

INTERNATIONAL STAR CLASS YACHT RACING ASSOCIATION

Lake Ontario American Fleet

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The number of mast failures occurring during the past season has prompted us to learn some of the technical aspects of the "new rig". Even a casual review of a few of the problems shows clearly that the flexible mast is far from a toy and that careful study and considerable practice are necessary to successful operation.

The enclosed paper is submitted for your consideration. It is not a panacea nor should it be held as authoritative. If you receive any new impressions, or if you find some features applicable to your manner of handling the "new rig", the effort of preparation will be considered to have been well spent.

Sincerely yours,

BAH:EH  
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Fleet Captain.

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## OPERATION AND TUNING OF FLEXIBLE RIG STAR MAST

### IN GENERAL

The new flexible rig Star mast incorporates many new features in tuning and operation, in many cases completely new to the sailorman, and in some instances contrary to what has been their general practice with the old conventional rig.

This new rig, with its many adjustable features, which are often altered during the course of a race, make it absolutely essential that both skipper and crew be completely familiar with the operation of the mast and the result that can be expected by moving any of the adjustable features.

The modern flexible Star masts are amply strong enough for the most severe conditions, providing that they are properly operated. However, it is possible to create a situation where the mast will give trouble or break due to inexperience in handling this type of equipment. Of course, it would be possible by materially increasing the weight aloft, the size of the spar, and many other features, to reduce this possibility of breakage. However, it must be borne in mind that adding one pound aloft has the effect of taking five pounds off the keel; it is generally recognized that Star boats are generously canvassed, and there is little room to sacrifice any of the effective weight of the keel. Adding five or ten pounds aloft, and a resulting decrease in the effectiveness of the keel fifty to one hundred pounds, greatly reduces the possibility of the boat performing successfully in any breeze of over five or six miles per hour.

### HOW TO SET UP THE MAST AND RIG

Prior to placing the mast in the boat, providing it is a diamond rig, the diamond stays should be set up reasonably tight, and under normal conditions these stays will not need to be touched for some time. After stepping the mast in the boat, see that the mast raker is properly lubricated so that it can be easily adjusted, and that the mast partner fits the base of the mast rather snugly fore and aft with probably 1/8" clearance. If possible the mast partner should be so arranged so as to allow the mast 1" play on each side so that the mast at the deck can be moved athwartships. When not sailing and towing, blocks should be put on each side of the mast to prevent it from wobbling around and chafing too much on the mast partner.

The intermediate shrouds should lead down the center line of the mast and intersect the chainplates at approximately the center line of the mast, about 1" aft of the center line. The lower shrouds should lead 2 or 4 inches forward of the center line of the mast. The backstays should be so arranged that they can be adjusted fore and aft to take up the variation in rake that may be put in or out of the mast. The jibstay and headstay should go down to an adjustable bow fixture and lead under the deck to underdeck turnbuckles, where further adjustment can be made. The intermediate shrouds should be carried reasonably tight and the lower shrouds should be carried tight, but not quite as tight as the intermediate shrouds. The jibstay and backstays, of course, are always carried extremely tight and the headstay tight enough to keep the tip of the mast in the position you wish it.

HOW THE MAST SHOULD BE RAKED AND BOWED IN VARIOUS  
CONDITIONS OF SAILING

There are two distinct types of adjustment made on the flexible mast (1) raking the mast, and (2) bowing the mast. (To eliminate any misunderstanding we will call a bow aft, a bow where the peak of the mast falls aft and the center of the mast goes forward; and we will call a bow forward, when the peak of the mast goes forward and the center of the mast goes aft.)

It is very difficult for us, not knowing your boat, to absolutely state whether the boat sails best with or without a rake, and the amount of rake under different conditions. Different boats also react differently to different conditions of the mast, and therefore you will have to establish for yourself many of these points, however, in general, most boats will react favorably to the following type of adjustment:

RAKE

- Closehauled: In light air a perpendicular mast, increasing the rake as the wind increases to approximately 2' of rake in a heavy blow.
- Reaching: Some boats prefer a perpendicular mast, others moderate rake. We prefer to carry, for the purpose of simplicity, the same rake on a reach as was found best closehauled.
- Running: In all types of weather a perpendicular mast.

BOW (bend in the mast)

- Closehauled: Starting in light air, 1" of bow, increasing as the wind increases up to 6" or possibly 7" maximum bow.
- Reaching: A slight bow - 1" or 2".
- Running: A slight bow - 1" or 2" (mainly to offset the tendency of the peak to go forward and throw a forward bow in the mast.)

HOW TO MAKE THE ADJUSTMENTS FOR RAKING AND BOWING

RAKING: Raking the mast is done as follows:

To put rake in, screw the mast raker forward to move the butt of the mast forward, let off on the headstay, let off on the jibstay. You will have to let off more on the headstay than on the jibstay. Take up on the backstays by moving the adjustable track stops. Usually after a few weeks of experimenting with your rig you will determine about what rake is best in a given breeze, and actually it is seldom necessary to change the rake during a race unless weather conditions change radically. Reverse the process to take the rake out.

Off the wind the mast should be adjusted so that it is perpendicular. This is done by letting off the backstays and moving the butt of the mast aft with the mast raker. It is not necessary to change the headstay or jibstay under this condition because it does not hurt if they are slack, (running only) ALWAYS KEEP TRACK OF HOW MANY TURNS YOU TAKE IN THE MAST RAKER SO THAT YOU CAN PUT THE BOAT BACK IN THE SAME ADJUSTMENT AS BEFORE. For example - we will put the mast in the boat and we will start with a mast with 6" of rake, which is a good rake for normal conditions. It might take three turns aft on the mast raker to make the mast straight, after letting off the backstays, so that if your were sailing with a 6" rake and you ran before the wind you would take three turns out and then before going before the wind you would put those three turns back in again and set the backstays into the normal position.

If it was blowing quite hard at the start of the race and you decided to rake the mast more and you moved the butt of the mast forward six turns to put in 6" or a foot of extra rake, off the wind you would move the mast butt aft the six extra turns, plus three to make it perpendicular, and before going on the wind again, you would take those nine turns off. When going back to the anchorage it is best to put the mast back in the normal position so that you always have a definite starting point, counting the turns that you let off on the jibstay and take in on the headstay, or let off the jibstay and the headstay. If it is difficult to remember this, we recommend that you make pencil notations to keep track of these adjustments.

In straightening the mast up off the wind it is unnecessary to change the jibstay and headstay adjustment because it makes no difference if they are slack. We do not recommend changing the rake on a reach, at least until you are extremely familiar with the operation of the rig, because to change the rake when you are reaching means that not only must you move the butt of the mast and the backstays, but you must also change the adjustment on the headstay and the jibstay making it much more difficult to get back to the original position.

### BOWING THE MAST

It must be remembered when bowing the mast, that the danger of mast collapse is always fore and aft, and that the headstay prevents the peak of the mast from going aft and the leach of the sail prevents it from going forward; that the jibstay and backstay hold the mast at their point of intersection in a fixed position and that the lower part of the mast, which is the most vulnerable particularly around the lower spreaders, is prevented from going forward by the pull of the sail aft and is prevented from going aft by the slight forward lead of the lower shrouds. Removing the athwartship blocks at the partner further helps to allow the mast to move to leeward and automatically further tightens the lower shrouds. (Also it puts a bow to weather in the mast which is an advantage).

In light air you should carry possibly 1" of bow aft, increasing this bow up to 7" or 8" in a heavy blow. There should always remain a fixed pull aft on the mast raker which tends to push the mast forward at the lower spreaders or a bow aft. There should always be a tendency for the mast to

bow aft - more in heavy air than in light air. This is the greatest cause for mast failure, that the mast raker is not exerting sufficient strain aft on the butt of the mast and that the headstay is too tight. As the wind increases it requires more tension aft on the butt of the mast and more slack on the headstay. Never allow the mast to tend to bow forward because it will usually result in a compression collapse. If it tends to wobble fore and aft at the lower spreaders there is not enough pull aft at the butt.

Any turns taken on the mast raker to put the bow in the mast should be added or subtracted as the case may be, to the turns that you carry to rake the mast, and you should remember these figures so that the adjustment can be made properly.

For example - we started with a 6" rake, we are going to sail in a moderate heavy breeze and decide that we will add 6" more rake which means that we are going to move the mast butt forward six turns, (fictitious figures, check your own boat for number of turns) and we think that in this breeze we should carry a 3" bow in the mast which means that we should move the mast butt aft three turns. (again a fictitious number of turns). Therefore instead of moving the mast butt forward six turns we move it forward six turns, less three, or three turns. We let out on the headstay sufficient to make it one easy sweep, and, of course, adjust the jibstay and headstays for the increase in rake.

When we sail off the wind we want the mast perpendicular so we take the three turns out, plus enough more to bring the mast straight, and let off the backstays. When we come on the wind again we should put the rake and bow back again, but instead of doing it just the normal way the three or more times, the wind may have increased slightly or the wave conditions changed, so that the mast may need more tension aft on the butt to keep it from buckling in the middle or throwing. We want that mast to push forward in the middle. We had screwed the mast butt aft to take the rake out on the run, instead of pushing it forward quite as far as it formerly was, we omit a couple of turns on the mast raker to give more than a normal strain aft on the mast raker, then when on the wind look at the mast and if there is too much bow and no tendency to throw, take the extra turns previously omitted or adjust to a good fair bow.

We may, on the other hand, have to reduce the tension of the raker if the wind velocity has decreased. Always start with more bow than necessary, then take it out if you wish. The crew must look at wind and water conditions and adjust accordingly, and as a matter of fact he should look aloft every few minutes to see the condition of the mast, to see if the bow remains uniform, and to see if there is any tendency to throw, and to make any adjustments necessary on the mast raker to correct it.

The number of turns taken as an example were fictitious. You will have to experiment with your own boat to see how many turns are necessary to change the rake of the mast and how many turns are usually necessary to bow the mast. You will have to find out how far to let the backstays off, how much adjustment you will have to make and the number of turns you will have to take off in the jibstay and headstay to get a desired result in comparison with the adjustment you have made in your mast raker.

We do not wish to make this appear complicated. We are attempting to give a full description of how to use the mast, and once you are familiar with it the routine becomes simple and it is easily possible with no extra work to carry light weight rigging through extremely severe conditions.

There are a few DON'TS that we would like to state again.

DON'T EVER ALLOW THE MAST TO BOW FORWARD.

DON'T SAIL WITHOUT A SLIGHT BOW AFT.

DON'T FORGET TO HAVE YOUR CREW LOOK ALOFT WHEN YOU COME ABOUT TO SEE THAT THE BOW IS CORRECT AND THAT EVERYTHING IS AS IT SHOULD BE.

DON'T ADJUST THE RIG TOO MUCH UNTIL YOU ARE FAMILIAR WITH IT.

DON'T PUT MORE THAN 6" OR 8" MAXIMUM BOW IN THE MAST. MOST OF THE DRAFT IS REMOVED BY THE FLEXIBLE BOOM.

DON'T FORGET TO KEEP A TENSION AFT ON THE MAST RAKER AT ALL TIMES, A LITTLE MORE THAN IS NECESSARY.

DON'T FORGET THAT IN A CHOP YOU WILL OFTEN HAVE TO CARRY MORE TENSION ON THE MAST RAKER AFT TO PREVENT THE MAST FROM THROWING IN THE MIDDLE.

DON'T HESITATE TO WRITE US IF YOU DO NOT UNDERSTAND.

DON'T FORGET THAT THE MAST AND RIGGING ARE LIGHT, ALTHOUGH AMPLY STRONG ENOUGH IF PROPERLY HANDLED. THEY ARE BUILT TO MAKE IT POSSIBLE TO WIN RACES AND NOT COME IN THIRD OR FOURTH.

DON'T FORGET THAT IT IS A RACING RIG ALOFT - NOT A CRUISING RIG.

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#### ADJUSTING THE FLEXIBLE BOOM

On the modern flexible rig sails, most of the draft control is handled by the bending of the boom.

There are two adjustments to be made in bending the boom. (1) the position of the claws on the boom, and (2) the amount of athwartship movement on the travelers.

For a light breeze the forward claw should be moved further forward and the center claw further aft, close to the after claw. The travel of the traveler should be minimized. This means that in sailing closehauled the minimum down pressure is exerted on the boom, and what pressure is exerted is not exerted where it will cause it to bend the mast.

In a heavy breeze, move the forward claw on the boom aft, the middle claw on the boom forward, and increase the travel on the travelers. This puts more down pull on the boom claws to pull the boom into a given position, and the tension of the claws is exerted more in the center of the boom where it will cause a greater bend.

In winds between light and heavy, adjust the claws and the traveler accordingly. Practically any reasonable adjustment can be made to the fit of the sail by the position in which you carry the claws and the traveler. Try to make a nice easy curve in the boom and avoid hard spots if possible in the sail.

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