# The Oil Report
# February 2016

Oil the News that's Fit to Print!

Everyone's favorite part of the newsletter is the Report of the Month, so we thought this month we'd give you what you really want to see -- engine problems that you don't have to deal with! Below are four samples, each with some sort of problem. We have reported what the owner told us in the comments below each report. But before you look at the answer, take a minute to study the data. Can you figure out what went wrong?

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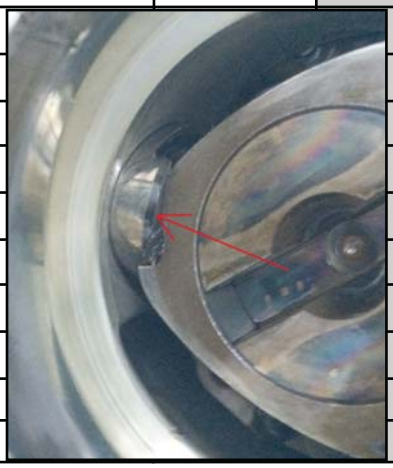
## Report of the Month

We included a picture of this 2007 VW GTi's 2.0L problem. (It's not covering up any important data.)

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

ELEMENTS IN PARTS PER MILLION

| | | UNIT/ LOCATION AVERAGES | | | | | UNIVERSAL AVERAGES |
|---|---|---|---|---|---|---|---|
| MI/HR on Oil | 9,156 | | 8,045 | 6,035 | 6,697 | 8,126 | |
| MI/HR on Unit | 82,902 | | 73,746 | 65,700 | 59,665 | 52,668 | |
| Sample Date | 5/20/2014 | | 11/5/2013 | 6/5/2013 | 2/12/2013 | 10/4/2012 | |
| ALUMINUM | 8 | 5 | 5 | 3 | 7 | 4 | 4 |
| CHROME | 2 | 1 | 2 | 1 | 1 | 1 | 1 |
| IRON | 126 | 60 | 103 | 41 | 60 | 39 | 27 |
| COPPER | 8 | 3 | 4 | 2 | 3 | 3 | 4 |
| LEAD | 2 | 1 | 1 | 0 | 0 | 1 | 2 |
| TIN | 2 | 1 | 0 | 0 | 0 | 2 | 1 |
| MOLYBDENUM | 0 | 9 | 3 | 1 | 3 | 13 | 33 |
| NICKEL | 1 | 1 | 1 | 0 | | | 1 |
| POTASSIUM | 6 | 3 | 3 | 2 | | | 3 |
| BORON | 43 | 14 | 19 | 26 | | | 52 |
| SILICON | 4 | 4 | 3 | 2 | | | 8 |
| SODIUM | 7 | 11 | 7 | 12 | | | 9 |
| CALCIUM | 1952 | 1796 | 2400 | 2022 | | | 2245 |
| MAGNESIUM | 23 | 329 | 42 | 19 | | | 189 |
| PHOSPHORUS | 744 | 796 | 852 | 821 | | | 849 |
| ZINC | 842 | 873 | 872 | 909 | | | 981 |
| BARIUM | 0 | 0 | 0 | 0 | | | 0 |



"It was driving me crazy about what in the world had gone wrong with iron in this last oil change. Well apparently the cam follower had started to wear a while back, causing the increase in iron. Then after the follower wore completely through during this last oil change, iron shot way up as (I'm guessing) the broken follower started eroding the cam lobe.You can see in the picture the follower that rides along the lobe, which powers the high pressure fuel pump. If you look very closely, there is a black vertical stripe on the edge of the follower; that is the teflon coating, which apparently when gone causes metal-on-metal friction shear, which eventually consumes the follower."

# Report of the Month

Check out the report on this '02 BMW 3.2L S54 engine. Can you figure out what's wrong?

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

| ELEMENTS IN PARTS PER MILLION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | MI/HR on Oil | 5,424 | UNIT/ LOCATION AVERAGES | | | | | UNIVERSAL AVERAGES |
| | MI/HR on Unit | 181,424 | | | | | | |
| | Sample Date | 6/14/2014 | | | | | | |
| | ALUMINUM | 15 | 15 | | | | | 4 |
| | CHROME | 0 | 0 | | | | | 0 |
| | IRON | 21 | 21 | | | | | 10 |
| | COPPER | 7 | 7 | | | | | 8 |
| | LEAD | 27 | 27 | | | | | 5 |
| | TIN | 0 | 096 | | | | | 1 |
| | MO LYBDENUM | 96 | 56 | | | | | 51 |
| | NICKEL | 1 | 1 | | | | | 1 |
| | PO TASSIUM | 1 | 1 | | | | | 2 |
| | BORON | 40 | 40 | | | | | 80 |
| | SILICON | 7 | 7 | | | | | 5 |
| | SODIUM | 8 | 8 | | | | | 7 |
| | CALCIUM | 2288 | 2288 | | | | | 1895 |
| | MAGNESIUM | 325 | 325 | | | | | 426 |
| | PHOSPHORUS | 855 | 855 | | | | | 844 |
| | ZINC | 1050 | 1050 | | | | | 1005 |
| | BARIUM | 0 | 0 | | | | | 0 |

| PROPERTIES | | | Values Should Be* | | | | |
|---|---|---|---|---|---|---|---|
| | SUS Viscosity @210°F | 96.9 | 80-100 | | | | |
| | cSt Viscosity @ 100°C | 19.63 | 15.5-20.06 | | | | |
| | Flashpoint in °F | 385 | 375 | | | | |
| | Fuel % | <0.5 | <2.0 | | | | |
| | Antifreeze % | 0.0 | 0.0 | | | | |
| | Water % | 0.0 | 0.1 | | | | |
| | Insolubles % | 0.2 | <0.6 | | | | |
| | TBN | | | | | | |

It's short and sweet with this one: "Shortly after this sample, this engine suffered a major rod bearing failure. BMW's M3 E46 is notorious for rod bearing wear, which you can see in the high lead reading. The original set of rod bearings in this engine were replaced at 40,000 miles under warranty. The second set was totally gone at 185,000 miles." We've heard the tolerances from the factory are extremely tight in the S54 engine.

# Report of the Month

This Corvette's LS-7 7.0L engine's problem really started in the second sample. Can you tell what it is?

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

| ELEMENTS IN PARTS PER MILLION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MI/HR on Oil | | UNIT/ LOCATION AVERAGES | 2,000 | | | | UNIVERSAL AVERAGES |
| MI/HR on Unit | | | 26,000 | 13,500 | | | |
| Sample Date | 10/6/2014 | | 9/25/2014 | 1/20/2012 | | | |
| ALUMINUM | 2 | 5 | 5 | 9 | | | 4 |
| CHROME | 1 | 3 | 2 | 7 | | | 2 |
| IRON | 26 | 73 | 31 | 163 | | | 37 |
| COPPER | 2 | 4 | 3 | 6 | | | 4 |
| LEAD | 3 | 20 | 38 | 19 | | | 8 |
| TIN | 1 | 2 | 5 | 0 | | | 1 |
| MO LYBDENUM | 58 | 85 | 73 | 125 | | | 102 |
| NICKEL | 0 | 1 | 1 | 2 | | | 1 |
| TITANIUM | 0 | 3 | 8 | 0 | | | 4 |
| BORON | 6 | 55 | 90 | 68 | | | 83 |
| SILICON | 4 | 11 | 17 | 13 | | | 10 |
| SODIUM | 2 | 6 | 6 | 10 | | | 13 |
| CALCIUM | 2273 | 2008 | 1085 | 2665 | | | 2188 |
| MAGNESIUM | 53 | 236 | 639 | 17 | | | 279 |
| PHOSPHORUS | 811 | 738 | 653 | 751 | | | 780 |
| ZINC | 934 | 840 | 742 | 843 | | | 899 |
| BARIUM | 0 | 0 | 0 | 0 | | | 0 |

| PROPERTIES | | Values Should Be* | | | | |
|---|---|---|---|---|---|---|
| SUS Viscosity @210°F | 57.6 | 55-62 | 59.7 | 59.3 | | |
| cSt Viscosity @ 100°C | 9.54 | 8.8-11.1 | 10.14 | 10.01 | | |
| Flashpoint in °F | 365 | >365 | 420 | 395 | | |
| Fuel % | TR | <2.0 | <0.5 | <0.5 | | |
| Antifreeze % | 0.0 | 0.0 | 0.0 | 0.0 | | |
| Water % | 0.0 | 0.1 | 0.0 | 0.0 | | |
| Insolubles % | 0.3 | <0.6 | 0.3 | 0.3 | | |
| TBN | | | | | | |

Don't be fooled by the first report - most of that metal was from wear-in. The real problem started in the second report. The customer states: "My September report showed a large increase in titanium. I pulled the heads and popped a valve spring, only to find the intake valve ready to fall out. All 16 had hard wear due to faulty valve guides. Better to find it this way than out on the road at full speed. And GMPP could not argue, paid full repairs of $7,000. So glad I found it - this could have been real bad. All Z06 427's need their oil tested forever!"

# Report of the Month

This 2004 RAV-4 has never had a transmission oil change! What do you think - is it doomed?

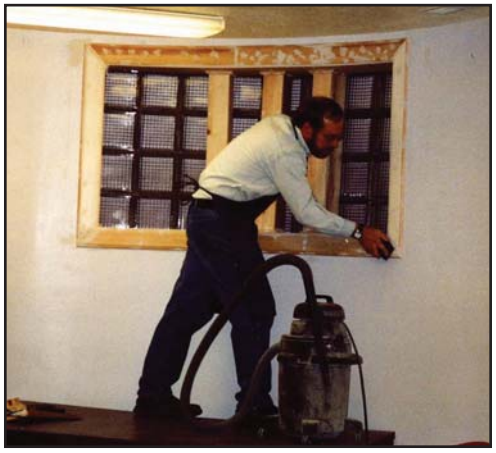
To learn more about where the elements are coming from, click here.

| ELEMENTS IN PARTS PER MILLION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| MI/HR on Oil | 265,000 | UNIT/ LOCATION AVERAGES | | | | | UNIVERSAL AVERAGES | |
| MI/HR on Unit | 265,000 | | | | | | | |
| Sample Date | 3/6/2015 | | | | | | | |
| ALUMINUM | 322 | 322 | | | | | 19 | |
| CHROME | 13 | 13 | | | | | 0 | |
| IRON | 1328 | 1328 | | | | | 54 | |
| COPPER | 327 | 327 | | | | | 65 | |
| LEAD | 760 | 760 | | | | | 15 | |
| TIN | 11 | 11 | | | | | 3 | |
| MO LYBDENUM | 2 | 2 | | | | | 1 | |
| NICKEL | 2 | 2 | | | | | 1 | |
| PO TASSIUM | 4 | 4 | | | | | 2 | |
| BORON | 32 | 32 | | | | | 77 | |
| SILICON | 62 | 62 | | | | | 18 | |
| SODIUM | 10 | 10 | | | | | 6 | |
| CALCIUM | 110 | 110 | | | | | 145 | |
| MAGNESIUM | 4 | 4 | | | | | 12 | |
| PHOSPHORUS | 227 | 227 | | | | | 324 | |
| ZINC | 75 | 75 | | | | | 41 | |
| BARIUM | 11 | 11 | | | | | 3 | |

| PROPERTIES | | Values Should Be* | | | | |
|---|---|---|---|---|---|---|
| SUS Viscosity @210°F | 44.1 | 43-51 | | | | |
| cSt Viscosity @ 100°C | 5.44 | 5.1-7.9 | | | | |
| Flashpoint in °F | 370 | >335 | | | | |
| Fuel % | - | - | | | | |
| Antifreeze % | - | - | | | | |
| Water % | 0.0 | <0.1 | | | | |
| Insolubles % | TR | <0.1 | | | | |
| TBN | | | | | | |

This one isn't a mystery - the oil has never been changed in this transmission. But you know what? All things considered, this is not that bad of a report. There's a lot of metal here, of course, but given that it's never had an oil change in all its 265,000 miles, things could be worse. We're especially impressed with the physical condition of the oil - that's the numbers you see in the Properties box at the bottom. When transmission oil is run too long, we usually find a low viscosity reading and high insolubles. Both those are okay. So the oil has collected a lot of metal since this unit rolled out of the factory, but an oil change will wash most of this stuff out and leave the transmission shifting better and happier all around.

Jim in the original Blackstone office, November 2000.


Jim renovates the new Blackstone office in 2005.

Jim Stark passed away peacefully at his home in Ossian, Indiana on Nov. 20, 2015. He was 73.

Jim was an inventor, entrepreneur, pilot, musician, writer, workshop tinkerer, mechanic, and an all-around interesting guy.

He enjoyed happy hour (three-beer limit unless scotch was available), playing guitar and the ukulele, traveling and camping with his wife Kathy, passionately rooting for Purdue, hot tubbing, writing stories, John Prine music, and checking himself out of the hospital. Jim and Kathy played music wherever they went on their travels across the country.

He founded Blackstone Laboratories in 1985, a world-class oil analysis company devoted to helping people learn more about the engines and machines by testing oil. He started this company with his brothers Bob and John, and was later joined by his son, Ryan, daughter Kristin, and a whole host of dedicated hard-working employees. He was building his own airplane – a Van's RV12 – just before he died.

Jim survived a tour in Vietnam (a First Cavalry helicopter mechanic), crashing an airplane, two heart attacks and two heart surgeries, jumping out of an airplane when he was 70 (barely), and the doctors in Indianapolis before lung cancer and a fall got him in the end.

His spirit is among the stars, and he will be greatly missed by all who loved him.


World-beaters Jim Stark and his brother Bob show off their new spectrometer in 1985.