

# What Can Your Oil Tell You?

GMCCI Spring Convention

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John Richardson



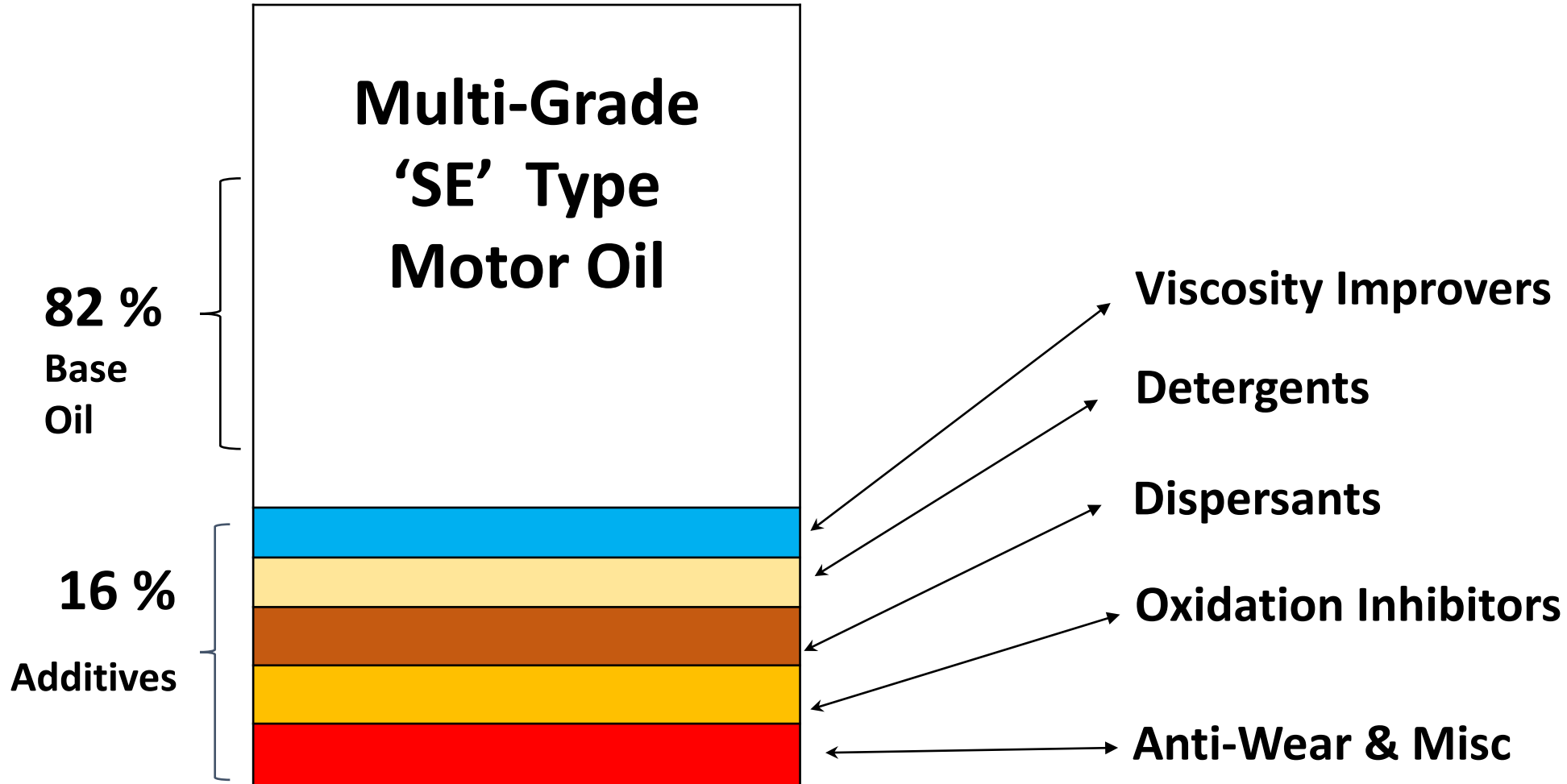
# “Modern Engine Oil is .....

..... not a cheap commodity.

It is a highly complex blend of synergistic components that come together to provide performance protection to advance the cause of better fuel economy and more powerful engines everywhere.”

Article, “motor Oil 101”, Bob Is The Oil Guy – [www.BITOG.com](http://www.BITOG.com)

# OIL FORMULATION



# Motor Oil Additives

- Viscosity Improvers (VI) – an additive used to assist the oil in maintaining a given viscosity, ie, 10W30.
- Dispersants – Improves the separation of particles and prevents settling and clumping in the oil.
- Detergents – Help keep engine parts clean by removing deposits from surfaces and keeping them trapped in the oil so they can be removed by the filter/oil change.
- Oxidation Inhibitors – prevents oxygen from reacting within the oil, thus slowing the aging of the oil.
- Anti-wear & Miscellaneous – anti-wear compound ( zddp = zinc and phosphorus) to provide protective coating to engine parts as well as corrosion inhibitor and antioxidant.

# OIL ANALYSIS DEFINITIONS

- Averages:** Both the universal and unit averages are running averages and change with the number of samples analyzed.
  - Elements:** Elements are quantified in the oil at parts per million levels (PPM). This list shows the most common sources of the elements in gasoline or diesel engine oil. Following each element is a description of where it comes from. They are grouped by category.
  - Wear Metals**
    - Aluminum:** Pistons, bearings, cases (heads & blocks).
    - Chromium:** Rings, a trace element in steel.
    - Iron:** Cylinders, rotating shafts, the valve train, and any steel part sharing the oil.
    - Copper:** Brass or bronze parts, copper bushings, bearings, oil coolers, also an additive in some gasoline engine oils.
    - Lead:** Bearings.
    - Tin:** Bearings, bronze parts, piston coatings.
    - Nickel:** Trace element in steel, platings on some cylinder types.
  - Trace Elements**
    - Manganese:** Trace element, additive in some foreign gasoline.
    - Silver:** Trace element, some types of bearings.
    - Titanium:** Trace wear metal.
  - Contaminants**
    - Potassium:** Antifreeze, additive in some oil types.
    - Sodium:** Antifreeze (ethylene glycol), additive in some gasoline engine oils.
    - Silicon:** Airborne dirt escaping air filtration, sealers, gaskets, sand-casted parts, and spray lubricants, antifreeze inhibitor.
  - Oil Additives**
    - Molybdenum:** Anti-wear additive, some types of rings.
    - Boron:** Detergent/dispersant additive, antifreeze inhibitors.
    - Calcium:** Detergent/dispersant additive.
    - Magnesium:** Detergent/dispersant additive.
    - Phosphorus:** Anti-wear additive.
    - Zinc:** Anti-wear additive.
    - Barium:** Detergent/dispersant additive used in some synthetics.
  - Physical properties**
    - Viscosity/Flashpoint:** If fuel is present in the oil, the Viscosity and Flashpoint will often be lower than stated in the "Values Should Be" line. A high viscosity may show oil oxidation or high levels of soot. It can also show an oil additive in use.
    - Fuel %:** Indicates the amount of volatile fuel dilution found in the oil.
    - Antifreeze %:** Indicates the amount of antifreeze found in the oil. A question mark means we found possible traces of coolant, but not enough to definitively say it's there.
    - Water %:** Indicates the amount of water found in the oil.
    - Insolubles %:** Insolubles are solid materials present in the oil. They are typically free carbon from the oxidation of the oil itself, along with blow-by past the rings.
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CC bronze part that's not wearing right. The other metals are okay (iron is high from your long oil run), and no contaminants were found. Let us know what you find!

2	↓	MI/HR on Oil	3,000	UNIT / LOCATION AVERAGES					UNIVERSAL AVERAGES
		MI/HR on Unit							
		Sample Date	06/26/14						
		Make Up Oil Added	1 qt						
3	→	ALUMINUM	7	7					7
		CHROMIUM	2	2					2
		IRON	57	57					40
		COPPER	106	106					21
		LEAD	76	76					44
		TIN	8	8					2
		MOLYBDENUM - ADDITIVE	74	74					65
4	→	NICKEL	1	1					1
		MANGANESE	1	1					2
		SILVER	0	0					0
5	→	TITANIUM	0	0					0
		POTASSIUM	4	4					6
		BORON - ADDITIVE	36	36					46
		SILICON	12	12					13
6	→	SODIUM	30	30					72
		CALCIUM	1099	1099					2334
		MAGNESIUM	786	786					248
		PHOSPHORUS	2055	2055					1148
		ZINC	2449	2449					1371
		BARIUM	0	0					2

Values  
Should Be\*

7	PROPERTIES	SUS Viscosity @ 210°F	77.3	65-78				
		cSt Viscosity @ 100°C	14.85	11.6-15.3				
		Flashpoint in °F	400	>375				
		Fuel %	<0.5	<2.0				
		Antifreeze %	0.0	0.0				
		Water %	0.0	<0.1				
		Insolubles %	0.3	<0.6				
		TBN						
		TAN						
		ISO Code						

# sample

ADDITIONAL INFO:

<b>CLIENT</b>	OSCAR HUFF 125 DOGG CT. BARK CITY, CA 95168	PHONE: (260) 555-1212 FAX: ALT PHONE: EMAIL: oscar@huffcontracting.com
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**COMMENTS** OSCAR: We found a lot of fuel in this sample. This is the first time it's read at a cautionary level. It has lowered the viscosity to a 20W oil and appears to be affecting your bearing wear. When fuel is present long enough in an engine it softens the babbit of the bearings, and we are concerned that's the case here. Upper-end wear (aluminum and chrome) is high too. You should have this engine looked at ASAP to see if you can determine the source of the problem. Note silicon too; this could be from dirt getting past the air filter and causing some of the poor wear, so we suggest checking out that possibility. Run shorter oil changes until the problem is corrected.

<b>ELEMENTS IN PARTS PER MILLION</b>	MI/HR on Oil	7,250	UNIT / LOCATION AVERAGES	5,000	7,000	10,000	<b>UNIVERSAL AVERAGES</b>	
	MI/HR on Unit	152,250		145,000	121,000	133,000		
	Sample Date	8/15/14		10/11/13	06/08/13	11/20/12		
	Make Up Oil Added			0 qts	0 qts	0 qts		
ALUMINUM	40	11	16	11	10	8		
CHROMIUM	9	2	3	1	2	2		
IRON	240	79	57	20	21	42		
COPPER	42	7	10	2	4	22		
LEAD	53	17	31	10	10	19		
TIN	9	4	2	3	2	3		
MOLYBDENUM	26	67	26	79	4	14		
NICKEL	5	2	2	1	1	1		
MANGANESE	3	1	0	0	0	2		
SILVER	0	0	0	0	0	0		
TITANIUM	0	0	0	0	0	0		
POTASSIUM	7	0	4	0	0	1		
BORON	8	22	3	7	5	41		
SILICON	49	28	25	11	12	18		
SODIUM	2	273	12	8	11	22		
CALCIUM	829	1308	961	1710	2446	1509		
MAGNESIUM	392	256	457	320	38	566		
PHOSPHORUS	1071	962	775	810	1024	804		
ZINC	1208	1009	883	1070	1198	967		
BARIUM	0	0	0	0	0	2		

Values Should Be\*

<b>PROPERTIES</b>	SUS Viscosity @ 210°F	52.7	59-65	84.3	88.3
	cSt Viscosity @ 100°C	7.94	9.9-11.9	16.58	17.56
	Flashpoint in °F	235	>360	310	450
	Fuel %	6.5	<2.0	2.5	<0.5
	Antifreeze %	0.0	0	?	0
	Water %	0.0	0.0	0.0	0.0
	Insolubles %	0.6	<0.6	0.6	1.1
	TBN				
	TAN				
	ISO Code				

\* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE



**COMMENTS**

JOHN: There's still enough potassium to suspect a coolant leak. There isn't as much silicon this time, so we were able to remove that highlight. Wear metals look pretty good, so if we are seeing coolant contamination, at least it isn't causing excess wear. Stick with this interval or less until we can rule out a coolant problem, especially if you're noticing coolant loss. Using short runs should help keep wear metals and coolant from accumulating too much. The viscosity was correct for a 10W/30 and no fuel or water showed up. Check back next time to monitor potassium.

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	4,960	UNIT / LOCATION AVERAGES				UNIVERSAL AVERAGES
	MI/HR on Unit	17,688	4,285	5,515	1,178	3,000	
	Sample Date	2/24/2017	6/7/2016	1/6/2016	3/7/2015	1/25/2015	
	Make Up Oil Added	1.50 qts	1 qt	1 qt	0 qts	1 qt	
ALUMINUM	5	9	5	10	5	15	6
CHROMIUM	2	5	3	6	3	7	2
IRON	50	70	49	89	38	104	37
COPPER	28	61	36	91	31	92	24
LEAD	31	83	41	117	39	146	41
TIN	5	13	5	21	4	20	2
MOLYBDENUM	53	31	45	66	2	4	66
NICKEL	1	1	1	1	1	1	1
MANGANESE	1	3	1	3	2	5	2
SILVER	0	0	0	0	0	0	0
TITANIUM	0	0	0	0	0	0	0
POTASSIUM	38	24	36	34	14	11	8
BORON	30	19	2	7	24	16	41
SILICON	20	59	28	50	48	118	13
SODIUM	10	15	12	14	11	25	78
CALCIUM	2317	2824	2429	3012	2661	3307	2244
MAGNESIUM	9	12	13	17	8	12	285
PHOSPHORUS	1087	1978	1024	1282	2182	3362	1134
ZINC	1317	2535	1342	1701	2770	4353	1366
BARIUM	0	0	0	0	0	1	1

Values Should Be\*

PROPERTIES	SUS Viscosity @ 210°F	61.7	58-65	63.9	64.5	67.0	75.8
	cSt Viscosity @ 100°C	10.69	9.7-11.9	11.31	11.46	12.14	14.45
	Flashpoint in °F	415	>385	415	405	420	435
	Fuel %	<0.5	<2.0	<0.5	<0.5	<0.5	<0.5
	Antifreeze %	?	0.0	?	0.0	0.0	0.0
	Water %	0.0	0.0	0.0	0.0	0.0	0.0
	Insolubles %	0.3	<0.6	0.3	0.3	0.3	0.2
	TBN						
	TAN						
	ISO Code						

# Recommendation

- Have your oil analyzed about once a year to develop trend information and monitor your engines 'health' and wear.
- More information on Oil and Analysis; [WWW.Blackstone-labs.com](http://WWW.Blackstone-labs.com), and "Bob Is The Oil Guy" at [WWW.bitog.com](http://WWW.bitog.com).

