

Chain / Lubricant Maintenance guide - IMPORTANT READING!

How to use this guide?

How you perform maintenance varies by lubricant type (immersive wax / refined wax drip lubricant / other wax type drip lubricant / wet lubricant), the type of riding conditions, and whether or not maintenance is going to be done off bike or on bike. This makes a number of permutations for recommended maintenance. *Scroll down to the section that matches your lubricant type, then read either the off bike or on bike steps guide depending on which method is for you. (*after you have read initial information below)*

Why is understanding chain maintenance basics important?

Your chain is

your hardest working mechanical part by orders of magnitude. Very conservatively your chain will complete approximately 1 million link articulations per hour of cycling. Many cyclists will be closer to 1.5 to 2 million link articulations per hour. Due to very small parts size, the pressure loads on your chain's main wear surfaces are extremely high. With a proven top lubricant and a high quality chain, these parts will wear very slowly. Allow abrasive contamination to build, and your wear rate can rapidly increase to many times the clean lab test rate for that lubricant. This makes sense. Instead of a super slippery lubricant between metal surfaces, if you allow abrasive particles to build in the lubricant, you will have initially a very mild abrasive liquid between the parts, but one that will continue to become ever more abrasive until you do some maintenance to reset contamination. Different lubricants resist / absorb contamination at vastly different levels. Also, certain lubricant types are more suited to certain riding conditions than others - ie wet lubricants and offroad = rapid contamination absorption.

Even a very small increase in the abrasiveness of the lubricant from contamination will have a measurable impact over time on your chain and drivetrain component wear rate (and your chains friction losses). This makes sense, if you multiply even a very small value by millions, and then tens of millions, and then hundreds of millions - even very small values multiply out to a notable number. A lubricant moving from being perfectly clean and slippery to even mildly abrasive from contamination - over millions of articulations under load - this causes notable wear vs if the lubricant well maintained. **Remember the Friction Facts testing that showed just cleaning your chain could easily give you back 3 watts? Depending on lubricant / your riding - maybe its a watt. Maybe its 5 watts. Whatever it is, it is X watts of friction energy going DIRECTLY into wearing your chain faster every pedal stroke.**

How often should you perform maintenance and how? That is what the guide below will assist with. Bicycle chain lubrication is actually quite an extreme challenge. This VERY hard working part and its lubricant are completely exposed to the environment. Not many similar hard working machine parts suffer this challenge. Remove the air filter and oil filter from your cars engine, and it will not have a very long life. Especially if you put a big opening in it and take it offroad. Remove the seals off your bikes bearings, they will not have a very long life, nor remain low friction and smooth after a couple of rides. Your chain is working orders of magnitude harder than your bicycles bearings, and is much more exposed.

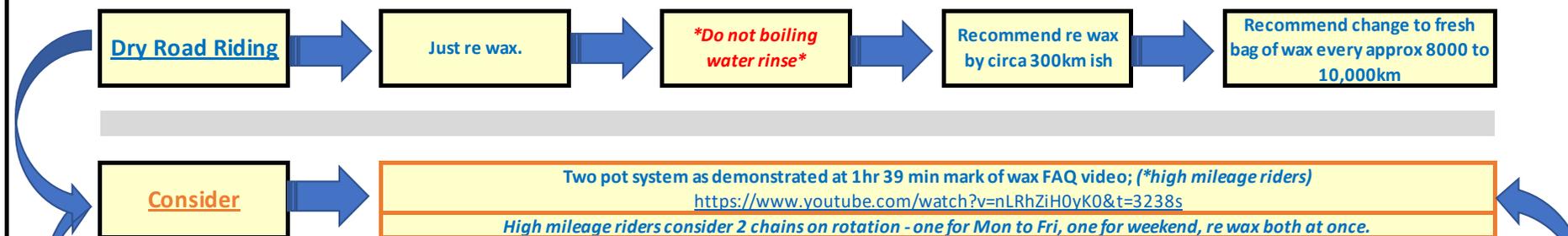
Some lubricant types absorb contamination easily, whilst some are highly resistant. Along with your type of cycling (dry road only / Gravel / Mtb / frequent wet conditions) - this will greatly impact how regularly you should intervene to minimise abrasive contamination building up in your lubricant. Take this into account. This guide cannot cover differences between are your trails mostly hard pack or soft soil dirt, or is your dust quite pervasive and made of crushed rocks. The latter becoming part of your lubricant is much more damaging than the former. A guide trying to provide step by step assistance for all environmental types around the would be a nightmare to create, and to read. If unsure, err on better maintenance vs slack maintenance.

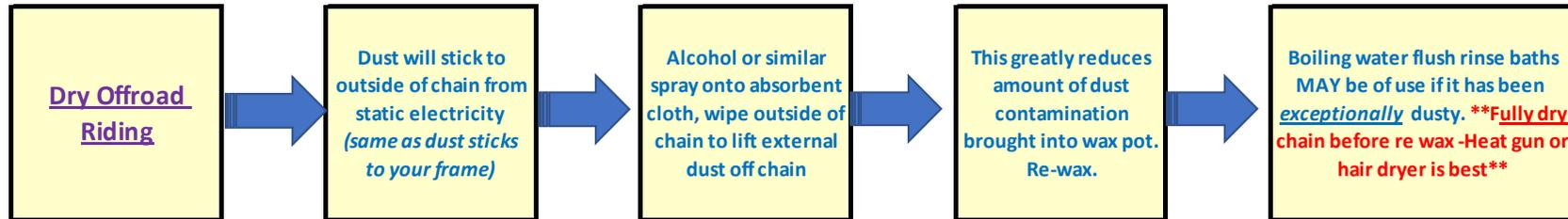
Highly contamination resistant lubricant and dry road cycling, your maintenance job is pretty darn easy. Lubricant that readily absorbs contamination and offroad riding - your maintenance regime needs to be pretty amazing - which in itself can carry a high cleaning product cost that really adds up over time vs simply going with a much better lubricant choice, let alone the amount of time frequently needed to perform maintenance. It may help to check lubricant test page, and key learnings from lubricant testing document or ZFC you tube video, and step one ensure you are on a proven top lubricant for your type of riding - ZFC has found quite a number of absolutely brilliant drip lubricants as well as immersive waxes.

The type of maintenance you perform can also differ by lubricant type, ie it may differ for wet lubricant vs a wax lubricant

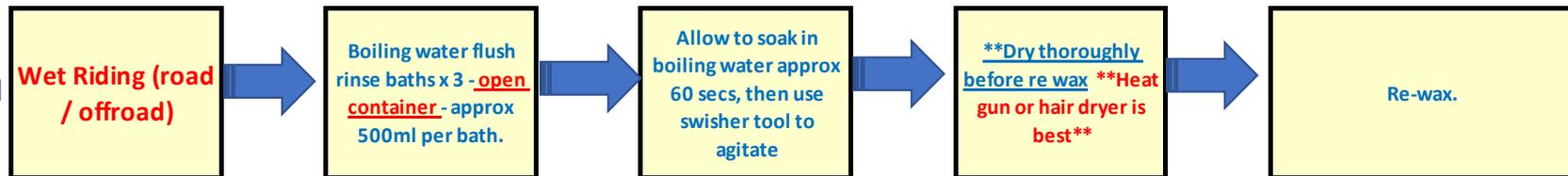
***Note that with drip lubricants & no / little maintenance - **chain wear rate is typically far from linear**. Initially wear rate can be very low - the lubricant has not yet absorbed too much contamination, and quality chains have some wear protection in the form of low friction coatings and wear resistant platings on pins / rollers. However, some good riding miles in the bank later, your lubricant now contains notably more abrasive contamination, and those wear protections will have been compromised. As such many cyclists get caught out by an ever increasing wear rate as its service life continues, ripping well past the recommended 0.5% replacement mark, and often then requiring a new cassette with a new chain (and with some good inroads to your chain rings as well). This can be VERY expensive on many groupsets. A little bit of knowledge and bedding in a routine that suits you can save you a lot of friction, component wear directly linked to that friction, and many \$\$ in running costs you can use to buy other fun cycling things instead of burning through your components*

Immersive wax drivetrain with a proven top wax

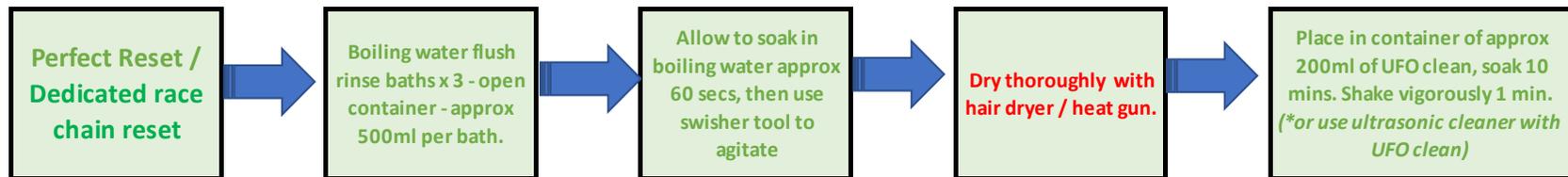




**Recommend change to a fresh bag of wax after approximately 5000km of offroad cycling.*



**Recommend change to a fresh bag of wax approx 5,000km if you ride in a lot of wet weather*



**Using this method, a bottle of UFO clean will last at least approx 50 chain resets, making it very cost effective vs degreaser maintenance of drip lube chains. Note that UFO clean is one of the few solvents that works on waxes.*



<https://www.youtube.com/watch?v=nLRhZiH0yK0&t=3238s> - two pot waxing like a boss - 1hr 39 min mark.

Two pot waxing system. This is really not needed for dry road cycling. However, for high contamination condition cycling, two pot system

CAN MAKE immersive waxing by far the absolute easiest way of maintaining a low friction chain / drivetrain. There is simply no easier way to reset contamination in your chain than by popping it into a pot of immersive wax. Watch the video link above re two pot system like a boss (1hr 39 min mark). With chain raised off bottom of pot 1, the old contaminated wax coating will melt off, and contamination settle to bottom. Gently remove chain, and put into pot two, and re wax as normal. This keeps pot 2 wax very clean. After approx 10,000km (*Road cycling), pot 2 wax becomes pot 1, fresh bag into pot 2. For one extra \$20 pot and pre buying your next bag of wax, you can skip all cleaning to reset your chain post harsh conditions riding - i only bother with boiling water flush rinses post full mudder rides - rest of the time for offroad it is just 2 pot system, and my chains / cassettes wear rate is exceptionally low. Every time chain comes out of pot, it looks clean and brand new, yet i didnt have to do any cleaning. So quick and easy compared to what is required to reset most drip lubricant chains post harsh conditions riding. Much less labour time, no solvent cost, no faffing boiling kettles and drying chains most of the time, and even when i do, really thats optional. Depending on your riding and environment, two pot system like a boss can simply be the easiest maintenance move to have an always clean, very low friction, very low wear chain and drivetrain vs other options. It is a pervasive myth that immersive waxing is not suitable for frequent wet weather riding. I know of no other way that is easier or faster to reset contamination as well as immersive waxing does.

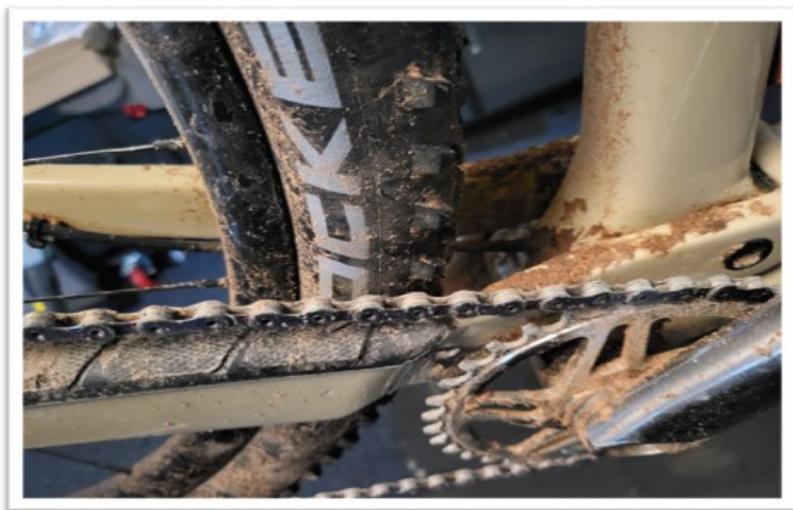
Two chains on rotation system. This can be brilliant for high mileage riders as well as those riding frequently in harsh conditions. If you ride a lot, or frequently ride in harsh conditions - sooner or later you will need a new chain. So pre buying your next chain to run two in rotation costs you no more. Benefits - 1) You guarantee two chains through your cassette instead of possibly just one if run your one chain too long. 2) it makes it easier to keep up with immersive waxing if time stretched as you can swap to a fresh chain whilst you put the one off your bike into pot, or wipe dry and wrap in an absorbent cloth (***NEVER PLASTIC BAG***) to rewax both chains at once on rest day. 3) it makes it easier if you wish to perform some maintenance on that chain before re wax - wrap in cloth and flush rinse and dry when you get spare tinker time, no rush to try to have to do before next ride as you had another chain ready to go on bike.

A good example - ZFC sponsors a number of local race teams, and hence quite a number of high mileage avid racers. Those who run 2 chains on rotation - one for mon to fri, one for weekend - to date not one has worn their 2 training chains to 0.5% and needed to replace before they have bought a new bike and started over (avid racers tend to buy new bike every approx 2 yrs / 20,000 to 30,000km). So, no drivetrain component replacement cost. Previous to waxing with msw / hot melt and two chain on rotation system, they would have worn through at least 4 chains and 2 to 4 cassettes in this same period. And with 2 chains on rotation + immersive waxing system - they often have NEVER needed / bothered with ANY chain cleaning maintenance, they simply re waxed, and changed to fresh wax every approx 10,000km. It has never been easier for them to be day in, day out very low friction, very low wear, lowest possible chain & drivetrain maintenance, and by far lowest cost to run.

Hence the myth that immersive waxing is some big faffy hassle vs drip lubricants is precisely that. It is an incorrect myth, perpetuated by those who a) either don't understand waxing at all, or b) have something to sell you such as the drip lubricant they stock, as well as they would like to as frequently as possible sell you new drivetrain components. Beware (in my opinion...) the LBS / mechanic that tells you waxing is crap and Muc-Off or Finish line are the best way to go. ZFC recommendations are based on the worlds most exhaustive and robust independent testing. What are their recommendations based on?

Don't forget to check out this video if you haven't seen just how easy immersive waxing is (and please try to wipe from memory any other terrible videos on waxing you may have seen on you tube. (episode 17 - immersive waxing - concise version) And if you have questions re DIY waxing, pls refer to that Q&A in the Waxing FAQ guide).

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



My chain post mud ride



Boiling water flush rinse 1





A lot of abrasive contamination no longer running in chain, or being brought into wax pot



Post 3 x boiling baths, dry and re-wax. Beautiful silky smooth super low friction, super low wear, no solvents

Immersive wax drivetrain with a proven top wax + used with an immersive wax compatible Drip lubricant

What makes a lubricant compatible with immersive waxing? The base wax needs to be similar highly refined paraffin (low oil content). Top lubricants recommended are Silca SS Drip, Ceramic Speed UFO drip, and Tru-Tension Tungsten all weather. Using such lubricants require no cleaning at all prior to rewaxing.

As such they are also brilliant waxers for use whilst on cycling holiday, stage races, bike packing etc

Other wax lubricants are broadly compatible - Ie Squirt, Smoove, Grax & similar. It is believed they are more of a slack wax base (higher oil content) - and so they work better in conjunction with immersive waxing if that drip lube treatment is run until starting to feel / sound a bit dry = there is not much of that wax type left. New outstanding wax drip lubricants known at the moment such as Effetto Mariposa Flower Power Wax which is Sunflower seed based, and Session components S-Wax which is Carnuaba wax based - compatibility with paraffin based immersive wax's are currently being tested and this document will be updated.

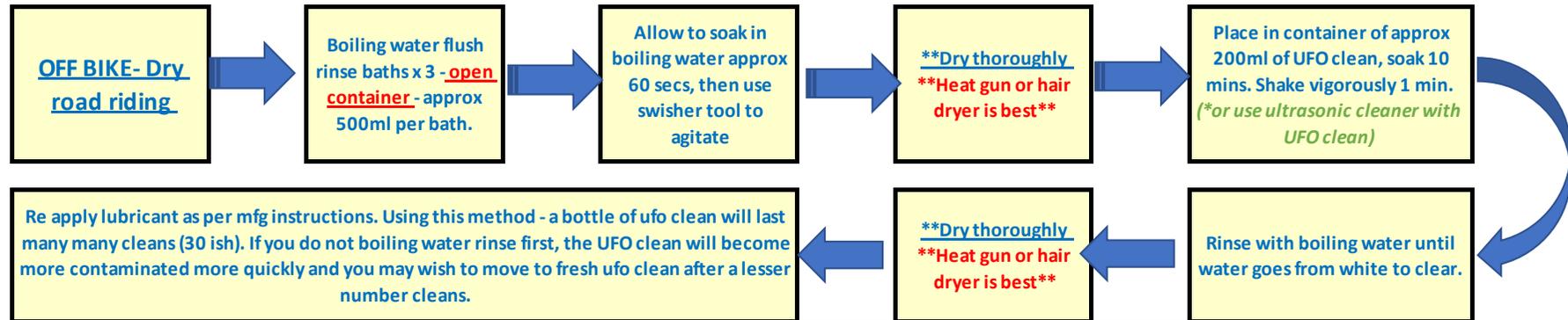
Factoring in that information - if using the known fully compatible was lubricants - **refer to section above re maintenance, as it is exactly the same.**

If you are using a different wax lubricant, note that boiling water will likely have no beneficial impact. Recommend use of UFO clean as per

section above, skipping the boiling water rinses prior. UFO clean is one of the very few solvents that works on waxes.

Wax Drip Lubricant - type using Highly refined Paraffin base blend

** Silca SS Drip / Ceramic Speed UFO drip / Tru Tension Tungsten All Weather or Race / Absolute Black Graphen lube



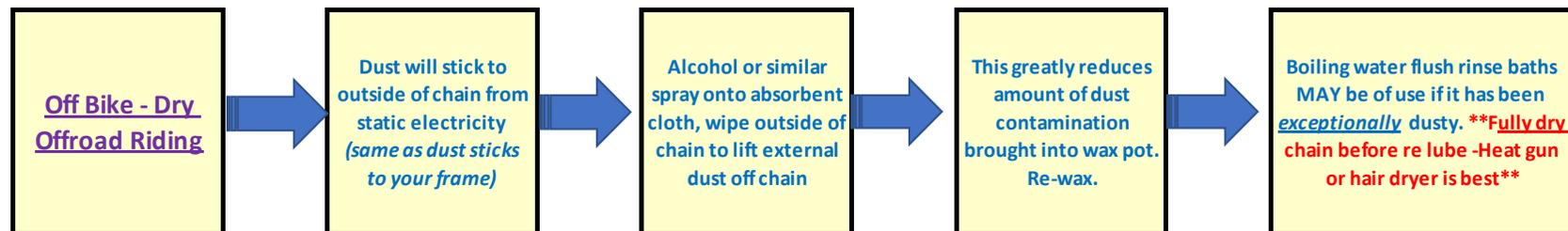
How Often? Typically the highly refined paraffin base wax drip lubricants such as UFO drip, Silca SS Drip, Tru Tension Tungsten all weather- require very infrequent maintenance as they have extremely high contamination resistance. As a general guide - every approximately 2000km is good for such lubricants.

**If you do not have UFO clean - then try what reasonably priced solvent is accessible in your country state. Allow 10 mins soak then agitate, repeat baths as needed.*

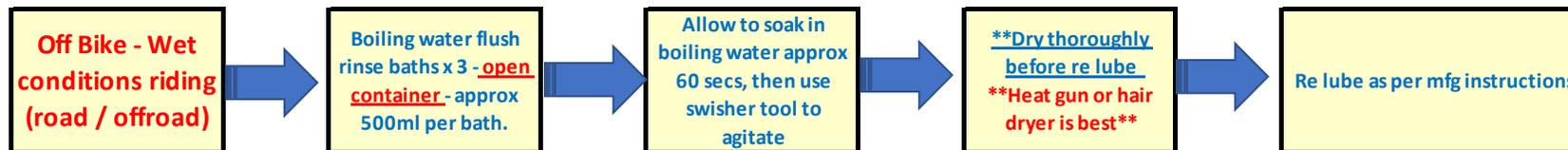
Note that a number of solvents & degreasers can be quite ineffective on waxes, and something that specifically states it works on waxes will be preferable

**Also Effetto Mariposa Alpine cleaner can be used same as UFO clean if that is easier to access and is made for cleaning wax and is very enviro friendly.*

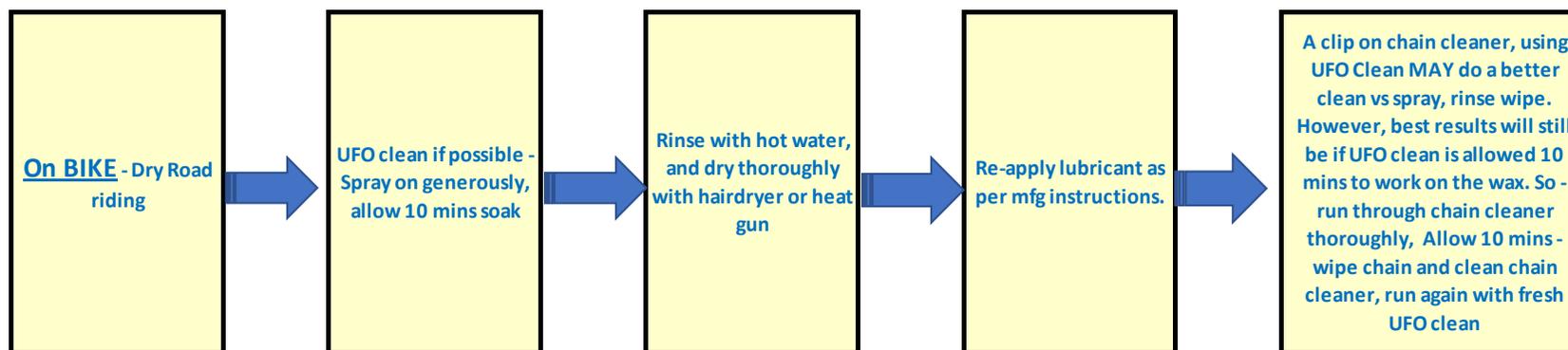
Same method above applies as "perfect reset" - if it is your dedicated race chain, simply use fresh clean UFO clean.



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How Often? As per above - ZFC recommends chain clean post ANY decent wet ride. Don't stress about a short light spray, but if it can be classed as a wet ride... If you do not remove the contamination - it will cause wear. If you ride a lot in the wet, balance frequent maintenance cost and time practicalities with how much maintenance you do, and how much product you use. The more expensive the groupset, the more one should err on maintenance.



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How clean is clean? There is a huge variance in how dirty your chain main be depending on lubricant used, how old, conditions ride in etc. It is possible that even generous application may not remove all contamination. Balance age of chain & cost of chain with how much product cost you want to put through to attempt to properly clean. Note that typically the very refined parafin base lubricants are highly contamination resistant, and unless riding conditions are very harsh - typically need only very periodic maintenance (circa 2000km dry road, 500km to 1000km dry offroad). ZFC recommends to ALWAYS reset chains post decent wet rides due to the amount of contamination water transports deep inside chain where it is pressed into set lubricant. From there it is basically land locked and not going anywhere unless you remove it. Just adding more lubricant helps - it improves ratio of lubrication to contamination, but you will still have a good amount of abrasive contamination directly abrading on wear surfaces at high pressure loads.

**On BIKE - Dry
Offroad riding**

As above - however key tip for offroad riding - dust will stick to surface of chain from static electricity generated by chain whizzing through the air (same as dust sticks to your frame and wheels). Spray some alcohol (methylated spirits / denatured alcohol / isopropyl alcohol) onto a microfiber cloth and wipe chain before re-lube to lift surface dust from chain. This greatly reduces the amount of surface dust dragged inside the chain with your lubricant -which is bad - inside the chain is where the wear damage will occur.

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**On BIKE - Wet
conditions riding -
road / offroad**

As above - however as per key findings from lubricant testing - unfortunately water is the great transport system. It runs right through your chain, bringing in with it whatever contamination is part of the water (typically your chains is hosed with dirty road water by front tyre, offroad - obviously its worse). The contamination will be pressed into the lubricant, and the lubricant will become much more abrasive. Just re lubing (usually 3 to 5ml of lubricant) will = around 0.03 to 0.05ml of fresh lubricant per link going on top of old now contaminated and abrasive lubricant. Generally there is a very low amount of flush cleaning. If you do not remove the contamination the wet ride has brought in - you will pay for this in friction and wear even if your next rides are in the sunshine until you do perform maintenance to flush clean .

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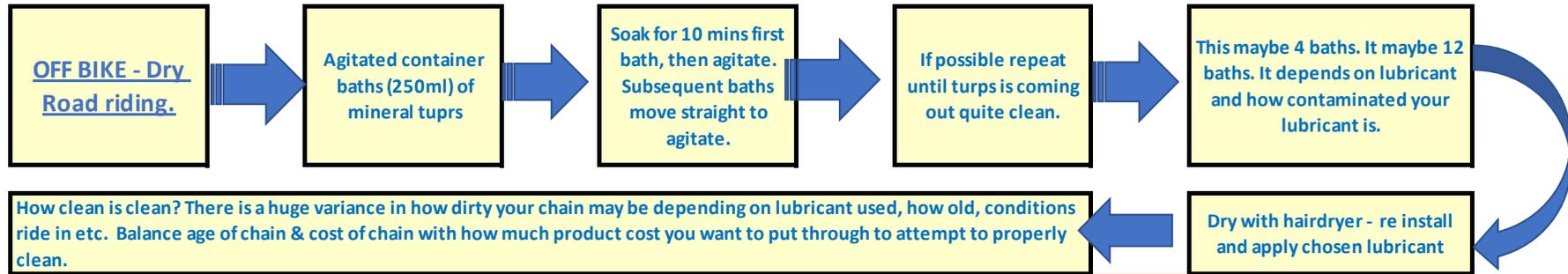
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Other wax type chains (Squirt / Smoove / Flower Power etc + many others)

Solvent Clean (wax solvent or try mineral turps / white spirits)

Typically boiling water rinses to melt off bulk of contaminated wax / wax lubricant is only effective on refined paraffin base waxes. Other wax types - this step may not do

anything effective, so this step is being skipped in the recommended process below. The default recommended cleaning agent for ON BIKE maintenance is UFO Clean, however if not suitably attainable, then move to a reasonably priced, reasonable powerful solvent that is accessible in your state / country. Mineral turpentine or its named equivalent in your location has proven to work well on squirt & similar however not all wax types may respond same - try and see. IF a lot of black product comes off easily until solvent goes clear on subsequent baths, it is working.

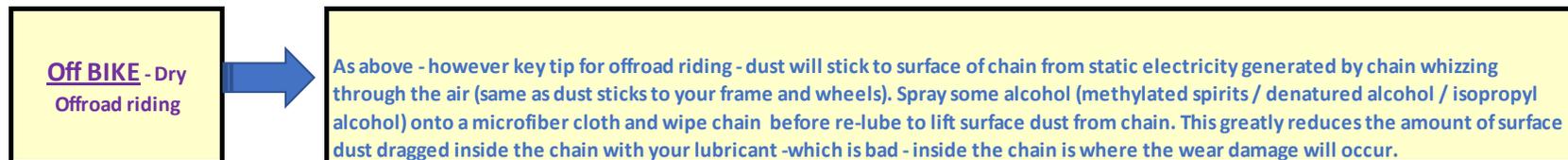


How Often? Typically wax lubricants have high contamination resistance and require less maintenance intervals - for top tested lubricants by ZFC (ie top 10) then approx every 2000km. If they tested middle of road or worse.... Then more often...

*Default for offbike is mineral turpentine vs UFO clean simply due to cost. It is likely an initial bath of UFO clean may be heavily contaminated, and then subsequent bath/s needed - which is just very expensive. Turps is \$5 per litre in Aus vs \$50 per litre for UFO clean - so you can smash through a lot of baths if needed until turps is coming out basically as clear as it went in. Final X number of baths that are not that heavily contaminated can be stored to initial Initial baths next maintenance round. Properly dispose of contaminated solvent.

** Note some wax lubricants have tested with significant initial penetration issues, which can cause high initial wear post proper clean. If bike + lubricant is stored in a cool area (ie shed / veranda - winter time) - a cold chain and cold wax lubricant can lead to very poor penetration deep into chain. It can be of benefit to have chain and lubricant at at least around 20deg c for application - especially post deep clean.

Perfect Reset - as above, just keep going until mineral turps is coming out basically as clean as it went in, then moving to 2 x Methylated spirits or alcohol baths to ensure no film left behind from cleaning for a more perfect bond of wax lubricant to chain metal surface. Ultrasonic may be used, but most effective is if for final 2 or 3 baths. Refer to ultrasonic guide - instructions tab. Some wax lubricants also greatly benefit from immersive re application post deep clean

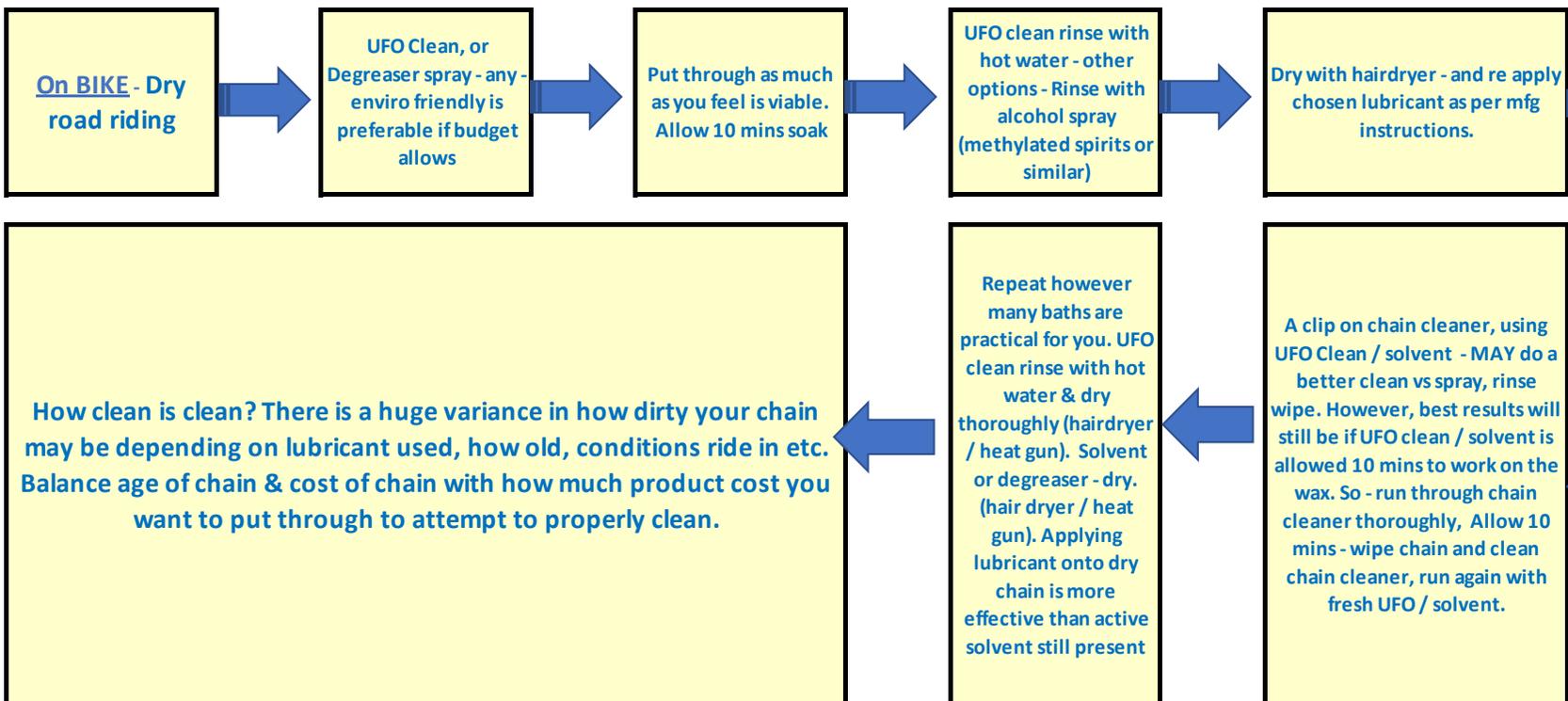


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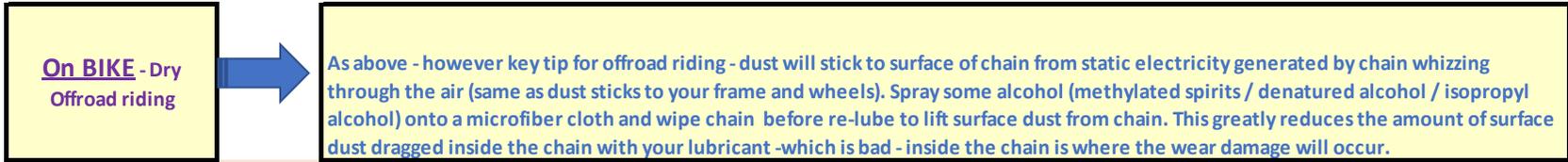
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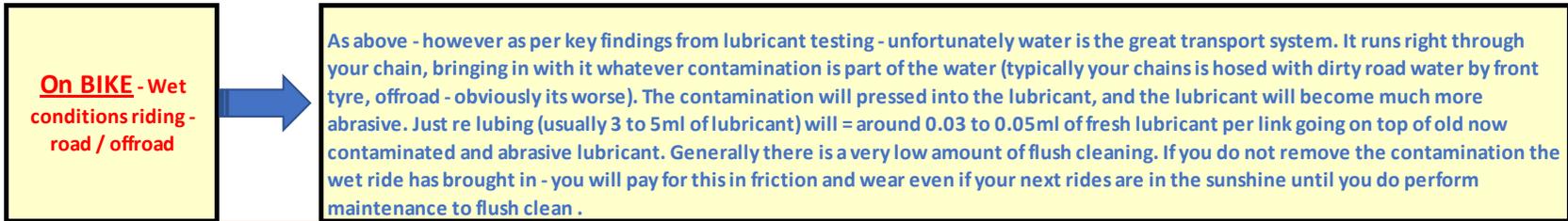


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Wet lubricants - all. Solvent Clean (mineral turps or similar)



How clean is clean? There is a huge variance in how dirty your chain may be depending on lubricant used, how old, conditions ride in etc. It is possible that 2 rounds may not remove all contamination. Balance age of chain & cost of chain with how much product cost you want to put through to attempt to properly clean. This is more important if switching to waxing. If a drip lube is less effective - thats one thing. Contaminating your pot of wax can be a much larger problem.

**Some wet lubricants really do not need an alcohol rinse post solvent clean, whilst some wet lubricants may benefit as they have additives they wish to bond to chain metal - ie tungsten disulphide platelets. If unsure and want to ensure best clean, then finish with an alcohol rinse.

How Often? There is HUGE performance difference between top tested wet lubricants and medium to worst performance. Lower performing gather contamination rapidly, and quickly become abrasive. Top tested remain very low friction for a very long time. Every approx 2000 km to top tested lubricants, more frequent for lesser performing lubricants

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Off BIKE - Dry
Offroad riding

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How Often? - Note!! Overall ZFC does not recommend using wet lubricants for offroad cycling. Every particle of dust sticks to wet lubricants. The only exceptions at this time recommended are Rex Black Diamond and Silca Synergetic, but note even those have wear rates if dry contamination test block many times higher than top tested wax lubricants. There is HUGE performance difference between top tested wet lubricants and medium to worst performance. Lower performing gather contamination rapidly, and quickly become abrasive. Top tested remain very low friction for a very long time. Every approx 1000 km to top tested lubricants, more frequent for lesser performing lubricants

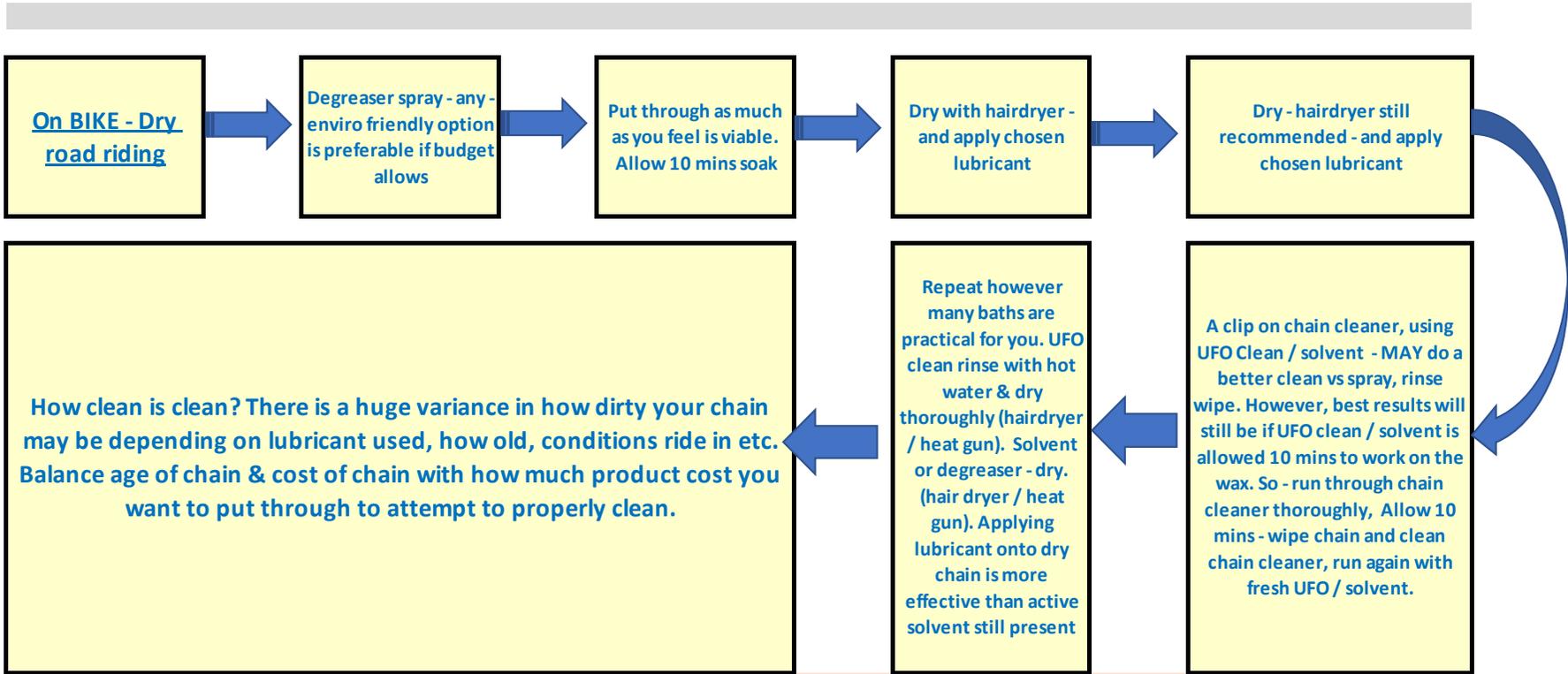
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*Note that I have not bothered to recommend final rinse with methylated spirits as general maintenance for wet lubricants. Typically there is not a bonding issue for wet lubricant post solvent clean. It is best to ensure dry deep inside chain (heat helps with this a lot), otherwise remaining solvent may act against fresh lubricant. Wet lubricant types vary ENORMOUSLY (some have carriers designed to evaporate, some have a mineral oil carrier, some have fancy high tech other type carriers) - and so any potential negative impact of applying over chain still wet with solvent / degreaser or similar may vary.

Perfect Reset - as above, just keep going until mineral turps is coming out basically as clean as it went in, then moving to 2 x Methylated spirits or alcohol baths to ensure no film left behind from cleaning for a more perfect bond of lubricant to chain metal surface. Many top wet lubricants have fancy stuff that works best if bonds to surface, and not fighting through a film left behind from degreaser etc really helps. Ultrasonic may be used, but is most effective if used for final 2 or 3 baths. Refer to ultrasonic guide - instructions tab



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Offroad riding

As above - however key tip for offroad riding - dust will stick to surface of chain from static electricity generated by chain whizzing through the air (same as dust sticks to your frame and wheels). Spray some alcohol (methylated spirits / denatured alcohol / isopropyl alcohol) onto a microfiber cloth and wipe chain before re-lube to lift surface dust from chain. This greatly reduces the amount of surface dust dragged inside the chain with your lubricant - which is bad - inside the chain is where the wear damage will occur.

How Often? - Note!! Overall ZFC does not recommend using wet lubricants for offroad cycling. Every particle of dust sticks to wet lubricants. The only exceptions at this time recommended are Rex Black Diamond and Silca Synergetic, but note even those have wear rates if dry contamination test block many times higher than top tested wax lubricants. There is HUGE performance difference between top tested wet lubricants and medium to worst performance. Especially so offroad, the lower performing wet lubricants become a veritably grinding paste in short order - refer lubricant test page for rather convincing test data. Lower performing gather contamination rapidly, and quickly become abrasive. Top tested remain very low friction for a very long time. **Every approx 1000 km to top tested lubricants, more frequent for lesser performing lubricants**

Off BIKE - Wet
conditions riding -
road / offroad

As above - however as per key findings from lubricant testing - unfortunately water is the great transport system. It runs right through your chain, bringing in with it whatever contamination is part of the water (typically your chains is hosed with dirty road water by front tyre, offroad - obviously its worse). The contamination will be pressed into the lubricant, and the lubricant will become much more abrasive. Just re lubing (usually 3 to 5ml of lubricant) will = around 0.03 to 0.05ml of fresh lubricant per link going on top of old now contaminated and abrasive lubricant. Generally there is a very low amount of flush cleaning. If you do not remove the contamination the wet ride has brought in - you will pay for this in friction and wear even if your next rides are in the sunshine until you do perform maintenance to flush clean .

How Often? As per above - ZFC recommends chain clean post ANY decent wet ride. Don't stress about a short light spray, but if it can be classed as a wet ride.... If you do not remove the contamination - it will cause wear. If you ride a lot in the wet, balance frequent maintenance cost and time practicalities with how much maintenance you do, and how much product you use. The more expensive the groupset, the more one should err on maintenance. And again remember there is a very large performance gap between the top tested wet lubricants vs medium to poor. Ensure you are on proven top lubricant choice to save lots of wear and \$\$

*Note that I have not bothered to recommend final rinse with methylated spirits as general maintenance for wet lubricants. Typically there is not a bonding issue for wet lubricant post solvent clean. It is best to ensure dry deep inside chain (heat helps with this a lot), otherwise remaining solvent may act against fresh lubricant. Wet lubricant types vary ENORMOUSLY (some have carriers designed to evaporate, some have a mineral oil carrier, some have fancy high tech other type carriers) - and so any potential negative impact of applying over chain still wet with solvent / degreaser or similar may vary.

