# GENERAL INFORMATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE AND USE OF THIS MANUAL</td>
<td>3</td>
</tr>
<tr>
<td>GENERAL DESCRIPTION</td>
<td>3</td>
</tr>
<tr>
<td>ELECTRONIC ENGINE CONTROL SYSTEM</td>
<td>4</td>
</tr>
<tr>
<td>ENGINE BRAKING POWER</td>
<td>7</td>
</tr>
<tr>
<td>GENERAL SPECIFICATIONS AND ENGINE VIEWS</td>
<td>7</td>
</tr>
<tr>
<td>ENGINE MODEL AND SERIAL NUMBER</td>
<td>13</td>
</tr>
<tr>
<td>EXHAUST GAS RECIRCULATION (EGR) SYSTEM</td>
<td>14a</td>
</tr>
<tr>
<td>SAFETY INSTRUCTIONS AND PRECAUTIONS</td>
<td>15</td>
</tr>
<tr>
<td>ENGLISH TO METRIC CONVERSION</td>
<td>26</td>
</tr>
<tr>
<td>DECIMAL AND METRIC EQUIVALENTS</td>
<td>27</td>
</tr>
<tr>
<td>TORQUE SPECIFICATIONS</td>
<td>29</td>
</tr>
</tbody>
</table>
EXHAUST GAS RECIRCULATION (EGR) SYSTEM

The purpose of the Exhaust Gas Recirculation (EGR) system is to reduce engine exhaust gas emissions in accordance with EPA regulations.

The EGR system consists of:
- EGR Cooler
- EGR Control Valves
- Reed Valves
- EGR Charge Air Mixer

The MBE 4000 engines for on-highway EPA 2004 regulation applications use a cooled EGR system. Part of the exhaust gasses from the front three cylinders are routed from the exhaust manifold through the EGR cooler, past control and reed valves, and are mixed with the intake manifold charge air. The addition of cooled exhaust gasses back into the combustion airflow reduces the peak in cylinder combustion temperature. Less oxides of nitrogen (NOx) are produced at lower combustion temperatures.

The recycled exhaust gasses are cooled before engine consumption in a tube and shell engine water cooler. See Figure 11.

Figure 11  Air flow Diagram through Engine with EGR System

1. Engine
2. Intake Air
3. EGR Modulated Valve
4. Reed Valves
5. EGR Cooler
6. EGR Shutoff Valve
7. Exhaust Air
For an general view of the MBE 4000 EPA 04 engine with an EGR system, See Figure 12 for a right side view and see Figure 13 for a left side view.

Figure 12    EPA 04 Engine with EGR Components and Revised Parts (Right View)
1. EGR Gas Outlet Pipe
2. Coolant Pump
3. Thermostat Housing
4. EGR Modulated Control Valve
5. EGR Cooler
6. EGR Shutoff Valve (hidden)
7. Crankcase Breather (Hengst filter)
8. EGR Mixer

Figure 13   EPA 04 Engine with EGR Components and Revised Parts (Left View)
EGR Cooler

The EGR Cooler is equipped with a single-pass cooler. Part of the exhaust gasses from the first three cylinders are directed through the EGR shutoff valve and through the cooler and reed valves, past the EGR modulated control valve and the mixer and then back to the cylinder.

EGR Control Valves

There are two EGR valves on the MBE 4000 EGR engine — the EGR shutoff valve and the EGR modulated control valve. The EGR shutoff valve is a pneumatically driven butterfly valve, located at the inlet of the EGR cooler. It closes when the exhaust flap or turbo-brake actuates, avoiding exhaust gas flow and excessive pressure in the EGR cooler and reed valves. The EGR modulated control valve is an electronically actuated butterfly valve located after the EGR cooler and reed valves, controlled by the DDEC-ECU (formerly PLD-MR). This valve controls the exhaust gas flow for the intake manifold.

Reed Valves

The reed valves work like a check valve, allowing flow of gas only in one direction, avoiding gas back flow when the intake pressure is higher than exhaust gas pressure. As the average exhaust pressure is lower than the intake pressure, the gas flow through the reed valves is possible due to exhaust gas pressure peaks — peaks slightly higher than the intake air pressure, which occur as the engine exhaust valves open. During this peak of pressure, the reed valves open and allow gas flow to the EGR modulated valve and mixer.

EGR Mixer

The purpose of the mixer is to ensure good mixing of the cooled EGR gasses with filtered charge air. Once the exhaust gasses are cooled and have completed their cycle through the EGR system, they are released into the EGR mixer. The recycled exhaust gasses are combined with the charged air and directed to the cylinders.