

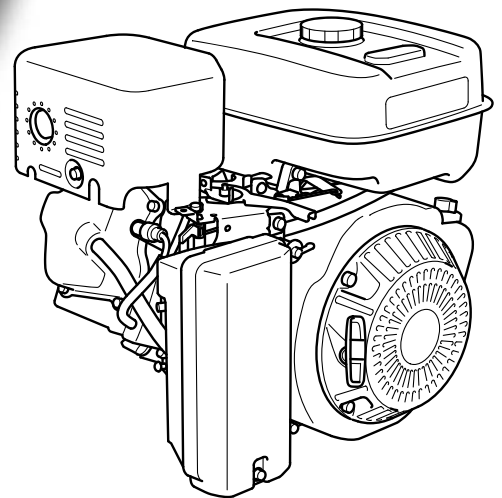
 **SUBARU**

EX35
EX40



Air-cooled, 4-cycle

Gasoline Engine



SERVICE MANUAL

CONTENTS

| <i>Section</i> | <i>Title</i> | <i>Page</i> |
|----------------|---|-------------|
| 1. | SPECIFICATIONS | 1 |
| 2. | PERFORMANCE | 2 |
| 3. | FEATURES (EX35, 40 series) | 5 |
| 4. | GENERAL DESCRIPTION OF ENGINE COMPONENTS | 6 |
| 5. | DISASSEMBLY AND REASSEMBLY | 12 |
| 5-1 | PREPARATIONS AND PRECAUTIONS | 12 |
| 5-2 | SPECIAL TOOLS | 12 |
| 5-3 | DISASSEMBLY PROCEDURE | 13 |
| 5-4 | REASSEMBLY PROCEDURE | 27 |
| 6. | ENGINE OIL | 45 |
| 7. | MAGNETO | 46 |
| 8. | IGNITION SYSTEM | 47 |
| 9. | WIRING DIAGRAM | 48 |
| 10. | ELECTRIC STARTER | 50 |
| 11. | OIL SENSOR | 52 |
| 12. | AUTOMATIC DECOMPRESSION SYSTEM | 53 |
| 13. | CARBURETOR | 54 |
| 14. | RECOIL STARTER | 58 |
| 15. | INSTALLATION | 63 |
| 16. | TROUBLESHOOTING | 66 |
| 17. | STANDARD REPAIR TABLES | 72 |
| 17-1 | STANDARD DIMENSIONS AND LIMITS OF USE | 72 |
| 17-2 | SERVICE DATA (The following are only for your reference.) | 77 |
| 17-3 | TIGHTENING TORQUE | 78 |
| 17-4 | AIR GAP AND CLEARANCE | 78 |
| 18. | MAINTENANCE AND STORAGE | 79 |

1. SPECIFICATIONS

| Model | | EX35D | EX40D |
|----------------------------|---|--|---------------------------------------|
| Type | | Air-Cooled, 4-Cycle, Slant Single-Cylinder, Horizontal P.T.O. Shaft, OHC Gasoline Engine | |
| Bore & Stroke | mm (in.) | 89 × 65 (3.50 × 2.56) | |
| Piston Displacement | ml (cu.in.) | 404 (24.65) | |
| Compression Ratio | | 8.3 | |
| Continuous Output | kW(HP)/r.p.m. | 5.5(7.5)/3000 6.3(8.5)/3600 | 6.3(8.5)/3000 7.0(9.5)/3600 |
| Maximum Output | kW(HP)/r.p.m. | 7.4(10.0)/3600 | 8.8(12.0)/3600 |
| Maximum Torque | N·m / r.p.m. (kgf·m / r.p.m.) (ft·lb. / r.p.m.) | 26/2400 (2.6/2400) (19.18/2400) | 27/2400 (2.7/2400) (19.91/2400) |
| 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 | | Splash lubrication system | |
| Lubricant | | Automobile engine oil ; Grade SE or higher (SG,SH or SJ in recommended) SAE 10W-30-----Under ordinary atmospheric temperatures SAE 5W-30-----In cold areas | |
| Capacity of Lubricant | L | 1.2 | |
| Carburetor | | Horizontal draft, Float type | |
| Fuel | | Automobile unleaded gasoline | |
| Fuel Consumption Rate | g/kW · h (g/HP · h) | 381 (280) | |
| Fuel Supply System | | Gravity type | |
| Fuel Tank Capacity | L | 7.0 | |
| Ignition System | | Transistorized magneto | |
| Spark Plug | | NGK BR-6HS | |
| Charging Capacity (Option) | V-A | 12-1A, 3A, 16.7A (Option) | |
| Starting System | | Recoil starter / Electric starter (Option) | |
| Governor System | | Centrifugal flyweight system | |
| Dry Weight | kg (lb.) | 33 (72.75) | |
| Dimensions (L x W x H) | mm (in.) | 389 x 450 x 443 (15.31 x 17.72 x 17.44) | |

*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 engine's life and fuel consumption.

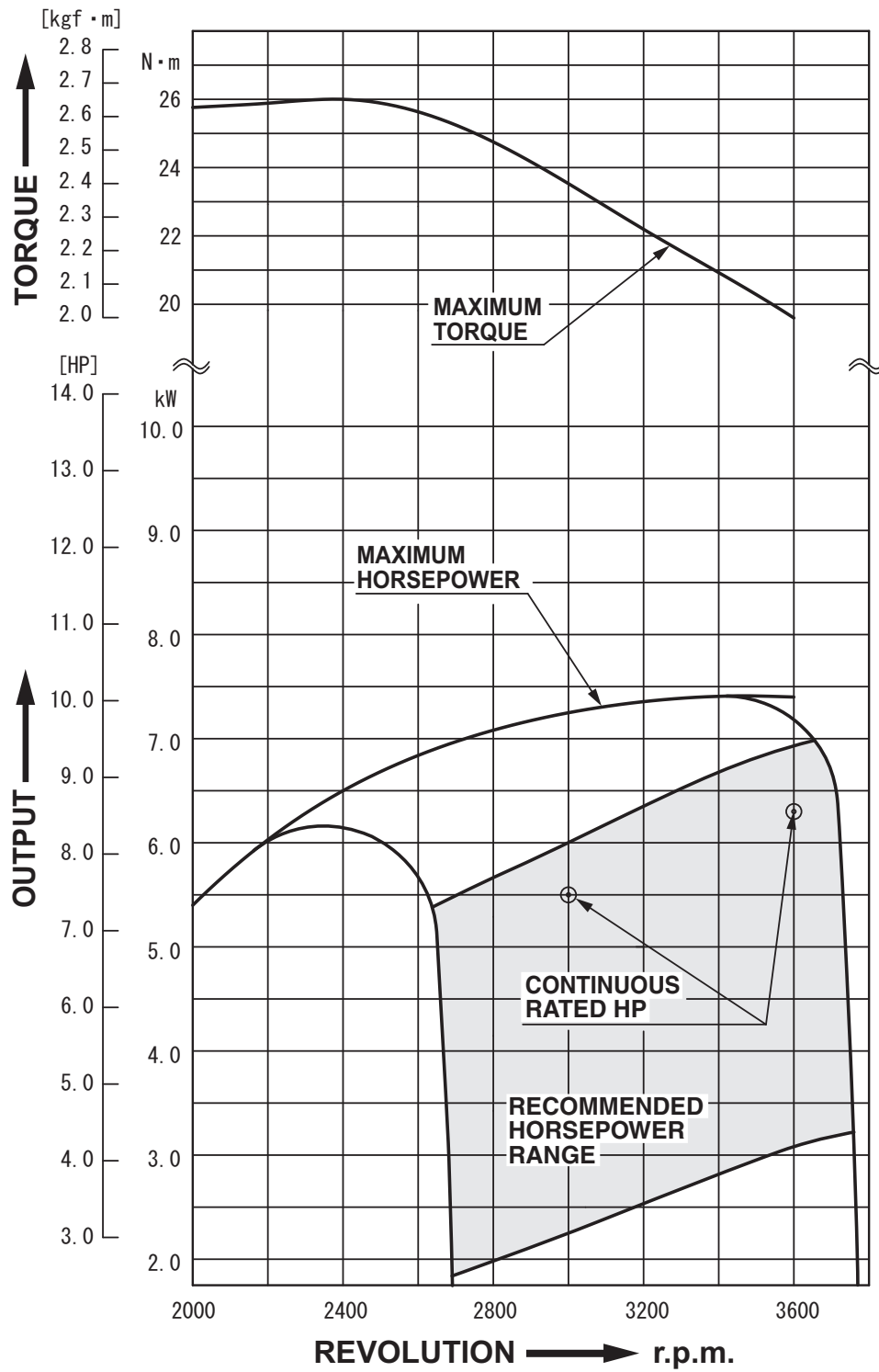
When the engine is installed on a certain equipment, it is recommended that the continuous output required from the equipment to be kept below this continuous rated output.

2-3 MAXIMUM TORQUE

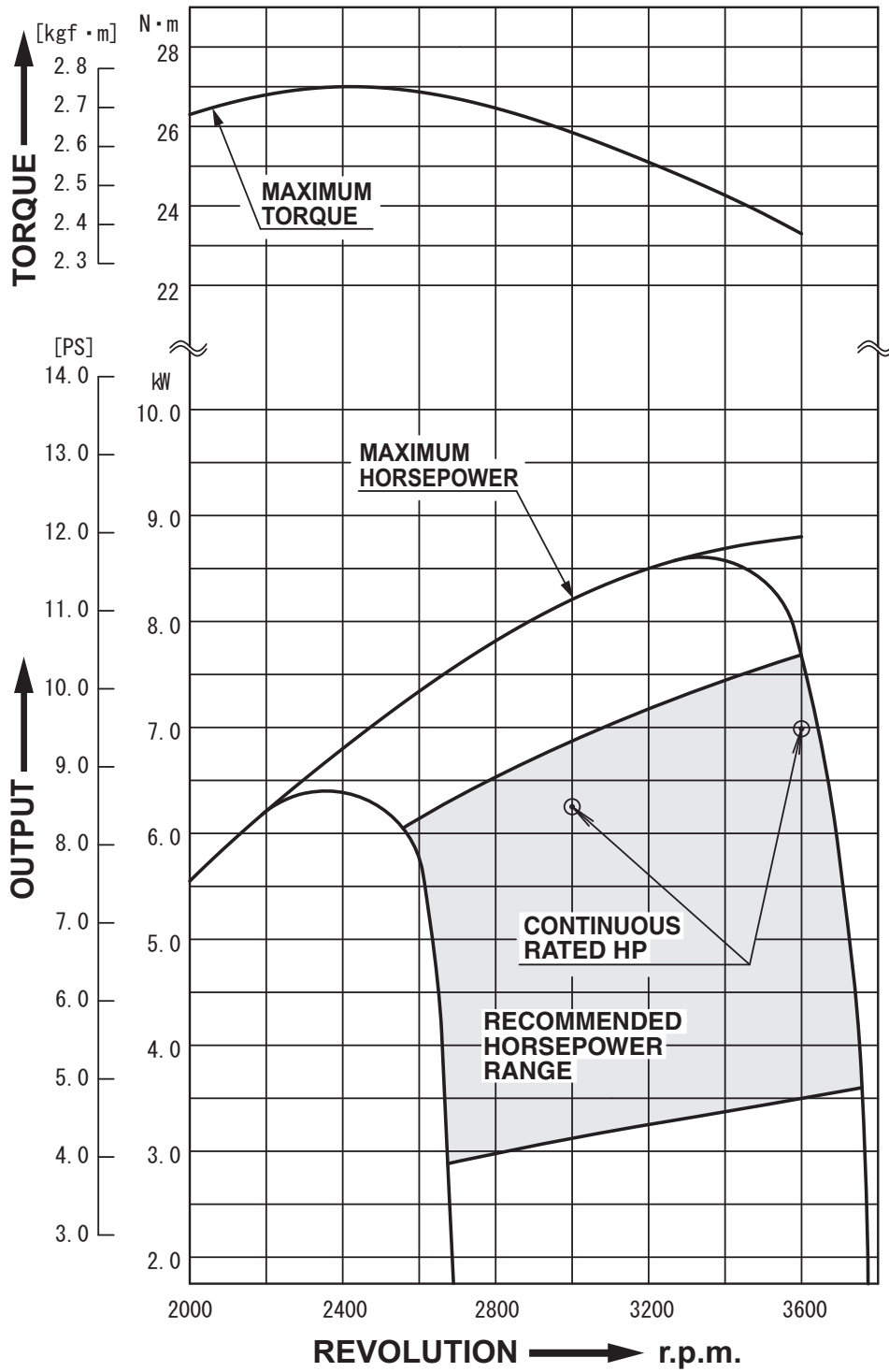
The maximum torque is the torque at the output shaft when the engine is producing maximum output at a specific r.p.m..

2-4 PERFORMANCE CURVES

EX35D



EX40D



3. FEATURES (EX35, 40 series)

3-1 HIGH OUTPUT

Thanks to the adoption of a cam profile exclusively for intake and exhaust and the optimization of the shape of the intake/exhaust port and the shape of the combustion chamber, the top-of-the-class-level maximum output is achieved.

3-2 EXTREMELY SILENT - SOFT TONE QUALITY

EX engines are 2dBA quieter and softer in tone than other engines in the same class.

This quiet and soft tone is achieved by:

- Resin blower housing reduce noise leakage of mechanical noise.
- Employment of an optimized capacity Rigid Muffler.

3-3 EXTREMELY EASY START

Reliable Starting and Less Pulling Force are achieved by:

Sophisticated Mechanical Compression Release System as well as newly designed Combustion Chamber.

3-4 EXTREMELY EASY MAINTENANCE

Extreme ease of maintenance is realized by:

- High Parts Commonality
simplifies maintenance & lowers repair cost due to fewer parts for service.
- Only with ordinary tools, routine maintenance, assembly and disassembly can be performed.

3-5 EXTREMELY ADVANCED TECHNOLOGY

Extreme reliability and durability are achieved by:

- Heavy Duty Chain Driven OHC System
Oval type case-hardened steel links enhance performance and resist stretching, which result in extended maintenance free operation.
- Completely New Main Bearing Cover's Design
Flush-mounted main bearing cover with lower moment of deformation significantly increases reliability and engine life.
- Superior Cooling and Lubrication System
Heat reduction is achieved by more efficient, larger and more numerous cooling fins on crankcase, cylinder and mounting base, as well as by outstanding oil delivery system.
- Large Ball Bearings on both ends of crankshaft for maximum stability under demanding loads.
- Cast Iron Cylinder Liner resists wear

3-6 EXTREME POWER AND PERFORMANCE

Extremely Higher Power and Lower Fuel Consumption are realized by:

- High speed and homogeneous combustion achieved by sophisticated Pentroof Combustion Chamber which includes Intake and Exhaust Valves located at optimum angle.
- Straight Intake Port with minimal air flow resistance.

Environmentally friendly

EX engines comply with EPA Phase 2 and CARB Tier III Emission Regulations in the USA.

Extreme application compatibility

With four versatile models, existing slant-cylinder engines can be easily replaced.

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. The cylinder is inclined to the right at an angle of 25 degrees from the horizontal as viewed from the output shaft side.

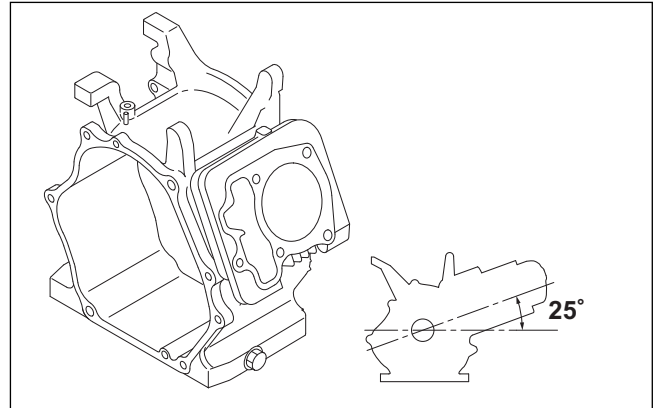


Fig.4-1

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. By removing the main bearing cover, the inside of the engine can be inspected with ease. Pilots and bosses are machined into the cover to facilitate the direct coupling of the engine with machines such as generators and pumps. Oil gauges (fillers) are on both sides of the cover for easy maintenance.

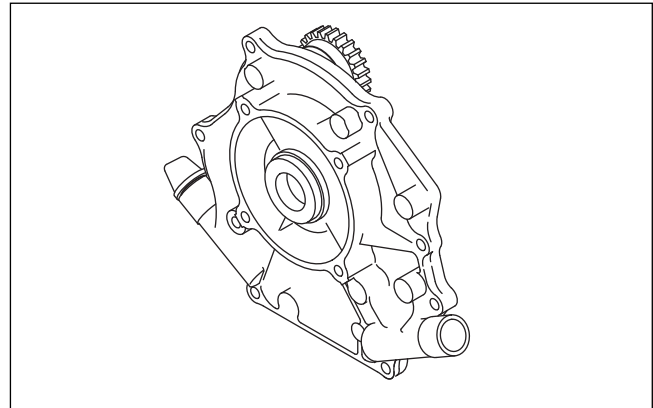


Fig.4-2

4-3 CRANKSHAFT

The crankshaft is forged carbon steel, and the crank pin is high-frequency inductionhardened. The crank sprocket used to drive the chain and the gear used to drive the governor gear are pressed into the output end of the shaft.

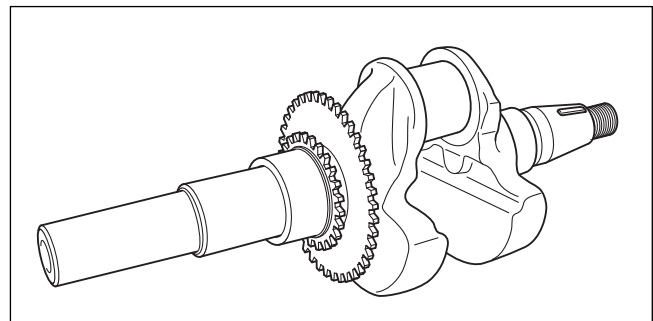


Fig.4-3

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. A splasher built into the connecting rod lubricates by splashing engine oil. The piston is an aluminum alloy casting with grooves for mounting one compression ring and one oil ring.

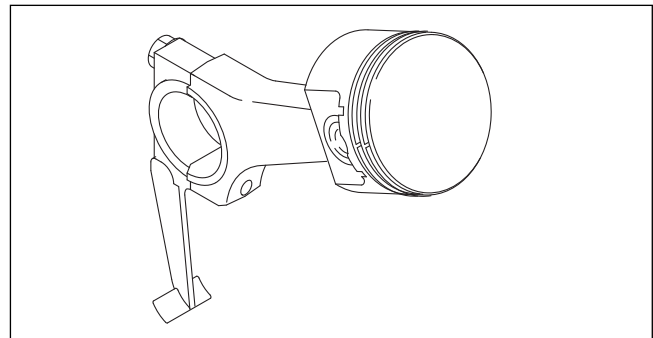


Fig.4-4

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.

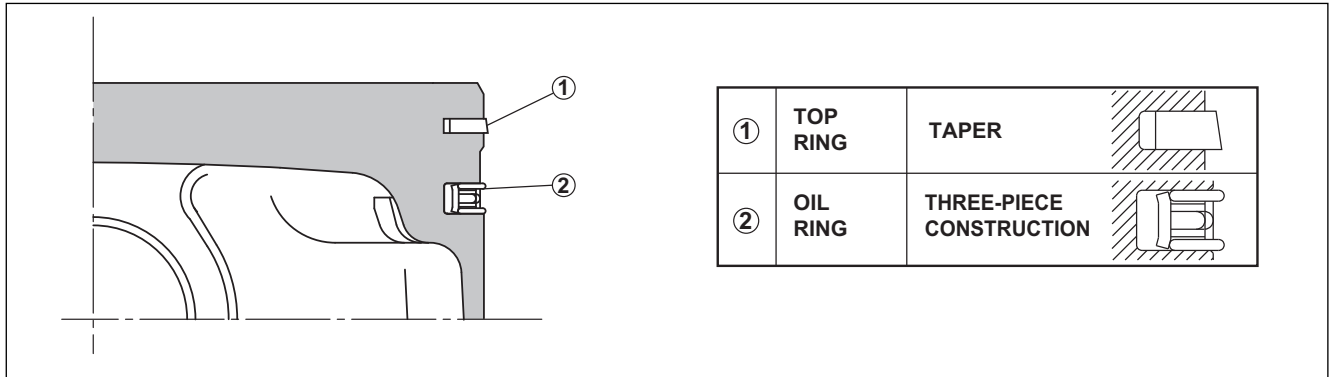


Fig.4-5

4-6 CAMSHAFT

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

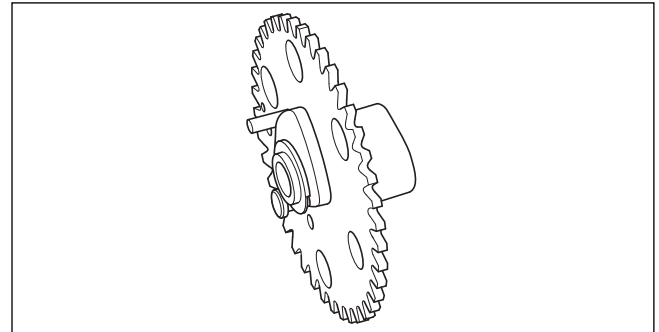


Fig.4-6

4-7 VALVE ARRANGEMENT

This engine has a chain-driven overhead cam and overhead valve construction, with a single cam which has individual profile for intake and exhaust to perform high output.

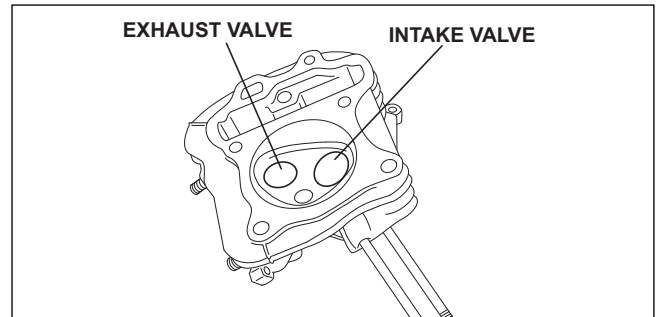


Fig.4-7

4-8 CYLINDER HEAD

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

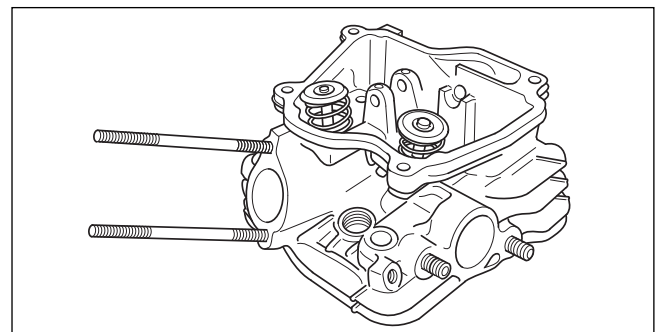


Fig.4-8

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.)

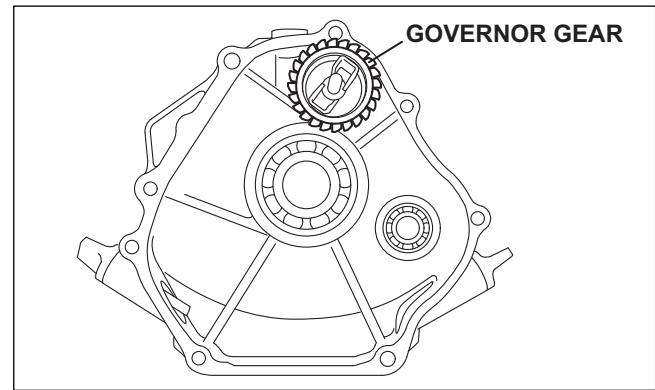


Fig.4-9

4-10 COOLING SYSTEM

The engine uses a forced air-cooling system in which a synthetic resin cooling fan (which is separate from the flywheel), reduce noise and forces cooling air into the cylinder and cylinder head.

Baffles are provided to guide the flow of cooling air. (As for with starting motor, baffle 1 is not mounted.)

4-11 LUBRICATION SYSTEM

The rotating parts, sliding parts and valves of the engine are lubricated with oil in the crankcase.

The oil is splashed onto the parts by the oil splasher on the connecting rod.

4-12 TIMING CHAIN

Timing chain system is adopted and designed for lubricating for the upper portion of cylinder head.

The timing chain is engaged between the sprocket portion of integrated camshaft in the cylinder head and the crankshaft gear sprocket.

The sprocket teeth in particular shape are adopted to enhance the durability and to realize low noise level.

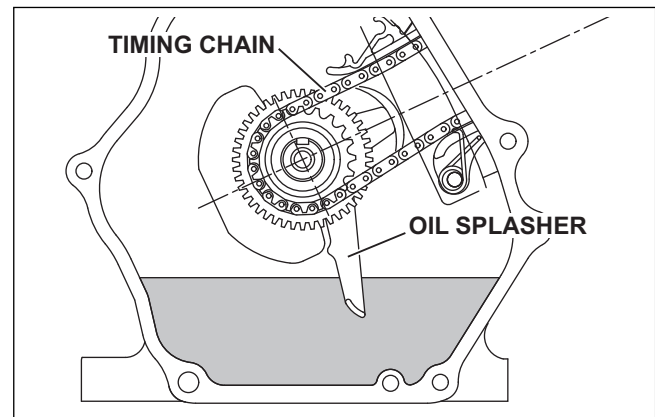


Fig.4-10

4-13 IGNITION SYSTEM

The ignition system is a transistor controlled magneto system with the ignition timing set at 24 degrees before the top dead center. The magneto consists of a flywheel and ignition coil. The flywheel (cooling fan is separate from the flywheel) is directly mounted on the crankshaft and the ignition coil is directly mounted on the crankcase.

* Model EX35 and 40 has a smooth advanced ignition timing system to improve starting performance. (For further details, refer to page 46, section "7. MAGNETO".)

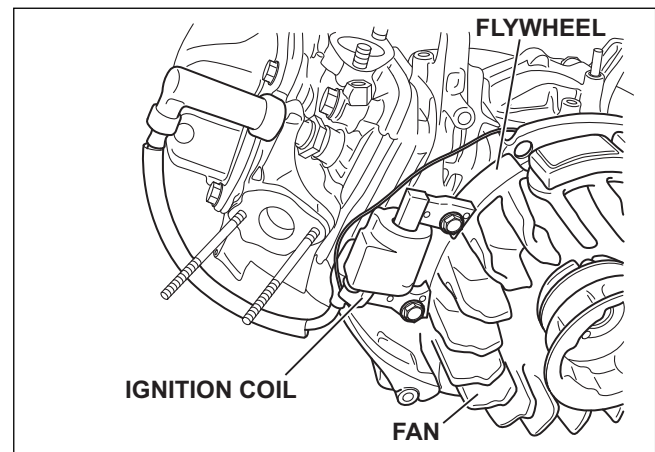


Fig.4-11

4-14 CARBURETOR

The engine is equipped with a horizontal draft carburetor. The carburetor setting is calibrated after careful testing for optimum all-round performance (including starting, acceleration, fuel consumption, output power characteristics). Special attention is also paid to the general-purpose use of the engine. (For further information, refer to page 54, section "13. CARBURETOR".)

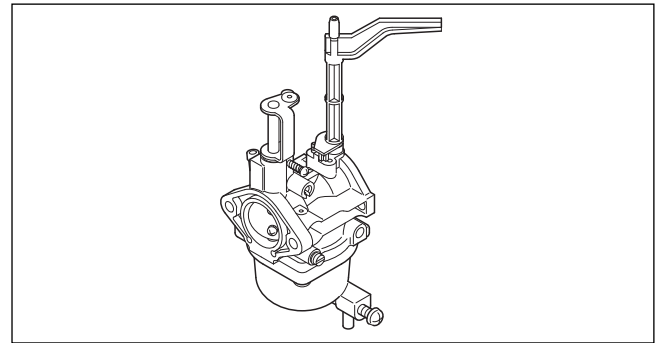


Fig.4-12

4-15 AIR CLEANER

The engine uses an air cleaner that is quieter than conventional ones. A semi-wet urethane foam element is used in the STD air cleaner.

Dual element air cleaner (with a primary element of dry type sponge and secondary element of dry type paper) and other types are also provided as special options.

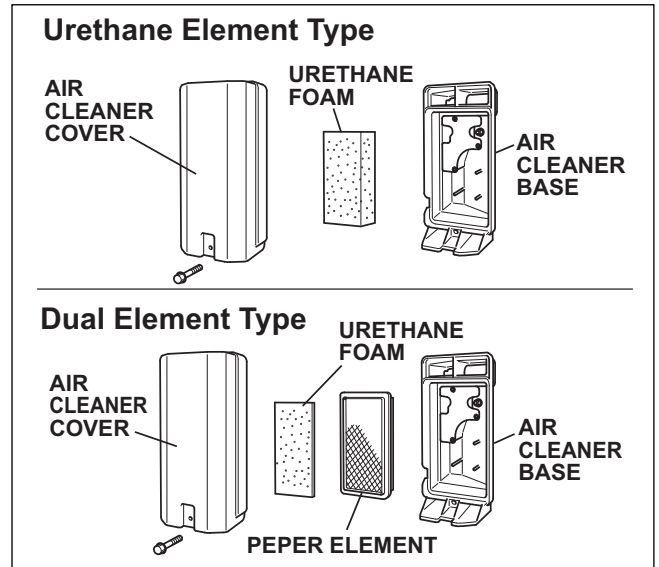


Fig.4-13

4-16 BALANCER

Unbalanced inertia force is cancelled by the balancer which rotates at the same speed as the crankshaft to effectively reduce vibration.

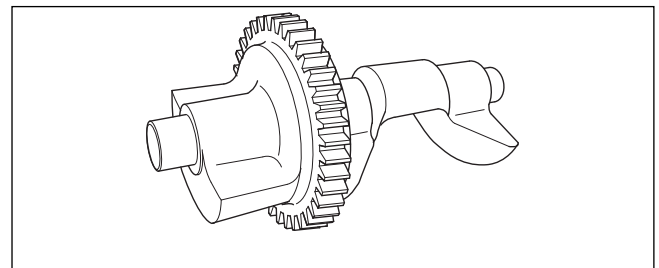


Fig.4-14

4-17 DECOMPRESSION SYSTEM

The automatic decompression system is mounted on the camshaft. 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.

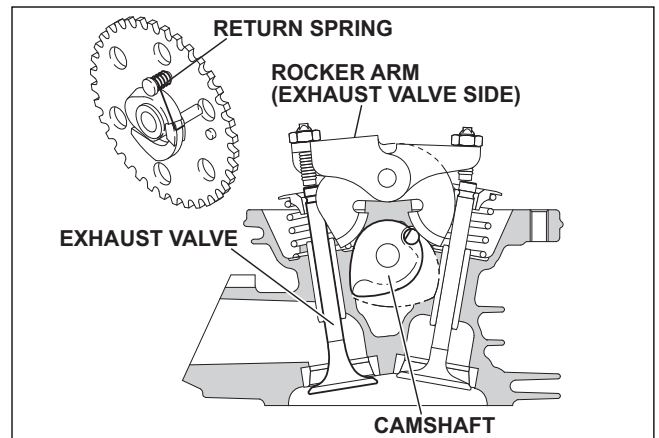


Fig.4-15

4-18 SECTIONAL VIEW OF THE ENGINE

Cross sectional view – across the shaft

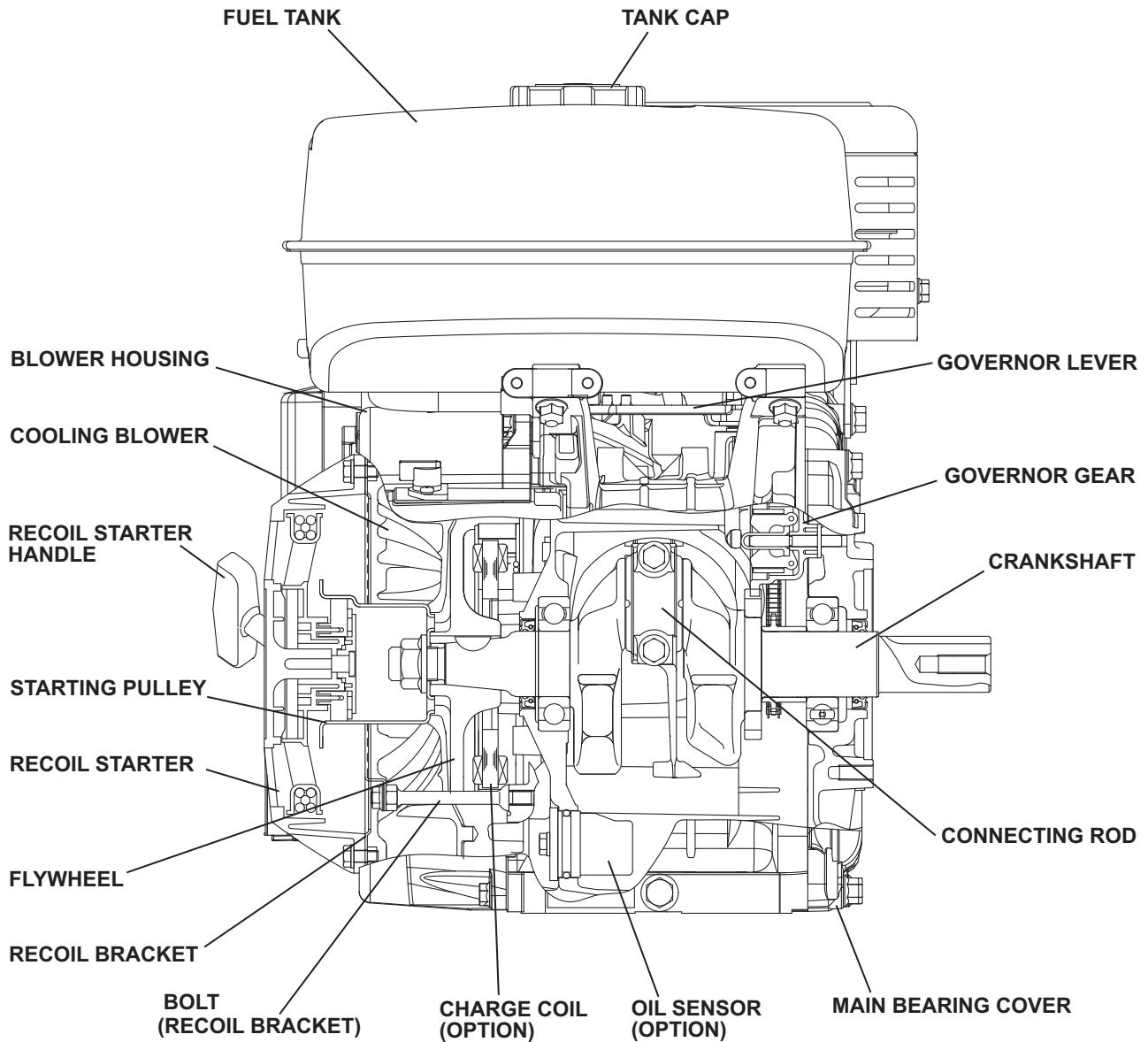
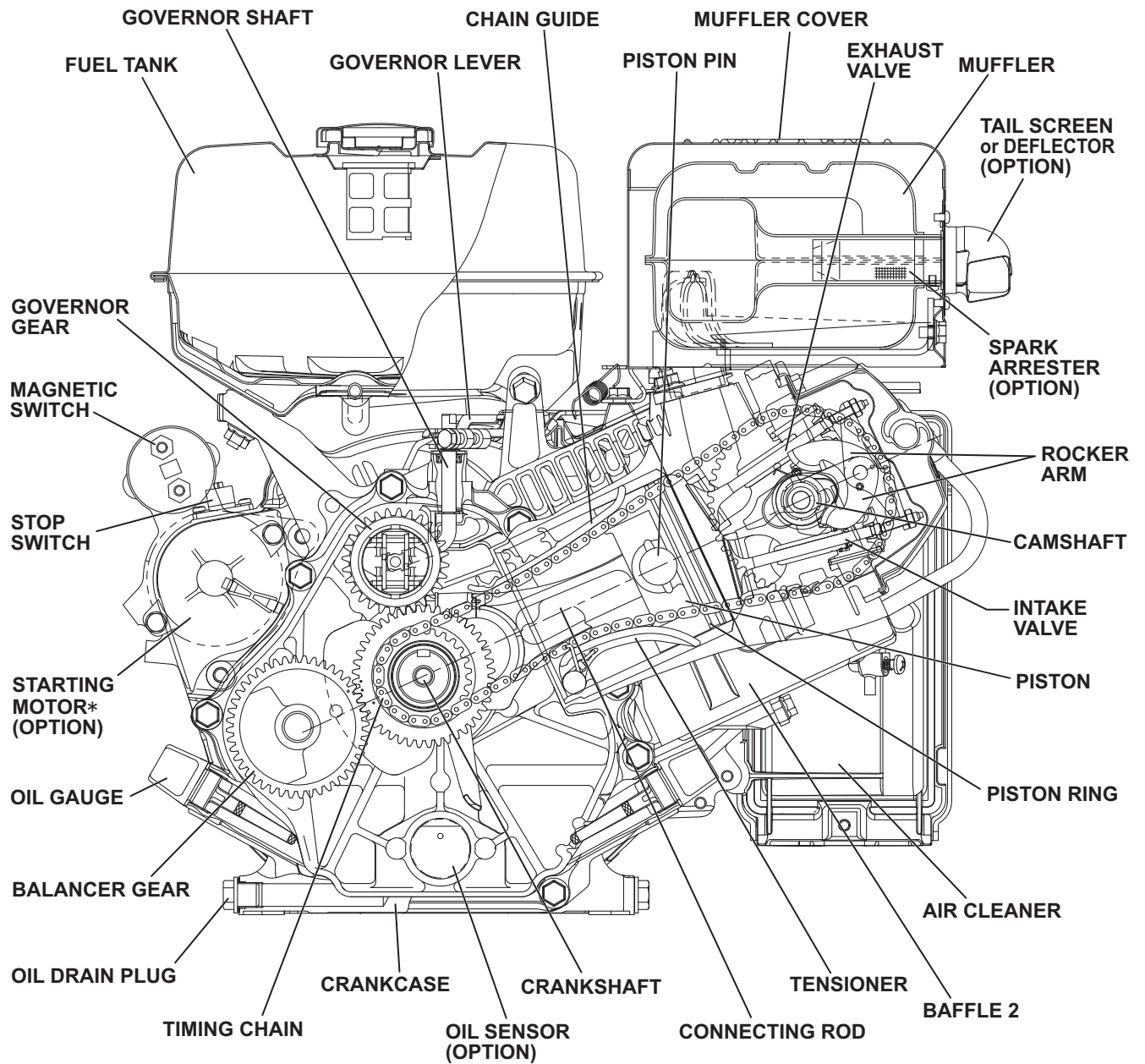


Fig.4-16

Cross sectional view – along the shaft



*For without starting motor : Buffle 1 is mounted, instead of starting motor.

Fig.4-17

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 | Chain wrench | For locking the flywheel |

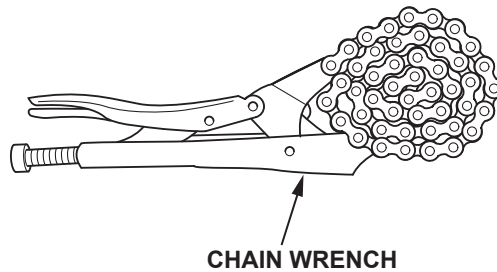
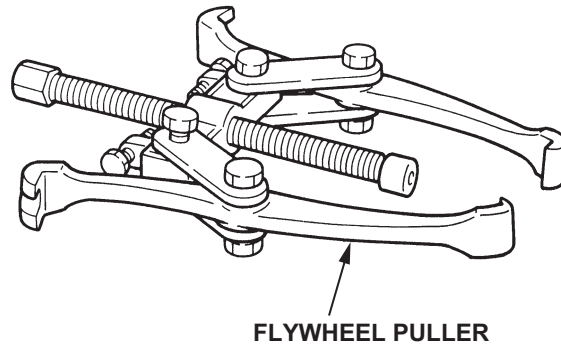


Fig.5-1

5-3 DISASSEMBLY PROCEDURE

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|----------------------|---|--------------------|
| 1 | Drain the engine oil | Remove a drain plug (M14 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). | 14 mm spanner |
| 2 | Drain the fuel | Shut (OFF) the fuel strainer. Drain fuel from the carburetor drain. | + or - screwdriver |

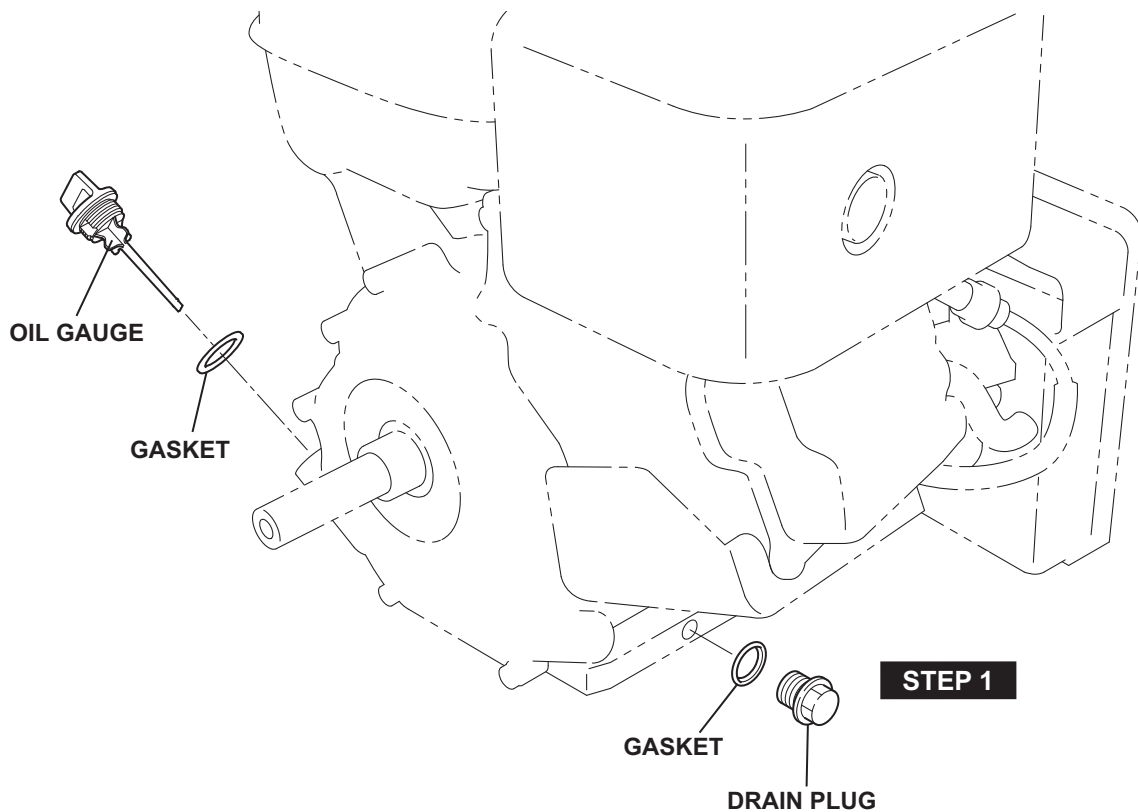


Fig.5-2

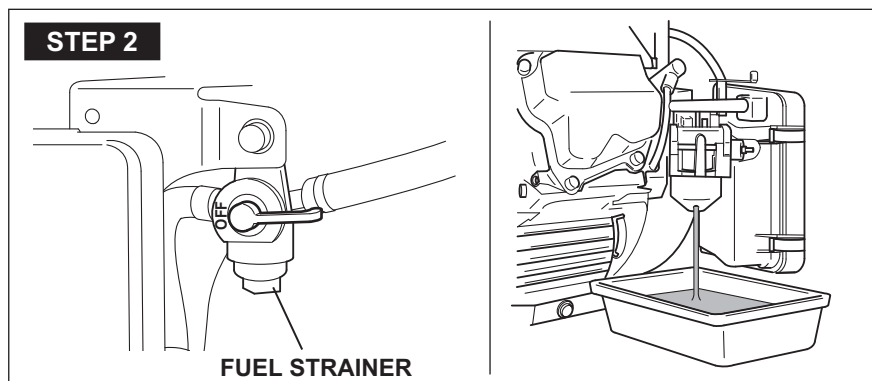


Fig.5-3

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|-------------------|--|---|
| 3 | Air cleaner cover | Remove the air cleaner cover and element. | - screwdriver |
| 4 | Air cleaner | Remove the air cleaner while pulling the breather pipe away from the rocker cover. | 10 mm box spanner M6 nut : 2 pcs. M6 x 16 : 1 pc. |

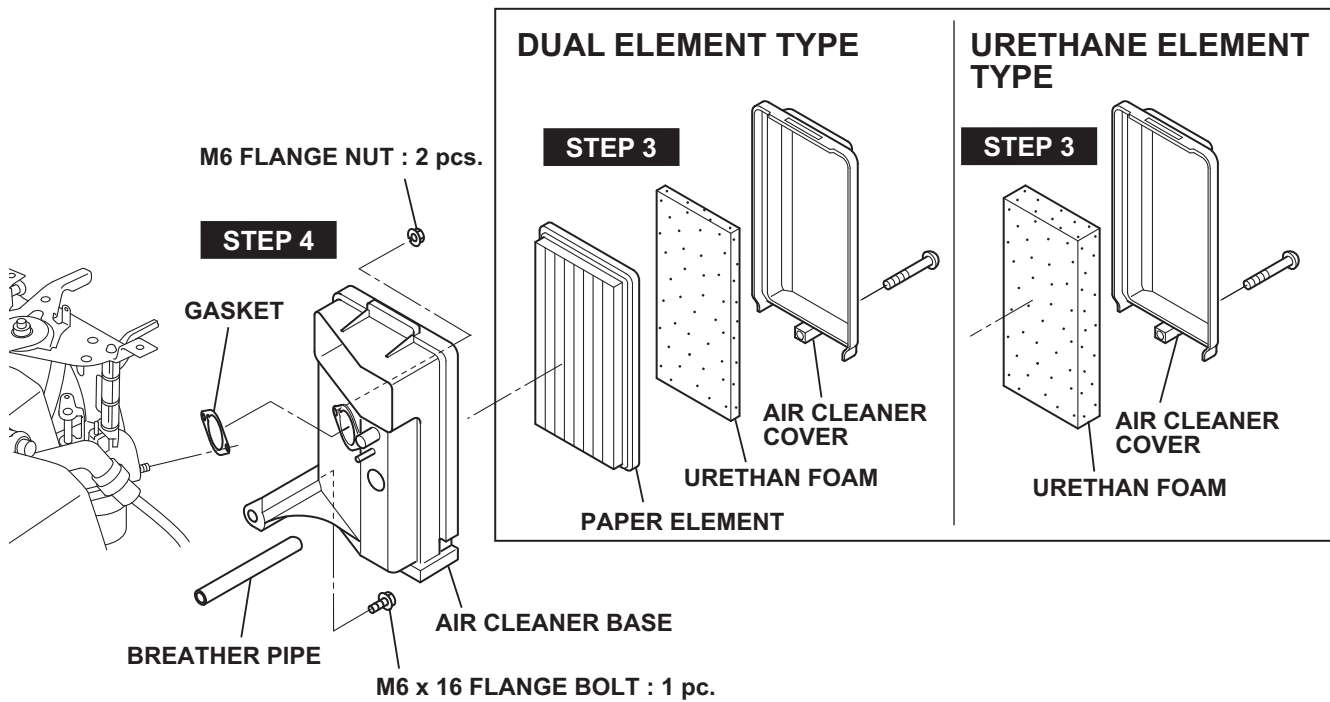


Fig.5-4

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---------------------------|--|---|
| 5 | Muffler and Muffler cover | (1) Remove the muffler cover from the muffler. (2) Remove the muffler from the cylinder head. Take care not to lose the gasket. *Take care not to cut your hand with the muffler gasket. *Seal the exhaust port with adhesive tape or plug it with cloth to prevent nuts and other objects from falling inside. | 12 mm box spanner 10 mm box spanner or spanner M6 x 8 mm : 4 pcs. M8 nut : 2 pcs. M8 x 12 mm : 1 pc. |
| 6 | Fuel tank | (1) Remove the fuel tank mounting nuts and bolts from the crankcase. (2) Disconnect fuel hose from the strainer to carburetor side. Remove the bolt for fuel strainer. (3) Remove the fuel tank from the crankcase. | 12 mm box spanner 12 mm spanner M8 nut : 2 pcs. M8 x 25 mm : 2 pcs. - screwdriver 10 mm box spanner M6 x 12 mm : 1 pc. |

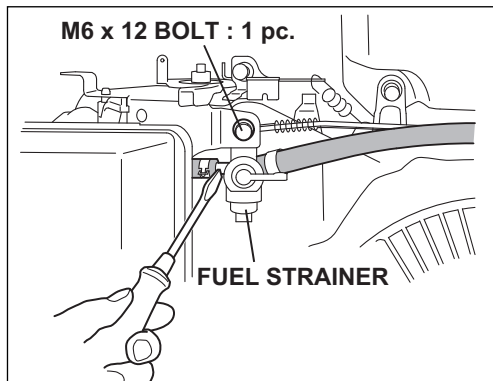


Fig.5-6

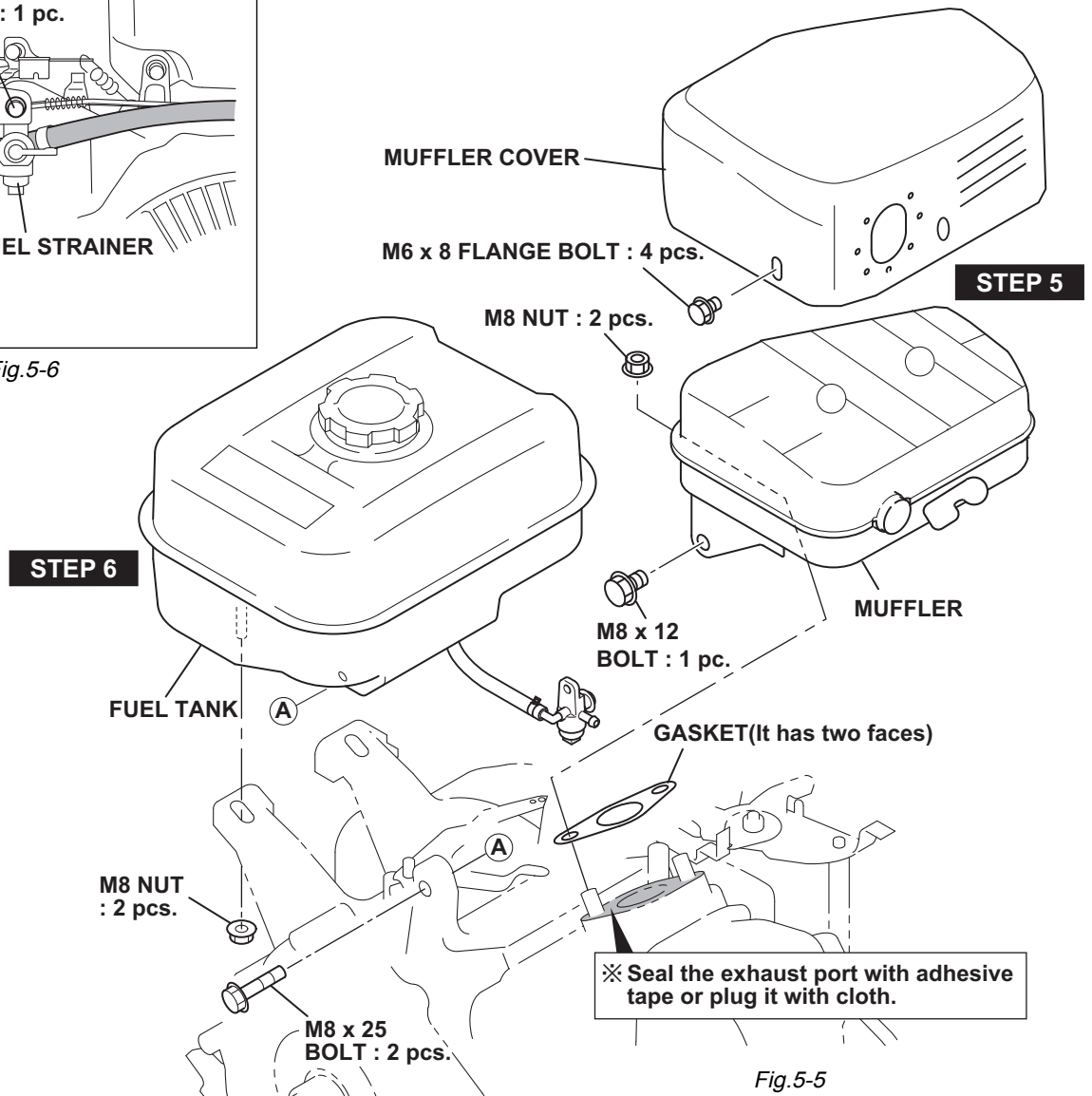


Fig.5-5

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|----------------------------------|--|---|
| 7 | Stop switch | Disconnect the wire and remove the stop switch from the blower housing. | + screwdriver M4 x 12 mm : 2 pcs. |
| 8 | Recoil starter | Remove the recoil starter from the blower housing. | 10 mm box spanner M6 x 14 mm : 4 pcs. |
| 9 | Blower housing Recoil bracket | (1) Remove the blower housing (synthetic resin) from the crankcase. (2) Remove the recoil bracket from the crankcase. | 10 mm box spanner M6 x 16 mm : 5 pcs. M6 nut : 4 pcs. |
| 10 | Baffle 2 | Remove the baffle 2 (synthetic resin) from the crankcase. | 10 mm box spanner M6 x 12 mm : 3 pcs. |

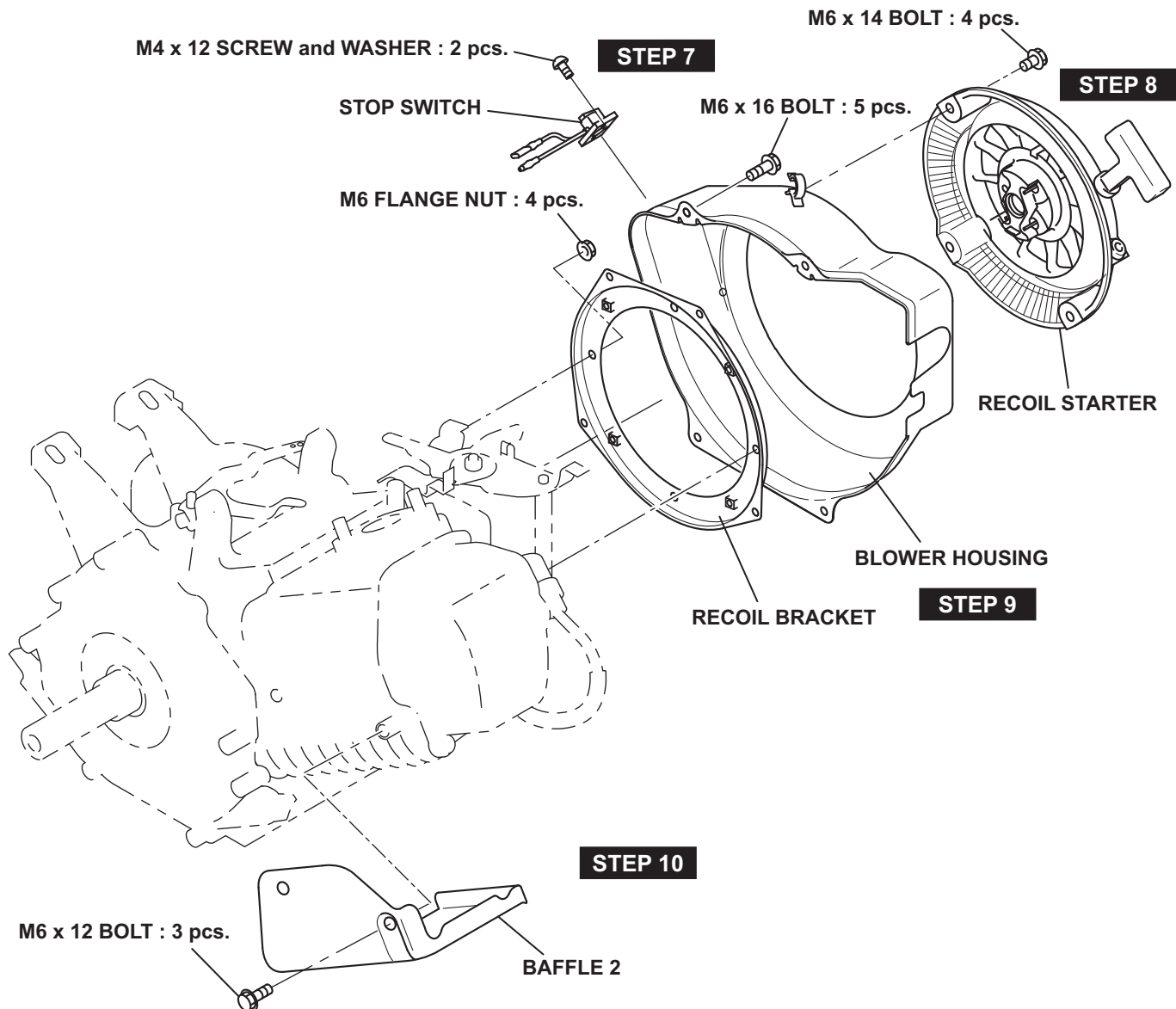


Fig.5-7

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---------------------------------|--|--|
| 11 | Speed control lever and Bracket | Remove the speed control lever and bracket from the cylinder head. Release the bolt temporarily. Slide to dismount the speed control lever and bracket from the cylinder head and the choke lever of the carburetor. | 10 mm box spanner M6 x 12 mm : 1 pc. |
| 12 | Governor system | (1) Loosen the bolt 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. | 10 mm box spanner or spanner M6 x 25 mm : 1 pc. |
| 13 | Carburetor, Insulator | Remove the carburetor from the cylinder head. Remove the insulator. | |

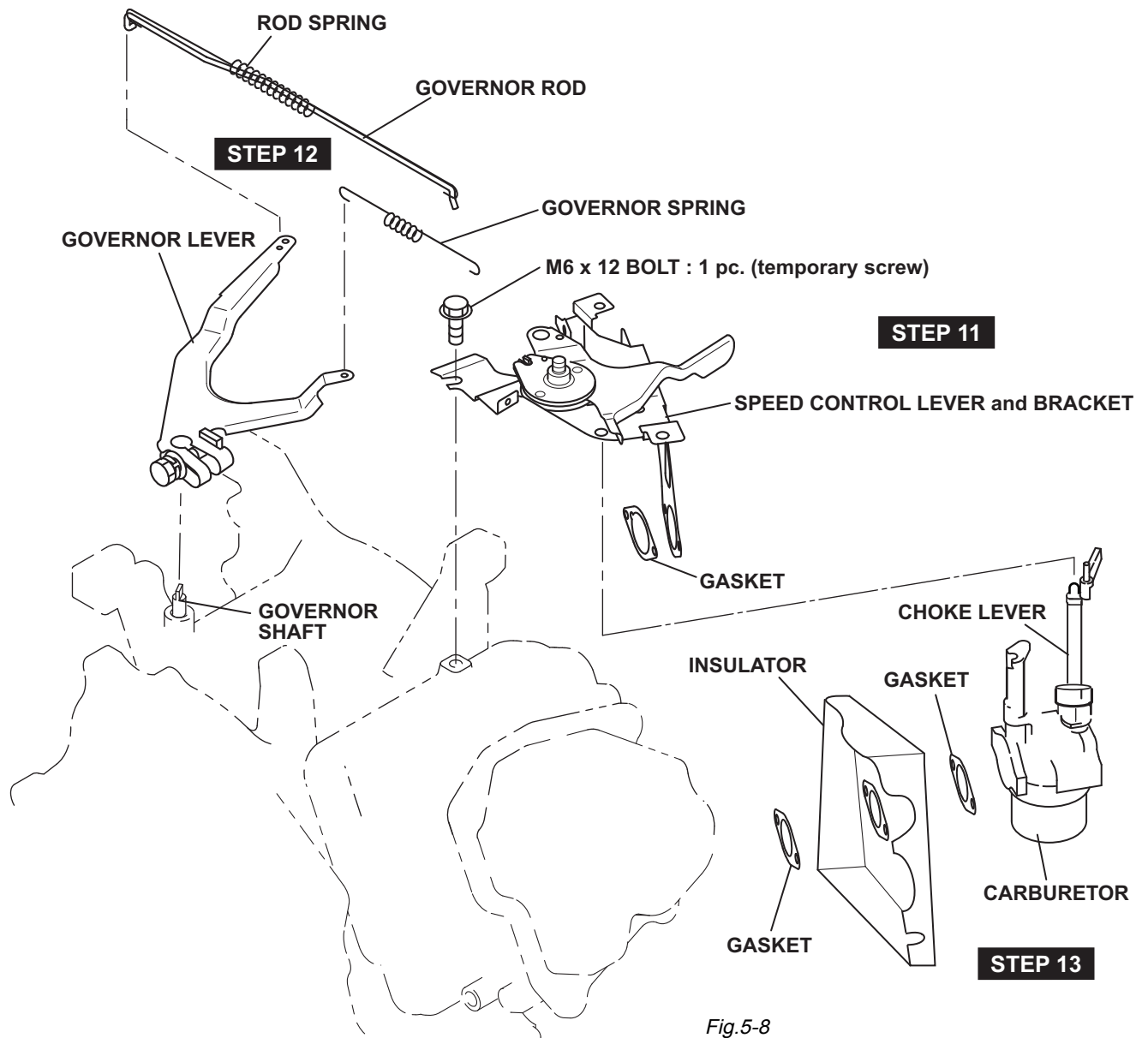


Fig.5-8

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|-----------------------------------|--|--|
| 14 | Ignition coil | Remove the spark plug cap from the spark plug and remove the ignition coil from the crankcase. | 10 mm box spanner M6 x 25 mm : 2 pcs. |
| 15 | Starting pulley Cooling Blower | Remove the starting pulley and cooling Blower 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. 5-10) NOTE: 1. Do not insert a 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. | 24 mm box spanner or socket wrench M18 nut |
| 16 | Flywheel | Remove the flywheel from the crankshaft. Leave the nut temporarily to prevent the flywheel from dropping out. Fit the flywheel puller as shown in Figure 5-11 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) | Flywheel puller |

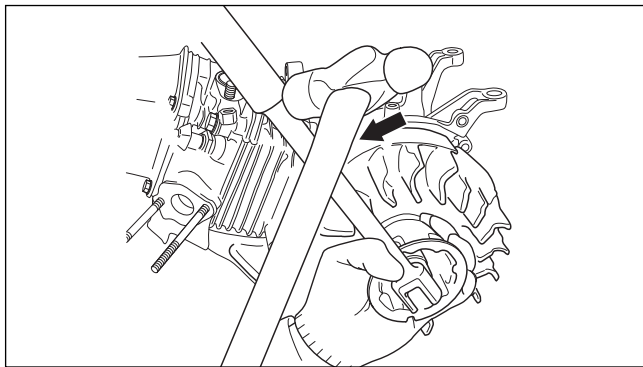


Fig.5-10

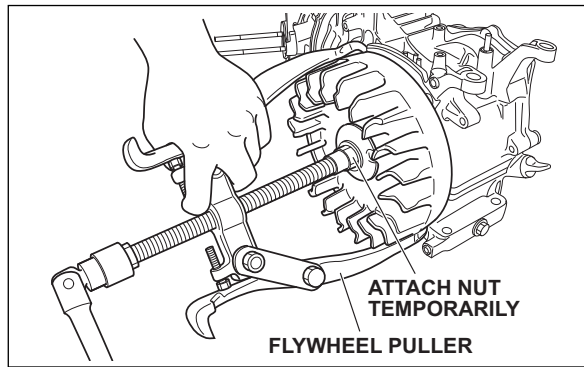


Fig.5-11

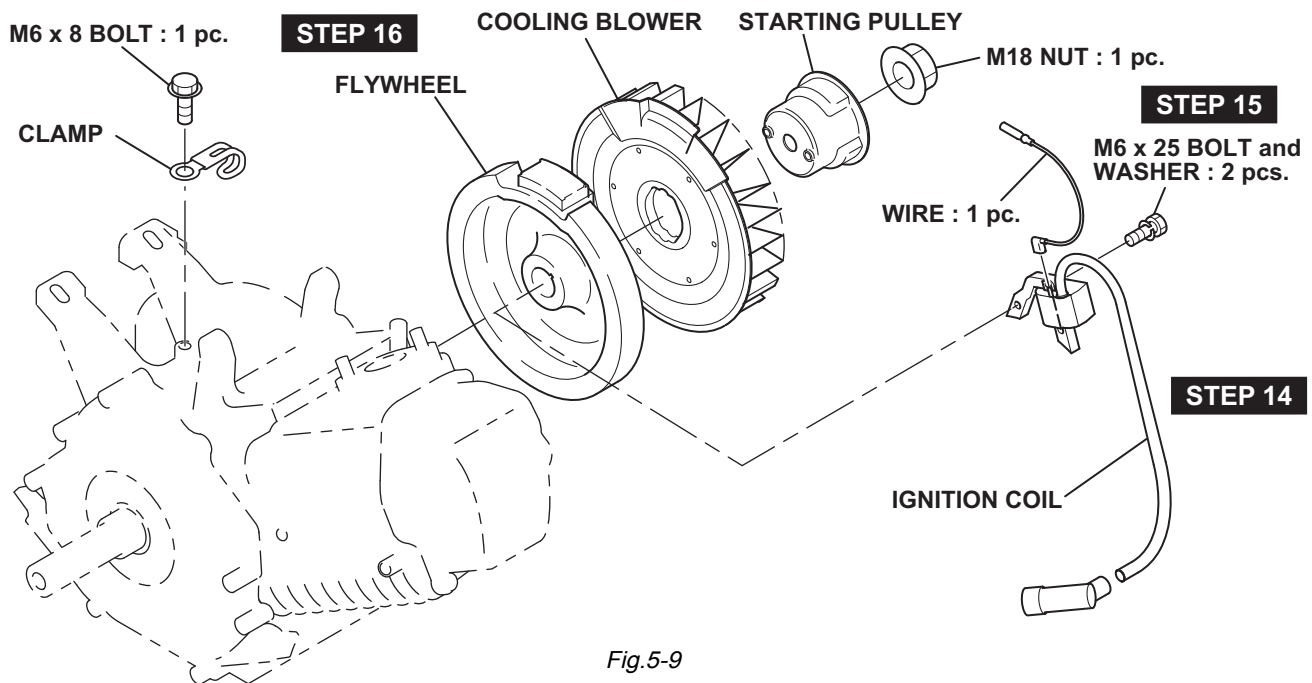


Fig.5-9

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---|---|---|
| 17 | [MODEL WITH ELECTRIC STARTER TYPE] Control box, Diode rectifier, Magnetic switch Electric starter (option) | (1) Disconnect the grounding cable from battery. (2) Disconnect the wire leading from the key switch "ST" terminal to the magnetic switch. (3) Disconnect the wire that connects the positive terminal of the battery to the magnetic switch. (4) Remove the electric starter. | 12 mm box spanner M8 nuts |
| | [MODEL WITHOUT ELECTRIC STARTER TYPE] Baffle 1 (Case) | Remove the Baffle 1 from the crankcase. | 12 mm box spanner M8 x 12 mm : 1 pc. |

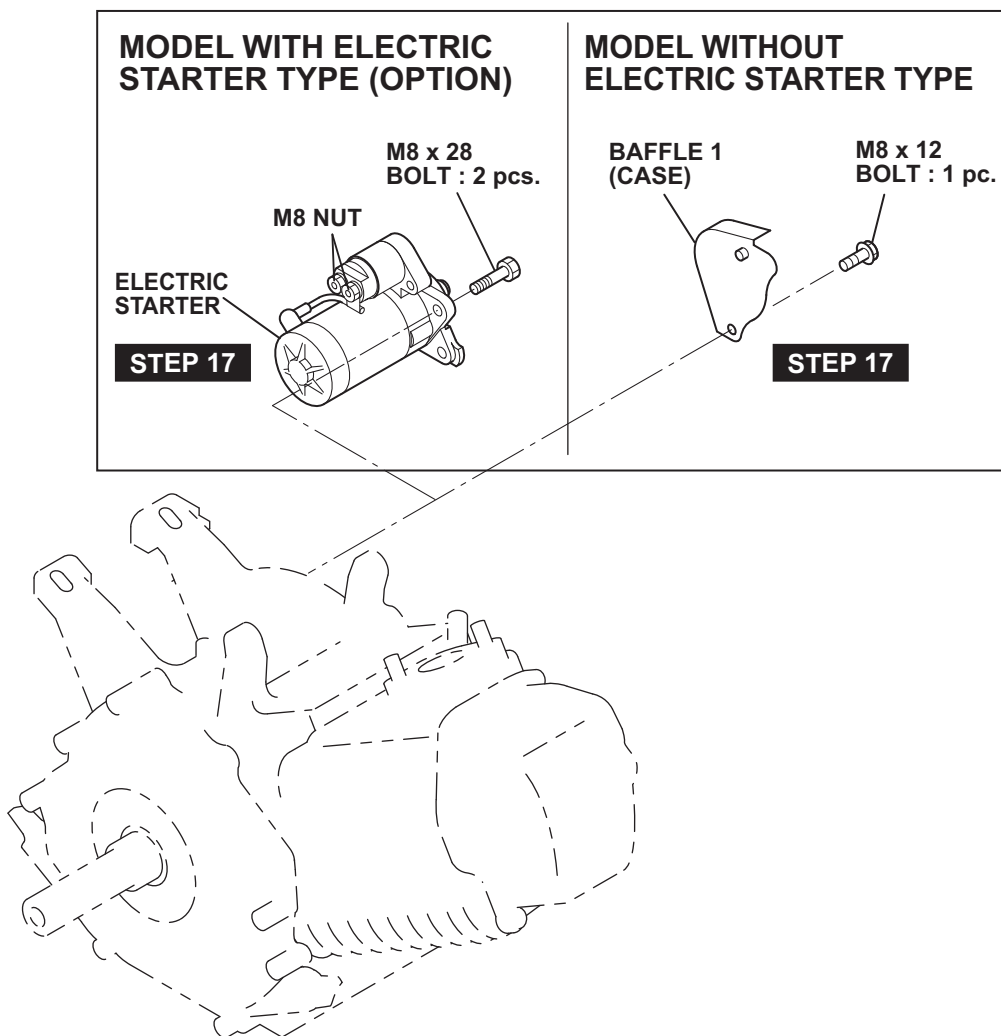


Fig.5-12

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---|---|---|
| 18 | [MODEL WITH CHARGE COIL TYPE] Wire clamp | Disconnect the wire clamp. NOTE: Disconnect the wire clamp in this step, also an engine which has both of the charge coil and the oil sensor. However, please make sure to not damaged (cut off) the oil sensor wire after disassembly procedure. | 10 mm box spanner M6 x 10 mm : 1 pc. |
| | Charge coil | Remove the charge coil. | + screwdriver |
| 19 | Spark plug | Remove the spark plug from the cylinder head. | 21 mm plug wrench |

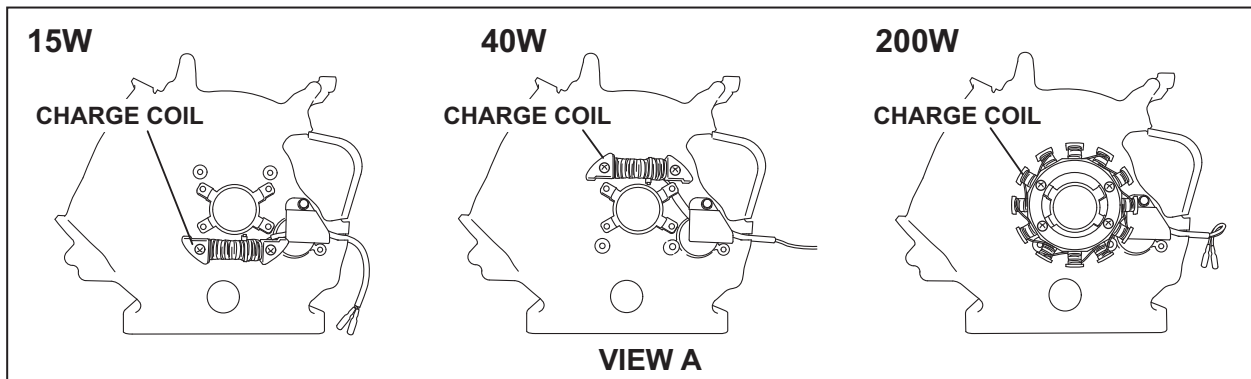
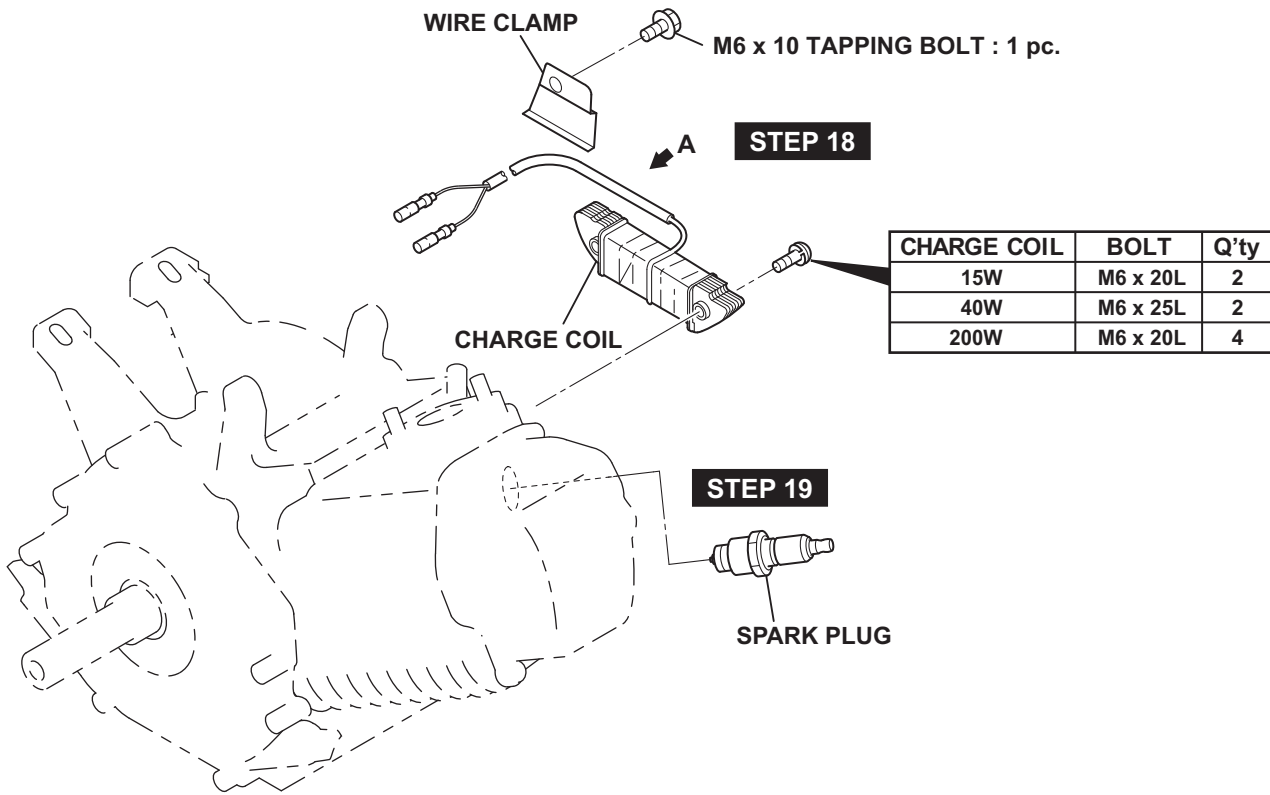


Fig.5-13

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|-----------------|--|---|
| 20 | Rocker cover | (1) Remove the rocker cover from the cylinder head. (2) Remove the gasket (rocker cover). | 10 mm box spanner M6 x 12mm : 4 pcs. |
| 21 | Rocker arm | Remove the pin (rocker arm) and the rocker arm from the cylinder head at the compression top dead center. (See Fig. 5-16) | |

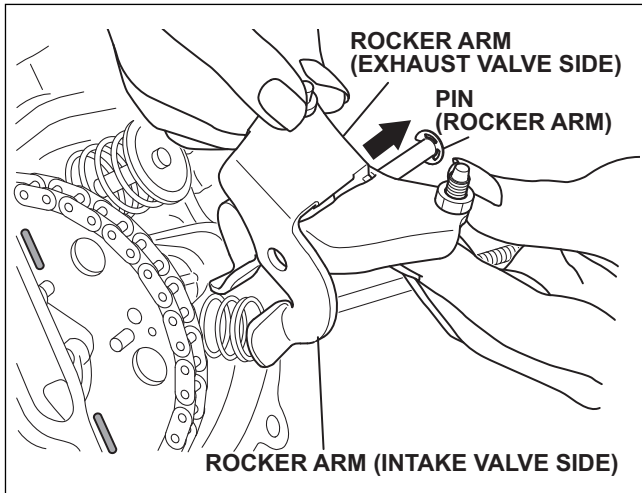


Fig.5-15

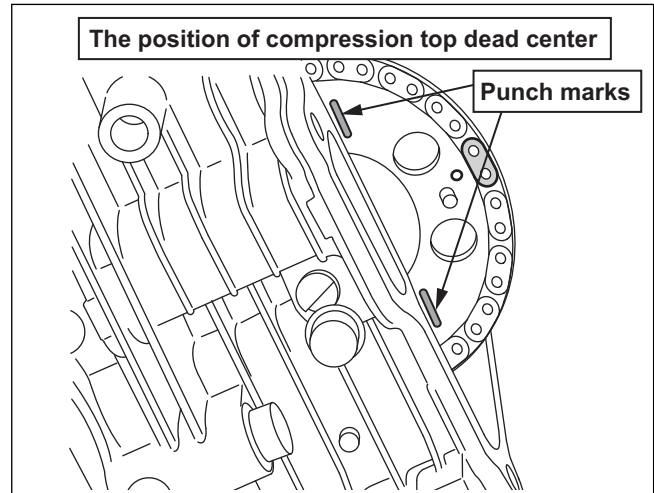


Fig.5-16

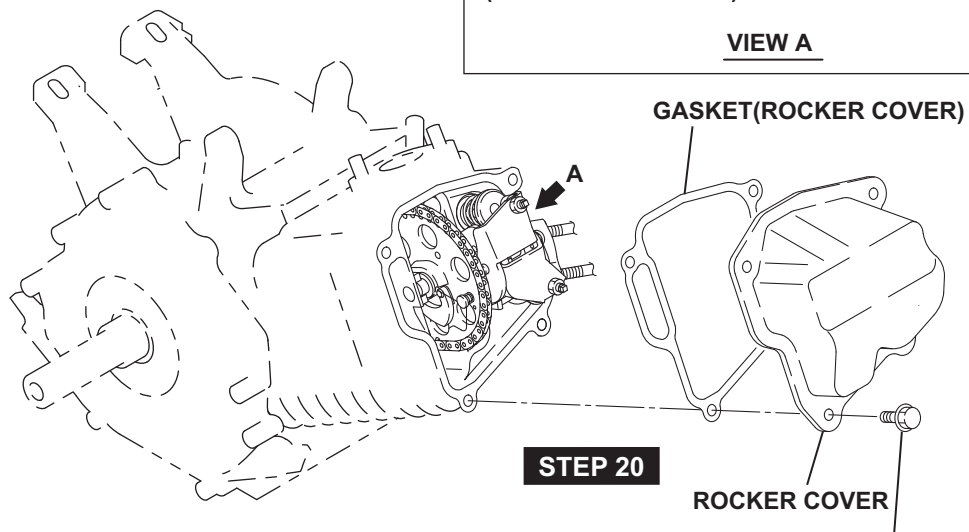
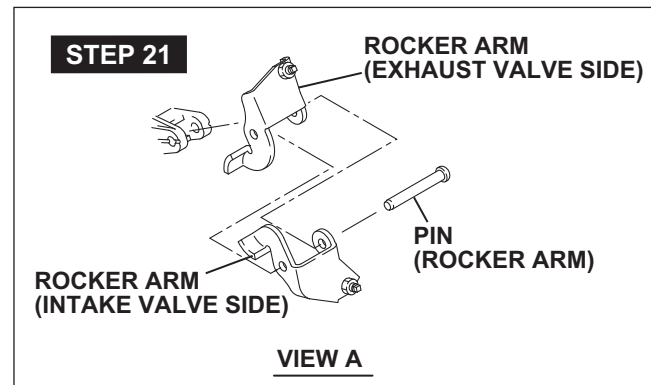


Fig.5-14

M6 x 12 BOLT : 4 pcs.

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|--------------------|--|---|
| 22 | 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. 5-18) Be careful not to damage the oil gauge or oil seal or not to lose the pipe knocks. | 12 mm box spanner M8 x 38mm : 8 pcs. |

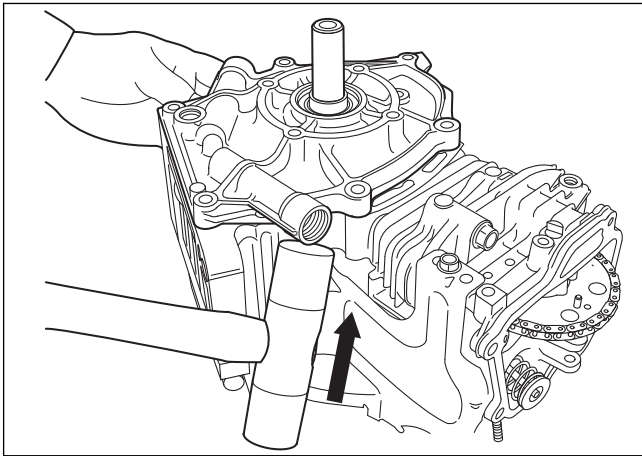


Fig.5-18

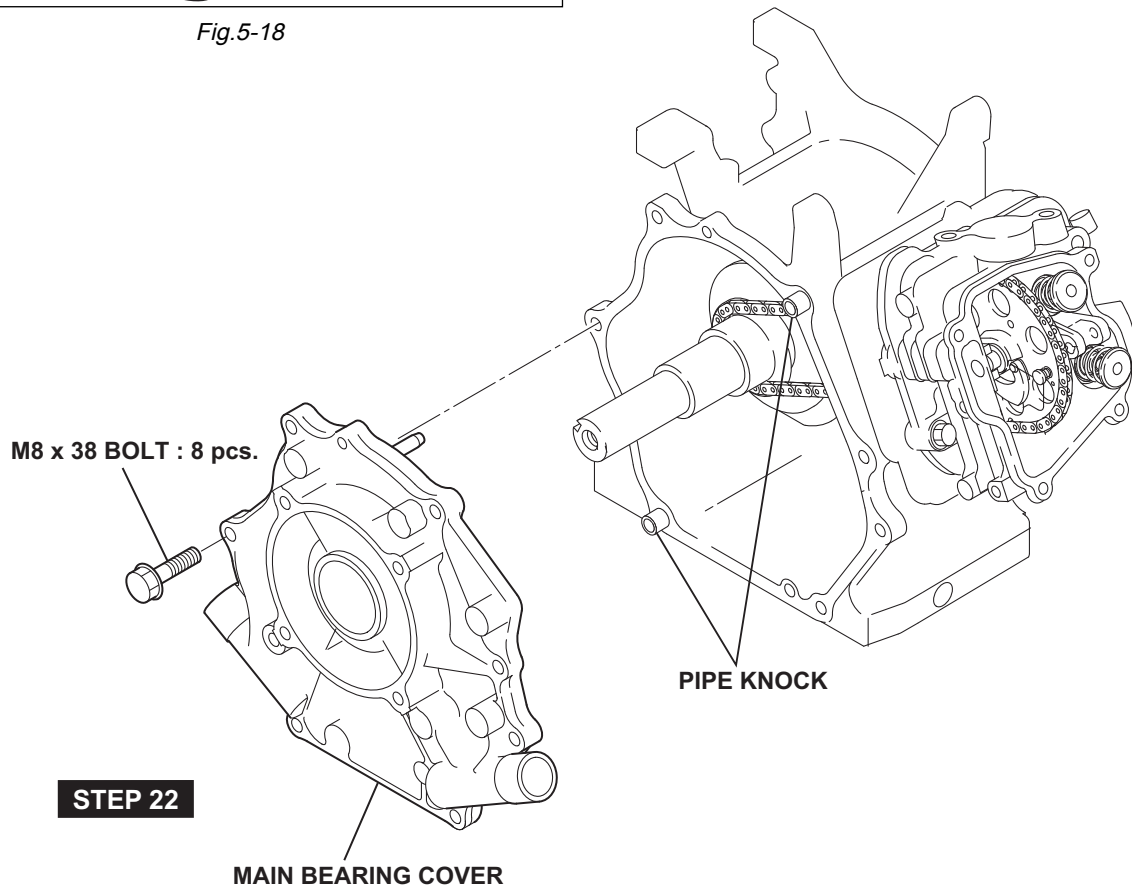


Fig.5-17

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---------------------|--|---|
| 23 | Tensioner, Camshaft | <ol style="list-style-type: none"> (1) Remove the tensioner. (See Fig. 5-20) Do not lose the pin (tensioner). (2) Remove the retaining bolt of pin (camshaft) from the cylinder head. (See Fig. 5-21) (3) Remove the pin (camshaft), taking care not to scratch the O-ring. (4) Remove the chain from the camshaft sprocket and then take out the camshaft. (See Fig. 5-22) (5) Remove the chain from the crankshaft. | M10 box spanner or spanner M6 x 12mm : 1 pc. Pliers |

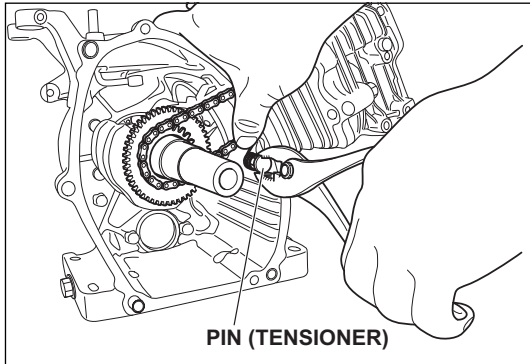


Fig.5-20

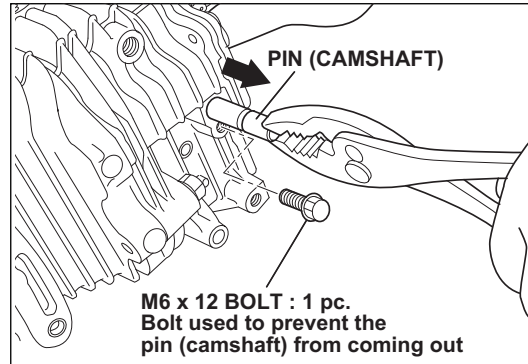


Fig.5-21

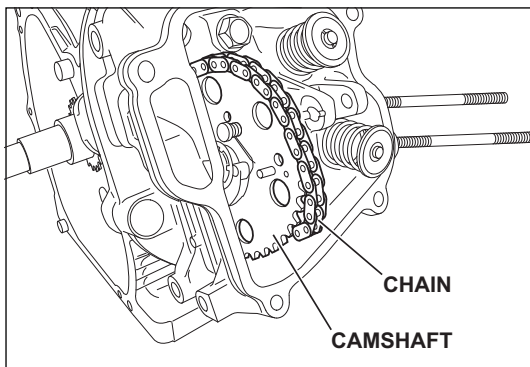


Fig.5-22

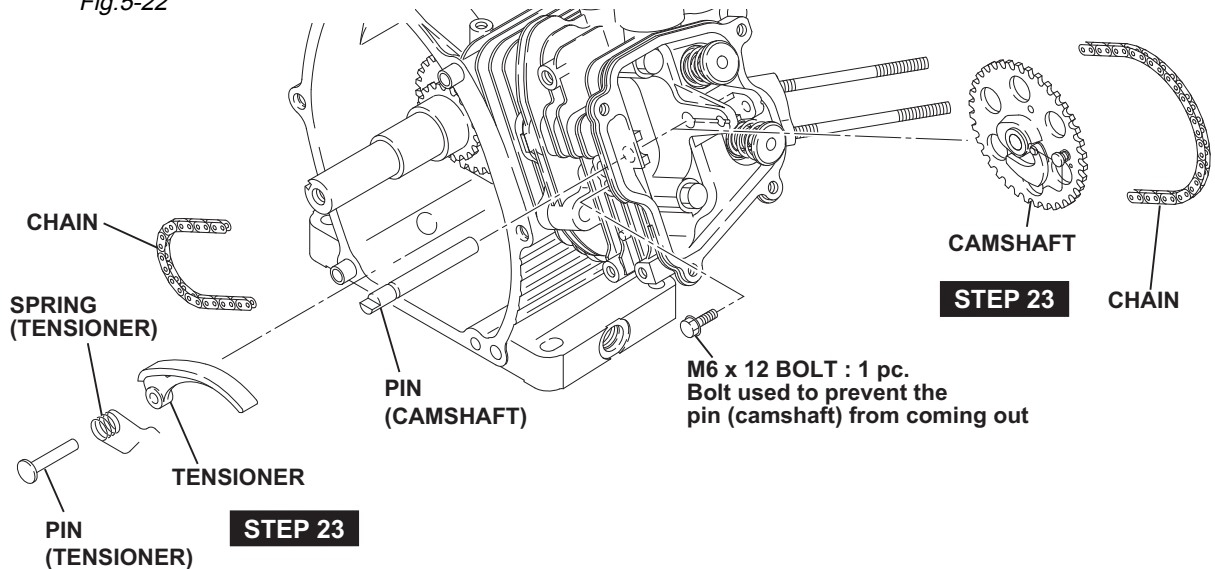


Fig.5-19

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|-------------------------------|---|--|
| 24 | Cylinder head, Chain guide | (1) Remove the cylinder head from the crankcase. (2) Remove the cylinder head gasket from the cylinder head. Take care not to lose the dowel pin. (3) Remove the chain guide from the top side of the crankcase. (If the chain guide is removed from the inner side of the crankcase, it might be damaged.) | 12 mm box spanner M10 × 75mm : 4 pcs. M8 × 35mm : 2 pcs. |
| 25 | Intake and exhaust valves | (1) Remove the collet valve from the spring retainer. (See Fig. 5-24) (2) Remove the intake valve and the exhaust valve. | |

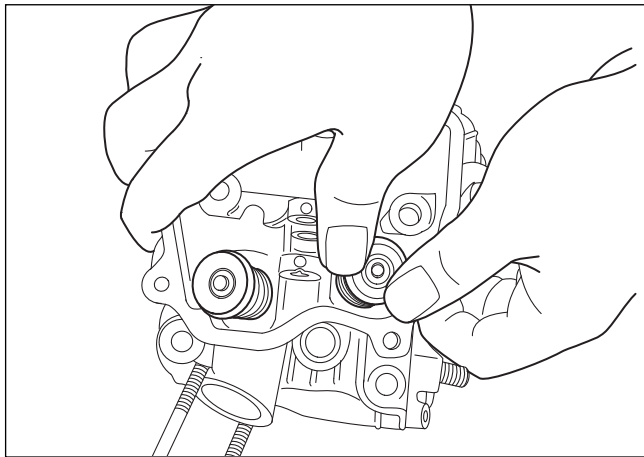


Fig.5-24

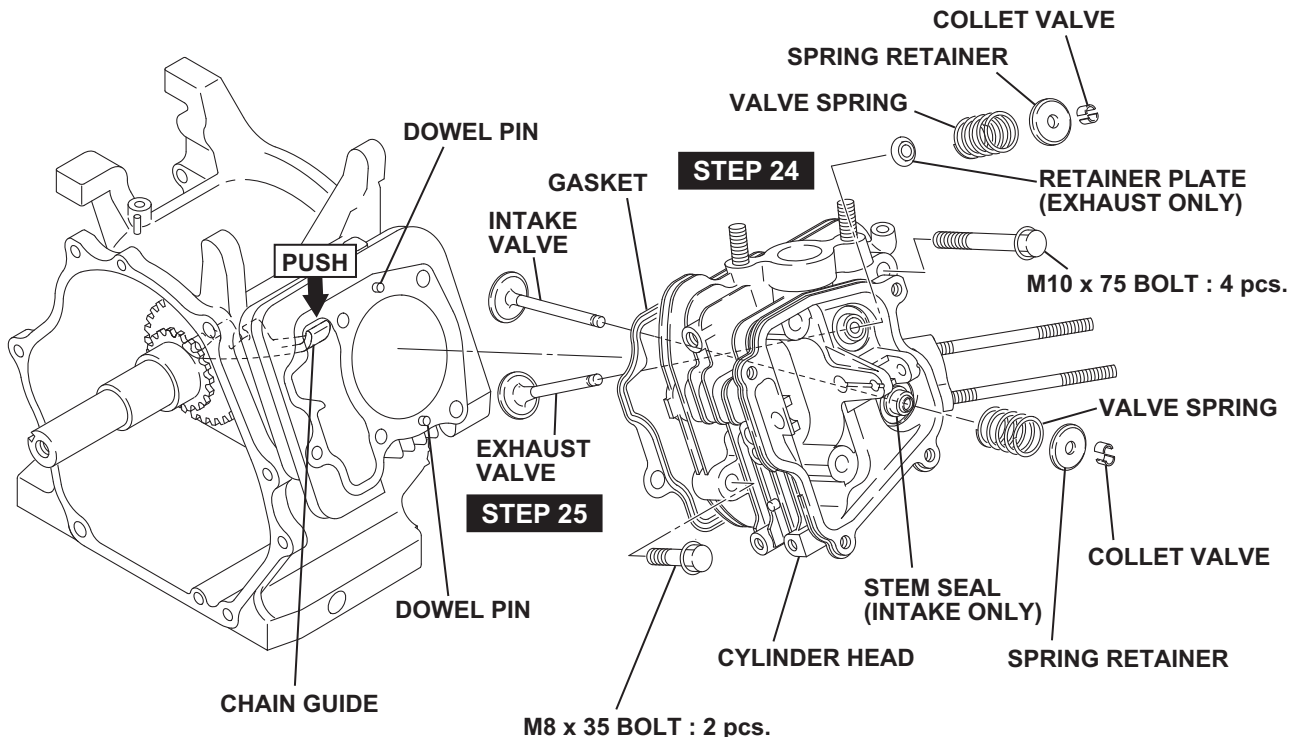


Fig.5-23

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|---------------------------|---|---|
| 26 | Connecting rod and piston | <ol style="list-style-type: none"> (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. | 12 mm box spanner M8 x 40mm : 2 pcs. |
| 27 | Piston and piston rings | <ol style="list-style-type: none"> (1) Remove the piston clips (2 pcs.). 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. | |

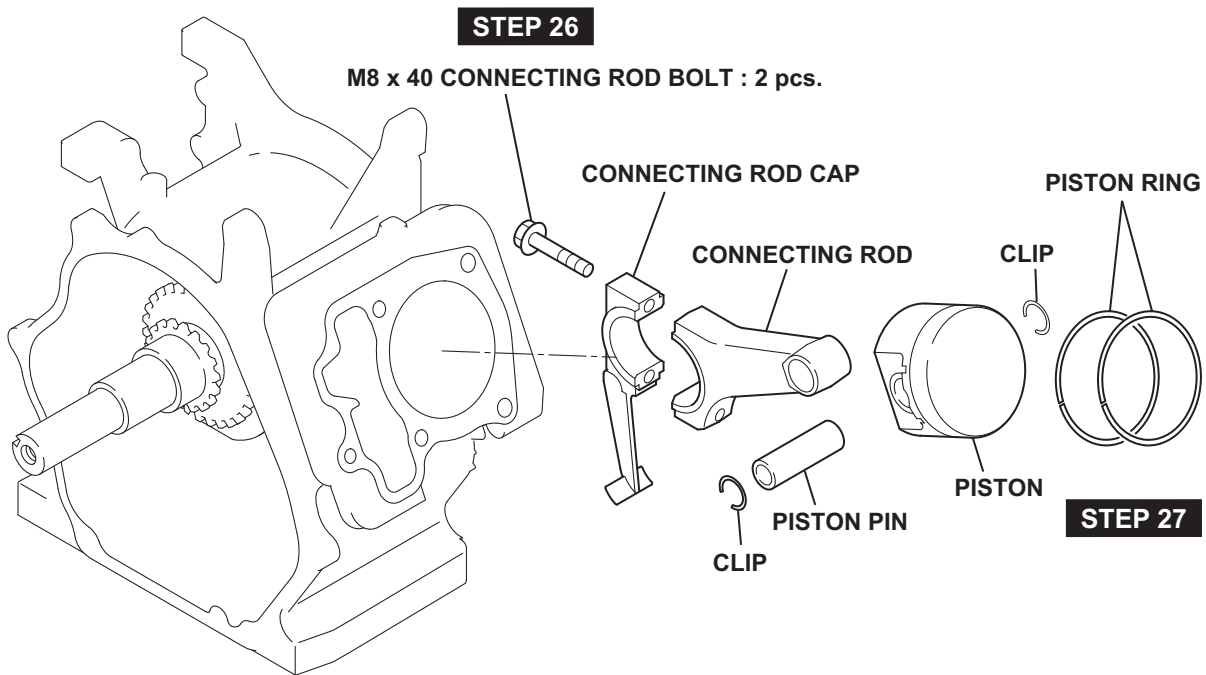


Fig.5-25

| Step | Parts to remove | Remarks and procedures | Fasteners |
|------|--|---|---|
| 28 | 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. (See Fig. 5-27) | Plastic hammer |
| 29 | [MODEL WITH OIL SENSOR TYPE] Oil sensor | (1) Remove the clamp.[Model without charge coil type] (See Fig. 5-28) (2) Remove the oil sensor from the crankcase. | M6 x 10mm : 1 pc. M6 x 16mm : 2 pcs. |

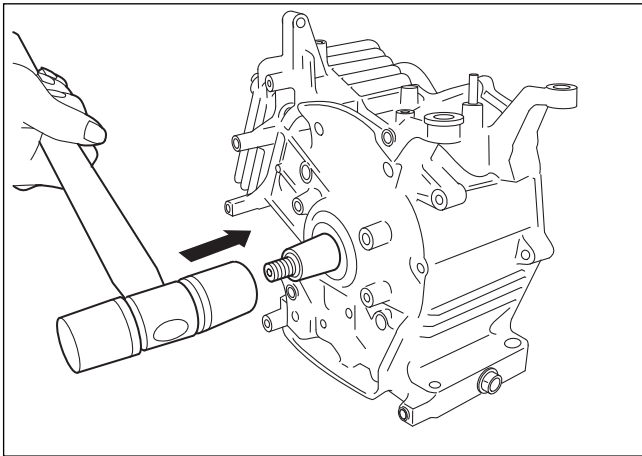


Fig.5-27

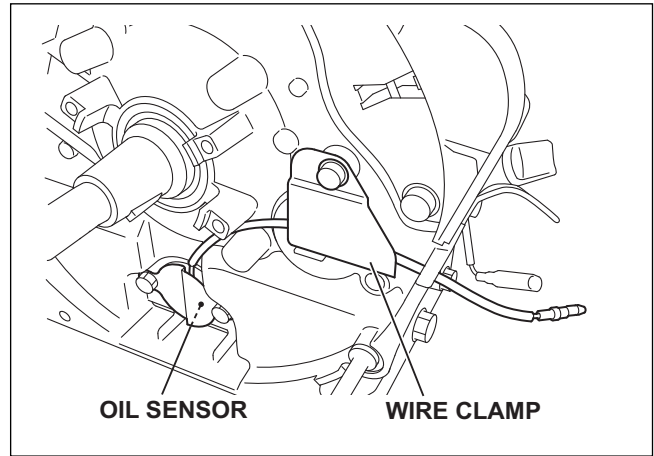


Fig.5-28

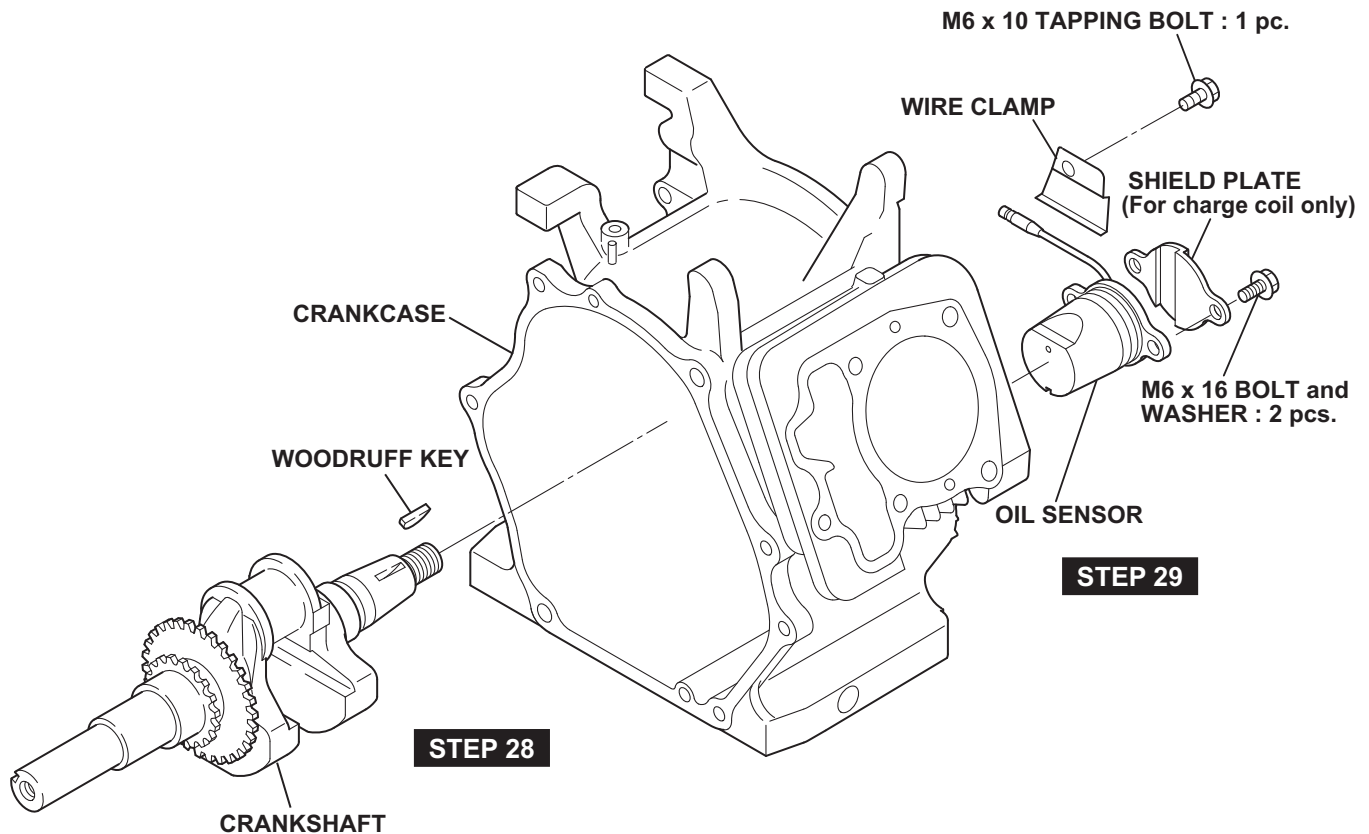


Fig.5-26

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) OIL SENSOR

- (a) Mount the oil sensor and fix the wire with the clamp.

| Tightening torque |
|---|
| 8.0 - 10.0 N·m (80 - 100 kgf·cm) (5.8 - 7.2 ft·lb.) |

NOTE :

Make sure to not damaged (cut off) the oil sensor wire after assembly procedure.

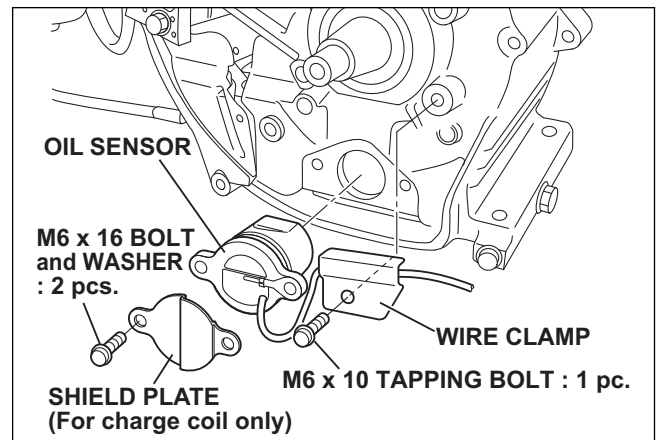


Fig.5-29

(2) 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.

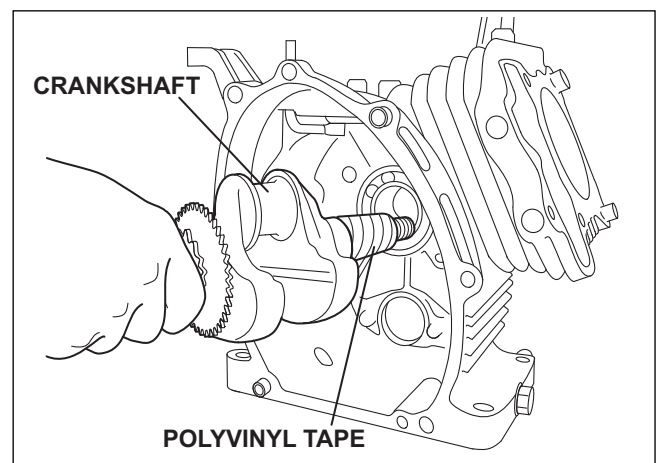


Fig.5-30

(3) 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.

(See Fig. 5-33)

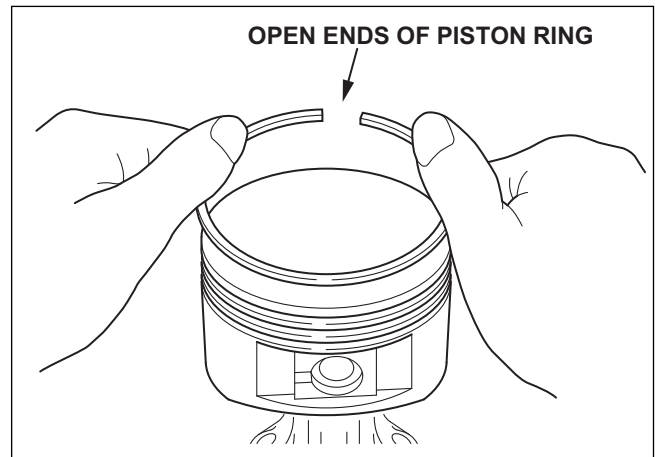


Fig.5-31

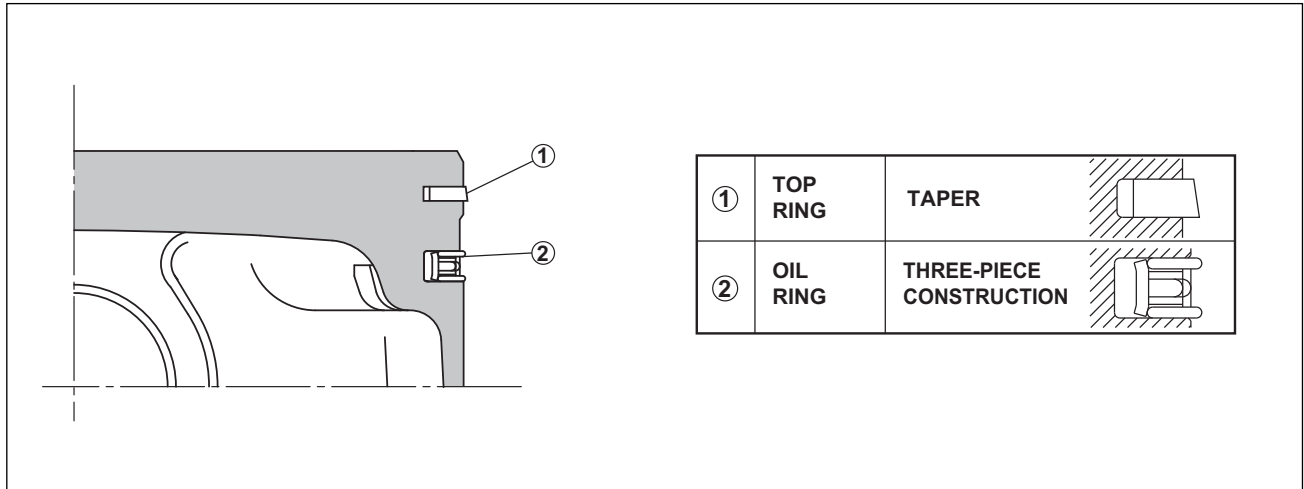


Fig.5-32

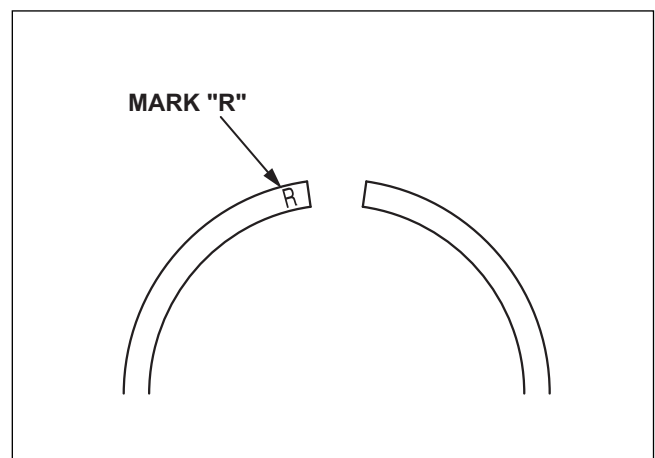


Fig.5-33

(4) 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 'MAG' 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.

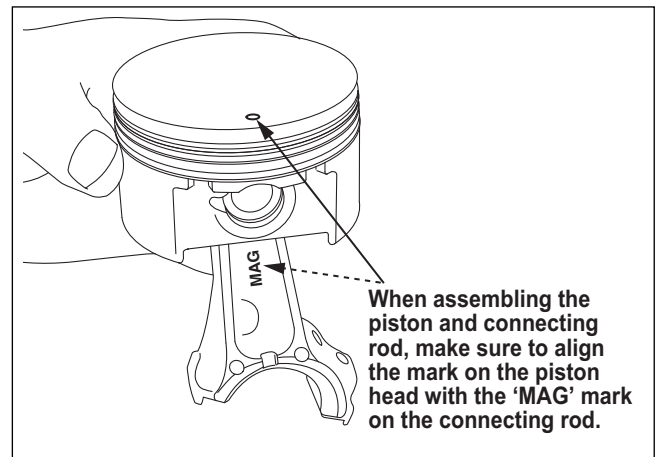


Fig.5-34

(5) CONNECTING ROD

(a) Install the piston and connecting rod assembly into the cylinder by holding the piston rings with the ring guide, with the 'MAG' 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. (See Fig. 5-36)

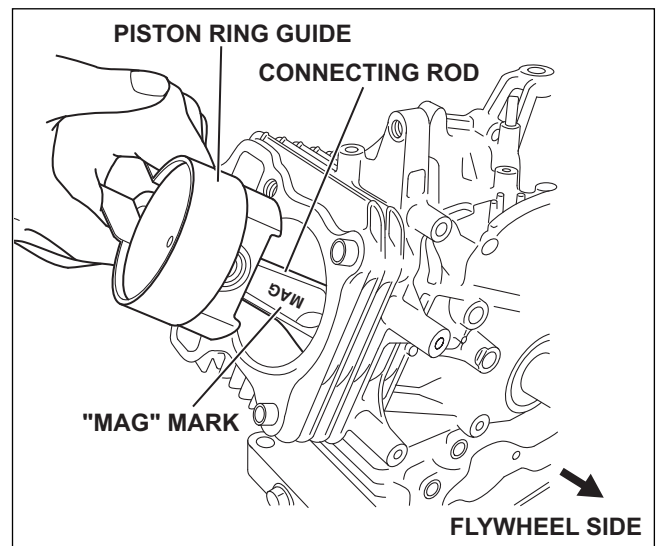


Fig.5-35

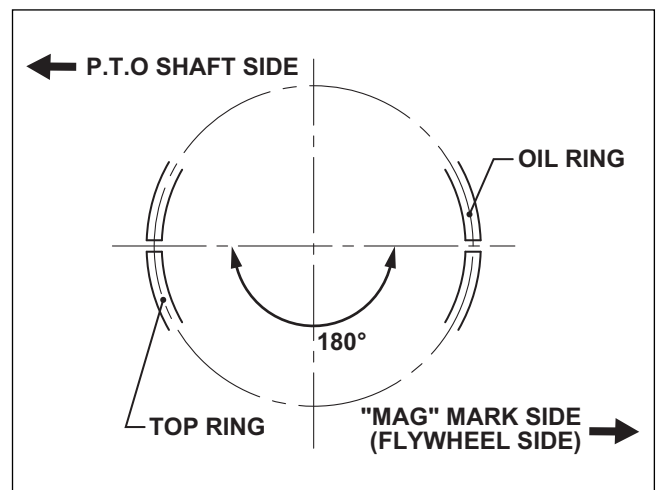


Fig.5-36

- (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.

M8 bolt (12mm box wrench)

| Tightening torque |
|---|
| 22.5 - 27.5 N·m (225 - 275 kgf·cm) (16.3 - 19.9 ft·lb.) |

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

(6) 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.
(Refer to the “STANDARD REPAIR TABLES” on page 76 and 77.)

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.)

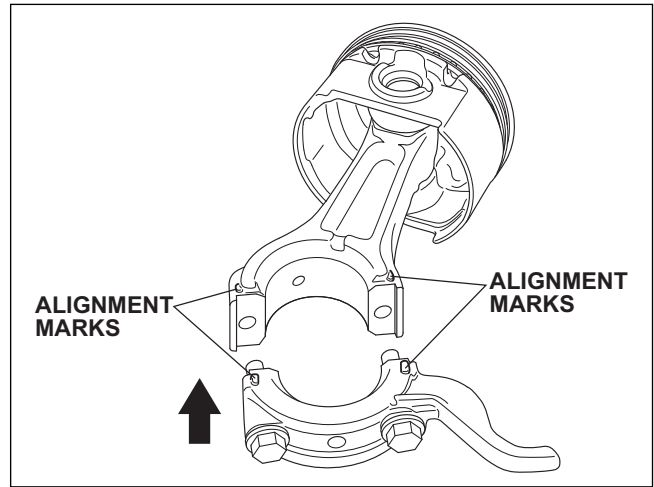


Fig.5-37

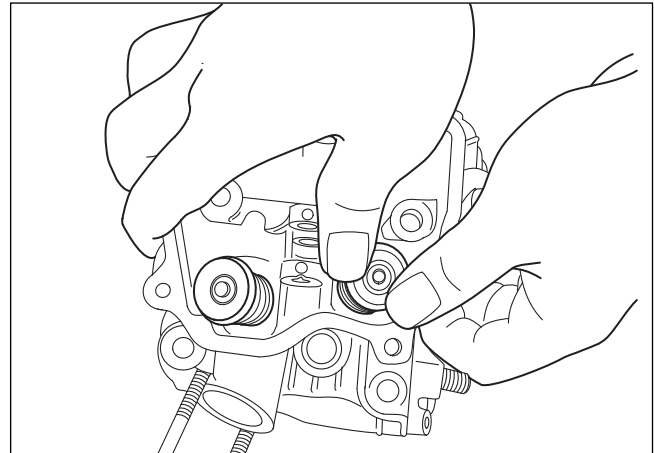


Fig.5-38

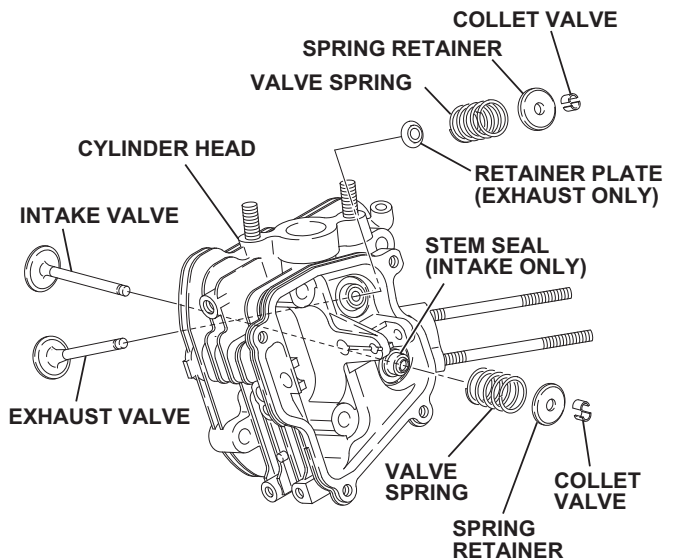


Fig.5-39

(7) CHAIN GUIDE

Mount the chain guide to the crankcase.

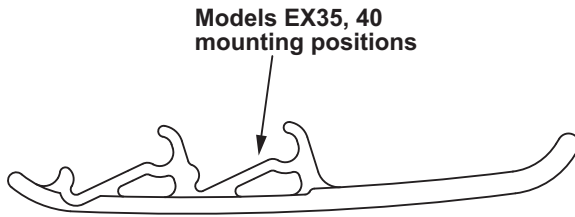


Fig.5-40

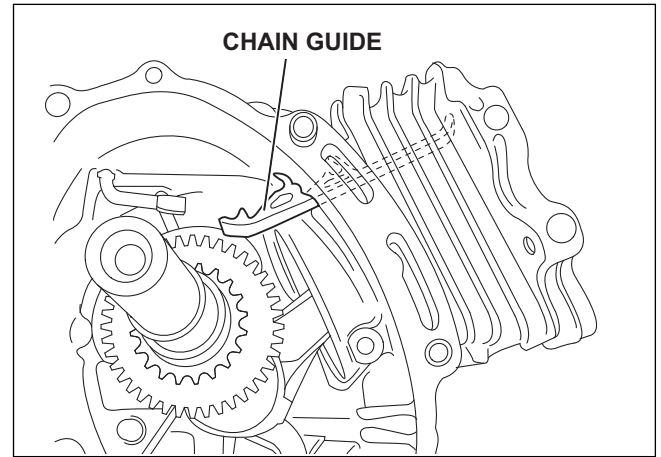
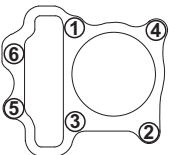
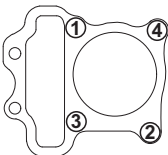


Fig.5-41

(8) CYLINDER HEAD

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

| Cylinder head bolts | Tightening Torque | | Remarks |
|--|--|---|---|
| | 1 st step | 2 nd step | |
| M10 × 75 mm : ①, ②, ③, ④, flange bolt : 4 pcs. (14mm box wrench) |  |  | Re-use |
| M8 × 35 mm : ⑤, ⑥ flange bolt : 2 pcs. (12mm box wrench) | 17.0 - 19.0 N·m (170 - 190 kgf·cm) (12.3 - 13.7 ft·lb.) | 29.0 - 31.0 N·m (290 - 310 kgf·cm) (21.0 - 22.4 ft·lb.) | When replace to new cylinder head and flange bolts |
| | | — | As for ⑤ and ⑥, only 1 st step tightening. |

Tighten the cylinder head bolts in diagonal order.

(1) Re-use (Oil the screw thread)

- Tighten all bolts (6pcs) by $18 \pm 1 \text{ N}\cdot\text{m}$ primary, and then tighten longer ones (M10 × 75mm flange bolt: 4pcs) by $30 \pm 1 \text{ N}\cdot\text{m}$.

(2) When replace to new cylinder head and flange bolts (Oil the screw thread)

- Tighten all bolts (6pcs) by $18 \pm 1 \text{ N}\cdot\text{m}$ primary, and then tighten longer ones (M10 × 75mm flange bolt: 4pcs) by $38 \pm 1 \text{ N}\cdot\text{m}$.

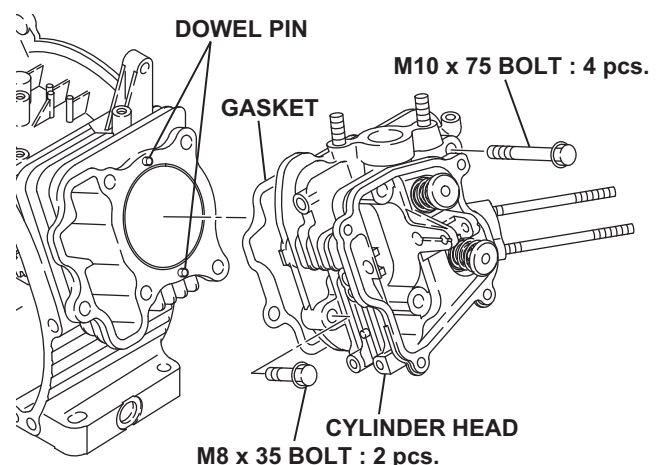


Fig.5-42

(9) SETTING THE TIMING CHAIN

- Align the timing mark on the crankshaft sprocket with the mark plate of the timing chain.
- Align the timing mark on the crankshaft sprocket with the mark plate of the opposite end of the timing chain.

Number of oval steel link : 112

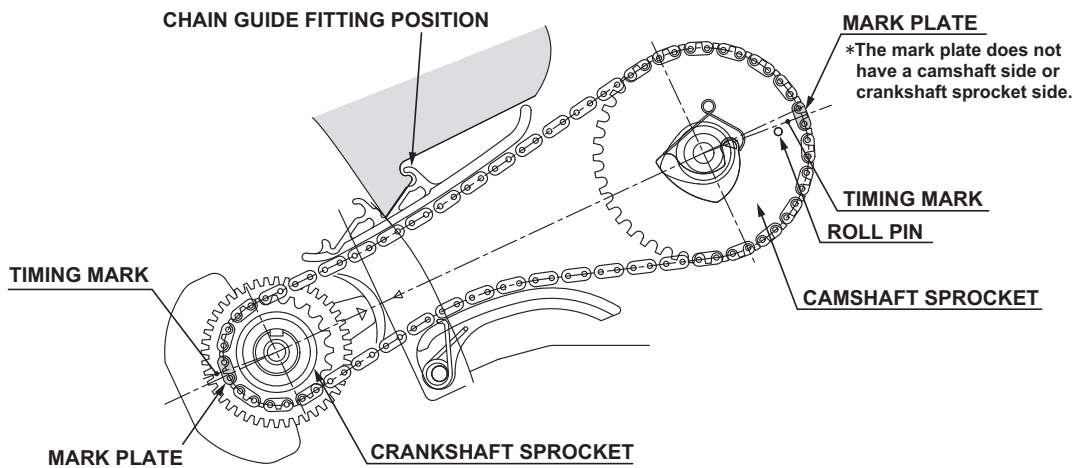


Fig.5-43

(10) MOUNTING THE CAMSHAFT ON THE CYLINDER HEAD

Mount the camshaft on the cylinder head by inserting the pin (camshaft) through the head. Fix the bolt to prevent the pin (camshaft) from coming out.

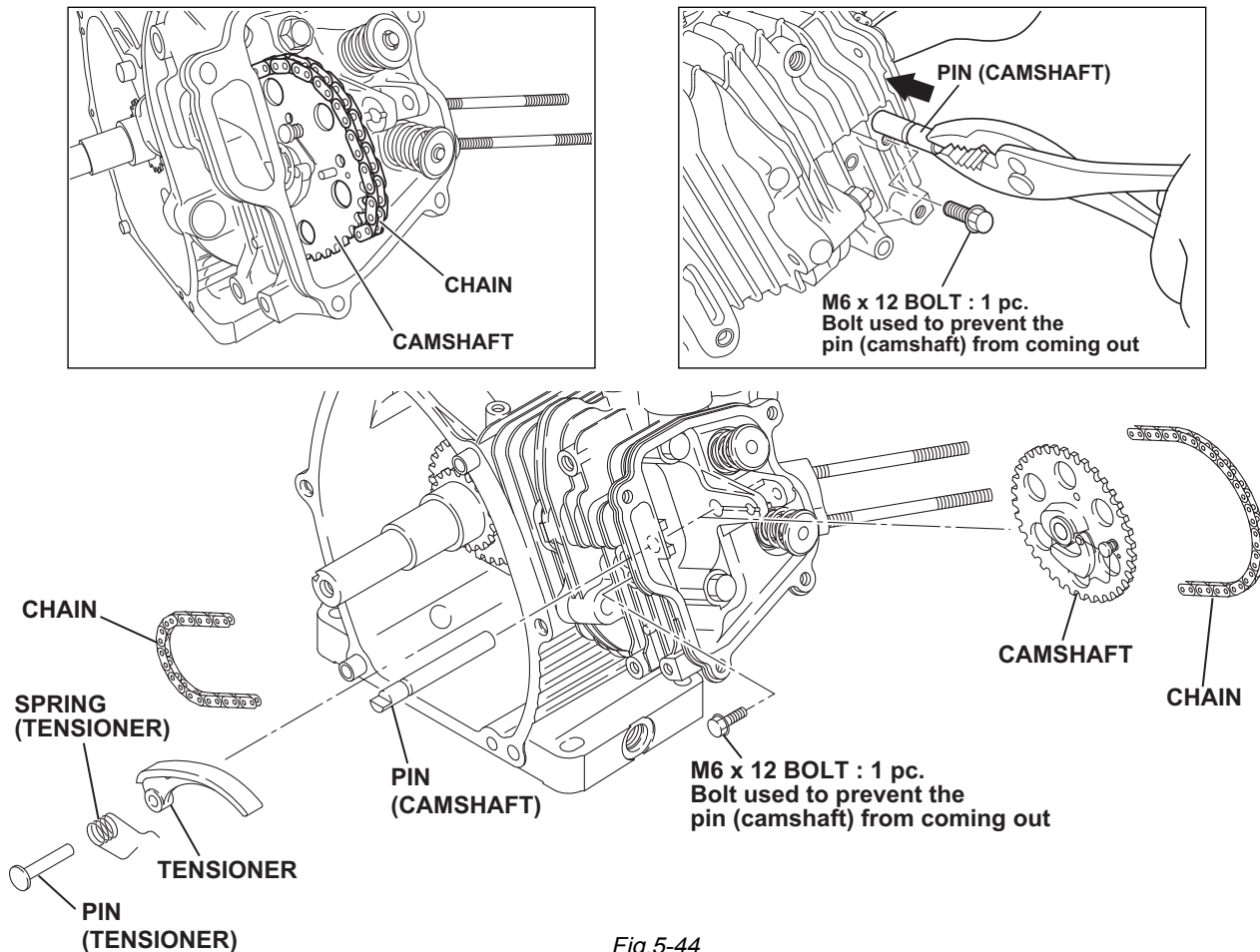


Fig.5-44

(11) MOUNTING THE TENSIONER

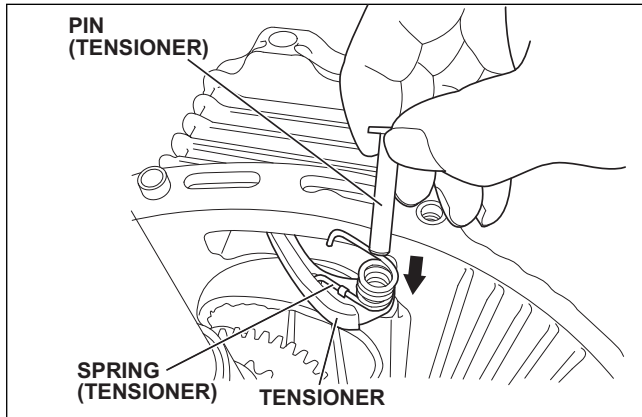


Fig.5-45

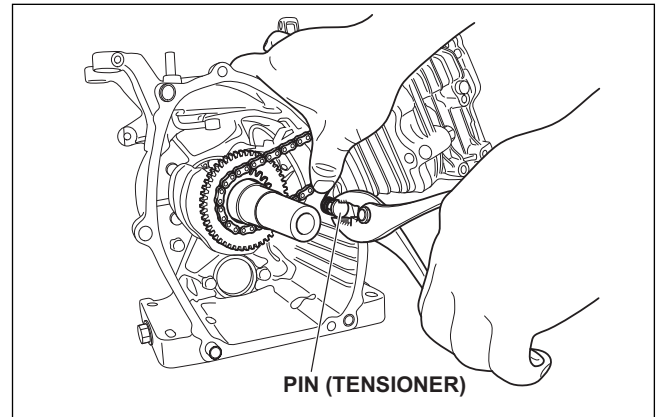


Fig.5-46

(12) BALANCER SHAFT

Mount the balancer shaft on the crankcase, align the timing marks on the balancer gear and the crankshaft gear.

NOTE: Incorrect alignment of the timing marks can result in malfunction of the engine, leading to damage due to interference of the parts.

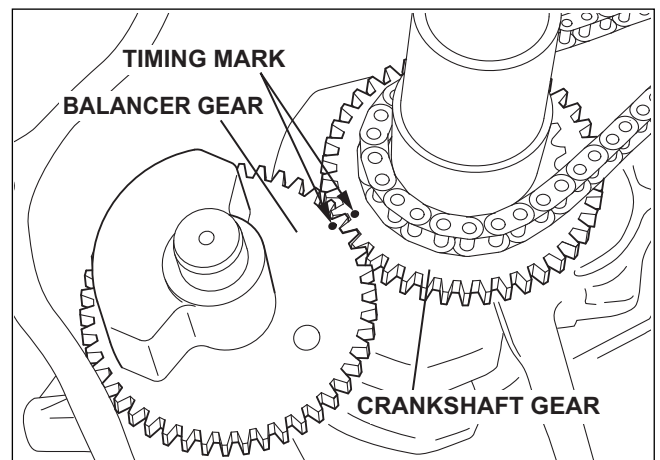


Fig.5-47

(13) MAIN BEARING COVER

Apply oil to the bearing and the oil seal lip when mounting the main bearing cover. Also apply sealant (Three Bond "1215") 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: Be careful that the lever portion of governor shaft does not face the main bearing cover.

| Tightening torque |
|---|
| 22.0 - 24.0 N·m (220 - 240 kgf·cm) (16.2 - 17.7 ft·lb.) |

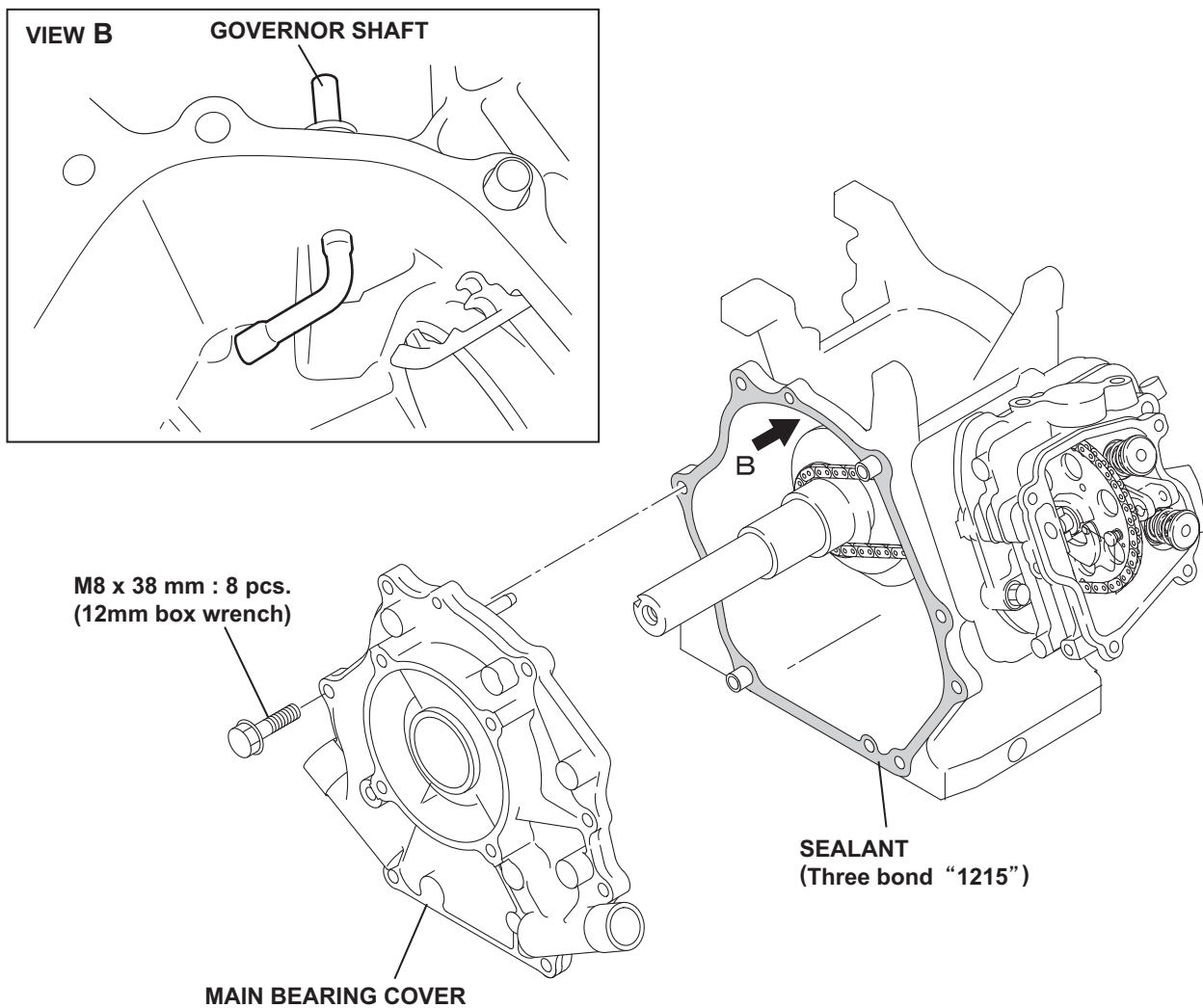


Fig.5-48

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

NOTE 1: Conduct this job at the compression top dead center.

(The position of two punch marks on cam sprocket is in parallel with the cylinder head surface at a time.)

NOTE 2: Make sure that the piston is at the compression top dead center by checking mutual position between the flywheel and the ignition coil or by checking that the key way is at the top. (See each Fig.5-50)

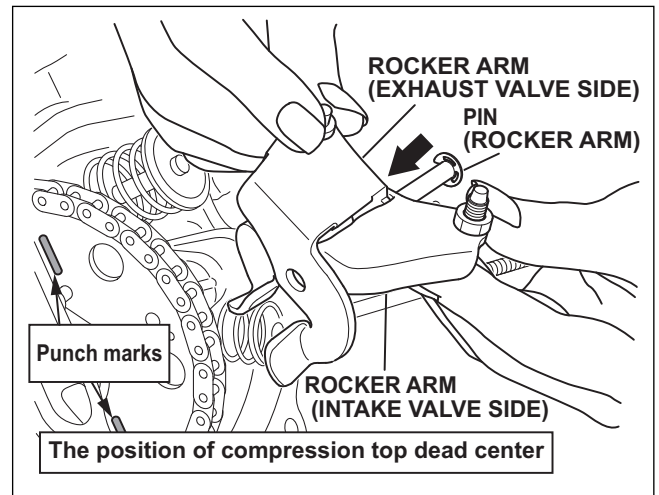


Fig.5-49

(15) 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.

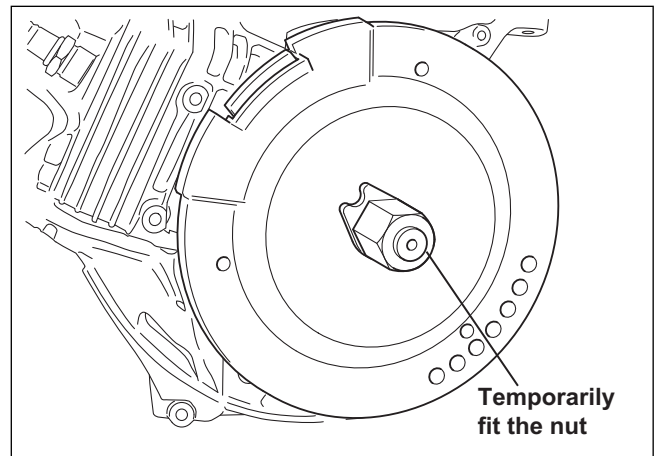


Fig.5-50

| Valve clearance (when the engine is cold) | |
|---|---|
| Intake valve side | 0.12 ^{+0.03} ₀ mm (0.0047 ^{+0.0012} ₀ 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.

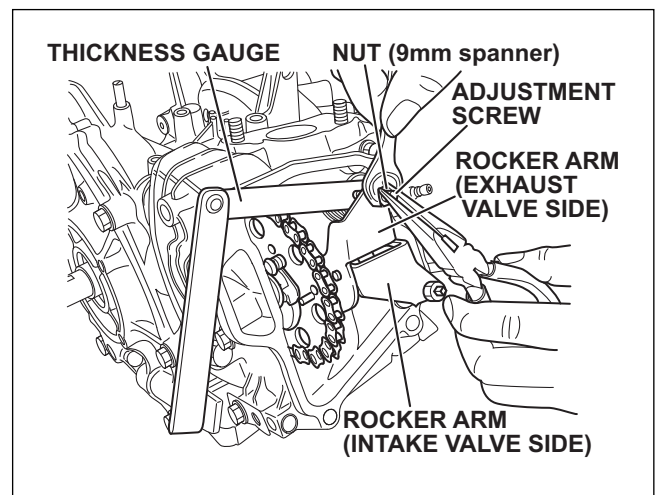


Fig.5-51

(16) ROCKER COVER

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

M6 × 12 mm flange bolt : 4 pcs.

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

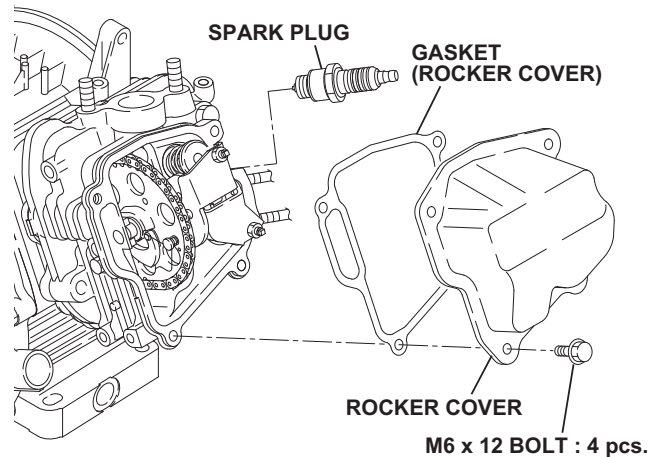


Fig.5-52

(17) 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 BR-6HS (21 mm plug wrench)

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

| Tightening torque | |
|--|---|
| New spark plug | Re-tightening torque |
| 12.0 - 15.0 N·m (120 - 150 kgf·cm) (8.7 - 10.8 ft·lb.) | 23.0 - 27.0 N·m (230 - 270 kgf·cm) (16.6 - 19.5 ft·lb.) |

(18) BAFFLE 1 (CASE)

The projection (upper) on the baffle 1 with the crankcase and mount it (under) with the bolt.

[MODEL WITHOUT ELECTRIC STARTER]

M8 × 12 mm bolt : 1 pc.

[MODEL WITH ELECTRIC STARTER]

Mount the electric starter and the charging coil, referring to the illustrations of disassembly.

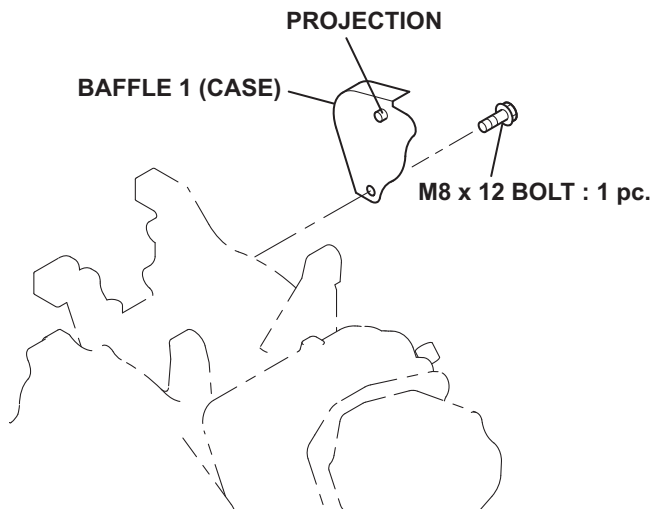


Fig.5-53

(19) FLYWHEEL, COOLING BLOWER and STARTING PULLEY

NOTE: When mounting the flywheel, be sure to wipe off any oil on the tapered portion of the crankshaft and flywheel.

- a) Mount the flywheel on the crankshaft.
- b) Install cooling blower and starting pulley to the crankshaft.

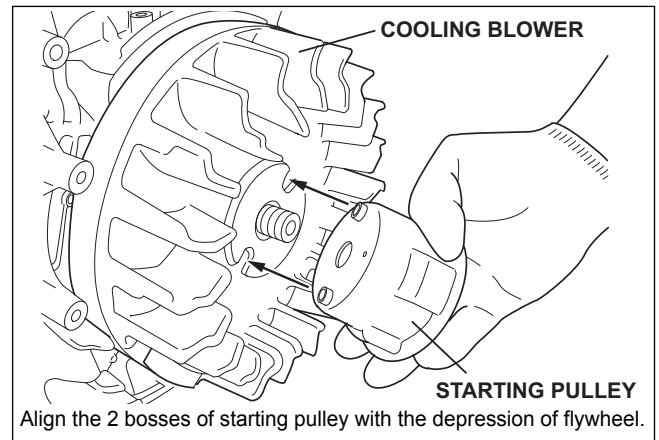


Fig.5-54

- c) Tighten crankshaft nut with locking pliers adopted as shown in the illustration.

| Tightening torque | |
|---|--|
| 100.0 - 120.0 N·m (1000 - 1200 kgf·cm) (72.3 - 86.8 ft·lb.) | |

M18 Nut : 1 pc. (24mm box wrench)

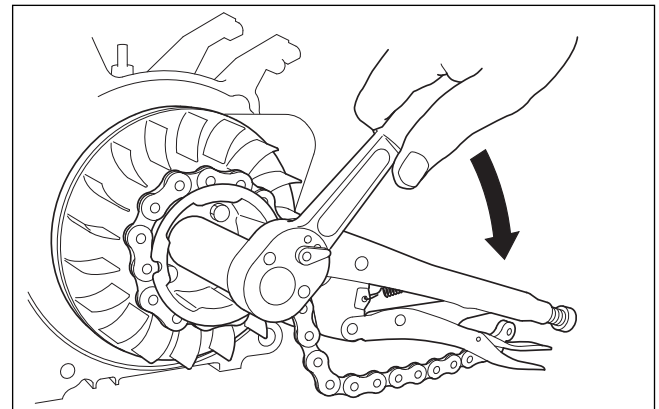


Fig.5-55

(20) 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 × 25 mm bolt and washer : 2 pcs.

Make sure to put in the wire 1 to the notch on the crankcase, and tighten it with the clamp.

(M6×8 mm bolt : 1 pc.)

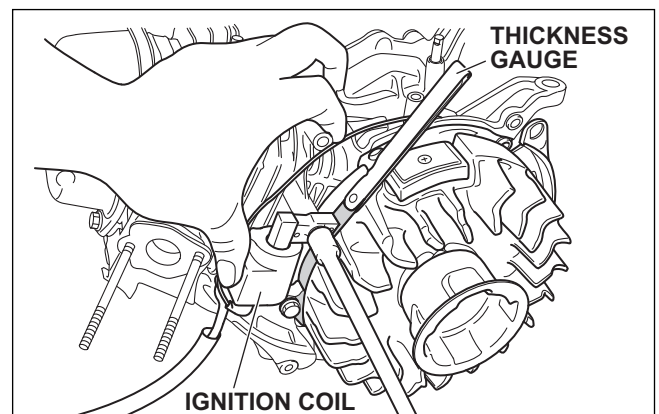


Fig.5-56

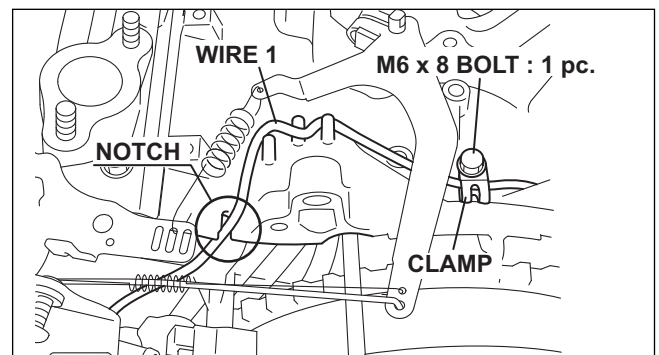


Fig.5-57

(21) CARBURATOR

- (a) Replace the gasket of insulator with a new one and mount the insulator on the cylinder head intake side.
- (b) Mount the carburetor.

(22) GOVERNOR LEVER (See Fig.5-58, 59)

- (a) Pass the governor rod through the rod spring, then connect to the throttle lever of the carburetor.
- (b) Attach the governor rod and rod spring to the governor lever, then mount the governor lever on the governor shaft. Do not adjust the bolt on the governor lever yet.
- (c) Connect the governor lever and the speed control lever with the governor spring.

NOTE : See page 40 for details on the adjustment method after mounting air cleaner base.

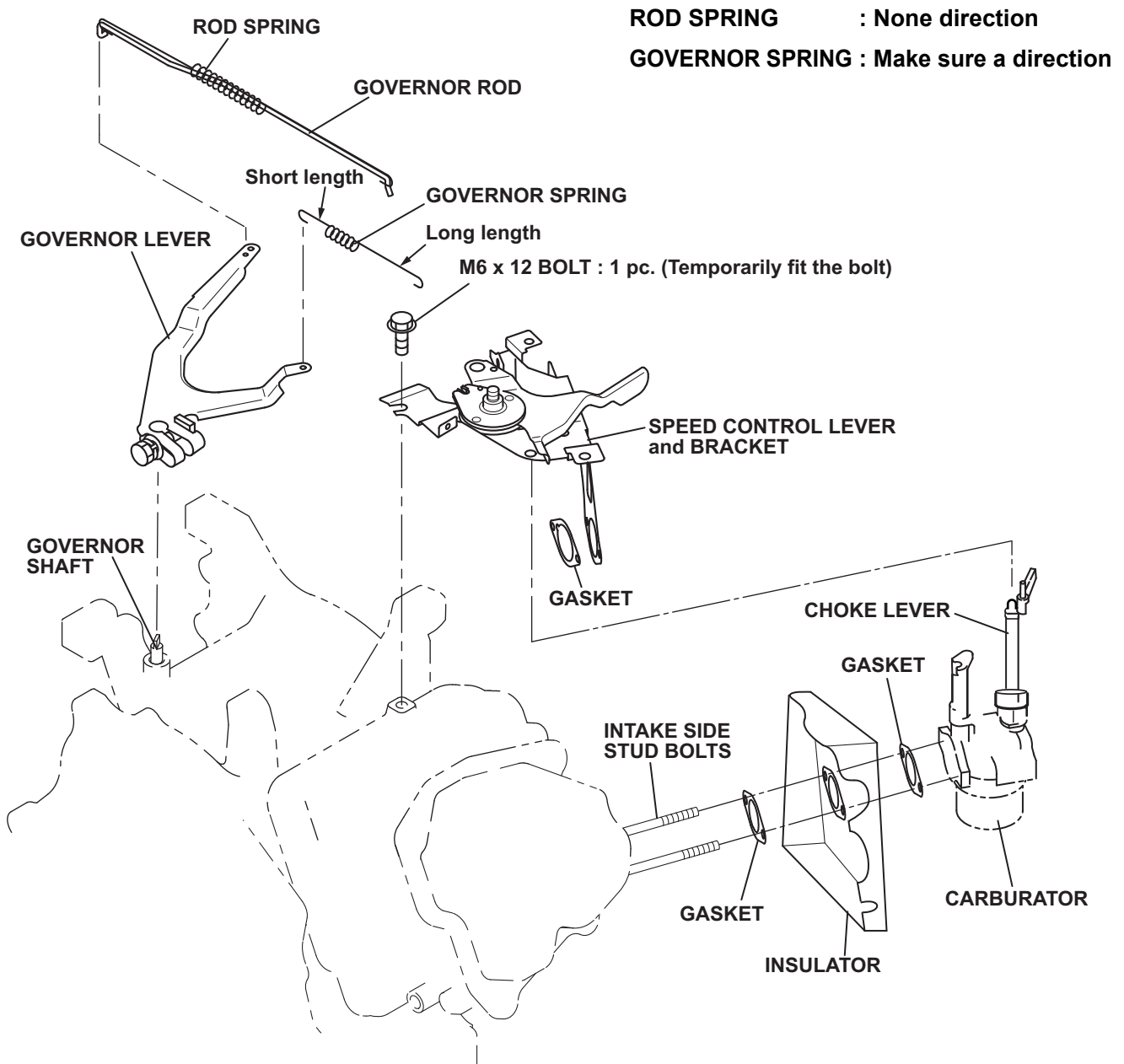


Fig.5-58

(23) SPEED CONTROL LEVER and BRACKET (See Fig.5-58, 59)

Install the speed control lever and bracket to the top* of the choke lever, at the same time mount the bracket to the intake side stud bolts on the cylinder head.

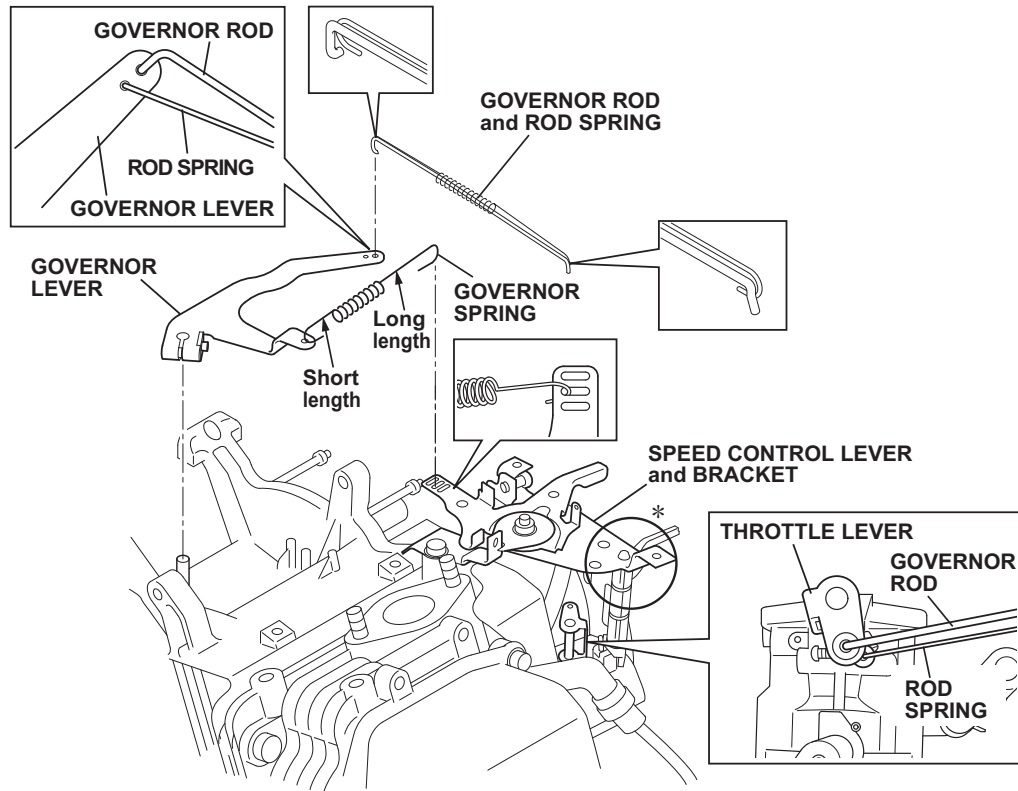


Fig.5-59

Variation of the governor spring

The dimensions of the governor spring are different each other according to the Hz.

The governor spring for the standard engine is same as that for the engine to be connected to the 60Hz generator.

- | | |
|--------------------------|-------------------------------|
| EX35 and 40 / 60Hz (STD) | color : silver |
| EX35 and 40 / 50Hz | color : Different from silver |

(24) AIR CLEANER BASE

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

The following are positions to insert for each type of element :

- Ⓐ : Dual element type
- Ⓑ : Urethane element type

M6 flange nut : 2 pcs.

M6 × 16 mm flange bolt : 1 pc.

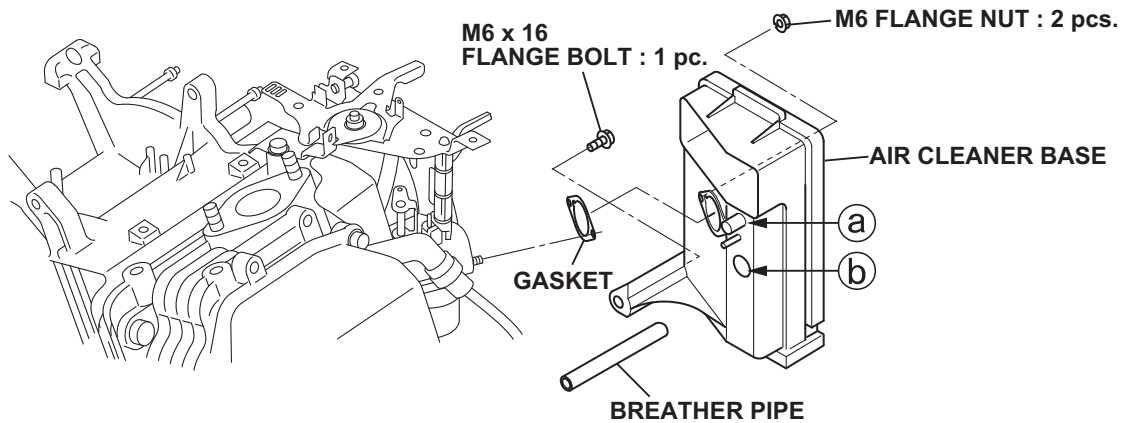


Fig.5-60

(25) SPEED CONTROL LEVER and BRACKET

Tighten the bolt which is temporarily fit. (Fig.5-58)

■ Governor system adjustment method

The governor unit is a centrifugal flyweight type and is installed on the governor gear.

Since it automatically adjusts the throttle valve of the carburetor by means of a link mechanism, it is possible to maintain a constant engine speed, even with load variations.

(1) Turn the speed control lever to the full speed position, making sure that the carburetor throttle valve is fully open.

(2) Hold the top of the governor shaft with the plier and turning it **counterclockwise** as far as it will go. Tighten the bolt on the governor lever.

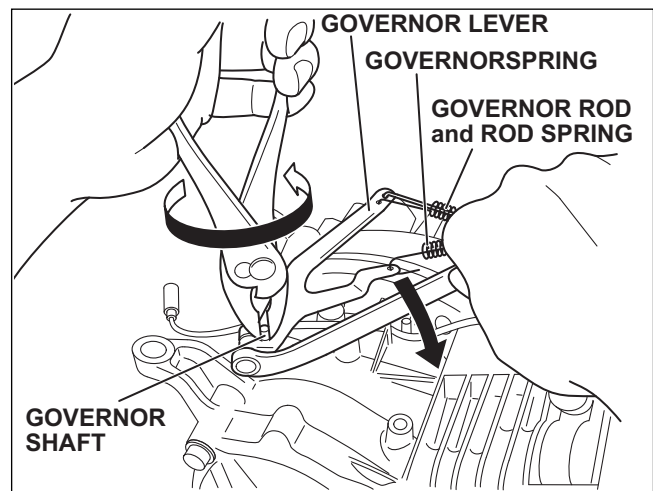


Fig.5-61

(26) BAFFLE2, RECOIL BRACKET, BLOWER HOUSING, RECOIL STARTER and STOP SWITCH

- (1) Set the ignition coil cord to the notch of the insulator, and then mount the baffle 2 to the crankcase.
(M6×12 mm bolt : 3 pcs.)
- (2) Mount the recoil bracket to the crankcase stud bolts. (M6 Nut : 4 pcs.)
- (3) Mount the stop switch to the blower housing. (M4 × 12 mm screw and washer : 2 pcs.)
*Tighten the wire 2 (ground) with the stop switch. (See Detail C)
- (4) Mount the blower housing on the crankcase. (M6 × 16 mm bolt : 5 pcs.)
*Tighten the wire 2 (ground) with the blower housing. (See View D)
- (5) Mount the recoil starter on the recoil bracket. (M6 × 14 mm bolt : 4 pcs.)

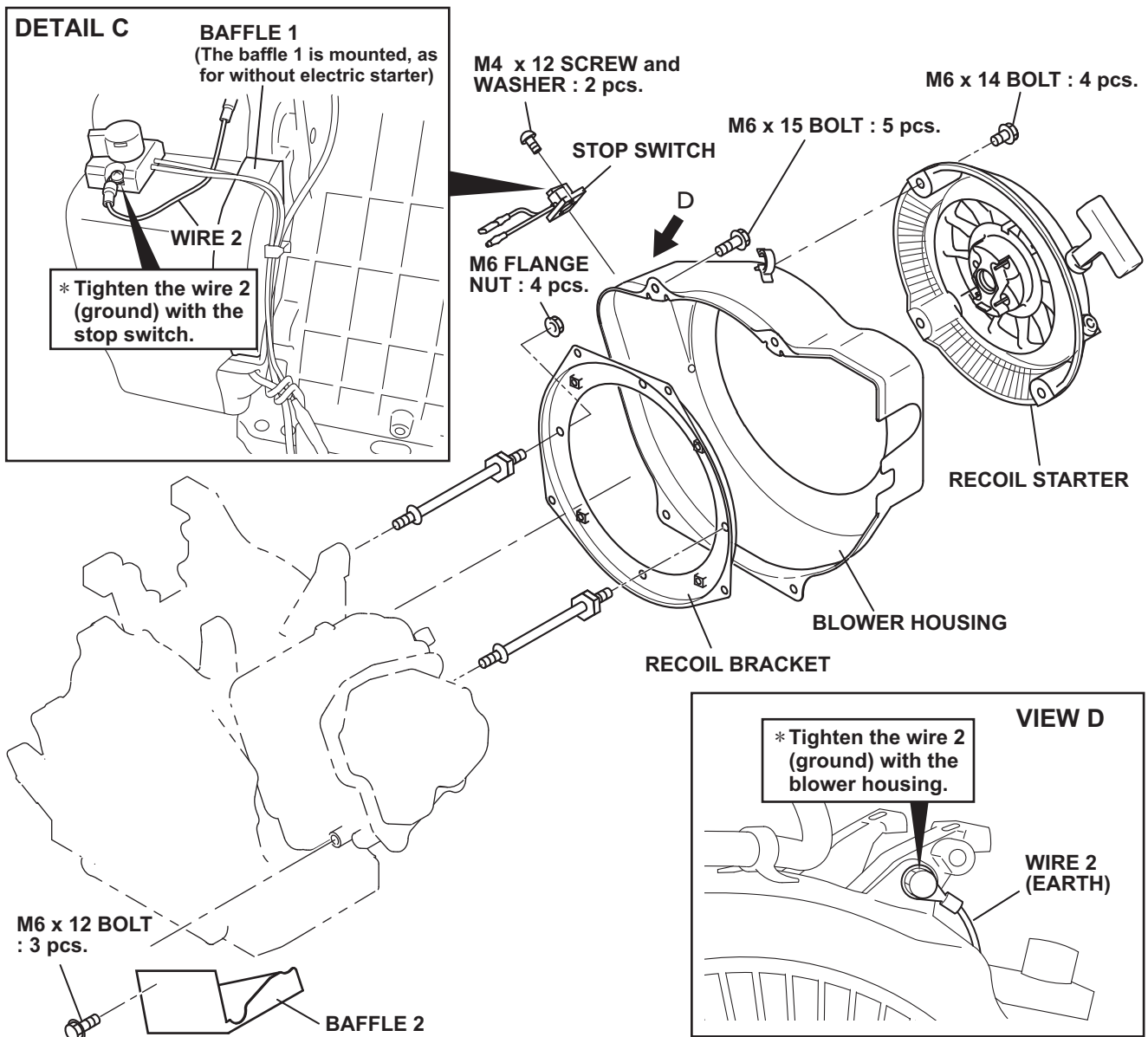


Fig.5-62

(27) WIRING

Refer to the wiring diagram (See page 48 and 49) for wiring details.

(28) FUEL TANK and FUEL STRAINER

- (1) Mount the fuel tank to the crankcase, and connect the fuel pipe to the fuel tank and the fuel strainer. Hold the fuel pipe with the clamp on the brower housing, and then tighten the bolts and nuts for the fuel tank.

M8 nut : 2 pcs.

M8 × 25 mm bolt : 2 pcs.

- (2) Connect the fuel pipe to the fuel strainer and the carburetor. Mount the fuel strainer to the speed control bracket.

M6 × 12 mm Bolt : 1 pc.

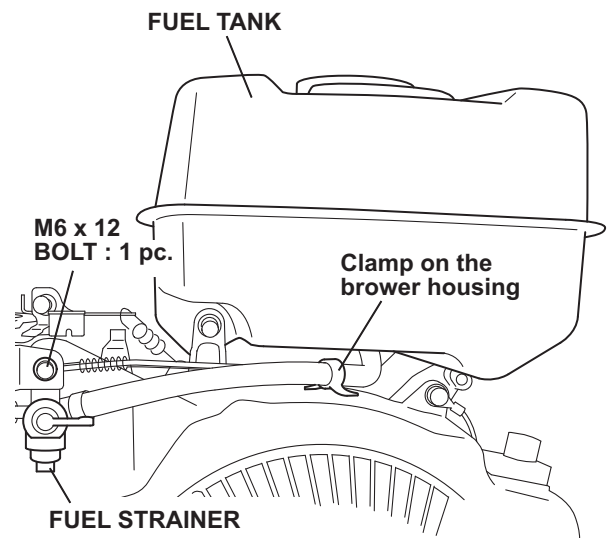
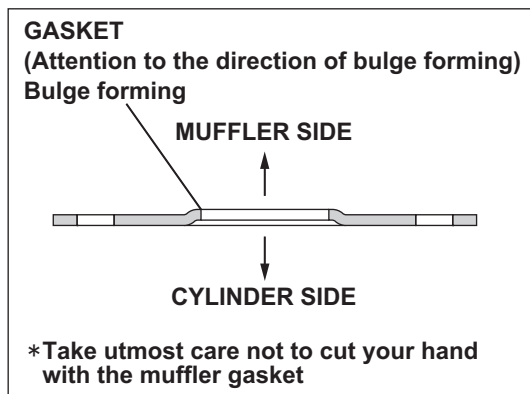


Fig.5-63

(29) MUFFLER

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

NOTE : Be sure to remove any tape or cloth used to cover the exhaust port when the engine was disassembled.



M8 × 12 mm Bolt : 1 pc.

M8 Nut : 2 pcs.

| Tightening torque |
|---|
| 18.0 - 22.0 N·m (180 - 220 kgf·cm) (13.0 - 16.2 ft·lb.) |

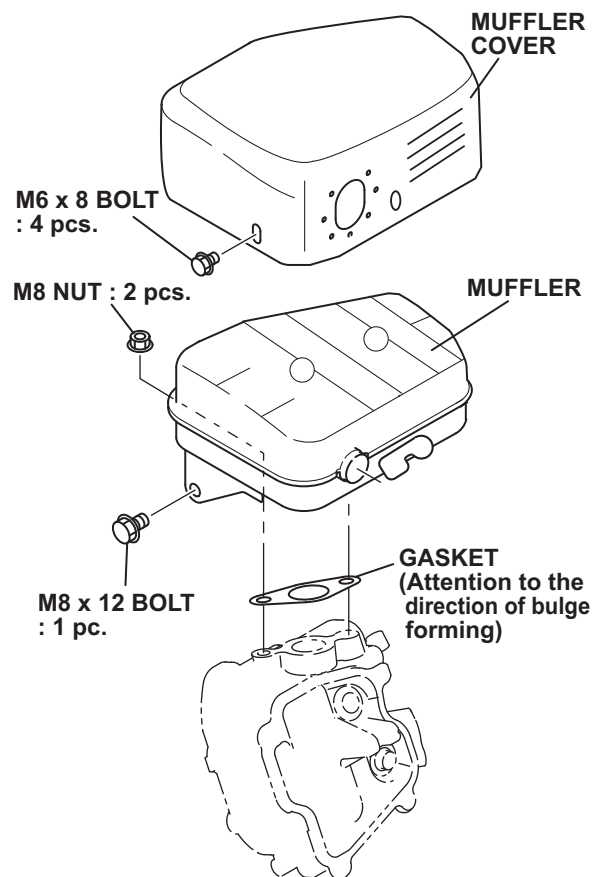


Fig.5-64

- (2) Mount the muffler cover on the muffler.

M6 × 8 mm Bolt : 4 pcs.

(30) AIR CLEANER

Mount the air cleaner element and cleaner cover.

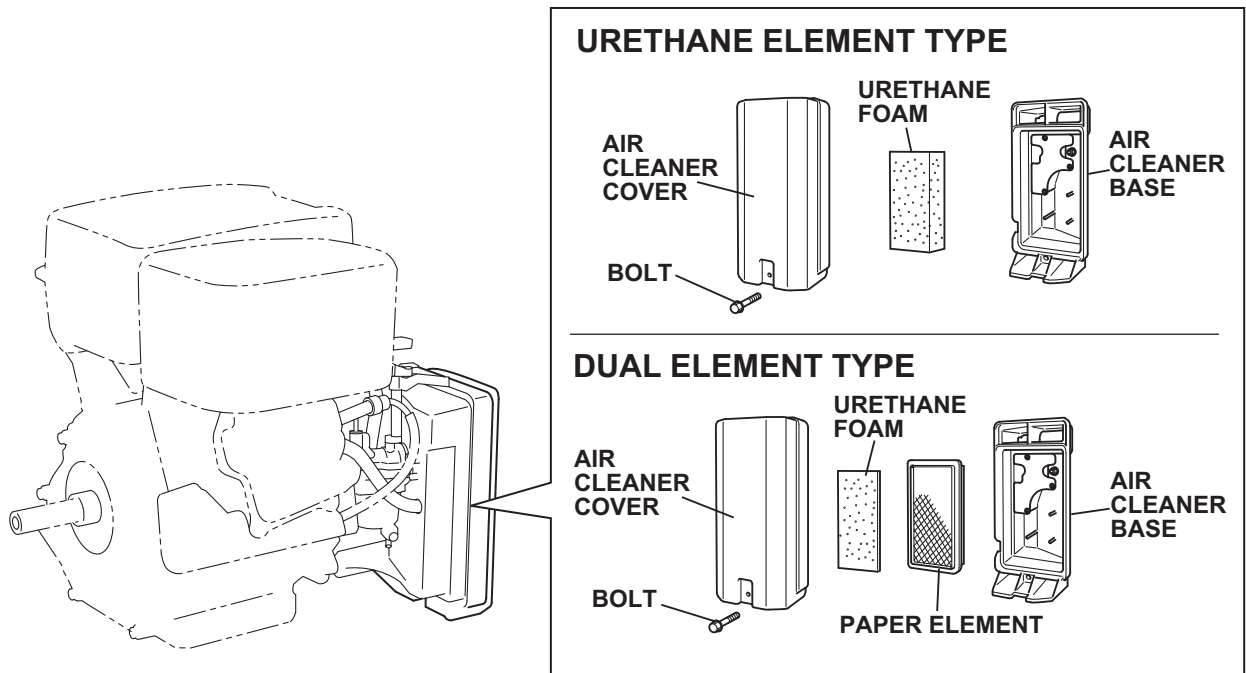


Fig.5-65

(31) 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.

(32) 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.

| | Model EX35 | Model EX40 |
|-----------------------------|------------|------------|
| Engine oil volume (maximum) | 1.2L | |

(33) 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 | Model EX35 | Model EX40 | 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 | 4.3 HP | 4.8 HP | 3600 r.p.m. | 30 min. |
| Step 5 | 8.5 HP | 9.5 HP | 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 recommended)

6-2 CLASSIFICATION BY OIL VISCOSITY

SAE (Society of Automotive Engineers)

| | | | | | | | |
|---------------------|--------|-----|----|----|----|----|-------|
| Single grade | 5W | | | | | | |
| | 10W | | | | | | |
| | 20W | | | | | | |
| | #20 | | | | | | |
| | #30 | | | | | | |
| | #40 | | | | | | |
| Multigrade | 10W-30 | | | | | | |
| | 10W-40 | | | | | | |
| Ambient temperature | -20 | -10 | 0 | 10 | 20 | 30 | 40°C |
| | -4 | 14 | 32 | 50 | 68 | 86 | 104°F |

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°C or rises above 40°C , 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

7. MAGNETO

7-1 MAGNETO

The Robin Engine uses a T.I.C. type breakerless magneto ignition system.

(1) T.I.C. (TRANSISTOR IGNITER CIRCUIT) has the ignition coil outside the flywheel, which is the standard specification. A charge coil system is available as an option.

(The flywheel is a specialized piece of equipment.)

As for the lighting coil, the ignition coil is outside the flywheel and a lighting coil is inside.

7-2 INSPECTING THE MAGNETO

If the engine does not start, has difficulty starting, or does not run smoothly, check the magneto for defects according to the following procedure:

(1) Carefully check the high-tension cable for any damage or short circuiting.

(2) Check the sparking.

① Take the spark plug out of the cylinder head, connect the spark plug with the plug cap and ground it on the cylinder head or any other metallic part of the engine.

(The gap between the electrodes of the spark plug should be between 0.6 mm and 0.7 mm).

② Rotate the engine by pulling the recoil starter and check the spark plug gap for sparking. If the spark plug is sparking, check the intensity of the spark.

(Before checking the spark plug, disconnect the primary wire from the connector.)

③ Next, disconnect the spark plug from the plug cap and check the end of the high-tension cable for sparking.

8. IGNITION SYSTEM

The ignition system is a 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 due to dirty, burnt or corroded point surface.

8-1 IGNITION COIL INTERNAL CIRCUIT

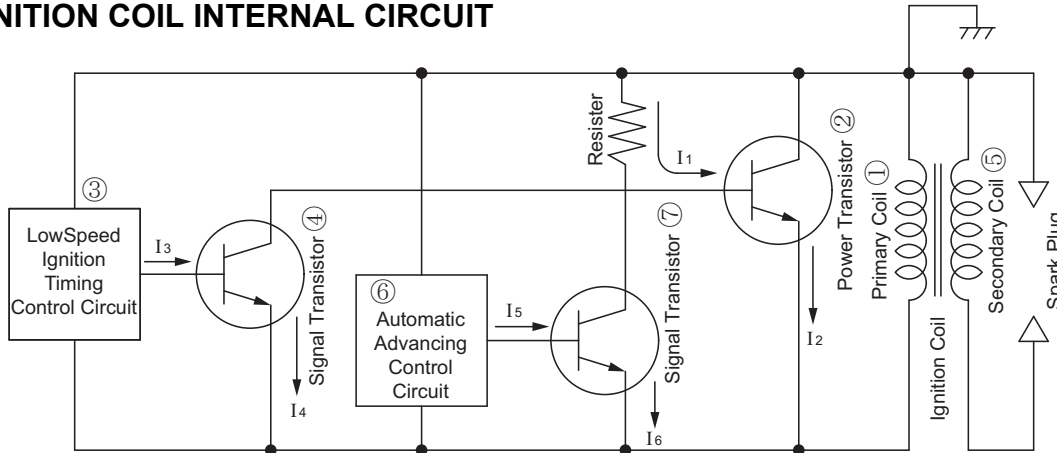


Fig.8-1

8-2 BASIC THEORY

(a) Revolution of the flywheel generates electricity on the primary side of the ignition coil (1), and the base current I_1 flows to the power transistor (2). Current I_1 turns the power transistor "ON" and the electric current I_2 flows. This is the same situation when the contact breaker is closed in a case of breaker point type ignition system.

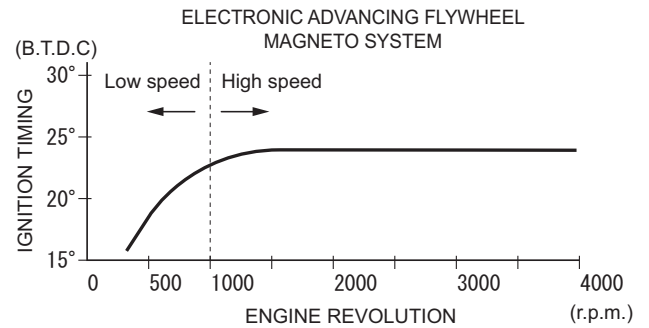


Fig.8-2

- (b) At lower engine revolution, when the flywheel reached the ignition point the low speed ignition timing control circuit (3) operates to run the base current I_3 to turn the signal transistor (4) "ON" allowing the current I_1 to bypass as current I_4 . At this moment the power transistor (2) turns "OFF" and the current I_2 is abruptly shut resulting in the high voltage generated in the secondary coil (5) which produces sparks at the spark plug.
- (c) At higher engine revolution, the advancing control circuit (6) operates at the ignition timing to run the base current I_5 to turn the signal transistor (7) "ON" allowing the current I_1 to bypass as current I_6 . At this moment the power transistor (2) turns "OFF" and the current I_2 is abruptly shut resulting in the high voltage generated in the secondary coil (5) 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. 8-2.

9. WIRING DIAGRAM

9-1 MODEL WITHOUT ELECTRIC STARTER

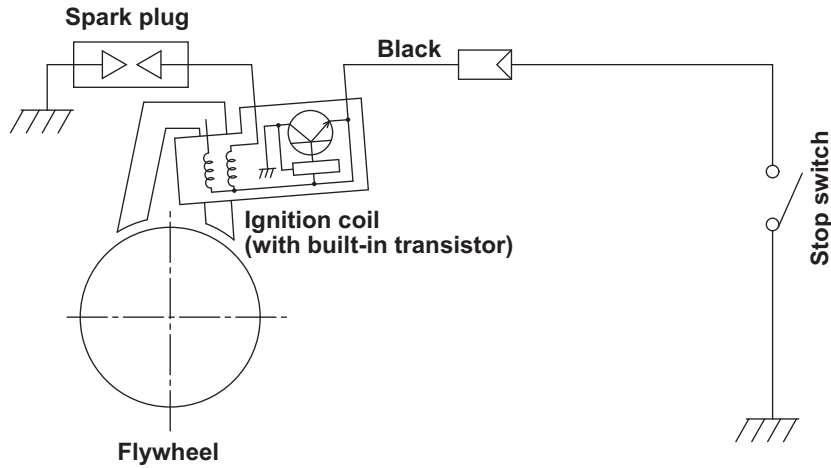


Fig.9-1

9-2 MODEL WITH ELECTRIC STARTER

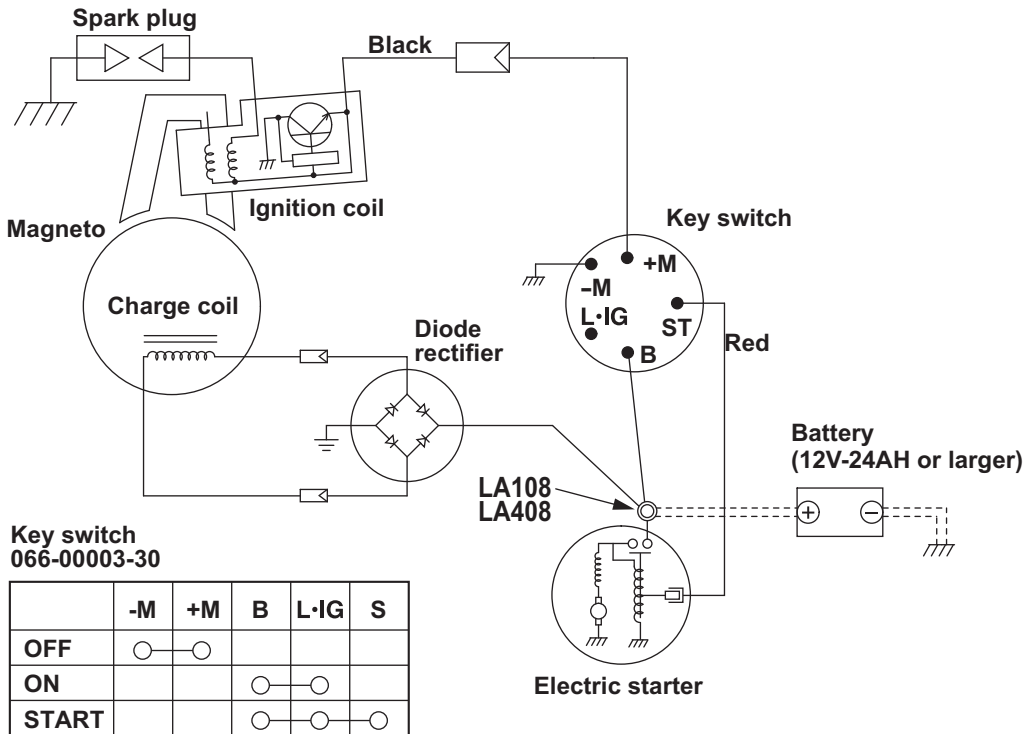
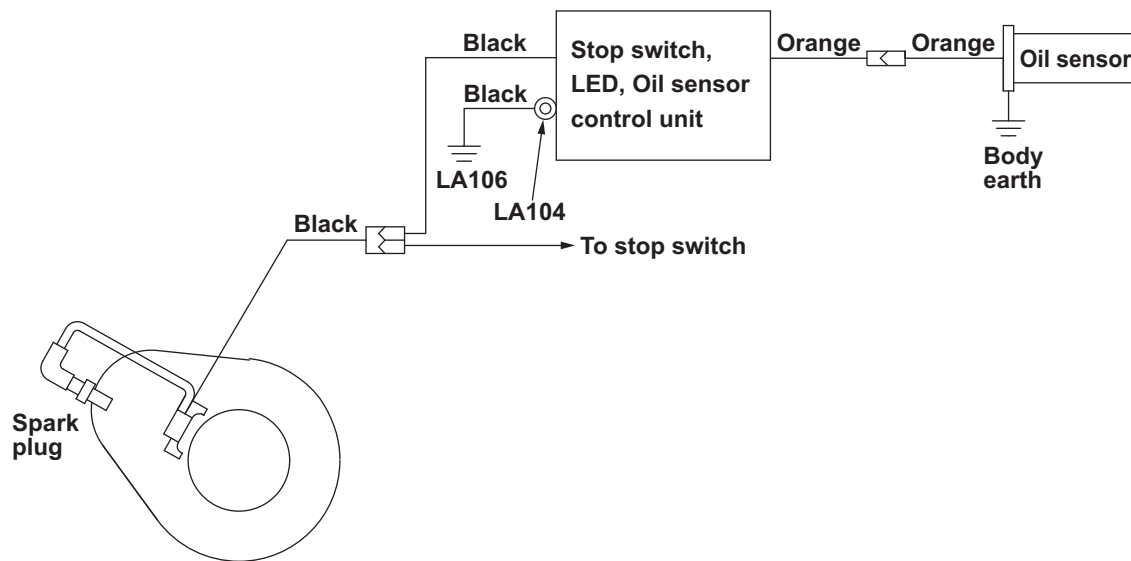


Fig.9-2

9-3 MODEL WITH OIL SENSOR



* Oil sensor as option

Fig.9-3

10-3 COMPONENT PARTS – Magnetic and shift type –

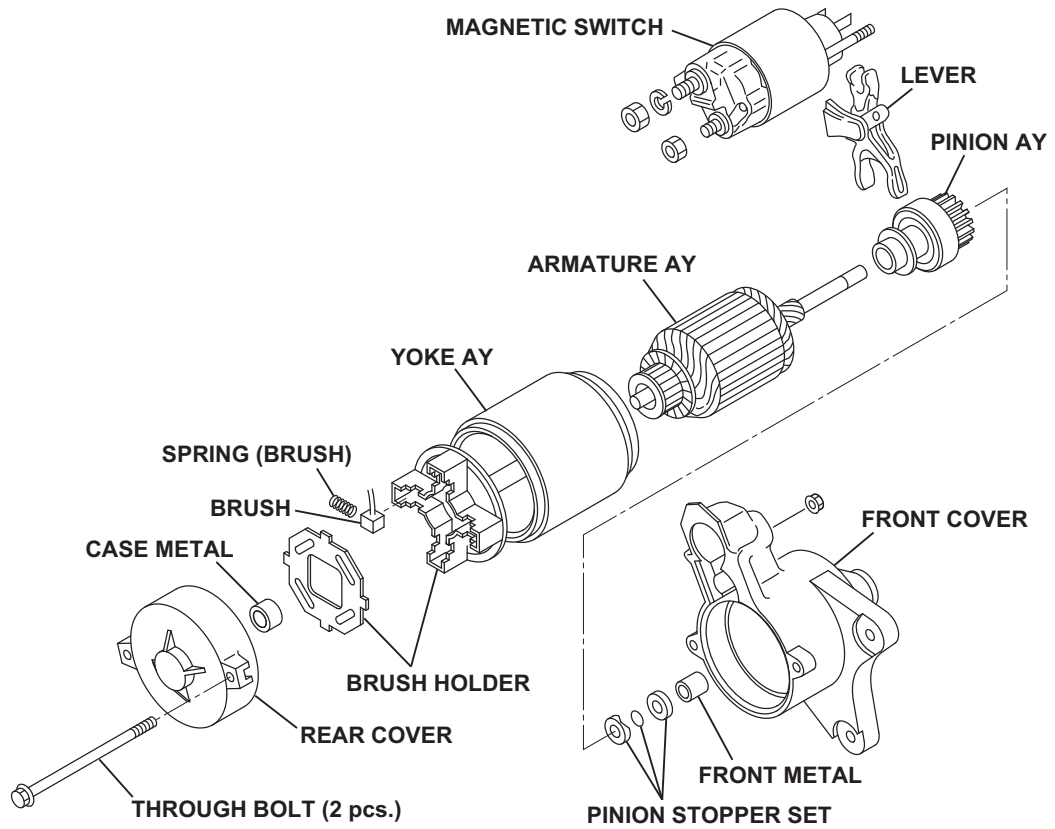


Fig.10-3

10. ELECTRIC STARTER

10-1 SPECIFICATIONS

| | Model EX35, 40 |
|--------------|-----------------------|
| Model | STARTING MOTOR AY |
| Manufacturer | DENSO |
| Voltage (V) | 12 |
| Power (kW) | 0.6 |
| Weight (kg) | 3.4 |

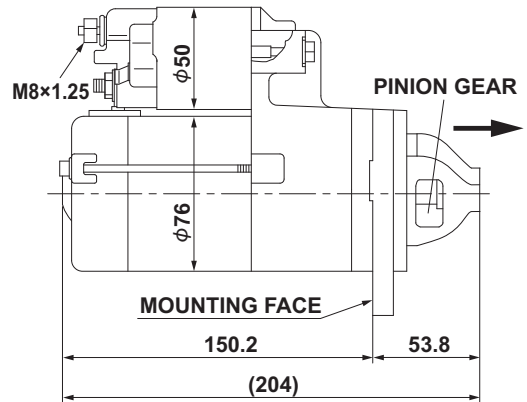


Fig.10-1

10-2 OPERATING PRINCIPLES

The battery is connected to the 8 mm diameter terminal of the magnetic switch.

The figure below shows the state when the starter is ON.

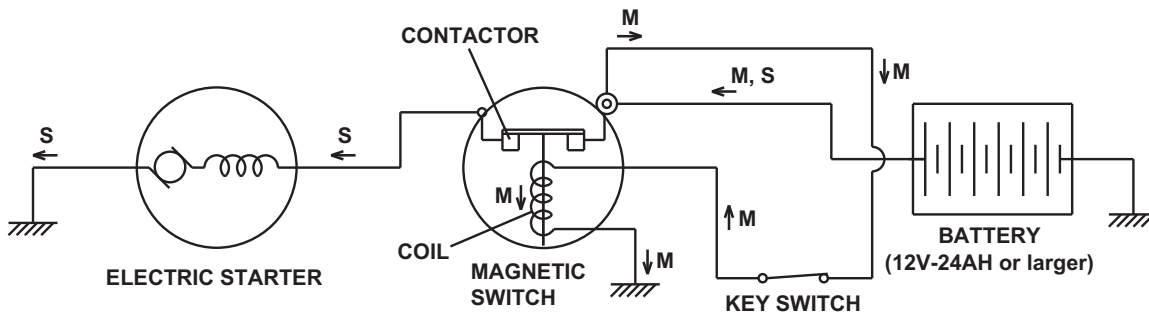


Fig.10-2

There are two energized circuits: the magnetic switch (M) circuit and the starter motor (S) circuit. When the key switch is ON, the (M) circuit is closed, the current flows in the direction of the arrows, the coil of the magnetic switch is magnetically excited and the contactor is pulled.

As a result, a low current flows through the (M) circuit and a high starter current flows through the (S) circuit. This energizes the starter motor and cranks the engine.

◇ Engagement of the pinion gear

When the starter motor is started, the weight built into the spiral splines located on the shaft moves in the direction of the axis driven by centrifugal force and pushes out the pinion gear, and the pinion gear engages the ring gear.

11. OIL SENSOR

11-1 SPECIFICATIONS

| | |
|---|---|
| Type | Float type (with lead switch incorporated) |
| Resistance (at FULL oil level) | 100 M ohms or over |
| Operating Temperature | -30 to +180 degree Celsius |

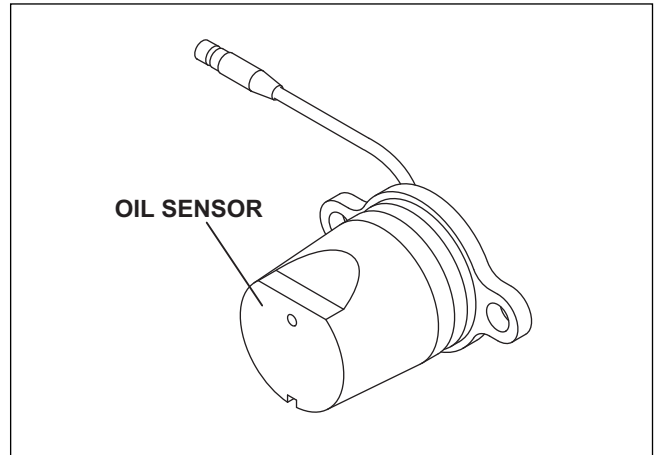


Fig. 11-1

11-2 CONSTRUCTION AND OPERATION

The oil sensor is composed of the float, permanent magnet incorporated into the float and the oil sensor.

In accordance with the oil level, the float moves up and down.

When the oil level is upper level, the float moves up.

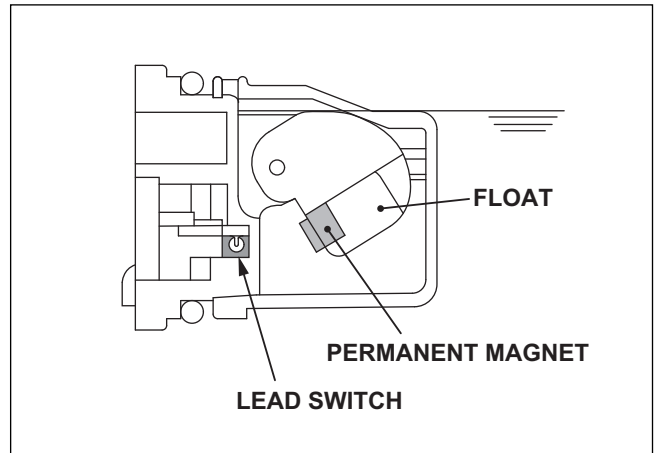


Fig. 11-2

When the oil level is lower level, the float moves down.

The permanent magnet is close to the lead switch, and the lead switch is activated by the magnetic force.

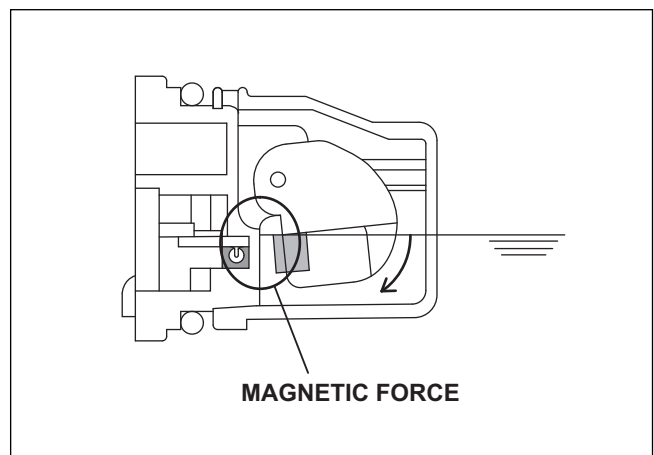


Fig. 11-3

NOTE : With regards to the wiring diagram, please refer to the section 9-3 (page49).

12. AUTOMATIC DECOMPRESSION SYSTEM

12-1 FUNCTIONS AND CONSTRUCTION

EX series engines employ an automatic decompression system as a standard feature. This enables easy starting of the engine, with lighter recoil pull.

The automatic decompression system releases the compression of the engine by lifting up the exhaust valve at cranking speed. The following is the explanation of the function.

At the end of the compression process, the release lever lifts up the rocker arm (exhaust) which in turn opens up the exhaust valve slightly to release the compression.

The release lever has a flyweight on its end and another end of the lever is a crescent cam.

When the engine is cranked, the crescent cam projects above the cam profile and lifts up the rocker arm (exhaust) because the force of the return spring on the weight is larger than the centrifugal force on the weight.

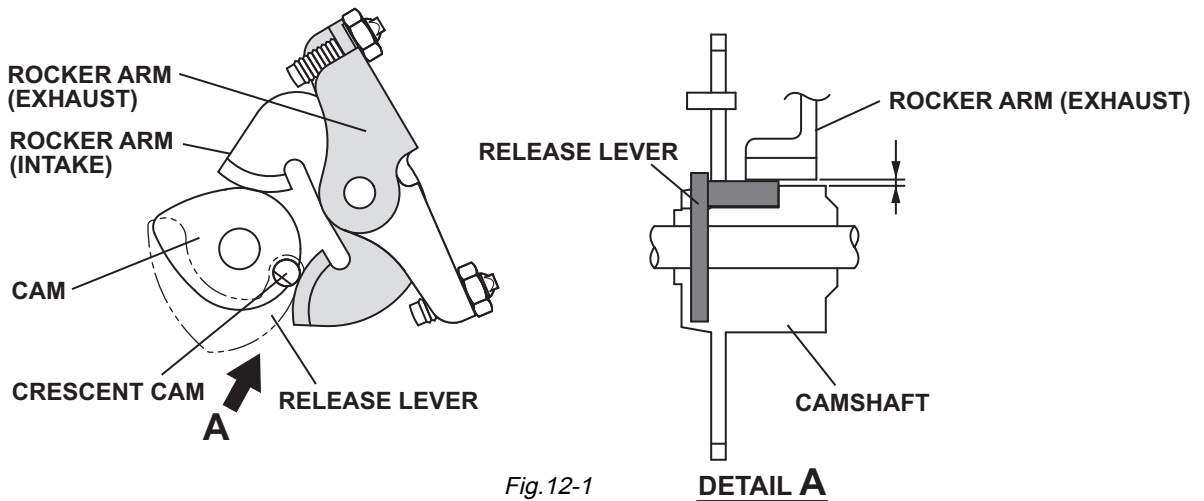


Fig. 12-1

When the cranking speed reaches a specified r.p.m., the crescent cam is retracted under the cam profile because the centrifugal force applied to the flyweight becomes larger than the force of the return spring on the weight and thus it is shifted to the position shown in the illustration below.

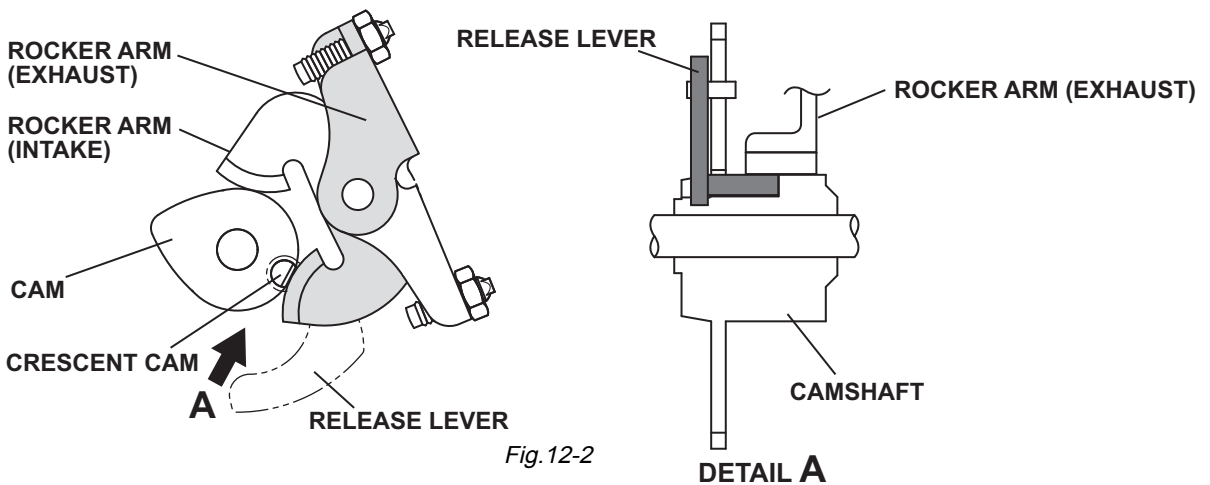


Fig. 12-2

12-2 INSPECTION

When assembling the release lever, make sure that it works smoothly.

13. CARBURETOR

13-1 SPECIFICATIONS

| | EX35 | | EX40 | |
|-------------------|-----------|------|-----------|------|
| A/C Type | URETHANE | DUAL | URETHANE | DUAL |
| Main Jet | 109 | 107 | 113 | 110 |
| Slow Jet | 40 | 44 | 49 | 51 |
| Venturi Bore (mm) | $\phi 17$ | | $\phi 19$ | |

13-2 FUNCTIONS AND CONSTRUCTION

13-2-1 FLOAT SYSTEM

The float chamber is located below the carburetor body. Through the operation of the float and the needle valve, the float chamber maintains a constant fuel level while the engine is working.

The fuel flows from the tank into the float chamber through the needle valve. When the fuel rises to a specific level, the float rises. When the buoyancy of the float is balanced with the fuel pressure, the needle valve shuts off the fuel passage, thereby maintaining the fuel at the predetermined level.

13-2-2 SLOW SYSTEM

The slow system supplies fuel to the engine during idling and low-speed operation.

Fuel is initially metered by the main jet and then metered once again by the slow jet.

The fuel / air mixture is fed to the engine through the pilot outlet and the bypass.

During idling, fuel is fed to the engine mainly through the pilot outlet.

13-2-3 MAIN SYSTEM

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

Fuel is metered by the main jet and flows into the main nozzle. Air metered by the main air jet is mixed with fuel through the bleed holes of the main nozzle. The fuel/air mist is injected into the Venturi and mixed once again with air from the air cleaner. This fuel/air mixture is now of optimum concentration and is fed into the combustion chamber of the engine.

13-2-4 CHOKE SYSTEM

The choke system is for easier start of the engine in cold weather conditions.

When the engine is started with a closed choke, the negative pressure applied to the main nozzle increases. This causes a larger amount of fuel to be drawn into the carburetor, which in turn makes it easier to start the engine.

FUEL SYSTEM OUTLINE

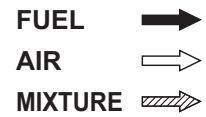
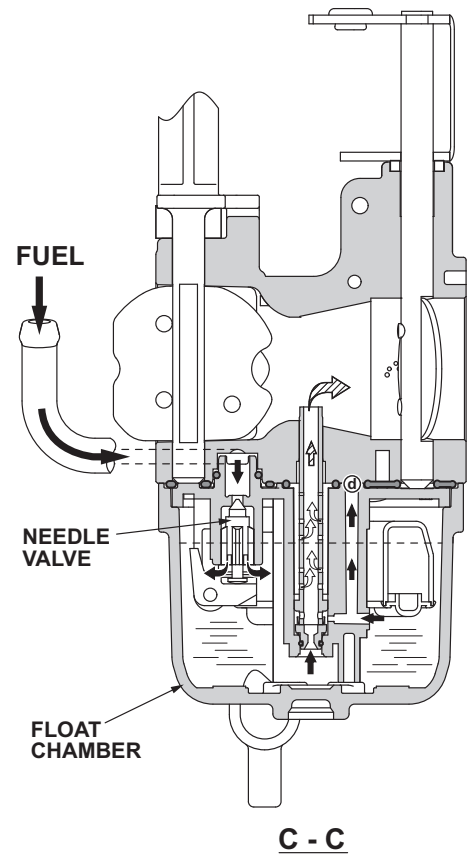
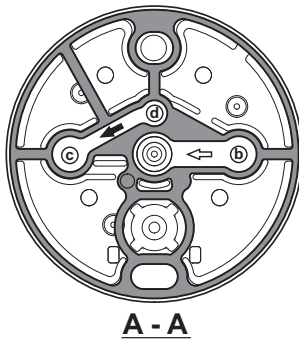
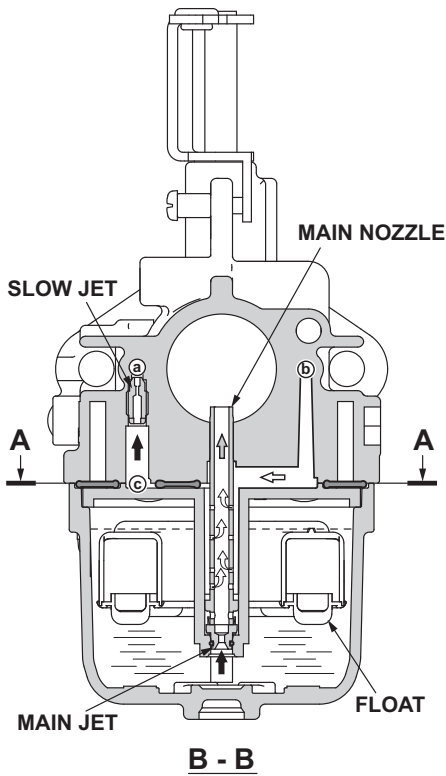
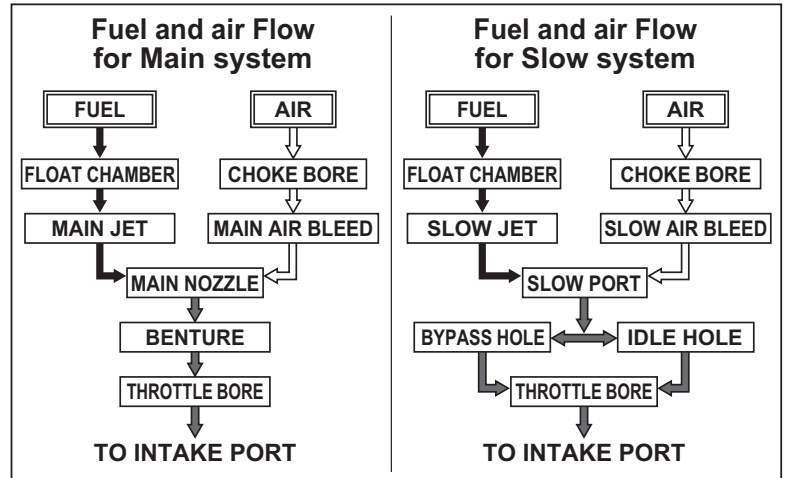
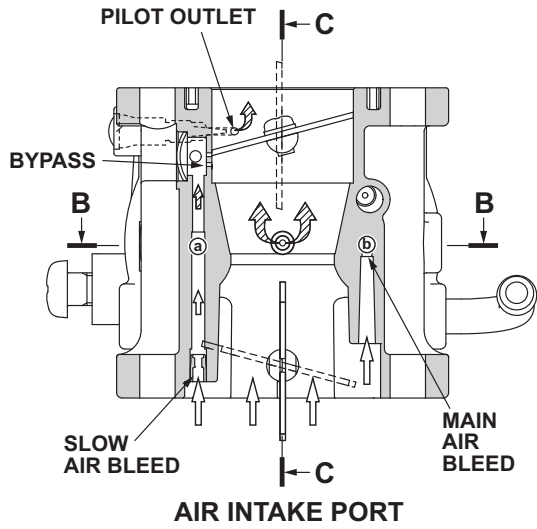


Fig. 13-1

13-3 DISASSEMBLY AND REASSEMBLY

Mechanical failures aside, most carburetor malfunctions occur when the fuel/air ratio of the mixture is not correct. This is usually caused by clogged jets, air passages and fuel passages, or by variations in the fuel level.

To get the best possible performance from the carburetor, ensure that the each passages are kept clean so that air and fuel can flow freely through them.

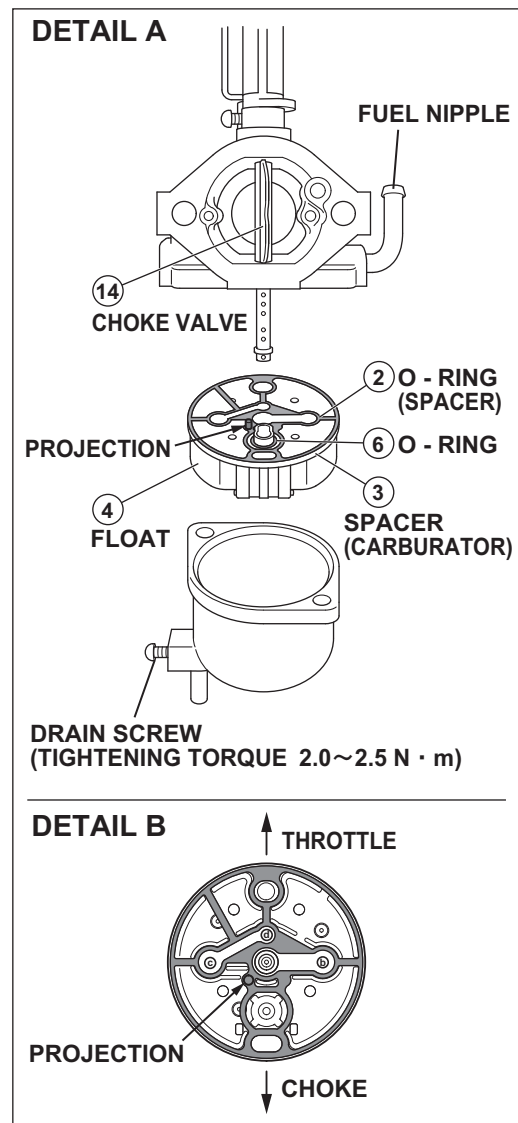
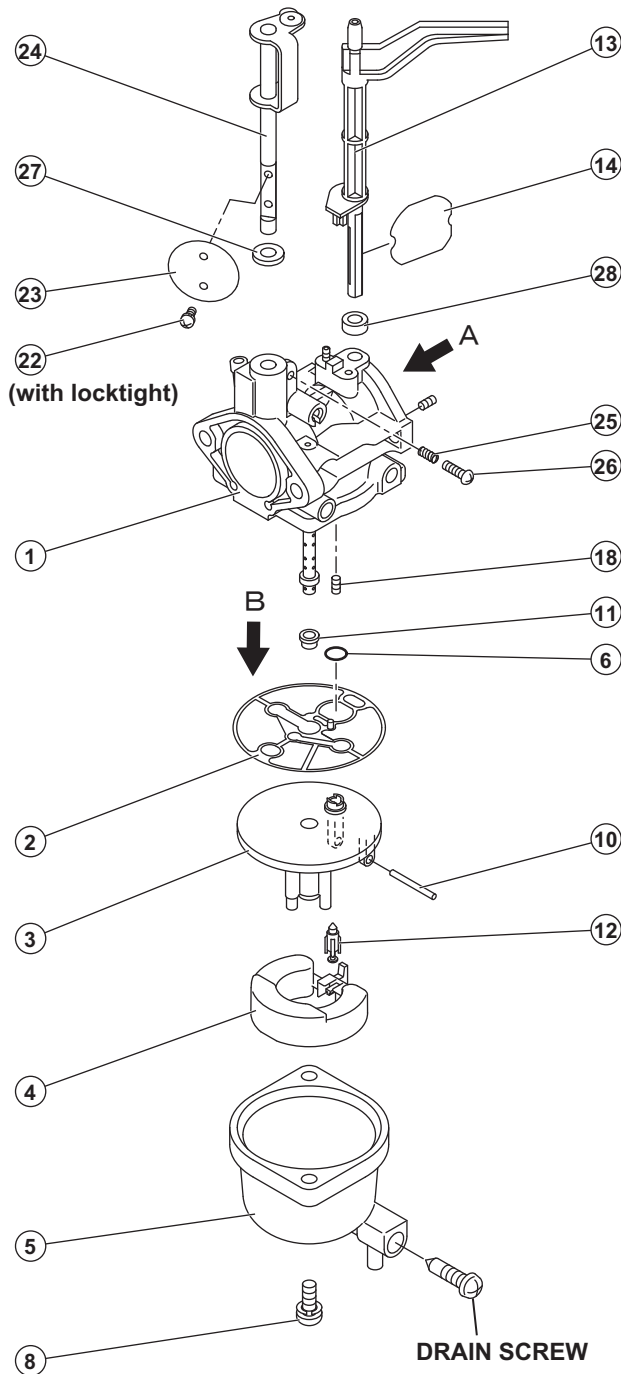


Fig.13-2

The procedures for overhauling the carburetor are described below. (Refer to Fig. 13-2.)

13-3-1 THROTTLE SYSTEM

- (1) When the throttle stop screw ⑳ is removed, the spring ㉕ can be taken out.
- (2) Remove the phillips screw ㉒ and the throttle valve ㉓, then take out the throttle shaft ㉔ and seal ㉗ as dust proof. When removing the throttle valve, take care not to damage the valve edge.

13-3-2 CHOKE SYSTEM

- (1) Remove the choke valve ㉑. Then pull out the choke shaft ㉒ and seal (polyurethane) ㉔ as dust proof.
- (2) When reassembling the choke shaft, be sure to position the cutout on the choke valve facing the pilot air jet.

13-3-3 SLOW SYSTEM

- (1) Remove the slow jet ㉖. Use the correct tool so as to avoid damaging the jet.
- (2) When reassembling the slow jet, be sure to firmly tighten it, otherwise fuel may leak, leading to engine malfunction.

13-3-4 MAIN SYSTEM

- (1) Remove the bolt ㉘ and remove the float chamber body ㉙ and spacer(carburetor) ㉚.
- (2) Remove the main jet ㉛ from the spacer(carburetor) ㉚.
*Do not dis-assemble, because of the main nozzle is press fit.
- (3) When reassembling the main system, be sure to fasten the main jet and main nozzle firmly to the body, otherwise the fuel concentration in the fuel/air mixture may become too rich, leading to engine malfunction.
- (4) The tightening torque of the bolt ㉘ is 4 N · m (40 kgf · cm / 2.9 ft · lb.). Be sure not to forget to mount the washer.

13-3-5 FLOAT SYSTEM

- (1) Take out the float pin ㉜ and then remove the float ㉝ and the needle valve ㉞.
- (2) When reassembling the float system, follow the step of the needle valve ㉞, the float ㉝, float pin ㉜, O-ring ㉟ and O-ring (spacer) ㊱.
*Since the needle valve ㉞ is linked to the float ㉝, take care when assemble.
*Do not use drill or similar objects for cleaning the jets, as these are likely to damage the orifices, which in turn can impair fuel flow. Use compressed air to clean the jets.
*The float pin is pressed into the carburetor body. When removing the needle valve and the float, a rod or a similar tool slimmer than the float pin should be used. Tap the reverse side gently and remove.
*Make sure the direction of the O-ring (spacer) ㊱ when reassembling.
Mount the O-ring (spacer) ㊱ to set the projection on opposite side of the fuel nipple. If it is mounted incorrect. An engine improper running.
*Make sure not any damage on the O-ring ㉟, and surely assemble, it may cause of overflow.

14. RECOIL STARTER

14-1 RECOIL STARTER

Tools required: Screwdriver, pliers and protective glasses

⚠ CAUTION

Put on the protective glasses prior to start disassembly.

14-1-1 DISASSEMBLY PROCEDURE

(1) Release the reel spring power

- 1 Hold the starter knob and pull out the starter rope.
- 2 Pull out the rope fully and align the rope knot in the reel with the rope guide.
- 3 Hold the reel down firmly with both thumbs, taking care not to allow it to spring back.
(Fig. 14-1)
- 4 Remove the knot from the reel, untie the knot and pull the rope out toward the starter knob.
Note: This procedure requires 2 people.
- 5 While controlling the reel with the thumbs, slowly wind it back as far as it will go.

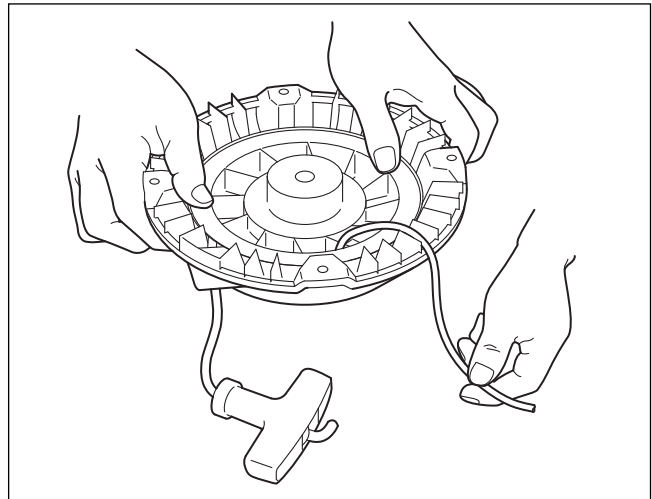


Fig. 14-1

⚠ CAUTION

When the rope is pulled out to its full length, the force stored in the spring reaches its maximum. Be careful not to drop it or release your grip on it suddenly.

(2) Remove the components. (Fig. 14-2)

- 1 Grip the case and loosen the set screw.
- 2 Take out the set screw, the ratchet guide, the friction spring and the ratchet in that order.

(3) Remove the reel. (Fig. 14-2)

- 1 Hold down the reel gently to keep it from escaping from its case and rotate it slowly back and forth by quarter turns until it moves smoothly.
- 2 Lift the reel up little by little and take it out of the case.
- 3 If the spring is about to pop out of the reel, repeat steps (3)-1 and (3)-2.

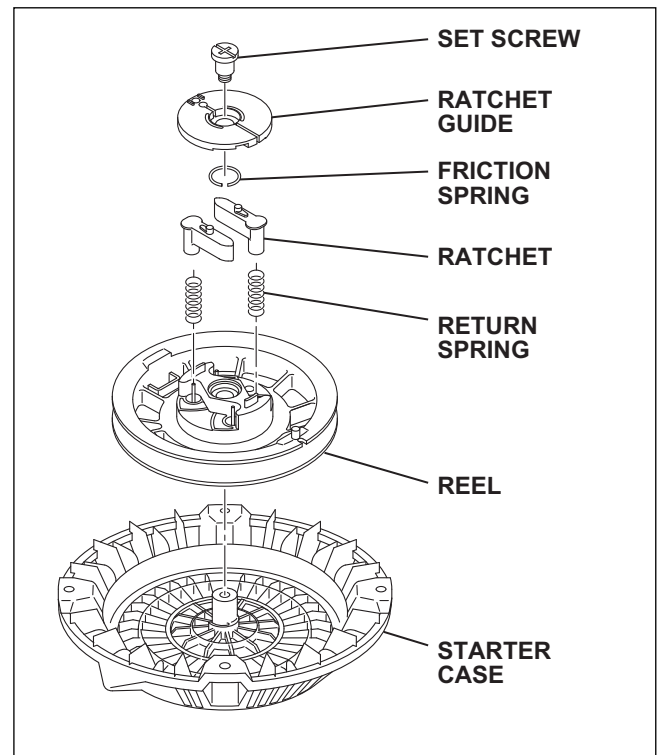


Fig.14-2

⚠ CAUTION

Since the spring is stored in the reel, make sure not to drop or shake the reel after removing it. Place it on a level surface such as a table.

Disassembly is completed.

⚠ CAUTION

Put on the protective glasses prior to start reassembly.

14-1-2 REASSEMBLY PROCEDURE

(1) Put the reel back into the case

- 1 Apply grease to the surface of the case. (Fig.14-3)
- 2 Adjust the position of the inner end of the spring in the reel. (Fig. 14-4)
- 3 Hold the reel in such a way that the inner end of the spring hooks onto the shaft hook and then place the reel carefully back into the case.
- 4 Turn the reel gently counterclockwise to confirm that the spring is hooked.

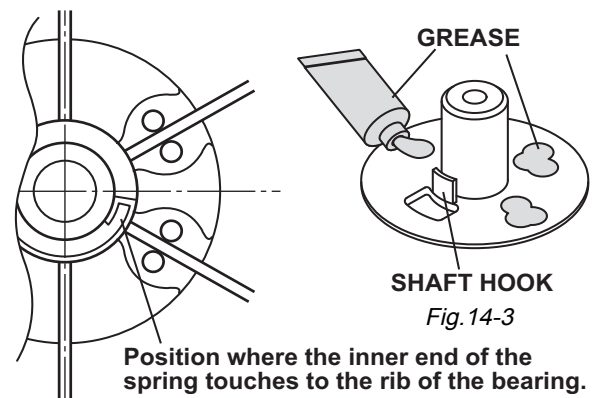


Fig.14-4

(2) Mount the components

-1 Mount the ratchet into the reel. (Fig. 14-5)

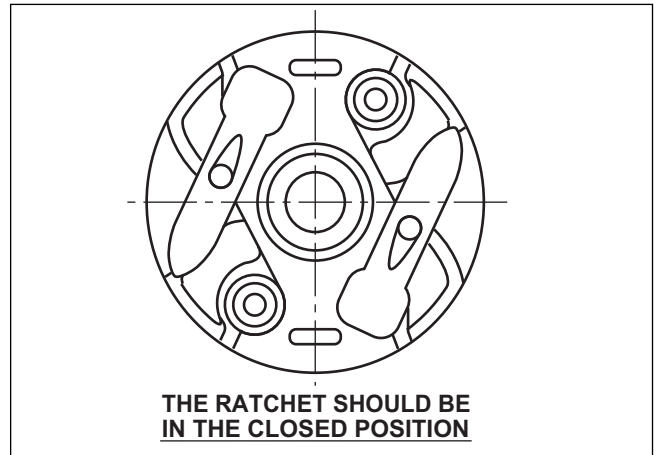


Fig. 14-5

-2 Mount the ratchet guide assembly, taking care not to move the ratchet. (Fig. 14-6)

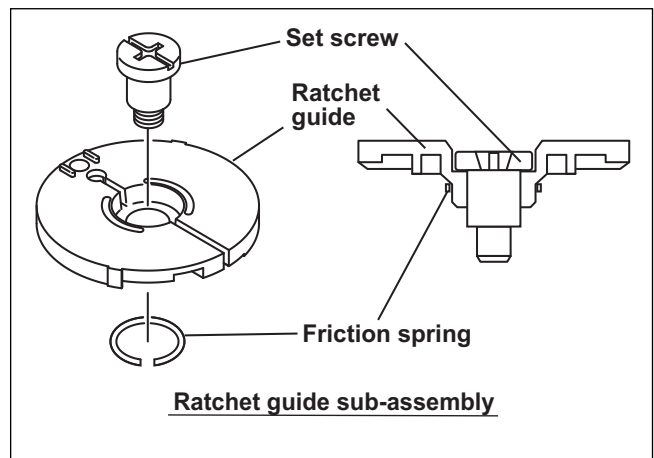


Fig. 14-6

(3) Tighten the set screw

-1 Hold the ratchet guide gently by your hand to prevent it from rotating, then tighten the set screw.

| Tightening torque (M6) |
|--|
| 5.5 N·m (55 kgf·cm) (4.0 ft·lb.) |

(4) Tension the reel spring

-1 Grip the case and turn the reel 6 times counterclockwise.

-2 Fix the reel so that the rope hole in the reel is aligned with the rope guide. (Fig. 14-7)

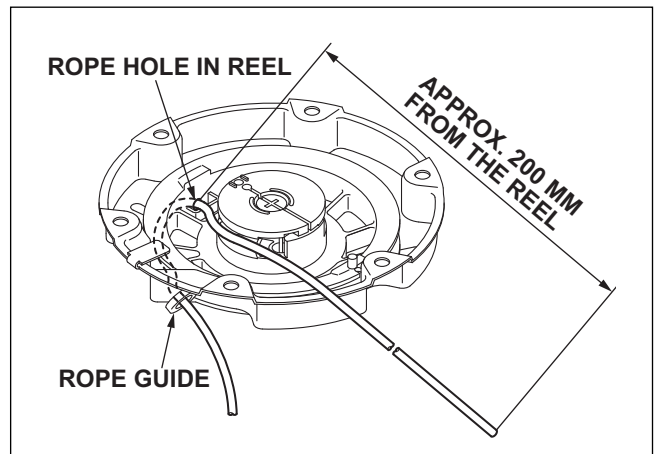


Fig. 14-7

CAUTION

The spring force reaches its maximum value when the reel is wound up. Be careful not to drop it or release your grip on it suddenly.

(5) Install the rope

NOTE: This procedure requires 2 people.

-1 Pass the rope end through the rope guide and the rope hole of the reel and pull through approximately 20 cm out of the reel.

(Fig. 14-7)

-2 Tie a knot in the rope end . (Fig. 14-8)

-3 Put the rope into the reel, taking care that the rope end does not stick up. (Fig. 14-9)

-4 Grasp the rope firmly with one hand at approximately 50 cm from the rope guide and keep the rope tense, taking care that the rope is not pulled into the reel.

-5 Release the reel carefully and allow the rope to be wound back slowly by the force of the spring until the knob reaches the rope guide.

Assembly is completed.

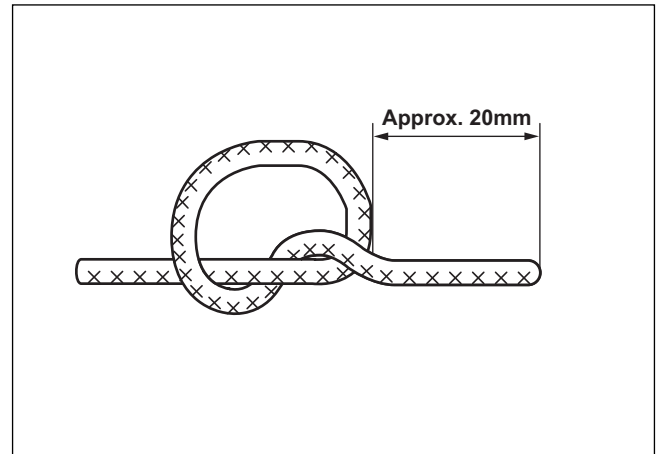


Fig.14-8

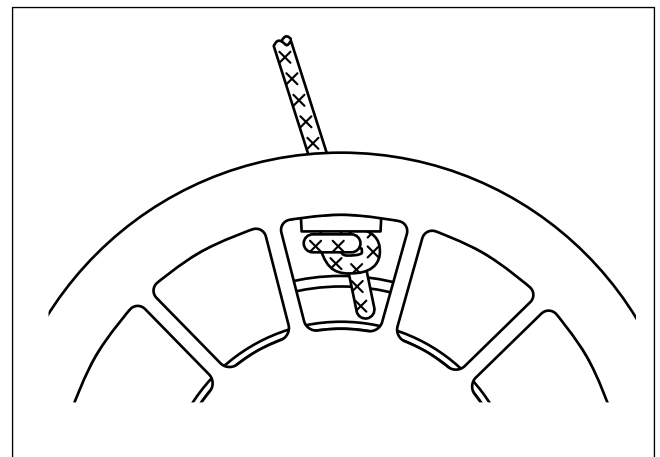


Fig.14-9

* The disassembly and the reassembly are completed, however, carry out the following to check if the necessary components have surely been assembled.

14-1-3 CHECKING THE RECOIL STARTER AFTER REASSEMBLY

- (1) Pull the starter knob about 2-3 times.
 - (a) If the starter knob is too heavy to pull, check that each parts have been assembled as specified.
 - (b) If the ratchet does not work, check for missing parts such as the friction spring.
- (2) Pull out the starter knob as far as it will go.
 - (a) If the starter rope remains in the rope slot in the reel, the spring may be over-stressed. To fix this, pull out the starter rope approximately 30 cm, and, controlling the rotation of the reel with your thumb, allow the starter rope to rewind about 1 or 2 turns.
 - (b) If the starter rope rewinds slowly or only partially, apply grease or oil to the rotary parts or the friction surfaces. If this does not help, try winding up the spring 1 or 2 turns, taking care not to over-stress the spring.
 - (c) If there is a sound indicating that the spring is off the hook and the starter rope does not be wound back, reassemble the recoil starter from the beginning.

14-1-4 OTHER GUIDES

- (1) If the spring escapes from the reel during disassembly
 - (a) Hook the outer end of the spring onto the gap in the reel, and rewind the spring, holding the spring with your fingers so as to prevent it from springing out of the housing unit.
(Wear protective gloves when doing this.)
 - (b) Hook the inner end of the spring onto the projection on the starter case.
*Refer to the assembly procedure for more details.

(2) About lubrication

Lubricate the rotating and frictional parts and the spring with grease (heat-resistant grease recommended) or engine oil when the starter is disassembled and prior to long term storage.

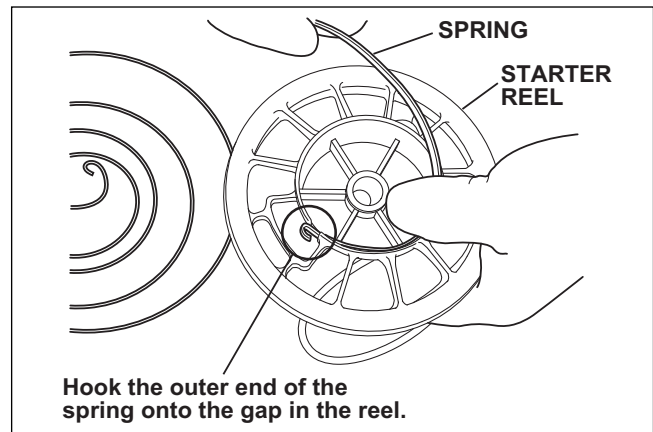


Fig.14-10

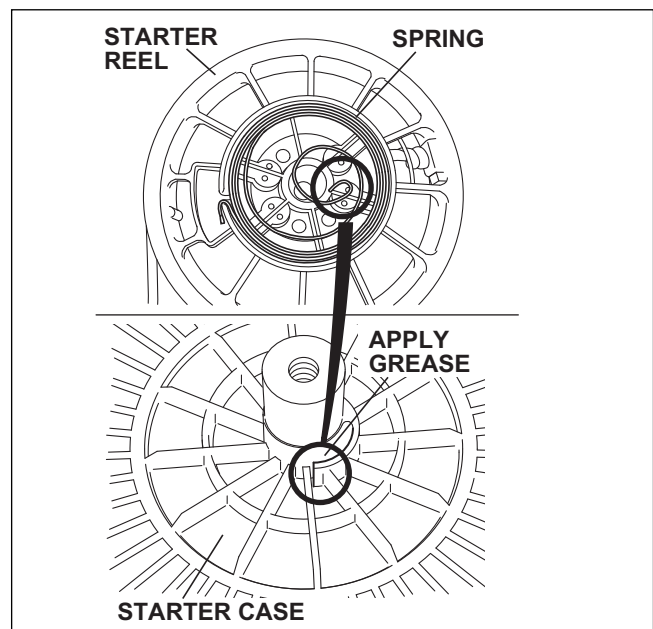


Fig.14-11

15. INSTALLATION

Installation has a decisive influence on engine life, ease of maintenance and inspection, frequency of inspection and repair, running costs and other related aspects. Before installing the engine, be sure to plan the installation with care, taking the points below into account.

15-1 INSTALLING

When installing the engine, pay special attention to the position of installation, the method for coupling with working equipment, and the foundations and supports for the engine. Position the engine so that tasks such as gasoline and oil replenishment and inspection, spark plug inspection, air cleaner maintenance, oil drainage and so on can be carried out as easily as possible.

15-2 VENTILATION

An engine requires fresh air for cooling and for burning fuel. When an engine is covered with a bonnet or is operated in an enclosed space, the temperature around the engine rises and this causes such problems as vapor lock, oil deterioration, increased oil consumption, power loss, engine seizure, and reduced engine life, making it difficult for the engine to function normally. It is thus necessary to install ducts and dampers to guide fresh air, so as not to recycle the hot air used to cool the engine and to prevent the working equipment from heating up.

Be sure to keep the engine room temperature below 50°C all year round and to prevent the accumulation of hot air in the engine room.

15-3 EXHAUST EQUIPMENT

Exhaust gas is noxious. When operating the engine indoors, make sure that exhaust gases are discharged outdoors. However, if the exhaust pipe is long, resistance increases and this lowers engine output.

Therefore, the longer the exhaust pipe the larger its inner diameter should be.

Exhaust pipe length: Less than 3 m Pipe inner diameter: 30 mm

Exhaust pipe length: 3 - 5 m Pipe inner diameter: 33 mm

The ideal solution is forced exhaustion (outdoors) by installing a blower on the exhaust pipe.

* Install a safety cover on the exhaust pipe, muffler and other related parts.

15-4 FUEL SYSTEM

If the fuel tank is detached from the engine, the height from the bottom of the fuel tank to the fuel joint of the carburetor should be between 5 cm and 50 cm.

When using a fuel pump, the bottom of the fuel tank can be up to 20 cm below the carburetor. Position the fuel tank carefully because, when it is low, fuel is not fed to the carburetor and when it is high, it can cause an overflow in the carburetor. When piping the fuel, the hose should be as short as possible and attention should be paid to heat transmission, size, bending, leakage at hose joints and so on. Care should also be taken to prevent air lock and vapor lock.

15-5 POWER TRANSMISSION TO DRIVE MACHINES

15-5-1 BELT DRIVE

Note the following:

- Use a V-belt rather than a flat belt.
- The drive shaft of the engine must be parallel to the drive shaft of the driven machine.
- The drive 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.

* A belt tensioner or similar should be installed if no clutch is used.

15-5-2 FLEXIBLE COUPLING

When using a flexible coupling, run-out and misalignment between the driven shaft and the engine shaft should be minimized.

The permissible margin of run-out and misalignment is specified by the flexible coupling manufacturer.

15-5-3 BELT PULLEY INSTALLATION ONTO KEYWAY-TYPE CRANKSHAFT

When installing the belt pulley and/or clutch onto keywaytype crankshaft (PTO shaft), proper and correct arrangements are needed. The following illustration shows the correct installation of the applicable component parts.

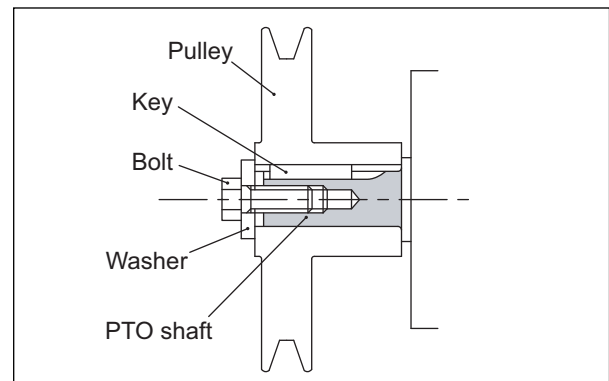


Fig. 15-1

■ Metric keyway-type crankshaft

Washer; Use the washer (material; SS41P) with the thickness described below;

| | | EX35/40 |
|--------------------|----|----------------------|
| Washer Thickness | mm | 6.0 or over |
| ROBIN genuine part | | 020-01002-20, Washer |
| Thickness; | mm | 6.0 |
| OD; | mm | 40 |
| ID; | mm | 10.5 |
| Material; | | SS41P |

Bolt; Select the proper bolt and tighten it to the specified tightening torque, as mentioned below;

| | | EX35/40 |
|---|-------------|---------------------------------|
| Effective thread length | mm | 18 to 27 |
| Strength | | "8T" or higher |
| Tightening Torque | N•m(kgf•cm) | 40 - 50 (408 - 510) |
| ROBIN genuine parts (Screw length; mm) | | 011-01003-00, Flange Bolt 30 |

Key Location

When using the belt pulley with the extended boss on both side as shown in the illustration, put the spacer so that the key stays in the keyway portion of the crankshaft.

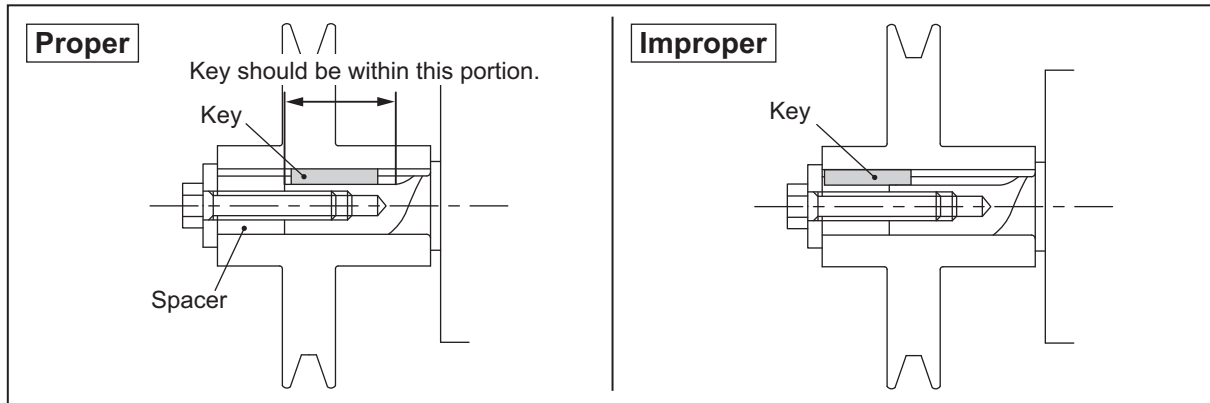


Fig.15-2

Belt Pulley Installation

Install the belt pulley in the no over-hang condition as shown in the illustration.

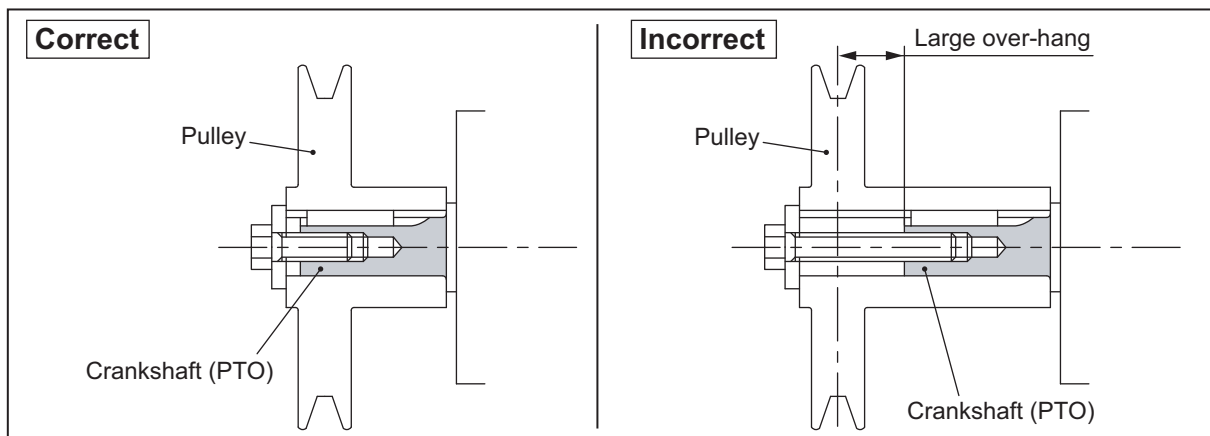


Fig.15-3

Pulley fitting onto PTO shoulder

For proper pulley fitting onto PTO shoulder, make round chamfer at pulley corner. Sharp edge of pulley corner strikes PTO shoulder. In this improper condition, bolt will be loosened, and PTO damaged finally.

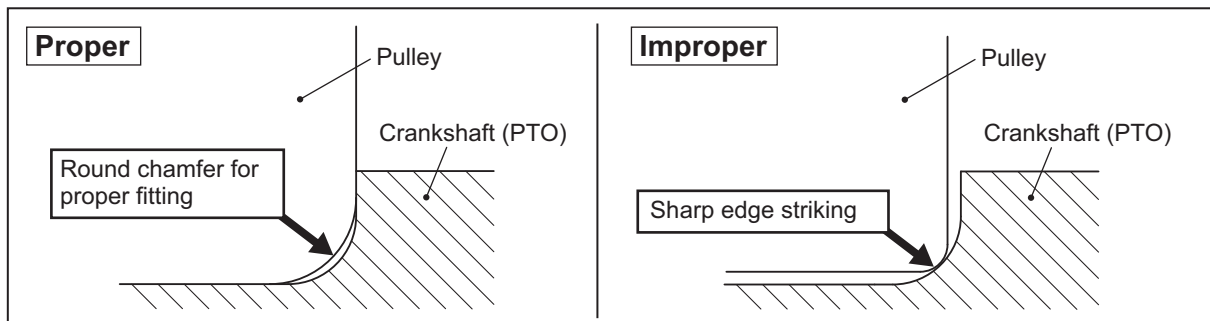


Fig.15-4

16.TROUBLESHOOTING

If the engine shows any sign of malfunction, the cause should be determined immediately and appropriate countermeasures should be taken to prevent the problem from worsening. This section describes certain known problems, their possible causes and appropriate countermeasures. Note, however, that the list of problems presented here is not all. Generally speaking, since there is the possibility of multiple causes for a single problem, please use your experience and common sense when deciding on what action to take.

16-1 ENGINE

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.

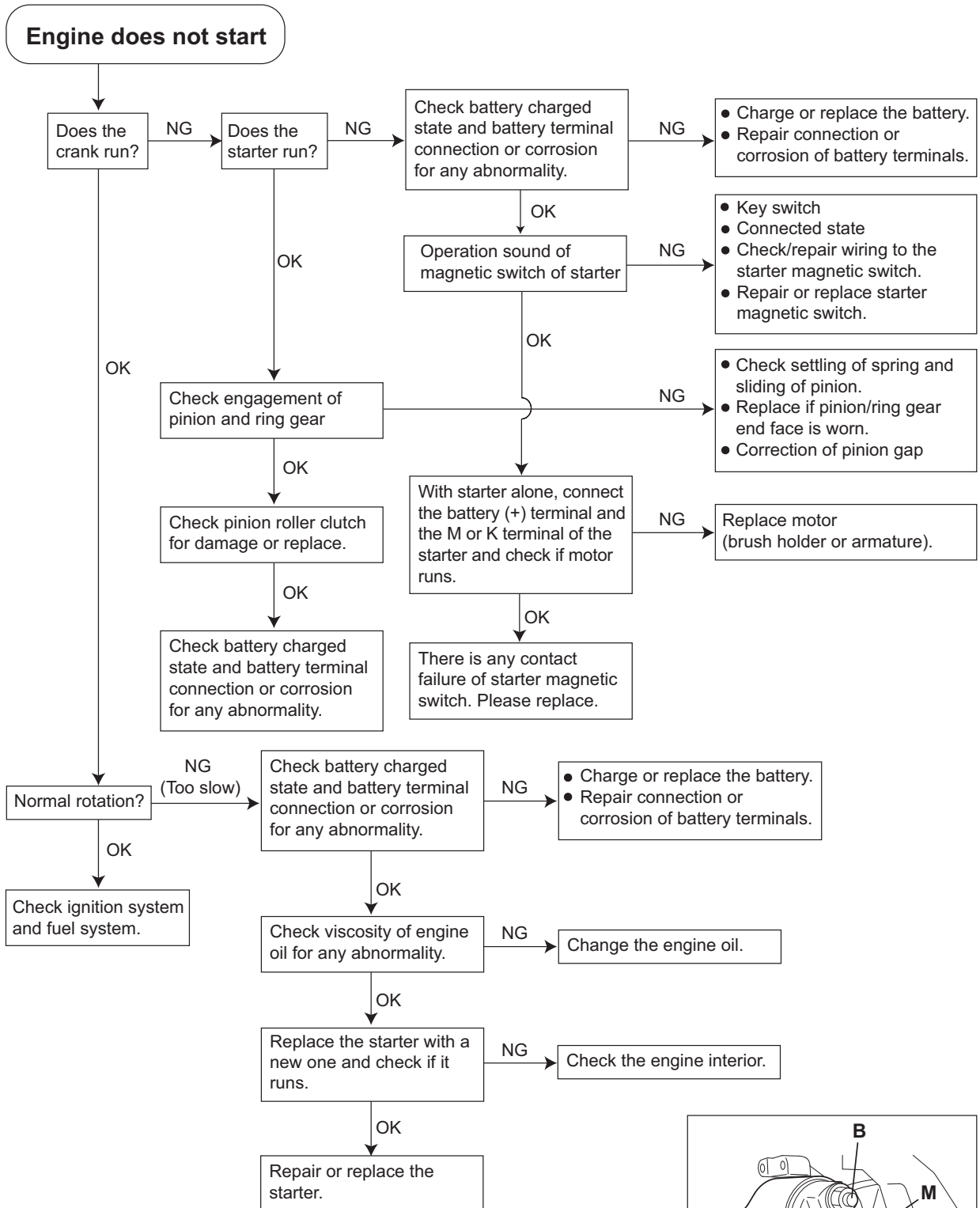
The engine cannot be started unless these three conditions are met. There are also other factors which make engine start difficult, e.g., a heavy load on the engine when it is about to start at low speed, and a high back pressure due to a long exhaust pipe.

| Problem and possible cause | | Remedy | |
|--|------------------------------------|--|--|
| Starting difficulties | 1. Ignition system problems | 1) Spark plug • Improper spark plug gap • Insulation defect • Carbon deposits | Adjust the gap Replace Clean |
| | | 2) Ignition coil • Insulation defect or discontinuity • Poor contact or broken wire | Replace Repair or replace |
| | | 3) Improper air gap between ignition coil and flywheel | Adjust |
| | 2. Fuel system problems | 1) No fuel in fuel tank | Refill |
| | | 2) Fuel hose clogged or pinched | Clean or replace |
| | | 3) Air in fuel lines | Check and retighten joints |
| | | 4) Poor quality gasoline or water in gasoline | Replace |
| | | 5) Carburetor • Overflow • Clogged or damaged • Throttle valve malfunction (does not close fully) | Adjust Overhaul Check and adjust |
| | 3. Engine core components problems | 1) Insufficient tightening of cylinder head bolts | Check and retighten |
| | | 2) Wearing of piston, piston rings and/or cylinder | Repair or replace |
| | | 3) Improper contact of valve and seat | Repair |
| | | 4) Valve sticking | Repair |
| | | 5) Improper valve clearance | Adjust |
| 6) Leakage from intake manifold gasket | | Retighten; replace gasket | |
| 7) Leakage from carburetor gasket | | Retighten; replace gasket | |
| 8) Insufficient tightening of spark plug | Retighten | | |

| Problem and possible cause | | | Remedy |
|-------------------------------|-----------------------------|--|-----------------------------------|
| Poor output | 1. Insufficient compression | 1) Loosen spark plug | Retighten; replace gasket |
| | | 2) Leakage from cylinder head gasket | Retighten; replace gasket |
| | | 3) Piston ring seizure or wear | Replace |
| | | 4) Piston or cylinder wear | Repair or replace |
| | | 5) Incorrect valve and seat contact | Repair or replace |
| | | 6) Valve stem seizure | Repair or replace |
| | | 7) Improper valve clearance | Adjust |
| | 2. Ignition system problems | 1) Faulty spark plug | Replace |
| | | 2) Faulty ignition coil | Replace |
| | | 3) Improper air gap between ignition coil and flywheel | Adjust |
| | | 4) Demagnetization (flywheel magneto) | Replace |
| | 3. Fuel system malfunction | 1) Carburetor clogged | Overhaul, clean |
| | | 2) Fuel strainer and/or hose clogged | Clean or replace |
| | | 3) Air in fuel lines | Check and retighten joints |
| | | 4) Poor quality gasoline or water in gasoline | Replace |
| | 4. Low air intake volume | 1) Air cleaner clogged | Clean or replace |
| 2) Throttle valve malfunction | | Repair or replace | |
| Overheat | 1. Engine | 1) Cooling air flow obstructed at inlet or cylinder baffle portion | Clean |
| | | 2) Poor quality engine oil | Replace |
| | | 3) Lean fuel/air mixture | Check and adjust carburetor |
| | | 4) Excessive back pressure of exhaust system | Check and clean or replace |
| | | 5) Overloading | Adjust to rated load |
| Rough Idling | 1. Carburetor system | 1) Low idling speed | Adjust |
| | | 2) Slow system passage clogged | Check and clean |
| | | 3) Hunting after engine stop | Check or replace O-ring (spacer) |
| | 2. Intake system | 1) Air mixing from air intake system joints | Check and tighten; replace gasket |
| | 3. Cylinder head | 1) Gasket faulty (blow-by) | Replace |
| | 4. Valve system | 1) Improper valve clearance | Adjust |
| | | 2) Leakage from valve seat | Repair |
| | | 3) Excessive clearance between valve stem and guide | Replace |
| | 5. Ignition system | 1) Weak spark | Check; adjust or replace plug |

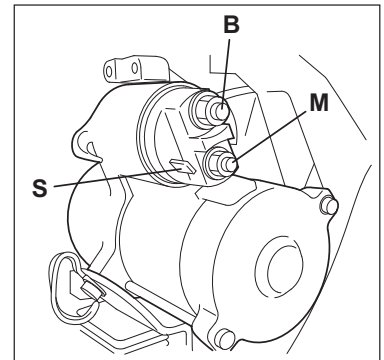
| Problem and possible cause | | Remedy | |
|---|-----------------------------|--|---|
| Excessive engine oil consumption | 1. Oil leakage | 1) Loose oil drain plug | Tighten |
| | | 2) Faulty oil drain gasket | Replace |
| | | 3) Loose main bearing cover bolts | Tighten |
| | | 4) Faulty main bearing cover gasket | Replace |
| | | 5) Crankshaft oil seal (front, rear) defect | Replace |
| | 2. Oil up | 1) Faulty piston oil ring | Replace |
| | | 2) Piston ring seizure, wear or poor contact | Replace |
| | | 3) Excessive wear of piston and/or cylinder | Replace |
| | | 4) Faulty stem seal | Replace |
| | | 5) Excessive oil level | Adjust oil level |
| | | 6) Breather defect | Repair or replace |
| High fuel consumption | 1. Fuel system | 1) Clogged air cleaner | Clean or replace |
| | | 2) Faulty needle valve and/or high fuel level in float chamber | Repair or replace |
| | | 3) Choke does not open fully | Repair or replace |
| | 2. Engine core components | 1) Low compression | Check and repair |
| | | 2) Overcooling | Check and adjust load and/or engine speed |
| Abnormal engine noise | 1. Ignition system problems | 1) Loose ignition system wiring | Inspect and tighten |
| | | 2) Improper or faulty spark plug | Clean or replace |
| | 2. Fuel system problems | 1) Lean or rich fuel/air mixture | Clean, adjust or replace carburetor |
| | | 2) Carburetor contamination | Overhaul or clean |
| | | 3) Dirty or clogged fuel lines | Clean or replace |
| | | 4) Air mixing from air intake system joints | Tighten; replace gasket |
| | 3. Cylinder head | 1) Carbon deposit in combustion chamber | Clean |
| | | 2) Leakage from cylinder head gasket | Replace |
| | 4. Valve system problems | 1) Improper valve clearance | Adjust |
| | | 2) Valve heat deterioration | Replace |
| | | 3) Worn or broken valve spring | Replace |
| | | 4) Improper valve timing | Adjust |

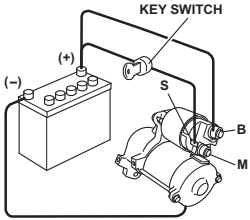
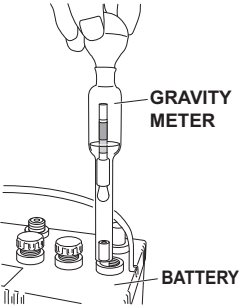
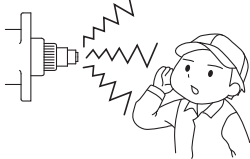
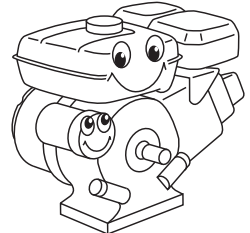
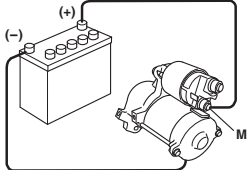
16-2 ELECTRIC STARTER

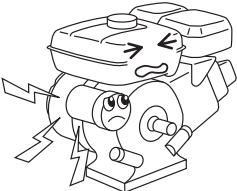
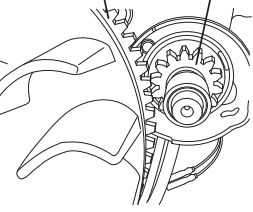
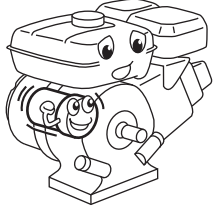


※ When the starter continuously runs
(Immediately remove the (-) terminal of the battery)

Motor does not stop even when the key switch is turned off. → Repair or replace the key switch or starter magnetic switch.



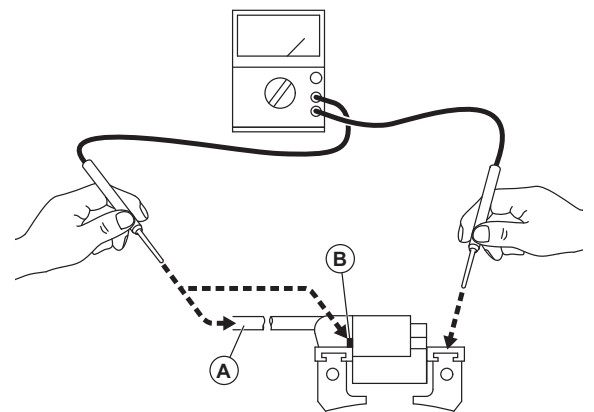
| Problem and check item | Description | | Remedy |
|--|---|---|--|
| (1) Starter does not run or only "click" sound is heard. | <p>1. Checking of continuity of wiring</p> <p>Check S terminal and B terminal for deformation, looseness, rusting, or dust sticking. Carefully check inserting method of the S terminal.</p> <p>If not abnormal, set the key switch to START position while cranking (no ignition of engine) and check if voltage is applied to the S terminal and B terminal of starter motor.</p> |  | <p>(1) When no voltage is applied to the S terminal and B terminal, check continuity of the terminals and key switch and repair or replace if necessary.</p> <p>(2) If voltage is applied to the S terminal and B terminal, go to "2. Battery checking."</p> |
| | <p>2. Battery checking</p> <p>Check battery voltage and specific gravity of battery fluid.</p> <p>[Voltage] Normal value : 12.4 to 12.8V Limit (charging required): 12.4V or lower Starting limit : 12V (at 20°C)</p> <p>[Specific gravity] Normal value : 1.22 to 1.29 Limit (Charging required) : 1.22 or lower</p> <p>[Service life] Variance in specific gravity among cell : 0.04 or more</p> |  | <p>(1) Charge or change the battery when voltage is lower than 12.4V or specific gravity is lower than 1.22 (at 20°C).</p> <p>(2) If the wiring and battery are normal, remove the starter and go to "3. Checking of pinion operation."</p> <p>*Use battery rated 12V-24AH or larger</p> |
| | <p>3. Checking of pinion operation</p> <p>Check if the pinion operates or sound of magnetic switch contactor is heard.</p> <p>If the pinion does not operate or magnetic switch sound is not heard, check continuity of each coil of magnetic switch.</p> |  | <p>(1) If the pinion operates or contactor sound is heard, step to "4. Checking of magnetic switch (1)."</p> <p>(2) In case of no continuity Replace the magnetic switch.</p> <p>(3) When continuity is OK Step to "4. Checking of magnetic switch (2)."</p> |
| | <p>(1) Operate the magnetic switch and check B-M terminals</p> |  | <p>(1) In case of no continuity Contact continuity failure. Replace the magnetic switch.</p> <p>(2) When continuity is OK Step to "5. Motor checking."</p> |
| | <p>(2) Check the magnetic switch plunger and bobbin interior for dust sticking or rusting.</p> | | <p>(1) Clean the plunger. If the bobbin interior is contaminated, replace the magnetic switch.</p> |
| <p>5. Motor checking</p> | <p>Connect the (+) side of the battery to the M terminal of magnetic switch and check if the motor runs.</p> |  | <p>(1) If the motor does not run, check electric circuit inside the motor, field coil, armature, and brush and replace faulty parts.</p> |

| Problem and check item | | Description | | Remedy |
|---|--|--|---|--|
| (2) Starter runs but engine not | Check engaged state of pinion and ring gear. | Motor idles and engine does not run. |  | (1) Remove and check the starter. Check or replace the pinion clutch if necessary. (2) Check battery charged state and battery terminal connection or corrosion for any abnormality. |
| | | If pinion and ring gear do not engage with each other and abnormal noise is heard between end faces of pinion and ring gear, check the starter pinion and ring gear. | RING GEAR PINION GEAR  | (1) Remove the starter and check pinion and ring gear end faces. If worn, replace the pinion and ring gear. (2) In case of sliding fault of the pinion, correct it. (3) If shift lever or spring is deformed, replace it. |
| (3) Both starter and engine run, but the engine does not start. | | Check if the rotation speed is normal or slow. If slow, check the battery and engine oil viscosity. |  | (1) When the rotation speed is normal Check the ignition system and fuel system. (2) When the rotation speed is slow (a) Check the battery. (b) Check the viscosity of engine oil. If not normal, change the oil. (c) If both (a) and (b) are normal Remove and check the starter. |

16-3 IGNITION COIL

[20 degree C (68F)]

| | NORMAL RESISTANCE |
|-----------------------|-------------------|
| HIGH-TENSION WIRE (A) | 5 - 7 k Ω |
| PRIMARY WIRE (B) | 1 - 1.4 Ω |



16-4 CHARGE COIL

[20 degree C (68F)]

| Charge Coil | NORMAL RESISTANCE | |
|-------------|-------------------------------|--------------------|
| 15W | 6 Ω | |
| 40W | Green / White - Yellow | 1 Ω |
| | Black / White - Yellow | 1.1 Ω |
| | Green / White - Black / White | 0.1 ~ 0.2 Ω |
| 200W | 0.1 ~ 0.2 Ω | |

17. STANDARD REPAIR TABLES

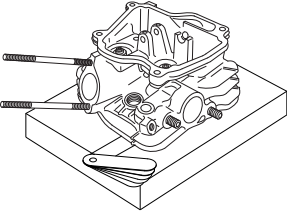
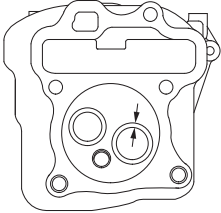
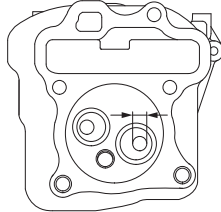
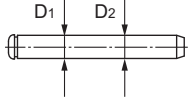
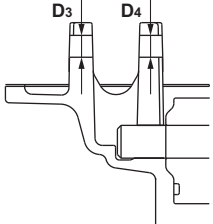
“STD” in the following table is the parts dimension from the brand new engine or the spare parts.

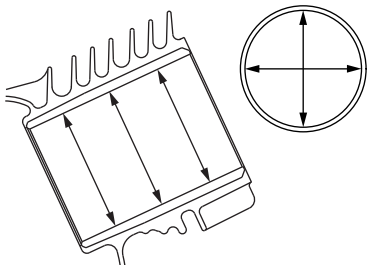
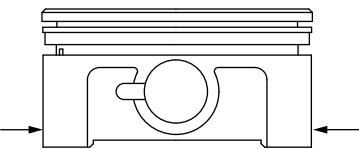
Whereas, “Limit” shows the maximum allowance for the parts to be used on the engine.

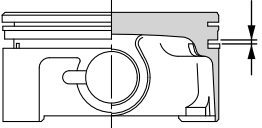
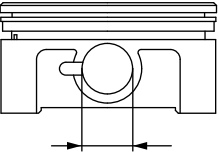
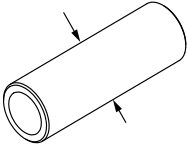
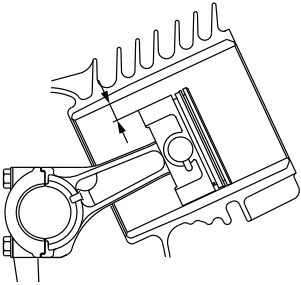
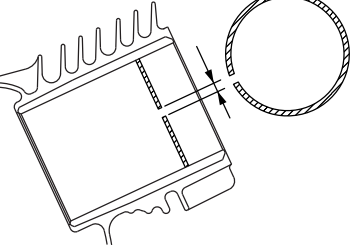
If the measurement exceeds beyond the “Limit”, the part needs to be replaced and/or repaired.

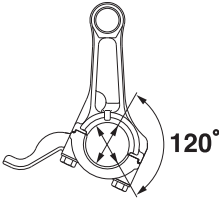
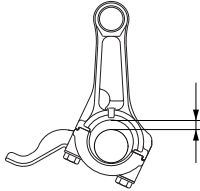
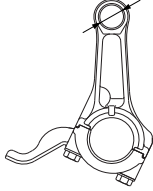
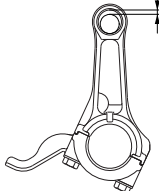
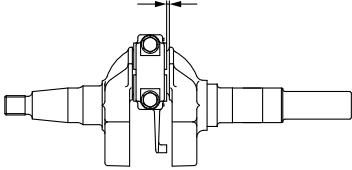
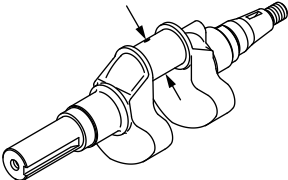
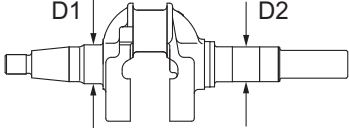
17-1 STANDARD DIMENSIONS AND LIMITS OF USE

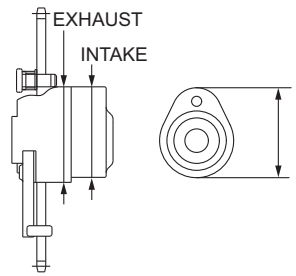
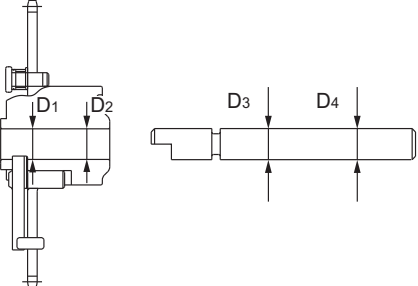
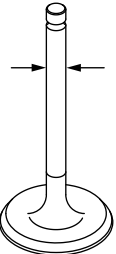
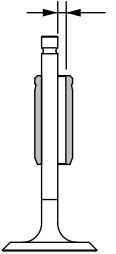
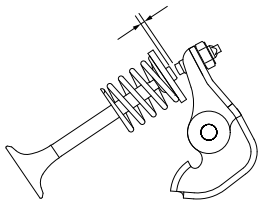
Unit: mm (in.)

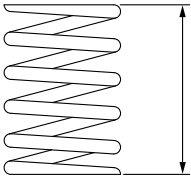
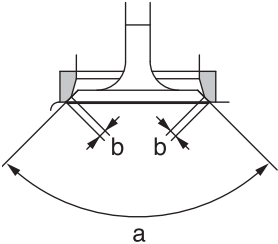
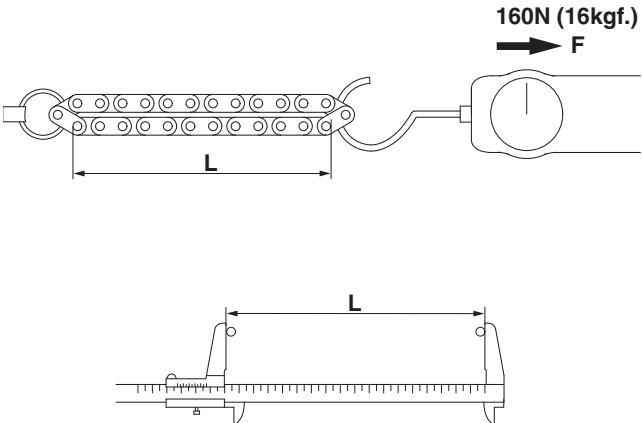
| ITEM | | STD | Limit |
|--|----------------------------------|------------------------------------|------------------|
| CYLINDER HEAD * Flatness  | | 0.05 (0.002) | 0.1 (0.004) |
| * Intake/exhaust valve seat contact width  | Intake Exhaust | 0.7 - 1.0 (0.0276 - 0.0394) | — |
| * Intake/exhaust valve guide inner diameter  | Intake Exhaust | 6.035 - 6.053 (0.2376 - 0.2383) | — |
| * Rocker arm pin outer diameter  | Pin outer diameter D1, D2 | 7.970 - 7.980 (0.3138 - 0.3142) | 7.9 (0.3110) |
| * Rocker arm pin support inner diameter  | Support inner diameter D3, D4 | 8.00 - 8.018 (0.3150 - 0.3157) | 8.05 (0.3169) |

| ITEM | STD | Limit |
|--|-------------------|--------------------------------------|
| <p>CYLINDER</p> <p>* Inner diameter</p>  | Standard | 89.000 - 89.022 (3.5039 - 3.5040) |
| | First reboring | 89.250 - 89.272 (3.5138 - 3.5147) |
| | Second reboring | 89.500 - 89.522 (3.5236 - 3.5245) |
| * Roundness after reboring | | Less than 0.01 (0.0004) |
| * Cylindricity after reboring | | Less than 0.015 (0.0006) |
| <p>PISTON</p> <p>* Outer diameter at skirt in thrust direction</p>  | Standard | 88.980 - 89.000 (3.5032 - 3.5039) |
| | Oversize +0.25 | 89.230 - 89.250 (3.5130 - 3.5138) |
| | Oversize +0.50 | 89.480 - 89.500 (3.5228 - 3.5236) |

| ITEM | | STD | Limit |
|---|---------------------------|--------------------------------------|---------------------|
| PISTON * Ring groove side clearance  | Top | 0.050 - 0.090 (0.0020 - 0.0035) | 0.15 (0.0059) |
| | Oil ring (three-piece) | 0.030 - 0.125 (0.0012 - 0.0049) | — |
| * Piston pin hole  | | 20.989 - 21.022 (0.8263 - 0.8276) | 21.045 (0.82854) |
| * Piston pin outer diameter  | | 20.992 - 21.000 (0.8265 - 0.8268) | 20.960 (0.8252) |
| * Clearance between piston and cylinder at skirt  | | 0.065 - 0.107 (0.0026 - 0.0042) | 0.25 (0.0098) |
| * Piston ring end gap  | Top | 0.10 - 0.25 (0.0039 - 0.0098) | 1.5 (0.0591) |
| | Oil ring (three-piece) | 0.15 - 0.55 (0.0059 - 0.0217) | 1.5 (0.0591) |

| ITEM | STD | Limit |
|---|---|--|
| <p>CONNECTING ROD</p> <p>* Large end inner diameter</p>  | <p>38.000 - 38.016 (1.4961 - 1.4967)</p> | <p>38.1 (1.5000)</p> |
| <p>* Clearance between large end and crank pin</p>  | <p>0.030 - 0.060 (0.0012 - 0.0024)</p> | <p>0.2 (0.0079)</p> |
| <p>* Small end inner diameter</p>  | <p>21.010 - 21.023 (0.8272 - 0.8277)</p> | <p>21.08 (0.8299)</p> |
| <p>* Clearance between small end and piston pin</p>  | <p>0.010 - 0.032 (0.0004 - 0.0013)</p> | <p>0.12 (0.0047)</p> |
| <p>* Large end side clearance</p>  | <p>0.100 - 0.780 (0.0039 - 0.0307)</p> | <p>1.0 (0.0394)</p> |
| <p>CRANKSHAFT</p> <p>* Crank pin outer diameter</p>  | <p>37.956 - 37.970 (1.49433 - 1.4949)</p> | <p>37.85 (1.4902)</p> |
| <p>* Journal outer diameter</p>  | <p>D1</p> | <p>34.986 - 34.997 (1.3774 - 1.3778)</p> |
| | <p>D2</p> | <p>34.986 - 34.997 (1.3774 - 1.3778)</p> |

| ITEM | STD | | Limit |
|---|--|---|-------------------|
| CAMSHAFT * Cam peak height (intake and exhaust)  * Cam sprocket inner diameter * Pin (cam sprocket) outer diameter  | Cam peak height | Intake 35.658 - 35.758 (1.4039 - 1.4078) | 35.61 (1.4020) |
| | | Exhaust 39.408 - 39.508 (1.5515 - 1.5554) | 39.36 (1.5496) |
| | Cam inner diameter D ₁ ,D ₂ | 10.0 - 10.036 (0.3937 - 0.3951) | 10.05 (0.3957) |
| INTAKE/EXHAUST VALVES * Valve stem outer diameter  | Intake | 5.970 - 5.985 (0.2350 - 0.2356) | 5.85 (0.2303) |
| | Exhaust | 5.970 - 5.985 (0.2350 - 0.2356) | 5.85 (0.2303) |
| * Clearance between valve stem and valve guide  | Intake | 0.050 - 0.083 (0.0197 - 0.0033) | 0.3 (0.0118) |
| | Exhaust | 0.050 - 0.083 (0.0197 - 0.0033) | 0.3 (0.0118) |
| * Valve clearance (in cold state)  | Intake | 0.12 - 0.15 (0.0047 - 0.0059) | 0.25 (0.0098) |
| | Exhaust | 0.12 - 0.15 (0.0047 - 0.0059) | 0.25 (0.0098) |

| ITEM | STD | Limit |
|--|---------------------|--|
| VALVE SPRING FREE LENGTH  | 36.5 (1.4370) | |
| VALVE SEAT ANGLE (INTAKE AND EXHAUST) * Valve cutter angle (a) * Valve contact width (b)  | Intake Exhaust | a: 90° b: 0.7 - 1.0 (0.0276 - 0.0394) 2.0 (0.0787) |
| CHAIN LENGTH  | 346.20 (13.6299) | 349.0 (13.7402) |

17-2 SERVICE DATA (The following are only for your reference.)

| | | EX35 | EX40 |
|----------------------|-----------------------------------|------|------|
| Compression pressure | (kg/cm ² / 500 rpm) | 4.5 | |
| Fuel consumption | Continuous load / 3600 rpm (L/Hr) | 3.3 | 3.8 |
| Lubricant | Capacity (L) | 1.2 | |
| | Efficacy (mL) | 600 | |
| | Consumption (mL/Hr) | 7~11 | |

* Oil consumption has been measured under-following condition :

- Good break-in operation has been finished.
- Oil : 10W-30 (Grade SE)
- Load : Continuous load / 3600 rpm

17-3 TIGHTENING TORQUE

| ITEM | | | Tightening Torque | | |
|--------------------------|--------------------|--|-------------------|-------------|-------------|
| | | | N·m | kgf·cm | ft·lb |
| Cylinder head bolts | M10×75 flange bolt | Re-use | 29.0 - 31.0 | 290 - 310 | 21.0 - 22.4 |
| | | When replace to new cylinder head and flange bolts | 37.0 - 39.0 | 370 - 390 | 26.7 - 28.2 |
| | M8×35 flange bolt | | 17.0 - 19.0 | 170 - 190 | 12.3 - 13.7 |
| Connecting rod cap bolts | | | 22.5 - 27.5 | 225 - 275 | 16.3 - 19.9 |
| Flywheel nut | | | 100.0 - 120.0 | 1000 - 1200 | 72.3 - 86.8 |
| Main bearing cover bolts | | | 22.0 - 24.0 | 220 - 240 | 16.2 - 17.7 |
| Spark plug | New | | 12.0 - 15.0 | 120 - 150 | 8.7 - 10.8 |
| | Re-tightening | | 23.0 - 27.0 | 230 - 270 | 16.6 - 19.5 |
| Muffler nut | | | 18.0 - 22.0 | 180 - 220 | 13.0 - 16.2 |
| Ignition coil | | | 7.0 - 9.0 | 70 - 90 | 5.1 - 6.5 |
| Oil sensor (Option) | | | 8.0 - 10.0 | 80 - 100 | 5.8 - 7.2 |

17-4 AIR GAP AND CLEARANCE

| ITEM | | Clearance | |
|-----------------|-------------------------|-------------|-----------------|
| | | mm | in. |
| Valve clearance | (Intake, Exhaust) | 0.12 - 0.15 | 0.0047 - 0.0059 |
| Air gap | (Ignition and flywheel) | 0.3 - 0.5 | 0.012 - 0.020 |
| Electrode gap | (Spark plug) | 0.6 - 0.7 | 0.024 - 0.028 |

18.MAINTENANCE AND STORAGE

The maintenance jobs described below apply to correct use of the engine under normal conditions.

The maintenance intervals mentioned in this section are not a guarantee that no maintenance is required during those intervals.

For example, when the engine is used in dusty conditions, the air cleaner should be cleaned every day, rather than every 100 hours.

18-1 DAILY MAINTENANCE (EVERY 8 HOURS OF USE)

| MAINTENANCE ITEMS | REASON / REMARKS |
|--|--|
| (1) Clean dust from engine. | (1) Dust can impair operation of various parts. Governor linkage is especially sensitive to dust. |
| (2) Check for fuel leakage. Tighten or replace parts, if necessary. | (2) Uneconomical and dangerous. |
| (3) Check all parts are securely fastened. Tighten, if necessary. | (3) Looseness can result in vibration and accidents. |
| (4) Check oil level and add up to full mark. | (4) Running the engine with insufficient oil can result in serious problems, including engine seizure. |
| (5) Check that the air cleaner element is clean. Clean or replace, if necessary. | (5) A clogged air cleaner can cause power loss and malfunction. |

18-2 INSPECTION AND MAINTENANCE AFTER THE FIRST 20 HOURS

| MAINTENANCE ITEMS | REASON / REMARKS |
|-------------------------------|--|
| (1) Change the crankcase oil. | (1) Sludge is deposited during running-in. |

18-3 INSPECTION AND MAINTENANCE EVERY 100 HOURS (EVERY 10 DAYS)

| MAINTENANCE ITEMS | REASON / REMARKS |
|--|---|
| (1) Change the crankcase oil. | (1) Contaminated oil quickens wear. |
| (2) Clean the air cleaner. | (2) A clogged air cleaner can cause engine malfunction. |
| (3) Inspect the spark plug. Clean with gasoline or polish with sandpaper if dirty. | (3) A faulty spark plug can cause low power output and poor starting performance. |

18-4 INSPECTION AND MAINTENANCE EVERY 100 TO 200 HOURS (EVERY MONTH)

| MAINTENANCE ITEMS | REASON / REMARKS |
|--|---|
| (1) Clean the fuel strainer and fuel tank. | (1) Contaminated fuel can cause engine malfunction. |
| (2) Change the air cleaner element. | (2) A clogged air cleaner can cause engine malfunction. |
| (3) Clean and adjust the spark plug electrode. | (3) Cause low power output and poor starting performance. |

18-5 INSPECTION AND MAINTENANCE EVERY 300 HOURS

| MAINTENACE ITEMS | REASON / REMARKS |
|--|--|
| (1) Inspect the intake and exhaust valve clearance. Adjust if necessary. | (1) Incorrect clearance can cause low power output and engine malfunction. |

18-6 INSPECTION AND MAINTENANCE EVERY 500 TO 600 HOURS (EVERY 6 MONTHS)

| MAINTENACE ITEMS | REASON / REMARKS |
|---|--|
| (1) Remove the cylinder head and remove any carbon. | (1) Carbon deposits can cause engine malfunction. |
| (2) Disassemble and clean the carburetor. | (2) A faulty carburetor can cause engine malfunction. |
| (3) Inspect and fitting the intake and exhaust valve and the seats of them. | (3) Unfitting can cause low power output and engine malfunction. |

18-7 MAINTENANCE EVERY 1,000 HOURS (ANNUAL MAINTENANCE)

| MAINTENACE ITEMS | REASON / REMARKS |
|--|--|
| (1) Overhaul the engine. Clean and correct the engine parts, replacing if necessary. | (1) Dirty, misaligned or worn parts can cause low power output and engine malfunction. |
| (2) Replace the piston rings. | (2) Faulty piston rings can cause low output power and engine malfunction. |
| (3) Replace the fuel hose. | (3) To prevent fuel leakage and attendant dangers. |

18-8 SPARK ARRESTER AND TAIL SCREEN (OPTION)

Check and clean the spark arrester and the tail screen, which are mounted on the tail of the exhaust muffler every 100 hours.

Clogged the spark arrester or the tail screen can cause prevents the flow of exhaust gas, reduces engine output, increases fuel consumption and makes starting difficult.

⚠ CAUTION

If the engine has been running, the muffler, the spark arrester and the tail screen will be very hot. Allow the muffler to cool before checking or cleaning the spark arrester and the tail screen.

HOW TO REMOVE THE SPARK ARRESTER AND TAIL SCREEN

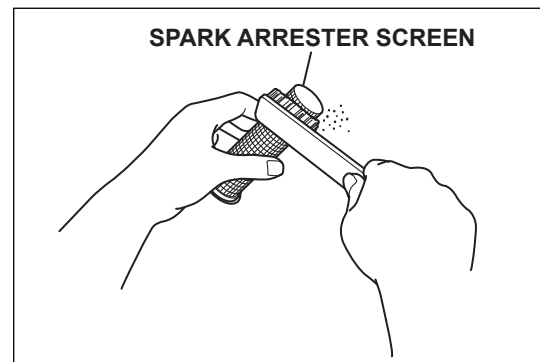
(1) Remove the tapping screw, the spark arrester (screw : 1pc.) and the tail screen (screw : 3ps.).

CLEAN THE SPARK ARRESTER AND TAIL SCREEN

(1) Use a brush to remove carbon deposits from the spark arrester screen. Be careful to avoid damaging the screen.

(2) The spark arrester must be free of breaks and holes. Replace the spark arrester if it is damaged.

(3) Install the spark arrester, and muffler protector in the reverse order of disassembly.



18-9 ENGINE STORAGE

- (1) Carry out the maintenance jobs described in step 18-1 above.
- (2) Drain fuel from the fuel tank and carburetor float chamber.
- (3) To prevent rust in the cylinder bore, inject oil through the spark plug hole, pull the recoil starter knob gently 2 or 3 times and then put back the spark plug.
- (4) Pull the recoil starter knob until the resistance is heavy. Leave it in that position.
- (5) Clean the exterior of the engine with an oiled cloth. Place a plastic cover or similar over the engine, and store the engine in a dry place.

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SUBARU

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