POSITION PAPER

Setting Contamination Flagging Limits

Fluid analysis looks at three major categories of fluid and equipment health: wear metals, contamination, and fluid properties. Wear metals get a lot of focus because they are a good indication of the equipment's health at the time of sampling, but it is equally important to understand the contaminants present in fluid because controlling contamination levels will allow for optimal equipment and fluid life.

Dirt

Dirt (silica) is one of the most common lubricant contaminants. It is especially detrimental to equipment due to its abrasiveness. Over time a small amount of dirt can cause quite a bit of component wear.

Silicon limits are set based on component type. Gear systems can tolerate higher levels of dirt before significant damage is done. Dirt contamination is more critical in engines, hydraulics, turbines, and compressors and can quickly cause costly damage. Our limits are derived from statistics as well as OEM and industry agreed-upon levels.

Severity 0	<20
Severity 1	20
Severity 2	30
Severity 3	60
Severity 4	100

General dirt flagging limits in ppm

Coolant

Coolant in oil (seen as sodium and potassium in our metals test) is primarily a concern for engines. The presence of coolant can corrode soft metals (primarily bearings) and can eventually lead to costly equipment repair. It can also have an effect on the lubricant viscosity by thickening oil, which leads to boundary wear conditions.

It is important to be aware of coolant contamination at low levels so plans can be made for future maintenance. Most coolant leaks cannot be detected through normal diagnostics until the combined level of sodium and potassium is 400-500 ppm. We recommend investigating the source of the leak and correcting the issue as soon as it reaches a detectable level to prevent damage to other components such as main/rod bearings.

Soot

Soot is a normal byproduct of the combustion process in diesel engines and is present at some level in all in-service diesel engine oil. Diesel engine oils are formulated with dispersant additives that prevent the soot from agglomerating into large particles and keep them in circulation so that they can be filtered out of the oil. Excessive blow-by, exhaust system

restrictions, and poor timing can lead to harmful levels of soot in the lubricant. Since soot particles are abrasive in nature, they will cause engine wear if not controlled.

We use OEM recommendations to determine when to recommend investigating the cause of high soot. After a while, the lubricating oil can no longer effectively handle the soot. Most equipment OEMs list 5% as the warning limit for soot. When these limits are reached, a recommendation will be given to change the lubricant and check for the cause of the high soot.

Fuel Dilution

Fuel dilution is another common source of contamination in unleaded gasoline and diesel engine oils. It is normal to see low levels of fuel in engine oils as a byproduct of the combustion/ignition process. When fuel levels start to exceed 1%, the lubricant's viscosity will begin to decrease. As percent of fuel in oil increases, the lubricant's ability to maintain a full fluid film and protect against boundary wear is diminished. Fuel in oil will also dilute the additives, which could lead to other wear and performance issues.

Some engines are more prone to high fuel dilution, but this does not mean the fuel will not harm the engine. We base limits for fuel dilution on equipment OEM recommendations.

Particle Count

Particle count is a useful test for determining fluid and system cleanliness in filtered systems such as hydraulics, turbines, compressors, auto/power shift transmissions, recirculation systems, and filtered gear systems with a fluid viscosity of less than ISO 320. Particle count testing measures all particles that have accumulated in a system, which may include metallic and non-metallic particulate, dirt, fibers, water, biological growth, etc.

We use several key pieces of information to evaluate particle count levels.

1. **Filter micron rating** – The filter micron rating is the most critical piece of information for particle count evaluation because it is a direct indication of system clearances and equipment criticality.
2. **Application** – The application the equipment is used in also affects particle count flagging. Equipment used in industrial and mining applications typically has tighter system clearances, meaning the lubricants must maintain high levels of cleanliness to prevent component wear.
3. **Component type** – If the filter micron rating is not provided, assumptions about the clearances in the equipment and cleanliness goals will be made based on the component type listed.

Water

Water contamination is one of the most detrimental contaminants in a lubricating system. Water oxidizes metal, increases friction, and effects lubricant properties. While water ingression can be harmful to any lubricating system, it is more critical in some components than others. Because of this, our water flagging limits are largely defined by the component type. General limits are listed below, but the fluid and equipment OEMs should be consulted for these limits.

General water flagging limits in ppm

	Engines	Gear systems	Hydraulic systems	Transmissions	Refrigeration Compressors
Severity 0	<1000	< 1000	< 500	<1000	<150
Severity 1	1000	1000	500	1000	150
Severity 2	2000	2000	750	1500	300
Severity 3	4000	4000	1000	2000	500
Severity 4	5000	5000	5000	4000	1000

Contamination can come in many varieties, and each has its own cause, effect, and solution. Therefore, it is no surprise each has its own flagging limit, and that limit can further depend on the type and application of the equipment being tested. Our Data Analysts will be happy to discuss our recommendations and the contamination found in the test results. .