FASAFE
Keeping it together under pressure

Your first State Championships! Results in your first two races in light conditions were better than you'd expected. You've just rounded the bottom mark and tacked onto starboard for the final beat to the finish line. The entire race has been a close, intense battle to cover a regular rival who is normally ahead of you at this stage of the race. The wind is freshening, the waves are getting bigger and victory is in reach when **"THWAANG!!!!!"** ... The jolt goes right through the boat, and you.

Instantly alert, you scan the rig. What has failed? All stays still seem attached, the mast looks OK, the main beam is still straight. It was definitely metallic, so it wasn't the hulls or foils. Was it wire strands breaking, or worse, a jumper strap bolt shearing off???? Whatever the cause, your race concentration is now stuffed and your rival, whom you had worked so hard to conquer, may well get the better of you yet again.

This need not have been the case. If your boat was well built and regularly maintained , the unexpected sound could have quickly been dismissed as a loose leeward stay shackle that had misaligned when coming under tension on the new tack and had simply corrected itself. On the other hand, if your boat was not thoughtfully constructed and your maintenance program consisted of washing the possum poo off the deck at the start of the season, it could have heralded disaster, or at least an expensive day's outing.

There are a few items on a PT which may quickly bring your race to an end if they fail. I say ***may***, rather than ***will***, because I know of instances where skippers have carried on to the finish line regardless. However, these were not your run of the mill skippers and the conditions were favourable. There are other items which may only slow you down if they fail but may well cost you a vital placing. So what can you do to minimise the risk of an early return to the beach?

The following article attempts to highlight areas where problems may arise. Some of these should be checked weekly, some before major series, some annually, and yet others perhaps after many years of sailing. As individual skippers often devise their own operating systems, there may be items peculiar to you own boat that are not mentioned.... but let's continue:

DOLPHIN STRIKER/JUMPER STRAP

This is number one when it comes to a failure causing significant damage. If this assembly fails when under load, the forebeam can break below the mast causing extensive damage to the hulls, and possibly mast damage. Assuming that the central strut is solid enough to take the compression loading, and the strap meets the minimum dimensions specified in the rules, there are three areas to be checked.

Firstly, the strut should be held perpendicular to the lower surface of the main beam. It usually passes through the bottom of the beam and is held in place by a bolt or pin through the top surface. It must not be able to move fore and aft or sideways and should be straight. Also check for corrosion where it is attached to or pierces the bottom of the beam.

Next you should check where the strut presses against the strap. Desirably the foot of the strut should cover the full width of the strap. If it doesn't, look for any deformation or cracking of the strap as this could indicate early signs of impending failure. The strut should also be designed to prevent the strap from sliding fore and aft.

Finally check the attachment points at each end of the strap. The minimum bolt diameter used to attach the strap should be 8mm. The inner bolts where the strap bends (which take the greater load) are shown on the plans as a larger diameter than the outer bolts. However, if the inner bolt fails, a smaller outer bolt is unlikely to save the day. An extra few grams is not going to lose you a race or series but a broken main beam will.

These bolts can also pull out of the beam if the load isn't spread over a wide area. Check for any gap between the strap ends and the underside of the beam

which could indicate that the beam is deforming around the bolt, or the bolt is loose. If the beam is distorting, it can be reinforced on the inside with a 3mm thick aluminium plate drilled to take both bolts, or a stainless steel plate with both nuts lightly welded on. The plates should be the full width of the inside of the beam. They should be installed with anti-corrosion paste.

BEAM BOLTS

Twisting of the hull platform whilst sailing places high stresses on the beam bolts. If the bolts are strong enough to withstand the load, these stresses are taken by the lower beam surface and the hull beam pads. The inner bolt positions on the rear beam are particularly vulnerable to damage.

Check for any gap between the deck and the beam. It should not be possible to slip anything between them. If there is a gap, it could indicate that the bolts are loose, or that the bottom surface of the beam is distorting around the bolt, or that the beam pad is compressing. In a worst case scenario the bottom face of the beam can crack and pull away from the sides.

If the beam and pads are sound, tighten all bolts firmly. If the beam is distorting or the pad is compressing, fix the beam and add large washers or 3mm thick aluminium plates to distribute the load away from the bolt hole. If the beam has cracked, a new beam will probably be required as welding may soften the tempered aluminium.

NZ style inner beam bolt

TRANSOMS AND PINTLES

The rudders can exert significantly different loads on this part of the boat depending on how well the boat is balanced, how often the boat is sailed in strong conditions and how often they impact with jelly fish or run aground. Failure of one rudder can stress and damage the rest of the rudder system.

Pintle pivot pins less than 6.4mm dia. are more likely to bend and crack over time. Check for distortion and cracking and straighten or replace if necessary. Loose pivot pins can be welded at the bottom flange on stainless steel fittings to remove slop in the system. Obviously they should be removed before welding.

Check for loose pintle attachment bolts, due to compression of the transom and packing blocks. Before tightening, check that there are large washers or a plate on the inside to distribute the load away from the bolts. There should also be sealant around the bolts on the outside and inside of the transom to prevent water ingress. Loose bolts can result in leakage and deterioration of the transom.

There have been at least two recent incidents of transom failure in older foam sandwich boats recently. This has involved a significant chunk of transom and the pintle ripping out under normal sailing loads, not due to impact. The hulls were from different manufacturers. As this was a totally unexpected event, it is not known if there were any telltale signs that would have indicated a progressive failure.

Check for any cracking or excessive flexing of the transom and reinforce if necessary. Reinforcing of the transoms in older foam boats may be worth considering.

CENTREBOARD CASE

Leakage through the centreboard case is probably one of the most common and annoying issues for PTs. Leakage in timber boats is usually due to poor construction resulting in failure of the joints holding the sides of the case together or to the bottom of the hull. Foam hulls usually develop leaks when the centreboard wears through the back of the case as a result of the centreboard being pulled forward at the top by a shockcord connected to the main beam. Both hull types can suffer damage from running the centreboard aground. A good, long term fix to this problem in either hull type is a pain.

There is little chance of effectively repairing the centrecase in a timber hull without major surgery. This will probably require cutting a hole in the hull (probably through the side under the trampoline) large enough to easily get an arm all around the case and be able to see what you are doing. The extent of work involved will depend on the nature of the damage.

With foam hulls it may be possible to repair the case from within the slot if the centreboard is sufficiently smaller than the case. Otherwise the same process as used on timber hulls will probably be required. Once repaired, it is worth bonding a length of narrow nylon webbing to the inside rear of the case (if there is room) to reduce wear on the case and board.

TRAMPOLINE AND CENTREBEAM

The trampoline should last a long time if it is maintained. The old style tramps, which were laced

on, were inclined to fail around the eyelets or pull the attachment points out of the hull. The modern track mounted or wire supported versions are most likely to fail when the stitching wears through in the areas where the skipper crosses the boat. They can also wear through where they rest on the centrebeam if the beam is not padded.

The centrebeam can also take a hiding from mainsheet pressure on a beat (if the mainsheet block is deck mounted), and when the skipper changes tack, especially when calorie challenged.

Check for worn stitching and oversew with thick polyester thread, or take it to a sail maker. Pad the centrebeam, if necessary, with light weight closed cell foam. This will also reduce shin bruising.

Check for permanent bending of the centrebeam and corrosion , cracking and loose fastenings at the mainsheet block and beam end attachment points.

If the trampoline support tracks are surface mounted, check for loose screws. If loose, remove screws and reset in epoxy adhesive.

MAINSHEET TRAVELLER TRACK

Gybing in a strong breeze can subject the ends of the traveller track to considerable upward forces, and the stops at the ends of the track will also cop a hiding if the traveller car hits them. The traveller control line should desirably stop or cushion the traveller car before it hits the stops. If the stops fail and a ball bearing traveller car leaves the track, the bearings may be lost.

Check that the track is not pulling away from the top of the beam and replace fastenings if necessary. Consider using bolts rather than rivets to hold the ends of the track. Check the track end stops for cracking or distortion and bent fastenings. Repair or replace as required.

Low profile traveller

HULL SURFACES

Surface damage of hulls falls into two categories. That which is superficial and may result in a microknot reduction in boat speed if it is below the water surface in flat water, and that which is a sign of more insidious damage.

Ply

Minor scratches and chips that penetrate the paint film should be filled and smoothed off to prevent water ingress. Surface splits on ply hulls can occur with poor quality timber, or under dark coloured paints (due to heating) if the ply hasn't been thoroughly sealed and bonded with epoxy before painting. It could also be a sign of a failed joint or deck stringer.
Check that the split doesn't go deeper by flexing the surface. Superficial surface splits can be opened with a fine blade and filled with epoxy, but widespread cracking may require stripping, sealing and repainting. Any structural failure requires a proper fix if it is to last.

Foam Sandwich

Splits in foam hulls usually mean that something significant is going on and it will not necessarily be an easy fix (well, not neatly anyway). Apart from letting water into the foam core of the hull skin, failure of the outer surface layer may quickly lead to failure of the inner surface layer. Therefore any cracks should not be ignored.

RUDDER STOCKS

There are many different styles of rudder stocks used on PT's, but those fabricated from square section aluminium tube are fairly common. If you have these, the bolts and rivets that hold them together can be subjected to considerable stresses. The bottom attachment point to the transom comes under the greatest strain and if failure occurs here, the rest of the stock can be damaged.

Check for obvious cracking of the frame, loose joints and rust leeching from stainless steel fastenings. Aluminium corrosion around stainless steel fittings and bolts is also a concern. Consider disassembling and cleaning the stocks at regular intervals (perhaps every 3 to 4 years). If the aluminium frames are held together with 4.8mm dia. fully threaded bolts, consider replacing at least those at the high stress points. Reassemble using anti-corrosion paste.

If you use flexible plastic fittings to attach your tiller cross bar and tiller extension, check for splits in the flexible joints. These can fail quickly once they start splitting.

FOILS

Centreboards and rudders can be subject to large stresses. Any weakness in construction usually shows up fairly quickly...possibly on the first really heavy day or series. Even well made foils can deteriorate over time or as a result of impact.

Check for any cracking on the centreboards immediately below the hull when the foil is fully down and on the rudder blade immediately below the rudder stock as these are the most stressed areas. Once cracking begins, failure is pretty much guaranteed. Effective repairs to this sort of damage are difficult. A new foil may be the best option.

Surface damage and chipped edges should be filled and smoothed off. Check the rudder blade pivot hole for wear and repair if necessary. Ensure that timber foils are well sealed so that water isn't penetrating the wood.

SAIL HALYARD

The basic sail halyard incorporates a wire strop with a shackle at one end which attaches to the headboard of the sail and a slug at the other end that fits into a notch in the halyard lock at the top of the mast. Check that there are no broken strands in the wire, especially at the swages. Any broken strands indicate that the wire is over stressed and it should be replaced. Using a double run of wire will lessen the risk of sudden failure.

Many boats now use rigid hook and eye halyard locks. Check for wear or cracking.

Of course no system will keep the sail up if it isn't correctly locked in place before leaving the shore.

MAST HOUNDS

Today's hounds are quite robust fittings. However, some of the older designs had a large hole for attaching shackles. These are prone to distortion and failure around the hole. If the hounds have been installed without anti-corrosion paste, significant corrosion of the mast can develop under the hound.

Check for distortion, corrosion and loose rivets. Replace the hound if it is damaged. If corrosion is apparent, remove hound, clean hound and mast and reset with anti-corrosion paste.

MAST BASE

If the mast base isn't tightly fitted into the mast extrusion it can twist out when under load, splitting the mast walls in the process. If the base is fitted with spanner attachment lugs, these are subjected to substantial stress.

Check that the mast base is securely attached and there is no sign of cracking. If it isn't a natural tight fit it should be tightly packed with aluminium and held securely in place with 4.8mm dia. rivets. Check that the spanner bolt lugs are not cracked.

MAST SPANNER

The mast spanner cops a hiding during a gybe in a stiff breeze. If the spanner is loosely attached to the mast, this can increase the impact loadings.

If you have the machined mast base that has been in common use for many years, you will probably have your mast spanner attached to it by a 6.4mm diameter bolt. Over time this bolt can crack and fail in the threaded section.

Check for cracks in the spanner at the attachment points to the mast and adjustment tackle. Check the attachment bolt and consider replacing it every few years regardless.

GOOSENECK

The PT gooseneck may take a hiding in three ways. When sheeted on hard with the mast rotated, forward pressure applied to the boom by the mainsheet tries to twist the gooseneck out of the mast track - when the boom hits the limit of the mainsheet during a gybe it also tries to twist the gooseneck out of the track - and if the boom is not prevented from hitting the backstays, especially during a gybe, it will try to lever the gooseneck out of the mast track (as well as do other nasty things to the mast).

If the gooseneck is fixed to the mast, these issues should not be a problem. If the gooseneck has a large snugly fitting plug or wide plate that distributes the load within the mast track, the potential for damage is considerably reduced. If the gooseneck has a small plug that holds it in the mast track, there is a significant risk of damage to the mast.

Check for damage to the mast where the gooseneck normally operates and modify or replace the gooseneck if necessary. Carefully bend the mast track back into line if it is starting to spread open.

STAYS AND THIMBLES

Stainless steel stay wire comes in different qualities and has a limited life depending on how much heavy weather sailing is undertaken. Strands can break anywhere along their length but tend to fail more

frequently at the ends where the wire is bent around the thimble or pinched by the swage. Thimbles can crack, where they press against a shackle or fitting, and will stress the wire when they collapse.

Check all stays for broken strands and rust stains. Flex the wire at the swages and rust spots to expose any weakened strands. If there are broken strands, the stay should be replaced as it will continue to stretch, deteriorate and eventually fail. New stays will stretch when first installed, so it is best to replace them in pairs. Check all thimbles for cracks and replace where necessary.

SHACKLES

Shackles are one of the hardest working and reliable PT components. However, they can fail with age. If the shackle has distorted, it is possibly too small for the task.

Check all shackles. If the pin is worn and loose or hard to screw in due to distortion of the shackle body, consider replacement.

BLOCKS

Basic, non ball bearing blocks seem to last forever. Modern, ball bearing blocks are also very durable but need to be looked after. Metal sheaved blocks for wire can seize and damage the wire that then has to slide over them. Ratchet blocks that don't work properly are a liability.

Blocks should be flushed with fresh water after sailing in salt water on breezy days. Check all blocks to ensure that they are running freely and lubricate if they don't. I have noticed that non silicon lubricants are sometimes recommended for plastic components. Replace any block that won't free up.

Check the sheaves for chipping of the outer edges. This could indicate that the rope is too large for the block and is putting too much outward pressure on the sheave. Replace the block and/or switch to a smaller diameter rope.

Check the operation of ratchet blocks. They must grip and release reliably or they will cause fatigue upwind and may not release quickly enough to avoid a nasty capsize off the wind. If they have a plastic sheave, check for wear on the gripping surfaces. Once these are worn away, the block is of little use and the mainsheet tension is transferred to your hand (unless you cleat the main).

CLEATS

A cleat that doesn't grip the rope properly, or jambs open, could seriously effect race performance.

Check that the cams move freely. If very tight, carefully disassemble, clean and lubricate, taking care not to lose the return spring. Otherwise hold open the cams and spray WD type lubricant (using the tube) up underneath them. Then work the cams until they loosen up. If the cam teeth are worn away, it is time for a new cleat.

If the cleat has a plastic rope guide and a groove has been worn in one side, swap it with another that is wearing on the opposite side. Otherwise, replace the guide or it will make releasing the cleat harder and the guide will eventually fail.

ROPES AND WIRES

Modern sailing ropes and flexible wire are very strong and durable. However, there are some locations where they are subject to excessive wear. Dragging through cam cleats will abrade rope over time. Also, ropes that are regularly under high stress at the same point, such as a rudder hold down passing over a sheave, can fail.

Single braided mainsheet rope tends to swell up over time and can become tight through the mainsheet blocks making it hard to ease the mainsheet in light weather, especially going onto the run. Double braided mainsheet rope is more stable but doesn't suit all types of ratchet blocks and is a bit harder on the hands.

1 x 19 type rigging wire is not suitable for use around blocks, but even 7 x 19 wire can fail over time where it turns around a sheave. Using wire around plastic sheaves is a bad idea.

Check for obvious wear where ropes are held by cams or drag over ratchet blocks. Basic braided ropes become furrier before eventually failing, but the outer layer of ***Spectra*** tends to fail completely and bunch up along the core strands.

Check that the mainsheet runs freely through the blocks and is gripped firmly and released easily by the ratchet block. If the outer layer of the mainsheet fails (usually at the ratchet block position when on the beat) it will jamb in the blocks. Consider a new mainsheet if it doesn't run freely or is showing wear.

Check **carefully** for broken strands on wire rope as a broken strand through the finger hurts like hell. Replace wire once strand breakage occurs.

SAIL

Sails will last a long time if salt is rinsed off after races, they are rolled without creasing and are stored dry. No fittings should be left attached to the stored sail as they can result in rust stains on the cloth.

Check the sail for worn stitching and wear along the sail batten pockets where they rub against the stays. Worn stitching can be oversewn with thick polyester thread or taken to the sail maker. Wear at the batten pockets will need a patch of heavy sail tape or clear plastic sail material stitched or bonded over it. Self adhesive rip-stop nylon patches aren't a long term solution. Fitting patches before there is a hole in the sail is the best option.

Check any sail telltales that are fitted. The ribbon type will fray and may come unstuck. Check that they are well bonded to the sail. Trim and carefully melt the ends or bond with a waterproof glue.

Between seasons, sails can be hung up and given a gentle wash with mild laundry detergent and a soft brush to keep them clean. Dry thoroughly before storage.

Rust marks used to be easily removed with a product called ***Rustiban,*** which was available from chemists. Apparently this is no longer available as it contained a 10% solution of Hydrofluoric Acid, which can do really nasty things if it comes in contact with people. Actually, if anyone still has a little bottle of ***Rustiban,*** I would suggest that you do some online reading (such as the site below) just so that you learn to treat it with the respect it deserves.

http://www.commerce.wa.gov.au/worksafe/PDF/Bulletins/Hydrofluoric_acid.pdf

The bad news is that there doesn't appear to be a clear cut alternative, although things such as Phosphoric Acid and lemon juice are promoted.

CORROSION

Corrosion is the big enemy. A sleek looking boat can soon look pretty ordinary if corrosion isn't controlled and the damage can lead to gear failure under load if left unchecked.

Stainless steel fittings attached to aluminium, or aluminium components joined with stainless steel rivets, will set off corrosion if not isolated from each other with anti-corrosive paste. Some pastes dry out over time and loose their effectiveness. Pastes that stay "wet" such as Res-Q-Steel" (International Paints) are preferable. Silicones won't provide long term protection.

Remove fittings that are causing corrosion, clean all surfaces and reinstall using paste. Don't clean surfaces with steel wire brushes (unless they are stainless steel wire) as they leave traces of iron imbedded in the surface, which then creates orange rust stains that are hard to remove.

All metal surfaces should be thoroughly washed down with fresh water after sailing in salt water as residual salt will draw moisture from the air and promote corrosion while the boat is stored.

Ralph Skea

"Flex the wire to check for broken strands...."