

Talkin'bout

the vang

This is the fourth in the series on Paper Tiger control systems for newcomers to the class, or for those who are isolated from the main fleets.

The aim is to describe the variations in PT rigs and the possible advantages and disadvantages of the different systems used. It is intended as a guide only. This time we'll examine the vang and associated mast rotation system.

THE VANG

What does it do

The primary function of the boom vang on a Paper Tiger is to apply tension to the sail leech when the mainsheet system is not able to carry out this function. This occurs when the mainsheet attachment point at the outer end of the boom is no longer above the traveller car, i.e. when on a broad reach or when running downwind. If the boom is not held down by the vang, the sail leech may twist to leeward reducing the power developed by the sail.

The secondary function is to control mast rotation when on a beat to windward or close reach. Until recently the vang was the only way of controlling the mast's rotation in relation to the boom. This meant that once on a broad reach or run in other than light airs, the vang automatically pulled the long axis of the mast in line with the boom and no adjustment could be made to the relative angle between the two to improve air flow onto the leeward side of the sail. While this is still the case on most PTs, an amendment to the rules now allows a separate rotation control (see "The Right Spanner For The Job" - Issue 2 of APT).

On boats without this extra control, the vang operates primarily as the rotation control on a beat or close reach, with the mainsheet doing the bulk of the leech control.

However, even with a separate system, the vang is still the preferable rotation control upwind, but more on this later.

Another function of the vang is to bend the mast when on a broad reach or run, thus flattening the sail and changing its drive, drag and effective area. It can also help to support the top of the mast when on a broad reach in a blow by keeping the leech tight.

The configuration

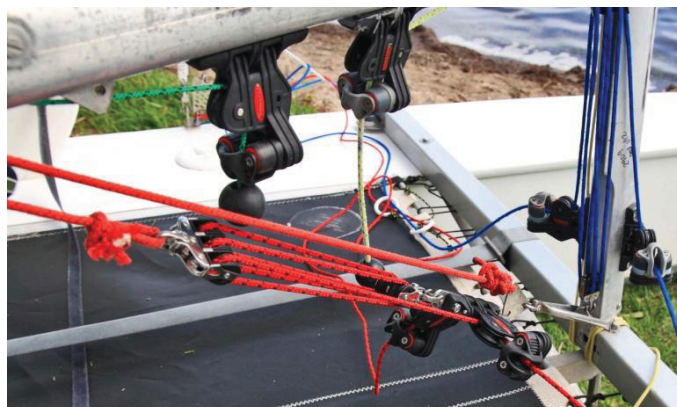
Class Rule No. 8 - SPARS, Part 9 states "**The boom vang shall be connected to one point only on the boom and shall be attached to a saddle or a spanner, attached at or near the base of the mast. The spanner may be designed to control mast rotation**" and Part 14 states "**The tails of control lines may be lead to positions of convenience and the slack taken up as long as the primary control load is taken by fittings positioned in accordance with the relevant class rule.**"

Traditionally the vang consisted of a triangular "spanner" arm of restricted length attached to, or just above, the mast base with a block and tackle system connecting from the outer end of this to a fixture located approximately a quarter of the way along the boom. The restriction on spanner length was removed in the latest revision of the class rules.

The spanner arm is usually made of stainless steel tubing or various aluminium sections. However, creative minds have devised spanners using more exotic designs and materials.

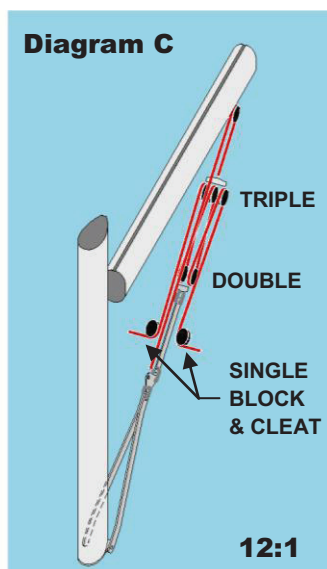
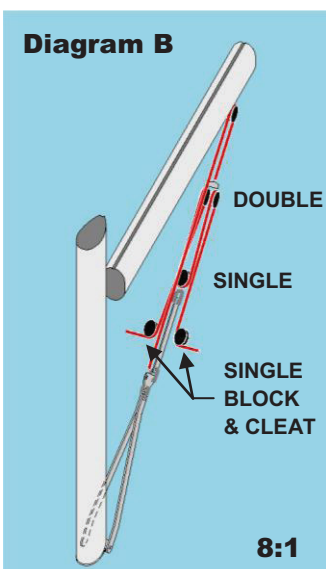
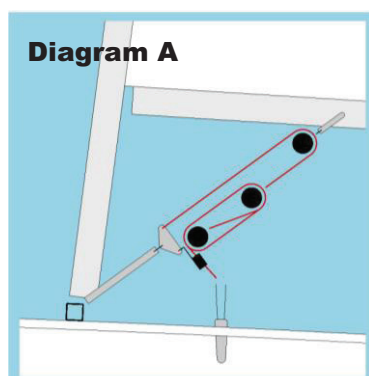
As the vang can be used upwind to adjust mast rotation (and therefore sail twist and layoff of the sail leech) it is advantageous to be able to adjust the system whilst hiking. Therefore, it is not uncommon to see systems where dual cleats are fitted and the rope tails are extended out to the gunwales.

A typical double sided vang setup



The ratio

An 8-to-1 block and tackle system is the minimum required. This is achieved by attaching a 4-to-1 system to the end of the spanner, then doubling its power by attaching the other end to a rope or wire that passes through a block on the boom, then back to the spanner (see Diagrams A & B). If easier operation is desired, it can be increased to a 12-to-1 system (see Diagram C).



The rope

4mm diameter pre-stretched, braided polyester rope is quite adequate for the tackle system. Low stretch "Spectra" type rope can be a bit stiff through the blocks in light weather. Smaller diameter rope can be harder to grip and harder on the hands. "Spectra" type rope or 7x19 strand stainless steel wire is preferable for the doubling component.

The blocks

The vang can be subjected to significant loadings, especially when gybing in strong breezes. Therefore, it needs to be robust. 19mm diameter blocks are adequate for the tackle system. The turning block used on the boom will be determined by the use of rope or wire for this component of the system. A 25mm dia. metal sheaved block for wire or 19mm plastic sheaved block for rope should be adequate. If affordable, ball bearing blocks (not for the metal one) are preferable as they will allow the rope to run more freely in light airs.

Attachment

The mast base commonly used on PT masts has mounting holes for the spanner on its rear edge which

accepts a 6.4mm (1/4 in.) dia. bolt. As this bolt takes a serious hiding during its lifetime (and nasty things can happen if it fails) it is worth considering the following:

- Buy a bolt that is unthreaded over the full length of the section that is supporting the spanner. Add washers if necessary to tighten it. The threaded section is where many a bolt fails.
- Relace the bolt every few years regardless; they are not expensive.
- Keep the bolt firmly tightened. Over time a gybe in heavy weather can take the end off a loose bolt.

If the spanner is bolted through the body of the mast, insert an internal spacer to prevent it squashing the mast.

Attachment of the system to the boom is usually by a standard mast hound fitting.

The cleats

The basic vang system usually has a single cleat which can swivel to either side of the boat for ease of operation. As mentioned earlier, the disadvantage of this system is that it can't be readily adjusted whilst hiking. It is possible to add a double rope tail to a single cleat system, allowing it to be adjusted from the gunwale, but generally a dual cleat system is used (at additional cost of course). The cleats are mounted close to the spanner to avoid pulling the boom when adjusting the system and to reduce the length of rope tails required as the boom swings across the boat.

The skipper's preferred operating angle of the cleats will determine how they are set up. If standard swivel cleats are used, they are pulled backward and forward to engage and release (see image on previous page). If up and down operation is preferred, a custom built arrangement with fixed cleats will have to be built. (see second image on the following page)

SEPARATE ROTATION CONTROL

What does it do?

As mentioned previously, there is now the opportunity to install a mast rotation device which operates independently of the vang system, although it must be attached to it.

Initially this seemed like an opportunity to set the vang up to control the sail shape on any point of sailing and use the rotation control to do that task alone. However, experience is tending to show that having the rotation control looser than the vang upwind tends to stop the mast rotating freely when tacking. This is a nuisance especially in stronger winds, as the mast may have to be kicked across to the new tack (and it won't go easily). It doesn't appear to be a problem when gybing though.

Therefore, it would appear preferable to pull the rotation control in line with the vang lever when sailing upwind and use the vang to adjust mast rotation as has been

the tradition. Of course this is a matter for each skipper to find what works for them.

Before rushing off to fit a system, an observation: in comparable boats, where one has since fitted separate rotation control, there has not necessarily been a noticeable improvement in downwind performance. There could be other reasons for this, but just don't expect this extra distraction to be an immediate race winner.

The configuration

The basic system as described in Issue 2 of APT consists of an additional arm pivoting at the base of the spanner with a rope and cleat system to adjust the angle between the two. The vang is attached to this arm and the spanner acts as the rotation control. Some boats have variations which achieve the same end result.

The interaction of the two components as they rotate needs to be considered carefully when designing this setup. If not thoughtfully aligned vertically, the two components can conflict.

The wide spanner shown in the bottom image (New Zealand boat) allows for the mast to be easily rotated to leeward with the foot downwind in light weather.

The ratio

As most systems have the control rope running through guides rather than blocks, friction is a factor in the ease of operation. However, a 2-to-1 system is sufficient to operate the rotation in most conditions. 2-to-1 becomes hard to work once the sail is sheeted in on a beat in a decent breeze though. Therefore it is advisable to centre the rotation before rounding the leeward mark.

If the rotation is to be used upwind, increasing the length of the spanner and arm and/or considering using a 4-to-1 system may be advisable.

The rope

Because the rope needs to be able to slide smoothly over guides (and possibly itself, depending on the

setup) and can be under significant load at times, 4 to 5mm diameter "Spectra" type rope is desirable. Running the tail ends of the rope to the toe straps or gunwales makes the system more convenient to operate.

The blocks

The basic system doesn't use any, but if block and tackle systems are added, 19mm dia. (or smaller) blocks would be adequate.

Attachment

An existing spanner can be adapted by attaching a plate between the arms as close as possible to the mast (ensuring that it can still tilt up to the correct angle for the vang operation). The vang arm attaches to the centre of this plate and should be slightly longer than the spanner. The plate needs to be quite robust (3mm thick) as the loads on it are significant

The cleats

Two cleats are required for convenient operation. They can be mounted on the spanner or the vang arm. If placed on the spanner they will rotate away from you when the mast is rotated, and there will be slightly greater friction as the rope end being adjusted has to turn back on itself. If the cleats are placed on the vang arm, they will remain in roughly the same spot regardless of rotation angle and there is less rope friction, as the line of pull on the spanner is more direct. However, the spanner is likely to be a more stable platform for mounting the cleats.

For more information on setting up the vang and other systems, visit

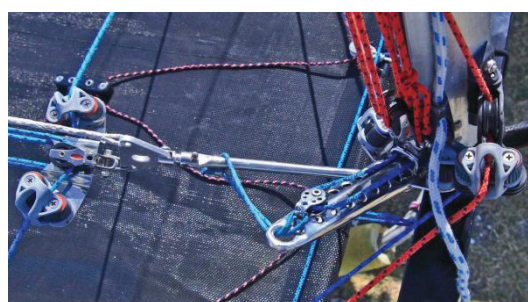
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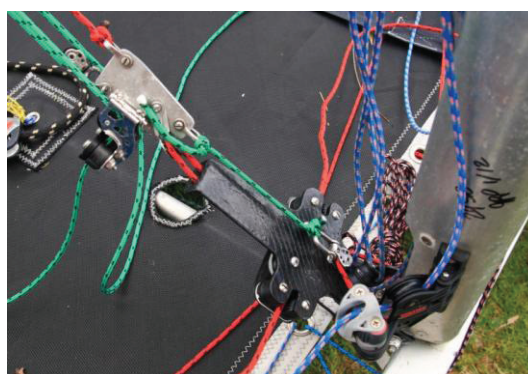
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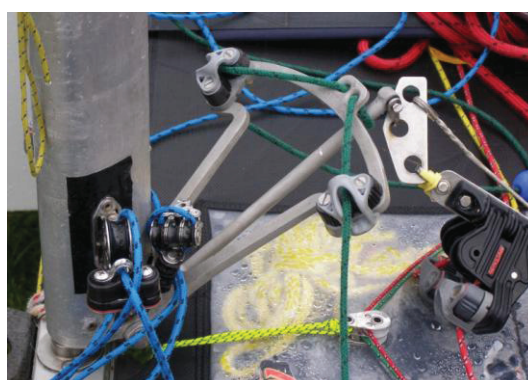
Basic conversion



4:1 system



Carbon fibre spanner with rope vang arm



Wide spanner