

ISSUE EMD-ES1039



Robin Engines

Air-cooled, 4-cycle Gasoline Engine

Model

EH30/34

SERVICE MANUAL



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1. SPECIFICATIONS

Model		EH30			
		EH30B	EH30BS	EH30D	EH30DS
Type		Air-Cooled, 4-Cycle, Single-Cylinder, Horizontal P.T.O. Shaft, Gasoline Engine			
Bore × Stroke		78 × 61 mm (3.07 × 2.40 in.)			
Piston Displacement		291cm ³ (17.76 cu.in.)			
Compression Ratio		8.3			
Output	Continuous	5.1kw (7.0HP)/1800 r.p.m.		5.1kw (7.0HP)/3600 r.p.m.	
	Max.	6.6kw (9.0HP)/1800 r.p.m.		6.6kw (9.0HP)/3600 r.p.m.	
Max. Torque		38.2N · m (3.90kg · m)/1250 r.p.m.		19.1N · m (1.95kg · m)/2500 r.p.m.	
Direction of Rotation		Counterclockwise As Viewd From P.T.O. Shaft Side			
Cooling system		Forced Air Cooling			
Valve Arrangement		Overhead Valve			
Lubrication		Splash Type			
Lubricant		Automobile Oil SAE # 20, # 30 or 10W-30			
Capacity of Lubricant		1.2 liters (0.32 U.S. gal.)			
Carburetor		Horizontal Draft, Float Type			
Fuel		Automobile Gasoline			
Fuel Consumption Ratio		310g/kw · h (230g/HP · h) At Continuous Rated Output			
Fuel Feed System		Gravity Type			
Fuel Tank Capacity		6 liters (1.58 U.S. gal.)			
Ignition System		Flywheel Magneto (Solid State)			
Spark Plug		NGK B6ES (CHAMPION N5C)			
Charging Capacity		-	12V - 1.1A	-	12V - 1.1A
Starting System		Recoil Starter	Electric Starter	Recoil Starter	Electric Starter
Speed Reduction		1/2 Cam Shaft Drive		-	
Governor System		Centrifugal Flyweight Type			
Air Cleaner		Double Element Type			
Dry Weight		31.0kg (68.3lb.)	34.0kg (75.0lb.)	30.0kg (66.1lb.)	33.0kg (72.8lb.)
Dimensions	Length	377mm (14.84in.)	333mm (13.11in.)	377mm (14.84in.)	333mm (13.11in.)
	Width	421mm (16.57in.)	425mm (16.73in.)	421mm (16.57in.)	425mm (16.73in.)
	Height	485mm (19.09in.)			

Specifications are subject to change without notice.

Model		EH34			
		EH34B	EH34BS	EH34D	EH34DS
Type		Air-Cooled, 4-Cycle, Single-Cylinder, Horizontal P.T.O. Shaft, Gasoline Engine			
Bore x Stroke		84 x 61 mm (3.31 x 2.40 in.)			
Piston Displacement		338cm ³ (20.63 cu.in.)			
Compression Ratio		8.3			
Output	Continuous	5.9kw (8.0HP)/1800 r.p.m.		5.9kw (8.0HP)/3600 r.p.m.	
	Max.	8.1kw (11.0HP)/1800 r.p.m.		8.1kw (11.0HP)/3600 r.p.m.	
Max. Torque		47.3N · m (4.82kg · m)/1250 r.p.m.		23.6N · m (2.41kg · m)/2500 r.p.m.	
Direction of Rotation		Counterclockwise As Viewd From P.T.O. Shaft Side			
Cooling system		Forced Air Cooling			
Valve Arrangement		Overhead Valve			
Lubrication		Splash Type			
Lubricant		Automobile Oil SAE # 20, # 30 or 10W-30			
Capacity of Lubricant		1.2 liters (0.32 U.S. gal.)			
Carburetor		Horizontal Draft, Float Type			
Fuel		Automobile Gasoline			
Fuel Consumption Ratio		310g/kw · H (230g/HP · h) At Continuous Rated Output			
Fuel Feed System		Gravity Type			
Fuel Tank Capacity		6 liters (1.58 U.S. gal.)			
Ignition System		Flywheel Magneto (Solid State)			
Spark Plug		NGK B6ES (CHAMPION N5C)			
Charging Capacity		–	12V – 1.1A	–	12V – 1.1A
Starting System		Recoil Starter	Electric Starter	Recoil Starter	Electric Starter
Speed Reduction		1/2 Cam Shaft Drive		–	
Governor System		Centrifugal Flyweight Type			
Air Cleaner		Double Element Type			
Dry Weight		31.0kg (68.3lb.)	34.0kg (75.0lb.)	30.0kg (66.1lb.)	33.0kg (72.8lb.)
Dimensions	Length	377mm (14.84in.)	333mm (13.11in.)	377mm (14.84in.)	333mm (13.11in.)
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	Height	485mm (19.09in.)			

Specifications are subject to change without notice.

2. PERFORMANCE

2-1 MAXIMUM OUTPUT

The maximum output is the output of an engine with its throttle valve fully opened under the condition that all the moving parts are properly worn in after the initial break-in period. A new engine may not produce full maximum output while its moving parts are still not broken-in.

2-2 CONTINUOUS RATED OUTPUT

The continuous rated output is the output of an engine at optimum governed speed which is most favorable from the view point of engine's life and fuel consumption.

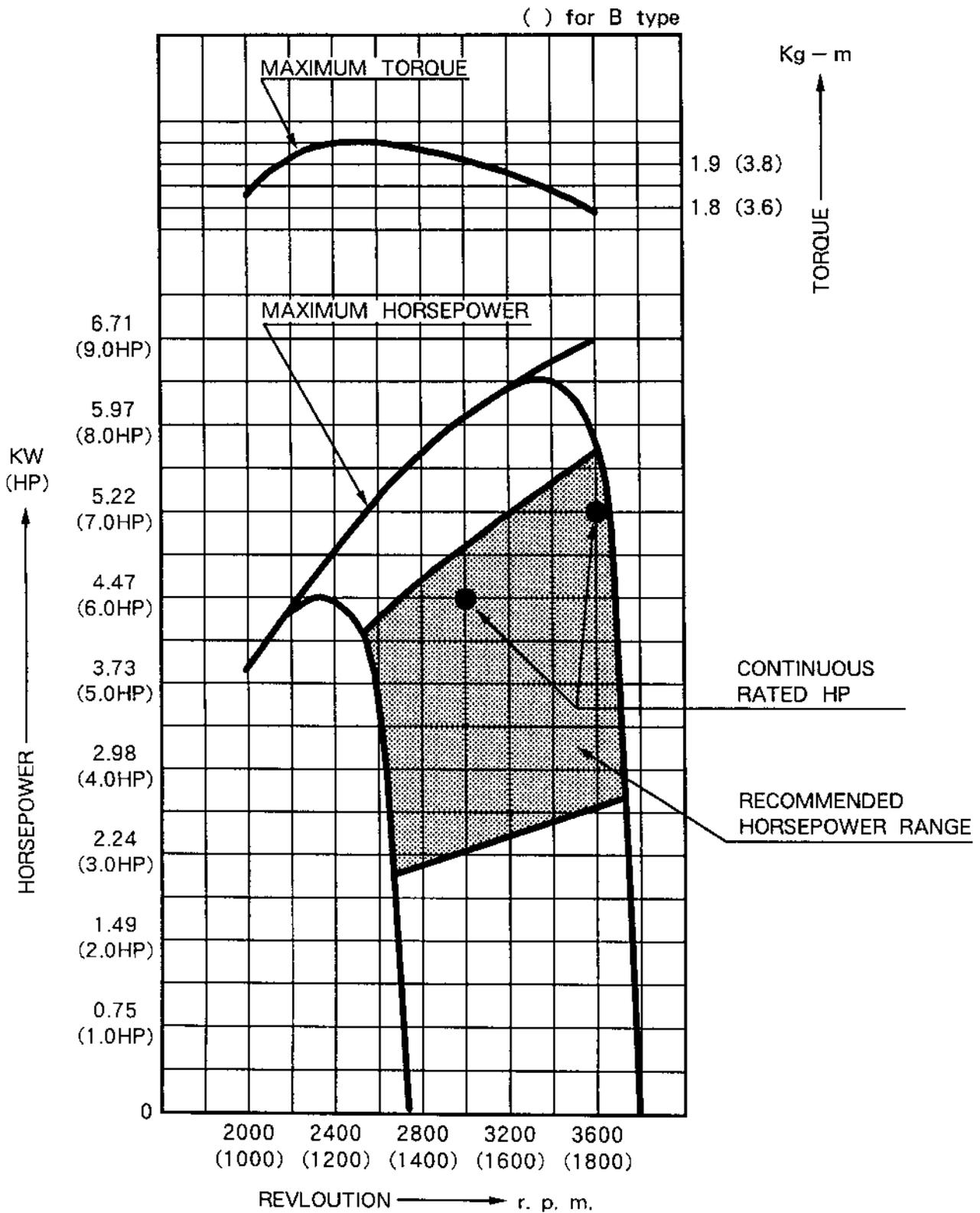
When the engine is installed on a certain equipment, it is recommended that the continuous output required from the engine be kept below this continuous rated output.

2-3 MAXIMUM TORQUE

The maximum torque is the torque at the output shaft when the engine is producing maximum output at certain revolution.

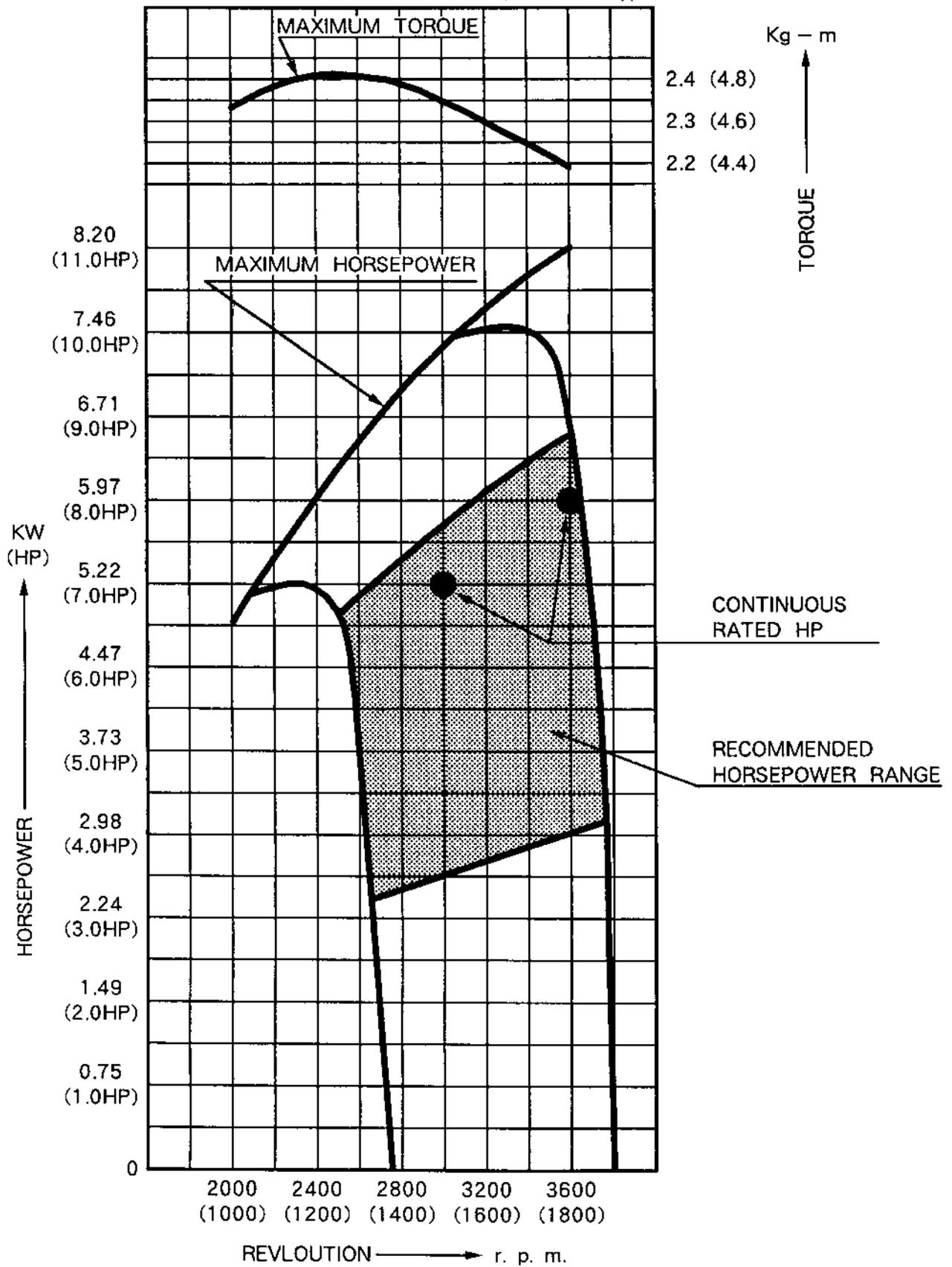
2-4 PERFORMANCE CURVES

●EH30D, B



●EH34D, B

() for B type



3. FEATURES

1. The overhead valve design offers a compactness, light weight and ideal combustion characteristics resulting in more power from less fuel and prolonged engine life.
2. The vibration free design with the balancer system and lighter reciprocating parts.
3. Such parts as the large capacity muffler, dual element air cleaner, helical type balancer gear with extra long teeth and the blower housing and muffler cover made of resin laminated "DAMPING SHEET" reduce noise to a minimum.
4. The automatic decompression system offers easy, dependable starting.
5. The muffler and carburetor are located on opposite sides, making the arrangements for cooling air flow much easier in the design of power equipment.

4. GENERAL DESCRIPTION OF ENGINE COMPONENTS

4-1 CYLINDER AND CRANKCASE

The cylinder and crankcase is single piece aluminum die-casting. The cylinder liner, made of special cast iron, is molded into the aluminum casting.

The crankcase has a mounting surface on the output shaft side, where the main bearing cover is attached. (See Fig. 1.)

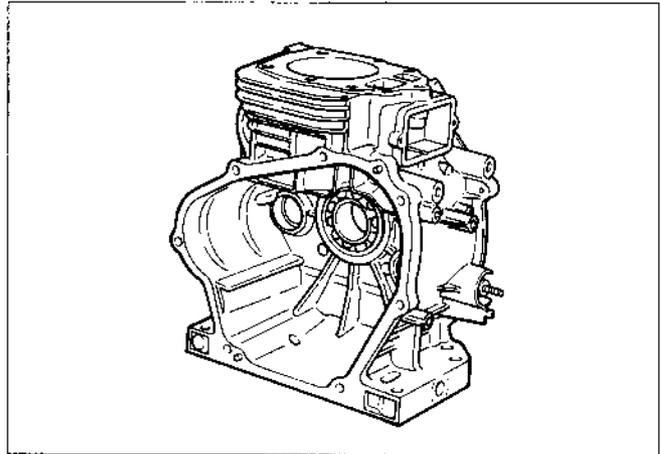


Fig. 1

4-2 MAIN BEARING COVER

The main bearing cover is an aluminum die-casting, which is mounted on the output shaft side of the crankcase.

Remove the main bearing cover to inspect inside of the engine.

Pilots and bosses are machined on the cover for direct mounting of the engine onto such machines as generators and pumps.

Oil gauge (fillers) are on both sides of the cover for easy maintenance.

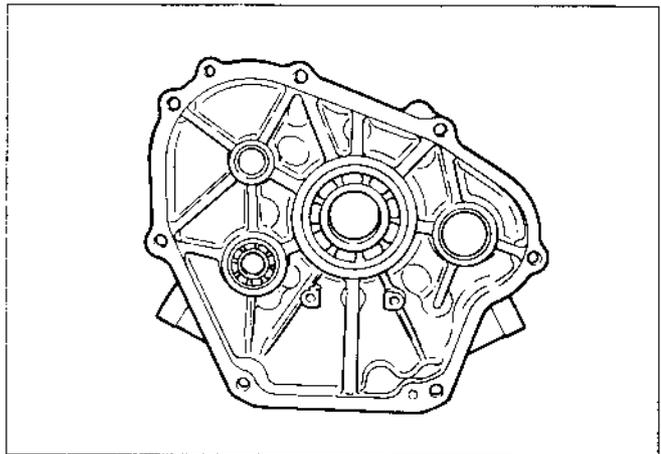


Fig. 2

4-3 CRANKSHAFT

The crankshaft is forged carbon steel, and the crank pin is induction-hardened. The output end of the shaft has a crankshaft gear and balancer gear that are pressed into position. (See Fig. 3.)

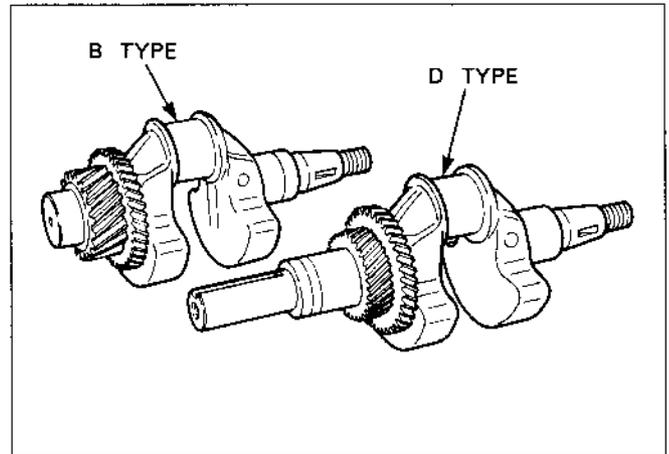


Fig. 3

4-4 CONNECTING ROD AND PISTON

The connecting rod is forged aluminum alloy, and its large and small ends function as bearings. The piston is an aluminum alloy casting, and carries two compression rings and one oil ring. (See Fig. 4.)

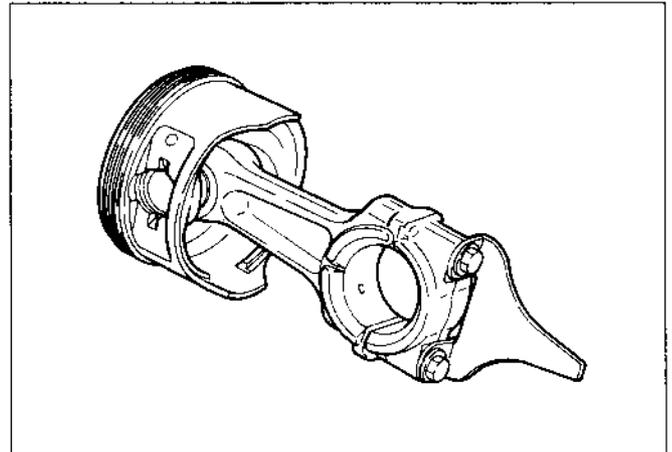


Fig. 4

4-5 PISTON RINGS

The Piston rings are made of special cast iron. The profile of the top ring is barrel face and the second ring has a tapered face with an under-cut.

The oil ring consists of a cutter ring and a coil expander for better sealing and less oil consumption.

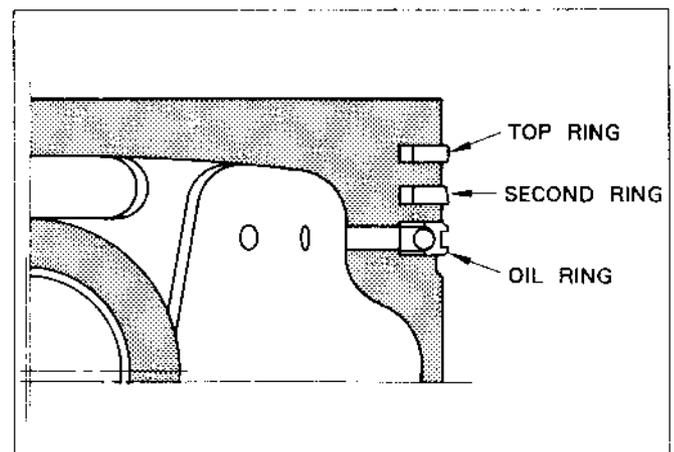


Fig. 5

4-6 CAMSHAFT

The camshaft for the D-type engine is made of special cast iron and camshaft gears are casted together in one piece.

Both sides of the shaft fit into the plane bearings on the crankcase and main bearing cover.

The camshaft for B-type engine is made of forged carbon steel and also functions as PTO shaft.

Cam gear is press fitted on the shaft and ball bearings are employed on the both sides for supporting the shaft. (See Fig. 6.)

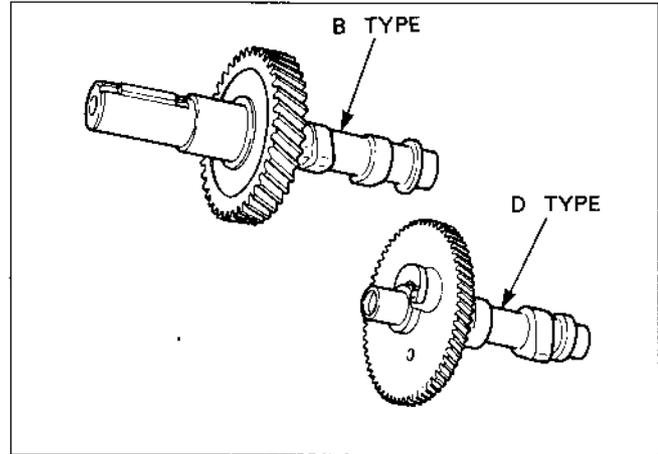


Fig. 6

4-7 VALVE ARRANGEMENT

The intake valve is located on flywheel side of the cylinder head.

Hard alloy valve seats are molded in the cylinder head and stellite is fused to the exhaust valve face.

The cylinder baffle leads cooling air to the exhaust valve area for the optimum cooling.

(See Fig. 7.)

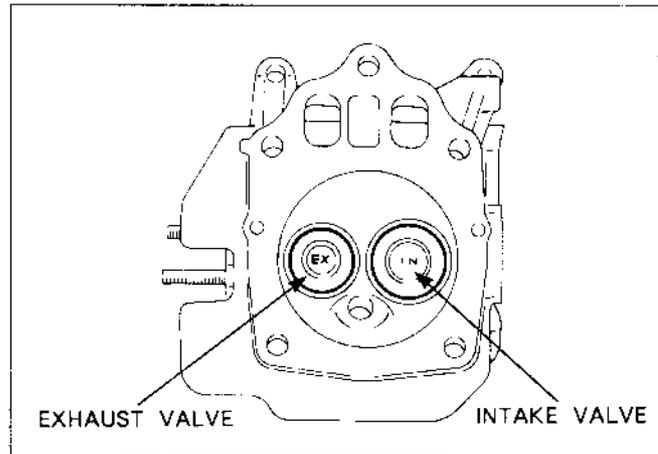


Fig. 7

4-8 CYLINDER HEAD

The cylinder head is an aluminum die casting which utilizes wedge type combustion chamber for the highest combustion efficiency.

(See Fig. 8.)

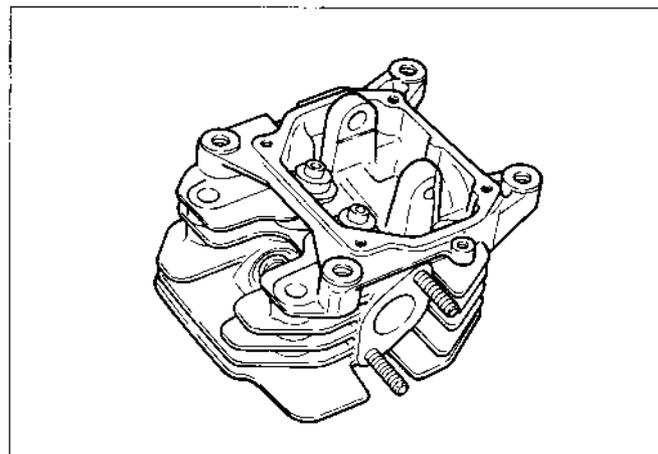


Fig. 8

4-9 GOVERNOR SYSTEM

The governor is a centrifugal flyweight type which ensures constant operation at the selected speed against load variations.

The governor gear with governor weights is installed in the crankcase and driven by the balancer shaft. (See Fig. 9.)

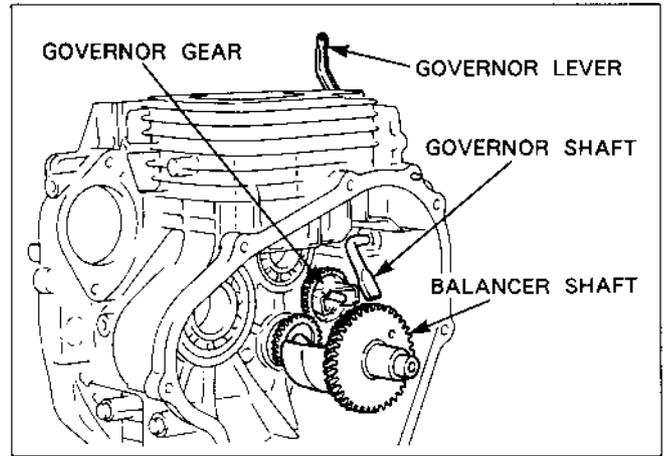


Fig. 9

4-10 COOLING SYSTEM

The large fins on the flywheel provide sufficient cooling air capacity for the inlet and exhaust area and cylinder.

The cylinder baffle helps the cooling air flow efficiently.

4-11 LUBRICATION

All the rotating and sliding parts are splash-lubricated by the oil scraper on the connecting rod. (See Fig. 10.)

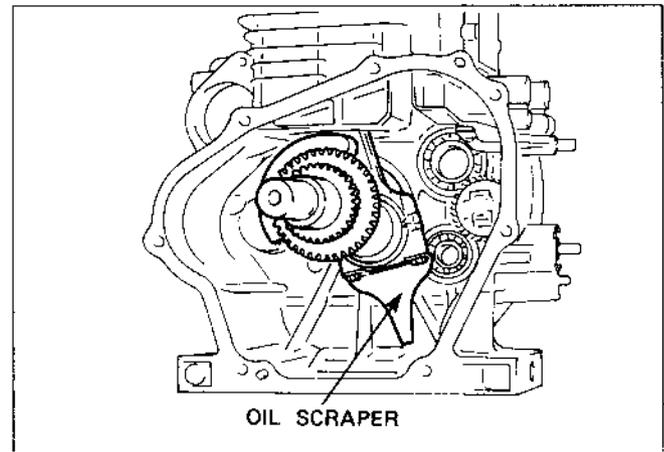


Fig. 10

4-12 IGNITION SYSTEM

The ignition system is a transistor controlled magneto ignition system which consists of a flywheel and an ignition coil with a built in transistor mounted on the crankcase.

This system has an ignition timing advance for easy starting. (See Fig. 11.)

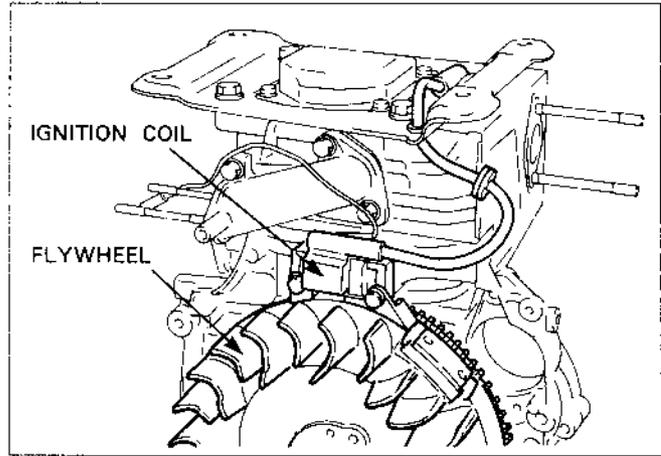


Fig. 11

4-13 CARBURETOR

The engines are equipped with a horizontal draft carburetor that has a float controlled fuel system and a fixed main jet.

The carburetors are calibrated carefully for the sure starting, good acceleration, low fuel consumption and sufficient output.

For the details, refer to page 46, section "8 CARBURETOR". (See Fig. 12.)

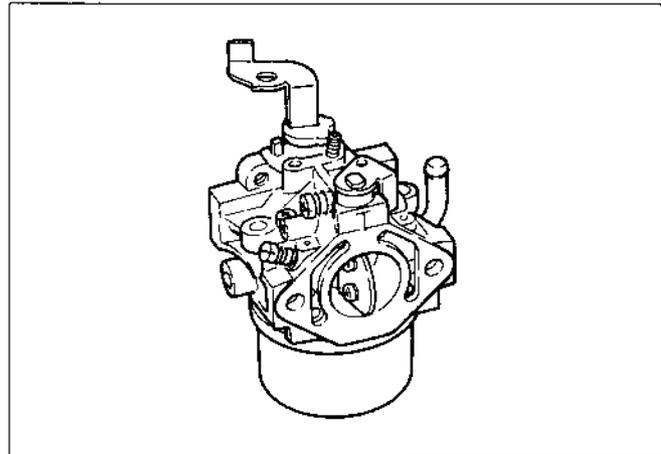


Fig. 12

4-14 AIR CLEANER

The air-cleaner is a heavy-duty type with a dual element system. (See Fig. 13.)

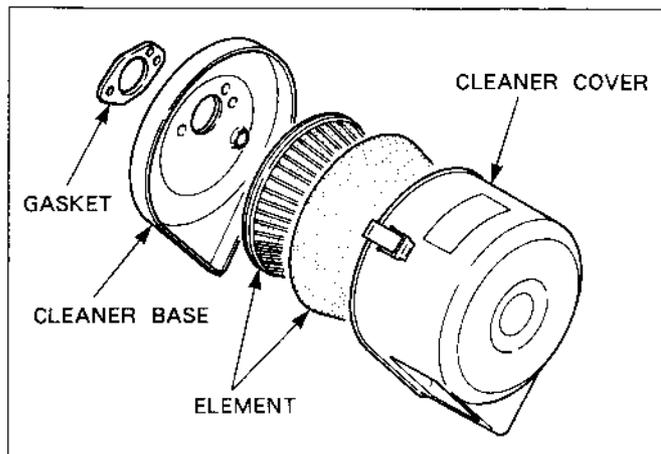


Fig. 13

4-15 BALANCER

Unbalanced inertia force is balanced by the balancer which rotates at the same speed with the crankshaft to effectively reduce vibration. (See Fig. 14.)

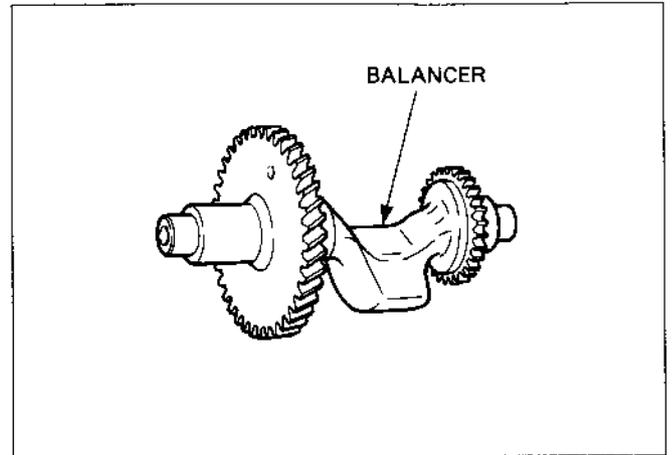


Fig. 14

4-16 DECOMPRESSION SYSTEM

An automatic decompression mechanism which opens exhaust valve before the piston reaches compression top is assembled on the camshaft for easy starting. (See Fig. 15)

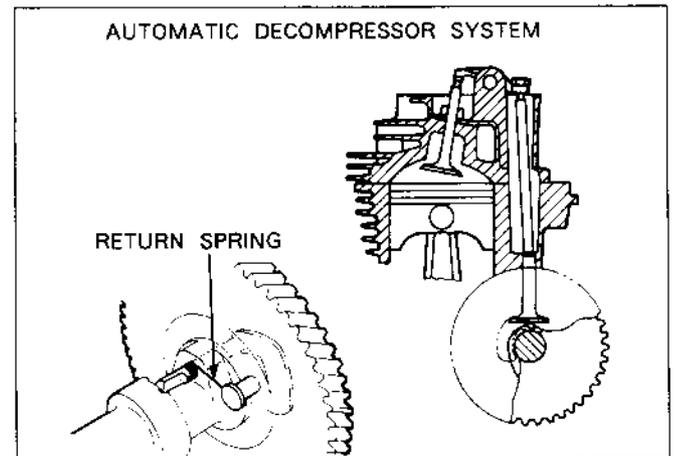
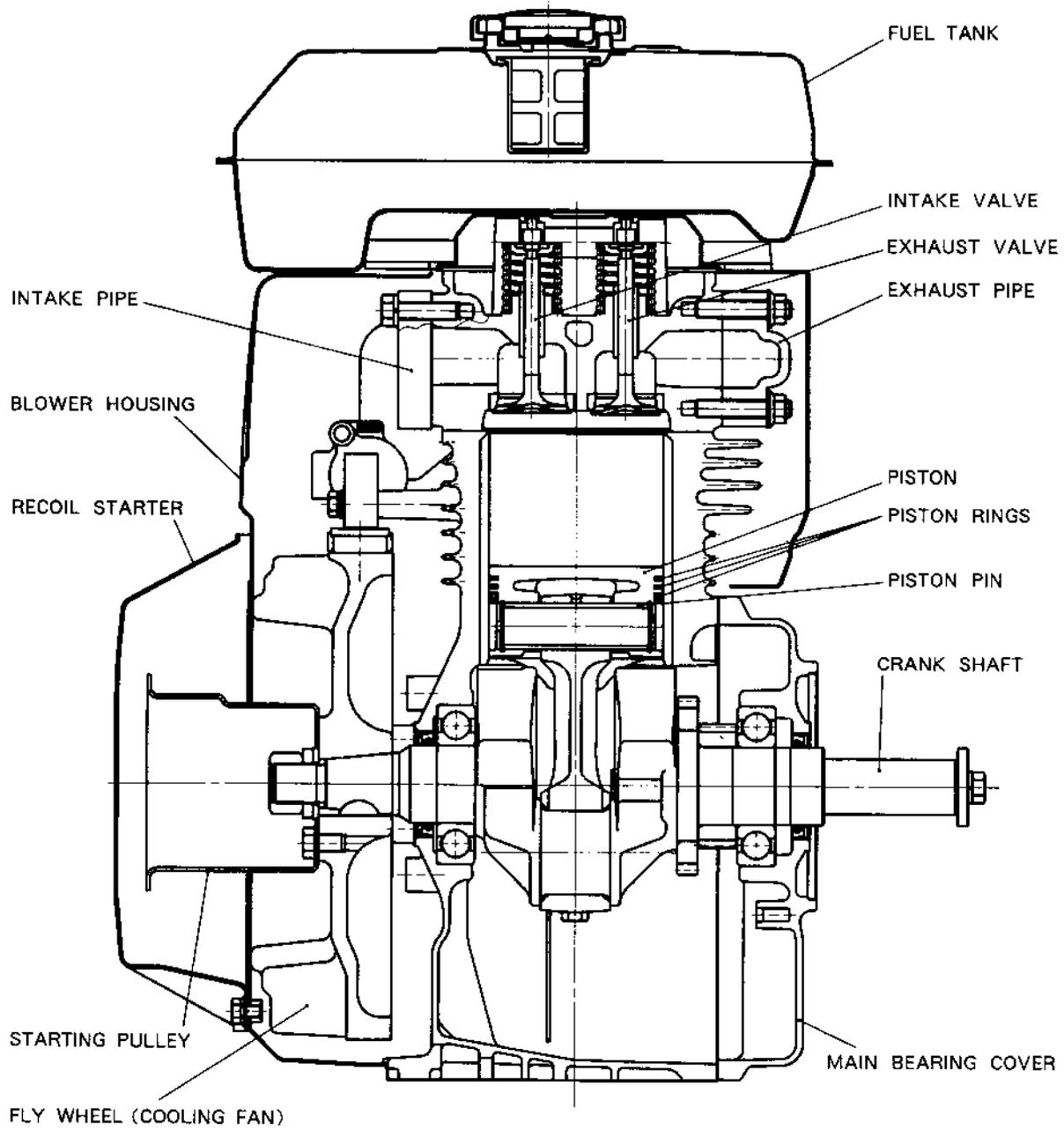
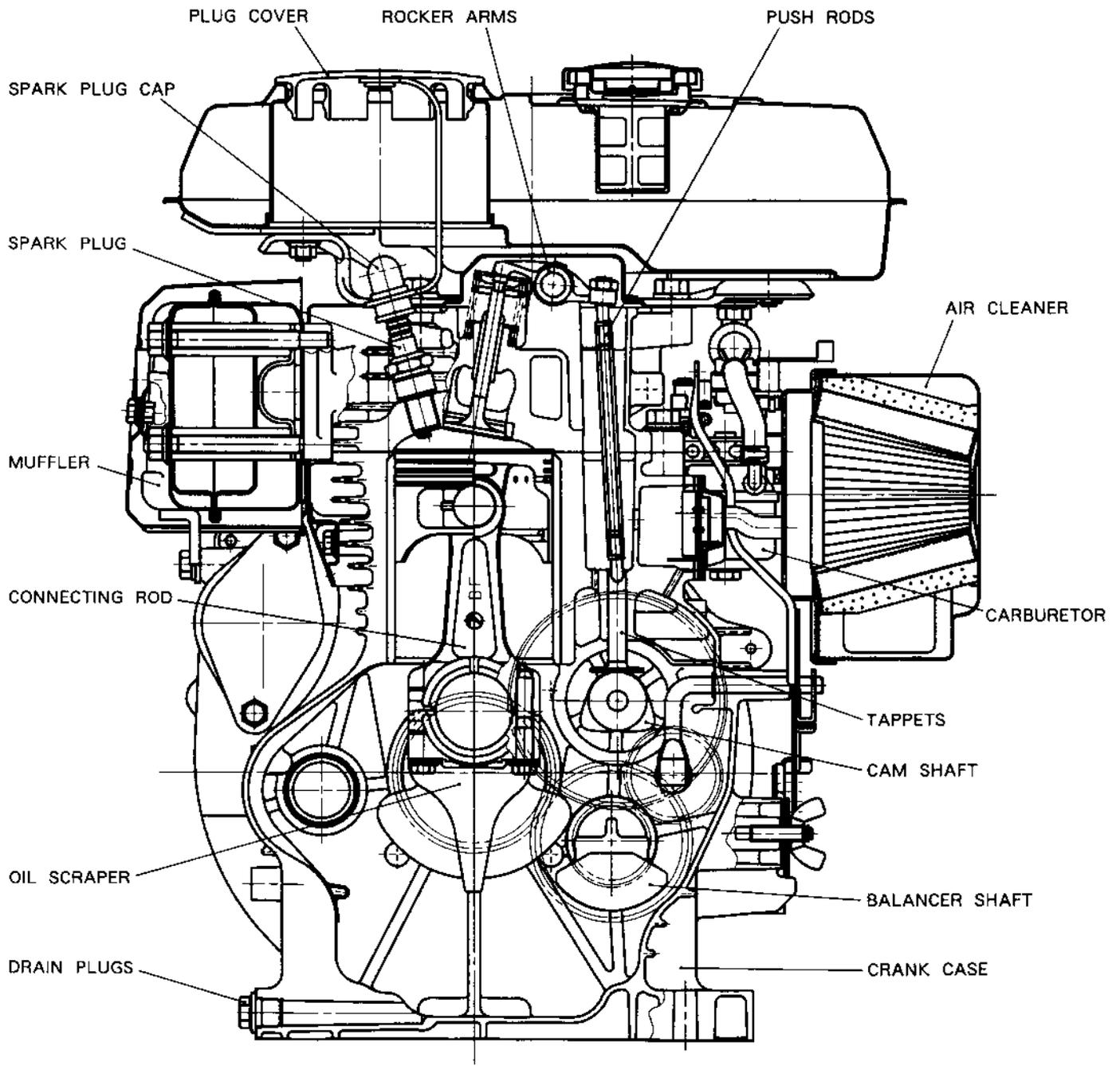


Fig. 15

4-17 SECTIONAL VIEW OF ENGINE





5. DISASSEMBLY AND REASSEMBLY

5-1 PREPARATIONS AND SUGGESTIONS

- 1) When disassembling the engine, memorize the locations of individual parts so that they can be reassembled correctly. If you are uncertain of identifying some parts, it is suggested that tags be attached to them.
- 2) Have boxes ready to keep disassembled parts by group.
- 3) To prevent losing and misplacing, temporarily assemble each group of disassembled parts.
- 4) Carefully handle disassembled parts, and clean them with washing oil if necessary.
- 5) Use the correct tools in the correct way.

5-2 SPECIAL TOOLS

Tool No.	Tool	Use
209-95004-07	Flywheel puller with bolt	For pulling off the flywheel
228-95003-07	Piston ring compressor	For placing piston ring

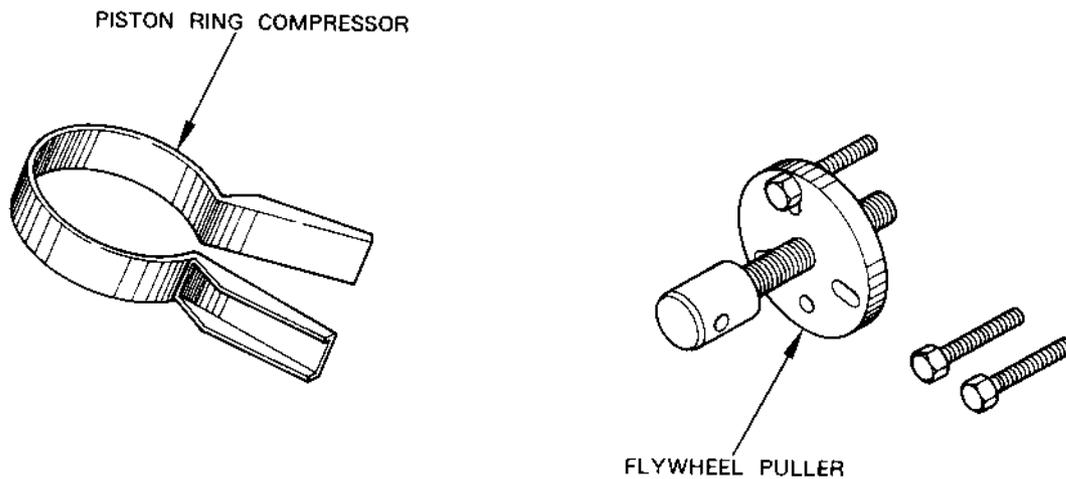


Fig. 16

5-3 DISASSEMBLY PROCEDURES

Step	Part to remove	Procedures	Remarks	Tool
1	Oil drain	(1) Remove oil drain plug and drain oil. (2) To discharge oil quickly, remove oil gauge.	Be careful not to lose the gasket.	14mm box wrench

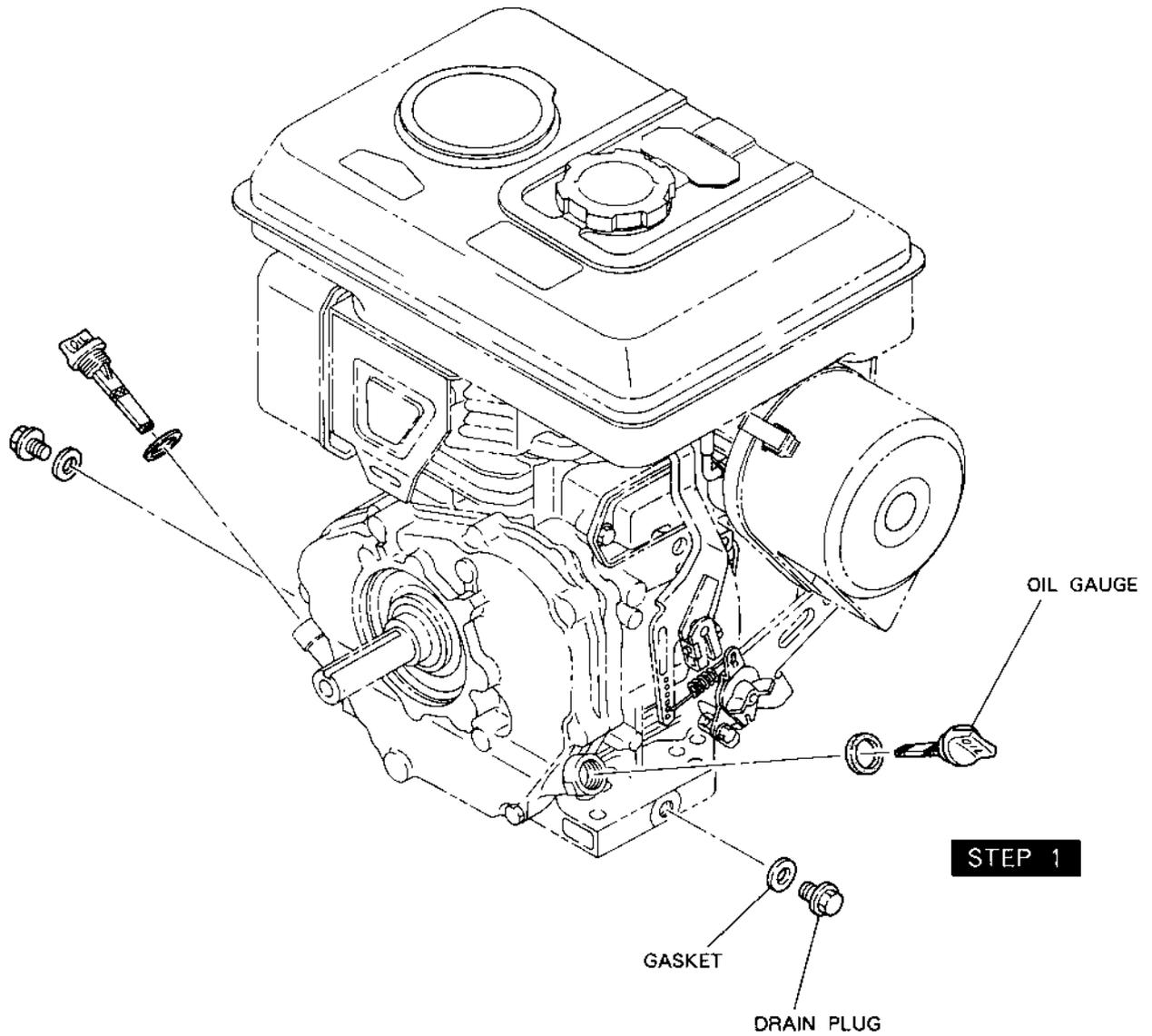


Fig. 17

Step	Part to remove	Procedures	Remarks	Tool
2	Air cleaner	(1) Remove cleaner cover and element. (2) Remove cleaner base and gasket. M6 × 12mm bolt and washer •••• 1pce. M6 flange nut •••• 2pcs.	Fastened together with carburetor.	10mm socket wrench

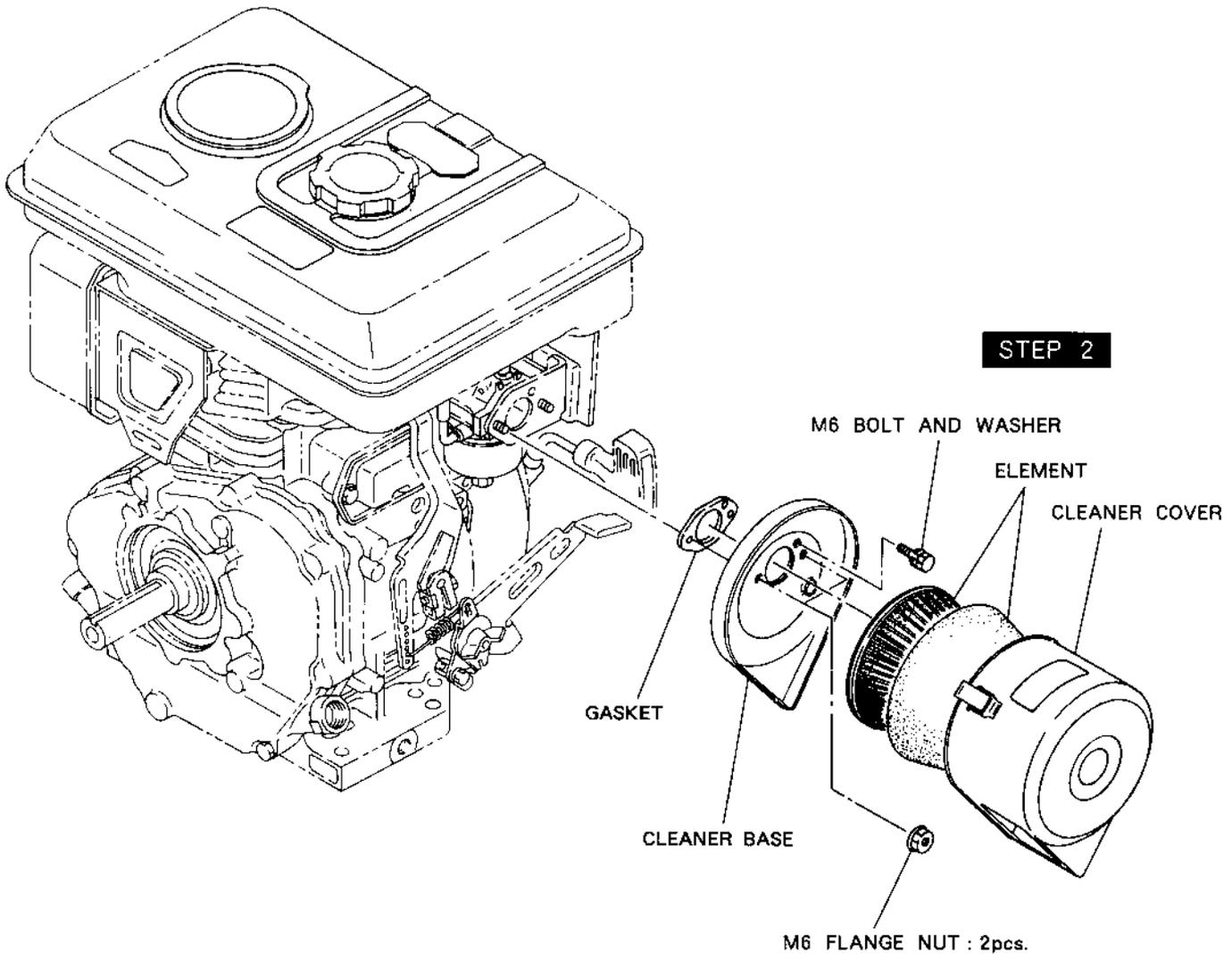


Fig. 18

Step	Part to remove	Procedures	Remarks	Tool
3	Key switch control panel and bracket (Option)	(1) Remove control panel. M4 × 6mm tapping screw •••• 2pcs. (2) Remove panel bracket, gasket, and key switch. (3) Disconnect wire 2 complete from panel bracket. M6 × 8mm flange bolt •••• 1pce.		+ driver 10mm box wrench
4	Carburetor	(1) Close fuel valve. (2) Disconnect fuel pipe from fuel strainer. (3) Remove carburetor carefully unhooking governor rod and rod spring from governor lever.	Be careful not to bend governor rod or stretch rod spring.	

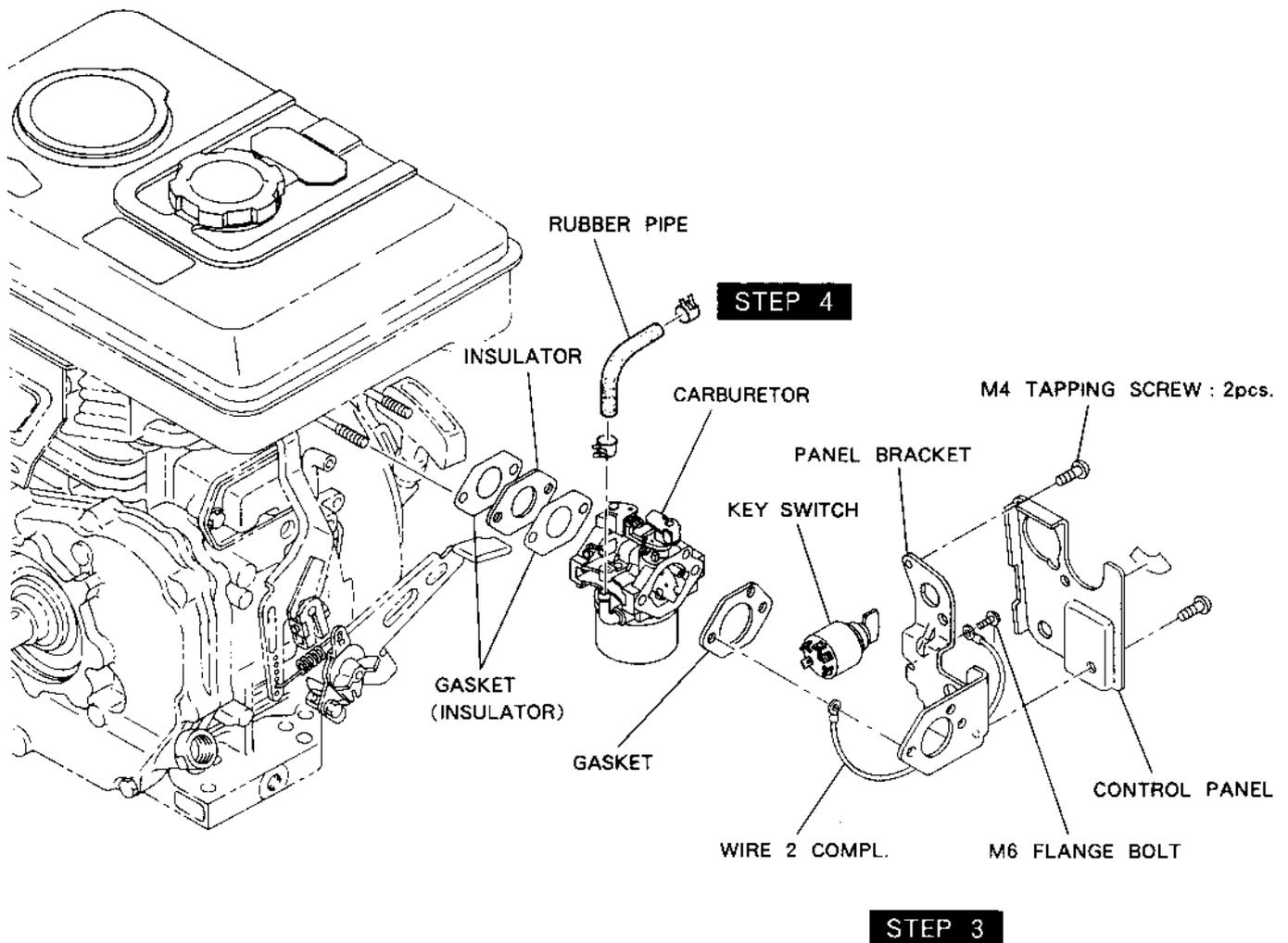


Fig. 19

Step	Part to remove	Procedures	Remarks	Tool
5	Speed control lever and governor lever	(1) Unhook governor spring from governor lever. (2) Remove clip, wing nut, stop plate, friction plate, and speed control lever. (3) Loosen the bolt and remove governor lever.	Note governor spring hole on governor lever.	

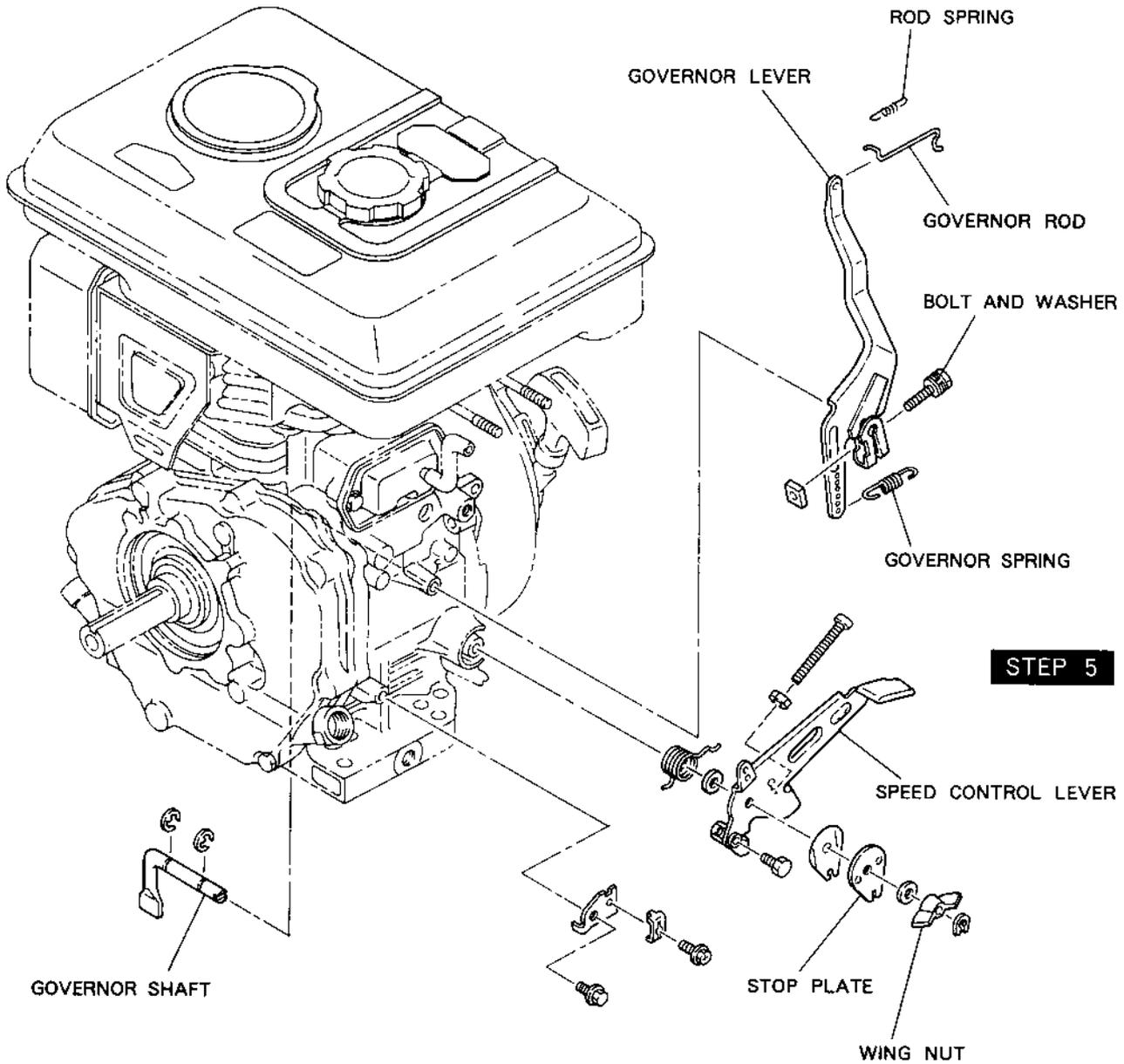


Fig. 20

Step	Part to remove	Procedures	Remarks	Tool
6	Oil sensor (New type) (Option)	(1) Unclamp sensor cord from main bearing cover. (2) Remove oil sensor unit.	Be very careful not to damage stick and sensor unit in any way.	
7	Oil sensor (Old type) (Option)	(1) Unclamp sensor cord from main bearing cover. (2) Remove oil sensor unit. M6 × 10mm screw and washer... 2pcs. (3) Remove joint, gasket and oil sensor stick. M22 joint... 1pce.	Be very careful not to damage stick and sensor unit in any way.	+ driver M22 spanner
8	Muffler	(1) Loosen two flange nuts, three flange bolts and bolt and washer. (2) Remove muffler and muffler cover from stud bolts. M8 flange nut... 2pcs. M8 × 16mm bolt and washer... 1pce. M6 × 8mm flange bolt... 3pcs.	Be careful not to lose muffler gasket.	12mm box wrench 10mm socket wrench

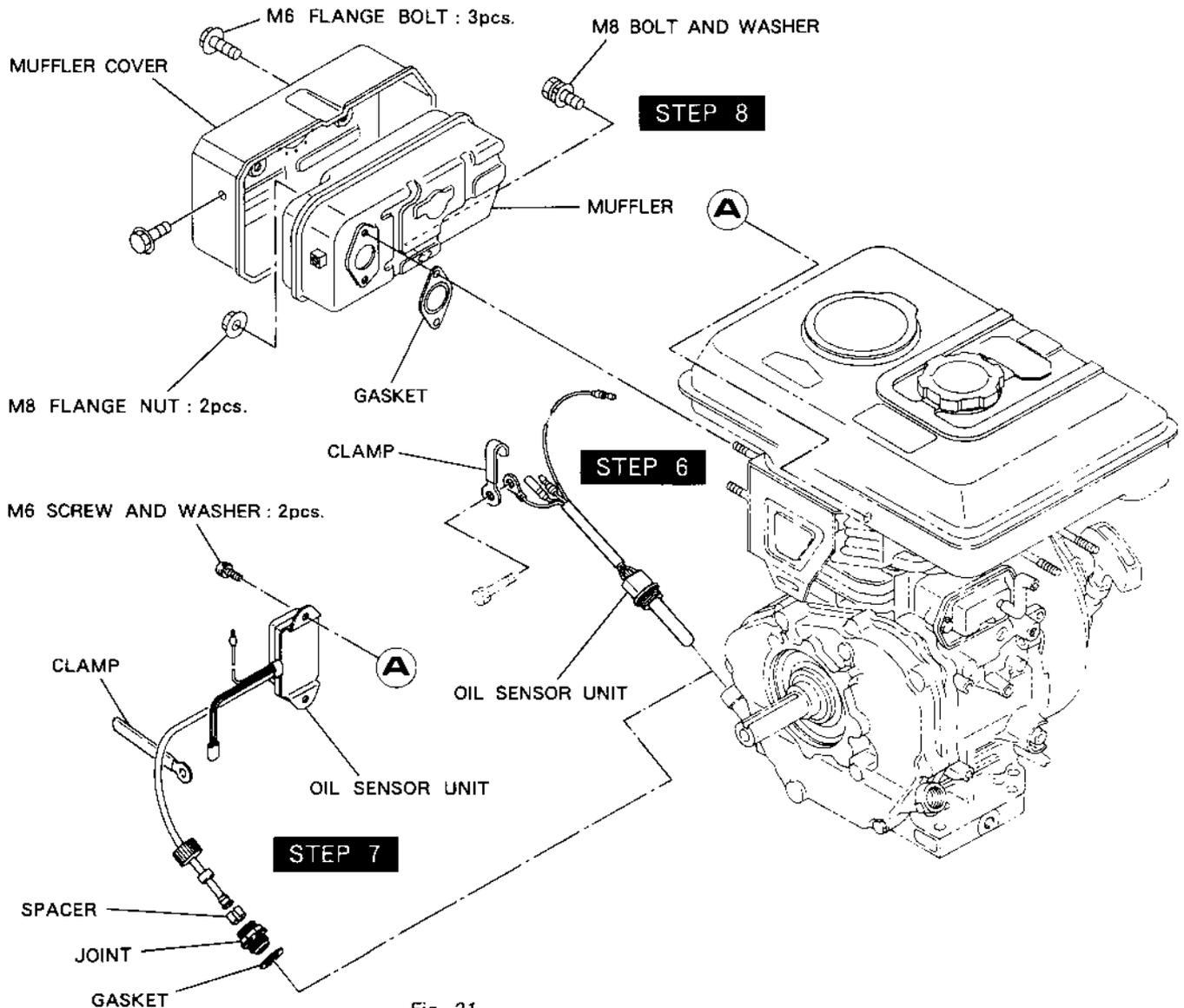


Fig. 21

Step	Part to remove	Procedures	Remarks	Tool
9	Electric starter	(1) Remove black wire from electric starter. (2) Loosen two bolts and remove electric starter. M8 × 30mm bolt 2pcs. M8 washer 2pcs. M8 spring washer 2pcs.	Reattach terminal nut to starter to keep it from missing.	12mm socket wrench
10	Diode rectifier and magnetic switch (Option)	(1) Disconnect wire harnesses. (2) Remove magnetic switch. M5 nut 2pcs. M5 spring washer 2pcs. (3) Remove regulator bracket from crankcase. M6 × 8mm flange bolt 2pcs. (4) Remove diode rectifier from bracket. M6 × 10mm screw and washer.....1pc.		8mm box wrench 10mm box wrench + driver

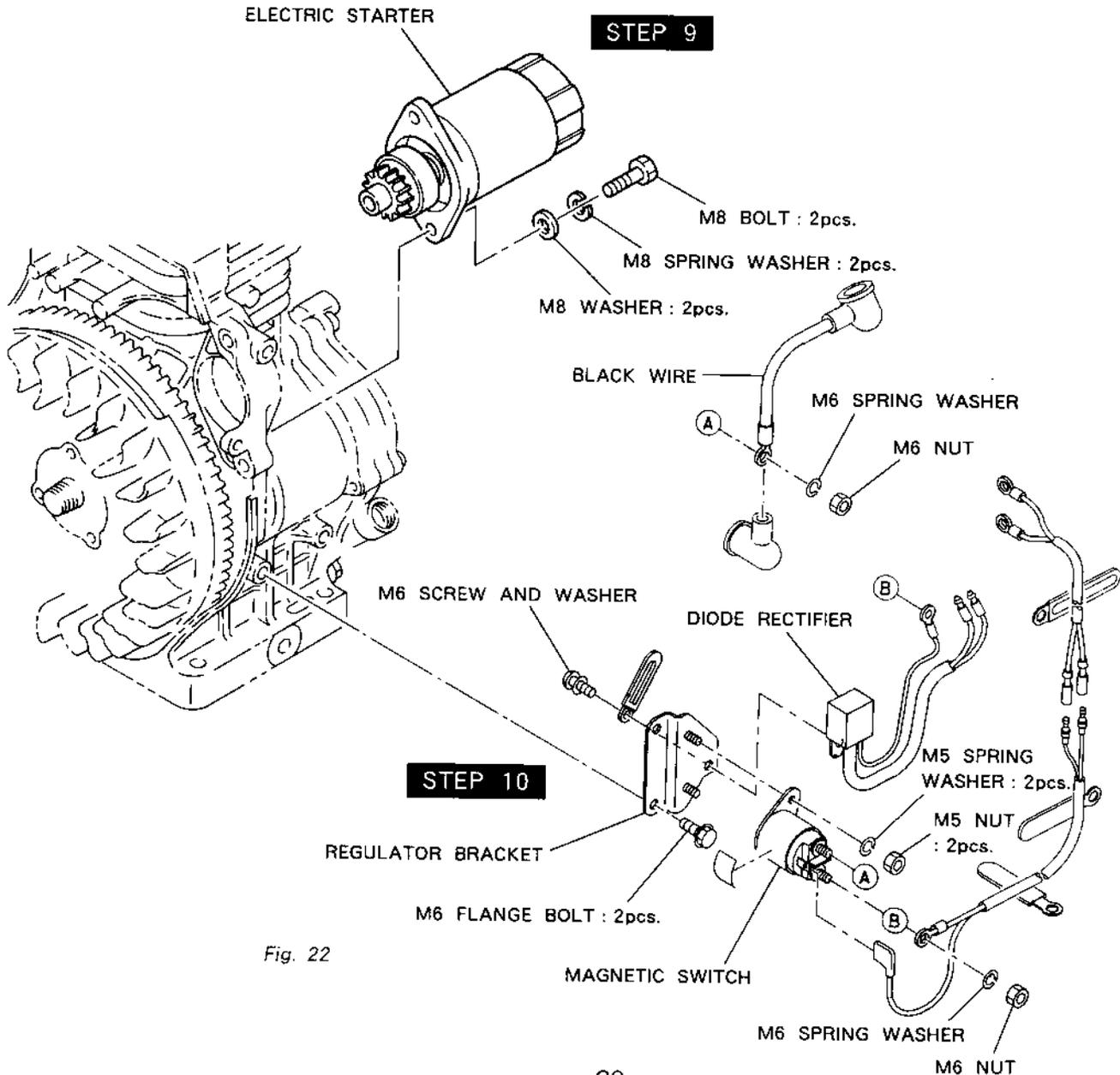


Fig. 22

Step	Part to remove	Procedures	Remarks	Tool
11	Fuel tank	Loosen four flange nuts from bottom of fuel tank and remove fuel tank. M8 flange nut **** 4pcs.	Wipe off spilt fuel thoroughly.	12mm socket wrench

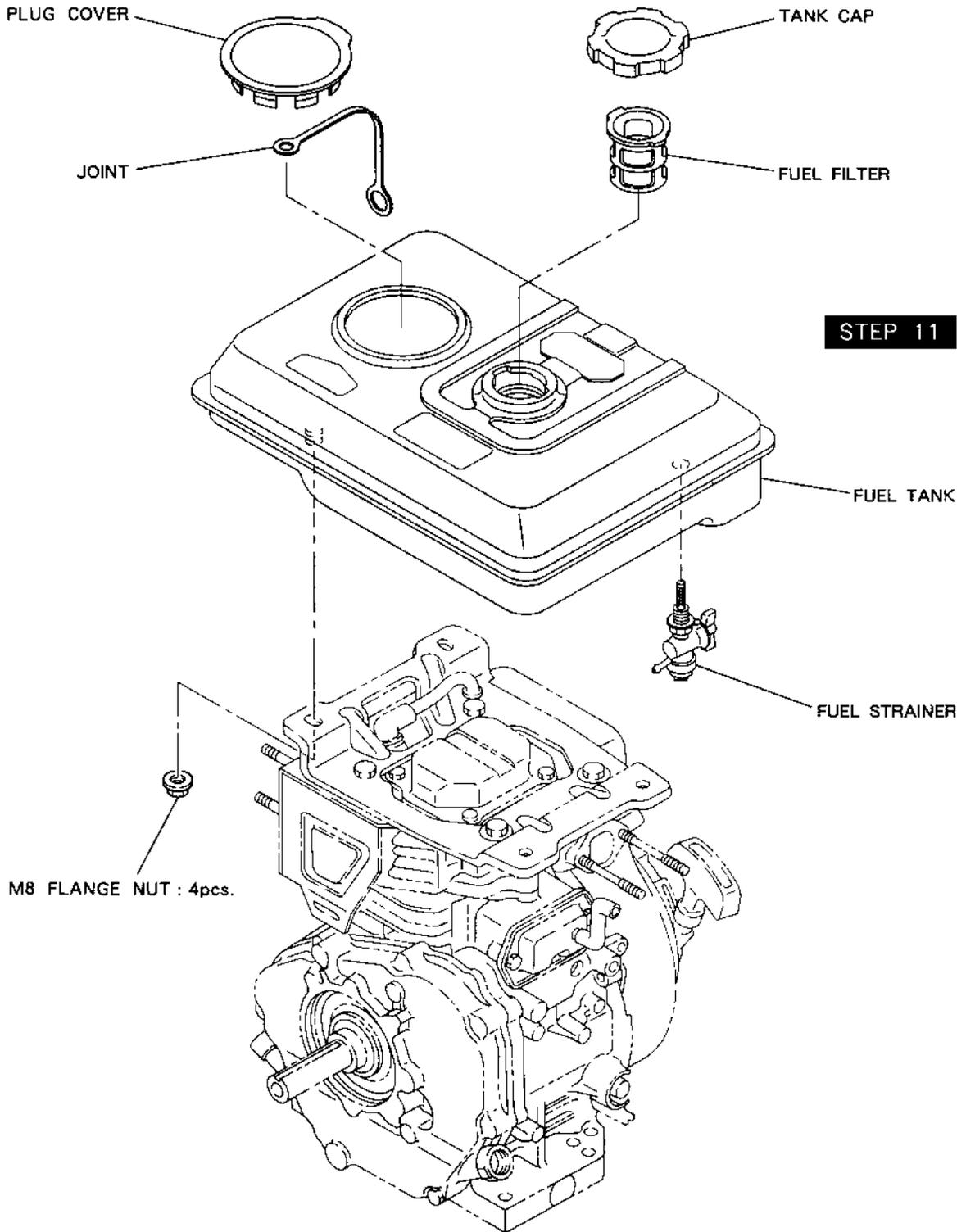


Fig. 23

Step	Part to remove	Procedures	Remarks	Tool
12	Recoil starter	Remove recoil from blower housing. M6 × 8mm flange bolt •••• 4pcs.		10mm box wrench
13	Blower housing	Remove blower housing from crankcase. M6 × 8mm flange bolt •••• 4pcs.		10mm box wrench
	Stop switch	Disconnect wire 1 complete. Remove stop switch. M4 tapping screw.		+ driver
	Pulley cover (Option W/starting motor)	Remove pulley cover. M6 × 8mm flange bolt ••• 4pcs.		10mm box wrench

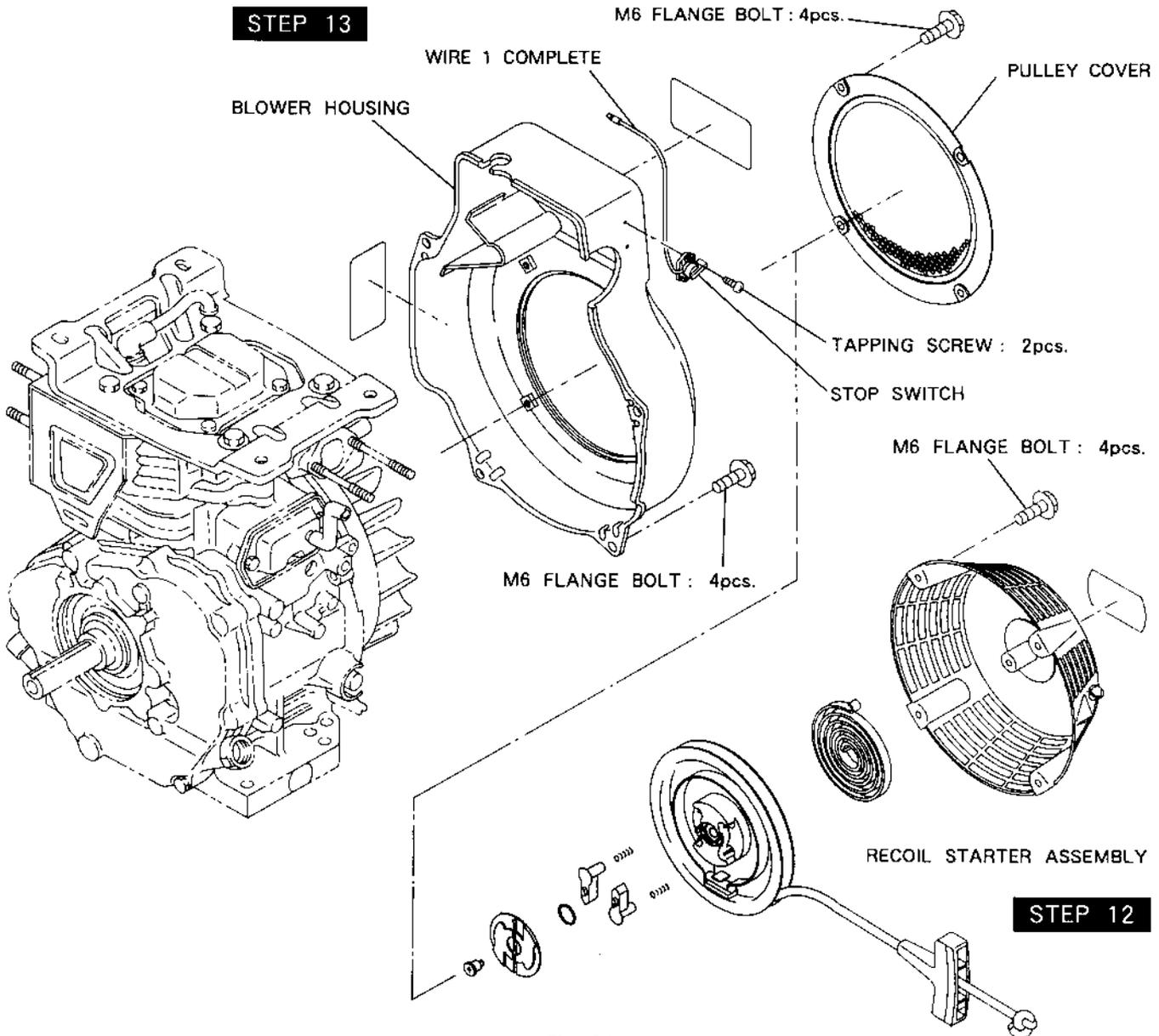


Fig. 24

Step	Part to remove	Procedures	Remarks	Tool
14	Ignition coil	(1) Remove spark plug cap from spark plug. (2) Remove ignition coil from crankcase. M6 × 30mm bolt and washer •••• 2pcs.		10mm box wrench
15	Fuel tank Bracket	Remove the fuel tank bracket. M10 × 20mm bolt and washer •••• 4pcs.		14mm box wrench
16	Cylinder baffle	Remove the cylinder baffle from cylinder. M6 × 8mm flange bolt •••• 1pc.		10mm box wrench

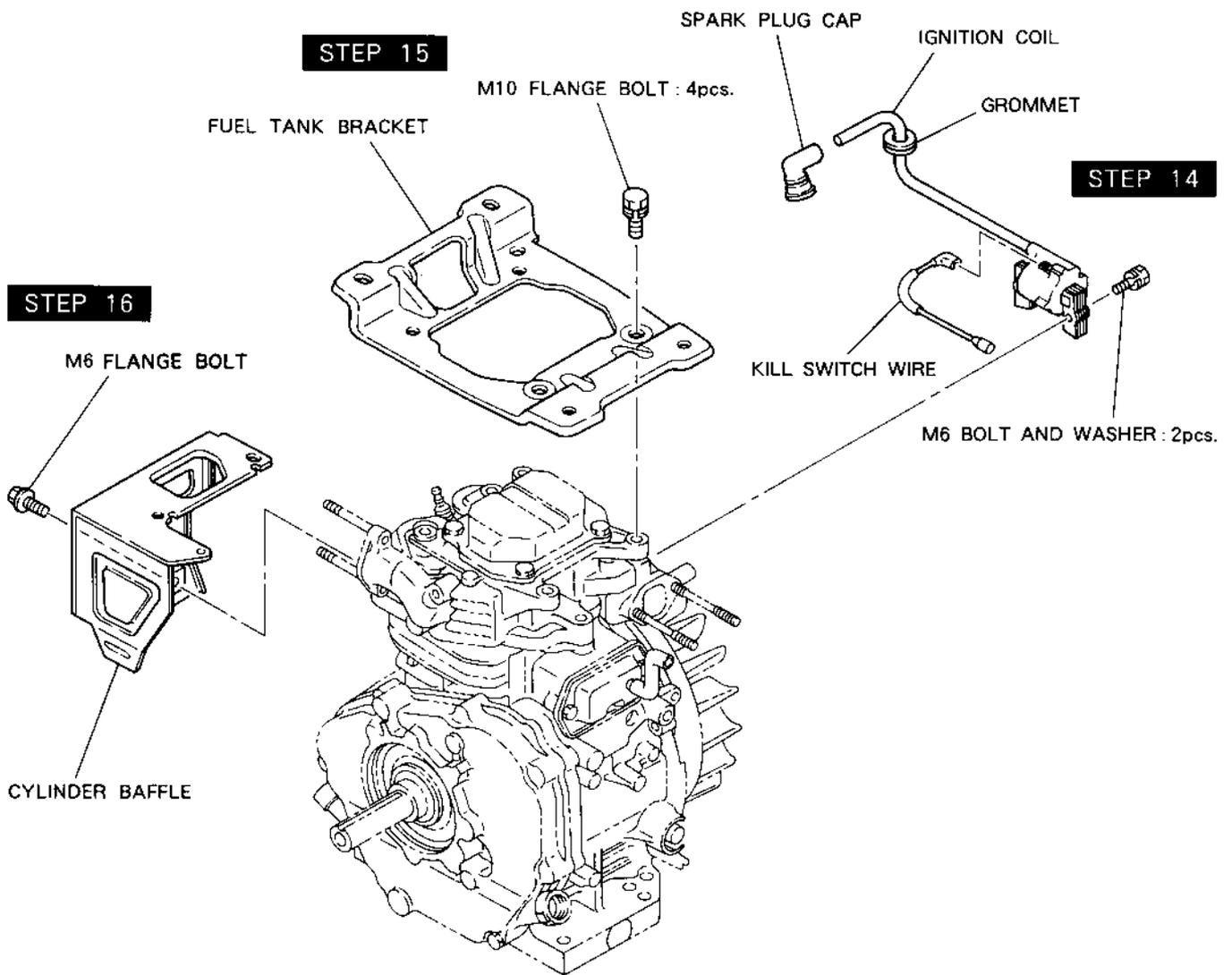


Fig. 25

Step	Part to remove	Procedures	Remarks	Tool
17	Flywheel	(1) Remove nut from crankshaft. M16 nut 1pce. (See Fig. 26.) (2) Remove the starting pulley. M8 × 12mm bolt 3pcs. (3) Remove flywheel using flywheel puller. (See Fig. 28.) (4) Remove the key from crankshaft. (See Fig. 29.)	Flywheel can easily be removed by striking the head of the center bolt of the flywheel puller with a hammer. Be careful not to lose the key.	24mm socket wrench 12mm socket wrench
18	Charge coil	Remove the charge coil. M6 × 20mm screw and washer 2pcs. M6 × 8mm screw 1pce.		Phillips screwdriver

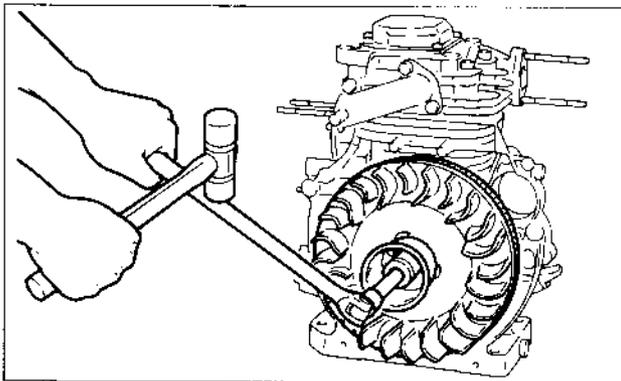


Fig. 26

STEP 17

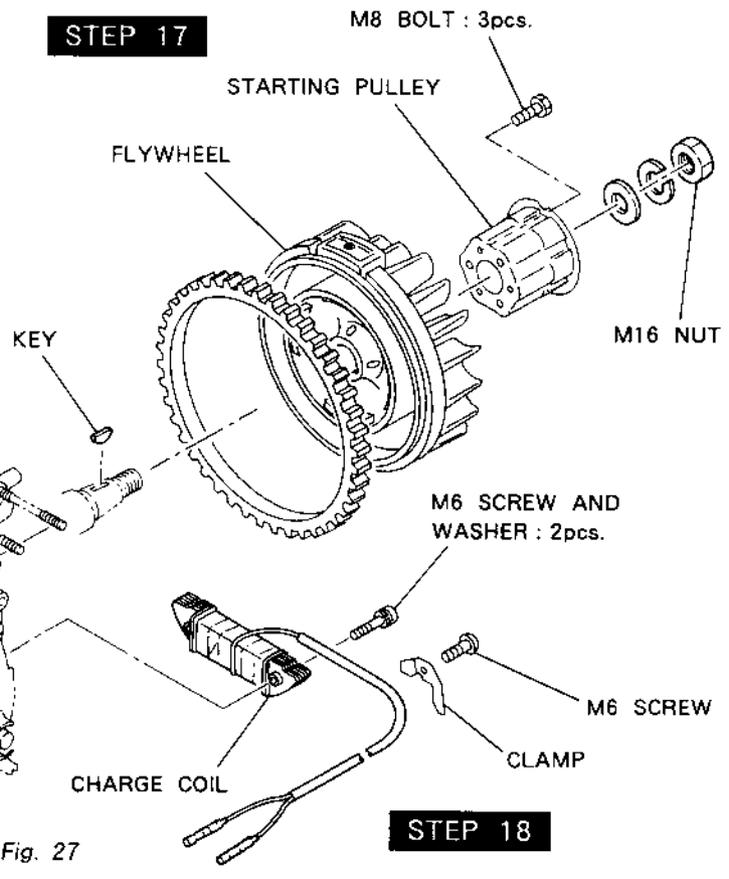


Fig. 27

STEP 18

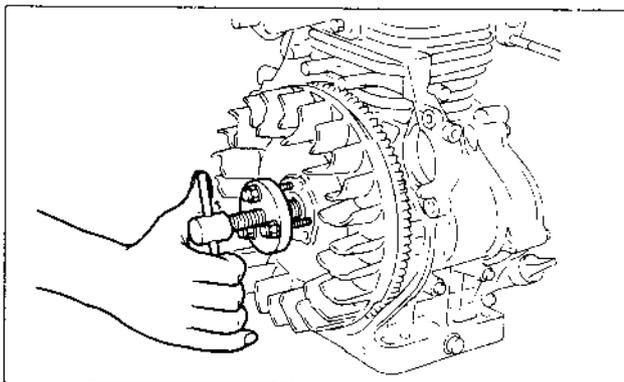


Fig. 28

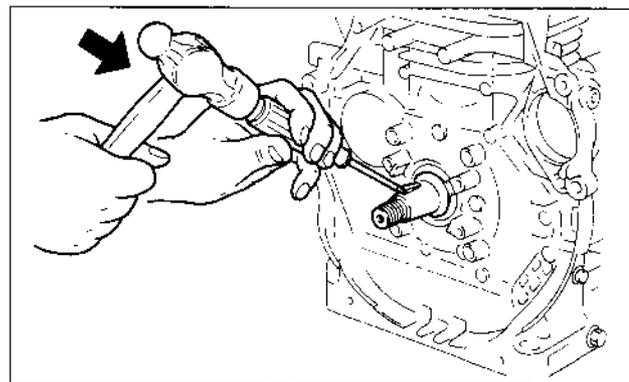


Fig. 29

Step	Part to remove	Procedures	Remarks	Tool
19	Exhaust manifold	Remove exhaust manifold and gasket from cylinder head. M8 flange nut •••• 2pcs.		12mm box wrench
20	Intake manifold	Remove intake manifold and gasket from cylinder head. M8 × 28mm bolt and washer •••• 2pcs.		12mm box wrench
21	Spark plug	Remove spark plug from cylinder head.		21mm socket wrench

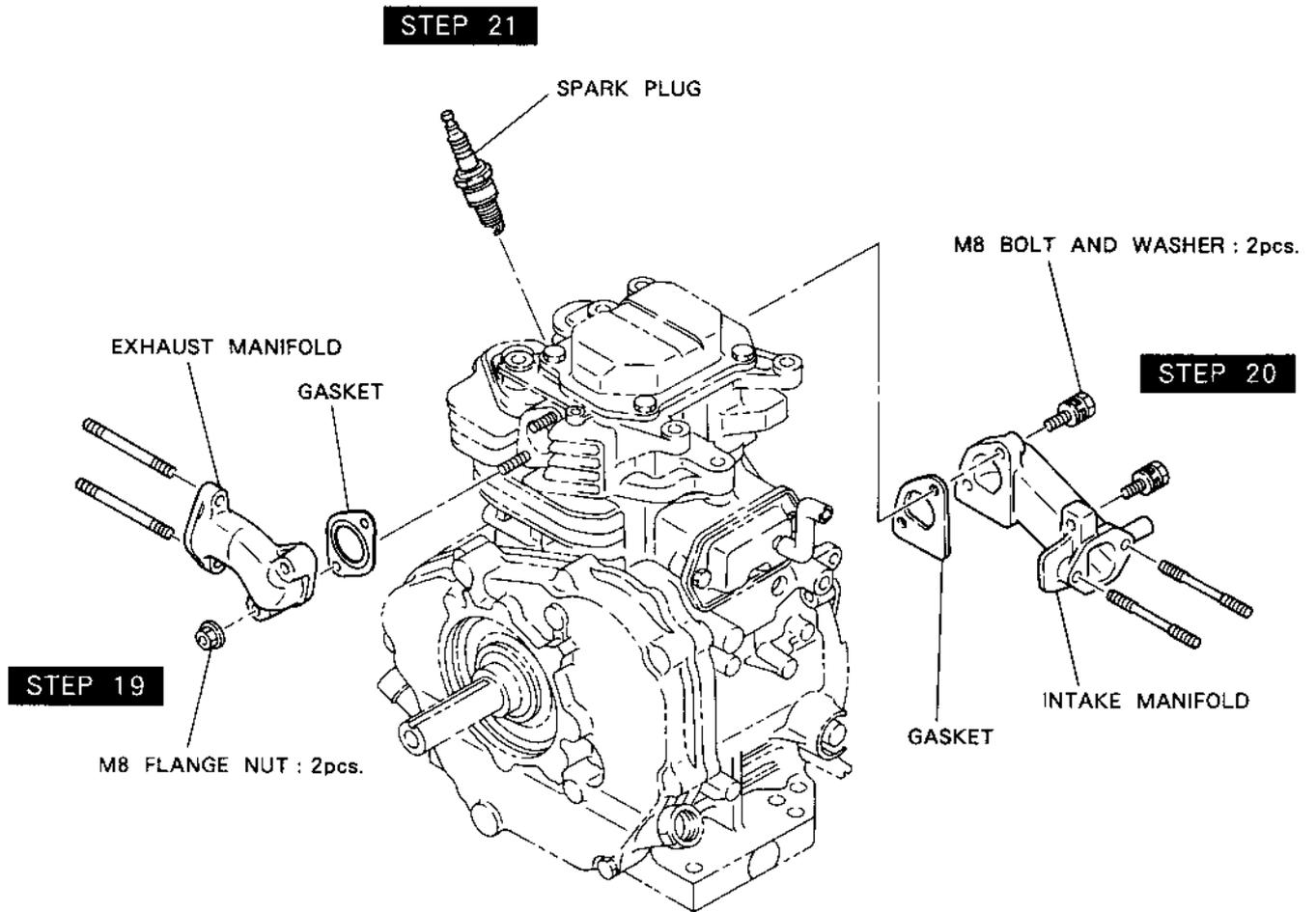


Fig. 30

Step	Part to remove	Procedures	Remarks	Tool
22	Cylinder head	<p>(1) Remove rocker cover and gasket from cylinder head. M6 × 12mm flange bolt ••• 4pcs.</p> <p>(2) Loosen adjusting screws on rocker arms. M8 nut ••• 2pcs.</p> <p>(3) Pull out rocker shaft from the intake side of cylinder head. (See Fig. 31.)</p> <p>(4) Remove push rods from cylinder.</p> <p>(5) Remove cylinder head and gasket from crankcase. M10 × 75mm flange bolt ••• 4pcs. M10 × 42mm flange bolt ••• 1pce.</p>	Mark rocker arms and push rods so they be reinstalled in their original positions.	<p>10mm box wrench</p> <p>12mm box wrench</p> <p>14mm box wrench</p>

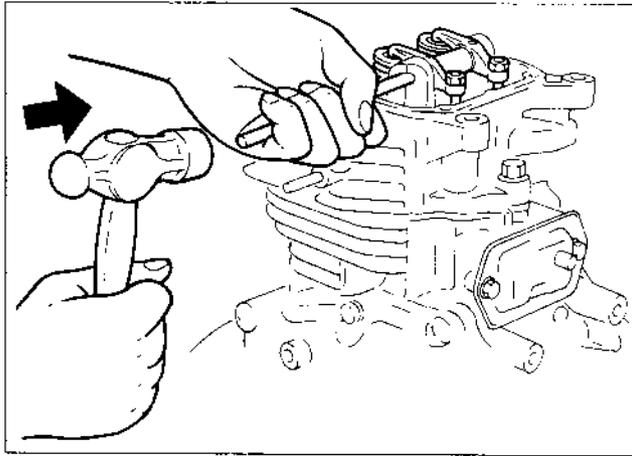


Fig. 31

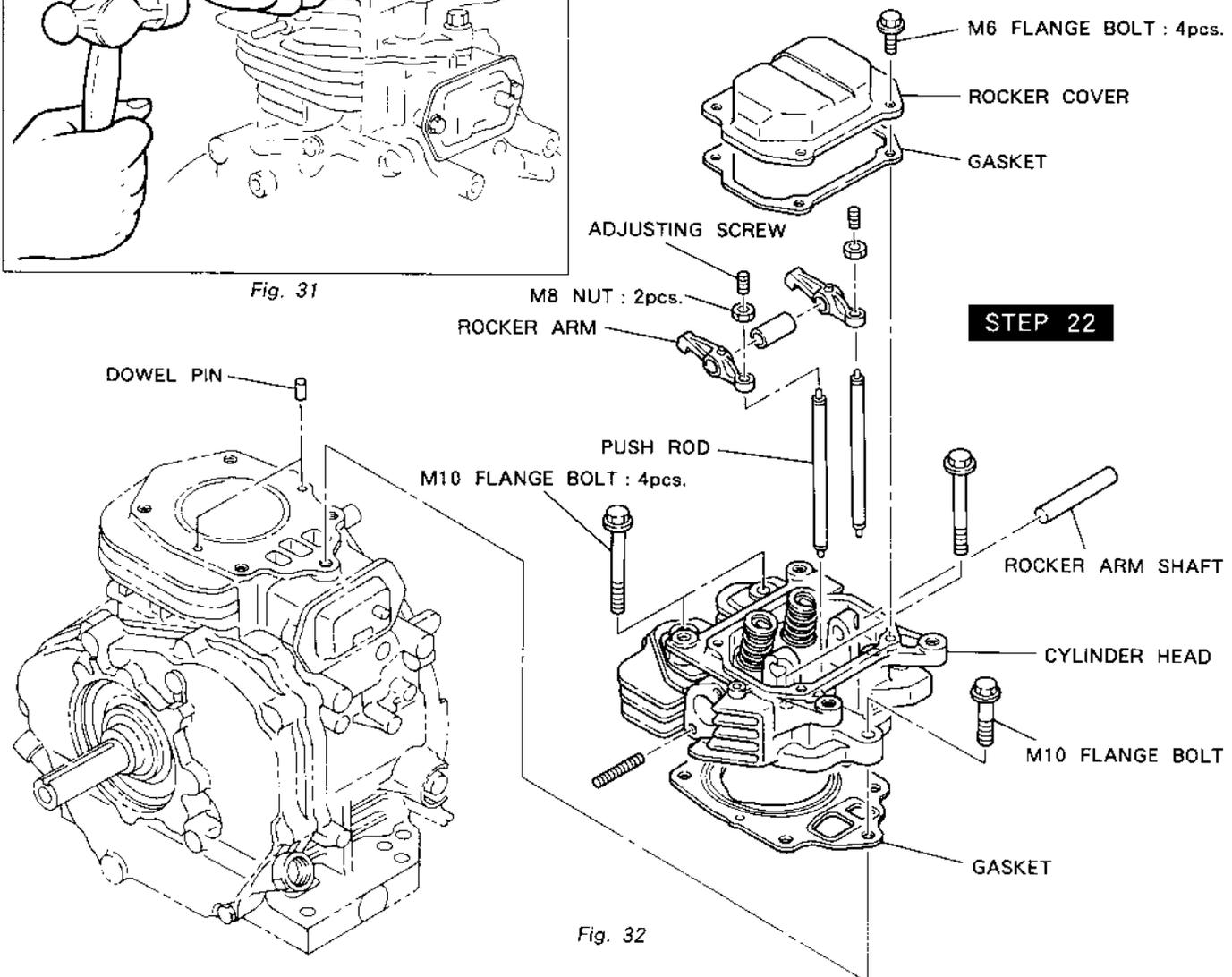


Fig. 32

Step	Part to remove	Procedures	Remarks	Tool
23	Intake and exhaust valve	(1) Press down spring retainer and slide it to release from the groove of valve stem, then remove spring retainer and valve spring. (See Fig. 33.) (2) Remove intake and exhaust valves from cylinder head.	Put marks on valves, springs and retainers so they be reinstalled in their original positions. Clean carbon and gum deposit from the valves, valve seats, ports and guides. Inspect valves, valve seats and guides.	
24	Breather	Remove breather cover. M6 × 12mm flange bolt •••• 2pcs. Remove gasket (Breather cover), breather plate and gasket (Breather plate).		10mm box wrench

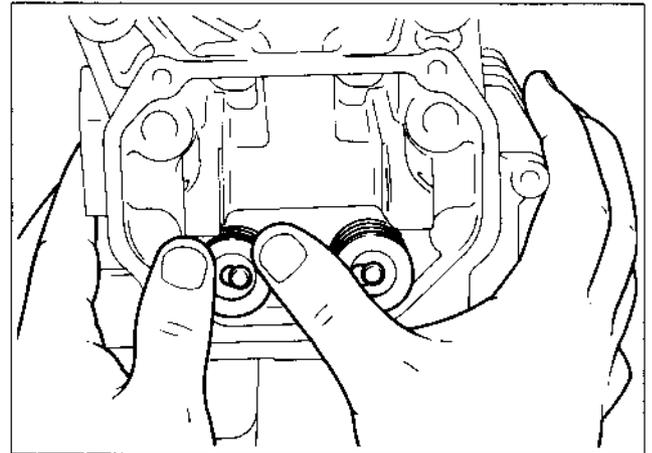
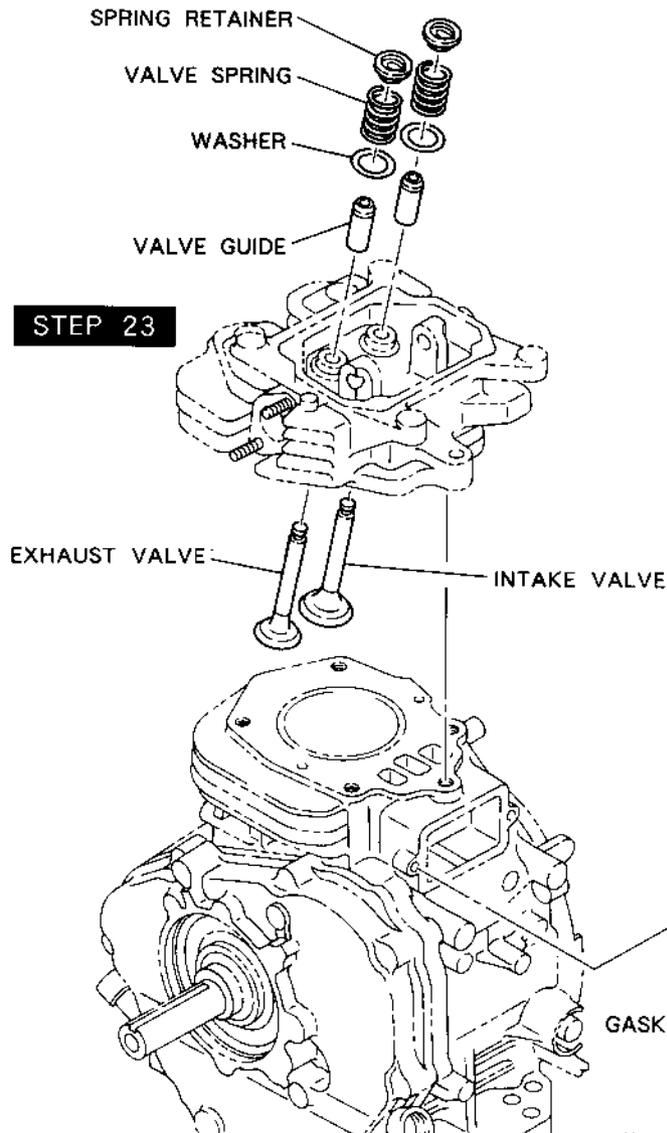


Fig. 33

Fig. 34

Step	Part to remove	Procedures	Remarks	Tool
25	Main bearing cover	(1) Remove bolts fastening main bearing cover on crankcase. M8 × 40mm bolt and washer •••• 7pcs. (2) Remove main bearing cover from crankcase. (See Fig. 35.)	Be careful not to damage the oil seal. Use a soft hammer and evenly tap around outer surface of cover.	12mm box wrench

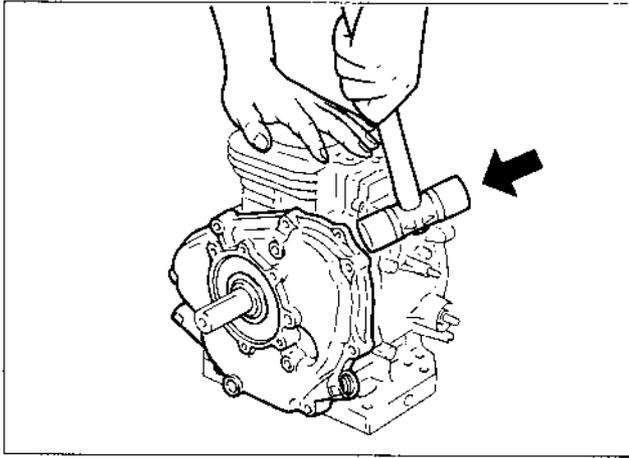


Fig. 35

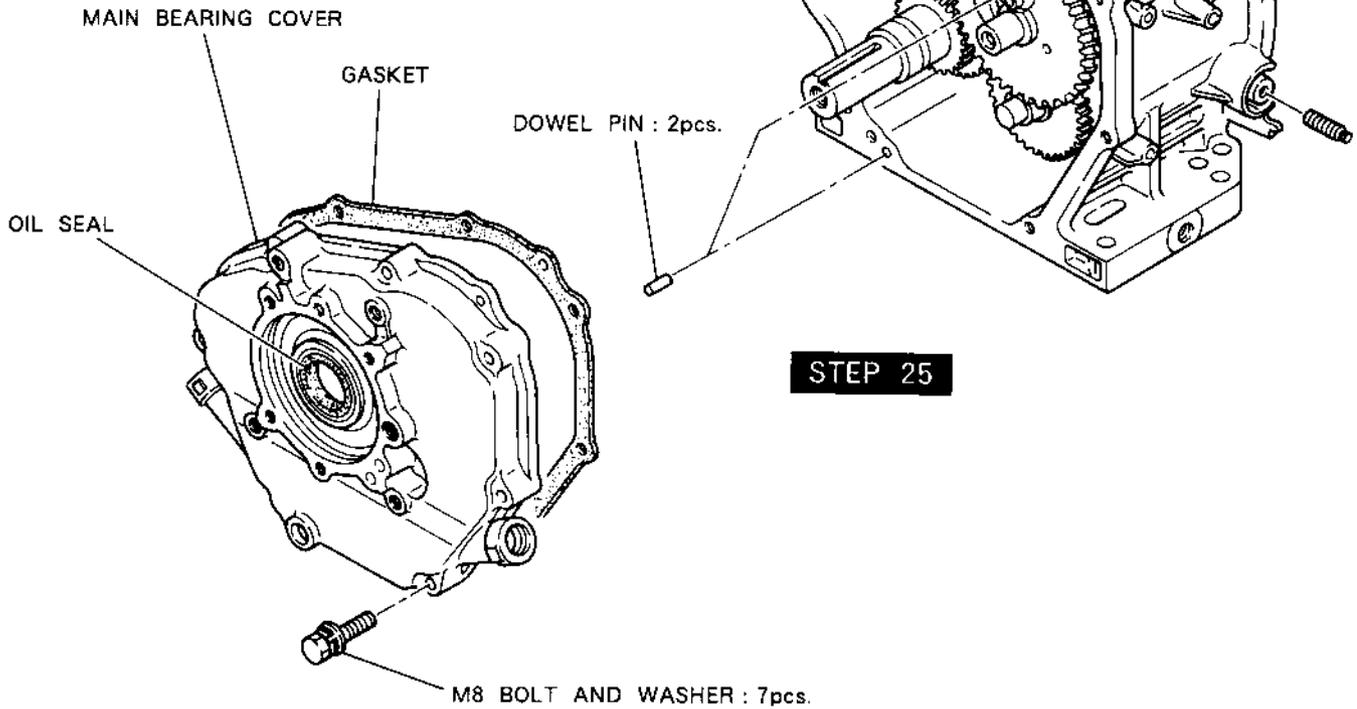


Fig. 36

Step	Part to remove	Procedures	Remarks	Tool
26	Camshaft and tappets	(1) Remove camshaft from crankcase. (2) Remone tappets from crankcase.	(1) To prevent tappets from getting damages , put crankcase cylinder side down. (See Fig. 37.) (2) Put marks on tappets to distinguish intake from exhaust.	
27	Balancer and governor gear	(1) Position piston at top dead center and remove balancer. (2) Draw out governor sleeve from governor gear shaft and remove governor gear.		

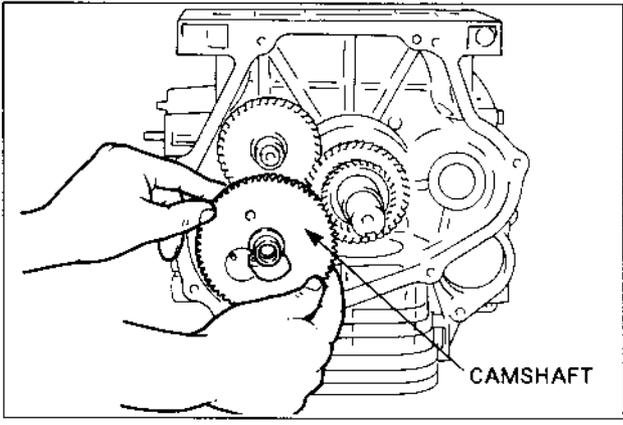


Fig. 37

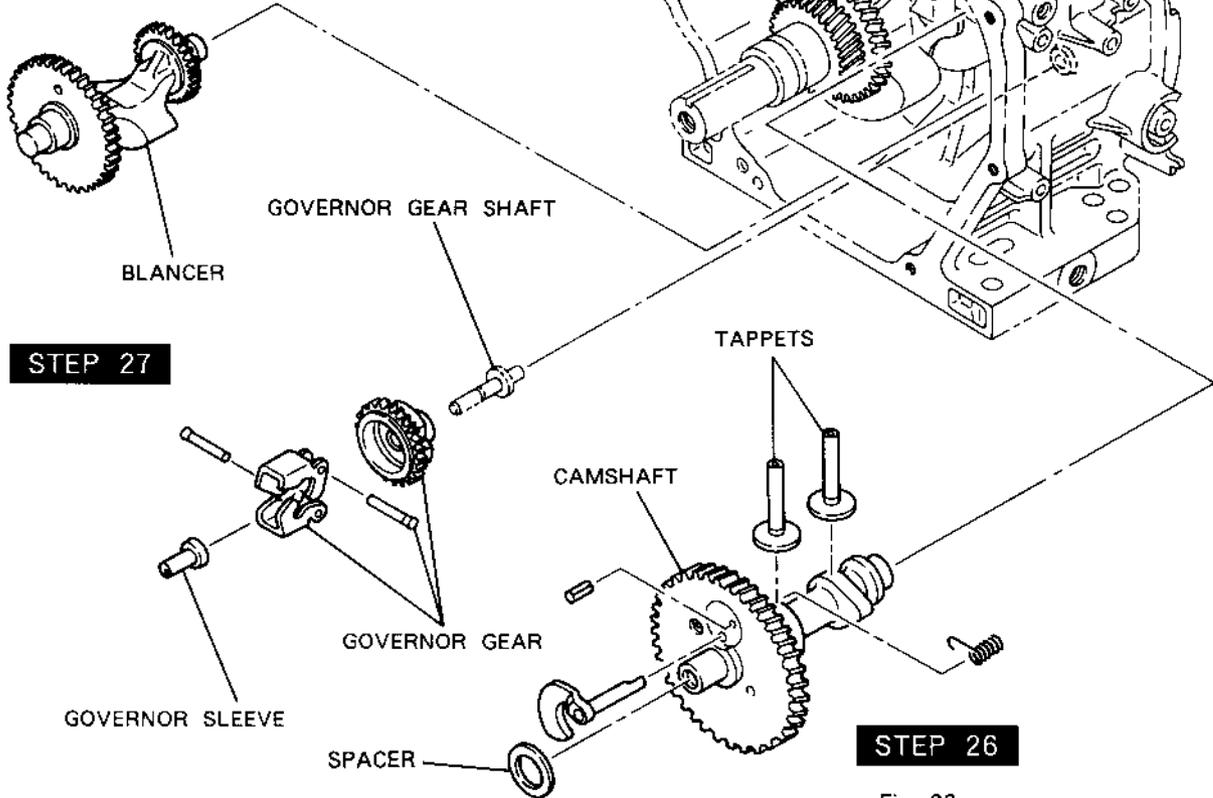
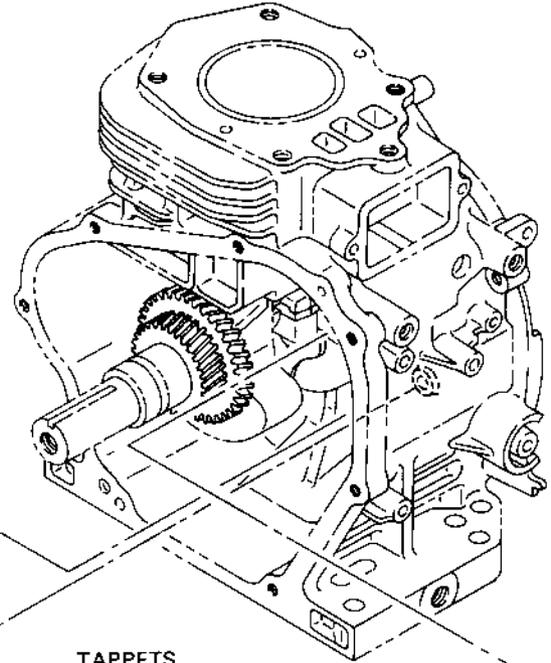


Fig. 38

Step	Part to remove	Procedures	Remarks	Tool
28	Connecting rod and piston	(1) Remove connecting rod bolts and connecting rod cap. (2) Turn crankshaft until piston is at top dead center, push out connecting rod and piston assembly through top of cylinder.	Scrape off all carbon deposits that might interfere with removal of piston from upper end of cylinder.	10mm box wrench
29	Piston and piston pin	(1) Remove clips and piston pin to remove connecting rod from piston. (2) Remove piston rings from piston.	Be careful not to give damages to piston and connecting rod. Be careful not to break rings by spreading too much or twisting.	Ring expander

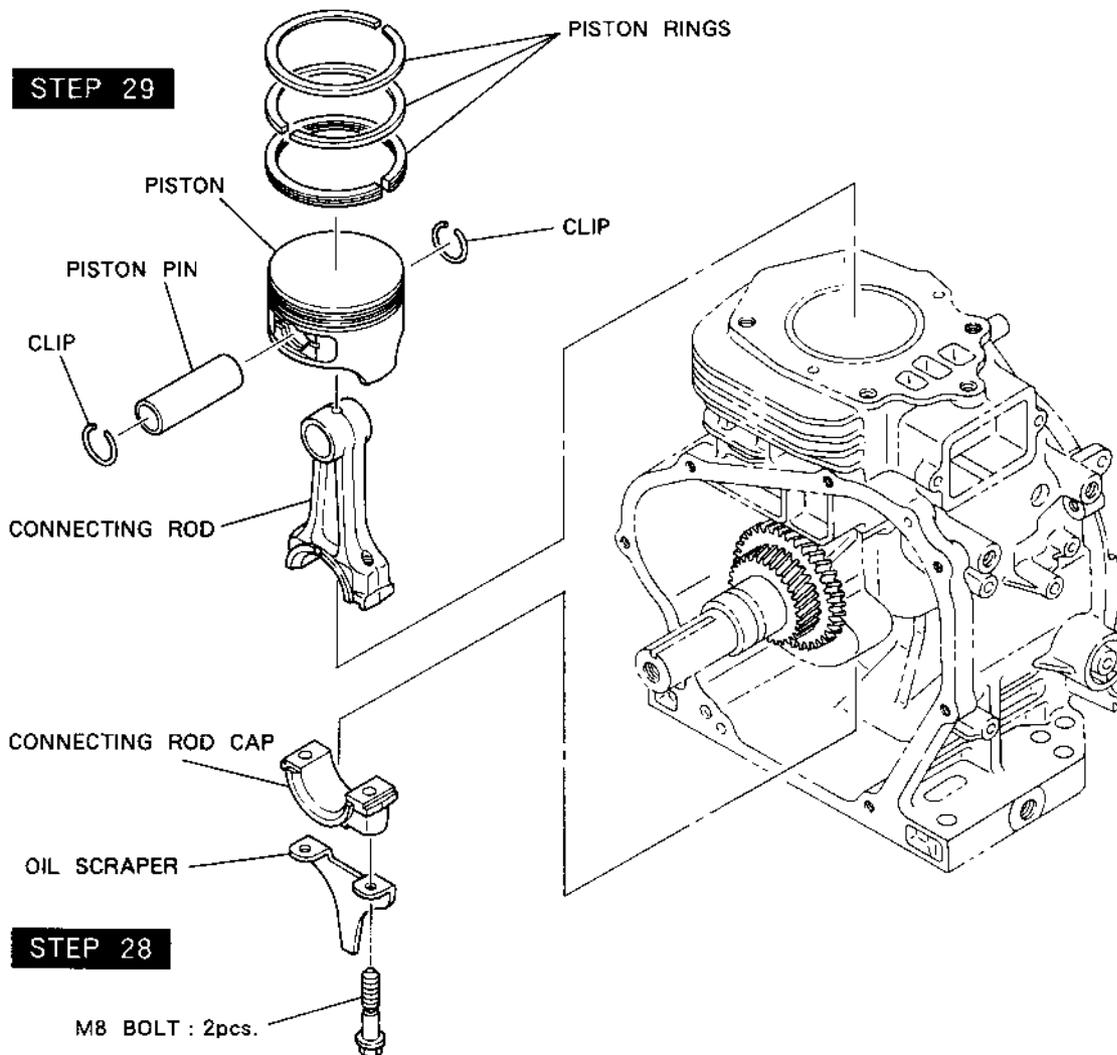


Fig. 39

Step	Part to remove	Procedures	Remarks	Tool
30	Crankshaft	(1) Tap lightly on flywheel end of crankshaft to rmove from crankcase. (See Fig. 40.)		

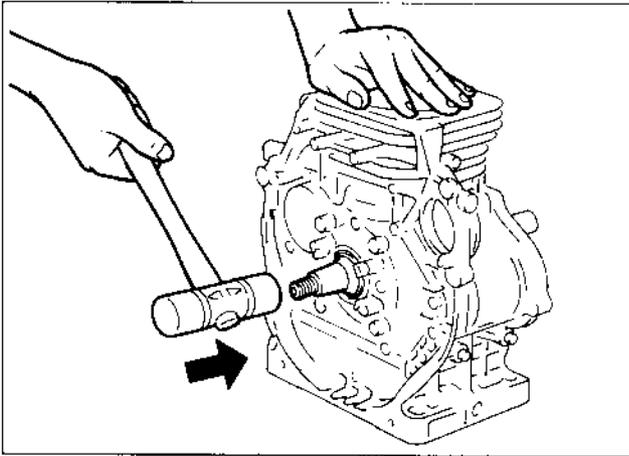


Fig. 40

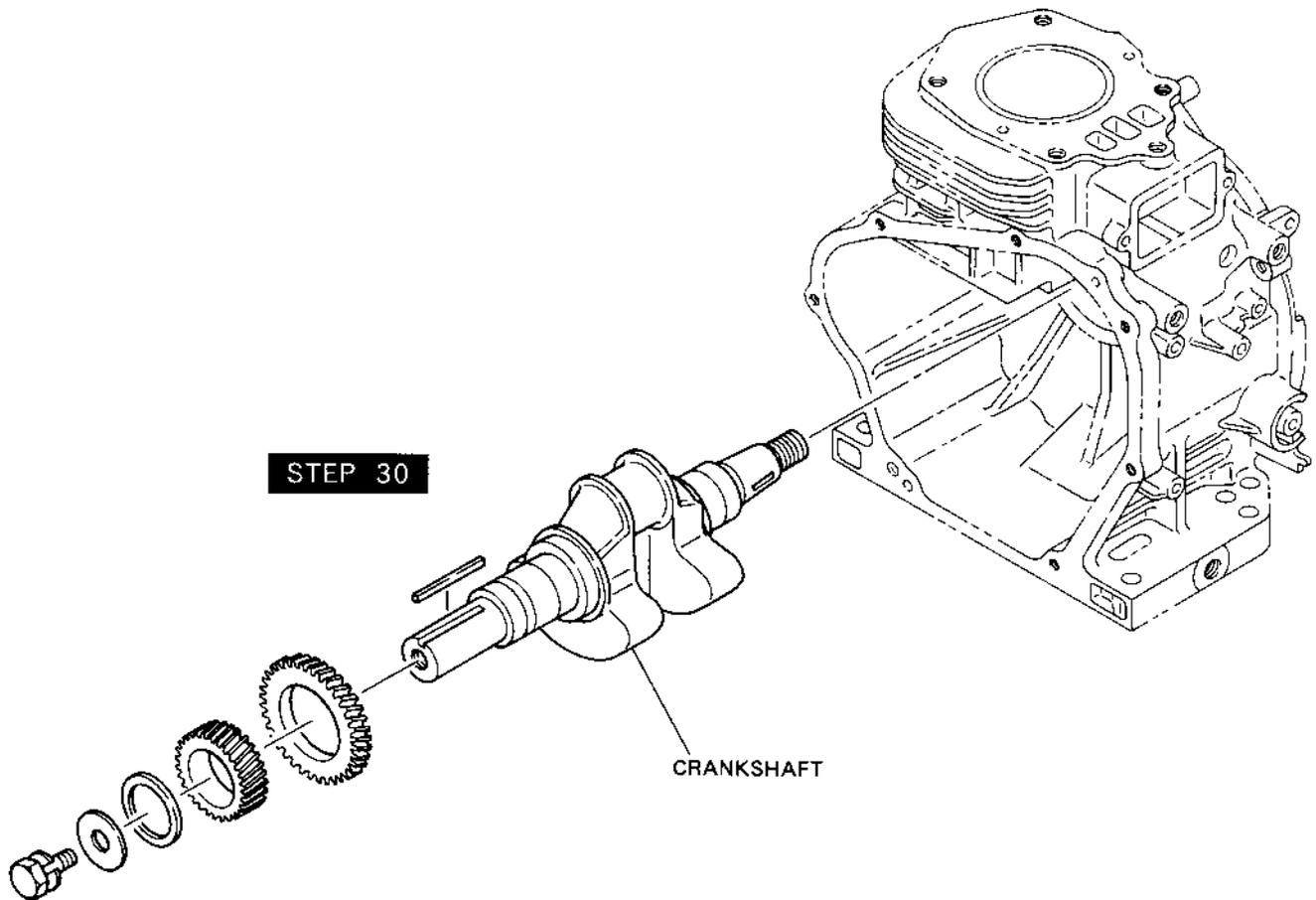


Fig. 41

5-4 REASSEMBLY PROCEDURES

● PRECAUTIONS FOR REASSEMBLY

1) Clean parts thoroughly before reassembly.

Pay most attention to cleanliness of piston, cylinder, crankshaft, connecting rod and bearings.

2) Scrape off all carbon deposits from cylinder head, piston top and piston ring grooves.

3) Check lip of oil seals. Replace oil seal if the lip is damaged.

Apply oil to the lip before reassembly.

4) Replace all the gaskets with new ones.

5) Replace keys, pins, bolts, nuts, etc., if necessary.

6) Torque bolts and nuts to specification referring to the "TORQUE SPECIFICATIONS".

7) Apply oil to rotating and sliding portions.

8) Check and adjust clearances and end plays where specified in this manual.

5-4-1 CRANKSHAFT

(1) Install crankshaft on crankcase using an oil seal guide to avoid damage to oil seal. (See Fig. 42.)

(2) Install woodruff key for flywheel on crankshaft.

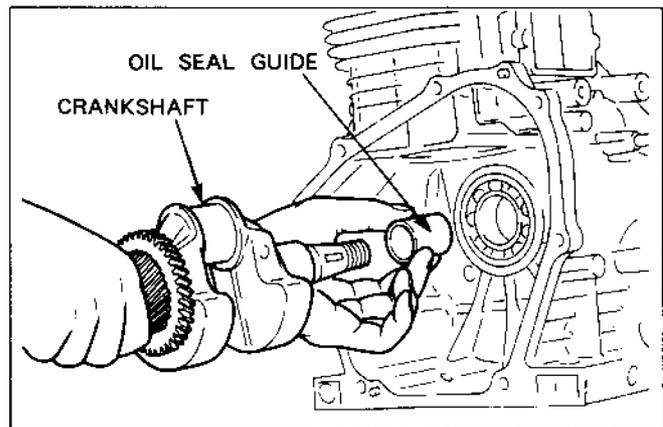


Fig. 42

5-4-2 PISTON AND PISTON RINGS

(1) Install oil ring first, then second ring and top ring.

Spread ring only far enough to slip over piston and into correct groove. Use care not to distort ring. (See Fig. 43.)

Install second ring with punched mark beside the gap on the top side. (See Fig. 45.)

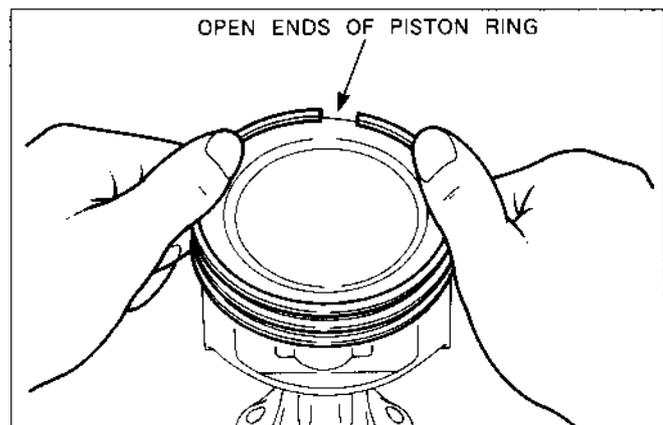


Fig. 43

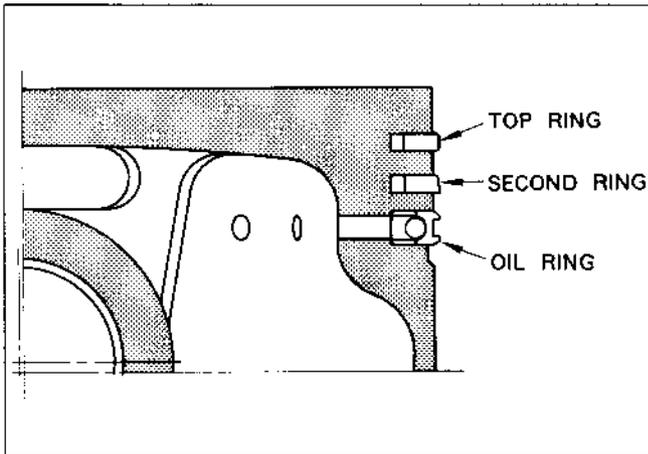


Fig. 44

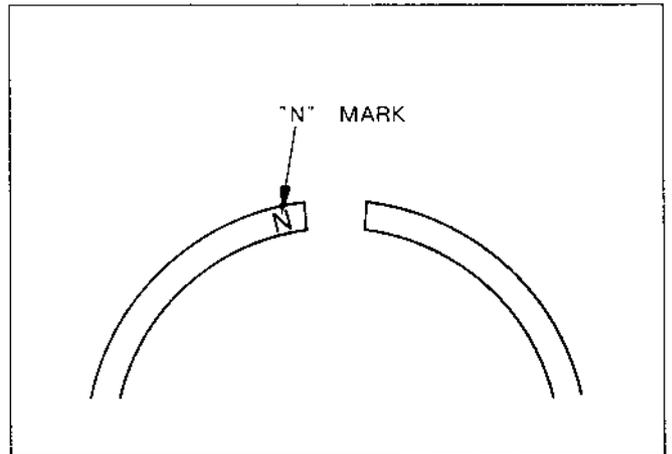


Fig. 45

5-4-3 PISTON AND CONNECTING ROD

When installing piston on connecting rod on D type engine, match the mark "DF" on the piston with the mark "DF" on connecting rod.

On B type engine, match the mark "BF" on the piston with the mark "BF" on connecting rod. (See Fig. 46.)

Oil small end of connecting rod before installing piston and piston pin.

Use clips on the both side of the piston pin to secure piston pin in position.

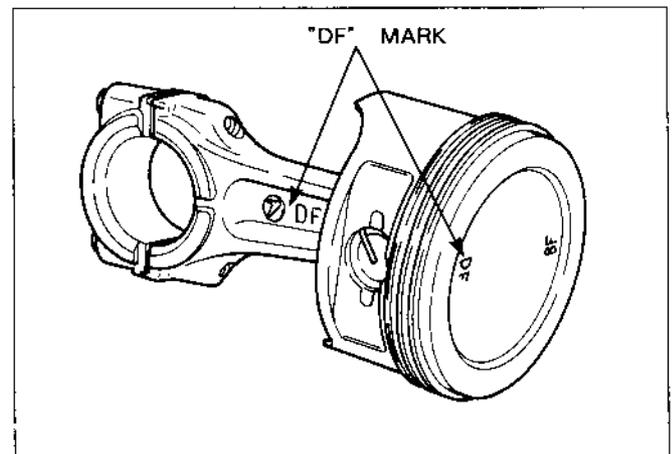


Fig. 46

- (2) Install piston and connecting rod assembly into cylinder.

Use a piston ring compressor to hold piston rings.

The "DF" mark of the connecting rod for "D" type engine or the "BF" mark for "B" type engine is to face flywheel side when assembled. (See Fig. 47.)

[NOTES]

- (1) Apply enough oil to piston rings, connecting rod bearings and cylinder bore before assembly.
- (2) Set gaps of the piston rings 90 degrees apart from one another before assembly. (See Fig. 48.)

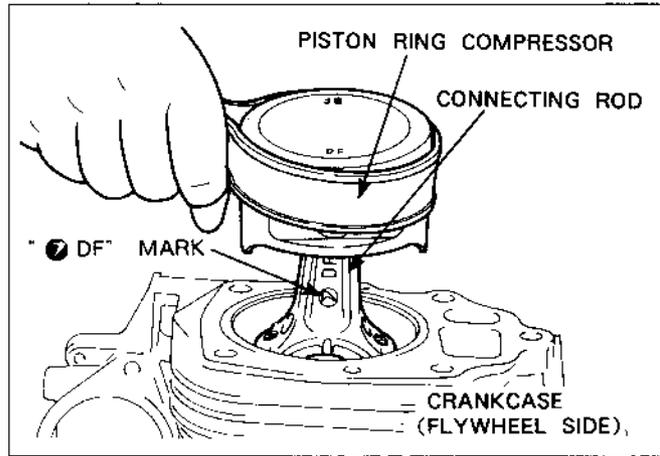


Fig. 47

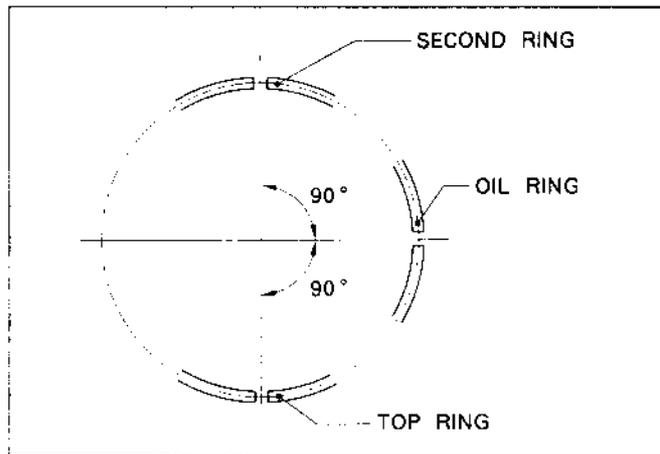


Fig. 48

5-4-4 CONNECTING ROD

- (1) Turn crankshaft to bottom dead center, lightly tap top of the piston until large end of the rod meet crank pin.

- (2) Install connecting rod cap and oil splasher to connecting rod matching alignment marks. (See Fig. 49.)

Torque connecting rod bolts to specification.
M8 × 46 mm connecting rod bolt •••• 2pcs.

Tightening torque
22.1 - 27.0 N·m
(225 - 275 kg·cm)
16.3 - 19.9 ft·lb

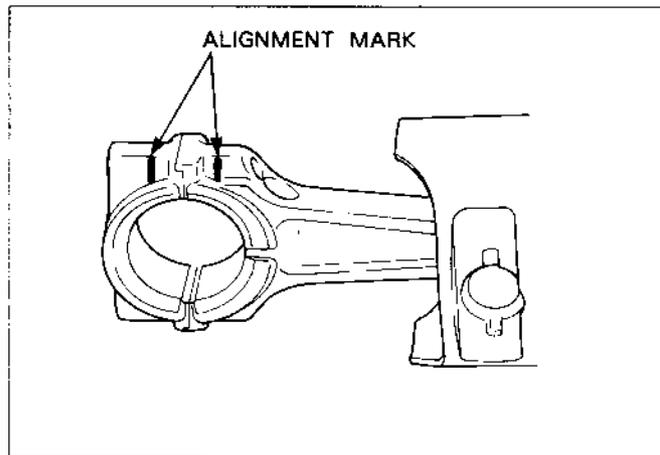


Fig. 49

- (3) Check for free movement of connecting rod by turning crankshaft slowly.

5-4-5 BALANCER SHAFT

Install balancer shaft to crankcase aligning matching mark of balancer gear and crank gear as shown in Fig. 50.

Matching mark for balancer shaft is two dots. Align the same mark on balancer gear and crank gear.

CAUTION

- (1) When installing balancer shaft, be sure that governor gears mesh properly to drive gears on balancer shaft.
- (2) Incorrect timing of the gears will cause malfunction of the engine and may result in damage due to interference of the parts.

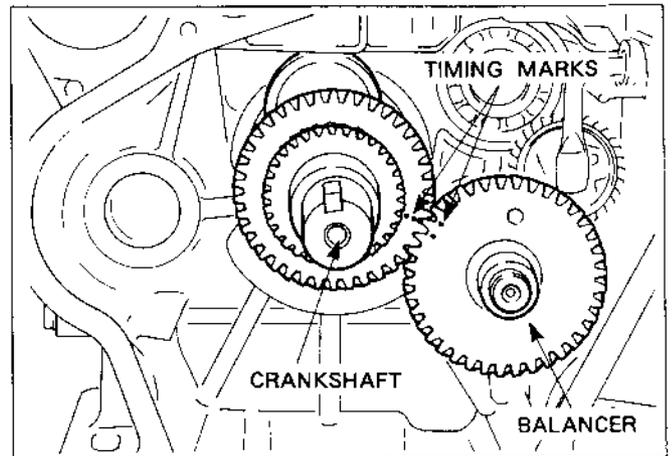


Fig. 50

5-4-6 TAPPETS AND CAMSHAFT

- (1) Oil tappets and install in their original position.

Push in fully to avoid damage during camshaft installation.

- (2) Lubricate bearing surfaces of camshaft.
Align timing mark on crankshaft gear with timing mark on camshaft and install camshaft in the crankcase. (See Fig. 52.)

CAUTION

Incorrect valve timing will cause malfunction of the engine.

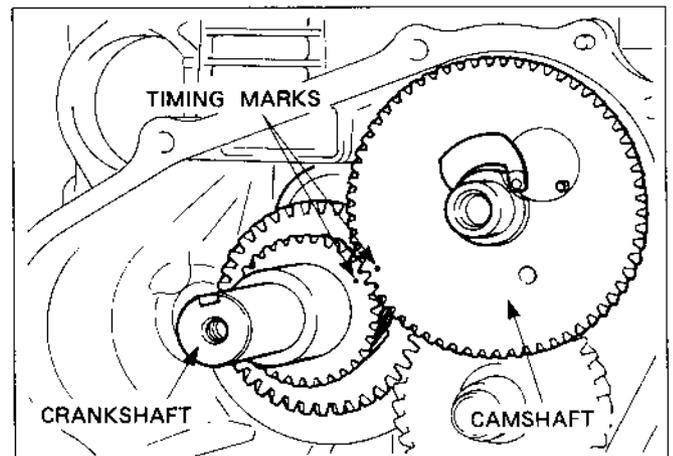


Fig. 51

5-4-7 ADJUST CRANKSHAFT AND CAMSHAFT END PLAY

(1) Measure end play of crankshaft and camshaft.

Adjust end play to the specified values using the proper spacer.

	CRANKSHAFT		CAMSHAFT	
	Type D	Type B	Type D	Type B
SIDE CLEARANCE	0-0.2 mm	0-0.2 mm	0.13-0.29 mm	0-0.2 mm
ADJUSTING SPACER	T = 0.6 mm	T = 0.6 mm	T = 0.6 mm	T = 0.6 mm
	T = 0.8 mm	T = 0.8 mm	T = 0.7 mm	T = 0.7 mm
	T = 1.0 mm	T = 1.0 mm	T = 0.8 mm	T = 0.8 mm

* Take the thickness of GASKET, BEARING COVER into account as 0.26mm when calculating the side clearance.

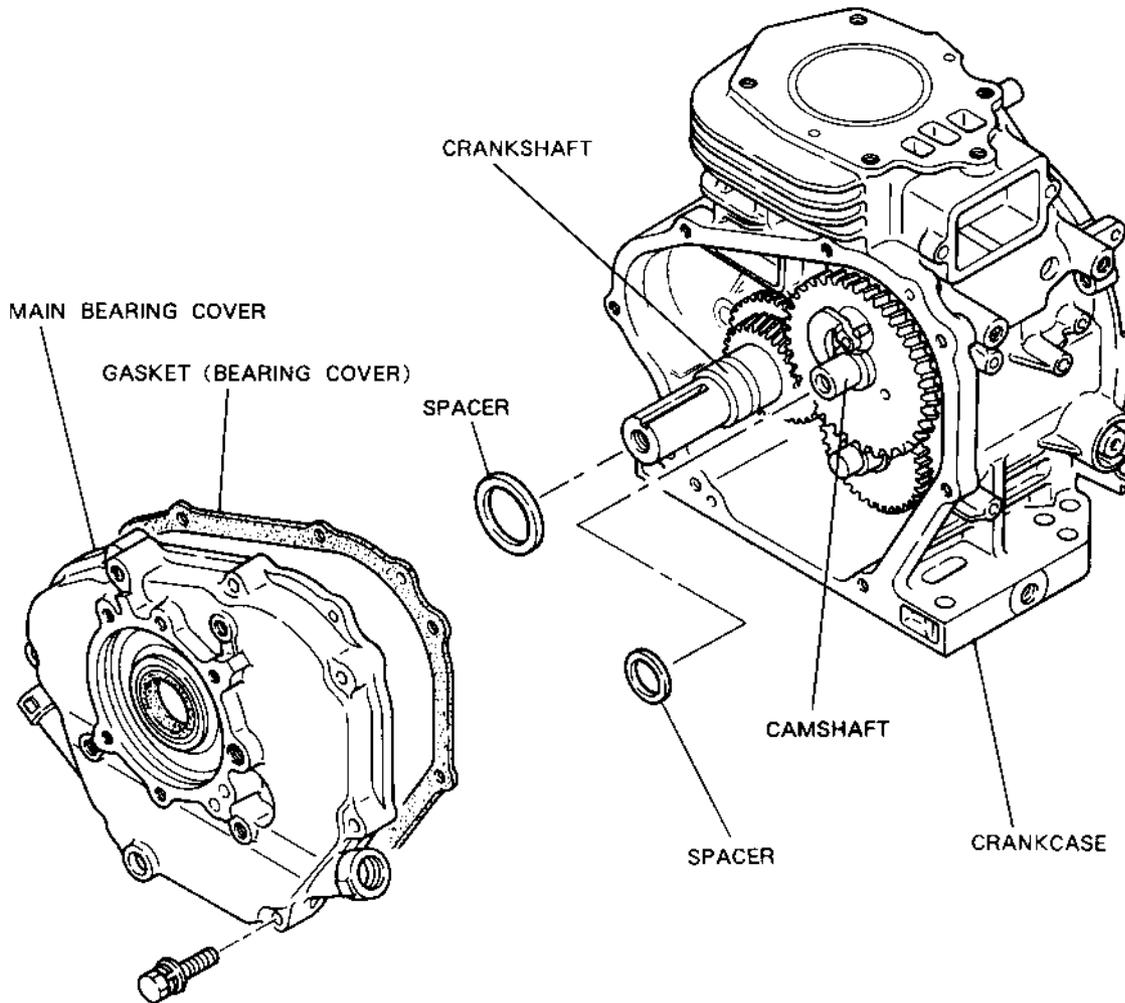


Fig. 52

(2) Lubricate oil seal and bearing surfaces. Add a light film of oil on main bearing cover face to hold gasket in place.

Place spacers chosen at procedure (1) on crankshaft and camshaft.

Use an oil seal guide when installing main bearing cover to avoid damaging the seal.

Tap cover into place with a soft hammer.

Main bearing cover M8 × 40 mm bolt and washer •••• 7 pcs.

Tightening torque	
16.7 - 18.6 N•m	
(170 - 190 kg•cm)	
(12.3 - 13.7 ft•lb)	

5-4-8 BREATHER VALVE

Attach breather plate (breather valve) and breather cover to crankcase using proper gaskets.

Put breather plate in such position as its reed valve opens outside towards main bearing cover.

Replace gaskets with new ones if they are torn or damaged.

5-4-9 CYLINDER HEAD

(1) Clean carbon and gum deposits from the valves, seats, ports and guides. Inspect valves, valve seats and valve guides.

(2) Replace valves that are badly burned, pitted or warped.

(3) When installing valves in cylinder head, oil valve stems and insert them into valve guide. Then place cylinder head on flat table, install washer, valve spring and spring retainer.

(4) Valve guides should be replaced when valve stem clearance exceeds specifications (See "SERVICE DATA").

Draw valve guides out and press new guides in.

Refer to "SERVICE DATA" for clearance specifications.

After replacing valves and guides, lap valves in place until a uniform ring shows around the face of the valve. Clean valves and wash cylinder head thoroughly.

(5) Install cylinder head to cylinder with new head gasket.

Tighten five flange bolts evenly in three steps by the following tightening torque :

Cylinder head M10 × 75 mm bolt •••• 4 pcs.

M10 × 42 mm bolt •••• 1 pcs.

Tightening torque		
1st step	2nd step	final step
9.8 N•m	19.6 N•m	33.3 - 41.2 N•m
(100 kg•cm)	(200 kg•cm)	(340 - 420 kg•cm)
(7.2 ft•lb)	(14.5 ft•lb)	(24.6 - 30.4 ft•lb)

5-4-10 ROCKER ARMS AND PUSH RODS

(1) Insert push rods into crankcase.

Put push rod tip in the hollow of tappet top.

(2) Apply oil to rocker arms and assemble them to cylinder head using rocker shaft and spacer.

5-4-11 VALVE CLEARANCE ADJUSTMENT

- (1) Position piston at top dead center of compression stroke by matching the mark "T" of flywheel with the mark "T" of crankcase. (See Fig. 53.)
- (2) Loosen lock nut on rocker arm and turn adjusting screw to adjust the clearance between rocker arm and valve stem end. (See Fig. 54.)
Tighten lock nut.

Valve clearance
0.085 - 0.115 mm (0.0034 - 0.0045 in.)

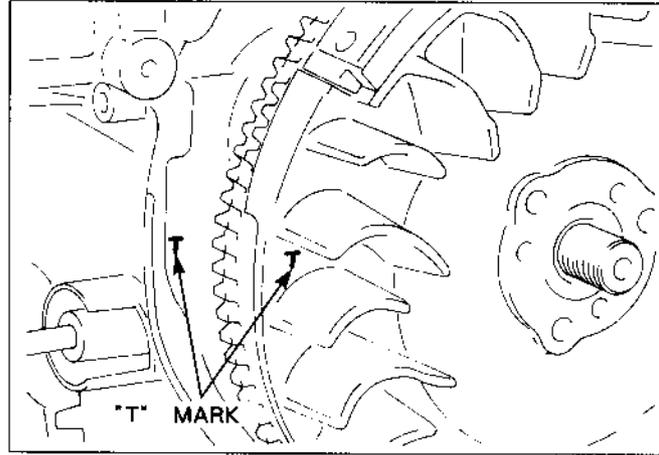


Fig. 53

[NOTE]

Check and adjust valve clearance with engine cold.
Check operation of valves by turning crankshaft .
Remeasure tappet clearance.

- (3) Install rocker cover and gasket.
Rocker cover M6 × 12 mm bolt •••• 4 pcs.

5-4-12 SPARK PLUG

Install spark plug to cylinder head.
Spark plug : NGK BP6ES or CHAMPION N9YC

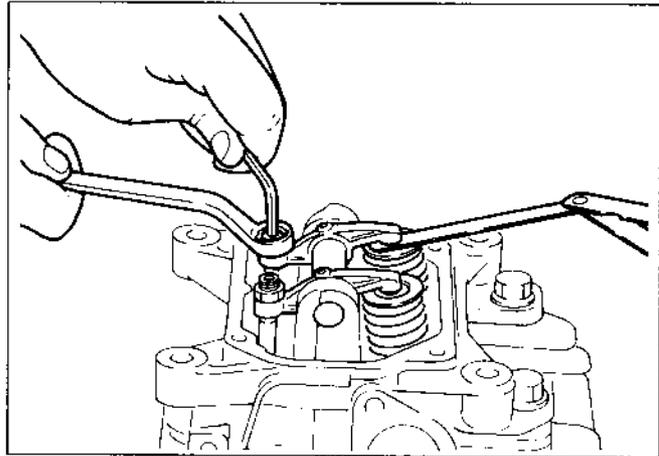


Fig.54

Tightening torque	
New spark plug	Retightening
11.8 - 14.7 N·m (120 - 150 kg·cm) (8.7 - 10.9 ft·lb)	22.6 - 26.5 N·m (230 - 270 kg·cm) (16.6 - 19.5 ft·lb)

5-4-13 INTAKE AND EXHAUST MANIFOLD

- (1) Install intake pipe to cylinder head with gasket.
Tighten three bolts.

Tightening torque
9.8 - 13.7 N·m (100 - 140 kg·cm) (7.2 - 10.1 ft·lb)

- (2) Install exhaust pipe to cylinder head with gasket.
Tighten two flange nuts.

Tightening torque
17.7 - 21.6 N·m (180 - 220 kg·cm) (13.0 - 15.9 ft·lb)

5-4-14 FLYWHEEL MAGNETO

- (1) Install charge coil to crankcase.
Clamp coil wire to crankcase.

[NOTE]

Be careful not to pinch coil wire between charge coil and crankcase.

- (2) Put woodruff key in keyway of crankshaft.
Wipe off oil and grease thoroughly from tapered portion of crankshaft and flywheel center hole.

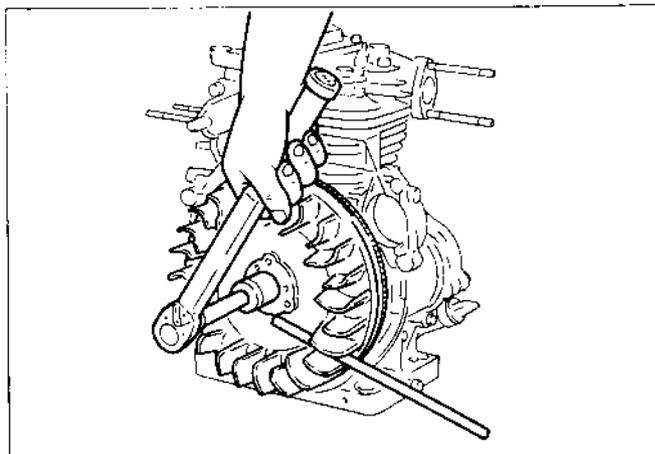


Fig. 55

- (3) Install flywheel to crankshaft.
Tighten flywheel nut with spring washer and washer.
(See Fig. 55.)

Tightening torque
83.4 - 93.2 N·m
(850 - 960 kg·cm)
(61.5 - 68.7 ft·lb)

- (4) Install starting pulley to flywheel.

Tightening torque
6.9 - 8.8 N·m
(70 - 90 kg·cm)
(5.1 - 6.5 ft·lb)

5-4-15 CYLINDER BAFFLE AND FUEL TANK BRACKET

Install cylinder baffle and fuel tank bracket to cylinder head.

5-4-16 IGNITION COIL

Install ignition coil to crankcase.
Adjust air gap between ignition coil and flywheel using a thickness gauge and tighten bolts. (See Fig. 56.)

Air gap
0.3 - 0.5 mm
(0.012 - 0.020 in.)

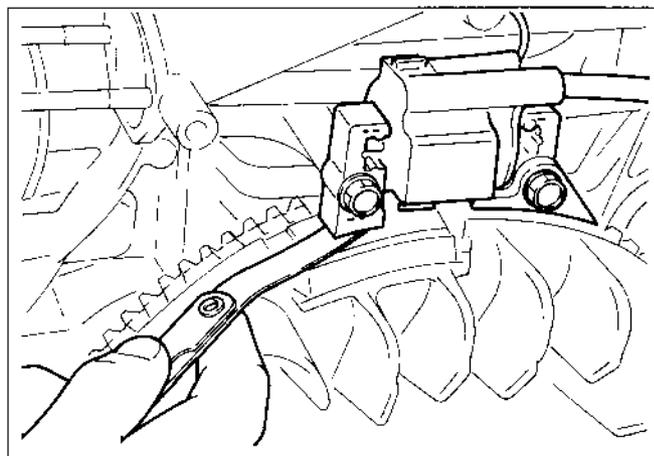


Fig. 56

5-4-17 BLOWER HOUSING AND RECOIL STARTER

- (1) Attach blower housing to crankcase.
Tighten four flange bolts.
- (2) Install recoil starter to blower housing.
M6 × 8mm flange bolt •••• 4 pcs.

[NOTES]

Be careful of pulling direction of starter rope.

5-4-18 FUEL TANK

Install fuel tank to fuel tank bracket.

5-4-19 ELECTRIC STARTER(Optional equipment)

- (1) Install magnetic switch to crankcase.
- (2) Install diode rectifier to crankcase.
- (3) Install electric starter to crankcase.
- (4) Connect wires referring to the wiring diagram.

5-4-20 MUFFLER

Install muffler to exhaust pipe with muffler gasket.

5-4-21 OIL SENSOR

- (1) Install oil sensor unit to crankcase.
(sensor unit separate type)
- (2) Screw in sensor probe into the oil filler.

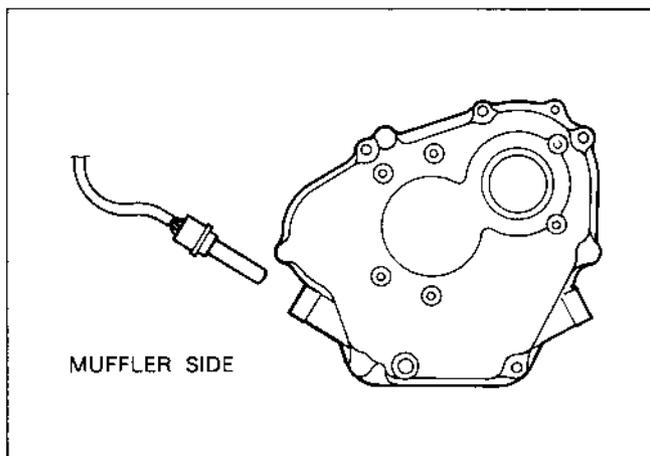


Fig. 57

5-4-22 GOVERNOR, SPEED CONTROL SYSTEM

- (1) Install governor lever to governor shaft.
Tighten locking bolt temporarily.
- (2) Install speed control lever to crankcase with return spring, spacer, friction washer, wing nut, etc. as shown in Fig. 58.
- (3) Hook governor spring to proper holes of governor lever and speed control lever.
(See Fig. 61.)
- (4) Install insulator and gaskets to intake pipe.

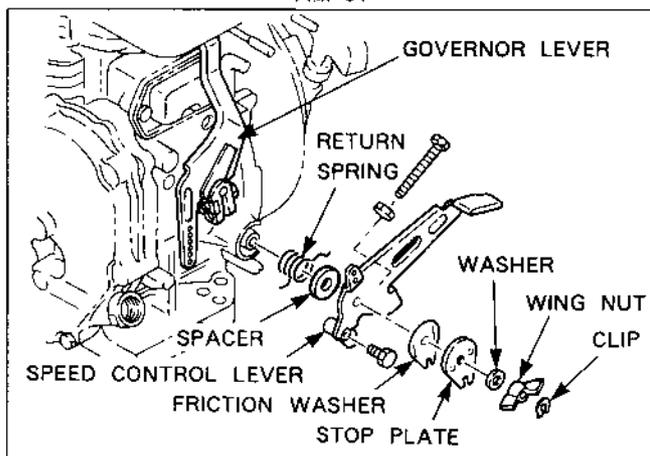


Fig. 58

- (5) Install carburetor to intake pipe hooking governor rod to governor lever and throttle lever of carburetor. Hook rod spring over governor rod.
(See Fig. 59.)
- (6) Attach panel bracket and air cleaner base to carburetor with gaskets.
Tighten two flange nuts and a bolt.
Connect breather pipe from tappet cover to cleaner base.
- (7) Adjust governor system.
- Push speed control lever all the way to the high speed position and fix it by tightening wing nut. (See Fig. 60.)
 - Check that governor lever is pulled by governor spring and carburetor throttle valve is fully open.
 - Turn governor shaft counterclockwise all the way using a screw driver, and tighten lock bolt to secure the lever on the shaft. (See Fig. 60.)

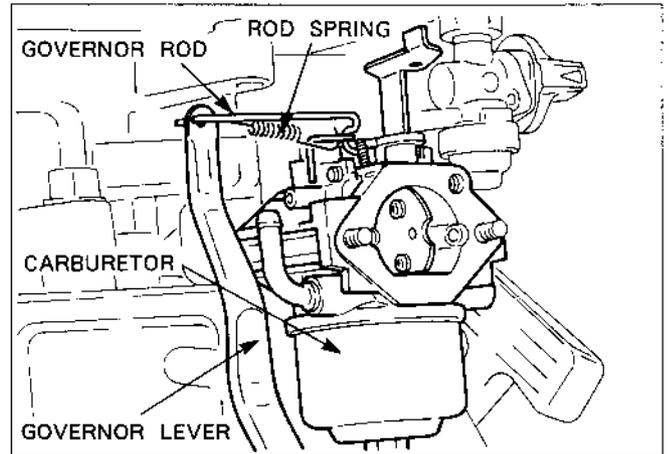


Fig. 59

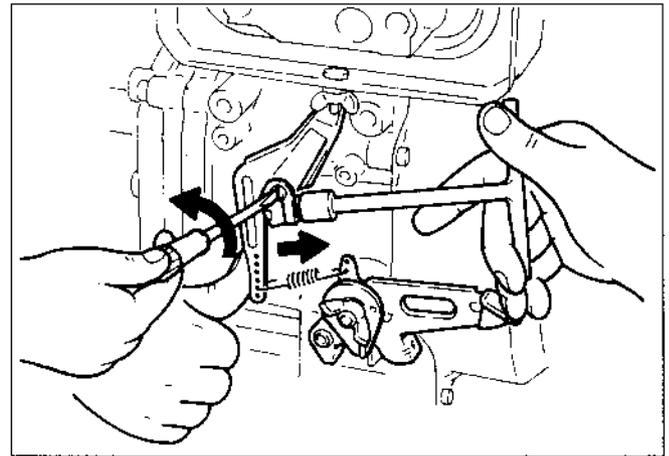
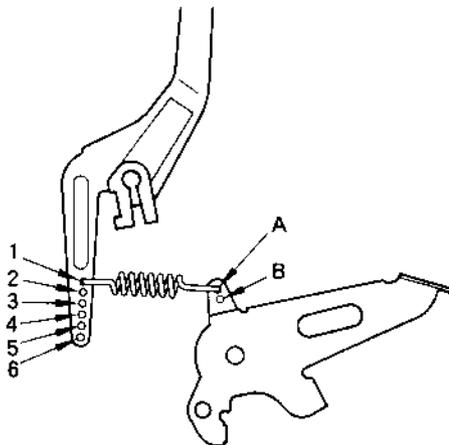


Fig. 60

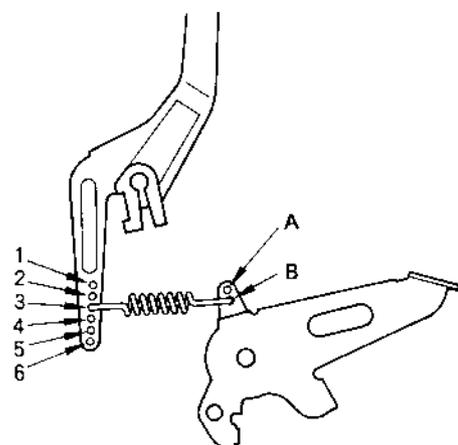
HOOKING POSITION OF THE GOVERNOR SPRING

• Rated 3000 rpm (50Hz) applications : 1-A

• Rated 3600 rpm (60Hz) applications : 3-B



Governor spring material : Stainless steel
Color : Silver



Governor spring material : Zinc plated steel
Color : Gold

Fig. 61

- (8) Install key switch and control panel to bracket. (Option : W/electric starter)
Connect wires.
- (9) Install air cleaner gasket and cleaner base and tighten them with 2-M6 flange nuts and M6 bolt and washer. Then install element and cleaner cover.

5-5 BREAK-IN OPERATION

An engine that has been completely overhauled by being fitted with a new piston, rings, valves and connecting rod should be thoroughly RUN-IN before being put back into service.

Good bearing surfaces and running clearances between the various parts can only be established by operating the engine under reduced speed and loads for a short period of time.

While the engine is being tested, check for oil leaks.

Make final carburetor adjustment and regulate the engine operating speed.

Steps	Load		Engine speed	Time
Step 1	No load		2500 rpm	10 min
Step 2	No load		3000 rpm	10 min
Step 3	No load		3600 rpm	10 min
Step 4	EH30	2.6 KW (3.5 ps)	3600 rpm	30 min
	EH34	2.9 KW (4.0 ps)		
Step 5	EH30	5.1 KW (7.0 ps)	3600 rpm	60 min
	EH34	5.9 KW (8.0 ps)		

6. MAGNETO

6-1 FLYWHEEL MAGNETO

The ignition system of the EH30/EH34 is pointless flywheel magneto with automatic advancing characteristic.

Being different from the breaker point type ignition system, this system is completely free from such troubles as starting-up failure owing to dirty, burnt or corroded point surface.

The electronic automatic advancing ensures extremely easy starts and stable high performance at operating speed by advancing the ignition timing to the most suitable point.

6-2 BASIC THEORY

(1) Revolution of the flywheel generates electricity on the primary side of the ignition coil, and the base current I_1 flows to the power transistor.

Current I_1 turns the power transistor "ON" and the electric current I_2 flows.

(2) At lower engine revolution, when the flywheel reached the ignition point the low speed ignition timing control circuit operates to run the base current I_3 to turn the signal transistor A "ON" allowing the current I_1 to bypass as current I_4 .

At this moment the power transistor turns "OFF" and the current I_2 is abruptly shut resulting in the high voltage generated in the secondary coil which produces sparks at the spark plug.

(3) At higher engine revolution, the advancing control circuit operates at the ignition timing to run the base current I_5 to turn the signal transistor B "ON" allowing the current I_1 to bypass as current I_6 .

At this moment the power transistor turns "OFF" and the current I_2 is abruptly shut resulting in the high voltage generated in the secondary coil which produces sparks at the spark plug. The operating timing of the advancing control circuit advances in accordance with the increase of engine speed resulting in the advancing of ignition timing as shown in Fig. 62 (b).

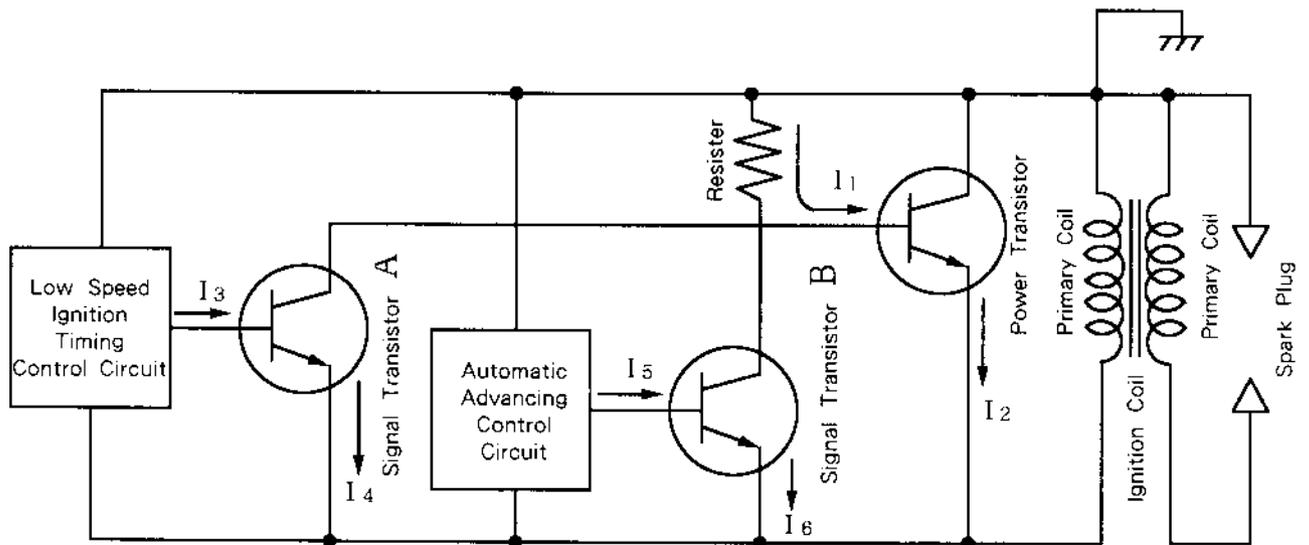


Fig. 62 (a)

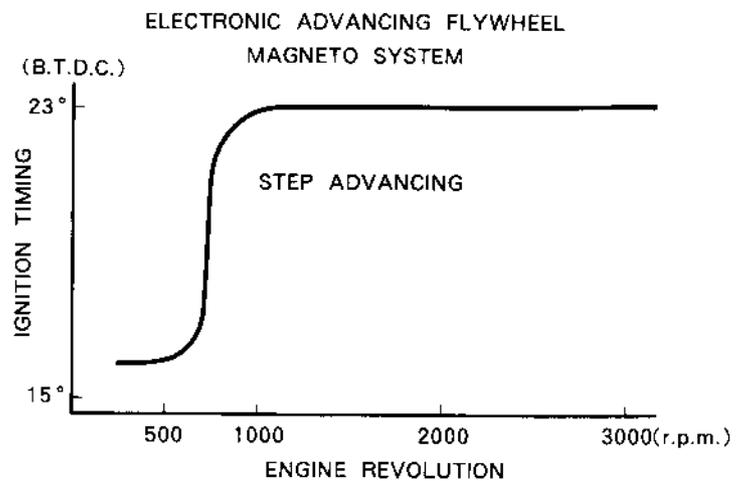
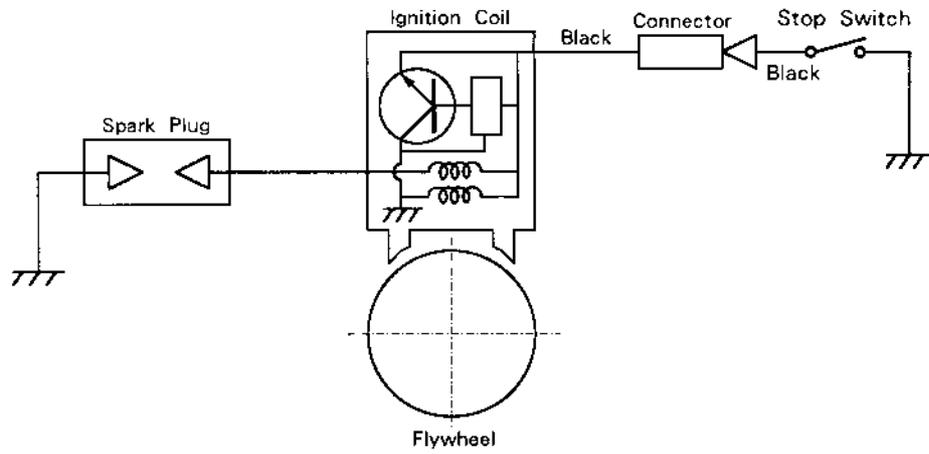


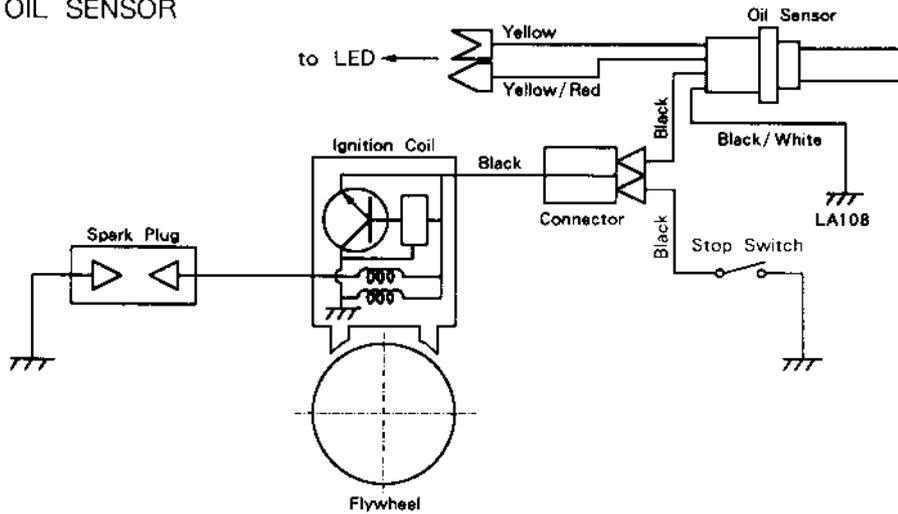
Fig. 62 (b)

6-3 WIRING DIAGRAM

• STANDARD



• ENGINE WITH OIL SENSOR



• ENGINE WITH ELECTRIC STARTER

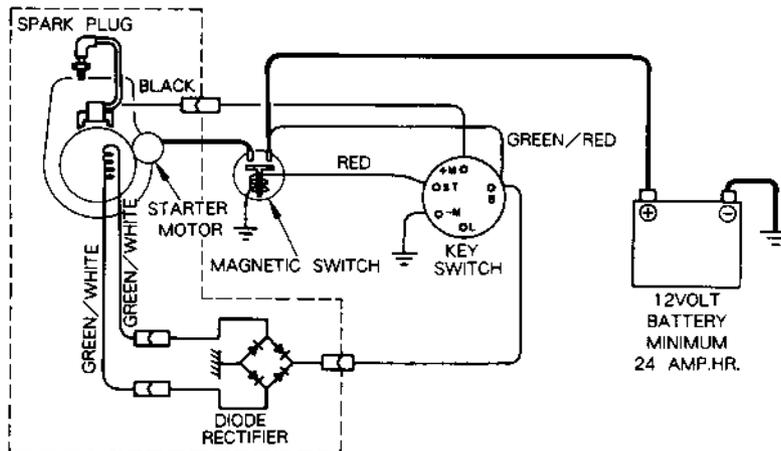


Fig. 63

7. AUTOMATIC DECOMPRESSION SYSTEM

The decompression system operates to release compression by lifting up the exhaust valve at starting.

The release lever mounted on the camshaft has a flyweight at one end and a crescent cam at the other end. When starting the engine, the crescent cam juts out from the exhaust cam.

The exhaust tappet rides over the crescent cam opening the exhaust valve to release compression.

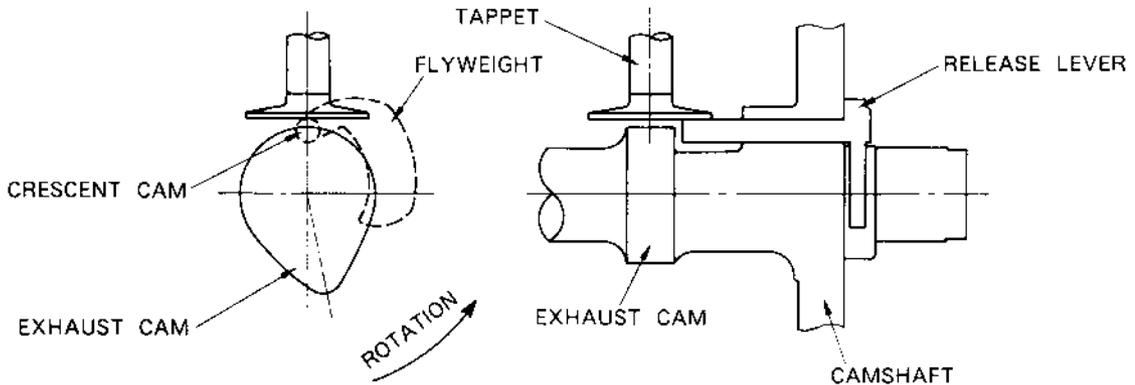


Fig. 64

When the crank speed reaches a certain revolution, the flyweight of the release lever moves outward by the centrifugal force turning the release lever to retract the crescent cam. Thus the exhaust valve closes allowing a sufficient compression for the engine to start up.

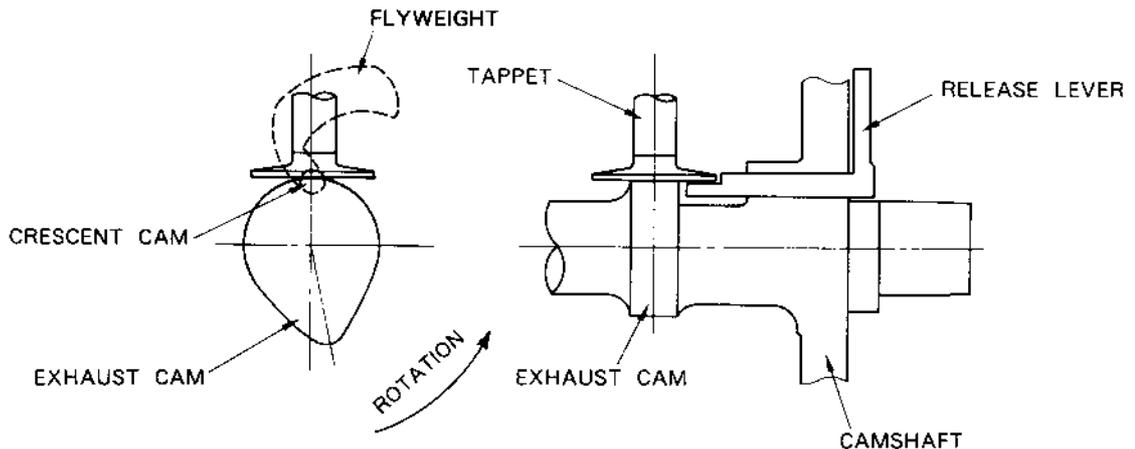


Fig. 65

The components of the decompression system are different between "D" type and "B" type engines, however the principle of operation is the same.

8. CARBURETOR

8-1 OPERATION AND CONSTRUCTION

8-1-1 FLOAT SYSTEM

The float chamber is located below the carburetor body and, with a float and a needle valve, maintains a constant fuel level during engine operation. (See Fig. 66.)

The fuel flows from the fuel tank into the float chamber through needle valve. When the fuel rises to a specific level, the float rises, and when its buoyancy and fuel pressure are balanced, the needle valve closes to shut off the fuel, thereby keeping the fuel at the predetermined level.

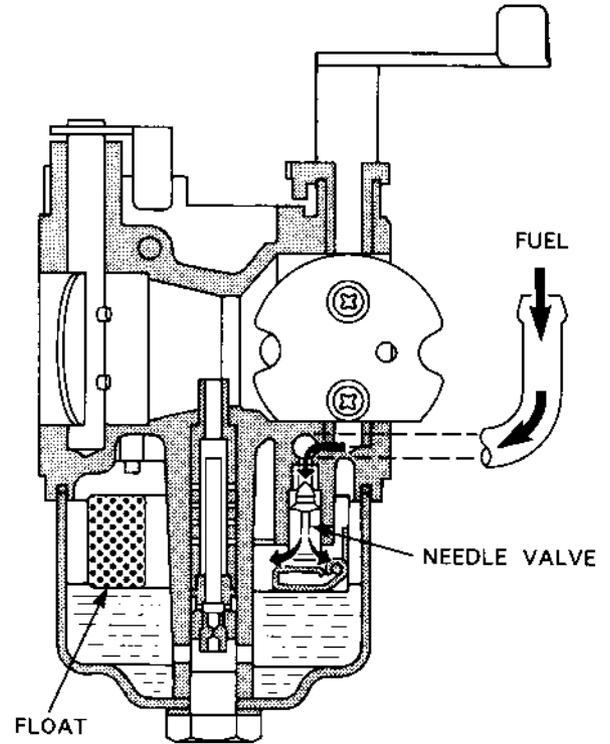


Fig. 66

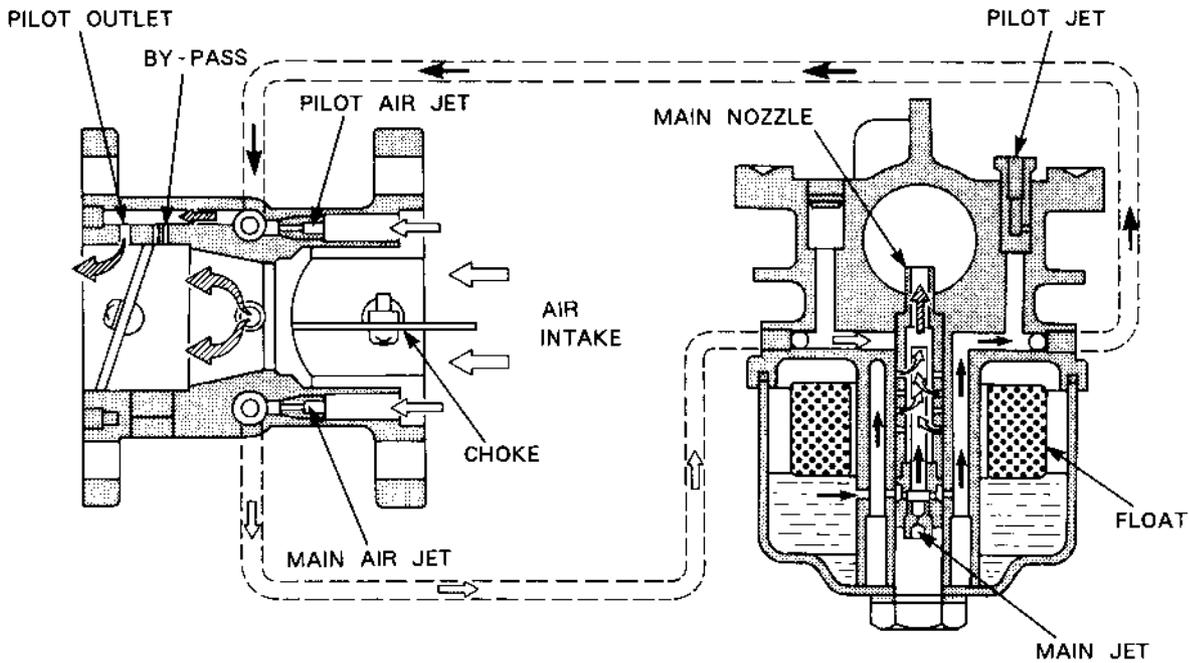


Fig. 67

8-1-2 PILOT SYSTEM

The pilot system feeds the fuel to the engine during idling and low-speed operation. The fuel is fed through the main jet to the pilot jet, where it is metered, and mixed with the air metered by the pilot air jet.

The fuel-air mixture is fed to the engine through the pilot outlet and the by-pass. At idling speed, the fuel is mainly fed from the pilot outlet.

8-1-3 MAIN SYSTEM

The main system feeds the fuel to the engine at medium- and high-speed operation.

The fuel is metered by the main jet and fed to the main nozzle. The air metered by the main air jet is mixed with the fuel through the bleed holes in the main nozzle, and the mixture is atomized out of the main bore. It is mixed again with the air taken through the air cleaner into an optimum fuel-air mixture, which is supplied to the engine.

8-1-4 CHOKE

The choke is used for easy start when engine is cold. When the starter is operated with a closed choke, the negative pressure applied to the main nozzle increases and draws much fuel accordingly; thus easily start up the engine.

8-2 DISASSEMBLY AND REASSEMBLY

Apart from mechanical failures, most of carburetor troubles are caused by an incorrect mixing ratio, which may arise mainly due to a clogged up air or fuel passage in jets, or fuel level variations. In order to assure proper flow of air and fuel, the carburetor must be kept clean at all times. The carburetor disassembly and reassembly procedures are as follows: (See Fig. 68.)

8-2-1 THROTTLE SYSTEM

(1) Remove the phillips screw (1) and throttle valve (2), and pull out the throttle shaft (3).

(2) The spring (4) can be taken out by removing the throttle stop screw (5).

*Exercise care not to damage throttle valve ends.

8-2-2 CHOKE SYSTEM

(1) Remove the phillips screw (6) and choke valve (7), and pull out the choke shaft (8).

(2) When reassembling the choke shaft, make sure that the cutout in the choke valve faces the main air jet.

Meantime, when reassembling set the rings (9) and (10) at the right position.

8-2-3 PILOT SYSTEM

(1) Remove the pilot jet (11), using correct tool to avoid damage to it.

(2) Reassembly

Tighten the pilot jet securely. Otherwise, the fuel may leak, causing engine malfunction.

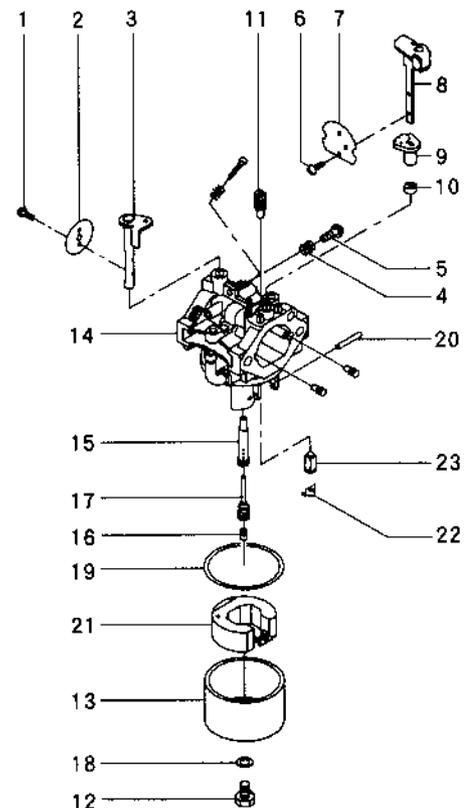


Fig. 68

8-2-4 MAIN SYSTEM

- (1) Remove the bolt (12) and take out float chamber body (13).
- (2) From the body (14) remove the main nozzle (15), and then remove the main jet (16) and guide holder (17) from the main nozzle (15).
- (3) Reassembly
 - a) Fasten the main jet securely to the body. Otherwise, the fuel may become too rich and cause engine malfunction.
 - b) The bolt tightening torque is 70kg - cm. Be sure to set the gasket (19) and washer (18) for chamber (13).

8-2-5 FLOAT SYSTEM

- (1) Pull out the float pin (20) and remove the float (21) and then remove the clip (22) and needle valve (23).

If the needle valve need to be replaced, replace it with rubber needle.

CAUTION

When cleaning the jets, use neither a drill nor a wire(because of possible damage of the orifice which will adversely affect fuel flow). Be sure to use compressed air to blow them clean.

- (2) When removing the needle valve and float, gently tap the reverse side using the rod more slender than the float pin and remove, since the float pin is calked to the carburetor body.

9. STARTING SYSTEM

9-1 RECOIL STARTER

Trouble in the recoil starter rarely happens while it is in normal operation.

If the starter develops trouble or when it is lubricated, carry out in accordance with following disassembling and assembling procedures.

Tools ; Box spanner (spanner)
Pliers
Screwdriver
Nippers or Knife

9-1-1 HOW TO DISASSEMBLE

- (1) Remove the recoil starter from engine.
- (2) Pull the starter knob to draw out the starter rope by about 30cm and tie a tentative knot as show in Fig. 69
- (3) Untie the knot inside the knob to remove the knob.

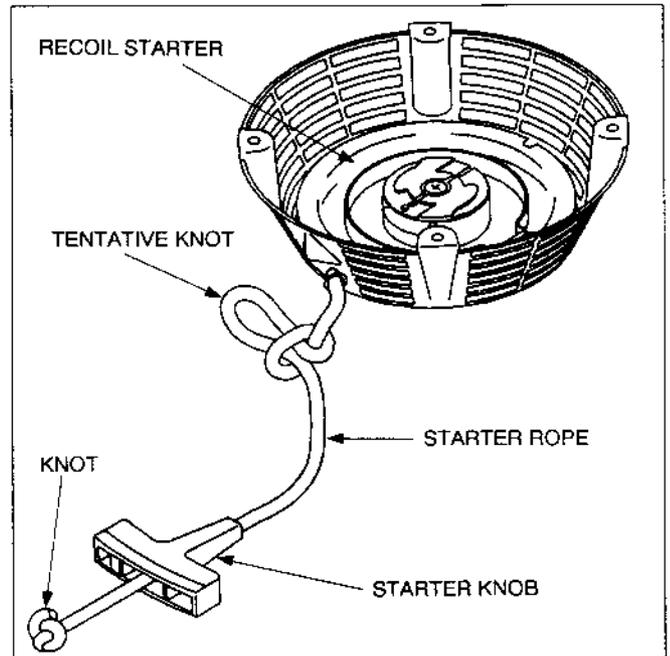


Fig. 69

- (4) Hold the starter case and the reel firmly with your left hand and untie the tentative knot with your right hand. Continue to hold the case and the reel with your left hand and hold the reel center with your right hand, then loosen both hands alternately to allow the reel gradually to turn to the arrow direction until the spring is completely released.
(Do this carefully to avoid dangers caused by spring-back.)

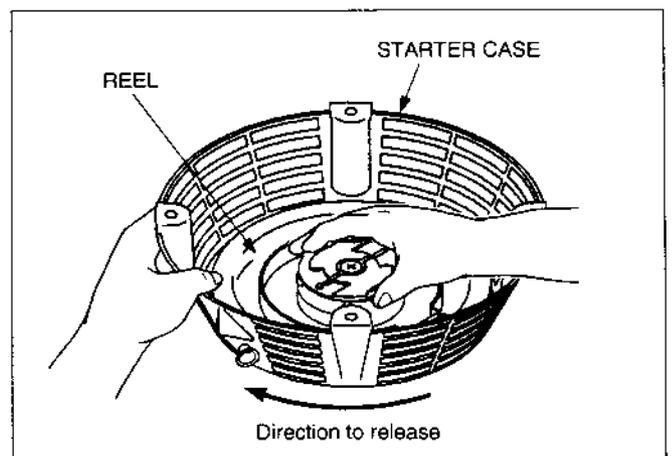


Fig. 70

(5) Remove each part in accordance with Fig. 71

1. Center screw
2. Friction plate
3. Friction spring
4. Ratchet
5. Ratchet spring
6. Reel

Take out the reel slowly while turning it back and forth gently, otherwise the spring may escape from the case which may invite danger.

(If the spring escapes, put it in the housing by following procedures shown in Fig. 76)

Untie the starter rope knot at reel end and withdraw it to complete disassembling.

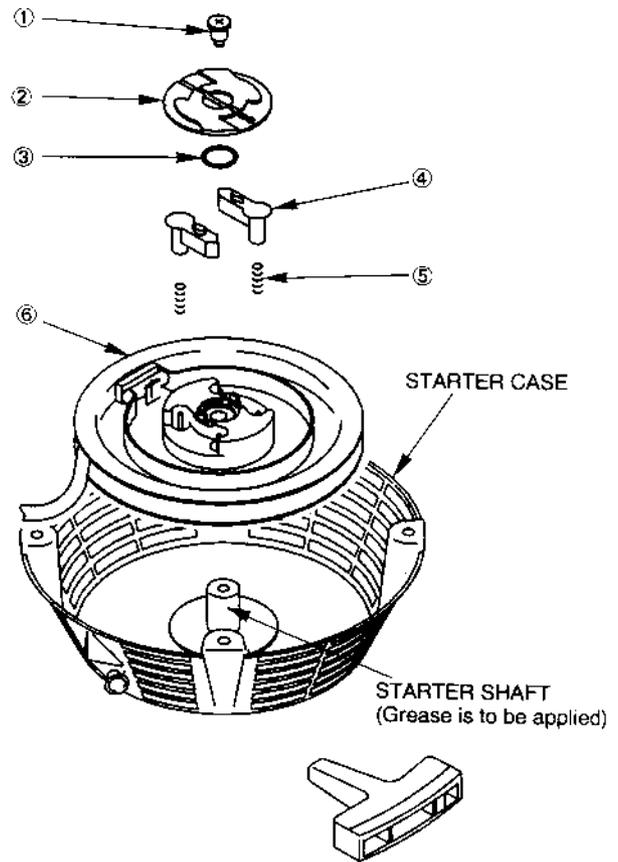


Fig. 71

9-1-2 HOW TO REASSEMBLE

(1) Cut off a part of the reel shown in Fig. 72 with a nippers or a knife to form a which is required when pre-winding the spring.

(2) Check that the spring is securely set in the reel and form the spring end to measure 1mm to 2mm for clearance between inner end of the spring and the reel bushing edge so that the hook catches securely as shown in Fig. 73

The shape of spring inner end (approx. 10cm from the end) may be adjusted with a plier if necessary.

(3) Apply a small amount of grease to the starter shaft and to the spring.

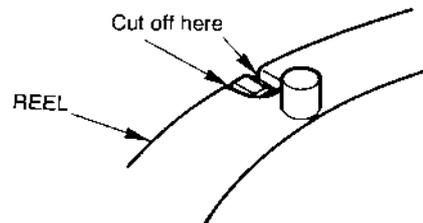


Fig. 72

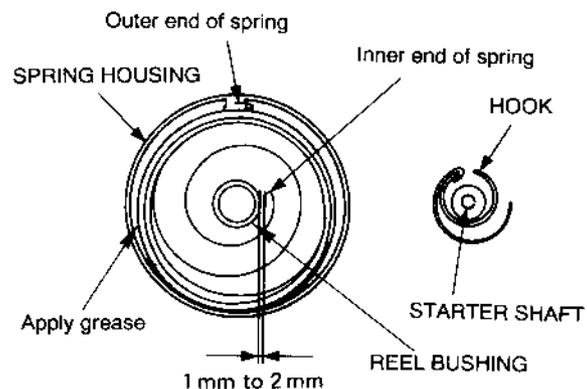


Fig. 73

- (4) Pass the starter rope through the starter knob and tie the rope end to make a tight overhand knot as shown in Fig. 74. Then put the knot into the knob.
- (5) Pass the other end of the rope from the starter case to the reel and make a knot as illustrated above, then put the rope end securely into the rope housing in the reel.
- (6) Wind the starter rope by 1.5 turns in the arrow direction as shown in Fig. 75 to let the rope out of the reel through the notch, then install the reel securely in the starter case so that the hook catches inner end of the spring.

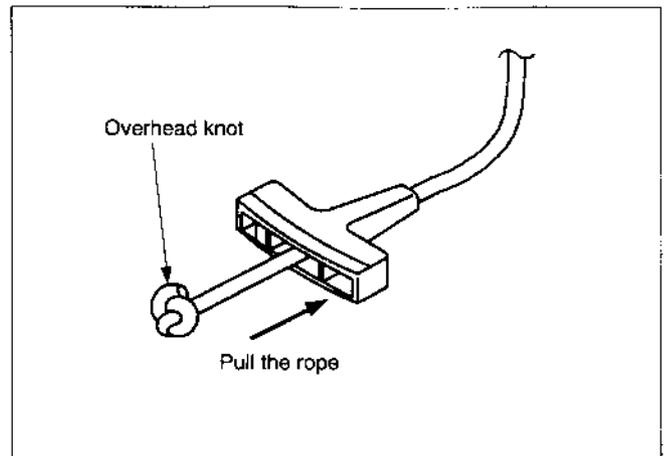


Fig. 74

- (7) Hold the starter rope as shown in the Fig. 73 and rotate the reel 6 turns by applying the force directly to the reel notch. (pre-winding)
Hold the reel securely to prevent it from reverse turn and pull the starter knob to stretch the rope tight then release the knob slowly.

Reassemble the parts in reverse order of disassembling shown in Fig. 71. Tighten the center screw securely.

※This concludes disassembling/re-assembling. Be sure to check the following to make sure of it.

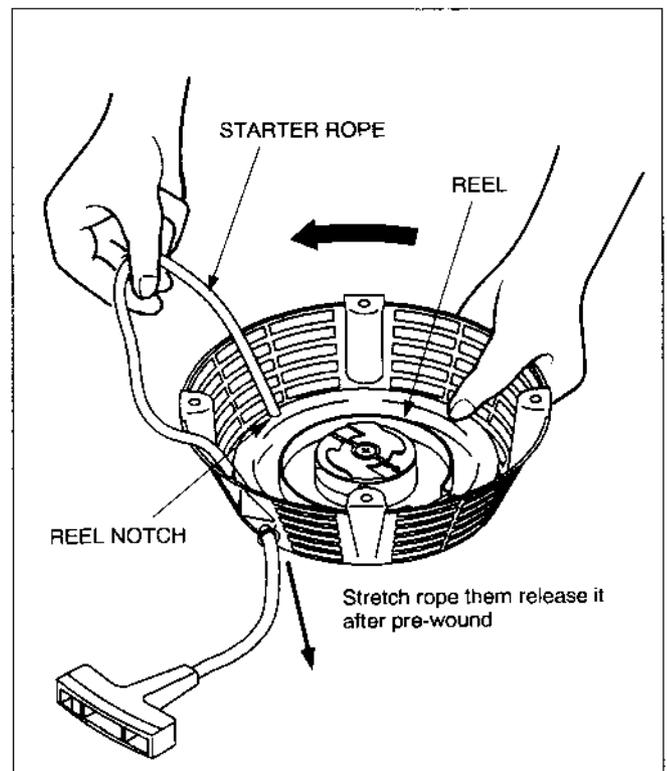


Fig. 75

9-1-3 CHECK AFTER BEING RE-ASSEMBLED

- (1) Pull the starter knob a few times to see if :
 - A. The starter knob is too heavy to pull, check that each part has been mounted as specified.
 - B. The ratchet fails to function, check that parts such as friction spring have been missing.
- (2) Pull out the starter knob to extend the rope to its extreme to see if :
 - A. The starter rope still remains in the rope slot in the reel, unwind the rope by 1mm to 2mm turns as the spring may be over-stressed.
 - B. The starter rope is found weak to recoil or droops in halfway, apply grease or mobile oil to the rotating part and to the friction parts.
If this persists, wind-up the spring by 1mm to 2mm turns. (In this case, check that the spring is not over-stressed.)
 - C. The spring escapes with a sound and the starter rope fails to spring back to its original position, re-assemble the starter from the beginning.

9-1-4 OTHER GUIDES

- (1) When the spring escapes from the reel :
Make a ring having a rather small diameter than spring housing using a thin wire. Hook the outer end of the spring onto a part of the ring and re-wind the spring into the wire ring as shown in Fig. 76 then put it into the housing.
Remove the ring slowly while holding down the spring to avoid getting out of place. The ring can easily be removed by prying it with the tip of a screwdriver. Refer to Fig. 73 for which way the spring must be placed.
If the wire ring is not available, re-wind the spring directly into the housing.

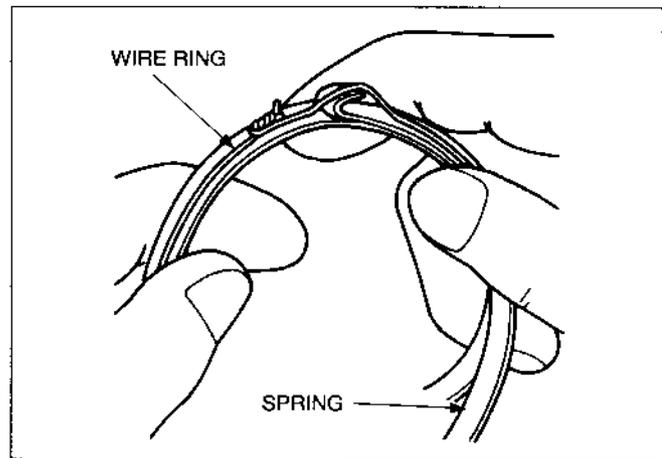


Fig. 76

- (2) When it is lubricated :
Lubricate the starter shaft and the spring with a grease (If possible, heat-resistant type is preferable) or a mobile oil when the starter is being disassembled and prior to long term storage.

10. TROUBLESHOOTING

The following three conditions must be fulfilled for satisfactory engine start.

1. The cylinder filled with a proper fuel-air mixture.
2. Good compression in the cylinder.
3. Good spark, properly timed, to ignite the mixture.

The engine cannot be started unless these three conditions are met. There are also other factors which make engine start difficult, e. g., a heavy load on the engine when it is about to start at low speed, and a high back pressure due to a long exhaust pipe.

The most common causes of engine troubles are given below :

10- 1 STARTING DIFFICULTIES

10- 1- 1 FUEL SYSTEM

- (1) No gasoline in the fuel tank ; or the fuel cock closed.
- (2) The carburetor is not choked sufficiently especially when the engine is cold.
- (3) Water, dust or gum in the gasoline interfering the fuel flow to the carburetor.
- (4) Inferior grade gasoline or poor quality gasoline not vaporized enough to produce the correct fuel-air mixture.
- (5) The carburetor needle valve is held open by dirt or gum. This trouble can be detected as the fuel flows out of the carburetor when the engine is idling.(Overflow)
This trouble may be remedied by lightly tapping the float chamber with the grip of a screwdriver or the like.
- (6) If the carburetor overflows, excessive fuel runs into the cylinder when starting the engine, making the fuel-air mixture too rich to burn. If this happens, remove the spark plug, and turn the starting pulley a few turns in order to let the rich fuel-air mixture out of the spark plug hole into the atmosphere. Keep the choke valve open during this operation. Dry the spark plug well, screw it into place, and try to start again.

10- 1- 2 COMPRESSION SYSTEM

If starting difficulties and loss of power are not due to the fuel system or ignition system, the followings must be checked for possible lack of compression.

- (1) Engine inside is completely dried up because of a long period of storage.
- (2) Loose or broken spark plug. This causes a hissing noise made by mixture gas running out of cylinder in compression stroke during cranking.
- (3) Damaged head gasket or loose cylinder head. A similar hissing noise is produced during compression stroke.
- (4) Incorrect Valve clearance

If the correct compression is not obtained even after remedying the above, disassemble the engine and check further as follows :

- a) Valve stuck open due to carbon or gum on the valve stem.
- b) If the piston rings are stuck on the piston, remove the piston and connecting rod from the engine. Clean or replace the parts.

10-1-3 IGNITION SYSTEM

Check the followings for lack of sparks.

- (1) Wires of the ignition coil, spark plug or contact breaker disconnected.
- (2) Ignition coil damaged and shorted.
- (3) Spark plug cable wet or soaked with oil.
- (4) Spark plug dirty or wet.
- (5) Spark plug electrode gap incorrect.
- (6) Spark plug electrodes are connected or bridged.
- (7) Incorrect spark timing.

10-2 ENGINE MISFIRES

- (1) Incorrect spark plug electrode gap. Adjust it to anywhere between 0.7 and 0.8mm.
- (2) Ignition cable worn and leaking.
- (3) Sparks weak.
- (4) Ignition wire connections loose.
- (5) Water in gasoline.
- (6) Insufficient compression.

10-3 ENGINE STOPS

- (1) Fuel tank empty. Water, dirt, gum, etc. in gasoline.
- (2) Vapor lock, i. e., gasoline evaporating in the fuel lines due to overheat around the engine.
- (3) Vapor lock in the fuel lines or carburetor due to the use of too volatile winter gas in the hot season.
- (4) Air vent hole in the fuel tank cap plugged.
- (5) Bearing parts seized due to lack of oil.
- (6) Magneto or ignition coil faulty.

10-4 ENGINE OVERHEATS

- (1) Crankcase oil level low. Add oil immediately.
- (2) Spark timing incorrect.
- (3) Low grade gasoline is used, or engine is overloaded.
- (4) Cooling air circulation restricted.
- (5) Cooling air path misdirected causes loss of cooling efficiency.
- (6) Cylinder head cooling fins clogged up with dirt.
- (7) Engine operated in an enclosed space without sufficient cooling air.
- (8) Exhaust gas discharge restricted, or carbon deposits in the combustion chamber.
- (9) Engine running on low-octane gasoline detonates due to heavy load at low speed.

10- 5 ENGINE KNOCKS

- (1) Poor quality gasoline.
- (2) Engine operating under heavy load at low speed.
- (3) Carbon or lead deposits in the cylinder head.
- (4) Spark timing incorrect.
- (5) Loose connecting rod bearing due to wear.
- (6) Loose piston pin due to wear.
- (7) Curses of engine overheat.

10- 6 ENGINE BACKFIRES THROUGH CARBURETOR

- (1) Water or dirt in gasoline, or low-grade gasoline.
- (2) Intake valve stuck.
- (3) Valves overheated, or hot carbon particles in the combustion chamber.
- (4) Engine cold.

11. INSTALLATION

Engine life, ease of maintenance and inspection, frequency of checks and repairs, and operating cost all depend on the way in which the engine is installed. Review the following instructions carefully for installing the engine.

11-1 INSTALLING

When mounting the engine, carefully examine its position, the method of connecting it to a machine, the foundation, and the method of supporting the engine.

When determining its mounting position, in particular, make sure that gasoline and oil can easily be supplied and checked, the spark plug can easily be checked, the air cleaner can easily be serviced, and that the oil can easily be discharged.

11-2 VENTILATION

Fresh air is necessary for cooling the engine and burning the fuel.

In the case the engine is operated under a hood or in a small room, temperature rise in the engine room can cause vapor lock, oil deterioration, increased oil consumption, loss of power, piston seizure, shorter engine life, etc., making it impossible to operate the engine properly. It is necessary, therefore, to provide a duct or baffle to guide cooling air to the engine to prevent recirculation of the hot air used for engine cooling, and temperature rise of the machine.

Keep the engine room temperature below 50°C even in the hottest period of the year.

11-3 EXHAUST GAS DISCHARGE

Exhaust gas is noxious. When operating the engine indoors, be sure to discharge the exhaust gas outdoors. If a long exhaust pipe is used in such a case, the internal resistance increases causing loss of engine power. Thus pipe inside diameter must be increased in proportion to exhaust pipe length.

Exhaust pipe : Less than 3m long, pipe inside diameter 30mm,
Less than 5m long, pipe inside diameter 33mm.

11-4 POWER TRANSMISSION TO DRIVEN MACHINES

11-4-1 BELT DRIVE

Take the following notes into consideration.

- * V-belts are preferable to flat belts.
- * The driving shaft of the engine must be parallel to the driven shaft of the machine.
- * The driving pulley of the engine must be in line with the driven pulley of the machine.
- * Install the engine pulley as close to the engine as possible.
- * If possible, span the belt horizontally.
- * Disengage the load when starting the engine.

If no clutch is used, use a belt tension pulley or the like.

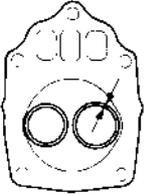
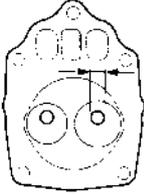
11-4-2 FLEXIBLE COUPLING

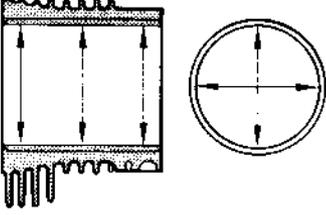
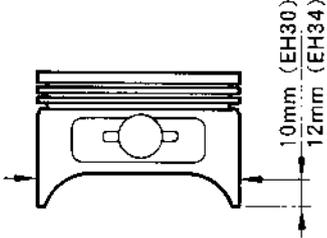
When using a flexible coupling, run out and misalignment between the driven shaft and engine shaft must be minimized. Run out and misalignment tolerance are specified by the coupling manufacturer.

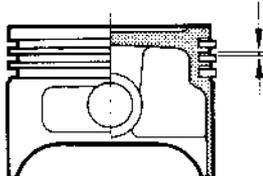
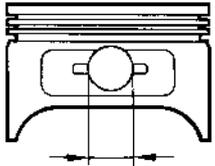
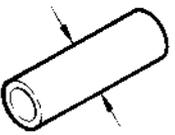
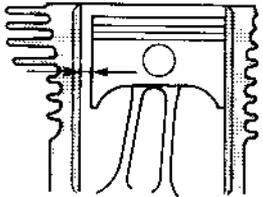
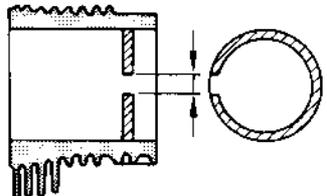
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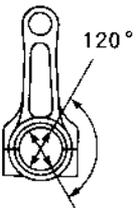
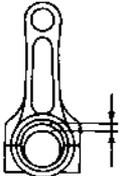
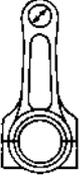
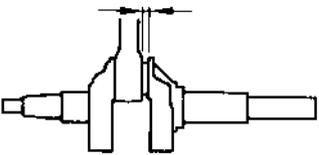
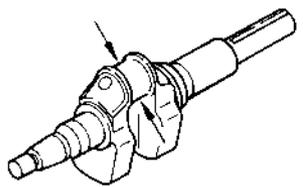
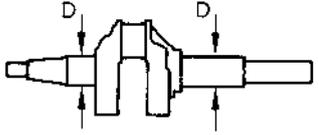
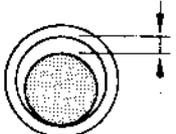
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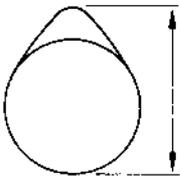
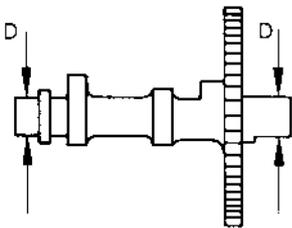
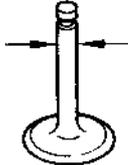
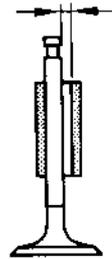
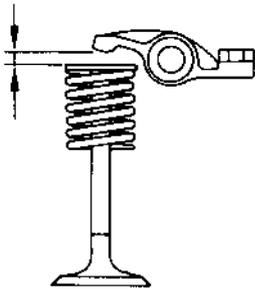
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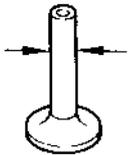
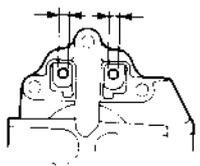
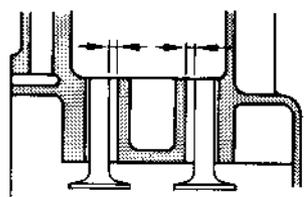
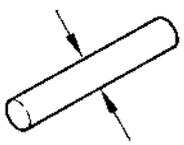
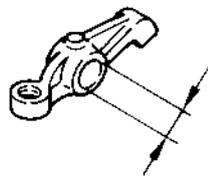
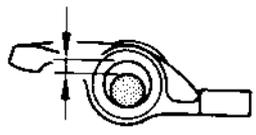
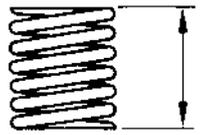
ITEM	EH30/EH34		
	STD	Limit	
CYLINDER HEAD ● Flatness 		0.05 (0.002)	0.1 (0.004)
● Valve seat contact width 	IN. EX.	0.7-1.0 (0.028-0.039)	2.0 (0.079)
● Valve guide inside dia. 		6.600-6.622 (0.260-0.261)	6.75 (0.266)

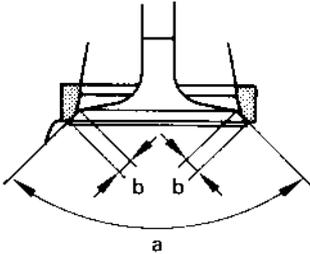
ITEM	EH30		EH34		
	STD	Lmit	STD	Lmit	
CYLINDER ● Inside dia.  ● Roundness after re boring. ● Cylindricity after re boring.	STD	78.000-78.019 (3.071-3.072)	To be rebored when the difference between max. and min. of diameter reached to 0.1 (0.004).	84.000-84.022 (3.307-3.308)	To be rebored when the difference between max. and min. of diameter reached to 0.1 (0.004).
	1st re boring	78.250-78.269 (3.081-3.082)	Ditto	84.250-84.272 (3.317-3.318)	Ditto
	2nd re boring	78.500-78.519 (3.091-3.092)	—	84.500-84.522 (3.327-3.328)	—
		0.01 (0.004)	—	0.01 (0.004)	—
		0.015 (0.0006)	—	0.015 (0.0006)	—
PISTON ● Piston size (At skirt in thrust direction) 	STD	77.96-77.98 (3.069-3.070)	77.87 (3.066)	83.96-83.98 (3.305-3.306)	83.87 (3.302)
	1st o/s	78.21-78.23 (3.079-3.080)	78.12 (3.076)	84.21-84.23 (3.315-3.316)	84.12 (3.312)
	2nd o/s	78.46-78.48 (3.089-3.090)	78.37 (3.085)	84.46-84.48 (3.325-3.326)	84.37 (3.322)

ITEM	EH30		EH34		
	STD	Limit	STD	Limit	
<ul style="list-style-type: none"> ● Ring groove side clearance 	Top	0.05-0.09 (0.002-0.0035)	0.15 (0.006)	0.05-0.09 (0.002-0.0035)	0.15 (0.006)
	2nd	0.03-0.07 (0.0012-0.0028)	0.15 (0.006)	0.03-0.07 (0.0012-0.0028)	0.15 (0.006)
	Oil ring	0.01-0.065 (0.0004-0.0026)	0.15 (0.006)	0.01-0.065 (0.0004-0.0026)	0.15 (0.006)
<ul style="list-style-type: none"> ● Piston pin hole 		20.995-21.008 (0.8266-0.8271)	21.035 (0.8281)	20.995-21.008 (0.8266-0.8271)	21.035 (0.8281)
<ul style="list-style-type: none"> ● Piston pin outside dia. 		20.991-21.000 (0.8264-0.8268)	20.960 (0.8251)	20.991-21.000 (0.8264-0.8268)	20.960 (0.8251)
<ul style="list-style-type: none"> ● Clearance between piston and cylinder at skirt area. 		0.025-0.064 (0.0010-0.0025)	0.25 (0.0098)	0.025-0.067 (0.0010-0.0026)	0.25 (0.0098)
<ul style="list-style-type: none"> ● Piston ring end gap 	Top	0.2-0.4 (0.0079-0.0157)	1.5 (0.0591)	0.2-0.4 (0.0079-0.0157)	1.5 (0.0091)
	2nd				
	Oil ring	0.1-0.3 (0.0004-0.0118)	1.5 (0.0591)	0.1-0.3 (0.0004-0.0118)	1.5 (0.0591)

ITEM	EH30 / EH34	
	STD	Limit
CONNECTING ROD ● Big end inside dia. 	38.000-38.016 (1.4961-1.4967)	38.1 (1.5000)
● Clearance between big end and crankpin 	0.030-0.060 (0.0012-0.0024)	0.2 (0.0079)
● Small end inside dia. 	21.010-21.023 (0.8272-0.8277)	21.080 (0.8299)
● Clearance between small end and piston pin 	0.010-0.032 (0.0004-0.0013)	0.12 (0.0047)
● Big end side clearance 	0.1-0.3 (0.0039-0.0118)	1.0 (0.0394)
CRANKSHAFT ● Crankpin outside dia. 	37.956-37.970 (1.4943-1.4949)	37.85 (1.4902)
● Journal dia. 	34.986-34.997 (1.3774-1.3778)	
● Clearance between journal and main bearing 	-0.009-0.014 (-0.00035-0.00055)	

ITEM	EH30 / EH34		
	STD	Limit	
CAMSHAFT ● Cam height  ● Journal outside dia. "D" type 	IN.EX. cams	36.1-36.3 (1.4213-1.4291)	35.95 (1.4154)
		19.967-19.980 (0.7861-0.7866)	19.950 (0.7854)
VALVE ● Valve stem outside dia.  ● Clearance between valve stem dia. and valve guide  ● Valve clearance 	IN.	6.535-6.550 (0.2573-0.2579)	6.450 (0.2539)
	EX.	6.522-6.544 (0.2568-0.2576)	6.450 (0.2539)
	IN.	0.050-0.087 (0.0022-0.0034)	0.30 (0.0118)
	EX.	0.056-0.100 (0.0022-0.0039)	0.30 (0.0118)
	IN./EX. (cold)	0.085-0.115 (0.0034-0.0045)	

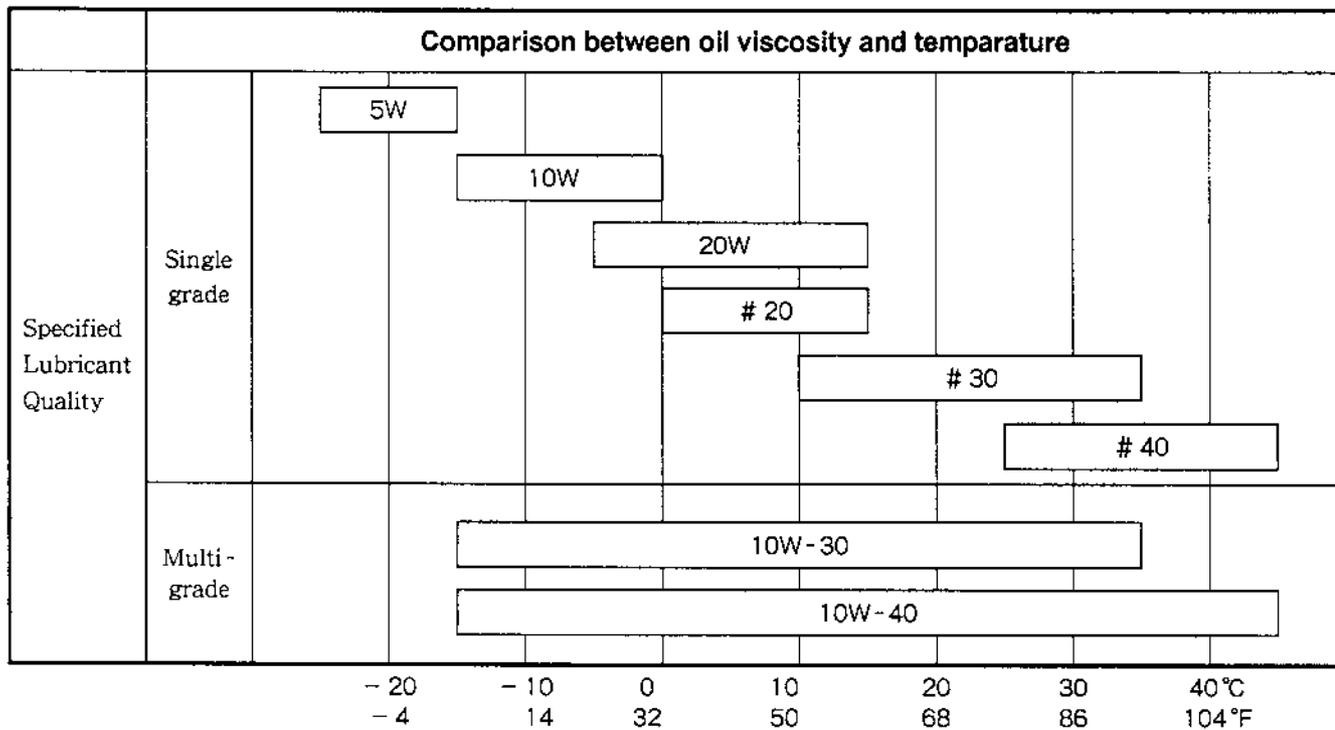
ITEM	EH30/EH34	
	STD	Limit
TAPPET ● Stem outside dia. 	8.960-8.975 (0.3528-0.3533)	8.93 (0.3516)
● Guide inside dia. 	9.00-9.015 (0.3543-0.3549)	9.08 (0.3575)
● Tappet guide clearance 	0.025-0.055 (0.0010-0.0022)	0.15 (0.0059)
ROCKER ARM ● Rocker shaft outside dia. 	11.986-11.994 (0.4719-0.4722)	11.92 (0.4693)
● Rocker arm hole dia. 	12.006-12.024 (0.4727-0.4734)	12.07 (0.4752)
● Rocker arm shaft clearance 	0.012-0.038 (0.0005-0.0015)	0.15 (0.0059)
VALVE SPRING FREE LENGTH 	39.5 (1.5551)	—

ITEM	EH30 / EH34	
	STD	Limit
VALVE SEAT ANGLE (IN. EX.) ● Valve cutter angle (a) ● Valve contact width (b)	 <p>a : 90° b : 0.7-1.0 (0.028-0.039)</p>	2.0 (0.079)

12-2 TORQUE SPECIFICATIONS

DESCRIPTION		TIGHTENING TORQUE
Cylinder head bolts		33.3-41.2 N·m (340-420 kg·cm) (24.6-30.4 ft·lb)
Connecting rod cap bolts		22.1-27.0 N·m (225-275 kg·cm) (16.3-19.9 ft·lb)
Flywheel nut		83.4-93.2 N·m (850-950 kg·cm) (61.5-68.7 ft·lb)
Main bearing cover bolts		16.7-18.6 N·m (170-190 kg·cm) (12.3-13.7 ft·lb)
Spark plug	New spark plug	11.8-14.7 N·m (120-150 kg·cm) (8.7-10.9 ft·lb)
	Retightening	22.6-26.5 N·m (230-270 kg·cm) (16.6-19.5 ft·lb)

12-3 OIL GRADE CHART



Use oil classified as SC or higher.

Multi-grade oil tends to increase its consumption at high ambient temperature.

13. MAINTENANCE AND STORAGE

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.

13- 1 DAILY MAINTENANCE

MAINTENANCE	REMARKS
1) Clean away dust and chaff from engine.	Governor linkage is especially sensitive to dust.
2) Check fuel leakage from fuel system. If any, retighten fasteners or replace necessary parts.	
3) Inspect for loose hardwares and retighten if necessary.	Loose bolts and nuts may come off and result in breakage of other parts.
4) Check oil level and add to full mark.	

13- 2 INITIAL 20 HRS. MAINTENANCE

MAINTENANCE	REMARKS
1) Change crankcase oil.	To remove sludge from run-in operation.

13- 3 EVERY 50 HRS. (10 DAYS)MAINTENANCE

MAINTENANCE	REMARKS
1) Change crankcase oil.	Contaminated oil quickens wear.
2) Clean air cleaner.	
3) Check and clean spark plug.	If dirty, wash in gasoline or polish with emery paper.

13- 4 EVERY 100~200 HRS. (MONTHLY)MAINTENANCE

MAINTENANCE	REMARKS
1) Clean fuel filter and fuel tank.	
2) Inspect cooling system and remove dirt and chaff.	Remove blower housing and clean up between fins and housing.

13- 5 EVERY 500~600 HRS. MAINTENANCE

MAINTENANCE	REMARKS
1) Remove carbon from cylinder head.	Carbon deposits in combustion chamber causes lack of power.
2) Disassemble and clean carburetor.	

13- 6 EVERY 1000 HRS. (YEARLY)MAINTENANCE

MAINTENANCE	REMARKS
1) Overhaul engine.	Clean and correct parts. Replace piston rings and other necessary parts.
2) Replace fuel lines once a year.	Avoid hazards caused by fuel leakage.

13- 7 ENGINE STORAGE

- (1) Perform the above 13-1 and 13-2 maintenance jobs.
- (2) Drain fuel from the fuel tank and carburetor float chamber.
- (3) To prevent rust in the cylinder bore, apply oil through the spark plug hole and turn the crankshaft several turns by hand. Reinstall the plug.
- (4) Turn the starting pulley by hand and leave it where the resistance is the heaviest.
- (5) Clean outside of the engine with oiled cloth.
- (6) Put a plastic cover or the like over the engine and store the engine in dry place.