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A Comprehensive Guide to Chain and Wire Rope Steering Systems

STEERING COMPARTMENT INSPECTION:

1) Photograph the steering system below decks from a number of angles so you have a record of what it looks like in case a repair is needed at sea. You want to know what “right” is in case you have a cable failure and you need to put it back together. If you can, print the photos, laminate them, and tape them to the walls of the steering compartment so they are where they need to be if repairs are required.

2a) Center the rudder and tighten the wheel brake before going below.

2b) Wipe down the hull under all the junction points where the steering cables run into and out of the sheaves, quadrant, or radial drive wheel using a clean white rag. If it looks like you have struck gold, your wires are chafing and are thus misaligned with a bronze sheave or a bronze quadrant. If it looks like you struck silver, you are chafing an aluminum sheave or aluminum radial drive wheel. If you look above the area you will see that one wall of the sheave is shiny and perhaps even sharp. This is because S.S. steering cable is wearing away at the component because it is misaligned. You need to align the sheave so that the wire runs in the center of the groove. You also need to inspect the steering cable for broken wire strands in the affected area while someone turns the steering wheel hard-over to hard-over. The steering cable could be affected over a length of 1 ½ -2 ½ feet.

3) Look at the overall area in which the steering cables run, where the sheaves are mounted and where your rudderpost is located. Is there anything stored in the area that could get loose in a knockdown and fall into your steering system? You need to isolate

your steering in a way that prevents this from happening. This can be done with netting, plywood, a bulkhead fastened to glassed in cleats, or some other method to keep everything from falling into the steering system. Whatever system you use, make sure it can be removed relatively easily so that the steering system can be easily accessed for both inspection and/or service at sea.

4) Tighten the wheel brake, take the nuts off the wire takeup eyes, and remove the wire takeup eyes from the quadrant or radial drive wheel (which is attached to the rudderpost). With the steering cables detached you now have the slack required to allow you to remove the sheave pins from the sheaves for inspection. Inspect the pins for wear and replace any worn pins or brass pins. Edson started using only stainless steel sheave pins in 1989 as they last longer. Clean the bushing with WD-40 and re-lubricate it with 30 weight motor oil. WD-40 should be used to clean only, use oil to lubricate. Most sheaves use oilite bronze bushings that will soak up oil. If left to run dry, they get abrasive and will wear your sheave pins. Most boats have two to four sheaves in the steering system.

5) Inspect the idler plate which is located below your steering pedestal. It is the plate to which your sheave housings are attached. From 1974 to 2003 these plates were stamped in steel and galvanized, powder coated, or coated with a special black coating. These plates can rust over time if water leaks down thru the compass or thru the pedestal. If you see signs of rust replace it immediately. Also, tap it with a hammer – it should sound solid. If you hear a dull soft thud the plate may be rusting from the top which is typically where rust starts. Grab the sheave housings with your hand and try and move them. They should be very solid. Replace the idler if in question.

Leave your steering cables disconnected from the quadrant or radial drive and move to the cockpit.

ABOVE DECK INSPECTION & MAINTENANCE:

1) Before removing your compass, take three to four pieces of masking tape approximately 6” long and stick them to the compass, running them vertically down the pedestal. Using a razor blade or sharp knife, cut the tape where the compass intersects the pedestal top. The tape will help you properly realign the compass when you re-install it.

- 2) Stuff a large, preferably white, rag into the pedestal and below the sprocket. This will allow you to retrieve any parts that you might drop in the process.
- 3) Remove the cotter pins and clevis pin that connect your engine control cables to the engine control levers. Remove the engine control from the top of the pedestal, cutting the masking tape as previously stated in step 1 above.
- 4) Center your rudder and tighten your wheel brake. Mark the center link in your chain and then pull the chain up off the sprocket. Inspect the chain from one end to the other. There should be no sign of rust on it, especially where the pins are peened over as they come thru the link plates. Rust is a sign of crevice corrosion and your chain should be replaced immediately. Steering chain should literally drip over your finger. When crevice corrosion sets in it freezes the links in place. So, when the chain passes over the sprocket, it doesn't want to bend. This causes failure of the link plate, and ultimately the chain.

Look carefully at the ends of the chain, as the ends can be difficult to reach during routine annual maintenance. They should be "rolling" as easily as the rest of the steering chain. If replacing the chain is required, bathe it in T-9 Boeshield or 30 weight motor oil before installing.

Crevice corrosion happens most frequently on boats that spend the winter in the Caribbean where the salt air attacks stainless steel. Over the past 33 years I have found chain failure occurred on boats that had been in the Islands. We recommend replacing steering chain and cable every 5-7 years and keeping your old one on board as a spare.

- 5) Look at the wire and check it for signs of chafe. If you see any signs of chafe or any "meat hooks" replace the cable. If replacing the steering cable is required, you will need to go back under the cockpit and remove the wire rope clamps and takeup eyes. The wire will not pass thru the sheaves and the idler plate with those components in place. Tape a long piece of flag halyard to each end of the wire as a messenger line and mark the messenger lines port and starboard, so you know which goes to each side. Go back to the cockpit.
- 6) Remove the white rag from the pedestal. Pull the wire up thru the pedestal. When the messenger lines come up un-tape the messenger lines from the old wire and tape them to the new wire. Pull the new wire back down thru the pedestal with the messenger lines.

This is best done with two people – one guiding from above, while the person below in the steering compartment pulls. You want to make sure your new steering cables follow the exact same path as your old ones.

- 7) The person guiding the steering cable from the cockpit should make sure the chain is centered on the sprocket as you finish this process.
- 8) The next step in the process is to reassemble the wire takeup eyes and wire rope clamps. When installing the wire rope clamps, remember the rule – “never saddle a dead horse”. A wire rope clamp has two basic components, a “U” bolt and a “saddle” that slides down the legs of the u-bolt. The saddle needs to engage the working end of the cable, NOT the dead end of the cable. **Do not fully tighten the wire rope clamps yet.**
- 9) Install the wire takeup eyes to your quadrant or radial drive wheel, but only put one nut on the wire takeup eye bolt, and only tighten the nut until the thread of the eye bolt comes thru the nut. Do this to both steering cables so that both wire takeup eyes are attached to the quadrant or radial drive wheel.
- 10) Now, with your wheel brake tight, your rudder centered, and steering chain centered on your sprocket, you are ready to tighten your wire rope clamps. Take the appropriate size wrench for your wire rope clamps and with one hand put it on the clamp closest to the eye bolt. With your other hand, pull the tail of the wire as tight as you can and then tighten the nuts on the u-bolt, first one and then the other. Next, move to the other steering cable and do the same thing. The object is to get as much tension on the wire as you can before you rely on the wire takeup eyes to do the job. This will give you more thread on the takeup eye to do adjustments over a longer period of time. Tighten the second wire clamp down on each side before tightening the wire takeup eye.
- 11) Tighten the nuts on the wire takeup eyes equally 5 turns of the wrench on each side. Continue this procedure, moving from one side to the other, until you have your wire snug. The tension of the wire should be such that you cannot move the quadrant or radial drive wheel with the wheel brake tight. I would recommend one extra turn on the tensioning nuts of the eye bolt at this point. Your steering cables should be snug, but not piano wire tight.
- 12) To test your wire tension, have someone at the wheel loosen the wheel brake and spin the wheel hard over against the rudderstops and lean on the wheel. You will note

that one cable will be loaded with tension while the other cable is the “lazy cable”. The lazy cable should not be so loose that it could fall out of the sheave grooves, quadrant grooves, or radial drive wheel grooves. If it looks like this could happen, add another turn or two on the wire take-up eyes to put more tension on the cable on that side. Repeat this test on the other side and tension as needed.

13) Install the second wire take-up nut and tighten it down so that it locks the tensioning nut in place.

14) If you have a hydraulic backstay adjuster, pump it up to your maximum tension. Go below to the steering compartment and make sure your steering cable tension has not changed.

BACK TO THE COCKPIT:

1) Release the steering brake and turn the wheel hard over. The end of the steering chain should be no closer than about 1 ½” from the sprocket teeth. Check this on both sides hard to port and hard to starboard, until the rudder hits the rudderstops.

2) If your chain ends and wire rope adapter ride up on the sprocket, inspect your sprocket teeth for damage and dents in the ends of the sprocket teeth. This is indicative of too much rudder travel for the amount of chain you are using. You can pad the rudderstop blocks, or shorten the tether if your boat is equipped with a tether stop, in order to limit the rudder travel to the length of chain that you have.

3) Lubricate your wheel shaft bearings through the holes above the foreward and aft bearing housing using Teflon grease. Turn the wheel slowly when performing this function, so that all the rollers get lubricated in the bearings.

4) You are now ready to reinstall your engine control. Find your white rag and stuff it into the pedestal so you can easily retrieve any dropped components. When the engine control cables are hooked up to the control levers you can remove the white rag.

5) Reinstall your compass with the long ¼-20 bolts that go through the compass, engine control, and guard top plate. Lubricate the threads with Tef-Gel before reinstalling the bolts. When all four bolts are started, but not tight, line up the masking tape between your pedestal and compass and tighten all bolts.

ADDITIONAL THOUGHTS:

- 1) Check your emergency tiller. Does it fit? Is it easily accessed? How well does it handle the boat under sail and power?
- 2) Turn on your autopilot and drive your boat around outside the harbor on autopilot alone. Make sure that all on board know that your Autopilot is your “electronic emergency tiller”.
- 3) Add an LED light to your steering compartment. Light is a wonderful thing to have when working on your steering system.
- 4) Know that steering cables will take an initial stretch. If you install new cables give them an opportunity to stretch and be sure to re-tension the steering before leaving on an offshore passage.
- 5) Store wrenches of the necessary sizes in your steering compartment (typically 1/2", 9/16", 8mm, and 10mm).