Zero Friction Cycling

# Race chain and Ultrasonic Cleaning Quick Guide



The fun low friction world of fully optimised race chains, re optimising, ultrasonic cleaning – there is a bit to try to cover, here is my current attempt at a run through guide that is not as clunky as the last one. Hopefully this is more concise and in a more user friendly order to cover all you should know.

## Ultrasonic Cleaning

This is something that is coming up very frequently – here we go;

- Not necessary unless preparing race chains / re optimising race chains and going for every possible watt saving.
- Very handy for if have broken in chain (ridden 50 to 100km to break in with factory grease). A chain with a good break in in clean conditions will be a faster chain than a chain straight out of the box cleaned and waxed. However, the break in will bring in contamination. Agitated container baths will not perfectly clean from all tiny fissures, nooks and crannies. If looking to prep a fully optimised race chain by doing a break in with factory grease, an ultrasonic is a must or the break in will be negated by contamination imported that you cannot perfectly clean out via agitated container baths.
- Following on from above point, the ultrasonic cleaning rounds should be used for the FINAL cleaning rounds. Use agitated container method first to do the heavy lifting. If use ultrasonic from the start – solvent will go black from contamination in seconds. Not much good happens after that. You can't get a good clean if what is doing the cleaning is dirty. So rip through agitated container baths until mineral turps is coming out similarly clear as to what went in, then move to Ultrasonic clean rounds to finish off. Normally 2 x ultrasonic rounds is sufficient if container rounds done well. When satisfied chain is perfectly cleaned, dry (hairdryer / heat gun / air compresser) then finish with ultrasonic methylated spirits to ensure no film left prior to waxing. MUST ALWAYS FINISH with methylated spirits.
- There is still some benefit to ultrasonic cleaning a brand new chain even if not doing an initial chain break in. After initial 2 x overnight / long soaks in mineral turps to dissolve stubborn factory grease, finish with final round in ultrasonic – this will help dislodge fine metal particles left inside chain from manufacture – you will often see these at bottom of ultrasonic after cleaning.
- ***If you have broken chain in with 50 to 100km of riding you do not need to overnight soak. Factory grease is very stubborn unless oxidised by riding. Once oxidised it dissolves readily so you can just rip through agitated container baths. If cleaning brand new not ridden chain, 2 x overnight soaks is best to dissolve stubborn factory grease.*

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- Ultrasonic Cleaning Wax chains – need an "Aqueous" or water based cleaner. Wax does not respond readily to solvents, so you need an aqueous cleaner that will take full advantage of an ultrasonics scrubbing effect. Ultrasonics work by billions of imploding bubbles doing the scrubbing which is far more effective with an aqueous solution for substances that do not respond readily to solvents. Washing detergent & water mix is fine - I use a specific ultrasonic cleaner by Mykal from RS Components. Aqueous cleaners need to be "degassed" so run for 7 to 10 mins with nothing inside until insert chain. When you pour in water and detergent the solution will be highly aerated. Lots of gas in solution = no imploding bubbles as the gas fills the bubbles. No imploding bubbles = no scrubbing. Hence the need to "De-Gas" aqueous cleaning solutions prior to popping chain.
- Wax chains - Need temperature – you need to be cleaning above the waxes melting temp of 60 dg c, but preferably below 70dg c as above that the US cleaning efficiency can be reduced. A temp control US can greatly assist.

- **As always, get the heavy lifting done first prior to US cleaning.** Give chain 2 to 3 boiling water rinses in an **OPEN container** using same swisher tool you use for waxing to melt bulk of old wax off, then move to degassed ultrasonic solution for final round or two. **NEVER** agitate boiling water in a closed container – agitation releases steam, steam pressure will blow lid off container – face will be sprayed with scalding steam and water – not cool.
- After Ultrasonic solution cleans rinse chain with boiling water / ultrasonic with boiling water at least 2 times post final US solution clean.
- Dry chain with hair dryer / heat gun / aircompressor – finish with at least one ultrasonic methylated spirits rinse.
- Dry chain again, wax.
- It is much quicker and easier to use some boiling water to bring US solution up to temp vs waiting half a day for US heater to do it. Pour in ¾ boiling water, ¼ cold water, add detergent / cleaning solution , degass, clean.
- If you do not have a temp control Ultrasonic cleaner, using a candy thermometer / cooking thermometer to get ratio of boiling water and cold water to be in right temp range of 60 to 70dg c.

Note that especially once waxing, you will always be on a very low friction chain and so the above time and effort is really only worth it for race chains / race re-optimisation where every watt counts.

If just training chains, you will not see the payback for the time and effort to ultrasonic clean in any trackable difference re chain longevity that would offset cost of equipment, time and electricity to conduct the above. Simply container baths is fine for training chains moving from factory grease / drip lube to waxing, or a boiling water rinse or two post really wet / muddy rides for wax chains to lessen contamination imported into wax pot. Other than that, once switched to waxing, just pop chain off and re wax and its happy happy days with no drive train cleaning required and unprecedented parts longevity and cleanliness.

If you are going through the effort of Ultrasonic cleaning to prepare race chain / re-optimise race chain, then it is highly recommended to have a dedicated race chain and a dedicated race wax pot. Even with the best maintenance, the chain you hammer away at in training will simply not remain ultra low friction as the thousands of km's clock up from training. Even running the best chain on the best known lubricant and with full re optimisations you can expect the chain will lose a watt of efficiency after a couple of thousand kms, another watt a couple thousand km's further on etc. The first to go is a chains low friction coating which is why world tour teams typically replace their chains every 500 to 1000km.

If you are racing, you are training. Sooner or later, even on YBN and MSW, you will need another chain. It costs not more in the long run to simply pre by next chain to be your dedicated race chain, and pre bought next bag of wax. Your only extra cost is one more cheap $30 slow cooker that's it, and you have simply super smart system in place with dedicated race chain and race pot. When training chain hits 0.5 wear, or race chain has done 1500 to 2000km, then race chain is moved over to be next training chain, get new chain to be dedicated race chain. When training wax pot has done 20 to 30 re waxes at approx. 300km per wax, move training wax on, race pot wax becomes training pot wax, fresh wax goes into race pot. Depending on what zen master level you aim for, your race

chain is either just not being hammered like training chain so it and race pot remain in great condition, or its being given some level of attention between races ranging from simple boiling water flushes or fully ultrasonic cleaning – the latter options keep race pot wax almost perfectly clean.

## Race Powdering

MSW race powder is the lowest friction race powder I know of. It is the moly stops PTFE clumping together and so it remains ultra fine and penetrates better. Race powder also lowers friction by around another 0.5w, and it also extends the lifespan of a re wax treatment keeping the ultra low friction window going longer - especially if re powder between each race if the km's clocked up in an event were not sufficient to warrant re waxing / re-optimising chain. MSW race powder also takes up space in the chain that airborne dust would otherwise love to take up.

If not cleaning or re-optimising before re waxing, you can re wax a powdered chain no problems as is, the powder does not contaminate the wax, it is the same stuff that is in Molten Speed Wax as the friction modifiers.

How to powder your wax race chain;

- You cannot powder a freshly waxed chain. Well, you can, but it can't penetrate as the chain is blocked solid with wax. You need to break a re wax treatment in with 30 to 40 mins of riding. Excess wax will have been pressed out of chain, and wax surface polished.

- Powder by using a fine paint brush (or my favourite, a make up brush). Get a small aluminium tray bent into a u-shape, put in a bit of powder, and use tray to catch excess powder which you can pour back into tub. Doing this a tub of race powder lasts a very long time. Powder top and bottom spans of chain, then rotate chain to powder next section.

- If powdering a disc brake bike, either powder chain off bike – put in a long channel of bent cardboard or paper – powder one side and flip to do other. Or better is to use a chain keeper so you can remove rear wheel and powder on bike. Fine powder dust may get on disc if powder with disc wheel in place. I have never had powdering chain affect rim brake wheel yet, and I have done a lot – but I have heard of powdering disc wheels that even a small amount of powder finding its way to disc may contaminate disc and pads.

- Wear gloves and preferably dust mask. Powder contains moly and ptfe.

**Quick Race chain Facts**

- A clean chain is fast chain. A clean chain on the fastest lubricant known is a really fast chain. A chain that has been broken in, perfectly ultrasonically cleaned, waxed with clean msw, wax broken in and race powdered – this is as fast a chain as chain as current knowledge knows how to make. Tested every which way from Sunday by multiple independent bodies – Wax and powder race chains are the dominating chain of choice at highest levels when going for the win.

- Many manufacturers have jumped on the race chain bandwagon these days. Some have genuinely worked to bring a great product to market, some are just there to make a quick buck off the back of powerful marketing, some – who knows at the moment.

  What I can tell you without a doubt is that when it comes to making the fastest chains, as with most things the devil is in the detail. A number of brands race chains may be being done in a mass production process. It is worth pondering;
  - How long was the break in? (I have heard some may be as low as 15mins)
  - How many rounds of Ultrasonic cleaning were done post break in?
  - How many chains were put into the same cleaning solution?
  - How many chains saw the same batch of wax / lube?
  - How long was the post wax break in?
  - How was the powdering done and with what powder?

Race chains prepared by Molten Speed Wax in America have no shortcuts on any step. To get the fastest chain possible, the highest level of prep at every step is completed. Full break in, multiple cleaning rounds in fresh solution per chain, fresh wax, full wax run in, and meticulously powdered with the fastest race powder known at this time. If I believed there was a higher performing race chain, I would stock that.

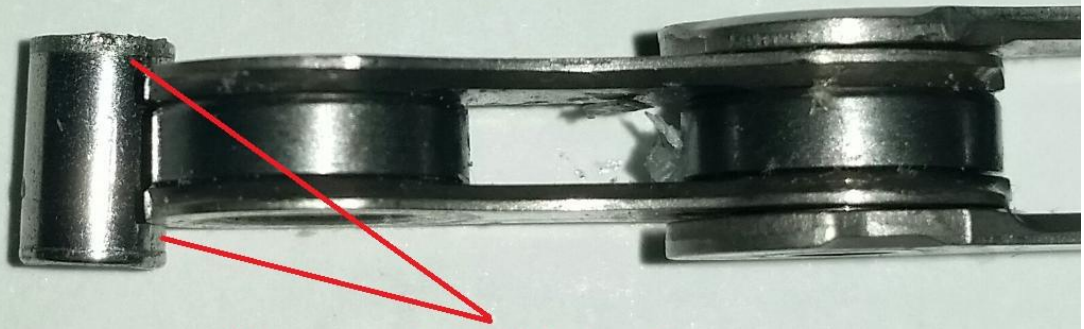
- A fully optimised race chain is not an expensive one off purchase. With the information above regarding re-optimising, you can easily re-optimise your race chain multiple times and expect 1500 to 2000km of ultra low friction race km's, by which time it is probably around when you would be looking to move training chain on, move race chain over to be new training chain, buy / prepare new dedicated race chain. It is a very very smart way of saving a lot of watts on race day vs racing on same chain that gets pummelled in training.

## Non Wax Race chains

If preparing a non MSW race chain then the cleaning prep above remains the same, just take note of lubricant application on a perfectly clean chain. Do NOT underestimate the difficulty some of the best drip lubricants have in penetration to pin. A number of the best drip lubricants are a wax emulsion lubricant which are quite viscous and I have exhaustively tested 6 ways from Sunday and they all have notable penetration difficulties to get through to the pin. You will not feel it, but the initial wears of pin during test have been conclusive, much more attention needs to be paid when applying some lubricants to ensure penetration to the pin. There is no access for the lubricant to disseminate across pin from between inner and outer plate shoulders, the only access is via a tiny gap between inner plate shoulders underneath roller.

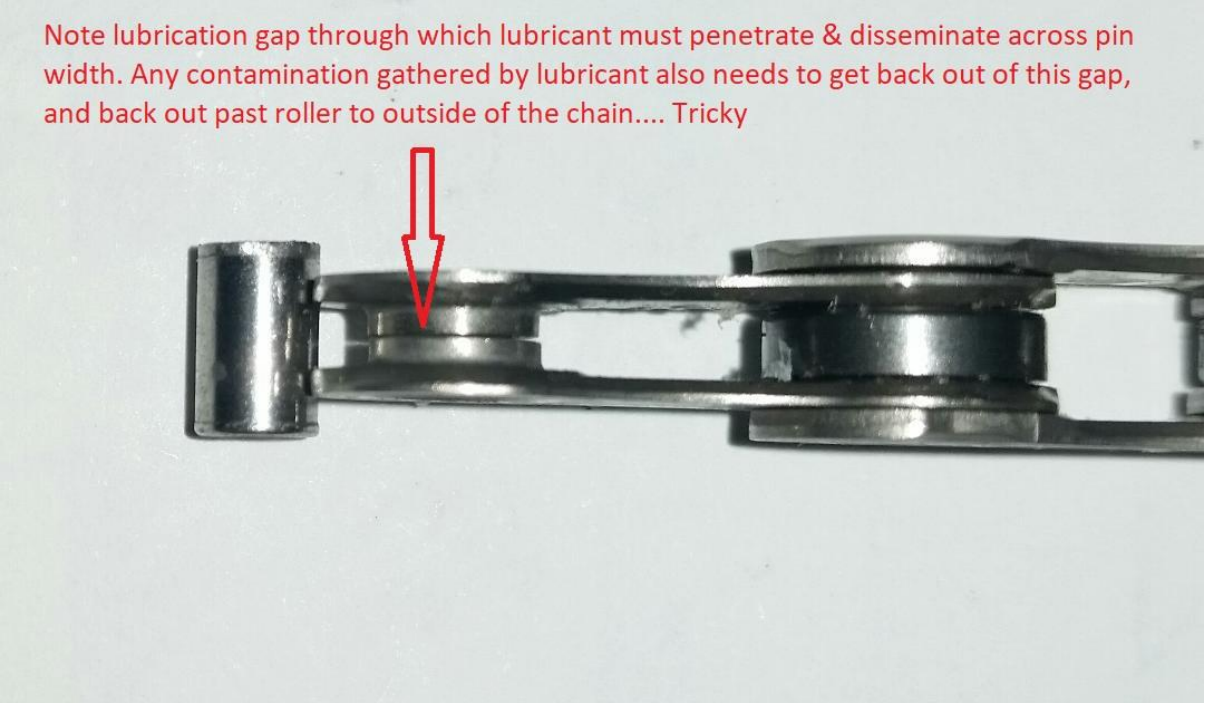
Manufacturer instructions are not sufficient – marketing department would have a fit if developer was to put full proper instructions on as may risk scaring customers away to a bottle of lube that has easy instructions on it – so I can only recommend if using Smoove (or squirt) or UFO D – please refer to advanced application guides for these products in my instructions tab on website. Skimping on application will ruin all the time you spent cleaning and prepping the chain.

Pin is riveted to outer plates & does not move. Inner plate articulates around pin. When roller contacts teeth roller stops, and so inner plate also articulates inside roller.



Note amount of pin width that requires lubrication - inner plate shoulders articulate around this area under full rider load.

Note chamfer on outer plate. This prevents lubrication from also being able to access pin via gap between inner & outer plates, leaving the small gap underneath roller as the only lubrication gap access to pin.




**Summary**

- A clean fast chain is where it is at for the easiest and most cost effective drive train watts savings. The chain works orders of magnitude harder than your bearings, and it is operating completely exposed. You can expect to save up to double the watts vs bearing upgrades and at a fraction of the cost. Not only that, the friction you are saving that is now propelling you forwards faster with every pedal stroke was previously being used to wear out your drive train faster. It is a win win that has always been a siren song to me. Irresistible.

- A chain that has had a proper break in (50 to 100km clean conditions – preferably ergo indoors) will be a faster chain vs a new chain not broken in.

- It is not worth breaking in chain to be a race chain if you do not have an ultrasonic cleaner as contamination is inevitable and you will not get perfectly clean, negating the benefits of break in.

- It is in my view not worth having an ultrasonic cleaner unless you are prepping / re optimising race chains. Just rip through full flush solvent cleans in agitated container. (NEVER agitate a wax chain in boiling water in a closed container – agitation releases steam, lid will explode off and spray your face with scalding steam and water – swish in open container with swisher tool)

- Do heavy lifting of cleaning in agitated container baths before moving to Ultrasonic Cleaning rounds.

- Solvents do not need to be degassed but aqueous cleaners required for cleaning wax chains do need to be degassed for 7 to 10 mins prior to inserting chain.

- The best ultrasonic cleaner I know of for wax chains is Mykal Ultrasonic cleaner from RS Components

- US cleaning wax chains is by far most effective if temp is above 60dg (melting point of paraffin) and below 70dg after degassing. A temp control US cleaner helps greatly, but use of kettle and mix of boiling and cold water can do the job in conjunction with a cooking / candy thermometer.

- Like all things there is a right tool for the job. A jewellery cleaner is likely not powerful enough. I have had customers using auto parts cleaner at work that have pitted chain metal – this would stripped low friction coatings and plating's off chain – too strong. Somewhere between around 70 to 120w max cleaning power is about the right cleaning power for bicycle chains. Note this is not total power consumption – a US cleaner may use 100w but only 35w of that is cleaning power – check the specs.

- Best place to find a range of suitable US cleaners that match the above appears to be amazon australia. I have seen some applicable ones at Super cheap auto but going off reviews they tend to fail a lot. My US cleaners cost a bomb but have been hammering away having prepped thousands of chains now – like all things you get what you pay for. If just doing your own chains, you don't need an industrial quality US. But you don't want a cheap heap of junk that will fail after a few uses or set your house on fire either. Pick an applicable price point and if possible check that unit for user reviews prior to purchase.

That will do! This document was typed in a hurry so there is probably a good amount of typo's plus shocking grammar, but I had to get something up due to the number of queries. Under the pump so this is it for now, will review and refine when I get a spare moment!

## Own All Your Watts!!!