2.6 LITER MOBIS DIESEL ENGINE SERVICE MANUAL
This manual has been published by GENERAC® POWER SYSTEMS, INC. to aid our dealers’ mechanics, company service personnel and general consumers when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures for these products, or like or similar products, manufactured and marketed by GENERAC® POWER SYSTEMS, INC. It is also assumed that they have been trained in the recommended servicing procedures for these products, which includes the use of mechanics hand tools and any special tools that might be required.

Proper service and repair is important to the safe, economical and reliable operation of the products described herein. The troubleshooting, testing, service and repair procedures recommended by GENERAC® POWER SYSTEMS, INC. and described in this manual are effective methods of performing such operations. Some of these operations or procedures may require the use of specialized equipment. Such equipment should be used when and as recommended.

We could not possibly know of and advise the service trade of all conceivable procedures or methods by which a service might be performed, nor of any possible hazards and/or results of each procedure or method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a procedure or method not recommended by the manufacturer must first satisfy himself that neither his safety, nor the product's safety, will be endangered by the service or operating procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. However, GENERAC® POWER SYSTEMS, INC. reserves the right to change, alter or otherwise improve the product at any time without prior notice.

Some components or assemblies of the product described in this manual may not be considered repairable. Disassembly, repair and reassembly of such components may not be included in this manual.

The engines described herein may be used to power a wide variety of products. Service and repair instructions relating to any such products are not covered in this manual. For information pertaining to use of these engines with other products, refer to any owner's or service manuals pertaining to said products.
ENGINE OIL RECOMMENDATIONS

The unit has been filled with “break in” engine oil at the factory. Use a high-quality detergent oil classified “For Service CC, SD, SE or SF.” Detergent oils keep the engine cleaner and reduce carbon deposits. Use oil having the following SAE viscosity rating, based on the ambient temperature range anticipated before the next oil change:

**Engine Lubrication System:**
- Type of Oil Pump: Gear
- Oil Filter: Full Flow, Cartridge
- Crankcase Oil Capacity: 5.4 L (5.7 U.S. qts.)

**Coolant**

Use a mixture of half low silicate, ethylene glycol base antifreeze and half soft water. Use only soft water and only low silicate antifreeze. If desired, you may add a high quality rust inhibitor to the recommended coolant mixture. When adding coolant, always add the recommended 50-50 mixture.

**Cooling System:**
- Type: Pressurized, Closed Recovery
- Coolant Capacity:
  - System: 2.6 L (2.8 U.S. qts.)
  - Engine: .95 L (1.0 U.S. qts.)

DANGER

Do not remove the radiator pressure cap while the engine is hot or serious burns from boiling liquid or steam could result.

Ethylene glycol base antifreeze is poisonous. Do not use your mouth to siphon coolant from the radiator, recovery bottle or any container. Wash your hands thoroughly after handling. Never store used antifreeze in an open container because animals are attracted to the smell and taste of antifreeze even though it is poisonous to them.

Do not use any chromate base rust inhibitor with ethylene glycol base antifreeze, or chromium hydroxide (“green slime”) will form and cause overheating. Engines that have been operated with a chromate base rust inhibitor must be chemically cleaned before adding ethylene glycol base antifreeze. Using any high silicate antifreeze boosters or additives also will cause overheating. We also recommend that you DO NOT use any soluble oil inhibitor for this equipment.

The 2.6 Liter Diesel Engine has been engineered for use in Generac Power Systems products. The contents of this manual have been reprinted from the original manufacturer’s service and repair manual.
2.6 Liter Diesel Engine Service Recommendations

8 KW - 35 KW SMALL STANDBY GENERATOR SETS
Following is a recommended maintenance schedule for Generac small standby and residential generator sets from 8 kW to 35 kW in size, and applies to both diesel engine and gas engine driven units. The established intervals in the schedule are the maximum recommended when the unit is used in an average service application. They will need to be decreased (performed more frequently) if the unit is used in a severe application. Use the unit hour meter or calendar time, whichever occurs first, from the previous maintenance interval to determine the next required maintenance interval.

Service Maintenance Interval Information:
The various service maintenance intervals are designated by interval numbers as follows:

1. An early inspection of the generator set to insure it is ready to operate when required and to identify any potential problem areas.
   
   Performed monthly or following each 10 hours of operation of the unit and requires approximately .5 man-hours per unit to complete.

   This inspection may be performed by the end user providing the following safety steps are taken to prevent the engine from starting automatically without warning:

   To prevent injury, perform the following steps in the order indicated before starting any maintenance:

   • Disable the generator set from starting and/or connecting to the load by setting the control panel Auto-Off-Manual switch to the “OFF” position.
   • Remove the control panel fuse.
   • Turn off the battery charger.
   • Remove the negative battery cable.

   The battery charger must be turned off BEFORE removing the battery cable to prevent an over current condition from burning out sensitive control panel components and circuits.

   Following all maintenance, reverse these steps to insure the unit is returned to standby setup for normal operation when required.

2. A break-in service inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.
   
   Performed ONLY ONCE following the first three months or the first 30 hours of operation after purchase of the unit and requires approximately 2.5 man-hours per unit to complete.

   This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by an authorized Generac Service Dealer.

3. An operational inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.
   
   Performed semi-annually or following each 50 hours of operation of the unit and requires approximately 1.5 man-hours per unit to complete.

   This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by an authorized Generac Service Dealer.

4. A mid-level inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.
   
   Performed annually or following each 100 hours of operation of the unit and requires approximately 4.0 man-hours per unit to complete.

   This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by an authorized Generac Service Dealer.
WARNING!  

To prevent injury, perform the following steps in the order indicated before starting any maintenance:

- Disable the generator set from starting and/or connecting to the load by setting the control panel Auto-Off-Manual switch to the “OFF” position.
- Remove the control panel fuse.
- Turn off the battery charger.
- Remove the negative battery cable.

NOTE:

The battery charger must be turned off BEFORE removing the battery cable to prevent an over current condition from burning out sensitive control panel components and circuits.

Following all maintenance, reverse these steps to insure the unit is returned to standby setup for normal operation when required.
## 2.6 Liter Diesel Engine Service Recommendations

<table>
<thead>
<tr>
<th>Maintenance Tasks</th>
<th>Level 1 Required to be done</th>
<th>Level 2 Required to be done</th>
<th>Level 3 Required to be done</th>
<th>Level 4 Required to be done</th>
<th>Task Comp. (Date-Initials)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task Comp. (Date-Initials)</td>
<td>Task Comp. (Date-Initials)</td>
<td>Task Comp. (Date-Initials)</td>
<td>Task Comp. (Date-Initials)</td>
<td></td>
</tr>
<tr>
<td>1. Disable the unit from operating per the first page warning.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Check the engine oil level. Adjust as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Check the engine coolant level. Adjust as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Check the engine coolant thermal protection level. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Check the natural gas delivery system on gas engine driven units. Tighten connections as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Check the diesel fuel supply level for diesel engine driven units. Fill as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Drain water and sediment from the diesel fuel tank on diesel engine driven units.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Drain water from the fuel line water separator on diesel engine driven units if the unit is equipped with one.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Check the air inlets and outlets for debris. Clean as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Check the battery electrolyte level if accessible. Adjust as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Check the battery posts, cables, and charger for loose connections, corrosion, and proper operation. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Check the unit wiring for loose connections, corrosion, and damage. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Check the engine accessory drive belts for wear, weather cracking, and damage. Replace as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 2.6 Liter Diesel Engine Service Recommendations

<table>
<thead>
<tr>
<th>Maintenance Tasks</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task Comp. Required to be done monthly/ 10 hrs.</td>
<td>Task Comp. Required to be done 3 months/ Break-in 30 hrs.</td>
<td>Task Comp. Required to be done Semi-annually/ 50 hrs.</td>
<td>Task Comp. Required to be done Annually/ 100 hrs.</td>
</tr>
<tr>
<td>14. Visually inspect the unit looking for leaks, wear or damage, loose connections or components, and corrosion. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Test the engine and transfer switch safety devices. Correct and/or adjust as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Initiate an automatic start and transfer of the unit to site load and exercise it for at least 1 hour looking for leaks, loose connections or components, and abnormal operating conditions. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Start and exercise the unit at full rated load (use a load bank if the site load is not enough) for at least 2 hours looking for leaks, loose connections or components, and abnormal operating conditions. Correct as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Change the engine oil.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Replace the engine oil filter(s).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Replace the engine air filter(s).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Replace the engine fuel filter(s) on diesel engine driven units and re-prime the fuel system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Check the engine spark plugs on gas engine driven units. Clean and re-gap or replace as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Perform a 5 minute no-load operational run of the unit looking for any post service problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Return the unit to standby setup for operation when required.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
D4B (FOR INDUSTRIAL USE)  
MAINTENANCE MANUAL

FOREWORD

This Maintenance manual contains the proper operating and handling procedures, and simple inspection and maintenance procedures for the Hyundai diesel engine Model D4B for industrial use.

To insure top performance, economical and safe operation and long life, those who use and control this engine should read through this manual and strictly observe the instructions when operating the engine.

Should there arise questions concerning the Hyundai industrial diesel engine or in the event of trouble, consult with your nearest service shop.

HYUNDAI MOTOR COMPANY  
Printed in Korea  
INDUSTRIAL ENGINE DEVELOPMENT TEAM
# CONTENTS

1. Before Use ................................................................. 5
2. Names of Engine Parts .................................................. 9
3. Handling of New Engine ................................................ 15
4. Pre-operational Checks ............................................... 17
5. Correct Operating Procedures and Handling ...................... 21
   5-1. Engine Starting(Manually) ........................................ 22
   5-2. Cautions During Operation ........................................ 23
   5-3. Engine Stopping .................................................. 26
   5-4. Checks to Make After Engine Stopping ....................... 26
6. Operation in Cold and Hot Weathers ............................... 27
7. Lubricant, Fuel Oil and Coolant ...................................... 31
8. Instructions for a Long Period of Storage ......................... 35
9. Inspection and Maintenance .......................................... 39
   9-1. Intake and Exhaust System ...................................... 40
   9-2. Lubricating System ............................................. 44
   9-3. Fuel System ..................................................... 46
   9-4. Cooling System ................................................ 48
   9-5. Electrical System .............................................. 50
10. Periodic Check and Service Chart ................................ 53
11. Troubleshooting ..................................................... 59
12. Main Specifications .................................................. 63
13. Service Data .......................................................... 65

## 1. BEFORE USE

- PERIODIC INSPECTION
- HYUNDAI GENUINE PARTS
- ENGINE NUMBER
- ENGINE NAMEPLATE
1. BEFORE USE

PERIODIC INSPECTION

It is quite essential for the engine to have periodical inspection and maintenance service so as to prolong its life and secure safety. The procedure of check is described in "PERIODIC CHECK AND SERVICE CHART."

HYUNDAI GENUINE PARTS

Please use Hyundai Genuine Parts, Oil/Grease and Optional Equipment. All Hyundai Genuine Parts are identified with the mark shown above.

ENGINE NUMBER

Please specify the engine model and engine number when ordering parts or in the event of trouble. The engine number is stamped at the position shown above.

EX:
D4BB X 000001

Engine Number
Product year
Engine model

ENGINE NAMEPLATE

The nameplate is mounted at the position shown in the illustration above. The nameplate shows the engine model, total displacement, output, valve clearance, fuel injection order and fuel injection timing.

INDICATION METHOD:
1. Engine model
2. Total displacement
3. Rated output

NOTE
- The terms "front and rear", "right and left", "clockwise and counterclockwise" are used in this manual as shown above.
2. NAMES OF ENGINE PARTS

- MODEL:
  1. D4B BUS AIRCON ENGINE
  2. D4B EXCAVATOR ENGINE
  3. D4B SKID LOADER ENGINE
  4. D4BB GENERATOR ENGINE

[Diagram of engine parts]
MODEL : 3. HANDLING OF NEW ENGINE

- INITIAL CHECK
- OPERATION OF NEW ENGINE
- REPLACING OIL

3. HANDLING OF NEW ENGINE

A good start is important for everything. The life and performance of a new engine depend largely on how it is handled at the early stage. Especially on new engine, observe the following points.

OPERATION OF NEW ENGINE

Your new engine is broken in during the first 60 hours. To smooth away high spots of moving parts and maintain high performance, pay special attention to the following points.
1. Allow the engine to warm up after starting.
2. Avoid racing the engine.
3. Limit load to 70% maximum.
4. Avoid changing extreme load.

INITIAL CHECK

When the service meter (hour counter of the tachometer) reads initial 200 hours or after 3 months, Whichever occurs earlier, have your engine checked at your nearest service shop.

REPLACING OIL

On a new engine, replace the following oils after the first 60 hours and 250 hours of operation. After the first 500 hours, Engine oil
4. PRE-OPERATIONAL CHECKS

- CHECKING ENGINE OIL LEVEL
- CHECKING FUEL LEVEL
- CHECKING COOLANT LEVEL
- WATER LEAKS
- TENSION OF V-BELT
- DEFECTIVE POINTS FOUND ON PREVIOUS DAY

To ensure safe and smooth operation at all times, check the following points before starting a day's operation.

CHECKING ENGINE OIL LEVEL

Remove the oil level gauge, wipe clean with a cloth, reinsert and remove again. If the oil level is between the upper and lower notched lines, the oil level is good.

If the oil level is low, add oil through the oil filler. At the same time, check the oil for contamination and viscosity, and replace as necessary. Check for oil leaks, too.

- NOTE

1. With the engine placed on a flat surface, inspect the oil level before starting the engine or about 30 minutes after it has stopped.

2. Allow 5 to 6 minutes between addition of engine oil and checking of oil level. If the oil level is checked immediately after addition of engine oil, excessive oil will be added because the oil level may be checked before all added oil falls down.
2.6 Liter Diesel Engine OEM Contents

- CHECKING FUEL LEVEL -
Check to ensure that the fuel tank is filled. Check for fuel leaks, too. To start an engine after a long period of shutdown or after fuel has run out, the fuel system should be bled beforehand. For bleeding procedure.

- WATER LEAKS -
Check for water leaks from the radiator, radiator hose and other parts of the cooling system. Check also for traces of water leaks under the engine.

- CHECKING COOLANT LEVEL -
Check the coolant level in the radiator or coolant tank.

- NOTE -
1. Use soft water
2. If the coolant in the cooling system is a mixture of water and anti-freeze or antitrust, addition of only water will lower the concentration of the coolant. Mix water with anti-freeze or anti-rust at the same mixing ratio as the current coolant in the system and add this mixture.

- PRE-OPERATIONAL CHECKS -

- V-BELT TENSION: 10~13 N
PRESS approx 10k

- TENSION OF V-BELT -
Press down the mid point of the belt with a finger to check the deflection. Check the V-belt for oil or grease, damage, etc. For tension adjustment procedure.

- DEFECTIVE POINTS FOUND ON PREVIOUS DAY -
Check the points found defective during the previous day's operation to confirm that there is nothing that may hinder operation.

5. CORRECT OPERATING PROCEDURES AND HANDLING

5-1. ENGINE STARTING (MANUALLY)
- CHECKS TO MAKE DURING WARM UP OPERATION
- REVERSE ROTATION OF ENGINE AND STEPS TO TAKE

5-2. CAUTIONS DURING OPERATION
- OIL PRESSURE GAUGE OR WARNING LAMP
- WATER TEMP GAUGE OR OVERHEAT ALARM LAMP

5-3. ENGINE STOPPING

5-4. CHECKS TO MAKE AFTER ENGINE STOPPING
2.6 Liter Diesel Engine OEM Contents

5. CORRECT OPERATING PROCEDURES AND HANDLING

Before starting the engine, be sure to perform pre-operational checks. Some machines may call for different procedures for their starting and stopping. Refer to the operator's manual delivered with the machine.

5-1. Engine Starting (Manually)

1. Confirm that the engine is at no load. On an engine with a clutch, disengage the clutch by operating the clutch lever as this will facilitate starting.
2. Set the battery switch to ON.

NOTE
During operation of the engine, do not place the switch to OFF. Operation of the engine with the switch in OFF position will result in failure of the electrical system. In addition, each gauge or switch becomes inoperative, causing a hazard.
3. Insert the key into the starter switch position.
4. Place the control lever to the FULL position.
5. Turn the key to the grow plug position. It will take approximately 20 to 30 seconds for the indicator to become red, indicating that the air heater is sufficiently heated up. At normal ambient temperature, the use of the air heater is not necessary.

NOTE
1. Avoid repeated use of the grow plug which consumes large power. Otherwise, a run-down battery will result.
2. If the grow plug indicator does not become red hot, it means that the fuse of the grow plug relay has blown.
6. Next, turn the key to "START" position and the starter will turn and the engine will start.

NOTE
1. When you cannot start the engine by a single attempt, operate the starter for 10 to 15 seconds and keep it stationary for 10 to 15 seconds before making another attempt. In cold weather, the engine may be harder to start. In such a case, avoid operating the starter continuously for more than 30 seconds.
2. After a long period of shutdown or after engine oil change or replacement of oil filter elements, operate the starter to crank the engine (at no load) for 15 seconds without fuel injection to make sure that the oil spreads throughout the engine before starting the engine.
3. When restarting the engine, confirm that the engine has completely shut down.
4. Do not turn the key to the "OFF" position during operation.
7. After the engine has started, return the control lever to the low idle position to allow the engine to warm up.

NOTE
Allow the engine to warm up for more than 5 minutes. The warm-up period is required for allowing the oil to spread throughout the engine and assuring proper lubrication.

CHECKS TO MAKE DURING WARM-UP OPERATION

1. Confirm that the oil pressure builds up. During warm-up operation, the pointer should indicate 150kPa (15kg/cm²) or more (at idle). Confirm that the warning lamp goes out.
2. Check to ensure that the charge function is good and that the charge lamp is OFF.
3. Check the engine for abnormal noise, vibration and odor.
4. Check for abnormal exhaust emission color.
5. Check for oil, water or fuel leaks from the engine.

NOTE
Avoid running the engine as this could cause engine malfunctions and troubles.

REVERSE ROTATION OF ENGINE AND STEPS TO TAKE

If reverse rotation of the engine occurs, no engine oil will be sent to the various parts of the engine, resulting in severe and other major troubles in a few minutes. Even a fire might start because exhaust gases come out from the suction side.

1. How to distinguish reverse rotation of engine:
   1. When reverse rotation occurs, the tachometer will remain stationary. Since the oil pressure does not rise, the oil pressure gauge will remain stationary or the warning lamp will not go out but will continue to light.
   2. When the engine is started, pay attention to the oil pressure gauge or warning lamp.
   3. Since exhaust gases come out from the suction side, large knocking sound will be produced in the early stage of reverse rotation, and the exhaust gases will be blown out from the air cleaner.
   4. When starting the engine, pay attention to the exhaust gases will be blown out from the air cleaner.
   5. When starting the engine, pay attention to the knocking sound and exhaust gases from the air cleaner.

Steps to take in the event of reverse rotation
(1) If the engine is turning in reverse direction, stop the engine immediately with the engine stop button.
(2) After the engine has shut down, check the air cleaner and intake rubber hose and replace if necessary.

5-2. CAUTIONS DURING OPERATION

After warm up operation, start loading the engine.

1. Pay attention to all parts of the engine to check for abnormal noise, vibration and odor.
2. Pay attention to exhaust emission color.
3. Pay attention to each meter and confirm it from time to time. The pilot lamps should be OFF during operation. If abnormal symptoms are evident, check immediately. If causes cannot be located or if correction is hard, call your nearest service shop.
Confirm that the oil pressure is normal and that the warning lamp is OFF. 
Standard indication: 42 to 71 psi at rated speed (1800 rpm).

- When oil pressure is abnormal
When the pointer indicates 29 psi or less (or red zone) at rated speed or when the warning lamp lights, the oil pressure is abnormal.

1. Stop the engine immediately. Sustained operation could cause seizure of the engine bearings.
2. Check for oil leaks. If leaks are evident, correct.
3. Check the engine oil level. Add if low.
4. Check the oil filter element for clogging.
5. Check the oil pressure gauge, lamp or piping. In this case, the oil pressure should be actually measured with an oil pressure gauge.
6. If, after taking the above steps, the abnormal oil pressure still persists, consult with your nearest service shop.
7. In the following cases the standard oil pressure may not be indicated, but there is nothing to worry about because the oil pressure will soon return to normal.
   a) When the engine is not hot yet as immediately after starting, a high pressure may be indicated. After starting, therefore, do not accelerate the engine but run the engine at idle until it fully warms up.
   b) After the engine has fully warmed up, the engine will have a low oil pressure at low idle. If the pressure is more than 98kPa (1kgf/cm²), there is nothing to worry about.

Check to ensure that the coolant temperature is good and that the alarm lamp is OFF.
Standard indication: 167°F to 203°F or green zone

- Overheating
When the pointer exceeds 100°C on a radiator-equipped engine (or when the pointer enters the red zone) or when the alarm lamp lights, it indicates that the engine is overheated.

1. Decelerate the engine to an idling speed immediately, and run the engine at idle until the coolant temperature falls. Sustained operation could cause seizure of the engine.
2. After the coolant temperature has fallen, stop the engine and check for water leaks, damaged or loose fan belt, and clogged radiator.
3. Check the coolant level. Add coolant as necessary.

- NOTE
1. Do not open the radiator cap while the coolant is hot. Hot water will gush out and you might get scalded. Raise the decompression lever of the radiator cap to relieve the pressure in the radiator.
2. Do not pour cold water in an overheated engine. Sudden cooling might cause cracks.
2.6 Liter Diesel Engine OEM Contents

- CORRECT OPERATING PROCEDURES AND HANDLING -

5-3. ENGINE STOPPING

If an overheated engine is suddenly stopped without cooling it, a quick rise in coolant temperature could cause seizure of engine moving parts such as pistons.

1. After the end of your work, run the engine at idle for about five minutes before stopping it.
2. Pull out the engine stop button to stop the engine and after complete stop of the engine, depress the stop button to the original position.
3. Place the control lever to the stop position.
4. Place the key to "OFF" position to remove the key.
5. Set the battery switch to "OFF" position.

- NOTE
Leaving the switch in "ON" position for a long time will result in consumption of the battery due to flow of useless current.

5-4. CHECKS TO MAKE AFTER ENGINE STOPPING

After operation, clean the engine and perform the following checks.
1. Check and correct points found defective during operation.
2. Check each part for looseness, damage, oil and water leaks.
3. In winter, remove all coolant unless it contains anti-freeze. If the coolant is not removed, it will be frozen and the crankcase could be cracked.

6. OPERATION IN COLD AND HOT WEATHERS

- OPERATION IN COLD WEATHER
- OPERATION IN HOT WEATHER
6. OPERATION IN COLD AND HOT WEATHERS

**OPERATION IN COLD WEATHER**

When the atmospheric temperature is lowered in cold weather, some special attentions should be paid for operation of the engine. Observe the following descriptions.

- **Engine oil**
  The engine oil becomes less fluid with decreasing temperature. As this makes it difficult to start the engine, use oil of viscosity adequate for atmospheric temperature. For selection of oil of adequate viscosity, see "Lubricant".

- **Fuel**
  (1) As temperature falls, fuel loses its fluidity and good atomization cannot be expected. Use therefore, a fuel adequate for atmospheric temperature. For details, see "Fuel".
  (2) Fill the tank with fuel as much as possible so that the air in the tank may come out and lessen the chance of freezing moisture, rusting, and the difficulty of starting.
  Be careful not to let the raindrops and snowflakes come in the tank by fastening the cap firmly.
  (3) Loosen the drain plug of the tank to drain out water sometimes so as to prevent moisture in the fuel from freezing.

- **Battery**
  (1) The battery capacity will decrease as the atmospheric temperature falls. Keep the battery fully charged at all times.
  (2) If the battery is not to be used during cold weather, remove the battery and store it indoors.
  (3) After battery fluid has been added, or when the specific gravity is very low, charge the battery, as there is danger of freezing.

- **Coolant**
  Add anti-freeze to water to prevent its freezing. For the use of anti-freeze, see "Coolant".

**NOTE**

When anti-freeze is not added to the water, be sure to open each drain cock of engine crankcase and radiator to drain off all coolant after operation so that these components may be protected against damage by freezing of the coolant.

**Operational precautions**

- Increased oil viscosity and reduced battery performance will result in hard engine starting. If the engine cannot be started by the first attempt, allow approx. 15 seconds before making another attempt. Do not operate the starter continuously for more than 30 seconds. Do not forget to heat the engine before starting.
- At a very low atmospheric temperature, the oil viscosity may increase to such an extent that heating of the oil pan is necessary.
- Warm up the engine sufficiently after start-up.

**OPERATION IN HOT WEATHER**

Pay a special attention to cooling system as it is easier to overheat under intense heat.

- **Engine oil**
  Choose the engine oil with high viscosity fitting the temperature of climate. See "Lubricant" for selection of oil with suitable viscosity.

- **Battery**
  The battery fluid level will fall fast. Check the level frequently and make sure that the fluid level is always near the UPPER level.

- **Cooling system**
  (1) Keep the coolant always filled to specified level, and check for coolant leaks.
  (2) Replace the coolant from time to time to clean up the cooling system. In hot weather, more scale and rust will be formed in the cooling system (radiator, in particular) and overheating could result. See the cleaning procedure of the cooling system.
  (3) Always check for loose fan belt and adjust belt tension as specified.

**Operational precautions**

(1) Pay attention to the water temp gauge and oil pressure gauge.
(2) When engine overheating is evident, do not try to stop the engine abruptly but run it at idle for a while before stopping it.

**NOTE**

Do not open the radiator cap while the coolant is hot. Hot water will gush out and you might get scalded. Do not pour cold water in an overheated engine, sudden cooling might cause cracks.
Periodic replenishment and replacement of oil and coolant are the key to the best maintenance, trouble-free performance, and increase of service life of the engine. Please follow the instructions in this chapter.

**GENERAL LUBRICATION INSTRUCTIONS**

1. Lubricate every necessary part as specified in "Periodic check and service chart."
2. Always apply the oil of optimum viscosity to ambient temperature. In cold weather, use of too high viscosity oil can be often a cause of difficult engine starting.
3. Prior to the lubrication, be sure to clean oil, grease gun, oil fillers, grease nipples, etc. If grease nipples or other oil filler parts are broken or bent, replace them at once with new ones.
4. If excessive leaks are noticed from oil seals or packings, etc., replace the seals or packings at once to stop leaks.

**FUEL**

Characteristics of diesel fuel for a high-speed diesel engine such as cetane number, specific gravity, and viscosity will affect engine starting, output, consumption, injection system function, knocking noise, and exhausting smoke. Diesel fuel containing much sulfur will deteriorate engine oil sooner, and it requires earlier replacement of engine oil with new one.

Accordingly, it is recommended to use fuel oil with cetane number of 45 or more of well-known maker's products for a high-speed diesel engine.

1. Select lower viscosity fuel under low temperature.
2. Handling fuel
   - The injection pump and injection nozzle are precision-built and lubricated by the fuel (gas oil) itself. Therefore, use of fuel contaminated with water or dust may lead to a serious trouble. Always use clean fuel and pay attention to the following when handling the fuel.
   1. After the end of the day's work, fill the fuel tank with fuel to its capacity. This is to expel air from the tank, as otherwise the moisture in the air might condense into water drops which contaminate the fuel. Also, this gives enough time for dust and water to be separated and settled before operation on the next day.
   2. Store the fuel in a storage tank for at least 24 hours to allow rust and water to precipitate before use. Use only the supernatant.
   3. When filling the fuel tank from a drum, take care not to allow deposits on the bottom to be carried over into the tank.
   4. Open the drain plug at the bottom of the storage and fuel tanks occasionally to drain off deposits and water.
Use soft water with a low impurity content as the coolant. Use of water containing salt, or water in the vicinity of a mine or spa could accelerate deposit of scale in the water jacket and corrosion of the external surface of the cylinder liner. Use anti-corrosive in hot weather to prevent corrosion and use anti-freeze in cold weather to prevent freezing of the coolant.

- NOTE
If the coolant in the cooling system contains anti-freeze or anti-corrosive, add a solution of the same concentration as the solution initially put into the system.

**Cautions on use and handling of anti-freeze:**
1. Use a permanent type anti-freeze.
2. When anti-freeze is to be applied or when the coolant with anti-freeze is to be replaced by coolant without anti-freeze to comply with the rise in atmospheric temperature, wash and clean the cooling system.
3. The anti-freeze/water mixing ratio depends on the lowest temperature expected. Fill anti-freeze as per the instruction Manual.

**LUBRICANT**
The high-speed diesel engines, which are often operated in severer conditions than the gasoline engines, require the use of higher quality engine oil. Use the oil and grease conforming to the specifications shown below.

<table>
<thead>
<tr>
<th>Oil and grease</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil</td>
<td>Under normal operating conditions</td>
</tr>
<tr>
<td></td>
<td>Under severe operating conditions or for engine with turbocharger</td>
</tr>
<tr>
<td>Gear oil</td>
<td>SAE 10W-30</td>
</tr>
<tr>
<td>Brake fluid</td>
<td>SAE J1703</td>
</tr>
<tr>
<td>Multipurpose type grease</td>
<td>NLG1 No. 2</td>
</tr>
<tr>
<td>Clutch shifter grease</td>
<td>MIL-G-3545B</td>
</tr>
</tbody>
</table>

**TABLE OF RECOMMENDED BRAND OF LUBRICANT**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SPECIFICATION</th>
<th>IDEMITSU</th>
<th>CALTEX</th>
<th>SHELL</th>
<th>MOBIL KOREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGINE OIL</td>
<td>API CC CD</td>
<td>APOLLO</td>
<td>SINGLE - GRADE</td>
<td>SINGLE-GRADE</td>
<td>SINGLE-GRADE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DIESEL</td>
<td>SUPER DUTY</td>
<td>RPM DELO 300</td>
<td>RIMULA X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOTIVE S 300</td>
<td>MOTOR OIL</td>
<td>SUMMER : 30</td>
<td>SUMMER : 30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SUMMER : 30</td>
<td>SUMMER : 30</td>
<td>WINTER : 20W/20</td>
<td>WINTER : 20W/20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WINTER : 20W/20</td>
<td>MULTI-GRADE</td>
<td>WINTER : 20W/20</td>
<td>MULTI-GRADE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MULTI-GRADE</td>
<td>SUPER DUTY</td>
<td>MULTI-GRADE</td>
<td>RPM DELO 400</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOTOR OIL 15W/40</td>
<td>15W/40</td>
<td>15W/40</td>
<td>15W/40</td>
</tr>
<tr>
<td>GEAR OIL</td>
<td>API GL-3 or</td>
<td>APOLLO</td>
<td>MPG</td>
<td>MP THUBAN</td>
<td>SPRAX</td>
</tr>
<tr>
<td></td>
<td>API GL-4</td>
<td>GEAR</td>
<td>LUBRICANT</td>
<td>EP 80</td>
<td>HD 80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>BRAKE AND CLUTCH FLUID</td>
<td>SAE J1703</td>
<td>APOLLO BRAKE</td>
<td>YUKONG SUPER</td>
<td>CALTEX BRAKE</td>
<td>DONAX HB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FLUID</td>
<td>BRAKE FLUID</td>
<td>FLUID</td>
<td>H/DUTY BRAKE FLUID</td>
</tr>
<tr>
<td>MULTIPURPOSE TYPE GREASE</td>
<td>MLGI NO.2</td>
<td>APOLLO</td>
<td>GULFCROWN</td>
<td>MARFAK</td>
<td>RETINAX A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AUTOLEX A</td>
<td>GREASE EP</td>
<td>M/</td>
<td>M/</td>
</tr>
<tr>
<td>CLUTCH SIFTER GREASE</td>
<td>MIL-G-3545B</td>
<td>DAPHNE</td>
<td>GULFLEX MOLY</td>
<td>MOLYTEX NO.2</td>
<td>RETINAX AM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MOLEBDAEN</td>
<td>GREASE</td>
<td>2</td>
<td>MOBIL GREASE</td>
</tr>
<tr>
<td>ANTIFREEZE FLUID</td>
<td>SEA J814B</td>
<td>APOLLO</td>
<td>YUKONG</td>
<td>HO YU AF</td>
<td>GLYCO SHELL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RADIATOR</td>
<td>SUPERA</td>
<td>COOLANT</td>
<td>PLUS</td>
</tr>
<tr>
<td>BATTERY TERMINAL</td>
<td>MS 565-1</td>
<td>RETROLA</td>
<td>TURMOVENT</td>
<td>RUST PROOF</td>
<td>COMPOUND</td>
</tr>
</tbody>
</table>
### 8. INSTRUCTIONS FOR A LONG PERIOD OF STORAGE

When the engine is to be removed from service for a certain period, proceed as described below and store the engine in a dry place.

**ENGINE STORED AS COMPLETED UNIT READY FOR OPERATION**

Run the engine once a week for warm-up to circulate engine oil throughout the engine. Prior to firing operation, race the engine with the starter and check the oil pressure gauge to confirm that the oil pressure rises. During warm-up operation, maintain the engine speed as low as possible. Accelerate the engine after the coolant has been properly heated.

**STORAGE PROCEDURES FOR ENGINE TO BE SHUT DOWN FOR A LONG PERIOD**

When the engine is to be removed from service for a definite period, take the steps described below according to the storage period and place a cover over the entire engine when stored.

<table>
<thead>
<tr>
<th>Description</th>
<th>Storage period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside of engine</td>
<td>One month or less</td>
</tr>
<tr>
<td></td>
<td>1) Intake system</td>
</tr>
<tr>
<td>Outside of engine</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1) External exposed portion</td>
</tr>
<tr>
<td>Accessories</td>
<td>1) Air cleaner</td>
</tr>
</tbody>
</table>

**NOTE**

1. When the initially expected storage period is exceeded, take proper steps according to the extended storage period.
2. When the storage period exceeds a year, repeat the same steps.
2.6 Liter Diesel Engine OEM Contents

- LUBRICANT, FUEL OIL AND COOLANT -

1. Intake system
   (1) Remove the air cleaner and crank engine three times at intervals of approx. 30 seconds by the starter without injection of fuel.
   (2) When the engine is cranked, spray an antitrust of MIL-L-6448 into the intake pipe with a spray gun.

2. Cooling system
   (1) After draining the cooling system, remove the thermostat and blow air into the coolant inlet and outlet to remove the remaining water as much as possible.
   (2) After sprinking about 2g of vaporizing type antitrust MIL-P-3420 in the water inlet and outlet, install the thermostat and close the drain cock.

3. Lubricating system
   (1) Remove the lubricant from the oil pan, oil filter, injection pump cam housing and governor housing, fill with antitrust of MIL-L-21260, and run the engine at 800 to 1000rpm at no load for 10 minutes. Use the antitrust fuel described in paragraph (4) for operation. After operation, remove the antitrust oil.

4. Fuel system
   Prior to above-mentioned operation, replace the fuel with an antitrust fuel (consisting of 50% gas oil and 50% antitrust of MIL-L-6448) and distribute the antitrust fuel throughout the fuel lines. After operation, remove the antitrust fuel.

Out of side of engine

Touch up unpainted portions and apply a thin coat of antitrust of MIL-L-21260 to the machined surfaces, aluminum parts and plated parts. seal off open ports with a paper tape.

Accessories of engine
(1) After cleaning air cleaner, spray antitrust of MIL-L-6448 and seal off open ports with a water proof tape.
(2) Clean the inside of alternator, starter with dry compressed air and cover them with a polyethylene sheet or polyethylene coated paper.

NOTE
Do not use a vinyl sheet.

Loosen the belt tension.
Add distilled water until the electrolyte level of the battery comes up higher than normal. Charge the battery fully, clean the terminals, and store the battery in a cool and dry place. Recharge the battery once a month.

9. INSPECTION AND MAINTENANCE

- PERIODIC INSPECTION AND MAINTENANCE -
- SAFETY PRECAUTIONS -
- AIR CLEANER -
- ENGINE OIL PAN -
- OIL FILTER -
- BLEEDING OF FUEL SYSTEM -
- OIL FILTER -
- WATER PUMP -
- COOLANT -
- ADJUSTMENT OF V-BELT -
- BATTERY -

An engine warmed-up once a week during the storage period presents no problem but an engine stored for a long period (more than three months) without warm-up operation must be checked and adjusted as described below before reuse:
1. Apply oil to the liner surface and piston top and manually turn the engine several times.
2. Remove antitrust oil from the oil pan, oil filter, injection pump cam housing and governor housing, and pour in the specified engine oil up to the specified level. Apply fuel and coolant, too, and bleed the fuel system.
3. Before trial operation, remove the rocker cover, apply oil unsparingly to the rocker arm bearing and push rod (check for incorrect valve clearance), race the engine three times with the starter, for about 15 seconds at a time, and confirm the oil pressure of the engine. After starting the engine, allow a sufficient period for warm-up to have smooth running of the parts before placing load on the engine.
4. During trial operation, check for water and gas leaks due to deteriorated gaskets.
9. INSPECTION AND MAINTENANCE

An emergency engine should also be inspected and maintained according to the maintenance standard table described earlier.

1. Determine the inspection and maintenance intervals by checking the service meter readings. When the engine is operated under poor or severe conditions, perform inspection and maintenance earlier.

- NOTE
After maintenance operations, be sure to check that no waste cloth or tool is left behind on or around the engine.

SAFETY PRECAUTIONS

1. Do not attempt any type of maintenance operations while the engine is running.
2. Wear safety shoes and goggles as necessary, and wear clothes suitable for operations. Use the right tools for the operations.
3. Before inspecting the electrical system, set the battery switch to OFF.

4. When parts are cleaned in an inflammable oil, use care to keep out fire.

9-1. INTAKE AND EXHAUST SYSTEM

CHECING ENGINE EXHAUST EMISSIONS

After the engine has fully warmed up, check the color of exhaust gas:

- Colorless or faint blue: Good
- Colorless or faint blue: Bad, showing incomplete combustion
- Black: Bad, showing combustion of oil-furred
- White: Bad

Please note that the exhaust gas which is really colorless or faint blue will look white due to the coldness of winter.

AIR CLEANER

A dirty air cleaner element, if left as it is, will decrease engine output at worst. It will also cause increased fuel consumption, increase in harmful contents of exhaust emissions and black smoke.

- Dust indicator
On an air cleaner with a dust indicator, the time to clean is indicated by a red signal when the element is dogged. When the transparent portion of the indicator turns red, clean or replace the element regardless of the check intervals. When the element has been cleaned or replaced, depress the reset button at the top.

- Cyclone type
(1) Remove the bottom cap and withdraw the element straight.
(2) Prior to installation, clean the inside of the case and bottom cap and then slowly insert the element straight.
If the air cleaner is placed in a horizontal position, install the bottom cap so that the assembling direction indicating mark of the lead valve will be faced upward.

- NOTE
Make sure that the element and bottom cap are securely installed. If it is loosely installed, dust will be drawn in and the air cleaner will fail to function properly.

- Clean element
Every 250 hours or when red signal appears in indicator.

- NOTE
When the engine is operated in dusty place, shorten the cleaning intervals properly. Clean the element by either of the following methods, depending on the degree of contamination.

- Wing screw
**2.6 Liter Diesel Engine OEM Contents**

**- Inspection and Maintenance -**

**- Dust indicator**

On an air cleaner with a dust indicator, the time to clean is indicated by a red signal when the element is clogged. When the transparent portion of the indicator turns red, clean or replace the element regardless of the check intervals. When the element has been cleaned or replaced, depress the reset button at the top.

**- Cyclone type**

1. Remove the bottom cap and withdraw the element straight.
2. Prior to installation, clean the inside of the case and bottom cap and then slowly insert the element straight.

If the air cleaner is placed in a horizontal position, install the bottom cap so that the assembling direction indicating mark of the lead valve will be faced upward.

**- NOTE**

Make sure that the element and bottom cap are securely installed. If it is loosely installed, dust will be drawn in and the air cleaner will fail to function properly.

**- Clean element**

Every 250 hours or when red signal appears in indicator.

**- NOTE**

When the engine is operated in dusty place, shorten the cleaning intervals properly. Clean the element by either of the following methods, depending on the degree of contamination.

1. If the element is contaminated with dry dust, clean dust, etc. by blowing clean compressed air [685 kPa (7kgf/cm²) or less] along the fins from inside the element.

**- NOTE**

Do not strike the element, strike it against an object or allow it to fall.

2. If black contamination due to oil smoke, soot or grease and oil is evident (a cyclone type), use an element cleaner to clean the element. Immerse the element in the aqueous solution of cleaner for approximately 30 minutes and shake the element until it is thoroughly cleaned. For higher cleaning efficiency, use water heated to approximately 40°C. Then, take out the element and rinse it in clean water to wash out stains and cleaner. (water pressure not to exceed 270kPa(2.8kgf/cm²)). Let it dry in a well-ventilated place. If it must be dried in haste, use an electric fan.

1. Dry the element well. Do not use a moist element.

2. Since natural drying require a long time, recommendation is to have a spare element ready.
3. Put an electric lamp in the cleaned element to check for damage. If pin holes or thin areas have been discovered or if the packing is broken, replace the element with a new one.

4. When the element is cleaned, remove the baffle and clean the dust cup, too. To remove the baffle, loosen the wing nut.

ENGINE OIL PAN

- Replace engine oil after the first 60 hours and every 250 hours thereafter. (Every 300 hours for the bus or con engine.)
- On a new engine, be sure to replace the oil after the first 60 hours of operation.
- After shutdown of the engine, remove the drain plug of the oil pan to remove the oil while it is still hot. At the same time, the oil in the oil filter should also be removed.
- Install the drain plug and pour in fresh engine oil [API CC or API CD] from the oil filler port up to the FULL mark on the level gauge.

3. After running the engine at idle for several minutes, check the oil level.

- Oil quantity:
  - Oil pan: 4.2 l
  - Oil filter: 0.7 l
  - Oil cooler: Approx. 0.5 l

- NOTE
  1. A badly contaminated or deteriorated oil should be replaced regardless of the replacement intervals.
  2. Replace the oil filter element replacement of oil.
2.6 Liter Diesel Engine OEM Contents

- INSPECTION AND MAINTENANCE -

(2) To install the filter, apply a thin coat of engine oil around the packing.
(3) If the element only has been replaced without replacing the engine oil, replenish approximately 2.3lt of engine oil and check the oil level.
(4) After installation, thoroughly wipe away split oil, start the engine, and check for oil leaks from the packing.

· NOTE
If a split oil on the engine is left as it is, there is danger of a fire. Make sure that the split oil is thoroughly wiped away.

OIL FILTER

The oil filter in use is pull-flow and by-pass type.
> Replace element
Every 500 hours: EXCAVATOR, S/LOADER
Every 600 hours: BUS A/CON

· NOTE
1. If the oil filter alarm lamp is ON, replace the element immediately regardless of the replacement intervals.
2. The element cannot be washed and reused.
(1) Remove the oil filter by turning it counter-clockwise (if hard, use a filter wrench).

9-3. FUEL SYSTEM

BLEEDING OF FUEL SYSTEM

The fuel system should be bled to remove air as described below if the fuel supply is exhausted during driving, when the fuel filter is replaced, or if the engine is not used for a long time.
1. Loosen the air plug at the top of the fuel filter.
2. Pump the hand pump until there are no more bubbles in the fuel coming out of the air plug. When doing this, place a cloth around the air plug to prevent the escaping fuel from spewing about.

3. Tighten the air plug when there are no more bubbles in the fuel.
4. Continue pumping until the hand pump becomes stiff.
5. Finally, check to be sure that there is no leakage of fuel.
If in doubt, consult your nearest authorized HYUNDAI dealer.

· NOTE
(1) Do not smoke or have any other open flame near the engine while bleeding the fuel system.
(2) Be sure to carefully clean away any fuel which spilled onto nearby parts coming out of the air plug, because such accumulations of fuel might ignite and cause a fire.
2.6 Liter Diesel Engine OEM Contents

- INSPECTION AND MAINTENANCE -

2. Operate the hand pump slowly 6 or 7 times in order to force the water out through the drain plug.
3. Tighten the drain plug when water no longer comes out.
4. Loosen the air plug and bleed the air. (Refer to "Bleeding the fuel system").
5. Check to be sure that the warning lamp illuminates when the ignition key is turned to "ON", and that it goes off when the engine is started.

- NOTE -
(1) Do not smoke or have any other open flame near the engine while

bleeding the fuel system.
(2) Be sure to carefully wipe away any water drained out in this manner, because the fuel mixed in the water might be ignited and result in a fire.

- 9-4. COOLING SYSTEM -

COOLANT

- Replace coolant and clean system
Every 500 hours

Scale and rust are engine water jacket in the course of time. Clean the radiator and water jacket to remove scale and rust as they cause reduction of the cooling efficiency. Also make sure that the system is cleaned if the coolant contains anti-rust or anti-freeze.

When cleaning the system, heat the coolant to 90°C or higher and keep the engine idling. If the water temperature is lower, the thermostat is closed to shut off flow of the coolant to the radiator, making it impossible to clean the system thoroughly.

1) Open the radiator cap and open the crankcase drain cock of the engine crankcase and radiator to remove the coolant.
2) Close the drain cocks and pour in coolant. Run the engine until the coolant is heated to about 90°C
3) If there is considerable scale or rust, pour in a cleaning solution and run the engine until the solution is heated to about 90°C.
4) Continue to idle the engine for about 5 minutes.
5) After stopping the engine, open the drain cocks and pour in coolant to flush out the system thoroughly.

- NOTE -
1. Use soft water. Use of well water or river water may cause scaling or rusting.
2. Add anti-corrosive water in hot season to prevent corrosion and add antifreeze in cold season to prevent freezing of the coolant.

the coolant level will fall after initial operation as a result of expelling of air from the system.

25
2.6 Liter Diesel Engine OEM Contents

---

**ADJUSTMENT OF V-BELT**

If the V-belt is loose, adjust by the following procedures.

- **NOTE**

1. After adjustment, firmly tighten the bolts and nuts. If the V-belt is too tight, damage to the V-belt and bearing will result.
2. Keep the V-belts free from oil and grease.
3. When the pair of V-belts need replacing, make sure that both are replaced with new ones.

---

**9-5. ELECTRICAL SYSTEM**

**BATTERY**

Pay attention to the following when handling the battery.

1. The battery fluid is a dilute sulfuric acid solution. Be careful not to allow the fluid to come in contact with eyes, skin, clothing, and metal surfaces. If the fluid has come in contact with them, wash it out immediately with water.
2. The battery is emitting inflammable hydrogen gas. Avoid using fire near the battery.
3. When the battery is recharged or charged when the electrical system is serviced, the starter switch should be set to OFF and the negative terminal of the battery disconnected beforehand for safety's sake.
4. When the battery is removed, make sure that the negative terminal is disconnected first. When the battery is installed, the negative terminal should be connected last.

- **Check for fluid level**
  Every 125 hours (or every two weeks; every week in summer)

  1. The fluid level should be between the "UPPER" and "LOWER" level lines. If the level is below the "LOWER" level line, add fluid or distilled water up to the "UPPER" level line.

- **NOTE**

  Some batteries have only one level line, which denotes the "LOWER" level.

- **Correct level range**
  10 to 15 mm

- **Correct level range**
  10 to 15 mm

(2) As for a battery which has no level lines, the level should be 10 to 15 mm above the battery plates. Add fluid until the fluid level reaches the lower surface of the case.

- **NOTE**

  Make sure that fluid is added before charge (before operation); in cold weather, there is danger of freezing.
2.6 Liter Diesel Engine OEM Contents

- INSPECTION AND MAINTENANCE -

1. Inspection of battery terminals:
   Every 250 hours
   Check the terminals for looseness. If contamination or corrosion is evident, clean.
   (1) If there is white powder on corroded terminals, wash away with warm water.
   Badly corroded terminals should be polished with a wire brush or sandpaper.

- NOTE -
  Tighten the vent caps to prevent entry of foreign substances into the battery cell.
  (2) After cleaning, apply a very thin coat of grease to the terminals.

10. PERIODIC CHECK AND SERVICE CHART
2.6 Liter Diesel Engine OEM Contents

10. PERIODIC CHECK AND SERVICE CHART

Daily and periodic check and service operations are listed in the following chart.
1. The following chart is intended for regularly used engines.
2. The check and service intervals should be determined on the basis of the service meter readings.
   The standard check and service intervals have been determined on the basis of standard operating conditions.
   On an engine operated each day for a longer period than normal, the intervals should be shortened.
3. Inspection items on devices such as accessories not attached to your engine should be disregarded.

<table>
<thead>
<tr>
<th>Check and service item</th>
<th>Pre-operational (every 10 hours)</th>
<th>Every 60 hours</th>
<th>Every 125 hours</th>
<th>Every 250 hours</th>
<th>Every 500 hours</th>
<th>Every 1000 hours</th>
<th>Every 7000 hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting condition and noise</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low speed and acceleration (rated) condition</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust condition</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder head, manifold and mounting bracket installation</td>
<td>• ○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Items marked are applicable to new engine only.</td>
</tr>
<tr>
<td>Compression pressure</td>
<td></td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve clearance</td>
<td>• ○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Items marked are applicable to new engine only.</td>
</tr>
<tr>
<td>Timing belt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>○</td>
<td>Inspection of 4000 hour</td>
<td></td>
</tr>
<tr>
<td>Lubrication system</td>
<td>Oil leaks</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Damaged hose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## PERIODIC CHECK AND SERVICE CHART

<table>
<thead>
<tr>
<th>lubrication system</th>
<th>Check and service item</th>
<th>Pre-empted</th>
<th>Every 60 hours</th>
<th>Every 125 hours</th>
<th>Every 250 hours</th>
<th>Every 500 hours</th>
<th>Every 1000 hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil pan</td>
<td>Check oil for contamination and quantity</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Replace oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>*On new engine, be sure to replace. (engine oil)</td>
</tr>
<tr>
<td>Oil filter</td>
<td>Replace</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(600hr)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>fuel system</th>
<th>Check and service item</th>
<th>Pre-empted</th>
<th>Every 60 hours</th>
<th>Every 125 hours</th>
<th>Every 250 hours</th>
<th>Every 500 hours</th>
<th>Every 1000 hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel leaks (Check hose for damage and deterioration)</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel filter</td>
<td>Replace</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injection pressure and spray condition of injection nozzle</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injection timing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check and clean prefilter (gauge filter or strainer)</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge water and sediment from inside fuel tank</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* ( ) : Replace bus air con engine.

## PERIODIC CHECK AND SERVICE CHART

<table>
<thead>
<tr>
<th>check and service item</th>
<th>Pre-empted</th>
<th>Every 60 hours</th>
<th>Every 125 hours</th>
<th>Every 250 hours</th>
<th>Every 500 hours</th>
<th>Every 1000 hours</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water leaks (Check hose damage and deterioration)</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace coolant and clean system</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Be sure to clean system before and after use of antifreeze</td>
</tr>
<tr>
<td>Loose or damaged V-belt</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damaged fan, mounting condition of fan</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiator</td>
<td>Water quantity</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cap function</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clogged and damaged core</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical system</td>
<td>Battery</td>
<td>Electrolyte quantity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specific gravity of electrolyte</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Connected condition of terminals</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loose electrical wiring connections and loose or damaged insulators</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Every two weeks, but every week in summer
11. TROUBLESHOOTING

Do your best to find trouble in its earliest possible stage and correct the trouble before it develops into major trouble. When symptoms not covered in the following tables are evident, when trouble persists even after correction and when troubles (marked with an asterisk* in the table), are not readily corrected, please contact nearest service shop for repair, informing of the condition of trouble.
## 2.6 Liter Diesel Engine OEM Contents

### TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine does not run when starter switch is turned on (starter does not turn or turns only slowly)</td>
<td>Battery switch is turned off.</td>
<td>Turn on battery switch.</td>
</tr>
<tr>
<td></td>
<td>Disconnected, loose or corroded battery terminals.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Battery capacity insufficient or discharged battery.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Earth cable disconnected</td>
<td>Connect securely.</td>
</tr>
<tr>
<td>Engine does not run when starter switch is turned on (starter runs but engine does not start)</td>
<td>Empty fuel.</td>
<td>Replenish fuel.</td>
</tr>
<tr>
<td></td>
<td>Clogged fuel filter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Air trapped on fuel system.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Defective preheating system.</td>
<td>Check and correct.</td>
</tr>
<tr>
<td></td>
<td>Clogged air cleaner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incorrect valve clearance.</td>
<td>Check and correct.</td>
</tr>
<tr>
<td>Insufficient engine output</td>
<td>Clogged fuel filter.</td>
<td>Check and correct.</td>
</tr>
<tr>
<td></td>
<td>*Clogged air cleaner or air leaks.</td>
<td></td>
</tr>
<tr>
<td>Black or dark gray exhaust gas.</td>
<td>Clogged air cleaner.</td>
<td>Check and correct.</td>
</tr>
<tr>
<td></td>
<td>*Incorrect valve clearance.</td>
<td></td>
</tr>
<tr>
<td>Excessive fuel consumption</td>
<td>Fuel leaks</td>
<td>Check or correct.</td>
</tr>
<tr>
<td></td>
<td>Clogged air cleaner.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Clutch slipping.</td>
<td>Check and correct.</td>
</tr>
</tbody>
</table>

### TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive engine oil consumption</td>
<td>Improper oil.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High oil level.</td>
<td>Adjust to FULL mark.</td>
</tr>
<tr>
<td></td>
<td>Oil leaks.</td>
<td>Check.</td>
</tr>
<tr>
<td></td>
<td>Oil replacement intervals too long.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insufficient warm-up operation.</td>
<td>Warm-up until coolant is heated to approx 60°C</td>
</tr>
<tr>
<td>Oil pressure too low.</td>
<td>Low engine oil level.</td>
<td>Replenish to FULL mark.</td>
</tr>
<tr>
<td></td>
<td>Improper engine oil viscosity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Broken pipe or oil leaking from connection.</td>
<td>Check oil pan and oil pipe for damage and oil leaks.</td>
</tr>
<tr>
<td></td>
<td>Clogged oil filter</td>
<td></td>
</tr>
<tr>
<td>Engine overheating</td>
<td>Low coolant level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clogged radiator front surface</td>
<td>Clean.</td>
</tr>
<tr>
<td></td>
<td>Loose or broken V-belt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rust or scale in coolant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>*Defective thermostat</td>
<td>Check and replace.</td>
</tr>
<tr>
<td>Battery runs down frequently</td>
<td>Disconnected, loose and corroded battery terminals</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low battery fluid level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loose or broken V-belt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Defective battery</td>
<td>Replace.</td>
</tr>
</tbody>
</table>
## 12. MAIN SPECIFICATIONS

### MAIN SPECIFICATIONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ENGINE MODEL</th>
<th>D4BA</th>
<th>D4BB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td>Water-cooled, 4-cycle diesel, overhead valve type</td>
<td>4-in-line</td>
</tr>
<tr>
<td>No. of cylinders-arrangement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bore X stroke</td>
<td>mm</td>
<td>91.1 x 95</td>
<td>91.1 x 100</td>
</tr>
<tr>
<td>Total displacement</td>
<td>cc</td>
<td>2477</td>
<td>2507</td>
</tr>
<tr>
<td>Combustion chamber type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression ratio</td>
<td></td>
<td>21:1</td>
<td>22:1</td>
</tr>
<tr>
<td>Firing order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turning direction</td>
<td></td>
<td>Counter clockwise as viewed from flywheel</td>
<td></td>
</tr>
<tr>
<td>Engine dimensions (length X width X height)</td>
<td>771.7 X 598 X 648 (Bus air con)</td>
<td>931.6 X 652.2 X 648 (Excavator)</td>
<td>755.4 X 486 X 648 (Skid loader)</td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td>Diesel fuel (Cetane number 45 or more)</td>
<td></td>
</tr>
<tr>
<td>Fuel injection pump</td>
<td></td>
<td>Bosch type VE</td>
<td></td>
</tr>
<tr>
<td>Governor</td>
<td></td>
<td>Variable speed control</td>
<td></td>
</tr>
<tr>
<td>Injection nozzle</td>
<td></td>
<td>Hole type</td>
<td></td>
</tr>
<tr>
<td>Lubrication system</td>
<td></td>
<td>Geared pump pressure feed type</td>
<td></td>
</tr>
<tr>
<td>Engine oil (Heavy duty class, API service classification Grade)</td>
<td></td>
<td>CC or better</td>
<td></td>
</tr>
<tr>
<td>Cooling system</td>
<td></td>
<td>Forced circulation by centrifugal pump</td>
<td></td>
</tr>
<tr>
<td>Starter</td>
<td></td>
<td>12V-2.0KW (Excavator, Skidloader, Generator)</td>
<td>24V-5KW (Bus air con engine)</td>
</tr>
<tr>
<td>Alternator</td>
<td></td>
<td>12V-60A (Excavator, Skidloader, Generator)</td>
<td>24V-40A (Bus air con engine)</td>
</tr>
</tbody>
</table>

**NOTE**
1. Only standard specifications are shown in the above.
2. The specifications are subject to change without notice.
## 13. SERVICE DATA

<table>
<thead>
<tr>
<th>Check Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil quantity</td>
<td></td>
</tr>
<tr>
<td>Oil pan</td>
<td>Approx 5.4 l</td>
</tr>
<tr>
<td>Oil filter</td>
<td>Approx 4.2 l</td>
</tr>
<tr>
<td>Oil filter</td>
<td>Approx 1.2 l</td>
</tr>
<tr>
<td>Oil pressure</td>
<td></td>
</tr>
<tr>
<td>At rated speed</td>
<td>295 to 490kPa (3 to 5kgf/cm²)</td>
</tr>
<tr>
<td>At idling speed</td>
<td>0.8kg/cm² (80kPa) or more</td>
</tr>
<tr>
<td>Cooling water quantity</td>
<td></td>
</tr>
<tr>
<td>Only engine proper</td>
<td>Approx 3.9 l</td>
</tr>
<tr>
<td>V-belt tension</td>
<td></td>
</tr>
<tr>
<td>Belt deflection when middle of belt is</td>
<td>10 ~ 13mm</td>
</tr>
<tr>
<td>depressed at about 98 N (10kgf) of force</td>
<td></td>
</tr>
<tr>
<td>Valve Lash — Cold Intake and Exhaust</td>
<td>See tag on Valve Cover</td>
</tr>
</tbody>
</table>