

## Copper Anyone?

Elevated levels of engine wear metals in oil analysis results is cause for concern and should be investigated. Copper is one of these metals that we frequently see, but take little action on. The main reason for this was the introduction of copper tubes in oil coolers some time ago. While that assumption is usually correct when we see elevated readings, we should not become complacent about high copper readings.

Elevated copper readings can be explained by one or more of the following:

- During early operation of new coolers, copper leaches off tubes and is picked up by the oil. There is no base line or uniformity and copper levels can go as high as 1,000 ppm depending upon manufacturing. For example, Cat C-11 & C-13 coolers are manufactured differently than C-15 & C-16 engines. Looking at a broad base of oil sampling, the C-11 & C-13 leaching levels tend to be higher than C-15 & C-16. The leaching will persist until a protective coating forms to stop the reaction, which normally takes place between the second and fourth oil changes for new coolers.
- A different oil formulation can cause leaching because of chemistry changes made necessary by API categories. For example, when switching from CI-4 to CJ-4 oils it would be normal to see an increase in copper for equipment with older engines. It should be monitored and will usually decrease after a few oil changes.
- Elevated copper could be a sign that the oil has been in use too long and has become corrosive. Extending drain intervals can lower operating costs and is becoming an industry standard, but engines should be serviced at the designated drain intervals to avoid over extension of the oil.
- Copper coolers develop expansion memory from normal operation. If water or oil temperature exceeds the recommended level for the engine design, the cooler can expand and create leaching. For example, a dirty radiator or malfunctioning thermostat can cause elevated copper wear metal readings.

When determining the source of elevated copper readings you should:

1. Know your fleet. Not all oil coolers have copper cores and you need to be aware of which engines in your fleet have copper cores. Copper in an engine with a steel cooler core requires action.
2. Review sodium and potassium numbers. An increase in both of these two numbers identifies the presence of antifreeze and action is needed.
3. Revisit bullet points outlined above. Do any of these points match unit with high copper?
4. Interview the driver/operator if possible. Is engine making new sounds or operating differently?
5. Review maintenance records and check the oil for copper flakes that are visible to the naked eye. If copper is visible, this could be a wear metal problem. A few common places that copper is used in engines include the turbo, camshaft follower, and gear train bearing.

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