

Robin Industrial Engines®

SERVICE MANUAL

Model

EC13V

1193S122



ROBIN AMERICA, INC.
ROBIN TO WISCONSIN ROBIN
ENGINE MODEL CROSS REFERENCE LIST

ROBIN

WISCONSIN ROBIN

SIDE VALVE

EY08	W1-080
EY15	W1-145
EY15V	W1-145V
EY20	W1-185
EY20V	W1-185V
EY23	W1-230
EY28	W1-280
EY35	W1-340
EY40	W1-390
EY45V	W1-450V
EY21	EY21W
EY44	EY44W
EY18-3	EY18-3W
EY25	EY25W
EY27	EY27W

OVERHEAD VALVE

EH11	WO1-115
EH12	WO1-120
EH15	WO1-150
EH17	WO1-170
EH21	WO1-210
EH25	WO1-250
EH30	WO1-300
EH30V	WO1-300V
EH34	WO1-340
EH34V	WO1-340V
EH43V	WO1-430V

TWO CYCLE

EC13V	WT1-125V
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DIESEL

DY23	WRD1-230
DY27	WRD1-270
DY30	WRD1-300
DY35	WRD1-350
DY41	WRD1-410

FOREWORD

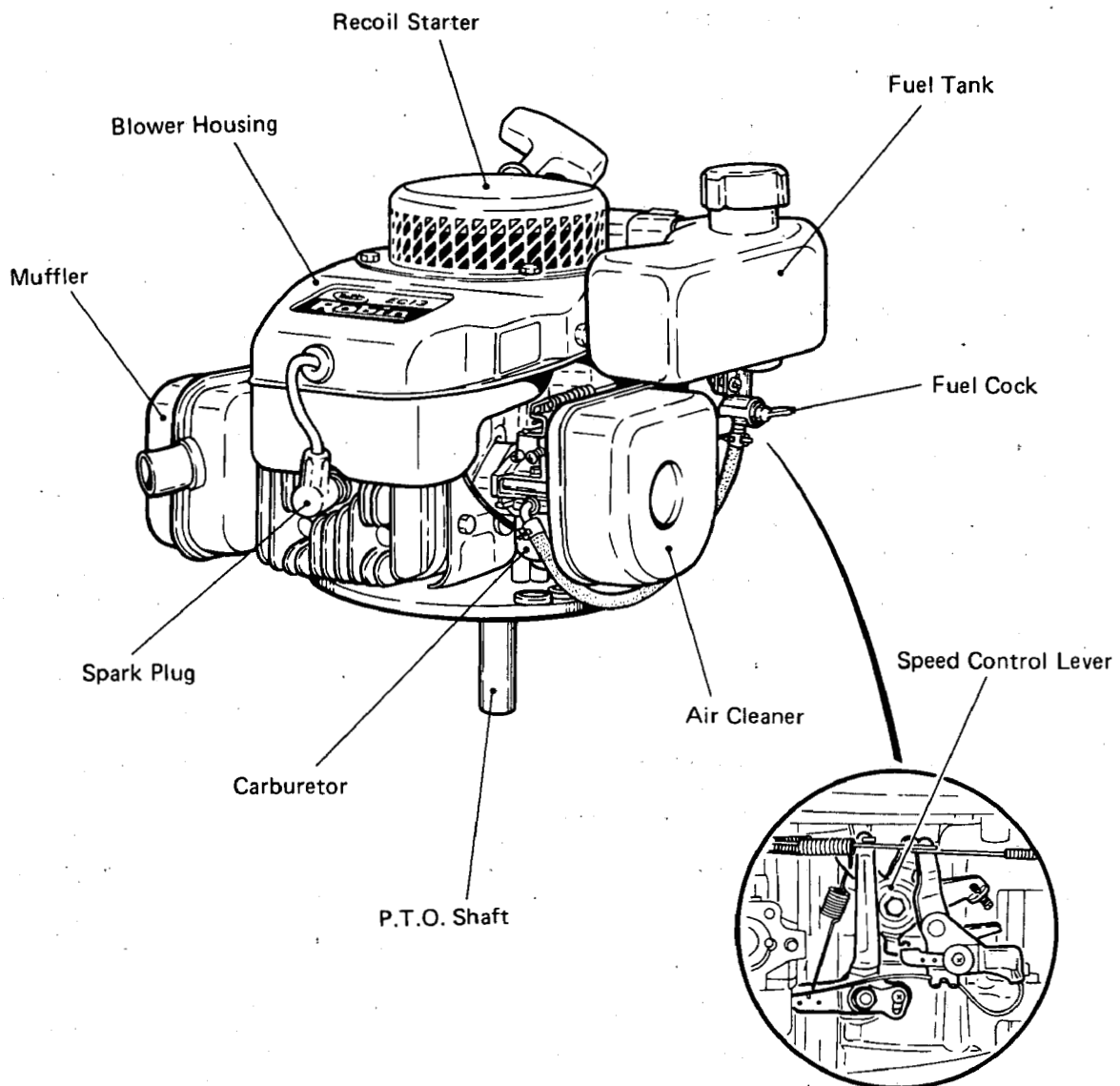
This manual covers the construction, function and servicing procedures of the **Robin engine model EC13V**.

Good operation and a planned maintenance program as outlined in this manual are of vital importance in obtaining maximum engine performance, and long engine life. Careful observance of the instructions will result in better, safer service work.

IMPORTANT: All information, illustrations, directions and specifications in this book are on the basis of information available at the time it was written.

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CONTENTS

<i>Section</i>	<i>Title</i>	<i>Page</i>
1.	SPECIFICATIONS	1
2.	PERFORMANCE	2
2-1	Maximum Output	2
2-2	Continuous Rated Output	2
2-3	Maximum Torque and Fuel Consumption Ratio at Continuous Rated Output	2
3.	FEATURES	3
4.	SECTIONAL VIEW of ENGINE	4
5.	DISASSEMBLY and REASSEMBLY	6
5-1	Preparations and Suggestions	6
5-2	Special Tools	7
5-3	Disassembly and Reassembly Procedures	8
6.	MAGNETO	17
6-1	Operation of the Ignition System	17
6-2	Ignition System Check	18
6-3	Ignition Unit Installation	18
7.	GOVERNOR	19
7-1	Construction and Operation	19
7-2	Governor Adjustment	20
7-3	High Speed Adjustment	21
8.	BREAK IN OPERATION of REASSEMBLED ENGINE	22
9	TROUBLE SHOOTING	23
9-1	Starting Difficulties	23
9-2	Slow-speed out of order	24
9-3	Overheating and Knocking	24
9-4	Power Drop	24
9-5	Excessive Fuel Consumption	24
9-6	Engine Hunting	25
9-7	Other Complaints	25
10.	CHECKS and CORRECTIONS	26
11.	CLEARANCE DATA and LIMITS/TORQUE SPECIFICATIONS	27
12.	MAINTENANCE and STORING	29
12-1	Daily Checks and Maintenance	29
12-2	Every 50 Hours (10 days) Checks and Maintenance	29
12-3	Every 100 ~ 200 Hours (Monthly) Checks and Maintenance	29
12-4	Every 500 ~ 600 Hours (Semiannual) Checks and Maintenance	29
12-5	Every 1000 Hours (Yearly) Checks and Maintenance	30
12-6	Preparation for Long Storage	30

1. SPECIFICATIONS

Model		EC13V
Type		Air-cooled, 2-Cycle, Vertical Shaft, Single Cylinder Gasoline Engine
Bore x Stroke		56 mm x 50 mm (2.20 in x 1.97 in)
Piston Displacement		123 cc (7.49 cu. in)
Continuous Rated Output		3.2 HP/3600 rpm (2.4 KW/3600 min ⁻¹)
Max. Output		4.2 HP/4000 rpm (3.1 KW/4000 min ⁻¹)
Max. Torque		0.8 kg-m/3000 rpm
Rotation		Counter-clockwise facing to P.T.O. shaft
Cooling System		Forced Air Cooling
Lubrication		Gasoline Oil Mixing Type (Mixing Ratio 50:1)
Lubricant		2-Cycle Engine Oil
Carburetor		Horizontal Draft, Float Type
Fuel		Automobile Gasoline (mixed with oil)
Fuel Consumption Ratio (gr/HP-h)		360 at continuous rated output operation
Fuel Feed		Gravity Type
Fuel Tank Capacity		Approx. 2.0 liter (0.53 U.S. gal.)
Speed Governor		Centrifugal Flyweight Type
Ignition System		Flywheel Magneto Type (Solid State Ignition)
Spark Plug		NGK BM6A or CHAMPION CJ8
Starting System		Recoil Starter
Dry Weight		11.2 kg (24.7 lbs)
Dimensions	Length	400 mm (15.7 in)
	Width	334 mm (13.1 in)
	Height	331 mm (13.0 in)

2. PERFORMANCE

2-1 MAXIMUM OUTPUT

The maximum output of the engine is the power delivered by the engine running with full throttle opening after the engine is thoroughly broken in.

A brand new engine may not produce this maximum output until it has been sufficiently broken in.

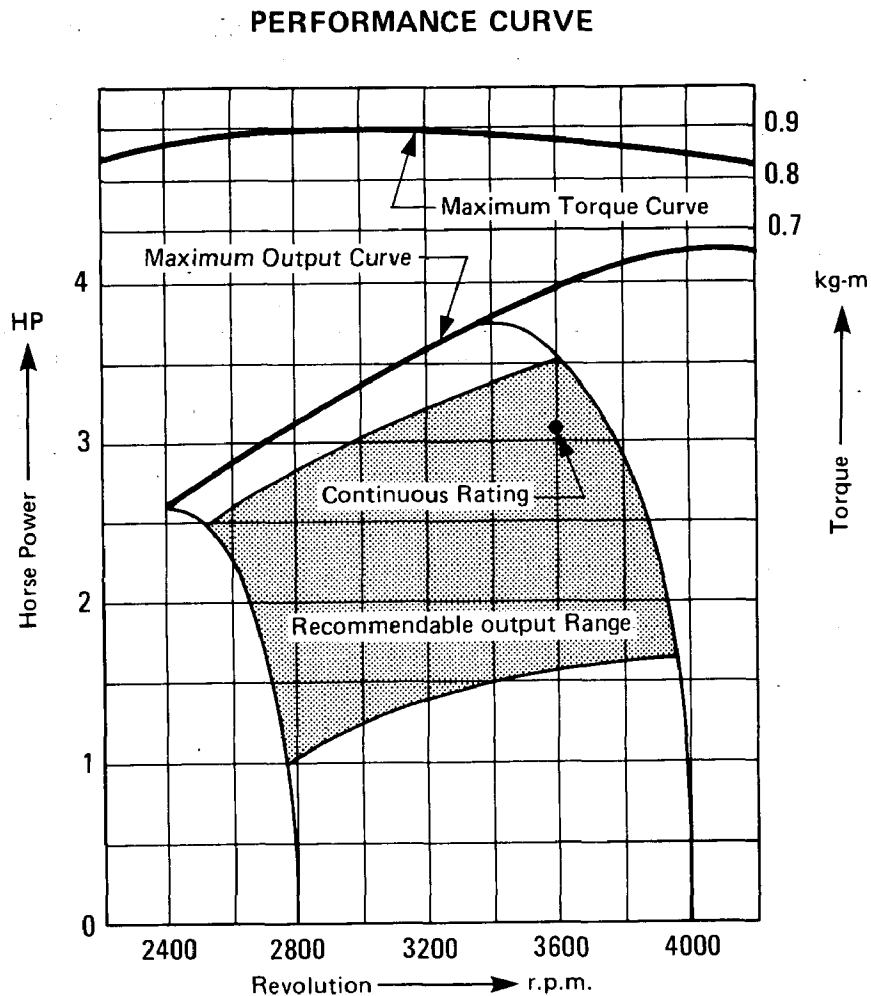
2-2 CONTINUOUS RATED OUTPUT

The continuous rated output of the engine is the power delivered by the engine running at an optimum speed most favorable for engine life and fuel consumption. When designing an equipment driven by an engine, it is most important to keep the power requirement less than continuous rated output of the engine.

2-3 MAXIMUM TORQUE and FUEL CONSUMPTION RATIO AT CONTINUOUS RATED OUTPUT

The maximum torque curve of the engine is the output torque curve at P.T.O. shaft when the engine is running with full throttle opening.

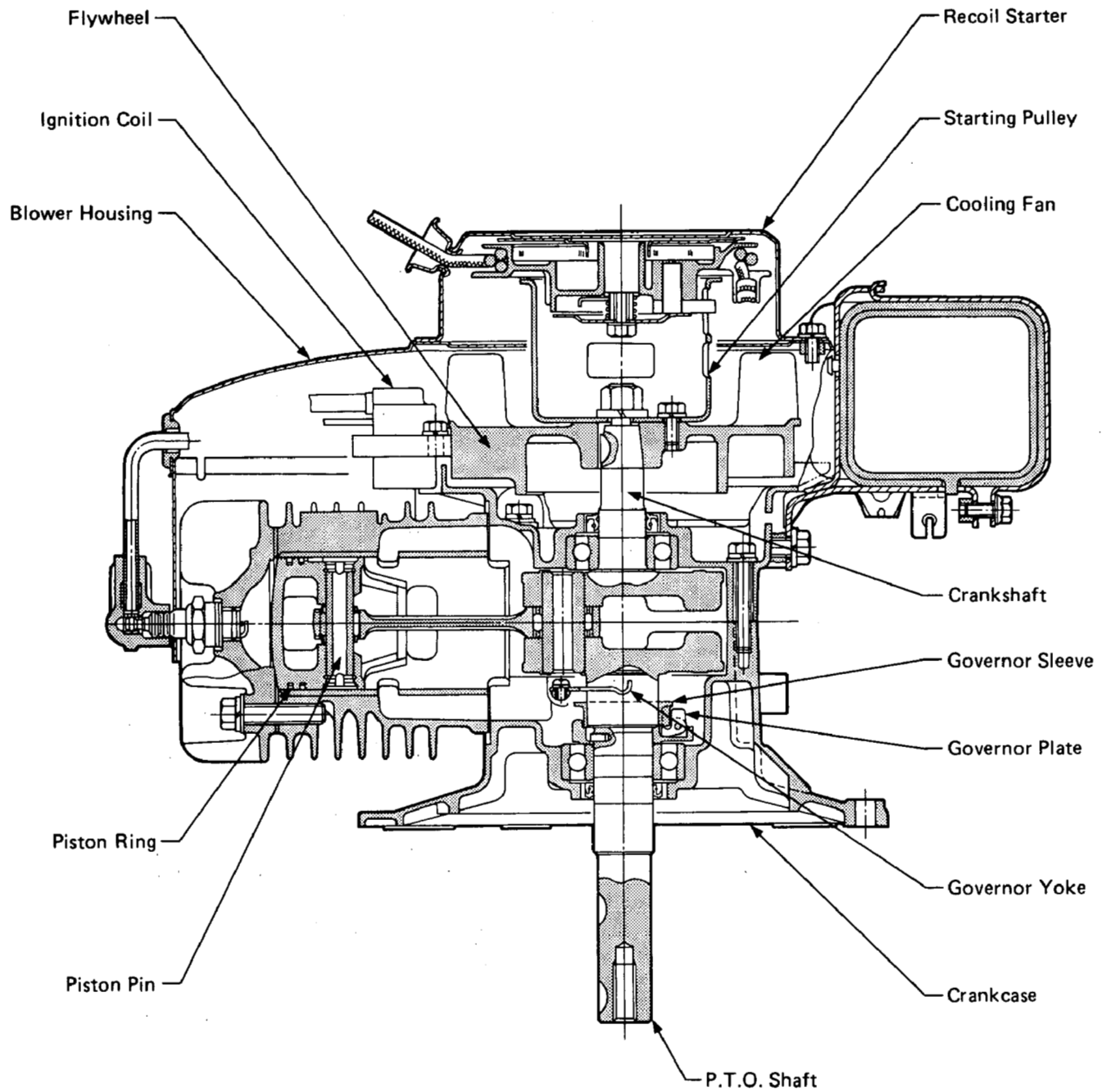
Fuel consumption ratio at continuous rated output is the one while the engine is delivering continuous rated output.

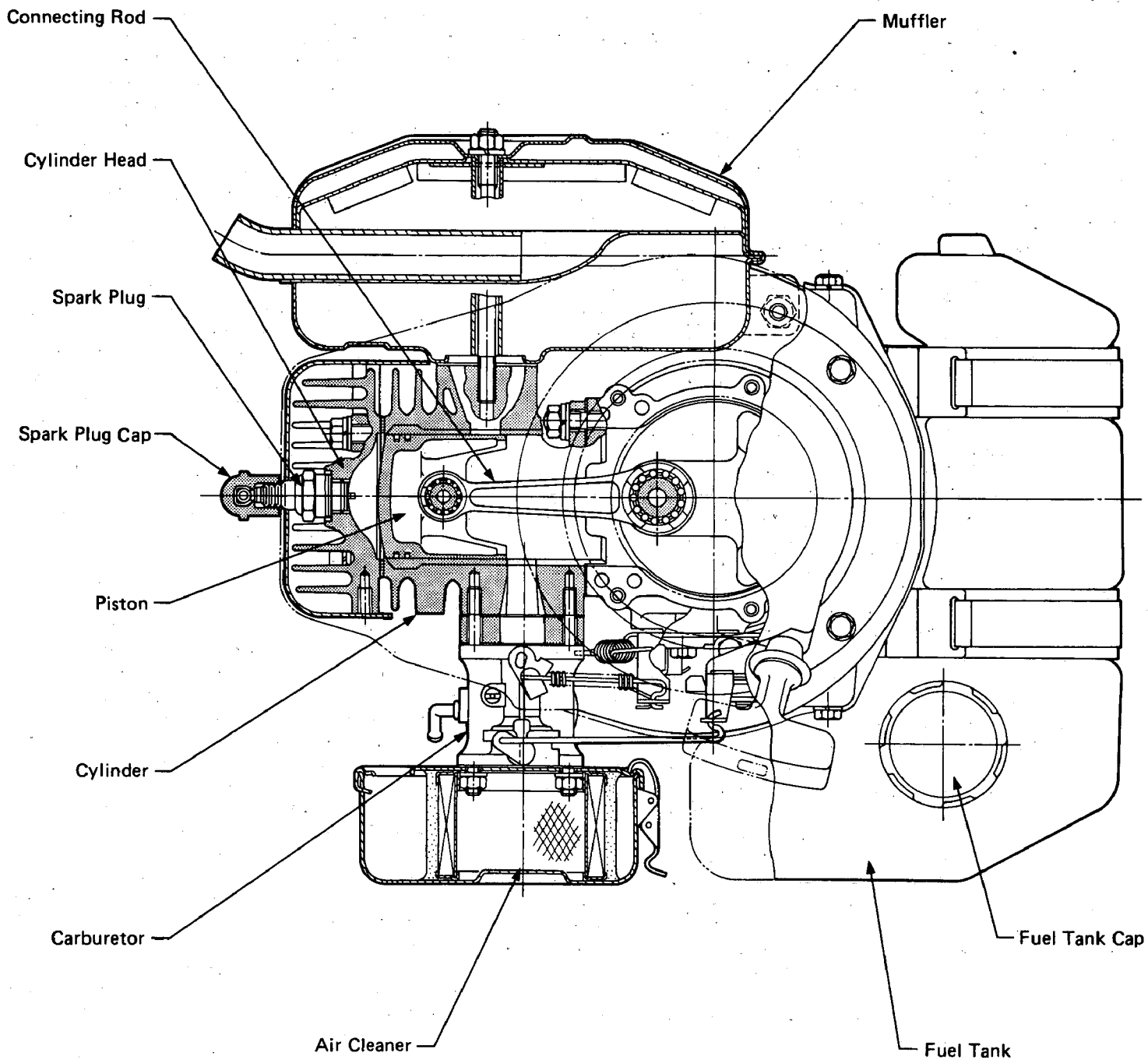


3. FEATURES

1. **CRANKSHAFT:** Forged steel crankshaft assembled with induction hardened crankpin, precision balanced for low engine vibration, durability, greater shock loading resistance and longer life.
2. **BEARINGS:** Ball bearings at both ends of crankshaft and needle roller bearings at small end and large end of connecting rod give less friction, better radial support, maximum side loading capability and longer life.
3. **ALUMINUM CYLINDER and CRANKCASE:** Aluminum die-cast cylinder with molded-in cast iron liner makes the engine light in weight with extra strength, durability, lower oil consumption and longer life.
4. **AIR CLEANER:** Rugged dual stage air cleaner with high efficiency, ease of service and longer engine life.
5. **SOLID STATE IGNITION:** Solid state, high energy electronic ignition gives more precise ignition timing, hotter spark for easy starting, no breaker points to service, ease of maintenance and longer spark plug life.
6. **ALL-SPEED GOVERNOR:** Rapid response mechanical flyweight type governor system is fully lubricated with oil mixed fuel for long life and which enables more precision speed regulation and better reliability.
This all-speed governor system enables the setting for any desired speed by simply moving the control lever.
7. **CARBURETOR:** Precision modern design with butterfly throttle and choke. Removable fixed jet and float type design gives maximum fuel economy and ease of starting.
8. **PISTON:** High strength aluminum alloy piston is specially designed for durability and longer life.
9. **PISTON RINGS:** Two ring design. Chromium plated top ring and perkarized second ring give smooth running and durability.
10. **FUEL TANK:** Large, no rust resin tank gives trouble-free long operation.

4. SECTIONAL VIEW of ENGINE





5. DISASSEMBLY and REASSEMBLY

5-1 PREPARATIONS and SUGGESTIONS

5-1-1 DISASSEMBLY

- 1) When disassembling the engine, memorize where and how each part is assembled in order to reassemble it correctly. Tag parts if there is a possibility of confusion.
- 2) Take care not to damage packings and gaskets, which are fragile.
- 3) In order to prevent missing and misplacing, group related parts together, tentatively assembling them, immediately after disassembled each sub-assembly.
- 4) Handle the disassembled parts carefully, and wash them in kerosene.
- 5) Use the correct tools in the correct way.
- 6) Standard tools required for disassembly and reassembly:
 - a) Work table
 - b) Washing pan
 - c) Disassembling tools
 - d) Washing oil (kerosene or gasoline), Mobile oil, Brush
 - e) Emery paper, Cloth
- 7) Before starting to disassemble the engine, drain fuel. (To prevent from danger and stain)

5-1-2 CLEANING before reassembly

- 1) Check all sliding and rotating parts, such as piston, cylinder, crankshaft and bearings for defect.
- 2) Wash the disassembled parts in kerosene to remove dust, dirt and contaminated oil thoroughly. Wash them twice, first time remove visible dirt roughly, and second time using fresh kerosene.
- 3) After washing, blow them thoroughly with compressed air.
- 4) Do not wash electric parts. Wipe them with clean cloth and dry them.
- 5) Accumulated carbon on the cylinder head, gasket, piston, cylinder and inside the muffler to be carefully removed, and finish the piston with oil stone to get smooth surface.
- 6) Parts of carburetor to be washed carefully with gasoline and blow them thoroughly with compressed air.
- 7) Check the cable for any damage.
- 8) Air cleaner element shall be washed in the detergent and dry thoroughly. Then put it to mixture of 2 ~ 4 kerosene and 1 engine oil, and assemble it after squeezed well.
- 9) Take special care not to contaminate the parts with dust and apply mobile oil on the surface in order to prevent from rust.

5-1-3 CHECKS and CORRECTIONS before reassembly

After disassembling and cleaning the engine parts, check them and, if necessary, correct them according to the section "**11. CLEARANCE DATA and LIMITS/TORQUE SPECIFICATIONS.**"

Gaskets and rubber pipes shall be replaced with new ones.

5-1-4 REASSEMBLY

- 1) Before reassembly, wash parts in kerosene and blow them with compressed air.
- 2) Apply mobile oil on the rotating and sliding surface.
- 3) Take care not to contaminate the parts with dust during reassembly.
- 4) Be sure to assemble those parts provided with alignment marks by bringing the marks in alignment.
- 5) Tighten bolts, nuts and screws to the correct torque specified. When there is no torque specification, tighten them to torque readings appropriate to the size.

Standard Tightening Torque for screws are as follows:

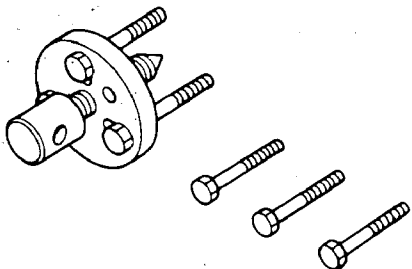
6 mm	90 kg-cm (6.5 ft-lbs)
8 mm	250 kg-cm (18 ft-lbs)
10 mm	370 kg-cm (26.7 ft-lbs)

If small screws are tightened too hard, they may get broken. Tighten the large size nuts such as ones for the magneto flywheel, enough by giving hammer blows on the socket wrench handle.

When tightening the several screws fastening the single part, tighten them all evenly, by alternately tightening diagonally located pairs.

- 6) Do not apply oil to the part to which packings or sealing agent to be applied.
- 7) When engine is completely reassembled, make sure that there is no parts remained.
- 8) During the assembly, turn the moving part by hand to check for friction and noise.
- 9) After the completion of reassembly, turn the engine by hand and check if there is any disorder or loose members.

5-2 SPECIAL TOOLS

Part No.	Tool	Use	Applicable Model	Shape
209 95004 07	Flywheel Puller (without bolt)	For pulling off Flywheel	All Robin gasoline engines	

5-3 DISASSEMBLY and REASSEMBLY PROCEDURE

5-3-1 FUEL TANK and FUEL TANK BRACKET

- 1) Disconnect fuel pipe from carburetor.
- 2) Remove mounting bolts, and detach fuel tank and fuel tank bracket from crankcase and blower housing.

CAUTION: Replace fuel pipe once a year in order to prevent from the danger of fuel leakage caused by the cracks.

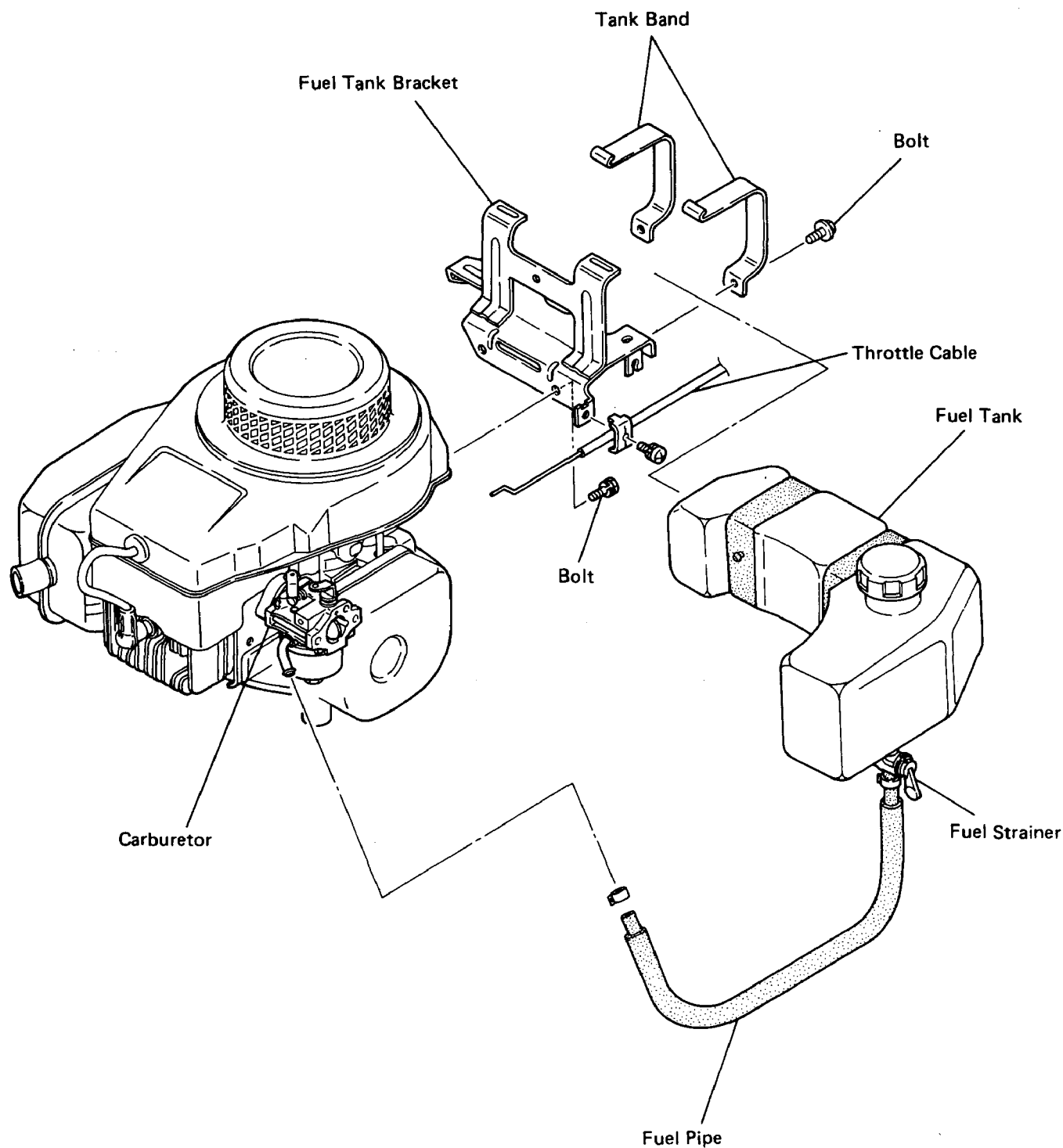


Fig. 1

5-3-2 AIR CLEANER

- 1) Remove air cleaner cover and element.
- 2) Unscrew two nuts and bolts which clamped air cleaner base plate to carburetor and remove base plate.

In reassembly, wash element based on the following procedure before reassembly:

- 1) Wash outer and inner elements with detergent and dry them thoroughly.
- 2) Soak them in the mixture of 2 ~ 4 kerosene and 1 engine oil, and squeeze the outer element to remove excess oil.

5-3-3 CARBURETOR

- 1) Remove governor rod and rod spring from carburetor.
- 2) Remove carburetor from cylinder block.

In reassembly:

Refer to section "7. GOVERNOR."

5-3-4 GOVERNOR LEVER

- 1) Remove governor lever from governor shaft.
- 2) Remove governor spring from control lever.

In reassembly:

Refer to section "7. GOVERNOR." Assembly shall be made correctly including engine speed adjustment.

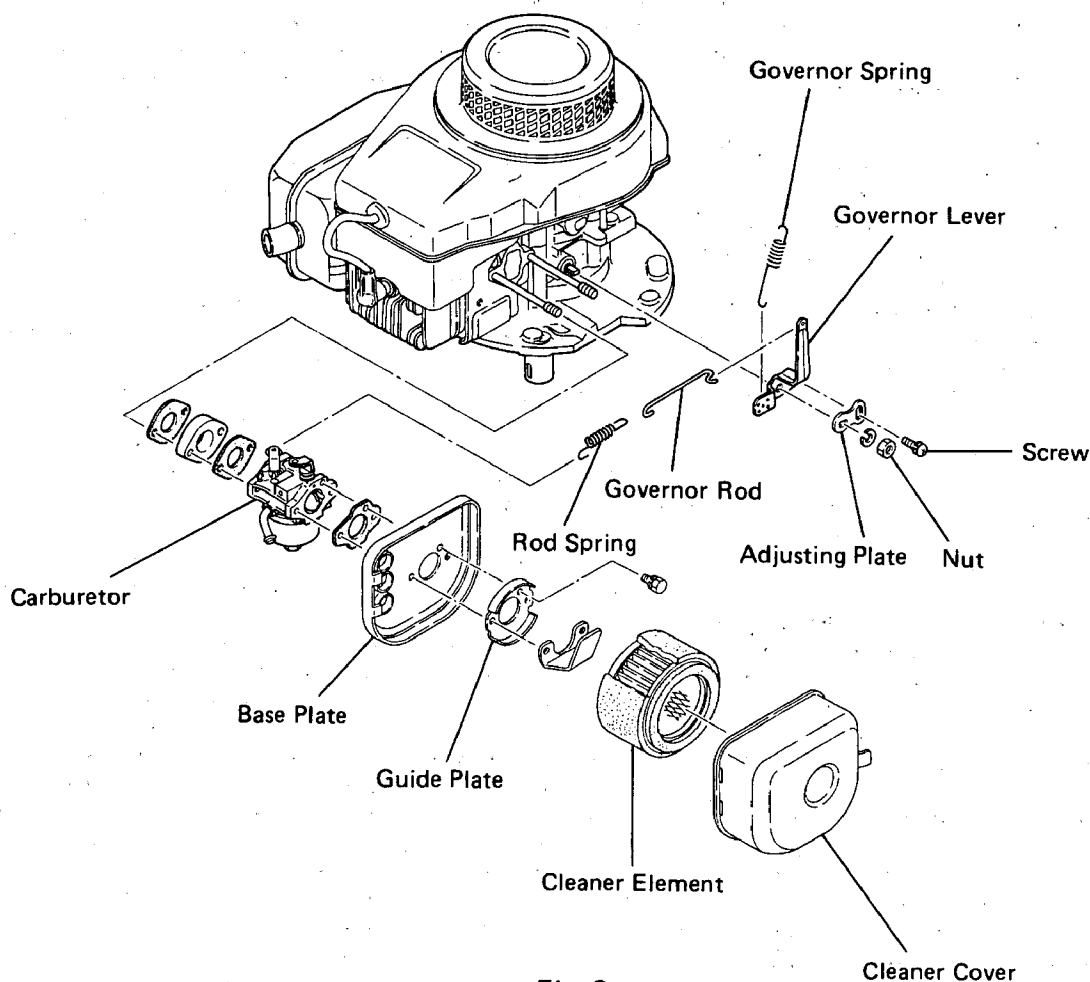


Fig. 2

5-3-5 MUFFLER

Unscrew nuts and remove it from cylinder.

5-3-6 BLOWER HOUSING

Unscrew bolts and remove blower housing from crankcase and cylinder head.

5-3-7 RECOIL STARTER

1) Remove recoil starter from blower housing by unscrew 4 × M6 bolts.

2) Remove starting pulley from flywheel by loosening bolts clamped.

NOTE: Unless it is necessary, do not disassemble recoil starter as special tools are required for reassembly.

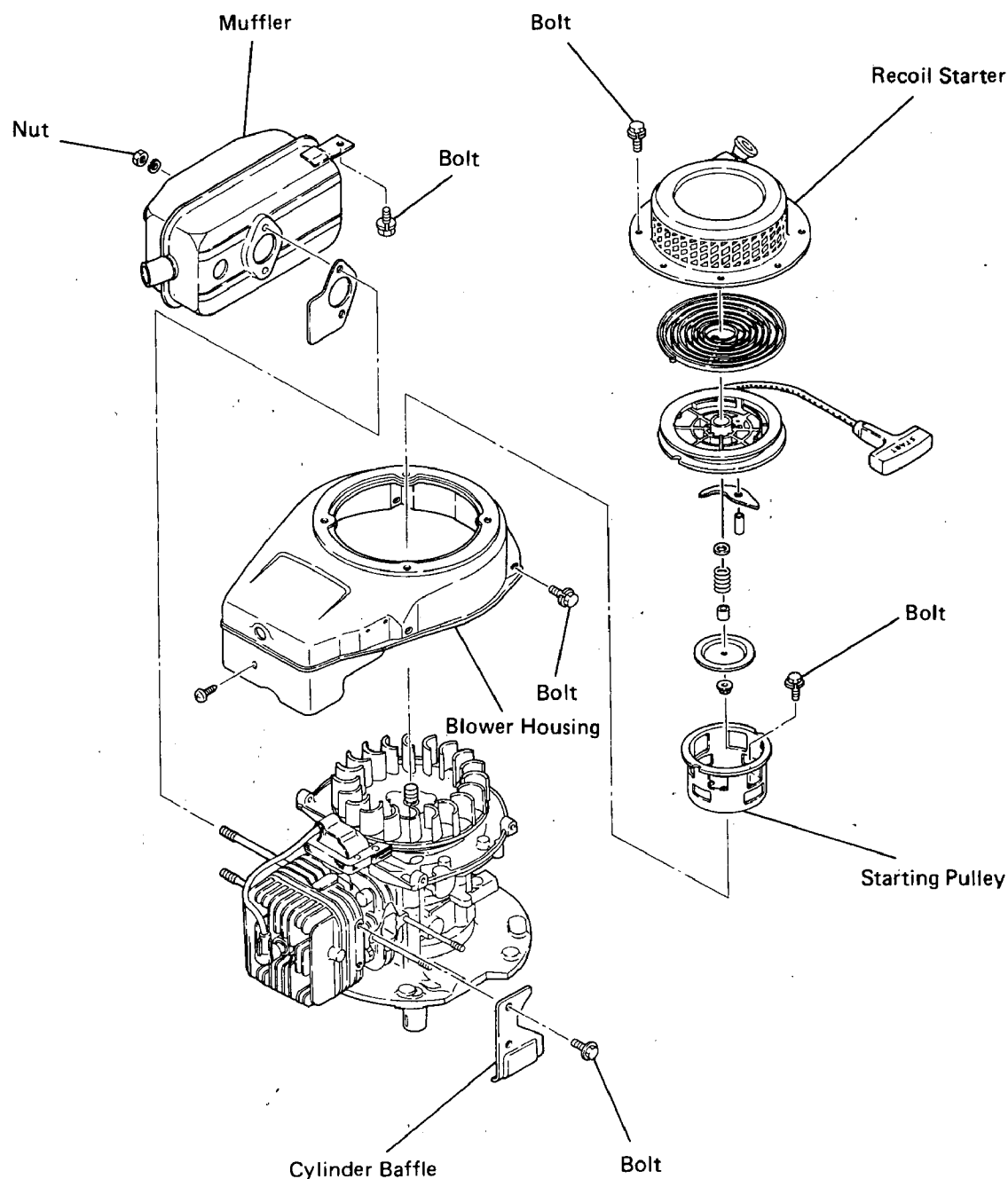


Fig. 3

5-3-8 MAGNETO and FLYWHEEL (Fig. 4)

- 1) Remove flywheel from crankshaft.

Apply a socket wrench over the nut at the end of crankshaft and give the wrench handle a sharp blow with a hammer.

Remove nut and spring washer. Attach flywheel puller to flywheel as illustrated in Fig. 4, turn the center bolt clockwise until flywheel comes loose enough to be removed.

- 2) Remove spark plug cap from high tension cable of ignition coil. Then, remove ignition coil from crankcase.

In reassembly:

Refer to section "6. MAGNETO."

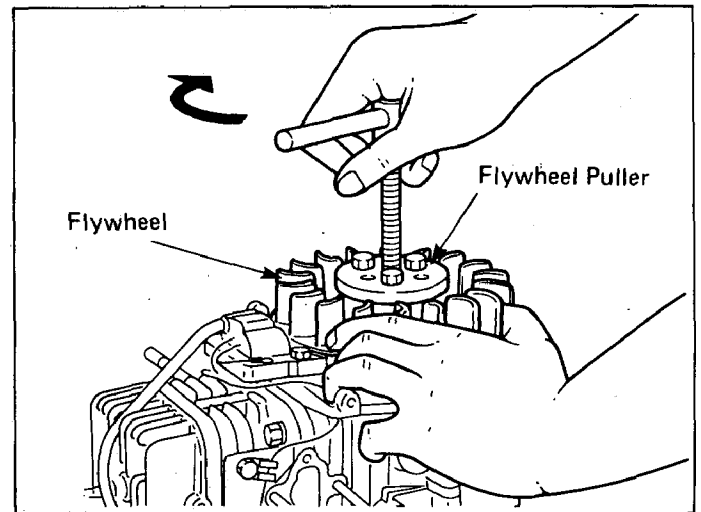


Fig. 4

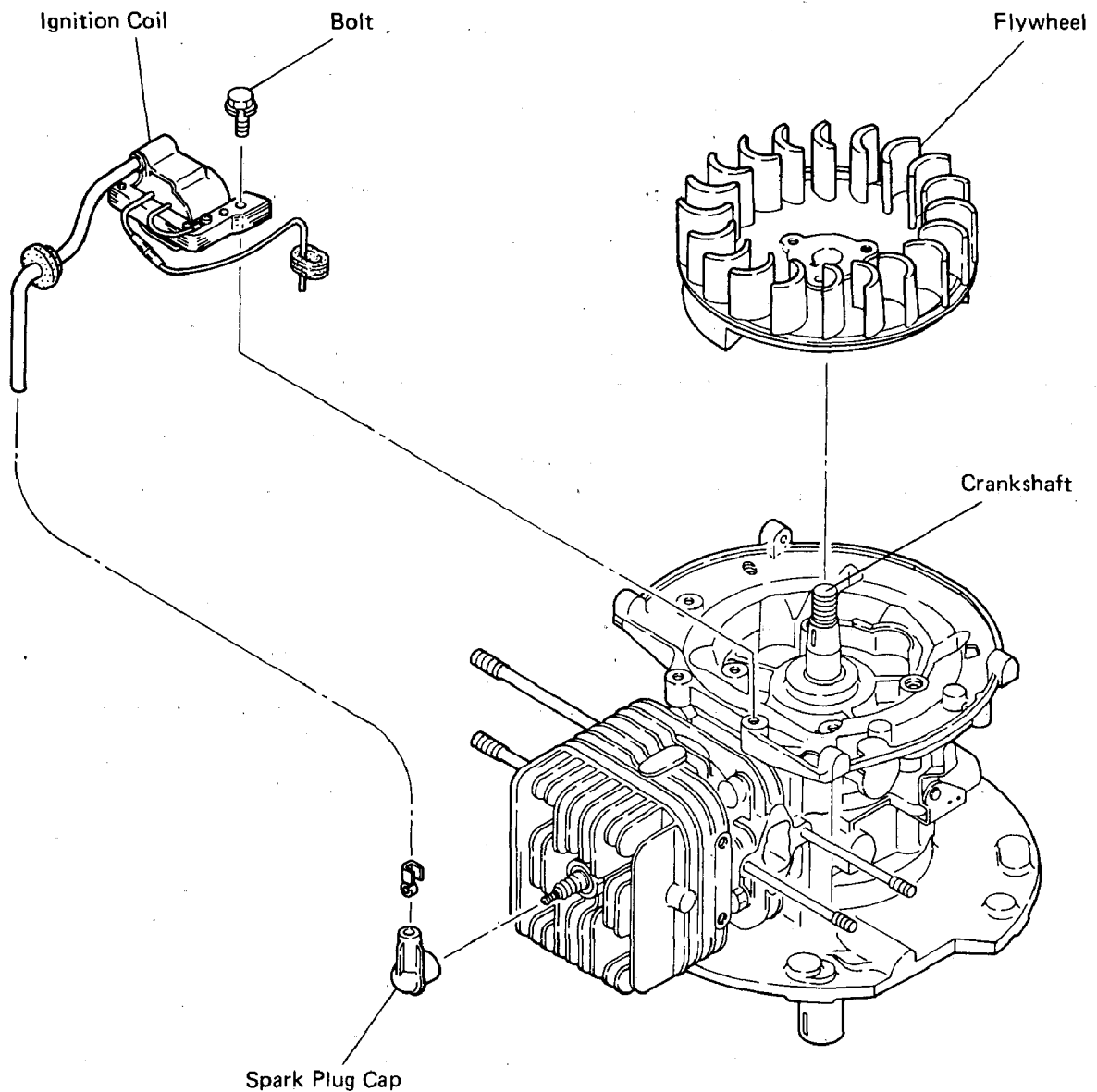


Fig. 5

5-3-9 CYLINDER HEAD

- 1) Remove spark plug from cylinder head.
- 2) Unscrew four head bolts and remove cylinder head from cylinder.
- 3) Remove cylinder head gasket from cylinder.

In reassembly:

- 1) Clean carbon from combustion chamber and dirt from between the cooling fins of cylinder head. Check its mounting face for distortion.
- 2) Use new cylinder head gasket.

NOTE: Cylinder head gasket must be placed folded edge upside (To the cylinder head).

- 3) Cylinder head fin must be placed in parallel with crankshaft.
Tightening torque for head bolt is 180 ~ 220 kg-cm (13 ~ 16 ft-lbs).
- 4) Tightening torque for spark-plug is 250 ~ 300 kg-cm (18 ~ 22 ft-lbs) for a new spark plug.

5-3-10 CYLINDER

- 1) Remove cylinder from crankcase by removing nut, spring washer and washer.
- 2) Remove cylinder gasket.

In reassembly:

- 1) Clean carbon deposit from cylinder head and combustion chamber.

CAUTION: Without cleaning the carbon deposit, it may damage the piston and inner surface of cylinder when reassembling.

- 2) Replace cylinder gasket with a new one.
- 3) Intake of cylinder should be positioned to the left against view from blower side. Apply oil to piston ring and cylinder walls. After assembling the cylinder securely, make sure if the crankshaft rotates smoothly.
- 4) Tightening torque for cylinder is 180 ~ 220 kg-cm (13 ~ 16 ft-lbs).

CAUTIONS:

- 1) *When fastening cylinder, tighten four nuts evenly.*
- 2) *Before reassembling cylinder, apply oil to needle bearing located at the small end of connecting rod.*

5-3-11 PISTON

- 1) Remove piston pin clips of both sides.
- 2) Pull piston pin out of the piston, and remove the needle bearing from the small end of connecting rod.

CAUTION: In order not to damage piston, hold the piston firmly and pull out piston pin. Also due caution should be exercised when disassembling needle bearing.

- 3) Remove piston rings from piston, expanding the open ends of the rings.

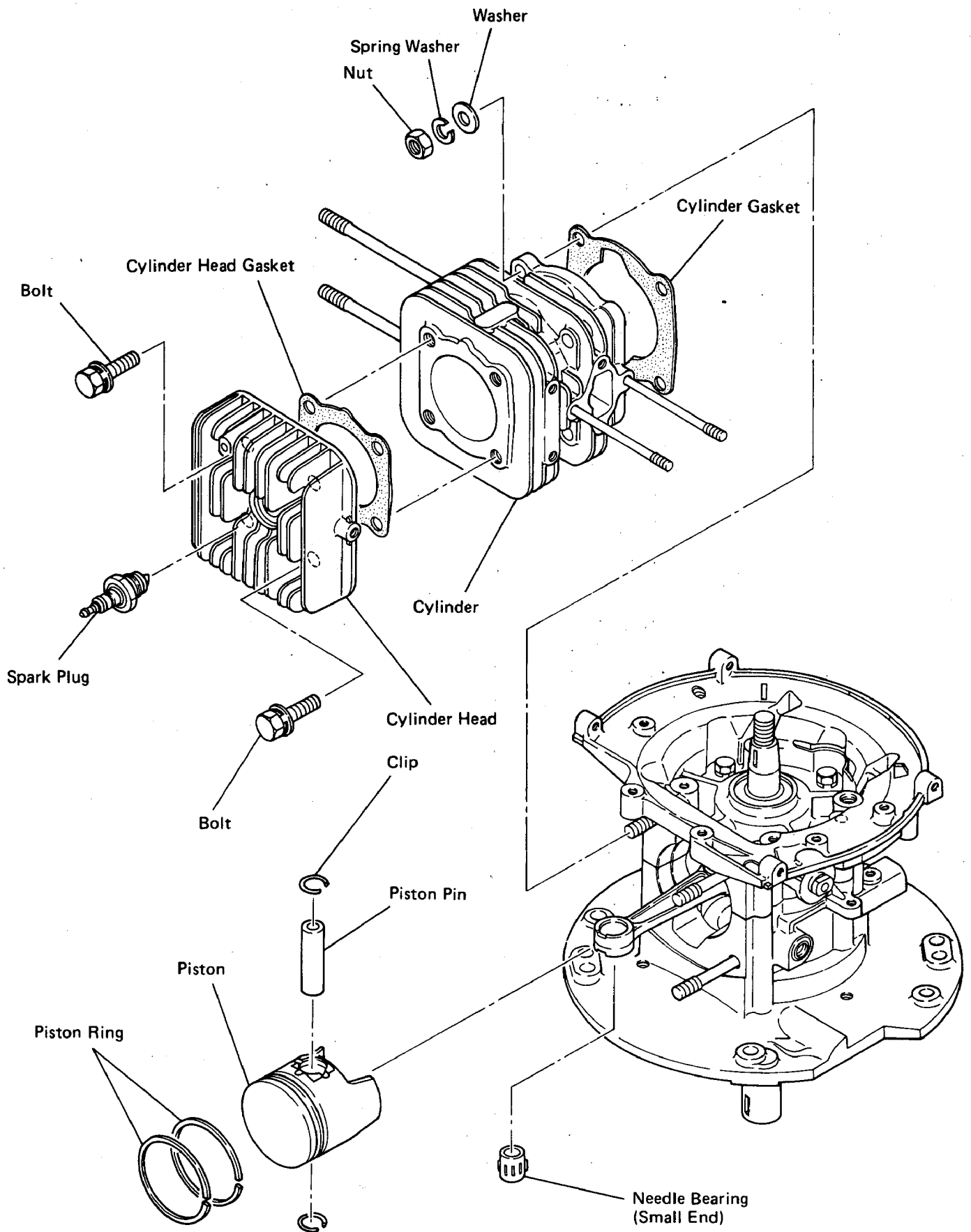


Fig. 6

In reassembly:

●PISTON RINGS (Fig. 7 and 8)

If an expander is unavailable, install the ring by placing the open ends of the ring on first land of piston, then spread the ring only far enough to slip over the piston and carry it into the correct groove.

CAUTIONS:

- 1) *Be extremely careful not to distort and break the ring.*
- 2) *Put the open ends of piston rings to the knock pins in the grooves. (This is to prevent the rings from rotation while operating the engine.)*
- 3) *Assemble the rings in the order of the 2nd ring and then top ring. (Fig. 8)*
Top ring Chromium plated surface (looks white silver in colour)
2nd ring Perkarized surface (looks dark in colour)

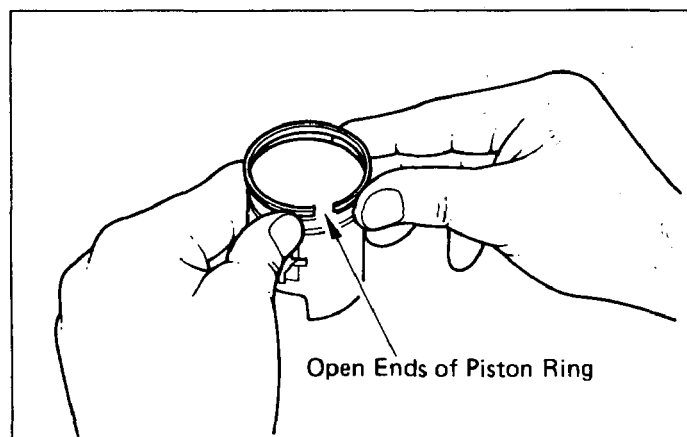


Fig. 7

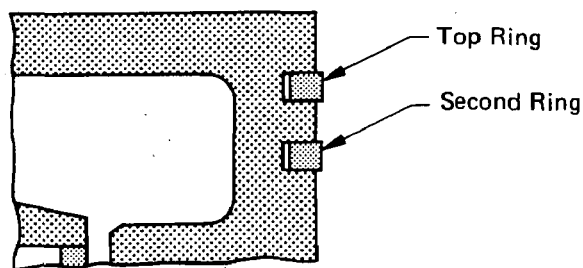


Fig. 8

●PISTON

- 1) Position the "F" mark of piston top to flywheel side and reassemble the piston and connecting rod with the needle bearing by gently striking the piston pin.

CAUTION: *Apply oil to the needle bearing before reassembling it to piston pin.*

- 2) Assemble piston pin clip.

CAUTION: *Replace piston pin clip if there is any looseness after reassembling it.*

- 3) Be sure that piston and connecting rod move smoothly after reassembled.

5-3-12 CRANKCASE

Unscrew 5 bolts which fasten upper and lower parts of the crankcase, and divide the crankcase into two parts by tapping with soft hammer, and detach crankshaft connecting rod assy.

In reassembly:

- 1) Before reassembling upper and lower parts of the crankcase, check bearing and oil seals if there is any damage, and in case of any damage being found, replace them with new ones.
 - 2) Apply oil to the bearings of crankcase and ascertain that there is no warp on the lip of oil seal.
- Tightening torque is 90 ~ 100 kg-cm (6.5 ~ 7.0 ft-lbs).

Clean the joint of both crankcases and apply sealing agent to the fitting surfaces of both crankcases. Assemble the crankshaft and join both crankcases with press (or tap them with a soft hammer) having extra care not to damage the oil seal.

CAUTION: When reassembling the crankcase, tighten the diagonally located pairs of bolts according to the specified tightening torque.

NOTE: After reassembling the crankshaft to the crankcase, check if the crankshaft rotates smoothly.

5-3-13 CRANKSHAFT and CONNECTING ROD ASSY

Do not take apart the crankshaft and connecting rod.

Crankshaft and connecting rod assembly is supplied as a spare part.

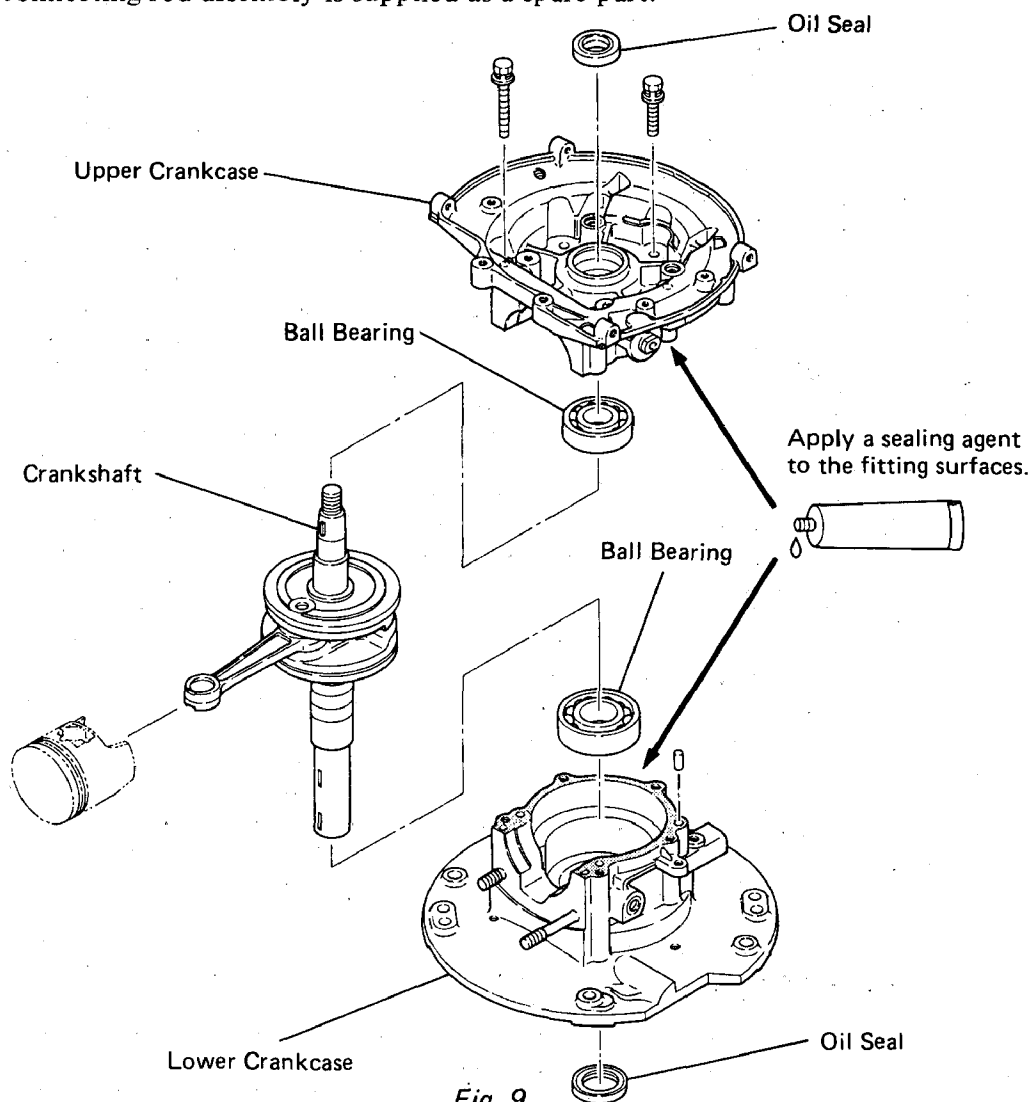


Fig. 9

5-3-14 GOVERNOR PLATE

Pull out governor plate, governor sleeve from crankshaft.

In reassembly:

Reassembly is just reverse of disassembly sequence.

5-3-15 GOVERNOR SHAFT

- 1) Unscrew 2 screws and remove governor yoke.
- 2) Pull out governor shaft from crankcase.

NOTE: Do not disassemble unless it is required.

In reassembly:

Refer to section "7. GOVERNOR."

5-3-16 CONTROL LEVER

Unless it is required, do not remove control lever from crankcase.

For disassembly and reassembly procedures, refer to section "7. GOVERNOR."

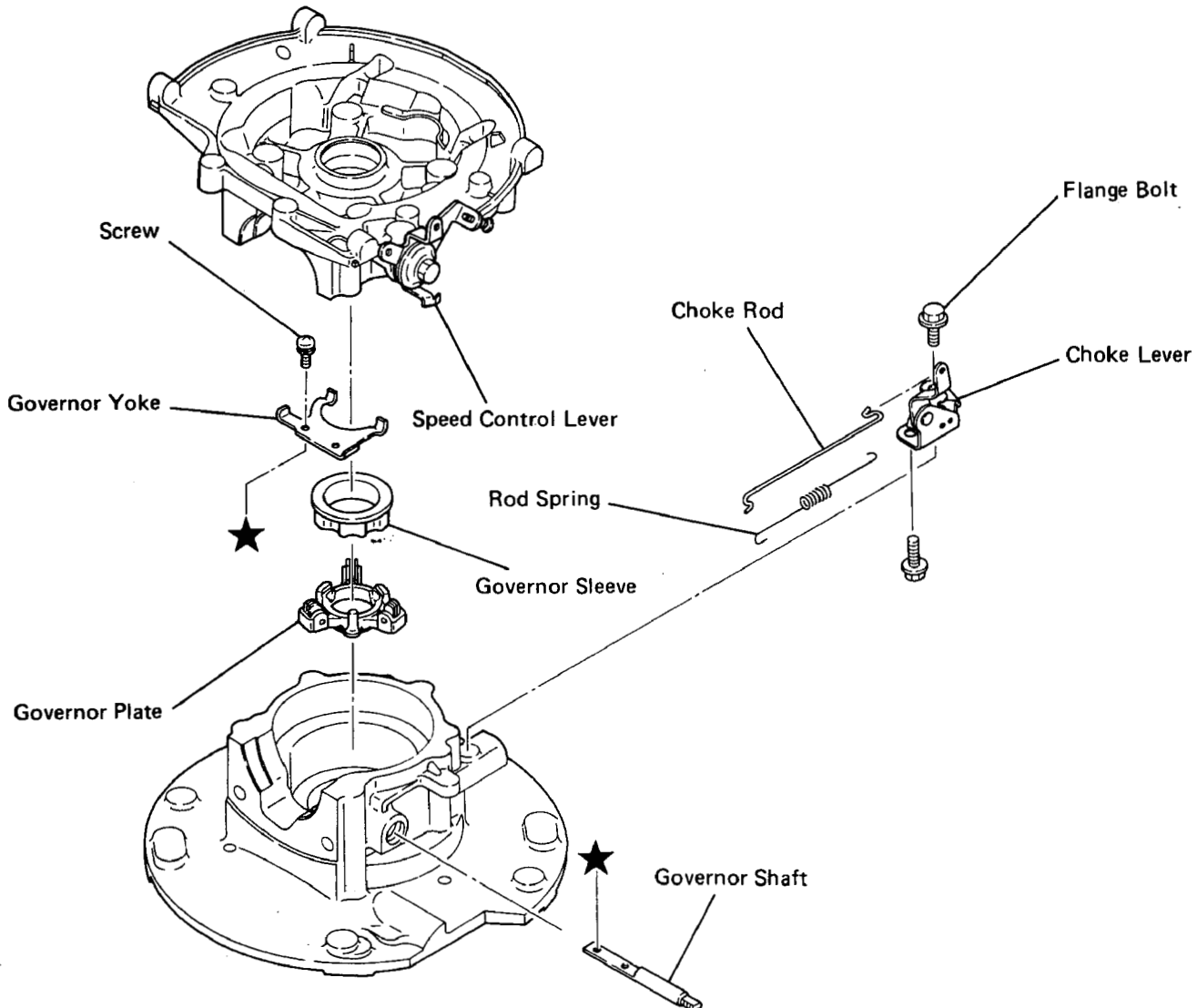


Fig. 10

6. MAGNETO

EC13V engine is equipped with a pointless Solid State Ignition system. This is a circuit breaker type ignition device which utilizes the power transistor as an element for controlling electric current.

This system is free from start-up failure due to dirty, burnt or oxidized point surfaces, low ignition efficiency because of moisture, rough breaker point surface and incorrect timing resulting from worn mechanical parts.

6-1 OPERATION of the IGNITION SYSTEM

This system is referred to as T.C.I. (Transistor Controlled Ignition) system.

As illustrated in Fig. 11, this is a simple system, consisting of a flywheel with magnetic fields, an ignition coil with built-in transistor, and lead wires to spark plug and stop switch.

Rotation of the flywheel generates a voltage on the primary side of the ignition coil.

By this voltage, electric current (I_1) flows through the resistor (R_1) to the base of the power transistor. This current actuates the transistor to permits the amplified flow of current (I_c).

With further rotation of the flywheel, the voltage at the point (B) reaches up to the trigger voltage of the thyrister (SCR) and the current (I_3) flows eliminating current (I_1). At this moment, current (I_c) is cut off abruptly resulting in high voltage on the secondary side of the ignition coil, which in turn fires the spark plug.

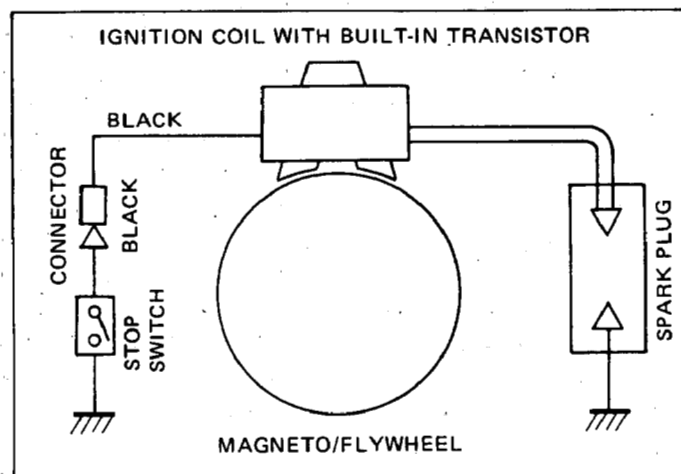


Fig. 11 WIRING DIAGRAM
SOLID STATE IGNITION

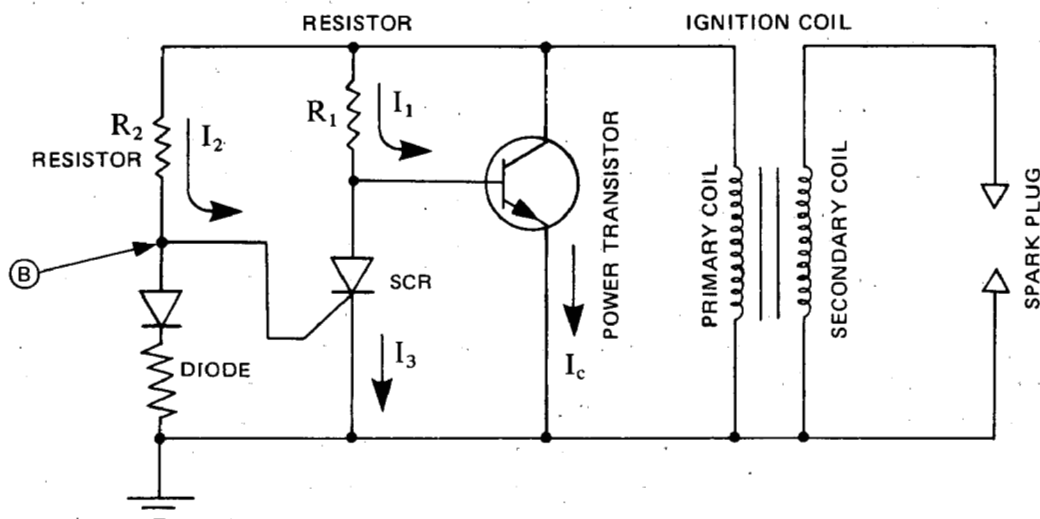


Fig. 12 T.C. IGNITION CIRCUIT

6-2 IGNITION SYSTEM CHECK

In the event of malfunction of the ignition system, check the followings at first:

- Broken, frayed, loose or disconnected ignition wires.
- Faulty spark plug – wet, dirty, insulation broken or incorrect plug gap.

If difficulty is experienced in starting the engine or if engine misses firing, the strength of the ignition spark should be checked:

Remove spark plug – then with the ignition cable connected to it, lay the spark plug on a convenient metal part of the engine so that the gap can be observed as you rotate the crankshaft several times by means of the recoil starter. If a good strong spark occurs, the ignition system can be eliminated as the source of trouble. If there is a weak spark or no spark at all, check the ignition system as follows:

- 1) Check to make sure that the external magnet, mounted on the flywheel is in a good condition.
- 2) Since the solid state ignition unit is self-contained, the only testing which can be performed is on the secondary coil resistance.

Using a good quality ohm-meter, check the secondary coil resistance between the plug terminal of the ignition cord and the core of the ignition coil.

This resistance reading should be approximately 13,000 ohms $\pm 10\%$. If the resistance reading is infinite, this indicates open winding in the ignition unit, a loose or broken spark plug connector or a failed high tension lead.

If a very low reading is taken, the secondary coil is probably shorted. If, after testing, the ignition unit itself is determined to be faulty, then it will have to be replaced.

6-3 IGNITION UNIT INSTALLATION

When installing the ignition unit on the crankcase, use a non-metallic feeler gauge to measure the air-gap between the ignition coil and flywheel. The ignition coil can be moved to adjust the air-gap by loosening its hold-down screws.

Adjust the air-gap between 0.4 ~ 0.5 mm (0.016" ~ 0.02").

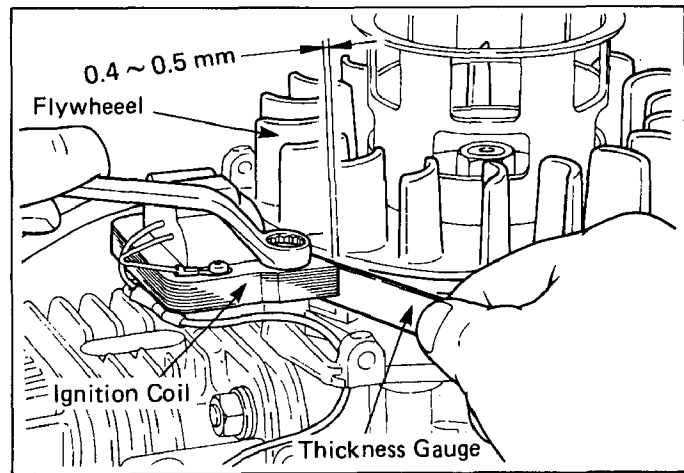


Fig. 13

NOTE:

- If the flywheel is removed, wipe off oil and grease thoroughly from the tapered portion of the crankshaft and flywheel before reassembly.

Tightening Torque for flywheel nut
390 ~ 420 kg-cm (28 ~ 30 ft-lbs)

7. GOVERNOR

7-1 CONSTRUCTION and OPERATION

A centrifugal flyweight type governor is used. The governor plate, governor sleeve and governor yoke are installed in the crankcase, and lubricated by the oil mixed fuel.

As the engine speed fluctuates, flyweights on the governor plate, rotating together with the crankshaft, changes its opening angle and moves the governor sleeve, which in turn rotates the governor shaft through the governor yoke. The governor lever is connected to the extending part of the governor shaft and this governor lever is connected to the carburetor throttle lever through the governor rod at the other end; thus the throttle valve is opened or closed and engine speed and output are controlled.

When the crankshaft speed increases, all the relevant members move in the direction indicated by \leftarrow marks and the carburetor throttle valve closes, reducing the fuel supply and consequently reducing the speed and output. When the crankshaft speed decreases, the same members move in the direction indicated by \rightarrow marks and the carburetor throttle valve open, increasing the fuel supply and consequently recovering the failing speed and output.

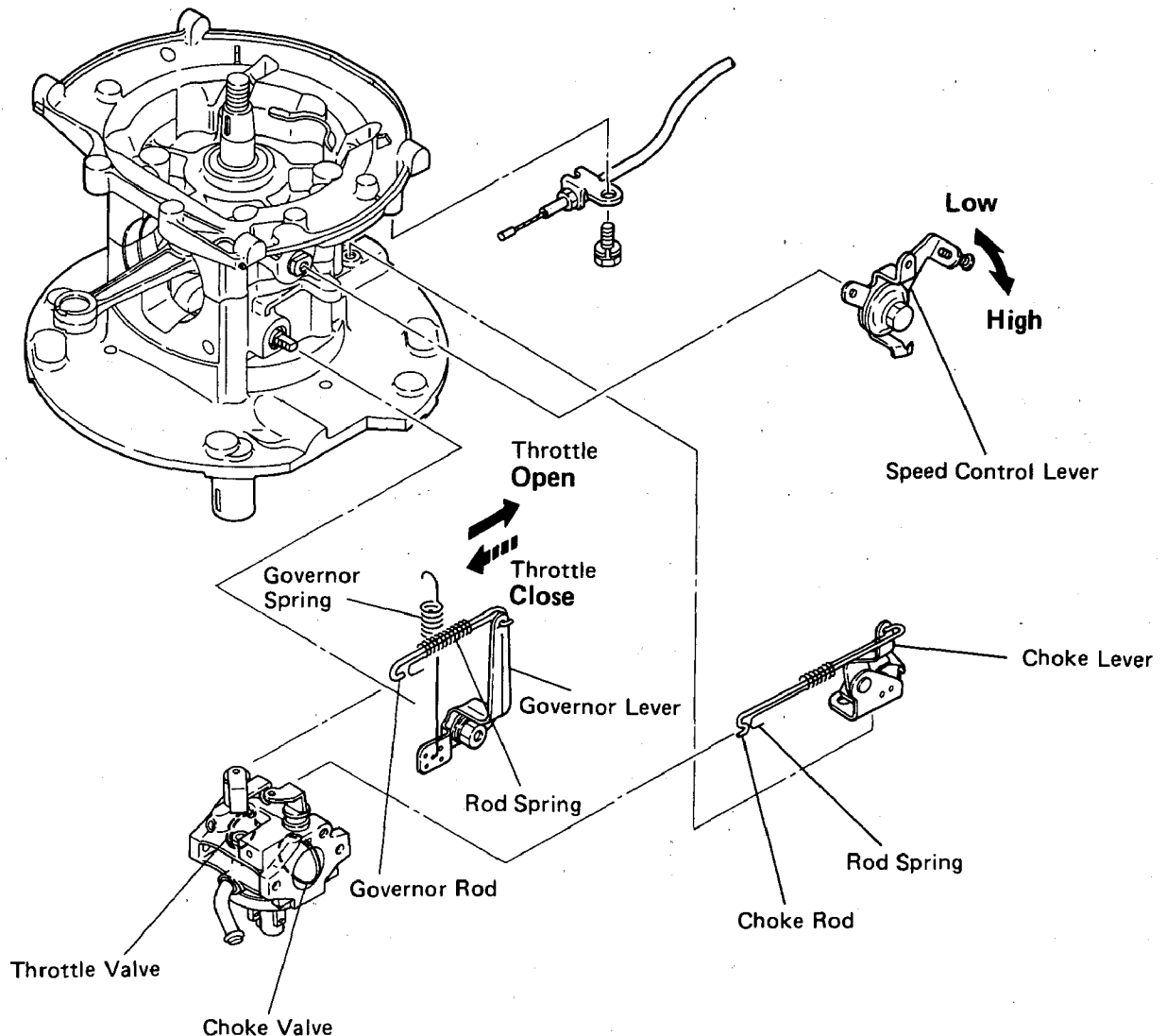


Fig. 14

7-2 GOVERNOR ADJUSTMENT

The governor system should be adjusted at reassembly by the following procedures.

- 1) Connect governor rod and rod spring to carburetor throttle lever and governor lever, then install governor lever to governor shaft.

NOTE: *Never tighten the set screw for the adjusting plate at this time, and do not fix adjusting plate, governor lever and governor shaft.*

- 2) Connect governor lever and control lever with governor spring, and install control lever to crankcase. And the governor adjustment is to be made in the following sequence:

- a) Attach the governor lever on the governor shaft.
- b) To the governor shaft, fasten temporarily the adjusting plate with nut and spring washer.
- c) To the governor lever, fasten temporarily the adjusting plate with screw and washer assy. At this moment, the adjusting plate is free to move. (See Fig. 15.)
- d) Push down the adjusting plate downward and tighten the screw. (See Fig. 16.)
- e) Set the speed control lever at the position "High," and tighten the nut. (See Fig. 17.)

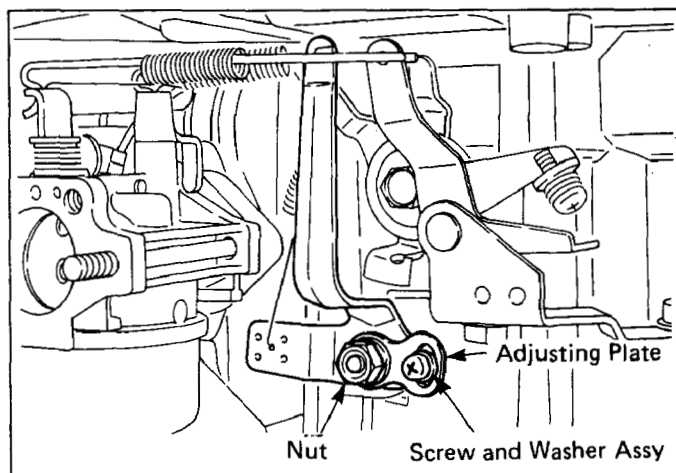


Fig. 15

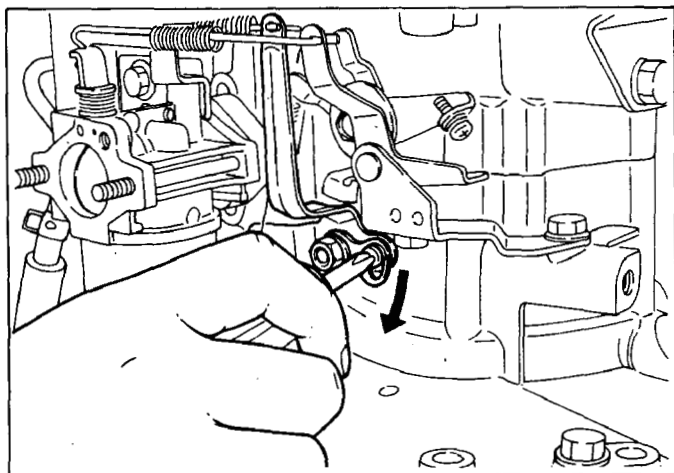


Fig. 16

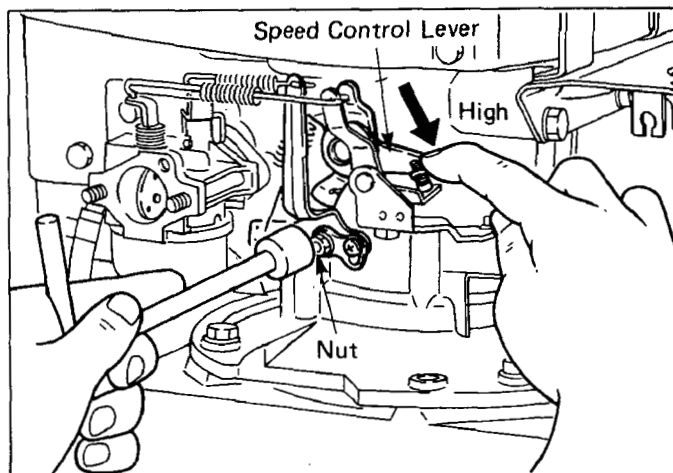


Fig. 17

7-3 HIGH SPEED ADJUSTMENT (Fig. 16)

7-3-1 WHEN NO TACHOMETER IS AVAILABLE

Unless required in the process of disassembling, do not remove control lever and/or other related parts from crankcase. If it is necessary to remove them, never turn high speed stopper bolt on control lever (Fig. 18).

7-3-2 WHEN A TACHOMETER IS AVAILABLE

- 1) Install control lever and other related parts.
- 2) By turning control lever with governor spring on it, increase gradually the engine speed up to specified engine speed.
- 3) Locate high speed stopper bolt on the control lever and lock it so that it will work as stopper of control lever against the stopper plate.

Make sure that the governor spring is hooked in the same hole on the governor lever as original. There are 5 holes on the governor lever.

Normally, hook governor spring in the center hole.

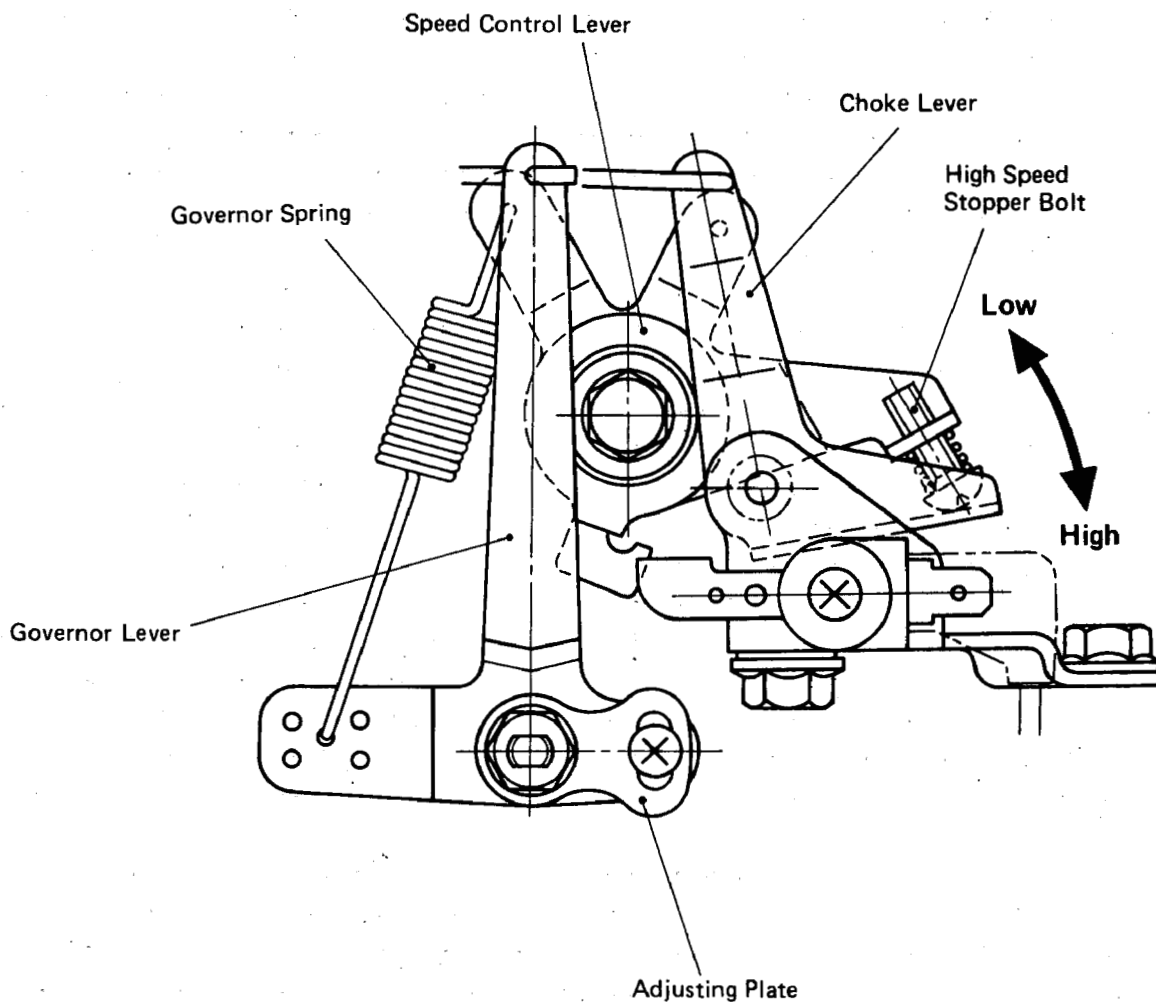


Fig. 18

8. BREAK IN OPERATION of REASSEMBLED ENGINE

An overhauled engine must be carefully broken in to get proper surface condition on newly installed parts. Especially when cylinder, piston or piston rings are replaced, a thorough break in operation is indispensable. The recommended break in schedule is as follows:

LOAD	SPEED	TIME
NO LOAD	2,000 rpm	10 minutes
NO LOAD	3,000 rpm	10 minutes
NO LOAD	3,600 rpm	10 minutes
1.6 HP	3,600 rpm	30 minutes
3.2 HP	3,600 rpm	60 minutes

NOTE: Use 25:1 oil mixed fuel for break in period.

9. TROUBLE SHOOTING

For a gasoline engine to start and run satisfactorily, the following three requirements must be met:

- 1) A proper fuel-air mixture is supplied to the combustion chamber.
- 2) An appropriate compression in the cylinder.
- 3) Good spark at correct time to ignite the mixture.

If all the three requirements are not met simultaneously, an engine cannot be started. There are also other factors such as heavy load at starting or too long an exhaust pipe causing a high back pressure, which contribute to hard starting.

The most common causes of engine troubles are given below.

9-1 STARTING DIFFICULTIES

	Cause	Remedy	Preventive measure
Little or No Spark	Defects in spark plug	<ol style="list-style-type: none"> 1) If contaminated, wash in gasoline, remove foreign matters and dry. 2) If spark plug is broken or lost insulation, replace plug. 3) Adjust spark gap to 0.6 ~ 0.7 mm. 	<ol style="list-style-type: none"> 1) Use spark plugs of specified heat range. Do not use poor grade oil. Clean air cleaner and avoid dust entry. 2) Do not hit or bend the center electrode of the spark plug at adjusting or the insulator may get damaged.
	Defects in high-tension cord	If cord is burnt or damaged, replace the ignition coil unit.	
	Defects in magneto	<ol style="list-style-type: none"> 1) If wire or insulation is broken, replace magneto. 2) If magnetism is weak, re-magnetize (at the magneto maker) or replace flywheel. 	
	Other defects in electric system	<ol style="list-style-type: none"> 1) If switch is faulty (short circuit), replace or repair. 2) If primary wire is grounded to the engine body, insulate it with insulating tape. 	
Little or No Compression	Gas leak through head gasket or other parts	<ol style="list-style-type: none"> 1) If head gasket is defective, replace. 2) If head bolts are loose, tighten. 3) If spark plug is loose, tighten. 4) If spark plug is defective, replace. 	
	Defects in piston assembly	<ol style="list-style-type: none"> 1) If piston is worn, replace. 2) If cylinder is worn, re-bore and use over-size piston and piston ring. 3) If piston rings are worn, replace. 4) If piston rings are stuck, clean or replace rings. 	<ol style="list-style-type: none"> 1) Keep air cleaner always clean. 2) Do not use poor grade oil.
No Fuel Supply	Defects in fuel tank system	<ol style="list-style-type: none"> 1) Clean clogged tank outlet. 2) Clean clogged fuel strainer. 3) If incorrect fuel is poured into tank or water is mixed, drain tank completely and fill it with correct fuel. 4) When fuel pipe is locked with air, discharge air. 	<ol style="list-style-type: none"> 1) Be sure to use a filter when adding fuel. 2) Use mixture (gasoline 50:1) as fuel.
	Defects in carburetor	<ol style="list-style-type: none"> 1) If clogged with dust, clean. 2) If defective, replace. <p>Clean jets and other orifices, if they are clogged.</p>	

	Cause	Remedy	Preventive measure
Excessive Fuel	Defects in fuel supply	1) Start engine with fully open choke valve and half open throttle valve. 2) Remove drain plug from crankcase, and close fuel cock, repeat starting operation several times to discharge excess fuel.	1) Never close choke valve when engine is warm. 2) When stopping the engine, run it at slow speed for a while. This practice not only favorably affects next starting, but also improves engine life. 3) Clogged air cleaner results in too rich air fuel mixture. Clean it thoroughly.
	Defects in carburetor	If fuel overflows, check needle valve seat for wear. Replace, if necessary.	Be careful clogged carburetor.
Too much resistance at starting	Excess load	1) If tension of transmission belt is too tight, reduce tension. 2) If load is still too heavy, install a clutch.	
	Piston or Connecting Rod seized	1) If piston seizes, repair or replace. 2) If connecting rod large end or small end seize, replace.	1) Do not use poor grade oil. 2) Use fuel of proper mixing ratio.

9-2 SLOW-SPEED out of order

Most defects listed as causes for starting difficulty are also causes for faulty slow-speed operating.

9-3 OVERHEATING and KNOCKING

- 1) If too much carbon deposits are accumulated in the combustion chamber, remove it.
- 2) If the heat range of the spark plug is too cool, replace it with a correct one, i.e. NGK BM6A or CHAMPION CJ8.
- 3) If the air-fuel mixture is too lean, clean jets and other passages in the carburetor. Clean the air cleaner also.
- 4) If the load is in excess, reduce it below the specified continuous load.

9-4 POWER DROP

- 1) If the cylinder, piston or piston rings are worn, replace them or re-bore the cylinder and fit oversize piston and piston rings. Replace or clean piston rings if they are stuck in the grooves.
- 2) If the carburetor is out of order, re-adjust or clean it.
- 3) If the spark plug is faulty (contamination, gas leakage or faulty insulation), clean it or replace it.
- 4) If combustion gas leaks through the head gasket, re-tighten the clamping screws.
If the gasket is faulty, replace it.
- 5) If the magneto is faulty, replace them.
- 6) If the air cleaner is clogged, clean it.
- 7) If the fuel system is clogged, clean it.
- 8) If the oil seals at the crankshaft are worn and the compressed gas are leaking, replace them.

9-5 EXCESSIVE FUEL CONSUMPTION

- 1) If air-fuel mixture is too rich, clean jets and passages in carburetor.
- 2) If the throttle shaft of carburetor is worn, replace throttle shaft. (carburetor)
- 3) If fuel is leaking, re-tighten screws or replace faulty part.
- 4) If the engine suffers power drop accompanied with excessive fuel consumption, trouble-shoot by following step 9-4.

9-6 ENGINE HUNTING

- 1) If the governor lever, governor shaft, governor spring or other members are incorrectly adjusted, re-adjust or correct them.
- 2) If the fuel-air mixture is too lean, clean and adjust the carburetor.
- 3) If the governor spring is distorted permanently, replace it.
- 4) If the governor sleeve is not functioning correctly, correct it.
- 5) If the flyweight or the governor sleeve is worn, replace it.
- 6) If the governor shaft does not move smoothly, correct it.

9-7 OTHER COMPLAINTS

- 1) Fuel overflows from carburetor.
If the fuel flows into the air cleaner or much fuel flows into the crankcase while the engine is standing still (over-flowing), the needle valve or the float is faulty. Correct or replace them.
- 2) If the engine suddenly stops with abnormal noise, the piston or the crankshaft or the connecting rod is seized. Repair or replace them.
- 3) If the engine produces abnormal noise during operation, be sure to stop the engine and do not start it again before the cause is removed.
If the cause of the trouble cannot be found, contact your dealer and ask them for service.

10. CHECKS and CORRECTIONS

After disassembling and cleaning the engine parts, check them, and if necessary, correct them according to the correction table.

The correction table applies whenever engines are repaired. Its contents should be thoroughly understood by those who undertake the repairing.

Its specifications must be abided by to effect correct maintenance.

Followings are the terms employed in the correction table.

1) CORRECTION

All operations performed on the engine parts for the purpose of improving or recovering the engine performance, consisting of repairs, readjustments, and replacements.

2) STANDARD SIZE

The design dimension of the part without the tolerance.

3) CORRECTION TOLERANCE

The tolerance on the re-finished part dimension or on the readjusted dimension.

4) CORRECTION LIMIT

The limit on the part and adjustment, beyond which any dimensional and functional changes, due to wear, burn, and other causes will adversely affect the normal engine performance.

5) USE LIMIT

The limit, beyond which the part is no longer usable, due to defects in function or strength.

NOTE: All dimensions in the "CLEARANCE DATA AND LIMITS/TORQUE SPECIFICATIONS" are given in millimeter, except where otherwise specified.

11. CLEARANCE DATA and LIMITS/TORQUE SPECIFICATIONS

ITEM		STANDARD SIZE	TOLERANCE	LIMIT	USE LIMIT	REMARKS	TOOL	CORRECTION METHOD
Flatness of cylinder head		Less than 0.1	0.1	0.2			Surface plate, Feeler	Correct
Cylinder	Bore	S.T.D. $\phi 56$ O.S. $\phi 56.25$ O.S. $\phi 56.50$	$+0.019$ 0	0.15	0.65		Cylinder gauge	Boring
	Roundness		0.01					
	Cylindricity		0.015					
Piston	Outside Diameter	S.T.D. $\phi 55.96$ O.S. $\phi 56.21$ O.S. $\phi 56.46$	0 -0.015	-0.1	-0.1	Diameter from bottom, in traverse to piston pin (max. dia.) 3 ~ 20.5	Micrometer	Replace
	Piston pin hole	$\phi 12$	0 -0.011	-0.035	-0.035		Cylinder gauge	Replace
	Width of ring groove	Top 2.0 2nd 2.0	$+0.060$ $+0.040$ $+0.040$ $+0.020$	0.15	0.15		Vernier caliper	Replace
	Clearance between piston ring and piston groove	Top 2nd	0.05 ~ 0.09 0.03 ~ 0.07	0.15	0.15		Feeler gauge	Replace
	Clearance between piston and cylinder	0.04 ~ 0.74		0.25	0.25	Max. cylinder dia. and min. piston dia.	Cylinder gauge, Micrometer	Replace
	Fit between piston and piston pin	0.008L ~ 0.008T		0.06L	0.06L		Cylinder gauge, Micrometer	Replace
Piston Ring	Ring gap	Top 2nd	0.1 ~ 0.25	1.5	1.5		Feeler-gauge	Replace
	Ring width	Top 2.35 2nd	± 0.1	-0.1	-0.1		Micrometer	Replace
Piston pin O.D.		$\phi 12$	-0.003 -0.008	-0.03	-0.03		Micrometer	Replace
Crankshaft & Connecting Rod	Large end I.D.	$\phi 24$	$+0.009$ 0	+0.020	+0.020		Cylinder gauge	Replace
	Clearance between rod large end I.D. and crank pin needle bearing	0.004 ~ 0.022		+0.055	+0.055	Clearance in radial direction	Cylinder gauge, Micrometer	Obtain correct clearance by replacing parts
	Small end I.D.	$\phi 16$	$+0.011$ 0	+0.020	+0.020		Cylinder gauge	Replace
	Clearance between small end I.D. and piston pin needle bearing		0.003 ~ 0.027	0.055	0.055	Clearance in radial direction	Cylinder gauge, Micrometer	Obtain correct clearance by replacing parts
	Large end side or small end side		0.5 ~ 0.1	0.7	0.7		Feeler gauge	Replace
	Parallelism and Twist between large end and small end bores	Parallelism Twist	0.08 0.08	0.1 0.3	0.1 0.3	Holding large end as reference, measure test bar, (L = 100) inserted in small and large end	Test bar, Dial-indicator	Replace

ITEM		STANDARD SIZE	TOLERANCE	LIMIT	USE LIMIT	REMARKS	TOOL	CORRECTION METHOD
Crankshaft & Connecting Rod	Large and small end I.D. roundness & cylindricity	Roundness Cylindricity	Max. 0.004 Max. 0.004				Cylinder gauge	
	Distance between large end & small end bores	94	±0.05		±0.25		Mandrels, Micrometer	Replace
	Crankpin O.D.	φ18	0 -0.005	-0.020	-0.020		Micrometer	Replace
	Crankpin O.D. Roundness & Cylindricity	Roundness Cylindricity	Max. 0.005 Max. 0.005				Micrometer	Replace
	Crankshaft journal O.D.	φ20	+0.003 -0.006	-0.04	-0.04		Micrometer	Replace
	Thrust clearance between crankshaft & crankcase		0 ~ 0.2	1.0	1.0	Measure between bearing & crankshaft	Feeler gauge	Replace
	Runout of crankshaft		0.05	0.12		Supporting assembled crankshaft between centers, measure journal.	Dial-indicator	Correct
	Dia. of small end needle bearing needles	φ2	0 -0.004				Micrometer	Replace
Carburetor	Metering needle unscrew	Fixed						
Electric Equipment	Spark plug	NGK BM6A CHAMPION CJ8						
	Spark timing (before T.D.C.)	18° (fixed)	±2°	±5°				
	Spark plug gap	0.6	+0.1 0	1.0			Feeler gauge	Adjust
	Spark gap	Min. 5				Magnet revolution: 400 rpm		

TORQUE SPECIFICATIONS

ITEM		kg-cm	ft-lbs	TOOL	REMARKS
Specified Tightening Torque	Flywheel nut	390 ~ 420	28 ~ 30	Torque wrench	
	Spark plug	250 ~ 300	18 ~ 22		
	Cylinder nuts	180 ~ 220	13 ~ 16		
	Crankcase bolts	90 ~ 100	6.5 ~ 7.3		

12. MAINTENANCE and STORING

The following maintenance jobs apply when the engine is operated correctly under normal conditions. The indicated maintenance intervals are by no means guarantees for maintenance free operations during these intervals.

For example, if the engine is operated in extremely dusty conditions, the air cleaner should be cleaned every day instead of every 50 hours.

12-1 DAILY CHECKS and MAINTENANCE

Checks and Maintenance	Reasons for requiring them
Remove dust from whatever parts which accumulated dust.	The governor linkage is especially susceptible to dust.
Check external fuel leakage. If any, retighten the loose part or replace faulty part.	Danger of causing fire
Check screw tightening. If any loose one is found, re-tighten.	Loose screws and nuts will cause vibration resulting in the engine damage.

12-2 EVERY 50 HOURS (10 DAYS) CHECK and MAINTENANCE

Checks and Maintenance	Reasons for requiring them
Clean air cleaner	Clogged air cleaner affects engine operation.
Check spark plug. If contaminated, wash in gasoline or polish with emery paper.	Output power is reduced and starting is made difficult.

12-3 EVERY 100 ~ 200 HOURS (MONTHLY) CHECKS and MAINTENANCE

Checks and Maintenance	Reasons for requiring them
Clean fuel strainer and fuel tank.	The carburetor will be clogged with dirt or dust causing bad starting or poor operation.

12-4 EVERY 500 ~ 600 HOURS (SEMIANNUAL) CHECKS and MAINTENANCE

Checks and Maintenance	Reasons for requiring them
Remove cylinder head and remove carbon deposit. Remove carbon deposit from exhaust port and muffler.	The engine output power drops.
Disassemble and clean carburetor.	The carburetor will be clogged causing bad starting or poor operation.

12-5 EVERY 1000 HOURS (YEARLY) CHECKS and MAINTENANCE

Checks and Maintenance	Reasons for requiring them
Perform overhaul, clean, correct or replace parts.	The engine output drops and becomes out of order.
Change piston rings.	
Replace fuel pipe once a year.	Rubber pipes may be hardened and cracked by the ozone in the air.

12-6 PREPARATION for LONG STORAGE

- 1) Perform the above 12-1 and 12-2 maintenance jobs.
- 2) Drain fuel from the fuel tank, carburetor float chamber and fuel lines.
- 3) To prevent rust in the cylinder bore, apply oil through the spark plug hole and turn the crankshaft for several turns by hand. Re-install the spark plug.
Turn the starting pulley by hand and leave it where the resistance is the heaviest.
- 4) Clean the engine outside with oiled cloth.
- 5) Put a vinyl or other cover over the engine and store the engine in dry place.



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