

Tuning Guide

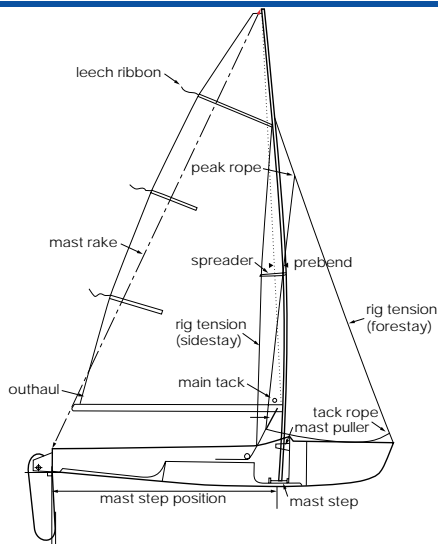
470



NORTH SAILS

NORTH SAILS JAPAN CO.,LTD.

2001.3.1



Before Tuning...

It's important to tune the mast to get the best sail shape while sailing. For this reason, checking the boat settings is very important. It's better to ensure mast is straight and in symmetry. The alignment and positioning of rudder and centerboard is also important. Otherwise you can't get correct data.

These data are for 470 sails produced in North Sails Japan Loft. You should consider these data as a guide to find your best settings according to your crew weight and type of masts.

Mast Rake

Mast rake will affect helm balance and sail force. When you feel overpowered, you should rake the mast aft to de-power. It makes less overlap between main and jib. Doing so will:

1. increase mast bend
2. reduce heeling moment
3. balance helm from resulting flatter mainsail shape
4. increase the forestay angle makes the forestay tighter

But with too much aft-rake in full power condition, you will lose the power, speed and height. If your crew weight is light or you use a hard mast, you will meet overpowered condition in lower range than standard, so you must rake the mast further aft and more earlier.

To set up the mast to measure the rake, you should be using standard rig tension, the deck chock loose, and the tape measure at the mainsail maximum hoist position. The rake is measured to the top of the transom on the centreline.

Wind Range	0-7m/s	7-9m/s	9m/s-
Mast Rake	6720-6740mm	6670-6690mm	6630-6650mm

For light weight team wanting to cover wide wind range with one setting, base setting is 6700-6730mm. For heavy weight team wanting to get more power at lighter wind range, you should set mast rake as 6740-6770mm. Higher rake makes more power, but also you will feel overpowered earlier.

Rig Tension

Why is rig tension required?

1. To transfer wind pressure of sails to the hull sensitively.
2. Prevent forestay from sagging.
3. To control the mast bend which affects the mainsail shape.

If rig tension is loose,

1. Unstable rig leads to loss of force.
2. Jib sail will get deeper and attack angle will become wider which can reduce pointing.
3. Can not control mast bend.

*There are 3 types of tension gauges. Loose Model A (Plate:Left), Loose Model PT-1 Metric (Spring:Middle), Super Spars (Plate:Right). The tension unit number is all different.

The average diameter of side stays is 3mm, and there is more twisted standard wire (1*19) and less twisted hard wire. Refer this chart, because numbers are all different.



Tension Gauge		Loose A	PT-1	S. Spars
Sidestay	Standard	41-42	33-34	35-36
	Hard	42-43	34-35	36-37
Forestay	(measure over the sail)	34-36	25-26	28-29

Mast Step

This position affects sail balance. When the mast step moves forward, it decreases pre-bend and increases overlap with jib sail. When mast step moves aft, it increases pre-bend and decreases overlap with the jib. The characteristic of the different boat designs affect the boat balance and therefore, the step position will be different from one boat builder to the next. The position of the shroud base also affects where the step should be. Generally, if the shroud base position is forward, then the mast base should be at the forward position.

Hull type	Step Position
Tiegel-mayer	3100 ±10mm
Mackay	3095 ±10mm
Devoti	3100 ±10mm
Navtivala	3095 ±10mm

Mast Puller

This controls mast fore and aft bend. At full power sailing, the mainsail requires the deepest camber from the view point of lift. You should pull up to 20-30mm bend at spreader position, this is maximum puller. We set the puller in response to wind speed. You should provide big bend in flat water and small bend in rough water.

In light conditions, you can use the puller to induce pre-bend to keep the ideal camber.

Spreaders

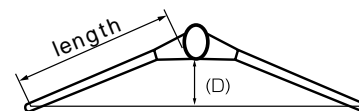
[Length]

Spreader length can control mast side-bend. Spreader deflection can control mast fore and aft bend. Spreader setup has a close relation with crew weight. You should find the proper length from the table below.

[Deflection]

The deflection is the final measurement for mast tuning after the rig tension, mast step position and rake is set. You will find the deflection measurement at the spreaders to be between 130 mm and 150 mm with no mast chock.

Measurement: Set the Rig Tension as Sailing Condition and release the Puller, then measure the distance of (D).



Mast type	Length
SUPER SPAR M7	470-490mm
SUPER SPAR M7+	460-480mm

For light weight (under 115kg) teams, you should try shorter than the above number.

Pre-bend

Pre-bend is defined by mast step position, spreader and rig tension. If pre-bend is small at light and heavy wind conditions, it results in loss of speed from too much deeper sail shape and less leech twist. (high drag & sideforce.)

Appropriate pre-bend may be changed by stiffness of mast and crew weight. For a soft mast or heavy weight team, you should set a small pre-bend. For stiff mast or light weight team, you should set more pre-bend.

Measurement: Mast Pre-bend is measured using a stringline on the aft face of the mast touching the back of the track at the mainsail luff black bands. The measurement position is at the spreader position.

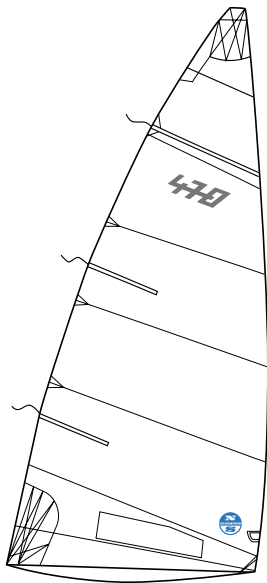
Mast Type	Prebend(A4)	Prebend(A9)
SUPER SPAR M7	40-50mm	70-75mm
SUPER SPAR M7+	50-60mm	75-80mm

*These numbers are for regular mast rake.

For light weight (under 115kg) teams, you should use more pre-bend than the above number according to your crew weight.

Leech Ribbons

The top Leech ribbon is sign of sail twist at under 4m/s condition. A ribbon flowing constantly means too much twist, and stall means too tight twist. You should control the leech to keep the top ribbon flowing at 50%-80% ratio (middle and bottom ribbon should be flying constantly).

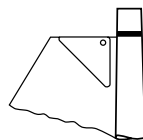


Outhaul

Outhaul can be eased 10mm-15mm from inner black band under 0-5m/s condition. If you need power in bad wave conditions, the outhaul can be eased to 10-25mm. Over 5m/s condition, when you feel overpowered a little, you should pull the outhaul to the black band. The mainsail tack should be touching the aft face of the mast when you are getting back wind. (refer to the section about the mainsail tack rope.)

Peak

You should adjust the main halyard length so that the peak of mainsail (upper edge of head board) is the same height as lower edge of the mast top black band.



It's important that you should hoist the main halyard to this position for measuring mast rake.

Cunningham

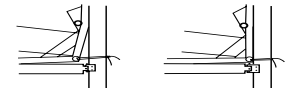
When you pull the cunningham, the draft position will be moved forward and the leech will be opened giving a flatter shape. As the wind increases, there is a tendency that the draft will move aft. So you should pull the cunningham to get the proper draft position. In maximum wind condition, you must pull the cunningham harder until the ring is sitting near the tack position.

Tack Rope

Mainsail has cutback tack for more wider control of depth:

fullpower -- set sail edge at tack 10 mm apart from backside of mast.

overpower -- set sail edge at tack nearby the mast when backwind appears.



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Tack Rope and Outhaul control

Condition	Tack Rope (Mast side)	Outhaul (Black Band)
0m/s- Full Trapeze or just before (no vang)	10mm apart	ease 10-15mm
Full Trapeze - use some vang	10mm apart	pull until at the black band
Boom is constantly out of boat	0mm	pull until at the black band

Trim Line

When Jib track position is right and you luff up the boat, all telltales will respond at the same time, because of effect of backwind at luff. Our sail includes a trim line which makes the lead angle easy to find up to full power sailing. This trim line shows proper track position when trim line and jib sheet is on the same line. This means good jib sail trim (middle batten is parallel to boat center line).

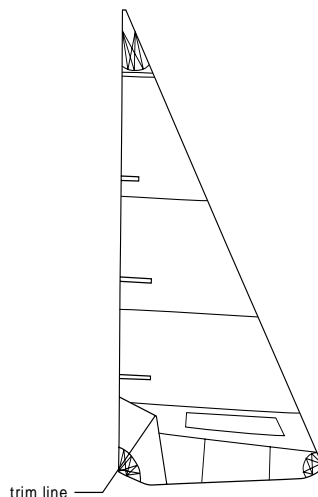
The trim line supports your lead angle trim up to full power sailing. When you feel over power from increasing wind speed, you should move the track position aft in relation to sail power. It is necessary to open leech in accordance with

keeping a proper slot between main and jib, because over-sheeting the jib causes the main boom to be eased too far in order to reduce heel. This means lower pointing.

Full Power

We define the Full Power Condition as the situation where we can keep the boat flat without the loss of wind power and hold the boom in the center with full trapeze. It's important to tune the mast to derive as much thrust as possible.

You should control the mast bend to deal with overpower and underpower condition.



Peak Rope

If you hoist the jib sail higher, it makes more gap between the sail foot and deck. Wind which flows under the jib foot is turbulent and causes loss of efficiency. You should adjust the peak rope so that the jib foot just touches the waterbreak at full power sailing. At this height, it makes the most effective sail area with end-plate effect of foredeck and less overlap of mainsail.



Tack Rope

You should use only light tension up to the middle wind range (4m/s). There should be almost no tension on the sail material behind luff tape. Too much tension makes the entry angle too wide and can damage the material which has a biased orientation at this edge. In strong wind, try to keep the creases out of the luff.

Tuning Data Example

	Wind range	Mast rake	
0	0-4m/s	6750mm	Light Wind Special
1	0-6m/s	6720mm	
2	7-9m/s	6690mm	>1/2pin shorter
3	9-10m/s	6660mm	>1/2pin shorter
4	10m/s-	6630mm	>1/2pin shorter

Trimming Table

Wind range	0-2m/s	3-4m/s	4-7m/s	7-9m/s	9m/s over
mast bend during sailing					
	← Same amount of bend →				
mast prebend					
A4 A9	50-60mm 75-80mm	40-30mm 60-75mm	30-20mm 70-80mm	30-65mm 90-100mm	60-90mm 100mm-
mast puller					12m/s Ease according to windspeed
main and jib leech tension					
vang tension	no vang	If you can't hold the boom in the center, use some vang		As the wind increases use more vang	Over 12m/s ease vang tension to depower mainsail
cunningham	no cunningham	Pull wrinkles out of luff if you can't hold the boom in the center		gradually pull →	Maximum
outhaul	clew in approximately 15mm. In waves, outhaul can be eased to 25-40mm. The mainsail tack should be 10mm from the aft face of the mast.			As the wind increases, pull outhaul until at the black band. The mainsail tack should be touching the aft face of the mast.	
boom position	3- 4 boom widths to leeward of the centreline.	centerline	As the boat becomes overpowered, boom position is further to leeward side. →		
jib track	align the fairlead with the trimline			3-8 cm aft of trimline if the boom is constantly off the centreline →	3-10 cm back from trimline position. Jib leech will open more with aft mast rake.
jib tack	wrinkles just removed from luff			gradually pull →	pull tight

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