OptiGenerators International, Inc

Owner’s Manual for

OPTI4000DE
OPTI6800DE
OPTI6800SDE

Opti Generators optimize your Life!
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PREFACE

We appreciate your business. The following manual is only a guide to assist you and is not a complete or comprehensive manual of all aspects of maintaining and repairing your generator. The equipment you have purchased is a complex piece of machinery. We recommend that you consult with a dealer if you have doubts or concerns as to your experience or ability to properly maintain or repair your equipment. You will save time and the inconvenience of having to go back to the store if you choose to write or call us concerning missing parts, service questions, operating advice, and/or assembly questions.

Our air-cooled diesel generators have some or all of the following features:

- Lightweight construction
- Air cooled
- Four-stroke diesel internal combustion engine
- Direct fuel injection system
- Electric, remote and recoil start (Open Frame Models only)
- Glow plug (also called preheater or cold starter)
- Large fuel tank
- Automatic voltage regulator
- NFB circuit protector
- AC and DC outputs
- Low oil pressure automatic shutoff sensor
- Heavy duty big solid wheels
- Sound-proof enclosure (silent model only)
- Specially designed exhaust system and power transfer box (truckin generator only)

The KSD air-cooled diesel generators are widely used when electrical power is scarce. Our generators provide a portable mobile solution in supplying power for field operations during project construction. Some other known applications include pipeline construction and metal welding when electrical power is not available.

This manual will explain how to operate and service your generator set. If you have any questions or suggestions about this manual, please contact your local dealer or us directly.

Consumers should notice that this manual might differ slightly from the actual product as more improvements are made to our products. Some of the pictures in this manual may differ slightly from the actual product as well. Optigenerators International, Inc. reserves the right to make changes at any time without notice and without incurring any obligation.
Chapter 1 Overview of 4000 and 6800 Series

1.1 Open frame model

- Control Panel
- Governor System
- Fuel Tank
- Fuel Filler Cap
- Battery
- Starter Solenoid
- Starter Motor
- Voltage Stabilizer (DC12V)
- Recoil Starter
Silent model has the same configurations as open frame model except that silent model has specially designed muffler system and sound-proof enclosure.

1.2 Soundproof(silent) model
### Chapter 2 Technical Specifications

#### Table 1 Technical specifications in SI units

<table>
<thead>
<tr>
<th>Item</th>
<th>Generator Type</th>
<th>4000 Series</th>
<th>6800 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Brushless, 2-pole, single phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Excitation</strong></td>
<td>Self-excitation voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage regulator</strong></td>
<td>Capacitor (brushless alternator) AVR (brush alternator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>60Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max Output</strong></td>
<td>4000 Watts</td>
<td>6500 watt</td>
<td></td>
</tr>
<tr>
<td><strong>Rated Output</strong></td>
<td>3500 Watts</td>
<td>5500 watt</td>
<td></td>
</tr>
<tr>
<td><strong>Rated Amps</strong></td>
<td>29A @ 120V, 14.5A @ 240V, 8.3A @ 12V</td>
<td>46A @ 120V, 23A @ 240V, 8.3A @ 12V</td>
<td></td>
</tr>
<tr>
<td><strong>Power factor (cos ϕ)</strong></td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operation Noise Level (dB @ 7m)</strong></td>
<td>80</td>
<td>87 (open frame)/70 (silent)</td>
<td></td>
</tr>
<tr>
<td><strong>Insulation</strong></td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Engine

<table>
<thead>
<tr>
<th>Item</th>
<th>4-Stroke, air-cooled, single cylinder, OHV</th>
<th>KSD178FG</th>
<th>KSD186FAG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engine Model</strong></td>
<td></td>
<td>KSD178FG</td>
<td>KSD186FAG</td>
</tr>
<tr>
<td><strong>Bore x Stroke (mm x mm)</strong></td>
<td>78 x 62</td>
<td>86 x 72</td>
<td></td>
</tr>
<tr>
<td><strong>Displacement (cc)</strong></td>
<td>296</td>
<td>418</td>
<td></td>
</tr>
<tr>
<td><strong>Rated Output (KW)</strong></td>
<td>4.4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Max Output (KW)</strong></td>
<td>4.92</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel Type</strong></td>
<td>Diesel</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lube Oil Capacity (L)</strong></td>
<td>0.8</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel Tank Capacity (L)</strong></td>
<td>12.5</td>
<td>12.5 (open frame)/14.7 (silent)</td>
<td></td>
</tr>
<tr>
<td><strong>Continuous Operation Hours</strong></td>
<td>12 hours @ half load</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ignition System</strong></td>
<td>T.C.I.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Starting System</strong></td>
<td>Recoil start (open frame only), electric start and remote start</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Compression ratio</strong></td>
<td>19:1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lube type</strong></td>
<td>SAE15W40 or 5W40 synthetic diesel engine oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dry Weight (kg)</strong></td>
<td>38</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td><strong>Dimension (LxWxH mm)</strong></td>
<td>38.3 x 42.1 x 45</td>
<td>41.7 x 44.1 x 49.4</td>
<td></td>
</tr>
</tbody>
</table>

#### Electric Outlets

<table>
<thead>
<tr>
<th>Item</th>
<th>NEMA Rating</th>
<th>2 x NEMA L5-20R for 120V @ 20A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 x NEMA L5-30R for 120A @ 30A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x NEMA L14-30R for 120/240V @ 30A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x DC12V @ 8.3A</td>
</tr>
</tbody>
</table>

#### Weight

<table>
<thead>
<tr>
<th>Item</th>
<th>Net weight (kg)</th>
<th>96.2</th>
<th>119.4 (open frame)/159.8 (silent)</th>
</tr>
</thead>
</table>

#### Dimensions (L*W*H in cm)

<table>
<thead>
<tr>
<th>Item</th>
<th>Product</th>
<th>69.1 x 47 x 55.6</th>
<th>73.9 x 50 x 58.9 (open frame)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carton</td>
<td>71.6 x 48.5 x 59.4</td>
<td>76.2 x 52.1 x 60.5 (open frame)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>94.5 x 54.6 x 73.7 (silent)</td>
</tr>
</tbody>
</table>
### Table 2 Technical specifications in British units

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>4000 Series</th>
<th>6800 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generator</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generator Type</td>
<td></td>
<td>Brushless, 2-pole, single phase</td>
<td></td>
</tr>
<tr>
<td>Excitation</td>
<td></td>
<td>Self-excitation voltage</td>
<td></td>
</tr>
<tr>
<td>Voltage regulator</td>
<td></td>
<td>Capacitor (brushless alternator) AVR (brush alternator)</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td>60Hz</td>
<td></td>
</tr>
<tr>
<td>Max Output</td>
<td></td>
<td>4000 Watts</td>
<td>6500 watt</td>
</tr>
<tr>
<td>Rated Output</td>
<td></td>
<td>3500 Watts</td>
<td>5500 watt</td>
</tr>
<tr>
<td>Rated Amps</td>
<td></td>
<td>29A@120V, 14.5A@240V, 8.3A@12V</td>
<td>46A@120V, 23A@240V, 8.3A@12V</td>
</tr>
<tr>
<td>Power factor (cos Φ)</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Operation Noise Level</td>
<td></td>
<td>80 (open frame)/70 (silent)</td>
<td></td>
</tr>
<tr>
<td>Insulation</td>
<td></td>
<td>B</td>
<td></td>
</tr>
<tr>
<td><strong>Engine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Type</td>
<td></td>
<td>4-Stroke, air-cooled, single cylinder, OHV</td>
<td></td>
</tr>
<tr>
<td>Engine Model</td>
<td></td>
<td>KSD178FG</td>
<td>KSD186FAG</td>
</tr>
<tr>
<td>Bore x Stroke (in x in)</td>
<td></td>
<td>3.07 x 2.44</td>
<td>3.39 x 2.83</td>
</tr>
<tr>
<td>Displacement (in³)</td>
<td></td>
<td>18.1</td>
<td>25.5</td>
</tr>
<tr>
<td>Rated Output (HP)</td>
<td></td>
<td>5.9</td>
<td>9.3</td>
</tr>
<tr>
<td>Max Output (HP)</td>
<td></td>
<td>6.6</td>
<td>10.3</td>
</tr>
<tr>
<td>Fuel Type</td>
<td></td>
<td>Diesel</td>
<td></td>
</tr>
<tr>
<td>Lube Oil Capacity (oz)</td>
<td></td>
<td>27.1</td>
<td>38.9</td>
</tr>
<tr>
<td>Fuel Tank Capacity (Gal)</td>
<td></td>
<td>3.3</td>
<td>3.3 (open frame)/3.9 (silent)</td>
</tr>
<tr>
<td>Continuous Operation Hours</td>
<td></td>
<td>12 Hours @ half load</td>
<td></td>
</tr>
<tr>
<td>Ignition System</td>
<td></td>
<td>T.C.I.</td>
<td></td>
</tr>
<tr>
<td>Starting System</td>
<td></td>
<td>Recoil start (open frame only), electric start and remote start</td>
<td></td>
</tr>
<tr>
<td>Compression ratio</td>
<td></td>
<td>19:1</td>
<td></td>
</tr>
<tr>
<td>Lube type</td>
<td></td>
<td>SAE15W40 or 5W40 synthetic diesel engine oil</td>
<td></td>
</tr>
<tr>
<td>Dry Weight (lb)</td>
<td></td>
<td>84</td>
<td>117</td>
</tr>
<tr>
<td>Dimension (LxWxH in)</td>
<td></td>
<td>15.1 x 16.6 x 17.7</td>
<td>16.4 x 17.4 x 19.5</td>
</tr>
<tr>
<td><strong>Electric Outlets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEMA Rating</td>
<td></td>
<td>2 x NEMA 5-20R for 120V @ 20A</td>
<td>29.1 x 19.7 x 23.2 (open frame)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x NEMA L5-30R for 120A @ 30A</td>
<td>36.2 x 20.9 x 27.8 (silent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x NEMA L14-30R for 120/240V @ 30A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x DC12V @ 8.3A</td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td>212</td>
<td>263 (open frame)/352 (silent)</td>
</tr>
<tr>
<td><strong>Dimensions</strong> (L<em>W</em>H in)</td>
<td></td>
<td>27.2 x 18.5 x 21.9</td>
<td>29.1 x 19.7 x 23.2 (open frame)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28.2 x 19.1 x 23.4</td>
<td>30 x 20.5 x 23.8 (open frame)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>36.2 x 20.9 x 27.8 (silent)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>37.2 x 21.5 x 29 (silent)</td>
</tr>
</tbody>
</table>
2.2 Standard Features

* Electric start, Recoil start and Remote Control with Preheater (Cold Start)
* Large fuel tank with 12 hours continuous operating capability
* Automatic Voltage Regulator
* Automatic shutdown for low oil pressure
* Vibration isolation mounting between engine/alternator feet & base frame
* Reduced vibration and improving durability
* Non-fused breaker protects for AC
* Overload protection and convenience
* AC Voltmeter, 120V/240V switch
* DC 12V charging system (car/boat batteries)
* Low fuel indicator, oil alert
* Ground fault interrupter
* Dependable, brush or brushless Alternator
* Advanced direct fuel injection system
* Provides low fuel consumption
* All American standard receptacles
* Vertical one-man mobile unit featuring
* Rugged construction
* Includes battery (truck generator excluded) and hour meter

2.3 Basic operating parameters

Under the given conditions, the generator will output the specified power listed in the Table 3 below.

Table 3 Basic operating parameters

<table>
<thead>
<tr>
<th>Height above sea level (ft)</th>
<th>Ambient temperature (°F)</th>
<th>Relative Humidity(RH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>+68 (+20 °C)</td>
<td>60%</td>
</tr>
<tr>
<td>&lt;3280.8 (&lt;1000 m)</td>
<td>41<del>104 (5</del>40 °C)</td>
<td>90%</td>
</tr>
</tbody>
</table>
2-4 Electric Diagrams for 4000 and 6800 Series

Special Notes:
The usually applied colors for G, R2, R1, L2 & L1 are listed as follow:
G -> Yellow/Green
R2 -> Red
R1 -> White
L2 -> Blue
L1 -> Black
Wiring Diagram for generator with Electric Start, Remote Start & Glow Plug

Electric Output Wiring Diagram

Device Electric Control Circuit

Remote Signal Receiver Plug (Male)  Ignition Key Switch Plug  Remote Signal Receiver Plug (Female)
2.5 Overall Dimensions of Diesel engine
2.5.1 Diesel engine coding

| 186 | X | X |

NONE: Recoil Start
E: Electric Start
F: Keyway Shaft
FP: Thread Shaft
FG: Taper Shaft
FS: Camshaft PTO

Model Name

Diesel engine coding begins with 3 digits: the 1st digit stands for number of cylinder head and the last two digits for bore size in mm, e.g., 186 means one cylinder head and bore size is 86 mm. Three digits are followed by letter F and/or by another letter that stands for the type of output shaft. The letter F also means that an engine is air-cooled. If the coding ends up at a letter E, it means that an engine comes with electric start.

The default stroke of 186 series diesel engine is 70mm. However, the stroke of a diesel engine may be expanded from 70 mm to 72 mm. If it is true, a letter A will be used directly after letter F for telling whether an engine is expanded.

2.5.2 Overall engine dimensions (unit in mm)
The values of letters in the above figures are tabulated in Table 2.3.

Table 2.3 Overall dimensions of diesel engine

<table>
<thead>
<tr>
<th>Model</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td>178</td>
<td>358</td>
<td>421</td>
<td>450</td>
<td>218</td>
<td>203</td>
<td>145</td>
<td>96</td>
<td>199</td>
<td>5</td>
<td>41.5</td>
<td>43.5</td>
<td>104</td>
<td>144</td>
</tr>
<tr>
<td>186</td>
<td>186</td>
<td>358</td>
<td>470</td>
<td>494</td>
<td>247</td>
<td>223</td>
<td>155</td>
<td>105</td>
<td>224</td>
<td>5</td>
<td>43.5</td>
<td>51.5</td>
<td>117</td>
<td>155</td>
</tr>
</tbody>
</table>

Note: All data subject to change without notice.

2.5.2 Connecting dimensions of output shafts and power-take off (PTO) flanges

<table>
<thead>
<tr>
<th>Model</th>
<th>Output Shaft</th>
<th>PTO Flange</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>
2.6 Installation of diesel engine

2.6.1 Installation Conditions

(1) There must be a tight stationary foundation for the diesel engine to avoid vibrations or movement when the engine is running. For prolonged engine life, consider using some type of motor mount.

(2) Make sure that the centering position of output shaft is properly aligned.

(3) For diesel engine with thread shaft or taper shaft, make sure that matched machines must have the same thread size or coned angle as output shaft of engine.

(4) For diesel engine with keyway output shaft, check whether the bearing hole (installation hole) on the belt pulley and keyway output shaft are properly aligned and whether their dimensions match. Also make sure that the bolt of the engine shaft is tightened to the proper torque specifications.

(5) When the engine is matched with other belt driven machines, the total desired belt distance traveled by the driven wheel must equal the total distance traveled by the driver pulley. If this is not properly calculated and matched, the desired speed on the driven pulley will be incorrect. The diameter of driving belt pulley can be calculated as follows:

\[
\text{Diameter of engine belt pulley} = \frac{\text{Diameter of driven machine} \times \text{speed of driven machine}}{\text{Diesel engine speed}}
\]

(6) Make sure that the belt is tightened properly.
Note: If the belt is installed too tight, the engine will be overloaded and its bearings will wear at a high rate leading to engine failure; if the belt is too loose, the belt will slip at high speed and high load causing high pitch whistling noises.

### 2.6.2 Allowed clearance between belt wheel and engine

The belt pulley should be as close to the engine as possible. The values of L are tabulated in table 2.3.

Table 2.4 Allowed belt pulley to engine distances.

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>178F</th>
<th>186F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belt</td>
<td>Type</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Qty.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Min. Diameter of pulley (mm)</td>
<td></td>
<td>97</td>
<td>135</td>
</tr>
<tr>
<td>L* (mm)</td>
<td></td>
<td>≤ 70</td>
<td></td>
</tr>
</tbody>
</table>

Note: * L means the distance between the crankshaft shoulder and the outer center of belt pulley groove.

### 2.6.3 Crankshaft driving and tilt angles

Crankshaft driving angles must be larger than 120° (see Fig. 2.1a). The tilt angles of engine must be kept within the allowed values shown in Fig. 2.1b.

<table>
<thead>
<tr>
<th>Output Shaft Tilt</th>
<th>Allowed Tilt (continuous running)</th>
<th>≤ 20°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Tilt</td>
<td>Allowed Tilt (continuous running)</td>
<td>≤ 20°</td>
</tr>
</tbody>
</table>

Fig. 2.1a Allowed driving angles.  Fig. 2.1b Allowed tilt angles.
2.7 Performance curves

Fig. 2.2 a Performance curve for 178 diesel engine.

Fig. 2.2 b Performance curve for 186 diesel engine.
Performance is measured after 30 hours of running with air cleaner and exhaust silencer. Measurement conditions for performance curves are listed in Table 2.5.

Table 2.5 Measurement conditions for performance curves.

<table>
<thead>
<tr>
<th>Item</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosperic condition</td>
<td>ISO 3046/I</td>
</tr>
<tr>
<td>Intake air temperature</td>
<td>20°C 27°C</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>760 mmHg 750 mmHg</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>60% 60%</td>
</tr>
</tbody>
</table>

2.8 Valve timing, initial angle of fuel delivery and valve clearances.

Table 2.6 Valve timing.

<table>
<thead>
<tr>
<th>Model</th>
<th>Phase (Degrees)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Item</td>
</tr>
<tr>
<td></td>
<td>Intake valve open</td>
</tr>
<tr>
<td></td>
<td>Intake valve close</td>
</tr>
<tr>
<td></td>
<td>Exhaust valve open</td>
</tr>
<tr>
<td></td>
<td>Exhaust valve close</td>
</tr>
</tbody>
</table>

Table 2.7 Initial angle of fuel delivery.

<table>
<thead>
<tr>
<th>Model</th>
<th>Item</th>
<th>178</th>
<th>186</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Engine speed (RPM)</td>
<td>3000</td>
<td>3600</td>
</tr>
<tr>
<td></td>
<td>Initial angle of fuel delivery (Degrees)</td>
<td>19 ± 1</td>
<td>20 ± 1</td>
</tr>
</tbody>
</table>

Table 2.8 Valve clearance, unit in mm.

<table>
<thead>
<tr>
<th>Model</th>
<th>Item</th>
<th>178</th>
<th>186</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intake valve</td>
<td>0.15 – 0.20 (cold state)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exhaust valve</td>
<td>0.15 – 0.20 (cold state)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.9 Ranges of temperature, smoke and pressure.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>178</th>
<th>186</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exhaust temperature (°C)</td>
<td>≤ 480</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engine oil temperature (°C)</td>
<td>≤ 95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoke (Bosch)</td>
<td>≤ 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pressure of injection MPa (Kgf/cm²)</td>
<td>19.6 ± 0.49 (200 ± 5)</td>
<td></td>
</tr>
</tbody>
</table>
## 2.9 Torque specifications for various engine bolts and nuts

Table 2.10 Allowed torque for various engine bolts and nuts. Unit in N.m

<table>
<thead>
<tr>
<th>Description</th>
<th>Model 178</th>
<th>Model 186</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting rod nut</td>
<td>25 ~ 30</td>
<td>40 ~ 45</td>
<td></td>
</tr>
<tr>
<td>Cylinder head nut</td>
<td>42 ~ 46</td>
<td>54 ~ 58</td>
<td></td>
</tr>
<tr>
<td>Flywheel nut</td>
<td>100 ~ 120</td>
<td>120 ~ 140</td>
<td></td>
</tr>
<tr>
<td>Nozzle retainer nut</td>
<td>10 ~ 12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightening screw bolt of rocker support</td>
<td>20 ~ 23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard M8 bolt</td>
<td>18 ~ 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard M6 bolt</td>
<td>10 ~ 12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Retighten up after break-in period
CHAPTER 3 OPERATING THE DIESEL GENERATOR

3.1 General main points of safety during operation of the generator set.

In order to operate the generator set safely, please follow all the instructions provided in this manual carefully. Otherwise, it may lead to accidents or equipment damage.

3.1.1 Fire prevention
The proper fuel for the diesel generator set is light diesel fuel. Do not use gasoline, kerosene or other fuels other than light diesel fuel. Keep all flammable fuels away from the generator as it may spark and ignite these gases. In order to prevent fires from occurring and to provide enough ventilation for people and the machine, keep the diesel generator at least 1.5 meters away from buildings or other equipment. Always operate your diesel generator on a level site. If the generator is operated on an incline, the lubricating system within the engine will not perform well and may lead to engine failure.

3.1.2 Prevention from inhaling exhaust emissions
Diesel engine exhaust emissions have the potential to cause a range of health problems. Diesel engine exhaust emissions (commonly known as diesel fumes) are a mixture of gases, vapors, liquid aerosols and substances made up of particles. They contain the products of combustion including:

- carbon (soot);
- nitrogen;
- water;
- carbon monoxide;
- aldehydes;
- nitrogen dioxide;
- sulphur dioxide;
- polycyclic aromatic hydrocarbons.

The carbon particle or soot content varies from 60% to 80% depending on the fuel used and the type of engine. Most of the contaminants are adsorbed onto the soot. Petrol engines produce more carbon monoxide but much less soot than diesel engines.

Never inhale exhausts emitted by the engine. The exhaust emissions contain toxic carbon monoxide, nitrogen dioxide, sulphur dioxide and aldehydes. Never operate your generator in places with poor ventilation. In order to operate this machinery indoors, a suitable ventilation system for the building is required to draw the poisonous exhaust gases out.

3.1.3 Prevention from accidental burns
Never touch the muffler and its cover when the diesel engine is running. Never touch the muffler and its cover immediately after the diesel engine is shut off, as the muffler remains hot for some time.

3.1.4 Electric shock and short circuits
Never touch the generator if the generator is wet. Also never touch the generator if your hand is wet. Never operate your generator exposed to air in the field or outside buildings if the weather conditions call for any type of precipitation such as rain, snow or fog. To avoid electrical shocks, the generator should be grounded. Use a lead to connect the grounding terminal in the control panel of generator to the grounding surface of choice. Please refer to Fig. 3.1 before operating generator.
3.1.5 Other safety items
Before operating generator, all operators must be aware of putting the CIRCUIT BREAKER to the OFF position if any accidents occur. Also, all operators should be familiar with all the switches and their functions of generator before using it. Wear safe shoes and suitable clothes during operation. Always keep generator out of reach of children and animals.

3.1.6 Battery
The electrolytic liquid of battery (known as battery acid) contains sulfuric acid. In order to protect your eyes, skin and clothing, wear protective glove and goggle when working with battery. If you contact with electrolytic liquid in your skin, wash it immediately with clean water and soap; if you contact with electrolytic liquid in your eyes, wash them immediately with distilled water, see a doctor as soon as you can.

3.2 Preparation before operation
3.2.1 Fuel choices and fuel treatment
Only use light diesel fuel. The fuel must be filtered clean. Never let dust and water mix with fuel in the fuel tank. Otherwise it will clog the fuel lines and oil nozzles. It may also damage your pressure pump. It is dangerous to overfill fuel tank. Never exceed 90% scale of fuel gauge.

Fresh diesel from gas station may contain water. Please put it in a diesel container and let it sit at least overnight, water and impurities will stay in the lower portion of container. Decant or suck top portion of diesel in the container into fuel tank of generator.

Caution:
Do not overfill tank. After filling, tighten the fuel cap. Never let fuel or fuel tank expose to sparks. Be careful not to spill fuel when filling. If any fuel is spilled, make sure to clean up all the spilled fuel before starting engine.

3.2.2 Charging battery
We recommend the use of accumulators rated 20 hours shown in table 3.1.
Either deep-recycle maintenance free or dry battery (white/red color) comes with your generator (see Fig. 3.2). You should use a trickle charge to fully charge your battery before you crank your generator for the first time. If voltage level of battery is low, you may not start your generator. Long time cranking may damage electric starter and engine.

| **Table 3.1** Specifications of recommended accumulators for electric start |
|-----------------------------|------------------|
| Model | Amps-hours |
| 178F | 24 ~ 26 |
| 186F | 36 ~ 45 |

Fig. 3.2 Maintenance free battery (left) and dry battery (right), battery actual color is subject to change without notice.

If it is dry battery, the battery must be filled with battery acid to required level. Acid can be purchased at a local automotive supply store. To properly maintain your dry battery, check the height of the battery acid once a month. If the level of the liquid drops too low, fill it with distilled water until it reaches up to maximum level mark. If there is not enough battery acid, diesel engine cannot be started. It is important to keep the liquid level between the high and low limits. If the level in the battery is too high, the liquid may flow out and corrode surrounding parts.

3.2.3 Filling engine oil
Remove the dipstick from the engine, make sure the generator is on level ground and fill the engine with SAE15W40 (warm weather) or SAE5W40 (cold weather) synthetic diesel engine oil. Put the dipstick back into the hole to check the engine oil level (see Fig. 3.2).

| **Fig. 3.3 Schematic for filling engine oil.** |
The following procedures help you start our generator with ease:

1. If dry battery (WHITE/RED COLOR) comes with your generator, please add enough acid to required level;

2. FULLY CHARGE BATTERY prior to cranking diesel engine;

3. Add engine oil to the required level (use oil plug to check); Mobil Delvac SAE 15W40 (warm weather) or SAE 5W40 (cold weather) synthetic DIESEL ENGINE OIL is recommended;

4. Add enough diesel in fuel tank, turn knob fuel Shutoff valve (Down) ON position. On open Frame this is under Fuel Tank, on enclosed Units this is on filter inside of the door;

5. Pull off the fuel hose connected to the fuel pump and LET FUEL DRAIN OUT FREELY, then replace the fuel hose;

6. Connect fully charged battery to generator;

7. DO NOT apply any load at this point and put the CIRCUIT BREAKER to the OFF position;

8. Push RED lever next to oil level check stick to the RUN position;

9. Turn on to the START position and release the key to the ON position;

10. In cold winter area please turn key counterclockwise to HEAT and hold about 20 seconds to preheat cold air, then turn clockwise to START engine, release the key to on position after engine starts; it helps start the engine in cold weather; if your remote control unit has remote preheater function, please see refer to operating procedures for remote start for your reference;

11. If the engine does not start, wait 1 to 3 minutes and repeat the 8 or 9;

12. Only try to use remote control after you successfully start the engine using a key switch.

Note: Open frame models usually come with recoil starter. If you want to pull start your generator, please refer to Section 3.10 Procedures for recoil starting.
3.4. Generator Break-in
A brand new engine must be properly broken in. The break-in period is about 20 hours. An oil change for a brand new engine is about 20 hours or one month. After break-in period, oil change shall be performed routinely every 100 hours or 3 months.

**IMPORTANT**: Do not apply high load during the **first 20 hours of break-in period**, change engine oil and check oil filter after first 20 hours of break-in running; if you find any dirty or metal scraps on the oil filter (please refer to Fig. 3.4), please use diesel to wash them away, otherwise, it may cause serious damage to your engine.

![Fig. 3.4 Partial Front View of Diesel Engine](image)

3.5 Applying Load to your Generator
After generator is started, push circuit breaker to ON position and you should read 120V in volt meter when voltage selector is set for 120V output or 240V in volt meter when voltage selector is set for 120V/240V output.

When applying loads to generator, make sure to apply loads in order. Apply larger load onto the generator first. If the generator labors great with applied load, smaller load can then be added. Never overload generator. Otherwise, generator will black smoke or circuit breaker will be stripped. In this event, decrease the number of small loads until generator labors normally. Please see Table 2-1 for technical specifications of generator for your reference. If the indication of the volt meter is too high or too low, adjust the engine speed (capacitor used for brushless alternator) or electric resistance of AVR used for brush alternator accordingly. Special skills are required to perform speed adjustment. An authorized professional is recommended to perform this work. If there are problems, stop the generator immediately and fix the issue.

**Note**: During operation, the generator should be put in a place with good ventilation. Never cover open frame generator using your own cage to solve a noisy problem, as this will cause overheating problem and then damage your generator. You must obtain our prior authorization for any change in our generator. Otherwise, the warranty for your generator will be voided.
Do not apply more than two loads simultaneously. Each load should be started one by one to avoid overloading generator. The generator should be running at 3600 revolutions per minute in order to achieve the frequency of 60Hz. The speed of the engine can be adjusted through speed governor.

**CAUTION:** A alternator consists of two sets of windings, namely R2 & R1 and L2 & L1 (see Fig.3.5a), each set of winding gives 120V output. A voltage selector is used to obtain 120V and/or 240V outputs (see Fig. 3.5d). Two sets of windings are in parallel when a selector is set at left while two sets of windings are in serial when a selector is set at right (see Fig.3.5b & c). If you push voltage selector left for only 120V output, you can apply full rated load at 120V outlets; if push selector right for both 120V & 240V outputs, you can apply full rated load at 240V outlet from four-prong socket; however, you can only apply HALF RATED LOAD at either 120V outlet (total two 120V outlets) from four-prong socket.

![Wiring diagram for alternator](Fig.3.5a)

**Fig.3.5b**  Parallel Connection

**Fig.3.5c**  Serial Connection

NEMA L14-30R for 120/240V @ 30A Four-Prong Socket
3.6. Operating Procedures for Remote Start

Fig. 3.5d Wiring Diagram of Electric Output for Control Panel

Fig. 3.6 Remote Control Unit (left) and Remote Jumper (right)
There are two sets of ON and OFF buttons in RF transmittal key. If your remote start unit (with 7 wires on) has no remote glow plug function, the operating procedures are as follows:

1. Please refer to above generator operation instruction for start using key switch;
2. If you want to use remote start, please make sure that your electronic key switch is either put on “OFF” position or taken away from the control panel;
3. There are two sets of ON and OFF buttons in RF key, you can depress either one of ON buttons to start the generator and either one of OFF buttons to shut down the generator respectively;
4. If you use key switch to start the generator and then use RF key to shut it down, make sure that you need turn electronic key switch to OFF position; otherwise, your generator battery will drain charge gradually;
5. In case your remote control unit fails and a remote jumper comes with your user’s manual package, please unplug your remote control unit first, then plug the remote jumper; this will enable you to use key switch to start your generator; if there is no remote jumper with your package, please follow the order shown in the picture of remote jumper to electrically shorten the two corresponding wires coming out of your control unit (a small black box with either 7 or 8 wires on), then you shall use key switch to start your generator.

If your remote start unit (with 8 wires on) has remote glow plug function, the operating procedures are the same as the 7-wire remote control unit except the following:

There are two sets of ON and OFF buttons in RF key, you must depress ON button of set 1 to start the generator and OFF button of set 1 to shut down the generator respectively (see Fig. 3.6), also refer to Section How to Use Glow Plug;
3.7 How to Use Glow Plug

Diesel generator will be very hard to start in cold winter. However, glow plug will help start diesel generator much easier. There are two types of control panel used in our portable diesel generators:

**Type A** control panel has heat knob (see Fig. 3.7 A) and **Type B** has preheater button (see Fig. 3.7 B).

For type A control panel, please turn key counterclockwise to HEAT position and hold about 20 seconds to preheat cold; for **Type B** control panel, please depress a small red button right above grounding terminal and hold about 20 seconds to preheat cold.

If your diesel generator comes with 8-wire remote control unit (it needs special order, extra charge applies), you can remote control glow plug. The operating procedures are as follows:

Two sets of ON and OFF buttons used for remote starting engine and turning on glow plug respectively (see Fig. 3.6), Set 1 for starting engine and Set 2 for controlling glow plug, Sets 1& 2 are interlocked each other and only one set of ON & OFF works at a time, Set 2 is programmed for powering on glow plug 25 Sec and glow plug will automatically power off after 25 Sec, you can also DEPRESS OFF button in SET 2 for power off earlier.
3.8 Charging battery
1. All 4000 and 6800 series diesel generators can automatically charge DC12V battery through voltage rectifier (voltage stabilizer) installed in the rear side of engine when they are running.
2. If generator is not used for a long time, the battery should be disconnected to avoid energy loss from the battery.
3. Do not connect the negative and positive terminals of the battery together at any time. Doing so will damage the battery and cause serious injuries.
4. Do not reverse the polarities when attaching battery cables to battery. Doing so will damage both battery and electric starter.
5. Battery will produce flammable gases during charging. Do not expose the battery to any flames and sparks during charging as this may cause a fire. To avoid sparking while connecting cables to battery, connect the cables to the battery then to electric starter. To disconnect battery cables, first disconnect the cable at the end of electric starter.

3.9 Stop generator
1. Remove the electrical load off the generator.
2. Let the engine idle for 3 minutes after unloading. Do not stop the diesel engine immediately. Stopping the diesel engine suddenly may raise the temperature of engine abnormally and lock the nozzle and damage the diesel engine.
3. Turn key to the “off” position or depress “off” button in RF key.
4. If do not use generator for a long time, please shut off fuel valve and then make sure that both intake and exhaust valves are closed for avoiding engine rusting. Pull slowly on the recoil handle (open frame models) or use one of your hands to manually rotate fly wheel (silent model) until you feel resistance when the piston of engine is in the compression stroke where both intake and exhaust valves are closed).

Emergency Stop:
If you turn key to the “off” position or depress “off” button in RF key, the engine is still running, please depress emergency stop lever (see Fig. 3.4) to stop it manually. If emergency stop lever fails, please shut off fuel valve to stop it.
3.10 Procedures for recoil starting

1. Open the fuel cock.

2. Put the engine speed lever in the "RUN" position.

3. Hold the starting handle loosely.

4. Pull the starting handle slowly until you feel resistance.

5. Hold the starting handle firmly.

6. Pull the rope hard and fast. Pull it all the way out. Use two hands if necessary.

7. Push the decompression lever down and release.

If the engine doesn't start, try again from step 1.
For 3, don't pull the rope too fast or hard.

Always pull the rope slowly.

For 5, if you don't pull the rope all the way out, the engine won't start.

Always pull the rope all the way out.

For 5, if you don't pull hard enough, the engine won't start.

Always pull the rope hard and fast.
CHAPTER 4 MAINTENANCE

4.1 Maintenance schedules
Keeping your generator well maintained will prolong the life of your generator. Everything needs to be checked including the diesel engine, generator, control panel and frame. For overhauling procedures, please refer to the instruction manual of relative subassembly. If you need these manuals, please call our company and we will send you one.

Before starting the maintenance, make sure the diesel engine is off.

Please refer to the Table 4-1 below for the proper maintenance schedule.

<table>
<thead>
<tr>
<th>Item</th>
<th>Everyday</th>
<th>1st Month or 20hrs</th>
<th>Every 3 months or 100hrs</th>
<th>Every 6 months or 300hrs</th>
<th>Every year or 1000hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check &amp; fill enough fuel</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain fuel out of fuel tank</td>
<td></td>
<td>○</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check &amp; replenish engine oil</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check oil leakage</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check &amp; tighten each engine part</td>
<td>○</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Change lube oil</td>
<td></td>
<td>○</td>
<td>(1st time)</td>
<td>○</td>
<td>(2nd time &amp; thereafter)</td>
</tr>
<tr>
<td>Clean oil filter</td>
<td>○</td>
<td>(replace)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace air filter element</td>
<td>Service more frequently when used in dusty area</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean fuel filter</td>
<td>○</td>
<td></td>
<td></td>
<td>●</td>
<td>(replace)</td>
</tr>
<tr>
<td>Check fuel injection pump</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check fuel injection nozzle</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check fuel pipe</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>(replace if necessary)</td>
</tr>
<tr>
<td>Adjust the gaps of air intake &amp; exhaust valves</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grind air intake &amp; exhaust valves</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace piston rings</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check dry battery fluid</td>
<td>Monthly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check carbon brush &amp; slide ring</td>
<td>○</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Check insulation resistance</td>
<td>○</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “●” mark indicates that it needs special wrench, please contact with OPTI dealer.
4.2 Changing the engine oil (every 100 hours)

Engine oil is the most important factor in determining the life of your generator engine. If you use poor engine oil or if you do not change the oil regularly, the piston and cylinder will wear off easily or seize up. The life of the other engine parts such as bearings and rotating parts will be shortened considerably as well.

All our portable diesel generators are installed low oil pressure automatic shut-off function. However, manual check of engine oil level using dipstick (oil filler cap) is strongly recommended prior to cranking engine. If the oil level is low, fill it up to required level. Oil is easily drained out of engine due to low viscosity and high fluidity when diesel engine is still hot. If the engine is fully cooled, the viscosity of oil turns higher and oil will be dense and sticky, especially in winter, it is more difficult to drain all the oil out or some impurities will remain in the engine.

Take the dipstick off. Remove the oil drain bolt when the diesel engine is still hot. Be careful of hot oil and hot engine as you may get burned. The bolt is located at the bottom of the cylinder. After draining the oil, put the bolt back and tighten it. Then fill with the proper engine oil to the proper level.

**Warning:** Do not fill engine oil when engine is running!

4.3 Air filter element replacement

Paper-based air filter element is used in diesel generators. It is non-reusable. So, do not try to wash the air filter for reuse purpose. Replace air-filter element every 6 months or 300 hours of regular operation. Never start the diesel engine without the air filter. Otherwise, it can cause serious damage to the engine if foreign objects enter the intake system. When the output of the diesel engine is reduced or the color of the exhaust emissions is abnormal, replace the air filter element on time. To replace an air filter element, first loosen the butterfly(wing) nut, take the cover of the air filter off and take the air filter element out, then after replacing the air filter element, replace the cover and tighten the butterfly nut firmly (see Fig. 4.1).
4.4 Fuel filter maintenance

The fuel filter should be cleaned often to keep the engine running at maximum performance. The recommended interval for cleaning or replacing fuel filter is 6 months or 500 hours of operation. Two types of fuel filter are used in our portable diesel generators: type A is solely used in open frame model; type B is mainly used in silent model and may be used in some open frame units. Fuel filter is either installed inside fuel tank (open frame model) or outside fuel tank in a fuel coke assembly (silent model). Please refer to Fig. 4.2 for your convenience.
How to replace fuel filter

a. Type A fuel filter:

1. Drain all the fuel out of fuel tank.
2. Keep fuel tank right up, loosen two hex nuts on a fuel coke assembly, then take off fuel coke assembly;
3. Loosen 3 small screws on a fuel gasket metal cover underneath fuel tank and remove metal plate cover.
4. Take used fuel filter out of fuel tank, remove circular rubber and O-ring seals and paper-based gasket(s) from the used filter and keep them for reuse if applicable and discard the used filter. You may use diesel fuel to clean up the used filter for reuse. However, the use of new filter is recommended.
5. Put circular rubber and O-ring seals and paper-based gasket(s), and then put gasket metal plate cover to the new filter.
6. Install new filter to fuel coke assembly and then manually slight tighten two hex nuts to the bolts of filter.
7. Place new filter inside fuel tank, align positions for three small screws. You can keep fuel tank upside down for your convenience.
8. Tighten three small screws and two hex nuts completely.

b. Type B fuel filter

Type B filter is very easy to replace: use one hand to hold the alumina head of fuel coke assembly and the other hand to hold thread flanged alumina ring, turn loose the ring counterclockwise, replace used filter with a new one and then tighten the ring completely.

4.5 Fuel injection nozzle
Check fuel injection nozzle every 6 months or 300 hours for possible blockage. Please clean up carbon deposit in fuel injector. Replace the used fuel injector if necessary.

4.6 Cylinder head bolt tensions
The cylinder head bolts should be tightened to specifications. Please refer to the diesel engine manual for specifications and the special tools are required to do this.

4.7 Battery check
For dry battery, make sure that the battery acid is full. Electric starting system uses a DC12V battery. Due to numerous starting cycles, the battery acid may be used up. Also, before filling, verify that the battery is not damaged in any way. Add distilled water to the battery when filling. Perform checks on the battery once a month.

For maintenance free battery, please check the color of indicator: green means the battery is good, dark means recharging battery and Clear means replacing battery.

Caution: Color indicator is only used for reference, sometimes even though the indicator shows clear color, the battery itself may still work well.

4.8 Storage for a long period
If your generator needs to be stored for a long period, the following preparations should be made:
1. Start and run the engine for about 3 minutes, then stop.
2. Change the engine oil with new oil of proper grade when the engine is still hot.
3. Remove the screw plug out of the cylinder head cover and add 2CC of lubricating oil in plug hole, then replace the plug.

4. Recoil starting:
   a. Depress the decompression lever (non-compression position) and pull the recoil handle 2 or 3 times. This pushes the intake out. (Do not start the engine)

5. Electric starting:
   a. Depress the decompression lever, turn ignition key to “ON” position and crank the engine for 2-3 seconds. (Do not start the engine)

6. Pull the decompression lever up, pull the recoil starter (open frame) or manually rotate flywheel (silent) until you feel resistance; this is when the piston is on the compression stroke where both intake and exhaust valves are closed. Having intake and exhaust valves closed will keep moisture away from combustion chamber and prevent engine from rust.

7. Clean the engine and store in a dry place.
CHAPTER 5  TROUBLESHOOTING

5.1 Inspections before Operation and Maintenance
5.1.1 Inspection before operation
5.1.1.1 Check the insulated resistance
An insulated resistance usually results in the creepage of the alternator when it is below the regulated value and then brings on the security problems. The user should check the insulated resistance between the master and subordinate reels and the insulated resistance between the reels and the crust with 500V mega ohmmeter regularly. The value should not be under 2 M ohms at normal temperature; otherwise these parts should be dried. Use the electric cooker, infrared ray or big bulb or something else to heat them up outside until the insulated resistance reaches the regulated value.

5.1.1.2 Check the alternator assembly
Make sure all the firming components are tight and the rotor is easy to turn by hand without impacting, scrubbing and any abnormal noise. Do not let the rain or other liquid drop into the alternator.

5.1.2 Starting the generator
The end of voltage output should be on before running the machine. Generator should self excite, generate voltage in gear and reach the rated power when engine speed is accelerated to the rated value. Otherwise, stop the machine and check it.

5.1.3 Maintenance
Keep generator away from the oil, vapor, acidic/alkaline gas, saline brume and do not let any other solid matter fall into the generator. Keep drafty when the generator is running. Do not put anything on the surface of generator for baffling ventilation and heat dispersion. Do not operate under over-loading condition continuously and inspect bolts and mechanical firming components routinely.

5.2 Malfunction and Troubleshooting for Diesel Engine
5.2.1 Causes and Troubleshooting for the Engine Not Being Started
There are many factors causing non-starting issues. General causes for non-starting problem are summarized in Table 5.1.

For brand new diesel generator, if you can not start it, it is usually caused by entrapped air in the fuel hose. Please full off fuel hose from fuel injection pump and drain fuel freely to release all the entrapped air.

If you have used your generator for some time and find you can not start it or it shuts off automatically, it is usually caused by failure fuel system such as running out of fuel, non-energized solenoid, and burned solenoid or by failed remote control unit. If there is no DC 12V power to solenoid, please troubleshoot as follows:

1. Check whether solenoid fuse blows out or not. If it blows out, replace it.
2. If solenoid fuse is fine, please directly use a copper wire to feed 12V to solenoid (when disconnect blue wire to solenoid, make sure electrically insulate it for avoiding short circuit) and crank engine, see whether you can start it or not. If it works, solenoid control board or remote control unit fails.

Caution: there is a blue wire connected to the top of solenoid, NEVER touch the blue wire to engine case while with battery hooked up! Otherwise, a fuse (new 2008 or later model) or a control board for solenoid behind control panel will be burned!
<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air exists in fuel system</td>
<td>Release trapped air in the fuel hose.</td>
</tr>
<tr>
<td>It is cold</td>
<td>Preheat cold air using glow plug first, then crank engine.</td>
</tr>
<tr>
<td>Engine oil is viscous</td>
<td>Fill machine oil into crankcase after warming-up.</td>
</tr>
<tr>
<td></td>
<td>Fill machine oil into inlet pipe.</td>
</tr>
<tr>
<td></td>
<td>Remove the connection belt from the machine (tapered shaft only), start the</td>
</tr>
<tr>
<td></td>
<td>engine and then stop it. When it is warmed up, assemble the belt and then</td>
</tr>
<tr>
<td></td>
<td>restart the engine.</td>
</tr>
<tr>
<td>Failure of fuel system</td>
<td>Check solenoid and see whether it is energized.</td>
</tr>
<tr>
<td></td>
<td>Check fuel injection pump.</td>
</tr>
<tr>
<td>Water mixed in the fuel</td>
<td>Clean fuel tank, fuel filter and fuel pipe and change the fuel.</td>
</tr>
<tr>
<td>The fuel get thickening and can’t flow</td>
<td>Use prescribed brand fuel</td>
</tr>
<tr>
<td>easily</td>
<td></td>
</tr>
<tr>
<td>Injection fuel is little or the spray is</td>
<td>Check the position of governing handle or check and clean the fuel nozzle,</td>
</tr>
<tr>
<td>not excellent</td>
<td>change fuel injector if necessary.</td>
</tr>
<tr>
<td>Incomplete combustion</td>
<td>Mainly by ill spray</td>
</tr>
<tr>
<td></td>
<td>Incorrect delivery angle</td>
</tr>
<tr>
<td></td>
<td>Leakage in gasket of cylinder head</td>
</tr>
<tr>
<td></td>
<td>Deficiency in pressure of compression</td>
</tr>
<tr>
<td>Interrupted of diesel fuel</td>
<td>Run out of fuel and get air in the fuel hose, should refill fuel into the</td>
</tr>
<tr>
<td></td>
<td>fuel tank and drain fuel hose freely.</td>
</tr>
<tr>
<td></td>
<td>Fuel pipe leaks or fuel filter is obstructed.</td>
</tr>
<tr>
<td>Deficiency in pressure of compression;</td>
<td>Tighten the nuts of cylinder head in the diagonal sequence; check the</td>
</tr>
<tr>
<td>Loosened nut of cylinder head;</td>
<td>gasket of cylinder as per the standard requirement. When the engine with the</td>
</tr>
<tr>
<td>Damage or leakage in the gasket of</td>
<td>new gasket is heating, tighten the nut of cylinder head again.</td>
</tr>
<tr>
<td>cylinder</td>
<td></td>
</tr>
<tr>
<td>Big gap in the piston ring due to wear</td>
<td>Change the piston ring</td>
</tr>
<tr>
<td>and tear</td>
<td></td>
</tr>
<tr>
<td>Leakage caused by each gap of piston ring</td>
<td>Make each gap of piston at angle of 120</td>
</tr>
<tr>
<td>lined in one direction</td>
<td></td>
</tr>
<tr>
<td>Serious stickiness or breakage in piston</td>
<td>Clean it by diesel fuel or change the piston ring.</td>
</tr>
<tr>
<td>ring</td>
<td></td>
</tr>
<tr>
<td>Leakage in valves</td>
<td>Skive the valves, or send it to repair factory if the vestige is too deep.</td>
</tr>
<tr>
<td>Incorrect valve clearance</td>
<td>Adjust the gap as specified (0.15~0.20 mm).</td>
</tr>
<tr>
<td>The valve stem is clipped in the guide</td>
<td>Disassemble the valve, clean the stem and guide pipe with diesel fuel.</td>
</tr>
<tr>
<td>pipe</td>
<td></td>
</tr>
</tbody>
</table>
3. Use remote jumper to test, if it works, the remote control unit fails and needs replaced.

4. If remote jumper does not work, please turn Key Switch to "ON" position, use a multimeter (voltage tester) to measure the voltage on the solenoid, put positive polarity to the conjunction of blue wire and solenoid and negative polarity to engine case, you should read 12V in your meter. If the reading is ZERO, the solenoid control board (named CJX22 control board in green color behind control panel) fails and needs replaced.

If there is DC 12V power to solenoid, please troubleshoot as follows:

1. Take off solenoid from fuel pump using two wrenches. You should use one wrench to hold the solenoid firmly and turn counterclockwise to take it off fuel pump, at the same time, you must use the other wrench to hold metal pipe of fuel pump for avoiding its rotating. Take out a spring and a plunger in the solenoid, replace the solenoid (means bypassing solenoid) to fuel pump, crank the engine and see whether you can start or not; if works, solenoid is burned and needs replaced.

2. If you can not solve starting problem by bypassing solenoid, fuel pump or fuel injector may have failed.

How to test fuel pump or fuel injector?

a. Loosen the end of high pressure metal fuel pipe to fuel pump, crank engine and see whether you can see diesel popped out of fuel pump, if you can see diesel out of pump, the pump is fine. Otherwise, fuel pump needs replaced.

b. Take off fuel injector and test it: open the cover right on the top of enclosure (silent model) or muffler cover (open frame model), loosen two 10MM nuts, take out fuel injector with high pressure metal fuel pipe hooked up together, reconnect the other end of metal fuel pipe to fuel pump so that make sure you can observe the tip of fuel injector when cranking engine. if fuel injector is fine, you shall observe 4 well-sprayed diesel mists out of fuel injector tip; if not, try to use a piece of soft cloth to clean it and then try again; if you still can not see four mists, one or more tiny holes of fuel injector is/are bitted and fuel injector needs replaced.

c. Also, please check your battery voltage level, if it is below 12.5V, you probably can not start your engine; please fully charge your battery or try using your vehicle battery to crank.

d. If you can not hear cranking sound at all when you turn ignition key to start or use remote control unit to start, electronic key switch or the solenoid of electric starter is burnt and needs replaced. You can use a small copper wire to jump start your electric starter motor: jump start your electric starter and see whether your engine turns over; if it turns over, the starter is good and key switch needs replaced; otherwise, starter needs replaced.

Make sure you leave key in OFF position or simply remove key from control panel when you use remote start! Also, please depress OFF button after you remote shut down generator, otherwise, the battery will be gradually drained; it will also have a risk of burning solenoid.

Caution: please disconnect battery from your generator prior to conducting any maintenance or repair. Otherwise, some electronic parts will be burned with power operation.
If you perform all the above procedures and find fuel system is fine, please further check your diesel engine. Adjustment screw or tappet of your engine is probably snapped:

Remove fuel injector from your engine and take off cylinder cover, pull recoil handle or manually rotate flywheel, perceive whether you can see both intake and exhaust valves moves; if one of them does not move, please take a closer look at the cylinder head and make sure whether adjustment screw or tappet is snapped. If adjustment screw is snapped, try to take out the broken screw and replace it with a new one. Make sure you correctly adjust the gap of valves in the range of 0.15 ~ 0.20 mm. If tappet is snapped, you must remove alternator from diesel engine and then disassemble engine for replacement.

5.2.1.1 Instructions for disassembling alternator from engine

1. Drain out all the fluids from your generator including oil and fuel.
2. Remove generator frame (open frame) or soundproof enclosure (silent) from base pan.
3. Loosen four long bolts for holding alternator first and then remove stator from alternator. You should use two flat head screwdriver to warp up the stator out through two symmetrically distributed notches in the alternator cast case. It usually takes less than 10 seconds to remove stator from alternator.
4. Remove rotor from engine shaft. Completely loosen the long bolt with a 14MM hex head nut that is used to hold rotor to engine shaft so that you can take it out. However, you should not take out the long bolt, but to leave the loosened bolt in place, then use a RUBBER HAMMER hit heavily hit the 14MM hex head nut of long bolt about 10 times at the directions of left, right, back and forth, take out long bolt and then you shall pull out the rotor from engine shaft easily.

Warning: Never use metal hammer rather than rubber hammer to hit the nut and avoid hitting in the bearing of rotor. Otherwise, the bearing will be broken.

5.2.1.2 Instructions for disassembling diesel engine

1. Loosen the end of high pressure metal fuel pipe to fuel injection pump and then remove the fuel injection pump from engine.
2. Remove fuel injection nozzle (injector) with high pressure fuel pipe from engine.
3. Remove cylinder gasket cover.
4. Remove rocker arm.
5. Remove two push rods.
6. Remove the half crankcase in alternator side (drive shaft side) from engine.
7. Remove cam shaft.
8. Replace the snapped tappet with a new one.

5.2.1.3 Instructions for setting valves and reassembling diesel engine

A. How to reassemble a diesel engine:

1. Suppose a diesel engine is disassembled at this step, e.g., fuel pump, fuel injector removed from, rocker arm and push rods taken off engine; DO NOT REPLACE THEM NOW,
OTHERWISE, YOU CAN’T PUT BACK THE HALF CASE OF ENGINE ON ALTERNATOR SIDE!

2. If tappets are snapped, please replace them and put the new ones in holes;
3. In case you pull off balance shaft during disassembling engine and need replace, please align balance gear and crank gear: there are TWO DOTS and ONE DOT in balance and crank gears respectively, you must align them at this step before aligning crank and cam gears;
4. Align crank gear (drive shaft) and cam gear (cam shaft): there are TWO DOTS and ONE DOT in crank and cam gears respectively, you must align them at this step;
5. Put case gasket and match two halves of engine together, tighten all bolts.
6. Put back push rods and rocker arm assembly, tighten two bolts for holding rocker arm, adjustment screws and nuts on rocker arm assembly and make sure adjustment screws touch push rods slightly so that you can lift up and down push rods. **DO NOT TIGHTEN ADJUSTMENT SCREWS FIRMLY AT THIS POINT, OTHERWISE, YOU CAN’T ADJUST VALVE GAP.**

B. How to set valve gaps:

The 4 strokes for engine are:

intake-->spray fuel, compress-->explode--->outtake exhaust.

When you spin flywheel, you can see push rods and rocker arms moving back and forth to make intake and exhaust valves open and/or close;

When both push rods move to their lowest positions, both intake and exhaust valves are close, then you can use your hand to move both rocker arms a little (both valves are close at this position);

This position is very important, you need adjust the valve gaps at this point: the gap between rocker arm and valve clip (a small round platform) for both sides (intake and exhaust valves) is 0.15 ~ 0.20mm (about 0.005906~0.007874 in). You can use a filler ruler of 0.15~0.20mm thickness to adjust.

C. Install fuel injector first, then install fuel pump.

**You must install fuel pump correctly, otherwise you either can’t start engine or overspeed engine. Below are brief procedures for reinstallment:**

1. When you reinstall fuel pump, pull its needle half way in OBSERVATION WINDOW (bottom opening in fuel pump), push speed handle (fuel throttle lever) halfway. You can see a HOOD of speed handle when you move speed handle from left to right. The HOOD is used to hold fuel pump needle so that you can simultaneously move needle while push speed handle from left to right.
2. Use one hand to replace fuel pump while use the other hand to hold speed handle half way, let fuel pump needle right sit in the HOOD of speed handle, tighten upper two nuts first, then move fuel lever and see whether the needle moves with fuel throttle lever, otherwise, you need reinstall the fuel pump again.
IMPORTANT NOTES:

When you need use a hammer during disassembling or reassembling process whenever necessary, please NEVER USE METAL HAMMER to hit any parts, otherwise, you will deform or damage them.

5.2.2 Causes and Troubleshooting for Deficient Power of Diesel Engine

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malfunction of fuel system</td>
<td>Check the fuel switch, they should be opened fully.</td>
</tr>
<tr>
<td>Parts obstruction in fuel filter and fuel pipe</td>
<td>Clean the fuel filter and fuel pipe.</td>
</tr>
<tr>
<td>Inadequate fuel supplying</td>
<td></td>
</tr>
<tr>
<td>Bad pressing of fuel pump</td>
<td>Check or change the damaged parts of fuel pump.</td>
</tr>
<tr>
<td>Malfunction of the fuel nozzle</td>
<td>Adjust the injection pressure</td>
</tr>
<tr>
<td>Incorrect injection pressure</td>
<td></td>
</tr>
<tr>
<td>Carbon deposit in the nozzle hole</td>
<td>Clean</td>
</tr>
<tr>
<td>Needle was bit</td>
<td>Clean or change</td>
</tr>
<tr>
<td>Loose fit between needle and needle body</td>
<td>Change</td>
</tr>
<tr>
<td>Obstruction in air filter</td>
<td>Remove, clean or change the filter core.</td>
</tr>
<tr>
<td>Not fast enough of engine speed</td>
<td>Check the speed of engine with the tachometer, and then readjust the speed limit bolts.</td>
</tr>
</tbody>
</table>

Fig. 5.1 Speed Governing System
5.2.2.1 Instructions for speed adjustment

There are three bolts used in the speed limit system (see Fig. 5.1): left (C), middle bottom and right (A) screws. Screws A & C are used for tightening metal plate B, A is also used for fine adjustment of speed and middle bottom screw for setting maximum fuel throttle. Please note that there is an oval-shaped hole in the metal plate B with A through.

Screw A is used for fine adjusting RPM (Frequency < 5 Hz), moving B up decreases RPM while moving B down increases RPM.

There are two rows of three small holes right behind the metal plate B (not shown in Fig. 5.1) and four large holes in location E. If the adjusted frequency > 10 Hz, the thick spring D is used for coarse tuning. Try to hook two ends of D in one of six small and four large holes E respectively for obtaining desired frequency, e.g., if we need change 60Hz to 50Hz, this method will be involved. Given position of hooked small hole, the obtained frequency decreases in the order from left to right holes of E; given position of hooked large hole, the obtained frequency decreases in the order from left to right small hole in the same row and upper to lower small holes. Frequency adjustment shall be conducted with a frequency meter.

Bolt F is preset for maximum power output position by manufacturer, it NEVER touches fuel lever unless the maximum power output is reached. So, NEVER adjust the position of threaded bolt.

Caution: If your generator runs unstable, e.g., runs at upper or lower speed and you excludes fuel system problem, you must try hooking the two ends of coarse spring D in different small and large holes to find out flexibly balanced position.

5.2.3 Causes and Troubleshooting for Engine Stopping Automatically

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malfunction of the fuel system</td>
<td>Check solenoid, fuel pipe, fuel pump &amp; fuel injector</td>
</tr>
<tr>
<td>Run out of fuel</td>
<td>Fill fuel.</td>
</tr>
<tr>
<td>Low oil level or oil is too dirty</td>
<td>Check oil and change if necessary.</td>
</tr>
<tr>
<td>Air exists in fuel system</td>
<td>Release the air.</td>
</tr>
<tr>
<td>Nozzle needle was bitted</td>
<td>Clean, skive the nozzle or change it if necessary.</td>
</tr>
<tr>
<td>Obstruction in air filter</td>
<td>Check, clean or brush off, or change the filter element</td>
</tr>
<tr>
<td>Sudden increase of load</td>
<td>Lighten the load.</td>
</tr>
<tr>
<td>Remote control unit fails</td>
<td>Use remote jumper or replace with a new remote unit</td>
</tr>
</tbody>
</table>

5.2.4 Causes and Troubleshooting for Exhaust with Black Smoke

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload</td>
<td>Lighten the load; change the unmatched loads if it does not comply with the requirements.</td>
</tr>
<tr>
<td>Bad spray</td>
<td>Faulty fuel injection system, change the nozzle if it is damaged.</td>
</tr>
<tr>
<td>Lack of air or leakage</td>
<td>Damaged or clogged air filter</td>
</tr>
<tr>
<td>Incomplete fuel combustion</td>
<td>Wrong grade of fuel</td>
</tr>
<tr>
<td></td>
<td>Incorrect fuel injection pump timing</td>
</tr>
<tr>
<td></td>
<td>Engine overheating</td>
</tr>
<tr>
<td></td>
<td>Low compression ratio</td>
</tr>
</tbody>
</table>
### 5.2.5 Causes and Troubleshooting for Exhaust with Blue Smoke

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil mixed in cylinder</td>
<td>Check the oil level, drain off the redundant engine oil</td>
</tr>
<tr>
<td>Piston ring is clipped, worn or lack of elasticity, hatch of each ring turned to the same direction and make engine oil up</td>
<td>Check and replace the piston ring and cross hatch of each ring</td>
</tr>
<tr>
<td>Big gap between piston and cylinder</td>
<td>Remedy or change</td>
</tr>
<tr>
<td>Worn and torn valve and guide</td>
<td>Change</td>
</tr>
</tbody>
</table>

### 5.2.6 Causes and Troubleshooting for Exhaust with White Smoke

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water mixed in diesel fuel</td>
<td>Clean the fuel tank and filter and change the diesel fuel.</td>
</tr>
<tr>
<td>Improper air/fuel mixture</td>
<td>Faulty fuel injection system</td>
</tr>
<tr>
<td></td>
<td>Incorrect fuel injection and valve timing</td>
</tr>
<tr>
<td></td>
<td>Engine overheating</td>
</tr>
<tr>
<td></td>
<td>Faulty fuel pump and/or injection pump</td>
</tr>
</tbody>
</table>

### 5.2.7 Checking Methods for malfunctioned Engine

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed sometimes fast, sometimes slow</td>
<td>Check if the speed governing system is flexible, and if air mixed in oil pipeline.</td>
</tr>
<tr>
<td>Abnormal noise suddenly sent out</td>
<td>Stop the engine and inspect each movable parts carefully</td>
</tr>
<tr>
<td>Exhaust with black suddenly</td>
<td>Check fuel system, especially the nozzle.</td>
</tr>
<tr>
<td>Rhythmically metal knocking sound in the cylinder</td>
<td>The fuel delivery angle is too big, should adjust the angle.</td>
</tr>
</tbody>
</table>
## 5.3 Overhaul and Troubleshooting for Diesel Generator

### 5.3.1 Causes and troubleshooting for the generator not being started

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of diesel fuel</td>
<td>Add diesel fuel</td>
</tr>
<tr>
<td>Fuel switch is not on the position of “ON” (start switch)</td>
<td>Turn fuel switch handle to the position of “ON”</td>
</tr>
<tr>
<td>Air entrapped in fuel system</td>
<td>Release air</td>
</tr>
<tr>
<td>No or little spray from injection pump and nozzle</td>
<td>Disassemble the nozzle and adjust it on the test table</td>
</tr>
<tr>
<td>The governor speed handle is not on the position of “RUN”</td>
<td>Turn the governor handle to the position of “RUN”</td>
</tr>
<tr>
<td>Oil lever is too low or oil is too dirty</td>
<td>The standard of lubricating oil is between upper line “H” and bottom line “L” Change oil if necessary</td>
</tr>
<tr>
<td>Recoil starter is not swift and powerful enough</td>
<td>Start the engine according to “Start Operation Procedure”</td>
</tr>
<tr>
<td>Dirty in the nozzle</td>
<td>Clean the nozzle</td>
</tr>
<tr>
<td>Ambient temperature is very low</td>
<td>Preheat cold air</td>
</tr>
<tr>
<td>No electricity of storage battery</td>
<td>Charge up or change the storage battery</td>
</tr>
<tr>
<td>Solenoid is not energized or stuck</td>
<td>Check fuse, CJX22 control board or replace solenoid</td>
</tr>
<tr>
<td>Ignition Key or remote control unit fails</td>
<td>Change if necessary</td>
</tr>
<tr>
<td>Electric starter fails</td>
<td>Change starter</td>
</tr>
</tbody>
</table>

### 5.3.2 Causes and troubleshooting for the generator not generating electricity

<table>
<thead>
<tr>
<th>CAUSES</th>
<th>TROUBLESHOOTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power switch is on the position of “OFF”</td>
<td>Turn the switch handle to the position of “ON”</td>
</tr>
<tr>
<td>Bad contact of the socket</td>
<td>Adjust the socket pins</td>
</tr>
<tr>
<td>Burned AVR or capacitor</td>
<td>Change the AVR or capacitor</td>
</tr>
<tr>
<td>Nuts loosened in volt meter</td>
<td>Tighten loosened nuts</td>
</tr>
<tr>
<td>Voltage selector is burned</td>
<td>Replace voltage selector</td>
</tr>
<tr>
<td>Carbon brush is snapped or worn off</td>
<td>Check carbon brush</td>
</tr>
<tr>
<td>Stator is short-circuited</td>
<td>Change stator</td>
</tr>
<tr>
<td>Rotor Diode(s) is broken through</td>
<td>Change diode(s)</td>
</tr>
<tr>
<td>Rotor is burned</td>
<td>Change rotor</td>
</tr>
</tbody>
</table>
## 5.4 Damage Cause and Remedy of Brushless Alternator

<table>
<thead>
<tr>
<th>Phenomena</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Can not generate</strong></td>
<td>1. Switch is on the position of &quot;OFF&quot;.</td>
<td>1. Turn the switch to the position &quot;ON&quot;.</td>
</tr>
<tr>
<td></td>
<td>2. Worse connection of the plug or the control panel.</td>
<td>2. Adjust the contactor of the plug or the wires inside the control panel.</td>
</tr>
<tr>
<td></td>
<td>3. Circuit break of the stator coil or the capacitor overloads.</td>
<td>3. Check the stator at the point of the break; if it is the just reason that causes problem, change the stator; or check the capacitor with the multimeter, if the needle does not move, change the capacitor.</td>
</tr>
<tr>
<td></td>
<td>4. Short circuit of the rectifier.</td>
<td>4. Check the rectifier by the Multimeter as the following steps: connect the pens to each two of the four contactors of the rectifiers both in the clock-wise way and in the counter-clock-wise way; if you find that both ways are electrically conducting or non-conducting, it needs replaced.</td>
</tr>
<tr>
<td></td>
<td>5. Connection between the coil of the rotor and the rectifier is wrong, which can not make the different magnetic poles (N/S).</td>
<td>5. Check the reel and the rectifier by the Multimeter. Kindly note the current way while connecting.</td>
</tr>
<tr>
<td><strong>Low Voltage</strong></td>
<td>1. Low engine speed</td>
<td>1. Increase the engine speed.</td>
</tr>
<tr>
<td></td>
<td>2. Short-circuit of the rotor reels.</td>
<td>2. Change the rotor.</td>
</tr>
<tr>
<td></td>
<td>3. Short-circuit of the capacitor or the stator.</td>
<td>3. Change the capacitor or stator.</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>1. The rectifier of the rotor gets short circuit and the output voltage decreases suddenly after loading.</td>
<td>1. Check the rectifier as per the above instruction. Replace a new one.</td>
</tr>
<tr>
<td></td>
<td>2. After loading, the Power take-off (PTO) drive shaft skids. This causes voltage to drop and alternator to overheat.</td>
<td>2. Disassemble the engine. Maintain the PTO shaft and the inside hole of the rotor until the conic degree reaches the reasonable level, then reassemble the engine.</td>
</tr>
<tr>
<td></td>
<td>3. Short-circuit of the rotor or the stator makes the alternator overheat. The voltage drops.</td>
<td>3. Change the stator or the rotor.</td>
</tr>
</tbody>
</table>
### 5.5 Damage Cause and Remedy of Brush Alternator

<table>
<thead>
<tr>
<th>Phenomena</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can not generate</td>
<td>1. Switch is on the position of &quot;OFF&quot;.</td>
<td>1. Turn the switch to the position &quot;ON&quot;.</td>
</tr>
<tr>
<td></td>
<td>2. Worse connection of the plug or the control panel.</td>
<td>2. Adjust the contactor of the plug or the wires inside the control panel.</td>
</tr>
<tr>
<td></td>
<td>3. The connection of the AVR contact is bad or AVR burns.</td>
<td>3. Connect the contactor well or change AVR.</td>
</tr>
<tr>
<td></td>
<td>4. The carbon brush wears out or its positive pole and its negative poles are connected crossly.</td>
<td>4. Change the carbon brush or make the wrong connection right.</td>
</tr>
<tr>
<td></td>
<td>5. The second reel of the alternator has turnoff.</td>
<td>5. Check the reel by the Multimeter. And change the stator if it needs.</td>
</tr>
<tr>
<td></td>
<td>6. The rotor has turnoff.</td>
<td>6. Check the reel by the Multimeter and change the rotor if it needs.</td>
</tr>
<tr>
<td>Low Voltage</td>
<td>1. Low engine speed</td>
<td>1. Increase the engine speed.</td>
</tr>
<tr>
<td></td>
<td>2. Short-circuit of the rotor reels. AVR burns.</td>
<td>2. Change AVR firstly. If the voltage is not high enough, change the rotor.</td>
</tr>
<tr>
<td></td>
<td>4. The sample voltage has short circuit.</td>
<td>4. Adjust the resistance of AVR. If the voltage remains, change the stator of the alternator</td>
</tr>
<tr>
<td>Others</td>
<td>1. AVR burns after load. The voltage decreases, even disappear.</td>
<td>1. Change AVR.</td>
</tr>
<tr>
<td></td>
<td>2. After loading, the PTO shaft skids, the voltage decreases, and the alternator overheats.</td>
<td>2. Disassemble the engine. Maintain the PTO shaft and the inside pole of the rotor until the conic degree reaches to the reasonable level. Then reassemble the engine.</td>
</tr>
<tr>
<td></td>
<td>3. Short-circuit of the rotor or the stator makes the alternator overheat. The voltage decreases.</td>
<td>3. Change the stator or the rotor.</td>
</tr>
</tbody>
</table>

If you are still having trouble, please contact with your nearest dealer or with our company directly if necessary.

### 5.6 Questions and doubts

If you do not understand anything or have any questions, please feel free to contact your local dealer or with our company directly. Below is a list of some information you should have ready before contacting your local dealer or us.

1. Model of diesel engine generator and engine model number.
2. Purchase date and number of generator-operating hours along with the problem that occurred.
3. State of residency
4. A detailed serving condition and time when the problem occurred.
CHAPTER 6 GENERATOR PARTS DIAGRAMS AND LISTINGS

Fig. 6.1 Exploded view of frame assembly for 4000DE and 6800DE
Table 6.1 Parts list of frame assembly for 4000DE/6800DE (refer to Fig. 6.1)

<table>
<thead>
<tr>
<th>Number</th>
<th>Part</th>
<th>Description</th>
<th>Quantity</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 M6 x 25 Bolt</td>
<td>4</td>
<td>1710625</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2 M6 flat washer</td>
<td>4</td>
<td>1710206</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 Cylindrical washer(collar)</td>
<td>4</td>
<td>17145</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4 Shock absorber</td>
<td>4</td>
<td>17143</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5 M6 nut</td>
<td>4</td>
<td>1710106</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 Engine cover</td>
<td>1</td>
<td>6800422</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7 Rubber cover</td>
<td>1</td>
<td>6800423</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8 Handle rubber cover</td>
<td>2</td>
<td>6800424</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9 Handle</td>
<td>2</td>
<td>6800425</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10 M6 x 40 bolt</td>
<td>4</td>
<td>1710640</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11 M6 nut</td>
<td>6</td>
<td>1710106</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12 M6 x 60 bolt</td>
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<td>1710660</td>
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<td>13</td>
<td>13 Handle hinge</td>
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<td>14</td>
<td>14 Battery retainer</td>
<td>1</td>
<td>6800s412</td>
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</tr>
<tr>
<td>15</td>
<td>15 M6 wing nut</td>
<td>2</td>
<td>78-1710107</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16 Tie hook bolt</td>
<td>2</td>
<td>6800s414</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17 Battery</td>
<td>1</td>
<td>MF24AH/MF36AH</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18 M8x12 bolts</td>
<td>2</td>
<td>1710812</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>19 Rubber absorber</td>
<td>1</td>
<td>4000427</td>
<td></td>
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<tr>
<td>20</td>
<td>20 Motor mount</td>
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<tr>
<td>21</td>
<td>21 Battery tray</td>
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<tr>
<td>22</td>
<td>22 M8 nut</td>
<td>1</td>
<td>1710108(also refer to 6800s224)</td>
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<td>23</td>
<td>23 Spring washer 8</td>
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<td>6800s222</td>
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<td>24</td>
<td>24 M8 x 25 Bolt</td>
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<td>1710825</td>
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<td>25</td>
<td>25 M10 nut</td>
<td>1</td>
<td>171215</td>
<td></td>
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<td>26 Spring washer 10</td>
<td>1</td>
<td>171214</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>27 Flat washer 10</td>
<td>1</td>
<td>1710210</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>28 M10 x 20 bolt</td>
<td>1</td>
<td>1711020</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>29 Vibration reducing Bracket</td>
<td>1</td>
<td>4000408/6800s408</td>
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</tr>
<tr>
<td>30</td>
<td>30 M10 nut</td>
<td>4</td>
<td>171215</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>31 Spring washer 10</td>
<td>4</td>
<td>171214</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>32 Flat washer 10</td>
<td>4</td>
<td>1710210</td>
<td></td>
</tr>
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<td>33</td>
<td>33 Rubber mounts</td>
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<td>6800s417</td>
<td></td>
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<td>34</td>
<td>34 Flat washer 10</td>
<td>4</td>
<td>1710210</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>35 Spring washer 10</td>
<td>4</td>
<td>171214</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>36 M10 nut</td>
<td>4</td>
<td>171215</td>
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</tr>
<tr>
<td>37</td>
<td>37 Axle</td>
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<td>38</td>
<td>38 Bracket</td>
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<td>4000430/6800430</td>
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<td>39</td>
<td>39 Rubber insulator</td>
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<td>4000431/6800431</td>
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<td>40 Flat washer 20</td>
<td>4</td>
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<td>41 Cotter pin 32 x 32</td>
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<td>6800s419</td>
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<td>42</td>
<td>42 Wheel</td>
<td>2</td>
<td>6800418</td>
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<td>43</td>
<td>43 Rubber leg</td>
<td>2</td>
<td>6800432</td>
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<td>44</td>
<td>44 Rubber cushion</td>
<td>2</td>
<td>6800433</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>45 M10 nut</td>
<td>10</td>
<td>171215</td>
<td></td>
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<tr>
<td>46</td>
<td>46 M10 x 15 bolt</td>
<td>8</td>
<td>1711015</td>
<td></td>
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<tr>
<td>47</td>
<td>47 M10 x 30 bolt</td>
<td>2</td>
<td>1711030</td>
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</tbody>
</table>
Fig. 6.2 Exploded view of parts list for alternator and engine assemblies of 4000 and 6800 series
Fig. 6.3 Exploded view of muffler system and frame assembly for 6800SDE and of fuel tank and air cleaner assemblies for 4000 and 6800 series.
Table 6.2 Parts list of 4000DE, 6800DE and 6800SDE (refer to Figs. 6.2 & 6.3).

<table>
<thead>
<tr>
<th>No.</th>
<th>Part No.</th>
<th>Part name</th>
<th>Qty.</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>17121</td>
<td>Drain plug</td>
<td>1</td>
</tr>
<tr>
<td>1-2</td>
<td>171211</td>
<td>Drain plug extension</td>
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</tr>
<tr>
<td>2</td>
<td>17120</td>
<td>Drain plug gasket</td>
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</tr>
<tr>
<td>3</td>
<td>78-1711702</td>
<td>Rear oil seal 30 x 45 x 8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>86-1711704</td>
<td>Rear oil seal 35 x 50 x 8</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>78-1700103</td>
<td>Engine cylinder block</td>
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</tr>
<tr>
<td></td>
<td>86-1700110</td>
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<td></td>
</tr>
<tr>
<td>4-2</td>
<td>171212</td>
<td>M10 x 50 hexagon bolt</td>
<td>4</td>
</tr>
<tr>
<td>4-3</td>
<td>171213</td>
<td>Washer(also refer to 1710210)</td>
<td>4</td>
</tr>
<tr>
<td>4-4</td>
<td>171214</td>
<td>Spring washer</td>
<td>4</td>
</tr>
<tr>
<td>4-5</td>
<td>171215</td>
<td>M10 x 12 hexagon nut</td>
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</tr>
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<td>5</td>
<td>78-17126</td>
<td>Fuel controller assembly</td>
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<td>86-1712601</td>
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<td>6</td>
<td>1711324</td>
<td>O ring for oil dipstick</td>
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<tr>
<td>7</td>
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<td>8</td>
<td>171216</td>
<td>Oil pressure sensor</td>
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<td>9</td>
<td>17123</td>
<td>Fuel pump fastening bolt (short)</td>
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<td>17122</td>
<td>Fuel pump fastening bolt (long)</td>
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<td>1719605</td>
<td>Fuel pump gasket(0.5)</td>
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<td>17159</td>
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<td>13</td>
<td>17158</td>
<td>Sealing plate</td>
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<td>Thrust piece</td>
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<td>1710636</td>
<td>Flange head hexagon bolt(GB5789-86)</td>
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<td>1710010</td>
<td>Needle bearing 7941/15</td>
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<tr>
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<td>78-1700302</td>
<td>Cylinder head bolt (short)</td>
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<tr>
<td></td>
<td>86-1700303</td>
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<tr>
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<td>78-1704802</td>
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<td>78-1704902</td>
<td>Cylinder head nut (long)</td>
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<tr>
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<td>86-1704903</td>
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<td>27</td>
<td>78-1700202</td>
<td>Cylinder head bolt (long)</td>
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<tr>
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<td>86-1700203</td>
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</tr>
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<td>78-17182</td>
<td>Oval ring gasket 5.1 x 2.5</td>
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<tr>
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<td>86-1720106</td>
<td>Oval ring gasket 5.1 x 2.6</td>
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<td>78-1704602</td>
<td>Crankcase cover gasket</td>
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<td>86-1704603</td>
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<td>78-1710003</td>
<td>Ball bearing 206(GB/T276-94)</td>
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Table 6.2 continued to next page.
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<tbody>
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<tr>
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<td>Crankcase cover</td>
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<tr>
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<td>78-1711703</td>
<td>Front oil seal 30 x 45 x10</td>
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<tr>
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<td>78-1710083</td>
<td>Flange head hexagon M8 x 33.5 bolt</td>
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<td>1710083</td>
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<td>Washer</td>
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<td>4000310 M6 x 140 flange hexagon head bolt</td>
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<td>Fuel coke assembly</td>
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<tr>
<td>309-2</td>
<td>M6 nut(GB6177-86)</td>
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<td>310</td>
<td>Control panel assembly(silent model)</td>
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<tr>
<td>311</td>
<td>Starter switch with key</td>
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<tr>
<td>312</td>
<td>Low oil warning indicator light</td>
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<tr>
<td>313</td>
<td>Power indicator light</td>
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Table 6.2 Continued from previous page.

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<tr>
<td>314</td>
<td>6800s503</td>
<td>Volt meter</td>
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<td>315</td>
<td>6800s504</td>
<td>Glow plug button</td>
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<td>316</td>
<td>6800s502</td>
<td>Glow plug indicator light</td>
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<td>317</td>
<td>6800s505</td>
<td>120V outlet</td>
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<td>6800s506</td>
<td>Dual GFI 120V outlet</td>
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<td>6800s507</td>
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<td>6800s508</td>
<td>Ground terminal</td>
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<td>6800s509</td>
<td>Four prong twist lock(120V/240V dual outlet)</td>
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<td>6800s510</td>
<td>Three prong twist lock(120V outlet)</td>
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<td>6800s511</td>
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<td>322</td>
<td>6800s512</td>
<td>DC negative terminal</td>
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<td>323</td>
<td>6800s513</td>
<td>250V 10A fuse(3mm x 15mm)</td>
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<td>6800s514</td>
<td>250V 10A fuse(5mm x 30mm)</td>
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<td>6800s515</td>
<td>Circuit breaker</td>
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<td>325</td>
<td>1710815</td>
<td>M8 x 15 bolt</td>
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<td>326</td>
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<td>6800s224</td>
<td>M8 nut(also refer to 1710108)</td>
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<td>328</td>
<td>1710612</td>
<td>M6 x 12 bolt(GB5787-86)</td>
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<td>6800s223</td>
<td>Washer</td>
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<td>6800s225</td>
<td>Muffler connection gasket</td>
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<td>331</td>
<td>6800s225</td>
<td>Ripple pipe exit gasket</td>
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<td>6800s421</td>
<td>Ripple pipe inlet gasket</td>
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<td>6800s421</td>
<td>Air filter inlet shock absorber</td>
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<td>336</td>
<td>6800107</td>
<td>M6 screw</td>
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<td>6800s232</td>
<td>Fuel line shock absorber</td>
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<td>6800s233</td>
<td>M8 x 30 bolt</td>
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<td>171003</td>
<td>M6 nut(GB6177-86)</td>
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<td>340</td>
<td>171302</td>
<td>Fuel injector retaining plate</td>
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<td>341</td>
<td>171303</td>
<td>Fuel line fitting</td>
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<td>342</td>
<td>17212</td>
<td>Fuel return hose clamp</td>
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<td>343</td>
<td>17192</td>
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<td>344</td>
<td>78-1710745</td>
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<td>345</td>
<td>78-1702100</td>
<td>Exhaust rocker arm</td>
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<td>346</td>
<td>78-1702102</td>
<td>Intake rocker arm</td>
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<td>347</td>
<td>17165</td>
<td>Valve clearance adjusting screw</td>
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<td>348</td>
<td>1706075</td>
<td>M6 x 75 special nut</td>
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<td>78-1702101</td>
<td>Rocker arm support</td>
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Table 6.2 continued to next page.
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<tr>
<th>Part No.</th>
<th>Description</th>
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<tr>
<td>350</td>
<td>78-1702106 Valve cap</td>
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<td>351</td>
<td>78-1702702 Valve clip</td>
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<td>86-1702703</td>
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<td>352</td>
<td>78-1782802 Valve spring seat</td>
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<td>86-1702803</td>
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<td>353</td>
<td>78-1702902 Valve spring</td>
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<td>86-1702903</td>
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<td>354</td>
<td>78-17136 Valve spring washer</td>
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<td>86-1713601</td>
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<td>354-1</td>
<td>78-1702004 Valve guide oil seal(between 353 &amp; 354)</td>
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<td>86-1702100</td>
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<td>1711104 Pin 4 x 8(GB119-86)</td>
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<td>358</td>
<td>78-1710955 Double ended bolt AM6 x 55(GB899-88)</td>
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<td>359</td>
<td>78-1712201 AM 6 x 42 fuel injector bolt</td>
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<td>86-171222</td>
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<td>360</td>
<td>1710920 Double ended bolt AM8 x 20(GB899-88)</td>
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<td>361</td>
<td>78-17168 Rocker arm assembly</td>
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<td>86-1716801</td>
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<td>362</td>
<td>78-1716802 Rocker arm shaft</td>
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<td>363</td>
<td>6800s516 Flat head screwdriver</td>
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<td>364</td>
<td>6800s517 Hexagon key (8/10mm)</td>
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<tr>
<td>365</td>
<td>6800s518 Hexagon key (12/14mm)</td>
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<td>366</td>
<td>6800s519 Hexagon key (17/19mm)</td>
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<tr>
<td>555-5</td>
<td>6800s520 Tool bag(optional)</td>
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</table>
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