

FOCUS ON TIER III ENGINE MAINTENANCE

CLEANLINESS IS CRITICAL FUEL SYSTEM

Before we get too far into this topic, this is probably the point at which you hand the magazine over to your Equipment Manager, Service Manager, or Service Technician, or at the least, share this vital technical information with them.

While Tier III Engines have proven to be quite reliable and relatively low maintenance, there are a few key maintenance practices that will extend the life of your engine and allow it to run at maximum efficiency. Fuel System cleanliness is critical.

Today's low-emission engines require more attention to cleanliness than the engines of years past. Diesel fuel-injection systems can only work as designed when the fuel pressure is at a high level. Many of the systems work at a pressure of over 25,000 psi. If the pressures are not this high,

the systems simply cannot keep the burn pattern in a controlled state to maintain low emissions levels and not contaminate the environment. To achieve these pressures, the fuel systems tolerances between components have been tightened. So contaminants must be controlled to keep these parts working. Further, not maintaining the fuel systems may result in damage to the engine not covered by warranty, or may void the engine warranty entirely.

Regular maintenance procedures evolve to prevent contamination. In the past, many users would pre-fill the fuel filters to avoid hard starting after a fuel-filter change. Unfortunately, the fuel used to pre-fill the filter is too contaminated and was not being filtered before reaching critical fuel system parts. Today the filter must be kept clean

and installed without pre-filling. Refer to your equipment manual for proper procedures, or use an electric fuel pump to fill the filter with filtered fuel.

While fuel system maintenance in the past may have been conducted by your favorite or on-site mechanic, today's engines require a trained and qualified service technician. What should you expect when trained technician provides fuel-system maintenance?

First, provide a sterile work environment, free of airborne contaminants. The internal drillings of a modern injector are often extremely small and very susceptible to plugging from contamination. Plugging of an injector on Tier III / IV diesel engines' fuel systems can cause a continuous fueling event (or dribbling) that may result in engine damage, and emission troubles.





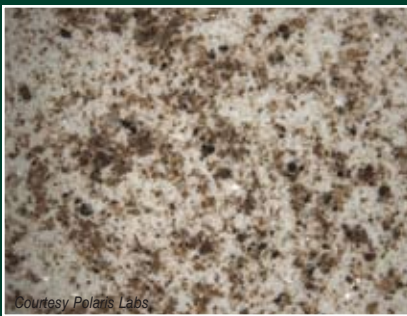
Courtesy Polaris Labs

The silver, sliver-like particle measures about 200 microns and is evidence of sliding wear — particles have been magnified 100x.



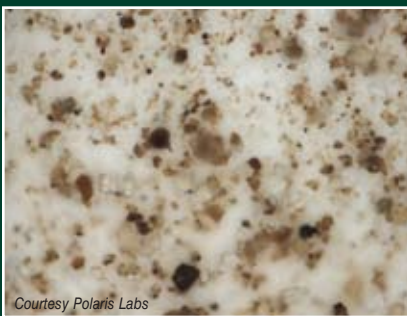
Courtesy Polaris Labs

The black particles measure about 15-20 microns — the lighter-colored, fibrous-looking particles are about 30-40 microns (magnified 500x)



Courtesy Polaris Labs

The black particles measure about 30-40 microns (magnified 100x).



Courtesy Polaris Labs

The black particles measure about 15 microns — the lighter-colored ones are about 5-10 microns (magnified 500x).

Micropatch photographs — digital images of the residue left behind after filtering a fuel sample through a 0.8 micron absolute filter. As a point of reference, a cross section of a human hair measures about 40 microns in size.

*Sample Fuel Contaminant Images
courtesy Polaris Labs*

Tier III fuel injection systems operate at very high pressures. High pressure fuel can convert simple particles of dirt and rust into a highly abrasive contaminant that can damage the high pressure pumping components and fuel injectors. Many modern injectors are nonserviceable, with the exception of a few parts, and some injectors are completely nonserviceable.

Secondly, use electrical contact cleaner or a spray parts cleaner rather than compressed air, to wash dirt and debris away from fuel system fittings. Diesel fuel on exposed fuel system parts attracts airborne contaminants. Usually the fitting, even with the most minimal amount of collected fuel at the fitting area, will have a dirt and dust residue at the fitting where the work is being done.

The word micron is the abbreviation for a micrometer, or one millionth of a meter. The micron rating is the size of the smallest particles that will be captured by the filter media. To put it in perspective, a human hair is 0.003 mm [3/1000 in] in diameter. One micron measures 0.00004 mm [4/100,000 in].

There are many engines that require secondary fuel filtration at the 3-micron level. The contaminants needing to be

removed are far smaller than can be seen with the human eye, a magnifying glass, or even a low-powered microscope.

The tools used for fuel system troubleshooting and repair are often overlooked as a potential source of contamination. Like fuel-system parts, if service tools are coated with oil or fuel they are much like a magnet for airborne contaminants. Be sure fuel-system tools are clean before use, especially if they are shared tools.

Keeping a fuel system clean is easier than cleaning up and repairing a contaminated system. Once a fuel system is contaminated, it is nearly impossible to know if you have successfully removed contaminants. To assist in avoiding entry of contaminants, cap and plug fuel lines, fittings, and ports whenever the fuel system is opened, even if the repair is only going to take a short time to complete. Airborne contaminants can come from the next bay, from bumping the engine housing, or from dirty clothing.

Carefully adhering to these steps will extend the life of the diesel engine in your Kawasaki loader, resulting in a cleaner, clearer, environment for many generations to come.

