Maintaining Diesel Engines for Emissions Control

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Auditing Engine Maintenance

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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

Auditing Engine Maintenance

Housekeeping

Intake Systems

Intake Systems

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

- Measure Restriction
- Suction and Charge Sides

Intake Systems

TEST FOR INTEGRTIY OF SYSTEM !!!

Exhaust Systems

Exhaust Systems

MEASURE

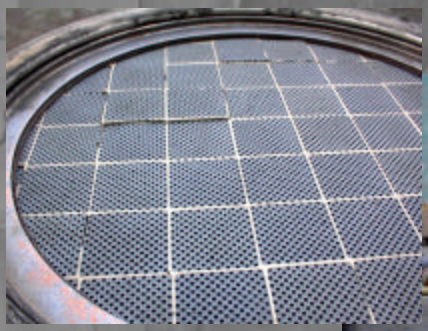
Exhaust Systems

UNDERSTAND

EMISSION	CAUSE	TYPICAL LEVEL IN UNTREATED EXHAUST	EFFECTS
Carbon Monoxide (CO)	Product of incomplete combustion of fuel. Usually problems with fuel system (injectors, pump, etc.) or plugged intake.	100 - 400 ppm	Lethal in large doses. Causes headaches and lethargy
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. Partly responsible for smog.
Sulfur Dioxide (SO2)	From sulfur content in fuel.	5 - 50 ppm	Partly responsible for acid rain.
Hydrocarbons (HC)	Unburned components of fuel. Could be derived from any of the conditions described above.	20 - 200 ppm	Responsible for harsh odor and eye / throat irritation.
Diesel Particulate Matter (DPM) Incl. Soluble Organic Fraction (SOF)	DPM is a product of incomplete combustion of fuel. Composed of the solid, visible particulate suspended in exhaust gas SOF: component of DPM hydrocarbons and their derivatives adsorbed on the surface on inorganic carbon (soot) particles. SOF may constitute 30% and more of the total DPM.	5 - 100 mg/m3	The black, blue and white smoke commonly seen in diesel exhaust. Commonly referred to as soot. Suspected to be a human carcinogen.

Exhaust Systems

INSPECT & SERVICE



Exhaust Systems

INSPECT & SERVICE

Fuel & Injection Systems

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

Cooling Systems

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

PROBLEM	CAUSE
Low Coolant Level	External leaks caused by loose / worn hoses, radiator cap, or defective relief valve Internal leaks caused be cracked cylinder head, cracked block, loose heads, damaged cooler core, damaged aftercooler, damaged gaskets
Reduced Air Flow Through Radiator	Plugged radiator core Damaged or bent fins Low fan speed due to idle settings Fan damaged or incorrectly installed Loose fan belts, worn pulleys Damaged fan shroud, incorrect fan Incorrect fan blade / shroud position – 50% projection Excessive fan blade / shroud clearance – 0.38" max Closed shutters Fluid coupling or clutch not engaged
Low Cooling System Pressure	External / Internal leaks Defective radiator cap gasket Defective cooling system pressure relief valve Defective radiator top tank neck Defective pressure gauge
Coolant Overflow	Air in cooling system due to incorrect system fill Combustion gases in cooling system Steam in system due to overload or low level
Insufficient Coolant Flow	Stuck thermostat Absence of thermostat Low engine speed – High idle Loose or eroded water pump impeller Radiator plugged internally
High Intake Air Temperature or Restriction	High ambient air temperature Plugged openings in screens for engine compartment with a blower fan Dirty aftercooler core Plugged air cleaner Damaged or carbon packed turbocharger
Low Heat Transfer	Insufficient flow through heat exchanger Hot air for radiator due to overheating hydraulic oil cooler Scale on cylinder liners or cylinder head High ambient air temperatures with a marginally sized radiator
Exhaust Restriction	Plugged air cleaner Damaged turbocharger Restriction in exhaust pipes Plugged aftertreatment device Excessive elbows, piping, etc.

Fuel Quality & Handling

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- 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

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

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
1
ST8-B
INTAKE TEST
3
2

Tools

Exhaust Emissions - UGAS

Tools

Intake Testing

Tools

Intake & Exhaust
- **Pressure / Restriction**

Tools

Cooling Systems
- **IR Temp Gun**

Tools

Electronic Engines

- **Detroit Diesel Diagnostic Link**

Contact Info

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