

Do I Regalvanise or not and what pitfalls could there be?

Below is a discussion and comments made in response to this question by an offshore cruising yacht as to whether they should regalvanise their HT* anchor chain.

- * It was not clear if the HT they mentioned was a High Test or a High Tensile. So the replies cover most grades.
- The discussion was specifically around a US made chain but the same applies to all chains.

From Grant of Chains Ropes and Anchors.

Chains Ropes and Anchors is a NZ supplier of premium anchoring systems and gear.

I don't know the real technical details of why but the high temps do play havoc. High tensile chains can suffer something called Hydrogen embrittlement. Again I'm not too clued up on how it happens just know that it does and is potentially a big issue.

Basically it all comes down to how long the chain sits in the assorted baths as it goes thru the process. Over cooking it does decrease strength, as does multiple cookings. Not to mention the other assorted liquids it gets dipped into on the way thru.

Higher the tensile the bigger the issues become. That is why 'cunning plans' like getting a G7 transport chain and galvanising it is not so cunning after all. That is a particular issue we see a growing amount. There are only a couple of places that do make a dedicated G7 galvanised chain worldwide. I've spoken with our people about why we have supply issues with this and they tell me it is due to the galvanising. They ship theirs off to a place, which specializes in this sort of galvanising even though they have their own galvanising plant. These guys have been making chains for over 8 generations of the same family so if it was easily do-able I'm sure they would be doing it themselves.

Many like the idea of G7 chains, god knows why really as generally that means they go down a size or 2 and end up with a tiny chain that hates shock loads. Seems to go against many things like keeping away from shock load issues, weight on the floor when anchored, keeping the cruising kitty up rather than down and more.

Basically I'm advised by my galvaniser (been in the game since Adam was a school boy sort of thing), our chain people and 2 industry associations here that use chains of many grades in specialised situations that regalvanising does have some potentially serious downside regarding strength loss. Having tested many bits I can say I have seen some loses and big ones at that especially the cunning plan ones.

We tell people that regalvanising is OK for the lower grade chains G3 and G4, two or three times if the guys doing it know their stuff. On grades above that it is best not to go there unless you are very very sure the galvaniser knows what grade the chain is and how to deal with it even then I'd test after just to make sure.

How do you know what a galvaniser is like? The \$64 mil question. I'd ask questions and see if the answers inspire confidence and hope like hell I suppose. If the galvanisers there are like ours, some of the guys out the back are at the lower end of the pay scale (it is a nasty job) and either don't know or give a damn, hopefully the 1st option.

So if you want to regalvanise a G3 or 4 and it was from new I'd say you are probably OK 99% of the time unless you hit a real shabby galvaniser. If you are regalvanising for the 2nd or more times I'd think about getting it proof loaded afterwards.

If you want to galvanise a G7 transport chain to get a G7 anchor chain, don't do it, it can't be done. At best you would probably end up at about a G5, at worse a steel reinforced bit of zinc. I would certainly recommend re-testing a G7 galvanised if you regalvanise it.

There are places that can test your chain. Not that tricky really. Obviously a worse case situation would

be you pay to regalanise then test and find it breaks below specification. Then again it's better it happens on a test bed than a lee shore at 3am.

I'm probably making it sound a bit worse than it is but as an anchor chain keeps you alive when you're asleep understating is not a good idea. Sort of thinking worse case scenario thing.

I've had people argue against all of this but I've seen big strength loses on newly regalanised chains with my own eyes on more than one occasion and believe the people who should actually know. We've also had the odd "I've regalanised my chain 5 times now and it's perfectly fine". To that I'd say how the bloody hell would you know unless you've tested it. Also an anchor chain doesn't take that bigger load on 98% of boats so they will hopefully never find out how much loss anyway.

Another telling point is have you ever seen a truckie, a crane or other gear that lives outside and that uses chains in vengeance have galvanized chain? Nope, they are all painted or only have a light electro-zinc finish, never hot dipp galvanized.

One day I will find a moment and get deeper into the technicals of it.

Needless to say, a good galvaniser doing a good job should be no problem at all. Also Acco are top end manufacturers so you're starting from a real good spot from the get go.

Hope that helps rather than spooks.

Some expansion on the subject by Gary of 1st Chain Supply.

1st Chain Supply is a supplier of top quality gear based in Chicago, USA

With all due respect to Grant, whose expertise in all things marine I hold in highest regard, I need to make a couple of minor adjustments and clarifications to his advice. *(editors note – I do need an eye kept on me at times and thanks for the suck-up Gary ☺)*

First 'hydrogen embrittlement' that is the thief in the night for any HEAT-TREATED metal that has been galvanized. You can Google "hydrogen embrittlement" for any number of essays explaining the metallurgical reasons for it, but the end result is what matters - the metal becomes brittle and not in any consistent way. By that I mean that not necessarily will the whole chain length will become brittle - a single link of chain may be brittle (or three or four or...) and that single link (with no distinguishing characteristics) makes the whole length of chain unusable.

I emphasize "heat treated" because neither BBB (a G30) nor G4 High Test have been heat treated so there is no fear of hydrogen embrittlement for those grades. The cautions for hydrogen embrittlement goes for the two common kinds of galvanizing, electro zinc (the thin shiny coating normally found in most hardware stores) and hot dip galvanizing (the thick, gray coating that boaters are familiar with) since both methods of plating raise the temperature of the metal in order to bond. Heat treated metals that have been plated by either of those two methods have to be "baked" for several hours in order to remove any trace of hydrogen embrittlement. Baking for hours, of course, raises the cost of the product and it's not fool proof, so rarely, if ever, will a manufacturer even attempt applying zinc to a heat-treated chain using a hot method. Some manufacturers, including ACCO, will coat using a mechanical galvanizing method that applies the powdered zinc by "beating" it into the metal by tumbling it with plastic pellets. Although the manufacturer claims it's as good as hot dip galvanizing, the zinc is thinner than hot galvanizing so the jury is still out on that question. But it is better than the electro zinc plating method which applies about a two ten thousands thick coating which is more cosmetic than practical.

I have no experience with "re-galvanizing" so I cannot comment on whether it's good, bad or dangerous. Grant's well-researched explanation makes sense to me and his wealth of personal experience should be heeded. I trust it implicitly.

About "retesting" the chain after having it galvanized: I've have been asked of me a couple of times "Can I send you a foot or two to pull test?" and I have to answer no. First because I don't have the equipment to pull test but most importantly because "chain" is a series of connected links, not a few links that you can test by the piece. Just because the 20 to 30 links you sent me to test come out fine, doesn't mean the other 2,000 links are not weak either by link-touching-link wear or by scattered pockets of hydrogen embrittlement. The whole length of chain would need to be pulled to at least twice its working load to satisfy a safety test.

And a bit from Gary Lind

*The Quality Assurance Manager/ISO 9001 Management Rep. from Peerless Chain Co (ACCO's new owner).
Acco/Pearless is a US manufacturer of premium chains.*

We can re-galvanize chain. The chain may be stripped and cleaned prior to galvanizing, but will depend on the existing condition of the chain and number of times it has been galvanized. Re-galvanizing "used" chain without knowing the material type, number of prior galvanizing operations and service conditions the chain has been subjected to, can be an issue.

The overall chain performance can be affected based on the type of chain being run. Heat-treated alloy and high tensile strength chain will be affected and may require baking after pickling for hydrogen embrittlement relief. Accelerated age straining based on the material type can also affect performance.

Our typical internal allowance for galvanizing low carbon non-heat treated chain is no more than twice, with a requirement for bend and tensile testing after a re-galvanizing based on the noted possible performance issues. Flash pickling and shot blasting is also used for galvanizing alloy steels to minimize exposures to hydrogen.

As for the issue of loss in material, I'm assuming that the customer is speaking of base metal; it is negligible from the stripping and cleaning process. The chain is not exposed to acid for the length of time necessary to significantly reduce material diameter.

Hope this is helpful and clears up some unanswered questions,
Gary

Note: this does not mean that ACCO/Pearless will regalvanize YOUR chain.

So in Summary –

Yes you can re-galvanise lower grade chains once or twice as long as you have a good galvaniser. If you do it anymore than that, get the chain re-tested. Not just a section of it, the entire length.

When talking High Tensile chains, just don't go there. If talking dodgy galvanisers, don't go there.

Note for NZ viewers – Many galvanisers here now will look at your chain and if they decide it is not up to scratch they will decline to regalvanise the chain. While this may seem strange and a pian in the botty, please bare in mind they are doing it from a professional point of view for your safety.

Big thanks to Gary 1st Chain Supply and Gary Pearless/Acco for the great information, much appreciated by all I'm sure.