BLACKSTONE LABORATORIES

The Oil Report
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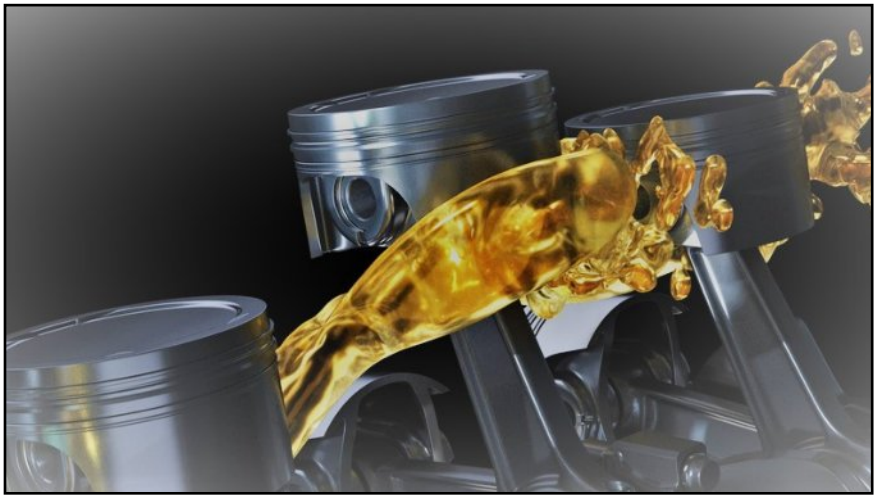
Oil the News that's Fit to Print!

All About Viscosity

by Jim Stark & Kristin Huff



Most of us have only a vague understanding of viscosity. We tend to choose an oil with a viscosity that we believe is correct for our particular engine, but would another viscosity improve or reduce the life of the engine? Can we pick and choose a viscosity outside the manufacturer's recommendations?

Technically, viscosity is defined as resistance to flow. Commonly, though, we think of it as an oil's thickness. To be more specific, it is the thickness of oil at a given temperature. The plot thickens (ha!).

The viscosity of an oil could be reported at any temperature, but to standardize things, most laboratories report either a low temp (100F or 40C) or a high temp viscosity (212F or 100C) and stick with either Fahrenheit or Celsius. At Blackstone we report the high-temp viscosity, which is generally the temperature the engine is at while it's running and the temperature at which the oil spends most of its time. We can do the low-temp viscosity too, if you're interested, but the engine spends so little time running at the low-temp viscosity that it's not a useful test for most people.

An apple is an apple, no matter what language you use to describe it. In the same respect, there are many ways to describe viscosity: engines use the SAE engine chart, industrial equipment mostly uses the ISO chart, gear oils use the SAE gear chart, etc. (Download your own viscosity chart here.) No matter what you call it, the number given defines the thickness of the oil at the standard high temperature.

Multi-Grades Explained

Engine oil can be either straight weight or a multi-grade viscosity. A major difference between the two is simply the addition of a VI additive, which allows the oil to maintain more or less the same flow rate regardless of its operating environment. Think of the difference between honey and water. Cold honey flows very slowly, but if you put it in the microwave and heat it up, it will flow much more easily. Water,

on the other hand, flows at pretty much the same rate whether it's hot or cold. That's because water has a very narrow viscosity range, whereas honey's is much wider. When it comes to engine oil, it naturally has a wide viscosity range, like honey, flowing slowly when it's cold and faster when it's hot. But we want it to act like it has a narrow viscosity range, like water, maintaining a fairly consistent flow rate regardless of whether the oil is cold or warm. That's where viscosity improvers enter the picture. The VI additives in multi-grade oil help it move more easily through a cold engine upon start-up, but still provide cushion and lubrication when it's hot.

Which Viscosity to Use?

People often ask us if it's okay to use a different viscosity oil than what the manufacturer recommends. And typically, the answer is yes. Engine manufacturers dyno-test their engines using a specific viscosity oil, so when you use the viscosity they recommend, you are working with a known result. Going to another viscosity is an experiment, but it's usually a harmless one. For the sake of efficiency, you want to run the lightest grade oil in your engine possible, within limits. If you're racing, for example, that may require a thicker oil to stand up to the heat demands of more extreme use.

Over the last few years we have seen a trend of lighter oil for new engines. The common 10W/30 of a decade or two ago has become a 5W/30, 5W/20, or 0W/20. Many manufacturers use 5W/20 or 0W/20 oil at the factory (even in trucks) and recommend it for everyday use for many light vehicles. On the other hand, we can't see in analysis where it hurts anything to run a 10W/30 or a 10W/40 when a lighter oil is called for. Feel free to try different grades until you find one that suits your particular situation.

Changes in Viscosity

Lots of things can affect the viscosity. Adding anything foreign to your oil can change its viscosity -- some types of aftermarket additives cause a high viscosity, and some solvent-type additives can cause the viscosity to thin out. Another thing that can change a viscosity is contamination. Moisture and fuel can change the viscosity, depending on the contaminant and how long it has been present in the oil. Excessive soot and antifreeze often increase an oil's viscosity. Exposure to excessive heat (leaving the oil in place too long, engine overheating) can increase the viscosity of engine oil, though leaving ATF in place too long can cause it to get thinner, not thicker. Some engines will shear the viscosity down no matter what oil you use.

When your oil's viscosity comes back as either lower or higher than the "Should Be" range, something is causing it. The key is to find out why and repair your engine or adjust your driving habits accordingly, and to correct the viscosity and optimize your engine's efficiency. Test your oil while figuring out what to use. Your wear metals don't lie!

Report of the Month

This Volvo marine engine has a problem.
Can you guess what happened?

To learn more about where the elements are coming from, click here.

UNIT				
MAKE/MODEL:	Volvo Marine D6-435	OIL TYPE & GRADE:	15W/40
FUEL TYPE:	Diesel	OIL USE INTERVAL:	293 Hours
ADDITIONAL INFO:	Delta 54		

COMMENTS

This is the port engine, and it's wearing heavily due to seawater contamination (evident in sodium and potassium). Silicon can be dirt or sealer material. Every metal is high, but the aluminum level is particularly concerning. In a healthy D6-435, aluminum is normally in the single digits and about 1/4 of the iron level. In this case, aluminum is easily the dominant metal and off the charts at 518 ppm. Chrome is a ring metal with iron from cylinders and shafts. Copper, lead, and tin are from bearings and bushings. Inspect ASAP.

ELEMENTS IN PARTS PER MILLION		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	293							
MI/HR on Unit	1,800							
Sample Date	7/7/2021							
Make Up Oil Added								
ALUMINUM	**518**	20						3
CHROMIUM	**44**	3						1
IRON	**361**	59						11
COPPER	**24**	15						5
LEAD	**32**	5						1
TIN	**9**	2						1
MOLYBDENUM	73	72						30
NICKEL	**10**	4						1
MANGANESE	4	1						0
SILVER	0	0						0
TITANIUM	0	0						0
POTASSIUM	**52**	1						3
BORON	4	5						73
SILICON	**15**	7						7
SODIUM	**1142**	5						4
CALCIUM	1306	1223						1749
MAGNESIUM	1454	1199						493
PHOSPHORUS	1169	1137						1091
ZINC	1434	1400						1238
BARIUM	0	0						0

PROPERTIES		Values Should Be*					
SUS Viscosity @ 210°F	79.5	69-80					
cSt Viscosity @ 100°C	15.39	12.7-15.8					
Flashpoint in °F	450	>415					
Fuel %	<0.5	<2.0					
Antifreeze %	**2.28**	0.0					
Water %	0.0	0.0					
Insolubles %	0.4	<0.6					
TBN							
TAN							
ISO Code							

*** THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE**

The owner writes: Just wanted to let you guys know you nailed it! The center engine blew a sea water hose in the Bahamas. The engine was discovered to have excessive blow-by and low compression on two cylinders. This analysis will aid in the insurance claim.