SUBARU

Industrial Power Products

ER12

SERVICE MANUAL

CONTENTS

1. SPECIFICATIONS

Model		ER12
Type		Air-Cooled, 4-Cycle, Single-Cylinder, Horizontal P.T.O. Shaft, OHC Gasoline Engine
Bore × Stroke	mm (in.)	60 × 43 (2.36 × 1.69)
Piston Displacement	ml (cu.in.)	121 (7.38)
Compression Ratio		9.6
Maximum Output	kW(HP)/r.p.m.	2.6(3.5)/3600
Maximum Torque	N·m / r.p.m. (kgf·m / r.p.m.) (ft·lb. / r.p.m.)	7.3/2400 (0.74/2400) (5.38/2400)
Direction of Rotation		Counterclockwise as viewed from the P.T.O. shaft side
Valve Arrangement		Overhead cam system
Cooling System		Forced air cooling system
Lubrication System		Trochoid Pump, Forced and Splash lubrication system
Lubricant		Automotive detergent oil - SAE; #20, #30 or 10W-30 API service class; SE or higher (SG, SH or SJ is recommended)
Capacity of Lubricant	L (U.S. gal.)	0.35 (0.092)
Carburetor		Horizontal draft, Float type or Diaphragm type
Fuel		Automobile unleaded gasoline
Fuel Supply System		Gravity type
Spark Plug		NGK CR5HSB
Starting System		Recoil starter
Governor		Centrifugal flyweight type
Air Cleaner system		Semi wet type
Dry Weight	kg (lb.)	9.9 (21.78)
Dimensions (L x W x H)	mm (in.)	264 x 288 x 334 (10.39 x 11.34 x 13.15) : Float type Caburetor 264 x 288 x 336 (10.39 x 11.34 x 13.23) : Diaphragm type Caburetor

∗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 and considering that all the moving parts are properly broken in.

A new engine may not produce full maximum output while its moving parts are still not broken-in.

NOTE :
Power curves shown in the following charts are made in conformity with SAE internal combustion engine standard test code J1349.

2-2 CONTINUOUS RATED OUTPUT

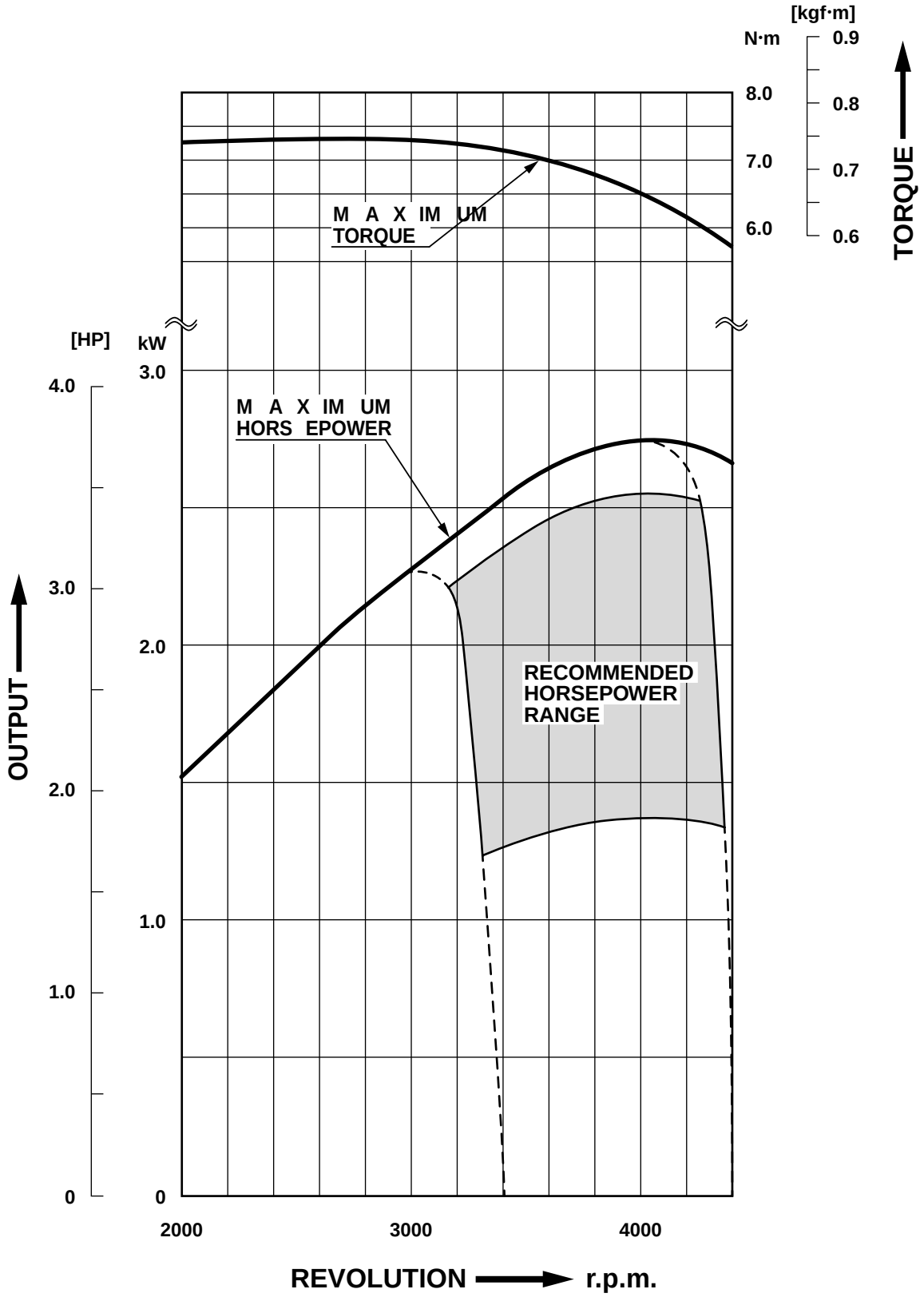
The continuous rated output is the output of an engine at optimum governed speed which is most favorable from the view point of engin's life and fuel consumption.

When the engine is installed on a certain equipment, it is recommended that the continuous output required from the equipment to 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 a specific r.p.m..

2-4. PERFORMANCE CURVES



3. FEATURES

3-1. DEVELOPED EXCLUSIVELY FOR RAMMER

The new ER12 has been developed exclusively for rammer, which especially requires the engine for high durability, high power output and superb mountability among many construction machineries.

3-2. LIGHTWEIGHT AND COMPACT DESIGN

ER12 has realized lightweight and compact design, while achieving high power output of 2.6kW (engine displacement 120cc) that enables to widely fulfill the operating weight of 60 to 80kg-class rammers, the lightest-in-class* weight of 9.9kg, and the smallest-in-class* on the length and width.

3-3. DESIGNED TO OFFER SUPERIOR MOUNTABILITY

ER12 has been designed to offer superior mountability, which is valued for rammer engine, by the optimal center of gravity for right-and-left balance.

3-4. USER'S SAFETY AS WELL AS USER FRIENDLINESS

ER12 offers several new functions as standard equipment, which has been required to rammer engine for user's safety as well as user friendliness, such as oil sensor that monitors the oil level not only at starting-up but also during operation, and automatic shutoff device that stops engine when the rammer rolls over or has no operation with idling.

3-5. EASE OF MAINTENANCE AND ECONOMICAL EFFICIENCY

ER12 has beeh designed in consideration of ease of maintenance and economical efficiency, such as adopting solid crank case or the newly developed resinous dust-proof air cleaner for realizing ease of maintenance, realizing longer operational hours without oil-refilling.

* FHI researches

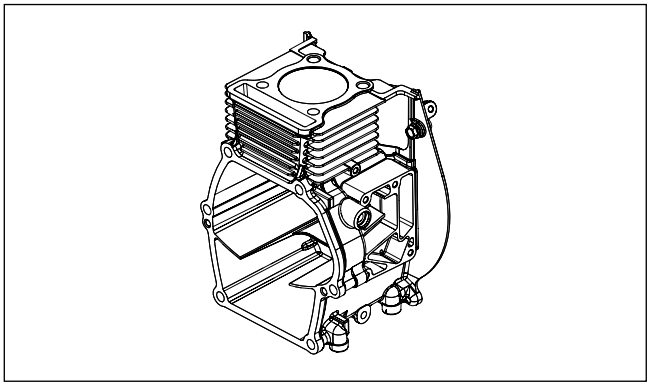
4. GENERAL DESCRIPTION OF ENGINE COMPONENTS

4-1 CYLINDER AND CRANKCASE

The cylinder and crankcase are aluminum die-casting as a single piece. A special cast iron cylinder liner is molded into the aluminum die-casting.

The crankcase has a mounting surface on the output shaft side to which the main bearing cover is attached. And the lib is made for the crankcase room center cum oil shelter plate, that improvement breather function and strength up.

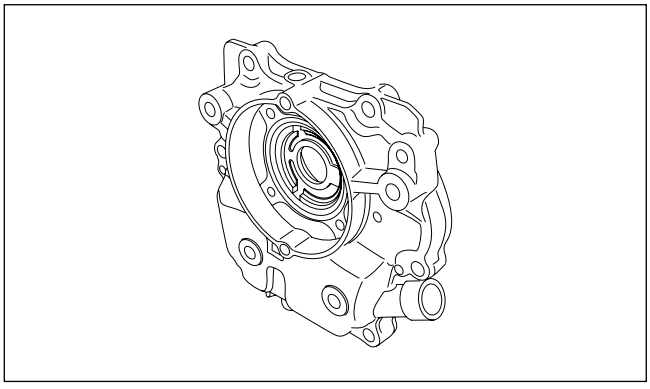
And inside of the crankcase has large rib for oil shelter which to inprove the breather function and stiffness.



4-2 MAIN BEARING COVER

The main bearing cover is an aluminum die-casting with heavy-duty structure to endure to install on rammers, which is mounted on the output shaft side of the crankcase. By removing the main bearing cover, the inside of the engine can be inspected with ease. Pilots and bosses are machined into the cover for direct mounting of the engine onto rammers.

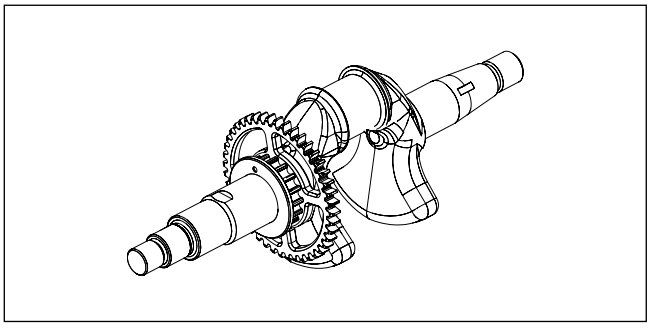
And it have suction pipe, oil pump, oil filter and oil pressure switch.



4-3 CRANKSHAFT

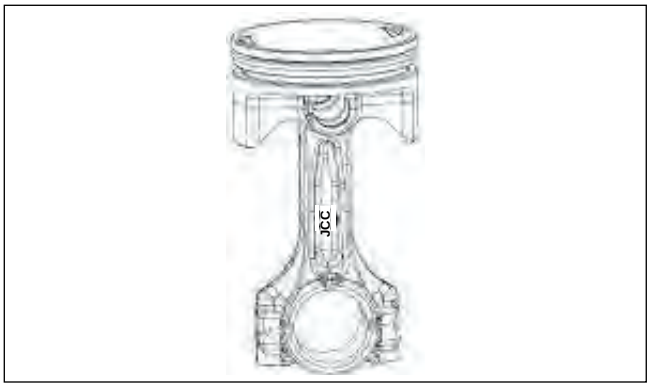
The crankshaft is forged carbon steel, and the crank pin is high-frequency inductionhardened.

The crank pulley used to drive the timing belt and the gear used to drive the governor gear are pressed into the output end of the shaft.



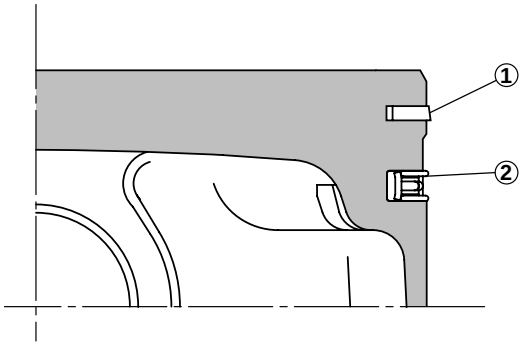
4-4 CONNECTING ROD AND PISTON

The connecting rod is a specially heat-treated aluminum alloy die-casting. Its large and small ends function as bearings. The piston is an aluminum alloy casting with grooves for mounting one compression ring and one oil ring.



4-5 PISTON RINGS

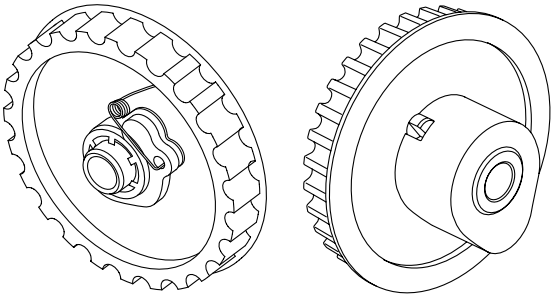
The piston rings are made of special cast iron. The profile of the top ring is a tapered face.
The oil ring is designed for better sealing and less oil consumption, in combination with 3 pieces.



①	TOP RING	TAPER
②	OIL RING	THREE-PIECE CONSTRUCTION

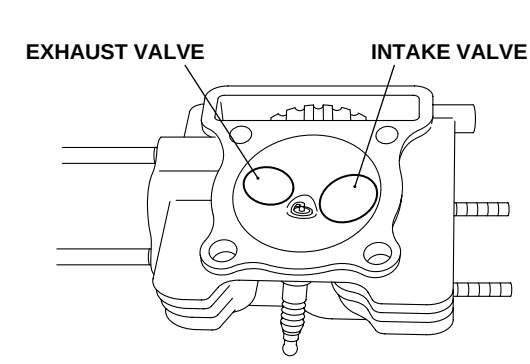
4-6 CAMPULLEY

The campulley is made of special nylon. They are constructed as a single piece. The campulley is provided with intake and exhaust cam, and the decompression release lever is mounted on the sprocket shaft end side.



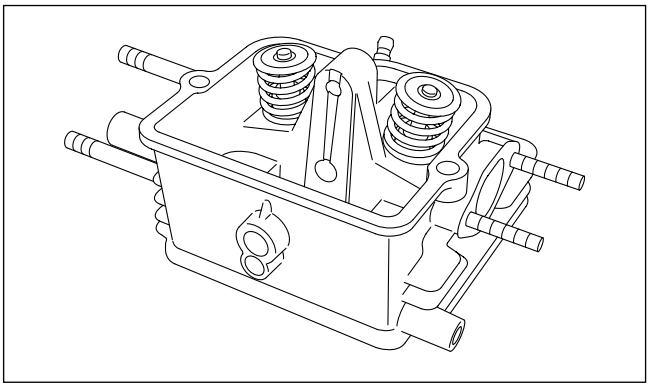
4-7 VALVE ARRANGEMENT

This engine has a belt-driven overhead cam and overhead valve construction, with a single cam performing both intake and exhaust operations.



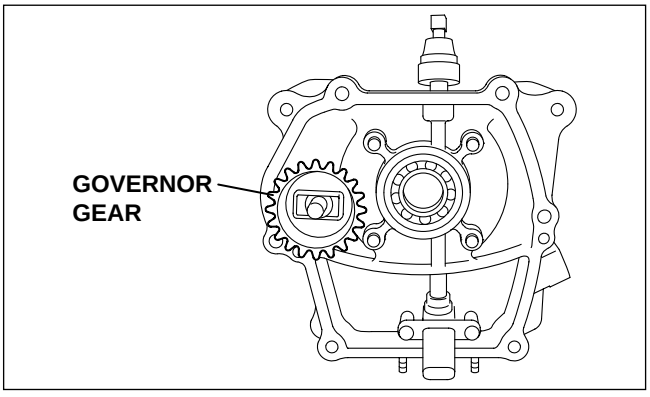
4-8 CYLINDER HEAD

The cylinder head is on aluminum die-casting with a lens-shaped combustion chamber. The intake and exhaust ports are arranged in a cross direction to improve combustion efficiency.



4-9 GOVERNOR SYSTEM

This engine is equipped with a centrifugal flyweight type governor that makes it possible to operate the engine at a constant speed, even with load variations. (The governor flyweights are mounted on a governor gear.)



4-10 COOLING SYSTEM

The engine uses a forced air-cooling system in which a cooling fan on the frywheel, reduce noise and forces cooling air into the cylinder and cylinder head.
Baffle is provided to guide the flow of cooling air.

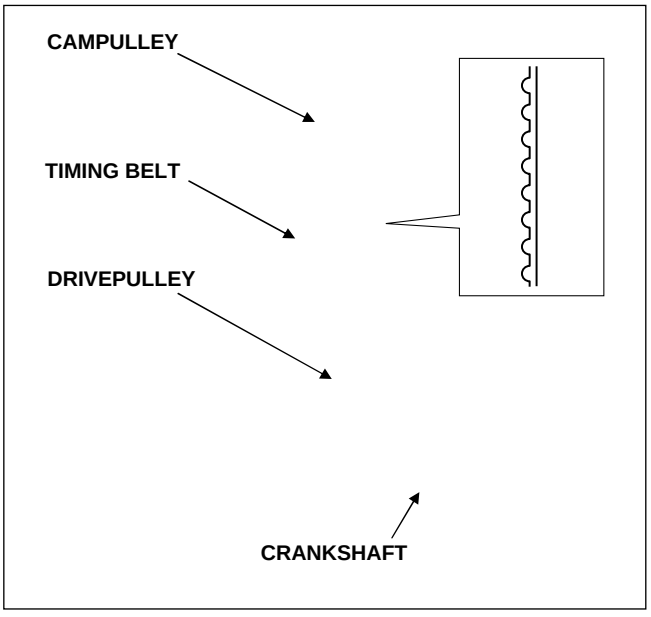
4-11 LUBRICATION SYSTEM

Lubricant (engine oil) is sprayed onto the parts with pressure spray by the trochoid type of oil pump, and those parts splashes to the parts necessary to be lubricated.

The trochoid pump is driven by the crankshaft. Lubricant is wholly filtered by the oil pump filter plugged in the under of the main bearing cover.

4-12 TIMING BELT

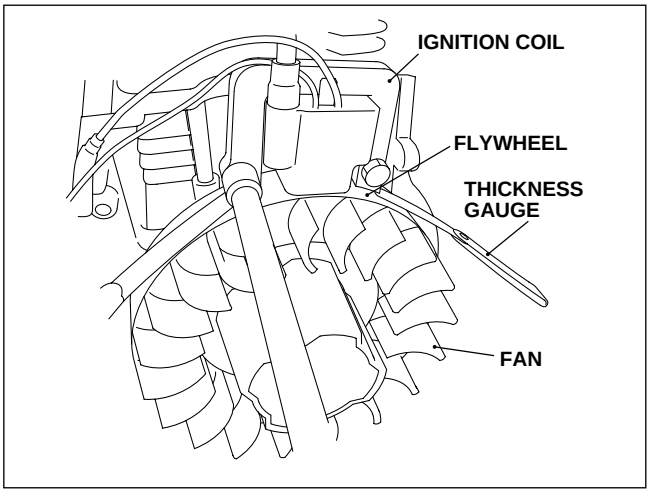
Timing belt system is adopted and designed for lubricating for the upper portion of cylinder head.
The timing belt is engaged between the campulley in the cylinder head and the crankshaft gear.
The pulley and the gear teeth in round shape are adopted to enhance the durability and to realize low noise level.



4-13 IGNITION SYSTEM

The ignition system is a pointless flywheel magnet by a digital control.

The magneto consists of a flywheel and ignition coil with CPU (Central Processing Unit.) and CDI (Capacitor Discharge Ignition.). The flywheel is directly mounted on the crankshaft and the ignition coil is directly mounted on the crankcase.

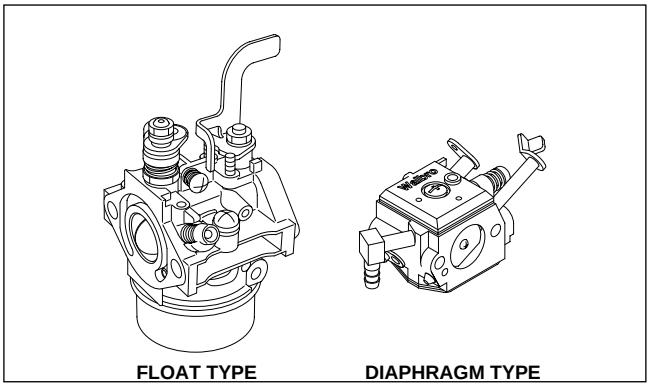


4-14 CARBURETOR

The engine is equipped with two types of horizontal draft carburetors, one has a float controlled fuel system and a fixed main jet, and another is diaphragm type.

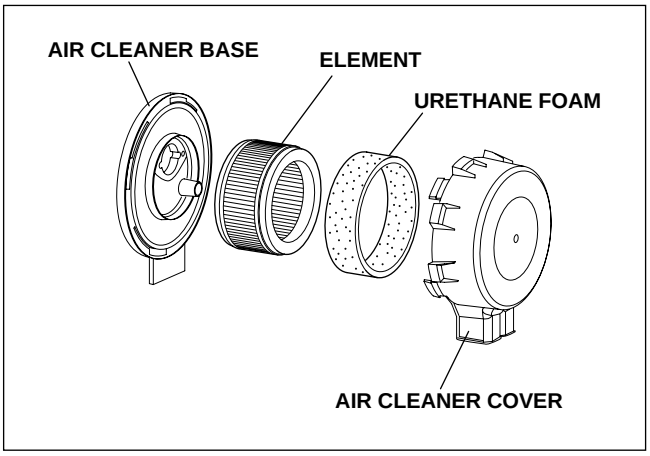
The carburetors are calibrated carefully for sure starting, good acceleration, less fuel consumption and maximum output.

For details, refer to page 50, section “11-3 FLOAT CARBURETOR As details of diaphragm type, refer to page 53, section “11-4 DIAPHRAGM CARBURETOR”.



4-15 AIR CLEANER

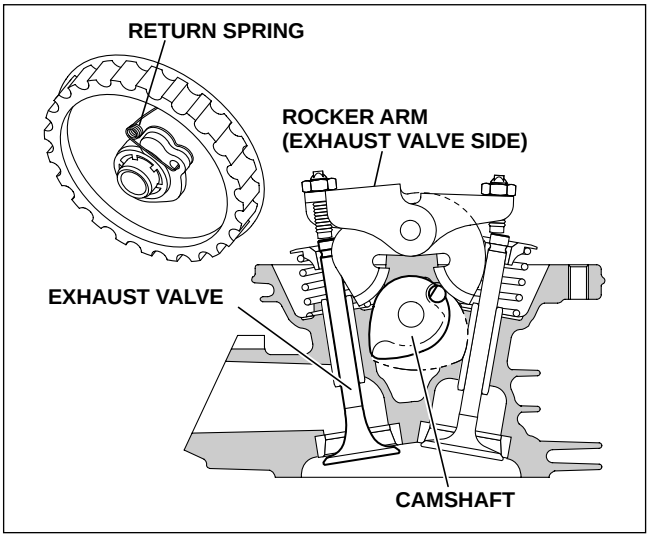
The air-cleaner is a heavy-duty type with a dual element system; the primary one is an urethane foam (semi-wet) and secondary one is a semi wet type element.



4-16 DECOMPRESSION SYSTEM

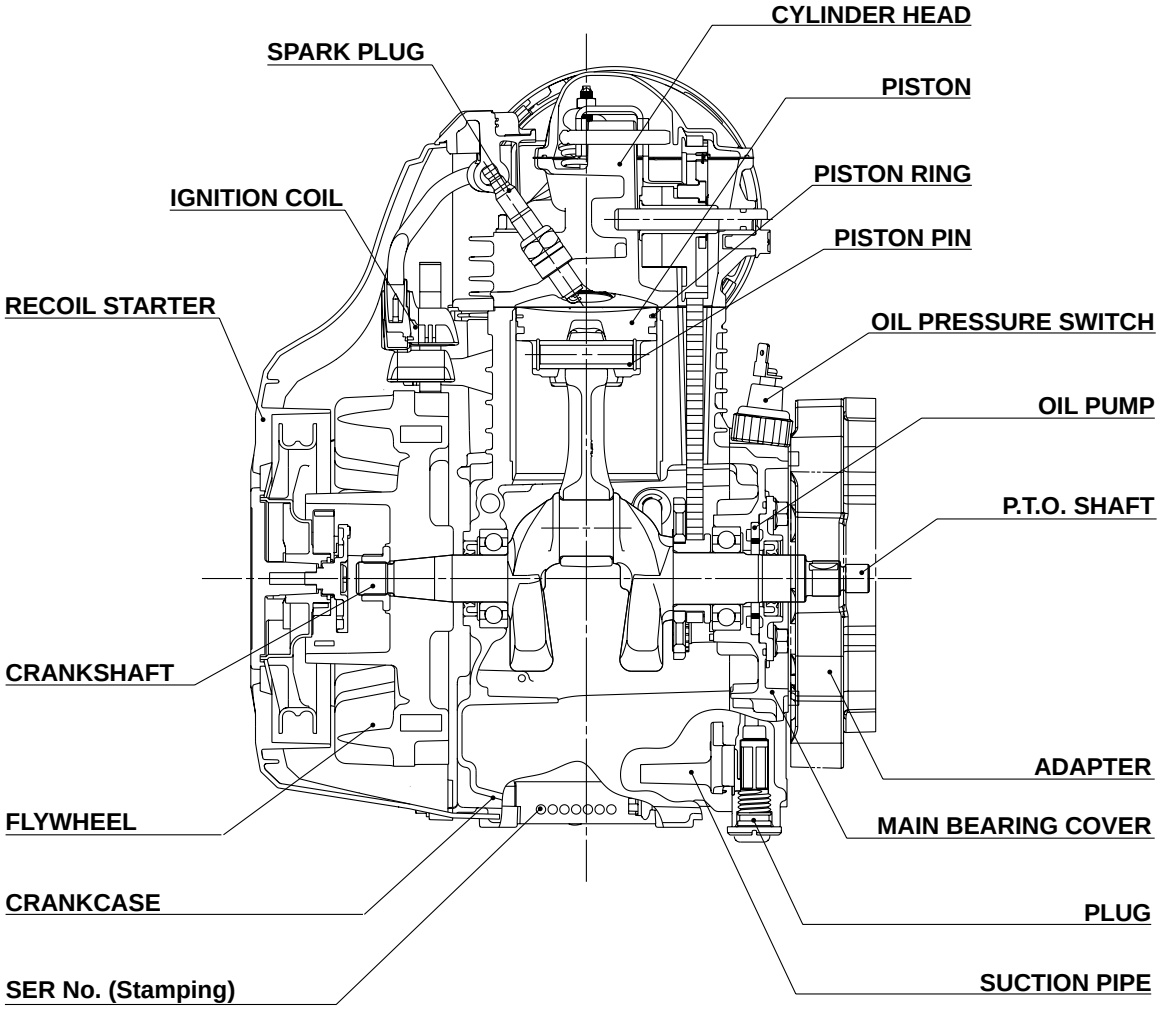
The automatic decompression system is mounted on the campulley. It opens the exhaust valve before the compression top, thereby alleviating the compression pressure and reducing the force required to pull the recoil starter.

During engine operation, the decompression system is overpowered by centrifugal force and compression is fully utilized to produce power.

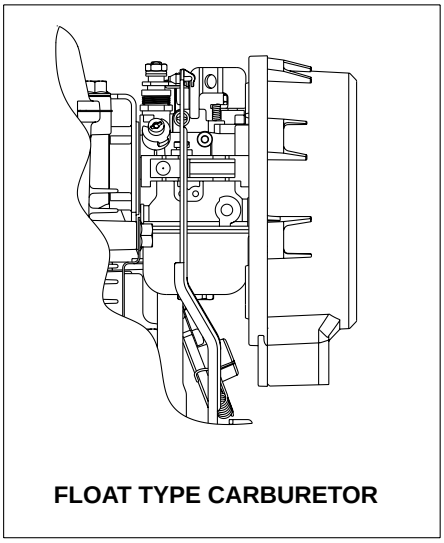


4-17 SECTIONAL VIEW OF THE ENGINE

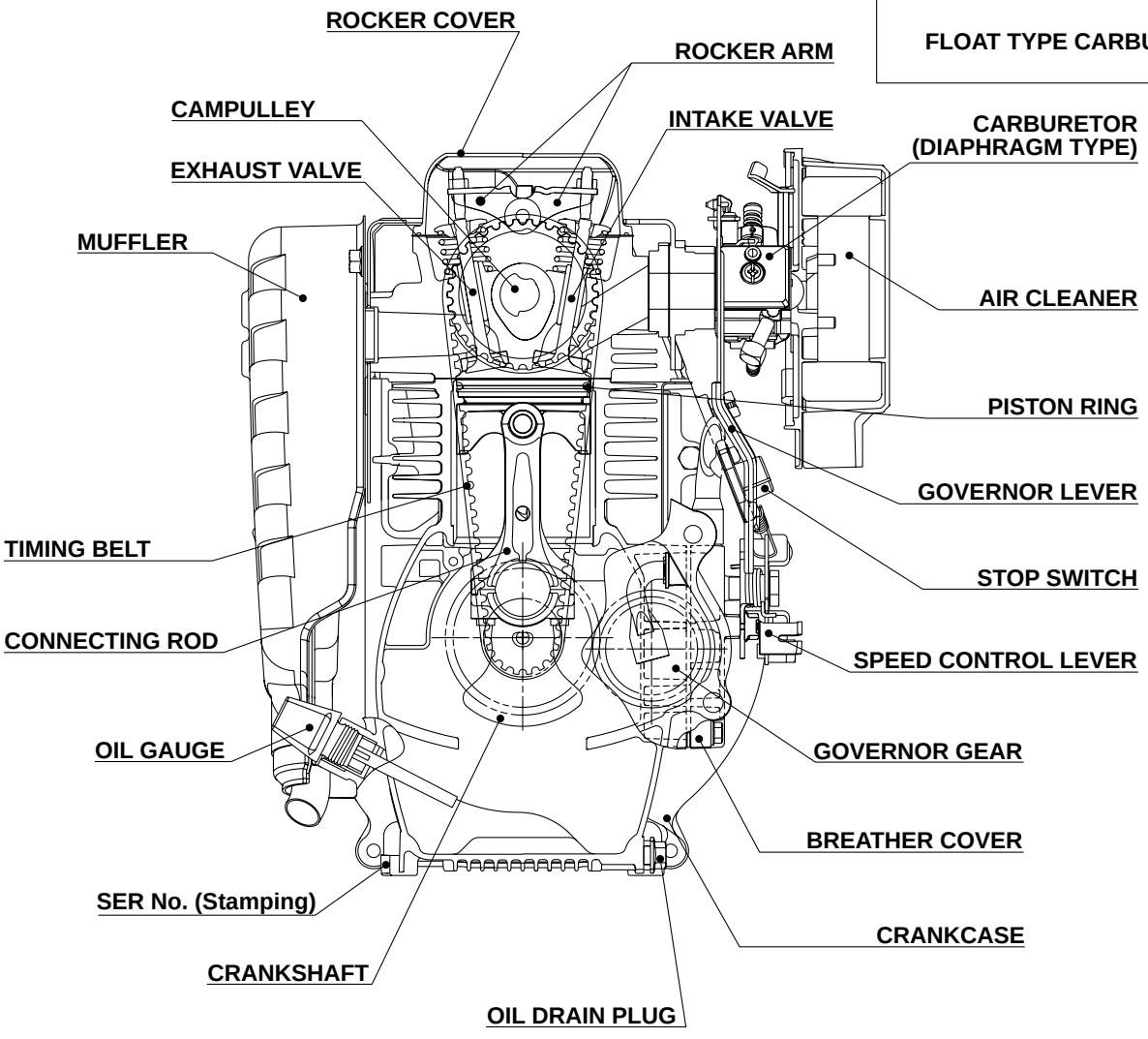
Cross sectional view – across the shaft



Cross sectional view – along the shaft



FLOAT TYPE CARBURETOR



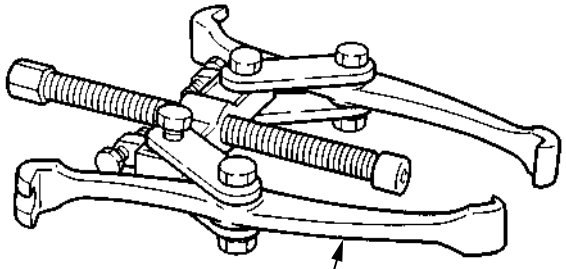
5. DISASSEMBLY AND REASSEMBLY

5-1 PREPARATIONS AND PRECAUTIONS

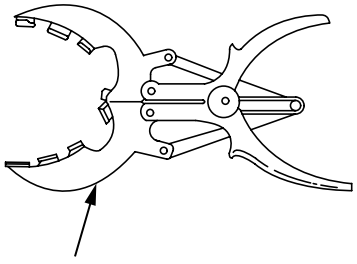
1) When disassembling the engine, memorize the location of each part so that you can reassemble the engine correctly. If necessary, attach identification tags with the required assembly information to the parts.
2) Store groups of parts in separate boxes. This will make reassembly easier.
3) To prevent parts from being mislaid, keep each group provisionally assembled after removing the parts from the engine.
4) Handle the disassembled parts with the utmost care. Clean them with cleaning oil if necessary.
5) Use the correct tools in the correct way when disassembling and reassembling the engine.

5-2 SPECIAL TOOLS

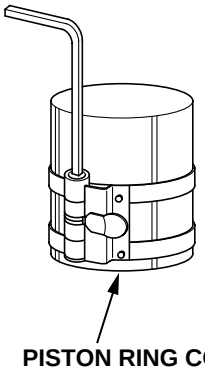
	Tool name	Use
Commercially available product	**Flywheel puller**	**For pulling off the flywheel**
Commercially available product	**Piston ring plier**	**For removing and installing piston rings**
Commercially available product	**Piston ring compresser**	**For holding piston rings**
Commercially available product	**Chain wrench**	**For locking the flywheel**



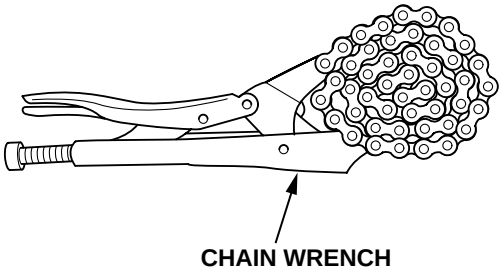
FLYWHEEL PULLER



PISTON RING PLIER



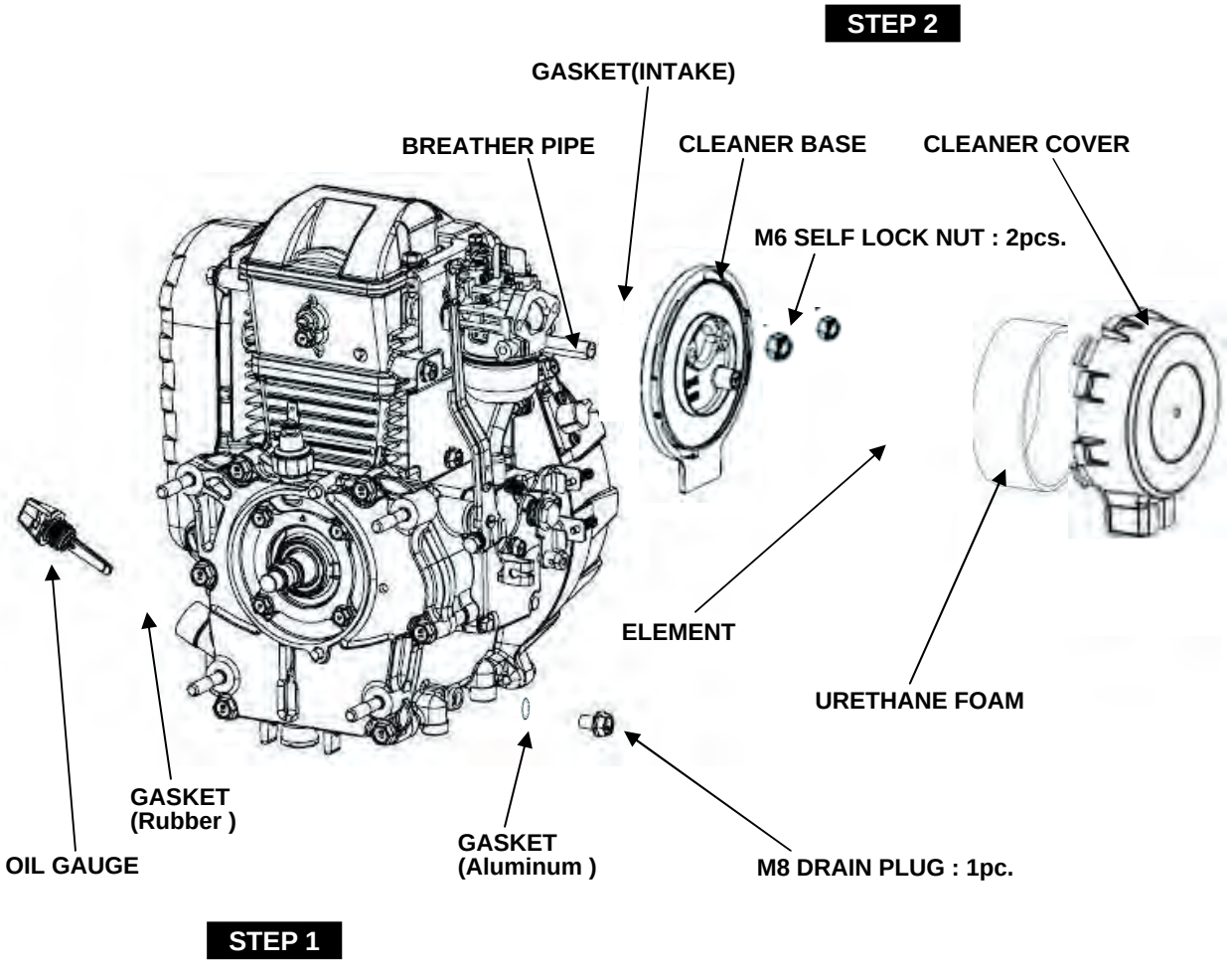
PISTON RING COMPRESSER



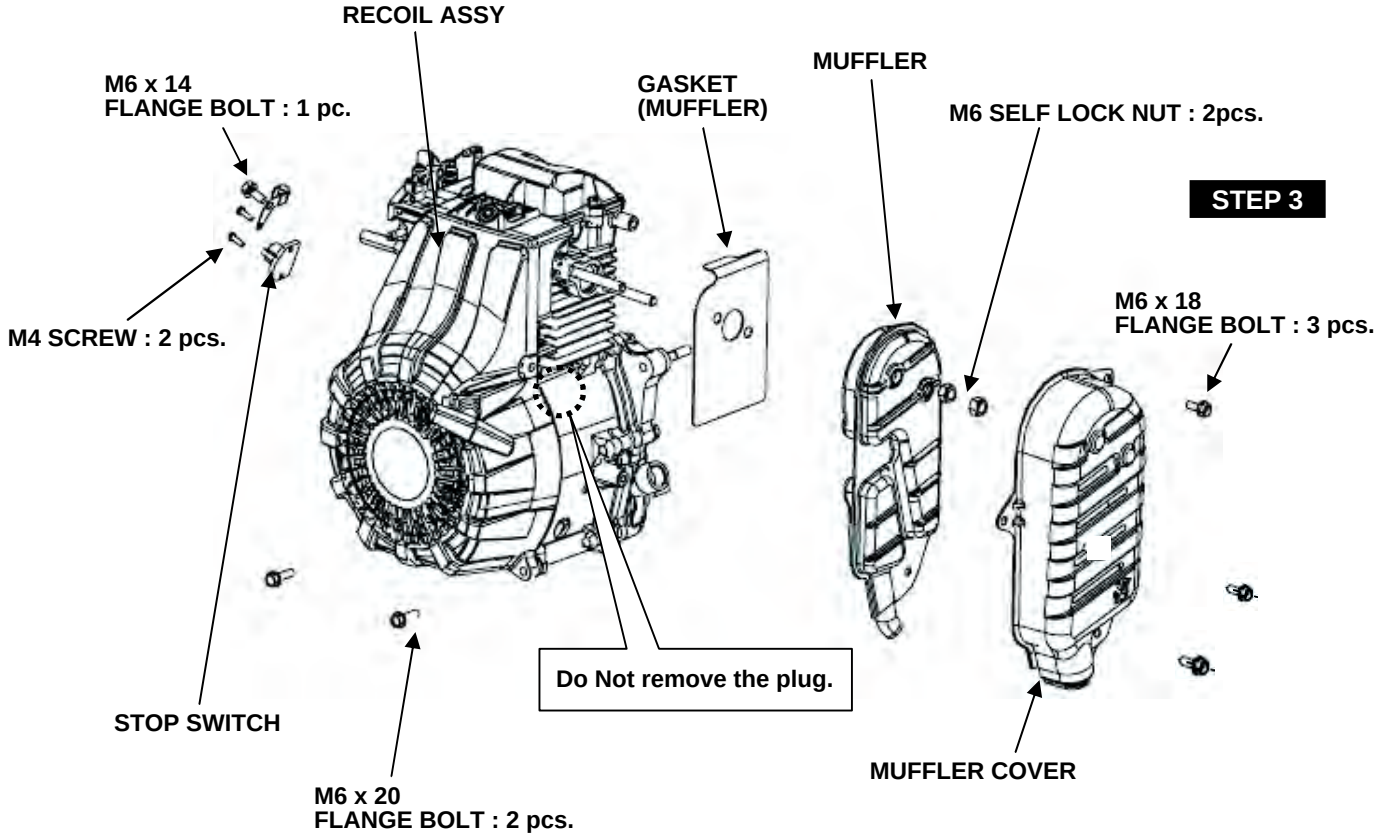
CHAIN WRENCH

5-3 DISASSEMBLY PROCEDURE

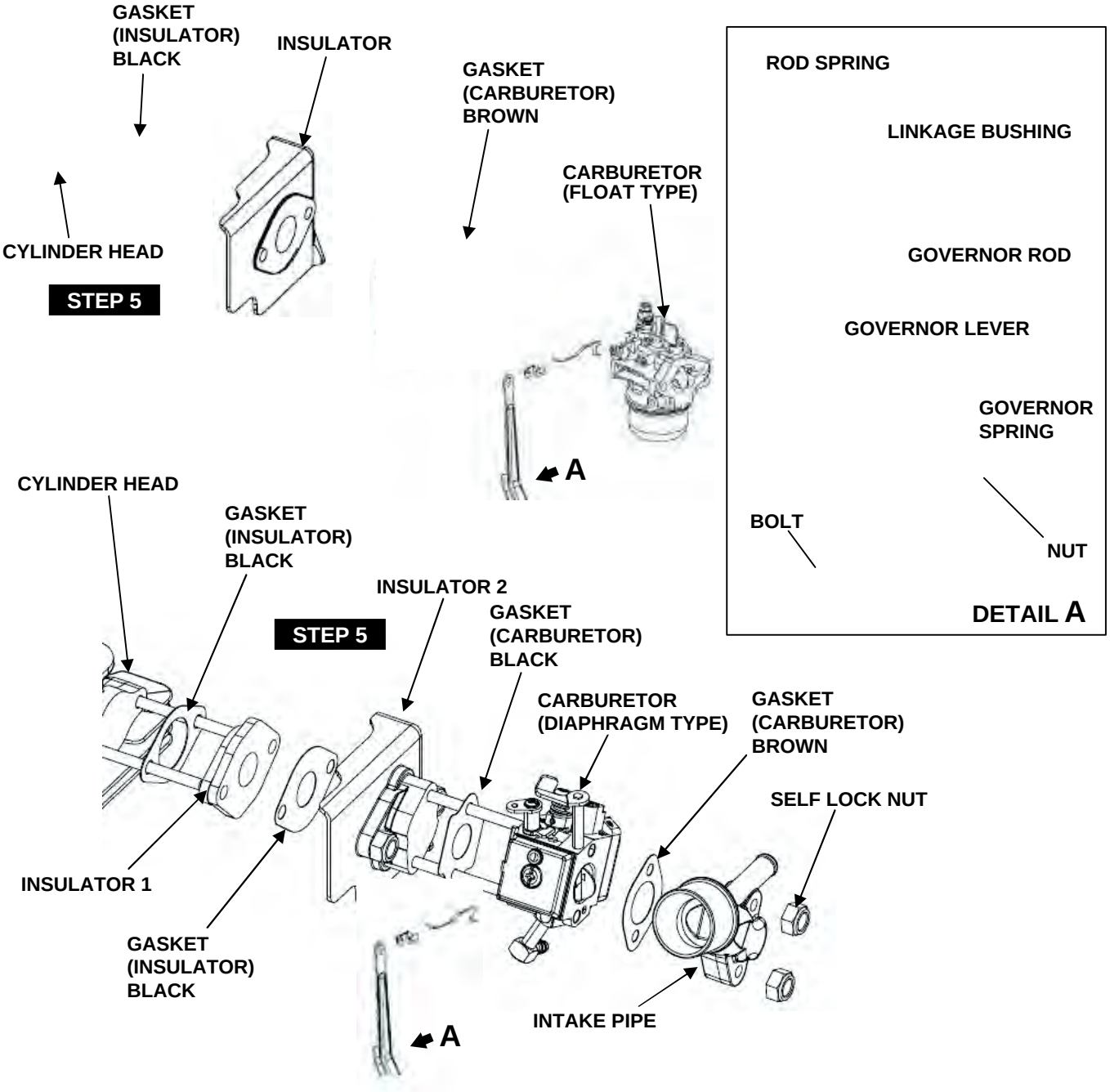
Step	Parts to remove	Remarks and procedures	Fasteners
1	Drain the engine oill	Remove a drain plug (M8 x 12mm) located on both sides of the case. Take care not to lose the gaskets. ∗ To discharge oil quickly, remove the oil gauge(M22).	12 mm spanner
2	Air cleaner	Remove breather pipe from rocker cover.	10mm box spanner M6 nut:2pcs.



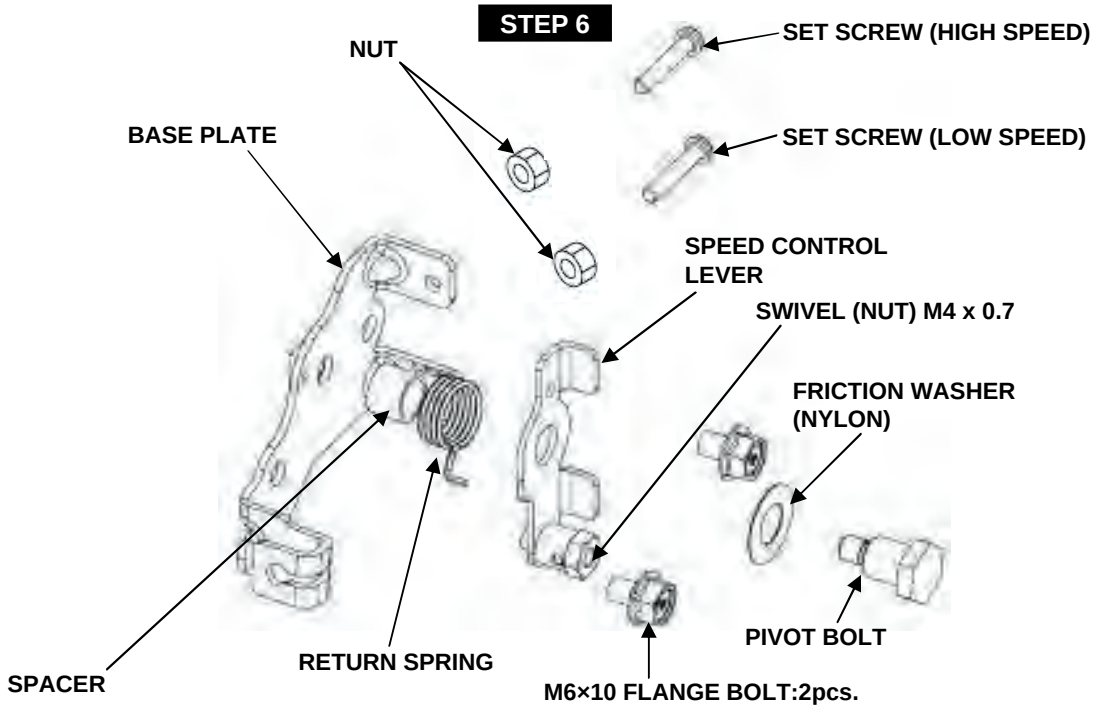
Step	Parts to remove	Remarks and procedures	Fasteners
3	Muffler and Muffler cover	(1) Remove the muffler cover from the muffler and gasket(muffler). (2) Remove the muffler from the cylinder head. Take care not to lose the gasket. ＊ Take care not to cut your hand with muffler gasket.	10mm box spanner or spanner 13mm box spanner M6×18mm:3pcs. M6 nut:2pcs.
4	Recoil starter	Disconnect wire of stop switch first, then remove recoil starter.	10mm box spanner M6×20mm:2pcs. M6×14mm:1pc.



Step	Parts to remove	Remarks and procedures	Fasteners
5	Carburetor, Insulator	Remove the linkage bushing from governor rod. (1) Loosen the and remove the governor lever from the governor shaft. There is no need to remove the bolt. (2) Remove the governor spring. (3) Remove the governor rod and the rod spring from the carburetor. Remove the carburetor from the cylinder head. Remove the insulator.	10mm box spanner or spanner M6×20mm:1pc. M6 Nut:1pc.

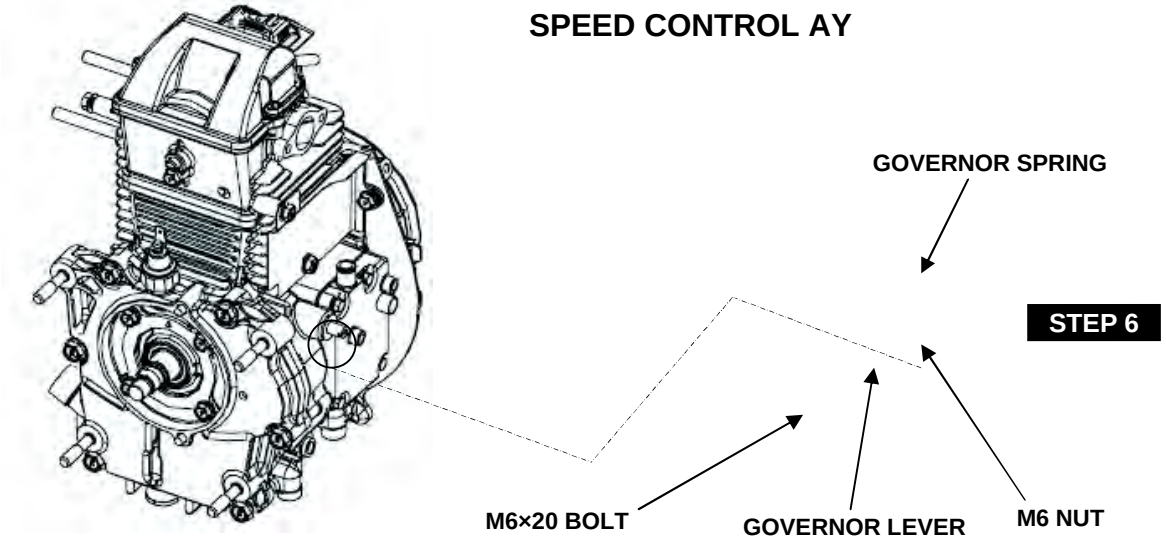


Step	Parts to remove	Remarks and procedures	Fasteners
6	Speed control lever and Base plate	Remove the speed control lever and base plate from the crankcase. (If necessary)	10mm box spanner M6×10mm:2pcs. 14mm box spanner Pivot bolt:1pc.

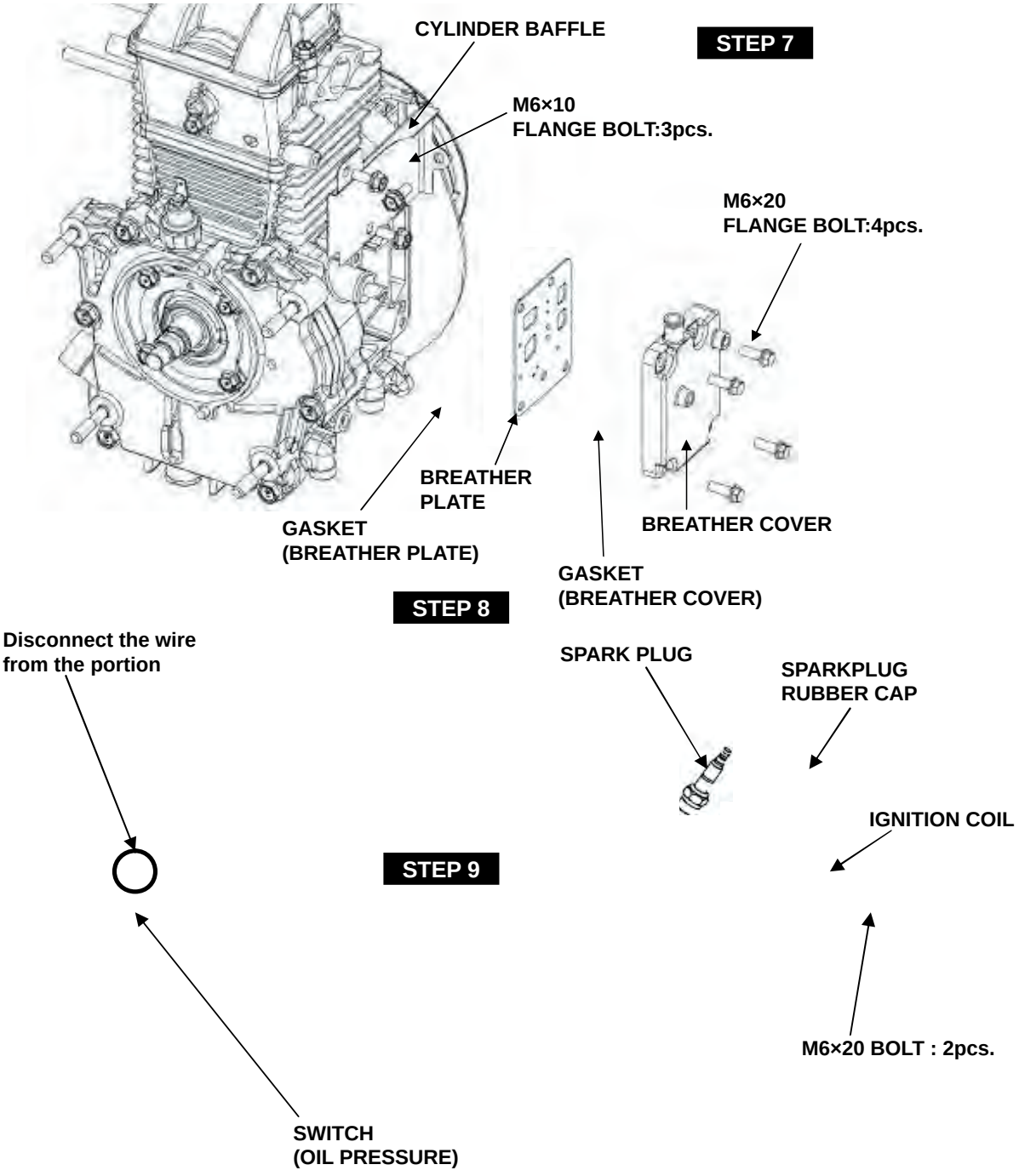


PIVOT BOLT Tightening torque : 7.0 - 9.0 N•m (70 - 90 kgf•cm) (5.1 - 6.5 ft•lb.)

SPEED CONTROL AY



Step	Parts to remove	Remarks and procedures	Fasteners
7	Cylinder baffle	Remove the Cylinder baffle. (If necessary)	10 mm box spanner M6 x 10 mm : 3 pcs.
8	Breather	Remove the breather cover and plate. (If necessary)	8 mm box spanner M6 x 20 mm : 4 pcs.
9	Ignition coil	Remove the spark plug cap from the spark plug. Disconnect wire of oil pressure switch. Remove the ignition coil from the crankcase.	10 mm box spanner M6 x 25 mm : 2 pcs.



Step	Parts to remove	Remarks and procedures	Fasteners
10	Flywheel	Remove the starting pully from the flywheel. Fit a box wrench or a socket wrench on the flywheel nut and loosen the nut by knocking the wrench sharply with a hammer. (See Fig.4-a) NOTE: 1. Do not insert screwdriver or other object between the flywheel blades which is a synthetic resin, otherwise the risk of damaging the blades might be occurred. 2. Knock the wrench with a hammer in a counter clockwise direction. Remove the flywheel from the crankshaft. Leave the nut temporarily to prevent the flywheel from dropping out. Fit the flywheel puller as shown in Figure4-b and remove the flywheel from the crankshaft by rotating the bolt at the center in a clockwise direction.(Knock the center bolt with a hammer sometimes)	19 mm socket wrench M14 nut : 1pc. Flywheel puller

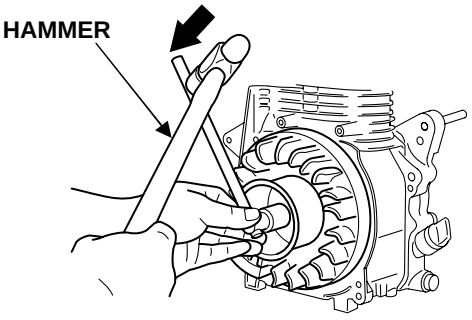
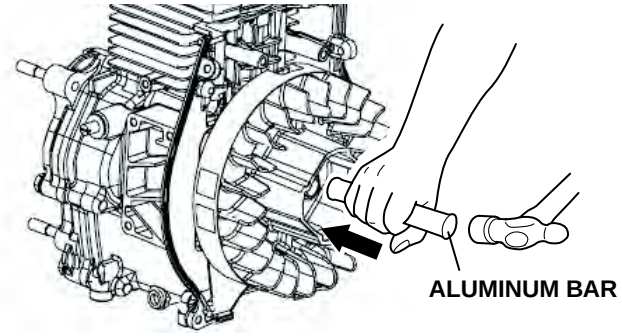
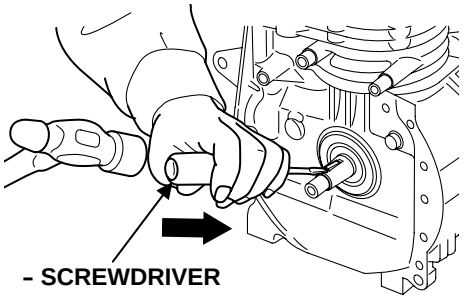


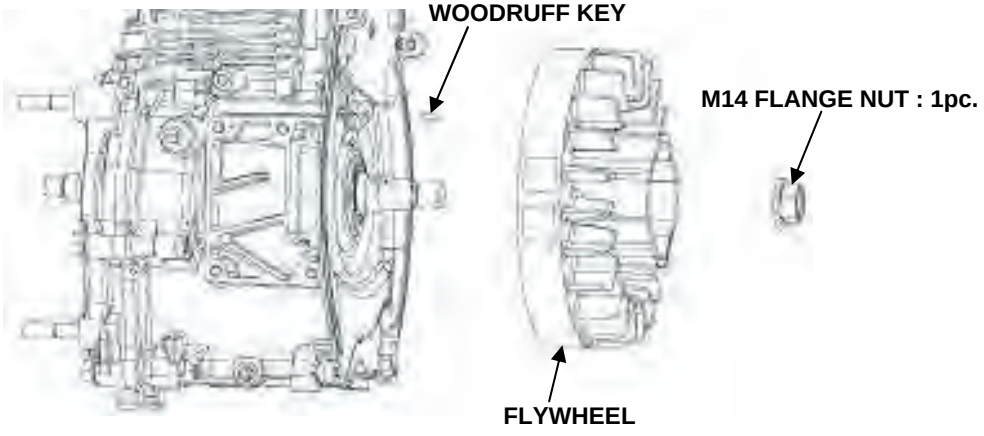
Fig.4-a



STEP 10

Fig.4-b





Step	Parts to remove	Remarks and procedures	Fasteners
11	Spark plug	Remove the spark plug from the cylinder head.	16mm plug wrench
12	Rocker cover	(1) Remove the rocker cover from the cylinder head . (2) Remove the gasket (rocker cover)	10mm box spanner M6×14mm : 2pcs.
13	Rocker arm	Remove the pin (rocker arm)and the rocker arm from the cylinder head at the compression top dead center. (See Fig.4-c)	Pliers

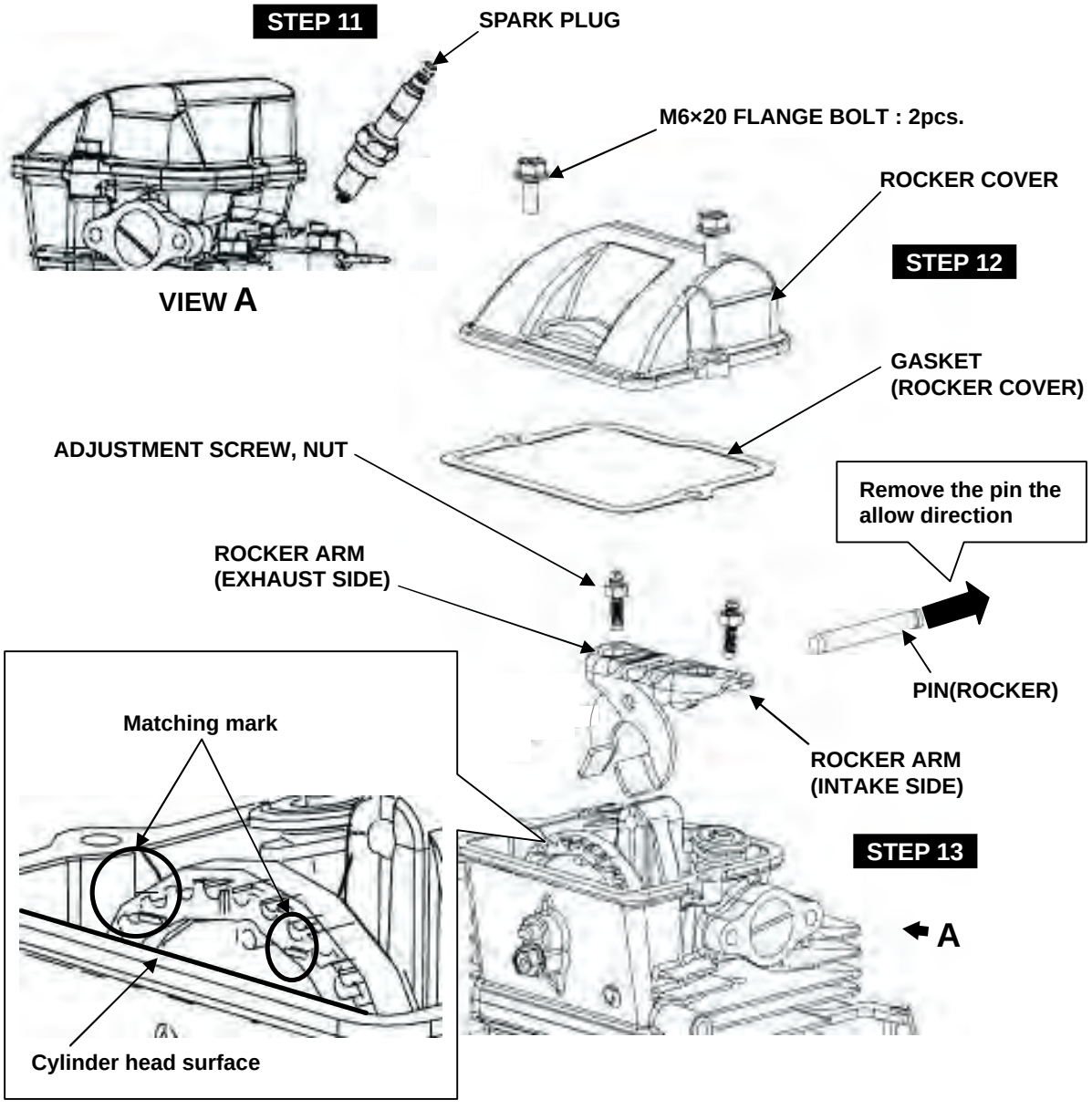
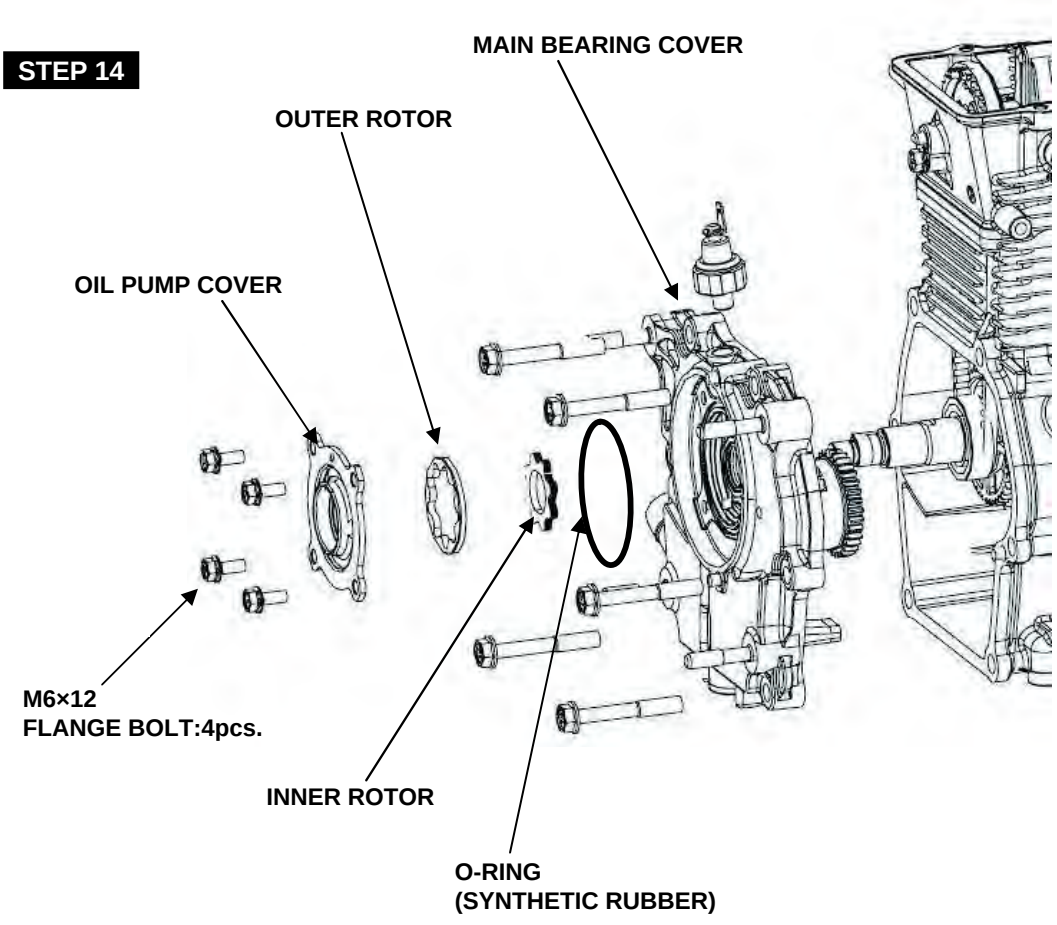
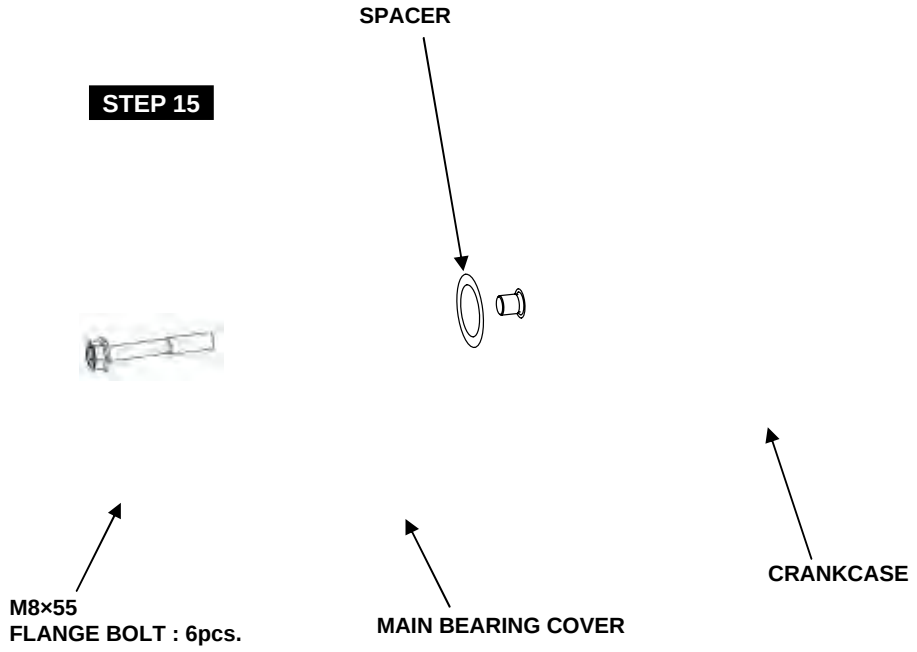


Fig.4-c

Step	Parts to remove	Remarks and procedures	Fasteners
14	Oil pump	Remove oil pump cover o-ring outer rotor and inner rotor.	8mm box wrench M6×12mm:4pcs.



Step	Parts to remove	Remarks and procedures	Fasteners
15	Main bearing cover	Remove the flange bolts of main bearing cover from the crankcase. Remove the main bearing cover while tapping gently around the cover using a plastic hammer or similar tool. (See Fig.4-d) Be careful not to damage the oil gauge or oil seal or not to lose the pipe knocks.	12mm box wrench M8×55mm:6pcs.



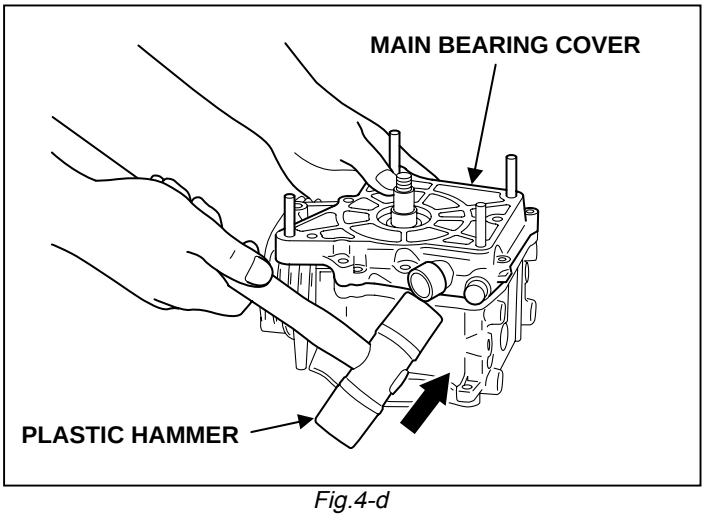
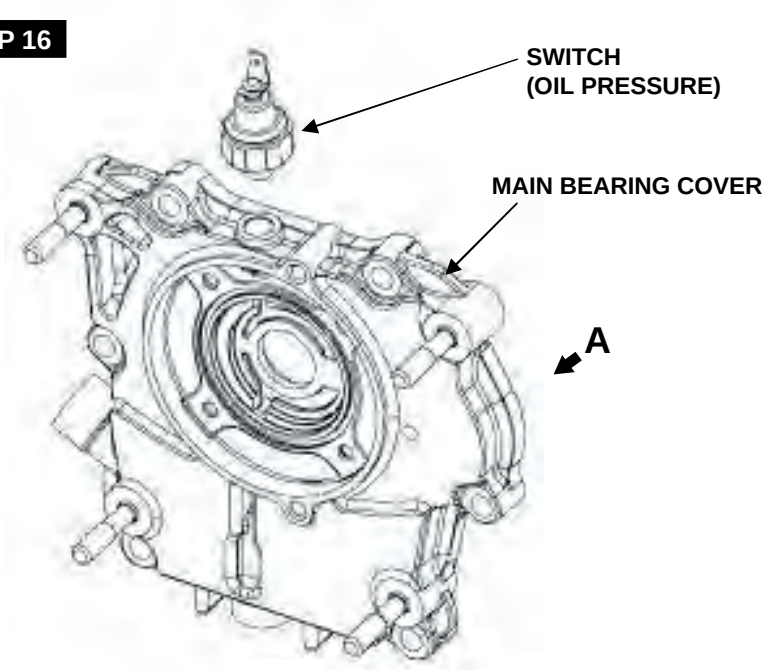


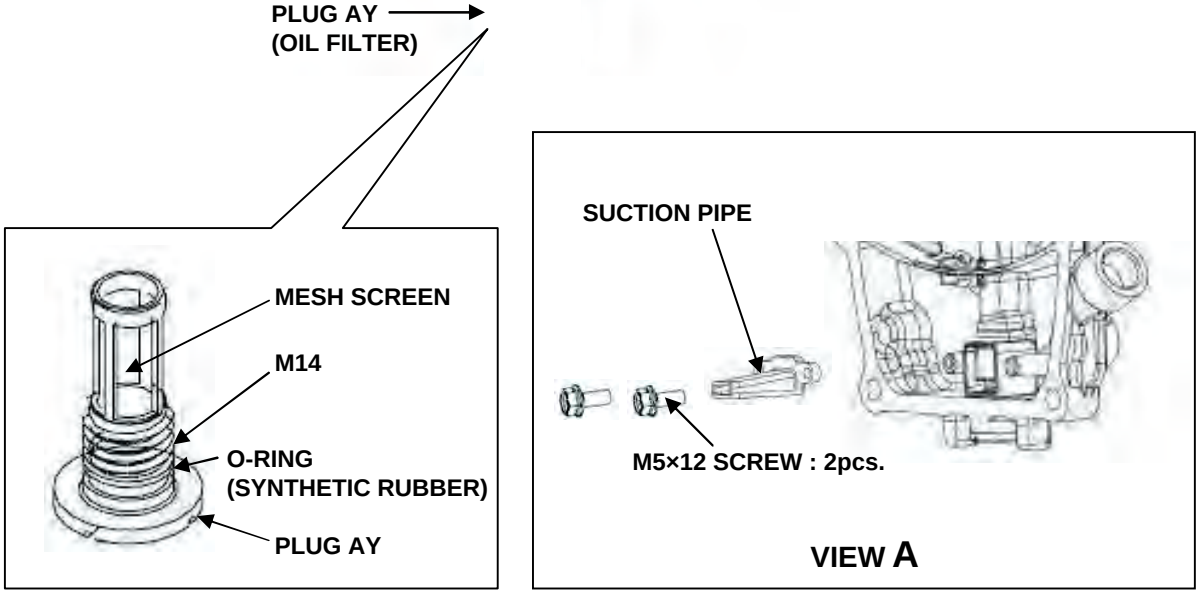
Fig.4-d

Step	Parts to remove	Remarks and procedures	Fasteners
16	Switch (Oil pressure)	Remove the oil pressure switch. (If necessary)	24mm spanner
17	Plug and suction pipe	Remove the plug and suction pipe from the main bearing cover. (If necessary)	M5×12mm:2pcs.

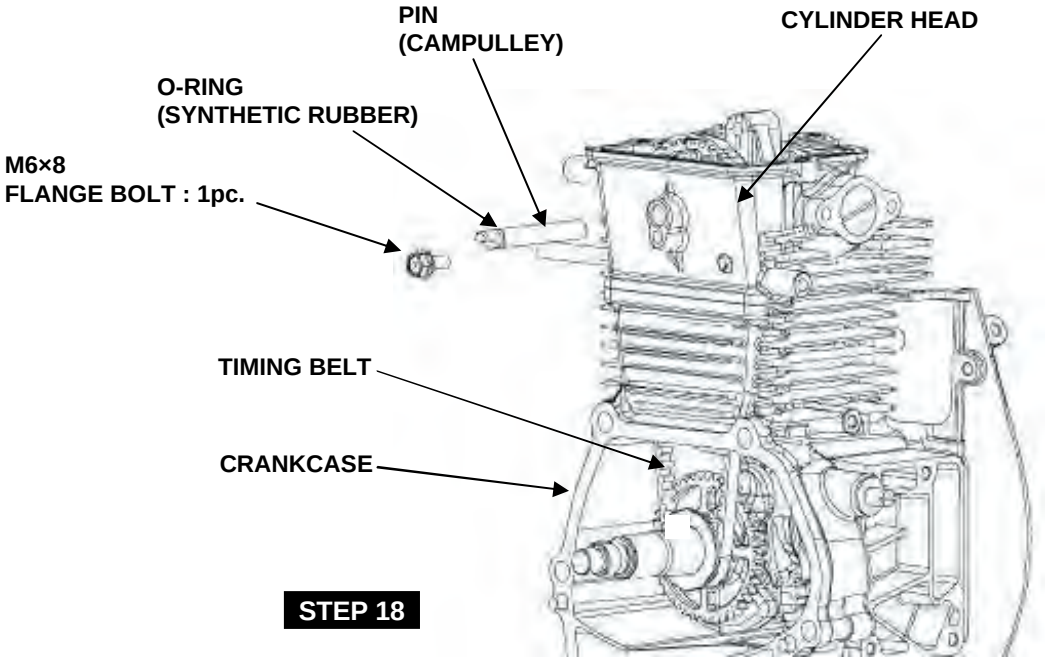
STEP 16

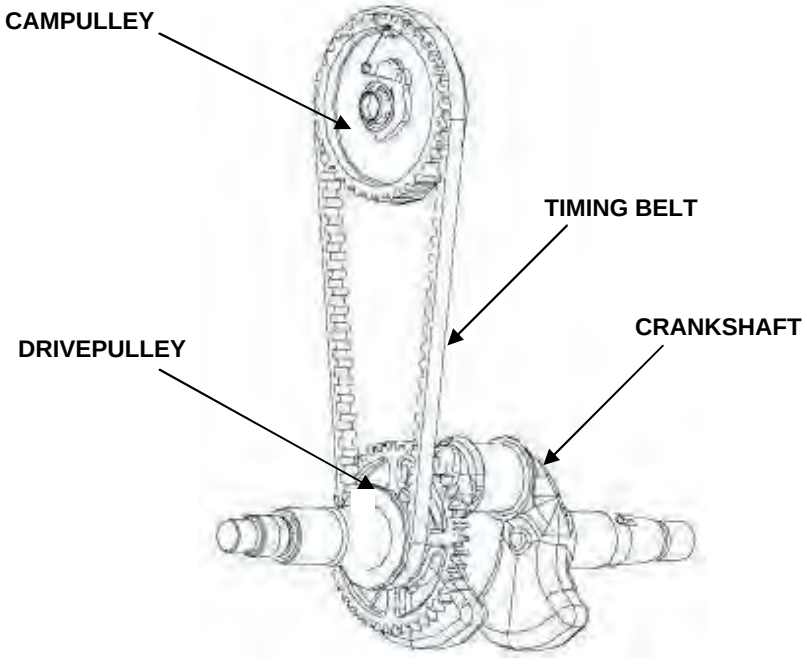


STEP 17



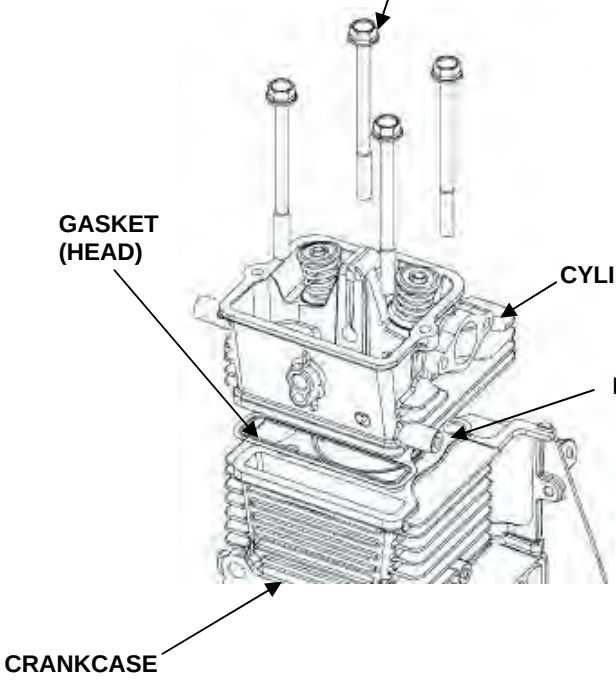
Step	Parts to remove	Remarks and procedures	Fasteners
18	Campulley	(1) Remove the retaining bolt of pin (campulley) from the cylinder head. (2) Remove the pin (campulley), taking care not to scratch the O-ring. (3) Remove the timing belt from the campulley and then take out the campulley. (4) Remove the timing belt from the crankshaft.	10mm box spanner M6×8mm:1pc. Pliers



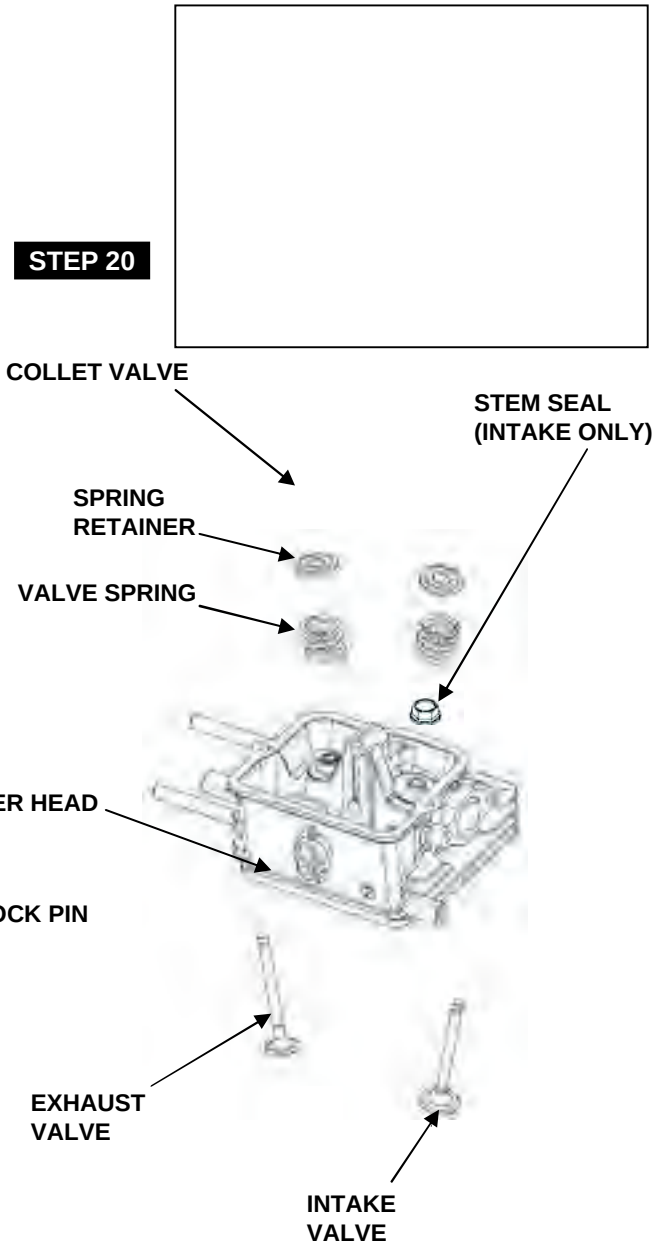


Step	Parts to remove	Remarks and procedures	Fasteners
19	Cylinder head	(1) Remove the cylinder head from the crankcase. (2) Remove the cylinder head gasket from the cylinder head. Take care not to lose the pipe knock	12mm box spanner M8×98mm:4pcs.
20	Intake and exhaust valves	(1) Remove the collet valve from the spring retainer. (If necessary) (2) Remove the intake valve and the exhaust valve.	

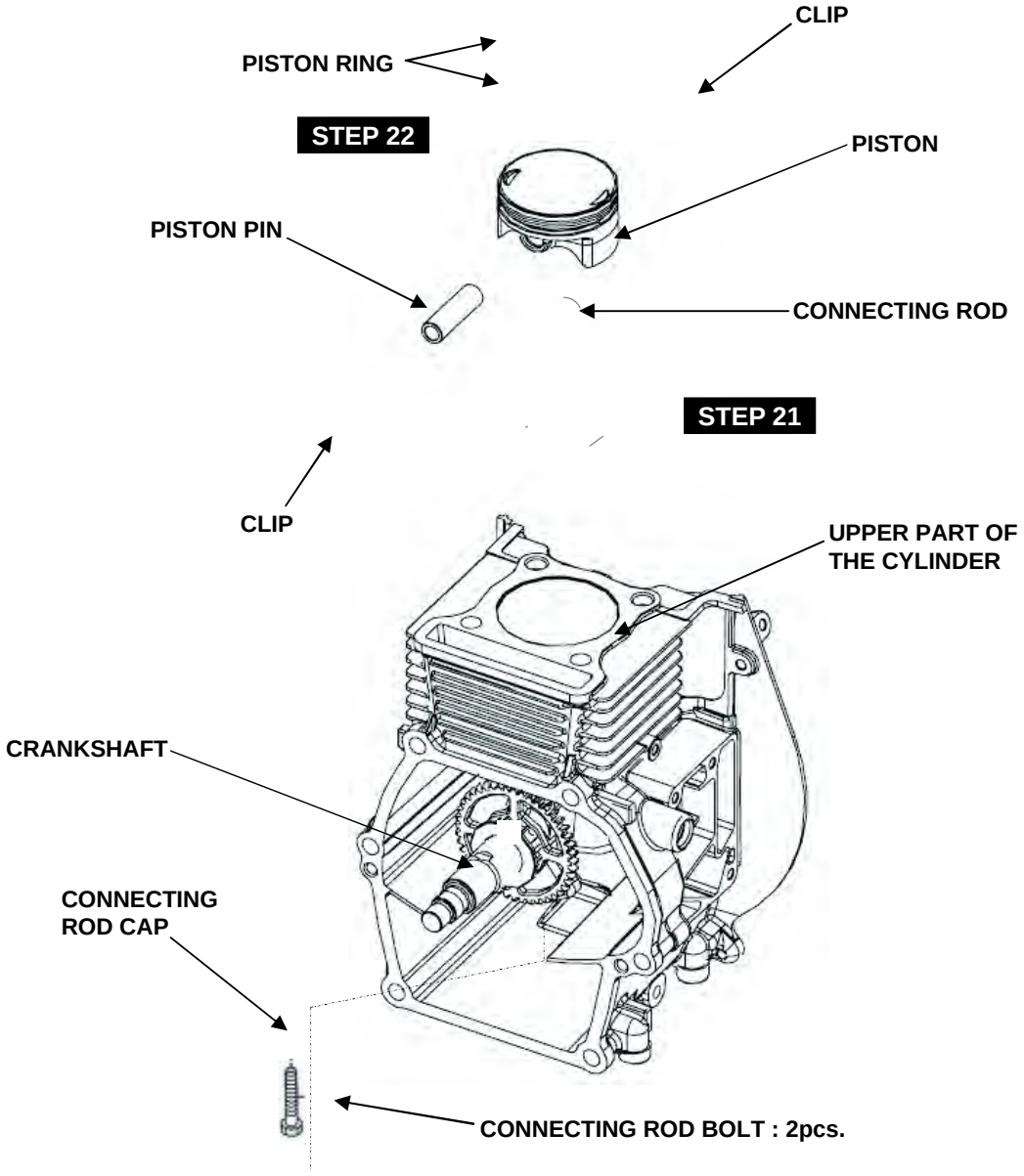
STEP 19



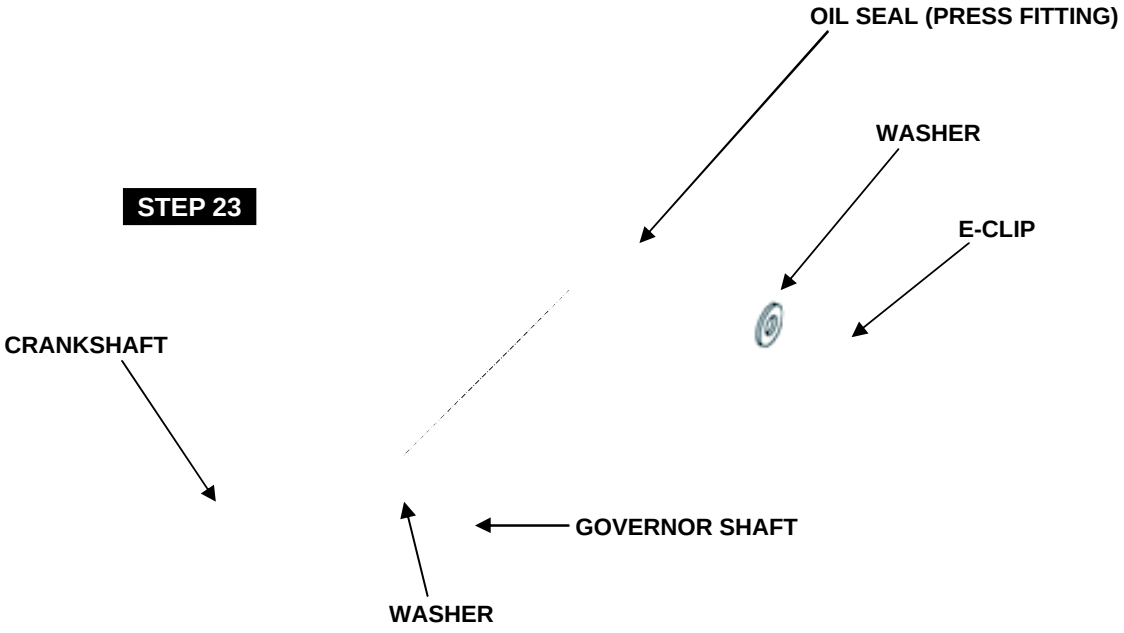
STEP 20



Step	Parts to remove	Remarks and procedures	Fasteners
21	Connecting rod and piston	(1) Scrape off any carbon from the cylinder and the piston head, then remove the connecting rod bolt. (2) Remove the connecting rod cap. (3) Rotate the crankshaft until the piston comes to its top position. Push the connecting rod and remove the piston from the upper part of the cylinder.	8mm box spanner M5×25mm:2pcs.
22	Piston and piston rings	(1) Remove the piston clips(2pcs.). Take out the piston pin and then remove the piston from the connecting rod small end, taking care not to damage the connecting rod small end. (2) Remove the piston rings from the piston by spreading them at the gap. Take special care not to damage the rings when doing this.	



Step	Parts to remove	Remarks and procedures	Fasteners
23	Crankshaft	(1) Remove the woodruff key (for the flywheel magneto). (2) Remove the crankshaft from the crankcase by tapping its magneto side end with a plastic hammer, taking care not to damage the oil seal.	Plastic hammer



5-4 REASSEMBLY PROCEDURE

5-4-1 NOTES ON REASSEMBLY

(1) Clean the each parts carefully, taking special care with the piston, cylinder, crankshaft, connecting rod and bearings.

(2) Scrape off any carbon deposits on the cylinder head and the piston head. Be particularly careful when removing carbon from the piston ring grooves.

(3) Inspect the oil seals for any damage to the lip. Replace them if damaged. Apply oil to the lip before reassembly.

(4) Replace all the gaskets with new ones.

(5) Replace the keys, pins, bolts and nuts with new ones, if necessary.

(6) Tighten nuts and bolts to the specified torque settings.

(7) When reassembling the engine, apply oil to all moving parts.

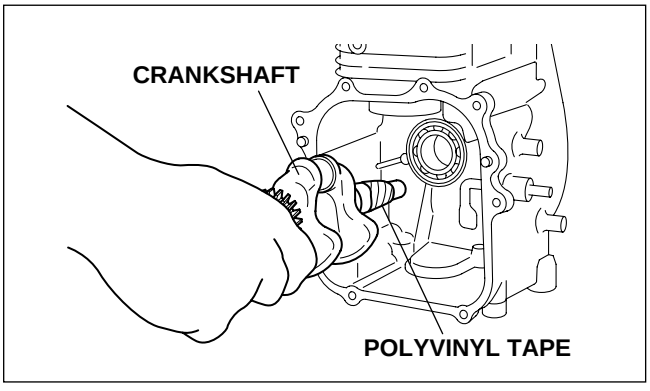
(8) Check clearances and end plays and adjust, if necessary.

(9) When mounting any major part during reassembly of the engine, rotate it with your hand to check for any jamming or abnormal noise.

5-4-2 ASSEMBLY STEPS AND PRECAUTIONS

(1) CRANKSHAFT

(a) Wrap the key-way portion of the crankshaft with polyvinyl tape and insert the crankshaft into the crankcase, taking care not to damage the oil seal lip.



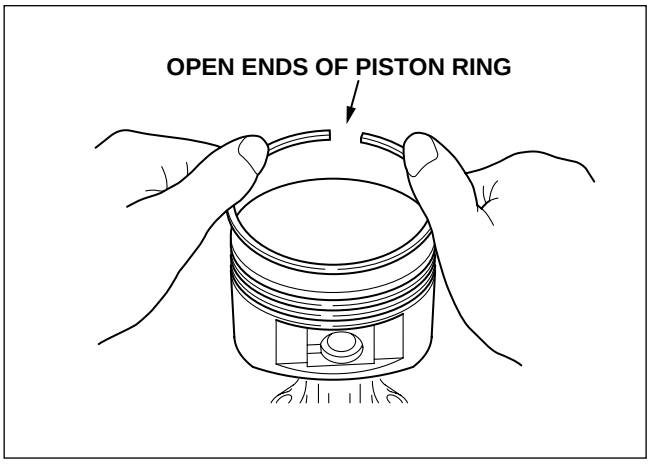
(b) Insert the woodruff key (for the flywheel magneto).

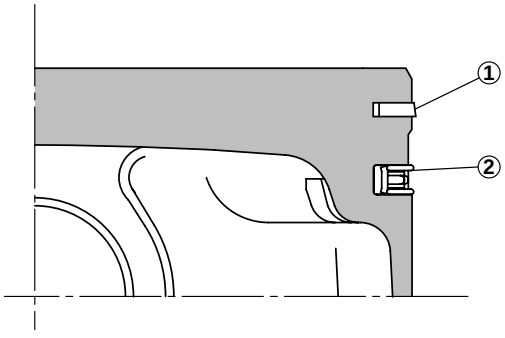
NOTE: Do not insert the woodruff key before inserting the crankshaft into the crankcase.

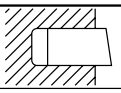
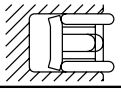
(2) PISTON AND PISTON RINGS

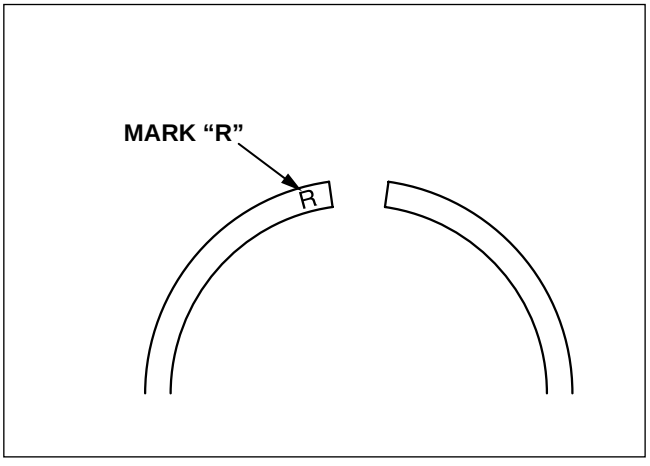
(a) Install each piston ring in the correct groove of the piston by widening it enough to slide it over the piston.

NOTE: Be careful not to twist the rings too much, as they may be damaged. Install the oil ring first, followed by the top ring. When installing the piston ring, make sure that the "R" mark is face up.





①	TOP RING	TAPER	
②	OIL RING	THREE-PIECE CONSTRUCTION	



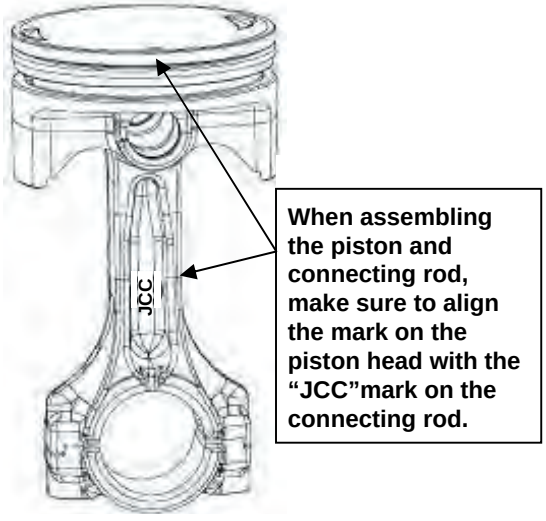
(3) PISTON AND CONNECTING ROD

The piston is attached to the connecting rod by the piston pin.

When assembling the piston and connecting rod, make sure to align the mark on the piston head with the 'JCC' mark on the connecting rod.

NOTE 1: Before assembling the connecting rod, apply oil to its small end.

NOTE 2: Be sure to insert the clips in the two ends of the piston pin and check the clips for any play.

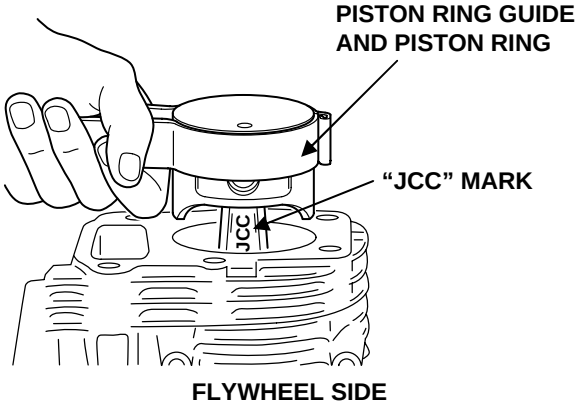


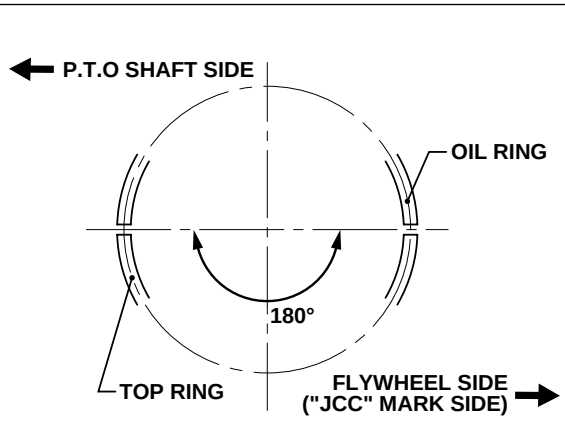
(4) CONNECTING ROD

(a) Install the piston and connecting rod assembly into the cylinder by holding the piston rings with the ring guide, with the 'JCC' mark on the connecting rod on the flywheel side. (If you do not have a ring guide, hold the piston rings with the fingers and tap the upper part of the piston with a piece of wood.)

NOTE 1: Apply oil to the piston rings, the large end of the connecting rod and cylinder before installing the connecting rod into the cylinder.

NOTE 2: The piston ring gaps should be positioned around the piston at 180-degree intervals.





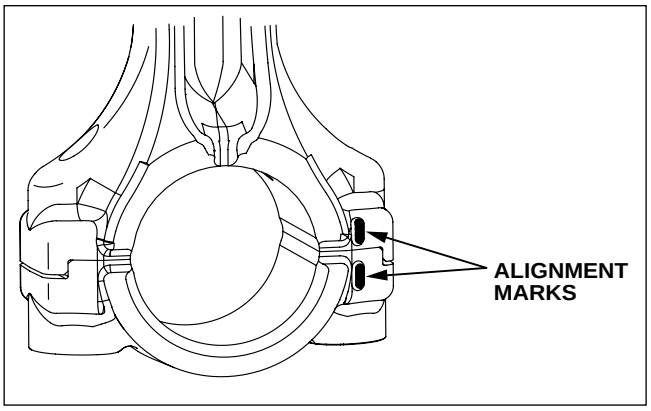
(b) Rotate the crankshaft down to the bottom dead center and lightly tap the piston head until the large end of the connecting rod touches the crank pin.

(c) To mount the connecting rod, line up the matching marks and fit the clinch portions firmly together.

M5×25mm Connecting rod bolt : 2pcs.
(8mm box wrench)

Tightening torque
6.0 - 8.0 N·m (60 - 80 kgf·cm) (4.3 - 5.8 ft·lb.)

(d) Check for free movement of the connecting rod by turning the crankshaft slowly.

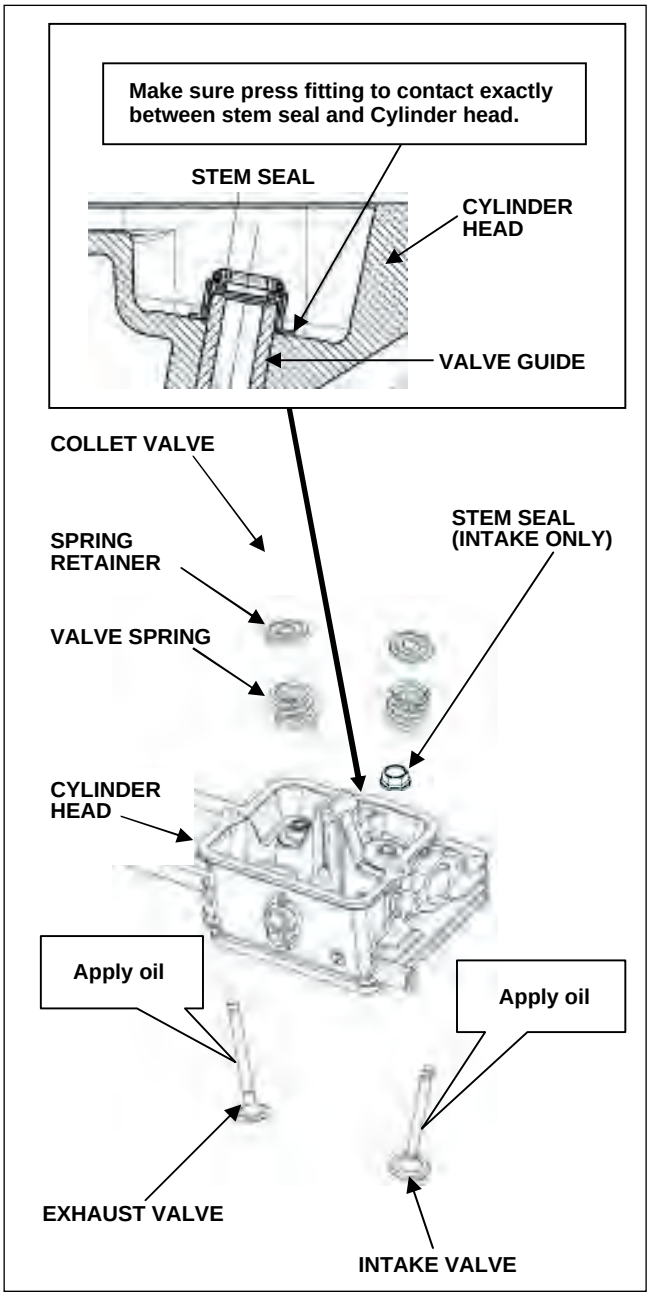


(5) INTAKE AND EXHAUST VALVES

Take the following points into account when mounting the intake and exhaust valves on the cylinder head.

NOTE 1: Replace the valve with a new one if it shows signs of wear.

NOTE 2: Carefully scrape off any carbon deposits on the combustion chamber. Apply oil to the valve stems before mounting the intake and exhaust valves. Insert the valves in the cylinder head and place it on a level workbench. Next, mount the valve springs, the spring retainers and collet valves. (Mount the stem seal on the intake valve guide.)



(6) CYLINDER HEAD

(a) Inspect and repair any scratches on mounting surface and replace head gasket to new one before installing.

(b) Insert the pipe knocks between crankcase and cylinder head.
Install cylinder head onto cylinder with new head gasket.
Apply oil to the screw thread.
Tighten four flange bolts evenly in three steps by the following tightening torque:
Cylinder head M8×98mm bolt : 4pcs.

Tightening torque		
1 st step	**2 st step**	**Final step**
5.0 N·m (50 kgf·cm) (3.6 ft·lb.)	9.8 N·m (100 kgf·cm) (7.2 ft·lb.)	20.0 - 24.0 N·m (200 - 240 kgf·cm) (14.4 - 17.7 ft·lb.)

(7) SETTING THE TIMING BELT

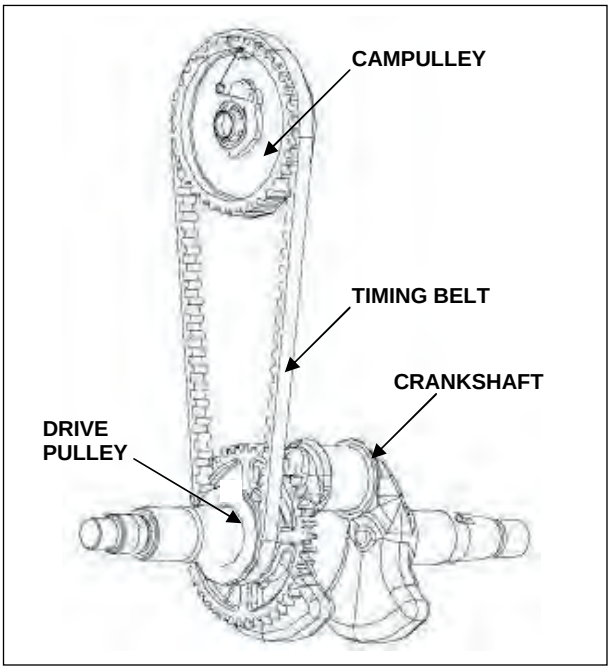
(a) Set the crankshaft to the top dead center.

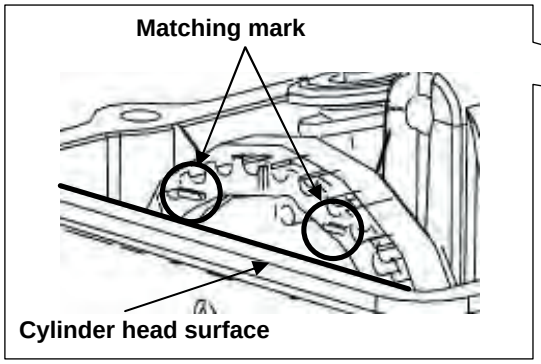
(b) Set the timingbelt to the drive pulley on the crankshaft.

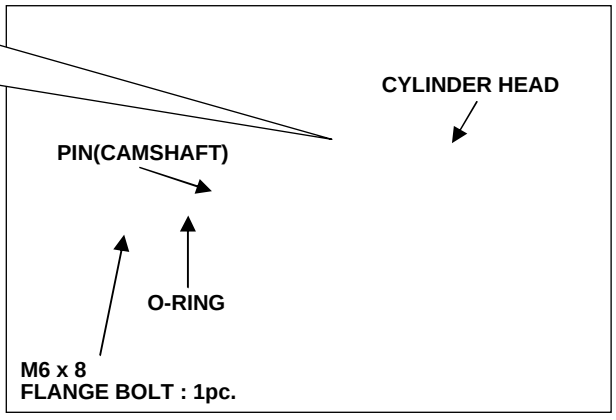
(c) Install the campulley to the cylinder head.
Meet the matching mark of campulley and cylinder head.

(d) Mounting the campulley on the cylinder head.
Mount the campulley on the cylinder head by inserting the pin (campulley)through the head.
Fix the bolt to prevent the pin (campulley) from coming out.
M6×8mm flange bolt : 1pc.

Tightening torque
4.0 - 6.0 N·m (40 - 60 kgf·cm) (2.9 - 4.3 ft·lb.)







(8) ADJUST CRANKSHAFT END PLAY

(1) Adjust end play to 0.2 mm (0.008") using the proper spacer.
The proper spacer may be determined in the following manner.

1) Measure the height “A” (From the mating surface to the inner race of the ball bearing.)

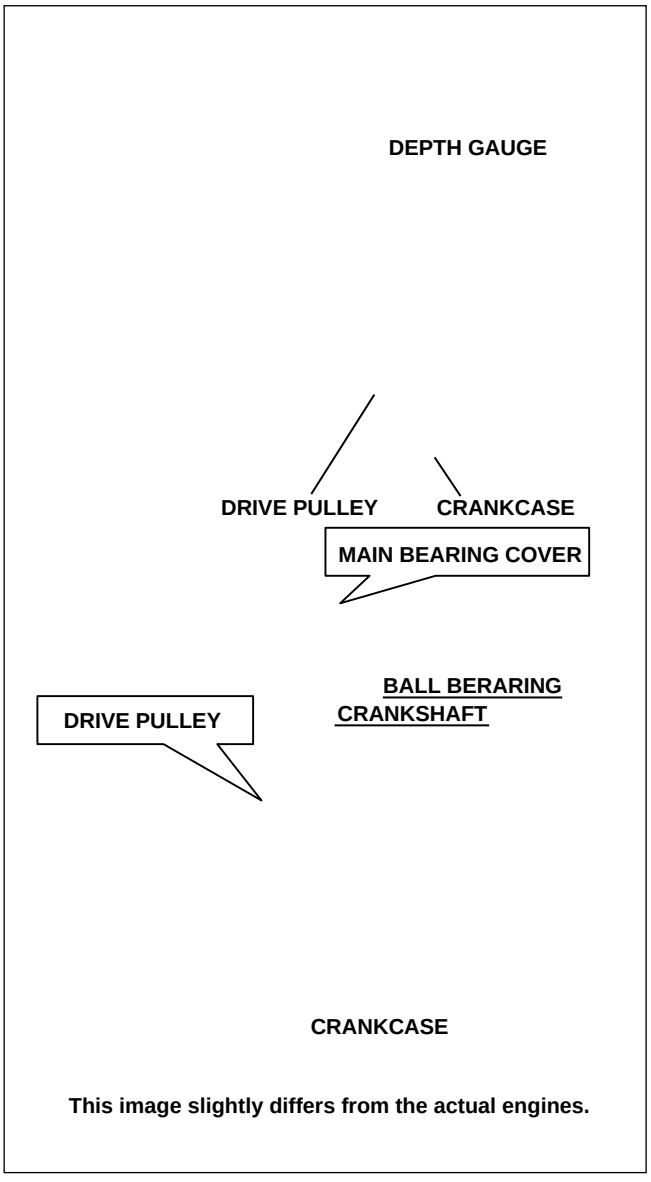
2) Measure the depth “B” (From the mating surface to the drive pulley.)

B – A = SIDE CLEARANCE (mm)
(SIDE CLEARANCE) – 0.2 mm = THICKNESS OF CRANKSHAFT SHIM (mm)

B – A = SIDE CLEARANCE (in.)
(SIDE CLEARANCE) – 0.008 in. = THICKNESS OF CRANKSHAFT SHIM (in.)

Following are available spacer shims.

	CRANKSHAFT
SPACER SHIMS	T = 0.8 mm (0.031 in.) T = 1.0 mm (0.039 in.) T = 1.2 mm (0.047 in.)



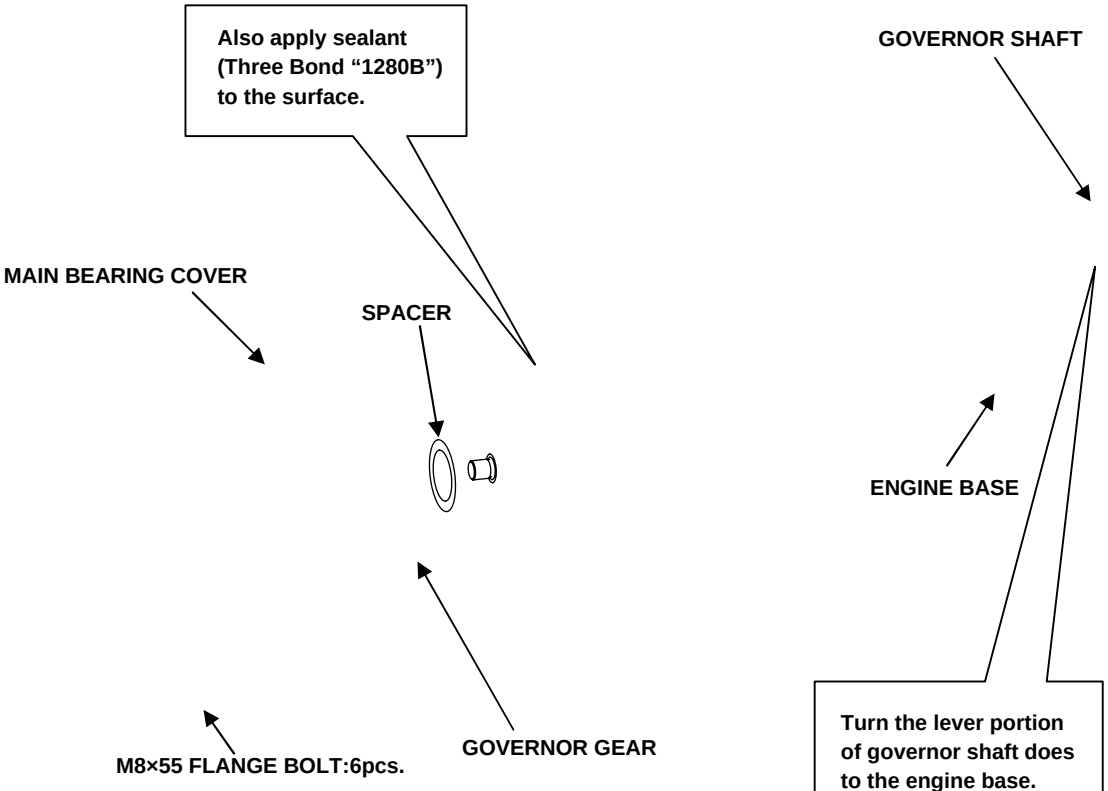
(9) MAIN BEARING COVER

(a) Insert the plug, suction pipe and oil pressure switch.

PLUG	SUCTION PIPE	OIL PRESSURE SWITCH
0.8 - 1.2 N·m (8 - 12 kgf·cm) (0.6 - 0.9 ft·lb.)	6.0- 8.0 N·m (60 - 80kgf·cm) (4.3 - 5.8 ft·lb.)	8.0 - 10.0 N·m (80 - 100 kgf·cm) (5.8 - 7.2 ft·lb.)

(b) Apply oil to the bearing and the oil seal lip when mounting the main bearing cover. Also apply sealant (Three Bond “1208B”) to the surface of the crankcase. To avoid damaging the oil seal lip, wrap the crankshaft key-way portion with polyvinyl tape before mounting the main bearing cover.

NOTE: Turn the lever portion of governor shaft does to the engine base.



Tightening torque
24.0 - 26.0 N·m (240 - 260 kgf·cm) (17.7 - 18.8 ft·lb.)

(10) OIL PUMP and COVER

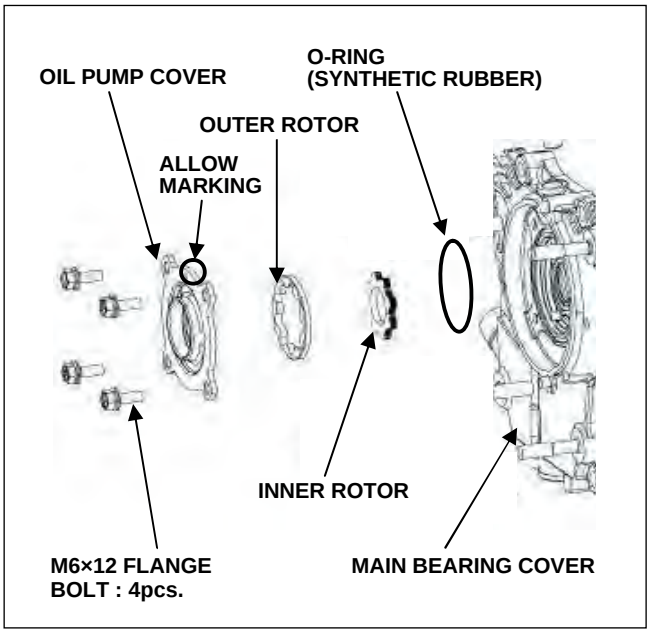
(1) Apply oil to inner and outer rotors of oil pump and attach them in position.

(2) Set O-ring in position.

(3) Install oil pump cover with the allow marking upwards.

M6×12mm flange bolt : 4pcs.

Tightening torque
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)

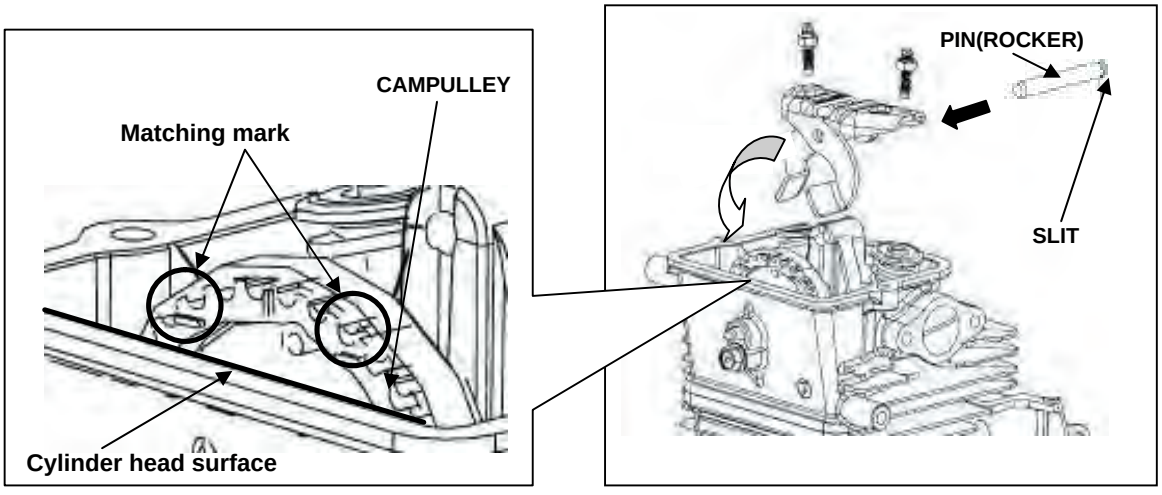


(11) ROCKER ARM

(a) Conduct this job at the compression top dead center.
The position of two matching marks on campulley is in parallel with the cylinder head surface at a time.

NOTE: Make sure that the piston is at the compression top dead center by checking mutual position between the flywheel and the ignition coil is at the top.

(b) Pass the pin (rocker arm) through the rocker arm and mount them on the cylinder head.



(12) VALVE CLEARANCE ADJUSTMENT

Temporarily fit the flywheel.

Rotate the crankshaft up to the compression top dead center and insert the thickness gauge between the valve and the adjusting screw of rocker arm to measure the clearance.

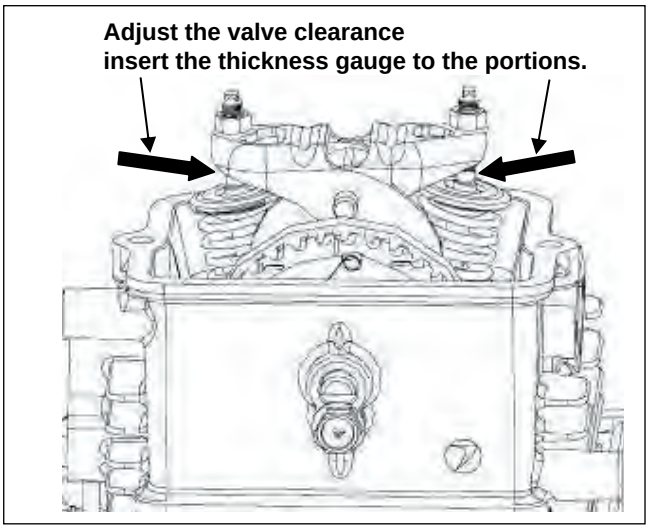
[Adjustment method]

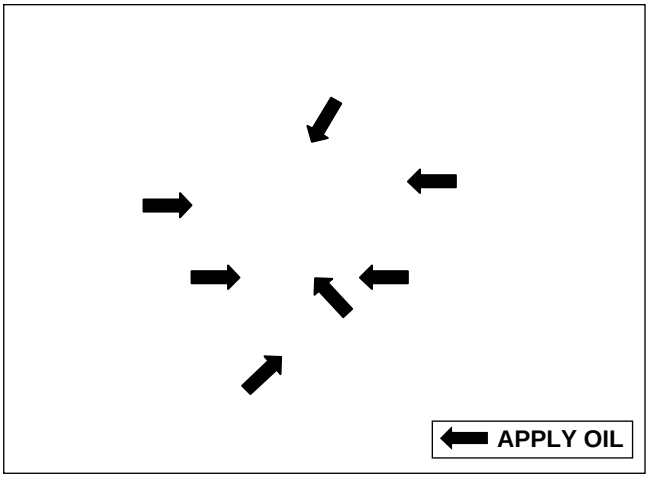
Loosen the nut on the adjustment screw and turn the screw to adjust the valve clearance. When the valve clearance is correct, tighten the nut.

Valve clearance (when the engine is cold)	
Intake valve side	0.11 - 0.16 mm (0.0043 - 0.0063 in.)
Exhaust valve side	

Tightening torque
5.0 - 7.0 N·m (50 - 70 kgf·cm) (3.6 - 5.1 ft·lb.)

NOTE: After adjusting the valve clearances, rotate the crankshaft and check again that the intake and exhaust valve clearance are correct.



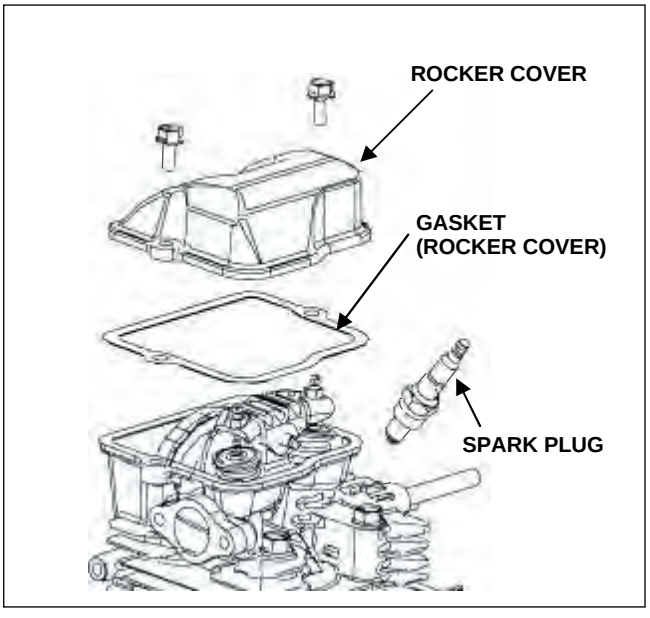


(13) ROCKER COVER

Replace the gasket with a new one, and mount the rocker cover.

M6 × 20 mm flange bolt : 2 pcs.

Tightening torque
5.0 - 7.0 N·m (50 - 70 kgf·cm) (3.6 - 5.1 ft·lb.)



(14) SPARK PLUG

Remove any carbon deposits from the spark plug and inspect the electrode for damage before mounting. Replace with a new one, if necessary.

Spark plug : NGK CR5HSB (16 mm plug wrench)

Electrode gap	**0.6 - 0.7 mm (0.024 - 0.028 in.)**

Tightening torque	
New spark plug	Re-tightening torque
10.0 - 12.0 N·m (100 - 120 kgf·cm) (7.2 - 8.7 ft·lb.)	23.0 - 27.0 N·m (230 - 270 kgf·cm) (16.6 - 19.5 ft·lb.)

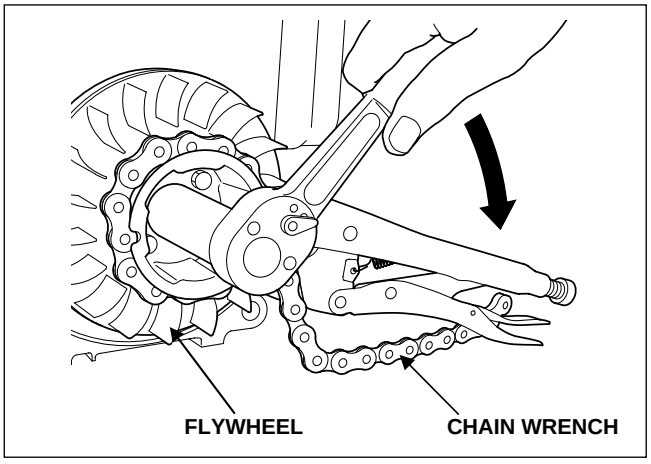
(15) FLYWHEEL

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

(2) Install the flywheel to crankshaft. Tighten the flywheel nut.

Tightening torque
60.0 - 70.0 N·m (600 - 700 kgf·cm) (43.4 - 50.6 ft·lb.)

M14 nut : 1 pc. (19mm box wrench)



(16) IGNITION COIL

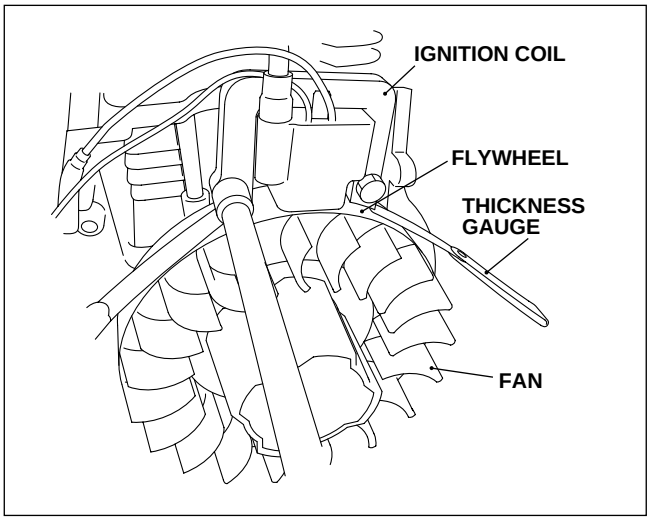
When mounting the ignition coil, insert a thickness gauge between the ignition coil and the flywheel to check the air gap.

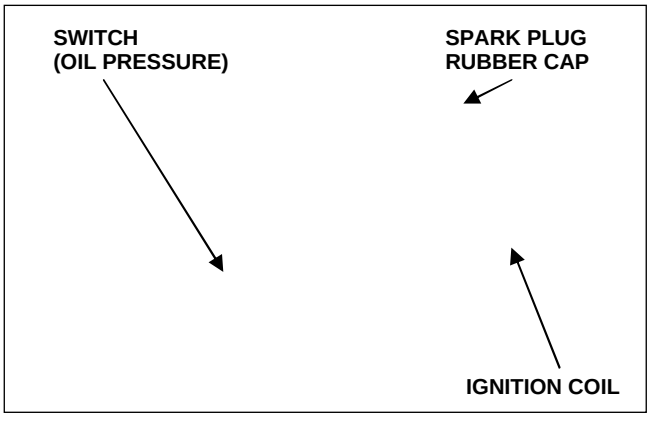
Air gap	**0.3 - 0.5 mm (0.012 - 0.020 in.)**

Tightening torque
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)

M6 × 20 mm bolt and washer : 2 pcs.

Connect wires referring to the wiring diagram.



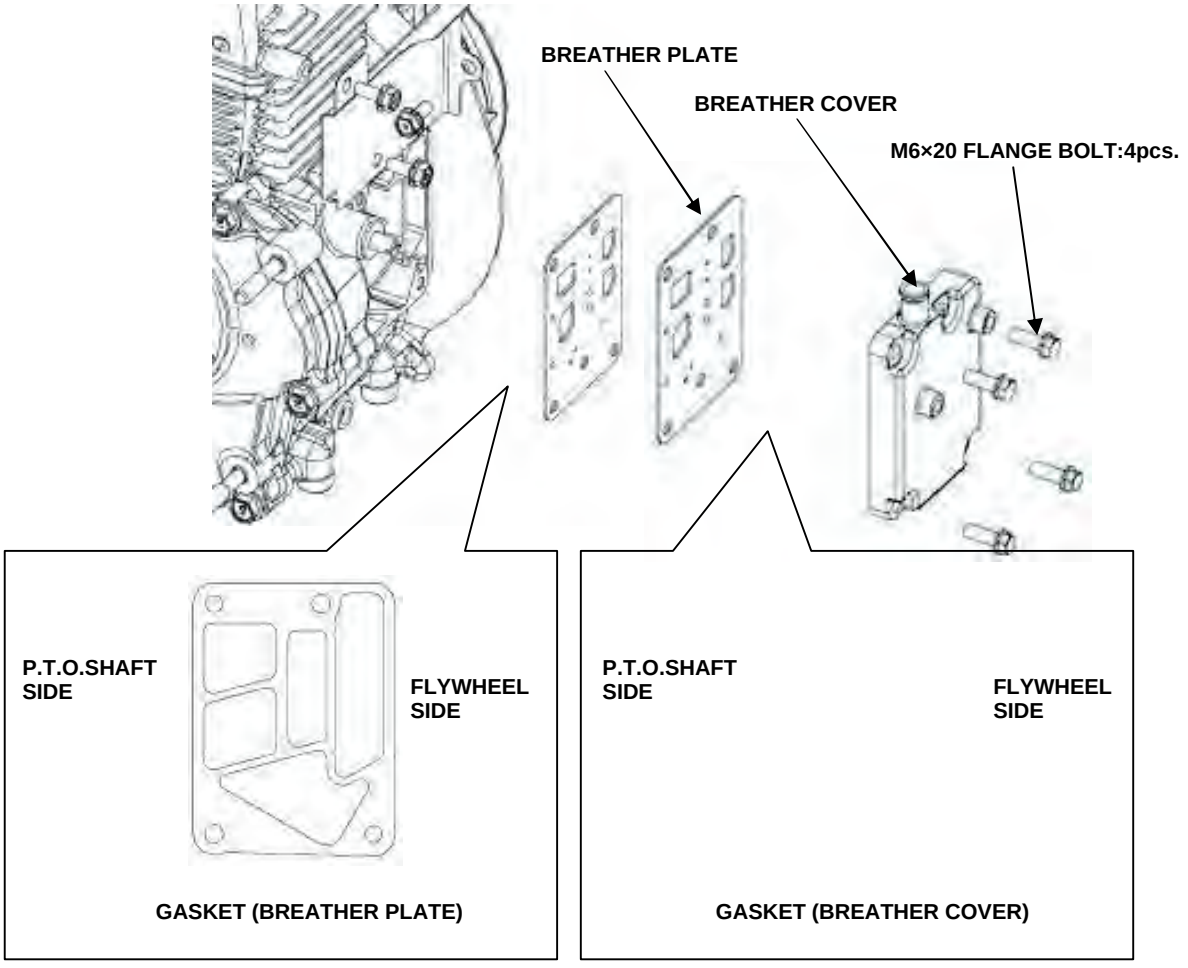


(17) BREATHER

Assemble gasket (breather plate), breather plate, gasket(breather cover) refer to the following.

M6 × 20 mm flange bolt : 4 pcs.

Tightening torque
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)



(18) BAFFLE

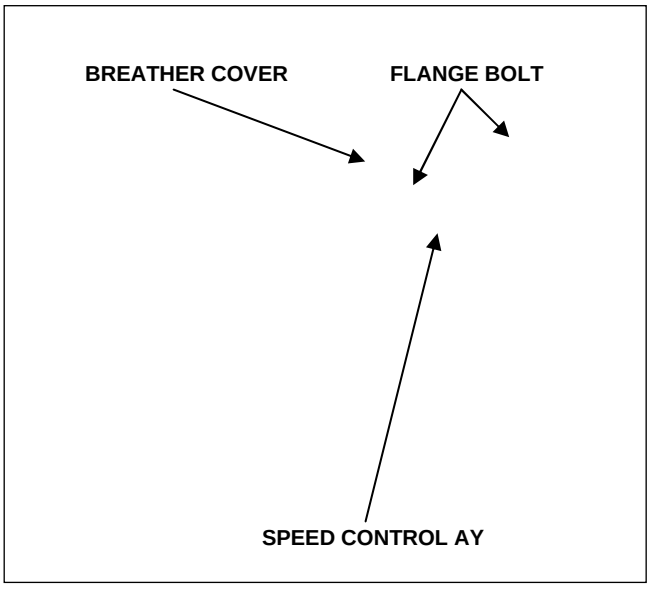
Mount the cylinder baffle to the crankcase with the bolts.

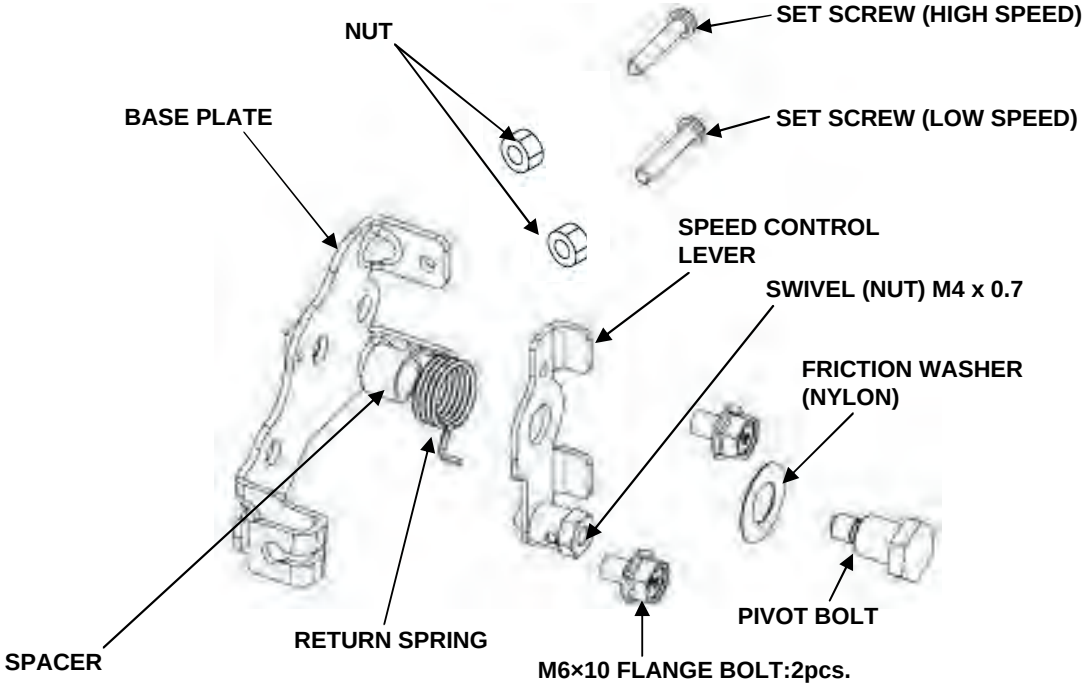
M6 × 10 mm bolt : 3 pcs.

(19) SPEED CONTROL

Install the speed control to the top breather cover with the bolts.

M6 × 10 mm flange bolt : 2 pcs.





(20) GOVERNOR LEVER, CARBURATOR

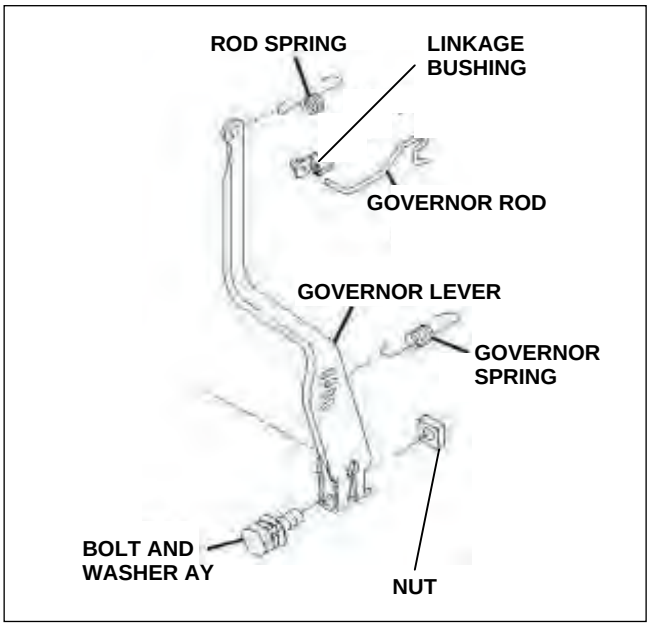
(a) Mount the governor lever on the governor shaft. Do not adjust the bolt on the governor lever yet.

(b) Attach the governor rod and rod spring to the governor lever.

(c) Replace the gasket of insulator with a new one and mount the insulator on the cylinder head intake side.

(d) Hook governor rod to the governor lever and throttle lever of carburator.
mount the carburator to the cylinder head.

(e) Hook the linkage bushing to the governor rod.



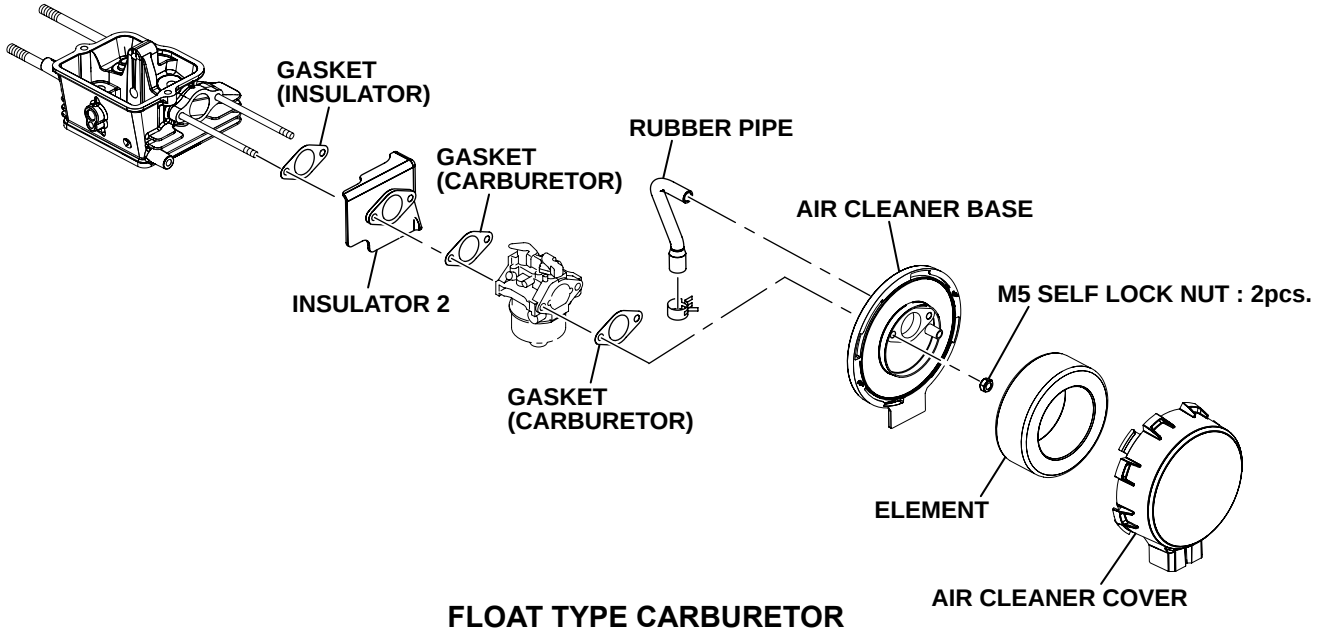
(21) AIR CLEANER BASE

Insert the breather pipe into the breather cover and air cleaner base then mount the air cleaner base.

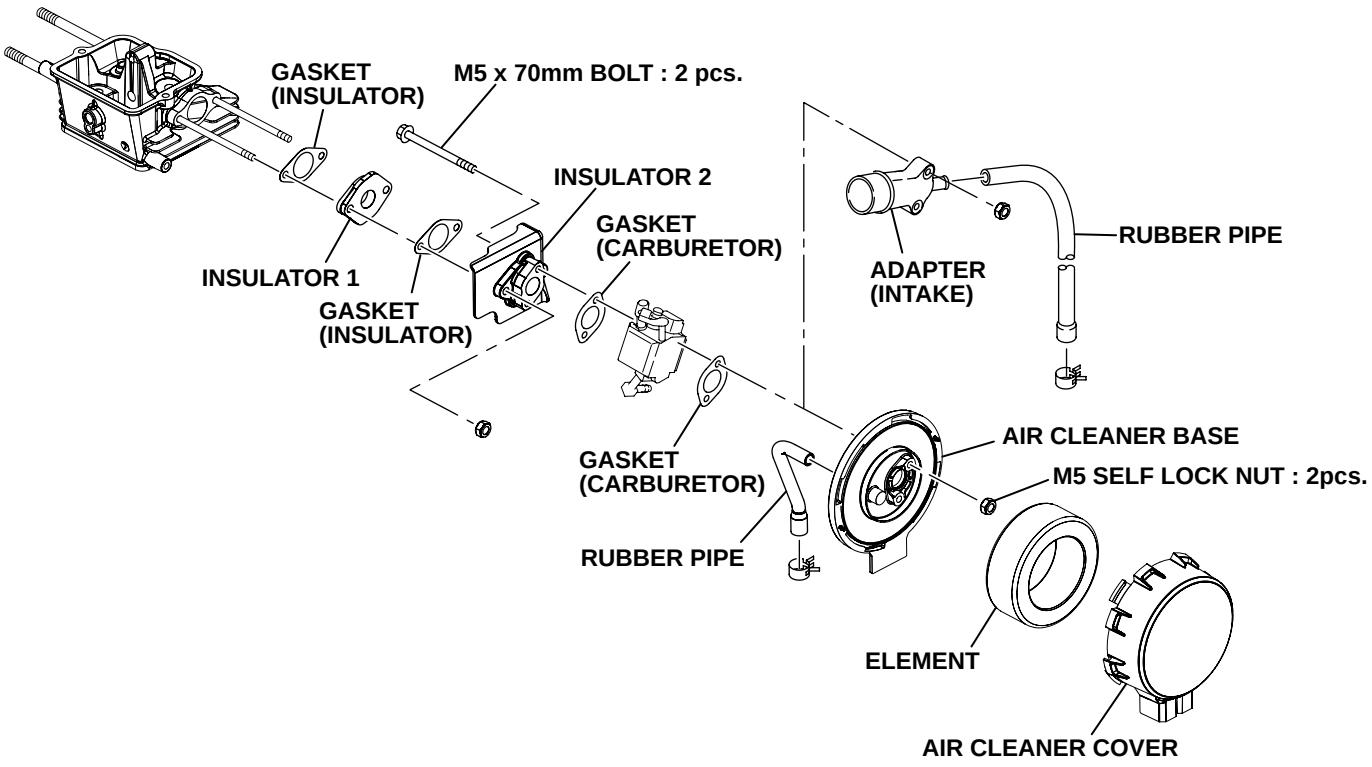
M6 salf lock nut:2pcs.

Tightening torque	
Float type carburetor	Diaphragm type carburetor
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)	4.0 - 5.0 N·m (40 - 50 kgf·cm) (2.9 - 3.6 ft·lb.)

Then install the element and cleaner cover.



FLOAT TYPE CARBURETOR



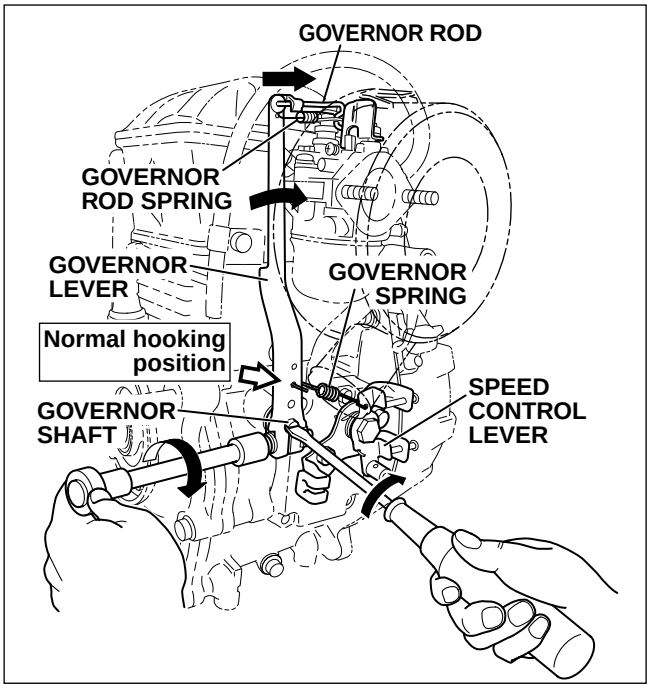
DIAPHRAGM TYPE CARBURETOR

(22) ADJUST GOVERNOR SYSTEM

(1) Turn the speed control lever all the way toward the high speed position.

(2) Check that the governor lever is pulled by the governor spring and carburetor throttle valve is fully open.

(3) Turn the governor shaft clockwise all the way using a screw driver, and tighten lock bolt to secure the lever on the shaft.



(23) RECOIL STARTER

Attach recoil starter to crankcase.

Tighten flange bolts.

M6 x 20 mm flange bolt : 2 pc.

M6 x 14 mm flange bolt : 1 pcs.

Tightening torque
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)

Insert the high tension cord from the ignition coil into the notch of the blower housing so as not to pinch the cord.

(24) STOP SWITCH

(1) Install stop switch to blower housing.

(2) Connect wires referring to the wiring diagram.

(25) MUFFLER

(1) Mount the muffler and the gasket on the cylinder head.

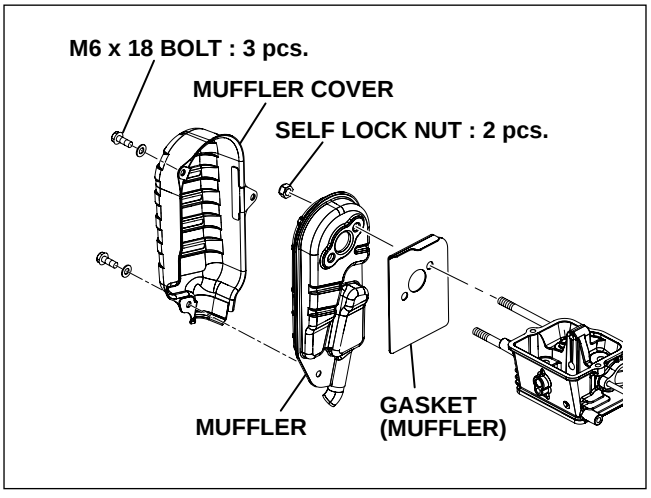
Self lock nut : 2 pcs.

Tightening torque
19.0 - 21.0 N·m (190 - 210 kgf·cm) (13.7 - 15.2 ft·lb.)

(2) Mount the muffler cover on the muffler.

M6 × 18 mm bolt : 3 pcs.

Tightening torque
7.0 - 9.0 N·m (70 - 90 kgf·cm) (5.1 - 6.5 ft·lb.)



- End of the reassembly -

(26) EXTERNAL INSPECTION

Reassembly is completed. Check that the wiring is correct and that there are no loose nuts and bolts or any other faults visible on the outside of the engine.

(27) FILLING WITH ENGINE OIL

Use the automobile engine oil of API service class SE or higher grade.

The amount of oil, refer to the table below.

Engine oil volume (maximum)	0.35L

(28) BREAK-IN OPERATION

A new engine or 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.

Step	Load	Engine Speed	Time
Step 1	No Load	2500 r.p.m.	10 min.
Step 2	No Load	3000 r.p.m.	10 min.
Step 3	No Load	3600 r.p.m.	10 min.
Step 4	1.3 kW	3600 r.p.m.	30 min.
Step 5	2.6 kW	3600 r.p.m.	30 min.

6. ENGINE OIL

Using engine oil of the correct grade and viscosity greatly lengthens engine life and improves performance. Too much or too little oil can also result in serious problems, including engine seizure.

6-1 CLASSIFICATION BY OIL GRADE

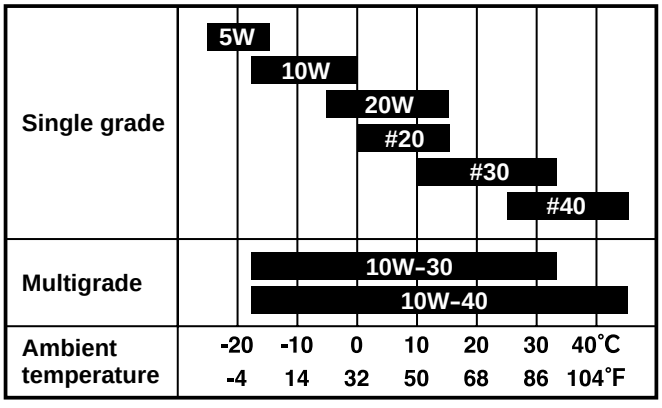
API (American Petroleum Institute)

Classification	SA	SB	SC	SD	SE	SF	SG	SH	SJ

Grades suited for Robin Engine: SE or higher (SG,SH or SJ in recomended)

6-2 CLASSIFICATION BY OIL VISCOSITY

SAE (Society of Automotive Engineers)



Be sure to use automobile engine oil of the viscosity shown in the table above, depending on environmental air temperature.

When the air temperature falls below –20℃ or rises above 40℃, be sure to choose engine oil of appropriate viscosity and grade, according to the prevailing conditions.

∗Care must be taken when using multi-grade engine oil, because the oil consumption rate tends to increase when the air temperature is high.

6-3 ADDING AND CHANGING ENGINE OIL

○ Engine oil inspection and filling up . . . Every time you use the engine
(add engine oil up to the designated maximum level)

○ Engine oil change . . . . . First time . . . . . After 20 hours' use
Thereafter . . . . . Every 100 hours' use