The Oil Report

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"Oil the News That's Fit to Print!"

Which Oil is Best? *Really* the Best?

When the friendly folks at Paradise Garage got tired of the different oil companies all declaring their oil was the best, they decided to create a test and find out for themselves. The test works like this: They take a fill of oil and run it as long as they can, having the oil analyzed every 1000 miles to gauge the condition of the oil and the engine. When things start to look ugly, they change it out.

BLACKSTONE LABORATORIES

The test started with Mobil 1, and they just pulled this fill out of the engine after a whopping 18,000 miles. Next in line is Amsoil, then Red Line, then Royal Purple. To learn more and see the results of the test so far, visit http://oilstudy.spacebears.com **Disclaimer!** They are using Blackstone for their testing lab. But we didn't even ask them to! To see the laboratory comparison they conducted before beginning the test, click here: http://neptune.spacebears.com/cars/stories/labtest.html

Spotlight on... Insolubles

by Jim Stark

Once upon a time I lived in primitive conditions as a soldier in a war zone. We had few amenities, eating our three daily meals from a can. The morning coffee routine wasn't very refined, either. The cooks worked in a tent. They heated water for coffee in large 15-gallon pans over a gasoline-fired stove. To make coffee they simply dumped tins of ground coffee beans into the boiling water, and after it steeped for a while, the water turned brown. When it appeared to be the right color, the heat was turned down and the churning grounds—at least most of them—settled to the bottom. If you were early when you passed through the chow line, you got a top-of-the-brew serving that wasn't bad. If you were late and your cuppa joe came from somewhere near the bottom, you could chew it.

We enjoyed the coffee grounds in our coffee as much as your engine enjoys insoluble materials in its oil. These days, there's usually only one reason I find grounds in my coffee: the coffee filter failed for one reason or another. Usually, one or more of the filter pleats has laid down, letting grounds overflow the rim. But the insolubles in your engine's oil are not quite as simple as the grounds in my Mr. Coffee machine. There are many reasons that insolubles form in a gas or diesel engine oil sample.

What are Insolubles?

Insolubles are the total solids we find in an oil sample. Insolubles are often caused by oxidation, which is a natural process that occurs when oil is exposed to heat or oxygen (in the air). Oxidation leaves free carbon in the oil when the oxygen molecules combine with hydrogen. Virgin oil usually doesn't have any insoluble materials in it. When it occasionally does, the most we normally find is a trace level. The insolubles in virgin oil are from the normal oxidation process of the oil. At least some of the insolubles in the oil samples we analyze are free carbon particles, which are hard particles that can damage sensitive, close tolerance parts like friction bearings. Keeping insolubles within the normal range is important for anyone wanting to run extended oil change intervals, but it's also important to anyone wanting to get the longest life possible from their engines.

Measuring Insolubles

There are various methods of measuring insolubles in oils. One way is to draw the oil through a very fine filter (½ micron) and then weigh the filter. The filter's weight gain is reported as a percentage of insoluble

materials by weight, compared to the weight of the sample that was drawn through the filter. Another measuring method rates the darkness of the filter patch compared to a standard.

The insolubles test we use at Blackstone is a centrifuge method. A measured volume of oil is mixed with a heated solvent, agitated, and spun at high speed. Insoluble materials collect at the bottom of a tapered glass tube and can then be measured as a percentage of the sample by volume.

The insolubles test is a good measure of how fast the oil is oxidizing and receiving contaminants from blow-by or other engine systems, and how effectively the system's oil filtration is functioning. Any contaminant in the oil will accelerate its tendency to oxidize, so the insolubles test is a good crosscheck when we suspect a contaminant like gas, moisture, or coolant. Excessive metals in an oil sample will also increase the oxidation tendency. So will frequent and/or extreme heat cycles. Stop-and go-driving is harder on engine oils (and creates more insolubles) than highway driving, because the engine experiences more heat cycles.

What Causes High Insolubles?

We like to see insolubles for gas engines at or below about 0.5% or 0.6%, depending on the type of engine. Some diesel engines are cleaner than others so the normal range may run from 0.5% to 0.8%. As engines age insolubles in the oil tend to increase. You may think, judging from the appearance of a used diesel engine oil, the insolubles would be unbearably high. Actually, the blackness of these samples is from fuel soot, which is clearly distinguishable from, but also contributes to, insolubles. Fuel system and combustion problems will cause excessive soot. If we detect excessive soot in your (diesel) oil sample, we will mention it in the comment section.

If we found no contamination (soot, coolant, etc.) in your oil and your oil change intervals are normal, we often mention a problem at oil filtration as a possible cause of high insolubles. The oil filter could be inferior. Or, it's possible the oil filter bypass valve relived if the filter was becoming restricted. The filter system bypass may also open upon cold starts when the oil is too thick to pass through the filter media, which may be partially restricted. Once the bypass relieves, the filter is effectively out of the system. Insolubles may also be forming because your oil use interval is too long for the operating environment of the engine, and your oil filtration system can't keep up.

Insolubles are just one of the tests we provide to determine the condition of your diesel and gas engines and used oils. It's an important test that helps us gauge the condition of your oil and engine, and helps keep you driving happily for many miles to come!

Report of the Month

See if you can figure out what caused the high insolubles in this Ford 2.0L engine before reading the caption below.

(To learn where the various elements might be coming from, click here.)

MI/HR ON OIL	3114	UNIT/ LOCATION AVERAGES	3510	3462			UNIVERSAL AVERAGES
MI/HR ON UNIT	73,459		70,345	66,835			
SAMPLE DATE	09/12/03		06/03/03	04/15/03			
ALUMINUM	3	5	**5**	4			11
CHROMIUM	1	1	1	1			2

Elements in Parts Per Million

IRON	7	20	**20**	**32**			33
COPPER	2	6	5	6			3
LEAD	2	2	**2**	**2**			7
TIN	2	2	2	1			1
MOLYBDENUM	32	18	23	0			18
NICKEL	1	1	1	1			1
POTASSIUM	247	2	3	2			1
BORON	21	8	1	1			8
SILICON	10	8	8	7			8
SODIUM	73	94	5	5			9
CALCIUM	922	927	908	951			959
MAGNESIUM	3	1	0	1			486
PHOSPHORUS	423	657	750	798			748
ZINC	340	694	864	877			848
BARIUM	0	0	0	0			0

Properties

TEST	cST VISCOSITY @ 40 C	SUS VISCOSITY@ 100 C	cST VISCOSITY@ 100 C	SUS VISCOSITY @ 210 F	FLASHPOINT IN F	FUEL %	ANTI-FREEZE %	WATER %	INSOLUBLES %
VALUES SHOULD BE				68-78	>405	<2.0	0.0	<0.05	0.8
TESTED VALUES WERE				118.3	BOIL	-	POS	2.2	2.5

This engine developed a sudden antifreeze problem (note that 2.2% of the sample was coolant). When a contaminant gets into the oil, it causes oxidation that results in increased insolubles. The problem is not too severe just yet—the engine could still be saved it it's repaired soon. But the coolant contamination has also drastically increased the viscosity, and the oil is too thick to properly lubricate and clean the engine. The coolant problem will need to be fixed, and the sooner the better.

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