

How to Tune Your Rig

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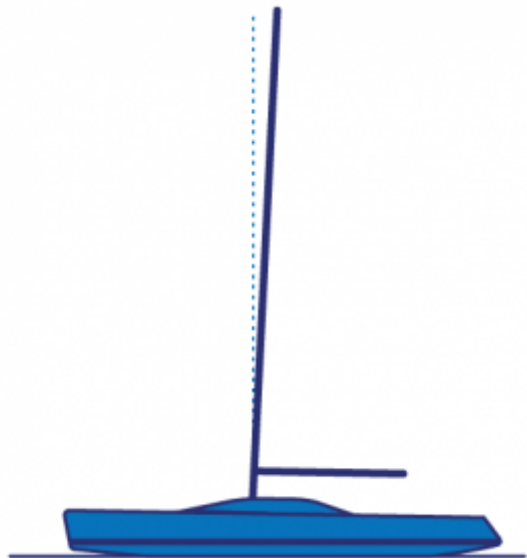
North Sails RESOURCES

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Without a properly tuned rig, you won't be able to control your mast's behavior over the full range of conditions. Fortunately, rig tuning is a straightforward step by step process for both masthead and fractional rigs.

The goals in rig tuning are the following: (1) Eliminate side bend and lean, (2) Set mast rake for proper helm balance, (3) Set pre-bend to match the mainsail design, and (4) Control mast bend and headstay sag.

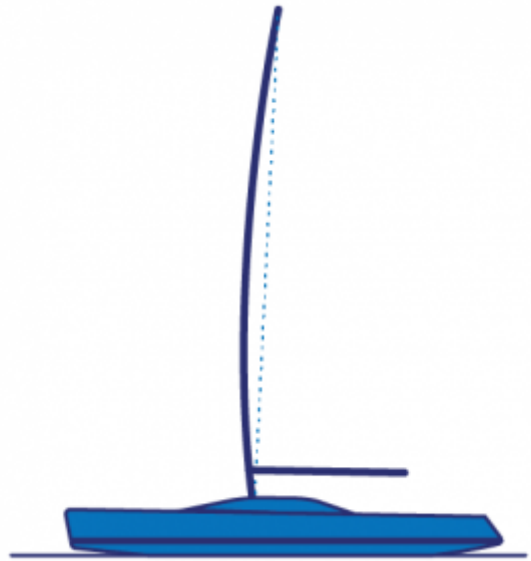
Here are a few definitions and explanations to get us started.



Rake

Rake is the lean of the mast forward and aft. Changes in rake change the balance of the helm. Raking the mast aft (usually called "adding rake") creates weather helm. Standing the mast up straighter reduces weather helm. Changing the rake may be as simple as adjusting the forestay and the backstay, or it may require moving the mast step.

The goal is to find a setting that provides some weather helm upwind in light air, without becoming unbearable in a blow. Most boats are designed for some rake, but the best amount depends on sail design, predominant conditions, and even the size of the crew. To find an optimum rake, experiment with several settings in a variety of conditions until you have 3-5 degrees of weather helm in moderate conditions. You may find it pays to adjust rake for other conditions. You may also want to sail with more headstay tension on heavy air days and less in light air.

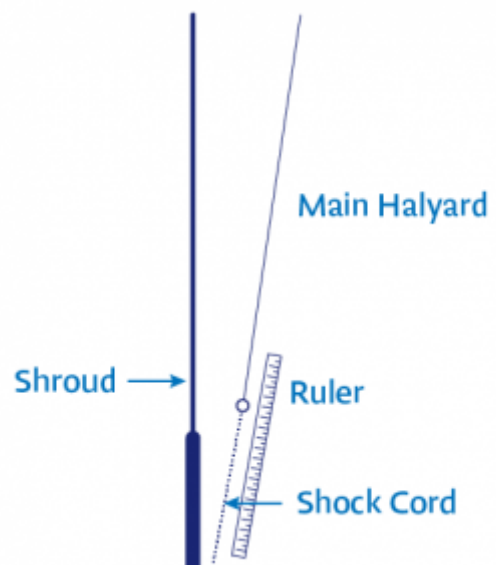


Pre-Bend

Pre-bend is bend that is tuned into your rig to match your mainsail. Pre-bend is achieved by a combination of compression (through tight rig tension) and adding mast blocks at the deck partners. Your mast will need somewhere between an inch and a few inches of pre-bend.

If your main tends to be too deep, add more pre-bend by tensioning the shrouds and/or adding blocks between the aft side of the mast and the partners. If you cannot get enough power and the sail seems too flat, straighten the mast by putting blocks in front of the mast at the partners.

As your main ages, you may want to add pre-bend to take out some to the extra depth, but that will also exacerbate the other problem of age – the draft creeping aft. Stiff, tapered full length battens can alleviate that problem.



How to Center the mast side to side

The first step to tuning a rig is to center it side to side so the rig behaves the same way on either tack. The process is the same no matter what size boat or type of rig you have. Here's how to do it:

1. Make sure there is little or no tension on headstay/backstay.
2. Check that the mast step is centered in the hull and that the mast butt is secured to step.
3. Center and block the mast at partners. (Ideally, before stepping the mast, run a line from stem to mid-stern to check that the partners are centered in the boat.)
4. Use the main halyard to "measure" symmetrical points on the port and starboard side of the boat (chainplates are usually a good reference point). Pull the halyard down to the deck until it just touches the starboard (or port) chainplate, and then cleat the line. When you check the other side (look up to make sure the halyard isn't wrapped around anything), the halyard should just touch the same point on the opposite side as well; if not, ease off the upper on the side that is too "short" and tighten the other the same number of turns. Continue to do this until the main halyard "measurement" is the same port and starboard.

Once the mast is centered and the rake is set, how to tune your rig depends on what kind of rig it is.

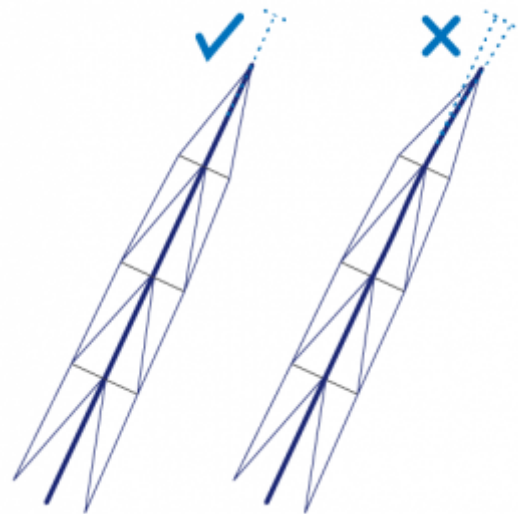
Tuning Keel-Stepped Masthead Rigs

Once the mast is centered side to side, tighten both upper shroud turnbuckles evenly. Continue to tighten the uppers until they are both firm to the touch, or until the tension matches numbers provided by your tuning guide/rigger/sailmaker.

If the mast goes out of column, ease off tension until it is straight again. Be careful not to strip the turnbuckle threads. Do not overtighten.

Tighten all intermediates and lowers evenly on each side, sighting frequently up the aft side of the mast to make sure it remains straight.

This is the initial setting, with mast centered and straight, and all shrouds firm. When you tension the headstay/backstay, the mast should remain straight side to side.



Under sail

In moderate breeze, take the slack out of the upper on the leeward side (and count your turns so you can replicate the amount on the other tack). Tack, and then tighten the other upper the same amount.

Once the leeward uppers are tight, sight up the mast on each tack to check for side bend. If the middle sags to leeward, tighten the lowers. If the top appears to fall off to leeward, it could actually be the middle popping to windward; either loosen lowers or tighten uppers accordingly. Both over-tight lowers and loose uppers allow the tip to fall off, which creates a narrow angle of intersection between the uppers and the mast. Beware, as this can overload the shroud fittings and cause rig failure.

Proper tension will leave the leeward upper shrouds taut with 15 degrees of heel and a full crew on the rail. The uppers should be tighter than the lowers; they have more load and also stretch more because they are longer.

Check the rig periodically, particularly after sailing in heavy air. Look for stretch in the uppers and for over-tensioned lowers, which can overload the upper spreaders.

From this base setting, you will probably want to fine tune your rig for sailing conditions. Generally this would mean adding tension to the uppers in heavy air, and backing off a couple of turns in light air. Sometimes fine tuning is best done by tensioning/loosening the headstay instead.



Mast Bend and Headstay Sag

Working with the backstay and a combination of running backstay, baby stay, and/or vang, it is possible to control mast bend and headstay sag separately.

Backstay tension will bend the mast through compression as well as tighten the headstay. The mix depends on running backstay tension. If the runners are tight, they restrict mast bend, and the backstay impacts headstay sag. Looser runners allow more mast bend.

With a stiff mast, backstay tension translates primarily into headstay tension, controlling sag. A baby stay can then be used to add bend. The backstay contributes to bend as well, particularly once bend has been initiated by the baby stay.

Running backstays allow control of mast bend independent of headstay sag. A tight backstay will tighten the headstay and bend the mast. Tensioning the runners will straighten the mast.





Tuning Keel-Stepped Fractional Rigs

The procedures for tuning a fractional rig differ slightly from those for a masthead rig. There are many varied configurations of fractional rigs (swept spreaders versus straight, runners vs. no runners, etc.), which also makes it difficult to generalize. The procedure described here is for swept spreaders. Straight spreader procedure is a mix of this and the masthead procedure described above.

If your rig has swept back spreaders, shroud adjustment will affect lean, side bend, pre-bend, sag, and mast bend. Spreader sweep should be fixed; spreaders should not swing. Use pins &/or epoxy to secure swinging spreaders.

First, center the mast at step and partners as explained earlier. Then, with lowers loose, pull the backstay to max. Tighten the upper shrouds, keeping the rig centered and mast straight side to side. If the mast tends to bend sideways, you may have to ease backstay slightly.

Release the backstay. The mast will still have some bend. Tighten the lowers to remove bend as necessary to match your mainsail.

The rig is now tuned for maximum headstay tension, which is often difficult to achieve. Backstay tension will bend the mast and add some headstay tension.

To get the mast to bend more easily, ease off the lowers. To make backstay tension affect the headstay tension as much as possible, tighten the lowers.

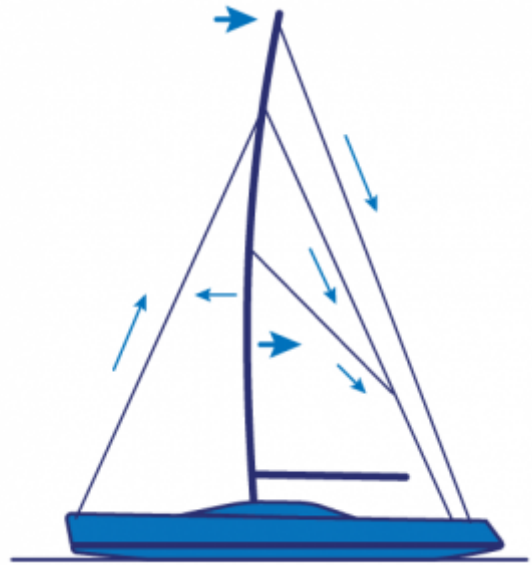
There is a limit to the amount of headstay tension that can be achieved without running backstays. If your mast tends to bend too much try less spreader sweep. To encourage bend, add more sweep and ease the lowers.

Upwind in a breeze the top of the mast will fall off to leeward, and the middle will bow out to weather. This side bend de-powers the rig to a greater degree than fore and aft bend. Easing the lowers may reduce side bend, but it will allow more headstay sag and fore and aft mast bend. The other solution is longer spreaders, which will push in harder on the middle of the mast. This can

reduce, but will not eliminate, side bend, and depending on your boat's sail plan longer spreaders may also interfere with genoa trim.

Changing rake requires a complete retuning of the shrouds. Rake should be set for a balanced helm.

Shrouds must be adjusted daily to achieve proper mast bend and headstay sag characteristics for varied conditions. Upper and lower shrouds should be eased in light air for less bend and less headstay tension. In heavy air, tighten both uppers and lowers a couple of turns for best performance. Keep track of base, light, and heavy air settings that seem to work well.



To control sag properly and independently on a fractional rig, running backstays are required.

Fine Tuning your Rig

The tune of your rig needs to match the designed luff curve of your main and luff hollow of your jibs. It is often necessary to retune the rig for new sails. If your boat's performance is not all you hope for, especially in certain conditions, try a small change in rig tuning. Small adjustments in rig tension, rake, and pre-bend can have a significant impact on performance.

If you decide to re-tune your rig, carefully mark and note your current settings so you can revert back to where you were if you are unhappy with the test.

[Purchase the North U onboard, laminated Rig Tune and Sails Trim Guide](#)