

Zero Friction Cycling

HOT VS COLD?! - The great wax Temperature Debate

**Pls note pictures are for illustrative purposes only, and are not pictures of the test chains*



Premise of the Debate;

FOR;

It has been postulated in numerous corners of the immersive waxing world that a tip / hack to get greater treatment lifespan from one's immersive wax / re wax - that they should remove chain from wax that is cooler or close to the waxes "Set temperature". Theory being this will "Lock in as much wax as possible" inside the chain.

The mechanism by which one has more wax "inside" the chain, thus giving them a longer treatment lifespan, is by retaining more wax inside chain that would have otherwise run out of the chain before the wax is able to cool sufficiently to become solid.

Against;

The argument against the above is simply that the pressure loads inside chain from your pedalling force and very small parts surface area size –

they do literally reach easily thousands, even tens of thousands of PSI pressure load. This pressure will press out “excess” wax, and only a very thin layer of wax remains after initial approx. 10 to 15 mins of cycling to break in the wax treatment.

Even IF one was successful in “Locking more wax IN” the chain, all that would mean is more EXCESS WAX is pressed out during initial break in.

It is worth noting that this waxing method is not without its costs.

- It often adds time and fuff to the waxing process.
- It brings more wax out of the pot each re wax (much of which is “ON” the chain vs whatever extra may be locked “IN” the chain. This greatly increases wax consumption rate.
- There is notably more mess of excess wax coming off the chain during initial pedalling when installing back onto bike and initial minutes of riding.

As such it is not a free “why not” tip to follow. If there was no cost, and the possibility of benefit even if unsubstantiated – no issue. However the costs are real, in time, wax loss and mess – and so for people to continue to follow this tip, it should be substantiated that the juice is worth the squeeze so to speak.

Silca Blog Post;

A recent blog post by SILCA exploring the above stirred up this debate and numerous enquiries to ZFC around this topic. This post covers some testing of how much wax weight was measured “IN” the chains after removing them at different wax temperatures.

They discovered that the chain removed at 95dg Celsius had 0.5g less wax weight measured vs chain waxed at 75dg C, and at 125dg C there was 1.3grams of wax less vs 75C.

A direct conclusion to the extra wax weight for the 75c temp chain was not made, **however a strong correlation between that extra wax weight and attaining a longer treatment lifespan was made.**

Below is from the “conclusion section on blog post”

Silca Blog post Conclusion

The temperature you pull your chain out of the hot wax certainly matters for how much wax is left in the chain. *(*ZFC disagrees with “left in the chain”. They have not established what amount more wax may be “IN” the chain vs how much extra is “ON” the chain)*

This test tells us that there is more wax left at lower temperatures and is absolutely larger than the margin of error here *(yes – but again, much of that will be ON the chain, it has not been established in anyway that more is left ON the outside of the chain which cannot have any impact on treatment lifespan. Nor have they tested that IF there is slightly more wax IN the chain, that a thicker layer can be retained after wax break where thousands of PSI Pressure load dictate that only a very thin layer of wax can remain coating internal parts).*

What this simple test tells us is, how does that impact performance? Does a 12% reduction in wax mean a 12% reduction in longevity? Is it 5%, 20% or does it matter at all? **It will likely have an impact**, *(I have highlighted this as this is a strong intimation by Silca of a relationship between removing at lower temperature and attaining a longer treatment lifespan)* but as with almost all tests, we leave with more questions than when we started. Keep an eye on this topic for more testing to come in the future.

I do not wish for this to come across unduly critical as Silca have indeed done a lot of outstanding work in the field of bicycle chain lubrication. They have genuinely put in a huge amount of R&D and testing – control and field – to deliver numerous of the genuine top level products in this category. Silca, (Josh Poertner in particular), has also contributed greatly to information and education in chain and drivetrain lubrication space, greatly helping to increase the number of cyclists on chain and drivetrain lifespan extending lubrication and maintenance paths. This is of course much better

than manufacturers who do nothing but market products that deliver very poor chain and drivetrain wear life.

However – factoring that context in, Silca have extensive knowledge of chain lubrication and especially immersive waxes. Whilst I accept the caveat stated at the end that more testing is coming on this topic, considering the overall ease of taking their testing one step further – simply putting the chains through initial wax break in run – can be done on an ergo for 15 or 20 mins at same average power, and then re weigh chains and check for wax weight difference.

I do not believe it is correct to have stopped their testing for the blog post at just weighing chains post waxing, as it is frankly extremely obvious, even visually, that much of the extra wax weight is on the OUTSIDE of the chain, which will have zero impact on treatment lifespan. Making no attempt to ascertain what level of extra wax weight is INSIDE the chain, and then checking if that REMAINS INSIDE the chain after initial break in run, I find for Silca's level of knowledge around waxing and chain lubrication that this is an odd error.

I personally think there are times when if you are not going to test fully to arrive at a correct answer, and that only conducting the first part of the testing needed, which will have you arrive at an incorrect answer – then just don't do the testing partway, or avoid publishing incorrect conclusions and intimations based on obviously incomplete knowledge. Wait until the next step in the testing is completed, then put out a post or paper with the correct answers and information.

Why invest lower resources to arrive at the wrong place, when investing the right resources would have easily seen you arrive at the correct place. In this particular topic, the level of resources needed to have simply arrived at the correct answer, especially for Silca, are not high.

Silca have the knowledge around waxing. They know that more wax on the outside of the chain will not help treatment longevity. They will know that much of the extra wax weight is staring right at them from the outside of the chain. They will know that excess wax is pressed out from inside the chain during break in run. So taking further steps to ascertain what level of extra wax may have or not have been able to make a thicker layer for longer treatment lifespan was simply always going to be a given if you are going to

delve into this topic, or don't delve in until you are ready to do it properly, not partially – and communicate incorrect information based on a half done test. It is like testing sealant performance without taking the next step of actually inflating the tire, and communicating findings and initial conclusion around sealant performance. It would make no sense to conduct a sealant test without the next obvious step, it makes no sense to link wax weight to treatment longevity without taking the next step to ascertain if more wax has been retained INSIDE chain vs just pressed out as excess, as well as how much wax weight is ON the outside of the chain.

Silca also know that not everyone has an expensive temperature control pot, and so intimating a tip that will have people standing by wax pots with a thermometer adding significant time and fuff to an immersive wax based on incorrect test and information - again not to harp on too much (I likely have), I just think this is a rare miss by Silca in an area they have so far been exceptionally strong in.

Silca have very much been at the forefront of a lot of great information and products helping many cyclists save a lot of money on chain and drivetrain wear, as well as saving racers literal watts of friction. ZFC has also enjoyed an excellent relationship with Silca for many years due to their simply excellent work and products in this space.

So, credit where it is due, overall Silca have been outstanding for years on much of the best information and products in this space. Hence why this, without sounding too harsh, frankly half baked test, and the incorrect information intimated from it, is a strange outlier for a company with so much knowledge of chain lubrication and waxing.

Zero Friction Cycling Test to answer the question once and for all.

Since the blog post re-ignited the debate, testing wax temperature removal for improved treatment lifespan became the next open test voted in by ZFC you tube channel audience.

The Test

Two Shimano Ultegra 11spd chains were stripped clean of factory grease by ultrasonic cleaning rounds, and cut to 110 links in length. One chain had a link engraved with a “H” for hot, and another “C” for cool.

Both chains were weighed on fancy expensive accurate scales accurate to 0.01g and their clean 110 link weight recorded.

The “Hot” chain wax waxed at 100dg Celsius and hung to set over the pot. The “Cold” chain wax waxed initially at a “normal” 90dg Celsius, then pot turned off and wax allowed to cool to 65dg C where it was then removed and hung to set over pot.

The wax used was Silca hot melt, same wax, pot, swishing and hanging to set for both chains.

After both had cooled and set, both chains were weighed. The difference between “waxed weight” and net weight recorded as below;

Chain	Net Weight (grams)	Waxed Weight	Weight of Wax	Difference
100dc C wax chain	246.33	250.66	4.33	
65dg C Wax chain	246.95	253.7	6.75	2.42g more wax removed Equals 55.8% greater wax Consumption rate

As we can see, there is clear difference in wax weight from the cooler temperature. But even visually it was obvious much of this would indeed be “ON” the chain, and any extra amount “LOCKED IN” not ascertained.

Break in Run

Both chains were then run on test machine 4 for 15 minutes at 250w load, large chain ring, cog 4. Generally around 20 to 30 mins wax break in will have a wax treatment in its “optimal” zone ready for a race start, however the bulk of wax break in and “excess” wax being pressed out should be done by 15 minutes.

After this break in run both chains were again weighed;

After 15 mins @ 250w load on test machine

Chain	Net Weight (grams)	Waxed Weight	Weight of Wax	Difference
100dc C wax chain	246.33	249.1	2.77	
65dg C Wax chain	246.95	249.4	2.45	0.32 grams across 110 links Equals 0.0029 grams per link difference

It doesn't matter which one had slight wax weight advantage, it is such a tiny difference that it is the same.

As we can see there was now a tiny 0.32gram difference in wax weight between chains. Across 110 links of chain, I would class this as too small a difference to possibly lead to one chain now going to go on and have a measurably (or any amount) longer treatment lifespan.

Not only that, but the slightly heavier chain was the “HOT” chain. This tiny difference is either simply test variance – if repeated 10 times approx. half the time a tiny difference would be in favour of the HOT or COLD chain, or if statistically the COLD chain was slightly lighter, my theory to support that is that there a larger blobs of wax on outside of the COLD chain, which when they break off during run in, may take slightly more wax with them off the link plates vs the HOT temp chain where only a very thin, barely visible layer of wax is left on the outside for most of the chain.

CONCLUSION Part 1

It was already clear after simply re weighing post wax break in run that even **IF** more wax is able to be “locked in” by removing from cooler wax, that;

- It is pressed out as excess and same thin layer inside chain remains due to pressures involved
- That very, very clearly much of the extra wax weight is ON the chain.
- That even if the 0.32g extra weight was in favour of the 65dg C chain, still some / most of that would be wax “ON” the chain, on some unknown fraction of 0.32grams of wax could possibly be still “IN” the chain, and so whatever that fraction of 0.32grams is, then divided across 110 links of chain – it would again be simply unable to increase treatment lifespan.

It was thus always going to frankly be a completely useless test to conduct treatment lifespan for both chains. There is no possible meaningful difference of wax weight, and the tiny amount higher wax weight was in favour of the hotter waxed chain. But, I was here to put this debate to rest once and for all, so many hours of machine test time ensued.

Single Application Longevity testing

Both chains were put through the normal S.A.L test used to determine a lubricant treatment lifespan. Basically they are put through continuous intervals and wear of the chain very accurately checked every 150km. If a lubricant treatment gives out at a particular point, this shows up with wear rate jump and or higher overall wear rate of the chain.

Below are the main checkpoints post each set of 4 intervals (600km, and 1200km). We can see the wear rates are slightly in favour of the HOT chain at 600km mark, and slightly in favour of the COLD chain at the 1200km mark, but the difference in wear is tiny, and well within test variance.

For all Main Test and S.A.L test – no two chains are ever exactly the same, and so even same chain, same lubricant, same test protocol – there will be some small variance. For the S.A.L test we really need an absolute minimum of +/- 1% (2% total) variance to consider a possible performance difference between two products regarding treatment longevity. A 0.57% difference is far too small to call a difference in performance. If tests were run again, it would be complete 50/50 odds which one would have a very small benefit simply due to chain variances.

After many hours of completely useless testing

Chain	600km of S.A.L test	1200km of S.A.L test	Difference	Test tolerance
100dg C wax chain	8% chain wear	13.14% chain wear	0.57%. This is a tiny difference, well within test variance.	For S.A.L need AT LEAST 2%+ difference to be statistically significant, otherwise it is simply chain variance
65dg C Wax chain	8.86% chain wear	12.57% chain wear		

CONCLUSION Part 2

The treatment longevity testing confirmed that having basically no difference in wax weight after initial wax break in leads to.....would you believe no difference in the wax treatment longevity. Due to of course there being the same amount of wax IN the chain after initial break in run. Due to the extremely high pressure loads only allowing a certain thickness wax layer, which is very thin.

The only way to try to change the thickness of the layer left behind after wax break in would be to change the properties of the wax such that its behaviour under tens of thousands of PSI pressure load allow it to retain a thicker layer and have less of it pressed out as excess.

You cannot change the thickness of the layer of wax after break in for X wax being used by hoping you managed to retain more inside from your waxing

process. That particular wax's properties will determine how much excess is pressed out, the thickness of the layer remaining, and how long that layer performs in X conditions based on the performance properties of that wax.

Where have others gone wrong?

Silca's blog post is only a recent case of this pro tip / hack coming to light to attain longer wax treatment lifespan. It has been put forward by others on various You Tube channels, especially some DIY wax channels like "Oz Cycle", as well as various articles, blog posts, forums etc etc.

It has been quite a persistent Tip / Hack, and yet previously no one had ever substantiated the key theory underpinning it.

- Can you lock more wax "IN", or is the extra wax weight simply stuck "ON" the outside of the chain
- IF you do manage to "LOCK MORE IN", can any extra in remain inside the chain despite tens of thousands of PSI pressure loads that will only allow a very thin bonded layer to remain after initial break in.

Numerous others in this space over time had the knowledge and resources to simply weigh their chains after break in after waxing at various temperatures vs just after waxing, where especially in the case of the cooler waxed chains it is extremely obvious a lot of the extra wax weight is staring you in the face on the outside of the chain. I have even seen on Oz Cycle channel where he removes at near the waxes set temp, standing there with a thermometer as it cools, and then upon removing chain immediately dunks chain in cold water to "Lock as much wax in as possible".

In general I believe more work should be done by those making claims to substantiate their claims. I have not seen any other channel even begin to substantiate this "tip / hack", it is has just been continually pumped out

there, and those who don't spend their lives thinking about how lubricants work in chains (ie – NORMAL PEOPLE) and those who place tacit trust in the channel they are following, are sent down a more fatty, more costly, more messy path for zero benefit. Silca did at least do something to help back this tip, but that something was as you know if you have read this far – a very odd miss step in my view considering their expertise and resources.

All that said, the work has now been done, and can we please move on from this wax temp and treatment longevity tip. If you ever hear any cyclist talking about it in your cycling group, or on a YT channel, or on forums etc – please direct them here! And don't forget this is covered on video, link below – please help stop your fellow cyclists wasting time and wax!

Great wax temp debate video link;

<https://www.youtube.com/watch?v=Is4aOgQ97Ws>

Below is a bonus issue which is linked, but in case you don't want to read that far, and you just want some final groovy stuff around waxing – please find the following.

ZFC best mantra and advice overall is;

Just relax and Re-wax!!

Immersive waxing is extremely easy and time efficient. It is only difficult, fatty and time consuming IF YOU MAKE IT SO!

Majority of cyclists please just follow this and all will be amazing;

Waxing – concise version;

<https://www.youtube.com/watch?v=TwXdeOBXlBQ&t=183s>

There may be cases where some VERY EASY extra steps can be taken, such as two pot system like a boss for avid offroad riders who ride in dusty conditions, to post proper wet riding, as well as if it is your dedicated race chain and you want it absolutely mint again ready for next race/s.

IF you want to dive deeper than the concise version (which honesty is all the vast majority need to do), then please refer to the chain maintenance guide which covers everything including perfect reset for race chains, or the most excellent Waxed Life Like a Boss video that covers the key hints and tips for deeper level waxing. All of it groovy, none of it nonsense based on nada or feels.

Chain maintenance guide;

<https://zerofrictioncycling.com.au/wp-content/uploads/2025/01/Chain-Maintenance-Guide-v5a.pdf>

Waxed Life like a Boss

<https://www.youtube.com/watch?v=kVzhm-yTojk&t=2141s>

BONUS ISSUE WE CAN COVER AS WELL WOOHOO!

Strongly linked to the above are the contortions people go through to ensure even distribution of wax amongst the links of their waxed chain.

Some hold a belief that if you remove from wax pot and hang to set over the pot, that you will have more wax on the end (or ends depending on how you hang) of the chain and less at the top or in the middle. This belief is correct, but for all the reasons covered above, it does not matter at all.

The worry is that the wax treatment will give out in those area's of the chain with less wax first whilst the ends of the chain that had more wax set will still be well coated.

On top of this, some even worry more wax will be on one side of the pin and less on the other – causing one side of the pin to run out of wax earlier etc.

Again I can assure you that no worrying is needed re any of the above. YES you will have more wax on the ends. YES, you will have more wax on one side of the pin.

But again ONLY A VERY THIN LAYER of wax can and will remain post break in. ALL PARTS of chain will still have TOO MUCH wax initially, excess will still be pressed out from ALL parts and internal surfaces, after which the same very thin layer will be remaining on all parts and surfaces, regardless of how much they started with.

Proof of this in practice across my nearly 150,000km of waxing for my own chains, is that say as my chain approaches 0.5% wear after typically around 15,000km for road – I have even chain wear across the chain. If there was an issue, I would expect less wear at ends of chain, more in the mid section etc (I hang mine over a metal rod so two ends of chain are dripping excess as wax cools back into pot. The middle of the chain will have less wax, the ends will have more). All sections of the chain have the same wax lifespan. All sections of the chain wear very evenly. Because all of the chain simply has the same thin layer of wax it needs after wax break in run.

Also – isn't it interesting in that all this time I have never had someone raise a concern around their wax drip having more wax settle on the bottom of the pin vs the top etc, and yet wax drips typically take hours to set, vs minutes for an immersive wax.

Why the worry for the chain that is submerged in 100% lubricant and that sets in typically 10 minutes, and not worry at all when adding a tiny amount

of wax drip (3ml application across 100 links = 0.03ml per link), that takes hours to set, and as it is liquid for hours and so subject to gravity for hours – more of that 0.03 ish ml per link will settle to the bottom, leaving less of that tiny amount for the top – and typically half of what you apply with most wax drips is carrier). Has anyone ever seen a wax drip chain where the top of the pin, top of the inner link plate bore, top of the inner link plate shoulders and top of roller bore wore more than the bottom due to the top parts of chain components running out of lubricant whilst the bottom was fine?

It is perplexing to say the least why distribution of immersive wax on chains component parts is continually a concern and some waxers have frankly astounding (to me) processes in place to ensure more wax doesn't end up on one side of pin than the other etc, and yet in nearly a decade in this space not once have I ever seen a comment or received an enquiry concerning lubricant distribution on setting for wax drip lubricants.

I do not understand what drives some to make immersive waxing as unnecessarily complicated as possible. Some combine multiple unnecessary steps to their immersive waxing making it overall extremely time consuming (from cleaning post dry riding before re waxing, to ultrasonic waxing, to letting wax cool, to all sorts of multiple step interventions during cooling for even distribution). I think this is what drives some of the bad myths and misconceptions around immersive waxing where some think it is reserved for very strange people who are groovy to set aside an entire afternoon to re lubricate their chain.

In short, remember the ZFC mantra.

“JUST RELAX AND RE WAX”

For most immersive waxers for most re waxes it should be a total labour time of 4 minutes – that is it. Watch the video below, and that should be all most cyclists ever need to do.

Waxing – concise version;

<https://www.youtube.com/watch?v=TwXdeOBXlBQ&t=183s>

There may be cases where some VERY EASY extra steps can be taken, such as two pot system like a boss for avid offroad riders who ride in dusty conditions, to post proper wet riding, as well as if it is your dedicated race chain and you want it absolutely mint again ready for next race/s.

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Chain maintenance guide;

<https://zerofrictioncycling.com.au/wp-content/uploads/2025/01/Chain-Maintenance-Guide-v5a.pdf>

Waxed Life like a Boss

<https://www.youtube.com/watch?v=kVzhm-yTojk&t=2141s>