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TUNING TO WIN: PERFECTING THE PENGUIN

By Dick Tennerstedt

The Penguin Class has attracted and held top calibre sailors for many years, and most of them have stayed with the class because of its sailing qualities. Many of these qualities were put into the boat by the designer, Phillip Rhodes, in 1939, but only by proper tuning can they be fully appreciated. This article is not to argue the merits of the design, but is intended to help all Penguin owners improve their own boats. It is aimed at those items that are legally changeable – basic hull shape is quite rigidly controlled by the rules.

Tuning of boats for any class is an argumentative subject, and it's very difficult to "prove" the effect of a small change. This year's winning boat may be quite different from last year's. To get a broad background for the article, a number of past national champions were asked to contribute. Represented are comments from Gardner Cox, Bob Smith (not O-D&OYs'), Sandy Rapp, Runyon Colie and Bruce Goldsmith. Together they have won 13 of the past 25 Penguin international championships and only where they disagreed or had unique comments are their names mentioned.

Tuning is no more than making the best of the variable factors which affect boat speed. Many of these factors are interactive, which is a fancy way of saying that when you change one thing, something else may have to be changed also. If your boat is in balance, and you want to try more Mast rake, you will have to sail the boat flatter or angle the centerboard back.

The one item the champions agreed upon was to have minimum weight and total moment of inertia. This subject has been discussed many times in O-D&OY in relation to the Penguin and other boats. Consider how important a few pounds are in a boat completely rigged and ready to sail at 165 pounds. This subject will be discussed again in relation to individual items.

Until July, 1970, 130 pounds is minimum hull weight for wood boats and 137 pounds for fiberglass. The most competitive boats are generally under 140 and every effort should be made to get rid of excess weight – especially in the ends. Needless to say, the bottom should be fair and smooth. The hull shape is quite closely controlled and if yours is light and stiff, you have the basic ingredients for a fast boat. Effective July, 1970, the minimum weight limit will be at least 140 pounds for both fiberglass and wood, including the weight of buoyance equipment if fitted. Sail light this year and worry about getting up to weight next year.

The centerboard slot is limited by the class rules to one inch in width. This is what yours must be and the width will very likely be checked at the 1969 Internationals. Check the centerboard, rudder, and skeg to see that they line up with the center of the boat. The handle of the board should be thick to help keep the board vertical when down. To further minimize sideways bend, Bob Smith suggests glassing the handle for strength and stiffness and bracing the trunk at frame 3.

Regardless of the shape, the rudder and centerboard should be very smooth as they represent more than 30 per cent of the wetted surface. The board should be stiff, but can be light also if made of cedar planks covered with glass or dacron cloth and resin. A good cedar board, glass covered, will weigh six to seven pounds, and a mahogany plywood board eight to nine pounds. The board should be as thick as possible and still fit in the one inch opening. Don't try to save too much weight in the handle – this is what usually breaks, especially at the joint between handle and blade. The rules state that except for the first three quarter inch, the portion of the board that remains in the trunk when down cannot be streamlined. Leaving all the portion in the trunk square helps prevent twist (Fig. 4).

There is general agreement that the rudder should have the normal streamline shape, i.e. maximum thickness about 30 per cent aft of the leading edge. Everyone also agrees that the trailing edge of the board should be sharp. There is controversy over the rest of the shape, with the proponents of the maximum draft 30 per cent back winning more championships than the draft 50 per cent or more back ("laminar" type board). Experience in Skokie Lagoons (10 tacks to a 100 yard beat) has shown one definite disadvantage of the "laminar" type board. This shape apparently does not develop lift as quickly after tacking and several extra feet of leeway are made for every tack. Regardless of the basic shape, the bottom of the board should be sharp as it is the trailing edge when the board is partially raised.

Make sure you have a positive stop fitted to prevent the rudder floating out of the gudgeons. The consequences are humorous – to your competitors. A good cedar planked glass covered rudder with tiller will weigh about five pounds. This weight is really in the ends, and if you make a new lighter one, separate the pintles as far as possible to minimize stresses. Bob Smith had an interesting suggestion: Use commercial self aligning rod end bearings for gudgeons to permit a tight fit to the pintle without binding. They require frequent oiling around salt water but he says they will last for years.

If you sail in weeds, Runnie Colie suggests painting the lower part of your rudder white so they may be more easily seen.

The tiller should be long enough to you can just get around in front of it when tacking. The proper position for the skipper on a beat is right up against the thwart rubbing shoulders with the crew and a good long tiller helps keep you there. About 38 inches from pivot to end is a good start. Two hiking sticks are helpful if your arms are long (Fig. 4). The heavy air one shown is 26 inches long with a 18-inch long stick on top of it for medium air. A rubber band holds both together when using the long one, but small magnets or Velcro can also be used.

Aluminum masts are now legal but are not yet being used by the top sailors. About 12 to 13 pounds is minimum weight for a good spruce mast. Anything over 15 lbs. without rigging has too much intertia for open water performance. The top should be tapered to reduce inertia but it is more important to maintain good sail shape than save a few ounces. Forget fancy sheaves at the top and use a curved stainless steel tube. Use a halyard lock to reduce compression. The most favored location for the mast step is about 23 inches from the centerboard pivot pin. Runyon Colie has his at 21 and-a-half, but sails with his board cocked further aft. Everyone agrees that the mast should be rigged to be nearly vertical.

The most common location for the shrouds on the mast is five feet from the top. Sandy Rapp, however, feels strongly that a lower position promotes a more uniform mast bend and attributes a big improvement in heavy air performance

to a change in this item alone. He stresses that mast shape is a determining factor in finding the best location. Sandy has a 13-pound spar and attaches his shrouds six feet, five inches down from the head. Regardless of the rigging, the mast should be a snug fit in the partner to minimize shaking when running in a chop with little air.

The mast can be rotated to fair in the lee side of the spar with the sail, and in heavy air the amount of mast bend can be controlled. Increasing rotation in heavy air produces more fore-aft bend because the mast is made thinner in a fore-aft direction. If bend is too much, less than normal rotation will add stiffness. Experimenting with various amounts of rotation will soon show the best for your boat, but control is necessary. Colie uses 40 to 45 degrees rotation on a beat in moderate air. He has rigged a rotator with control lines running to the thwart. To aid rotation, the support for the boom can be run higher than normal up the mast. The down haul should be rigged so that it does not restrict rotation. Leading the rigging to a common location on the front of the mast as in Fig. 5 also aids rotation. The mast should rotate freely in the step. Metal, nylon or Teflon at the partner also helps. The pressure of the boom jaws may be hindering rotation especially with the boom and JC strap set. A metal or stiff plastic band around the mast is necessary both to aid rotation and prevent wear from the boom jaws. It also helps to lead the point of attachment of mainsheet blocks on the boom farther forward. If your mast does not rotate freely by itself, it is crucial that your crew give this number one priority when tacking. In heavy air, your mast can break if not rotated far enough to prevent a sideways bow.

Levers are preferred to sailtrack for easing the lee shrouds downwind. The throw should be eight inches or more, i.e. the shroud should be slacked at least eight inches to let the sail go to and preferably beyond 90 degrees. Several past O-D&OY articles have pointed out the speed advantages and it is sometimes necessary to sail by the lee; for example to stay on starboard when approaching the downwind mark. Your mainsheet will have to be 36 feet long to let the boom out more than 90 degrees.

Stiffness in the boom is very important and the rules permit up to two inches square section. The depth should be the full two inches and the width at least one and-a-half. A full two-inch square boom with cedar core as shown in Fig. 7 will weigh about seven pounds with all fittings including winch. The maximum dimensions should be reached where the boom vang is attached. The disadvantage of a bendy boom is that with every strong puff your sail draft is increased – just the opposite of what is desired. The boom jaws must be strong to take the load from an effective vang.

The vang shown has a 4:1 power. The attachment to the boom should be as far back as possible without interfering with the centerboard. (34 inches on the boat shown) Have everything strong enough so you don't have to be afraid to really use it. Bob Smith prefers to attach his vang by a wire bridle with a loop over the boom. Fig. 9.

The worm gear winch type outhaul is favored by nearly everyone who has tried one. If yours has been in use for over a year, check the wire where it goes through the tube at the end of the boom. The winch lets you adjust when the overhaul is stressed and you may never notice the fraying inside the tube.

Runyon Colie and Bruce Goldsmith recommend having the sail six to eight inches from the boom. Goldsmith believes very little change in draft is necessary to compensate for different wind strengths. He suggests no change in draft for

running because more draft results in loss of projected sail area and more air loss around the boom. He does suggest, however, increasing draft on a reach by slacking the outhaul about two inches.

Many skippers are changing their rigs so that the downhaul can be adjusted from the cockpit. Fig. 3 shows Colie's downhaul and Cunningham control which is led aft to a winch under the thwart. He says the winch handle is spinning regularly.

An adjustable traveller is a must. The easiest adjustment is slacking or tightening the traveller, but this is not very precise. The limit arrangement shown has worked very well and will weigh even less if a plastic tubular jam cleat is used. With this system the traveler is made as tight as possible after the rudder is mounted. In light air the block will be pulled almost to the center of the boat.

Crew harmony alone justifies one self-bailer without even considering the increase in boat handling efficiency. The bailer works best if located to one side of the centerboard trunk. Port side is preferable if you usually take marks to port.

The "JC Strap" is now in broad use. One picture is worth a thousand words. (Figs. 2 & 7). This idea, borrowed from the Finns, really works and is worth the weight in light air. Three-eighth inch shock cord is required and must be stretched *tight*.

The Penguin is very sensitive to fore-aft trim. A small line level screwed to the top of the centerboard trunk is a great help especially if you sail with different weight crews. Have a competitor watch you trim and move your crew until stem and transom are each just touching the water. This is the designed waterline as shown on the plans and can be attained only if you have an absolute minimum weight boat and crew. Gardner Cox observes that for more normal weight combinations, the level should be "zeroed" with the transom just touching and the bow immersed three quarters of an inch.

There are many ways to save weight and cut down the moment of inertia. Wood oars can be sanded and shaved to be under two and-a-half pounds while adequately strong. The oars can be strapped to the centerboard trunk to minimize inertia. The locks are available in aluminum and the sockets can be made of nylon. The bailing equipment required by the rules can be a cutaway bleach bottle which weighs only two ounces. Carry a pump in heavy air – one long enough so the crew can pump from the weather rail. The lightest legal painter is 30 feet of 3/16 polypropylene. In your search for weight reduction don't forget yourself. Sandy Rapp went on a diet and lost 10 pounds before the 1968 Internationals to bring his live weight closer to the 275-pound minimum. He won.

Sails from at least four different sailmakers are used by our past champions and checking the yearbook will show recent winners for your area. Try a window on at least one of your sails. The chances are that the first close port-starboard situation will sell you on the idea. Bob Smith suggests the clew re-enforcement be larger than normal to minimize the clew wrinkles. It is interesting that Bruce Goldsmith, himself a sailmaker, does not think sails quite as important a factor in Penguins as in other classes.

In other than a drifter, Smith and Colie agree that the boat should be sailed "very flat" upwind. Gardner Cox limits this to four to five degrees as ideal. Sandy Rapp prefers a little more heel, but I know from watching him that it's not more than 10 degrees. Most skippers allow their boats to heel too much. Downwind the boat can be heeled to weather to minimize helm. To emphasize

the effect of heel on handling, Runyon Colie, in an old Penguin Handbook, suggested sailing around the race course without a rudder. It can be done and all direction changes including tacking and jibing can come from heel changes alone. Gardener Cox commented on the same idea in responding for this article. He suggested sailing without touching the rudder to quickly find optimum centerboard angle, mast position, and mast rake as a function of heel.

The plans show the centerboard angled back 10 degrees. Gardner Cox and Bob Smith use this in moderate air. Sandy Rapp likes his more vertical and Runyon Colie carries his angled back 25 degrees (remember that his mast is stepped further aft). Bob Smith carries his board more vertical in light air and everyone rakes it further aft in a blow. Unless you remember this, you'll find yourself in irons when slow in making a tack in heavy air.

On his centerboard handle Colie has a mark which ensures that the lower aft corner of the board is just inside the trunk.

This article includes the more important suggestions made by our champions. Where possible it has been specific to bring you closer to optimum in setting up your own boat.

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