
TORTURE
TEST MAGAZINE
BREAKING
OR SCIENCE...AND FUN
157
2004–2017
CRF250X PART 1
VOLUME 2 , PART 1
SUMMER 2019

Horizontal

For best reading experience

STILL ALIVE!

In April, 2018, I started working on the first Torture Test Magazine. I thought it was a great idea, until I was 60 hours into it, had gone riding with the KDX200 about 30 times, had already spent about $3,000 on the project, and had absolutely no clue if I had even put a dent in the progress of the project. That's when I started to get the feeling that what I was doing was not sustainable, and that Torture Test Magazine was destined for extravagant failure. Even worse, I wasn't the only one feeling that way. Of the people that I let in on what I was doing, nobody thought it was a great idea. Everyone presented good, logical reasons for why this would probably not work. Reasons like how there would never be industry support for, well, the destruction of the industry's products. And the simple math of having to put hundreds of hours on a bike in a matter of months, while still working to pay the bills, and somehow not getting hurt in the process.

Despite the unfavorable odds of success, I pressed on for months, published the first Torture Test Magazine in November, 2018, and guess what? It was an extravagant failure. No surprise there. We all saw it coming. Not only was there not enough revenue to even think about starting the next project, but, after 2 months, there was not even enough revenue to keep the website open. At that point, I tried to force the beginning of the next project, just hoping the announcement would drive a little more traffic to the website and get a search-ranking fire started. That kept the website open a couple more months, but Torture Test Magazine was broke again two months later. At that point, I just started paying the website bills out of pocket, made the magazine free, and let people decide if they wanted to help out with a donation when downloading it.

Since then, a bunch of people have helped me keep the website open by using that donation option, even though I'm not asking anybody to do so. I did not expect that to happen. You people are ridiculously awesome. Seeing that inspired me to keep going on this second project. I didn't keep going with the hope that it would ever make financial sense. I just kept going because I wanted to thank the people who helped out with keeping the website open when they didn't have to. It just made me feel that there are actually people out there who do value this content. Thank you, everyone!

This whole Torture Test Magazine thing might never really take off, but I'll keep trying as long as there are people out there who love it enough to lend a hand with it. I can't let those people down.

DIE TRYING

TIER I BIKE SETUP

Front tire: 80/100-21 Kenda Trakmaster II (2)

Rear tires: 110/100-18 Shinko 546 (1), 110/100-18 Kenda Trakmaster II (2)

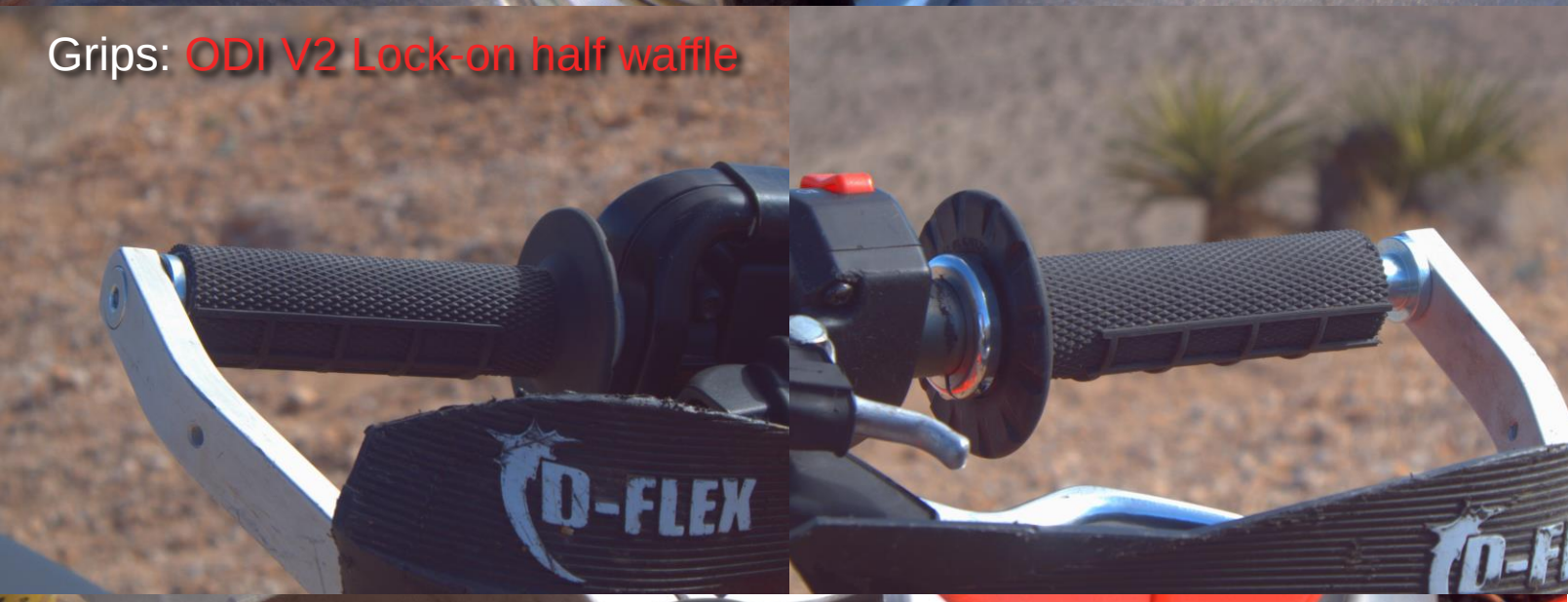
Front brake: All OEM.

Rear brake: OEM. Pad sets: 1x OEM, 1x ProX

Rear suspension: OEM, preload adjusted, rebound 4 clicks fast.
Front suspension: OEM, compression 4 clicks soft.

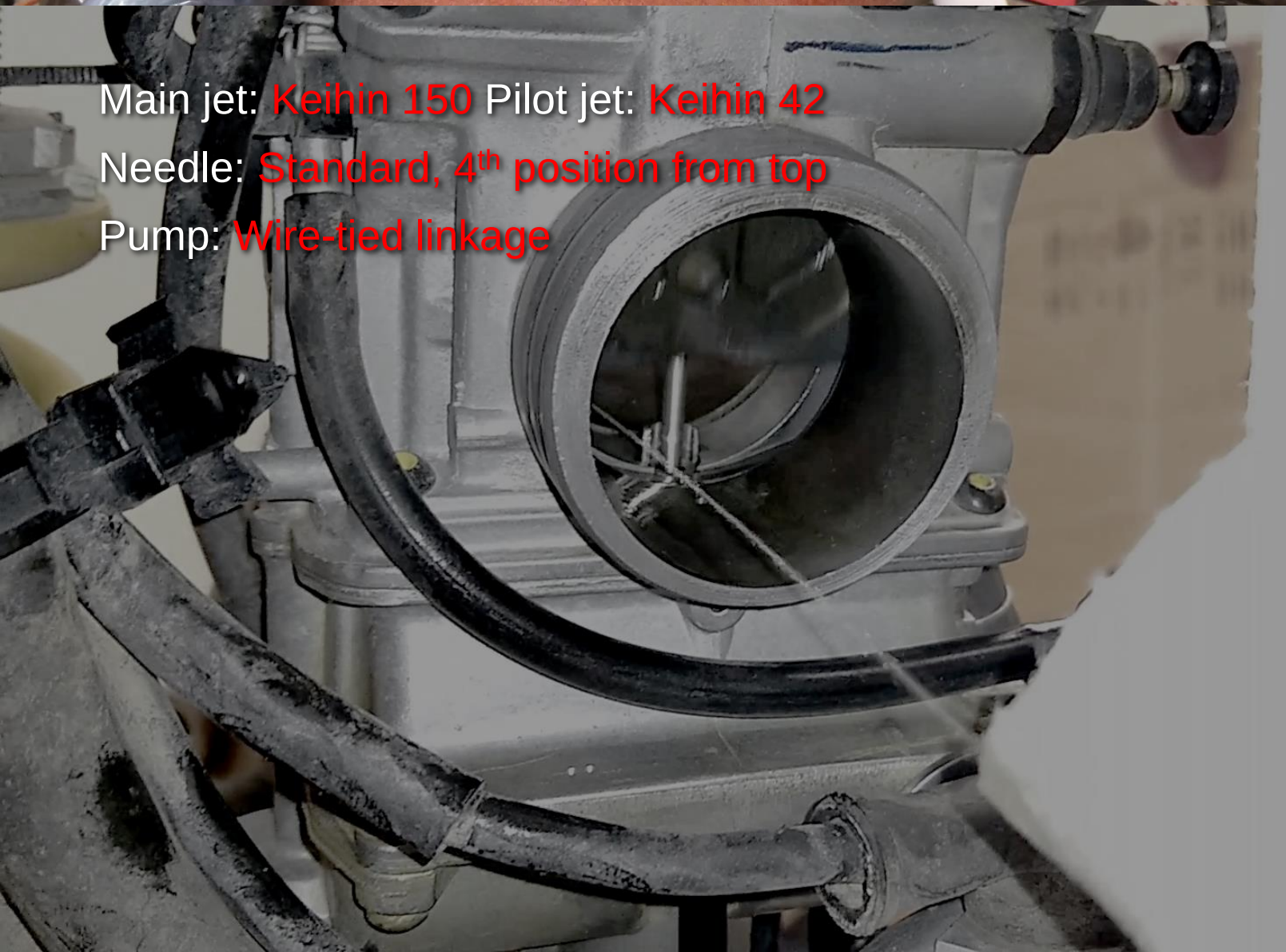
Handlebar: Renthal 971, 7/8” RC bend (OEM)

Grips: ODI V2 Lock-on half waffle



Exhaust: Full OEM without removable baffle

Air filter: Tusk First Line oiled foam with PJ1 oil



Main jet: Keihin 150 Pilot jet: Keihin 42

Needle: Standard, 4th position from top

Pump: Wire-tied linkage

Spark plugs: NGK Iridium IMR8C9H Oil: Mobil Delvac 1300 Super 15W-40 (transmission) & Mobil 1 10W-40 (motor)

Drive chains: OEM & DID VT2 Narrow Enduro Racing X-Ring

Rear sprockets: Sunstar aluminum 53T & Primary Drive aluminum 53T

Front sprockets: JT 14 tooth & Primary Drive 14 tooth

TORTURE TEST

It's time to kill my 2006 CRF250X. It is an excellent bike that I would never want to get rid of, but I have always wondered how long it would last before it required an expensive overhaul. That is what this project seeks to discover. The rules of the torture test will be the same as in the KDX200 torture test. The bike will be ridden off-road for both practice and racing until it mechanically fails. Minor failures will occur along the way, but those will be corrected and the torture test will continue. Crash damage will not end the torture test, and will not count toward cost of running figures. The test will only be concluded when the bike has a major failure which requires any of the following:

a) Removing the cylinder head.

b) Splitting the main crank cases.

c) Replacing the frame (major frame breaks or bends)

d) Spending more than the purchase price of the vehicle ($2,400 USD in this case).

Yes, removing the head and performing engine rebuilds is standard maintenance on a dirt bike. I am fully aware of that, and I acknowledge that the bike would survive indefinitely with the proper care. However, the point of this project is not to demonstrate that by making the bike last forever. This project will, instead, find out how far the bike will go on a lazy, standardized maintenance schedule. The same lazy, standardized maintenance schedule that the KDX200 was put through, and which future bikes will endure as well. This is a torture test, and if a bike can't handle it, it will rank poorly against bikes that can. To put it simply, quoting the first Torture Test Magazine:

"**This is not Let's Pamper this Bike and Take Care of it Perfectly Magazine. This is Torture Test Magazine. Bikes are going to die here."**

10 Hours of Glen Helen Endurance Race, 2019

TIERS AND RANKING

The torture test is broken up into “tiers” of 60 running hours each. The 60-hour figure is based on a nine-round race season, and roughly matches up to the amount of use a bike gets when racing and practicing for a single off-road race series out here in the desert. The idea is that it is crucial that a bike can make it through at least one 60-hour period without a teardown. Mid-season teardowns for those of us riding and racing without parts support can get very tricky, and often result in missed rides or race days due to back-ordered parts, or being sent the wrong parts and having to wait on returns in order to get what is needed to get the bike running.

- Tier I: 0-60 hours. Failure within this tier means a bike is “not very reliable” because it can’t make it through one season’s worth of torture.
- Tier II: 60-120 hours. Failure within this tier means a bike is “decently reliable” because it can make it through a whole season of torture and even survive into the next season.
- Tier III: 120-180 hours. Failure within this tier means a bike is “highly reliable” because it can handle two whole seasons of torture and then some. That is, honestly, quite impressive.
- Tier IV: 180-240 hours. Failure within this tier means a bike is “exceptionally reliable” because it can handle multiple seasons of torture.
- Tier V (the Forgotten Bike Tier): 240+ hours. Failure somewhere beyond 240 hours means a bike is “bulletproof” because it will be approaching half a decade’s worth of continuous, torturous seasons without any major work. A bike like this should last decades when ridden in a more relaxed manner and given better care. This tier also holds an extra special kind of torture, which will be revealed if a bike ever makes it this far.

This document, being Part 1 of the CRF250X torture test, only covers Tier I. I decided to publish this one in smaller parts, so that everybody out there waiting to read the report doesn’t have to wait an entire year for the bike to finally bite the dust.

TORTURE TEST DIRT BIKE MAINTENANCE SCHEDULE

- Air filter clean: 20 hours
- Spark plug replace: 60 hours
- Oil top up: As needed before each ride
- Oil and filter changes: Ladder format – X hours per 100ml of reservoir capacity, with X being the oil change iteration. The CRF250X's two sumps measured out to about 800ml each from completely drained, so the first oil change will be at 8 running hours. The second will be 16 running hours after that. The third will be a 24-running hour interval on the same oil.
- Valve clearance inspection and adjustment: Inspected every 10 hours. Adjusted as needed.
- All other work will be performed on an as-needed basis.

It's definitely not supposed to be a good maintenance schedule. It is quite a lazy schedule. It only needs to be decently consistent for the sake of comparing the results between bikes. Please, don't try any of this on your own bike! Let's have a look at the actual, recommended, maintenance schedule from the Honda service manual below.

COMPETITION MAINTENANCE SCHEDULE

Check all items before each race.

Perform the Pre-ride inspection in the Owner's Manual at each scheduled maintenance period.

I: Inspect and Clean, Adjust, Lubricate or Replace if necessary. C: Clean. R: Replace. A: Adjust. L: Lubricate.

FREQUENCY / ITEMS	NOTE	Each race or about 2.5 hours	Every 3 races or about 7.5 hours	Every 6 races or about 15.0 hours	Every 9 races or about 22.5 hours	Every 12 races or about 30.0 hours	Refer to page
THROTTLE OPERATION		I					3-8
HOT START		I					3-9
AIR CLEANER	(NOTE 1)	C					3-10
CRANKCASE BREATHER		I					3-11
SPARK PLUG		I					3-11
RADIATOR COOLANT	(NOTE 2)	I					3-13
VALVE CLEARANCE/ DECOMPRESSOR SYSTEM	(NOTE 4)			I			3-14
ENGINE OIL	(NOTE 3)	I		R			3-17
ENGINE OIL FILTER	(NOTE 3)			R			3-17
ENGINE IDLE SPEED		I					3-19
PISTON AND PISTON RINGS				R			9-5
PISTON PIN				R			9-5
TRANSMISSION OIL	(NOTE 5)	I		R			3-20
COOLING SYSTEM		I					3-13
DRIVE CHAIN		I, L	R				3-21

Honda's recommended competition maintenance schedule for this bike is very interesting, and shows that they do not suggest trying to get an entire season out of the bike without major work. This schedule calls for, basically, all of the engine maintenance to be done at the same time. They expect us to inspect and adjust the valve clearances, change the engine oil and filter, change the transmission oil, and replace the piston, all at once, every 15 running hours.

I doubt anybody is putting in a new piston every time they change the oil. That would be quite absurd. However, the CRF250X has become known for requiring cylinder head rebuilds fairly often. The CRF Valve Issue™, as it has been named, is often the single reason why people choose not to buy a CRF250X. Early on, when the CRF250R/X and CRF450R/X were still new to the market, owners started making a big fuss about how the valves would rapidly fail, making expensive cylinder head rebuilds necessary in order to have a decently reliable bike. You can still find a lot of internet-yelling and arguing on various forums and discussion boards about the CRF Valve Issue™. Some people say the bikes aren't worth owning because the issue is so bad. Some people claim it was never an issue, and blame CRF owners for abusing their bikes. Some people claim the issue existed and then Honda fixed it after a few years. Others claim that the issue is caused by one thing or the other, and everyone has their own fix that they swear by, like re-sealing the mating surfaces in the airbox or installing foam filters on all of the carburetor vents. There are **a ton** of claims, opinions, and different trains of thought on the subject. You've probably seen some of it at some point if you've ever read into the CRF250X or the other carburetor-equipped Unicam bikes. It's quite the dizzying internet rabbit hole.

Instead of going by the word of random internet forums to try to find out what Honda has actually done to address reliability issues, because I've now seen way too many different explanations of when and how Honda supposedly fixed the CRF250X's issues, let's look through Honda's official press releases to see what they've publicly mentioned.

- 2005 – No changes to the engine.
- 2006 – New intake valve seat material for improved valve durability.
- 2007 – Cylinder head porting from CRF250R, CRF250R piston and (thinner) ring. Not really anything having to do with the valve issue, but it's the last time the engine changed.

Honda has not mentioned any changes to the head since the change in 2007, and the head assembly part number (12010-KSC-A10) has not changed at all since 2007. So, the latest CRF250X (2017) is using the exact same head as bikes from 13 years ago. Problem solved with the change to different valve seat material on the 2006 model then, right? Well, not really, because just about all of them that I see out here in the desert, regardless of the model year, have a Fastheads decal on the head.

Fastheads is a local business that specializes in one thing: rebuilding dirt bike cylinder heads. They're especially fond of Honda CRF bikes because of all the business that they bring in, and they've developed their own solution to the CRF Valve Issue, without a switch to heavy steel intake valves, which they call the Fastheads Extreme Package. A new cylinder head with the Fastheads Extreme Package will set you back about a thousand dollars, so it's not cheap, but they are so confident in it that they guarantee the titanium intake valves they use will outlast the rest of the engine.

That all sounds pretty sweet to me, and I'd probably go ahead with that option for my CRF250X if I wasn't doing this project, but in this torture test I wanted to start out with an OEM head to see what people are dealing with when they buy the bike from Honda. So, I took my 2006 CRF250X and replaced the 2006 top end with a brand new, OEM, 2007-present head assembly as well as a brand new, OEM, 2007-present piston and ring. I also went with a Hotcams Stage 1 cam, just for fun.

OUTCOME GUESSES

My guess on how this torture test will turn out: I have to guess that the CRF Valve Issue will be the thing that makes the bike fail the test, because it will require removing the cylinder head to correct. I don't think that is a wild guess, either. I've been around several CRF250 bikes of various years, and they all fall victim to the CRF Valve Issue pretty early. It is pretty safe to guess that mine will suffer the same fate as all the rest that I've seen. And how long will it last before failing the test? I'm guessing about 100 running hours, in the middle of Tier II.

But the CRF Valve Issue is rarely the ultimate end of a CRF250's life. Most people keep the bike, refresh the top end and rebuild the head with more durable components, then run it until it explodes. So, if we run into the CRF Valve Issue in this test before the end of Tier II, that's what we'll do. We'll rebuild the top end with a Fastheads package and see what else ends up giving out. Though the bike will have officially failed the test whenever the CRF Valve Issue creeps up, we can still have a lot more fun with it before giving up on it!

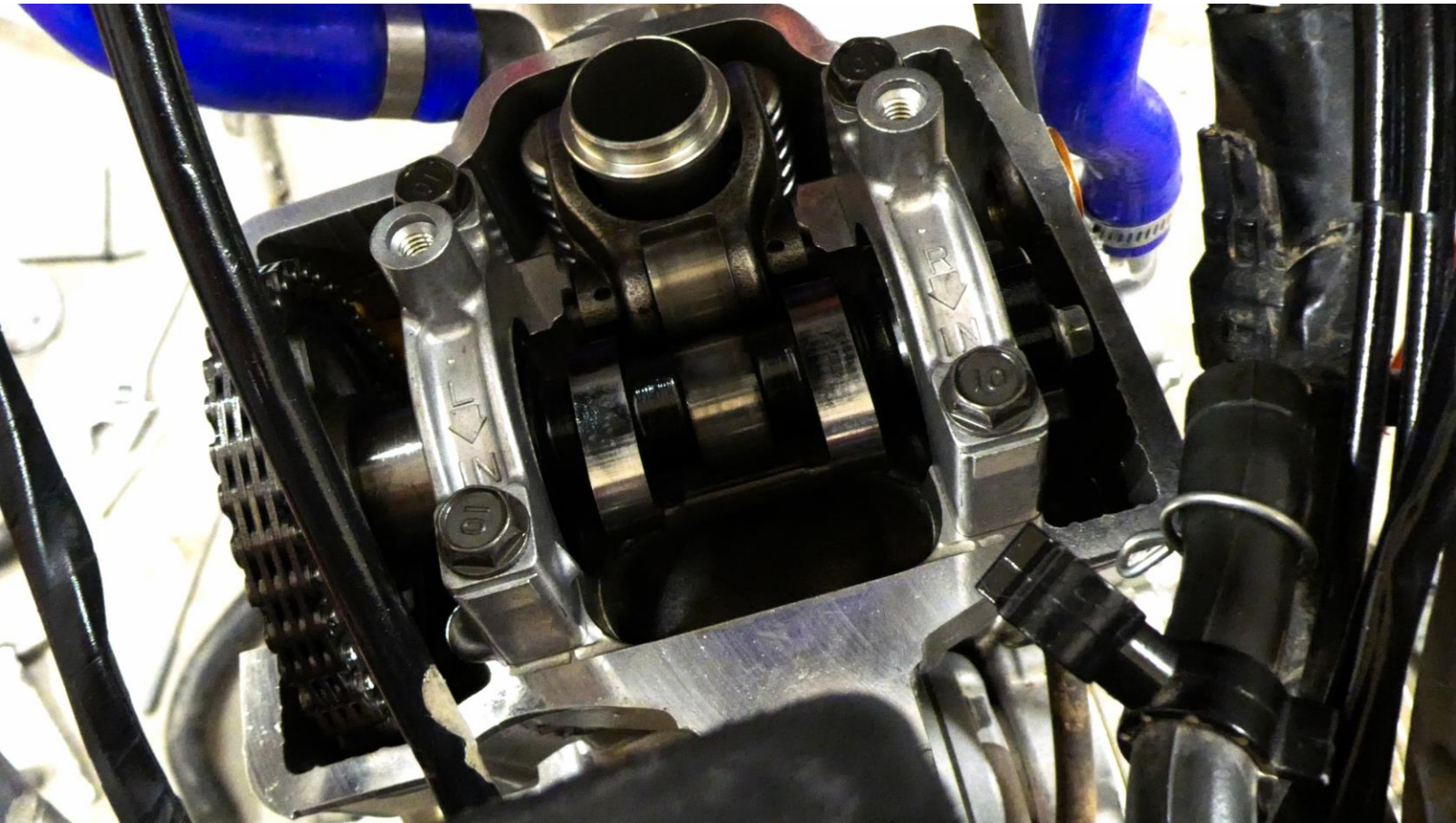
BASELINE READINGS

In the KDX200 torture test, we monitored the condition of the cylinder by using a bore scope and compression testing. Cylinder wear is not really something that needs to be monitored on the CRF250X, since it has a very strong cylinder plating. Instead, throughout this torture test, we'll be mostly keeping an eye on how the valve clearances change with miles and hours on the bike, since that is what is likely to cause the test to end.

With the brand-new head installed, I set the valve clearances to 0.28mm on the exhaust side and 0.13mm on the intake side. With shims in size increments of 0.05mm, that was as close as I could get to spot-on. The manual calls for a clearance of 0.28±0.03mm on the exhaust side and 0.12±0.03mm on the intake side.

At the end of each tier, I'll also be measuring the 0-60MPH acceleration of the bike to see if it has lost or gained performance. On the very first ride, a clutch issue (explained in the coming pages) prevented me from recording an accurate 0-60mph time, but after correcting the issue the bike had a 0-60MPH time of 5.6 seconds. Before switching to the updated top end components, the 0-60MPH time was 6.1 seconds, so the components that I'm running for this torture test made the bike a lot more powerful. This was recorded on asphalt at 3,000ft elevation and all future acceleration tests will also be recorded on asphalt at that elevation.

Now, on to the torture test!



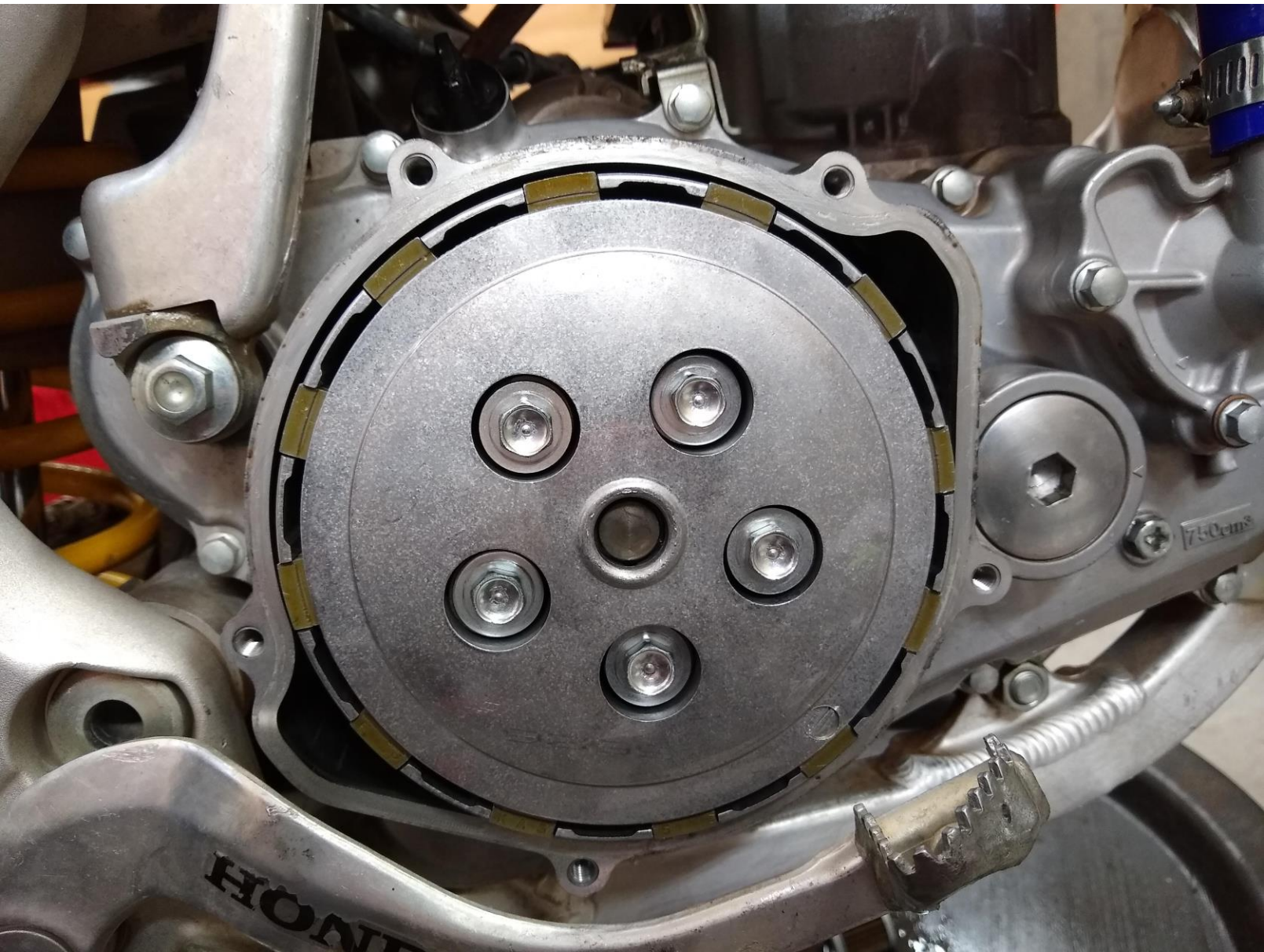
0-10 HOURS

The torture test began with a very short ride. The newly refreshed motor easily fired up with a short push of the electric start button, and the bike immediately idled as it should, without having to nurse the throttle much. I gave the bike some gentle blips of throttle while it warmed up and observed small amounts of light-colored smoke puff out of the exhaust. I wasn't too concerned since it was the first start up. I've had some bikes smoke a bit immediately after a top end rebuild, and others go straight to burning clean. (video of the smoking, for the curious: https://www.youtube.com/watch?v=0kxgUEUiAhQ)

Once the CRF was warmed up, I tried to go straight to riding it as I normally would, but there was a problem. The throttle response was tack sharp and the power was far beyond what this bike was previously capable of. The power delivery was, in fact, so improved that the standard CRF250X clutch stood no chance! When getting on the throttle in third gear or higher, the bike's pull would feel great until mid-RPM when the clutch would slip out significantly, dulling the otherwise excellent power. I was not okay with this, and ended the ride to examine my options for improving the clutch. This was already a fresh clutch pack, so a little modification was in order. On the bright side, the smoking had stopped immediately after the first time going hard on the throttle in gear.

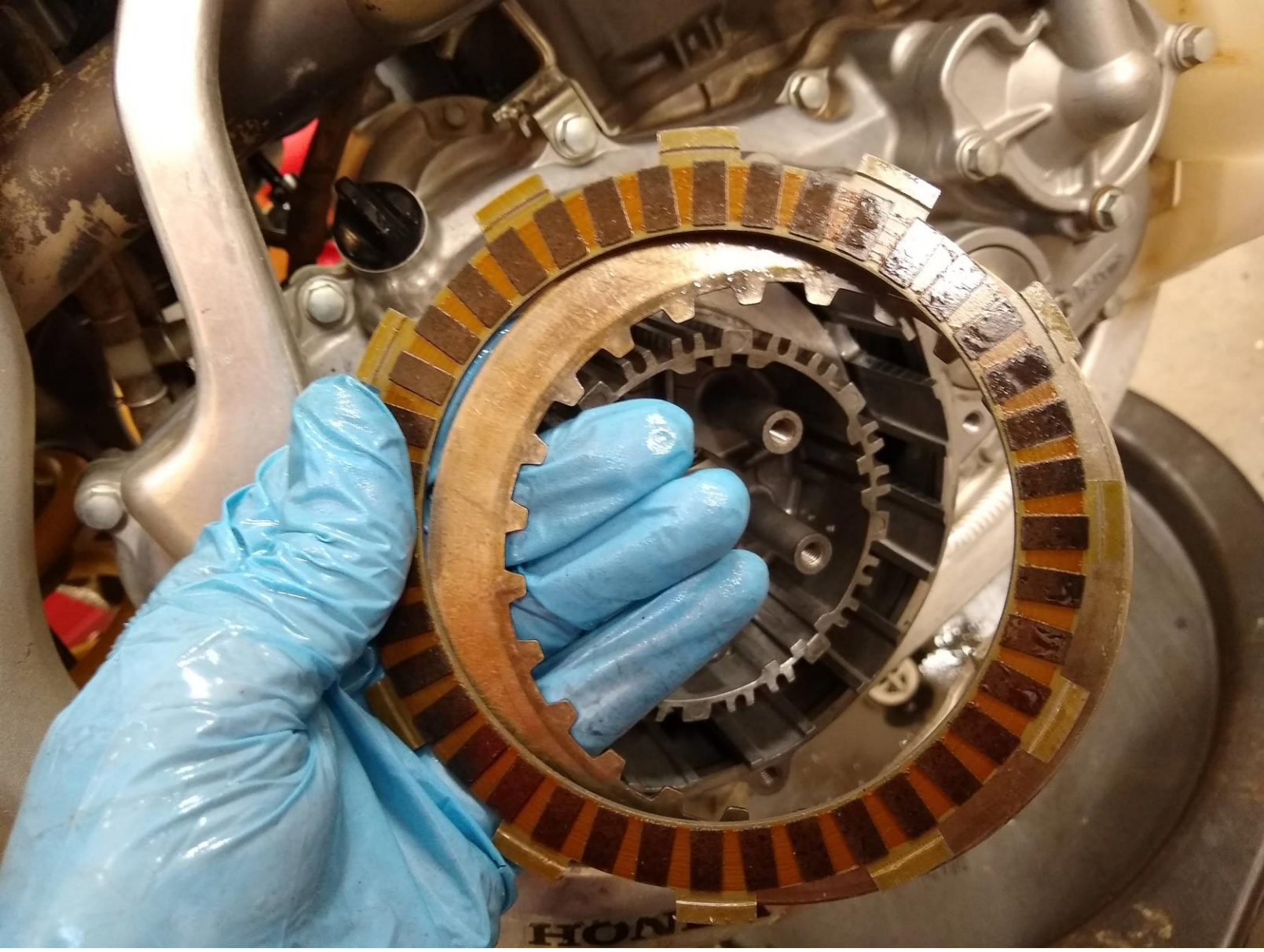
The standard 2006 CRF250X clutch uses a judder spring mechanism, different pressure springs, and different friction pad material to differentiate it from the stronger-grabbing CRF250R clutch (The 2008 and beyond Unicam CRF250R, however, switched to using a judder spring). The CRF250X clutch, in comparison to the early-R clutch, produces a wider, more progressive engagement zone at the clutch lever. It also has an easier pull force at the clutch lever. These differences make the X clutch more user-friendly, especially in rough terrain and low traction situations where a less predictable, grabby clutch can be a detriment to performance.

As much as I love the standard X clutch's buttery smooth engagement, I was willing to sacrifice some of that user-friendliness in order to make use of the full power available from the newer head. Fortunately, as with most MX-based engines, the clutch on the CRF250X is easily serviceable by removing the 5 bolts holding the magnesium clutch cover in place. From there, the 5 clutch spring bolts can be removed and the whole clutch pack slides out just like that! There's no need to un-stake and force off a huge clutch nut, lock the transmission, or any of that old school business.



With the clutch pack in hand, I picked out the judder spring mechanism from the stack. The mechanism includes a large inner diameter friction disc with a steel Belleville style spring that fits within the extra inner diameter of the friction disc, and a hard steel seat for the spring. This mechanism simulates a thicker, though compressible, friction disc in order to provide a more progressive and predictable clutch engagement. The mechanism attempts to take up more space in the clutch pack when the clutch is lifted (disengaged) so that the clutch pack will start engaging sooner as the clutch is dropped (engaged), but in a gentle manner since the judder spring flattens out and takes up less space as more pressure from the main springs is applied to the whole clutch pack.

While the judder spring makes the clutch feel nice, it also significantly reduces the maximum friction available from the clutch pack. I got rid of the judder spring mechanism and replaced it with a full-sized friction disc.



As you can see, replacing the judder spring with a full-sized friction disc provides some extra surface area for the clutch to grab with. Since I didn’t actually have a brand-new full-sized friction disc, and I wasn’t going to wait to have one shipped, I just installed the least-worn one from the previously used clutch pack.

While assembling the clutch, I started playing with one of the pressure springs and thought it felt quite soft for a clutch spring. I dug through my pile of parts to see if I had some stiffer springs that might fit, but didn’t find anything in the right size. I did, however, have some drain plug washers that were exactly the right size to preload the clutch springs a little bit. In an attempt to simulate stiffer springs, I used those drain plug washers to add extra compression to the clutch springs. Using drain plug washers in this manner is risky business, because if they are too soft they will eventually just be eaten away by the spring. This just made me want to go ahead with this modification even more, because I had to find out if this will actually happen. We will get to find out at the next clutch tear down, or whenever one breaks loose and grenades the transmission. What fun!

Of course, adding extra load to the springs to simulate stiffer springs must increase the maximum force required to pull the clutch lever. That, plus the removal of the judder spring could really hurt the ease of clutch control on this bike. To find out how much the clutch lever maximum pull force was increased, I measured the pull force at the point where my clutch finger rests before and after the modification. Before the modification, the maximum pull force measured at about 12 pounds. After the modification, it was exactly one pound more difficult at 13 pounds. Although it might not sound like much, this is a fairly significant increase with the pre-modified pull being only 92.3% the difficulty of the modified pull. A little human clutch finger (and the associated forearm muscles which actuate it) is going to feel that after several hours of riding. I resolved to “just deal with it.”

I put the clutch cover back on, re-using the same gasket and making this the fourth time I’ve reused that gasket. We’ll see how many times I get away with that! With the clutch modified, I rode out on the bike again. This time, the clutch was much more aggressive. It definitely did lose some smoothness in the way it engages, but it no longer slipped under power, and I liked that!

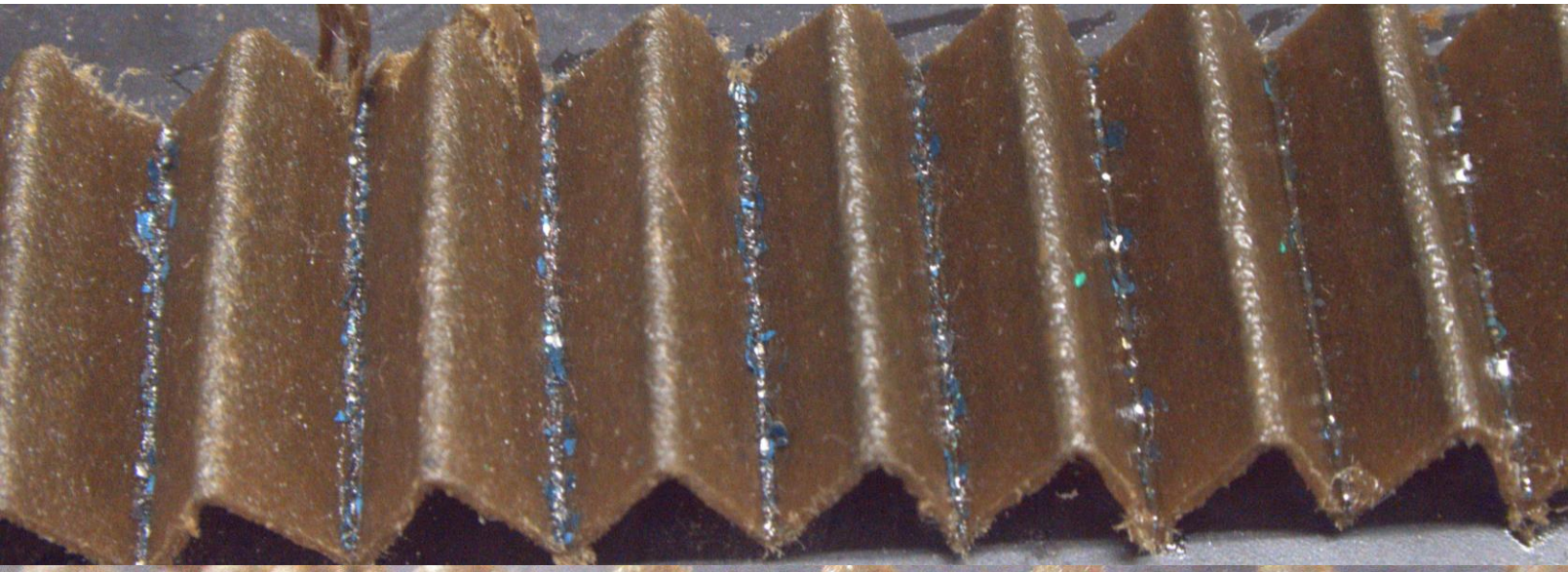

Before: ~12lb
Capacity 35kg/80lb
Graduation 1000g/1lb
SMARTRIP

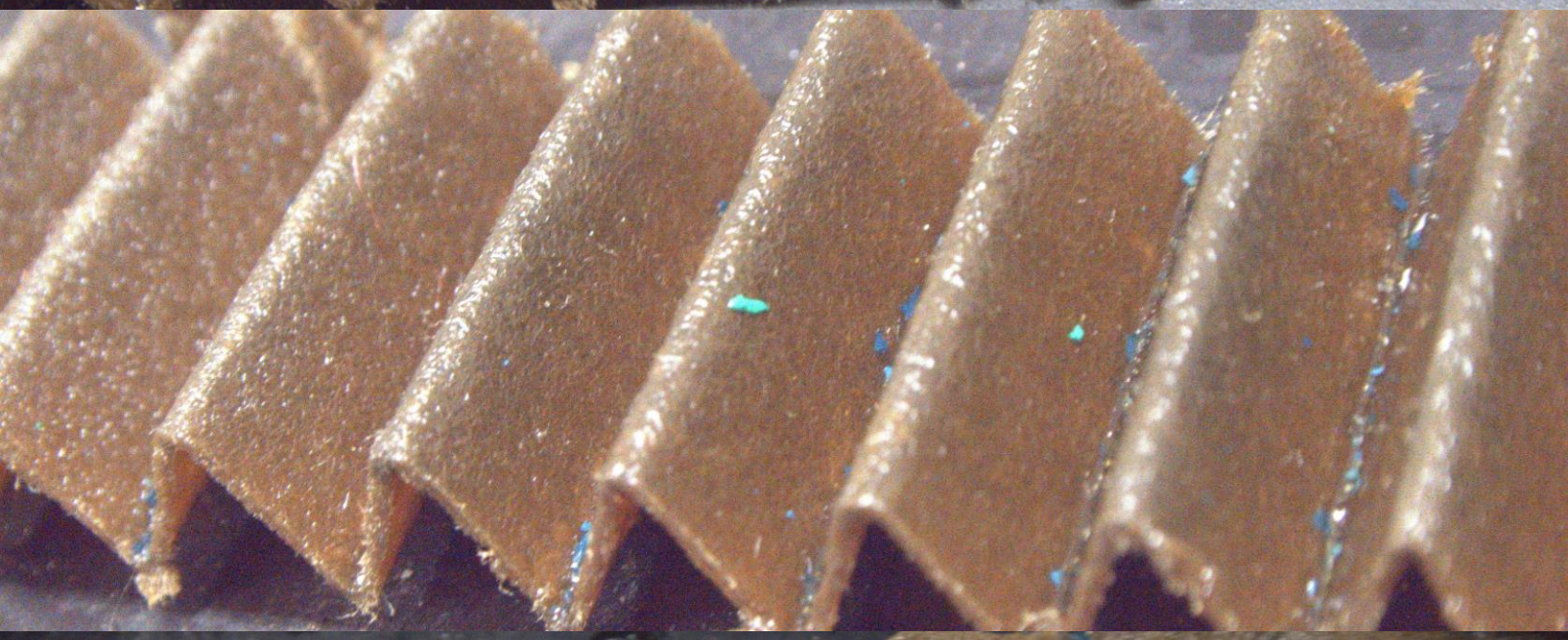

After: ~13lb
Capacity 35kg/80lb
Graduation 1000g/1lb
SMARTRIP
THE SENSE OF TRAVEL

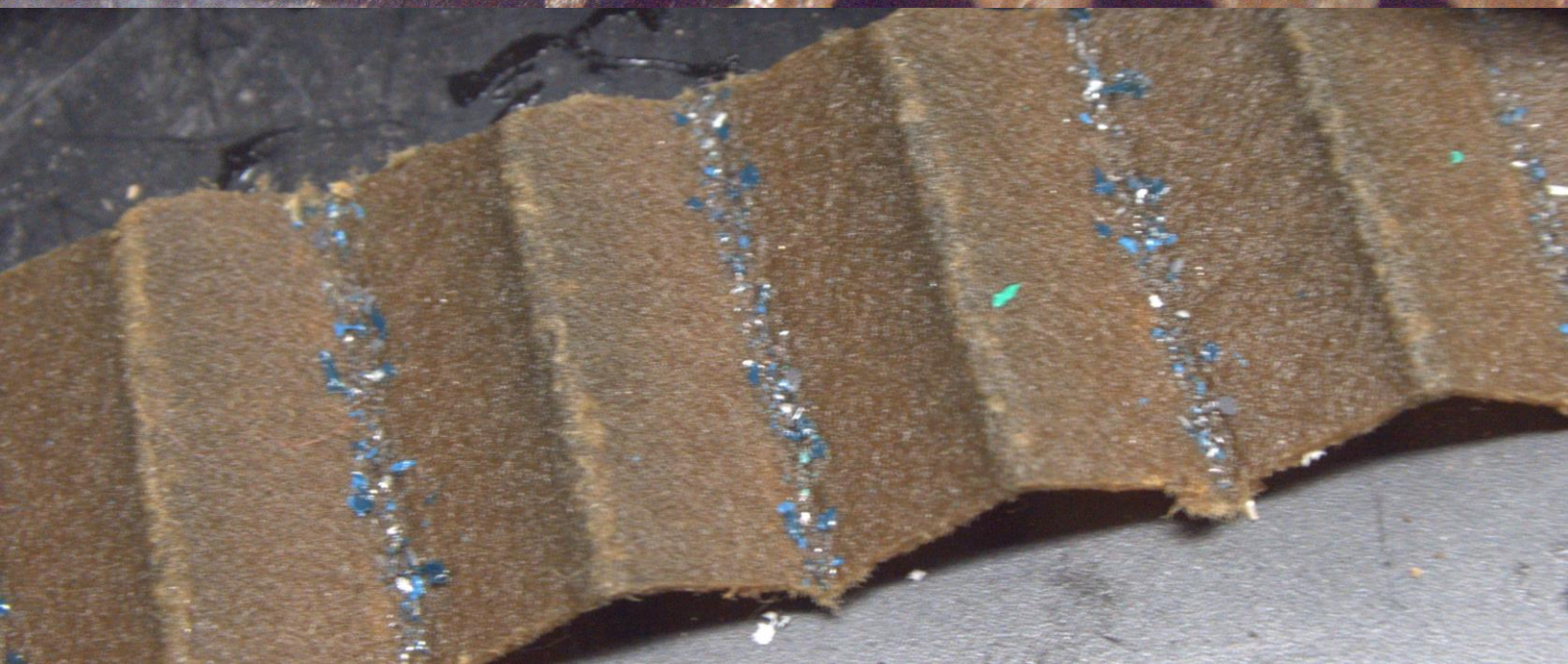
With the bike in excellent working order, the torture test was on, and the CRF250X was put to work straight away as my guide bike for an EveRide shred rally in southern Utah. I showed up to the event with 4:13 running hours (102 miles) on the bike and came home with 8:30 running hours (154 miles), which meant it was time for the first oil drop and lab analysis.

The oil in the motor side came out looking relatively clean. It still had the normal golden hue of new oil, but was substantially darkened.

The oil filter had a pretty good amount of visible solids stuck in it. I could easily identify most of it as aluminum flakes, blue paint from the intake valve springs, and green paint from the exhaust valve springs.







OIL REPORT

LAB NUMBER:	K93850	UNIT ID:	06 CRF
REPORT DATE:	2/14/2019	CLIENT ID:	127894
CODE:	146/32	PAYMENT:	CC: Visa

UNT

MAKE/MODEL: Honda Motorcycle CRF250X
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil 1 10W/40
OIL USE INTERVAL: 8 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: The viscosity of this sample was low, and that's typical for motorcycles. They tend to shear the oil so a low viscosity is probably going to be the norm for your CRF, and as long as wear metals are in good shape, it's just something to note. The reported hours suggest this is the first oil change for this engine, and we typically find a lot of wear-in material (metals and silicon). That's not the case for your Honda and that's okay. Wear metals look great next to universal averages, which show typical wear after ~5 hours of oil use. Just check back for trends. Nice first report!

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	8							
MI/HR on Unit	8							
Sample Date	2/7/2019							
Make Up Oil Added	0.10 qts							
ALUMINUM	16	16						12
CHROMIUM	1	1						4
IRON	28	28						21
COPPER	4	4						11
LEAD	1	1						5
TIN	2	2						1
MOLYBDENUM	69	69						138
NICKEL	2	2						2
MANGANESE	2	2						1
SILVER	2	2						7
TITANIUM	0	0						0
POTASSIUM	2	2						2
BORON	98	98						56
SILICON	15	15						13
SODIUM	5	5						5
CALCIUM	1187	1187						1538
MAGNESIUM	589	589						520
PHOSPHORUS	721	721						1009
ZINC	793	793						1194
BARIUM	1	1						0

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	**63.1**	65-76					
cSt Viscosity @ 100°C	**11.09**	11.6-14.8					
Flashpoint in °F	400	>385					
Fuel %	<0.5	<2.0					
Antifreeze %	0.0	0.0					
Water %	0.0	0.0					
Insolubles %	0.2	<0.6					
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

Typically, in an effort to pull some useful data from the oil analysis, I'll compare the amount of wear metals found in the oil at different oil change intervals. Since this is the first analysis, it can only be compared to an unused sample of the same oil and Blackstone's CRF250X average sample, which is an average oil change interval of about 5 running hours in this case.

When looking at these numbers, a lower count is generally better since it means less of that element was found in the oil.

Element	Actual 8hr	5hr average	Unused oil
Aluminum	16	12	1
Chromium	1	4	0
Iron	28	21	0
Copper	4	11	0
Lead	1	5	0
Tin	2	1	0
Nickel	2	2	0
Total	54	56	1

From the total wear metal perspective, our 8 running hour oil change interval turned out slightly more-healthy than Blackstone's CRF250X average. That's good news for the Mobil 1 10w-40, since it's cheap but doing slightly better than average. The viscosity did shear down quite a bit (the unused oil analysis put this oil in the 15w-50 range) but it doesn't appear to have caused a problem.

There are even more ways to look at an oil analysis, though, and of course I'll show my other two favorite ways to compare results as well. The next comparison is the extrapolated run time comparison, where the results of shorter run time oil change intervals are extrapolated out and compared to a longer run time oil change interval to see if wear is increasing linearly with run time or if wear is accelerating/tapering with increased run time on the oil. In this case, again, we can only compare the 8 hour sample to a slightly shorter 5 hour average. It's not an especially useful comparison at this point in our torture test, so it might not make sense right now, but in the KDX200 volume of Torture Test Magazine the results started to get very interesting when comparing very high hour oil to the extrapolated results of low hour oil.

Element	Actual 8hr	5hr average extrapolated 1.6x (to 8hr)
Aluminum	16	19.2
Chromium	1	6.4
Iron	28	33.6
Copper	4	17.6
Lead	1	8
Tin	2	1.6
Nickel	2	3.2
Total	54	89.6

This is already an interesting result. Extrapolating the 5 hour average out to simulate 8 hours shows that our actual 8 hour sample on Mobil 1 10w-40 is looking very healthy in comparison to the average, with only tin being very slightly higher.

The next thing I like to look at is anti-wear element depletion. Oils contain anti-wear compounds which get used up as the oil is used. By comparing used oil to unused oil of the same kind, we can see how much of the anti-wear element is missing in the used oil. This is how some used oil reports determine “oil life” percentage.

One thing to note, however, is that 100% “oil life” does not always provide the highest level of protection for a given oil. Some oil products are formulated for extended use and have an extra load of additive which acts as a buffer to make sure the oil does not reach its wear out point too early. This extra additive load, however, can actually hurt the oil’s protection performance for a certain amount of time until the additive package has been broken down to a certain point where it performs best. This caused me a lot of confusion in the KDX200 torture test, because I wasn’t aware of this and was surprised to find that the transmission oil needed a lot of use before it provided its highest amount of protection. Will we see this same trend happen with this different oil (Mobil 1 10w-40) being used in a four stroke engine? I can’t wait to find out!

Component	8hr	Unused
Molybdenum	69	71
Phosphorus	721	717
Zinc	793	820
Total	1,583	1,608
Difference from previous	25	-
“Oil life” (anti-wear element remaining)	98%	100%

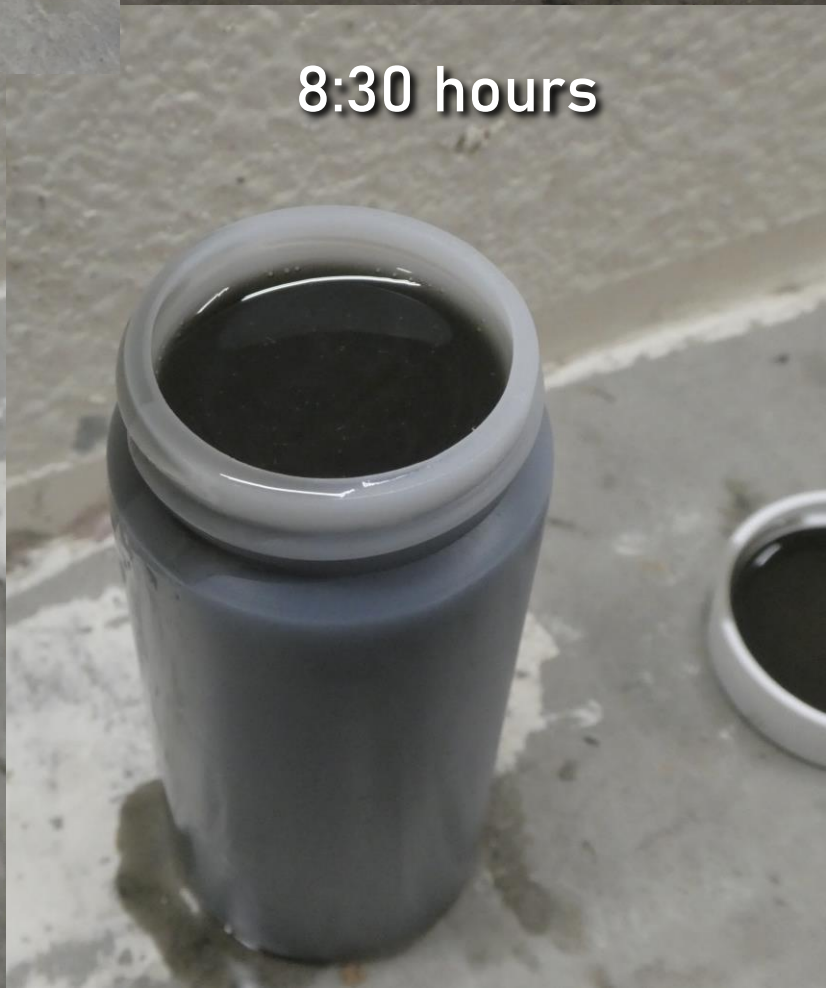
The Mobil 1 10w-40 starts out with a moderate amount of anti-wear element, and the CRF engine doesn’t appear to be using it up very quickly. It even seems to have generated some phosphorus? Interesting!

The last piece of information I want to record about this oil change is that over the course of the 8:30 running hours, I had to add 100ml of oil to keep the level at the top of the dipstick. On a bike like this, oil is lost in several ways. Some oil leaks past the piston ring and some leaks down the stems of the intake and exhaust valves. On a fresh engine, those two sources of oil loss (known as oil burning) should only make up a very small amount of oil loss. Even when oil isn’t sneaking its way into the combustion chamber, some is vaporized by heat, slinging and thrashing inside the engine and subsequently gets thrown out of the engine breather into the airbox. On this bike in particular, there is always plenty of motor oil that has been blown into the airbox where the engine breather connects, so that is usually the largest source of oil loss.

Of course, a small amount of oil is lost before each ride when wiping the dipstick clean to check the oil level as well. On a small sump like this one, it all adds up to a noticeable amount of oil loss.

On the oil report from Blackstone the make up oil measurement is marked in quarts, but I'm actually recording in liters. The rate of oil loss for this oil change interval was 11.8ml per running hour (12.5ml per hour rounded to 8 hours). Now let's have a look at how the CRF's transmission oil held up.

The transmission oil came out much more discolored (grey/charcoal hue) and much more-opaque, with lots of very fine visible dust suspended in it. You can see how opaque it is with just a small amount poured into this white cap.



BLACKSTONE LABORATORIES

OIL REPORT

LAB NUMBER: K94119
REPORT DATE: 2/15/2019
CODE: 146/32

UNIT ID: 06 CRF-TR
CLIENT ID: 127894
PAYMENT: CC: Visa

UNIT

MAKE/MODEL: Transmission Honda Motorcycle Trans
FUEL TYPE:
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil Delvac 1300 15W/40
OIL USE INTERVAL: 8 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: This transmission sample looks pretty good. Universal averages show typical wear for oil run about 10 hours and, and while your metals are a bit higher, that could be reasonably explained by lingering break-in combined with the hard use your bike is seeing. Silicon is a touch elevated due to sealers/lube used during assembly, and that along with some of the metal should wash out over the next few oil changes. The viscosity is in spec for 15W/40, and no water was detected. Nice report! Try up to about 12 hours or so before the next service.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	8							
MI/HR on Unit	8							
Sample Date	2/7/2019							
Make Up Oil Added	0 qts							
ALUMINUM	89	89						49
CHROMIUM	0	0						0
IRON	31	31						16
COPPER	4	4						4
LEAD	1	1						2
TIN	0	0						0
MOLYBDENUM	43	43						92
NICKEL	0	0						0
MANGANESE	1	1						2
SILVER	0	0						0
TITANIUM	0	0						0
POTASSIUM	0	0						0
BORON	64	64						5
SILICON	26	26						14
SODIUM	3	3						15
CALCIUM	1634	1634						2863
MAGNESIUM	525	525						8
PHOSPHORUS	805	805						973
ZINC	910	910						1161
BARIUM	0	0						1

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	69.1	69-78					
cSt Viscosity @ 100°C	12.72	12.7-15.3					
Flashpoint in °F	430	>420					
Fuel %	-	<0.0					
Antifreeze %	-						
Water %	0.0	<0.1					
Insolubles %	0.2	<0.6					
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

First, a straight across comparison to the 10-hour average from Blackstone. The only difference with a transmission oil comparison is that I also add in the silicon count because silicates are sometimes used in clutch friction pad material.

Element	Actual 8hr	10hr average	Unused oil
Aluminum	89	49	1
Chromium	0	0	0
Iron	31	16	1
Copper	4	4	0
Lead	1	2	0
Tin	0	0	0
Nickel	0	0	0
Silicon	26	14	7
Total	151	85	9

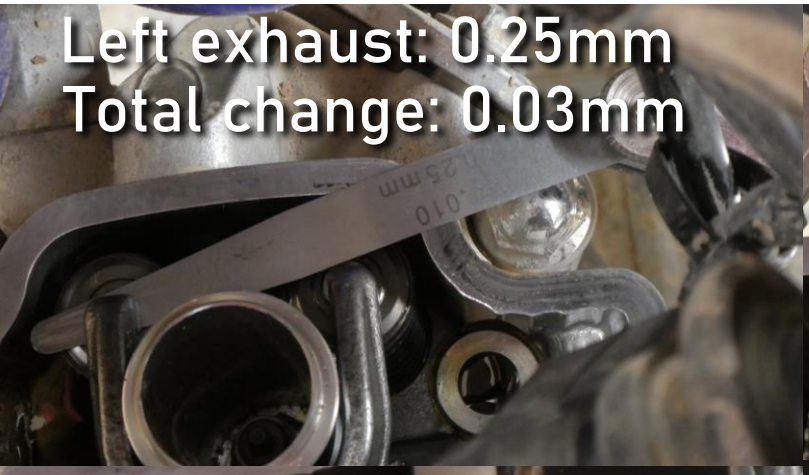
Wow, 151PPM of wear element is an enormous amount for only 8 hours on transmission oil. The KDX200 never got anywhere near that. I guess I should have expected this since I usually only get about 25 running hours out of a clutch on this bike, and that was before increasing the power! Anyway, in our straight-across comparison here, the average 10-hour oil sample totally dominates our 8-hour sample. Let's interpolate the 10-hour average back to 8 hours and make this look even worse.

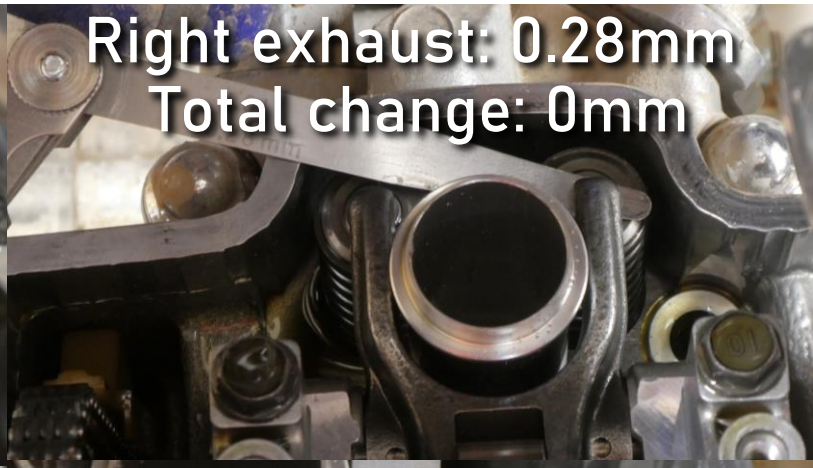
Element	Actual 8hr	10hr average interpolated 0.8x
Aluminum	89	39.2
Chromium	0	0
Iron	31	12.8
Copper	4	3.2
Lead	1	1.6
Tin	0	0
Nickel	0	0
Silicon	26	11.2
Total	151	68

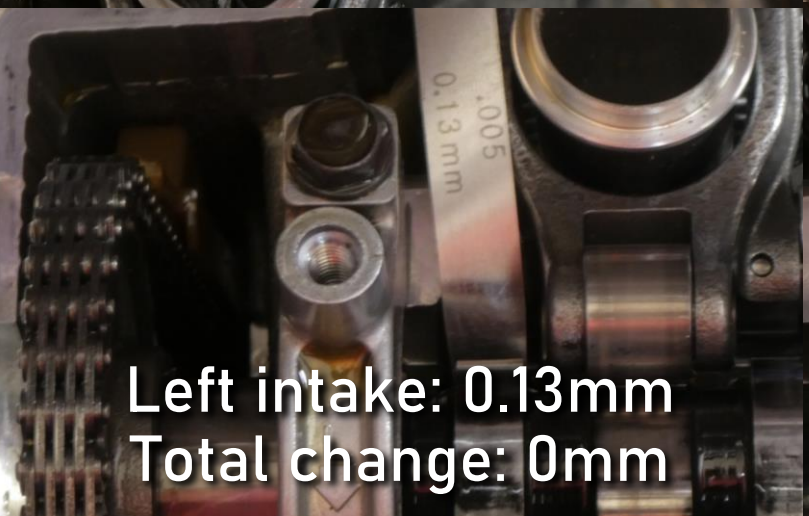
Component	8hr	Unused
Molybdenum	43	40
Phosphorus	805	725
Zinc	910	838
Total	1,758	1603
Difference from previous	+155	-
“Oil life” (anti-wear element remaining)	109%	100%

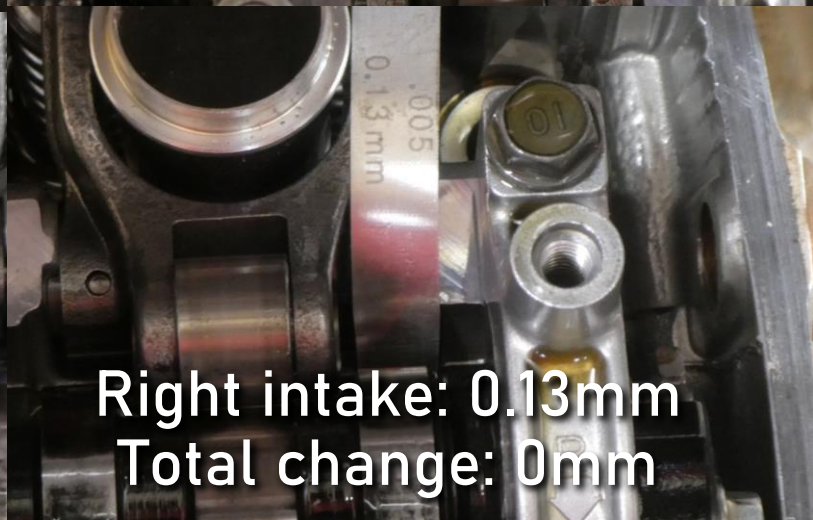
Behold, the holy grail of oil! It has gained immortality! This is a really funny result. It is definitely not what I expected based on what I saw from the KDX200 transmission oil testing, which was that these elements decrease relatively quickly in the earlier hours of oil use. Actually, I was a little bit concerned when the unused oil analysis for this bottle of Mobil Delvac came back completely different from the unused oil analysis for the previous bottle of the same oil. Maybe I was right to be concerned. I don’t have a clue at this point why this would happen besides the obvious possibility of inconsistency in the oil testing process. Got any ideas? Let me know!

When the bike hit 10 hours, it was time for the first valve clearance check.

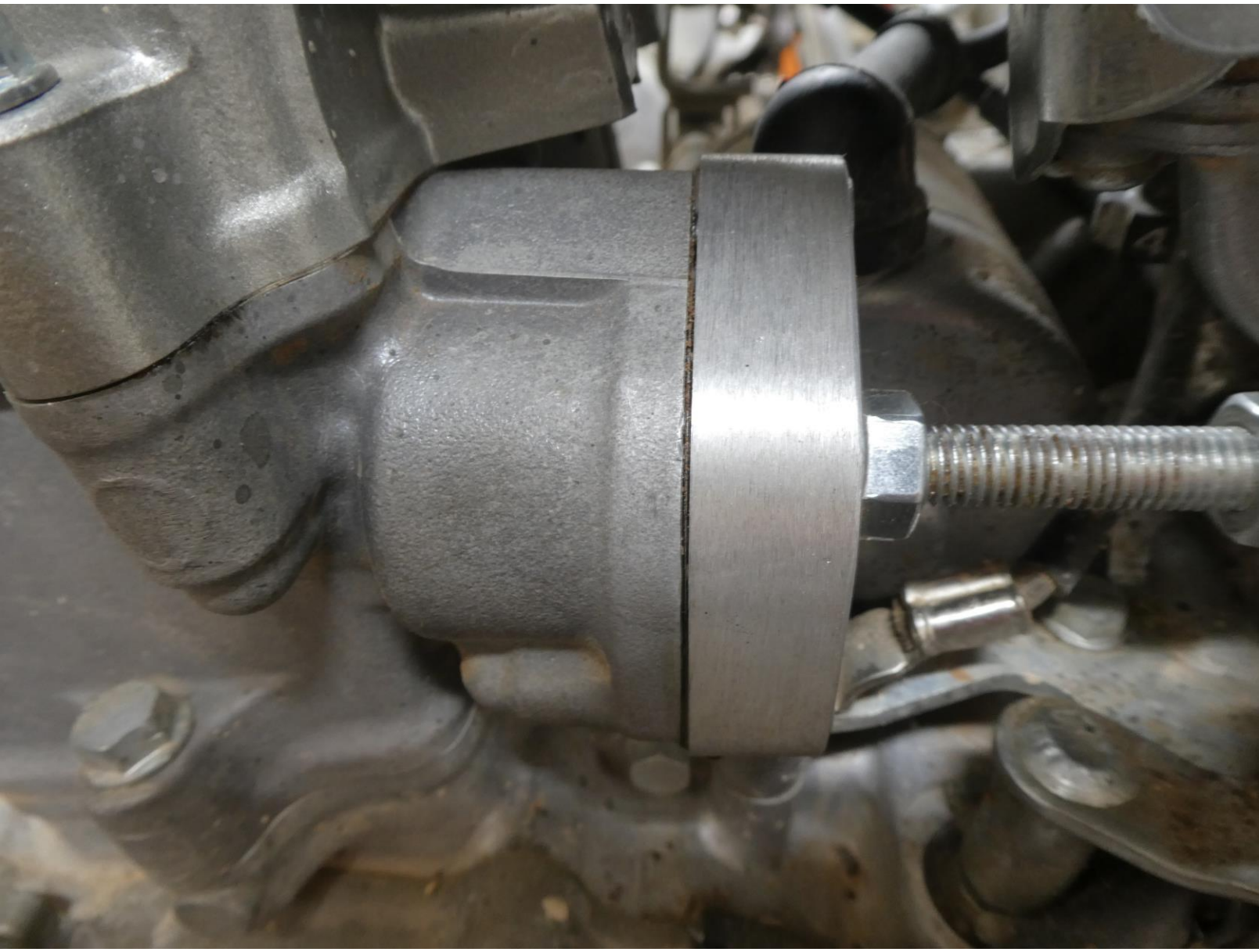








The required valve clearances for this bike are 0.12±0.03mm for the intake valves and 0.28±0.03mm for the exhaust valves. The left exhaust valve has worn by 0.03mm and is close to being worn out of the specified clearance range already. If it wears more, it will need to be shimmed back to the specified range. This has me worried since it happened so quickly. Fastheads of Saint George, Utah, urges CRF owners to get a head rebuild anytime any of the four valves reach 0.10mm of accumulated wear. This exhaust valve is already 30% of the way there. Will it really only make it to somewhere around 30 running hours? I sure hope not. The previous 2006 head survived longer than that.



To check the cam chain tension, I feel the cam chain during the valve clearance inspection and then loosen the tensioner mounting bolts a few turns to see how much the tension from the cam chain pushes the tensioner out, just to make sure there’s still a couple millimeters of preload. The cam chain tensioner did not require an adjustment.

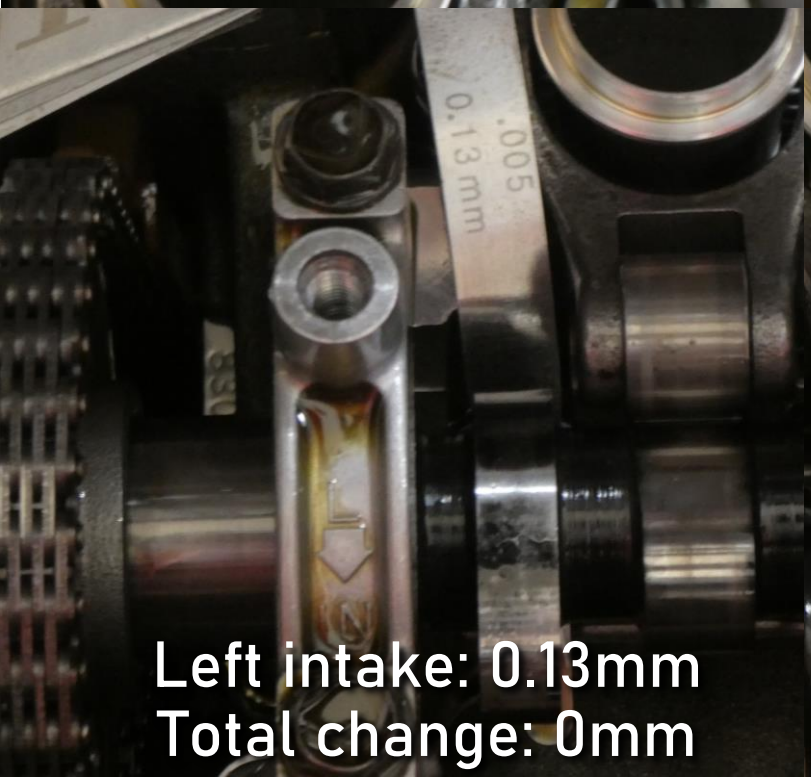
10-20 HOURS

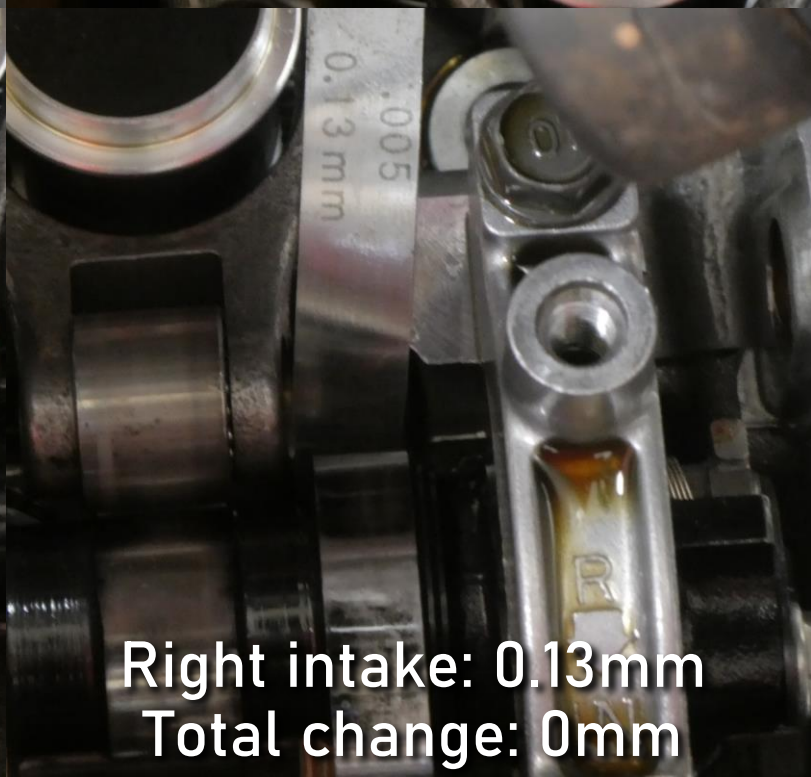
The 10 to 20 hour period held only a few events. To start it off, we experienced rare snow storms in southern Nevada. This has nothing to do with the bike, other than how I was forced to do some snow riding. I made a video about the first day of light snow (https://youtu.be/zMgCuNkfSE4) thinking it was just a one-time deal and everything would be fine. Maybe I should not have welcomed and played in the snow that day, because it looks like Mother Nature took that as an invitation to dump even more snow on us. It snowed again and again until the trails were covered in a foot of snow.

Riding cautiously in wet, icy conditions apparently makes me use the rear brake in a more abusive manner, because I chewed right through the last quarter inch of the OEM rear brake pads as if they were made of Styrofoam. I replaced them with Pro X brake pads for $22.95, simply because I had never tried Pro X pads and wanted to give them a shot. They turned out to have a good feel, so I have no complaints yet.

At 20 hours, I inspected the valve clearances and cam chain again. It looks like the right side exhaust valve is following along with the left, as the clearance measured out to 0.25mm on both sides. This brings both exhaust valves to 0.03mm of wear. The titanium intake valves are not showing any wear at all. The cam chain, again, did not require any adjustment.

While the exhaust valve wear was a little concerning, the bike still did manage to go more than 24 running hours without needing any real work. That's pretty much the magic number for my needs, because it proves the bike is capable of competing in the longest local endurance race on a new head without having to stop for adjustments or a head replacement.





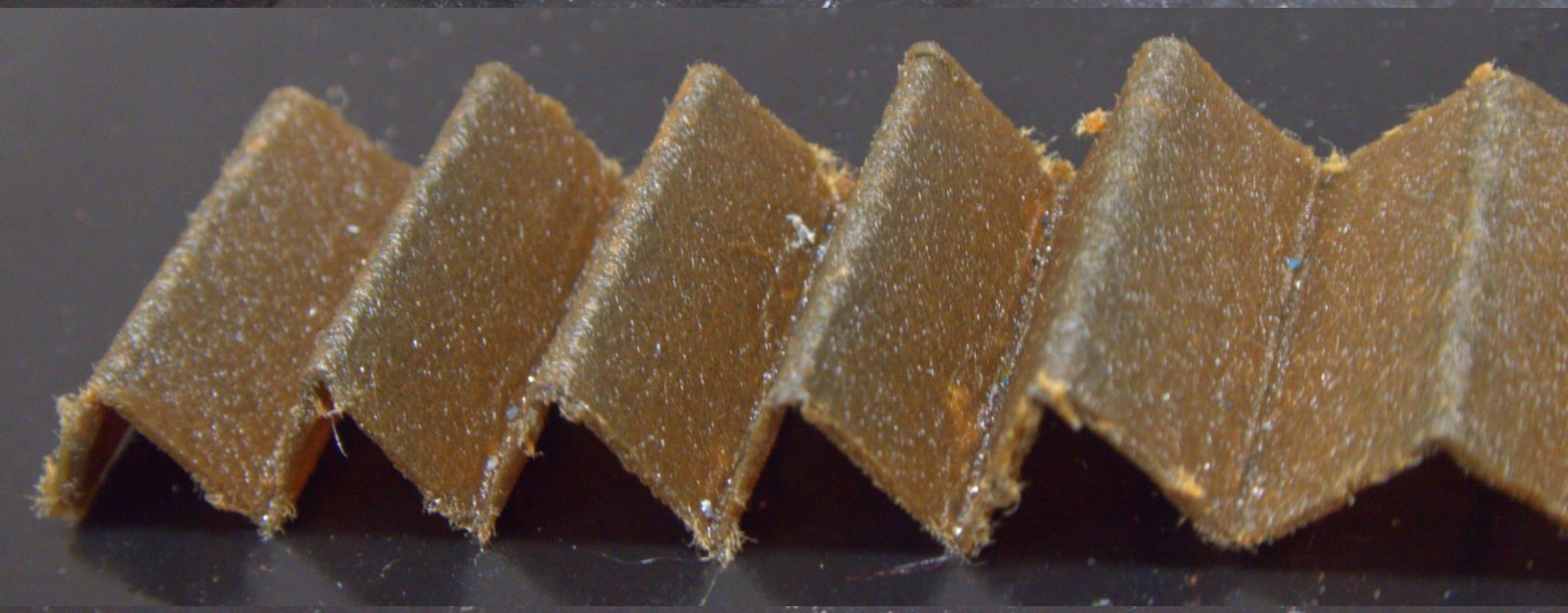
20-30 HOURS

The snow didn’t let up, but the first local endurance race of the 2019 season, the 6 Hours of Glen Helen, was coming up in two weeks and I wasn’t about to stop practicing! So, I just kept on riding until 24:03 running hours (460 miles) when it was time to change the 16-hour oil. First up, the motor side oil.


16 hours


New

The oil filter still contained the same types of debris as last time. It still had aluminum flakes, blue and green paint flakes, but this time there was much less of it all caught in the filter.



OIL REPORT

LAB NUMBER:	K97413	UNIT ID:	06 CRF
REPORT DATE:	3/1/2019	CLIENT ID:	127894
CODE:	146/32	PAYMENT:	CC: Visa

UNT

MAKE/MODEL: Honda Motorcycle CRF250X
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil 1 10W/40
OIL USE INTERVAL: 16 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: Wear-in is proceeding according to plan in this second report for your CRF 250X. All significant markers either went down (aluminum, iron, copper, tin) or held steady (chrome, lead) which tells us the initial accumulations of these metals are continuing to wash out nicely. Viscosity read even lower in this sample. It's not a concern, and may just be connected to the small amount of fuel dilution we found this time as well as continued shearing. We'll keep an eye on it in your next sample. Insolubles went down, indicating good oil filtration. Check back in ~20 hours.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	16		8					
MI/HR on Unit	24		8					
Sample Date	2/22/2019		2/7/2019					
Make Up Oil Added	0.2 qts		0.10 qts					
ALUMINUM	12	14	16					12
CHROMIUM	1	1	1					3
IRON	18	23	28					20
COPPER	3	4	4					10
LEAD	1	1	1					4
TIN	1	2	2					1
MOLYBDENUM	71	70	69					128
NICKEL	1	2	2					2
MANGANESE	1	2	2					1
SILVER	2	2	2					6
TITANIUM	0	0	0					0
POTASSIUM	1	2	2					2
BORON	83	91	98					60
SILICON	9	12	15					13
SODIUM	4	5	5					5
CALCIUM	1050	1119	1187					1469
MAGNESIUM	688	639	589					544
PHOSPHORUS	745	733	721					972
ZINC	806	800	793					1139
BARIUM	0	1	1					0

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	**57.0**	65-76	**63.1**				
cSt Viscosity @ 100°C	**9.36**	11.6-14.8	**11.09**				
Flashpoint in °F	**370**	>385	400				
Fuel %	0.8	<2.0	<0.5				
Antifreeze %	0.0	0.0	0.0				
Water %	0.0	0.0	0.0				
Insolubles %	0.1	<0.6	0.2				
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

First of all, the amount of viscosity break down that has occurred to this oil after 16 hours is huge. The unused analysis showed this oil at 15.75 cSt @ 100C. After only 16 hours it has been sheared down to 9.36 cSt @ 100C, which puts it near where an XW-20 oil should be. That's a huge reduction, but it doesn't look like the engine is being ruined by it yet.

Element	16hr	8hr	5hr average	Unused oil
Aluminum	12	16	12	1
Chromium	1	1	4	0
Iron	18	28	21	0
Copper	3	4	11	0
Lead	1	1	5	0
Tin	1	2	1	0
Nickel	1	2	2	0
Total	37	54	56	1

Since the top end was breaking in during the 8 hour oil change interval, the above result makes sense. The 16 hour oil change interval looks better because there was less junk breaking off of all the new surfaces. That was pretty clear to see just by looking at the oil filter. Next, the extrapolated run time comparison. This comparison is going to be even more thrown off by the effect of break in.

Element	Actual 16hr	8hr extrapolated 2x	5hr average extrapolated 3.2x
Aluminum	12	32	38.4
Chromium	1	2	12.8
Iron	18	56	67.2
Copper	3	8	35.2
Lead	1	2	16
Tin	1	4	3.2
Nickel	1	4	6.4
Total	37	108	179.2

Lastly, the anti-wear element and oil usage data.

Component	16hr	8hr	Unused
Molybdenum	71	69	71
Phosphorus	745	721	717
Zinc	806	793	820
Total	1,622	1,583	1,608
Difference from previous	+14	25	-
“Oil life” (anti-wear element remaining)	>100%	98%	100%

This one is another head scratcher. I wonder why the phosphorus has continued to increase. The only thing I could find that might cause this is that “Top Tier Detergent Gasolines” in the USA use high levels of phosphates in an effort to keep engines clean. The gasoline pump I’m using for this project is indeed marked with the “Top Tier Detergent Gasolines” label. I’m no scientist, but I think this could have something to do with what we’re seeing here. Afterall, there is some fuel being detected in the oil sample. If these numbers are getting fudged by contamination like that, this comparison could be pointless.

Oil loss	16hr interval	8hr interval
Total	200ml	100ml
Per hour	12.5ml	12.5ml

Oil loss appears to be continuing at the same pace, which is good to see because this loss rate is very low for this type of bike. With this rate of loss, I shouldn’t need to top up during the 6 hour endurance race coming up as long as I can keep the bike upright most of the time. We’ll see if I can manage that!

The transmission oil looked pretty much the same as the 8-hour run.

OIL REPORT

LAB NUMBER:	K97417	UNIT ID:	06 CRF-TR
REPORT DATE:	3/1/2019	CLIENT ID:	127894
CODE:	146/32	PAYMENT:	CC: Visa

UNT

MAKE/MODEL: Transmission Honda Motorcycle Trans
FUEL TYPE:
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil Delvac 1300 15W/40
OIL USE INTERVAL: 16 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: This transmission looks great after a significantly longer run on the oil. Our expectation was that wear metals and silicon would continue to wash out, and we are seeing just that. We'll look for this trend to continue across the board as the next few samples come in. Viscosity read a bit low this time, but that's not unusual for motorcycles in general and shouldn't cause you to lose any sleep. It looks like this CRF's transmission is having no trouble handling the use you're giving it, so try taking the next oil to ~25 hours. Have fun.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	16		8					
MI/HR on Unit	24		8					
Sample Date	2/22/2019		2/7/2019					
Make Up Oil Added	0 qts		0 qts					
ALUMINUM	53	71	89					51
CHROMIUM	0	0	0					0
IRON	26	29	31					21
COPPER	2	3	4					3
LEAD	0	1	1					1
TIN	1	1	0					1
MOLYBDENUM	42	43	43					67
NICKEL	0	0	0					0
MANGANESE	0	1	1					1
SILVER	0	0	0					0
TITANIUM	0	0	0					0
POTASSIUM	0	0	0					0
BORON	64	64	64					35
SILICON	16	21	26					15
SODIUM	3	3	3					9
CALCIUM	1649	1642	1634					2256
MAGNESIUM	517	521	525					263
PHOSPHORUS	805	805	805					889
ZINC	890	900	910					1026
BARIUM	0	0	0					1

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	**67.6**	69-78	69.1				
cSt Viscosity @ 100°C	**12.31**	12.7-15.3	12.72				
Flashpoint in °F	430	>420	430				
Fuel %	-	<0.0	-				
Antifreeze %	-		-				
Water %	0.0	<0.1	0.0				
Insolubles %	0.1	<0.6	0.2				
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

Total wear material comparison.

Element	16hr	8hr	10hr average	Unused oil
Aluminum	53	89	49	1
Chromium	0	0	0	0
Iron	26	31	16	1
Copper	2	4	4	0
Lead	0	1	2	0
Tin	1	0	0	0
Nickel	0	0	0	0
Silicon	16	26	14	7
Total	98	151	85	9

The clutch was new during the 8-hour oil run, which might help explain the drop in wear material seen here. Blackstone's average is still looking significantly better than my actual results when compared straight across, but when the 10-hour average is extrapolated out to 16 hours, the story is different.

Element	Actual 16hr	8hr extrapolated 2x	10hr average extrapolated 1.6x
Aluminum	53	178	78.4
Chromium	0	0	0
Iron	26	62	25.6
Copper	2	8	6.4
Lead	0	2	3.2
Tin	1	0	0
Nickel	0	0	0
Silicon	16	52	22.4
Total	98	302	136

Anti-wear element comparison.

Component	16hr	8hr	Unused
Molybdenum	42	43	40
Phosphorus	805	805	725
Zinc	890	910	838
Total	1,737	1,758	1603
Difference from previous	21	+155	-
“Oil life” (anti-wear element remaining)	108%	109%	100%

In the transmission, these numbers are decreasing which is how things *should* be going, based on what happened with the KDX200, so that makes me less inclined to doubt the oil analysis process. However, all the numbers are still above what they were in the unused sample. It’s still possible that there was some error with the analysis of the unused sample this time around. Or is something else going on? Let’s have a look at these numbers compared to the unused sample from the *previous* bottle of Mobil Delvac.

Component	16hr	8hr	Previous bottle unused
Molybdenum	42	43	46
Phosphorus	805	805	993
Zinc	890	910	1208
Total	1,737	1,758	2,247
Difference from previous	21	489	-
“Oil life” (anti-wear element remaining)	77%	78%	100%

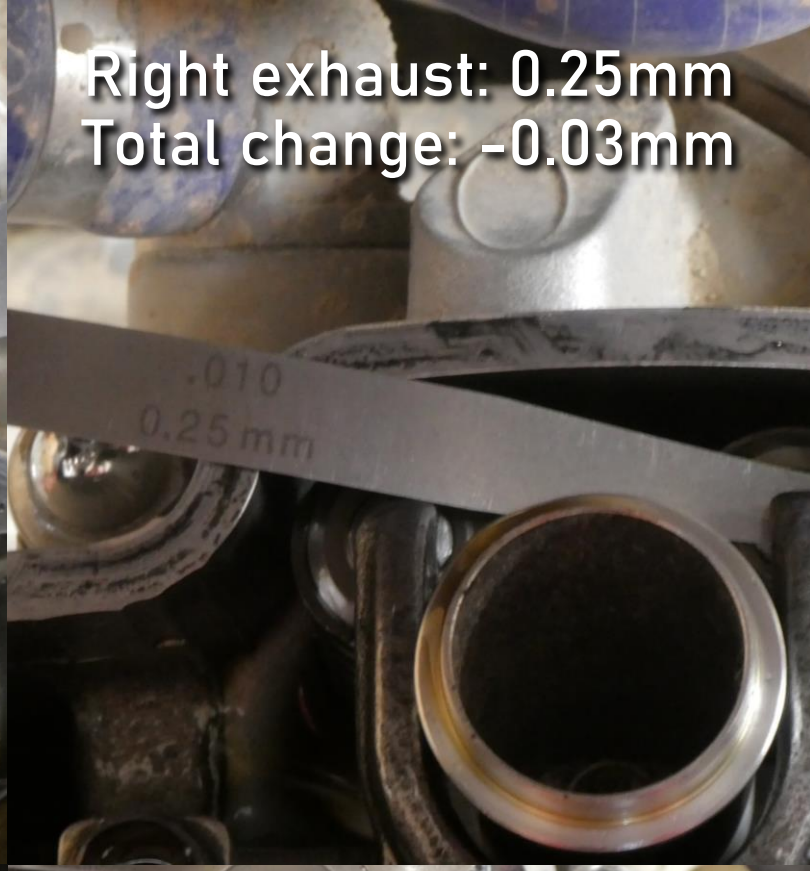
Looking at the two different unused samples from different bottles, and then looking at the used oil, I have a guess to explain what we're seeing. I think we're just seeing a mix of the two different bottles of Mobil Delvac happening in the transmission. This transmission was using oil from the previous bottle before this project started, and my tilt-and-shake effort to drain it completely was probably not good enough. I didn't think the contamination would be so great that it would throw off the numbers like that. I didn't even expect that the Mobil Delvac from the new bottle would have, what seems to be, a completely different formulation. So, contamination from the previous bottle would be my best guess. The numbers for the used oil are much closer to the numbers for the newer bottle of unused oil, but they are being boosted a bit by contamination within the transmission from the older oil.

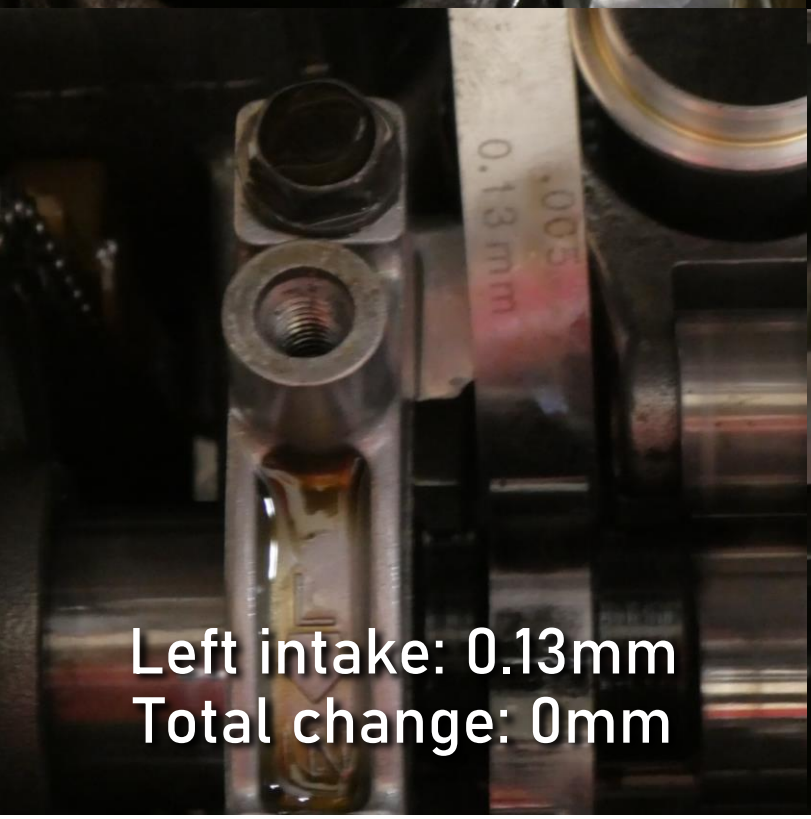
Lesson learned. Contamination of that nature will be a difficult hurdle for future projects, but I might be able to get it down to insignificant levels by flushing oil sumps repeatedly before starting a project and then buying all of the oil bottles that I expect to use for a project at the same time, from the same store, so I don't get bottles with different formulations throughout the project.

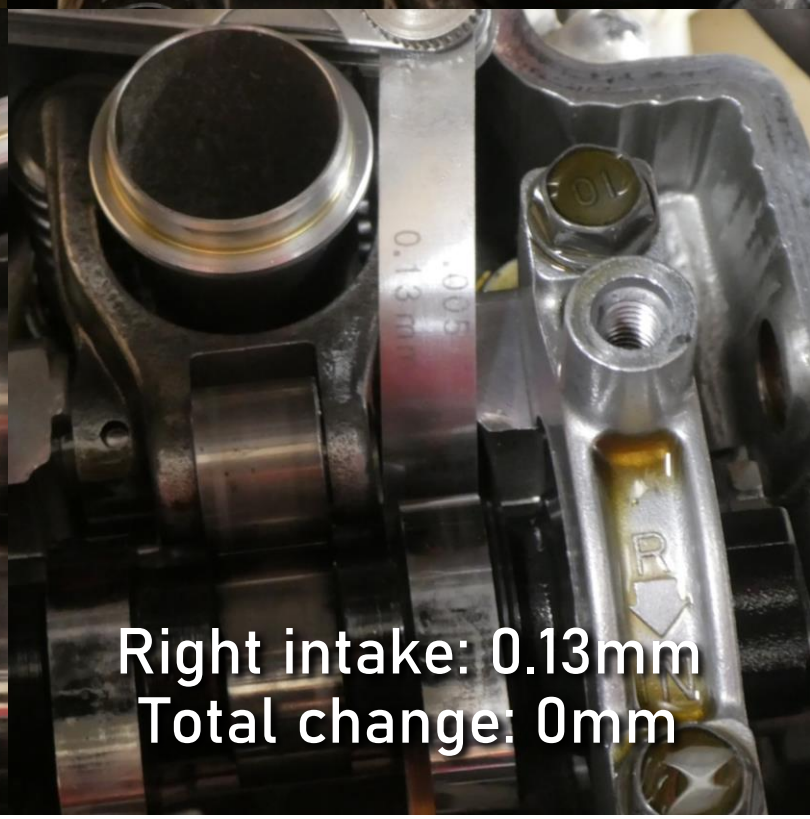
In other non-oil related news, the bike had its first problem that will count toward the issue count for Tier I. During the ride that brought the bike to 28:39 hours (553 miles), it started having what felt like subtle fueling issues. The bike was partially cutting out when it was at part throttle and on the face of bumps, like it was running out of fuel. At one point, I even switched the fuel to reserve because I was sure I had run low on fuel. That, however, just wasn't the case. Here's a quick video where you can hear it cut out abnormally: https://youtu.be/ExhdfETkQZ8

I got home from that ride, shut the bike off, and started taking my gear off when I was interrupted by some terrifying noises coming from the bike. I was hearing the breather cap for the fuel tank breathe in big, gurgling whooshes and then choke up. It sounded like a dying animal. It kept doing this in a cycle, and didn't stop until I put a different fuel tank cap on. With a different cap, the tank started to vent normally. This seemed to be the issue causing the fueling issues, because the bike ran much better on the next ride.

At 29:27 hours (573 miles), I had to pack the bike up for the 6 Hours of Glen Helen endurance race, so I went ahead and checked the valve clearances a tiny bit early.







Both exhaust valves still sat at 0.25mm and both intake valves held steady at 0.13mm. Reaching 30 hours without the bike requiring a clearance adjustment offered a little bit of relief from my “CRF Anxiety” because a lot of the complaints early on with the unicam CRFs stated that the early heads “didn’t even make it to 30 hours.” Well, this one with the updated valves and seat material has made it, even with an aftermarket camshaft and lazy air filter maintenance. Yes, there has been some change in the clearances, but the run-away wear indicative of CRF Valve Issue™ is not occurring yet. The cam chain still did not require an adjustment.

30-40 HOURS

The 30-40 hour period was particularly rough for the CRF250X. The 6 Hours of Glen Helen resulted in 5:51 additional running hours, with just a few minutes of the 6-hour event spent stuck in the mud, tipped over, or stopped in the pits. We came home from the event with an 8th out of 26 ironman-class finish, two busted OEM wheels, a nearly-fried clutch, and a worn-through chain guard.

Here's a video of the first lap of the race: https://youtu.be/J7gvM50F--o

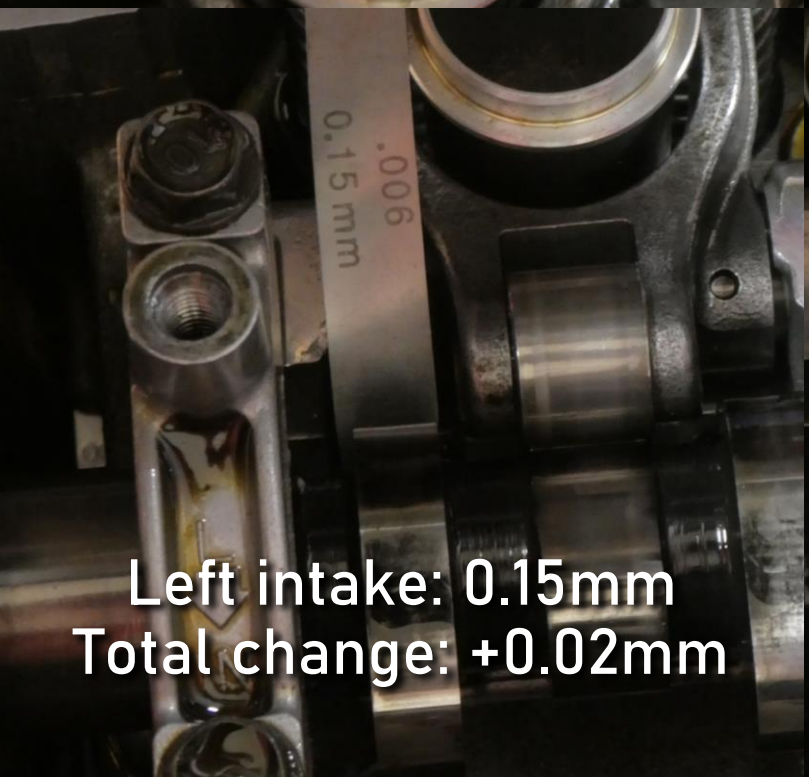
The front rim crack actually occurred before the race, and I noticed it while getting ready before leaving town. I went with the quickest fix, which was buying a complete wheel. I purchased a Warp 9-brand, fully-assembled wheel, and threw it on for the race. The OEM rear rim got busted up during the race by a concrete edge that was in the race course, which resulted in 5 hours of the race being run on a rear flat. After the race, I fixed up the OEM wheel with Tusk rims, so in the cost of running calculation I am only using the price of those Tusk rims and new spokes.

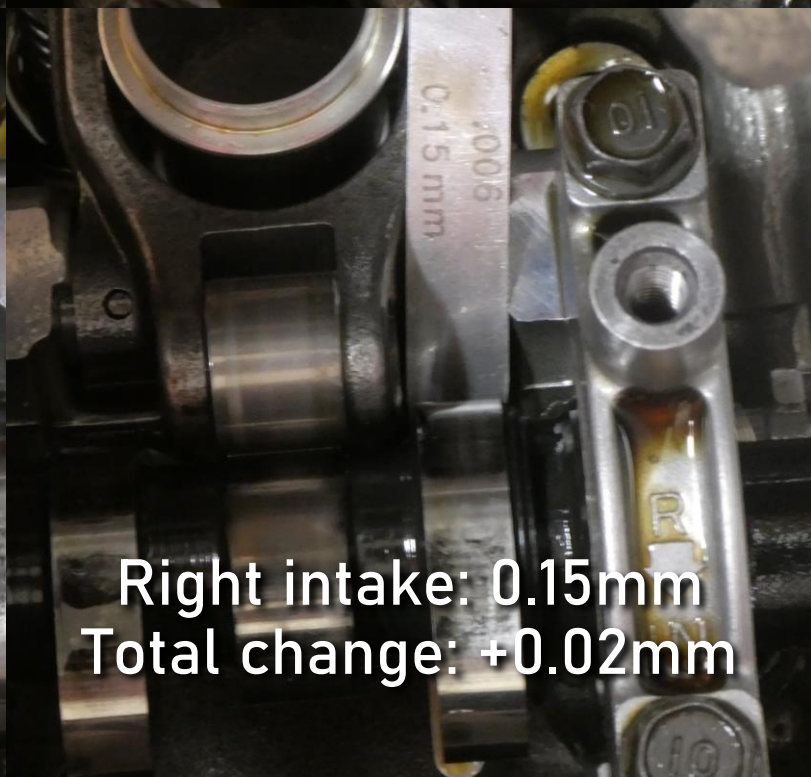
The clutch took a lot of abuse on the first lap when I got stuck in mud, and continued to get a little bit worse every time I needed to use it to get through the mud. It held together well enough to complete the race without it becoming a major problem, but this revealed that the clutch is still a bit of a weak point. Before the race, I purchased a complete, OEM, CRF250R clutch kit in case I needed to swap the clutch mid-race, so that's what will be getting installed at the next transmission oil change (at the 48-hour point, if it can hang on until then). My hope is that the CRF250R clutch pack will put an end to the constant clutch-frying on this bike.

The rubber on the bottom of the chain guide simply wore through. I replaced it with a Primary Drive chain guide for $35.99 to see if it will last longer. However, it's interesting to point out that the wear-out of the OEM chain guide was within 5 hours of the wear-out of the OEM chain, which I replaced before the race, so if I'm ever using the OEM guide again it will be a simple maintenance task to just replace the rubber every time the chain is replaced.

The “CRF Anxiety” has returned. At 39:47 hours (810 miles), the valves are starting to look like a problem. The left exhaust valve has continued to wear steadily, shrinking the clearance out of the specified range and requiring a shim change. That exhaust has now worn a total of 0.05mm, or half of what is allowed before the head should be removed for work. It’s starting to look like this thing will just barely make it through Tier I.

To bring the left exhaust valve clearance back into the specified range, I swapped out the 2.45mm shim for a 2.40mm shim. This brought the clearance back to 0.28mm. The intake valve clearance *increased* on both sides, oddly enough. They are both now at 0.15mm, up from 0.13mm at the last inspection. I hope that is not an indication of cam or bucket wear! They are both still in the specified range, so an adjustment is not needed at 0.15mm. The cam chain still has not required any adjustment.





40-50 HOURS

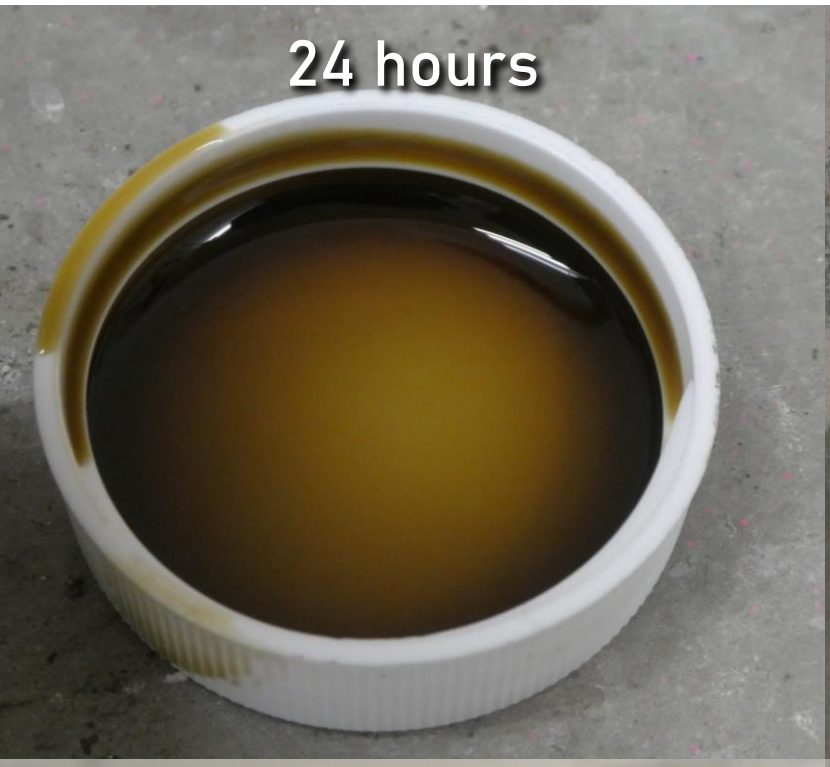
From 40 to 50 hours, the CRF250X endured two desert practice days, one motocross practice day, and a euro scramble race. It ended up achieving a 450cc Novice-class win at the euro scramble, which was a high-speed, wide-open course. Our overall finish was a 5th place out of 36 finishers, bested by a 250cc novice, two 450cc experts, and a 450cc intermediate. Here's a video of the race: https://youtu.be/J1JF5jNu8fQ

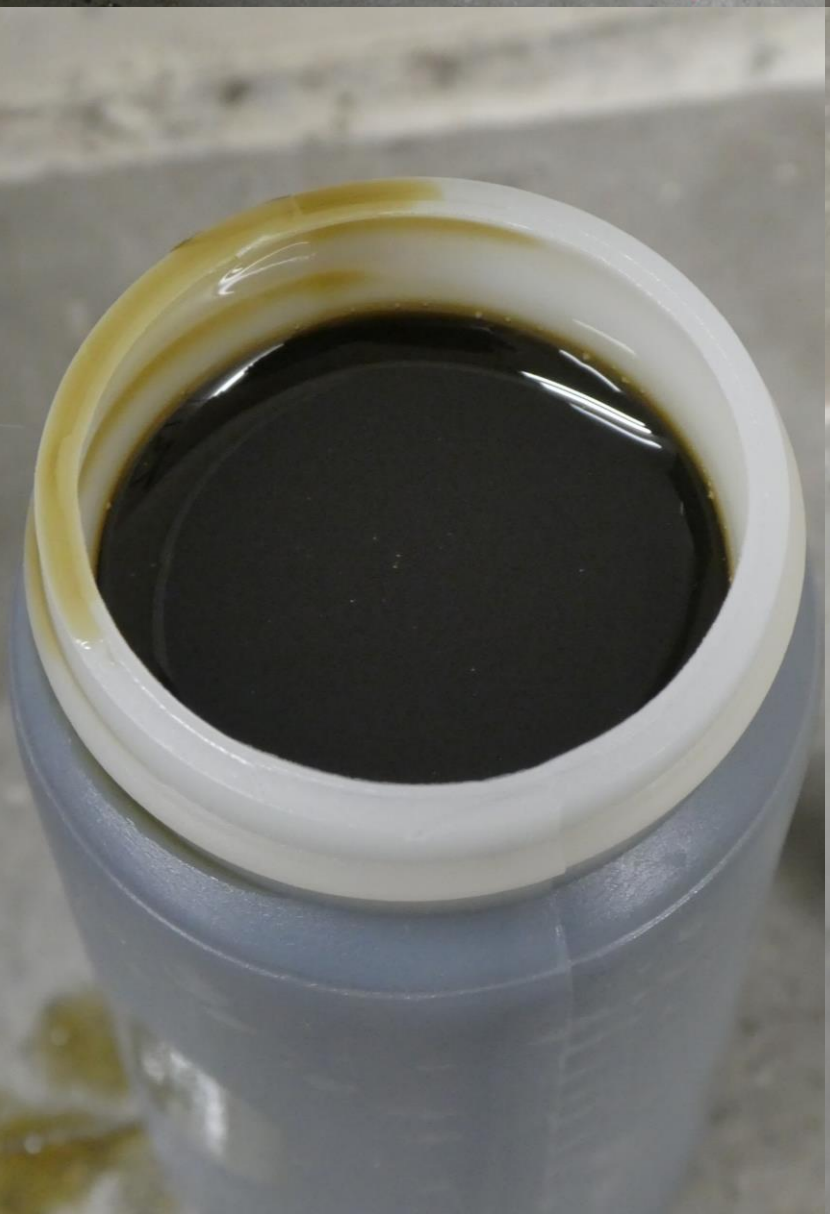
After the course of an hour, the 250X's finishing time was 48 seconds off from 2nd place overall. This gave me my next training target: to get 1% faster out in the desert so I can be at the podium-level against those expert class racers.

During all this riding, the CRF250X didn't develop any other noticeable issues. The only work done to it was an oil change at 48 running hours, when the oil reached 24 hours of use, and a clutch change at the same time to get rid of the clutch that got cooked in the mud at Glen Helen. The clutch came out in "black and blue" condition, indicating it had definitely been overheated when struggling through that Glen Helen mud.

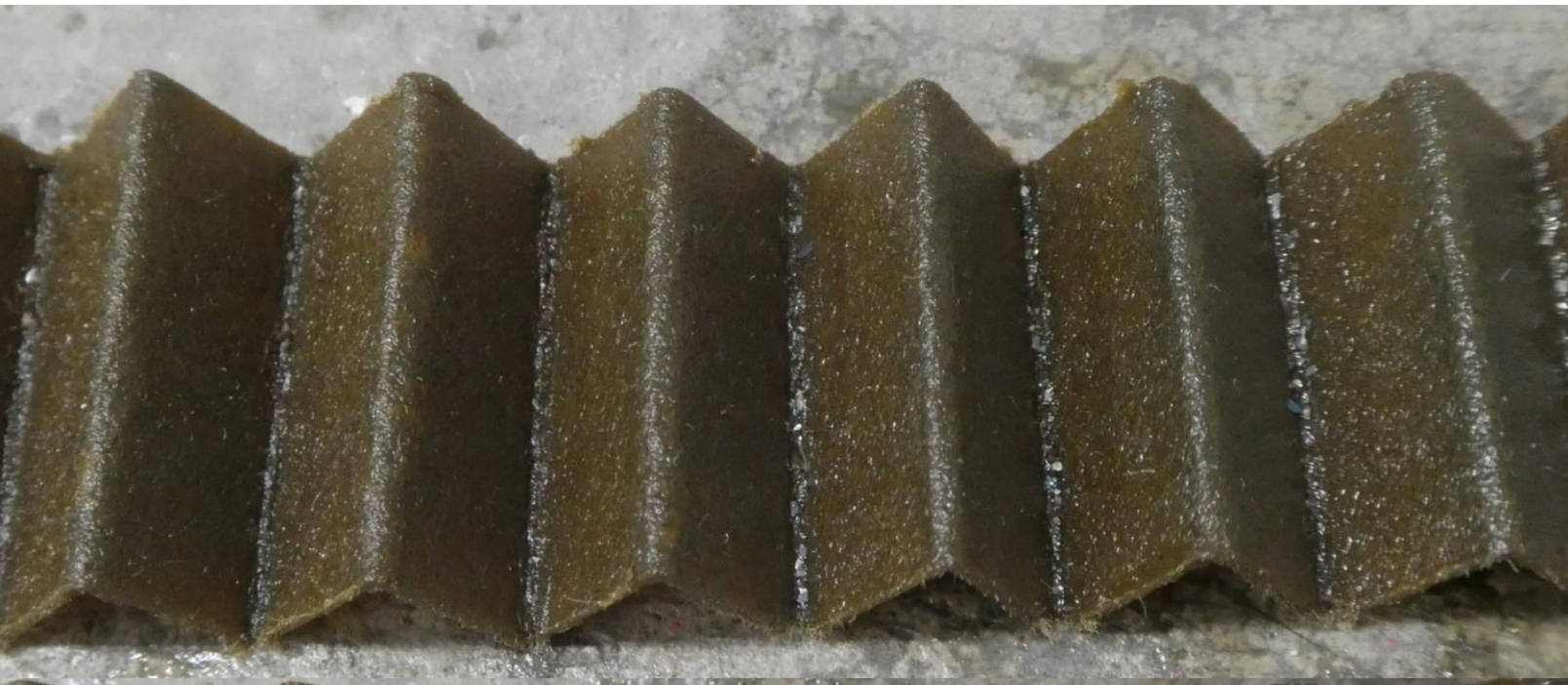
Also, remember how I used crush washers to shim the clutch springs? That actually worked out, but not without flaw, and it is definitely only a short-term alternative to stiffer clutch springs. The inner diameter was too small, so they got pinched by the posts of the clutch hub that the spring-bolts thread into. That didn't affect the way they worked, but it cause aluminum to get pinched off, and that must have ended up in the transmission somewhere. The washers also did start to deform and get eaten by the springs, and that may have eventually become a problem. However, they outlasted the clutch pack, so I'd still call it a viable solution as long as they're replaced at each clutch change.

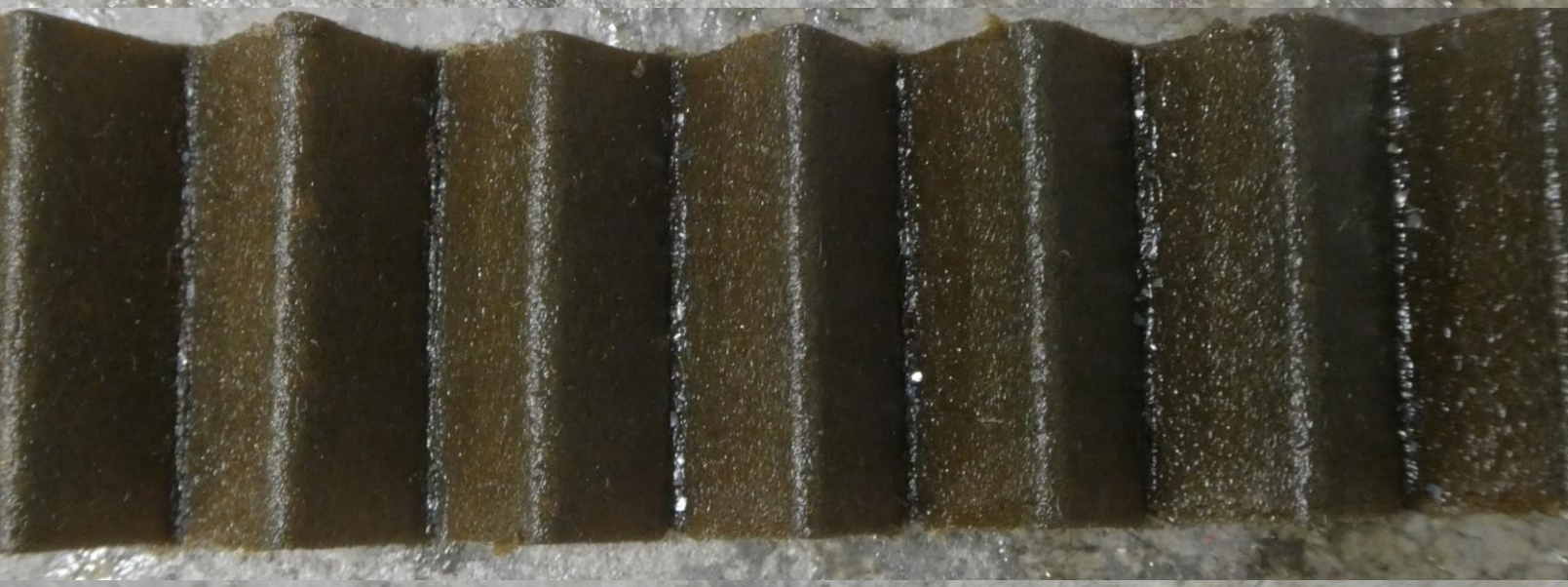
No large change in the appearance of the motor oil compared to shorter runs.





The oil filter was stained a lot darker this time. It is probably more saturated with fine, sooty dark junk after that whole hour of wide-open riding during the euro scramble. The visible solids caught in it look the same as the last oil change. The visible chunks are still just some aluminum flakes and blue paint.





BLACKSTONE LABORATORIES

OIL REPORT

LAB NUMBER: L24109
REPORT DATE: 6/3/2019
CODE: 146/32

UNIT ID: 06 CRF
CLIENT ID: 127894
PAYMENT: CC: Visa

UNIT

MAKE/MODEL: Honda Motorcycle CRF250X
FUEL TYPE: Gasoline (Unleaded)
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil 1 10W/40
OIL USE INTERVAL: 24 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: This is another solid report for your CRF. Metals like aluminum, iron, and copper are a bit higher than before, sure, but that's probably just from the longer oil run. Metals are still in a good balance to one another, and nothing is really excessive for this type of engine. Maybe you could try 24 hours again next oil change, just to get a good apples-to-apples comparison. That said, a longer run would be okay too, and we don't think 35 hours or so next time would be an issue. Fuel dilution remains harmless at just a trace. The thin viscosity isn't a problem, either.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	24		16	8				
MI/HR on Unit	48		24	8				
Sample Date	5/21/2019		2/22/2019	2/7/2019				
Make Up Oil Added	0.20 qts		0.2 qts	0.10 qts				
ALUMINUM	21	16	12	16				13
CHROMIUM	1	1	1	1				3
IRON	29	25	18	28				21
COPPER	7	5	3	4				10
LEAD	0	1	1	1				4
TIN	1	1	1	2				1
MOLYBDENUM	64	68	71	69				120
NICKEL	2	2	1	2				2
MANGANESE	1	1	1	2				1
SILVER	1	2	2	2				5
TITANIUM	0	0	0	0				0
POTASSIUM	2	2	1	2				2
BORON	67	83	83	98				61
SILICON	15	13	9	15				13
SODIUM	5	5	4	5				5
CALCIUM	941	1059	1050	1187				1403
MAGNESIUM	604	627	688	589				551
PHOSPHORUS	661	709	745	721				933
ZINC	705	768	806	793				1085
BARIUM	0	0	0	1				0

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	**59.9**	65-76	**57.0**	**63.1**			
cSt Viscosity @ 100°C	**10.18**	11.6-14.8	**9.36**	**11.09**			
Flashpoint in °F	**385**	>385	**370**	400			
Fuel %	TR	<2.0	0.8	<0.5			
Antifreeze %	0.0	0.0	0.0	0.0			
Water %	0.0	0.0	0.0	0.0			
Insolubles %	0.2	<0.6	0.1	0.2			
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

The 24-hour oil showed a big jump in wear elements compared to the 16-hour, which is exciting! Let's add it up in the direct comparison below.

Element	24hr	16hr	8hr	5hr average	Unused oil
Aluminum	21	12	16	12	1
Chromium	1	1	1	4	0
Iron	29	18	28	21	0
Copper	7	3	4	11	0
Lead	0	1	1	5	0
Tin	1	1	2	1	0
Nickel	2	1	2	2	0
Total	61	37	54	56	1

In the direct comparison above, the 24-hour oil is the worst-looking of the samples from this actual bike. However, in the total parts per million wear element count, the 24-hour sample is not too far off from Blackstone's average with a 5-hour oil change. It seems safe to say that the bike isn't dramatically falling apart internally from the 24-hour oil change interval. Looking below at the shorter runs extrapolated out to 24 hours, the 16-hour column shows us that the rate of wear did spike up a little bit going from 16 to 24 hours. Finally, my extrapolated comparison showed that it would have been better to run the oil for less time! I don't often see that in testing oil like this, so that's really interesting.

Element	Actual 24hr	16hr extrapolated 1.5x	8hr extrapolated 3x	5hr average extrapolated 4.8x
Aluminum	21	18	48	57.6
Chromium	1	1.5	3	19.2
Iron	29	27	84	100.8
Copper	7	4.5	12	52.8
Lead	0	1.5	3	24
Tin	1	1.5	6	4.8
Nickel	2	1.5	6	9.6
Total	61	55.5	162	268.8

There was no fuel contamination this time, so let's see in the anti-wear additive comparison below if the oil is still magically gaining phosphorus.

Component	24hr	16hr	8hr	Unused
Molybdenum	64	71	69	71
Phosphorus	661	745	721	717
Zinc	705	806	793	820
Total	1,430	1,622	1,583	1,608
Difference from previous	192	+14	25	-
"Oil life" (anti-wear element remaining)	89%	>100%	98%	100%

Nope, the oil is not magic after all. This lends more evidence to the possibility that the phosphorus number of the previous oil samples was fudged because of fuel contamination. Why there is a different amount of fuel contamination in each sample is beyond me, but if we see high fuel contamination again in an oil sample, I'll be skeptical of the phosphorus number. At 89% anti-wear element remaining, the 24-hour oil has seen significant depletion.

Oil loss	24hr interval	16hr interval	8hr interval
Total	200ml	200ml	100ml
Per hour	8.3ml	12.5ml	12.5ml

The oil loss rate for this oil change interval was an incredibly low 8.3ml per hour, which is as close to no consumption as I've ever seen on a bike where the engine breathes straight into the airbox.

No large change in the appearance of the transmission oil compared to shorter runs.

BLACKSTONE LABORATORIES

OIL REPORT

LAB NUMBER: L24142
REPORT DATE: 6/3/2019
CODE: 146/32

UNIT ID: 06 CRF-TR
CLIENT ID: 127894
PAYMENT: CC: Visa

UNIT

MAKE/MODEL: Transmission Honda Motorcycle Trans
FUEL TYPE:
ADDITIONAL INFO:

OIL TYPE & GRADE: Mobil Delvac 1300 15W/40
OIL USE INTERVAL: 24 Hours

CLIENT

[redacted]

COMMENTS

GABRIEL: It looks like racking up great reports will soon become old hat for this Honda. Wear metals have gone up to match the longer oil change interval, but there was actually improvement in the wear rates (how much metal was made per hour). The latter is good evidence that oil-sharing parts haven't struggled to keep up. Other than a slightly low viscosity (which looks to be normal for this system and not a problem with the oil), nothing garnered a highlight. Insolubles (solids) are still quite low. Go ahead and run ~35 hours before taking the next sample.

ELEMENTS IN PARTS PER MILLION

		UNIT / LOCATION AVERAGES						UNIVERSAL AVERAGES
MI/HR on Oil	24		16	8				
MI/HR on Unit	48		24	8				
Sample Date	5/21/2019		2/22/2019	2/7/2019				
Make Up Oil Added	0 qts		0 qts	0 qts				
ALUMINUM	69	70	53	89				57
CHROMIUM	1	0	0	0				0
IRON	35	31	26	31				26
COPPER	3	3	2	4				3
LEAD	1	1	0	1				1
TIN	0	0	1	0				0
MOLYBDENUM	37	41	42	43				57
NICKEL	1	0	0	0				0
MANGANESE	1	1	0	1				1
SILVER	0	0	0	0				0
TITANIUM	0	0	0	0				0
POTASSIUM	2	1	0	0				1
BORON	57	62	64	64				42
SILICON	18	20	16	26				16
SODIUM	3	3	3	3				7
CALCIUM	1371	1551	1649	1634				1961
MAGNESIUM	429	490	517	525				318
PHOSPHORUS	678	763	805	805				819
ZINC	723	841	890	910				925
BARIUM	0	0	0	0				0

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	**65.3**	69-78	**67.6**	69.1			
cSt Viscosity @ 100°C	**11.70**	12.7-15.3	**12.31**	12.72			
Flashpoint in °F	435	>420	430	430			
Fuel %	-	<0.0	-	-			
Antifreeze %	-		-	-			
Water %	0.0	<0.1	0.0	0.0			
Insolubles %	0.1	<0.6	0.1	0.2			
TBN							
TAN							
ISO Code							

* THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

Total wear material comparison below.

Element	24hr	16hr	8hr	10hr average	Unused oil
Aluminum	69	53	89	49	1
Chromium	1	0	0	0	0
Iron	35	26	31	16	1
Copper	3	2	4	4	0
Lead	1	0	1	2	0
Tin	0	1	0	0	0
Nickel	1	0	0	0	0
Silicon	18	16	26	14	7
Total	128	98	151	85	9

The resulting total wear material was a little higher than the 16-hour oil change interval, but when we compare the rate of wear element accumulation below, the 16-hour oil change interval did not turn out better than the actual 24-hour oil change interval.

Element	Actual 24hr	16hr extrapolated 1.5x	8hr extrapolated 3x	10hr average extrapolated 2.4x
Aluminum	69	79.5	267	117.6
Chromium	1	0	0	0
Iron	35	39	93	38.4
Copper	3	3	8	9.6
Lead	1	0	3	4.8
Tin	0	1.5	0	0
Nickel	1	0	0	0
Silicon	18	24	78	33.6
Total	128	147	453	204

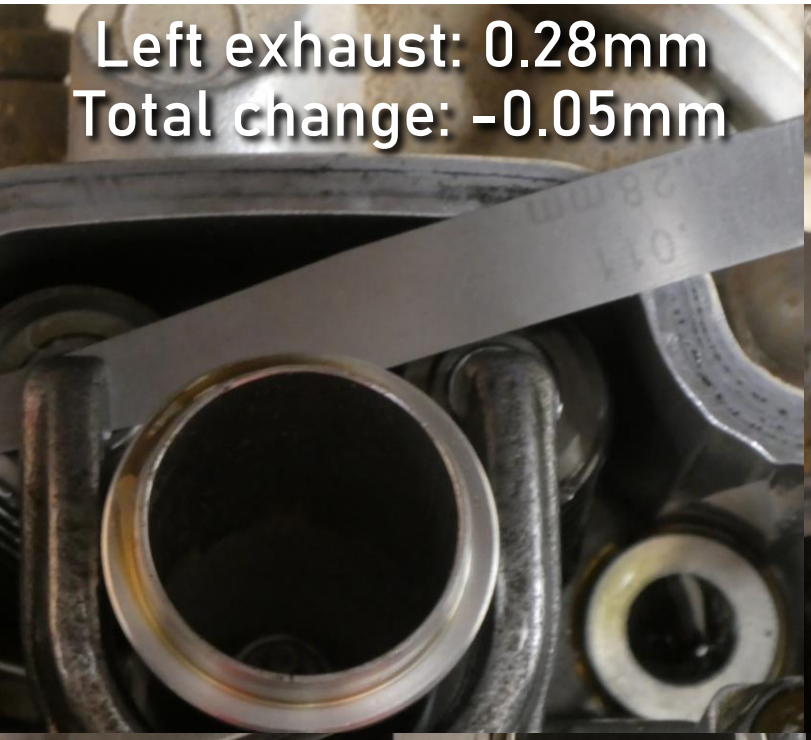
It looks like the transmission oil has finally flushed out enough to now contain oil mostly from the new bottle, but see below for both comparisons anyway.

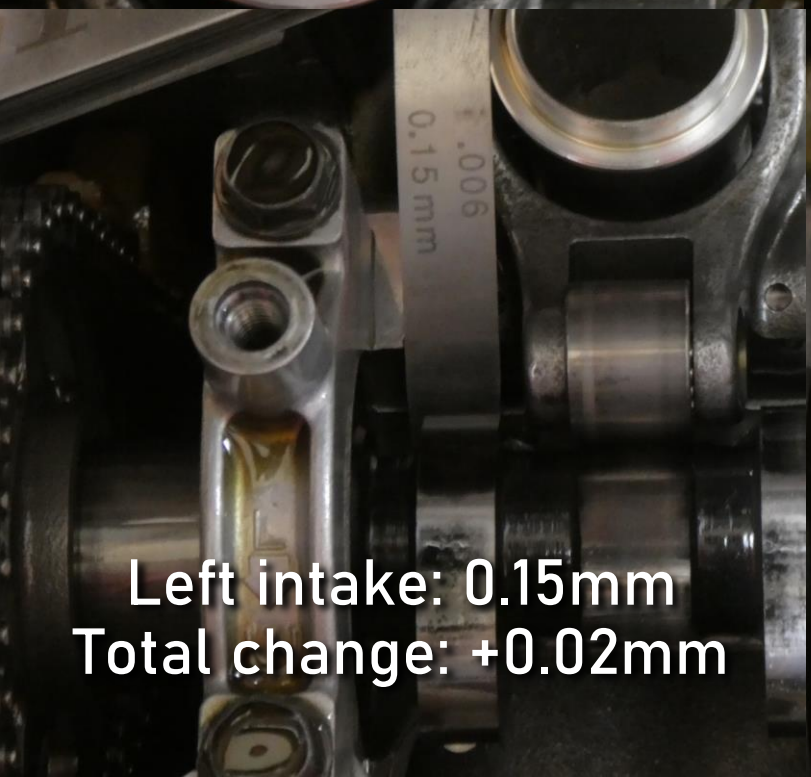
Component	24hr	16hr	8hr	Unused
Molybdenum	37	42	43	40
Phosphorus	678	805	805	725
Zinc	723	890	910	838
Total	1,438	1,737	1,758	1603
Difference from previous	299	21	+155	-
“Oil life” (anti-wear element remaining)	90%	108%	109%	100%

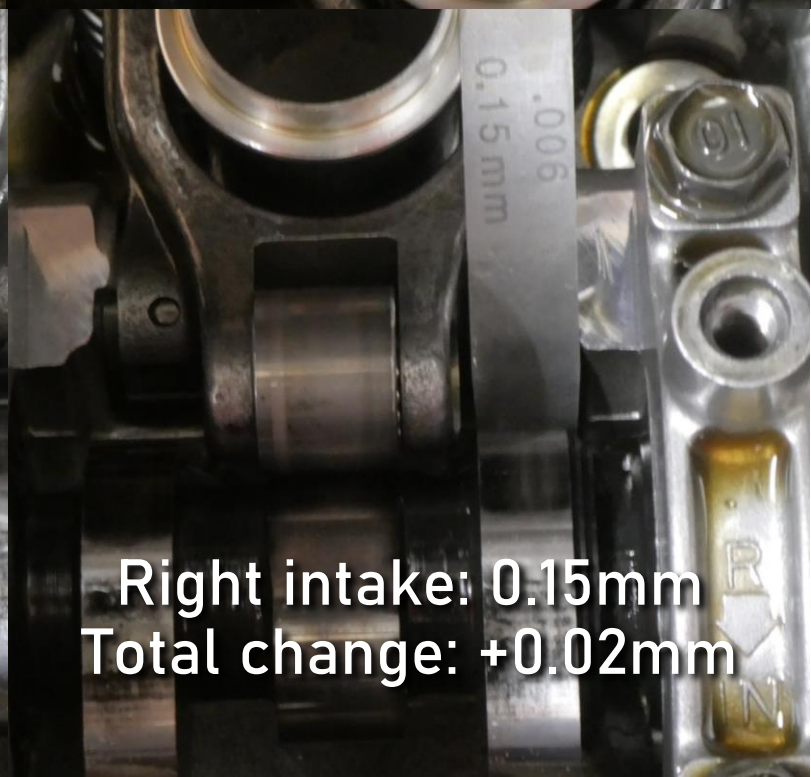
Component	24hr	16hr	8hr	Previous bottle unused
Molybdenum	37	42	43	46
Phosphorus	678	805	805	993
Zinc	723	890	910	1208
Total	1,438	1,737	1,758	2,247
Difference from previous	299	21	489	-
“Oil life” (anti-wear element remaining)	64%	77%	78%	100%

Depending on which source bottle the 24-hour sample is compared to, it is either very highly depleted, or only moderately depleted. With three flushes now complete, it’s probably a lot more accurate to compare it to the new stuff, so we’ll call it moderately depleted.

At 50 hours, the valve clearances had not changed since the last inspection. It looks like this head hasn't hit full-on runaway valve wear yet. When CRF Valve Issue really strikes, the valves start wearing huge amounts in just a single ride. This head just went 10 hours without any measurable change.







50-60 HOURS

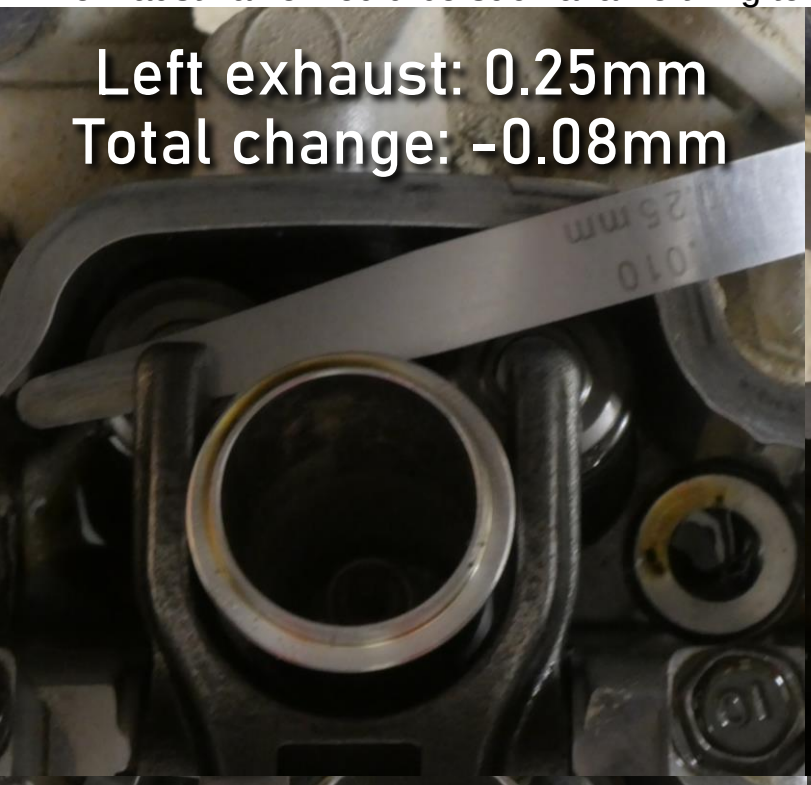
To finish out Tier I, I raced the CRF250X in the Glen Helen 10 Hour endurance race. I entered the ironman (solo) class, and came away with a 4th out of 12 finish. It was a brutal fight, and the bike sustained a lot of damage. The radiators got smashed up, controls got bent, the subframe got a little smashed, and the coolant reservoir broke open. However, none of the damage counts toward torture test expenses because it was all crash damage. I have a video of the race here: https://youtu.be/-4TuFYh7JJs

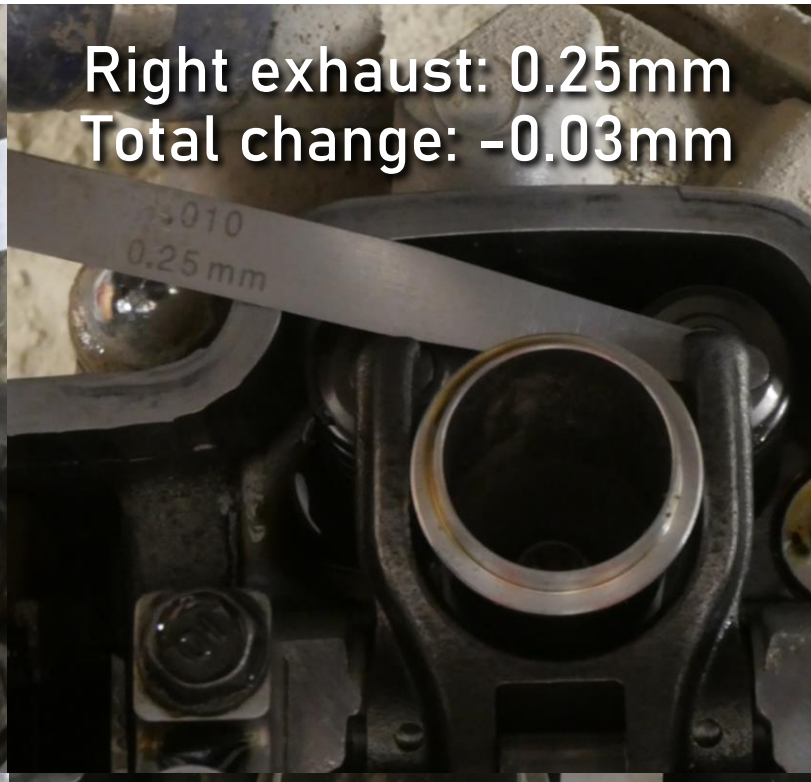
Other than the crash damage, nothing went wrong with the bike. It has successfully completed Tier I! The race actually brought the run time to 65:06 hours (1,379.8 miles) because it was at 55 hours at the start of the race, so I overshot the end of the tier a little bit, but that doesn't really mess anything up too badly. The CRF250X with updated head has achieved my "reliable enough" rating, but in the coming pages, we'll look at how much it has already cost just to get there.

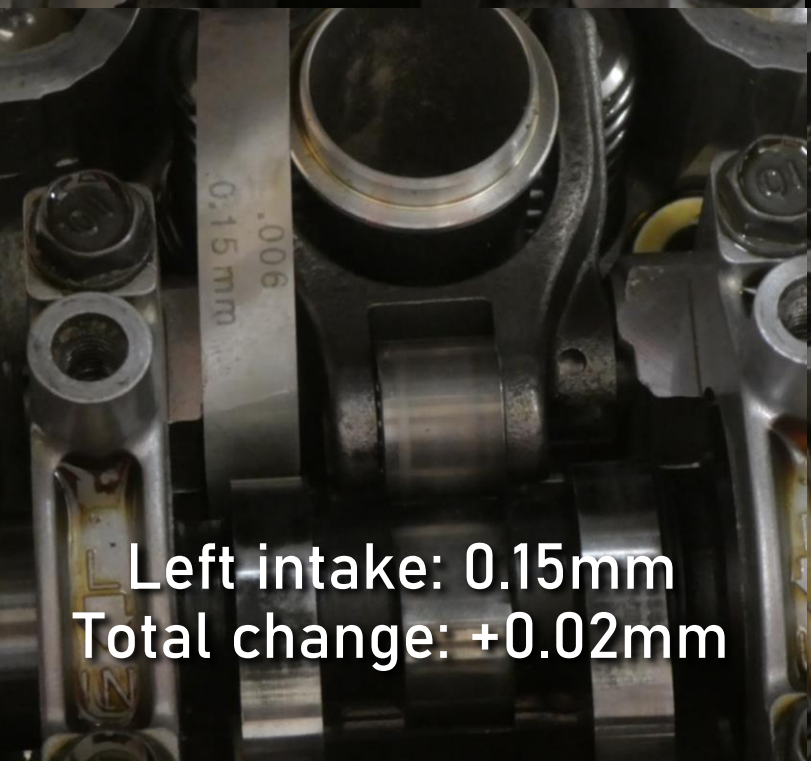
Bent Subframe and radiators

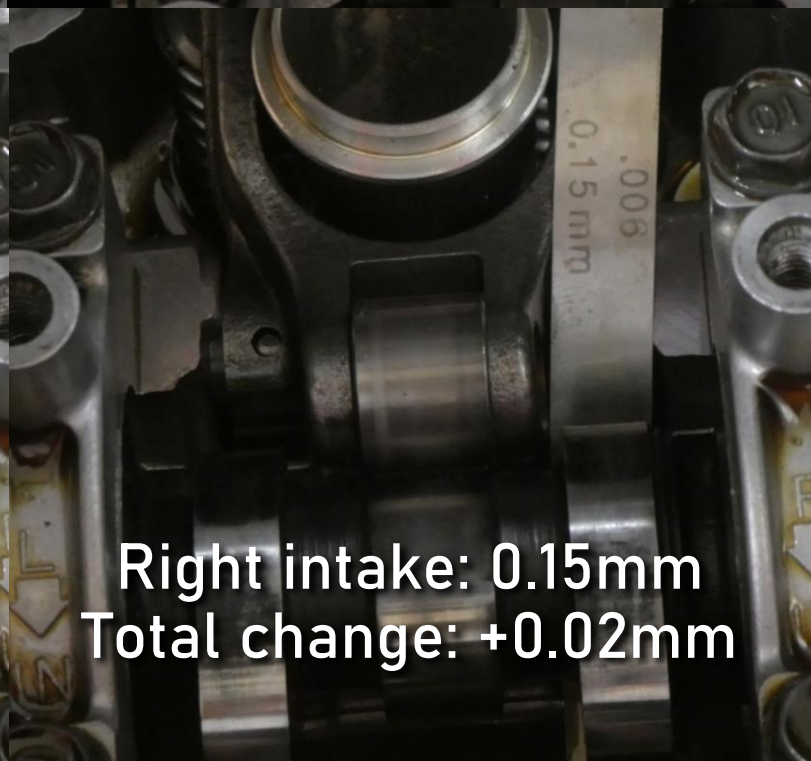
At 60 hours, the valve clearances had stayed the same with the exception of that pesky left side exhaust valve. It has worn itself back down to 0.25mm of clearance, which means it is 80% of the way to the safe limit or “danger zone.” It barely made it through the tier, which is a little bit disappointing. It could just stop wearing where it’s at, but that is extremely unlikely, so this head will probably not make it through the next tier. The frustrating part is that it is only that one valve which is being a problem. It was the same deal with the 2006 CRF250X head that the bike came with. Nothing ever wore in the head except for one exhaust valve which wore consistently.

If this head hits the danger zone in Tier II with everything else on the bike still looking good, we’ll just go ahead and swap to an upgraded head setup so we can compare Honda OEM to an aftermarket solution. Ending the torture test due to one little exhaust valve would be such a lame thing to do!









MATERIALS CONSUMED TIER I

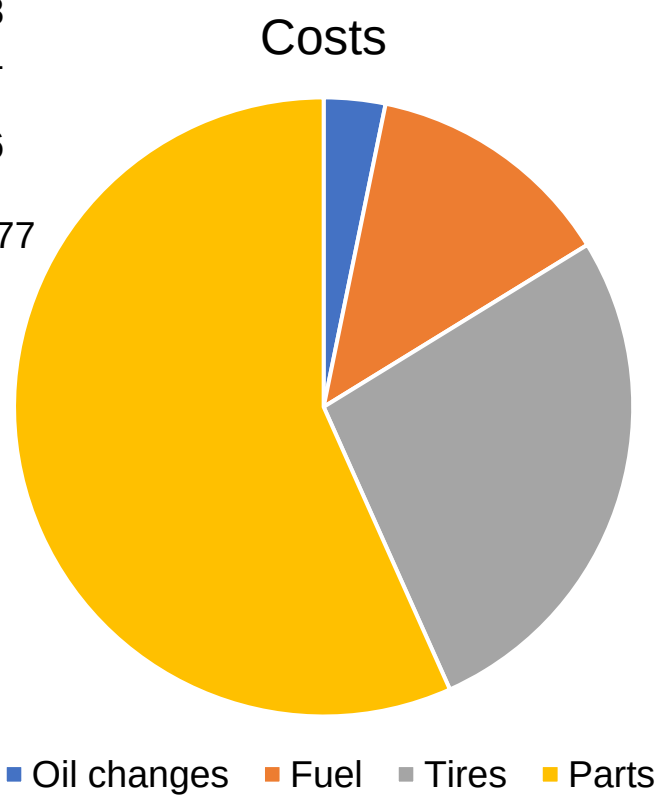
Thus far, the CRF250X has consumed 41.2 gallons of 91 octane gasoline (~$3.50 per gallon) over the course of 1,379.8 miles. This gives us an average fuel consumption of 33.5 miles per gallon for Tier I, which is very efficient. The fuel cost was approximately $144.20.

3.8 liters of Mobil 1 10w-40 motor oil ($22.88 per 4.73-liter bottle) have been used, with 0.8 liters of that still inside the bike. Motor oil cost has been $18.38, along with $6.57 worth of oil filters consumed.

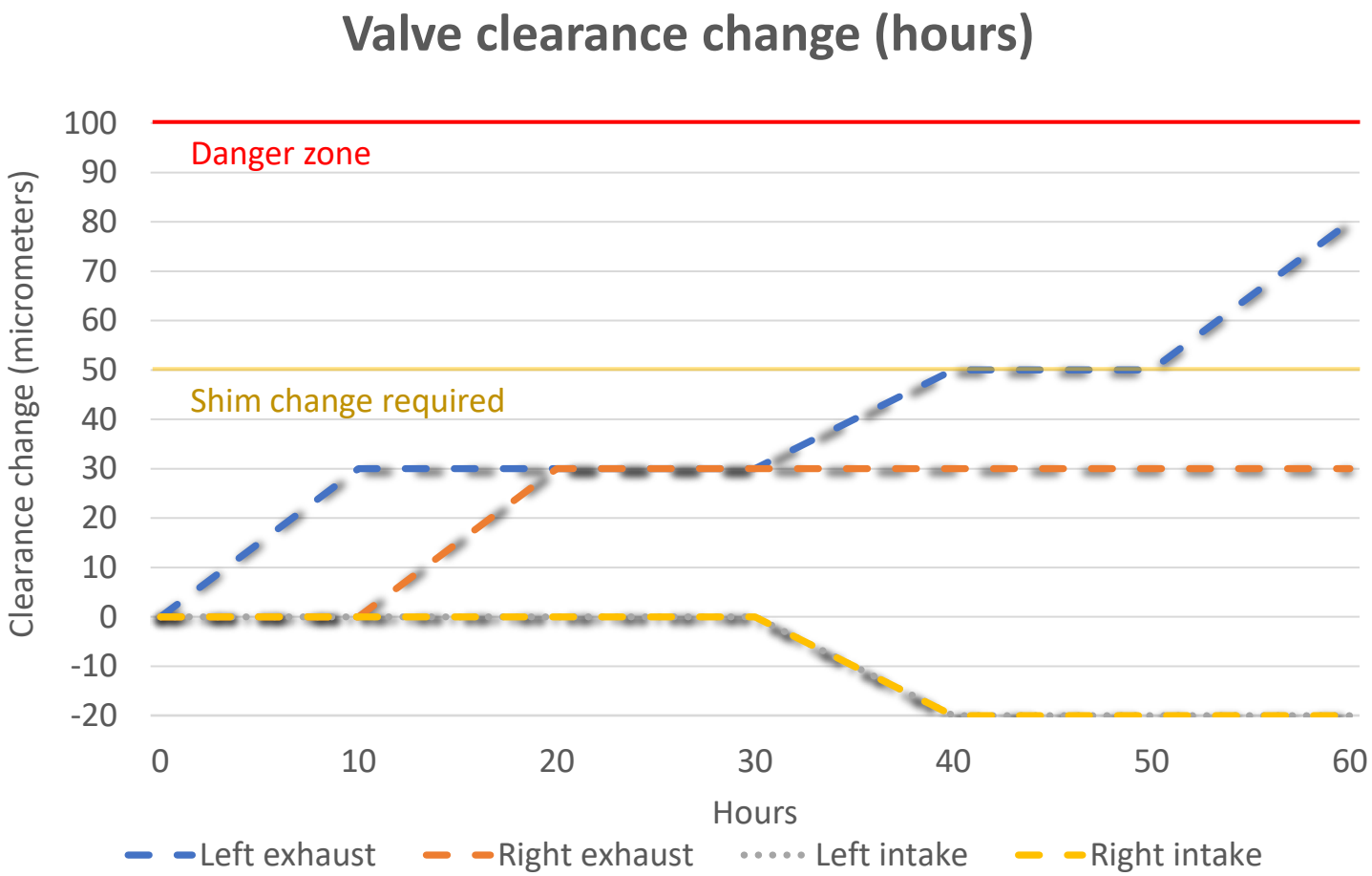
3.2 liters of Mobil Delvac 15w-40 ($31.47 per 9.46-liter bottle) oil has been used for the transmission, with 0.8 liters still in the bike. Transmission oil cost has been $10.64.

The CRF has consumed three rear tires and one front tire. Like in the KDX200 test, I have been testing out different tires with varying prices, so I'm just going to call it $75 per tire. Therefore, tire cost has come out to $300. Let's tally up these costs along with the other odds and ends that were required to get through Tier I.

Motor oil…	$18.38
Oil filters…	$6.57
Gasoline…	$144.20
Transmission oil…	$10.64
Tires…	$300.00
Spark plug…	$13.99
Brake pads…	$22.95
Replacement rims and spokes…	$254.98
OEM clutch pack…	$126.21
Replacement chain guide…	$35.99
Chain and sprockets…	$173.86
Total…	$1,107.77



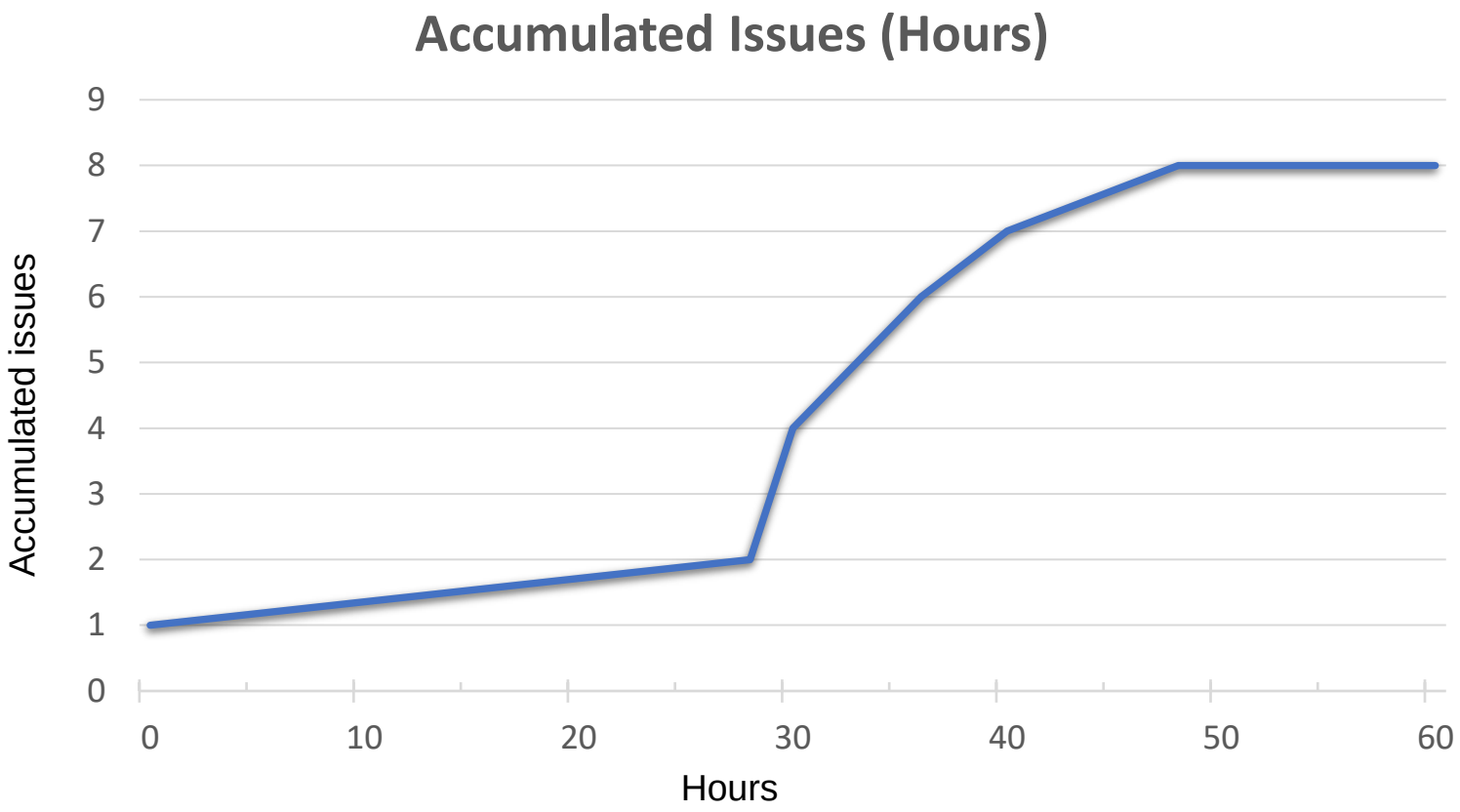
Tier I turned out to be rather expensive. $1,107.77 total, which comes out to about $17.04 per running hour, or $0.80 per mile. Compared to the KDX200's $764.15 total, $12.67 per running hour, and $0.64 per mile in Tier I, the cost of running has been steep on the CRF250X. Since the CRF250X is now on aftermarket rims, a CRF250R clutch, and an aftermarket chain, those expenses probably will not come back up in Tier II. Losing those expenses would help cut down the cost of running greatly, but there is another large expense which will probably need to be addressed sometime during Tier II. The OEM head will probably need work in Tier II.



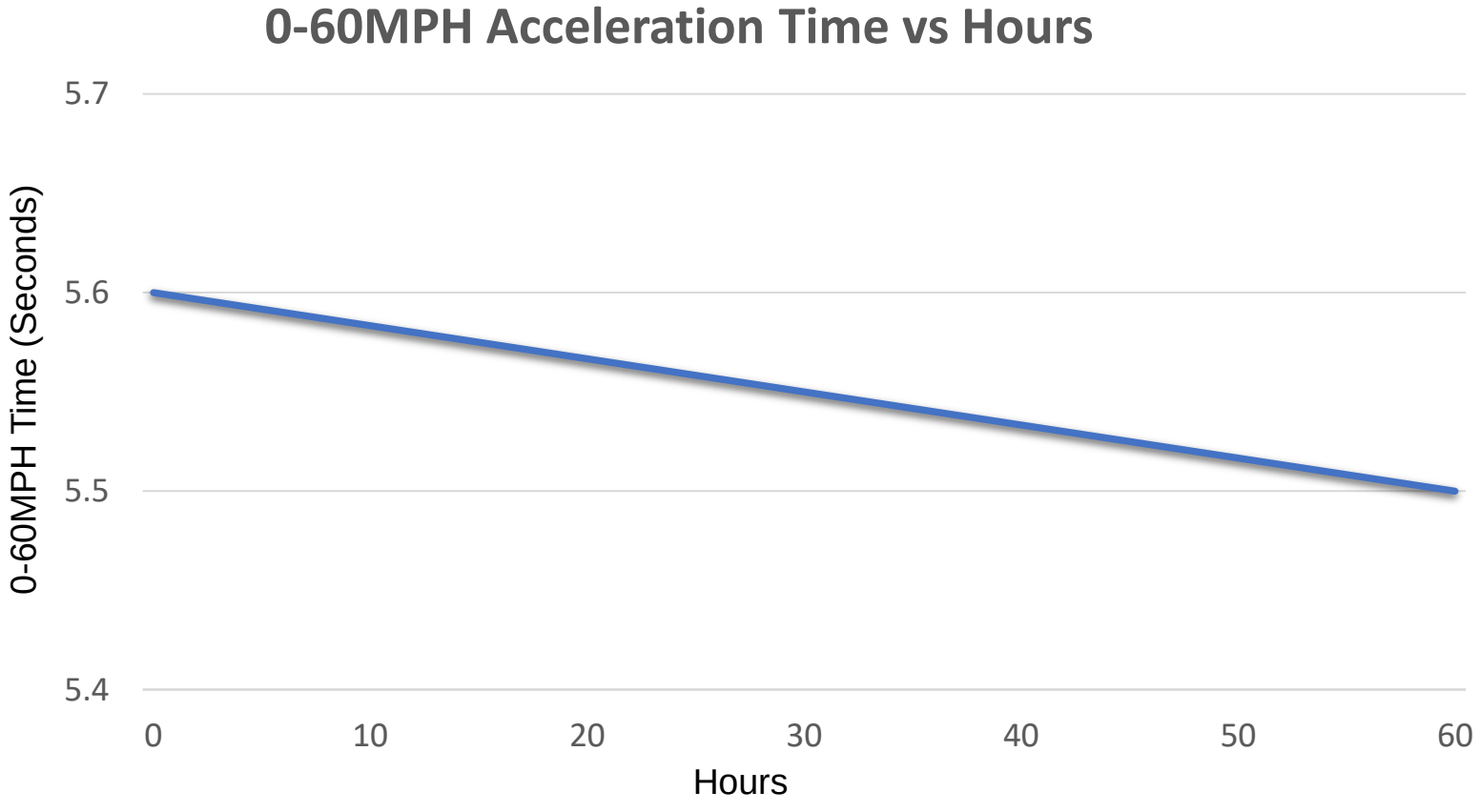
Looking at the charted valve clearance change for Tier I, the only valve showing a real trend is that left exhaust valve. It is averaging about 13.3 micrometers (0.0133mm) of wear-in every 10 hours, and it looks like it's only speeding up.

Below is a list of all the things that have required attention on the CRF250X in Tier I, excluding crash damage.

- 20 hours – Rear brake pads replaced
- 28 hours – Fuel tank cap replaced
- 30 hours – Front rim replaced, chain and sprockets replaced
- 36 hours – Rear rim replaced, chain guard replaced
- 40 hours – Left exhaust valve shim change
- 48 hours – Clutch pack change



The CRF250X has had 8 issues requiring attention throughout Tier I. Averaged out, it has required attention once every 7 hours and 30 minutes, which is pretty close to once every four rides. I'd say this is a pretty normal result. The KDX200's worst result was 9 issues in Tier I, and it's best result was when it had only one single issue in Tier II. So far, the CRF250X isn't doing worse than the KDX200 in how often it requires attention. The 0-60MPH time is about the same, but came out 0.1 second faster at the end of the tier. The motor seems to have loosened up just a bit.



HOW'S IT LOOKIN'?

Besides just looking all bent up from crash damage…

…There is definitely some external wear and tear. Most notably, the subframe is getting ground through badly where I grip it with my boots. It is especially bad on the left side of the bike. It might actually rub through if not addressed.

The swingarm has a rub mark from the kickstand rubbing on it, but there's not much depth to it. It would probably never rub through.

The front brake looks completely fine, and the rear pads are back down to about 50%. It’s funny how quickly I wear out the rear pads on this bike compared to the KDX200. The heavier rotating mass of this four-stroke engine really makes the rear brake less responsive. The suspension is fine except for a minor leak of the right fork.

That wraps up part one of the CRF250X torture test. I'll just need to straighten things out and put a little bit of work into the bike to get it ready for the Glen Helen 24-hour endurance race coming up in a few months. For that, I'll really just be upgrading the electrical system on the bike so that it can power a brighter headlight. It doesn't really need much else!

Thanks for checking out this content! I hope you enjoyed it. If you did, maybe consider buying some stickers or something from the online store at https://torturetestmagazine.com/

See you for the next part of the torture test!