Preventive Maintenance

BY **STEVE SCOTT**

"An ounce of prevention is worth a pound of cure."
— Benjamin Franklin

It's doubtful that Benjamin Franklin was thinking about a combustion engine when he coined that phase, but it does apply. Considering that a diesel engine could weigh several hundred or thousand pounds, that could add up to a fair amount of prevention. Preventive and proactive maintenance can save you money, extend the life of your equipment, and you can plan it in advance. Most likely everyone has heard the old comedy line, "Doc, it hurts when I do that" — but since engines can't talk, they may be telling you something is wrong in a different manner.

With the variations in diesel engine designs running in equipment today, it is impossible to make a complete list of the symptoms and causes you may encounter. This article will provide you with a general list of possible causes related to some of the more common conditions you may encounter. Of course, indicators and causes will vary between engine models, applications and designs.

As you review the list, you will most likely be able to add and delete information based from your own experiences.

(continued)

Problem Indicators and Possible Causes (not listed in order of probability)

Excess black smoke during full load (un-burnt fuel)

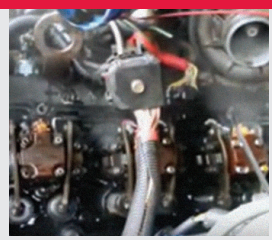
- Fuel ratio setting
- Intake or exhaust restrictions
- Lugging
- Over fueling
- Over loading
- Faulty injector
- Failing turbocharger

Blue Smoke (oil consumption)

- General engine wear due to hours of operation
- Worn piston rings and liners
- Worn valvetrain components
- Leaking turbocharger seals

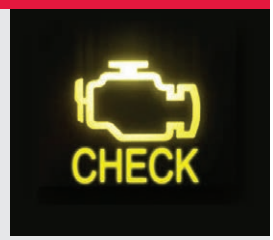
White Smoke (water)

- Cold mode
- Leaking head gasket
- Cracked cylinder head or liner
- Quality of fuel



Quality of Fuel

- Lack of power
- Intake or exhaust restrictions (plugged air cleaner?)
- Fuel restriction
- Faulty fuel components
- Failing transmission or torque convertor



Hard Starting

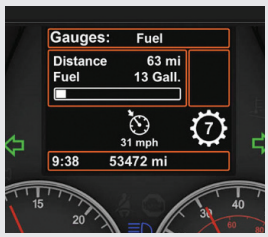
- Worn fuel components
- Fuel quality
- Slow cranking speed

Unusual Noises

- General engine wear due to hours of operation
- Faulty fuel nozzle or injectors
- Worn engine bearings and bushings
- Loose valve lash
- Failing turbocharger

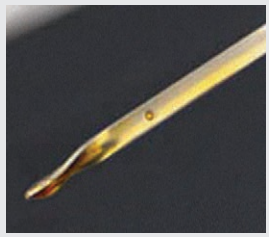
Overheating

- Plugged radiator
- Worn or loose belts
- Low coolant level
- Temperature Regulators
- Failing water pump
- Operating conditions



Increased Fuel Consumption

- Fuel leaks
- Intake or exhaust restriction (plugged air cleaner?)
- Turbocharger
- Nozzles or injectors
- Operator



Increased Oil Consumption

- External leaks
- Failing air compressor
- Too high oil level
- General engine wear due to hours of operation
- Worn piston rings and liners
- Worn valve train components
- Leaking turbocharger seals
- Overloading
- Prolonged idling

PREVENTIVE MAINTENANCE

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Engines equipped with ECMs (electronic control modules) and the variety of sensors that support those systems can affect many of the indicators listed. Reviewing and understanding those systems and the related fault and error codes can save a tremendous amount of time and expense. Beyond the symptoms and external signs of a problem, the preventative strategy using fluid sampling can be a reliable source of insight on what is happening inside the engine. Oil sampling can help determine trend lines and identify when various components are beginning to fail. These relatively inexpensive tests are like blood tests, but for your engine.

Oil analyses can identify metal from wear, condition of the oil, and any contaminants in the system.

- **Element Analysis** — amount of element, type of elements, contamination.
- **Oil Condition** — viscosity, ability to neutralize acids, service life of the oil (extend or shorten oil changes).
- **Contamination Analysis** — presence of water or coolant; presence of fuel; metals; dirt, soot, sulfur, etc.

The most important part of an analysis lab report is generally found in the lab's comments and recommended actions. The report will also include detailed micron size and particle counts, if this information interests you. Element analysis will help identify the source of various metals within the engine.

Depending on the applications and manufacturer, some examples of this are:

- **Aluminum (Al):** pistons, blowers, oil coolers, some bushings
- **Chrome (Cr):** rings, roller and taper bearings, valves, various liners
- **Copper (Cu):** oil cooler, connecting rod bushings, camshaft bushings, valvetrain bushings
- **Iron (Fe):** cylinder liners or block, gears, crankshaft or camshafts, oil pump, valvetrain, rings
- **Silicon (Si):** dirt, additives, coolant
- **Tin (Sn):** overlay from pistons, bearings, and bushings; oil coolers

Cooling system maintenance and analysis is just as important as oil analysis. Studies have reported that approximately 40% of all premature engine failures are the result of cooling system insufficiencies.

It is the engine owner's decision as to what level of maintenance program they choose to adopt — proactive, preventative, or the far more expensive post-failure program.

Some opt to use methods that test for potential issues, while some watch and listen for them. Yet, others will wait until the engine shows them there was a problem after it is too late… "Doc, it hurts when I do that."■

Steve Scott joined the service department at IPD in 1982, working with parts, service and sales for a variety of equipment, diesel, and natural gas engines. Since 2004, he has been the director of product development and technical support for IPD. For more information, email sscott@ipdparts.com.