Zero Friction Cycling

Main test protocol - What does the data mean?

What does the data mean? The recommended time to replace your chain is at 0.5% elongation wear. This is the benchmark used in the zfc main test.

As such, 0.5% elongation wear = 100% wear in the data tables below. So a result of say 50% means the chain has been worn halfway to the 0.5% wear replacement mark

And 150% wear would mean the chain is worn to 0.75% so is 50% past the recommended time to replace your chain to prevent accelerated wear to your cassette / chainrings

The ZFC test is a difficult test. Each block is 1000km, and alternates between clean and contamination blocks. Most facilities lubricant tests are very short (hours).

Wheras most ZFC tests last from 3000 to 6000km. There are re lubrication intervals, but NO cleaning during main test - it is up to the lubricant to resist becoming abrasive.

Assessing a lubricants performance via wear correlation is a blunt tool. It cannot directly predict efficiency (speed). Ie if two lubricants return similar wear rate results,

the ZFC test cannot say which may be 5w loss lube or a 6w or 4w etc. As a blunt tool to measure performance, we are looking for large differences in wear rate, as a high wear

rate denotes rapid wear of the chains steel parts, and it flat out takes friction to wear steel at a notable rate. So a 12% vs 15% result - I don't care.

But a 10% vs 30% result is quite a signicant difference. And results of very low vs very high wear rates - it is just EXTREMELY UNLIKELY that a "lubricant" rapidly eating its

way though your chains hardened steel parts is a low friction lubricant. As such, the LOWER the % numbers, the better, as this is lower wear.

Also look for notable changes by Block. Ie if a lubricant is impressive in block 1, but increases notably in block 2 - then it has absorbed a lot of contamination and become abrasive

The test is just a Tacx Neo smart trainer set to 250w resistance, driven by an industrial motor at 100 cadence. So it is an actual bicycle drivetrain.

So the chain, and its lubricant - is being tested in its ACTUAL use case, not some esoteric efficiency test method.

If a lubricant shows high chain wear in this test, it is EXTREMELY unlikely to be a high performing product in your cycling. If you are happy with a product that tests poorly here,

you will do cartwheels of joy if you switched to a high performing product of your preference (wet, wax, wax drip etc).

*Before you email me about the great results you have had with X poor result lubricant - pls not that getting 10,000km from a chain is easy if you run it WAY past recommended

0.5% wear mark. And or if you flush clean your chains every week to reset contamination. I would get about 60,000km if I took an Mspeedwax / Hot Melt / Rex BD chain to 2%.

The test is a true like for like benchmark. The lubricants are tested at same load, same intervals, same contamination introduced at the same time and same amount.

The wear rates are a true reflection of one lubricants performance vs another, as a bicycle chain lubricant, in its actual use case on a bicycle drivetrain.

At the bottom of the lubricant test page on website is the full test brief if you wish to read the full test protocol and deeper information.

Friction / wear test - CUMULATIVE wear - Main test protocol

WAX / Wax DRIP / DRIP - WET / GREASE

	Block 1 - No Contamination	Block 2 - Dry Cont.	Block 3 - No Cont.	Block 4 - Wet cont.	Block 5 - No Cont.	Block 6 - Extreme Cont.
Rex Black Diamond Wax - 11+1 mix	0.0%	1.4%	2.3%	6.9%	8.9%	44.6%
Mspeedwax New Formula	0.0%	1.1%	1.7%	10.8%	11.9%	31.6%
Silca Hot Melt	0.3%	2.0%	6.6%	14.6%	19.0%	27.4%
Molten Speed Wax Original Formula	0.0%	12.0%	12.0%	20.0%	20.0%	98.0%
Rex Black Diamond Wax - 4+1 Mix	0.0%	0.3%	1.2%	19.5%	21.4%	49.4%
Silca Hot wax X	0.0%	0.0%	0.0%	23.1%	28.2%	60.2%
Candle wax	5.3%	14.8%	20.3%	34.4%	40.2%	61.4%
Effetto Mariposa Flower power wax	2.3%	4.6%	4.6%	36.6%	48.0%	80.0%
Ceramic Spd UFO Drip New Formula	2.3%	5.7%	6.3%	38.6%	55.6%	92.2%
Silca Super Secret Drip	2.9%	7.5%	7.5%	44.4%	73.4%	133.0%
Ceramic Speed Wet Conditions	12.3%	28.3%	44.9%	86.0%	109.7%	153.7%
Tru Tension Tungsten Race - (*D.A)	5.4%	7.4%	9.7%	48.0%	78.0%	119.2%
Session S-Wax	14.6%	20.3%	25.4%	58.0%	84.6%	121.1%
Tru Tension Tungsten All Weather	14.0%	24.0%	36.0%	67.0%	85.0%	117.0%
Silca Synergetic	0.0%	18.3%	42.6%	70.0%	91.7%	147.0%
Rex Black Diamond (*E.A)	2.3%	13.4%	30.0%	73%	97.1%	161.20%
Smoove	19.1%	36.6%	38.6%	87.3%	118.0%	185.6%
Rex Domestique	5.1%	33.7%	48.8%	93%	126.2%	161.2%
Allied GRAX	22.0%	40.3%	59.1%	101.0%	127.8%	172.7%
Squirt	19.1%	39.0%	61.0%	109.4%	141.3%	193.1%
Boeshield T9 - Aerosol	11.1%	43.4%	65.7%	113.1%	150.5%	221.6%
Revolubes	4.0%	22.3%	39.7%	101.4%	153.1%	245.4%
Nix Frix Shun	12.6%	40.0%	54.3%	82.9%	155.0%	198.3%
Silca Synerg-E	2.0%	9.7%	29.4%	102.9%	166.2%	276.3%
Cycle Star Gold	22.3%	53.1%	98.3%	140.4%	172.5%	235.7%
Finish Line Dry	14.9%	50.0%	76.9%	131.2%	175.5%	257%
Rock N Roll Gold	8.9%	37.9%	57.9%	122.0%	177.9%	275.4%
Wend Wax test 2 (dissolved in)	35.7%	69.4%	98.0%	39.9%	205.9%	270.6%
AB Graphene Wax	22.0%	60.3%	85.1%	188.7%	209.8%	338.8%
Wolf tooth wt-1	16.9%	69.7%	123.7%	187.9%	239.0%	335.2%
Dumonde Tech Pro X-Lite	16.0%	84.9%	106.6%	186.7%	256.8%	376.9%
Muc Off C3 Ceramic Dry	10.6%	72.3%	124.6%	197.5%	260.4%	370%
Singer general purpose ($6.95)	9.1%	47.4%	87.4%			
Muc Off Ludicrous AF	8.9%	89.6%	159.4%	248.6%	327.8%	461.6%
White Lightning Epic Ride	22.9%	56.5%	160.9%	259.7%	348.5%	496.7%
Finish Line Wet (green bottle)	15.1%	106.3%	191.8%	294%	386.2%	554.1%
Prestacycle One	7.9%	102.9%	192.4%	298.6%	394.8%	554.1%
Muc Off Hydro Dynamic	27.6%	126.6%	219.9%	329.9%	429.9%	594.9%
Muc Off Nano Lube	37.7%	145.4%	247.6%	366.5%	475.4%	653.8%
Wolf tooth wt-1 on Factory grease	17.7%	54.8%	103.1%			
Shimano Factory Grease	10.9%	31.7%				
Finish line Ceramic Wax (unable to extrapolate data)	72.3%					
Wend Wax test 1 - stick only	74.0%					
NO LUBRICANT	90.3%					
Finish Line Halo IM wax (*RE-Test TBA)	99.7%					
Finish Line Halo Drip wax (*Re-Test TBA)	203.4%					
Average All lubes	22.6%	43.1%	72.8%	122.4%	167.9%	236.8%

*D.A = Re lube applications doubled — Red = extrapolated data as test stopped before testing this block.

*E.A = Extended application intervals — See Below Wear by block data table for current extrapolations.

Wear - Individual block (NOT Cumulative).   ****Please read the test information at top of page to understand the results and test**

WAX / Wax DRIP / DRIP - WET / GREASE

Lube	Block 1 - No Contamination	Block 2 - Dry Cont.	Block 3 - No Cont.	Block 4 - Wet cont.	Block 5 - No Cont.	Block 6 - Extreme Cont.
Rex Black Diamond Wax - 11+1 mix	0%	1.4%	0.9%	4.6%	2.0%	35.7%
Molten Speed Wax Original Formula	0.0%	12.0%	0.0%	8.0%	0.0%	78.0%
Mspeedwax New Formula	0.0%	1.1%	0.6%	9.1%	1.1%	19.7%
Silca Hot wax X	0.0%	0.0%	0.0%	23.1%	5.1%	32.0%
Silca Synergetic	0.0%	18.6%	24.3%	27.4%	21.7%	55.3%
Silca Hot Melt	0.3%	1.7%	4.6%	8.0%	4.0%	8.6%
Rex Black Diamond Wax - 4+1 Mix	0.3%	0.0%	0.9%	18.3%	2.0%	28.0%
Silca Synerg-E	2.0%	7.7%	19.7%	73.4%	63.4%	110.1%
Effetto Mariposa Flower power wax	2.3%	2.3%	0.0%	32.0%	11.4%	32.0%
Ceramic Spd UFO Drip New Formula	2.3%	3.4%	0.6%	32.3%	17.0%	36.6%
Rex Black Diamond (*E.A)	2.3%	11.1%	17.0%	42.6%	24.3%	63.9%
Silca Super Secret Drip	2.9%	4.6%	0.0%	36.9%	29.4%	66.0%
Revolubes	4.0%	18.3%	17.4%	61.7%	51.7%	92.3%
Rex Domestique	5.1%	28.6%	15.1%	43.7%	33.7%	65.6%
Candle wax	5.3%	9.5%	5.5%	14.1%	5.8%	21.2%
Tru Tension Tungsten Race (*D.A)	5.4%	2.0%	2.3%	38.3%	30.0%	41.2%
Prestacycle One	7.9%	95%	89.5%	106.2%	96.2%	159.3%
Rock N Roll Gold	8.9%	29.0%	20.0%	65.0%	55.0%	97.5%
Muc Off Ludicrous AF	8.9%	78%	72.5%	89.2%	79.2%	133.8%
Singer General Purpose ($6.95)	9.1%	38.3%	40.0%			
Muc Off C3 Ceramic Dry	10.6%	61.7%	52.3%	72.9%	62.9%	109.4%
Shimano Factory Grease	10.9%	20.8%				
Boeshield T9- Aerosol	11.1%	32.3%	22.3%	47.4%	37.4%	71.1%
Ceramic Speed Wet Conditions	12.3%	16.0%	16.6%	41.1%	23.7%	61.7%
Nix Frix Shun	12.6%	27.4%	14.3%	28.6%	72.5%	42.9%
Tru Tension Tungsten All Weather	14.0%	10.0%	12.0%	31.0%	18.0%	32.0%
Session S-wax	14.6%	5.7%	5.1%	32.6%	26.6%	36.5%
Finish Line Dry	14.9%	35.1%	26.9%	54.3%	44.3%	81.5%
Finish Line Wet (green bottle)	15.1%	91.1%	85.6%	102.2%	92.2%	
Dumonde Tech Pro X-Lite	16.0%	68.9%	21.7%	80.1%	70.1%	120.1%
Wolf tooth WT-1	16.9%	52.9%	54.0%	64.1%	51.1%	96.2%
Wolf tooth WT-1 on Factory Grease	17.7%	37.1%	48.3%			
Smoove	19.1%	17.4%	2.0%	45.1%	34.3%	67.7%
Squirt	19.1%	22.0%	18.0%	48.9%	33.3%	51.8%
Allied GRAX	22.0%	18.3%	18.9%	42.0%	26.6%	44.9%
AB Graphene Wax	22.0%	38.3%	24.9%	103.6%	21.0%	129.0%
Cycle Star Gold	22.3%	30.9%	45.1%	42.1%	32.1%	63.2%
White Lightning Epic Ride	22.9%	33.7%	104.3%	98.8%	88.8%	148.2%
Muc Off Hydro Dynamic	27.6%	98.9%	93.4%	110.0%	100.0%	165.0%
Wend Wax test 2 (dissolved in)	35.7%	33.6%	28.6%	61.8%	46.2%	64.7%
Muc Off Nano	37.7%	107.7%	102.2%	118.9%	108.9%	178.4%
Finish line Ceramic Wax (unable to extrapolate data)	72.3%					
Wend Wax test 1 - stick only	74.0%					
NO LUBRICANT	90.3%					
Finish Line Halo IM wax (*RE-Test TBA)	99.7%					
Finish Line Halo Drip wax (*Re-Test TBA)	203.4%					
Average All lubes	**21.8%**	**29.8%**	**28.2%**	**51.6%**	**40.1%**	**74.1%**

*D.A = Re lube applications doubled   Red = extrapolated data as test stopped before testing this block.
*E.A = Extended application intervals   See Below Wear by block data table for current extrapolations.

Wet lubricants Extrapolation update - May 2023
Average All Wet Block 1 - 15.5%
Average All Wet Block 2 - 43.8%
Extrapolation = +28.3%

Block 3.
Average All wet Block 2 = 38.4%
Average all wet Block 3 = 32.9%
Extrapolation = -5.5%

Block 4
Average All wet block 2 = 38.4%
Average all tested wet block 4 = 49.6
Extrapolation = + 11.2%

Block 5
Average all wet tested block 4 = 49.6%
Average all wet tested block 5 = 39.5%
Extrapolation = -10% reduction vs block 4

Block 6 - change to use a 1.5 multiplication on Block 4
Only one wet lubricant has been tested in block 6 - insufficient for data average extrapolation.

Wax lubricants Extrapolation update - May 2023

Average All Wax Block 1 - 11.3%
Average All Wax Block 2 - 9.5%
Extrapolation = -1.8%

Block 3.
Average All wax Block 2 = 9.5%
Average all wax Block 3 = 6.5%
Extrapolation = -3.0%

Block 4
Average All wax block 2 = 9.5%
Average all tested wax block 4 = 37.7
Extrapolation = + 28.2%

Block 5
Average all wax tested block 4 = 37.7%
Average all wet tested block 5 = 22.1%
Extrapolation = -15.6% reduction vs block 4

Block 6
Average all wax tested block 4 = 37.7%
Average all wet tested block 5 = 40.6%
Extrapolation = + 2.9% vs block 4

Immersive wax (excluding Graphenwax)
Average all wax tested block 4 - 14.6%
Average all wax tested block 5 - 3.1%