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Fritz Dragon Sails

Experiments by Vincent Hoesch and Werner Fritz,
collected, fine tuned and summarized by
Vincent Hoesch



Tuning advice for your *Fritz Dragonsails*

“Sailing fast, even being the fastest” -- isn't that what everybody wants? Our tuning instructions for your *Fritz Dragonsails* is made to help you achieve this goal.

Hard to believe, but our combination of the Allround main, Allround genoa-and-spinnaker has won the world championships 2003 in Tasmania, the 2003 Kieler Woche, the Europeans 2004, the Regattes Royales 2004 and prizes in regattas on most inland lakes.

Why? Simply because of perfectly fitting sails whose rig is tuned to the sail and not vice versa. Meeting those requirements, there are three main methods of tuning, only two of which may be applied while sailing:

- 1. The Runners :** They must be easy to use and run smoothly, so that the maximum tension of 16 lu (= units on LOOS PT 2M Gauge) on the runner wire can be reached.
- 2. The Mastlever (=ram):** With this you can bend the mast forward or trim it straight when sailing upwind.
- 3. The Shrouds:** These have to be tuned before the race starts, as it is not allowed to regulate them while racing. Therefore, it is very important to know how much tension you had on the shrouds before you left the dock and how much more or less tension you get when you increase or decrease the tension. In general, it is better to have too little tension than too much.

Of course, the **outhaul**, the **genoa halyard** tension, the **main- and genoa sheet**, and all the other means of tuning have to be handled easily and without any problems, but the decisive detail is in trimming the mast. Therefore, our tuning guide is the basis for the perfect tuning. Despite our utmost efforts to explain everything in detail, individual questions will certainly turn up which we would like to assist you with. We can help you personally during regattas if Werner Fritz or Vincent Hoesch are present or you can contact us via e-mail under info@fritz-segel.de or vincent2@t-online.de

For those who can't wait to try it out for themselves, Vincent Hoesch offers tuning and regatta trainings on his web site. www.vincent-hoesch.de

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II. Short tuning guide

1. TUNING THE RIG

Before you start: Use the "LOOS GAUGE PT-2M" for all measurements on shrouds, runners and forestay, since all measurements given below refer to that device. The point of measurement is appr. 1450 mm above the deck for all, shrouds and runners. All measurements on the upper shrouds have to be taken **without the plastic** shroud protection. To take measurements, cut the plastic at the point of measurement (1450 mm above deck) and apply the Gauge at the wire. This professional tension meter is by far the best your money can buy nowadays. Available at *FRITZ Sails*, Fax: +49-8051- 62202, e-mail: info@fritz-segel.de, or at Vincent Hoesch; e-mail: vincent-2@t-online.de.

Explanation of abbreviations: lu = are the measurements taken with the LOOS GAUGE; LW=light wind; MW = medium wind; HW= heavy winds; fw= flat water; cw= choppy water;

<i>Upper shrouds=US:</i>	LW (= 0 - 4 kn)	14 lu in cw;	15 lu in fw
<i>(=also uppers)</i>	MW I (= 5 - 10 kn)	15 -16 lu in cw;	16 -17 lu in fw
	MW II (= 11 - 16 kn)	17 -19 lu in cw;	18 -21 lu in fw
	HW (= 17 - 32 kn)	20 -28 lu in cw;	22 -10 lu in fw

Take all measurements with both runners set at 6 lu or tapemark 80mm over deck!

<i>Lower shrouds=LS:</i>	LW (=0 - 4 kn)	loose in cw	loose in fw
<i>(also lowers)</i>	MW I (= 5 - 10 kn)	6 - 7 lu in cw	6 - 8 lu in fw
	MW II (= 11 - 16 kn)	8 - 9 lu in cw	9-10 lu in fw
	HW (= 16 - 32 kn)	10 -13 lu in cw	11-14 lu in fw

Attention: Masts of different brands sometimes need different tensions in the lowers. The measurements above refer to most masttypes. Always check the sideways bend of the mast while sailing upwind. Lay down on the foredeck with your legs facing to the bow. Look at the sail track from behind the mast and check, if the mast is in line or bending leeward or even windward at the spreader. **The best thing to have is a straight mast when seen in the sailtrack.**

Shroud positions: All measurements are taken from station #4 towards astern up to the middle of the upper and lower shrouds.

Petticrows: US 790 - 800 mm behind station #4 ; LS 820 - 830 mm behind station 4

Börressen: US 790 - 810 mm behind station #4 ; LS 820 - 840 mm behind station 4

Glas : US 790 - 800 mm behind station #4 ; LS 820 - 830 mm behind station 4

Mast rake: Numbers for all boat types: All conditions = 1215 mm according to the method of measuring the mast rake (see page 9 of the detailed tuning guide)

Mast butt position: There is no fixed position, since the mast butt track is fixed in different positions depending on the type of boat you have.

Mastfront : Distance from station#4 to mastfront, when mastlever is set all the way back: 830 - 840mm. If upper shrouds are on 790mm behind station#4, mastfront should be on 830mm!! This is the recommended 40mm distance in between mastfront and uppers.

Jumpers: It is hard to give any reliable numbers, except for the fixed ones. Here some ideas for the adjustable ones: LW up to 4 knots: jumpers slack (more twist possible in the main sail). Wind from 7 to 15 knots: a bit tighter, use the lever for sideways adjustment to straighten your masthead in order to build up pressure. HW: jumpers set, that masthead comes straight; above 15 knots, keep the jumpers a bit looser, but masthead always straight (only possible with sideways adjustable ones.)

Backstay: The backstay is good to prebend the mast when sailing upwind in LW. Otherwise it is only used to secure the mast when jibing while sailing downwind.

Ram (to control the Upwind: LW up to 5 kn: push 10-15 mm forward and put the puller in.

mast bend: MW (from 6-15 kn): pull back completely so that you have a minimal forward bend in the mast. HW (more than 16 kn): push 10-15 mm forward. When sailing down wind, push the puller forward into maximum position (50 mm). When reaching, put it into neutral position, that the mast can't bend backwards.

2. TUNING THE MAINSAIL

Main sheet, upwind: The top batten should be parallel to the main boom. Put several reference marks on the main sheet in order to compare with other boats while tuning, until you have a "good feeling" about where the correct position of the mainsheet is. Change your trim according to wind conditions and your way of steering.

Outhaul:

The outhaul is adjusted only slightly

(10-50 mm) for the beat and is usually set once when

weather conditions are constant. Make sure that the outhaul is easy to handle, so that you can change it at any time if necessary. A ratio of 1:12 is optimal. The length of the outhaul differs depending on the manufacturer. Therefore, use the fold that turns up when pulling the outhaul parallel to the boom as a point of reference for the tension. **LW up to 4 kn**, the fold parallel to the boom should appear only slightly, in cw looser. **MW I up to 1 kn**, the fold should be seen in fw, in cw keep the outhaul looser. **MW II up to 18 kn**, the fold should be seen clearly, almost maximum tight. **Above 18 kn**: the outhaul should always be set at its maximum astern mark. On downwind courses, you should always open the outhaul so that the full depth of the sail can be used. Reference: 60mm in HW and up to 100mm in medium winds measured off the black band.

Boom vang: The vang should be set on a tight reach so that the **top batten lines up with the boom**. Going downwind, ease the vang so that the sail can open up (in upwind the vang is always loose).

1. TUNING THE GENOA

Genoa shape: In most weather conditions, the leech should be tuned **60-80 mm off the spreader tips**. In MW tune it closer to 30-50 mm, and in HW, tune it to 80-120 mm off the spreadertips when the genoa sheet has been tuned to an upwind position i.e. the foot of the genoa is touching the upper shrouds (by adjusting barberhauler and sheet) and the luff has been set properly (halyard). In MW conditions and flat water, you can tune it even closer to the spreader (30mm), but only as far as it will go without any signs of backwind in the main sail.

Genoa barber: Is tuned after the genoa sheet has been set. **LW:** The genoa outhaul is touching the uppers only 100-150 mm above deck (a.d.) **MW:** The genoa outhaul is touching the uppers at a height of 200-350 mm (a.d.) **HW:** The genoa outhaul is touching the uppers at a height of 400-500mm. **Important:** Tune it so that the genoa is set off the spreader as described under "genoa shape." Look from astern on the leeward side towards the genoa leech.

Genoa lead in & out: Measurements for the genoa lead in and out are taken from the outer edge of the deck where it meets the hull. Tune as following: **LW:** 360 mm from the edge; **MW:** 330 mm in fw and 300 mm in cw from the edge; **HW:** 250 -200 mm from the edge.

Genoa halyard tension: Tune the halyard in all wind conditions as follows: Get only as much tension as is necessary to get rid of the cross wrinkles at the luff. In light or middle air, small wrinkles in the luff may appear. *(Make sure that the luff is never overstretched because it will wear out your sails faster, though it will make your sail maker happy.)*

4. RUNNERS:

Upwind: **First of all: Get maximum tension on the runners for heavy air (16 lu):** Have the mast set as follows: Put the rake at 1215mm and tighten the runner on the port side up to 16lu, measured with the LOOS Gauge. Fix tape around the runner cable just above the deck where it intersects the opening or deck swivel. Now repeat the procedure on the starboard side. Do the same on the other side. Then you'll have the reference mark for the tightest position of the runners in HW. Double check the tension on the runners again and then at the forestay: **With the maximum tension on the runners you should measure 34-35 lu on the forestay!! Set your runners in different wind conditions as follows (reference mark is the tape above the deck): In cw up to 17 kn, you have to ease the tension of the runners around 20 -10 mm compared to the following measurements: 0 - 4kn = loose -to 200 mm; 5 - 8 kn = 160 to 110 mm; 9-12 kn = 110 to 100 mm; 11 - 16 kn = 90 to 50 mm; 17 -20 kn = 40 to 10 mm; 20 - 25kn = 20 to 00 mm; 25 + kn: = 00mm (= maximum tight).**

Beam Reach: When sailing reaches in LW, ease the runners up to the maximum of 110 mm above the deck. In MW, ease them up to 280 - 200 mm, and in HW, up to 180 - 100 mm. This allows the mast to "breathe." Push the ram 20 - 10mm forward.

Downwind: When sailing downwind, ease runners 650 - 680 mm and have the ram pushed all the way (50 mm) forward. Make sure your mast only bends slightly forward on a breezy run. Mark this loosest position on the coarse adjustment of the runners (680 - 700mm above deck), with a loose fine adjustment.

III). Detailed Dragon Tuning Guide

Before rigging the boat you should check the mast. Put the mast on two stands and check by looking up and down to see if it is straight. If not, carefully try to make it straight.

1. Adjusting the height of the spreader tip

The new *Petticrows* masts allow you to adjust the height of the spreader tip. The goal is to prevent the spreader from "hanging down." Measure the distance from each spreader tip to the chain plate to confirm that both spreaders are set at the same height. Tighten the spreader tip fitting on the upper shrouds ("US") at a location where the height of the spreader is correct.

2. Covering

Tape the spreader tip to prevent the sails from chafing on it. Also take the opportunity to cover all cotter pins and bolts carefully with tape.

3. Tuning the jumpers

If you have fixed jumpers which are not adjustable from the cockpit on your dragon, set the tension to 9-10 lu. We recommend putting the jumpers in fixed position only if the angle of the jumpstay is set *as open as permitted by Dragon rules*. The rule is that the chord from top to top should be a minimum of 10 mm (with that angle you can carry 11-12lu on the jumperwire), but you can be sure that this is only the case with a few newer masts or those made in 2003. Naturally, you can change the angle of the jumpstays by welding, if you want to sail with fixed jumpers. Vincent Hoesch will certainly help you there.

Check several times to see if the masthead is straight because once the boat has been rigged, you can only change the jumpers on top on a ladder, which is dangerous. It is much simpler with adjustable jumpers because you can tune them from inside the boat.

4. Shock cord as a safety device on the lower shrouds ("LS"):

If you sail with the spinnaker boom on the main boom, you should tie a piece of shock cord around the mast and LS. The shock cord should be 100 mm long and 3 mm in diameter. This prevents the spinnaker pole lift from getting stuck between the mast and the lower shrouds.

5. Checking bolts and screws on the mast

It can be helpful to check all screws, rings, pins, bolts or rivets on the mast now and then. Vibrations during transport or sailing can make them loose. Loose screws should be taken out and put back with special glue for securing screws (brand name: Loctite). Clean the shrouds, halyards and the stays with water and washing powder or acetone, which helps you prevent your sails and your genoa luff from getting ugly black streaks. Lubricate the rig with "Ballistol". Cleaning the mast is also useful for finding loose screws, rivets, and hook traps.

6. Suspension of runners

A quick glance at the suspension of the runners on the mast can save you a lot of trouble. **Especially look at the system in which the wire of the runners is fixed within the mast, since the runners tend to break right at the hole.** Always check there and when in doubt, change it. If they tend to break, we recommend using the *Petticrows* system. Broken runners can cost you the mast or even a good placement in races.

7. Check damage on main and jib halyard

Check your main halyard regularly for damage at the ball. It is especially necessary in HW, since a broken main halyard could cost you a good result. You should also check the genoa halyard. We use bee wax for the halyards to protect them. This is useful because the halyards run more smoothly and don't wear out as quickly. You will also notice any damage while waxing.

8. Fixing the wind direction indicator and telltales

Don't forget to install your wind direction indicator. We would recommend using "HAWK" for dinghies, since it is light (about 25gr.), easy to install and not twistable. Also install a telltale 2 metres above the deck on each of the US and LS (taken from a cassette tape). This will be enormously helpful to both the helmsman and the crew.

Those who regularly carry out a quick check before rigging the boat can save a lot of trouble and fiddling while sailing!

1). Tuning the rig

Influence and interplay of the tension of the US and the LS, tension of forestay, runners and ram in downwind conditions.

In order to understand the tuning of a boat and apply it, one has to get familiar with the function of the different meanings of tuning and the results of tuning procedures in different wind and water conditions.

The tuning objective in light winds below 1,5 - 3kn is to decrease tension by opening the leech of the main-sail:

Weight distribution of the crew: Both, crew and helmsman should sit on the leeward rail. In wind conditions of less than 1.5kn of wind, the helmsman/-woman should move from the bench to the leeward rail as well. Above 3 kn, he/she should sit windward on the edge, if the 2 crewmembers to leeward can heel the boat enough. Having enough heel in the boat is fundamental in LW!!

The tuning objective in LW (0,5 - 3kn) in fw is to get the mast to bend enough to flatten the main sail and open up the leech in the head of the sail.

A light breeze (0,5 - 3kn) enables the air to stay longer and flow more smoothly in a flat opening sail. In LW and cw one wants the mast to bend less in order to create more tension in the main sail.

In LW, you sail with little tension in the forestay, which makes steering easier. You can reach this prebend in the mast and the sag in the genoa by:

- 1. pulling the ram 10 -15 mm forward off the zero position**
- 2. by a little tension on the backstay.(applies only in light winds!!)**

The runners and the adjustable jumpers should be set loosely up to 1,5kn. Above 2kn, pull the runners slightly. Tune the boat in LW up to 2kn to the full weight of the crew on the leeward side in order to reach the necessary heel for LW. Above 1,5 kn, one should reach a heel of 7-10 degrees, but the helmsperson should always steer from a windward position, if possible. The jumpers should only be used from 1,5 kn upwards and tune, if necessary, the masthead straight seen sideways by using the jumper adjustment.

Remember: The lighter the air, *the fuller and faster you should steer, dont concentrate on pointing!* If there are choppy water conditions, "drive" the boat on the "speedside", dont squeeze it, as pointing is a result of speed!! The telltales in the genoa luff should run parallel on the windward and leeward sides.

The tuning objective in MW I from 4 - 9 kn is controlled pressure building.

Contribution of weight: The helmsman sits on the windward edge; the crew on the leeward side or in the middle of the boat. From about 4 kn and up, the middle person should sit windward in the cockpit. From 5 kn and up, he should move to the windward edge. In conditions of more than 8-9kn and fw, all three can already sit on the windward edge.

Attention: whereas in very copy waters the boat must be heeled more, the total weight of the crew should be shifted to the edge only at more than 10-11 kn.

The tuning objective in MW I from 4-8 kn is a straight mast (ram at zero, see p.11, paragraph E). The result is a deeper mainsail, which can be controlled at the leech, which leads to more pointing ability and speed.

The top batten should run roughly parallel to the main boom! From 8 kn onward the sag in the genoa luff is reduced by **increasing the tension on the runners** and also by **pulling the ram back** in order to sail higher.

The masthead above the jumpstay should under no condition bend toward the leeward side. Therefore, tune the jumpers sideways and windward. If the jumpers are adjustable on both sides, one should tune the mast in such a way that it is straight above the jumpstay. This will lead to a higher pointing ability and speed. **Attention:** Don't use too much tension on the runners in a chop.

Remember: The flatter the genoa entry is, the better the pointing ability, but only if one is sailing straight and pointing. (The telltales are touching the boat on the windward and the leeward sides). It is only better to heel more in cw.

The tuning objective in MW II from 9 - 16 kn is maximum pressure in the sails.

Distribution of the weight: Helmsman and crew should hang windward and try to sail the boat flat. The tuning objective in Mw II from 9 - 16 kn is to keep the mast straight by increasing the tension in the US.

The lower shrouds (LS) should be tuned so, that the mast is straight at the height of the spreader when looking into the sailtrack from behind the mast.

A flat entry of the genoa can only be reached by a high tension in the runners, which bends the mast forward (positive bend) at the same time. The ram will therefore be kept at zero (pulled back totally). The genoa and main sheet are trimmed increasingly tighter in conditions of more than 9 kn, but above 13-15 kn you have to allow the mainsail leech to open in order **to keep the optimal heeling of 7-10 degrees**. The more wind you have, the more you have to point the boat. (you will see backwind in the genoa entry)
 The telltales on the genoa must be parallel to the leeward ones from 3 - 15 kn. From 16 kn onward they can move up 10-20 degrees. In more than 19 kn, they should move up 20-40 degrees in order to sail the boat flat. **The genoa is, depending on the weight of the crew, at 16 -20 kn, sailed with a backwind in the entry (a 150-450 mm from the luff).**

The tuning objective in high winds of more than 17 kn is to release tension according to the rules; survival training at 29-38 kn means that everybody hikes out as far as possible.

The tuning objective in HW over 23 kn is to achieve forward/positive mast bend. In order to achieve this, you push the ram 5-15 mm forward from zero and tune the runners as tightly as possible (16lu!). At the height of the spreader, the mast should be straight sideways. Only when you have a light crew may it bend slightly windward above the spreader, which you can achieve by increasing the tension in the LS, but keep the uppers on the given numbers from 24 in 20kn and more, if the wind increases.

In this kind of tuning and when you have a very small bend leeward at the forestay, you can only reach the necessary forward bend in the mast when you pull the runners very tight.

All these adjustments release the pressure on the heeling and allow you to sail the boat with minimum helm and with a high pointing ability.

The jumpers are tuned only slightly in the middle adjustment and are geared toward the windward side in the head so that the mast is straight. The boat is pointed until the windward indicators move up considerably. The heeling shouldn't exceed 10-12 degrees when sailing in HW either. Adjust the main traveller, depending on the weight of the crew, from 17 kn and up, 50-100 mm, and from 22 kn and up, 200 mm leeward, and pull hard on the main sheet.

Attention: Don't pull the backstay, because a little too much tension will open up the head of the main sail, make it flat, and take away the momentum of the main sail in the head.

Sailing in HW of more than 25 kn is a question of adaptation and enjoyment, since tuning, weight of the crew, physical condition, patience, courage and experience are important factors in successfully finishing a race in HW. If you have the right tuning, you will see how much fun sailing in HW can be!

A). Upper Shrouds

The goal is to have a straight mast. You can check this by looking up from behind the sail track to confirm that there is no sideways bend in the mast. Very light crews will tune the mast so that the top bends a bit off. The lowers are tuned rather tightly, **but only until you reach 70 % of the tension of the uppers. (e.g. upper shrouds on 28 lu and lower shrouds on 20-21 lu)**

Remember: The sideways bending in the mast is affected by 4 factors: The opening of the deck which may not be too wide, the upper-, the lower shrouds and the jumpstay.

The upper shrouds control the sideways bending of the mast between the deck and the attachment point of the upper shrouds and to a small extent also the head and the jumpers when tuned.

The lower shrouds influence the sideways bending of the mast between the deck and the spreader and up to the attachment point of the uppers.

The jumpers only regulate the mast head above the attachment point of the uppers, but you shouldn't forget that jumpers pulled very tight can influence the bending of the mast head significantly.

Pay attention when measuring the tension of the shrouds: The measuring point for the "Loose Gauge" for all measurements at shrouds, forestay and runners is about 1450 mm above the deck. Lu are the units of measure with the "Loose Gauge"; when measuring the tension of the uppers **do the following:**

Set both runners at 6 lu and have mast ram at zero. All measurements should be taken without the plastic protection on the shrouds. We usually cut the plastic protection on the uppers twice in order to being able to apply the Gauge down at the two Teflon wheels and up at the measure groove.

Numbers for uppers shrouds:

LW:	0 - 4 kn	14 lu in cw	15 lu in fw
MW I:	5 -10 kn	15 -17 lu in cw	16 -17 lu in fw
MW II:	11 - 16 kn	18 -21 lu in cw	19 -21 lu in fw
SW:	17 - 32 kn	22 -28 lu in cw	25 -10 lu in fw

To reduce power in high winds, pull the runners tight, push the ram forward, put the main traveller leeward, increase the tension on the LS, and reduce the tension in the jumpers.

Attention: The jumpers must be loose. Check to see if the masthead is straight or if one of the jumper adjustments pulled it to the side by looking into the groove. Should your mast head, despite several attempts, bend toward one side because it is slightly bent, tune the jumpers as long as the mast, looking at the sail track, seems to be straight.

After tuning the mast, jumpers and shrouds according to the units above, take a steel tape measure, pull it up with the main halyard and let the ball click into the lock. Now measure the distance on both sides at the reference point (e.g. the connection between the hull and the deck) to see if the masthead is in the middle of the boat.

Don't forget to pull the tape measure straight (for this reason steel ones are best), and watch out for the wind coming from the side. If you get different results on each side, you have to change the shrouds until the masthead is straight. This procedure can take some time. When you have satisfying results, write down the measurements in your tuning guide.

B). Lower Shrouds ("LS")

The LS control the sideways bending of the mast between the deck and the spreader and the region of the intersection of the US. Very loose LS let the mast bend leeward at the spreader, narrow the slot between genoa and main, increase the pressure, and make the main get fuller in the lower and middle section.

Our measurements for the LS are only reference points. The best way to tune the LS is to look up the sail track while sailing upwind.

Rule: The mast should only bend slightly to the leeward below the spreader in winds from 8 -14kn. In all other winds, the goal is to have the mast straight sideways, when checked thru the mast track.

Pay attention to the tension of the LS: Masts of different producers may be tuned with different measurements for the LS. **Solution:** Always check the mast before racing when sailing upwind by looking at the groove of the mast from behind to see if it is straight, bent leeward, or bent windward at the spreader.

Write the numbers in your race record log book every day, it is worth the time.

The objective is to nearly always have a straight mast when looking at the groove from behind. So use our measurements, which we took for your basic tuning:

Lower shrouds, numbers:

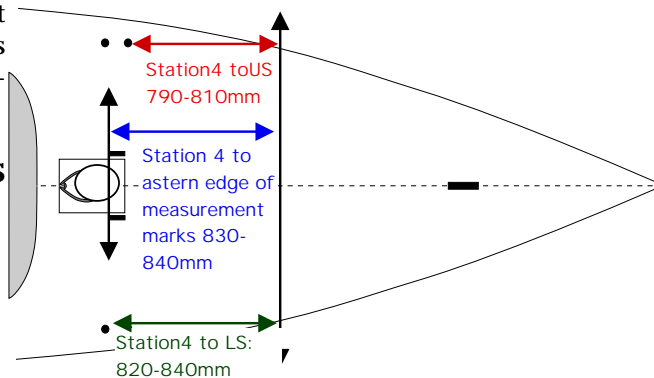
LW	(= 0 - 4 kn)	loose in cw	loose in fw
MW I	(= 5 - 10 kn)	6 - 7 lu in cw	6 - 8 lu in fw
MW II	(= 11 - 16 kn)	8 - 9 lu in cw	9 -10 lu in fw
HW	(= 16 - 32 kn)	10 -13 lu in cw	11-14 lu in fw

C). Position of shrouds thru deck:

The opening of the uppers and the lowers are the same for nearly all types of Dragon. This is the case for all boats that have similar positions of the mast step and measurements of the opening on the deck. Take all measurements relating to the US, LS and deck openings using **station #4 as a reference point**. It might be best to draw a line with a pencil across your deck in order to take or check measurements.

Measure the distance from station #4 to the US or the LS at the opening on the deck as follows:

Petticrows: US 790 -800 mm; LS 820-810 mm
 Börressen: US 790- 810 mm; LS 820-840 mm
 Glas: US 790- 800 mm; LS 820-810 mm



We generally recommend these shroud positions in all conditions. The drawing shows the distance from station #4 to the position of the US and the LS, as well as the distance between station #4 from the line across to the edge from astern of both measurement marks at the side of the mast.

Very important: If the front of the mast (excluding spinnaker boom track) is in line with the astern edge of both measurement marks on the mast (each 50 mm long), which is the zero position (see drawing on p.10), the LS will be in line with the front of the mast, and the US will be 10-40 mm farther forward. Make sure that the mast can only be moved sideways a maximum of 1 - 2mm at the deck opening(partners).

D). Length of the forestay = mastrake

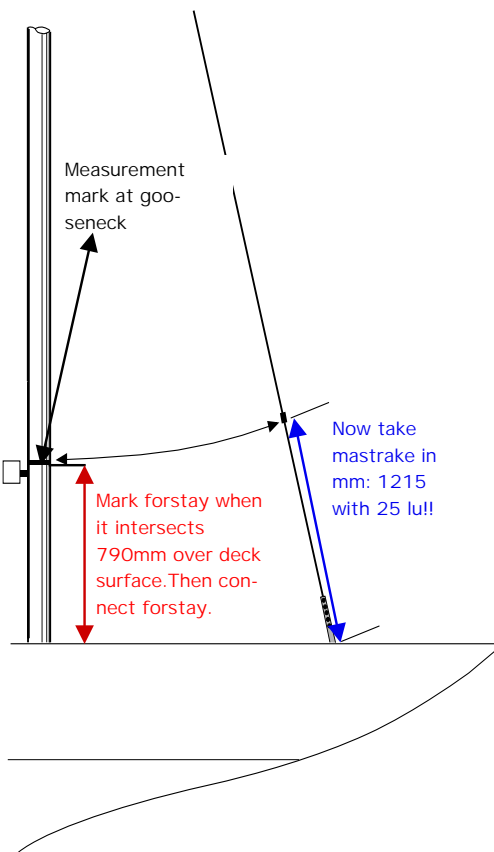
Please take this measurement very carefully, since all other measurements depend on it.

Hold a measuring tape against the mast and mark the point at 790 mm above the deck. As with most boats, this mark will be at the height of the mark at the goose neck. Don't measure from any plates or the mastflange, from the deck. Check your procedure with the drawing opposite.

Before attaching the forestay, hold it next to the mast and mark the headstay where it intersects the 790 mm mark. Do this very carefully, because the whole tuning of the boat depends on this mark.

Mark the forestay with a felt tip pen, so that **the lower edge of the mark you paint at the forestay is at the same height as the upper edge of the 790 mm mark.** Renew this mark from time to time, because it will make finding it again easier. Now attach the forestay into the metal fitting.

Now take the measurement with a measuring tape parallel to the forestay from the upper edge of the deck to the reference point which you have just marked on the forestay. Try it often so that it reaches the measurement of 1215mm. Don't forget: pull the runners until you have 25 -28 LOOS units at the forestay. We generally don't tune the rake ever again.

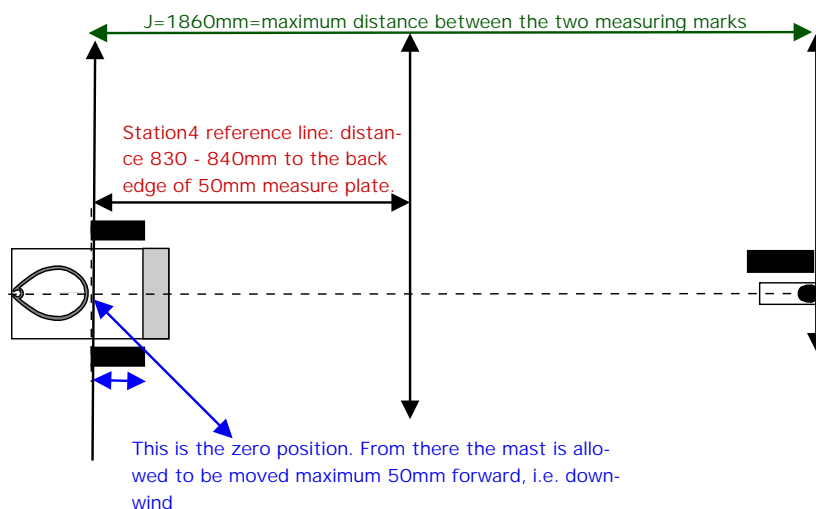


E). Mast butt position

Finding out the right mast butt position is not very easy, since the mast boot varies from boat to boat, sometimes even in boats of the same manufacturer. Since there is no way to take measurements from a reference point (e.g. from the mirror to the back edge of the mast butt), **the only thing you can do is follow our instructions on how to find the right mast butt position.**

This method is a bit time consuming, but once you have found the right position of the mast butt, you will never have any problems with your boat again. Take your time, because as with all important adjustments on your boat, you have to follow the instructions step by step and double check all measurements.

First step: Check the right position of both marks (50 mm long) next to the deck opening of the mast. First, put a line up between the measurement marks on station #4 put on the side of the hull by the manufacturer. The distance between the back edge of the 50 mm measurement point and the mark on station #4 in the middle should be between 830-840 mm. Take the opportunity also to measure the distance from the mark at the side of station #4 to the opening of the uppers on the deck (790-800 mm would be good; see also p. 9, position of shrouds thru deck)



Second step: Now you have to check the 70mm long mark at the opening of the forestay, to see if it is set properly. **Attention:** It is not a tuning measurement, but a real measurement.

According to the rules, the longest distance allowed (J measurement) from the back edge of the 50 mm marks beside the mast to the front edge of the 70 mm long measurement mark beside the forestay is 1860 mm. If necessary, you'll have to change the marks on the deck. This is allowed, you can change your rig forth and back however you want, as long as you keep the measurement of 1860mm!!!

Example: The 50mm mastmark has been set ex work, or by a preowner at 810 mm behind station #4, but you moved the mast back to 830 mm, which means 20 mm back toward astern; you also have to change the mark of the forestay 20mm back as well as the to stay with the J measurement at maximum 1860mm!!!

Third step: If you haven't rigged the boat yet, do it now and mark your forestay according to the method of taking the rake measurement (p. 9, paragraph D). Attach your forestay at a rake of 1215mm.

Fourth step: Tune your uppers and lowers to MWI tension (US--18-19 lu, LS--10 lu). Don't pull them any tighter, since you have to loosen them again sometimes when the mast butt has to be moved forwards or backwards.

Fifth step: When you pull the mast with the ram back towards zero (see drawing above), the front of the mast, **excluding the spinnaker boom track, should be in line** with the back edge of the 50 mm marks on both sides on the mast (drawing above). In order to check this, put a ruler or batten across in front of the mast to see when the front edge of the mast is in line with the back edge of both marks. **Don't forget to deduct the spinnaker boom track (7mm).** If the front edge of the mast is in front of the back edge of these marks, you must tune the ram or the turnbuckle of the shrouds between the lever and the mast in such a way that the mast can be pulled back in the deck to the line mentioned above.

Now you have reached the zero from which you can push the mast forward up to 50 mm when sailing downwind.

Sixth step: finding the **right mast butt position**: set the runner until it is in its tightest position of 16 lu, which means, it is at the opening of the deck next to the runners tape mark. Double-check the length of the forestay to make sure it's at 1215 mm, because it might have to be corrected when under tension (see paragraph 4 on p. 19 under "runners").

Remember: The maximum tension of the runners at a rake of 1215mm is at 16 lu. This runner tightening procedure seems to be very rough at first, **but if your Dragon can't take it in the harbour without waves or wind pressure, something will certainly break while sailing.**

You have tightened the runners to 16 lu at a mastrake of 1215mm and kept the jumpers loose. Pull the main halyard and hold it at the groove of the mast at the height of the black measure mark at the goose neck. Now you can see, how much the mast is bending forward (=bending positive) by measuring the distance from the groove and the main halyard at the point of the greatest distance, which is appr. at the height of the spreader.

Find out, if the whole mast is bending forward with a positive bend, standing straight, or bending backward with a negative bend at 16 lu on the runners.

When the runners are tight on 16 lu the mast must bend forward 60 - 90mm, measured in the middle at the height of the spreaders. Under no circumstances should it bend backwards. If the whole mast is bending forward more than 100 mm, the mast butt must be pushed forward one hole in the mast track. Loosen the shrouds down to 10lu on the uppers with lowers under 5lu, then put the mast butt forward one hole, which might be too much. Then check if you have to put it forward another hole, so that it is bending forward between 60-90 mm.

(Remember: all measurements have to be carried out with the maximum tension of 16 lu in the runners. US set on 22 lu and LS 10 lu and ram at zero)

If the mast is bending backwards or stays straight, the mast butt has to be pushed back toward astern until a bend of 60-90 mm is reached.

F) Jumpers

Introduction: The jumpers control the sideways and backward bending of the mast at **the point above the uppers and the forestay attachment point**. Jumpers, if individually adjustable, control the masthead in the upper region and control the sideways leeward or windward bend. For many dragons, the jumpers can be adjusted sideways separately, which prevents the mast head from leaning too much leeward in order to give the upper part of the main sail a deep, symmetrical profile.

Still, there are many reasons not to tune the jumpers: tight or fixed jumpers are tuned only once before rigging the boat and don't have to be changed ever again. Adjustable jumpers need three clamps, levers, ropes and many ratios less in the boat.

This, however, only works if the the jumper diamond has a very open angle (see drawing page12) which puts both jumpstays as straight as possible sideways of the mast.

The further the stay points are forward (this is the case with all older masts), the more the mast head bends forward by tightened fixed jumpers. It is clear that it closes the main in the head in LW. If you want to sail with fixed jumpers, you must enlarge the angle of the jump stay as much as possible.

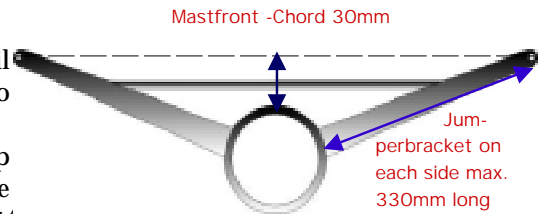
It is just simple: pull the chord in front of the mast as far out as possible between the ends of both stays, and count the difference between the mast and the chord, it has to be a minimum of 30 mm. This is the optimal opening of the jumperbrackets allowed by the rules, as well as the maximum length of each jumperbracket is 330mm. (See drawing on page 12).

Should you reach more than 40mm between chord and mastfront and you want to sail with fixed jumpers, you **must change** the opening of the brackets. When you have this measure - 30 mm on the chord between the stays - you can sail with fixed jumpers and tune them to 10-11 lu. You will see that the mast either won't bend forward(=negative), or will only a very little in the top. If you have a distance mast - chord of 40 mm or more, the jumpers should be adjustable in the centre and to the side. Of course you can have the jumper bracket welded to this numbers by a specialist.

To make things clear: with sideways adjustable jumpers you can make huge mistakes. One tends to forget to pull the windward jumper tight and to loosen it on the leeward side. This is bad for your pointing ability. ***We generally sail with the jumper central adjustment medium hard pulled and control the leeward bending of the mast head with the windward adjustment.*** This is only the case at 3-4kn windspeed and higher. Below 3kn, the jumpers are loose.

In LW below 3kn, the tuning objective is to tune the main sail flat in the region of the luff and to open the leech in order to create a current flowing above the surface of the sail.

The main traveller has to be kept windward in order to keep as little tension in the main sheet as possible and to ease the leech of the main sail. ***Here we recommend the boom strut/boom lift, which lifts up the main boom in LW.***



In very light wind keep the jumpers in the central position

and loose sideways, open the runners, push the ram 10-20 mm forward, and have the backstay pulled slightly.

At last, one understands that fixed jumpers with a big stays opening (a chord of more than 30mm from the mastfront) bend the mast head forward too much in the negative direction and will close the main sail in the head. Therefore, it is advisable to have the right tension for the fixed jumpers or have adjustable ones.

In more than 3kn of windspeed, there is enough wind pressure to open the main in the leech. Now it would be good to tune the main sail fully and close the leech more in order to have more pressure in the sail. The jumpers should be **pulled tighter in the central position** above 4 - 5kn, and the mast head should be tuned straight via the sideways adjustment of the jumpers. **Always check the sideways bending of the mast, when sailing upwind by looking at the groove from behind the mast.**

In 4 - 16 kn, one sails with jumpers fixed in the center and additionally tunes the mast straight in the head, which can be checked by looking at the groove from behind.

In more than 17 kn, one sails with less tension in the central position of the jumpers. The mast is only tuned via the sideways adjustable jumpers. In more wind you must, depending on the weight of the crew, set the jumpers more loosely, but **never totally open**. It is important to mark the pulling line of the jumper adjustment in order to find the perfect tuning again quickly. This is the case with all adjustment possibilities on board.

On our boats the jumpers are arranged as follows: The central adjustment is on a cleat at the front bar: the colour of the line is either white or light yellow. On it there are three marks: Loose for LW, middle for wind conditions of 1.0 - 3 kn and for more than 4 kn up to 17kn and hard for wind conditions exceeding 18 kn.

The sideways adjustment on the traveller bar has been built with a white line, marked as well, if mast is straight in different wind conditions, if weather tune is set and leeward is slack!!

If you don't want to adjust the jumpers (because you have to sail many tacks or just don't want to make any tuning mistakes in dangerous situations) then leave the sideways adjustments fixed on both sides.

G) Backstay

When sailing a beat, the backstay is not used for tuning the mast. **There is one exception: at LW below 3kn, you have to put some tension on the backstay instead of the runners.**

In all other wind conditions, the backstay is only used when jibing under the spinnaker to secure the mast because at that moment it is both difficult and unnecessary to use the runners. Gybing with open runners and the backstay pulled a little makes it much easier. It is important to increase the tension of the windward runners in HW at some point after the gybe.

Attention - safety for your boat! Tie a knot or a stopper in front of the cleat on the backstay string when the mast is tuned to 15-17 kn under the spinnaker going downwind. **This means that the ram is pushed forward completely and the runners are in downwind position** so that the mast can't bend forward when jibing in HW if the runners are kept loose during the manoeuvre. We know from experience that the mast doesn't allow a backstay to be **kept too loose** when gybing.

2. Tuning the main sail

A) Main sheet

The main sheet is one of the most important means of tuning on board. Next to the runners and the main sheet traveller, it is another tuning possibility which is used going downwind. The main sheet should always be tuned differently for changing wind and wave conditions, when the helmsman is not steering in the "groove". If you tune the main sheet harder, you prevent the twist in the main sail and the sail gets flatter. You should focus on the **twist at the leech of the main sail**.

In LW and HW, the main sheet should be opened up a little while tacking. Otherwise the tuning of the main sheet is used to see if you can sail faster or point more. Pull the main sheet as far as you can as long as the mainsail "**looks right**" and the boat "**feels right**" for you. The picture of "**looking right**" comes from experience and "**looking good/right**" comes from what good sailors have told us. The "**right feeling**" also comes from our experience and what answer the tiller gives us. If it tells us, that we have too much of a weather helm, then it is possible, that the main sheet is being kept too tight. ***Finding the right tuning requires some experience and trial.***

Once you have found a fast tuning, mark the main sheet in different colours symbolizing the different wind or wave conditions. While unrigging the boat, think about threading out your main sheet in such a way that you can use the marks to tune your main sheet the next time.

A **main rule** for Dragons is, as for most boats, to tune the top batten parallel to the main boom. The battens point less windward when looking upward from below. In very LW, the weight of the boom causes the top batten to be parallel to the main boom or even to hook to windward. In very HW, the top batten will automatically twist leeward, which takes the pressure off the main sail.

You need to keep experimenting with the position of the top batten. Different wind or wave conditions will always require slightly different tuning. Success is reached by constantly observing other boats with which you can compare your speed, and by always trying out a different tuning until you learn, which tuning of the main sheet is too tight and which is too slack.

One, better more marks in different colours at a range of 80 -120mm on the main sheet as well as on the fine tuning are very helpful to be able to reproduce and recreate the successful tuning on the next beat or on another day. Don't forget, however, that wind or wave conditions change often and so does the **optimal tuning**.

Therefore, we would recommend keeping a regatta logbook in which you can take notes after every race about wind, wave, area, weather, competitors, favourite sides of the courses, the beam reach and downwind sails, season, air and water temperature and your own speed. Also note how you have tuned the shrouds, the main and genoa sheet, the runners etc. It is very helpful when returning to a regatta site to know beforehand how a breeze will influence the boat or which hidden danger comes from the west wind from the land, and above all how one has tuned successfully the previous year.

At the end of this tuning guide you'll find a tuning sheet which has helped us a lot over the past years. Feel free to copy it and take advantage of our experience!

Like all means of tuning on your boat, the main sheet should run without any friction and have a big enough ratio. There is the possibility of a 1:4 ratio, which can even be reduced to a 1:3 ratio in LW. This is for the stronger helmsmen among us. The advantage of this ratio is a shorter sheet at the start and during other manoeuvres around the marks. The disadvantage is a smaller ratio in HW. The easier ratio, 1:5, can be reduced to a 1:4 in LW. The disadvantage of this way of tuning the sheet is an enormous length of the sheet during manoeuvres. Marking the main sheet, however, will be easy at these two ratios, since the sheet begins with a fixed part and can be marked at the cleat.

Nowadays a ratio of 1:4 with a fine tuning of 1:4 is mainly used. If you use the fine tuning, you'll have a ratio of 1:16 which makes the fine tuning of the main sheet easier in MW and HW. During manoeuvres, e.g. at the start one only has to pull the 1:4 ratio, which leads to a shorter sheet. You can mark this 1:16 system very easily by doing as follows: The coarse tuning on one side of the main sheet ends on a turning block with a cleat and is marked for the basic tuning with 1-2 marks. This coarse tuning is continued at the

D) Main sheet traveller

The most frequently asked question, how to adjust the traveller upwind, is very difficult to answer. The height of the traveller car in relation to the coaming, the distance of the main sheet track to the main boom and the kind of ratio of the main sheet (e.g. at the fine adjustment) influence the measures for the traveller considerably and make it impossible to answer.

In LW and MW, one should adjust the traveller very much to windward so that the extension of the main boom with a tuned main sheet towards astern would meet the backstay (in other words the main boom would stand about in the middle of the boat). In extremely LW, you should sail the main traveller very much to windward, in order to get the main boom somehow in the middle of the boat by pulling the main sheet as little as possible and not closing the main leech too much.

In MW, don't sail with the traveller so far to windward, but pull the main sheet tighter in order to reach the tuning objective of **keeping the top batten parallel** to the main boom.

Normally one only adjusts the main traveller in LW and MW in the middle of the boat only in extremely cobby water, otherwise tune it to windward.

In wind conditions of over 20kn and mainly in cw, the traveller is sailed between 50mm and 200mm off the middle towards the leeward side, depending on the waves. The main sheet, however, is tuned very tightly. By using this tuning, the main sail will be flatter. For light crews, easing tension in HW is the only option.

If the traveller is sailed very far leeward, but never more than 200 mm to leeward, there will occur a backwind in the main sail, which means one has to push the ram about 10 mm forward, pull the runners and sail the genoa lead wider towards the outside at about 200mm off the outer edge of the board. In Petticrows dragons just use the outer Genoa barberhaul.

E) Boom vang

On the reach, the boom vang should generally be tuned so that the top batten is **parallel to the main boom**. On the reach, particularly in **MW** and **HW**, the boom vang should be pulled very tight in order to avoid too much twisting in the main leech.

Going **downwind**, the boom vang should be kept a bit looser and the top batten **a bit more open than parallel to the main boom**. The crew should always watch the main leech and the top batten to be sure that the boom vang is correctly tuned and the main leech is being adjusted to the changing wind conditions and the respective tuning objectives. If the wind suddenly increases, pull the vang a little.

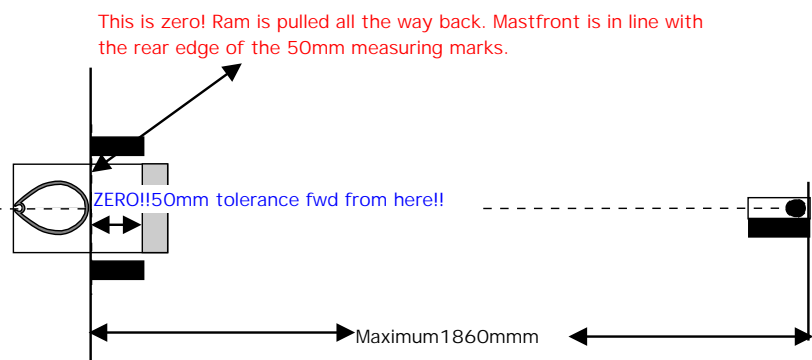
If it decreases, ease the vang again. You will find out yourself in due course that you will need relatively high tension in the vang on the reach in MW, and even more in HW.

In a brise a tight vang avoids rolling downwind, but remember, a tight vang, a controlled leech in the main is slower downwind than a twisting one.

F) Ram and Zero

The ram is responsible for an optimal tuning of the mast under all conditions. Therefore, you definitely need to rig a ram system if your boat doesn't have one.

Especially in HW on the reach and downwind the mast can be pushed forward at the deck up to 50mm (more isn't allowed), which leads to better control of the mast and an enormous amount of additional security in HW, since you sail with the runners opened up to downwind setting in those



wind conditions. What is the **zero** setting for the mast? Zero is reached when the **front edge of the mast, excluding the spinnaker boom track**, meets with the **rear edge of both 50mm measuring marks**, which are situated on the side next to the opening of the mast on the deck. This is also the maximum astern position of the front of the mast in the opening of the deck permitted by the rules.

Attention: You may apply these marks a bit further back if you prefer for tuning reasons, but in this case the front mark on the forestay must also be set back towards astern. The maximum distance according to the rules between the front edge of the mast and the opening of the forestay on the deck may not be more than 1860 mm.

We have found out the following measurements on the different types of boats as perfect numbers. All measurements refer to the distance from station #4 towards astern to the **rear edge** of both measuring marks next to the opening of the deck. See also the drawing on page 8.

Petticrows: 830-840 mm

Börressen: 820-840 mm

Glas: 820-840 mm

You can feel the advantage of the ram when sailing upwind because this tuning tool allows you to **bend the mast forward** lengthwise in the area from the deck up to the forestay attachment point or **make the mast straight by pulling the ram towards astern**.

In LW up to 3kn, the main leech should open (twist) and the sail should be kept flat. This is only possible through a **forward bending** of the mast. You can make the mast more flexible by **bending it forward 5-15mm off the zero at the deck**. If you pull slightly on the leech with the jumpers loose, you can reach the desired forward bend of the mast. The same applies in HW, in which the mast is being pushed forward in the deck from 5 to 15 mm, but with tight runners.

1. Tuning the genoa

Pull the genoa sheet tight until the leech is **60 to 80 mm off the spreader tip in LW, 20 to 50mm off the spreader tip in MW(I) and MW(II), or 80 to 120 mm off in HW**. Make sure that the foot of the genoa is not too tight. See next paragraph.

The right tuning of the genoa foot in LW, MW and HW also depends on the respective wave conditions. Usually the genoa outhaul should touch the uppers in LW. (It should be tuned to touch in the foot the uppers at a maximum of **50 mm in LW, 100-200mm in MW(I), 250-350 mm in MW(II), and 400-500mm in HW**).

There are seven areas of tuning which influence the position and the form of the genoa. These are: the genoa halyard, the mast rake, the genoa lead across (in & out), the genoa barber up and down, the genoa sheet tension, the tension of the runners and the main sheet.

Try to adjust as few as possible, since it is time consuming and the possibility of mistakes increases more than the benefits of the adjustments. Therefore, we no longer adjust the length of the forestay, (mast rake) as it stays always fixed at 1215mm.

A) The optimal form of the genoa at upwind

There are several ways to determine the right tuning of the genoa, e.g. the depth and twist of the genoa. The twist is the vertical changing of the opening of the sail at the leech. A headsail without any twist would only leave a little slot open between itself and the mainsail. **If the upper part of the sail is too tight, the genoa will collapse at the lower part of the luff. The lower windward telltales will rise first.**

A headsail with too much twist will open up a lot in the upper part and collapse in the upper part of the luff first. The upper windward telltales will rise first, then only the lower ones. A good reference point for the right twist is the controlling view at the leech in relation to the spreader tips.

B) Genoa sheeting

As already discussed in the section about the genoa form upwind, the following is about the tension of the genoa sheet. This is the main means of adjustment and also the only one that can be tuned quickly, if the right tuning has been found beforehand for the other means of adjustments.

There are four kinds of genoa sheet systems:

1. The genoa sheet is directly above the winch, which can be found on **older dragons**. You have to go to the leeward side to trim the genoa as you need to wind the winch on the leeward side.
2. The winch lead in connection with a lever fine tune beneath the deck. The lever allows for the fine tuning of the genoa sheet. This system is used on most **boats up to 1997 - 1998**, but can be built on old boats at considerable cost. It makes the fine tuning of the genoa in MW and HW much easier.
3. The possibility of winding the winch on the leeward side from the windward **on boats of all years**. A ratio of 1:2 under the deck connected with the winding of the winch makes pulling the genoa from the windward possible. A man on the windward edge pulls directly at the sheet. The other one repeats it at the winch ratio cord, which can be pulled from the windward and changes the leeward winding of the winch. This system is very simple and can be built in cheaply.
4. Winchless system, standard on **boats built after 1998**: the genoa sheet is directly diverted through the deck, from which it is led onto a block, which leads it back again, behind which there is a cleat. This block with the cleat is fixed onto a car, which can be tuned with a 600mm fine tuning. The sheet is pulled without a winch up to a marked position at the sheet and the fine tuning of the genoa is done via fine tuning. This method is very difficult to build in afterwards because the winches have to be dismantled. You also need to have a good, strong crew in MW(II) and HW. The price for that system is appr. € 2.500,-

C) Position of the forestay

You should definitely concentrate on the position of the forestay. The maximum distance between the opening of the forestay on the deck on the rolling mechanism and the front edge of the mast at zero is exactly 1860 mm (see also drawing on p.9). **Try to reach the maximum measurement.** Also, tune the attachment point of the forestay in front, which means pull the mast astern at zero. This point relates to the front edge of the 70 mm long measurement mark at the opening of the deck of the forestay, provided that the measuring marks have been applied correctly.

D) Tuning the genoa halyard

Tuning the genoa halyard determines the tension of the genoa luff. It is one of the “auxiliary engine” of the boat and should therefore always be accessible onboard and should easily be adjustable, even under heavy load, which can be reached upwind in HW. Next to a good ratio for the genoa halyard (we recommend 1:8-1:10), it is essential to use materials like Vectran- or Kevlarlines at the adjustment of the genoa halyard for the ratio of the adjustment.

No matter which wind conditions you want to tune the genoa luff in, **first tune the mast via the runners**, then the main sail. **Only after that should you pull the genoa sheet** that the foot is touching the uppers, referring to the windstrenght. Now, even before tuning the genoa barberhauler, **the tuning of the genoa halyard should be done as follows:**

Make sure the genoa halyard is always pulled just tightly enough that almost all “**crow's feet**” have vanished at the luff, no more. “Crow's feet” are the folds which appear at an angle of 90 degrees from the luff towards astern and reach into the sail.

With all **Fritz Smily** genoas, the tension of the genoa halyard should always be adjusted to changing wind and wave conditions. Let your crew experiment with the tension of the halyard and don't forget that too slack a genoa halyard is better than a too tight one.

One thing you should never forget: the tension of the genoa halyard is the auxiliary engine of your Dragon! It is very sensitive and will react to anything.

A good Dragon crew **changes and checks** the genoa and the tuning of the genoa as often as possible and takes all aspects into consideration. The criteria for the tension of the genoa halyard are:

In LW from 0 -6kn: First find a tension with which one can still see "crow's feet" at the luff. Then tune the genoa sheet and the barberhauler. If needed retune the genoa halyard again.

In MW(I) and (II) from 7 - 19kn: Have just enough tension that slight "crow's feet" can be seen. Only a constant check of the genoa halyard adjustment is a basis for high speed. Don't forget that each change in the genoa halyard means a readjustment of the barberhauler and, if necessary, a change in the tension of the genoa sheet.

In HW of more than 19kn: The genoa halyard should be so tight that all wrinkles in the luff disappear. If you're not sure if you've overdone it or not, release the tension a bit and tune it again, if it is still too slack.

The marks on the halyard line help you find a good tuning again. Always keep an eye on the genoa halyard and make sure that it's not pulled too tight!

What happens most often: Many sailors pull the mast forward on downwind in LW and MW using the "*genoa quick up*", but tend to forget in the heat of the moment to release it again for the next upwind: **Then it is like a movie:** the crew pulls with all his/her strength at the coarse adjustment of the runners in order to pull the mast back into upwind position and, realizing it does not come tight, takes the fine adjustment of the runners as a support. This is the end of the genoa: the luff is pulled too tight and the genoa has to be thrown away or recycled as a fashionable sailor's jacket at *Fritz Sails!* Your wallet is certainly going to cry, but anyway, Werner will make you a good offer on the jacket!!

E) Genoa lead position (up and down)

Next to the genoa halyard and the genoa sheet, the **genoa barber hauler up and down is another very important tuning device.** It should be easily accessible and adjustable from both, the cockpit and the windward edge. There are different systems on the market just now.

The most commonly known system is one in which the barber hauler runs through a cheek block, which is fixed onto the genoa car with the traveller.

You can find this system on all B6, Glas and on Petticrows before 1993. On new Petticrows, the genoa traveller and barber hauler are run together, which means there is no car, but two barber haulers. This very simple and cheap system works excellently. The both barber hauler should be adjustable from the windward side and in the cockpit.

The outer barber hauler needs to be adjustable from windward, because you only use it in wind conditions of more than 15 kn, and then you're sitting on the windward edge anyway.

The right lengthwise position for the genoa car or the barber haulers is 20- 40mm in front of station #8 of your Dragon. Tune the genoa barber as follows:

First tune the genoa sheet to 100 mm touching the US. Then do the fine tuning of the genoa halyard. Now, tune the genoa sheet, so that the genoa luff touches the US 100-150mm in LW right at the US, in MW about 200-350 mm at the US, and in HW about 400 -500 mm high.

If you have finished with this tuning, pull the barber hauler as long as the genoa leech follows the following criteria (distance from the opening of the spreader to the genoa leech):

LW	fw and cw:	about 50 - 80 mm off the spreader
MW	fw, no waves :	about 30 - 40 mm off the spreader
MW	chop:	about 40 - 50 mm off the spreader
HW	normal waves:	about 90 -100 mm off the spreader
HW	heavy chop:	about 100-120 mm off the spreader

General rule: You can keep the barber hauler tight until there is a slight backwind in the main sail.

Please note that at more than 22kn backwind can often occur in the main sail, which does not even disappear when sailing with the genoa barber hauler out and pretty opened!! **This backwind is due to tuning the main sail too full.**

Countermeasures:

1. push forward through mast (ram)
2. increase tension on the runners
3. increase tension on the main sheet
4. pull the main traveller more into the middle.

F) Genoa lead position (in and out)

We tried out the following numbers. All measurements are taken from the **outer edge of the board to the lead block of the genoa barber**. When taking the measurements, think about the fact that the genoa lead is moving outward when under pressure, because the block of the barber is not on the deck, but is, depending on the type and the make of the genoa, between 80 -150 mm above the deck.

From 0-8 kn, this measurement is at 360 mm off the outer edge of the board inward. From 9-16kn, it is 340-300 mm. At more than 18kn, we recommend 270 out to 200 mm, especially in cw.

Some jib car systems on old Börressen, Glas and Petticrows can't be moved inward more than 300-320 mm off the outer edge of the board because the cockpit or cuddy are too wide.

Don't trouble yourself too much with building in complicated constructions in order to sail the lead further in. You can tie a line to the genoa lead block for the barber hauler, lead it over the seaming into the cockpit and put a little cleat on it. This should only be used up to a maximum of 6 kn and only in flat water.

When the wind increases, sail the genoa lead step by step toward the outer edge in the direction of the hull and deck connection, between 300 mm in fw and 220-200 mm in HW and heavy chop.

G) Runners influence on the genoa

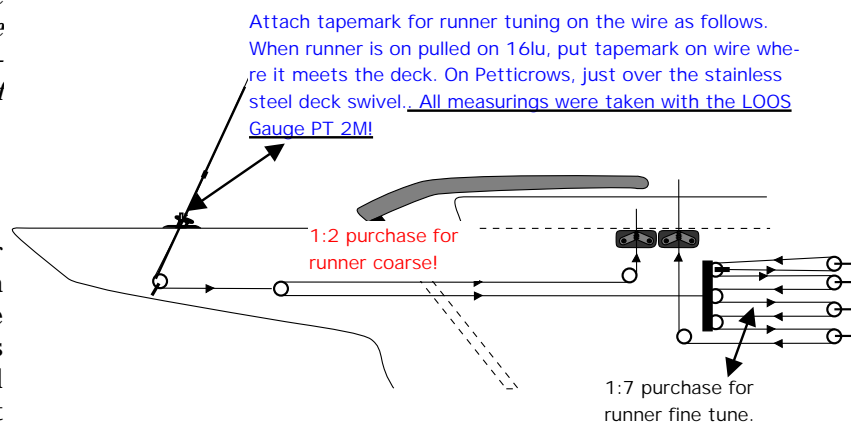
The runners **control the tension of the forestay(sagging) and the bending of the mast. It is the “tuning institution” on your Dragon.** Pulling the runners is bending the mast and preventing the forestay from slackening. Loose/too loose runners make the genoa entry sagging and the leech closing, also close the main sail in the leech, and flatten it at the same time.

4) The runners

The runners are changed almost as frequently as the main and genoa sheet. When pointing high, the runners are responsible for the fine-tuning of the sails and on a tight reach they secure the mast. Dont forget: The right tension in the runners is the engine of the boat, especially in high wind.

A. System below deck

The tackle/cascade system under the deck is used on all regatta Dragons. The advantage is the coarse adjustment, which makes the rig fall forward downwind after a jibe and enables the fast tuning backwards upwind in front of the leeward mark. There are some variations: a coarse adjustment with a ratio of 2:1, following a fine adjustment with a ratio of 6:1, better 7:1, which should be adjustable by the helmsman and the crew from a hanging position. We especially recommend these total ratios of at least 12:1, better 14:1, because



light crews have problems adjusting the necessary runners with smaller ratios (e.g. 1:5 or 1:6), which were built into Petticrows and most other Dragons. Boats built after the year 1997 nearly all have a serial 1:12 or 1:14 ratio in the runners.

The big disadvantage of a 1:5 or 1:6 overall ratio, however, is the amount of strength you need to pull in a 1:6 ratio the fine adjustment upwind as well as the 1:1 coarse on a downwind, when you want to pull the mast back to new upwind position in a breeze. This is mostly increased by a higher friction and due to badly fixed blocks. We noticed that the working weights of the runner blocks are far too low in most boats for the forces that occur on them. You can even hear the runners and blocks aching and screeching when you pull. That is a sign that the blocks are being strained and are not running smoothly anymore.

We therefore absolutely recommend changing the 1:1 coarse adjustment system on the older Petticrows Dragons **to a 1:2 coarse system**, which can be done in about two hours. You need a wire cutter, two Nicro press sleeves, and a Nicro press tool. There don't have to be done any other changes because the fine adjustment mainly already has a ratio of 1:5. This leads to a total ratio of 1:10. If you want to change to 1:6 (= overall ratio 1:12) or 1:7 (= overall ratio 1:14), you have to change blocks for the fine as well.

B. Tuning the runners

Runners upwind:

When sailing upwind, the **runners influence** the bending of the mast and the sagging of the forestay. The **ram influences** the bending of the mast fore and aft in the lower part up to the attachment point of the forestay. **We understand, that a lot of ram forward gives you more prebend, but reduces forestay-, runner- and shroud tension, as your mast is getting shorter.**

Directions: The boat should be always tuned with a **mast rake of 1215mm**. Put the **ram at zero** and set the coarse adjustment of the runners at heavy upwind mark. Now pull hard at the fine adjustment of one runner and take the measurement of the tension with the "LOOS GAUGE". **You have to reach a tension of 16 lu on each side, while other side is slack.** This high tension is only possible when you have at least a ratio of 1:12, better 1:14 in the runners or enormous muscles in your upper arms.

If you have reached the 16lu after pulling hard, tape the runner wire where it intersects with the opening on the deck or on Petticrows, the deck swivel. Then do the same with the other runner. The closer you pull the mark in the direction of the opening on the deck while sailing upwind, the more pressure you'll get on the runners. ***Double check the measuring of you forestag again, as if you havent had this kind of power on your runners and forestay, it might have stretched a bit!!***

If the tape mark gets to the opening on the deck or touches the swivel, you have reached the tightest tuning of the runners with 16 lu (see drawing on p.26).

The following numbers can be used as a basis for the tuning of the runners when sailing upwind: The measurements are the distance between the tape mark and the opening on the deck.

<i>Windspeed</i>	<i>Distance between tapemark and deck/swivel</i>
0- 4 kn	slack down to 200 mm;
5 - 8 kn	180mm down to 120 mm;
9 - 12 kn	110mm down to 100 mm;
11 - 16 kn	90mm down to 50 mm;
17 - 20 kn	40mm down to 10 mm;
20 - 25 kn	20mm down to 00 mm;
26 + kn:	00mm

Exceptions: *Choppy conditions (i.e. Medemblik), which have extremely hard, high and short waves. Here, you'll sail the tape mark at an average of 20-40 mm higher above the opening in all wind conditions as in the numbers shown above!!*

Runners on the reach:

When reaching, ease the runners with the **fine adjustment** until the tape mark is 300mm above the deck (LW), 280-200mm above the deck (MW), or 180-100mm above the deck (HW), so that the mast can get straight and there is less tension on the runners.

Basic Rules: The stronger the wind and the more pointed the course is, the less you should release the tension of the runners. The more the wind blows from astern and/or the weaker the wind, the more the masttop has to move forward. i.e. open runners up to downwind position on the course.

Don't forget to push the ram forward in these courses, before easing the runners in order to give the mast a certain bend forward and to prevent, in this case in HW, the mast from bending backward(=negative). There would be a big chance of losing the mast.

Runners downwind:

Going downwind, adjust the runners with the tapemark to about 680-700mm and push the ram forward into maximum position (50mm in the deck)! **On a run you have the runner fine loose and the course opened, that the tapemark is 680 - 700mm over deck! Make a mark with on your course, as this is a reference for all your downwinds up to 25 kn.**

The whole mast may bend slightly forward above the opening on the deck. **In really strong winds, make sure that the masthead is not too much in front. For 26 +kn have mark only 550 - 600mm over deck!!!!**

I often noticed in clinics and regattas that the mast is not tuned far enough forward in LW and MW. Make sure that **the mast can be pushed forward the permitted 50 mm with the ram.** Every millimetre counts because the straighter or the more bent forward the mast is downwind, the faster you'll be.

When putting a mark on the coarse adjustment of the runners at **the maximum downwind mast position**, do it only **if the fine adjustment of the runners is loose**, of course. Take the opportunity to make a knot or put a ball on the backstay line, **so that it can't get looser than the maximum downwind mast position**, as all jibes are sailed both runners on loose!!

5. Tuning the spinnaker*The spinnaker halyard:*

Hoist the spinnaker to the top, and put a mark at the spinnaker halyard at the cleat.

The basic rule is: On the reach, the halyard should be eased **about 200 mm** in order to keep the spinnaker head clear of the jump stays. Downwind, the halyard can be eased 100 mm, but beware of little wind and dead waves. In this case, the spinnaker must be totally on top in order to keep it relatively still.

The topping lift:

As a rule, set the height of the spinnaker pole with the topping lift so that **both clews of the spinnaker are at the same height.** With the spinnaker sheet very loose, you can recognize the correct height of the spinnaker pole at which the windward leech collapses. Going downwind, when you can't see the clew on the leeward side, you can recognize the correct height of the spinnaker pole when **the middle seam of the spinnaker is parallel to the mast**, which means it's vertical and both clews are at the same height.

On tight reaches and on the reach in LW, you should set the spinnaker pole knock, which is at the spinnaker sheet about **1200 mm above the deck**, as soon as there's enough wind pressure in the sail.

In very LW, the Fritz 3XL+ spinnaker loves it when you keep the spinnaker pole very low, about 900 - 1000 mm horizontal above the deck. The spinnaker fills much earlier. The moment the spinnaker fills, you can raise the boom again.

In MW, set the spinnaker pole knock at about 1100-1200 mm. On tight reaches and on the reach, the spinnaker boom knock should be about 1300-1500 mm above the deck, always measured at the front edge of the spinnaker pole. Check again and again at which part of the windward leech the spinnaker collapses. It should collapse there about 1500-2000 mm below the top.

In HW, the best position of the spinnaker pole knock downwind is at 1200-1300 mm. On the reach, it is about 1500-1700 mm above the deck. In this case, the windward clew is higher than the leeward one.

The spinnaker pole downhaul:

Attach the downhaul so strongly, that the rising of the spinnaker pole can be prevented especially during the setting of the spinnaker, that the pole can't swing backward onto the shrouds or, even worse, fold up and ruin the manoeuvre.

While jibing at more than 5 kn, the downhaul must be eased a bit in order to make it easier for the crew on the foredeck to shift the spinnaker boom to the new windward side.

The spinnaker barber hauler:

The windward barber hauler for the windward sheet must always, **on reaches, be pulled tight**. The leeward barber hauler is always to be sailed loose on reaches. The leeward clew will be prevented from rising because the spinnaker sheet on the leeward side is running under the main boom. We call this "under boom sheeting".

As a rule, you should always, in all kinds of winds, sail with the leeward sheet under the main boom. If you have any problems holding the boat in HW, you can loosen the boom vang, which has to be reset at the basic tuning position as soon as the gust or overpower is over.

Downwind, both barber hauler can be sailed 400mm loose in winds up to 16 -17 kn. In more than 17 kn, both barber always stay tight.

The guy:

Make sure that you keep the guy on the reach always tight enough that the spinnaker pole is at least **50-100 mm off the forestay**. Big (at least 50 mm long), **easy-to-see marks** made by a felt tip pen (Edding 750) on the windward spinnaker sheet are optimal for finding the perfect guy-tuning for the tight reach, while setting the spinnaker on the way to the offset mark or while jibing.

Procedure for marking the spinnaker sheets:

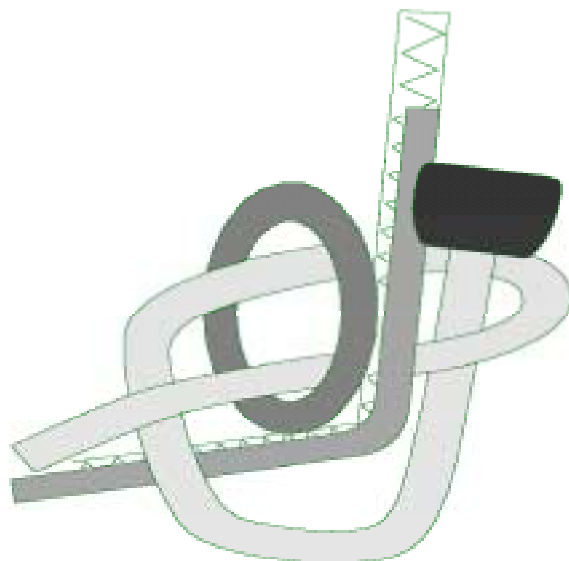
Proceed exactly as follows. Put a ball at the end of the spinnaker sheet, and a tie a knot behind it, letting it disappears into the ball. At a strength of the 5-6 mm of the spinnaker sheet at the thinner end, the ball fits. Put the spinnaker at the sheet so that you can always tie the same knot and the mark at the sheet will always be the same.

The connection at the spinnaker sheet grommet is as follows: Form a loop a short distance in front of the ball and push it through the thimble of the spinnaker (14 mm diameter) from the inner side of the spinnaker to the outside.

You'll recognize the inner side of the spinnaker (on Fritz spinnakers) by the colours of the leeches. Blue is the foot, green the starboard leech, and red is the port leech. Put the end with the ball through this loop and tie it. This connection holds tight and can be untied even after pressure.

The advantage of this kind of fixing is that you can mark the spinnaker sheets and you'll always have the same adjustment on the marks when resetting the spinnaker.

Now, while sailing on a tight reach, mark the spinnaker sheets both sides, with the spinnaker pole in the top position either at the point in which the spinnaker sheet goes through the barber hauler or where it is fixed in the cleat on the rim of the cockpit. We usually put a mark next to the one on the tight



reach and a mark for downwind on the sheet. We recommend that you use an Edding pen Type 750 because it is waterproof and stays on the sheet for a while.

Try to keep the spinnaker **pole from touching the forestay** and pushing it forcefully toward the leeward side because it can damage the genoa at the luff or even break the spinnaker pole. Use the marks on the sheet to avoid this.

On the reach, the boom should be set to about 90° to the true wind, which means about 20° tighter than to the apparent wind, which is indicated by the windex or the telltales downwind. Bring the spinnaker pole as far as possible astern until you reach the upper shrouds when you want to sail really deep. The tuning objective is to use the maximum surface (= projected sail area) of the spinnaker.

The spinnaker sheet:

Keep playing with the spinnaker sheet in all conditions. The luff of the spinnaker should always give way about 100-300 mm when playing with the sheet, which means that the spinnaker should “**waggle its ear**” which it is being balanced by a slight pulling. This constant play at the sheet guarantees that the leeward stream of air is kept and the spinnaker is sailed on the aerodynamic lift.

If the spinnaker stalls on the reach or on a tight reach while playing, pull it very tight quickly until the spinnaker is full again. Ease it again quickly, so that it won't be overtuned for too long and slow you down.

6. Tuning the rudder

Generally on a dragon, any movement of the rudder slows down the boat, because it puts pressure on the water current. A small amount of weather helm is an advantage and the tuning target, because it creates an aerodynamic lift at the rudder and on the other hand the boat points better.

Too much weather helm is created by too much heeling, due to wrong sail trimm.

If you wish to avoid too much weather helm, sail your Dragon upright/flat in all wind condition, except very light wind. If you can't compensate it any more by hiking you will have to sail depowered sails. With a light crew of course you have to “depower” much earlier than with heavy one.

Too harsh rudder movement slows down the boat, especially when jibing and doing little course corrections due to changing wind conditions. Therefore, be extremely careful with setting the rudder and avoid excessively harsh movements.

7. Use of sails

Finding the right type of sail for different races is a problem for many regatta sailors. The liberal measurement rules for the Dragon allow measuring up to 8 sails for competitions. **FRITZ SAILS makes your choice easier!**

We would like to help you choose the right type of sail with a short list.

Here, I will also remind you of the **regatta logbook**, which keeps track of specific races' wave and wind conditions. It will make your sailing much easier.

Generally, one set of sails will do: the main “Advantage allround” and the genoa “Smily allround” for open waters and for inland waters. The “3XL+” spinnaker is always the right choice. The diversity of areas is completely covered by our total program. If in doubt, go for the allround programm and you can be sure you have the race winning suit on your rig.

<u>Type of sail</u>	<u>Name</u>	<u>Wind</u>	<u>Sailing area</u>
Genoa	Smily Light-Medium	0 - 14 kn	inland waters and open waters in fw
Genoa	Smily Allround	2 - 25 kn.	All areas without exception
Genoa	Smily heavy	17 - 35+ kn.	in fw from 15kn, in cw from 18kn onwards
Main	Advantage Allround	0 - 35+ kn.	All areas without exception
Spinnaker	3 XL Plus	0 - 35+ kn.	All areas without exception

8. Sail Maintenance

With a little caution, the life of your sails can be considerably prolonged. The sails nowadays are made of tempered Dacron cloth. This is a heavy resinous cloth, which prevents the threads of the sail from moving and consequently diminishes stretching and prolongs the sail's life.

Continued folding and storing of the sail will eventually cause the finish to break down, which will ultimately change the form of the sail. You should always roll the main and genoa. You can't avoid the sail from fluttering before the start or during the race, but a little caution on the shore before and after the race will save the sail from wearing out too early. If, for any reason you had to fold your sails, i.e. transport in the plane, before sailing rinse the sail with fresh water and sails it dry under pressure.

If you have obtained a new set of sails, try to sail it first in conditions of 10 to 17kn on a pretty tight reach. In these conditions, the pressure on the sail in the seam between the luff and the leech is more even than at the same wind sailing upwind. When sailing upwind, only the aft portions of the sail are being used and the seams only stretch there. The result is that the profile and the deepest point of the sail move aft.

Note: When sailing at 10-17 kn on a tight reach, have a tight main boom vang for about 20-40 min. Do a few jibes and tune the genoa sheet correctly, have the outer barber pulled tight. Your sails will be grateful with a better stand and a longer life.

A) Setting Sails

We absolutely recommend that you roll your main sail and thread the outhaul carefully into the groove of the boom. When threading the battens in windy conditions, make sure that they are tightly clapped into the bar pocket with the Velcro fastening.

Please note: In windy conditions, before hoisting the main sail you should take all battens out of their pockets and thread them in again and close the velcro fastening tightly.

We usually deliver two top battens for each main sail. The softer batten is used from 0 -13 kn., the harder one for conditions from 14- 35 kn.

We also recommend that you close the shackle of the main and the genoa halyards very carefully. Perhaps you should tape it to avoid an unwanted opening of the sail while sailing.

B) Folding and Storage of the sails

Please roll your sail from the start for transport and storage. The battens may stay in their pockets when they are transported in a rolled form, but please roll the sail parallel to the battens so that they won't be bent within the sail. You can also store them rolled up in the boat. When you take down the main, let it slide down slowly on one side of the main boom. Fold it at the top batten and start to roll it parallel to the battens.

Make sure to always have some tension on the genoa halyard when taking down the genoa. This will keep it from breaking when you open the zipper and being dragged out of its car if the genoa falls into the water when being taken down. When taking down the genoa, keep it from bouncing against the mast and shrouds. This is pure **poison** for the sail.

Every time you hold your sails, either to roll or fold them, check them for scars around the spreader, the pockets for the battens, the foot at the height of the runners, and the luff rope. If you detect tears at the foot or at the height of the spreader on the main or the genoa, you should cover the ends of the spreader with a spreader cover or some white tape and at the same time look out for open cotter pins etc.

Small tears in the main sail and the genoa can be temporarily repaired with a sail repair tape or with tesa texture tape. It is very difficult to repair the spinnaker temporarily because of its silicone coated surface. Normally you should consult a sail maker.

If you want to store the spinnaker for a long period of time, it should not be pushed into a bag, but folded together. Lay the spinnaker flat onto the ground and fold it once by laying the clews onto another. Now, fold up the spinnaker like a white sail by using 600 mm broad tracks.

Generally one stores all sails **dry and without any salt**. Clean your sails after salt water regattas carefully with fresh water and let them dry out completely! Be especially careful of humidity in the strengthened parts or the sheet horns.

9. Professional rigging and tuning

Step 1: After checking the mast thoroughly when it is lying down (see page 5), rig it. Make sure that the mast sock, if existing on your boat, isn't hurt when you put the mast in the deck hole.

Step 2: When the mast is rigged, fix the ram first, then the forestay at 1215 mm, the runners, and last, after taking the tripod(=sheerlegs) away, the shrouds. The ram has to be put into zero (fully back) so that the front edge of the mast comes in line with the rear edge of both sideways marks on the mast.

Now it gets interesting: Put a thin string-shock cord or a batten-across the deck at station #4 and draw a mark in the middle of the boat. Station #4 can be found by marks at the side of the connection between the hull and the deck of the Dragon, about 810 - 840mm in front of the mast marks (these are 50mm long), next to the opening of the deck.

After putting the mark for frame #4 in the middle of the boat, measure the distance to the rear edge of the measuring marks (50mm long). This distance should measure 830-840mm. Also see drawing on p.12.

If these small measurement plates are attached less than 830mm from station #4, you must move both of them back to 830-840mm.

Now pay attention! In order to meet the measurement requirements, the front edge of the 70mm long plate next to the forestay has to be attached **no farther than 1860mm** in front of the rear edge of the sideways 50mm plates of the mast.

The forestay may not be in front of the front edge of this plate (see drawing page 10) at this point in which it would run through the deck. For this measurement, the imagined prolongation of the wire of the forestay is relevant, not the forestay gear in which the terminal of the forestay is fixed.

Step 3: When the mast and the forestay marks are in the right position, the upper shrouds are fixed to the deck about 790-800mm behind station #4. Measure as follows: Take the direct connection between station #4, which is at the side of the connection of the hull and the deck up to the middle of the upper shroud.

Should a distance of 790mm be impossible because the holes for the shrouds are drilled at a distance of 800 or 780mm, change the position of the upper shrouds related to the mast position of 30-40mm in front of the front edge of the mast when it is set at zero. (E.g. when the front edge of the mast is set at zero at 840mm, set the upper shrouds at 800mm, if at 830mm, have the uppers on 790mm!!)

Explanation: If the upper shrouds are set on the front side of the mast, the tension of the upper shrouds going upwind is slightly increased when the runners are pulled tighter, e.g. if the wind increases-, or if the wind drops, the runners are eased and the tension on the upper shrouds is released.

If you let the mast drop forward going downwind, the upper shrouds get even looser. That is exactly our goal in tuning the boat.

The lower shrouds should be 30mm behind the upper shrouds, which is 810-830mm behind station#4. This difference of 30mm between the upper and the lower shrouds is usually given on newer Dragons, as the distance between the shroudholes is 30mm.

Step 4: Check the length of the forestay (mast rake). Pull the upper shrouds on both sides equally tight, up to 20 lu. The lower shrouds are only pulled on 10 lu. Now, pull the runners until you reach 25 lu at the forestay. Then, measure the mast rake under this tension exactly, which should be 1215 mm, taken from the top of the deck up to the mark, as described on page 12, lower drawing.

It is worth doing this work extremely carefully, because the length of the forestay is never changed again! Keep the hole in which the forestay is hooked in mind, write it down and mark it. If you work hard once, you won't have to do it again.

Step 5: Leave the runners as shown above and check the position of the mast in the opening of the deck by putting a ruler or a batten in front of the mast when the ram is at zero (fully pulled astern). If there is a spinnaker pole track on the front of the mast, you must deduct the depth of the track because the front side of the mast is the relevant measuring point and not the track.

As for all Petticrows, this track has a depth of 7mm, which you must deduct automatically when measuring the front edge of the mast. This tuning should be done once and should normally, if it is done properly, not be altered again. You should fix the turn buckle, which can be tuned between ram lever and mast, tape it, so that it won't get loose, as if set once, you won't change it any more.

Note: Forestay and turn buckle for the shrouds at the ram are generally not altered again. Consequently, you can exclude two variables, which is the basis for sailing successfully.

Step 6: Now we have the look for the right mast butt position. For that, you have to pull the runners to 16 lu, the maximum tension (*e.g. both runners down to the tapemark! By the way: if the runners are measured to 16 lu on each side, the numbers, if both are pulled down at the tapemark should be 10 - 11 lu*).

Now you can see, if the runner system is able to take this tension (as for details see p. 19). When you have reached this tension, look at the mast from the side and check the fore and aft bend of the mast.

If the mast butt is too far in front, the middle of the mast may bend backwards (=negative). **The optimal forward bending of the mast with the runners pulled tight is between 80-100 mm**, measured with the main halyard, stretched from the top to the groove of the mast at the height of the gooseneck.

Please take the time to measure the bending of the mast correctly and carefully. If the bending is more than 100mm, you have to readjust the mast step and move it forward. For that, you'll have to loosen the shrouds and move the bolt, which limits the mast step forward. Please note that even 10 mm forward is a lot. Set the upper shrouds again at 20 lu, lowers at 10 lu, the runners at 16 lu, and the ram at zero. Find out if the mast has got the **right forward bend** after these measurements are taken. Finding the right position of the mast step can take some time, but as we said before, if you have tuned it correctly once, you will never have any trouble tuning it again.

For Petticrows GRP Dragons, we recommend the following mast butt position: The bolt which is fixed in the middle of the mast step and at the mast foot should be in the 9th hole from the front. In order to be absolutely sure, we also measured the distance from the bulkhead to the front edge of the mast at the mast step: it is 195 mm. From the bulkhead to the middle of the mast is 245 mm. For the Petticrows Cold Moulded Dragon, the front edge of the mast is roughly 140 mm away from the bulkhead. Please: don't rely on these numbers, always double check!!!!

If you tune the Dragon as we tell you to, you can reach an optimal boat speed with Fritz Dragon Sails. This has been proven by results during the last few years. All boats that Vincent Hoesch sails are tuned exactly the same way.

Step 7: In tuning the shrouds, both runners remain loose at first. One person looks up into the sail track from astern while a second person tunes the upper shrouds under the deck until you reach 18-20 lu on the LOOS PT 2M Gauge. Try to get the mast straight by adjusting the upper shrouds. The jumpers remain open during this procedure, unless you have fixed jumpers. Pull a steel measuring tape up the main halyard and let it click into the halyard lock. With exact measurements on both sides of the hull-deck connection where the upper shrouds are connected, so you can see if the top of the mast is in the middle. If it isn't, there are several reasons:

1. *You have taken the wrong measurement, so check if the main halyard has properly clicked in or has just been caught at the Curry clamp. Perhaps you haven't used enough strength to pull it down. Pull it down hard and only use a steel measuring tape!*

2. *The jumpers are not eased or not tuned smoothly. This only applies to fixed jumpers.*
3. *The lower shrouds are not tuned equally or are too tight.*
4. *The mast is not set straight coming out of the deck. There are two reasons.*
 - A) *the opening of the deck is not centralized or the blocks at the side of the mast in the opening don't have the same thickness.*
 - B) *the mast track is not fixed in the middle of the boat*
5. *The mast is bent, which you should have seen when you checked the mast before rigging the boat.*

If the mast is straight with a tension of 20 lu on the upper shrouds, you can tune the lower shrouds gradually tighter. One person always has to look up into the groove when tuning the shrouds to make sure the mast stays straight. Increase the tension of the lower shrouds up to 9-11 lu, with a straight mast. Most Dragons have markings at the shroud terminals above the deck. Count these markings on the upper and the lower shrouds above the deck and write them on a piece of cellar tape which you should then put under the deck.

Example: This will read as follows: Starboard: US 20 lu-5 markings; LS 10 lu-6 markings: Port: US 20 lu-5.1 markings; LS 10 lu-5.8 markings.

The lengths of the shrouds is rarely absolutely equal. Therefore, we quite often have different numbers for the markings. The advantage of this system is that the basic tuning of the shrouds is already set every time you rig the boat.

Step 8: Fine tuning of the shrouds and repeating measurements with the same parameters. As already stated, the upper shrouds stand in front of the mast and the tension of the runners changes the tension of the shrouds. Therefore, we generally tune the mast with every measurement of the shrouds as follows. Only measurements with the same parameters achieve good results!

***** ram at zero - pushed fully astern**

***** both runners are tightened at the same time, until the tape mark, which indicates the tension of the runners, is 80 mm above the opening of the deck on both sides.**

***** Only now should you measure the tension of the upper and lower shrouds.**

We know from experience that for Petticrows masts, **half a turn more or less on both sides at the original shrouds increases or decreases the tension about 1 lu.**

For example, if you have a tension of 20 lu at the upper shrouds and you would like to go up to 25 lu, you will have to use 5 half turns on both sides.

The lower shrouds change with half the number of half turns, which means that to go from 10 lu to 15 lu, you will have to add another 2 and a half turns.

These numbers are only rough reference points. You will have to measure them very carefully yourself. All numbers that you measure should be written in the regatta logbook, since no one can possibly remember so many different numbers.

Tuning the shrouds is very important on the Dragon, because too tight shrouds are a disadvantage in light winds and wave. Therefore, you should sail the shrouds more on the loose side, if in doubt. You can find the numbers in the tuning guide. Usually you only need to know how your shrouds are tuned at the moment you leave the dock, as a change in tension is easy when you know, how to change the tension.

Step 9: Clear and correct markings are a crucial point in recognizing and finding a fast tuning. We recommend the marker "EDDING 750", because it is really waterproof. Let's start with the **coarse tuning** of the runners. **For upwind, you should measure at an opened fine adjustment 230 mm** from the opening of the deck up to the maximum mark at 16 lu. Make a mark on the coarse adjustment. This is, according to our knowledge, a good midwind tuning for upwind.

When tacking upwind, only use the fine adjustment. For upwind we have three markings on the coarse, one for LW, one for MW, and one for HW. You must find the markings for LW and HW yourself.

For downwind marking, you sail with open fine runners. Have another mark on 680-700 mm from the opening of the deck up to the maximum tape of 16 lu. You'll end up with 4 markings on each side of the coarse adjustment of the runners. Therefore, use four different colours.

Remember: Every time you change something (e.g. the length of the forestay), all markings will change, too. Therefore, always sail it at 1215 mm! Of course, you should also mark all other tunings. It is definitely worth taking your time and working conscientiously.

If you have more questions about tuning or the boat itself, please don't hesitate to write or phone us. Good luck and have fun with your new FRITZ Dragon sails!

Your Fritz Dragon team

Werner Fritz

Vincent Hoesch

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Where do I get something for my Dragon?

FRITZ-SEGEL GmbH:

The best and fastest Dragon sails; tuning instructions, LOOS Gauges PT2M

Yacht Racing Services & Consulting, Vincent Hoesch

Petticrows masts and booms; main and genoa halyards; runners, LIROS ropes, rubbers and tapered sheets; LOOS PT-2M gauges, TICKTACK digital compass, HARKEN blocks and metal fittings, HARBECK Trailer, MUSTO sail gear. Check: www.vincent-hoesch.de

Yacht Racing Services & Consulting, Vincent Hoesch; Tulpenstraße 8; D-82353 Rimsting; Tel: +49(0)8051-966665; Fax: +49(0)8051-3223; Mobile: +49(0)175-2427006, also SMS: E-mail: vincent2@t-online.de; Internet: www.vincent-hoesch.de

Go fast in a breezy upwind over 18 knots: have shrouds at the right measurements! Then check:

- 1) Runners are set tight 40 down to 00 mm***
- 2) Ram is pushed forward 15-10 mm off zero***
- 3) Outhaul is all the way back to the black band***
- 4) Main car is centre or 100 - 150mm off the centre line to the leeward side***
- 5) Mainsheet is pulled pretty hard***
- 6) Cunningham is tight***
- 7) Genoa halyard is pulled so that all wrinkles disappear from the luff (careful - easy to overstretch).***
- 8) Genoa lead in and out is at 270-240 mm***
- 9) Genoa up and down: when the sheet is tuned the spreader distance is at 90 - 120 mm***
- 10) Genoa sheet: the foot hits the shrouds from 400 to 550 mm (remember the lines!). If you think you need the genoa foot even flatter, check it out.***

Good luck in your next races!

Vincent Hoesch

Dragon Racing Diary
Write additional notices, comments, observations during the race on the backside

Venue:	Racing area:
Race#:	Position:
Day/date:	
Weather:	
Current from: degree; speed: m/min; Kn.	Air temperatur: watertemp:
Wind strenght: kn.: Bft.: m/s:	Direction of wind/name:
<input type="checkbox"/> flat water; <input type="checkbox"/> medium waves; <input type="checkbox"/> med. waves chop	Compass course: Port tack: high; low;
<input type="checkbox"/> high, long waves; <input type="checkbox"/> high waves, choppy	Compass course: Starboard tack: high; low;
Observations:	

Boat type:	<input type="checkbox"/> Petticrows	<input type="checkbox"/> Glas	<input type="checkbox"/> Børresen	<input type="checkbox"/> Chang	<input type="checkbox"/> Pedersen	<input type="checkbox"/> Sail#:
Make of mast:	<input type="checkbox"/> Petticrows	<input type="checkbox"/> Hofbeck	<input type="checkbox"/> Børresen	<input type="checkbox"/> Borres.		
Make of boom:	<input type="checkbox"/> Petticrows	<input type="checkbox"/> Hofbeck	<input type="checkbox"/> Nordic	<input type="checkbox"/> Borres.		
Mainsail type:	#	Topbatten: <input type="checkbox"/> soft; <input type="checkbox"/> standard; <input type="checkbox"/> hard;				
Genoa type:	#					
Spinnaker:	#					
Position mastfoot:	Mastbutt frontedge to bulkhead in mm:		Mastbutt in whole#		on track;	
Mastrake on forestay:	<input type="checkbox"/> 1200mm;	<input type="checkbox"/> 1210mm;	<input type="checkbox"/> 1215mm;	<input type="checkbox"/> 1220mm;	<input type="checkbox"/> 1230mm;	<input type="checkbox"/> mm;
Position uppers beh. #4:	<input type="checkbox"/> 780mm;	<input type="checkbox"/> 790mm;	<input type="checkbox"/> 800mm;	<input type="checkbox"/> 810mm;	<input type="checkbox"/> 820mm;	<input type="checkbox"/> mm;
Position lowers beh. #4:	<input type="checkbox"/> 810mm;	<input type="checkbox"/> 820mm;	<input type="checkbox"/> 830mm;	<input type="checkbox"/> 840mm;	<input type="checkbox"/> 850mm;	<input type="checkbox"/> mm;
Tension US w/o plastic:	<input type="checkbox"/> 17lu;	<input type="checkbox"/> 18lu;	<input type="checkbox"/> 19lu;	<input type="checkbox"/> 20lu;	<input type="checkbox"/> 21lu;	<input type="checkbox"/> 22lu;
Tension lowers:	<input type="checkbox"/> 5lu;	<input type="checkbox"/> 6lu;	<input type="checkbox"/> 7 lu;	<input type="checkbox"/> 8lu;	<input type="checkbox"/> 9lu;	<input type="checkbox"/> 10lu;
Jumpers center:	<input type="checkbox"/> lite;	<input type="checkbox"/> medium;	<input type="checkbox"/> hard;	marks: <input type="checkbox"/> blue; <input type="checkbox"/> red; <input type="checkbox"/> black;		
Jumper sideways:	<input type="checkbox"/> straight mast; <input type="checkbox"/> windward bend; <input type="checkbox"/> leeward bend; marks: <input type="checkbox"/> blue; <input type="checkbox"/> red; <input type="checkbox"/> black;					
Spreader angle fwd:	<input type="checkbox"/> zero degree = straight; <input type="checkbox"/> 1 degree; <input type="checkbox"/> 2 degree <input type="checkbox"/> others					
SAILING UPWIND						
Runnermark above deck:						
Ram position upwind	<input type="checkbox"/> zero;	<input type="checkbox"/> 5mm fwd;	<input type="checkbox"/> 10mm fwd;	<input type="checkbox"/> 15mm fwd;	<input type="checkbox"/> mm fwd;	
Mainsheet rough tune:	<input type="checkbox"/> blue mark;	<input type="checkbox"/> red mark;	<input type="checkbox"/> black mark;	<input type="checkbox"/> mark;		
Mainsh. fine tune	<input type="checkbox"/> blue mark;	<input type="checkbox"/> red mark;	<input type="checkbox"/> black mark;	<input type="checkbox"/> mark;		
Outhaul off black band:	<input type="checkbox"/> 100 - 80mm;	<input type="checkbox"/> 70 - 50mm;	<input type="checkbox"/> 40 - 30mm;	<input type="checkbox"/> 30 - 20mm;	<input type="checkbox"/> 20 - 15mm;	<input type="checkbox"/> 10 - 0mm
Cunnighamhaul:	<input type="checkbox"/> slack	<input type="checkbox"/> lite	<input type="checkbox"/> medium	<input type="checkbox"/> tight	<input type="checkbox"/> very tight;	
Genoa in&out from edge:	<input type="checkbox"/> 360mm;	<input type="checkbox"/> 340mm;	<input type="checkbox"/> 320mm;	<input type="checkbox"/> 300mm;	<input type="checkbox"/> 280mm;	<input type="checkbox"/> 260mm;
Genoa up&down leech off spreader tip:	<input type="checkbox"/> 30 -50mm;	<input type="checkbox"/> 50 --70mm;	<input type="checkbox"/> 80 -100mm;	<input type="checkbox"/> 110 -130mm;	<input type="checkbox"/> 140 - 150mm;	
Genoa foot touches uppers:	<input type="checkbox"/> 50 -100mm;	<input type="checkbox"/> 150 -200mm;	<input type="checkbox"/> 250 - 300mm;	<input type="checkbox"/> 350 - 400mm;	<input type="checkbox"/> 450mm;	<input type="checkbox"/> 500mm;
Genoa halyard tension:	<input type="checkbox"/> lots of wrinkles; <input type="checkbox"/> some wrinkes; <input type="checkbox"/> no wrinkles; marks: <input type="checkbox"/> blue; <input type="checkbox"/> red; <input type="checkbox"/> black;					
DOWNWIND/REACH						
Vang downwind	<input type="checkbox"/> eased;	<input type="checkbox"/> lite	<input type="checkbox"/> medium;	<input type="checkbox"/> hard;	<input type="checkbox"/> ve ery hard;	Mark: <input type="checkbox"/> blue; <input type="checkbox"/> red; <input type="checkbox"/> black
Vang on reach	<input type="checkbox"/> eased;	<input type="checkbox"/> lite	<input type="checkbox"/> medium;	<input type="checkbox"/> hard;	<input type="checkbox"/> ve ery hard;	Mark: <input type="checkbox"/> blue; <input type="checkbox"/> red; <input type="checkbox"/> black
Spin.pole height o. deck:	marks: <input type="checkbox"/> red; <input type="checkbox"/> blue <input type="checkbox"/> black;					
Tapemark on runner above deck/reach:	<input type="checkbox"/> 250mm;	<input type="checkbox"/> 350mm;	<input type="checkbox"/> 450mm;	<input type="checkbox"/> 550mm;	<input type="checkbox"/> 650mm;	<input type="checkbox"/> 700mm;
Taoemark on runner above deck/ downwind:	<input type="checkbox"/> 450mm;	<input type="checkbox"/> 550mm;	<input type="checkbox"/> 650mm;	<input type="checkbox"/> 700mm;	<input type="checkbox"/> 750mm;	<input type="checkbox"/> mm;

The recommended tack position for the A-1 mainsail without adjustable inhole has to be 50mm as shown below.

