The Right Spanner For The Job

Rule changes allow for greater sail control off the breeze

Larger racing catamarans often have a mast rotation control system but no vang system. This is because they usually travel fast enough downwind in a breeze (reaching, not running) that the apparent wind swings forward sufficiently for the sail and boom to stay above the traveller track when performing optimally....therefore, no need for a vang. However, getting the best from the sail requires trimming the mast angle relative to the sail luff, and hence a mast rotation system is provided. The sail is allowed to twist when sailing off the wind in light weather.

The PT does not have enough sail area to achieve these speeds so, in order to maintain an effective aerodynamic sail form on a broad reach or run, a vang system is required to hold the boom down once it is beyond the end of the traveller track.

Other small cats tend to have fixed stops to allow some mast rotation to improve air flow onto the sail, and this is probably enough mast control as the mast section is round and stiff. The PT, with its tear drop mast section and flexible rig, benefits significantly from mast rotation control.

Attaching the vang system to a mast spanner enables it to serve two functions....mast rotation control whist the boom is over the traveller track and vang function once the boom is beyond the end of the track. Unfortunately the system doesn't allow rotation control whilst operating as a vang. As from October last year, changes to Rules 9 and 11 were passed by a ballot of the international membership which changed this situation.

The new rules allow for modifications to the vang system to allow a degree of independence of the boom vang and mast rotation functions. Some versions are already in operation, particularly in New Zealand. I haven't had the opportunity to try these, so my comments on their performance are speculative.

Previous Rules:

9. *The boom vang shall be connected to one point only on the boom and may be fixed to a saddle or the end of a spanner attached at or near the base of the mast. Such spanner shall have a maximum length of 250mm measured from the centre of the mast heel point to the point of vang attachment.*

Movable spanners shall be measured when positioned at an angle of 45 degrees to the mast.

11. *Devices to specifically control mast rotation are prohibited.*

Revised Rules:

9. *The boom vang shall be connected to one point only on the boom and shall be attached to a saddle or a spanner, attached at or near the base of the mast. The spanner may be designed to control mast rotation.*

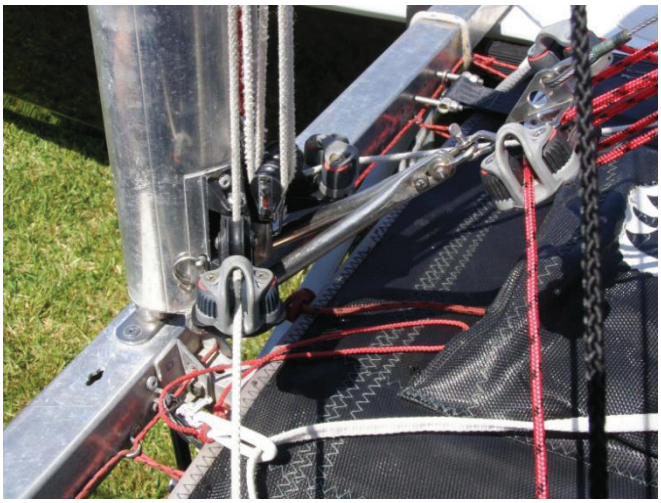
11. *Devices to specifically control mast rotation, other than the spanner and vang, are prohibited.*

The main arguments in favour of the change were:

- The changes would allow some development of the mast spanner whilst maintaining the existing requirement that it be confined between the boom and the mast base. Locking, over-rotation devices, as used in "Tornado" and "A" Class catamarans, would still be prohibited for safety reasons.
- This is an area of development that would keep the Paper Tiger Catamaran competitive with other 14ft catamarans.

As seen in the photos (next page), the basic difference between the old and new systems, so far, is the addition of a pivoting arm, attached near the base of the spanner and controlled by a simple tackle which allows the spanner to swing away from the line of the vang when the vang is under tension. This means that the vang is operating almost independently of the spanner and the spanner is operating almost exclusively to control mast rotation.

As the pivot point for the mast is near it's leading edge and the pivot point for the vang arm is located a distance back from this point along the spanner, there is still a tendency for the vang to pull the spanner in line with the boom when under tension. Any independent rotation of the two systems would rely on the forward rotation forces, applied to the trailing edge of the mast by the boom and sail, overriding the reverse rotation forces applied to the spanner by the tensioned vang. Mast curvature makes it very difficult to pull the vang totally in line with the boom with the normal vang setup without the mast reversing. Therefore, I suspect that the system would generally operate as intended.



Conventional spanner

Modified spanner - control system on vang

Modified spanner - control system on spanner

So assuming that there is now an effective mast rotation control available when on the reach and run, how should it be used and are there any potential hazards?

On a broad reach the vang would be tensioned as usual to achieve the required degree of twist in the sail and support for the sail leach for the breeze strength. Then the spanner would be eased to rotate the mast and achieve optimal flow onto the sail luff.

On the run in light weather the sail would be let out to the maximum, the spanner would be eased and pulled towards the centreline of the boat allowing the middle of the mast to bend back and sideways at the lower hounds (lower forestay eased), thus spreading the sail out flat for maximum area and allowing the outer end of the boom to go forward as square as possible to the boat centreline (the mainsheet must be set up so that the boom can **NEVER** touch the back stays). The vang would then be tensioned as much as necessary to prevent the head of the sail twisting too far forward.

Running in stronger breezes requires greater attention to protecting the mast. The lower forestays should hold the mast straight or curved forward at the lower hounds. The boom should be out to the maximum unless the wind is so strong, or the waves so steep, that the sail area needs to be reduced to prevent nosediving. If so, pull the boom in but hold a true course to prevent an accidental gybe. Apply plenty of vang to stop the sail twisting and support the top of the mast. Ease the spanner to rotate the mast forward enough to prevent it whipping in gusts or as the boat plunges into the back of waves.

It should be noted that there is a potential risk associated with the vang/rotation system described. The triangle of forces formed between the gooseneck, and the attachment points for the mast spanner and boom vang, acts to hold the mast at its rotated angle. If the spanner has been eased on a reach or run in strong winds, the increasing pressure on the vang during a gybe will hold the mast in its rotated position all the way to the new gybe position. It could then be held tightly with the wrong rotation until the vang is released. There is a risk that the mast could be damaged by a gybe in strong winds with the mast reversed this way. There is also a risk of nosedive if the skipper has to go forward to release the vang or force the spanner across, as well as a risk of mast damage if the boat does nosedive. It would probably be advisable to pull the spanner in to the "no rotation" position before gybing in these conditions, or if going forward to do this is too risky, don't use the rotation control at all.

Alex Craig – PT3033 - NEED FOR SPEED and Ian Marcovitch – PT3039 - MOJO broad reaching in a stiff NSW nor'easter

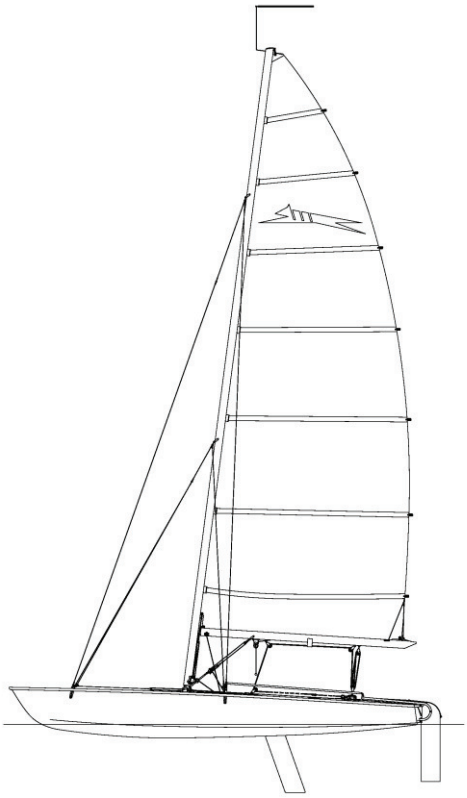
As a matter of interest, the following is a list of the things you can play with on the PT to optimise boat performance (allowable design variables such as centreboard and rudder profiles and rake are not included).

Pre race

- Mast rake.
- Upper stay tension.
- Lower back stay tension.
- Sail batten shape and stiffness.
- Sail batten tension.

During race

- Lower forestay tension.
- Sail luff tension.
- Sail foot tension.
- Sail leach tension.
- Boom vang tension.
- **Mast rotation angle.**
- Mainsheet tension.
- Mainsheet traveller location.
- Centreboard uphaul and downhaul.
- Rudder uphaul and downhaul.
- Tiller.



At least you won't get bored.

Ralph Skea *- PT3065 - SOLITAIRE*

My thanks to Ian Marcovitch for his input. Ed.