Anchor Chain Swivels

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Recently, there has been a good deal of interest in swivels placed between one's anchor and chain. Besides the obvious question of whether one is necessary or not, there are at least three issues worth careful consideration before purchasing a swivel. They are:

- Size and strength.
- Design characteristics.
- Construction material and mixed metals.

Why. There are at least three reasons to use a swivel. First, they make the attachment between the anchor and chain. Second, they minimize dangerous chain twist, especially in the chain locker. And third, they allow rotation of a large anchor hanging below the anchor roller tray in order to facilitate smooth retrieval over the roller. Both of these latter reasons assume that the swivel moves easily under load, a feature that is not true for most galvanized swivels. For those of us with a really big anchor, the roller issue is the major reason to use a swivel.

Modern scoop, plow and claw anchors do much better coming over a roller if the tip of their blade is pointed aft rather than forward. For anchors on the bow heavier than about 60 pounds, turning the anchor over is near impossible without a swivel. Leaving an anchor to turn itself over during retrieval is asking for trouble from the shock loading it puts on all the ground tackle.

Anchor swivel types (left to right): disassembled Mantus, Ultra ball and socket Flip, Chinese galvanized 5/8" bail to bail, disassembled Kong. All have suitable ratings for 3/8" G4 chain.

Size/Strength. When it comes to sizing an anchor swivel, bigger and stronger are usually better, within reason. The primary consideration is to ensure it has at least similar safe working load (SWL) and ultimate breaking strength (UBS) as the chain so that it does not become the weak link. That also goes for the connecting shackles. See the graph below indicating, for example, that G4 3/8" chain needs at least a 5/8" galvanized swivel and 7/16" G4 or 5/8" mild steel or stainless steel (SS) shackle in order to match the chain strength. BBB or Proof Coil 3/8" galvanized chain has about half that working strength, 2650 pounds, so smaller sizes could be used.

One of the other issues here is to make sure the shackle pin will fit through the chain end link. A 7/16" shackle pin is the largest that will fit standard 3/8" chain. If your chain is a different size, first determine whether it is BBB/G3 or HT/G4, and then check the strengths and fit of all your associated hardware carefully. One good source for strengths is the West Marine catalog, also on line.

It goes without saying that cheap swivels and shackles, especially some unrated SE Asian brands, are far riskier than the more expensive and rated swivels made by reputable companies. The recent loss of a boat on a mooring in St Croix, with an inexpensive, but properly sized galvanized swivel, is further proof to exercise caution here. The same goes for shackles and chain. Any metal components constantly immersed on moorings are a significant problem requiring constant monitoring.

Prices (as of 2014) and safe working loads (HT=high tensile, MS=mild steel) for various pieces of ground tackle. As an example, red items are full strength for HT/G4 chain, blue for BBB/G3. Side loading at the anchor shank is an issue for the galvanized jaw swivel in the top photo and for the SS shackle in the lower.

Design. There are dozens of swivels currently on the market. Some are designed specifically for marine use and others for construction purposes. For example, Crosby says their common bail to bail G-402 Swivels are “Positioning devices and are not intended to rotate under load". Wichard says their forged 316 SS mooring swivel is designed for “permanent immersion”.

Quality swivels will have a rated SWL stamped on them. Others, including some from SE Asia, may also have the same stamp but are a risk. If there is no stamp then consider them disposable and probably not approved by your insurance company.

One important design characteristic for any swivel is the ability to take it apart and inspect every square millimeter. There are over 625 square millimeters in a square inch of surface area, so for us more elderly cruisers it is probably best to use a magnifying glass. Stress corrosion cracking almost always starts with very small surface cracks that can be detected by several methods, including rust stains, x-ray and die penetrant testing. It is also possible, especially with cheaper metals, for there to be internal imperfections that won’t be immediately visible. The SS Mantus and Kong are two swivels designed to be completely disassembled for inspection and cleaning. Many other swivels cannot be fully disassembled, including most galvanized swivels.

Another feature to look at closely is a swivel’s connecting devices, including the pins between the two halves of the swivel and those that connect the anchor and chain. Are they properly sized for the rated load? Threading and welding, especially if in line with the load, as on most galvanized and some SS swivels have caused failures. Machined parts are better. The SS Mantus swivel has oval pins that increase the strength along the load axis, and the connection on the anchor end is designed to orient a shackle properly so there is no side loading. The Ultra Flip, Wasi Powerball and a few others use a strong machined ball and socket arrangement between the two swivel halves.

Side loading is a significant problem. Crosby degrades the strength of their shackles for offline pulls as follows:

0-5 deg = 100% SWL

45 deg = 70% SWL

90 deg = 50% SWL.

The strength degradation in Crosby swivel SWLs will be similar.

Kong says their swivel will lose up to 2/3 of its strength if loaded at 90 degrees to a straight-line pull. So always use a full-strength shackle between the anchor and swivel. Mount it so that the rounded bail is through the anchor shank to prevent dangerous side loading.

Construction. An important decision to be made here is what metals are <u>not</u> suitable for use in swivels and other ground tackle. For those that prefer galvanized steels the choices are:

- G7 high test
- G4 high tensile
- G3 mild steel

But only hot-dipped galvanizing should be considered, not hot flame or cold galvanize sprayed, or cadmium plated. We tried once having our chain re-galvanized using hot flame sprayed with zinc by a well-respected firm in Fiji, and it lasted less than a year.

G4 metals have a much greater strength, but do not stretch as much as G3 metals before failure. Both can be re-galvanized without significant loss of strength. G7 metals are only somewhat stronger than G4, much more expensive and cannot be re-galvanized. I believe that of the three, G4 has the best combination of desirable characteristics.

Common SS metals come in a variety of types. 200 series SS is a bit stronger than the 300 series but not very resistant to corrosion. Among the 300 series 316 is the most corrosion resistant but about 10% weaker than 304 SS. Forging and heat treating improve strength, longevity and reliability. Machining is better than welding. Almost all standing rigging and most deck fittings, for good reason, are made these days of 316 SS. Most SS swivels claim to be made of 316 SS, but as evidenced below, that is not always true. See this link for an informative look at a failed swivel's metallurgy and failure analysis:

https://www.fsc.com.au/wp-content/uploads/2016/07/Anchor20Swivel20Report.pdf

Flawed metallurgy is certainly a possible cause of swivel failures. There are some scary pictures on the internet showing swivel failures, but little good documentation. So, if purchasing any swivel, it is best to stick with a known reputable major brand for the best chance of getting a high-quality product. This applies to both SS and galvanized swivels.

Despite claims from others, I have found little evidence of failures from electrolysis. Based on the laboratory analysis of a failed swivel above, an analysis by an engineer from Mantus and the track record of quality SS swivels, as a cruiser I would be much more concerned about stress corrosion cracking than with galvanic corrosion in swivels.

Summary. Some of the better swivel-making companies have a good track record with few or no failures. My own experience includes 15 years cruising with a big SS Kong swivel that still shows no sign of deterioration. It gets taken apart, greased and carefully inspected at least once a year. Spade claims over 10 years with no breaks and no returns for their SS Wasi Powerball. Other quality SS swivels include the Ultra Flip and Mantus, both are well-designed of quality material but have a relatively short use history. Crosby (who also makes SS swivels) and Acco/Peerless both make forged, galvanized, bail to bail 'positioning device' swivels, and have a good reputation.

Google 'Anchor Swivels' for additional information on this important issue. Just remember that not everything you read on the internet is true, and some of the shorter negative comments on

forums are based entirely on unsubstantiated opinion. Unfortunately, there is little firsthand, well documented or laboratory analysis on the internet regarding swivel failures. What is there, as you would expect, mostly involves incorrect installation, undersize models, poor design, or flawed metallurgy.

A swivel, like other parts of your ground tackle, is not necessarily a weak link unless you make it so.

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Author: Dave McCampbell is a retired US Naval Diving and Salvage officer with over 40 years cruising and eight sailboats worth of maintenance experience. He and wife Sherry, based in the Philippines for the past 4 years, recently have cruised the Philippines and SE Asia. Earlier they spent eight years slowly crossing the Pacific. They have sold *Soggy Paws*, their CSY 44 monohull of 19 years, and moved to the 'enlightened side', purchasing in 2015 a St Francis 44 catamaran also named *Soggy Paws*.
