

Confused about the part of the oil slip that says "Mi/Hr/Km on the oil"? We get a lot of questions about this, so we'd like to clarify. Some people track their engine and oil time in miles, some in hours, and some in kilometers. Just circle the one you use and write in the appropriate number.

Fuel in Diesels

by Ryan Stark

For our [last newsletter](#), we did an experiment where we actually tried to get fuel dilution to show up in the oil. Amanda's Kia was our guinea pig, and she tried hard to get some fuel to show up but had very little success. She tried idling for ten minutes and she tried lots of city driving, but she could hardly get anything more than a trace or so. Maybe that's just a testament to Kia and their fuel system engineering, or maybe she was just unlucky. It's hard to say. However, fuel dilution does show up for a lot of our customers and after the last newsletter, we received some emails asking for more information about fuel, especially in diesel engines with possible fuel dilution problems.

The diesel engines that go into Ford, GM, and Dodge pickup trucks are very popular, and we see a lot of samples from them. Diesel engines started showing up in pickup trucks back in the 1980s and while those engines didn't particularly wear well, fuel dilution wasn't really a big issue. In the 1990s, these engines really started coming into their own. Wear metals improved and the oil changes started getting longer and longer. Ford started using the Navistar 7.3L Power Stroke and Dodge used the Cummins 6BT 5.9L, and both were excellent engines. They produced a lot of power and left very little metal in the oil to show for it. GM used the Detroit Diesel 6.5L, and while that was a good engine and a lot of them are still on the road today, it tended to make a lot more metal than its competitors. It wasn't until GM started the Isuzu 6.6L Duramax that it really had a world-class diesel that was every bit as good as what Ford and Dodge were using.

With this new generation of engines, we started seeing people run 5,000-mile oil changes regularly, where the old standard was just 3,000 miles. Oil changes have gotten longer and longer since, and by 2005 it was not uncommon at all to see those engines running 10,000 miles on the oil without any special oil filtration set-up. Of course, a lot of that was dictated by the type of use the engines saw. This was also the carefree days before emission controls starting becoming mandatory.

For some of you, the words emission controls may make you turn away in disgust and I'll admit, on my own truck engine (a gasoline-powered GM 350), the emission controls haven't gotten the attention the rest of the engine has. But the idea isn't really all that bad. Piston-powered aircraft engines

don't have any emission controls on them, but those engines are plagued by rust and corrosion because condensation from the air is allowed to enter through the breather. Modern gasoline and diesel engines don't have that problem because their crankcases are sealed to the elements and that keeps corrosion to a bare minimum. It's also one of the reasons you don't really need to change your oil on a time basis anymore. We get a lot of questions about whether an oil will last a year or not and the answer is almost always yes, because very little corrosion builds up in these engines.

Of course, gasoline-powered engines have had emission control systems on them since the 1970s and that means the engine designers have had a lot of time to get it right. When emission controls

started appearing on diesel engines in 2005 and 2006, there were a lot of growing pains with that introduction. Couple that with the fact that competition brought about the need for more and more power, and now we started seeing changes in the oil samples, mainly at fuel dilution.



Does fuel in the oil mean a diesel engine is junk? Not at all. You may not even need to do anything about it.

We first started seeing a lot of fuel when Navistar came out with the 6.0L Power Stroke in 2003. Those engines almost always had a lot of fuel in the oil, especially when they were new--and when I talk about a lot, I mean 4% and 5%. We weren't sure exactly what caused this, but it was showing up in almost every sample we saw and this presented a problem for us because we had always considered 2.0% to be an "action" level of fuel. So what do you do when every engine starts showing more than 2.0% fuel? Do you start sending every owner back

to the dealer saying there's a problem? And what do you do if you see a lot of fuel dilution, but wear metals continue to look good?

So the 6.0L Power Stroke caused us to take a different look at fuel and how much of a concern it really is. No longer could we consider 2.0% is a major problem. Now we suggest that it's only an issue if the oil level is rising on your dipstick, or if the amount of fuel we find in each sample is increasing. As it turns out, continual fuel dilution in the oil at around 2.0% to 3.0% sometimes is from a problem, but it should not be considered a major one and I know about that first-hand.

About My Passat

In 2003 my wife and I bought a Volkswagen Passat with the 1.8L turbo gasoline engine. Almost from the start, this engine was leaving a lot of fuel in the oil and I would look at the analysis results and just shrug my shoulders. The engine was running fine and wear metals were acceptable, but the fuel mileage was never quite as good as advertised. For me, that didn't seem like a good enough reason to tear into the fuel system.

Shortly after we bought the Passat, Volkswagen set us a letter saying they would extend the engine warranty to 10 years or 100,000 miles due to sludging problems they were having. I suspected these problems stemmed from a lot of fuel dilution in the oil coupled with really long oil runs, but I'm not sure. The kicker for the extend warranty was I had to change oil every 5,000 miles and I had to use a VW-approved oil. Of course, they approved expensive oils like Elf and Total, and those aren't on *my*

approved list. My list includes oils that are on sale at Wal-Mart, so I decided to stick with my preferred oil types and just change the oil at 3,000 miles. So far the plan has worked but if it fails, I'll be writing about how I [rebuilt the engine myself \(twice\) in my Dad's barn](#).

In the end, we haven't done anything about the continual fuel in our Passat's oil (except curse VW), but the engine is still running fine and is close to the magic 100,000-mile mark. When we hit 100K, we'll unload it and get my wife the new car of her dreams (a white Jaguar S-type). So despite the fuel being present in every report, really the only problem this has caused is our MPG isn't quite what it should be.



They've fixed the fuel problems in the 6.0L Power Stroke. They'll work out the bugs in newer diesel engines too.

Back to Diesel Engines

So anyway, the fuel dilution problems in the 6.0L Power Stroke eventually got better. Those engines now look as good as any we see, so they've changed something to solve the fuel problem. Then came the next generation of Navistar diesels (the 6.4L Power Stroke) and the fuel problems started up again. It's not uncommon to see excess fuel in more than twenty percent of the 6.4L diesel engine samples we see today, and when it shows up that often, it's hard to say it's a major issue. It shouldn't really be there, but it doesn't necessarily warrant a trip to the dealer either.

The source of the fuel dilution differs from one engine manufacturer to the next, though injectors and emission control systems appear to be the root cause of most of these problems. For the new 6.4L Power Strokes, if it's not an injector it could be another part of the fuel system, like a pump. The DPF (diesel particulate filter) regeneration process will also cause fuel to show up in the oil. Does that mean these new engines are junk? Not at all. It just shows they have some growing pains to work out and once that happens, the fuel dilution problems will eventually taper off. Until then, don't get too excited 2.0% or more of fuel dilution, but do watch for an increased oil level on your dipstick. While you may think an engine that makes oil is like the goose that laid the golden egg, it's really a possible sign of problems down the road. Small amounts of fuel are okay, but if the oil level is rising or if we're seeing more and more fuel in each sample you do, fuel could be a problem.

Report of the Month

What went wrong for this Chevy Tahoe's 5.3L V8 engine? Take a look at the data, then read the caption below to see what happened.

To learn more about where the elements are coming from, [click here](#).

ELEMENTS IN PARTS PER MILLION	MI/HR on Oil	1,100	UNIT/ LOCATION AVERAGES	1,500	4,000			UNIVERSAL AVERAGES
	MI/HR on Unit	93,300		90,000	85,000			
	Sample Date	03/31/10		01/30/10	11/22/09			
	ALUMINUM	5	6	8	6			3
	CHROME	3	2	1	1			1
	IRON	45	38	38	32			20
	COPPER	13	26	31	33			32
	LEAD	6	53	53	99			9
	TIN	1	2	3	2			1
	MO LYBDENUM	92	75	70	64			68
	NICKEL	1	1	1	1			1
	POTASSIUM	354	2195	2662	3569			3
	BORON	27	30	23	39			51
	SILICON	7	18	22	25			13
	SODIUM	447	702	1508	151			21
CALCIUM	1618	1645	1732	1586			2218	
MAGNESIUM	20	36	43	44			132	
PHOSPHORUS	654	549	534	458			684	
ZINC	880	740	729	612			839	
BARIUM	0	0	0	0			0	

Values
Should Be*

PROPERTIES	SUS Viscosity @210°F	56.9		105.3	56.5		
	cSt Viscosity @ 100°C	9.34		21.59	9.20		
	Flashpoint in °F	405	>365	325	220		
	Fuel %	<0.5	<2.0	2.5	7.8		
	Antifreeze %	0.89	0.0	3.02	POS		
	Water %	0.0	<0.1	0.0	0.0		
	Insolubles %	0.3	<0.6	14.0	1.7		
	TBN						
	TAN						
	ISO Code						

*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

This engine had a severe antifreeze problem (you can see the antifreeze in the potassium and sodium levels), but it took three dealers to find one that knew what to look for. The problem was defective head casting. This engine had a service bulletin out complete with pictures of the cracked heads. The owner was able to get both heads replaced, even though only one was cracked. You can see how much the antifreeze and bearing wear improved after the fix, which took place between the January and March samples.