

Rig Tuning per Don Kohlmann

Here are a few thoughts on tuning the deck stepped masts of the Pacific Seacraft 34's and 37's, which apply generally to all of the PSC deck stepped models. It may be released a bit hastily, so beware of typos and syntactical quagmires...

There are at least two objectives in accurately tuning the rig. Keeping the rig in the boat by keeping it in column is the most obvious, but promoting (or at least not degrading) sail shape is another one. The spar sections on all of the Pacific Seacraft's are quite robust, and engineered more for long-term strength than for sail shape control, but as subtle as it is, the sail shape factor will be a benefit of setting the rig up properly.

Whether your mast is in the boat now, or it is to be stepped, set it up so that the masthead is in center of the boat. It isn't necessarily that your boat will sail like a one-legged duck if it isn't, but the cumulative effect of all of these things will really help performance and handling. In my opinion, the best way to center the masthead is by hoisting a 50' metal tape up on the main halyard. The halyard itself can be used for measurement, but it is a bit stretchier than the tape, so you have to try to use the same tension as you extend it alternately to the port and starboard chainplates. It's prudent to attach a piece of 1/8" dacron to the halyard shackle as you hoist the tape, just in case the end fitting breaks off of the tape (ask me how I know). A plum bob suspended from the masthead for measuring lateral tune can be affected by the boat's flotation trim. It can give you a good reading on the amount of mast rake though.

It's not necessary to tension the rig to a z-flat, bar-tight condition. Rig load while sailing is additive to the static tuning loads, and there is no need to keep undue tension on the boat in general while it sits static. The side rigging on a race boat is heavily tensioned for a couple of reasons; one is to keep the mast as straight as possible athwartwise to reduce tip sag and minimize compression of the mast column, and the other is to add to fore and aft mast stability by "tip-loading" the spreaders. The overall structure is designed for high rig loading, and the extensions of, and foundations for, the rigging terminals generally encroach on the interior space.

On a cruising boat such as the PS 34 or 37, very adequate mast support can be achieved with moderate rig tension. Prior to starting, you might wish to apply a dab of anhydrous-lanolin (Lano-cote) to the turnbuckle threads right at the shoulder of the turnbuckle barrel where the threads enter it.

With the rig stabilized by the headstay backstay and shrouds (and the spreader tips well wired to the uppers, and all turnbuckle clevis pins pinned properly), start tensioning the rigging by hand-tightening the upper shroud (or "cap shroud") turnbuckles to center the masthead. Measure to the upper shroud turnbuckle clevis pins at the chainplates port and starboard to be sure that the masthead stays centered. As you go, take the slack out of the lower shrouds to keep the center of the mast generally under the masthead. Once the turnbuckles are hand tight and the masthead centered, drop the tape down and reel it in. With a wrench on the flat of the upper swage fitting,

and an adequate size screwdriver through the turnbuckle barrel, and working from side to side, tighten each turnbuckle about four full turns, but by two turns at a time on each side. If you feel any resistance on the threads, stop. Working against tight threads can gall them. The remainder of the upper shroud tensioning can easily be done on the leeward side of the rig when it is under sailing load. Be sure to re-insert the cotter pins in the turnbuckle threads to eliminate that chance of them backing off for any reason. (note: there is a way of trimming and shaping cotter pins so that they can be split to 10 degrees only, making them very easy to remove at any time - a topic worth another paragraph or two)

Tensioning the upper shrouds will compress the mast slightly and the lowers will now have slack in them again. Tension them only to remove the slack. The most common error in mast tuning is over-tensioning the lower shrouds. The lowers consist of two pieces of wire on each side, each piece the thickness of the single upper shroud but only half the length of the upper. The result is that the lowers will stretch far less than the upper shrouds. To compensate for the reduced stretch, the uppers would have to be over tensioned and over compressing the mast panels (sections between rigging attachments). Over-tensioning the lower shrouds will produce relative mast "tip sag" by pulling the mast out of column to weather of the masthead at the spreaders. In addition to not over-tensioning them, the other objective is to tune the lowers so that they will promote a slight forward bend in the middle of the mast when they come under tension. To accomplish that, tighten the forward lowers about 1 turn tighter than the aft lowers. The aft lowers may actually seem slightly slack at this point. Most 34's and 37's are sailed with the staysail stay in place, but some are not. Whether or not the staysail stay is in place, the forward lowers will encourage forward bend.

The degree of bend in a mast section of this size will be small, perhaps 2" in the middle when sighted from the gooseneck to the masthead, but it is important for two reasons; the first is that it will help form an "arch" of the spar itself, resisting the tendency for the mainsail load to pull it aft in the middle, which is the worst structural situation, and second, when the mast bends aft, it will allow the draft in the mainsail to move aft and deepen creating a more powerful shape with increased drag and heeling force just when you would least want it. Easing the mainsail excessively to de-power it aggravates the situation because it will often force you to sail a lower than optimum course to weather. Therein lies the important, but subtle detail in rig tuning. With the mast tuned correctly, your boat will simply be easier to sail in heavier air.

After the shrouds have been tensioned, or "dock-tuned," adjust the headstay until the mast is just aft of vertical. Tension the backstay against the headstay until the headstay feels firm when pulled on at shoulder height. In addition to promoting good headsail shape, a firm headstay will also make the roller furling system work more smoothly. After the backstay has been tensioned, the additional compression and little bit of fore and aft bend will usually allow the upper shrouds to be taken up one more turn prior to the sail test.

In my opinion, most boats go upwind better with some mast rake.

After the static tuning process is complete, check the spreader dihedral, which is the angle of the spreaders as they intersect the upper shrouds. During the tensioning process, the spreaders tips will have been pulled downward. The correct angle for the spreaders is for them to bi-sect the angle of the upper shroud as the shroud bends around the spreader. Hanging in a bosun's chair and tapping them into position with the heel of your hand is one of the best ways to do it. The process of checking the dihedral is more of an "eyeball" rather than a protractor operation. Beyond preventing a spreader collapse, you have all probably seen how funky flat or droopy spreaders look. Check them from time to time during the season, since flag halyard tension can cause the spreaders to creep downward when they are unloaded on the leeward side.

The only way to confirm that the rig is tensioned correctly is to sail on the wind in 15-18 knots apparent. With the sails trimmed for sailing to weather, walk forward and sight up the sail track on the mast. You will usually note that the mast is sagging off to leeward above the spreaders. After you have studied it, tack and put the rigging you have looked at on the leeward side. Pull the turnbuckle screw pins and tighten the turnbuckles two more turns. Sight the mast on this tack note any sag, tack and repeat the process for the other upper shrouds. Check the adjustments that you made to the first side. If the tip still appears to sag excessively, tack and tighten the upper shroud 1 to 1-1/2 turns more. Tack and check it. If the tip is still sagging, tack and loosen the lower shrouds a turn. Remember that these adjustments of the turnbuckles will be more pronounced on the lower shrouds. The lowers are loosened in order to place the mast back in column by lowering the center section under the masthead.

Tip sag is insidious because it produces excessive headstay sag which deepens and moves the draft aft in the genoa resulting in the same "powerful" shape characteristics as with the mainsail, resulting in more tip sag, headstay sag, etc. You heel more and go slower. In addition, the mast may become structurally unsound.

These masts are very strong for this size boat and quite still fore and aft. But when the mast does pump in heavy chop and waves, set up the running backstays against the inner forestay.

Remember also to check your halyard tension as the wind increases. When reefing, be sure that the halyard AND the reef outhaul are well tensioned. The effect of reefing is defeated when the sail area is reduced, but the remaining sail shape has deeper draft than when the sail was at full hoist. You will notice an amazing difference in handling and performance as the wind builds.

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