Beneteau First 40.7 Mast Tuning Instructions

by Dr. Jack Kitrenos

I have put together a comprehensive set of tuning instructions for the Beneteau 40.7. These instructions are a compilation of suggestions from the master spar crafter at the plant in France, input from one of the engineers from Bill Koch's America3 campaign, as well as my observations during the first year with this boat. We took a first at the Youngstown Level Regatta...so we must have done something right.

1. After stepping the mast, make certain that the mast butt is centered in the step and pinned in the center hole.

2. All deck fittings should be secured into place and tightened securely. The rubber mast collar should be tightened. Because the mast is locked at the deck in a centered position, it does not have to be adjusted as there is enough play in the step to adjust and correct the tuning depending on the weather conditions.

3. Mast pumping struts below deck should be tightened and locked in place. Failure to tighten and lock these struts in place can cause catastrophic mast failure.

4. Make certain there is NO TENSION on the backstay (all hydraulics released and the turnbuckle loose).

5. PRIOR TO CENTERING THE MAST, ALL DIAGONALS SHOLD BE LOOSENED COMPLETELY (ALMOST OFF). THIS IS CRITICAL AS THE DIAGONAL TURNBUCKLES, IF NOT LOOSENED COMPLETELY, WILL ADVERSELY AFFECT THE MAST TUNING AS THE PRE-BEND IS ESTABLISHED. THE VERTICLES WILL TIGHTEN AS THE BACKSTAY TENSION IS RELEASE. Tensioning the rigging on the V1 is without any effect if you do not full take off on the D2's and D3's. You must absolutely release completely the tension on the D2's and D3's before tightening V1's. If this is not done, then any tension placed on the V1's are transmitted to the D2's and D3's and this will place center part of the mast under tension without any tension at the top of the mast which is critical.

6. The mast should then be squared in the deck using a tape run on the main halyard to port and starboard chain plates.

7. Put approximately 3500 lbs of tension on the backstay or tighten until the masthead is back at least 30 inches.

8. Once the mast has been centered, port and starboard cap shrouds should be tightened evenly. The cap shrouds should be tightened until BAR TIGHT. (Note: this may seem unreasonably tight, however, it is imperative that the caps be extremely tight) Make certain that an equal number of turns are taken on each side so that the mast remains centered in the boat. The cap shrouds are discontinuous rigging and therefore must be tightened with the diagonal turnbuckles completely loose.

9. With the backstay still on, send a man aloft and tighten the upper diagonals until hand tight plus 4 turns on each side. Make certain the upper and middle segments of the mast are in column by having someone on the deck sight up the mast.

10. With the backstay still on, lower the man aloft to the middle verticals and tighten hand tight plus 4 turns. Make certain the upper and middle segments of the mast are in column by having someone on the deck sight up the mast.

11. With the backstay still on hand tighten the lower diagonals plus 1 turn on each side.

12. Ease the backstay completely off. At this point, the mast should be in column and there should be about 3-4 inches of pre-bend in the mast. With the backstay completely off, hand tighten the turnbuckle above the hydraulic backstay adjuster plus 2-3 turns.

13. It IS NOT necessary to adjust the general geometry of the rig as the rig was designed with racing rules in mind and to avoid runners, which are heavily penalized. There will be some level of pumping but this should be mitigated by tightening the mainsail leech upwind. Remember...set up the verticals VERY TIGHT and adjust the forestay length to the amount of rake for the wind conditions and play the backstay to tension the forestay!!
Special notes:
The Beneteau 40.7 spar has been designed from the original Farr sail plan in conjunction with Beneteau engineering.

Approximate time to tune the mast: 3-4 hours

Forestay length: open length pin to pin is 16,311mm. Tuning calls for the forestay to be located in the 3rd hole of the link plate (never shorter than this hole!!) which should be at 16,251mm. (53.513-53.316ft/642.16-639.8 in)

Mast step should be in the middle hole.

The head stay is Navtec-17 rod rigging with the lower assembly reference LRT-120 plus G100-17. This should be replaced with Navtec turnbuckle C550-17, but the forestay will have to be taken off the boat to a local Navtec agent to be re-swaged. THIS IS A MUST for adjusting forestay tension with aft raked spreaders.

The backstay turnbuckle CANNOT replace the forestay turnbuckle. The backstay turnbuckle is necessary in order to pre-tension the backstay. With the backstay cylinder fully released, the backstay must be tensioned. This will allow the backstay hydraulic cylinder to be very efficient and powerful. This will also decrease the possibility of a mast failure due to the masthead moving forward of the mast step.

Tuning Tips (from North Sails)

Tuning Tips

When the design office of Bruce Farr and Associates started their relationship with Beneteau, few observers would have believed the success and popularity that was to follow. The list of designs is vast that have been drawn by Farr and built by Beneteau. Of late two designs have proved to be devastatingly effective offering value for money, performance, competitive handicapping under both IRC and IMS and genuine cruising potential. They are the Beneteau First 40.7 and big sister the 47.7. With over one hundred and eighty 40.7's and fifty 47.7's sailing their success is unquestioned.

Racing fleets of 40.7's have strongholds in Spain, France, United Kingdom and Australia. Primarily campaigned within large handicap events these boats appear to be equally at home under both of the major handicap rules used around the globe. IMS results and fleet numbers have been impressive with wins at the Copa Del Ray, Hamilton and Hayman Islands and Commodores Cup. At IRC events around our own shores these boats can regularly be seen at or near the front of their respective classes.

Preparation of the 40.7 and 47.7

To gain the most out of these boats in fact any boat that is to be raced seriously you should start your preparation well in advance of the boat going afloat. Set yourself targets agreed between you and your crew on which events are the focus for the year and allocate your time and resources accordingly. Start your preparation before you think necessary. Having enough time in any campaign is a wonderful luxury.

Hull finish

The arguments of which hull finish is better are numerous and personal preference is probably the determinant factor. Whatever your choice, which may be influenced by the venue, how long the boat is to stay afloat, color or cost make sure that the best possible finish is achieved. Pay special attention to the foils. Check that they are symmetrical and that the trailing edges are as fair as they can be. Prop size may vary, be aware of what you require to satisfy your power requirements and that you aren’t sailing around with the proverbial dinner plate beneath the boat. Make sure that the strut is fair and that a new anode is fitted regularly.

Rig checks and change

The standard rig and rigging which arrives from the factory will benefit from the following tweaks, changes and checks:

Before stepping the mast check that the spreaders are equal length and that when fitted they are symmetrical with equal aft sweep. Make sure that they locate in position firmly with no play.

For the 40.7 check that the backstay length allows enough headstay tension to be achieved. Many of the boats that we have sailed have needed the backstay to be shortened by 200mm.

Check the headstay length. The length at half adjustment should be 16.335m from pin to pin.

On the 47.7 the same checks should be undertaken. Headstay Length 18.70m from pin to pin.

Running rigging

However serious your program it will benefit from improved running rigging. On the 40.7 the main halyard and center headsail halyard should be replaced with 10mmVectran. This material offers massively better stretch resistance than Dyneema / Spectra. Some boats choose to use a 2:1 main halyard, which reduces the weight aloft as an 8mm halyard can be used. To further reduce weight and cost, a 6mm or 8mm Dyneema / Spectra tail can be spliced into the halyard.

For anyone considering sailing offshore one of the wing halyards should also be 10mm Vectran. The principle spinnaker halyard should be Dyneema / Spectra. This offers a little forgiveness to the chutes through its greater elasticity. All the halyards can have their cases removed to reduce windage, weight and friction. Please be sure to coat any Vectran halyard that has its cover removed with Maxi Jacket or some other UV protective coating. Vectran when exposed to sunlight degrades very quickly so an UV shield is very important.

Spinnaker sheets and guys are fine in Spectra / Dyneema with 8mm sheets and 10mm guys the norm. Vectran offers some advantages but the cost implication does not make them a necessity on boats like this.

Genoa sheets should be 10 or 12mm Spectra / Dyneema and have "J" locks or Press Locks fitted to ease sail handling and to accelerate the sail's passage around the rigwhen tacking. Cover the clips with either velcro or bicycle inner tube to eliminate the risk of them flogging undone. This will also protect them, the rig and the coachroof.

With the style of mainsheet employed on these boats it is worth splicing the two ends together thus producing an endless system. This eliminates the worry of trying to bear away around a starboard tacker and running out of sheet tail on the weather drum.

Aboard the 47.7 the same materials should be used with increased sizing.

Instruments

Whatever electronics package you have it is imperative to make sure that your system is calibrated and understood by as many of the crew as possible. Allow time when commissioning a new boat or re-launching to check all readings.

A useful addition to your instrumentation package is a headstay load cell pin. Available from Diverse Yachts at Hamble this system offers you an accurate readout of headstay tension through a remote readout or integrated through your existing instruments. As any trimmer will agree this system is well worth the expenditure.

Crew

Too often on this size of boat the crews strengths are under used. Before sailing ascertain:

What jobs individuals wish to do? What jobs individuals are best at performing? What combination of crew gets the boat around the course fastest?

It is important to have your crew motivated but on the flip side it is also important to make the best use of the crew available to you. Some difficult decisions may be needed to ensure that the primary roles within the crew are filled by the crewmembers that offer the best skills in these areas. Be objective and select rather than divide up tasks equally. Everyone aboard must understand that whatever their contribution, it is having a positive effect. Canvass opinion from someone detached from the programs to crew selection and task allocation.

Make the hard decisions when planning your program rather than having to make changes at an event or during a race.

Ready to set up the rig

Both the 40.7 and 47.7 as standard have fractional three spreader rigs. Spreaders are aft swept to approximately 10 degrees. The rigs are relatively simple having no running backstays or check stays. Backstay adjustment is via a Navtec hydraulic ram.

Obviously the set up of each boat will vary as to what sails are used and the conditions to be encountered. Each sailmaker will no doubt have their own guidelines as to set up. The biggest factors to consider will be the mainsail luff curve and mast rake. This will vary between sailmakers, these are the basics which I have used when sailing the 40.7 with North Sails.

Before starting the rig set up make sure that the verticals (caps) and diagonals (intermediates) are all slack.

Mast foot / butt position. On the 40.7 the butt is located within a track with three set positions. If possible a new track should be fabricated with holes set 12mm apart. If using the standard track use the forward hole. At deck level the "J" measurement should be set at 4.41m. This measurement may vary depending on what is declared on your rating certificate. On the 47.7 "J" should measure 5.21m.

The base headstay length that I would recommend is 16.335m. This should be set with the turnbuckle half open. Make sure that your boat has an adjustable headstay.

Aboard the 47.7 the butt position as shown should see the front face of the mast 35mm from the main bulkhead.

Before tensioning the rig, basic checks to ensure that the rig is central in the boat at both deck level and at the hounds should be carried out. To check the hounds are central suspend a crewmember over the side on a bosuns chair. Wait for a minute allowing the halyard to take up. Now lower the human weight so that the halyard can be marked by using a batten laid flat on the deck extending over the gunwale and a permanent ink pen. Repeat from side to side making adjustments where necessary. Always check aloft to ensure that the halyard has clear passage.

Once the rig is centered, the butt set, the headstay at base and the rig set at "J" we are ready to start the laborious task of tensioning the caps. Make sure you have a good pair of large adjustable spanners to hand. On the standard rig in both the 40.7 and 47.7 a mast jack is not supplied. Unfortunately "hard work" is the order of the day here. To make life a little easier tension the backstay fully. With little or no diagonal / lower tension the rig will bend dramatically. Do not be alarmed. The compression in the spar will bring the hounds closer to the deck thus allowing the caps to be tensioned more easily. You should, with the correct tools be able to get to within 2 / 3 turns of the required tension before sailing. Ease the backstay off and you are now ready to tension the lowers and diagonals. The lowers D1's should be hand tight plus four turns.The D2's

and D3's should be hand tight plus three turns. Remember to sight up the back of the spar to keep the rig as straight as possible. On the 40.7 you should now have approximately 85mm of pre bend, on the 47.7 approximately 105mm of pre-bend should be showing. The above adjustments are guidelines that should provide a sensible base setting to start from.

Time to go sailing

Allow plenty of time for final rig adjustments. Three or four hours should suffice. Ideal conditions for this task is 12 to 15kts of breeze with flat water. You do not need all of the crew present, however you will need someone confident at working aloft whilst sailing. To finish tensioning the caps sail close hauled on each tack and assess the amount of slack in the leeward cap shroud. Adjust the leeward shroud one turn at a time. As mentioned you should need no more than three turns to give the required tension. Do not expect to eliminate all the slack from the leeward shrouds completely.

To tune the diagonals whilst sailing sight up the back of the luff track in the mast. Sight from above and below the gooseneck to see how the rig is behaving. The acid test for diagonal shroud tension? The mast must be straight sideways. Hopefully we should only be moving the diagonals by only one or two turns.

Repeat this procedure again and again until the rig stays in column even with 100% backstay applied. The compression loading on the spar will make this difficult to achieve. The rewards when this is accomplished are well worth the toil and trouble. Be aware that the diagonals pull the rig aft thus straightening it, as well as sideways.

On fine tuning the location of the mast butt look for an even fore and aft bend. Sight the first 600mm of mainsail coming off the rig from the gooseneck through to the second spreader. If the mainsail entry is too deep and round move the butt aft to bend the spar thus giving a finer entry. If the entry is too flat / fine move the butt forward to round the entry. Do not be afraid to move the butt in 12mm increments so you can easily see your adjustments.

The magic in these rigs is achieving the correct amount of headstay tension without runners, checks or jumpers. Therefore tuning has to be just right to allow the main to set correctly while transmitting the optimum tension down the headstay for a given windspeed and sea state. On the 40.7 I prefer to use five headstay lengths which are shown with other quick adjustments and sail choices in the table below.

TWS	Headsail	Headstay	Caps	D1's	D2's	D3's
0 to7	Lt / Lt Med	-8	Base	-2	-1	Base
6 to 11	Lt Med/ Med	-4	Base	Base	Base	Base
10 to 15	Med/ Med Hvy	Base	Base	Base	Base	Base
14 to 21	Hvy	6	Base	1	Base	Base
20+	#3	10	+1	2	Base	Base

A couple of tips for sailing

When sailing these boats remember they are relatively heavy and need to be coaxed around the race course. Build speed aggressively out of tacks by pressing on the genoa. Make sure that there is strong communication between the helmsman and the trimmers through the period of acceleration. The headsail trimmer should during the speed build be talking about the angle to the helm while the mainsheet trimmer calls the speed build. When turning the boat always consider how much speed you can afford to scrub off when making a tight turn. For instance making a tactical turn when position the boat will be

much faster than the optimum VMG tack when sailing upwind. Do not be afraid to ease backstay when accelerating out of tacks.

Given the relatively long spreaders that these boats carry it is necessary to sheet the headsails very hard around the rig. Make sure you have strong correctly positioned spreader patches. Check them for wear regularly.

Be aware that if your are moving your headstay length that you will need a well documented table of settings which show the sail, the position of the halyard and headstay.

Use crew weight as much as possible to minimize the amount helm needed for any manoeuver. A common mistake in these boats is not easing enough vang at the weather mark and not keeping all the available weight out as far as possible until the turn downwind has been completed. Make sure that all of the crew understand that its far better to hoist one boatlength later having completed a smooth bear away, rather than compounding a poor away by starting the hoist to early. Have a designated crewmember that continually encourages everyone to hike as hard as possible. Have them remind everyone prior to the mark rounding how important a smooth bear away is. Someone should take responsibility for the vang at every weather mark, easing when necessary to allow the bear away and then pulling on back to the downwind mark. A clear call is needed from the helmsman / tactician when to commence the hoist.

Upwind practice sailing in different modes. Using more mainsheet, traveler and backstay work at finding your "point mode". Do not be afraid to ease the outhaul 25mmwhen trying to sail high. This will create a little more weather helm giving the driver more feel. This mode is particularly effective on tight laylines or when trying to force a weather boat to tack away thus opening your options.

Work at finding your "fast forward mode". From your upwind VMG numbers sail two tenths quicker. Press on the headsail, sail with the main down track and ease the backstay slightly. This mode is particularly useful when covering an opponent or when looking to get to a heading shift first.

Downwind in above 12 kts of breeze roll the boat aggressively into the gybes. Have someone in the middle of the boat co-ordinate the weight transfer. Use as little helm as possible for the turn.

When gybing in under 10 kts of breeze lower the main halyard 150mm jut before the gybe. This allows the main to pass trough the backstay more easily. Once the turn is completed re-hoist the main.

Useful tips about the boat

Upgrade the genoa car pullers. Line and block size should be increased. Upgrade the vang with extra purchase and include ratchet blocks in the system. Position as a visual guide a marked batten on the backstay. Padding on bottom lifelines to aid hiking.

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