Maintaining Diesel Engines for Emissions Control

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Auditing Engine Maintenance
Auditing Engine Maintenance

AUDIT TEAM

- Cross Disciplined
- Group Breakouts
- Opening & Closing meetings
- Final Report
- Mgmt, OH&S, Union

Auditing Engine Maintenance

- Roles and Responsibilities
- Operational Issues
- Training
- Tools
- Maintenance Practices
- Process Detail
- Engine Subsystems
- Housekeeping and Organization
Auditing Engine Maintenance

Process Detail
PM and Recording Systems

Housekeeping
Intake Systems

- Visual Inspection
- Check clamps and piping
- Don’t overservice on replacement

Measure Restriction
- Suction and Charge Sides
Intake Systems

TEST FOR INTEGRITY OF SYSTEM !!!

Exhaust Systems
Exhaust Systems

MEASURE

Exhaust Emissions

<table>
<thead>
<tr>
<th>EMISSION</th>
<th>CAUSE</th>
<th>TYPICAL LEVEL IN UNTREATED ATMOSPHERE</th>
<th>EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Incomplete combustion of fuel. Usually problems with fuel system (injectors, pump, etc.) or plugged intake.</td>
<td>100 - 400 ppm</td>
<td>Lethal in large doses. Causes headaches and lethargy</td>
</tr>
<tr>
<td>Nitrogen Oxides (NOx)</td>
<td>Generated in the reaction between oxygen and nitrogen under high temperature and pressure in the engine cylinder. Usually problems with timing or valve settings.</td>
<td>650 ppm</td>
<td>Creates respiratory difficulties. Partially responsible for smog.</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO2)</td>
<td>From sulfur content in fuel. Could be derived from any of the conditions described above.</td>
<td>5 - 50 ppm</td>
<td>Partly responsible for acid rain.</td>
</tr>
<tr>
<td>Hydrocarbons (HC)</td>
<td>Unburned components of fuel. Could be derived from any of the conditions described above.</td>
<td>20 - 200 ppm</td>
<td>Responsible for harsh odor and eye/throat irritation.</td>
</tr>
<tr>
<td>Diesel Particulate Matter (DPM)</td>
<td>Includes Soluble Organic Fraction (SOF)</td>
<td>5 - 100 mg/m³</td>
<td>The black, blue, and white smoke commonly seen in diesel exhaust. Suspected to be a human carcinogen.</td>
</tr>
</tbody>
</table>

UNDERSTAND

Exhaust Systems

- Nitrogen Oxides (NOx): Generated in the reaction between oxygen and nitrogen under high temperature and pressure in the engine cylinder. Usually problems with timing or valve settings. 650 ppm. Creates respiratory difficulties. Partially responsible for smog.
- Sulfur Dioxide (SO2): From sulfur content in fuel. 5 - 50 ppm. Partly responsible for acid rain.
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Fuel & Injection Systems

- Primary Fuel System (Transfer Pump)
- Filters
- Pressure
- Temperature
Fuel & Injection Systems

- Injectors / Pumps / Valves
- Air : Fuel
- Justified and Verified by....
- MEASURED EMISSIONS !!!
- Trained & Qualified Mechanics

Cooling Systems
Cooling Systems

MYTH
- Air Cooled ≠ Maintenance Free

Water Cooled Systems & Radiators
- Clean with 1” hose and degreaser
- Verify with T measurement
- Pressure Test
- Coolant Mix & Additives
- Fan / Clutch / Belts
- Shutterstats & Aux Equip
## Cooling Systems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Coolant Level</td>
<td>Low coolant level caused by loose - worn hoses, radiator cap, or damaged relief valve</td>
</tr>
<tr>
<td></td>
<td>Internally caused by cracked cylinder head, cracked block, damaged coolant hose, damaged pressure gasket.</td>
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<tr>
<td>Reduced Air Flow Through Radiator</td>
<td>Plugged radiator core</td>
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<td></td>
<td>Damaged by heat lags</td>
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<tr>
<td></td>
<td>Low fan speed due to idle settings</td>
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<td></td>
<td>Fan damaged or incorrectly installed</td>
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<tr>
<td></td>
<td>Loose belts, worn pulleys</td>
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<tr>
<td></td>
<td>Damaged fan blade, loose blade</td>
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<td></td>
<td>Insufficient flow in radiator due to insufficient flow</td>
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<td></td>
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<tr>
<td>Low Cooling System Pressure</td>
<td>External / internal leaks</td>
</tr>
<tr>
<td></td>
<td>Defective radiator cap gasket</td>
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<tr>
<td></td>
<td>Defective cooling system pressure relief valve</td>
</tr>
<tr>
<td></td>
<td>Defective radiator cap gasket</td>
</tr>
<tr>
<td>Coolant Overflow</td>
<td>Air in cooling system due to incorrect fill</td>
</tr>
<tr>
<td></td>
<td>Combustion gases in cooling system</td>
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<tr>
<td></td>
<td>Coolant in system tank is overfilled or low level</td>
</tr>
<tr>
<td>Insufficient Coolant Flow</td>
<td>Insufficient coolant</td>
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<td></td>
<td>Insufficient coolant</td>
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<td></td>
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<tr>
<td>High Intake Air Temperature or Restriction</td>
<td>High intake air temperature</td>
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<tr>
<td>Low Heat Transfer</td>
<td>Insufficient heat transfer</td>
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<td></td>
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<tr>
<td>Intercooler Restriction</td>
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## Fuel Quality & Handling
Fuel Quality & Handling

- Storage Systems
- Verify and Follow Up
- Eliminate Contamination Sources

Fuel Quality & Handling

Ultimate Mine Diesel Fuel

QUALITY !!
- 500 ppm Sulfur max.
- 50 ppm Sulfur best

QUALITY !
- SULPHUR CONTENT - GUARANTEED < 50 ppm
- SUPERIOR L-10 PERFORMANCE (PREMIUM ADDITIVE PACKAGE)
- CETANE NUMBER - UNTIL EXPANSION & UPGRADE COMPLETE >43
- AFTER EXPANSION & UPGRADE COMPLETE >48
- AROMATICS - WE WILL DETERMINE THROUGH TESTING AND PROVIDE ACTUAL LEVEL AS REQUIRED. THE AROMATIC LEVEL WILL BE LOWER THAN TYPICAL INDUSTRY LEVELS.
- OTHERWISE MEET GENERAL STANDARDS BOARD (CGSB) TYPE "A" SPECIFICATIONS (90% POINT~</=290°C, FLASH~</=52°C, LUBRICITY~ ETC.). PLEASE SEE CGSB TYPE "A" SPECIFICATION ATTACHED COMPLETE WITH THE ACTUAL PRODUCT SPECIFICATIONS.
Lubrication

- Lube Oil Grade: CH-4
- Filters: Quality vs Cost
- Oil Analysis Program
- Details: Oil Level
Training

† Include operators & mechanics - select carefully
† Small groups - 4 to 6 people
† Balance of theory and practical
† Graduated stages - focus on systems
† Done by manufacturer reps and suppliers - technically qualified

Tools
Tools

Exhaust Emissions - UGAS

Intake Testing
Tools

Intake & Exhaust
• Pressure / Restriction

Cooling Systems
• IR Temp Gun
Tools

Electronic Engines
  • Detroit Diesel Diagnostic Link

Contact Info

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www.dieselnet.com

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