

A practical guide to rig tuning

Correct rig tension will maximise the efficiency of your boat's sails as well as reducing stresses on the mast. David Pugh demonstrates a simple rig set-up



As a cruising sailor, it's tempting to simply set up your rig at the beginning of the season, then leave well alone. Perhaps you leave the mast up, perhaps you mark the position of the turnbuckles before the mast comes down, perhaps you set the rig up from scratch or perhaps you pay an expert. All these can work, but none are immune from one basic problem: boats move. How much depends on the boat's construction, particularly whether the mast is keel- or deck-stepped, but most will do so within a few days or weeks after the initial rig tension is applied. The boat may continue to do so over time and rigging may stretch, especially when new, so it's worth knowing how to correct it yourself.

My own boat, *Contessa 26 Red Dragon*, is a devil for this. During the winter she sits on a trailer with the mast down, the keel supported along its length and in turn supporting the superstructure, aided by six pads and a bow post bearing on the

hull. At launch, these forces all change: the buoyancy of the hull now supports the keel, and the mast foot pushes down on the laminated deck beam under the step. The rigging, meanwhile, increases the pressure on the step while trying to pull the chainplates through the deck. I've never measured her beam before and after applying rig tension, but I suspect she becomes significantly wider. She certainly doesn't maintain her initial rig tension.

Benefits of correct rig tension

The first and most fundamental benefit of correct rig tension is safety. An improperly supported mast is put under all sorts of stresses that it is not designed to endure, and dismasting can be the result. Try sighting up the mast when the boat is close-hauled in a good breeze. If the lee shrouds are slack and the middle or top of the mast is sagging to leeward, your mast is not properly supported and you should check your rig tension.

The second benefit is efficiency. The

combination of rig, spars and sails is anything but simple, and if your sailmaker has done their job properly and measured your boat rather than making your sails from documented figures, the luff curve of the main and the hollow of the jib or jibs will have been cut to suit the bend in the mast and the forestay tension at the time of measurement. That means you'll need to be able to replicate that situation when you set up the rig in order to gain maximum efficiency from your sails. And, just to make things harder, as time goes by and your sails stretch, these optimum settings will change.

Conditions also affect the best settings for your rig. Light airs demand softer settings than sailing in a gale, and you'll often see racers tweaking their rig tensions to suit the conditions. For cruisers seeking to set up and forget about their rig, the best option is to err towards setting up the boat for stronger winds, especially with shroud tension. Forestay tension can be more dynamic, provided your boat has an adjustable backstay.

Simple rig set-up

Some boats have designer's recommendations for mast rake, bend and rig tension – if yours is one of them, follow the instructions. The rest of us are obliged to make it up from scratch – so where do you start?

While some professional riggers might be able to assess the tension in a wire with a carefully calibrated shove, the rest of us need a bit of help. You can either buy a rig tension gauge (we tested several in April 2016) or measure the extension of the wire. This latter method works on the basis that, for 1x19 rigging wire, an elongation of 1mm over 2m equates to 5% of the break load of the wire. Seldén have a good explanation on their website – search 'Seldén rig set-up'. The tension you are aiming for will vary from boat to boat and between types of rigging wire, but a gauge will make it much easier to keep the tension even on opposite shrouds.

For the initial set-up the boat should ideally be floating level – it makes it much easier to see whether, despite the measurements, everything looks right. I find it's best to be on a finger berth, which allows you to get off the boat to assess whether the mast is upright.

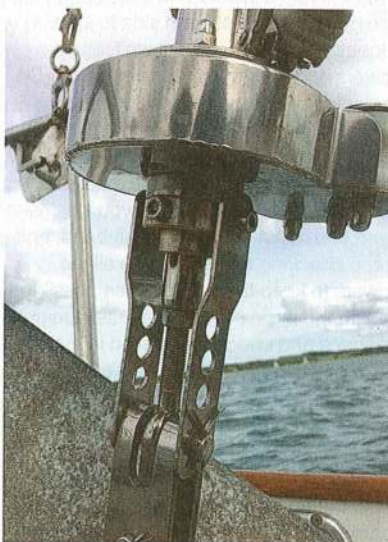
Make sure that the mast is upright

If you're starting from scratch, begin by centring the mast in the boat. Leave the lowers fairly slack and use the main halyard to measure to the chainplates on each side. You can then adjust the bottlescrews to make sure the cap shrouds are of equal length. If your boat is symmetrical, the mast will be upright. If

your mast is keel-stepped, insert the chocks in the partners now before you apply rig tension. Finally, tighten the cap shroud bottlescrews hand-tight, making sure you put the same number of turns on each.

Set up the mast rake

Next, set the mast rake. If you have a setting from the designer, use it. If not, you're most likely looking for a rake of between 1° and 2°, or 1:60 to 1:30. So for a 9m mast, you would expect the offset between masthead and mast foot to be between 15cm and 30cm. Measure it by hanging a weight from the main halyard and measuring the distance between the weight and the mast foot. If it's windy, hanging the weight in a bucket of water



The forestay bottlescrew sets mast rake

will help damp the swing of the halyard.

Pull on a little backstay before using the forestay bottlescrew to move the masthead fore or aft and adjust the rake. The backstay helps the masthead to move – with no tension, the forestay will simply become slack as you back off the bottlescrew. Steeper rakes tend to go with fractional rigs, but this is by no means a rule – you may need to experiment to find what works for your boat. Increasing the rake will increase weather helm, and vice versa.

Tension the cap shrouds

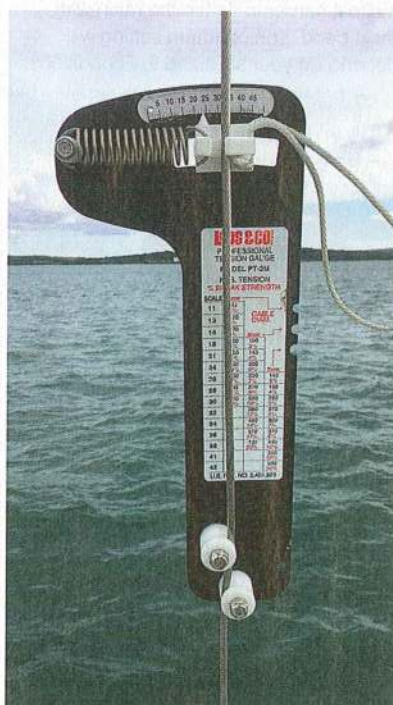
It's now time to begin tensioning the rigging properly. Take the slack out of the lowers at this stage, but don't tighten them fully yet. Then, using your tension gauge and making sure you keep the number of turns on each side equal, tension the cap shrouds to their working tension. Most tension gauges are calibrated to show a percentage of the breaking strength of the wire: with my boat, I find that around 15% is sufficient to keep the rig taut in the conditions in which we sail; on Ben Meakins' Impala *Polly* he will tension the caps to 17% for a windy race.

If you have a keel-stepped fractional rig with swept spreaders you should carry out this stage with the backstay fully tensioned, as it will initiate a bend in the mast which is fixed by tightening the caps. If you do this, be careful that the mast does not go out of column side to side – if it does, ease the backstay slightly.

Once the caps are tensioned, sight up



Use the main halyard to measure to the cap shroud chainplates on both sides



A gauge makes rig set-up easier

the mainsail luff groove to check whether the mast has any bend, fore and aft or side to side. If you have swept spreaders you can expect it to have some fore and aft bend, but otherwise it should still be in column. If it isn't, don't worry too much unless the bend is large, as you can remove small errors with the lower shrouds.

Set the mast pre-bend

The lower (and intermediate, if you have them) shrouds are your opportunity to set fore and aft mast bend, as well as preventing the middle of the mast sagging off to leeward. It's advisable to have at least some pre-bend in your mast to avoid it inverting downwind.

For straight spreader rigs, the lowers do all the work in setting bend. Start by tensioning the babystay or forward lowers. The optimum amount depends on how your mainsail is cut – for a stiff masthead rig like mine I only look for about 10cm of bend with the backstay off, measured by holding the main halyard tight to the foot of the mast and eyeballing the deflection. This usually equates to around 7% of the wire break load on the gauge. For more flexible masts and fractional rigs, you will probably need more bend. Again, use the tension gauge to keep the tension even from side to side. Finally, tighten the aft lowers, enough to remove any slack but not to significantly alter the mast bend.

Swept spreader rigs will tend to have lower and intermediate shrouds set abaft the mast, so the simplest thing to do is to tighten them enough to maintain the bend set when you tensioned the cap shrouds. The tighter they are, the less the mast wants to bend, which will help transfer backstay tension to the forestay but will make it harder to flatten the main with mast bend. The optimum setting will depend on your sails and the conditions.



Use a second spanner to hold the shroud still when tensioning the bottlescrew



Sight up the luff groove to check that the mast is in column from side to side

Check the mast is straight

With the fore and aft bend set, check the mast is still in column side to side. Hopefully it will be, but if it isn't, use the lowers and intermediates to true it up. On a single spreader rig the aft lowers are usually the best tool for this, but if the bend is significant you might need to relax the opposite forward lower, if there is one, to allow the mast to move. If you do, make sure you retain the fore and aft bend, and keep checking the tensions in all the lowers to keep them as even as possible.

With the bend set and the mast straight, go back and check the tension in the cap shrouds. It may have reduced with the mast bend, in which case bring it back up to your desired tension.

Tension the backstay

With the rig basically set up, tension the backstay bottlescrews to your minimum working tension. I set ours to about 7% of the wire load, with application of the tensioner taking it up to around 17%. Even on a stiff masthead rig like ours, this compresses the mast enough to introduce significantly more bend, and more importantly for us dramatically increases forestay tension.

If you don't use a backstay adjuster, set the backstay to a similar tension to that of the cap shrouds, then go forward and check the forestay. The tension should be similar, and will help with your upwind performance.



With a backstay bridle like this, check the tension above the joining plate

Go sailing

The above will give you a good initial set-up, but there's no substitute for seeing how it behaves under sail. Head out in a moderate breeze, put the boat on the wind and hand over the helm to someone else. Then check your leeward cap shrouds. They should still be taut in these conditions – if they aren't, you need more rig tension.

Next, sight up the mast to check it is still in column. If the middle sags to leeward, tighten the lowers.

If the tip sags off it could be the middle popping to windward or the tip sagging. Both over-tight lowers and loose cap shrouds will have this effect, and it can be dangerous as it reduces the angle at which the cap shroud meets the masthead, making its support less effective. If you have this problem, check your tension settings before making a decision which to alter.



In a moderate breeze the leeward shrouds should stay taut

PBO conclusion

A well-tuned rig makes a boat sail better, while ensuring your mast is correctly supported is a safety essential. As mentioned at the beginning of this article, boats move, so although you should be able to leave your mast rake and side-to-side centring alone, keep an eye on the shroud tensions. They may well reduce, especially in the first weeks after setting up the rig, so don't assume that all is well. You keep an eye on your engine levels – five minutes with a tension gauge or a wander around the deck under sail will do the same for your rig.

