (warm engine requires little or no choking).
3. Open throttle slightly when cranking the engine.
4. As soon as the engine starts open choke and release throttle.
5. Electric start:

Turn switch to "start" position. Release as soon as the engine starts (switch will remain in "on" position). Do not continue cranking the engine if it fails to start after approximately 30 seconds. Allow the starter to cool before making another attempt. If the battery is low use the recoil starter.

Operation

Before operating at full load, let engine warm up for a few minutes.

Idling

Do not let the engine idle for prolonged periods as this may result in carbon build-up, foul the spark plug or cause flooding.

Engines put under severe strain, may continue running after the ignition is turned off. To stop the engine under these conditions, shut off the air supply by closing the choke.

Stopping Procedure

Release the throttle to allow engine to idle. Turn switch to "off" position.

Do not use the choke to stop the engine. This can result in carburetor flooding, making it very difficult to restart.

Safety Precautions

1. Never add fuel while the engine is running as spilled fuel might ignite on contact with hot engine surfaces. Stop engine and allow to cool.
2. Always be sure ignition switch is in "off" position before working on engine.
3. Make sure all safety shields or guards on engine and driven equipment are in proper position and securely fastened.
4. When starting, keep hands, feet and clothing at a safe distance from moving parts.
5. Do not operate the engine in closed buildings unless exhaust pipe is vented to the exterior.

Fuel Mixture

Gas/Oil Ratio	Ounces Of Oil	Gasoline Required
20 to 1	32	5 Gallons
20 to 1	26	4 Gallons
20 to 1	19	3 Gallons
20 to 1	13	2 Gallons
20 to 1	6.5	1 Gallon

NOTE: Mix gasoline (90 octane minimum), with SAE 30-40 air-cooled engine oil. Premix thoroughly before pouring into vehicle tank by first mixing 1 gallon of gasoline with all the oil, shaking vigorously and then adding the rest of the gasoline. Always use fresh, clean gasoline to avoid gumming up or clogging the carburetor.

Volume Equivalents

1 U.S. Quart = .946 Liters
1 U.S. Quart = .833 Imperial Quart
1 U.S. Quart = 32 Ounces
1 U.S. Quart = 2 U.S. Pints

Exhaust Systems
Tuned Mufflers, Expansion Chambers

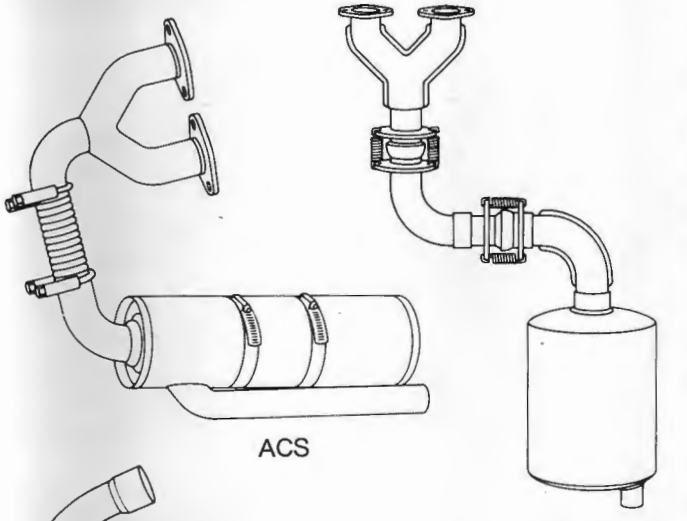
Selection
Selection of an exhaust system (including exhaust manifold, intermediate pipes, elbows and muffler), is a result of thorough test procedures involving measurement of fuel consumption, horsepower and noise level. Contrary to popular belief, the exhaust system is not only for quieting the engine, but also serves to increase the horsepower output (by as much as 25%). Changes made to the original equipment exhaust system by changing *any* component in the system can result in loss of power and/or *severe engine damage.* For these reasons, intermediate lengths of pipe between the cylinder and the muffler are particularly critical.

Tuned Mufflers
Tuned mufflers allow the engine to exhaust its spent charge into an adequate volume and properly matched muffling system. More important, the mufflers are "tuned", incorporate designs that "suck" the exhaust gas from the cylinder allowing fuel and air to rapidly replace it and also "cram" over-scavenged fuel and air mixture from the exhaust pipe back into the cylinder using sound waves and sound energy. This is accomplished at the speed of sound which allows the engine to produce higher torque at high RPM's.

How Tuning Works
The megaphone effect of the expanded intake tube scavenges exhaust gas from the cylinder, allowing rapid replacement of the fuel-air mixture from the crankcase. Reflected sound waves and sound energy stop over-scavenging and return fuel-air mixture to the cylinder. It gives a "super-charging" effect even though it operates from the exhaust rather than the intake side. Over-scavenging is also retarded by moderate muffler back pressure. Silencing is accomplished after power is maximized, by acoustical packing in the resonator outlet tube plus chambering and baffling which gives an effective 2-pass muffler design.

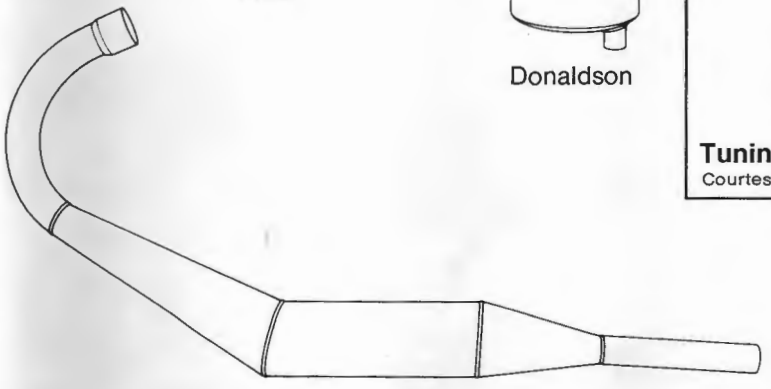
Racing Expansion Chambers
Expansion chamber incorporates power-tuning to increase horsepower of two-cycle engines up to 25 per cent.

Typical Exhaust Systems

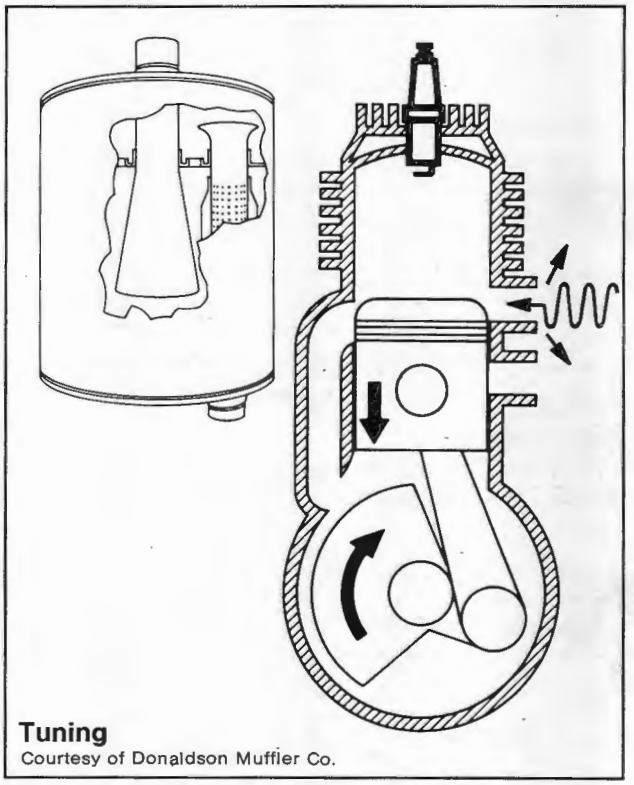


ACS

Donaldson



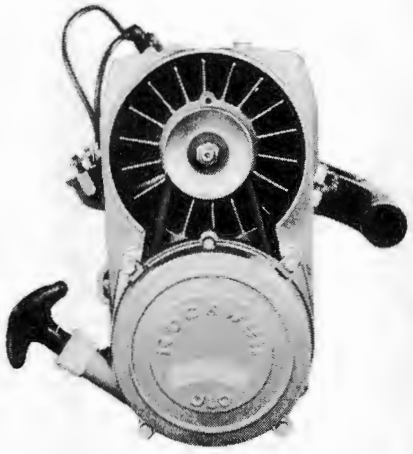
Expansion Chamber (Racing)



Tuning
Courtesy of Donaldson Muffler Co.

JLO Twin Cylinder Engines

Disassembly and Assembly Procedure - Model LR-440/2 (2F-440-3)



Disassembly

A. Recoil Starter

Remove four screws holding recoil to fan housing and the spacers and washers. Remove recoil assembly, complete. (For detailed service instructions refer to *Recoil Starter, Disassembly and Assembly).*

B. Lower Fan Pulley and Carrier Assembly

Remove three hexhead screws on carrier. Remove dust seal, carrier, lower pulley halves and V-belt.

C. Upper Fan Belt Pulley Assembly

To keep impeller from turning, insert a punch through the fan housing and into the impeller body. With a 17 mm. wrench, remove fan nut. Pull out the loosened assembly—nut, washer, spacers, and upper pulley halves.

D. Flywheel Magneto

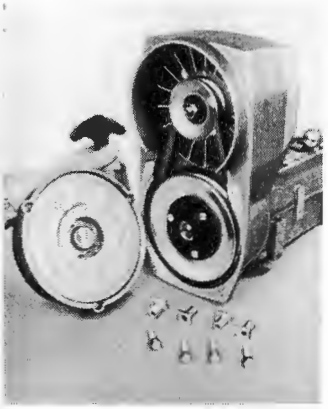
Make sure spark plugs are tight. Working against engine compression, with a 27 mm. wrench, remove crankshaft nut by striking wrench a few sharp blows with a hammer. To pull flywheel, attach special puller to flywheel flange, using three of the recoil starter screws previously removed. Screw into the three holes on flange and tighten. Turn puller until bolt touches tip of crankshaft. With a 24 mm. socket wrench, turn puller bolt clockwise and extract flywheel. Note that key may come loose and adhere to the flywheel magnets.

E. Intake Manifold

Remove the four nuts holding manifold and upper coil cover, plus the two lower coil cover screws. Remove screw holding spark plug wire to side of fan housing.

F. Fan Housing; Armature Plate

With a special Allen Head wrench, remove the 4 socket cap screws holding fan housing to crankcase. To loosen, place unit with fan housing protruding over end of workbench and, holding housing with one hand, hit light but sharp blows around periphery. Pull housing straight out past the crankshaft careful not to cut the oil seal on the sharp edges of keyway of the shaft. Disconnect solid blue and blue-yellow coil wires and remove entire assembly. The armature plate is attached to the fan housing by two slotted screws and can be removed at this time. Scratch-mark its original position before removal as this will facilitate engine timing. Impeller assembly should come loose and may be removed at same time as fan housing assembly. The fan housing bearings can be removed at this time, if necessary, by punching out from the side opposite that from which they are normally inserted.



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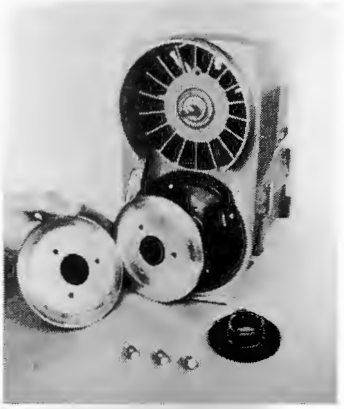

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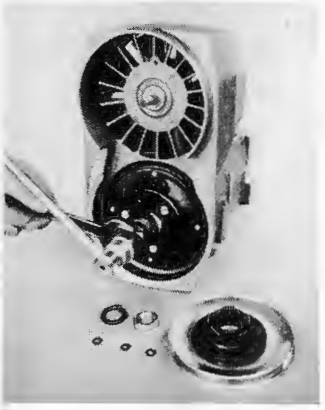

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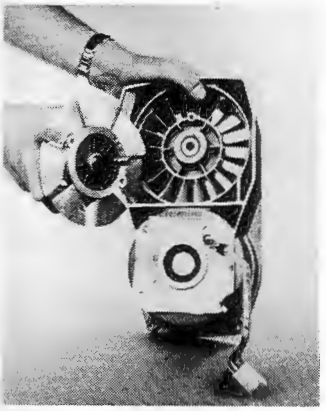

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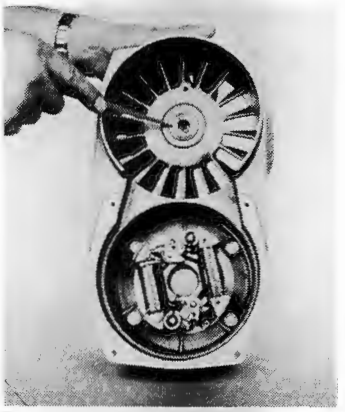

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G. Spark Plugs
Remove with special socket wrench.

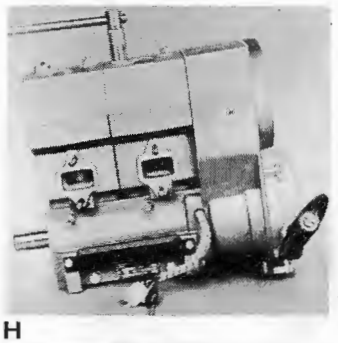
H. Cylinder Heads
Remove the 17 mm. head nuts and lift head and gasket from cylinder block. Mark cylinder head and corresponding cylinder in order to assure proper reassembly. (Cylinder closest to the P.T.O. end is always considered No. 1 cylinder.) Repeat operation for second cylinder.

I. Cylinders
Lay unit on end and with a 13 mm. socket remove the 8 cylinder-base nuts. (Unless complete disassembly is required, remove one cylinder at a time so as to maintain crankcase alignment.) Set unit upright again and lightly tap cylinder with a rubber hammer and lift gently until piston clears the skirt. Repeat operation for second cylinder.

J. Piston and Wrist Pin
Prior to removing mark each piston in relation to the cylinder with which it mates. With needle-nose pliers or special screwdriver remove the two different circlips on each side of wrist pin. Gently drive out wrist pin. Repeat operation for piston No. 2.

K. Crankcase
To separate crankcase halves, hold upper shell with left hand and "rock" slightly back and forth to break the sealing surfaces. If necessary, strike side of crankcase with rubber hammer to complete the separation. Remove crankshaft.

L. Crankshaft; Crankshaft bearings
With crankshaft on work surface, remove oil seal and alignment washer from P.T.O. end. To remove bearings use special puller. Slide puller body over crankshaft and align bolt with crankshaft end. Slip puller half-shells around the bearing and engage them on puller grooves. Slide retaining ring over half-shells to keep them on the bearing. Using two 27 mm. wrenches, turn puller center bolt with one wrench while holding puller body with the other. Keep turning puller center bolt clockwise until it pulls the bearing to the end of the crankshaft.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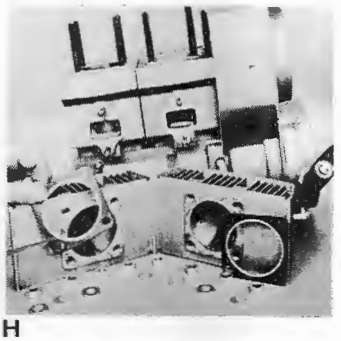
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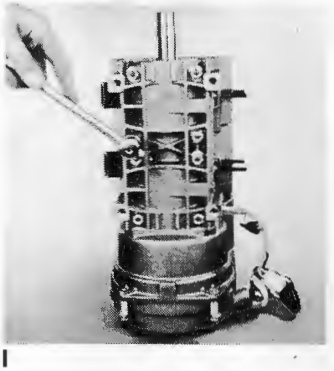
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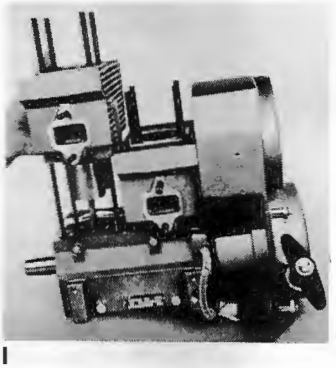
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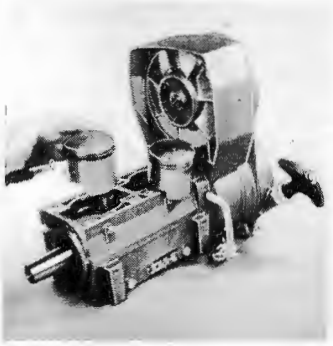
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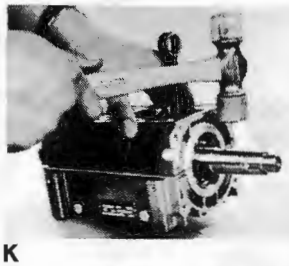
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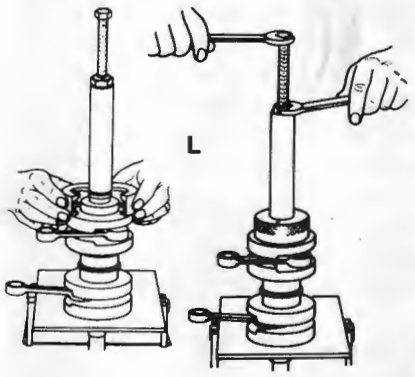
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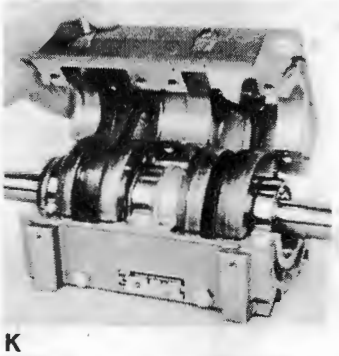
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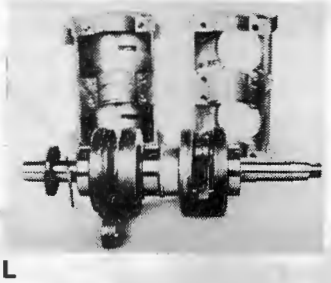
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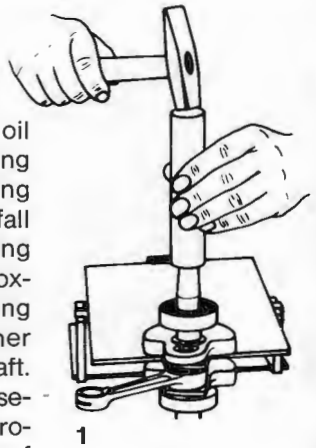
JLO Twin Cylinder Engines

Disassembly and Assembly Procedure - Model LR-440/2 (2F-440-3)

Assembly



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1. Crankshaft

Heat crankshaft bearings in oil preheated to 180°F. After reaching temperature, quickly slip bearing over end of crankshaft; it should fall freely on the counterweight. Using a hollow pipe with a diameter approximately that of the inner bearing race, hit pipe with a rubber hammer and seat the bearing on the shaft. The bearing should now rest securely and turn freely. Repeat procedure for bearing on other end of crankshaft.

2. Crankcase

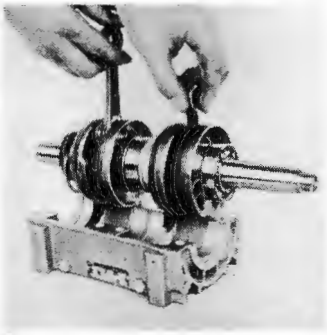
Inspect both halves of crankcase and clean carefully removing any left-over adhesive or burrs. Apply Permatex type sealing compound to lower crankcase shell sealing surfaces and a little on the bearing surfaces. Note that no seal gaskets are used. Place crankshaft in lower shell and align spacers with machined grooves. Place oil seal on P.T.O. end of shaft flush with the casting. Turn crankshaft with your hand to check freedom of movement and make sure that the oil seal is seated. Install upper crankcase shell and seat by tapping it lightly.

3. Piston and Cylinder

Clean carbon deposits from the piston. Check to see that rings move freely in their grooves. Mate piston with corresponding cylinder. The piston must be installed with the arrow pointing toward the exhaust port. Insert needle bearings into the connecting rod, then place a daub of grease on the connecting rod so that the spacers installed later will adhere to it. Gently guide the piston over the connecting rod and insert the wrist pin. Snap circlips into each side of the piston using a screwdriver or needle-nose pliers. Install cylinder base gasket. Place a V-shaped wood block under the piston, resting it on the crankcase. After lining up the rings with the locating pins on the piston, compress them with a ring compressor. Rest the piston on the wood block and carefully slide the cylinder over the piston until the rings disappear into the cylinder. *Be sure you use a gasket of the same color as was removed from the engine because there are four gaskets available having different thicknesses. Note that the top of the piston must be within ±0.008" of the top of the cylinder. Use a gasket which will achieve this result. Mark the dimension on the cylinder in pencil.* Remove ring compressor and wood block. Repeat procedure for second cylinder. Turn the unit over on its side and install the cylinder base nuts and tighten lightly. Assemble the intake manifold and tighten the four screws. Draw nuts tightly in order to evenly align both cylinders. Turn unit completely over (upside down) and torquedown the cylinder base nuts to specifications in a crosswise pattern. Remove the inlet manifold assembly (previously installed only to align the cylinders).

4. Impeller; Fan Housing Bearings

Install fan housing spacer and circlips—(one circlip on each side.) Pack fan housing opening with bearing grease and



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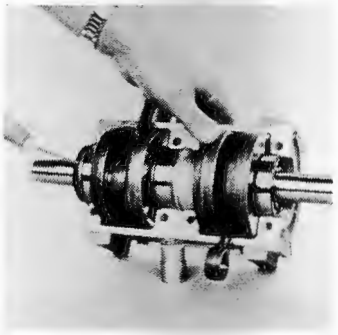

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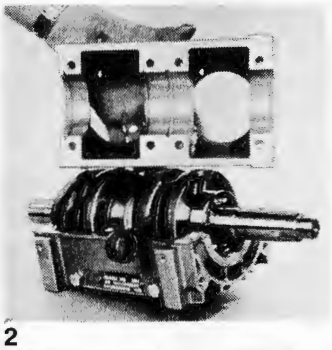

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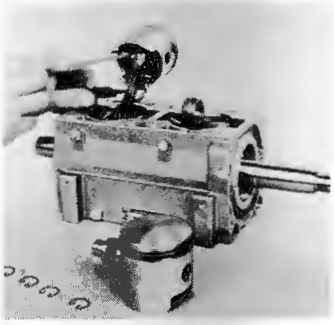

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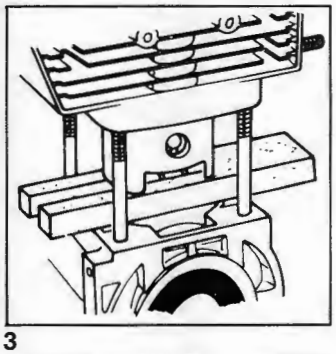

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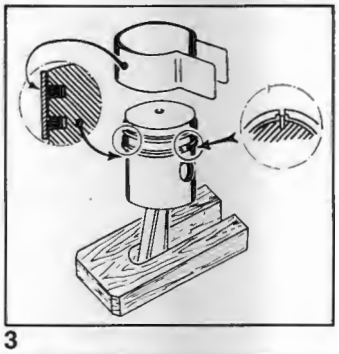

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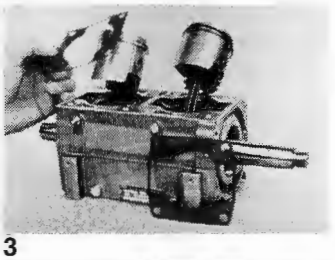

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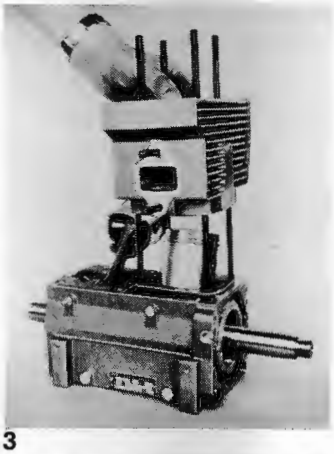

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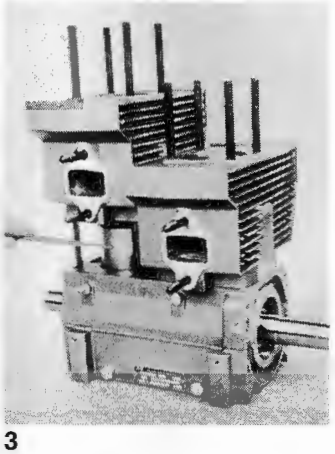

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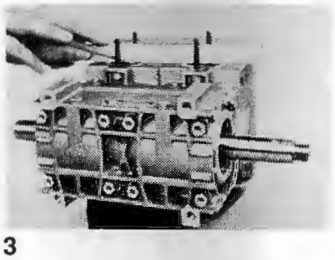

3

insert bearings—one on each side, with sealed surfaces facing outward. Slide shaft thru impeller and install Nilos ring on the side of the impeller which faces the housing, and then thru the bearings.

5. Fan Housing; Armature Plate

Install the armature plate aligning it with the scratch marks previously put on during disassembly. Tighten slotted screws. Check the wiring protruding from the fan housing to make sure that there are no broken wires. Slip the rubber grommet protecting the wires into the housing. Check the O-ring on the back side of the fan housing and the oil seal for cuts or other visible damage. Pass the fan housing over the crankshaft and avoid hitting the sharp edges of the keyway. Adjust the housing against the crankcase and insert the four screws with the special Allen Head tool. Tighten Allen Head Screws in crosswise pattern.

6. Intake Manifold; Coil Cover

Install intake manifold assembly and gasket; tighten the two upper manifold nuts. Connect the ignition coil wires to terminals. Replace coil cover making sure to reconnect the No. 2 cylinder ground wire (brown). Fasten spark plug wire clip to fan housing.

7. Upper Axial Fan Belt Pulley Assembly

Insert Nilos ring, first tapered spacer (dished side towards fan), first pulley half, four adjustment shims, second pulley half, second tapered spacer (dished side facing outward), washer and nut. **Note: block impeller with a punch when tightening nut.**

8. Flywheel Magneto; Ignition Timing

Align magnetic flywheel with keyway; insert and tap key into position. Lightly tighten flywheel nut. For timing details, see **Ignition Timing Procedure.**

9. Cylinder Heads

Install cylinder head gaskets. *If piston is below the cylinder by 0-.008" use cylinder head 438-07-006-00. If piston is above cylinder by 0-.008" use cylinder head 438-07-007-00. The gap between the piston and cylinder head must be measured after assembly. This is done by introducing a thick piece of solder into the spark plug hole at a 90° angle to the crankshaft with the end toward the inlet side of the engine. Rotate engine once and then remove solder. Measure the thickness. It should be between .040" and .060". If it is not, achieve this by changing heads and/or head gaskets.* Assemble cylinder heads with corresponding cylinders and install washers and nuts. Tighten to specifications.

10. Spark Plugs

Install and tighten spark plugs. Complete tightening of flywheel nut.

11. Lower Axial Fan Belt Pulley Assembly

Install the first pulley half with dished side facing the housing, the fan belt, the second pulley half with the dished side facing out and the carrier assembly. Tighten carrier screws while slowly rotating the crankshaft with your hand to prevent squeezing the fan belt.

12. Recoil Starter

Install recoil starter assembly using the four hexhead screws, clamps and lockwashers. For service details, refer to **Recoil Starter Service Instructions.**


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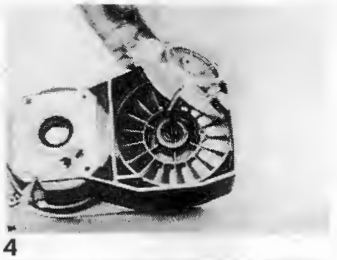
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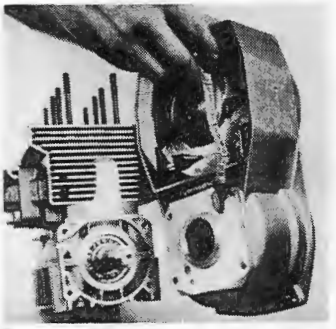
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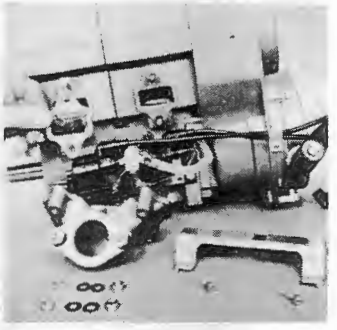
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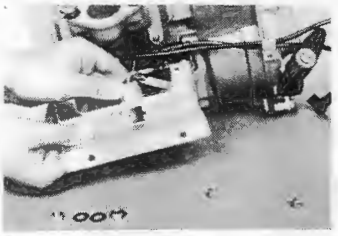
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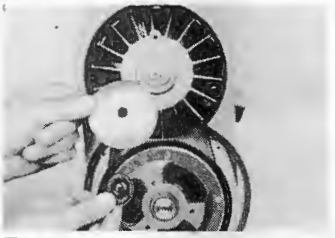
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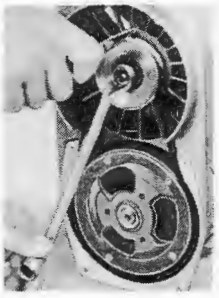
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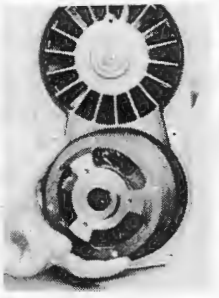
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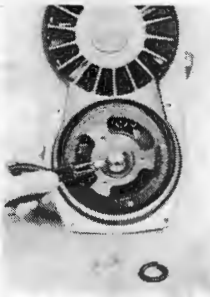
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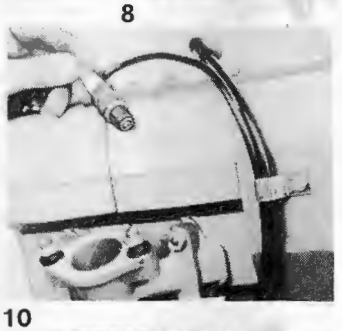
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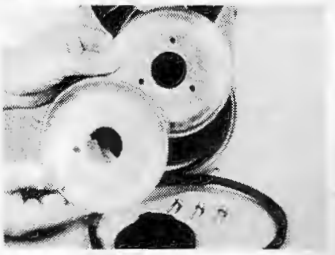
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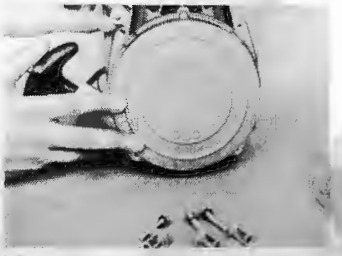

12

JLO Twin Cylinder Engines

Disassembly and Assembly Procedure - Recoil Starter, Model LR-440/2 (2F-440-3)

Disassembly

A. Take off cover plate and gasket ring by removing three slotted or Philipps head screws.

B. Lift out pawl assembly, including spring caps and pressure springs.

C. Remove intermediate plate.

D. Remove handle assembly. To provide needed slack for removal of handle, pull rope part way out and tie a knot.

E. After removing handle, untie knot in rope and carefully release spring tension by holding recoil pulley with one hand and letting the rope feed back slowly to gradually release spring tension.

F. Remove nylon rope bushing.

G. Lift out rope pulley with pliers. Keep coil spring in position using a screwdriver.

H. Turn recoil housing upside down in your hand and smack down sharply against workbench. This will release spring tension within the housing enabling you to grasp the spring and gradually and safely uncoil it.

Assembly

1. Clamp the special assembly jig in a vise.

Insert recoil housing in jig and lower the hub, locking it in position with a cotter pin. Hook end of spring onto the small boss cast in the housing and start rotating the housing clockwise, slowly guiding the spring into position. Complete the recoiling and remove housing from the jig.

2. With rope pulley in one hand and a Philipp's screwdriver in the other, guide the screwdriver into the spring loop and engage the end of the spring on the pulley hub. The spring loop must be properly seated on the pulley hub.

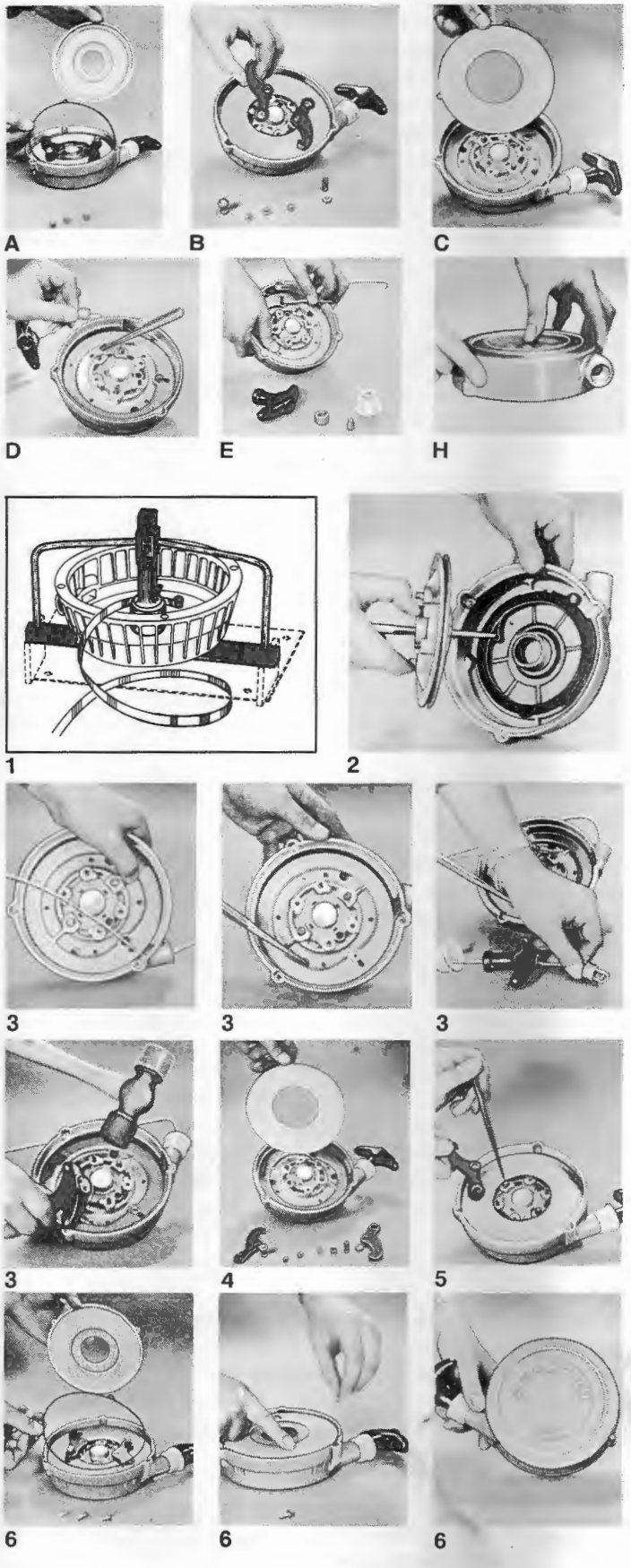
3. Before installing rope, turn rope pulley counterclockwise as far as possible. Back-off 1/2 to 3/4 of a turn and jam punch or screwdriver between pulley and housing to maintain tension. Align rope hole with outlet of starter housing and insert the rope. Install nylon bushing and handle assembly. Remove screwdriver and release tension while guiding the rope into the starter housing.

4. Install the Intermediate Plate.

5. Install Starter Pawl Assembly.

6. Install cover plate and gasket ring. **Note: when installing cover plate the spring cups have a tendency to become misaligned. To retain them, use a pair of clips.**

7. Check the complete assembly for free play.



Mounting Instructions for Electric Starter Kit

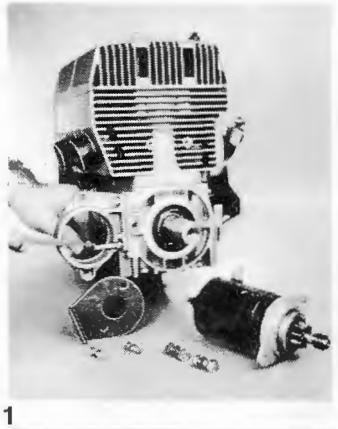
Model LR-440/2 (2F-440-3) Twin Cylinder Engine

Installation

1. Install front mounting bracket on crankcase using the two socket cap screws provided.

2. Insert starter unit into front bracket and loosely fasten with 2 hexhead screws.

3. Loosely install the rear support bracket to the starter. Now, fasten support bracket to the engine and then go back and firmly tighten it to the starter. Note: to simplify installation of rear bracket the engine mounting holes may be "slotted".



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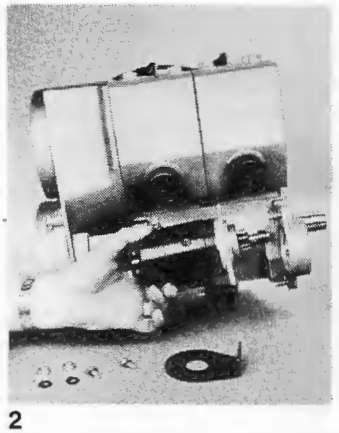
Removal

1. To remove, reverse the above procedure.



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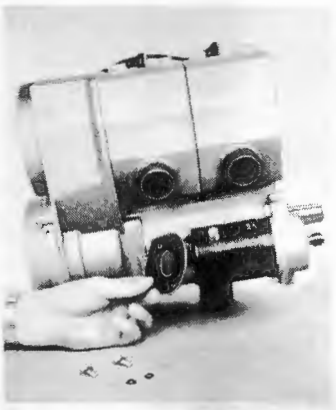


3

Ring Gear Kit

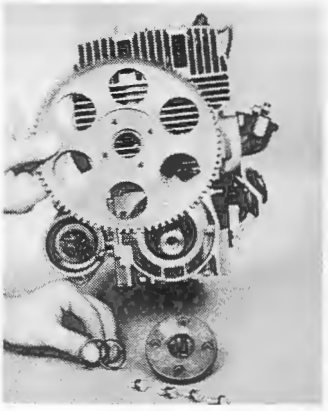
A. Pry out oil seal with screwdriver.

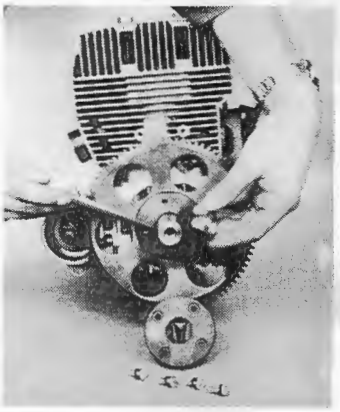
B. Insert new, larger seal flush with the crankcase.

C. Lightly grease ring gear hub.

D. Install the two ring gear wedge rings as follows: first, insert the smaller of the two rings into the ring gear opening with the tapered end facing you; then the larger ring with the tapered end facing the engine.

E. Insert pressure flange and tighten.





Timing Procedure
Model LR-440/2 (2F-440-3) Twin Cylinder Engine

With the recoil starter and carrier assembly removed, proceed as follows:

A. Attach the dial indicator to the cylinder. (Make a small notch in the cylinder head cover, around the spark plug area, to accept the timing device).

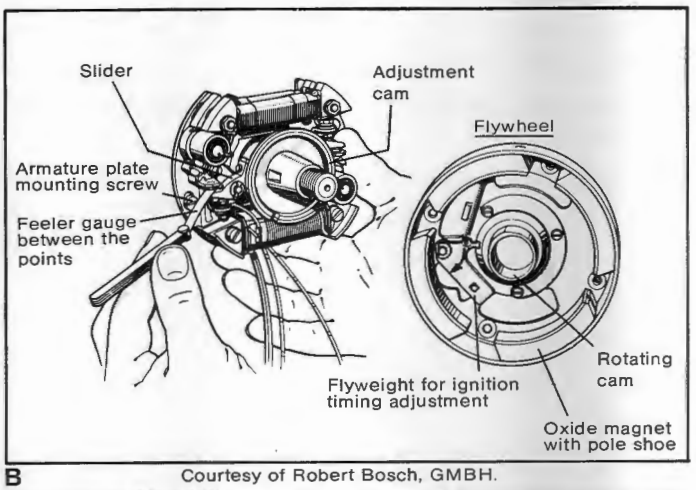
B. Turn the flywheel clockwise towards TDC (top dead center) until breaker points are visible. Use a clean feeler gauge and adjust the gap. Note: if flywheel is removed, use an old cam and rotate until the points are at their largest opening. Check gap and adjust to specifications as necessary. Repeat procedure for the other set of points.

C. Advance the centrifugal weight. Hold in place using locking pin, (a tool specially designed for this purpose.)

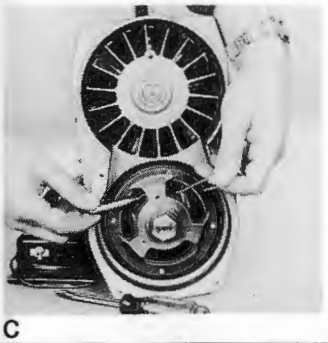
D. Attach one lead of the ignition continuity light to terminal of No. 1 cylinder coil, the other to ground (engine casting). For the second cylinder, attach continuity light lead to No. 2 cylinder coil terminal, (solid blue wire is for No. 1 cylinder; blue-yellow wire is for No. 2 cylinder).

E. Bring piston to TDC and adjust dial to zero.

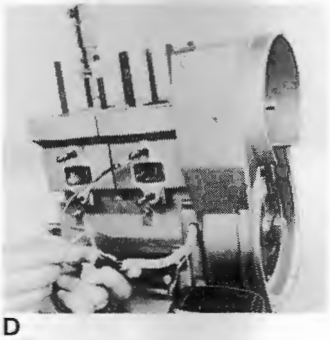
F. Working with No. 1 cylinder, turn flywheel counterclockwise (away from TDC), closely observing dial indicator and timing light. When piston reaches the timing point, the light will dim indicating the opening of the points. Now, check the dial indicator. If timing does not agree with specifications, do not change the breaker point gap; adjust by loosening and rotating the stator plate assembly (Illus. F). Rotate assembly clockwise to retard, counterclockwise to advance the ignition. Correct breaker point gap will insure maximum ignition output. **Important: to time cylinder No. 2 repeat procedure for cylinder No. 1 except do not rotate armature plate.** If timing of No. 2 cylinder is required, adjust the breaker point gap only.



B Courtesy of Robert Bosch, GMBH.



C



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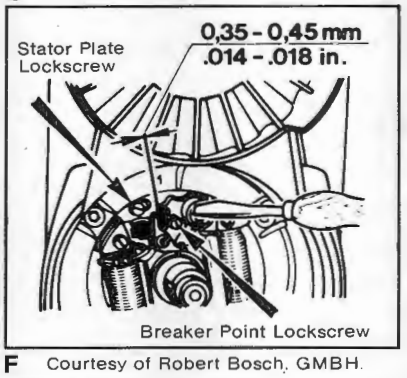
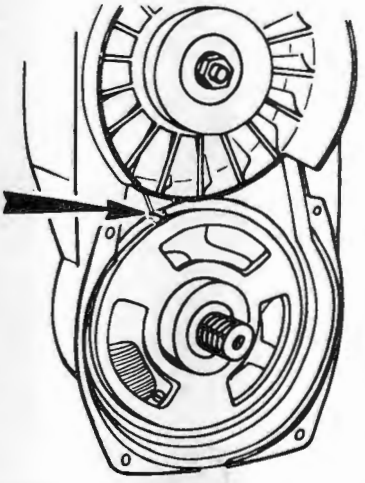


F Courtesy of Robert Bosch, GMBH.

NOTE: Rockwell-Jlo axial-fan twin cylinder engines have timing marks cast on the fan housing. This makes it possible to check timing while the engine is running. Use an automotive type strobe light and aim at the timing marks. If the notches on the flywheel are not in alignment with the marks on the fan housing, the engine is out of time. Note that there are two notches on the flywheel—one for each cylinder. This permits instant timing check of both cylinders.

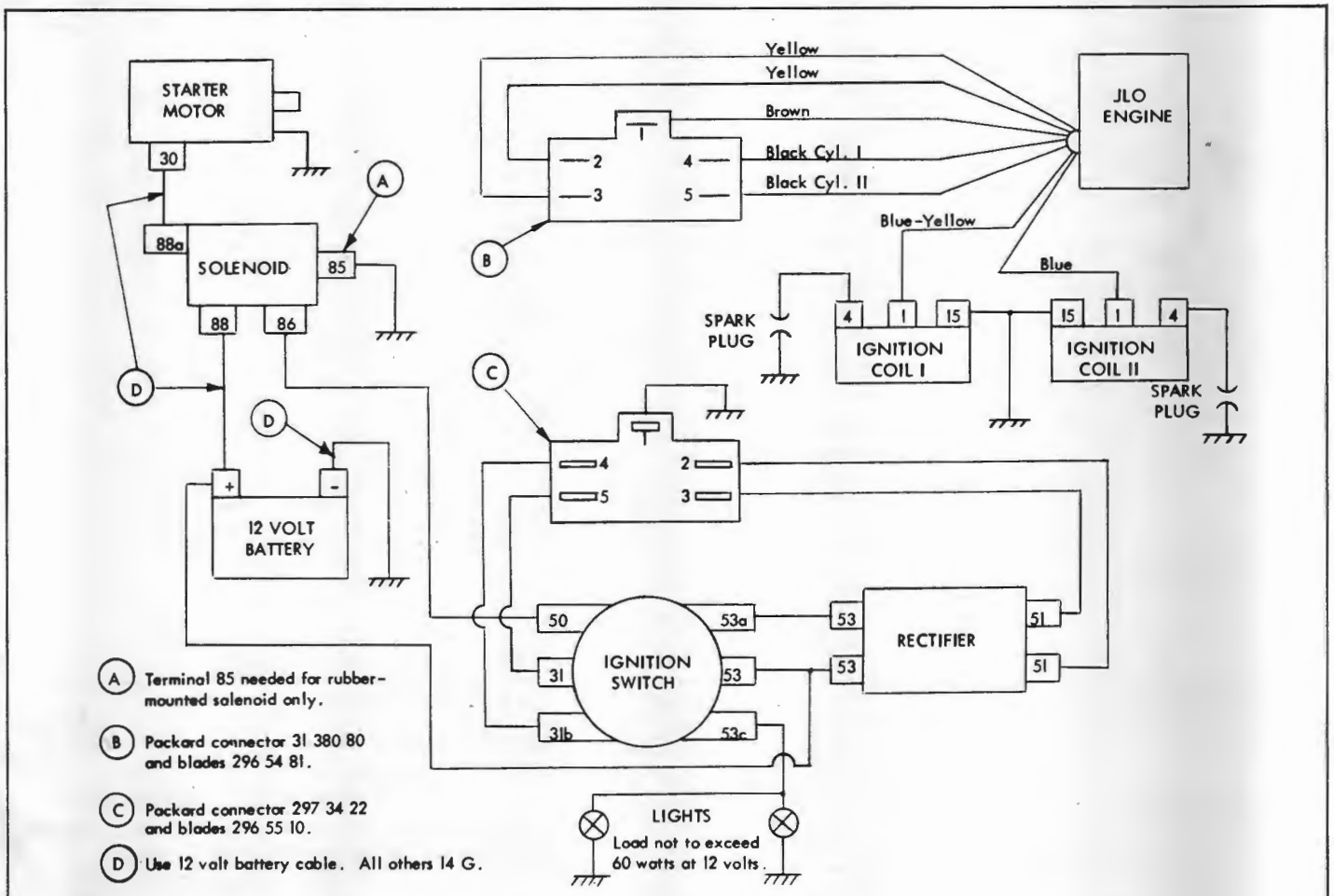
A quick timing check can also be performed with the engine not running. With centrifugal weight in retard position, attach the timing tester to the coil wire terminals and slowly turn the engine over by pulling on the recoil starter. Once the notch on the flywheel is aligned with the mark closest to the center, the timing tester light should dim. If the light does not dim when both timing marks are in alignment, the engine needs retiming.

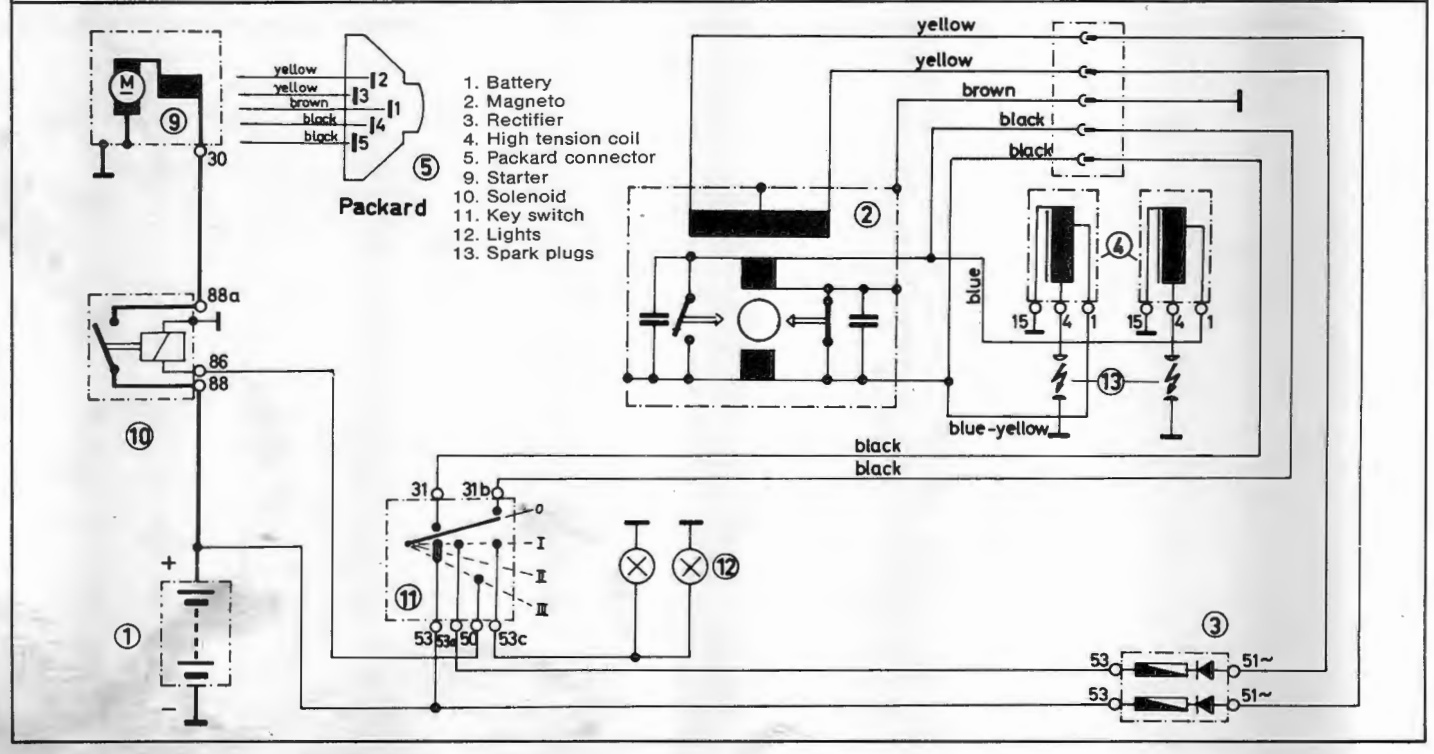


Specifications
Model LR-440/2 (2F-440-3) Twin Cylinder Engine

Bore	2.658″
Stroke	2.362″
Displacement	428cc
Compression Ratio	7.5 to 1 (Actual)
Maximum Torque	28.4Ft./Lbs. (BHP) at 6000 RPM
Brake H.P./RPM	37.5 H.P. at 6250 RPM
Lighting Coil	12 Volt, 75 Watt
Contact Breaker Gap	.014″ to .016″
Ignition Setting Before TDC (Cam Fully Advanced)	.083″ to .102″
Spark Plugs:	
Thread	14 x 1.25 mm. Long Reach Type
Gap	.016″ to .020″
Type:	BOSCH
Medium Load	W-240-T-2
Full Load	W-260-T-2
Racing	W-310-T-17
Rotation	Counterclockwise, viewed from P.T.O. End
Fuel-Oil Mixture	20:1 (1 Qt. Oil to 5 Gals. Gasoline)
Lubrication	Mixture of Good Brand of Gasoline (90 octane minimum) and Special Two-Cycle Engine Oil
Carburetor Type	WD or HD
Starter	Rewind Type, Standard; Electric, Optional
Recoil Rope	Steel
Weight	62 lbs.

Wiring Diagrams (Bosch)
Model LR-440/2 (2F-440-3) Twin Cylinder Engine

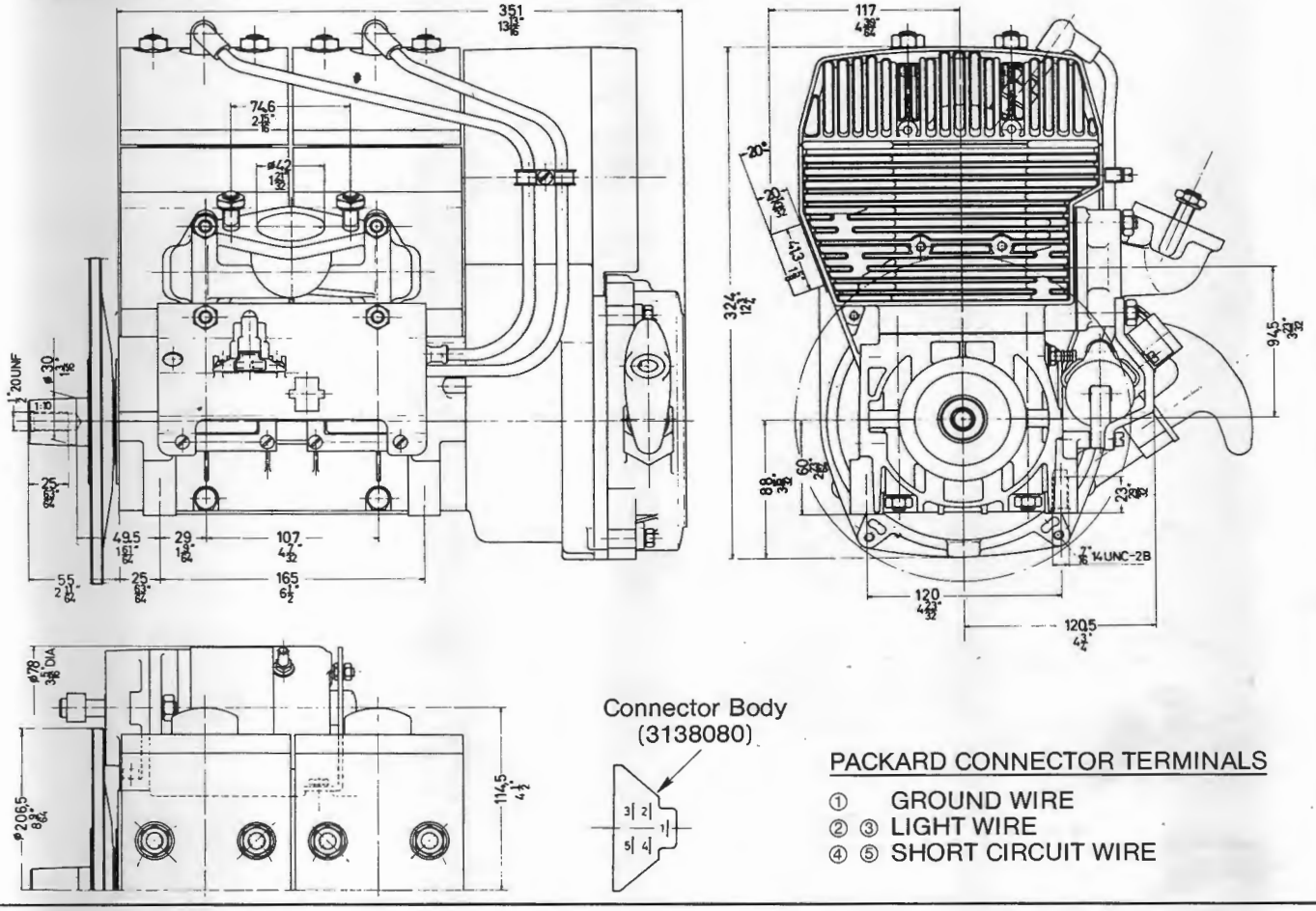




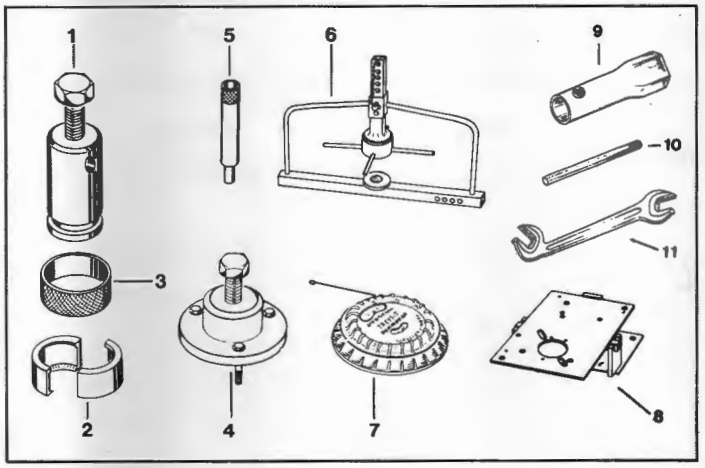
Dimensional Drawing and Special Service Tools

Model LR-440/2 (2F-440-3) Twin Cylinder Engine

Dimensional Data, Standard Configuration



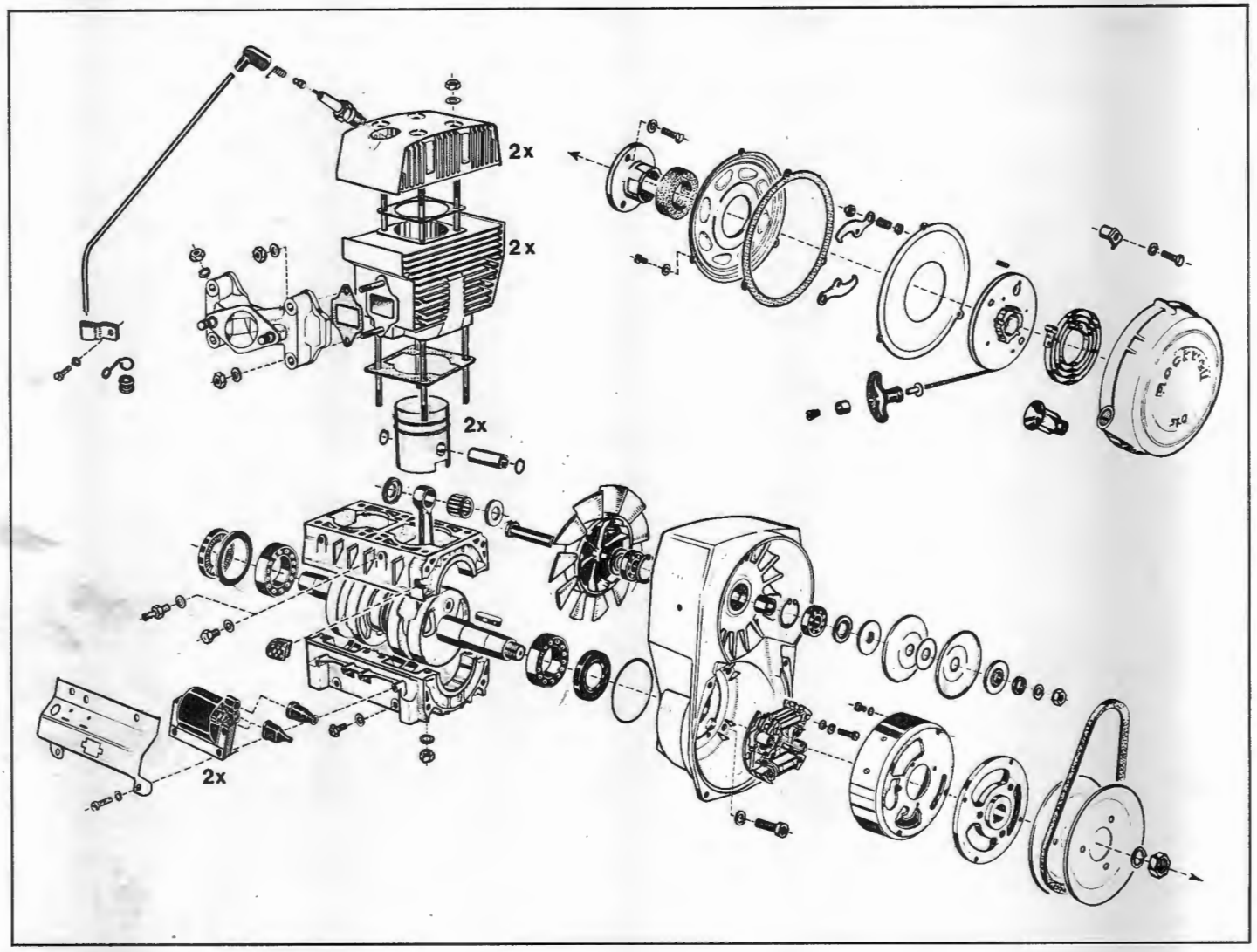
Special Service Tools



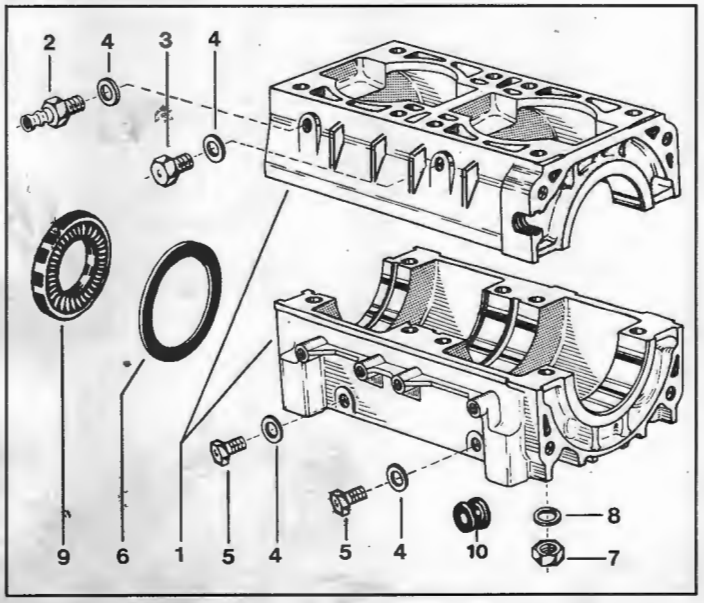
Illus. No.	Description	Part No.	Qty. Req'd.
1	Bearing Puller	444-31-807-00	1
2	Half Shells (2)	444-31-072-00	1
3	Retaining Ring	444-31-071-00	1
4	Flywheel Puller	444-31-843-10	1
5	Guide Pin	444-31-666-00	1
6	Assembly Jig (starter)	444-31-863-10	1
7	R.P.M. Indicator	000-15-30-010	1
8	Universal Mounting Plate	444-31-804-10	1
9	Spark Plug Wrench, 14 mm.; single end	000-15-20-421	1
10	Bar (use with sockets)	000-15-21-012	1
11	Wrench, double, 13 x 17 mm., open end, offset to clear carburetor	444-31-682-00	1
	—Gasket Set with Seals	438-61-802-00	1

Spare Parts List
Model LR-440/2 (2F-440-3) Twin Cylinder Engine

General View

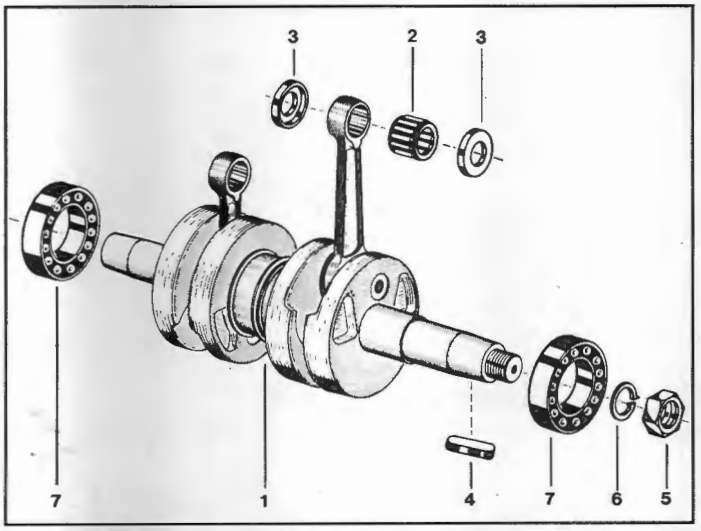


Crankcase



Illus. No.	Description	Part No.	Qty. Req'd.
1	Crankcase, complete, U.N.C. base thread. (Use with standard or electric starter)	338-01-810-20	1
2	Impulse Connector	002-45-513-26	1
3	Screw Plug	000-41-48-053	1
4	Gasket Ring	000-35-00-070	4
5	Hexagon Screw	000-41-01-089	2
6	Washer	338-03-007-00	1
7	Nut	000-41-97-010	8
8	Spring Washer	000-40-42-209	8
9	Oil Seal (Electric Start)	000-42-31-891	1
10	Grommet	002-44-430-00	1

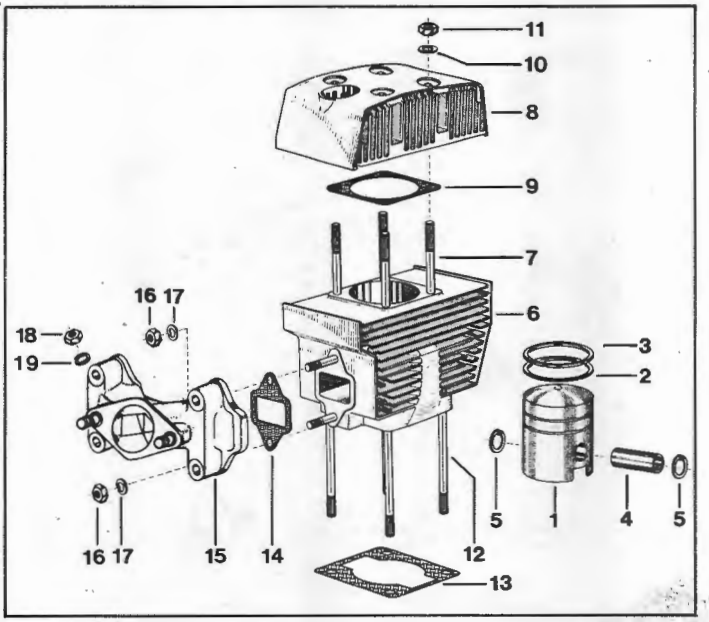
Crankshaft



Illus. No.	Description	Part No.	Qty. Req'd.
1	Crankshaft, complete P.T.O. with 1/2"—20 U.N.F. female thread; (including items 2 thru 6).	338-86-904-00	1
2	Needle Bearing	000-39-11-253	2
3	Check Plate (Spacer)	338-03-006-10	4
4	Key	000-40-89-615	1
5	Nut	000-41-95-507	1
6	Lock Washer	000-40-64-520	1
7	Ball Bearing	000-39-07-521	2

When ordering spare parts:
1) Indicate engine model number and serial number.
2) Order parts by part number, not by illustration number.
3) Give exact description of part required.
4) Indicate quantity required.

Piston and Cylinder

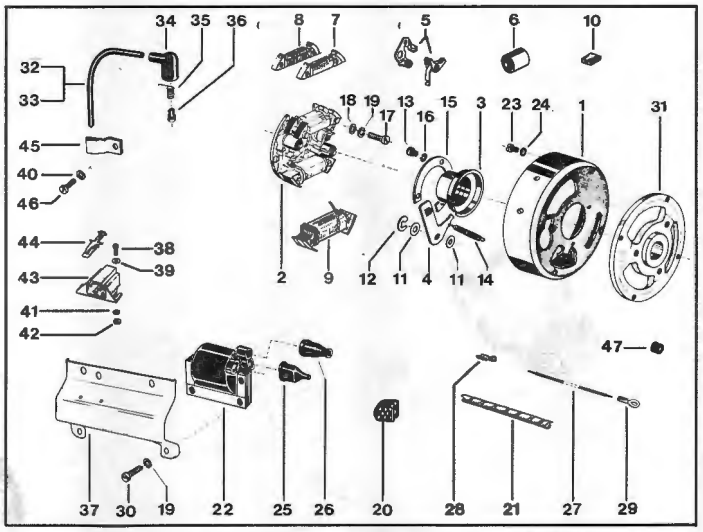


Illus. No.	Description	Part No.	Qty. Req'd.
1	Piston (including items 2 thru 5)	438-05-911-00	2
2	Piston Ring	000-42-12-488	2
3	Piston Ring	000-42-14-488	2
4	Wrist Pin	338-05-002-00	2
5	Circlip	000-40-62-142	4
6	Cylinder, includes illustration 7, studs	438-07-814-10	2
7	Stud	000-41-24-085	8
8	Cylinder Head	438-07-006-00	2*
	Cylinder Head	438-07-007-00	2*
9	Cylinder Head Gasket	438-07-002-00	2
10	Washer	000-40-51-010	8
11	Nut	000-41-97-011	8
12	Stud	000-41-24-360	8
13	Cylinder Base Gasket		
	Yellow; 5 mm.	338-07-008-00	*
	Red; 3 mm.	338-07-025-00	*
	Yellow-brown; .75 mm.	338-07-026-00	*
	Grey; 1 mm.	338-07-027-00	*
14	Intake Gasket	338-07-011-00	2
15	Intake Manifold, HD	338-07-017-00	1
16	Nut	000-41-97-010	4
17	Spring Washer	000-40-42-209	4
18	Nut (HD only)	000-41-96-011	2
19	Lock Washer (HD only)	000-40-64-508	2

*Type and quantity as required. (See items 3 and 9 Engine Assembly Procedure).

Spare Parts List
Model LR-440/2 (2F-440-3)

Electrical Equipment (Bosch)

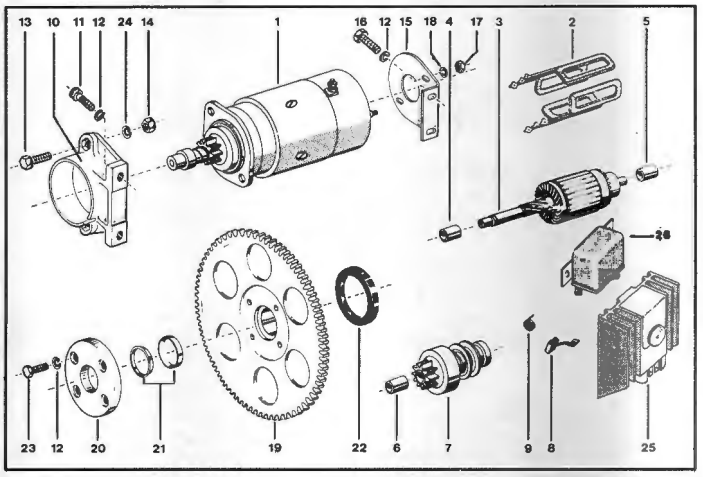


Illus. No.	Description	Part No.	Qty. Req'd.
1	Magnetic Flywheel	000-43-05-198	1
2	Armature Plate	000-43-05-331	1
3	Cam	000-43-05-728	1
4	Centrifugal/Weight	000-43-06-019	1
5	Ignition Points (2)	000-43-06-223	2
6	Condenser	000-43-06-530	2
7	Generator Coil	000-43-05-537	1
8	Generator Coil	000-43-05-538	1
9	Lighting Coil	000-43-05-534	1
10	Lubricating Wick	000-43-06-313	1
11	Washer	000-43-12-531	2
12	Lock Washer	000-40-76-008	1
13	Screw	000-41-50-094	3
14	Spiral Spring	000-43-08-768	1
15	Ring Segment	000-43-12-538	1
16	Lock Washer	000-40-64-504	3
17	Socket Cap Screw	000-41-50-115	2
18	Washer	000-40-51-006	2
19	Lock Washer	000-40-64-505	6
20	Grommet	002-44-450-01	1
21	Spiral Band	002-44-127-16	1
22	Ignition Coil	000-43-05-606	2
23	Socket Cap Screw	000-41-50-434	4
24	Spring Washer	000-40-42-208	4
25	Protective Cap	002-44-498-00	4
26	Protective Cap	002-44-499-00	2
27	Ground Cable (4 5/16")	002-44-140-11	2
28	Connector	002-44-523-00	4
29	Cable Connector	000-43-10-004	2
30	Socket Cap Screw	000-41-50-120	4
31	Magnetic Flywheel Flange	338-11-002-11	1
32	Ignition Cable (14")	002-44-152-36	1
33	Ignition Cable (20 7/16")	002-44-152-52	1
34	Spark Plug Connector	002-44-275-00	2
35	Spring	002-44-276-00	2
36	Contact Nut	002-44-277-90	2
37	Cover Plate	338-11-008-10	1

Electrical Equipment (Bosch)

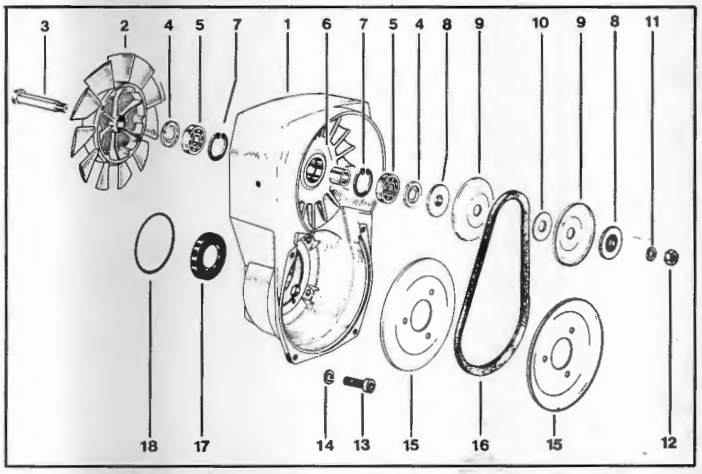
Illus. No.	Description	Part No.	Qty. Req'd.
38	Socket Cap Screw	000-41-50-097	2
39	Washer	000-40-51-005	2
40	Lock Washer	000-40-64-504	2
41	Nut	000-41-97-006	2
42	Terminal Case	002-44-556-00	1
43	Connection	002-44-550-00	5
44	Ignition Cable Bracket	002-50-120-08	1
45	Socket Cap Screw	000-41-50-438	1
46	Lock Washer	000-40-42-208	1
47	Grommet	002-44-472-90	2

Electric Starter (Bosch)



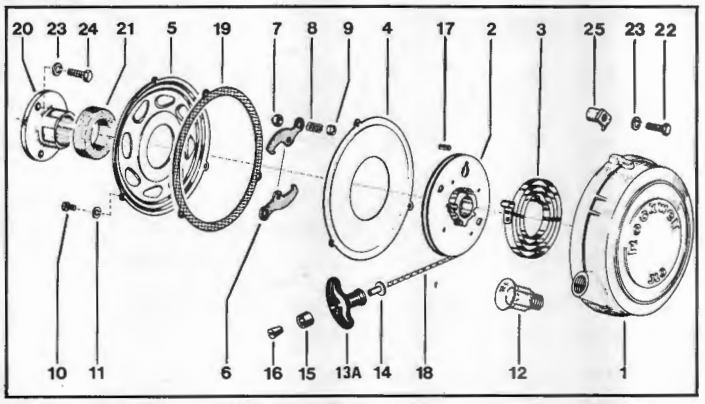
Illus. No.	Description	Part No.	Qty. Req'd.
1	Starter, complete (includes 2 thru 9)	002-44-037-00	1
2	Field Winding	000-43-08-313	2
3	Armature	000-43-05-533	1
4	Bushing	000-43-07-812	1
5	Bushing	000-43-07-801	1
6	Bushing	000-43-07-806	1
7	Drive Gear	000-43-07-421	1
8	Brushes (set of 4)	000-43-08-745	1
9	Pressure Spring	000-43-08-773	2
10	Bracket	338-11-011-00	1
11	Socket Cap Screw	000-41-75-082	2
12	Lock Washer	000-40-64-506	8
13	Hexagon Screw	000-41-01-093	2
14	Nut	000-41-97-010	2
15	Bracket	338-11-021-00	1
16	Hexagon Screw	000-41-01-067	2
17	Nut	000-41-97-007	2
18	Spring Washer	000-40-42-207	2
19	Starter Gear	338-11-010-00	1
20	Pressure Flange	338-11-015-10	1
21	Clamping Ring (set of 2)	002-42-640-30	1
22	Oil Seal	000-42-31-891	1
23	Hexagon Screw	000-41-74-011	4
24	Lock Washer	000-40-64-508	2
25	Rectifier	000-43-08-352	1
26	Relay	000-43-15-008	

Fan Case



Illus. No.	Description	Part No.	Qty. Req'd.
1	Fan Case	338-14-017-00	1
2	Impeller	399-14-004-00	1
3	Shaft	338-14-007-02	1
4	Nilos-Ring	000-40-47-735	2
5	Ball Bearing	000-39-07-113	2
6	Spacer	338-14-008-00	1
7	Locking Ring	000-40-61-432	2
8	Clamp Washer	338-14-009-00	2
9	Pulley Half (Small)	399-14-002-00	2
10	Spacer	338-14-012-00	4
11	Lock Washer	000-40-64-510	1
12	Nut	000-41-95-202	1
13	Socket Cap Screw	000-41-74-128	4
14	Lock Washer	000-40-64-607	4
15	Pulley Half (Large)	399-14-001-00	2
16	V-Belt	000-42-17-508	1
17	Oil Seal	000-42-31-548	1
18	O-Ring	002-52-665-00	1

Recoil Starter



Illus. No.	Description	Part No.	Qty. Req'd.
	Recoil Starter Assembly complete (includes items 1 thru 19); 65" rope	338-41-811-00	
1	Recoil Starter Housing	338-41-017-00	1
2	Rope Drum	197-41-070-00	1
3	Recoil Spring	252-41-429-21	1
4	Intermediate Plate	338-41-006-00	1
5	Cover Plate	338-41-005-00	1
6	Starter Pawl	252-41-065-10	2
7	Spring Cap	252-41-066-00	2
8	Pressure Spring	252-41-067-00	2
9	Inner Spring Cap	102-41-499-00	2
10	Screw	000-41-50-098	3
11	Lock Washer	000-40-67-005	3
12	Rope Bushing	102-41-469-00	1
13	Handle, complete (includes items 13A thru 16).	102-41-801-00	
13A	Handle	252-41-007-00	1
14	Bushing	252-41-009-00	1
15	Retaining Ring	252-41-015-00	1
16	Retaining Key	252-41-016-00	1
17	Tensional Pin	000-40-39-145	2
18	Rope; 65"	252-41-807-00	1
19	Gasket	338-41-007-00	1
20	Carrier	338-41-810-00	1
21	Dust Seal	079-11-017-00	1
22	Socket Cap Screw	000-41-50-136	4
23	Lock Washer	000-40-64-506	7
24	Hexagon Screw	000-41-01-069	3
25	Recoil Starter Clamp	338-41-016-00	4

Rockwell JLO Engines
WARRANTY

Rockwell-Jlo as manufacturer, warrants each engine for a period of 90 days from date of original retail purchase, or from November 15, 1971, whichever is later. Under this warranty Rockwell-Jlo will replace for the original purchaser any part or parts found, upon examination by an authorized service outlet or by central warehouse distributor, to be defective in material and/or workmanship.

All transportation charges on parts submitted for warranty shall be borne by purchaser.

This warranty shall not apply to Rockwell-Jlo products which must be replaced or repaired due to normal wear, misuse, negligence or accident or which have been repaired or altered outside Rockwell-Jlo's authorized service outlets.

There is no other warranty expressed or implied; and Rockwell-Jlo shall be under no liability whatsoever in respect of any loss, damage, injury or expense arising from any defect in said product or products.

scorpion, inc.
CROSBY, MINNESOTA 56441

SVM-7735 6/71—7.5M

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