# CONTENTS

1. ENGINE IN PHOTOGRAPHS .................................................. 1
2. OUTSTANDING FEATURES OF YSE SERIES ................................ 2
3. GENERAL DESCRIPTION .................................................. 3
   3.1 Construction .................................................... 3
   3.2 Power Take-off Shaft Pulleys ...................................... 5
4. PERIODICAL MAINTENANCE ............................................. 6
5. FUEL AND LUBRICATING OILS ........................................... 7
   5.1 Fuel Oils .......................................................... 7
      5.1.1 Property requirements ....................................... 7
      5.1.2 Recommended brands ......................................... 7
   5.2 Lubricating Oils .................................................. 7
      5.2.1 Functions .................................................... 7
      5.2.2 Classification by viscosity ................................... 8
      5.2.3 Recommended brands ......................................... 9
6. TROUBLE-SHOOTING .................................................... 10
   6.1 Engine Does Not Start ............................................. 10
   6.2 Difficult Start-up ................................................ 11
   6.3 Bad Exhaust Color ............................................... 12
   6.4 Momentary High-speed Revolution ................................ 12
   6.5 Hunting ........................................................... 12
   6.6 Output Decrease .................................................. 13
   6.7 Knocking during Operation ....................................... 13
   6.8 Sudden Engine Stop ............................................... 14
   6.9 Lubricating Oil Leak .............................................. 14
   6.10 Fuel Oil leak .................................................... 14
   6.11 Water Leak ...................................................... 15
   6.12 Cooling Water Failure .......................................... 15
   6.13 Clutch Slip ..................................................... 15
7. WEAR LIMIT OF EACH MAIN PART .................................... 16
8. INSPECTION AND SERVICING OF MAIN PARTS ....................... 17
   8.1 Fuel Injection Pump and Nozzle .................................. 17
      8.1.1 Fuel injection pump .......................................... 17
      8.1.2 Fuel injection nozzle (throttle nozzle) ...................... 19
      8.1.3 Air venting .................................................. 21
   8.2 Cooling Water Pump .............................................. 22
   8.3 Cylinder Head ................................................... 24
8.4 Piston and Connecting Rod Assembly ........................................ 26
8.5 Cylinder Liner ................................................................. 30
8.6 Crankshaft and Main Bearing Metal ....................................... 32
8.7 Electrical Equipment ......................................................... 35
  8.7.1 Starter ............................................................................. 36
  8.7.2 Generator ....................................................................... 37

9. ADJUSTMENTS ..................................................................... 38
  9.1 Governor Lever .................................................................... 38
     9.1.1 Adjustment procedure ................................................... 38
     9.1.2 Readjustment procedure ............................................... 39
  9.2 Intake/Exhaust Valve ............................................................ 39
     9.2.1 Adjustment procedure ................................................... 39
  9.3 Fuel Injection Timing ............................................................ 39
     9.3.1 Checking hints .............................................................. 39
     9.3.2 Adjustment procedure ................................................... 40

10. DISASSEMBLY ..................................................................... 41
    10.1 Preparation ...................................................................... 41
    10.2 Serviceman's Kit .............................................................. 41
        10.2.1 General tools .......................................................... 41
        10.2.2 Special tools ........................................................... 42
        10.2.3 Measuring instruments .............................................. 42
        10.2.4 Others .................................................................... 43
    10.3 Precautions ....................................................................... 43
    10.4 Clutch Disassembly Procedure ........................................ 43

11. REASSEMBLY ...................................................................... 47
    11.1 Precautions ..................................................................... 47

12. STERN ARRANGEMENT ......................................................... 48
2. OUTSTANDING FEATURES OF YSE SERIES

1. Its extra-compactness, light weight, and large output permit engine room to be miniaturized.

2. Wet type single-disc clutch, and reduction/reversing gear offer very light forward/backward change, easy and positive operation, and outstanding durability.


4. Selection of starting systems: electric starting, coupled also available with handle starting, and handle starting with speed-up chain gearing (available to install on either bow or stern side).

5. All-speed governor, interlocked with easy-to-operate, durable Yanmar-Dickel type fuel injection pump, assures minimum load fluctuations and excellent low-speed operation.

6. Rotary type cooling water pump featuring ample circulating water and simple construction makes the engine seizure-free.

7. Flywheel enclosed in the clutch housing provides safety to the operator.

8. Full sealed forced lubrication system saves oiling labor during operational mode, and thereby increases working efficiency.

9. Constructional simplicity of component parts makes the engine very easy to operate, maintain, and inspect.
3. GENERAL DESCRIPTION

Each of Yanmar diesel engines, models YSE8 and YSE12, comes equipped with clutch reduction gear, which together with a flywheel is totally enclosed in the flywheel housing and the clutch housing. The propeller shaft is run from the flywheel side.

The starter for electrical starting is directly mounted to the flywheel housing to drive the ring gear of the flywheel. For chain starting, the power take-off shaft is chain-connected to the starting shaft located immediately above the cylinder. The engine is started by clockwise rotation on the stern side and by counter-clockwise rotation on the bow side.

3.1 Construction

<table>
<thead>
<tr>
<th>Part</th>
<th>Description &amp; Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cyl. body</td>
<td>Monoblock casting of water jacket, crankcase and oil pan.</td>
</tr>
<tr>
<td>2. Cyl. liner</td>
<td>Wet type made of special cast iron and coated with special anticorrosive paint.</td>
</tr>
<tr>
<td>3. Main bearing</td>
<td>Side cover side: precision kelmet metal with thin back metal.</td>
</tr>
<tr>
<td></td>
<td>Flywheel side: Thick metal.</td>
</tr>
<tr>
<td>4. Cyl. head</td>
<td>Gasket type, part of monoblock including valve guides.</td>
</tr>
<tr>
<td>5. Intake/exhaust valve</td>
<td>Mushroom type.</td>
</tr>
<tr>
<td>6. Intake pipe</td>
<td>Intake enertia type made of steel.</td>
</tr>
<tr>
<td>7. Exhaust silencer</td>
<td>Round, expansion type, or water injection type.</td>
</tr>
<tr>
<td>8. Valve drive system</td>
<td>Tappet &amp; valve push rod type. Parabolic suction/ exhaust cam with approach ramp.</td>
</tr>
<tr>
<td>9. Crankshaft</td>
<td>Stamp forged, with induction hardened journal, pin and oil seal portions.</td>
</tr>
<tr>
<td>10. Flywheel</td>
<td>Mounted to clutch, enclosed in flywheel housing.</td>
</tr>
<tr>
<td>12. Piston rings</td>
<td>Three compression rings, one oil scraper ring.</td>
</tr>
<tr>
<td>13. Piston pin</td>
<td>Float type.</td>
</tr>
<tr>
<td>Part</td>
<td>Description &amp; Specifications</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------</td>
</tr>
<tr>
<td>15. Crankpin metal</td>
<td>Drum type</td>
</tr>
<tr>
<td>16. Lube oil pump</td>
<td>Trochoid pump, driven by camshaft.</td>
</tr>
<tr>
<td>17. Lube oil strainers</td>
<td>Inlet side: perforated steel type.</td>
</tr>
<tr>
<td></td>
<td>Outlet side: auto-clean type, full-flow passing type.</td>
</tr>
<tr>
<td>18. Indicators</td>
<td>Electric starting: hydraulic lamp</td>
</tr>
<tr>
<td></td>
<td>Manual starting: oil light</td>
</tr>
<tr>
<td>19. Lube oil circulation chart</td>
<td>Oil pan</td>
</tr>
<tr>
<td></td>
<td>Inlet side strainer</td>
</tr>
<tr>
<td></td>
<td>Trochoid pump</td>
</tr>
<tr>
<td></td>
<td>Outlet side strainer</td>
</tr>
<tr>
<td></td>
<td>Oil indicator</td>
</tr>
<tr>
<td></td>
<td>Gear case</td>
</tr>
<tr>
<td></td>
<td>Main bearing metal (flywheel side)</td>
</tr>
<tr>
<td></td>
<td>Valve rocker arm chamber</td>
</tr>
<tr>
<td></td>
<td>Main bearing metal (gear case side)</td>
</tr>
<tr>
<td></td>
<td>Crankpin metal</td>
</tr>
<tr>
<td></td>
<td>Oil pan</td>
</tr>
<tr>
<td>20. Cooling water pump</td>
<td>Rotary type (belt-driven from power take-off shaft)</td>
</tr>
<tr>
<td>21. Fuel injection pump</td>
<td>Yanmar-Dickel type pump</td>
</tr>
<tr>
<td>22. Fuel injection nozzle</td>
<td>Pintle nozzle</td>
</tr>
<tr>
<td>23. Fuel strainer</td>
<td>Filter paper</td>
</tr>
<tr>
<td>24. Fuel tank</td>
<td>Steel plate</td>
</tr>
<tr>
<td>25. Governor</td>
<td>Centrifugal, all-speed type</td>
</tr>
<tr>
<td>Part</td>
<td>Description &amp; Specifications</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>26. Governor remote control device</td>
<td>Remote control wire, steel lever</td>
</tr>
<tr>
<td>27. Decompression remote control</td>
<td>Remote control wire, steel lever</td>
</tr>
<tr>
<td>28. Electric starting device</td>
<td>Starter (ring gear type)</td>
</tr>
<tr>
<td></td>
<td>Output: 1.0 KW at 12 V (nominal)</td>
</tr>
<tr>
<td></td>
<td>Battery: 40-70 AH</td>
</tr>
<tr>
<td>29. Manual starting device</td>
<td>Speed-up chain (on stern or bow side)</td>
</tr>
<tr>
<td></td>
<td>Speed-up ratio: 2.07 (YSE8), 2.91 (YSE12)</td>
</tr>
<tr>
<td>30. Reversing clutch</td>
<td>Wet type single plate disc clutch</td>
</tr>
<tr>
<td>31. Reduction gear</td>
<td>Constant mesh spur gear type</td>
</tr>
<tr>
<td></td>
<td>Reduction ratio: 2 : 1, 3 : 1</td>
</tr>
<tr>
<td>32. Power take-off shaft pulley</td>
<td>Spur gear-driven from crank gear with pulleys for alternator and for cooling water pump.</td>
</tr>
</tbody>
</table>

### 3.2 Power Take-off Shaft Pulleys

The outside pulley is for the alternator and the inside pulley for the cooling water. If the alternator is not attached, the outside pulley can be used as desired to drive a bilge pump, winch, etc.

(Remark) The flexible mounting being on engine, not using P.T.O. shaft.

<table>
<thead>
<tr>
<th>Model</th>
<th>YSE8</th>
<th>YSE12</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTO shaft rotation speed/engine speed</td>
<td>4100/3200 rpm</td>
<td>3380/3000 rpm</td>
</tr>
<tr>
<td>Outside diameter of pulley</td>
<td>90 mm</td>
<td>110 mm</td>
</tr>
<tr>
<td>V belts</td>
<td>Single HM type</td>
<td>Single HM type</td>
</tr>
<tr>
<td>PTO max. permissible output power</td>
<td>1-1.5/3200 HP/rpm</td>
<td>2-3/3000 HP/rpm</td>
</tr>
</tbody>
</table>

---

- 5 -
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Checkpoints</th>
<th>Hours of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Every day</td>
</tr>
<tr>
<td>1</td>
<td>Fuel Oil</td>
<td>1. Check fuel oil level, and supply fuel, if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Discharge drainage from the fuel tank.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Clean fuel strainers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Renew the fuel strainer filter elements.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lube, Oil</td>
<td>1. Check lube oil levels in crankcase and reduction gear case, and supply lube oil, if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Lubricate the starting shaft, chain, and other parts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Turn the lube oil strainer handles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Overhaul the lube oil strainers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Renew crankcase lube oil.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Renew clutch case lube oil.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cooling Water</td>
<td>1. Discharge cooling water after operation in cold season.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Check the recirculated condition of cooling water.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Adjust the governor.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Check fuel injection timing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Clean the nozzle.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cylinder Head</td>
<td>1. Retighten the cylinder head bolts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Adjust the intake/exhaust valve clearance.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Clean the internal surfaces of combustion chamber.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Clean the pre-combustion chamber.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Check the intake/exhaust valve seat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Check valve rocker arm and valve guides.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Breather, Belt, Anticorrosive Zinc, Piston &amp; Ring</td>
<td>1. Wash the breather valve.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Check the belt tensions (cooling water pump, generator).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Renew the anticorrosive zinc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Check the piston and the ring.</td>
<td></td>
</tr>
</tbody>
</table>
5. FUEL AND LUBRICATING OILS

To the engine, fuel oil is food and lubricating oil is blood. Mis-handling might cause unexpected engine trouble. The efficiency of the Yanmar engine will depend upon strict adherence to these instructions and recommendations.

It is the salesman's or serviceman's duty and mission to urge the user to follow them.

5.1 Fuel Oils

5.1.1 Property requirements

(1) High cetane rating

Poor ignitability of fuel oil results in a ignition lag, causing difficult starting or knocking.

(2) Low sulphur content

Sulphur contained in fuel oil when burned is combined with water to produce sulphuric acid which corrodes metallic parts.

(3) No dust or moisture content

Dust and moisture contained in fuel oil can cause faster wear or sticking of the plunger of fuel injection pump and injection nozzle.

(4) Appropriate viscosity

Fuel viscosity has a relation to the condition of injection. It should be such that the plunger and the nozzle valve will be properly lubricated.

5.1.2 Recommended brands

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHELL</td>
<td>Shell Diesoline (or local equivalent)</td>
</tr>
<tr>
<td>CALTEX</td>
<td>Caltex Diesel Oil</td>
</tr>
<tr>
<td>MOBIL</td>
<td>Mobil Diesel Oil</td>
</tr>
<tr>
<td>ESSO</td>
<td>Esso Diesel Oil</td>
</tr>
<tr>
<td>B.P. (British Petroleum)</td>
<td>B.P. Diesel Oil</td>
</tr>
</tbody>
</table>

5.2 Lubricating Oils

5.2.1 Functions

(1) Lubrication—reduces friction and wear on sliding surfaces.

(2) Cooling—carries away combustion and friction heat.
(3) Air-tightening—keeps the cylinder air-tight, prevents escape of compressed air and operating gas.

(4) Cleaning—carries away carbon (combustion product) and internal dust.

(5) Rust prevention—keeps parts from rust.

Today, improved engines call for high-quality lubricating oils. Oil companies are now using a number of additives to improve the properties of their lubricating oils.

5.2.2 Classification by viscosity

Lube oil viscosity should be so selected as to suit the ambient temperature.

<table>
<thead>
<tr>
<th>SAE No.</th>
<th>0°F (-17.8°C)</th>
<th>210°F (98.9°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Saybolt universal viscosity, sec.</td>
<td>Kinematic viscosity, CSt</td>
</tr>
<tr>
<td>5W below 10°C</td>
<td>below 4,000</td>
<td>below 869</td>
</tr>
<tr>
<td>10W</td>
<td>6,000-12,000</td>
<td>1,303-2,606</td>
</tr>
<tr>
<td>20W</td>
<td>12,000-48,000</td>
<td>2,606-10,423</td>
</tr>
<tr>
<td>10 -20°C 20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>over 30°C 40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Recommended brands (for crankcase and gear box)

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Brand</th>
<th>SAE No.</th>
<th>below 10°C</th>
<th>10 - 20°C</th>
<th>20 - 35°C</th>
<th>over 35°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHELL</td>
<td>Shell Rotella Oil</td>
<td></td>
<td>20/20W</td>
<td>20/20W</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Shell Talona Oil</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Shell Rimula Oil</td>
<td></td>
<td>20/20W</td>
<td>20/20W</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>CALTEX</td>
<td>RPM Delo Marine Oil</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>RPM Delo Multi-Service Oil</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Delvac Special</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delvac 20W-40</td>
<td></td>
<td>20W-40</td>
<td>20W-40</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delvac 1100 Series</td>
<td></td>
<td>20-20W</td>
<td>20-20W</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Delvac 1200 Series</td>
<td></td>
<td>20-20W</td>
<td>20-20W</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>MOBIL</td>
<td>Estor HD</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Esso Lube HD</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Standard Diesel Oil</td>
<td></td>
<td>10W</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>ESSO</td>
<td>B.P. Energol</td>
<td></td>
<td>20W, 30</td>
<td>20W, 30</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>B.P. Venellus*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.P. Diesel S3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B.P. Venellus**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* API grade CB
** API grade CD
6. TROUBLESHOOTING

The best engine will come to malfunction if not properly handled day after day or after a prolonged period of service.
Locating the trouble is the first consideration. Pinpointing the trouble cause is to be done next. Then comes a proper remedy therefore. If careless handling is the case, the operator may be instructed not to cause the same trouble.
The following lists the troubles, check points, possible causes, and remedies.

6.1 Engine Does Not Start

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Intake/exhaust valve</td>
<td>1. No valve clearance.</td>
<td>Adjust to 0.2 mm.</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>2. Carbon or wear on valve seat.</td>
<td>Fit valve with quick.</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>4. Intake/exhaust valve stuck.</td>
<td>Clean or renew.</td>
<td></td>
</tr>
<tr>
<td>2. Fuel injection nozzle</td>
<td>1. Loose or unsymmetrically tightened nozzle guard.</td>
<td>Retighten.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Faulty or lost packing.</td>
<td>Repair or renew.</td>
<td></td>
</tr>
<tr>
<td>3. Cylinder liner &amp; piston</td>
<td>1. Unsuitable lube oil.</td>
<td>Change oil.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2. Gasoline overcharged at start-up.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Stuck or worn piston ring.</td>
<td>Renew.</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>4. Seized or worn piston and cylinder liner.</td>
<td>Renew.</td>
<td>27</td>
</tr>
<tr>
<td>4. Gasket</td>
<td>1. Gasket damaged (loose or unsymmetrically tightened head).</td>
<td>Renew or retighten</td>
<td></td>
</tr>
<tr>
<td>5. Fuel oil</td>
<td>1. Fuel failure.</td>
<td>Supply fuel.</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>2. Tank cock in closed position.</td>
<td>Open cock.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Dirty, scratched or worn delivery valve.</td>
<td>Clean or renew.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Dirty, scratched or worn regulator needle.</td>
<td>Clean or renew.</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>4. Stuck or worn plunger.</td>
<td>Clean or renew.</td>
<td>18</td>
</tr>
<tr>
<td>Check point</td>
<td>Possible cause</td>
<td>Remedy</td>
<td>Ref. page</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------</td>
<td>----------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>7. Fuel injection nozzle</td>
<td>1. Stuck or worn nozzle.</td>
<td>Clean or renew.</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. High or low injection pressure.</td>
<td>Adjust to 160 kg/cm².</td>
<td>20</td>
</tr>
<tr>
<td>8. Main bearing</td>
<td>1. Stuck or seized.</td>
<td>Clean or renew.</td>
<td>33</td>
</tr>
<tr>
<td>9. Crankpin metal</td>
<td>1. Stuck or seized.</td>
<td>Clean or renew.</td>
<td>26</td>
</tr>
<tr>
<td>10. Starter operation</td>
<td>1. Battery discharge.</td>
<td>Recharge up to 1.26 (S.G.) at 20°C.</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>2. Key switch fault.</td>
<td>Renew.</td>
<td></td>
</tr>
<tr>
<td>11. Battery</td>
<td>1. Battery discharge.</td>
<td>Recharge up to 1.26 (S.G.) at 20°C.</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>2. Voltage drop (under no load).</td>
<td>Renew if below 12V.</td>
<td></td>
</tr>
</tbody>
</table>

6.2 Difficult Start-up

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Temperature</td>
<td>1. Low.</td>
<td>Select suitable lube oil.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use start-up accelerator.</td>
<td></td>
</tr>
<tr>
<td>3. Injection</td>
<td>1. Stuck or worn nozzle valve.</td>
<td>Clean or renew.</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. Low injection pressure.</td>
<td>Adjust to 160 kg/cm².</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>3. Worn plunger.</td>
<td>Renew.</td>
<td>18</td>
</tr>
<tr>
<td>5. Compression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Electric equipment</td>
<td></td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>7. Heavy manual turning</td>
<td>1. Stuck or seized piston, liner.</td>
<td>Correct or renew.</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>2. Stuck or seized main bearing metal.</td>
<td>Correct or renew.</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>3. Stuck or seized crankpin metal.</td>
<td>Correct or renew.</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>4. Unsuitable lube oil.</td>
<td>Change oil.</td>
<td>8</td>
</tr>
</tbody>
</table>

- 11 -
### 6.3 Bad Exhaust Color

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Output decrease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Injection</td>
<td>1. Stuck or worn nozzle.</td>
<td>Correct or renew.</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. Low injection pressure.</td>
<td>Adjust to 160 kg/cm².</td>
<td>20</td>
</tr>
<tr>
<td>5. Injection timing</td>
<td>1. Injection lag.</td>
<td>Set to 10 ± 2° before T.D.C.,</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>listening to injection noise.</td>
<td></td>
</tr>
<tr>
<td>6. Carbon deposit</td>
<td>1. Stuck or worn piston ring or</td>
<td>Correct or renew.</td>
<td>27</td>
</tr>
<tr>
<td>(Sticky)</td>
<td>oil ring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Worn cylinder liner or piston.</td>
<td>Renew.</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>(Burning oil)</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

### 6.4 Momentary High-speed Revolution

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regulator handle</td>
<td>1. Sudden operation.</td>
<td>Do not move it suddenly.</td>
<td>38</td>
</tr>
<tr>
<td>2. Governor system</td>
<td>1. Misadjusted lever.</td>
<td>Readjust.</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>2. Stuck regulator spindle.</td>
<td>Clean and correct.</td>
<td></td>
</tr>
</tbody>
</table>

### 6.5 Hunting

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Governor system</td>
<td>1. Misadjusted lever.</td>
<td>Readjust.</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>2. Stuck regulator spindle.</td>
<td>Clean and correct.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Malfuncion of No. 1 lever</td>
<td>Correct.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shaft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Injection</td>
<td>1. Stuck or worn nozzle.</td>
<td>Correct or renew.</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2. High or low pressure.</td>
<td>Adjust to 160 kg/cm².</td>
<td></td>
</tr>
<tr>
<td>4. Injection timing</td>
<td>1. Injection advance or lag.</td>
<td>Set to 10 ± 2° before T.D.C.,</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>listening to injection noise.</td>
<td></td>
</tr>
<tr>
<td>5. Crankshaft side</td>
<td>1. Large gap. (worn main</td>
<td>Renew.</td>
<td>33</td>
</tr>
<tr>
<td>gap</td>
<td>bearing)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 6.6 Output Decrease

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Intake/exhaust valve</td>
<td>1. Over/under clearance.</td>
<td>Adjust to 0.2 mm.</td>
<td>39</td>
</tr>
<tr>
<td>3. Injection</td>
<td>1. Stuck or worn nozzle.</td>
<td>Correct or renew.</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. Pressure drop.</td>
<td>Adjust to 160 kg/cm².</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>3. Worn plunger.</td>
<td>Renew.</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>4. Scratched or worn delivery valve.</td>
<td>Correct or renew.</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>5. Misadjusted governor lever.</td>
<td>Readjust.</td>
<td>38</td>
</tr>
<tr>
<td>6. Moving parts</td>
<td>1. Stuck or seized cylinder liner and piston.</td>
<td>Correct or renew.</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>2. Stuck or seized crankpin metal.</td>
<td>Correct or renew.</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>3. Stuck or seized main bearing metal.</td>
<td>Correct or renew.</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>4. Stuck or seized piston pin and pin metal.</td>
<td>Correct or renew.</td>
<td>27</td>
</tr>
</tbody>
</table>

### 6.7 Knocking during Operation

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tightening parts</td>
<td>1. Loose end nut.</td>
<td>Retighten.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Loose connecting rod bolts and nuts.</td>
<td>Retighten.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Other tightening parts loose.</td>
<td>Retighten.</td>
<td></td>
</tr>
<tr>
<td>2. Moving parts</td>
<td>1. Worn or seized crankpin metal.</td>
<td>Renew.</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>2. Worn or seized main bearing metal.</td>
<td>Renew.</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>3. Worn or seized piston pin and pin metal.</td>
<td>Renew.</td>
<td>27</td>
</tr>
<tr>
<td>3. Intake/exhaust valve</td>
<td>1. Large clearance.</td>
<td>Adjust to 0.2 mm.</td>
<td>39</td>
</tr>
<tr>
<td>Check point</td>
<td>Possible cause</td>
<td>Remedy</td>
<td>Ref. page</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------</td>
<td>----------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>5. Injection.</td>
<td>1. Stuck or worn nozzle.</td>
<td>Correct or renew.</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2. High or low pressure.</td>
<td>Adjust to 160 kg/cm².</td>
<td>20</td>
</tr>
</tbody>
</table>

6.8 Sudden Engine Stop

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heavy manual turning.</td>
<td>1. Seized main bearing metal.</td>
<td>Renew.</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>2. Seized crankpin metal.</td>
<td>Renew.</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>3. Seized piston and cylinder liner.</td>
<td>Renew.</td>
<td>27</td>
</tr>
<tr>
<td>2. Injection</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>3. Compression</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.9 Lube Oil Leak

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Sliding parts.</td>
<td>1. Scratched or worn oil seals or shafts</td>
<td>Renew.</td>
<td></td>
</tr>
<tr>
<td>3. Lube oil tube.</td>
<td>1. Loose bolts or scratched.</td>
<td>Retighten or renew.</td>
<td></td>
</tr>
</tbody>
</table>

6.10 Fuel Oil Leak

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
<th>Ref. page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fuel tank cock retainer.</td>
<td>1. Loose bolts and nuts, or scratched packings.</td>
<td>Retighten, or renew.</td>
<td></td>
</tr>
<tr>
<td>2. Fuel oil pipe.</td>
<td>1. Loose or scratched bolts.</td>
<td>Retighten, or renew.</td>
<td></td>
</tr>
<tr>
<td>3. Oil reservoir.</td>
<td>1. Defective plunger tightening nuts, loose setbolts, damaged packings, or scratched contact surfaces.</td>
<td>Retighten, or renew.</td>
<td>23</td>
</tr>
</tbody>
</table>
### 6.11 Water Leak

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Loose bolts.</td>
<td>Retighten.</td>
</tr>
</tbody>
</table>

### 6.12 Cooling-Water Failure

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Loose tightening parts.</td>
<td>Retighten.</td>
</tr>
</tbody>
</table>

### 6.13 Clutch Slip

<table>
<thead>
<tr>
<th>Check point</th>
<th>Possible cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Friction disc.</td>
<td>1. Worn disc.</td>
<td>Renew if total wear on both sides exceeds 2 mm.</td>
</tr>
</tbody>
</table>
## 7. WEAR LIMIT OF EACH MAIN PART

<table>
<thead>
<tr>
<th>Description</th>
<th>YSE8 std. dim., mm</th>
<th>YSE8 wear limit, mm</th>
<th>YSE12 std. dim., mm</th>
<th>YSE12 wear limit, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearance between cylinder liner and piston</td>
<td>0.109</td>
<td>0.38</td>
<td>0.208</td>
<td>0.43</td>
</tr>
<tr>
<td>Clearance between piston pin and piston pin metal</td>
<td>0.0375</td>
<td>0.30</td>
<td>0.0375</td>
<td>0.30</td>
</tr>
<tr>
<td>Clearance between crankpin and crankpin metal</td>
<td>0.036</td>
<td>0.14</td>
<td>0.036</td>
<td>0.17</td>
</tr>
<tr>
<td>Clearance between crankshaft journal and crank metal</td>
<td></td>
<td></td>
<td>Flywheel side</td>
<td></td>
</tr>
<tr>
<td>Gear case side</td>
<td>0.057</td>
<td>0.17</td>
<td>0.059</td>
<td>0.18</td>
</tr>
<tr>
<td>Clearance between intake/exhaust valve and valve guide</td>
<td>0.0525</td>
<td>0.3</td>
<td>0.0525</td>
<td>0.3</td>
</tr>
<tr>
<td>Piston ring end clearance</td>
<td>0.3</td>
<td>1.5</td>
<td>0.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Cylinder liner top I.D.</td>
<td>75</td>
<td>+0.30</td>
<td>85</td>
<td>+0.34</td>
</tr>
<tr>
<td>Piston skirt O.D.</td>
<td>75</td>
<td>-0.23</td>
<td>85</td>
<td>-0.26</td>
</tr>
<tr>
<td>Piston pin O.D.</td>
<td>23</td>
<td>-0.10</td>
<td>28</td>
<td>-0.11</td>
</tr>
<tr>
<td>Piston pin metal I.D.</td>
<td>23</td>
<td>+0.10</td>
<td>28</td>
<td>+0.11</td>
</tr>
<tr>
<td>Crankshaft pin O.D.</td>
<td>42</td>
<td>-0.13</td>
<td>46</td>
<td>-0.14</td>
</tr>
<tr>
<td>Crankshaft journal O.D.</td>
<td>44</td>
<td>-0.13</td>
<td>52</td>
<td>-0.16</td>
</tr>
<tr>
<td>Crankpin metal I.D.</td>
<td>42</td>
<td>+0.11</td>
<td>46</td>
<td>+0.12</td>
</tr>
<tr>
<td>Main bearing metal I.D.</td>
<td>44</td>
<td>+0.11</td>
<td>52</td>
<td>+0.13</td>
</tr>
<tr>
<td>Top piston ring (chrome-plated)</td>
<td>Breadth</td>
<td>2.0</td>
<td>2.5</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>Thickness</td>
<td>3.3</td>
<td>3.7</td>
<td>-0.37</td>
</tr>
<tr>
<td>2nd &amp; 3rd piston rings</td>
<td>Breadth</td>
<td>2.0</td>
<td>2.5</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>Thickness</td>
<td>3.3</td>
<td>3.7</td>
<td>-0.37</td>
</tr>
<tr>
<td>Oil ring</td>
<td>Breadth</td>
<td>4.0</td>
<td>4.0</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>Thickness</td>
<td>3.3</td>
<td>3.7</td>
<td>-0.37</td>
</tr>
<tr>
<td>Intake/exhaust valve spring</td>
<td>Free length</td>
<td>36.5</td>
<td>-1.5 to -2.0</td>
<td>39.5</td>
</tr>
</tbody>
</table>
8. INSPECTION AND SERVICING OF MAIN PARTS

8.1 Fuel Injection Pump and Nozzle

Both the fuel injection pump and the fuel injection valve (nozzle) are super-high precision finished to atomize fuel oil at an elevated pressure so it can be intimately mixed with air.

Care should, therefore, be taken that they do not get dirty or scratched during disassembly and reassembly. And it is important that they are washed in clear cleaning oil before reassembly.

8.1.1 Fuel injection pump

Disassembled Pump
Disassembly

1) Remove the pump adjusting lever.
2) Remove the delivery valve holder, taking care not to drop the delivery valve (ball).
3) Remove the regulator body, taking care not to drop the regulator needle.
4) Remove the fuel injection pump body, taking care not to drop the spring and the spring washer.
5) Remove the plunger and the plunger barrel.
   Attach copper sheet to the vise or wind waste cloth on the body, and vise; then remove the barrel tightening screws, using an offset wrench (double head wrench).

Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust, scratches, wear on delivery valve seat and ball.</td>
<td>1. Clean if dusty.</td>
<td>YSE8</td>
</tr>
<tr>
<td></td>
<td>2. Renew if scratched or worn.</td>
<td>YSE12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delivery valve assembly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remark: Common to all models.</td>
</tr>
<tr>
<td>Dust, scratches, wear on regulator needle.</td>
<td>1. Clean if dusty.</td>
<td>YSE8</td>
</tr>
<tr>
<td></td>
<td>2. Renew if scratched or worn.</td>
<td>YSE12</td>
</tr>
<tr>
<td></td>
<td>Stepped wear</td>
<td>Regulator needle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remark: Common to all models.</td>
</tr>
<tr>
<td>Scratches or wear on plunger (plunger barrel)</td>
<td>1. Renew if scratched or worn.</td>
<td>YSE8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YSE12</td>
</tr>
<tr>
<td></td>
<td>Wear on plunger end</td>
<td>Plunger assembly</td>
</tr>
<tr>
<td>Note: Renew gasket and copper packing together with plunger.</td>
<td></td>
<td>102700-51100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remark: Also for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Also for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gasket: 172100-51290</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Common to all models.)</td>
</tr>
</tbody>
</table>
Reassembly

1) Tighten the plunger assembly.
   Check that the plunger moves lightly while tightening it gradually by use of an offset wrench.

2) Place the spring and the spring washer.

3) Attach the pump body to the engine.

4) Tighten the regulator, with the regulator body turned counter-clockwise to the degree within which it does not come off. Check that the regulator spindle moves lightly.

5) Tighten the delivery valve.

Note: This completes the reassembly; however, air venting of fuel injection pump and adjustment of governor lever are still necessary for engine start-up.

8.1.2 Fuel injection valve (nozzle)

Disassembly

1) Detach the fuel injection valve.

2) Remove the fuel injection valve lock nut.

3) Remove the nozzle valve assembly.
   If it is difficult to take out the nozzle body, drive it out by hammering the pipe (see fig.).
   Do not strike with a driver or the like, for the valve tip might be damaged.
4) Take off the fuel injection valve spring holder, taking care not to drop the nozzle spring adjusting plates.

Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle valve. Dusty, stuck, scratched or worn.</td>
<td>1. Clean if dusty.</td>
<td>YSE8</td>
</tr>
<tr>
<td></td>
<td>2. Clean or renew if stuck.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Renew if scratched.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Renew if worn.</td>
<td>Nozzle valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remark:</td>
</tr>
</tbody>
</table>

Reassembly

1) Attach the inter spindle, spring seat, nozzle spring, adjusting plate, packing, and nozzle spring holder to the fuel injection valve body. Be sure of the spring side of the spring seat, and do not drop the spring adjusting plates.

2) Attach the nozzle valve and the nozzle body to the fuel injection valve body.

3) Vise the fuel injection valve and tighten various parts.

Verification

After completion of the reassembly, verify that the injection pressure and the spray from are normal or as rated. A nozzle tester simplifies the verification, but if it's not available, fit the fuel injection valve and swing the V pulley of the power take-off shaft to left and right.

Note: Air venting is necessary.

<table>
<thead>
<tr>
<th>Check point</th>
<th>Judging criterion &amp; remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Injection pressure not normal.</td>
<td>1. Judgement using nozzle tester.</td>
<td>YSE8</td>
</tr>
<tr>
<td></td>
<td>2. Judgement without using nozzle tester.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Low pressure: large fuel particle size, or bad exhaust color.).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High pressure: small fuel particle size, or knocking.</td>
<td>Nozzle spring adjusting plate</td>
</tr>
<tr>
<td></td>
<td>Adjust to 160 kg/cm².</td>
<td>Note:</td>
</tr>
<tr>
<td></td>
<td>* Adjusting plate thickness and pressures</td>
<td></td>
</tr>
</tbody>
</table>
2. Spray form
not normal.

<table>
<thead>
<tr>
<th>Spray size</th>
<th>Approximate Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 mm</td>
<td>7 kg/cm²</td>
</tr>
<tr>
<td>0.2 mm</td>
<td>14 kg/cm²</td>
</tr>
<tr>
<td>0.3 mm</td>
<td>21 kg/cm²</td>
</tr>
<tr>
<td>0.5 mm</td>
<td>35 kg/cm²</td>
</tr>
</tbody>
</table>

Check the injection pressure and clean or renew nozzle valve.

---

8.1.3 Air venting

The fuel injection system includes the fuel tank, the fuel injection pump, the fuel injection pipe and the fuel injection nozzle.

Air contained in this fuel injection system prevents fuel injection.

In case of fuel failure and when the fuel injection pump is disassembled, air enters the fuel injection system.

Purge the system of air.

Air Venting Procedure

1) Place the fuel cock in the open position.
2) Loosen the nipples at both ends of the injection pipe, remove the injection pipe, and place the speed change lever in LOW position.

3) Loosen the delivery valve holder (by about two turns), and when bubble-free fuel comes out, securely tighten the delivery valve holder, and then, after attaching the injection pipe, securely tighten the fuel pump side nipple.

4) Confirm if fuel leak out of the nut of the fuel injection valve side, and then tighten securely the nut.

8.2 Cooling Water Pump.

The YSE type cooling water pump, of the rotary type, contains a rubber impeller; it can feed a sufficient quantity of cooling water to all the parts at high speed as well as at low speed.
Disassembly

1) Detach the pump assembly from the engine.
2) Remove the pump drive V. pulley and key.
3) Remove the bearing snap ring.
4) Take off the pump cover.
5) Drive out the drive shaft by hammering with copper hammer from the impeller side to the pulley side. (It comes off with the bearing.)
6) Remove the rubber impeller.
7) Draw out the seal from the pump body.
8) Remove two bearings, one nylon packing and one rubber seal from the drive shaft.

Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>scratches or wear on impeller.</td>
<td>Renew if scratched.</td>
<td>YSE8 YSE12</td>
</tr>
<tr>
<td></td>
<td>Renew if the gap between impeller and pump body side exceeds 0.5 mm.</td>
<td>Impeller 104211-42070</td>
</tr>
<tr>
<td>scratches or wear on pump body and cover surfaces over which impeller slides.</td>
<td>Renew if scratched or worn.</td>
<td>YSE8 YSE12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pump body 104211-42010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pump body cover 104211-42080</td>
</tr>
<tr>
<td>scratches or wear on pump seal.</td>
<td>Renew if scratched or worn.</td>
<td>YSE8 YSE12</td>
</tr>
<tr>
<td>wear or rust on bearing.</td>
<td>Renew if worn or rusty.</td>
<td>Pump seal 104211-42100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bearing (6200ZZ) 24107-062004</td>
</tr>
</tbody>
</table>

Reassembly

1) Insert the cooling water seal into the pump body and apply grease to the seal.
2) Place two bearings, distance piece nylon packing, and rubber seal upon the drive shaft, place the assembly into the pump body, and then place the snap ring.
3) With it set in the groove on the drive shaft, insert the impeller into the pump body. The drive shaft rotates counter-clockwise when viewed from the pulley side. Be sure the impeller is inserted correctly.

4) Place the pump body cover.
5) Attach the key and the V pulley, place the lock washer and tighten the nut.
6) Bend the lock washer.
7) Attach the pump assembly to the engine and tighten the V belt.

Adjust the finger-depressed deflection to 5-7 mm.

Verification

Attach the pump assembly to the engine and operate it to verify that its discharge is as specified below:

- **YSE8** 500 lit./hr. Pump shaft speed 2000 rpm
  - Crankshaft speed 3200 rpm
- **YSE12** 460 lit./hr. Pump shaft speed 1900 rpm
  - Crankshaft speed 3000 rpm

(Note) If operated without water, the rubber impeller will burn. Never operate without water!

8.3 Cylinder Head

The cylinder head is a gasket type: the valve guides and the cylinder head are in one piece, and a large diameter intake valve is used for greater suction efficiency. The intake and exhaust valves are of the totally enclosed and supplied lube oil with forced circulation lubrication system.

Disassembled Cylinder Head
Disassembly

1) Detach the cylinder head from the engine, remove thoroughly carbon from combustion surfaces of the cylinder head and from the internal surfaces of the pre-combustion chamber, and then inspect and service the valves.

2) Remove the split tapper collets by pressing each spring holder with spanner. They will come off toward the combustion chamber.

Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratches or wear on intake/exhaust valve seating surface.</td>
<td>Renew if stepped wear or deep scratches. Fit if poor fitting or shallow scratches. (Refer to next column.) Note: Seat width should be less than 2 mm.</td>
<td>YSE8 YSE12</td>
</tr>
<tr>
<td></td>
<td>Intake valve</td>
<td>104211 -11100 104511 -11100</td>
</tr>
<tr>
<td></td>
<td>Exhaust valve</td>
<td>104211 -11100 104511 -11100</td>
</tr>
</tbody>
</table>

Scratches or wear on cylinder head valve seat.

Lap if scratched or worn to a broader width than specified.

Lapping method
(If heavily worn or scratched, correct with a seat cutter.)

1. Lap till scratches are gone with coarse compound, then with fine compound. For finishing, use oil.

2. Wash off the lapping compound.
3. Apply red lead to the seat and check fitting after the lapping operation.
4. After that, be sure to apply oil to seat.
<table>
<thead>
<tr>
<th>Wear on valve guides and valves.</th>
<th>Renew cylinder head or valve if worn.</th>
<th>YSE8</th>
<th>YSE12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>104211</td>
<td>104511</td>
</tr>
<tr>
<td>setup</td>
<td></td>
<td>-11100</td>
<td>-11100</td>
</tr>
<tr>
<td>Exhaust valve</td>
<td></td>
<td>104211</td>
<td>104511</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-11110</td>
<td>-11110</td>
</tr>
<tr>
<td>Cylinder head</td>
<td></td>
<td>104211</td>
<td>104507</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-11010</td>
<td>-11010</td>
</tr>
</tbody>
</table>

Reassembly

1. Insert the intake and exhaust valves into the cylinder head, and secure each valve spring stop with a spanner placed upon the valve spring holder.

2. Check and renew (if necessary) the gasket.

3. Clamp the cylinder head evenly in the diagonal direction.

Cylinder head lock nut tightening torque.

<table>
<thead>
<tr>
<th>Tightening torque</th>
<th>YSE8</th>
<th>YSE12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.8</td>
<td>12.4</td>
</tr>
</tbody>
</table>

8.4 Piston and Connecting Rod Assembly

The piston of high silicon featuring a low expansion coefficient and outstanding resistance to heavy load is oval shaped externally. The stamp forged connecting rod has piston pin metal at its smaller end and crankpin metal at its larger end. The piston rings are composed of three pressure rings and one oil ring.

Piston and Connecting Rod Assembly
As Disassembled

Connecting rod lock nut tightening torque.

<table>
<thead>
<tr>
<th>Tightening torque</th>
<th>YSE8</th>
<th>YSE12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>3.5</td>
</tr>
</tbody>
</table>
Disassembly

1) Ring removal
   1-1 Make two 4 cm-dia. rings of tag wire.
   1-2 Slightly pull each ring and open with the wires placed at its ends and remove.
       Excessive opening will cause ring breakage.
   1-3 After removal of all the rings, clean the ring grooves.

2) Disassembly of piston and connecting rod
   The piston and the connecting rod are connected to each other through the piston pin.
   The piston pin hole has a little tightening allowance when cold. It is therefore necessary to heat the piston when it is to be taken out or inserted.
   2-1 Remove two piston pin stop rings.
   2-2 Heat the piston pin for 15 min. in oil at oil temperature of 80°C.

   2-3 Take out the piston pin using the exclusive tool.

Checking & Servicing

Note: It is recommended that parts be renewed at max. allowable values.

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear on ring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure their breadths and thicknesses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>using a micrometer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breadth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renew if wear exceeds max. allowable value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wear on ring</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YSE8</td>
<td>YSE12</td>
</tr>
<tr>
<td></td>
<td>nom.</td>
<td>max.</td>
</tr>
<tr>
<td>No. 1 ring</td>
<td>B</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>3.3</td>
</tr>
<tr>
<td>Chrome-plated</td>
<td>B</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>3.3</td>
</tr>
<tr>
<td>No. 2 &amp; No. 3 rings</td>
<td>B</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>3.3</td>
</tr>
<tr>
<td>Oil ring</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>Check point</td>
<td>Remedy</td>
<td>Part code</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Clearance between ring and ring groove.</td>
<td>YSE8 YSE12</td>
<td>YSE8 YSE12</td>
</tr>
<tr>
<td>Measure using a clearance gauge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.037 0.30</td>
<td>0.037 0.30</td>
</tr>
<tr>
<td>Renew if clearance exceeds max. allowable value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note: Nom. and max. in the above table represent nominal values in mm and maximum allowable values in mm, respectively.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ring end gap.</th>
<th>Standard gap</th>
<th>(See above.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insert each ring in liner skirt and measure its end gap using a clearance gauge.</td>
<td>YSE 0.2 to 0.4 mm</td>
<td>(Ditto)</td>
</tr>
<tr>
<td>YSE12 0.3 to 0.5 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renew if the gap exceeds 1.5 mm.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wear on piston.</th>
<th>YSE8 YSE12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure dia. of skirt using a micrometer.</td>
<td>std. max. allowable wear,</td>
<td>std. max. allowable wear,</td>
</tr>
<tr>
<td>YSE8 YSE12</td>
<td>mm mm</td>
<td>mm mm</td>
</tr>
<tr>
<td>75 φ</td>
<td>-0.23</td>
<td>85 φ</td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wear on piston pin.</th>
<th>YSE8 YSE12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure O.D. of piston pin using a micrometer.</td>
<td>std. max. allowable wear,</td>
<td>std. max. allowable wear,</td>
</tr>
<tr>
<td>YSE8 YSE12</td>
<td>mm mm</td>
<td>mm mm</td>
</tr>
<tr>
<td>23 φ</td>
<td>-0.10</td>
<td>28 φ</td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check point</td>
<td>Remedy</td>
<td>Part code</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>--------</td>
<td>-----------</td>
</tr>
<tr>
<td>Wear on piston pin metal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure using a cylinder gauge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>YSE8</td>
<td>YSE12</td>
</tr>
<tr>
<td>std. diam, mm</td>
<td>max. allowable wear, mm</td>
<td>max. allowable wear, mm</td>
</tr>
<tr>
<td>42 φ</td>
<td>+0.10</td>
<td>28 φ</td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear on crankpin metal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure using a cylinder gauge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>YSE8</td>
<td>YSE12</td>
</tr>
<tr>
<td>std. diam, mm</td>
<td>max. allowable wear, mm</td>
<td>max. allowable wear, mm</td>
</tr>
<tr>
<td>42 φ</td>
<td>+0.11</td>
<td>46 φ</td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cross-sectional views of piston rings:

- No. 1 ring (chrome-plated): Barrel-faced type that fits exactly in liner allowing minimum gas escape.
- No. 2 ring: Tapered type that also serves to scrape oil down.
- No. 3 ring: Beveled type that prevents oil from coming up as well as scrape it down.

Reassembly

1) Reassembly of piston rings

1.1 Clean piston ring grooves before ring placement, preferably with an old ring (broken).
1.2 Place rings upon piston, ring marks head side.

1.3 Check rings move lightly in the grooves.
1.4 Be sure that ends of one ring are 90° apart from those of neighboring ring or other rings.

2) Reassembly of piston, connecting rod
2.1 Place a piston pin snap ring upon the piston only one side.
2.2 Check that the piston pin enters lightly into the piston pin metal of the connecting rod.
2.3 Heat the piston pin for 15 min. in oil at oil temperature of about 80° C. Use either light oil or heavy oil.
2.4 Insert the connecting rod into the piston, then insert the piston pin, from the side without piston pin snap ring.
   DO NOT INSERT IT BY FORCE.
2.5 Place the other piston pin stop ring.
2.6 Check that both the piston and the connecting rod move lightly. If they do not move lightly, seizure will result.

8.5 Cylinder Liner

The cylinder liner is a wet type, made of special cast iron and coated with rust-preventing paint.

Cylinder Liner As Disassembled

Note: It is recommended that parts be renewed at max. allowable values listed in the following table.
<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratches or wear on cylinder liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Measure using a cylinder gauge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image1" alt="Image" /></td>
<td>YSE8: Nominal inside diam. mm, Max. allowable scratch or wear, mm</td>
<td>YSE8: 104211</td>
</tr>
<tr>
<td></td>
<td>75 φ, +0.30</td>
<td>YSE12: 104511</td>
</tr>
<tr>
<td></td>
<td>YSE12: Nominal inside diam. mm, Max. allowable scratch or wear, mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>85 φ, +0.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Renew if such wear or scratch exceeds the maximum allowable value.</td>
<td></td>
</tr>
<tr>
<td>(2) Another simpler method.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insert a new ring into No.1 ring position of liner, then measure the ring end gap using a clearance guage.</td>
<td>Renew if the gap exceeds 1.0 mm, on both YSE8 and YSE12 models.</td>
<td></td>
</tr>
<tr>
<td>Note: The ring inserted should be perpendicular to liner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image2" alt="Image" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Visual determination</td>
<td>Renew if observed stepless.</td>
<td></td>
</tr>
<tr>
<td><img src="image3" alt="Image" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Renewal**

1) Attach lock nuts to two cylinder head setbolts positioned symmetrically to each other, and pull out the liner with the liner puller. 
   Drive the nuts till four to five threads come into sight.

2) Remove the liner rubber packing.

![Image](image4)
3) Remove thoroughly paint and dust from liner setting surfaces, the rubber packing groove, etc.

Reassembly

1) Place the liner rubber packing correctly.
2) Apply white paint to liner setting surfaces (front and rear) as evenly as possible.
3) Insert the cylinder liner and tap with the cylinder head.
4) Attach head lock nuts to two head set-bolts positioned symmetrically to each other, then tighten.
5) Check that the liner top is about 0.2 mm projecting from the cylinder body.
6) Measure the inside diameter of the liner to check that it is of the same dimension in both $a$ and $b$ directions.

3.6 Crankshaft and Main Bearing Metal

The crankshaft is induction hardened and super-high precision finished. The main bearing metal uses thin back metal on the gear case side and gilled helmet back metal on the flywheel side.
<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wear on crankshaft. Measure with a micrometer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankpin</td>
<td>YSE8 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>YSE12 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
</tr>
<tr>
<td></td>
<td>46</td>
<td>-0.14</td>
</tr>
<tr>
<td>Journal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YSE8 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>YSE12 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>-0.16</td>
<td></td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear on main bearing metal. Measure with a cylinder gauge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main bearing metal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YSE8 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>+0.11</td>
<td></td>
</tr>
<tr>
<td>YSE12 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>+0.13</td>
<td></td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear on thrust metal. Measure with a micrometer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrust metal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YSE8 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>-0.3</td>
<td></td>
</tr>
<tr>
<td>YSE12 nom. dim., mm</td>
<td>max. allowable wear, mm</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>-0.3</td>
<td></td>
</tr>
<tr>
<td>Renew if wear exceeds the maximum allowable value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Renewal of Main Bearing Metal

1) Drawing-out of gear case side main bearing metal

   1.1 Draw out the crankshaft and the governor.
1. Mount the bearing metal puller.

1.3 Insert the bearing metal puller into the bearing metal, draw out bearing metal by tightening the puller nut.

2) Insertion of gear case side main bearing metal

2.1 Clean the bearing metal fitting surface of the cylinder body.

2.2 Reassemble the bearing metal puller for metal insertion.

2.3 Place a new bearing metal upon the bearing metal insertion tool, with the chamfered side of the bearing metal contour facing the cylinder body.

2.4 Insert both the bearing metal insertion tool and the bearing metal into the bearing metal hole from the crankcase side.

2.5 With the oil holes of the cylinder body and of the bearing metal agreeing exactly, tighten the nut till the bearing metal is fully inserted.

2.6 Remove the bearing metal insertion tool, then check that the oil holes agree exactly.

3) Drawing-out of flywheel side main bearing metal

3.1 Remove the oil seal.

3.2 Draw out the bearing metal in the same way as for drawing-out of gear case side main bearing metal, using the bearing metal puller.
4) Insertion of flywheel side main bearing metal

4.1 Clean the bearing metal fitting surface of the cylinder body.

4.2 Mark off a line on which knock pin is to be located.

4.3 Let the marked-off line on the bearing metal meet exactly with the flywheel housing lock groove, and insert the wooden insertion tool into the bearing metal fully with the use of a hammer.

4.4 Remove the insertion tool, and check that the knock pin and the lock groove as well as oil holes agree completely.

4.5 Attach the oil seal.

8.7 Electrical Equipment

The electric starter for the YSE series diesel engines, directly coupled to the flywheel housing, starts the engine, in engagement with the ring gear of the flywheel. The generator is driven by the V belt on the power take-off pulley.

WIRE DIAGRAM FOR YSE SERIES
1. The instrument panel can be optionally located within reach of the wire harness.
2. Fully tighten the terminals and apply grease.
3. Recheck after wiring.
   (Note) Do not operate the engine with the starter cable removed from the battery, for overheated generator might cause trouble.

8.7.1 Starter

![Starter Diagram]

<table>
<thead>
<tr>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Voltage</td>
</tr>
<tr>
<td>Output</td>
</tr>
<tr>
<td>Gear ratio</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Disassembly
1) Remove the starter from the engine.
2) Take off the band cover and clean the four carbon brushes.

Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush wear. Measure with vernier</td>
<td>Nominal length, mm</td>
<td>min. allowable length, mm</td>
</tr>
<tr>
<td>calipers.</td>
<td>Total length</td>
<td>16</td>
</tr>
</tbody>
</table>

Renew if the total length is below 9.5 mm.

Weakened or broken brush spring. Renew if weakened or broken.

Reassembly
1) Set the carbon brush and place the band cover.
   (Note) Check the (+) and (-) sides of the carbon brush.
   Also, secure the brush spring.
2) After reassembly, conduct a verification test, and then check that its performance is as specified.

* Whatever question you may have about the starter reassembly, please let us know.

8.7.2 Alternator

### Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Alternator (Tirrill type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal output</td>
<td>12V-25A/5,000 rpm</td>
</tr>
<tr>
<td>Earth polarity</td>
<td>(-) side grounded</td>
</tr>
</tbody>
</table>

### Checking & Servicing

<table>
<thead>
<tr>
<th>Check point</th>
<th>Remedy</th>
<th>Part code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage and current</td>
<td>1. Limit voltage: 14 ± 0.5V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Charging current: 25A or more at 14V/5,000 rpm (Alternator)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measure the charging current when the terminal voltage of the battery is 14V with the resistance load connected in parallel with the battery.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Renew the assembly if the above specifications are not satisfied.</td>
<td></td>
</tr>
</tbody>
</table>
9. ADJUSTMENTS

9.1 Governor Lever

9.1.1 Adjustment procedure

(1) Place the regulator remote control lever in "OPERATE" position.

(2) Turn the punch mark on the connecting screw toward the cylinder perpendicularly to the pump adjusting lever.

(Note) Drive in the connecting screw till its bottom comes to the top level of the pump adjusting lever.

(3) Lightly screw in the regulator spindle clockwise.

(4) Tighten the cross-recessed head screw for the pump adjusting lever, and tighten the lock nut on the other side.

(5) Turn the connecting screw (punch mark) counter-clockwise by 90°, then tighten the lock nut.

Note: If the pump adjusting lever moves outside when the connecting screw is turned by 90°, go back to step (3). After that, if the governor 2nd lever moves inside, the adjustment is perfect.

(6) a. Check that when the pump adjusting lever is pushed to the cylinder side, the regulator spindle moves, too.
   (Temporary high-speed rotation will result if the engine is started while the spindle does not move.)
b. After reassembly is completed, check, by turning the handle, that the fuel injection noise is normal.

9.1.2 Readjustment procedure

Although the above steps (1) to (6) will do, of course, the steps stated below may be followed for simplicity's sake.

(1) Loosen the connecting screw lock nut.
(2) Turn the connecting screw (punch mark) by 90° from left toward you.
(3) Tighten the connecting screw lock nut.

9.2 Intake/Exhaust Valve

9.2.1 Adjustment procedure

(1) Bring the TD mark on the flywheel to the marked-off line on the flywheel housing.

Note: Set to the top dead center of compression stroke (TD mark).

(2) Loosen the valve clearance adjusting screw lock nut.

(3) Adjust the clearance to 0.2 mm by means of the valve clearance adjusting screw.

Note: Adjust both suction valve and exhaust valve clearances to 0.2 mm when the engine is cool.

(4) Fix the adjusting screw using a (-) driver, then tighten the lock nut.

9.3 Fuel Injection Timing

On models YSE8 and YSE12, fuel injection is started at 10° plus or minus 2° before T. D. C.

9.3.1 Checking hints

(1) Remove the cover of the starter mounting hole.
   (Remove the starter for electric starting.)
(2) Set the TD mark of compression stroke on the flywheel to the mark on the flywheel housing.
(3) Place the accelerator lever in the "OPERATE" position.
(4) Read out the start position of fuel injection noise by swinging the power take-off pulley to left and right.
(5) Judge correctly by repeating the step (4) three or four times.

9.3.2 Adjustment procedure

(1) Detach the fuel injection pump and the pump mount.
(2) Increase or decrease the number of the fuel injection timing adjustment plates.
   If the timing is advanced, increase the number of the adjustment plates; delayed, decrease the number.
   0.1 mm of plate thickness is equivalent to approximately 2° of time difference.
(3) Mount the fuel pump mount and the fuel pump.

Note: Check the fuel injection timing.
10. DISASSEMBLY

10.1 Preparation

1) Choose a clean workshop put in order.
2) Prepare a worktable on which to place the disassembled parts.
3) Prepare wash oil and an cleaning-oil drum.
4) Prepare right tools.

10.2 Serviceman’s Kit

10.2.1 General tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Remarks</th>
<th>Tool</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Spanner</td>
<td>10 x 3</td>
<td>9 Pinchers</td>
<td></td>
</tr>
<tr>
<td>2 Spanner</td>
<td>17 x 9</td>
<td>10 Pliers</td>
<td></td>
</tr>
<tr>
<td>3 Spanner</td>
<td>22 x 24</td>
<td>11 Offset wrench</td>
<td>1 set</td>
</tr>
<tr>
<td>4 (+) driver</td>
<td></td>
<td>12 Box spanner</td>
<td>1 set</td>
</tr>
<tr>
<td>5 (-) driver</td>
<td></td>
<td>13 Scraper</td>
<td></td>
</tr>
<tr>
<td>6 Iron hammer</td>
<td></td>
<td>14 Lead bar</td>
<td></td>
</tr>
<tr>
<td>7 Copper hammer</td>
<td></td>
<td>15 File</td>
<td>1 set</td>
</tr>
<tr>
<td>8 Wooden hammer</td>
<td></td>
<td>16 Wrench for hexagonal socket head screw</td>
<td></td>
</tr>
</tbody>
</table>
10.2.2 Special tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>YSE8</th>
<th>YSE12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gear puller</td>
<td>Commercial</td>
<td></td>
</tr>
<tr>
<td>2 Bearing puller</td>
<td>Commercial</td>
<td></td>
</tr>
<tr>
<td>3 Liner puller</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>4 Flywheel puller</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>5 Main bearing puller</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>6 Piston pin puller</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>7 Piston pin metal puller</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>8 Piston insertion tool</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>9 Main bearing insertion tool</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>10 Valve seat cutter</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>11 Valve lapping tool</td>
<td>Also for TS60</td>
<td>Also for TS105</td>
</tr>
<tr>
<td>12 36 mm-dia. spanner for clutch</td>
<td>Special order</td>
<td>(Common to YSE8 and YSE 12)</td>
</tr>
<tr>
<td>ahead shaft lock nut</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.2.3 Measuring instruments

<table>
<thead>
<tr>
<th>Measuring instrument</th>
<th>Accuracy, measuring range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Vernier calipers</td>
<td>1/20 mm, 0-150 mm</td>
</tr>
<tr>
<td>2 Micrometer</td>
<td>1/100 mm, 0-25, 25-50, 50-75, 75-100 mm</td>
</tr>
<tr>
<td>3 Cylinder gauge</td>
<td>1/100 mm, 18-35, 35-60, 50-100 mm</td>
</tr>
<tr>
<td>4 Clearance gauge</td>
<td>0.05-2 mm</td>
</tr>
<tr>
<td>5 Torque wrench</td>
<td>0-13 kg-m</td>
</tr>
<tr>
<td>6 Nozzle tester</td>
<td>0-500 kg/cm²</td>
</tr>
</tbody>
</table>
10.2.4 Others

| Emery paper, emery cloth | White paint | Brush | Waste cloth |

10.3 Precautions

(1) Prior to disassembly, refer to the instruction manual and the parts list.

(2) Use the right tools, and take care not to scratch the parts or wound yourself.

(3) When driving out a shaft or other parts, use a protective bar or a copper hammer.

(4) Place in order the disassembled parts.

(5) Check 0 marks on coupling, cam gear and crank gear.

(6) Make proper provision for locking parts which give incidental rotation when other parts are moved.

(7) Take care not to scratch oil seals and other parts.

(8) For total disassembly, discharge beforehand lube oil, cooling water, and fuel from the crankcase, and from the gear case.

10.4 Clutch Disassembly Procedure

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
<th>Tools</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remove one cotter pin, one slotted nut and one woodruff key for shifter.</td>
<td>Pinchers, Spanner 17</td>
<td><img src="image1.png" alt="Illustration" /></td>
</tr>
<tr>
<td>2</td>
<td>Remove the two setbolts for clutch housings A and B, and then two spring washers by hand.</td>
<td>Spanner 17</td>
<td><img src="image2.png" alt="Illustration" /></td>
</tr>
<tr>
<td>3</td>
<td>Detach one slide shaft.</td>
<td></td>
<td><img src="image3.png" alt="Illustration" /></td>
</tr>
<tr>
<td>4</td>
<td>Pry separate the housing B from the housing A. Note: Positioning claws and springs leap out. Remove three claws and three springs.</td>
<td>(-) Drive</td>
<td><img src="image4.png" alt="Illustration" /></td>
</tr>
<tr>
<td>Step</td>
<td>Procedure</td>
<td>Tools</td>
<td>Illustration</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>5</td>
<td>Drive out two connecting spectacle link pins, from the holding friction the holding friction disc side.</td>
<td>Hammer protective bar</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Detach the clutch housing A assembly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Detach one piece of wire and five bolts from the ahead side.</td>
<td>Pinchers, Spanner 13</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Remove one ahead friction disc and one friction disc keep plate.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Remove one holding friction disc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Remove one ahead shaft lock nut. Note: Completely flatten the lock washer. Remove one lock washer.</td>
<td>(-) Drive, Hammer, Spanner 36</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Pull out one bearing from the clutch case rear box side.</td>
<td>Bearing puller</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Pull out one small ahead gear, one key.</td>
<td>Gear puller</td>
<td></td>
</tr>
<tr>
<td>Step</td>
<td>Procedure</td>
<td>Tools</td>
<td>Illustration</td>
</tr>
<tr>
<td>------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>13</td>
<td>Remove one ahead shaft (with bearing).</td>
<td></td>
<td><img src="image1.png" alt="Illustration" /></td>
</tr>
<tr>
<td>14</td>
<td>Remove one piece of wire and five bolts to detach one friction disc assembly and one bearing from the astern gear.</td>
<td></td>
<td><img src="image2.png" alt="Illustration" /></td>
</tr>
<tr>
<td>15</td>
<td>Pull out one ahead shaft bearing (housing A side).</td>
<td>Bearing puller</td>
<td><img src="image3.png" alt="Illustration" /></td>
</tr>
</tbody>
</table>
Disassembled Clutch
<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NAME</th>
<th>ITEM</th>
<th>PART NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Housing A</td>
<td>17</td>
<td>Ball bearing 6005</td>
</tr>
<tr>
<td>2</td>
<td>Housing B</td>
<td>18</td>
<td>Shifting shaft bush</td>
</tr>
<tr>
<td>3</td>
<td>Set piece for V lever</td>
<td>19</td>
<td>Feather key 7 × 20</td>
</tr>
<tr>
<td>4</td>
<td>Set bolt for V lever set piece</td>
<td>20</td>
<td>Ball bearing 6205 ZZ</td>
</tr>
<tr>
<td>5</td>
<td>Washer</td>
<td>21</td>
<td>Bolt M10 × 45</td>
</tr>
<tr>
<td>6</td>
<td>Friction disc</td>
<td>22</td>
<td>Set bolt and wire for keep plate</td>
</tr>
<tr>
<td>7</td>
<td>Friction disc claw</td>
<td>23</td>
<td>Bolt M10 × 30</td>
</tr>
<tr>
<td>8</td>
<td>Friction disc claw spring</td>
<td>24</td>
<td>Shifting shaft</td>
</tr>
<tr>
<td>9</td>
<td>Friction disc keep plate</td>
<td>25</td>
<td>Spring</td>
</tr>
<tr>
<td>10</td>
<td>Keep plate washer</td>
<td>26</td>
<td>Spring holder</td>
</tr>
<tr>
<td>11</td>
<td>Ahead shaft</td>
<td>27</td>
<td>Key 4 × 13</td>
</tr>
<tr>
<td>12</td>
<td>Reversing gear</td>
<td>28</td>
<td>V lever</td>
</tr>
<tr>
<td>13</td>
<td>Small ahead gear</td>
<td>29</td>
<td>Link</td>
</tr>
<tr>
<td>14</td>
<td>Ahead shaft lock nut</td>
<td>30</td>
<td>Link pin</td>
</tr>
<tr>
<td>15</td>
<td>Washer</td>
<td>31</td>
<td>V lever holder</td>
</tr>
<tr>
<td>16</td>
<td>Ball bearing 6205</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. REASSEMBLY

11.1 Precautions

1) Clean parts thoroughly in oil.
2) Use the right tools and assemble the engine faultlessly.
3) Apply lube oil to rotary and sliding parts.
4) Use new packings, cotter pins and lock washers.
5) Make sub-assemblies beforehand.
6) Correct or renew scratched or worn parts beforehand.
7) Take care to evenly tighten bolts and nuts located symmetrically to each other.
8) Let the setting marks on the crank gear and the coupling agree exactly.
9) Securely attach the cotter pins, lock washers, wire, etc.
10) Proceed with the assembly checking that the rotary and sliding parts move smoothly.
The following standard stern arrangements are prepared for use with the Yanmer diesel engines YSE8(G) and YSE12(G). Select the optimum model for your intended use and Hull.

1. Propeller Shaft

Direct-coupled propeller shafts.
Select the optimum model for the engine output and the ship size. When coupling it to the propeller shaft of the engine, be sure to center it in correct alignment with the latter.

### Standard Stern Arrangement

<table>
<thead>
<tr>
<th>Model</th>
<th>Propeller shaft, rpm</th>
<th>Propeller</th>
<th>Propeller shaft</th>
<th>Stern tube</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>diam. in.</td>
<td>pitch. in.</td>
<td>diam. mm</td>
</tr>
<tr>
<td>YSE8</td>
<td>1127</td>
<td>14</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>1332</td>
<td>13</td>
<td>8 1/2</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>1639</td>
<td>12</td>
<td>7 1/2</td>
<td>25</td>
</tr>
<tr>
<td>YSE8G</td>
<td>751</td>
<td>18</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>888</td>
<td>16 1/2</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1093</td>
<td>15</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>YSE12</td>
<td>1113</td>
<td>15</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>1316</td>
<td>14</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1518</td>
<td>13</td>
<td>8 1/2</td>
<td></td>
</tr>
<tr>
<td>YSE12G</td>
<td>718</td>
<td>19</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>849</td>
<td>18</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>980</td>
<td>17</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Note: Standard propeller is of integrated 3-blades type. It is made of manganese bronze, having an area ratio of 0.36.