

DIESEL ENGINE EXPLANATIONS

Bearings = Lead + Tin (Copper/Aluminum)

All rotating internal engine parts have lubricated bearings. **Lead** and **Tin** make up the surface of these bearings and when **Lead** and **Tin** are found together in oil, it indicates the beginning of bearing wear. If **Copper** or **Aluminum** is detected with the **Lead** and **Tin**, that indicates an increase in bearing wear and may cause drops in oil pressure and an abnormal knocking sound. Bearing wear can lead to a catastrophic engine failure and engine replacement.

Bushings = Lead + Iron

Bushings tend to be made of **Lead** and **Iron**. Bushings can be found in oil pump drives, piston pins, gear drives, etc. **Iron** plus **Lead** when found in the oil point toward bushing wear. It is rare that bushings fail by themselves; bushing failures usually accompany other problems such as sludge build up, oil pressure drops, or bearing wear.

Camshaft/Valve Train = Iron

The camshaft, timing chains/gears, push rods, and rockers are all parts of the valve train system, which open and close the valves that let the air into the engine and let exhaust escape. So when there is high **Iron** *only* in the oil, it most likely tells you that there are one or more parts of the valve train that need to be serviced. In some overhead cam engines, **Aluminum** with **Iron** can indicate cam bearing wear.

Crankshaft = Iron + Lead + Tin + (Copper / Aluminum)

Just about every moving part in the engine is driven by the crankshaft. It is the largest moving part in an engine and it is critical that it is properly lubricated. The crankshaft spins on bearings and attached to it are the connecting rods and pistons. Crankshaft wear is normally caused by other issues; bearing wear, dirt, sludge or low oil pressure. When **Lead** and **Tin**, along with **Copper** or **Aluminum**, plus **Iron** are in the oil, this indicates crankshaft wear. Often an *abnormal deep* knocking can be heard.

Cylinder = Iron + Chrome and/or Aluminum

Inside the engine block are precisely machined cylinder liners. These cylinder liners are what the pistons slide up and down in and the piston rings act as a seal for the fuel mixture. **Chrome** from piston rings and **Aluminum** from pistons are normally found with **Iron** from the cylinders. Incoming dirt, sludge or overheating can cause cylinder wear.

Piston = Aluminum + Fuel or Dirt

Pistons are primarily made up of **Aluminum**. They are what compress the fuel and air mixture as they slide up and down in the engine cylinders to make power. Piston wear is most commonly caused by abrasive dirt found in oil or from an engine being overheated. Too much unburned fuel can also wash the protective film of oil off of the pistons causing piston wear.

Piston Rings = Chrome + Fuel or Dirt

Piston rings serve many purposes in an engine; they act as a seal to keep the compressed fuel and air from escaping around the pistons and they also keep the crankcase oil from being burned. Piston ring wear, detected early by **Chrome** in the oil, is most commonly caused by incoming abrasive dirt or a build-up of carbon causing them to stick. **Fuel** may be found in the oil when rings are worn or stuck. Poor performance and oil consumption along with smoking will result.

Engine Block/Head/Intake Manifold = Antifreeze or Potassium/Sodium

Potassium and **sodium** and sometimes **Silicon** are by-products of burned antifreeze. If antifreeze gets into the combustion chamber, the water and antifreeze gets burned off and goes out the exhaust pipe, leaving **Potassium** and **Sodium** as a telltale sign of a problem. **Potassium** and **Sodium** can gain entrance through bad intake or head gaskets, cracked heads or cylinder liners/seals. Catching this problem early can save the high cost of engine replacement. (*Note: If a recent repair has been done, the amount of contamination should go down or get less with each oil change. If the contamination continues to rise during follow-up testing, then you should see your service center for a more thorough inspection.*)