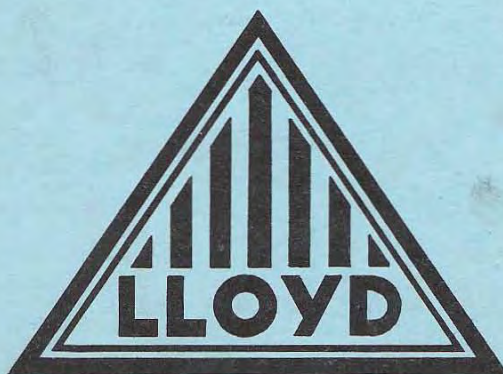


**OPERATING AND SERVICE
INSTRUCTIONS**

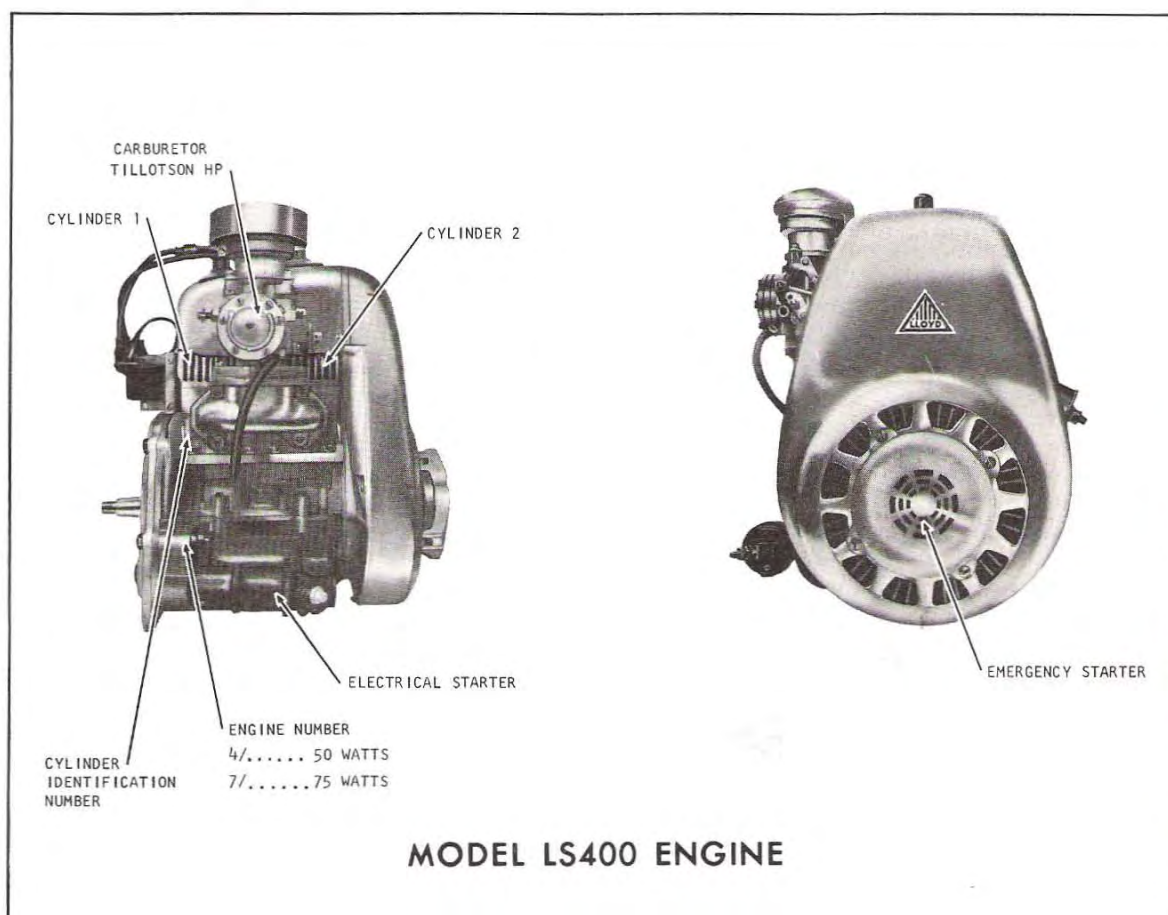
with

PARTS LIST



**ENGINE
MODEL NO. LS400**

LLOYD MOTOREN WERKE-BREMEN



CONTENTS

ENGINE SPECIFICATIONS AND ADJUSTMENTS	2
OPERATING INSTRUCTIONS	3
Engine Lubrication	3
Operating Procedure	3
Troubleshooting	3
ENGINE MAINTENANCE	4
Engine Disassembly	4
Repair and Overhaul	4
Engine Assembly	5
Inspection	7
SPARE PARTS LIST	8
FLAT-RATE LABOR SCHEDULE	13

ENGINE SPECIFICATIONS AND ADJUSTMENTS

Model and type	Lloyd LS 400, two-cylinder, two-cycle
Maximum torque	21 foot-pounds at 4200 RPM
Horsepower (See Note 1)	20 HP at 5500 RPM
Compression ratio	9.75 : 1
Engine lubrication	40-weight, two-cycle engine oil mixed at a 40-to-1 ratio, gasoline to oil
Cooling system	Air-cooling radial fan on flywheel
Cylinder arrangement	Two-cylinder, in-line
Cylinder material	Aluminum alloy, chrome-plated bore
Cylinder bore	62 mm (2.44 inches)
Stroke	64 mm (2.52 inches)
Displacement	386 cc (23.75 cubic inches)
Cylinder head	Aluminum alloy
Piston	Aluminum alloy
Piston rings	Two
Piston-pin support	Needle bearing
Wrist-pin bearing	Roller bearing with cage
Crankshaft	Steel, press-fit
Crankshaft bearings	Five ball-type main bearings
Crankcase	Aluminum alloy
Intake timing	Through transfer ports in cylinders
Engine rotation viewed to the drive shaft	Counterclockwise
Engine weight	60 pounds, 14 ounces (with electric starter)
Carburetor	Tillotson HD/16A diaphragm- type with built-in fuel pump
Carburetor quantity	One
Main jet (high-speed jet) (See Note 2)	At least one turn open
Idling jet	One turn open
Ignition	Bosch, flywheel-dynamo magneto
Ignition timing	Fixed timing: 22 to 24 degrees equals 3.1 to 3.3 mm (0.126 to 0.130 inch) before top dead center
Breaker-point gap	0.014 to 0.018 inch
Spark plug	Bosch 240 T1 or equivalent
Spark-plug gap	0.020 inch
Firing order	1 - 2
Starter motor	Bosch
Starter drive	Bendix
Starter operation	Electric
Battery charger	Alternator, 12-volt, 50-watts

NOTE 1: The listed horsepower rating was measured with a tuned air silencer or muffler according to SAE standards.

In a ready-to-use condition, but not yet broken in, the engine will develop at least 85 percent of the rated horsepower. After the break-in period, the engine will develop at least 95 percent of the stated horsepower.

The horsepower loss for each 1000 feet of elevation above sea level is 3 percent. For example: at 3300 feet above sea level, the loss of horse-

power is 10 percent; at 10,000 feet the loss of power is 30 percent.

NOTE 2: Excessive fuel, due to rich carburetor adjustment, causes the engine to four-cycle, smoke excessively at the exhaust, build up carbon and lose power.

CAUTION

A lean mixture causes the engine to overheat and may cause piston scoring or engine failure.

OPERATING INSTRUCTIONS

ENGINE LUBRICATION

The two-cycle Lloyd engine is lubricated by the oil content in the fuel mixture. Use only a good grade of regular gasoline and two-cycle, 40-weight engine oil. AMF oil, mixed at a ratio of 40 parts of gasoline to 1 part oil, is recommended.

FUEL MIXING PROCEDURE. To arrive at the proper 40-to-1, gasoline-to-oil mixture either mix 6-1/2 ounces of oil with 2 gallons of regular gasoline or 1 pint of oil with 5 gallons of gasoline in the following manner:

- a. In a clean, capped container combine the required amount of oil in 1 or 2 quarts of gasoline.
- b. Cap the container and shake the contents vigorously to completely mix the oil and gasoline.
- c. Uncap the container and immediately add the remaining gasoline to achieve the 40-to-1 mixture. Cap the container.

CAUTION

Adhere to the mixing procedure as carelessly mixed fuel may cause engine damage.

At the end of each season and before storage, drain the fuel tank and run the carburetor dry.

OPERATING PROCEDURE

- a. Fill the fuel tank with 40-to-1 fuel mixture. See mixture procedure for instructions.
- b. Turn the ignition switch to the ON position.
- c. Start a cold engine by closing the choke and cranking with the electric starter.
- d. Start a warm engine by opening the throttle slightly (do not use the choke).
- e. A rope starter is provided for emergency starting. Insert the tail end in one of the starter-cup slots and wrap the rope in the direction of engine-shaft rotation; pull rope through. When the engine has started, open the throttle slightly and open choke slowly.

- f. To stop engine, turn the ignition switch to the OFF position.

TROUBLESHOOTING

Engine stops:	Fuel tank empty Fuel pipe kinked or pinched Carburetor pulse hose disconnected
Fuel starvation:	Water in carburetor Air leak due to loose carburetor or intake manifold
No spark:	Spark plug fouled Loose or broken wire Contact-breaker points wet or burned Ignition coil damaged
No compression:	Cylinder head gasket blown Piston rings worn excessively
Poor performance:	Exhaust ports or manifold clogged with carbon Excessive carbon deposits in muffler Choke is closed Main jet open too far (particularly at higher altitudes) Contact-breaker points burned or dirty Ignition wires loose at connections Gas bubbles in carburetor (vapor lock) or leak in line
Pre-ignition at throttle:	Main jet set too lean Carbon deposits in combustion chamber
Backfire through carburetor:	Water in carburetor Idle jet set too lean Loose carburetor or intake manifold

ENGINE MAINTENANCE

ENGINE DISASSEMBLY

Proceed as follows:

- a. Disconnect wiring and remove the bracket with ignition coils.
- b. Remove the cylinder hood.
- c. Remove the blower housing assembly with the starter cover plate.
- d. Holding the emergency starter cup, loosen the M-16 nut with a socket wrench (figure 1).
- e. Remove the flywheel assembly and fan (figure 2).
- f. Remove the contact breaker plate and the ignition cam with waved washer.
- g. Remove the carburetor assembly with the insulators and intake manifold.
- h. Remove the exhaust manifold.
- i. Remove the spark plugs.
- j. Remove the cylinder heads and gaskets.
- k. Remove the cylinder base nuts with a 13-mm, box-end wrench.
- l. Place the piston in the bottom dead center position and carefully remove the cylinder.
- m. Place a wooden block under the piston; remove the piston-pin retainer rings with a snapping pliers; press piston pin out of piston.
- n. Remove piston and piston-pin bearing.
- o. Remove back panel of fan.
- p. Remove the bearing cap on the drive shaft side and the starter motor simultaneously.

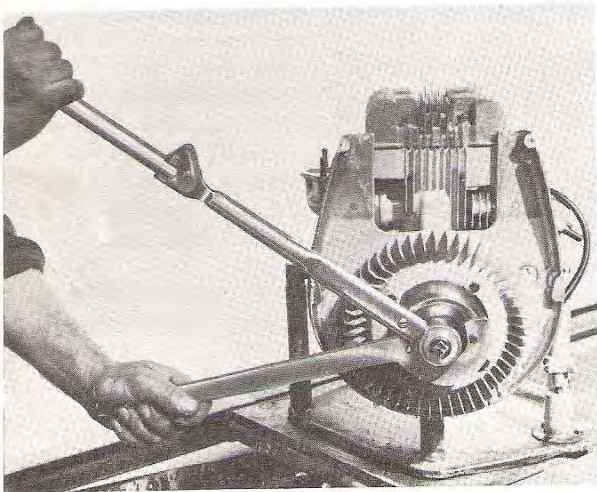


Figure 1

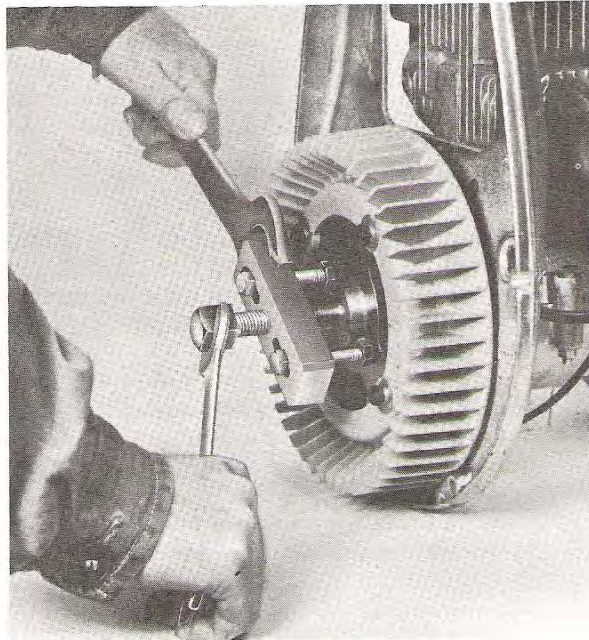


Figure 2

- q. Using a universal puller, remove the bearing on the drive shaft side.
- r. Using a universal puller, remove the ring gear and spacer.
- s. Remove the crankcase screws and split the crankcase.
- t. Carefully remove the crankshaft complete with oil seals from the crankcase.

REPAIR AND OVERHAUL

Carefully remove sealing compound from the crankcase mating surfaces with a scraper.

Carefully remove carbon from cylinder and cylinder head. Clean carbon from the ring grooves. If piston replacement is necessary, replace with same sized piston (see piston and cylinder replacement table).

Note

The hard-chromed bore makes its impossible to repair worn cylinders. Replace cylinders and pistons in sets.

Examine crankshaft. All bearings, bearing cages and piston-pin bearings should be checked for excessive tolerance. Outer crankshaft bearings may be removed and replaced. Check the condition of the outer oil seals, replace if worn or damaged.

ENGINE ASSEMBLY

Place the crankshaft in the bottom half of the crankcase. Apply a light coat of sealing compound (Permatex No. 2 or equivalent) on the mating surfaces and assemble the crankcase halves making certain the oil seals are not cocked. The upper and lower crankcase halves are numbered identically to signify that they are matched and cannot be interchanged.

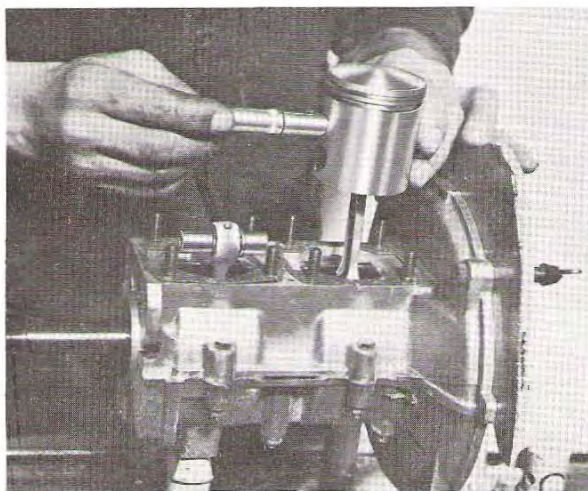


Figure 3

Mount the pistons with the arrow pointing to the exhaust side. It may be necessary to heat the piston to press in the piston pin (figure 3). Check the perpendicular alignment between the piston and the cylinder contact surface with a square (figure 4). If necessary, carefully line up the connecting rod. Install the piston-pin retainer rings. Piston tolerance is 0.05 mm (0.002 inch). The piston diameter is stamped on the piston head. The cylinder identification number may be found at the cylinder (see page 1).

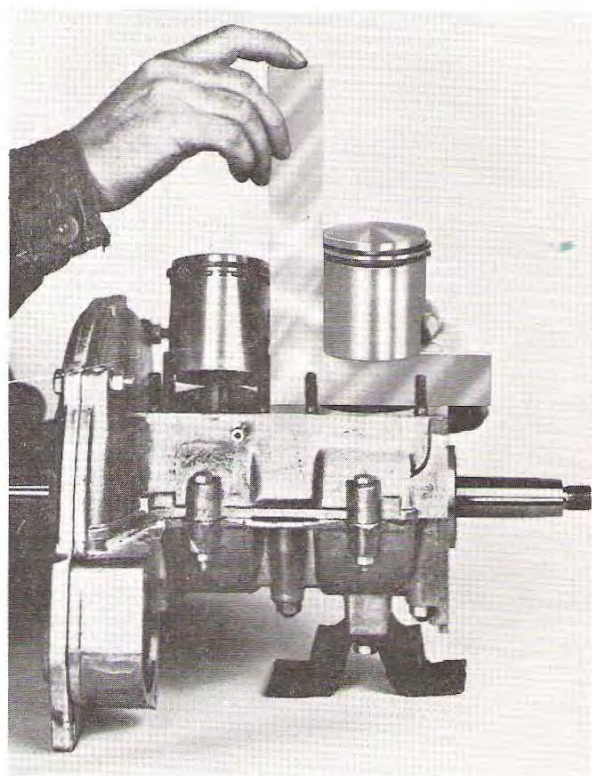


Figure 4

Cylinder ID No.	Cylinder DIA (mm)	Piston DIA (mm)
01	62.01	61.96
00	62.00	61.95
99	61.99	61.94
98	61.98	61.93
97	61.97	61.92

Cylinder Identification Numbers

After installing the cylinder base gasket and mounting the pistons, place a wooden block under the piston (figure 5). Be certain the piston rings are in position (pin to groove). Oil the rings and install using a ring compressor.

Carefully place the cylinder over the piston. Align the cylinder with the exhaust-manifold studs. Install the nuts finger tight. Using a 13-mm box spanner tighten nuts from the center out. See torque requirements chart. Install cylinder heads and gaskets; tighten bolts to specified torque.

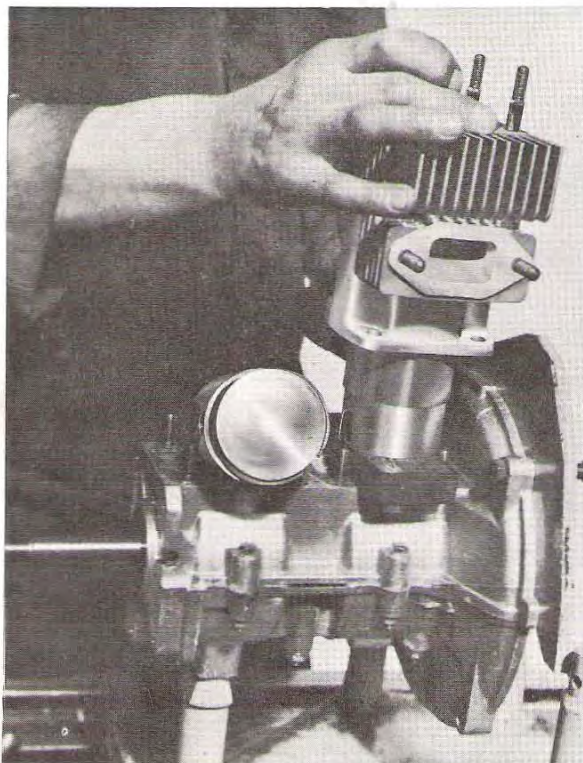


Figure 5

Note

The tapped hole in the No. 1 cylinder is for the cylinder-hood screw.

Install exhaust manifold; torque as specified. Install intake manifold complete with carburetor, gaskets and insulators. Tighten as required. Install spark plugs and mount back panel of fan. Install the oil-seal bushing on the magneto side with a spring washer on the crankshaft journal. Install the magneto plate with cable, the shortest blue cable going to cylinder No. 1. Install ignition cam and set key in keyway (figure 6).

Intake Manifold	16 to 18 foot-pounds
Exhaust Manifold	16 to 18 foot-pounds
Exhaust Pipe	27 foot-pounds
Cylinder Head	20 foot-pounds
Cylinder Base	16 to 18 foot-pounds
Drive Shaft	50 to 58 foot-pounds
Magneto Support	50 to 8 foot-pounds

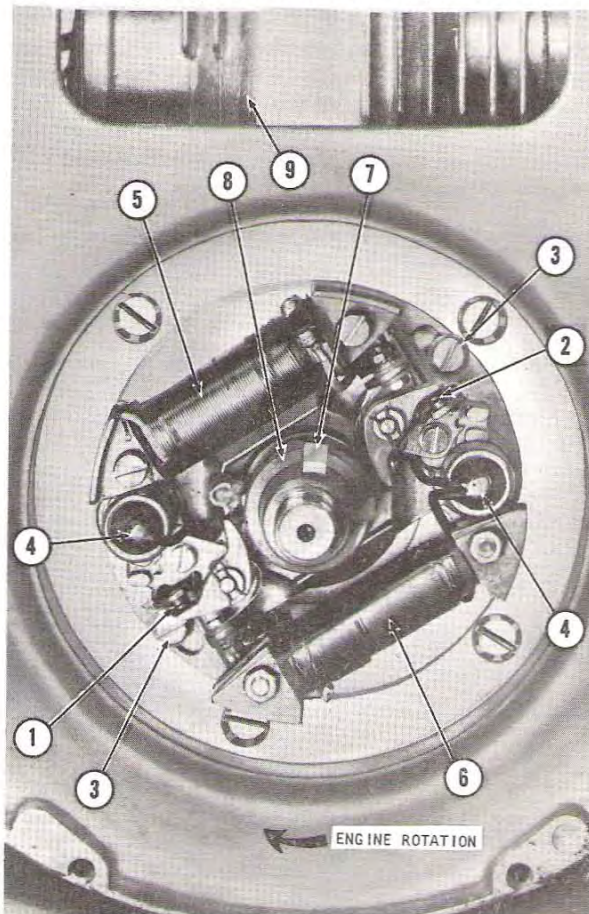
Torque Requirements

The key must be in the ignition-cam keyway (arrow to the left). Set the breaker-point gap between 0.014 and 0.018 inch.

Note

Set new points at 0.018 inch.

Adjust ignition timing from cylinder 1 (driven side) with timing gauge to 3.1 to 3.3 mm (0.126 to 0.130



1. Cylinder 1 Contact Breaker
2. Cylinder 2 Contact Breaker
3. Plate Screws
4. Condensers
5. Alternator Anchor
6. Ignition Anchor
7. Breaker Cam Key
8. Breaker Cam
9. Cylinder 2

Figure 6

inch) before top dead center. Rotate the contact-breaker plate until the breaker points for cylinder 1 just break. Tighten the contact-breaker-plate retainer screws securely.

Ignition timing for cylinder 2 (blower side) is similar to cylinder 1. However, fine adjustments must be made by varying the breaker-point setting slightly.

Rotating the contact-breaker plate in the direction of engine rotation retards ignition; rotation in the opposite direction advances the ignition.

Install magneto support and blower wheel. Mount cover tin. Hold the emergency starter cap and install the spring washer and M-16 nut. The stop on the emergency starter cap must engage the keyway in the magneto support. Tighten the nut to 50 to 58 foot-pounds torque.

Install the blower housing assembly. Heat the shaft side of the bearing cap to 212°F and shrink it on the

driven-shaft bearing. Install the bearing cap with coil bracket and the starter motor. Mount the lock ring and spring washer. Attach the cylinder hood and coil bracket on the cylinder head.

Install knurled nut on spark plug. Attach spark plug connector with extension and waterproof rubber cover. Attach spark plug lead wire.

CAUTION

Coil to plug 1 must have terminal 1 grounded; coil to plug 2 must have terminal 15 grounded. Plug 1 is on the power takeoff side (see figure 23, Ski-Daddler Instructions).

INSPECTION

After approximately 10 to 20 hours of operation, all screws and nuts should be retightened and the ignition timing and breaker-point gap checked.

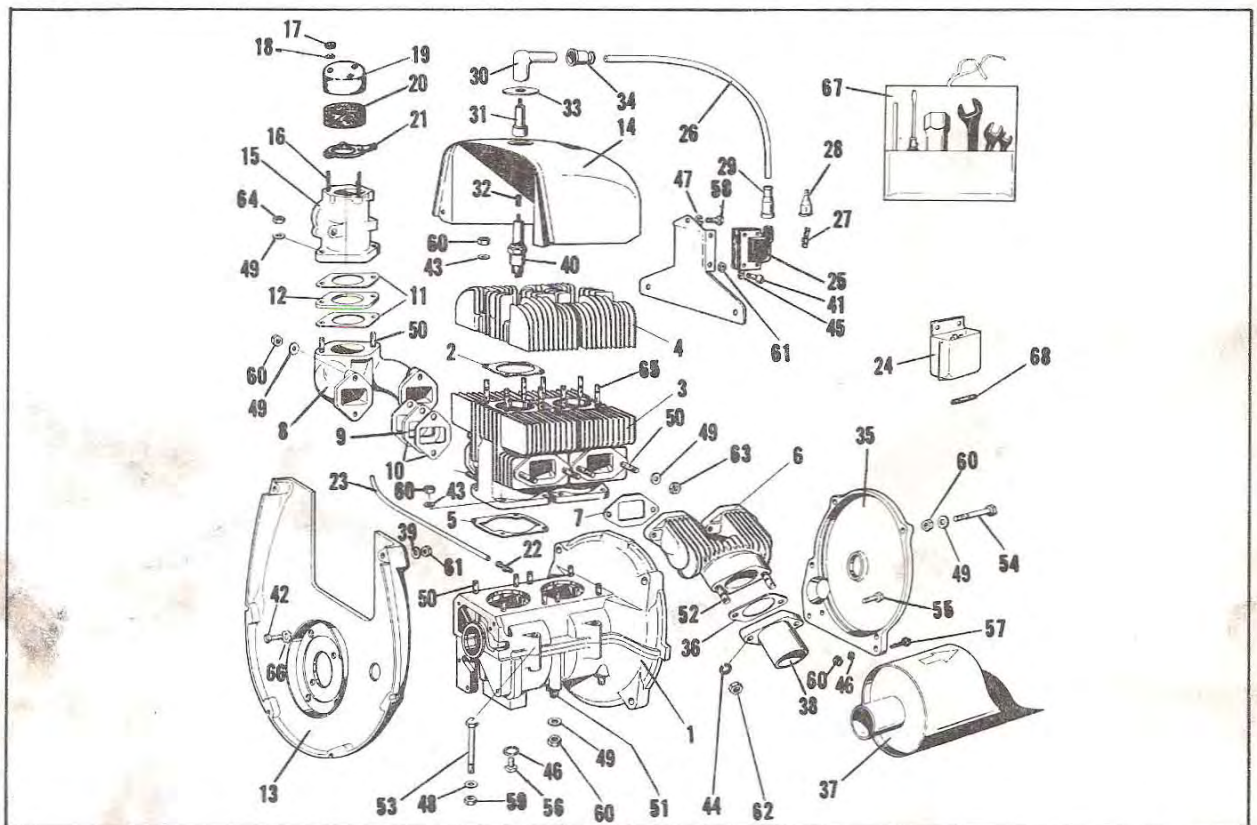


Figure 7

SPARE PARTS LIST

Figure & Index Number	Part Number	Description	Units Per Assy
7-1	04 11 0100-10	CRANKCASE, Complete	1
-2	05 12 0005-00	GASKET, Cylinder head	2
-3	04 12 0101-10	CYLINDER, Complete	2
-4	04 12 0102-10	CYLINDER HEAD	2
-5	04 12 0111-00	GASKET, Cylinder foot	2
-6	04 12 0300-00	EXHAUST MANIFOLD, 30-degree, aluminum	1
-7	04 12 0304-00	GASKET, Exhaust manifold to cylinder head	1
-8	04 12 0400-10	INTAKE MANIFOLD	1
-9	04 12 0401-00	INSULATION, Intake manifold	2
-10	04 12 0402-00	GASKET, Intake manifold	4
-11	04 12 0407-00	GASKET, Carburetor	2
-12	04 12 0408-00	INSULATION, Carburetor	1
-13	04 16 0018-00	BACK PANEL, Fan	1
-14	04 16 0019-00	HOOD, Cylinder	1
-15	04 17 0100-10	CARBURETOR, Tillotson HD/16A	1
-16	30375	STUD, Air cleaner	3
-17	995246	ACORN NUT	3
-18	120380	LOCKWASHER	3
-19	34089	COVER, Air cleaner	1
-20	34088	SCREEN, Air cleaner	1
-21	34123	BRACKET, Throttle	1
-22	04 17 0200-00	NIPPLE, Vacuum	1
-23	04 17 0201-00	HOSE, Vacuum	1
-24	04 18 0320-00	RECTIFIER, 50-watt	1
-25	04 18 0419-00	IGNITION COIL	2
-26	04 18 0440-00	WIRE, Spark plug, 7-mm, 400-mm	2
-27	30 35 2018-00	WIRE CONNECTION	7
-28	04 18 0441-00	COVER, Small	4
-29	04 18 0442-00	COVER, Large	2
-30	04 18 0715-00	CONNECTOR, Spark plug, 7-mm	2
-31	04 18 0716-00	EXTENSION, Connector	2
-32	04 18 0717-00	NUT, Knurled	2
-33	04 18 0730-00	COVER, Waterproof rubber	2
-34	30 18 1508-00	CAP, Plug connector	2
-35	04 22 0500-00	CAP, Driven shaft bearing	1
-36	05 36 0010-00	GASKET, Muffler	1
-37	04 36 0200-10	MUFFLER	1
-38	04 36 0340-10	TUBE, Flanged, 40-mm diameter, 90-degree bend	1
-39	896 180 3056	WASHER, Galvanized, 5 by 14	6
-40	890 240 1412	SPARK PLUG, 240	2
-41	900 084 3492	SCREW, Round head, 5 by 20	4
-42	900 084 3782	SCREW, Round head, 5 S, 6 by 15	4
-43	900 125 0080	WASHER, 8, 4	16
-44	900 127 1100	SPRING RING, A 10	2
-45	900 127 4050	SPRING RING, A 5	4
-46	900 127 4080	SPRING RING, A 8	10
-47	900 127 4060	SPRING RING, A 6	8
-48	900 137 2060	SPRING WASHER, B 6	4
-49	900 137 2080	SPRING WASHER, B 8	15
-50	900 835 1374	SCREW, 8 by 22, 8 G	18
-51	900 835 1474	SCREW, 8 by 65, 8 G	6

Figure & Index Number	Part Number	Description	Units Per Assy
7-52	900 939 1684	SCREW, 10 by 25, 8 G	2
-53	900 931 0874	SCREW, Hex, 6 by 50, 8 G	4
-54	900 931 1424	SCREW, Hex, 8 by 40, 8 G	3
-55	900 931 1484	SCREW, Hex, 8 by 70, 8 G	2
-56	900 933 1354	SCREW, Hex, 8 by 18, 8 G	2
-57	900 933 1414	SCREW, Hex, 8 by 35, 8 G	2
-58	900 933 3774	SCREW, Hex, 8 by 15, 8 G	1
-59	900 934 0063	NUT, M 6, 6 S	8
-60	900 934 0083	NUT, M 8, SW 13, 6 S	31
-61	900 934 3052	NUT, M 5, 5 S	10
-62	900 934 6106	NUT, M 10, brass, SW 14	2
-63	900 934 6086	NUT, M 8, brass, SW 12	4
-64	900 936 0112	NUT, M 8, SW 13, flat	2
-65	900 940 0835	SCREW, 8 by 35, 8 G	8
-66	906 797 4060	WASHER, Dented, 6, 4	4
-67	04 38 0100-00	TOOL KIT	1
-68	97 25 810050	FUSE, Rectifier	1

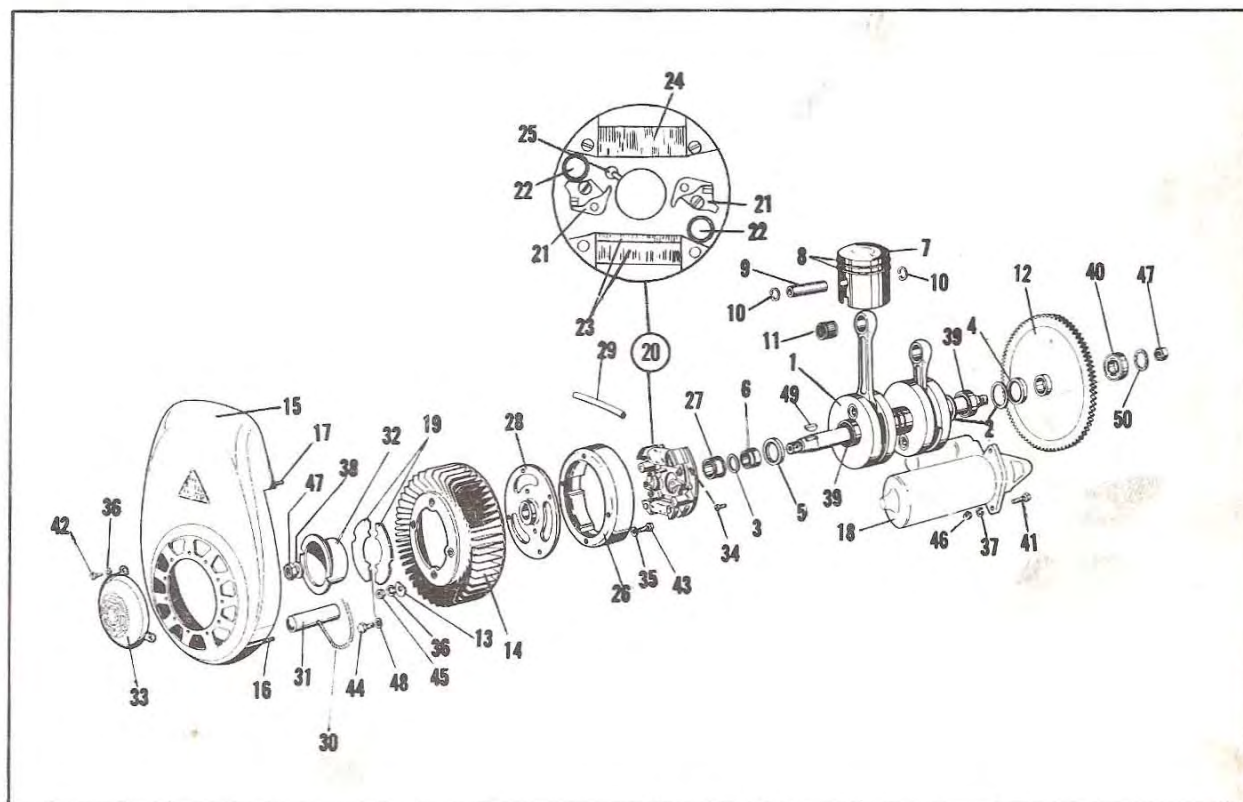


Figure 8

Figure & Index Number	Part Number	Description	Units Per Assy
8-1	04 13 0001-10	CRANKSHAFT COMPLETE	1
-2	05 13 0009-00	SNAP RING	2
-3	04 13 0011-00	WASHER, Waved	1
-4	05 13 0012-00	OIL SEAL, Radial 52 by 40 by 7	1
-5	04 13 0012-00	OIL SEAL, Radial, 52 by 35 by 7	1
-6	04 13 0014-00	BUSHING, 35 by 24 by 25, ZS	1
-7	04 13 0200-20	PISTON, Aluminum cylinder	2
-8	04 13 0202-20	PISTON RING, 2.0-mm	4
	04 13 0202-00	PISTON RING, 2.5-mm	4
-9	04 13 0208-00	PISTON PIN	2
-10	04 13 0209-00	RING	4
-11	04 13 0305-00	BEARING, Big end	2
-12	*04 13 0400-00	RING GEAR, 25.4-mm diameter	1
	04 13 0400-10	RING GEAR, 25.0-mm diameter	1
-13	04 16 0010-00	SPACING WASHER	4
-14	04 16 0017-00	ROTOR BLOWER WHEEL	1
-15	04 16 0210-00	BLOWER HOUSING COMPLETE	1
-16	04 16 0211-00	STUD, Short	4
-17	04 16 0212-00	STUD, Long	2
-18	04 18 0300-00	STARTER, Electric	1
-19	04 18 0415-00	COVER, Magneto	2
-20	05 18 0416-00	PLATE, Contact-breaker	1
-21	04 18 0500-00	CONTACTS, Set	2
-22	04 18 0501-00	CONDENSER	2
-23	04 18 0503-00	ARMATURE, Ignition	2
-24	04 18 0504-00	ARMATURE, Generator	1
-25	04 18 0505-00	WICK, Lubrication	1
-26	05 18 0417-00	MAGNET, Rotor, 50-watt	1
-27	05 18 0418-00	BREAKER CAM	1
-28	05 18 0420-00	SUPPORT, Magneto	1
-29	04 18 0445-00	HOSE, Insulating, 6/7-mm, 200/420 mm long	2
-30	01 31 0605-00	ROPE, Emergency starter	1
-31	01 31 0604-00	HANDLE, Emergency starter	1
-32	04 31 0602-00	ROLL, Emergency starter	1
-33	04 31 0603-00	COVER, Emergency starter	1
-34	900 084 3482	SCREW, Round head, 5 by 18	2
-35	900 125 0060	WASHER, 6, 4	4
-36	900 127 4060	SPRING RING, A 6	REF
-37	900 127 4080	SPRING RING, A 8	REF
-38	900 137 5160	SPRING WASHER, B 16	1
-39	*905 412 1205	BEARING, Rolled, NU 205	3
	*900 625 1255	BEARING, Grooved, 6205 C 3 25.4	1
	900 625 1254	BEARING, Grooved, 6205 C 3 25.0	4
-40	900 625 1257	BEARING, Grooved, 6205 2 Z C 3 25	1
	*900 625 1256	BEARING, Grooved, 6205 2 Z C 3 25.4	1
-41	900 931 1484	SCREW, Hex, 8 by 70 8 G	REF
-42	900 933 3755	SCREW, Hex, slotted 6 by 10	3
-43	900 933 0794	SCREW, Hex, 6 by 20 8G	4
-44	900 933 1334	SCREW, Hex, 8 by 12 8 G	2
*Only up to engine No. 4/1399			

Figure & Index Number	Part Number	Description	Units Per Assy
8-45	900 934 0063	NUT, M 6, 6 S	REF
-46	900 934 0083	NUT, M 8, SW 13, 6 S	REF
-47	900 936 0163	NUT, M 16 by 1, 5 5 S	2
-48	906 798 1080	WASHER, W-type	2
-49	906 888 6750	SPRING, 6 by 7.5	1
-50	896 408 0250	LOCK RING	1

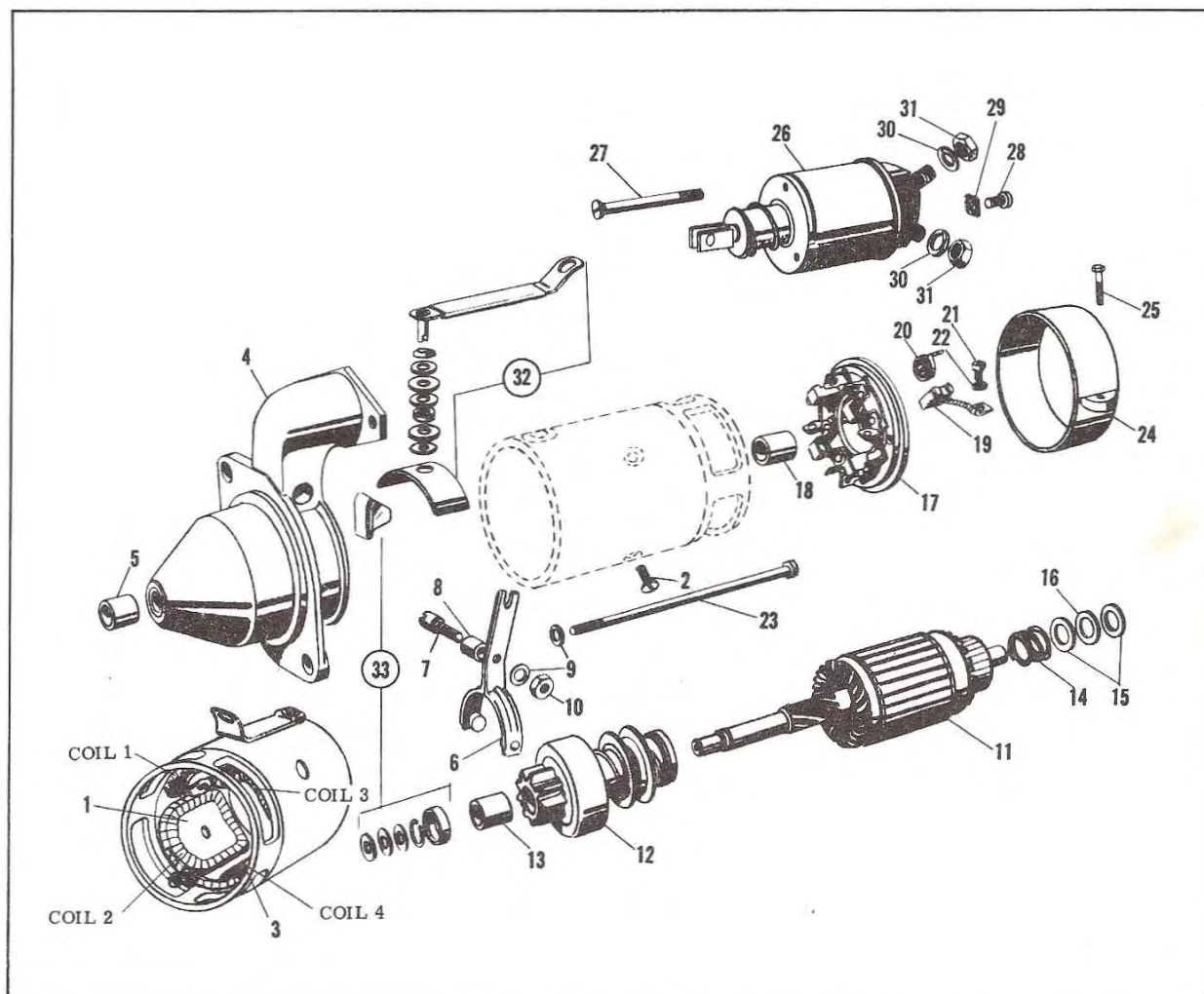


Figure 9

Figure & Index Number	Part Number	Description	Units Per Assy
9-1	04 18 0201-00	FIELD WINDING, Coils 1 through 4	1
-2	04 18 0202-00	SCREW	4
-3	04 18 0203-00	CONNECTING RAIL	4
-4	04 18 0210-00	DRIVE-END BRACKET ASSEMBLY	1
-5	04 18 0211-00	BEARING BUSHING	1
-6	04 18 0212-00	LEVER, Engaging	1
-7	04 18 0213-00	SCREW	1
-8	04 18 0214-00	BUSHING	1
-9	900 127 4050	LOCKWASHER, A 5	1
-10	900 934 3052	NUT	1
-11	04 18 0220-00	ARMATURE	1
-12	04 18 0225-00	DRIVE ASSEMBLY	1
-13	04 18 0226-00	BEARING BUSHING	1
-14	04 18 0227-00	SPRING, Helical	1
-15	04 18 0228-00	WASHER	2
-16	04 18 0229-00	WASHER, Insulating	1
-17	04 18 0235-00	COMMUTATOR-END BRACKET ASSEMBLY	1
-18	04 18 0236-00	BEARING BUSHING	1
-19	13 18 0302-00	BRUSH, Carbon	4
-20	04 18 0238-00	SPRING, Carbon brush	4
-21	900 084 3192	SCREW, M 4 by 8	4
-22	900 127 4040	LOCKWASHER	4
-23	04 18 0241-00	SCREW	2
-24	04 18 0242-00	BAND, Closing	1
-25	04 18 0243-00	SCREW	1
-26	04 18 0250-00	RELAY ASSEMBLY	1
-27	04 18 0251-00	SCREW	3
-28	900 084 3192	SCREW, M 4 by 8	1
-29	04 18 0254-00	PLATE	1
-30	900 127 4080	LOCKWASHER, A 8	2
-31	900 936 0112	NUT, M 8	2
-32	04 18 0270-00	PARTS KIT, Terminal	1
-33	04 18 0271-00	PARTS KIT, Armature	1