

Tune Your Rig to the Owner and the Sails

By early 1999, PLUM CRAZY was using a Loos gauge regularly to set rig tune to suit the conditions. By late 1999, I assumed that an article on rig tune would follow the pretty basic lines of “set mast butt here, set shroud tensions there” as is done by most sailmaker-published tuning guides. The topic however, proved to be dramatically more complex than just determining a set of numbers versus wind conditions. The whole rig setup used on PLUM has evolved through Key West 2000, Annapolis NOOD’s, Block Island Race Week and the rest of the sailing season. It is still evolving, which to us is one of the enjoyable elements of owning this flexible and responsive boat.

The primary lesson that we have learned through all of this is that proper rig tune isn’t a fixed set of numbers for all boats, all sails, all owners. There is a complex relationship between driver skill, sail trim skill on the boat, willingness to work the rig, deep draft (DD) versus shoal draft (SD) keel, and sail shape that determine ultimately how you setup the rig for a given set of conditions (wind speed and sea state). As a result, before you even begin to “set numbers”, you have to understand, honestly and frankly, where you are as a program, on the other variables.

We will get to the “numbers” in this article eventually, but to make sense of the end result, first we’ll go through some background, sail design as a function of boat and owner, and rig variables.

Background:

I think three distinguishing features of the crew (I include myself in that term) are important to remember when we start talking about sail trim and rig tune versus the boat. First, most of us are technophiles – we *like* to play with this boat, we get a kick out of learning the relationship between variable X and result Y. If you don’t enjoy doing that, it will affect the type of sails you should buy and it certainly affects rig tune.

Second, this is a pretty focused, type “A” group. A very strong willingness to train up, adjust the boat, change gears, whatever, both on and off the racecourse. Again, an honest assessment of the state of development of your own program’s efforts has a direct relationship to type of sails you use and hence correct rig tune/trim.

Third, this core group of people spends a lot of time on this boat. We do KW in January, the Chesapeake season starting in the beginning of April through Block, Newport, MAYRA in August and then back to the Chesapeake in the Fall, through November. This year’s schedule includes 37 regattas, in a lot of different places. The end result of that is that if we decide we need to shorten a forestay/move a mast butt position while actually motoring out to the NOOD or KW race, it will happen without hassles, without anxiety. It is why we can gather so much data on “if you do this, what happens?” because we can set up one way for a single race, see what works, and actually kick the whole setup around if we don’t like what happens. That also has a large effect on how you approach rig tune versus sails.

Sail Design versus Boat and Owner

Why the lengthy intro? Because you must make a frank and honest self assessment of where your program is on the learning curve, how much you want to put into learning rig tune/sail trim before you even buy a set of sails. And you must work with a sailmaker who will listen and respond to your personal situation. (The good ones do.) J/105 sails have evolved from some pretty generic, user friendly, forgiving sails to sails that now cover a spectrum of “maxed out performance” on one end to “user friendly” on the other. And you are not necessarily sacrificing large differences in performance to move from one end of the spectrum to the other.

Cutting edge performance, from what I've seen, might be a difference in a fraction of point, 0.1 to 0.15 knot of speed. You may pay for that cutting edge by having sails that then demand proper rig tune and trim, or suffer a big time drop in speed/point. Adding a half-inch of luff curve in the jib can make all the difference in the world to sense of groove for an owner whom is still mid-way up the learning curve, at only a modest offset in ultimate speed. Are you truly sailing at the top 5 in a KW or a NOOD or a North Americans? Then you might need that last edge. If you are not quite there yet, or if you honestly want a rig you set up at spring launch and then forget about, then work with your sailmaker and make sure you get sails designed for you and your program. The top sailmakers are all trying to produce top competitive sails—make sure your design is tailored to your program and capabilities.

Another thing to consider is the DD versus SD boat. (I sail with both keel types.) And the wind conditions in which you routinely sail. The SD boat is not very forgiving, especially in light air. It does not accelerate well, it does not feather for more than a few seconds before speed collapses, it requires a higher angle of heel under all wind conditions for optimum speed, and most importantly for sail selection and rig tune: it has very little “groove”. A wheel for a SD owner might make it even worse, if the helmsman is used to driving a tiller. A maxed out jib, with a flat entry (to get more of the allowable girth curve into the leach/roach for power) isn't as user friendly as a jib with a slightly rounder entry. While you can produce the effect of a rounder entry by tuning for more forestay sag, the SD owner, especially one still coming up the learning curve, will probably want about 0.75 inch more luff curve in his jib than a maxed out DD jib might have.

Rig Variables

In descending order, we adjust for the following:

- Mast prebend (affected by forestay length, mast butt position and partner chocks)
- Forestay sag (affected by mast prebend, forestay length, shroud tension, backstay, mainsheet tension)
- Mast straightness athwartships (shroud tension and adjustment)

The huge variable here is mast prebend versus sail design. The amount of mast prebend required is totally dependent upon your sail design. Almost all J/105's in the mid-1990's carried a lot of prebend in the mast due to deep luff curves in the mainsail design. In 1997, Ullman came out with a much flatter luff curve main (and jib), that requires a dead straight stick. North sails soon followed. So rig setting numbers published by anyone, myself, Sailmaker X, whoever, are only usable for a specific set of sails. They can be worthless for other sail designs.

Mast Prebend: Assuming your sails require a straight stick, to set rig from scratch, with backstay completely off and shrouds slack, we first set forestay to max length. (And we sail with the forestay at max length until the true wind gets over 25 knots.) Then with forestay set, mast butt is pushed forward, leveraging mast against forward partner chock until the mast just barely starts to invert. Then butt is locked down. You cannot safely use a dimension of mast butt from cabin bulkhead dimension (the old 9 1/2 inch dimension for example) because we have found that the bulkhead location varies by over 1 inch fore and aft from boat to boat. Sorry about that. Ditto for using the “maximum forward” butt position recommended in a newer guide. Mast butt adjustment range varies as well from boat to boat. So you have to set the mast to have correct amount of prebend by eyeing or measuring prebend, not by setting against someone else's butt position measurement.

Mast partner chock thickness also varies boat to boat. And a 1/8-inch difference in the thickness of the aft chock translates into a mast butt position difference of 5/16 inch. So again, Boat A's mast butt position versus bulkhead or versus step bolts is meaningless to Boat B. Also, make sure your mast is levered against the aft chock (jib sheet around mast and pulled up on secondaries does the trick) as you drive home the forward chock. You can fabricate your own chocks from hard rubber so that you can adjust the mast fore and aft in 1/8 inch increments at the partner. Finally, some boats have had their mast butt slip in

use. Put nail set punch mark on step plate and another on the head sole and mark in red (or drill a small hole in the sole for your reference). A glance will then tell you where you are set up.

Forestay Sag: This is critical in balancing drive of jib against drive in main in heavy air. It is also critical in developing the feel of groove in light air with a SD boat. Controlled by forestay length itself, shroud tension and backstay tension. The straighter the mast, the more directly shroud tension goes into the forestay (a derivative advantage of sail shapes requiring a straight stick). With lots of prebend part of shroud tension goes into creating more prebend and only part goes into forestay tension. After setting our forestay up for max length, and setting our shrouds for the tensions given below, we keep an eye on how much backstay we are having to use to control the boat as wind builds. When you get up into the 25-knot range, if we don't shorten the forestay by 0.5 to 0.75 inch, we find that we're having to use too much backstay for jib control. (Takes more power out of main than desired, just trying to control jib.)

Also, if you find that you don't have much feel for the groove in light air, you can induce the effect of more jib luff curve by adding more forestay sag. If you're at max forestay length (as you almost certainly should be), kick the mast butt aft 1/8 to 1/4 inch. With same shroud tensions, it results in more sag. Too much forestay sag? Go the other way with the butt.

Mast straightness athwartships: Assuming you're setting rig up from scratch, the first thing to do is center the tip. You'll need to measure equal distances aft from stem on both sheer lines. (We've filed a small groove in both sheers, marked with black paint to mark these equidistant points. Makes it trivial to check anytime.) Then pull mast halyard shackle down hand tight to one mark. It should also then just touch the other mark at same hand tight. Adjust the uppers set at modest tension, until both sides measure equally.

From this point forward, all setups on shrouds will refer to Loos gauge settings. I personally do not believe you can come even remotely close to getting shrouds set up by using "10 turns above hand tight" as a method. Whose hand tight? My 55-year-old desk jockey hands? Or my 22 year old, weight lifting son's hands? Lubed turnbuckles or not? And one turn on the uppers is the difference between 42 and 47 on a Loos gauge. You cannot possibly set the rig tension accurately without a gauge.

To my knowledge, there is only one model Loos out there for rod rigging, the RT-10 available from West Marine, Layline, and probably others. Buy one and keep it on the boat. Or, since they aren't cheap, get a couple of boat owners together and buy one as a group. (As weight conscious as we are, the Loos always rides with us.) Since there's really only one practical gauge, I will give the gauge calibration rather than convert those numbers into real tension numbers.

Starting from dead slack, take the intermediates and uppers up in equal turns, both sides, as you work your way up to the range where Loos readings become meaningful. You must eyeball the mast for straightness. Since the rods pull directly against one another, you can have exactly equal readings for, say, the intermediates, and still have the mast pulled to one side or the other.

Take the shrouds up to final mid-range (our 12-14 knot true wind speed) setting. Adjust them under sail looking for the following:

Lowens: initially set dead, sloppy soft. Zero tension, waving in the breeze. Set under sail to just enough tension to keep lower 1/3 of mast from sagging to leeward. Stick straight! Usually cannot read this tension on the Loos at the dock-too low to register. If you have to err, do not err with a bump to windward.

Intermediates: Loos setting should have stick straight – but check under sail as you warm up prior to race. Stick straight! No sag to leeward, no bump to windward.

Uppers: We don't adjust these much anymore. We may add a turn or two (see the numbers) in heavy air. But basically, you just don't want tip pulled to windward. Shouldn't sag to leeward in light/medium air. Some sag to leeward in the heavy stuff helps reduce heel.

The Numbers:

Lowers: no numbers! Dead soft – really! Then set under sail just to avoid leeward sag of mast. Once you have this setting, you don't really have to adjust unless air gets heavy. Then a single turn might be required. Site up mast under sail.

Intermediates: Mid-range setting – 17. Add turns as the air builds. Max out at about 22 for heavy stuff, about + 2 turns. We don't use lower than 15 in the light stuff.

Uppers: Mid-range setting – 47 to 49. Not much change per wind but could go up to 51 in heavy stuff.

Note: Rig tension is sensitive to temperature. The aluminum spar has a different coefficient of thermal expansion than the high nickel stainless shrouds. So if you set your rig to proper tensions on day one, when it's cloudy and 70 degrees, and day two is sunny and 88 degrees, you'll find the tensions have increased the equivalent of a turn or more. It can move you from your light air setting to a medium air setting. Check every day if the temperatures are varying.

Andy Skibo is Senior Vice President of Foster Wheeler, a very large, global engineering and construction firm. He has three sons (Zak-24, Nick-22, Jedd-19) and a daughter Bryn-16. Nick and Jedd have been regulars on the boat since day one. Zak now sails in local regattas. Bryn has done most major regattas with him this year. His wife Leslie does all the lodging/travel logistics but does not race. This year they took top honors at Key West and the Annapolis NOOD and have won silver in numerous other major regattas.