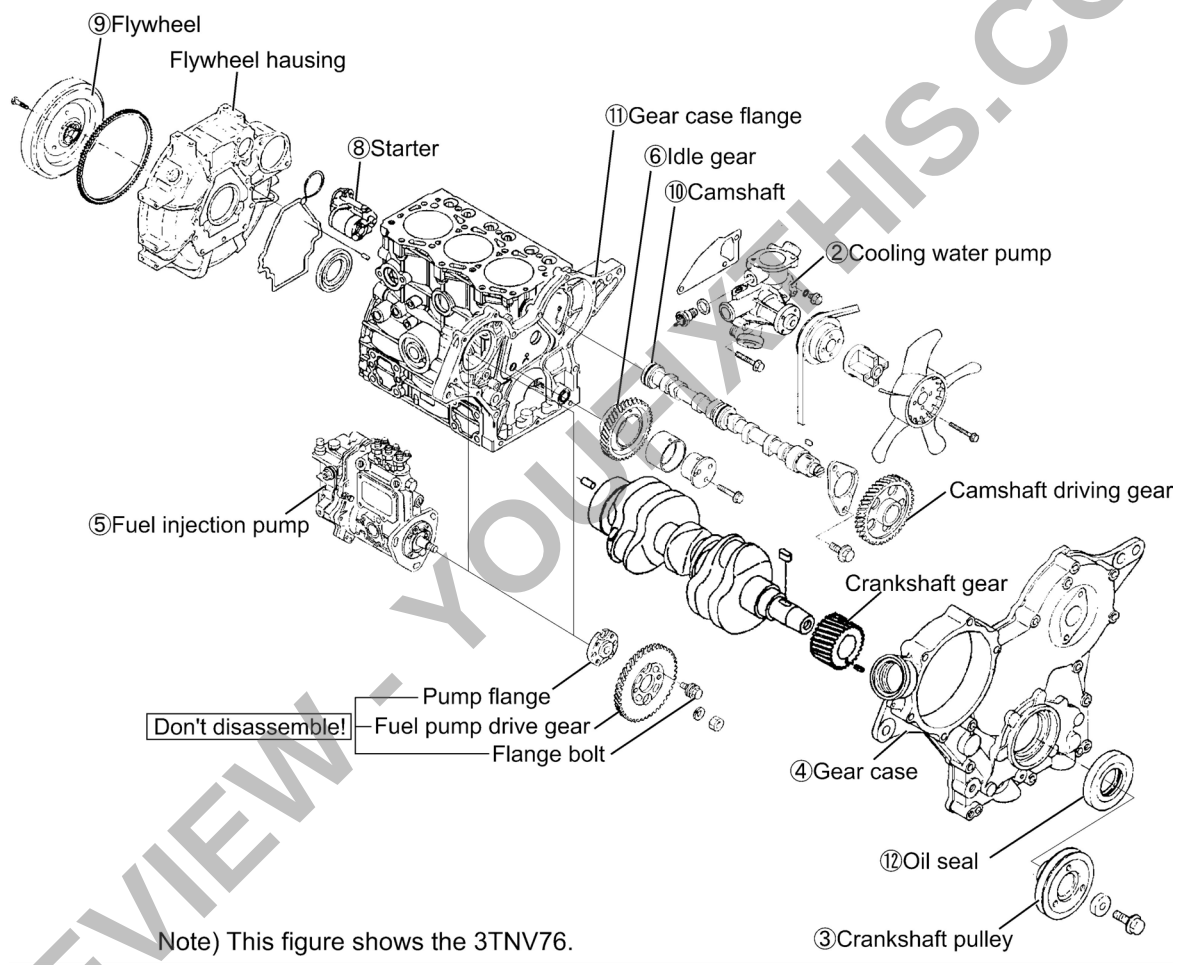
(2) How to Read the Explanations

- An exploded view, sectional views, a system diagram, etc. are shown at the beginning of each section as required for easy understanding of the mounted states of the components.
- For the removal/installation of each part, the procedure is shown with the procedural step No. in the illustration.
- Precautions and key points for disassembly and reassembly of parts are described as **points**. In the explanation for each point, detailed operation method, information, standard and precautions are described.

**Description Example**




Note) This figure shows the 3TNV76.

- Disassembly procedure

1) Follow steps (1) to (15) of the cylinder head disassembly procedure.
2) Remove the cooling water pump.
3) Remove the crankshaft pulley. (**Point 1**) ← Operation point to be explained on a later page.

- Operation points

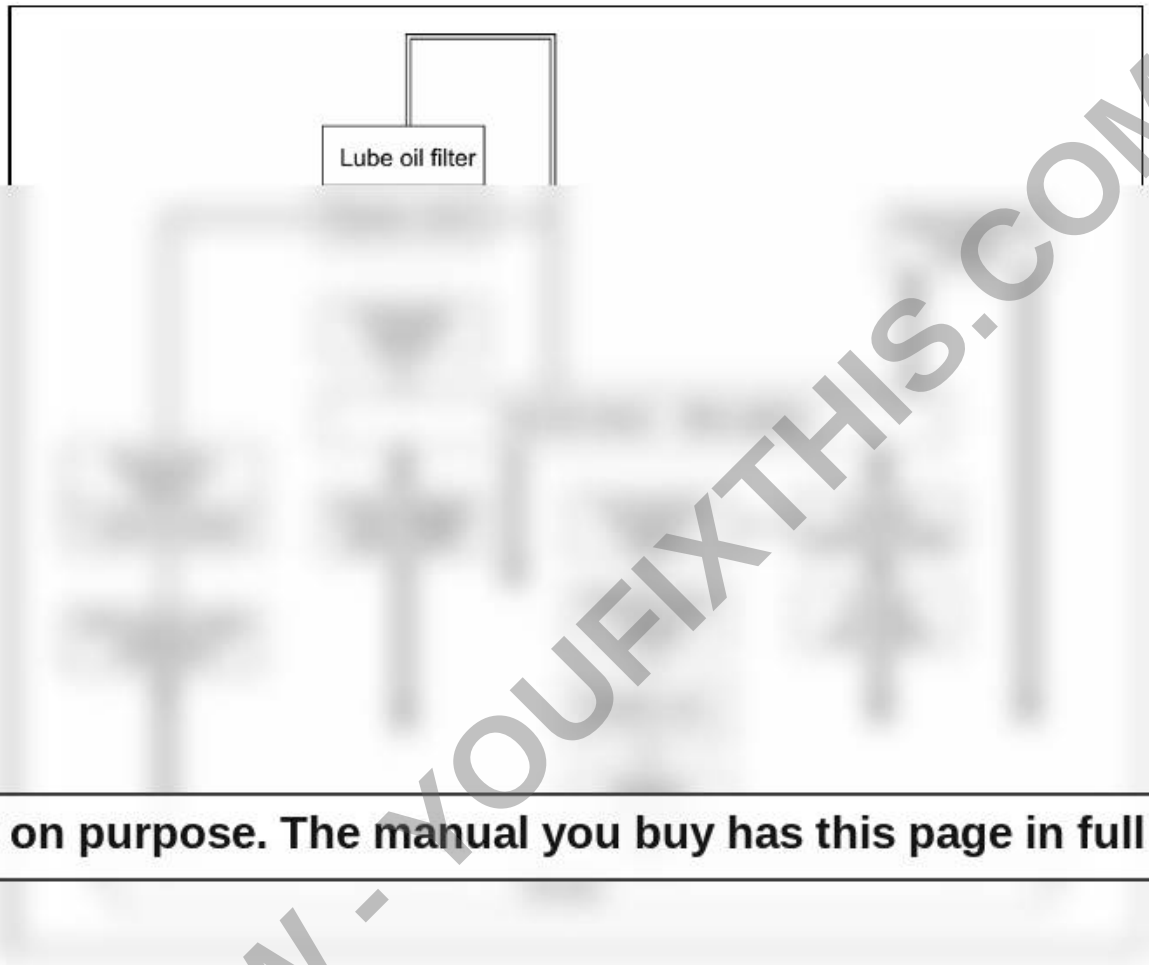
Disassemble: Service point for removal
Reassemble: Service point for installation
Disassemble-Reassemble: Service point required in both removal and installation.

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# 5. LUBRICATION SYSTEM

## 5.1 Lubrication System Diagram




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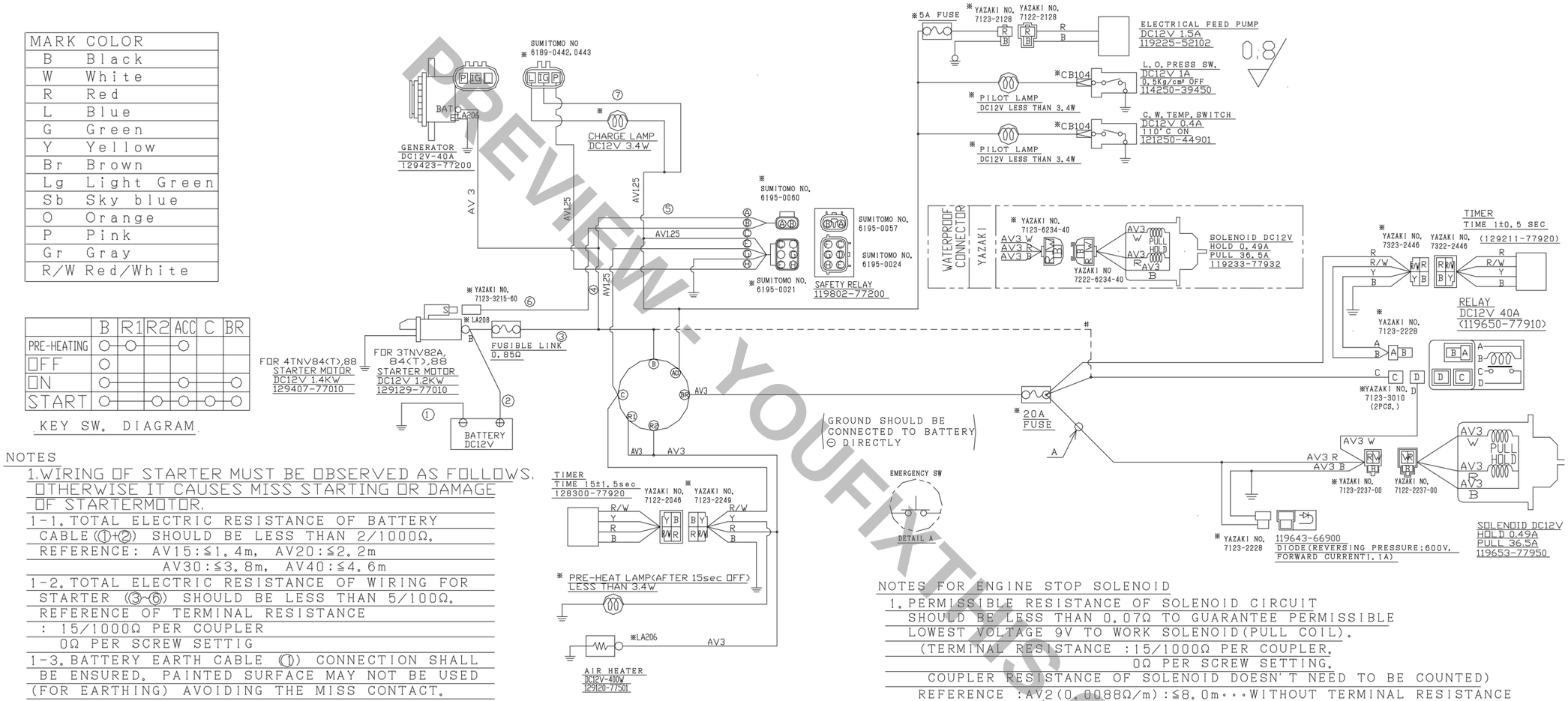


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# 10. Electric Wiring

## 10.1 Electric Wiring Diagram

This is a typical example.




NOTES

1. WIRING OF STARTER MUST BE OBSERVED AS FOLLOWS, OTHERWISE IT CAUSES MISS STARTING OR DAMAGE OF STARTERMOTOR.
   1-1. TOTAL ELECTRIC RESISTANCE OF BATTERY CABLE (①+②) SHOULD BE LESS THAN 2/1000Ω.
   REFERENCE: AV15: ≦1.4m, AV20: ≦2.2m
   AV30: ≦3.8m, AV40: ≦4.6m
   1-2. TOTAL ELECTRIC RESISTANCE OF WIRING FOR STARTER (③~⑥) SHOULD BE LESS THAN 5/100Ω.
   REFERENCE OF TERMINAL RESISTANCE
   : 15/1000Ω PER COUPLER
   0Ω PER SCREW SETTIG
   1-3. BATTERY EARTH CABLE (①) CONNECTION SHALL BE ENSURED. PAINTED SURFACE MAY NOT BE USED (FOR EARTHING) AVOIDING THE MISS CONTACT.
2. BATTERY TREATMENT MUST BE OBSERVED AS FOLLOWS, OTHERWISE IT MAY CAUSE BURNING OF ELECTRIC EQUIPMENTS OR COMPONENTS. ALTERNATOR (DIODES) BURNING CAUSED BY BATTERY CABLE CONNECTION REVERSELY IS NOT WARRANTED.
   2-1. BATTERY SHOULD BE FIXED BY FITTING. (NOT TO MOVE)
   2-2. BATTERY CABLE LENGTH SHOULD BE ADJUSTED PROPERLY AND CLAMPED NOT TO BE CONNECTED REVERSELY.
   2-3. NOT LOOSE THE BATTERY CABLE TERMINAL, NOR TURN THE BATTERY SWITCH OFF DURING THE ENGINE RUNNING.
3. ONLY THE SPECIFIED LOAD SHOULD BE APPLIED ON THE ALTERNATOR "L" AND "P" LINE. IT IS NOT ALLOWED TO CONNECT ANY LOAD UNSPECIFIED WITHOUT YANMAR APPROVAL.
4. CHECK ANY SURGE CURRENT OR VOLTAGE OCCURED UNDER NORMAL OPERATIONS AND EXPECTIVE ERRONEOUS OPERATIONS, AND CONFIRM THE CIRCUIT NO SURGE OCCURS.
   ESPECIALLY PROVIDE THE FLYWHEEL DIODE FOR "C-LOAD" AND DIODE FOR "L-LOAD".

NOTES FOR ENGINE STOP SOLENOID

1. PERMISSIBLE RESISTANCE OF SOLENOID CIRCUIT SHOULD BE LESS THAN 0.07Ω TO GUARANTEE PERMISSIBLE LOWEST VOLTAGE 9V TO WORK SOLENOID(PULL COIL).
   (TERMINAL RESISTANCE :15/1000Ω PER COUPLER, 0Ω PER SCREW SETTING.
   COUPLER RESISTANCE OF SOLENOID DOESN'T NEED TO BE COUNTED)
   REFERENCE :AV2(0.0088Ω/m): ≦8.0m···WITHOUT TERMINAL RESISTANCE
   AV3(0.0056Ω/m): ≦12.5m···SAME AS ABOVE
   WHEN YOU EXCEED PERMISSIBLE RESISTANCE, ADOPT THE CIRCUIT IMPRESSED FROM THE POWER SUPPLY TO THE SOLENOID DIRECTLY USING A RELAY ···REFER TO #
2. HIGH TEMPERATURE PARTS, SUCH AS AN EXHAUST PIPE, SHOULD NOT APPROACH FOR THE PULL POWER FALL OF SOLENOID, AND HEATING PREVENTION OF INNER COIL TEMPERATURE. (PERMISSIBLE AMBIENT TEMPERATURE:-30~100℃)
3. INSTALL FUSE TO PROTECT THE HARNESS AGAINST TROUBLES SUCH AS SHORT CIRCUIT OR CONTINUOUS DRIVE OF PULL-COIL.
4. THE POWER SUPPLY OF SOLENOID MAY NOT BE COMMON WITH THE LINE OF ALTERNATOR INITIAL EXCITATOR AS SHOWN IN THIS DRAWING. (OTHERWISE, SOLENOID MAY LOOSE STOP FUNCTION DUE TO THE POWER SUPPLY FROM ALTERNATOR "L" TERMINAL.)
5. IN CASE OF WATERPROOF CONNECT OR APPLICATION, CONNECTOR SHOULD BE FIXED BY FITTING TO PREVENT LEAD WIRE BREAK.
6. IN CASE OF EMARGENCY STOP OF MACHINE FOR SAFETY WILL BE APPLIED SWITCH LOCATION SHOULD BE SHOWN AS A.
7. IN CASE OF THE SOLENOID CIRCUIT RESISTANCE WOULD BE LIMIT, # WIRING IS APPLICABLE.

REMARKS

1. ※ MARKED PARTS ARE NOT PROVIDED BY YANMAR.

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# 2. Inspection and Adjustment

## 2.1 Periodic Maintenance Schedule

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lube oils used and handling status. General rules are described here.

○:User-maintenance ◎:Parts replacement ●:Shop-inspection

| Classification | Item | Daily | Maintenance period | | | | |
|---|---|---|---|---|---|---|---|
| | | | Every 50 hours | Every 250 hours or 3 months | Every 500 hours or 6 months | Every 1000 hours or one year | Every 2000 hours or two years |
| Whole | Visual check around engine | ○ | | | | | |
| Fuel oil system | Fuel tank level check and fuel supply | ○ | | | | | |
| | Fuel tank draining | | ○ | | | | |
| | Bleeding the fuel system | | ○ | | | | |
| | Water separator draining | | ○ | | | | |
| | Water separator cleaning | | | | ○ | | |
| | Fuel filter element replacement | | | | ◎ | | |
| Lubricating oil system | Lube oil level check and replenishment | ○ | | | | | |
| | Lube oil replacement | | ◎ 1st time | ◎ 2nd time and thereafter | | | |
| | Lube oil filter replacement | | | | | | |
| Cooling water system | Cooling water level check and replenishment | ○ | | | | | |
| | Radiator fin cleaning | | | ○ | | | |
| | Cooling fan V-belt tension check | | ○ 1st time | ○ 2nd time and thereafter | | | |
| | Cooling water replacement | | | | | ◎ | |
| | Cooling water path flushing and maintenance | | | | | | ● |
| Rubber house | Fuel pipe and cooling water pipe inspection and maintenance | ○ | | | | | ● |
| Governor | Inspection and adjustment of governor lever and accelerator | ○ | | ○ | | | |
| Air intake system | Air cleaner cleaning and element replacement | | | ○ | ◎ | | |
| | Diaphragm assy inspection | | | | | ● (2 years) | |
| Electrical system | Warning lamp & instruments function check | ○ | | | | | |
| | Battery electrolyte level check and battery recharging | | ○ | | | | |
| Cylinder head | Intake/exhaust valve clearance adjustment | | | | | ● | |
| | Intake/exhaust valve seat lapping | | | | | | ● |
| Fuel injection pump and nozzle | Fuel injection nozzle pressure inspection | | | | | ●* | |
| | Fuel injection timing adjustment Fuel pump inspection and adjustment | | | | | | ●* |

*) EPA allows to maintain the emission related parts as shown in 1.6.3 of chapter1.

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(1) 2TNV70

| Engine name | Unit | 2TNV70 |
|---|---|---|
| Engine specification class | - | VM |
| Type | - | Vertical, in-line, 4-cycle, water-cooled diesel engine |
| Combustion chamber | - | Indirect injection |
| Number of cylinders | - | 2 |
| Cylinder bore×stroke | mm× | 70×74 |

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## 3.2 Quick Reference Table for Troubleshooting

The following table summarizes the general trouble symptoms and their causes. If any trouble symptom occurs, take corrective action before it becomes a serious problem so as not to shorten the engine service life.

| Trouble symptom / Cause | | Starting failure | | | | Insufficient engine output | | | Poor exhaust color | | High knocking sound during combustion | Abnormal engine sound | Uneven combustion sound | Hunting | | Large engine vibration | Difficulty in returning to low speed | Excessive fuel consumption | Lube oil | | | | Much blow-by gas | Cooling water | | Air intake | | Exhaust temperature rise | Corrective action |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Engine starts but stops soon. | | | Exhaust color | | | During work | | | | | | | | | | | | | | | | | | | | | |
| | | Engine does not start. | Exhaust smoke: None | Exhaust smoke: Little | Exhaust smoke: Much | Ordinary | White | Black | White | Black | | | | During idling | During work | | | | Excessive consumption | Dilution by fuel oil | Mixture with water | Low L.O. pressure | | Overheat | Low water temperature | Pressure drop | Pressure rise | | |
| Engine system | Improper clearance of intake/exhaust valve | ○ | ○ | | | ○ | | | | | | | | | | | | | | | | | | | | ○ | | ○ | Adjust the valve clearance. (See 2.2.6(3) in Chapter2.) |
| | Compression leakage from valve seat | | | | | ○ | | ○ | | ○ | | ○ | | | | | | ○ | | | | | ○ | | | ○ | | ○ | Lap the valve seat. (See 4.2.6 in Chapter4.) |
| | Seizure of intake/exhaust valve | ○ | | | ○ | ○ | | ○ | | ○ | | ○ | | | ○ | ○ | | | | ○ | | | ○ | | | ○ | | | Correct or replace. |
| | Blowout from cylinder head gasket | | | | | ○ | | | | | | | | | | | | | | | ○ | | | ○ | | | | | Replace the gasket. (See 4.2.2-11) in Chapter4.) |
| | Seized or broken piston ring | ○ | | | ○ | | ○ | | ○ | | | ○ | | ○ | | ○ | | | ○ | ○ | | | ○ | ○ | | | | ○ | Replace the piston ring. (See 4.4.2-5), 10) in Chapter4.) |
| | Worn piston ring, piston or cylinder | ○ | | | ○ | | ○ | | ○ | | | | | | | | | | ○ | ○ | | | ○ | | | | | | Perform honing and use oversize parts. (See 4.4.5-(1),(4) and 4.4.6 in Chapter4.) |
| | Seized crankpin metal or bearing | ○ | ○ | | | | | | | | | ○ | | ○ | ○ | ○ | | | | | | | ○ | | | | | | Repair or replace. |
| | Improper arrangement of piston ring joints | | ○ | | | | ○ | | | | | | | | | | | | ○ | | | | ○ | | | | | | Correct the ring joint positions. (See 4.4.4 point 6 in Chapter4.) |
| | Reverse assembly of piston rings | | | | | | ○ | | ○ | | | | | | | | | | ○ | | | | ○ | | | | | | Reassemble correctly. (See 4.4.4 point 6 in Chapter4.) |
| | Worn crankpin and journal bearing | | | | | ○ | | | | | | ○ | | ○ | ○ | ○ | | | | | | ○ | | | | | | | Measure and replace. (See 4.4.5-(2) in Chapter4.) |
| | Loosened connecting rod bolt | | | | | | | | | | | ○ | | | | ○ | | | | | | ○ | | | | | | | Tighten to the specified torque. (See 4.4.4-point 2 in Chapter4.) |
| | Foreign matter trapped in combustion chamber | ○ | | | | | | | | | | ○ | | | | | | | ○ | | | | ○ | | | | | | Disassemble and repair. |
| | Excessive gear backlash | | | | | | | | | | | ○ | | | | | | | | | | | | | | | | | Adjust gear meshing. (See 4.3.4-point 2 in Chapter4.) |
| | Worn intake/exhaust valve guide | | | | | | ○ | | | | | | | | | | | | ○ | | | | ○ | | | | | | Measure and replace. (See 4.2.5-(2) and 4.2.7 in Chapter4.) |
| | Defective governor | | ○ | | | | | | | | | | | ○ | ○ | ○ | ○ | | | | | | | | | | | | Make adjustment. |
| | Improper open/close timing of intake/exhaust valves | ○ | | | | | ○ | ○ | ○ | ○ | | ○ | | | | | | | | | | | | | | | | | Adjust the valve clearance. (See 2.2.6-(3) in Chapter2.) |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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### 4.1.3 Complete disassembly

Peripheral parts such as air cleaner, muffler and radiator differ in installation and types for each application. Therefore, description in this Chapter is started with the steps to be taken just after the peripheral parts have been removed.

| Step | Removal Parts | Remarks |
|---|---|---|
| 1 | 1) Thoroughly remove sand, dust, dirt and soil from the surface of the engine.<br>2) Drain cooling water and lube oil from the engine. | |

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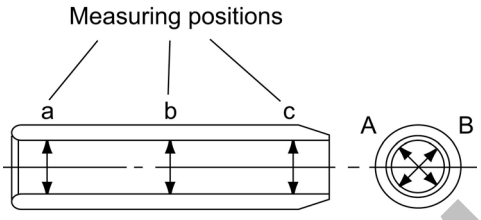
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## (2) Valve guide

Mainly check damage and wear on the inside wall.
Apply supply part code when replacing the part.

| Service part code |
|---|
| 119717-11800 |




**Valve guide inside diameter**

Valve stem clearance

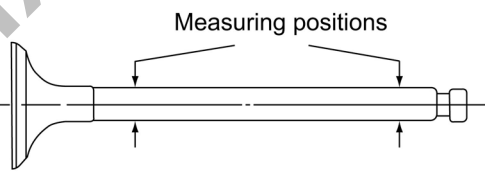
| Part name | Place | Standard | Limit |
|---|---|---|---|
| Intake valve | Guide I.D. | 6.000~6.012 | 6.08 |
| | Stem O.D. | 5.960~5.975 | 5.90 |
| | Clearance | 0.025~0.052 | 0.16 |
| Exhaust valve | Guide I.D. | 6.000~6.012 | 6.08 |
| | Stem O.D. | 5.945~5.960 | 5.90 |
| | Clearance | 0.040~0.067 | 0.17 |

## (3) Intake/exhaust valve

Mainly clean and check damage and wear at the valve stem and seat.

(a) Seat contact: See (1)(d) above.

(b) Stem outside diameter: See (2) above.

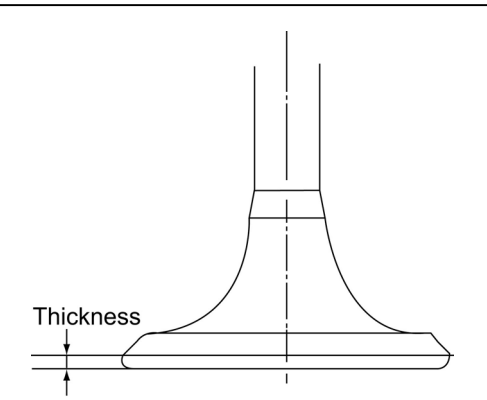



**Valve stem outside diameter**

(c) Valve head thickness

mm

| Part | Standard | Limit |
|---|---|---|
| Intake | 0.9~1.1 | 0.50 |
| Exhaust | 1.0~1.2 | 0.50 |




**Valve head thickness**

(d) Valve stem bend

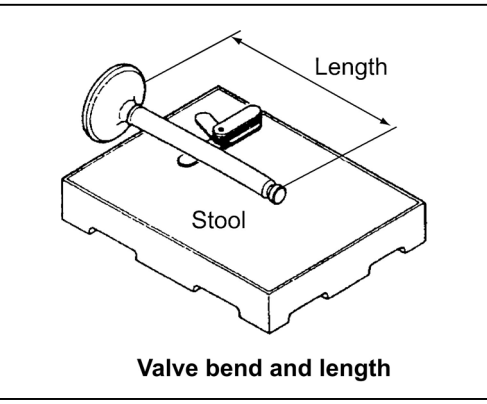
mm

| | |
|---|---|
| Limit | 0.01 |

(e) Overall length

mm

| | Standard | Limit |
|---|---|---|
| Intake/ Exhaust | 86.8~87.2 | 86.6 |




**Valve bend and length**

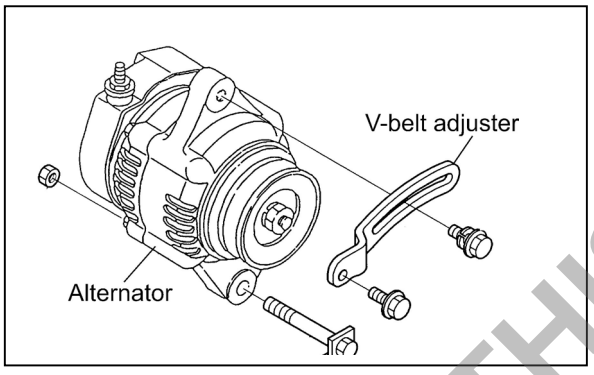
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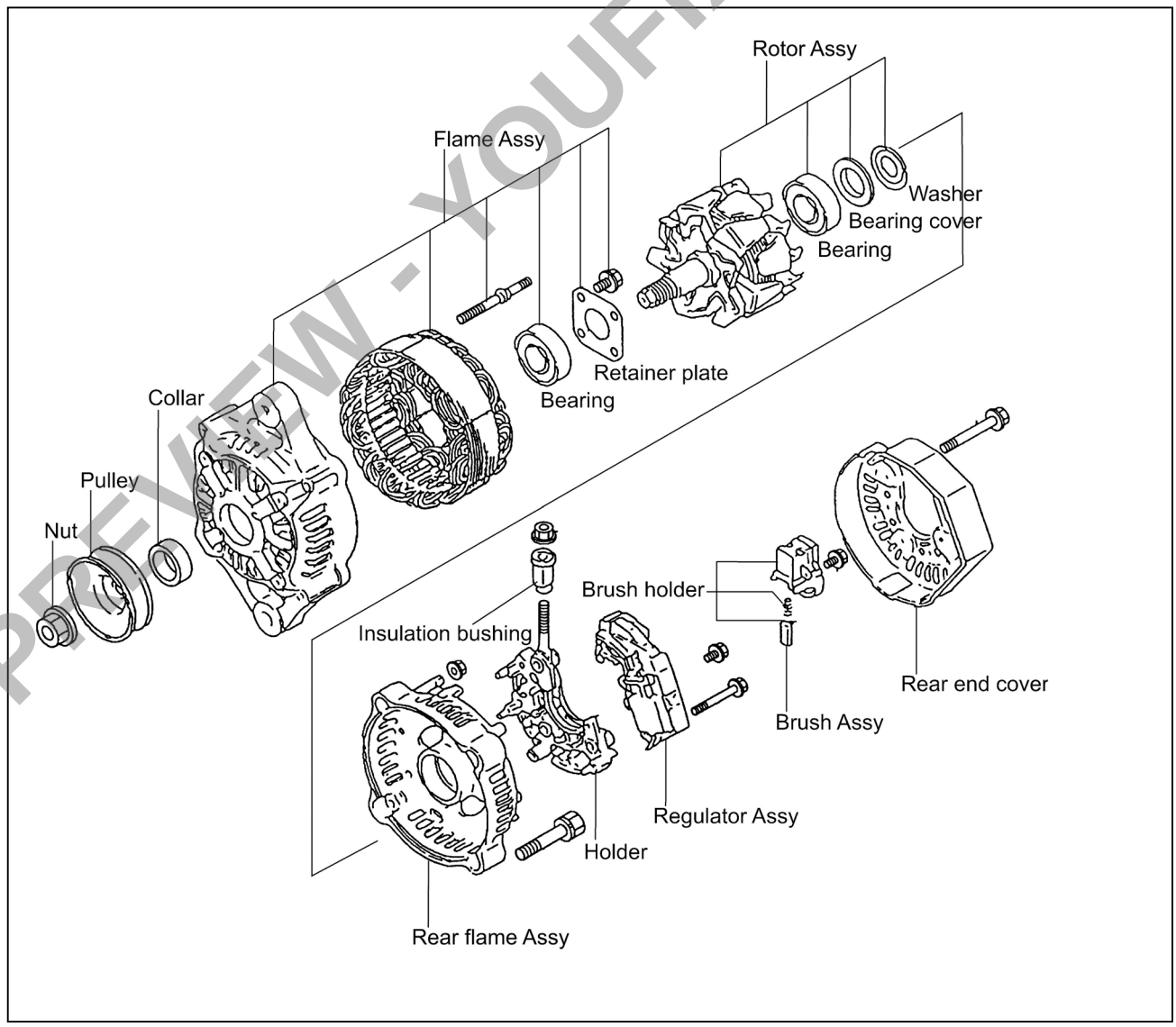
# 9.2 40A Alternator

## 9.2.1 Components

(1) Parts related to the alternator




(2) Alternator components of disassembly and assembly




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1.1 Engine Nomenclature ..... 1
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1.3 Fuel Oil, Lubricating Oil and Cooling Water ..... 7
1.3.1 Fuel oil ..... 7

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# SAFETY LABELS

- Most accidents are caused by negligence of basic safety rules and precautions. For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting at a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consideration for safety is required in addition to the matters marked ⚠ CAUTION. Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.

- Safety marks used in this manual and their meanings are as follows:

**⚠ DANGER** **DANGER**-indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

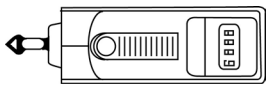
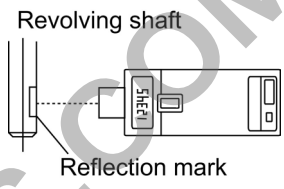
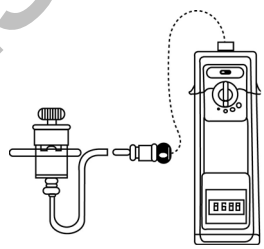
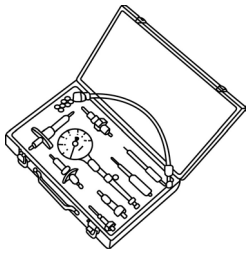
**⚠ WARNING** **WARNING**-indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

**⚠ CAUTION** **CAUTION**-indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

- **NOTICE**-indicates that if not observed, the product performance or quality may not be guaranteed.

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| No. | Instrument name | | Application | Illustration |
|---|---|---|---|---|
| 16 | Speedometer | Contact type | For measuring revolution by contacting the mortise in the revolving shaft |  |
| | | Photoelectric type | For measuring revolution by sensing the reflecting mark on the outer periphery of the revolving shaft |  |
| | | Fuel high-pressure pipe clamp type | For measuring the revolution regardless of the center or periphery of the revolving object. |  |
| 17 | Circuit tester | | For measuring resistance, voltage and continuity of electrical circuits |  |
| 18 | Compression gage kit | | For measuring compression pressure<br><br>Yanmar code No. TOL-97190080 |  |

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