

**LUBE**

# TECHNI-GRAM



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## **HIGH COPPER LEVELS IN USED OIL ANALYSIS**

Occasionally I receive questions from the field regarding unusually high copper levels showing up in used oil analysis reports. A typical question may be phrased, “what are the allowable wear limit values for copper?”

For years, major engine and equipment manufacturers...especially Caterpillar...have stated that, generally, high or unexplained rises in copper levels should not raise undue alarm.

Fundamentally, the problems associated with interpreting used oil sample data showing elevated copper readings stem from the fact that there are several potential sources of the measured readings that must be considered in evaluating a sample. Copper can come from:

- Actual wear of copper or bronze components within the compartment
- The oils formulation/additive package or any supplemental after-market additives that may have been added.
- A chemical reaction between the oil and copper or bronze components within the compartment (not a failure).

Since High Copper Readings can be present in the oil from Non-Failure Sources, it has long been recommended that the interpreter of these results NOT suggest a repair action on the basis of copper readings ALONE. Copper readings, in conjunction with other test results, can be an indicator of real system distress, however, especially when the readings are trended over several samples from the same compartment.

Most engine and equipment manufacturers agree that high copper levels in engine oil samples are quite common. Some are due to the usual causes...condensate, coolant leaks, fuel dilution, rocker arm bushing wear, thrust washer wear, etc. Others are from anti-seize compounds used in the manufacturing or rebuilding process. These compounds are used on rod bolts, pre-chamber threads, and anywhere else an assembler may see fit to use them. It is not uncommon that an amount much greater than necessary is used, which may take 1,000 operating hours or more to dissolve in the oil and be removed. Additionally, some additive packages in certain new oils or after-market additives may contain as much as 120+ PPM of copper before being used (SWEPCO's lubricant formulations contain no copper).



*... to keep it running*

It is generally agreed that the leading source of copper readings in oil samples is from leaching (chemical transferring) of copper into the oil from copper or bronze components within a compartment. Heat and certain oil additives may act as catalysts or accelerate this leaching process. This is particularly noticeable in engines and transmissions, where the hot oil passes through the copper tubes in the cooler core. Reputable used oil analysis laboratories will generally acknowledge the copper level is higher than normal industry expectations for a diesel engine, but rarely will the maintenance recommendation call for an oil drain. Copper is a soft, malleable metal. It is not abrasive and does not cause wear, which is generally evidenced by the lack of any unusual wear levels from other “hard” metals such as iron, aluminum, chromium, etc. Once again, high copper readings, with no other indications of system distress or abnormal wear, do not necessarily indicate a pending problem. If copper goes up by itself, it is probably being chemically generated from the oil cooler cores within a particular system, i.e., copper is being “leached” out of the cooling cores. Disassembly, or initiating a repair order, **SHOULD NOT BE DONE ON THE BASIS OF COPPER READINGS ALONE.**

In summary, the value of used oil analysis comes from establishing “trends” on individual equipment units. By establishing a trend analysis on each particular piece of equipment, sudden, dramatic deviations from the established trend line can be an indication of problems developing, or a signal that the oil may have reached the end of its useful life. High copper alone is not cause to initiate repair, until other additional indications confirm that a problem exists, such as increase of other wear metals or positive glycol. A high copper reading should, however, initiate further investigation and closer watch of the components/equipment in question.