How to conduct your own 'Pre-survey Survey' of a Mono-hull Sail-boat

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Summary

As a prospective mono-hull sail-boat buyer, which I assume to be the reason Dear Reader that you're perusing this report, you need to be sure that the boat you buy is the boat that fits perfectly with your intended use and suits you in every respect. As to the why of this, consider firstly the fact that re-selling a boat back into this market is challenging. The boat market as at 2011 presents arguably the most difficult selling environment since the great depression and there are no signs of improvement on the horizon.

It is well to dismiss ideas of 'flipping' the boat if you have a change of mind regarding its suitability. Of course it is possible to succeed as a boat vendor in this market or indeed in any boat market, but it requires considerable energy and commitment. You don't want to impose this burden upon yourself unnecessarily.

Secondly and from intimate experience, I suggest that the purchase of a boat is somewhat like the choice of a life partner. A poor choice can easily lead to bankruptcy which is usually a prelude to divorce. In a real sense you will be married to the boat you buy. You need to be happy with the choice you make, not just in the immediate term but off into the future, as your knowledge and experience expand.

Thirdly and without over emphasis upon the dark side of life experience; a sail-boat that is unsuitable to your purpose can kill you. So while looking at boats may be deemed a recreational experience, the decisions you make can be life changing and possibly life ending in their consequences. This is an exercise that requires the full focus of your attention. From the multitude of vessels available that might fit your requirements, you need to cull the list of 'possibles' down to a few boats upon which you need to conduct your own pre-survey survey.

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Your pre-survey survey is a process of elimination, in the context of your intended use. There are many factors in regard to end use that only you can know. There are moreover, limits to the marine survey, which in any event should only be undertaken upon the vessel you ultimately decide to purchase.

Marine surveys are an expensive undertaking. As buyer you are responsible for haul out charges pursuant to the underwater component of the survey in addition to the surveyor's bill.

Another factor in your pre-survey survey, is your perceived ability to rectify what may be wrong with the boat you buy. The advice here is to tread carefully.
Boat projects have a way of getting out of hand, thereby extracting a huge toll: financially, emotionally and in terms of your primary relationships. In general it is advisable to avoid any prospective purchase that constitutes 'a project'. It is generally advisable to purchase a vessel that is fully equipped for your intended use.

The scope of your pre-survey survey will largely be governed by your end use intentions. If these involve time at sea, you need to anticipate the unexpected. Among the many possibilities in this regard, are bad weather and groundings. Will the hull shape you choose stand up to the stresses of life at sea? When push comes to shove weather-wise, you don't want to be worried that the keel might fall off.

For reasons elaborated below, the onus is primarily upon you to evaluate hull structural integrity. The issues vary based upon build medium but broadly they entail hull shape, the construction medium and the adequacy of structural components. Production sail boats have a well deserved reputation for retention of re-sale value.

Despite this, (and in apparent contradiction), not all brands are well regarded from the viewpoint of structural integrity. Some are frankly; appalling! You should not make assumptions or accept without question the assurances of brokers, but rather pull up the cabin sole and look behind built-in furniture in order to come to your own conclusions based upon what you see.

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Maintenance is another issue that you need to be competent to evaluate. A maintenance problem could be merely a deficit of TLC, easily remedied or it could be terminal. Sometimes the distinction can be hard to draw. Build medium is relevant here because materials vary in their tolerance of poor maintenance.

All sail-boat construction media have their pluses and minuses. There is no magic bullet in this regard. Nor is there any certain fix to common problems like osmosis in GRP. The best advice is to avoid a vessel that has had such a problem because experience suggests that the ‘fix’ is unlikely to be permanent.

So having undertaken your own pre-survey survey as per the guidelines in the report hereunder, you will hopefully end up with a vessel that warrants a full professional marine survey. At this point the advice is to hire a surveyor whom you trust. Never accept a survey report commissioned by the vendor. It’s unlikely to be worth the paper its written on.

The bottom line is that buying a sail-boat to go to sea is a serious undertaking. There are more bear traps awaiting the unwary buyer than there are bare buttocks on Bondi Beach on a hot summer's day. Hopefully this report will save you a heap of money. It might save your life.

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Limitations of a Marine Survey

In attempting to define what a marine survey is, it might be helpful in the first instance to determine what it's not.

In this regard the Coroner's Report regarding the Farr 38 GRP yacht which sank off the NSW coast in 2001 may prove illuminating. Type 'Flying Fish Report' into your browser and you're sure to find the document on the public record. The vessel, subject of the Report, had been surveyed by a prominent Sydney based marine surveyor in order to gain approval as a sail training vessel by Yachting Australia. In their subsequent Nov 2003 press release referencing the Coroner's report Yachting Australia (previously known as The Australian Yachting Federation) 'commented': "YA does not make any comment or inference, save those made by the Coroner".

Not being a member of this old boys club, your author can draw plenty of inference. The Coroners Report supports what is already widely known in the industry namely that so called cruiser/racer designs like Rising Farrster and built to similar standards; are not sea worthy and should never leave the harbour. Going to sea in a small boat is risk enough; without the contingency of a keel falling off in any sailing conditions; let alone normal sailing conditions of 20kts of breeze.

The elephant in the room which the YA doesn't want to talk about; is that a swag of production sail-boats in existence carrying the handle 'cruiser/racer' are qualitatively in the same class as SV Rising Farrster. Yet this fact is highly unlikely to be noted in any marine survey.

Both Surveyors named in the report: are known by the author to have been at the top of their profession when their opinions were sought. Yet according to the Coroners Report, both surveyors describe their role as: "conducting a visual inspection of a yacht in order to comment on its seaworthiness. There is no structural analysis undertaken (sic)."

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There you have it: the unvarnished truth, about which every sail-boat buyer should be cognizant.

The fact is that the Rising Farrster incident is not an act of God or a one-off anomalous event like a one hundred year flood. There are many, many death traps out there in sail-boat land, most of which are described as cruiser/racers. If one of these vessels happens to be the object of your buyer interest, you cannot rely upon your surveyor to warn you off.

Put simply; comment upon structural integrity is not what surveyors consider their brief. There are other issues in play here. If a surveyor were to give a seriously bad report upon the structural integrity of any popular production vessel, he would be calling into question every extant vessel of the genre. The risk is that he would simply earn himself a “Doctor Death” appellation which would do nothing for his reputation in the industry and his career.

This is not to say that you cannot impress upon your surveyor that in the context of your intended use, the issue of structural integrity IS front and centre to you.
The onus nonetheless is upon you to make your own judgments about sail-boat structural integrity. And while this might seem to be a huge ask if your knowledge of boats is minimal, neither is it ‘rocket science’. You can get a fair idea of the structural integrity of a yacht hull and its suitability to your intended use if you follow the guidelines below.

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Your Intended Use

Structural issues are relatively less important if your usage intentions are limited to harbour sailing and occasional around the buoys racing. On the other hand if you plan to go to sea and go blue water cruising, you want to be sure that the boat will stand up to the stresses and hard usage that cruising imposes upon a yacht hull.

Usage has a large bearing upon the type of boat that is most suitable to your requirements. If you want to race, among other considerations, you will want an underwater profile that will hopefully win races. This probably translates to a modern light weight, deep draft design that will get up onto a plane, going to windward.

Obviously unsuitable for this purpose are heavy, old fashioned long keeled hulls having high wetted surface and high ballast to displacement ratios. But apart from draft issues, an underwater configuration suitable for competitive racing is not going to be suitable for taking the ground, with or without intent.

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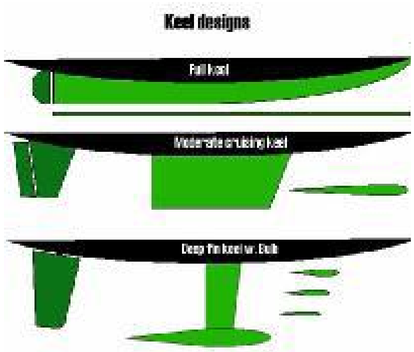
Hull Profile and Collisions with the Bottom

If coastal or blue water cruising is what you have in mind, there will be occasions when you will find yourself aground one way or another. Count on it!

In that circumstance, how will a hull profile comprised of a deep narrow fin with a bulb on the end fair, when hitting something solid at speed? Hitting anything with this kind of keel profile isn't going to produce a happy situation.

Among the countless embarrassing, unplanned and sometimes dangerous groundings that your author has experienced over the years, the scenario I'm about to relate occurred in Australia's Great Sandy Strait. Our long keeled yacht came away from this encounter unscathed, but what might have been the outcome had she sported a deep narrow keel with a bulb? Likely, the bottom would have been torn out of the boat.

How so …and what does the selection of keel shape have to do with cruising?



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The answer to this question as the following story will hopefully confirm: is a lot!

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“After a night of trying navigation through the confusing lights of the northern entrance to Queensland’s Great Sandy Strait, it is something of a relief to attain the Strait proper; revealed as it is in the reddish grey light of an approaching dawn. Relief I have found over the years is frequently an inducement to complacency, which in turn, often precedes some or other oversight, which precedes, well… you know what!

Navigation oversights figure rather prominently in the range of possibilities. In this scenario you discover too late that you’re headed to a place where you shouldn’t be. Indeed right at this juncture with the tide pushing the boat at 4kts and the big genny poled out wing and wing, we are unknowingly headed to a place where we shouldn’t be… at considerable speed: around 11-12kts over the ground to be precise. And my… doesn’t the bottom come up quickly at this speed?

Sure… I heard the sounder alarm… all of a nanosecond before impact!
And when the impact came, it was like tapping the brakes in a speeding vehicle; suddenly, involuntarily your body launches towards the open companionway hatch, narrowly avoiding the open void.

In one of those mid-air flashes of prescience, I realize that the island that we just attempted to pass to starboard. we should have actually passed to port. “Remind me Bosun, to order another fifty lashes for the navigator when we get out of this mess”. A silly navigational mistake, so you might think; but surely it’s not one that’s going to place the boat, in danger? This is Sandy Strait and not the open sea after all! Au contraire, Dear Reader; with the sails down, we rapidly appraise the true seriousness of the situation. The threat is hard to ignore!

There is a swell running and every swell lifts the hull which then drops heavily to the sand with a sickening thud, edging the boat each time, higher up the bank. If we don’t get off fast…we’ll be smashed up or marooned high and dry until kingdom come!

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The tidal race by this time is coursing around the hull in an ominous sucking wave, the force of water pushing to hull over to leeward and into ever shallower water up the sand bank. Fortunately the tide is making and not ebbing.

We cannot launch the dinghy with the hull listing 30 degrees to starboard. So jumping into water armpit deep, I decide to attempt to kedge off by walking or swimming the anchor and chain out to deeper water. Lily feeds out the Bruce and a couple of boat lengths of chain.

Moving this mass out to deep water looks easy but in fact it proves to be extraordinarily difficult. Against this tidal stream the only way that this can be achieved is to crawl on all fours underwater, dragging the anchor and chain along the sandy bottom for a few feet, coming up gasping for air after just moments, as exhaustion takes hold. The scene would have been comic were it not desperate. The entire apparatus is incredibly heavy and more difficult to drag with each foot advanced.

Eventually I can drag it no further and climb back aboard. All up we have only a single boat length of chain as anchor scope. It's not enough but it'll have to do. We fire up the engine and hit the cut out switch to engage the electric winch.

If ever there comes a time when the winch must earn its keep, this is going to be one of those times. The winch motor whines freely as the loose chain rattles back over the stem head and then it slows to a deep grinding metallic growl as the 5/16th chain pulls up bar tight. Slowly, link by link the chain grinds back through the hawse pipe and slowly the bow turns to face the tidal stream and deep water.

Silently my prayer is for the Bruce anchor to not let go now! This design was perfected in the North Sea and has a reputation for holding on short scope.

Miraculously we're down to less than a boat length …and still the anchor holds, on scope that's getting shorter and shorter.

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The anchor keeps pulling until the bow is only a few feet away then suddenly she's off and we power forward into the developing swell. Relief like that first cold beer on a parching hot day, courses through my aching body."

This little navigational oversight didn't result in any damage to the boat. A long keel design will generally shrug off being run up onto sand; at least in calm conditions. The pounding your hull might receive while aground might prove to be another matter indeed.

Perhaps you might think that this won't happen to you. You'll almost certainly be wrong. If cruising is your bag, unplanned groundings will inevitably come your way just as certainly as being 'puked upon' inevitably goes with raising small children. You need to think about this when you're coming to a view on the ideal boat for your purposes. How will the underwater shape you have in mind, take the ground?

Equally important is ease of slipping. Will your chosen hull shape be easy to slip in situations where facilities are rudimentary or non-existent? Or will this type of boat always require a sophisticated travel lift, to perform routine out of water maintenance?

Sometimes it's just helpful to know that you can run your boat up onto an out of the way estuarine sandbank, to check some or other issue on the hull at low water. The first time you do it might induce a heart in the mouth sensation, but it's nice to know that you can.

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Hull Thickness, Keel Bolts and Floors

In the aforementioned Flying Fish Report, the Coroner concluded that the primary cause of the Rising Farrster sinking was insufficient hull thickness in the vicinity of the keel bolts. Specifically the laminate was found to be 5.5mm thick in this area. Additionally certain floor structural members were omitted by the builder from the original specification.

You don't need to be a naval architect to understand that 5.5mm is way shy of the minimum laminate thickness necessary in the keel to hull connection area of the hull that carries tremendous sheer stresses in ordinary sailing. Inadequate structural floors (the transverse structural members distributing the loads of the rig) and flimsy hull structures are so common among cruiser/racer designs that hairline fractures and evidence of hull stress, typically provoke no comment from marine surveyors.

All of this points to the conclusion that as a responsible sail-boat buyer you need to be capable of conducting your own pre-survey survey of any vessel you consider suitable for your intended purpose: caveat emptor!

Notwithstanding these observations, your pre-survey survey is additional to and NOT a replacement for; a marine survey which you are strongly advised to commission as a vital part of your due diligence research on any boat you intend to purchase. In bringing to your attention the aforementioned Coroner's Report, the intention is to highlight the inherent limitations to your surveyor's report.

By recognizing these limitations and taking responsibility yourself, you could be saving your own life and the lives of crew.

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Pull up the cabin sole and look in the bilge. Does the hull have stringers? These are solid longitudinal structural members that extend the full length of the hull, the lower stringer being tied into the transverse floors, which should be solidly constructed sufficient to carry and spread keel stresses. Any damage breaks or evidence of movement in this area should set off alarm bells.

Few modern GRP sail-boats in fact have full length stringers, in which case the stresses need to be accommodated by a substantial grid of structural floor members. In response to the oft heard retort that; "modern GRP sail-boats don't have stringers": this is simply not true of well built boats.

The stresses imposed by the rig and keel have to be accommodated in some way. If the interior bulkhead and built in furniture have a semi-structural role in a vessel you inspect, this should be additional to and not a substitute for stringers and floors. If you are unsure as to the adequacy of these structural components, get some informed technical advice. Ask for core samples. Most owners keep core samples from through-hull fittings.

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The Maintenance TLC Distinction

While maintenance has a great deal to do with the longevity of a boat, and boats vary in the degree to which they are forgiving of poor maintenance, some issues can doom a hull from the get go. This complicates the distinction that a prospective buyer needs to make; between a recoverable maintenance issue and a terminal issue.

The distinction between ‘a bit of TLC’ meaning a recoverable maintenance situation and a terminal problem; is an important distinction to be able to make with confidence at the pre-survey survey stage, about which a great deal more later.

From a buyer’s viewpoint, given the current economic climate post GFC, many good boats are effectively abandoned by their owners at the point where the vessel is placed upon the market. Among the many lemons on the market, there are some amazing bargains. The owner’s abandonment of the vessel in these cases is often; primarily psychological. He/she is unable oftentimes, to face the accumulated guilt of over-due maintenance.

The owner typically hand balls the problem to the nearest boat broker to get what the broker can for the vessel; as is where is. And while yacht brokers seek to acquire new listings, they generally shun a ‘problem boat’. ‘Problem boats’ can involve the broker in a great deal of effort, which is wasted when sales fall thorough. Indeed, if such a vessel is the object of your buyer interest, the broker’s accommodations are highly likely to be skewed towards you as buyer, rather than towards the vendor notwithstanding that the vendor pays brokerage from the proceeds of the sale.

This syndrome of the owner washing his/her hands of the boat just wishing to be rid of the problem, is the flip side of the irrational ‘falling in love’ phase that the (poorly advised) new owner experiences when he/she makes the ego driven commitment to purchase; a trap that I hope you avoid Dear Reader.

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Pre-inspection

When you encounter a vessel that appears to meet your requirements and appeals to you in an aesthetic sense, before you inspect the vessel take a careful look at all the information available, including what might be available via forums on the internet and dial up your own intuition.

At the risk of your author being considered a 'tree hugging candidate for La La Land', it is actually helpful to do this exercise alone in a quiet meditative state. Relax into meditation and run your mind over the boat, allowing your intuition free rein. Range from bow to stern and mast head to keel. Relax and go deeper. What do you 'feel' about the condition of the boat? What do you 'feel' are the problem areas? When you get to trust your intuition, it is surprising how accurately your feelings will be in leading you precisely to the issues that might need attention or even disqualify a boat from further inquiry.

To supplement your intuition and prior to discussing particular problems associated with particular hull construction media, we look at a few general areas that might pose issues relevant to a purchase decision.

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Deck Issues

Many problems with boats originate in the deck, due to fresh water ingress. Put simply, boats tend to rot top down rather than bottom up. Rarely are deck problems superficial although sometimes they appear to be just that.

Occasionally a deck problem in a wood composite vessel can be so advanced that rot has penetrated the cold moulded, hull timber via the end grain exposed at deck level. Deck problems are often hidden by cabin lining material which if it is permanent, can greatly exacerbate the problem and complicate the solution. Linings are very common in production boats. They look good when new but create big problems in time, given the inevitability of deck leaks. Although the look may not be quite as clean and modern, access to under deck/cabin structures means that problems can be quickly identified and rectified.

Deck problems in practice are frequently front and centre among survey issues. You need to understand the deck construction of a boat that you may consider for purchase.

In 2008 a couple having recently returned from a circumnavigation in their 58' S&S yacht, needed to sell the boat into a market that was bad and getting worse. Their sail boat was built in the modern manner with three layers of timber (two laid diagonally and one longitudinally) epoxy glued and sealed. She was from the yard of a well know Australian boat builder. Given the yacht's provenance and form of construction, she should have been bullet proof, commanding a premium price on the market.

Unfortunately during a re-fit that had been undertaken some ten years prior, a mistake had been made by the foreign yard that had cascading consequences for the boat and its owners a decade later. Moreover, the oversight happened during a deck re-fit, arguably the worst place for any oversight or slip up in the process to occur.

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The story was that the old teak deck overlay, having been removed, was scheduled to be treated with a rot proofing epoxy product and overlaid with an epoxy glass sheath, prior to the re-laying of new teak. The overseas yard, by virtue of an honest mistake or malfeasance, omitted the epoxy glass step and laid the new teak directly onto the marine ply substrate. Lesson #1: never turn your back on a boat yard while they're working on your boat.

Ten years later the deck is leaking in several places and the ply is quietly rotting away beneath the teak, due to water ingress trapped between the teak and the ply substrate.

The owners now face a project that involves the total removal and replacement of the deck. Alternatively, the boat might be sold for a fraction of its worth otherwise, if that is, they could find a buyer. The boat meanwhile has a realistic market value of circa $AUD80K, a discount of around $AUD270K on her probable value minus the deck problem.

If the vessel has a laid deck it will almost certainly be an overlay in which case the nature of the substrate and method of attaching the top planks (usually but not always teak) to the substrate, are important issues which you need to understand. Ask to pull a deck bung. Many vessels built in India, Taiwan and China within the past twenty years are found to have very poor quality stainless or even mild steel fastenings under the deck bungs. If the latter is the case, the deck will likely be rust stained in the vicinity of weeping bungs. All in all this is a sure indication that sub-standard materials and shoddy workmanship will feature in every area of the vessel that you cannot see. If you discover this to be the case, your best course is to back off immediately.

With decks as with all of the components of a mono-hull sail boat, the distinction between a recoverable situation and a terminal one can be a difficult call. As to where a maintenance issue lies in relation to it, is a matter of experience. Judgment is influenced by a number of factors among which is the form of construction.

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Which Medium of Construction?

Having personally owned traditionally built wooden boats, composite boats and GRP (glass reinforced plastic) boats and worked on all of the remainder, I am inclined to the view that modern wood composite construction (strip planking/cold moulding or a combination of both) comes closest to the ideal in term of strength, longevity, maintenance and cost.

Opinions however vary greatly on this matter. Half a dozen experienced, well informed owners will render an equivalent number of opinions. Moreover, even with the modern wood composite form of construction, traps are ever present for the unwary.

Aluminium is strong and (potentially) very low maintenance, if you're game enough to own a boat constructed from this material, that is. Aluminium is unforgiving to say the least: one slip-up can easily doom a vessel. Once upon a time I was contracted to work on a large aluminium catamaran. Among a variety of projects, the boat was fitted with new engines.

The task of the installers was made vastly easier by virtue of the fact that the hulls were simply cut open at the engine rooms and the motors replaced; the old ones out via the new side door and new ones in. The hull sides were then welded back into place, bogged and faired and that was that.

All things being equal, aluminium performs reasonably well in salt water. The problems start to occur with salt water forming an electrical connection between dissimilar metals in proximity. Proximity can mean 'the other side of the marina finger wharf' or the 'next finger wharf'. Aluminium is well down the scale in terms of metal nobility which means; it turns pear shaped in proximity to say…copper or bronze.

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It should be possible to keep copper out of an aluminium boat and thereby eliminate the possibility of a corrosion source occurring from within. With care it should also be possible to keep an aluminium vessel away from other boats that by virtue of their construction material, pose a threat of electrolysis. But then no amount of planning and care can totally eliminate accidents and unintended consequences.

I was party to a conversation with one of the shipwrights some months after the project was completed and we had all of us, moved on. We were discussing the fearsome effects of electrolysis, and he mentioned an incident on that project that he figured 'might' have consequences for the boat we both worked on. He had been in the engine room doing a final clean up on the final day prior to commissioning. He noticed he said, a small copper ferrule, detritus from electrical work, overlooked by the electricians. He reached up with the vacuum hose to suck up this seemingly innocuous piece of metal, only to see it drop rolling into the bilge, under an engine and forever out of reach.

Any salt water reaching this point; the low point of the bilge, would set in train, ferocious corrosion that would send that piece of metal right through the aluminium hull, to the bottom of the sea, in short order. The shipwright was delving into understatement with his observation that the oversight 'might have consequences'. It probably doomed the vessel and who knows in what circumstances the chickens would come home to roost. Aluminium is unforgiving and not for the faint hearted.

Electrolysis is dangerous for other types of construction not limited to aluminium. I once had occasion to undertake repair work on a wooden yacht that was discovered to be sinking at her berth.

For some reason the wooden hull had rotted in places beneath the water line reducing solid timber to a blackened mush around fastenings. Why? The boat was originally copper fastened which means that from a galvanic viewpoint at least, it should not have happened since copper is high on the nobility scale.
However, work had been undertaken two years beforehand by way of adding fastenings, thereby strengthening the hull.

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Acting on professional advice, several hundred stainless bolt fastenings were added to the original copper fastened hull. In an error of judgment so egregious that is difficult to comprehend, the fastenings comprised 304 grade stainless, not 316, with the result that where they were proximate to the copper fastenings in the bilge, the 304 stainless disintegrated and turned the surrounding wood to mush.

This can occur within a couple of years. The ‘strengthening’ work effectively doomed a hull that otherwise, may well have survived another 80 years.

GRP the material originally touted as maintenance free, is anything but. Admittedly the maintenance bill for GRP in all likelihood comes in a rush after several years of use, rather than progressively by instalments, but come it will.

Problems of osmosis in GRP hulls originate with; improper bedding of the glass fibre laminate in resin, at the build stage. I have personally witnessed more than one marine surveyor push a screwdriver right through a GRP hull, riddled with osmotic de-lamination. The worry is that; of two identical GRP production boat hulls, produced from identical materials, in the same factory under similar conditions; one will be perfect in twenty years and the other will be good for land-fill.
It’s too late to then go looking for the kid with his hat on backwards and the chopper gun in his hands; who short sheeted your hull; resin-wise, because his mind was on ‘knock off time’, beer and sex… in that order, when arguably; it should have been upon, what was to become your boat.

There are several hi tech so called ‘final solution’ treatments for osmosis in GRP. These should all be regarded with the greatest suspicion. It is a far better strategy to buy a GRP vessel that has never had a serious problem with osmosis, than one that has been so called ‘fixed’. The bottom line is that the problem originated in ignorance and was probably fixed with an equal measure of same. Ninety nine percent of operators simply do not know what they’re doing with this kind of repair and the technology is not to be relied upon.

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The best sign of hull integrity in a GRP vessel is age and multiple layers of old antifouling paint because this suggests that the hull hasn't been repaired for sale. If a GRP vessel has escaped a dose of osmosis in her first decade, it is likely that she will do so in subsequent decades.

Steel is OK until it's not! Steel is strong, impact resistant and can be easily welded, meaning that a rusty bit can be cut out and new steel welded in place.
But if a steel boat is anything but perfect, the problems are likely to be worse than they appear. Once rust gets into a steel boat it can and often does signify 'end game'. The problem is exacerbated by built-in furniture.

There are boat owners who swear by ferro boats. Your author isn't one of them. Awahnee on the other hand, the famous ferro yacht owned by Bob Griffith: accomplished several circumnavigations of the globe including a severe grounding in the Red Sea. Ferro might be OK if it's perfect, but once saltwater penetrates the concrete and gets into the steel mesh reinforcing and concrete cancer appears, it's all over red rover! And salt water will eventually penetrate the concrete substrate. It's just a matter of time.

The most important issue for a boat Buyer is to be able to distinguish between superficial maintenance issues and terminal problems prior to the point where money changes hands.

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Maintenance History

Try to get a feel for the maintenance history of the boat. Is the current owner the only owner or have there been prior owners still? In what condition is the boat now? In what condition was she in when the prior owner took over the vessel?

Maintenance history is critical in a wooden boat; barely less critical to a steel boat and not quite so critical in a glass boat. A poor owner can condemn a wooden vessel for ever more. GRP (glass reinforced plastic) construction, up to a point, is more forgiving of poor maintenance.

A meticulous owner will be pro-active about maintenance, replacing items before they fail leading to unanticipated consequences. Similarly, a meticulous owner will be unlikely to sweep a problem under the carpet. More likely he/she will face the issue and deal with it in a proper manner.

If this seems like an extrapolation based upon the character of the vendor; it is indeed that. This is another way of saying that your impressions of the vendor are relevant to your purchase decision.

Has the boat been used on a regular basis? Boats that are rarely used will have far more problems, compared with boats that are regularly used. Unfortunately, most boats are rarely used. How does the boat look in relation to its age and in relation to other boats of a similar vintage? After seeing a few boats of the same genre, you will be equipped to make a judgment. Does the boat look like it has been restored? If so, what work was done to bring it up to its present condition and when? Was the boat brought back from the dead?

Has the vessel ever been in charter? The answer is relevant because vessels in charter have a hard life.

ISBN 978-0-9808173-0-0:

GRP Production Vessels: Build Quality & Sea Going Performance

Is the vessel in question a known production boat or a one-off? Production boats generally command a price premium in the second hand boat market. The probable reason is that production boats are a known quantity.

However, while a minority of 'production sail-boats' are notable for build quality, the majority are not. This fact likely passes by the average buyer with nary a blink. The pictures below depict a well known brand European production sail-boat that encountered a mishap while on charter in the Mediterranean. The vessel reportedly did not hit anything to cause the event whereby the bow section separated from the hull. Mere pressure of the rig was evidently sufficient. A close look at the flimsy chopped strand lay-up in this area which is supposed to be a hull strong point, is enough to see why. Where is the roving reinforcement? Look at the deck to hull joint and the absence of reinforcement behind the fittings.


The irony is that this brand commands a market premium.

ISBN 978-0-9808173-0-0:

How original is the boat? Does it have add-ons and if so are these in keeping with the design?

You need to know who built the vessel. Is this the only vessel the builder produced? Are there other extant examples? Can you talk to the builder? Does this type of vessel have a good reputation for build quality, longevity and sailing performance? Was the genre of production vessel, the object of your interest, built for the charter business?

In their seminal book: “Surviving the Storm”, Beowulf Inc 1999, Steve & Linda Dashew reference the case of SV Ocean Madam a Beneteau Oceanus 390. Having an 11.3m LOD and 3.8M beam this vessel displaced 13.6 tons and had been built in 1989. In 1997, the owners engaged a professional delivery crew to cross the Atlantic from the Mediterranean.

In the Bay of Biscay the crew encountered a gale force 8 or 9. At 2130 the boat was knocked down to starboard by a large breaking sea. When she righted everything below had broken loose (meaning we assume, that the internal fit-out furniture which is semi-structural in these boats, had broken loose from its bonding to the hull, meaning that the hull would flex like a flip flop sandal). A second wave inverted the boat and she stayed inverted long enough for the hull to partially flood with sea water.

Dis-masted the vessel eventually righted but the life raft which inflated during the inversion threatened to break loose prompting the remaining crew (one member was lost overboard) to retreat to the life raft where presumably the survivors felt safer.

They were subsequently rescued thanks to an activated EPIRB. The vessel was eventually found and sunk by the French Navy. The crew member lost overboard was never found.

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The vessel had a reported limit of positive stability of 109 degrees. Dashew conjectures that the actual number may have been somewhat less. He comments:

> "we would consider this to be well under the range of an ocean going vessel especially one this size with such a wide beam"

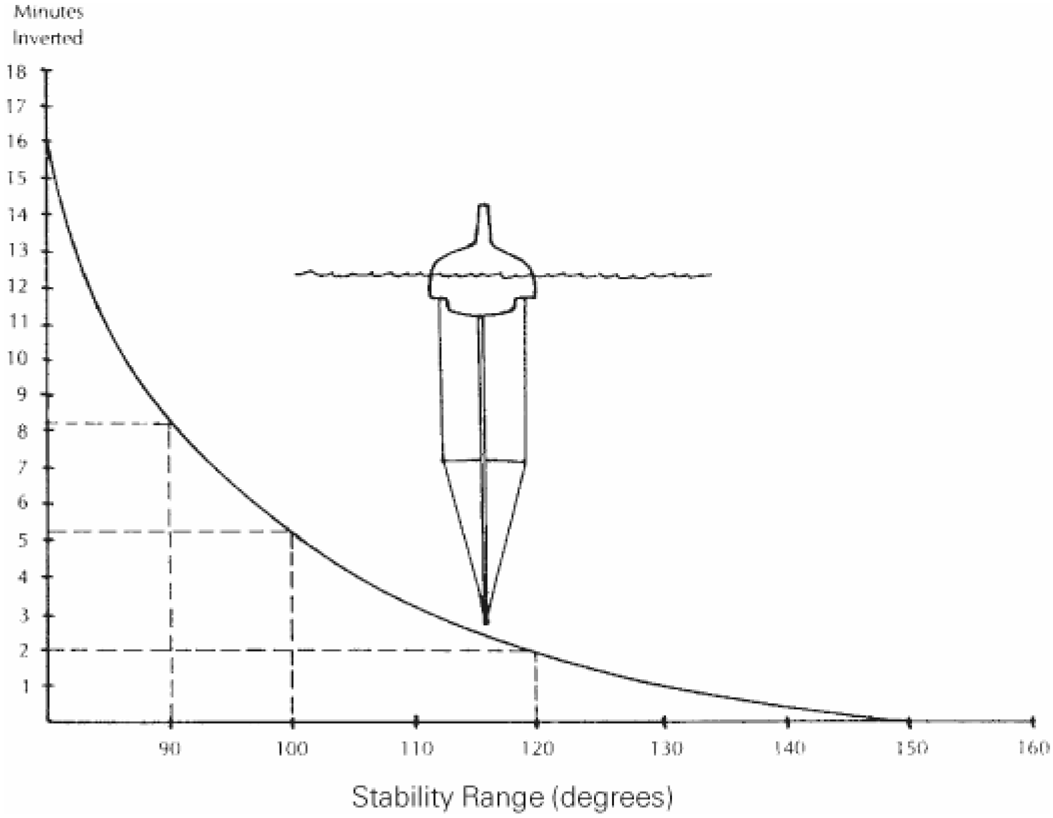
The Marine Accident Investigation Branch (of the British Government) Report has this to say about the Beneteau 390:

> "This class is typical of its type with high-volume, low ballast ratio, light displacement and shallow hull form. It is highly suitable for most activities including charter work and has a good safety record. It is not a suitable craft for crossing oceans in bad weather"

Most cruising folk plan to avoid bad weather. But nevertheless; passage planning notwithstanding, you will occasionally run into bad weather and you need to know that your vessel will keep you safe at sea.

ISBN 978-0-9808173-0-0:

What is the Limit of Positive Stability (LPS) on the Boat You Plan to Take to Sea?



Source: McGraw-Hill Boating Encyclopaedia

The issue from a sail-boat buyer perspective it is safe to assume: is that you presumably wish to avoid the prospect of being trapped in a sail-boat that inverts 180 degrees and stays put in that position long enough to sink the boat and drown crew trapped inside and/or drown those unfortunates tethered to the deck.

In this respect a yacht with a 120-degree range is almost 3 times less likely to be trapped in the upside-down position than is a boat with only 90 degrees of positive stability; a boat with a 150-degree range, such as the Contessa 32, is ten times less likely to be trapped.

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Depending upon your usage intentions, sea keeping qualities may be an important consideration. Classic long keeled yachts having high ballast to displacement ratios (35% plus) generally have high limit of positive stability (LPS) ratios 130 plus and superior sea keeping qualities, but this type of vessel is both increasingly rare and out of fashion.

Fin keeled and skeg-hung rudder configurations on hulls having modest beam can be similarly good sea boats. Even so, windows, lockers, hatches and the construction of the cockpit and companionway can have serious implications for sea worthiness. Large windows can render a boat dangerous when exposed to heavy sea conditions. A boat having largish windows can be fitted with storm shutters to ameliorate the flooding danger in a heavy sea.

In February 2002 I had several practical demonstrations of my boats LPS during a crossing of Bass Strait, fortuitously on this occasion…alone. This experience; not one I am anxious to repeat, is detailed in the blog 'Not how I want to die".

Of all the lessons of this fearful trip, possibly the most significant was an education in the effects of hull shape in storm conditions where knock downs were a frequent occurrence. A knock down typically occurs due to the force of a breaking wave bearing down on the vessel, or in more extreme events, due to the vessel falling out of a wave in which case the vessel impacts the bottom of the trough in the vicinity of the cabin/deck joint and heavy water descends upon the hull,

The ability of the hull to skid sideways unimpeded, is a big factor in dissipating wave energy in these circumstances. Excessive beam and any protuberance at deck level that might serve to trip the hull during this sideways skidding motion causing inversion, is highly undesirable.

ISBN 978-0-9808173-0-0:

Cockpit Security Issues

The cockpit: our boat has a large cockpit (too large) and while there are two 3/4" drains, they are (or rather…were) nowhere near large enough to quickly drain a cockpit filled by a boarding sea. Many times during passages in bad weather, has this cockpit been filled to the top of the bridge deck. At these times the weight of seawater from a full cockpit depresses the stern exposing the boat to further peril.

At the start of the aforementioned Bass Strait adventure, I had a box of spare shackles and rigging gear in the cockpit which included several spare sail slides. With heavy boarding seas during the first night, these slides washed out of the box into the cockpit drains causing a dangerous obstruction to the flow, in the worst possible circumstances. Since that occasion I have learned to have nothing in the cockpit small enough that it could block a drain. In addition I have installed an additional 1½" cockpit drain that rapidly removes incoming seawater.

Wash boards need to be substantial because in storm condition boarding seas will slam into the cockpit with surprising force. Our wash boards are a beefy 30mm mahogany. Several times on other passages I have had boarding seas impact the wash boards with no damage.

But frequently, wash boards are found to be barely adequate on GRP production sail-boats. Your boat may be dry in a normal sea way but there will be occasions when your wash boards will be tested. You can count on it.

Companion-way doors while they are a desirable feature in live aboard marina conditions, are no substitute for wash boards. I also silicone into place: the bottom wash board on a passage where bad weather might be anticipated.

A shallow cockpit or no cockpit can render a boat dangerous to the crew in a heavy seaway. There may be little to prevent crew members from being swept overboard by a boarding sea.

Lockers: in a similar vein, large cockpit lockers can be lethal in a seaway if there is any chance that the locker lid or fastening can be dislodged, or that sea water could leak past the locker lid into the hull.

Companionway: an entrance at cockpit sole level, is similarly dangerous in that a boarding sea could spill into the cabin. There should be an adequate bridge deck structure between the cockpit sole (the base of the cockpit) and the companionway entrance into the yacht's cabin.

Hatches: need to be strongly built for obvious reasons.

Jack lines: and secure points need to be more than adequate for the task rather than marginally adequate. Jack lines may have to take the full force and momentum of your projected body weight.

ISBN 978-0-9808173-0-0:

Vertical Centre of Gravity (VCG)

Comfort and safety at sea are related to another aspect of hull design namely the vertical centre of gravity (VCG). This is the centre of all of the weight which makes up the boat.

I have a friend who some years ago acquired a 100 year wooden old pilot sail-boat from the east coast of the US and sailed her down the east coast of the US, through the Panama Canal and across the Pacific to Australia, alone. The boat is amazingly 'low wooded' meaning low freeboard or very little vertical distance between the crew in the cockpit and the sea. By contrast, this boat has an equally amazing volume of boat hull beneath the waterline.

I quizzed him one time about the boat's performance in storm conditions. My friend, who is very experienced with ocean passage-making, replied that his boat was exceptionally comfortable in a seaway and no more prone to boarding seas than any cruising sail boat in his experience. Moreover he said the low wooded aspect of the hull presented less windage which can be an important consideration in nasty conditions.

This is counter intuitive because most people unfamiliar with living on the sea would associate high freeboard with safety. On a well found boat, the contrary is actually the case.

Crew comfort in a seaway is a function of nearness to the boats VCG. This is why the pilot berth on a small sail-boat is vastly preferable to the forward V berth in any kind of weather. In the pilot berth which is usually very close to the VCG, the boat is moving around you while you remain more or less in one place (this is a relative statement).

Our boat for example has a very comfortable latex double bed mattress in the forward cabin and a hard unforgiving mattress on the pilot berth.

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Yet in storm conditions the latex bed is a nightmare and the pilot berth is perfect. Being well away from the VCG, the motion is violent. With the movement of the hull coupled with the springiness of the mattress in the forward cabin, the unfortunate sleeper is being projected in every direction like bouncing upon a trampoline, while limbs are tangled in bed clothes and your face is mashed into whatever hard surface intervenes. Sleep in these conditions is impossible.

ISBN 978-0-9808173-0-0:

The Keel to Hull joint

Should you should be fortunate to encounter the boat on the hard check the keel to hull joint carefully. The keel to hull joint is unlikely to be a problem area in the case of a long keeled yacht, but it might well be a problem in the case of a fin keeled yacht. The more extreme the keel meaning the more narrow its root footprint, the more prone to problems will be the keel to hull joint.

Problems may be caused by grounding and sometimes even by the wracking stresses of sailing. Extreme racing designs with narrow foil and bulb configurations are vulnerable to damage because structural lay-up and internal floors are frequently inadequate in these type of boats. Signs of stress may be apparent at the leading edge of the hull to keel connection and sometimes at the trailing edge as the forces of a grounding force the leading edge down away from the hull and the trailing edge up into the hull.

Any signs of damage or prior repairs to the ballast lead or iron caused by impacts with the bottom should arouse suspicions in this regard. Persistent hull to keel bedding problems indicated by prior attempts to repair leaks in this area: point to inadequate internal floors in the hull. Floors are internal structural members designed to spread the forces imposed by the keel and support the mast.

Inadequate floors are a common feature of the modern GRP sail boat genre designated: “cruiser/racer”. No amount of sealant of fairing compound will fix the problem once it manifests. If the root cause is structural it will only get worse with age and use.

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Other General Structural Issues

Floors are transverse members across the yachts bilge. In the vicinity of the mast step floors distribute the stresses associated with the rig and keel. On a GRP hull where the floors are either comprised of transverse members across the hull or a honeycomb of transverse and fore and aft members, check the condition of these structural members. In the event that you detect any evidence of cracking or past repairs it is probably indicative of systemic weakness.

Are the keel bolts which should pass through floor members seemingly in good condition? Any sign of cracking and/or mechanical damage in this area should set off serious alarm bells. Keel bolts are generally in-built to the keel structure, meaning that their replacement entails building a new keel.

Centre boards theoretically offer the cruising sailor the best of all worlds in that the yacht can have very modest draft enabling access to shallow water anchorages for example, while possessing windward performance that otherwise would only be achievable with much deeper draft. Centre boards however are prone to damage in the course of an unplanned grounding. They can be bent in these circumstances or damaged in the area of the pivot pin. Centre boards can also be prone to hum and rattle when the yacht is sailing at speed. Apart from obvious flaws that might be revealed in a centre board yacht, this is an area probably beyond the limited scope of a pre-survey survey. Suffice to say that a centre board introduces a whole new set of potential problems in conjunction with several practical benefits. A centre board yacht should be carefully checked by your surveyor.

Hull to deck connection issues are dealt with under GRP build issues because they particularly relate to GRP boats. Suffice to say that this is an area where builders seek to save money. It is also the point where flexing most commonly occurs between hull and deck.

ISBN 978-0-9808173-0-0:

Hull access issues will become apparent if during your internal inspection of the boat, you find that you do not have access to all areas of the hull. Possibly built-in furniture is obstructing access? If access is inadequate, be prepared should you go ahead and purchase the boat, to either construct access hatches yourself or have a yard do it for you. What might you find when you do?

A boat built without adequate thought given to access, will likely suffer from other areas of inadequate planning like insulation material too close to the hull and prone to water ingress.

Chain plates need to be engineered so as to take the stresses of the rig. Chain plates need to be through bolted to the hull with adequate reinforcing or to a structural bulkhead with adequate reinforcing. It can be difficult to eliminate leaks where the chain plates exit the deck. Leaks will eventually cause dry rot in timber bulkheads.

I have seen the unfortunate legacy of a well known US designed production yacht of Chinese manufacture, having chain plates attached to flimsy, poorly constructed partial bulkheads. Hidden out of sight behind saloon cabin furniture, one of these plywood members had rotted due to water ingress over time. It let go with the result that the chain plate tore up out of the deck while the boat was underway, causing a loss of the rig.

Drive train systems on sail-boats fall broadly into three categories. The most common system and easily the most popular system, on sail boats is shaft drive. In this arrangement one of the main problems can be alignment. This is mainly the case on yachts having inadequate engine access. Where the propeller shaft and the engine are improperly aligned, vibration will occur in conjunction with wear to the cutlass bearing. This is the bearing at the external point where the propeller shaft exits the shaft log and connects with the propeller.

A properly aligned shaft should induce almost no wear in the cutlass bearing with the result that this (usually composite) bearing lasts a very long time. If alignment is poor on the other hand, the cutlass bearing will wear out quickly, producing an annoying rattle in the propeller shaft.

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Replacing a cutlass bearing means; firstly detaching the engine/shaft coupling and pulling the shaft out towards the stern, in order to provide access. This can be a problem if the rudder prevents the shaft being so removed. In this case the engine must be removed or lifted and the shaft pulled back (under the engine) into the boat. Since cutlass bearings are normally glued into place, the old bearing must be chopped out and the new one glued back into place whereupon the shaft is replaced and the engine bolted back into position and re-aligned.

Since all of this is quite a deal of work that you may either be obliged to do yourself or pay to have done, it is well to check the shaft thoroughly for movement indicating wear in the cutlass bearing. On many yachts due to difficulties posed by restricted engine access, it can be all but impossible to achieve perfect alignment of the engine and propeller shaft.

The task is actually made more difficult by the use of semi-flexible coupling fittings which don't allow the use of feeler gauges for alignment purposes.

Every engineer I have ever spoken to about the use of universal joint fittings in this area (as in motor vehicle shafts); have advised against their use, on account of the thrust issue. Universals are not engineered to deal with thrust. However, I once witnessed a universal joint used in a 30 HP yacht engine installation. The installation did not have a thrust bearing between engine/gearbox and shaft log and the whole arrangement was reported by the owner (himself an engineer) to have worked perfectly for over a decade.

Sail drive systems in yachts operate in much the same manner as outboard legs except that they extend through the hull and remain in position, unlike an outboard leg on an inboard powerboat engine which can be hydraulically raised. Obviously there are no alignment problems to contend with in this type of installation.

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Sail drive systems usually incorporate a feathering propeller which means zero drag under sail. To a sailor this is a huge plus.

And while sail drive systems are commonly found on modern boats, anecdotally, their popularity is less than conventional shaft drive installations which may indicate a susceptibility to problems.

Among these issues, may be that fact that a sail drive leg is alloy which means that the propeller must be alloy. This is an invitation to galvanic issues particularly if zinc anodes have degraded and/or if the yacht is kept in proximity to a copper fastened boat. More importantly, in the tropics where marine growth materializes before your eyes, a sail drive system means that the boat must use non-copper anti-fouling paint, the potency of which is considerably less than copper based paints.

Moreover, if coral growth on the unscreened intakes of the sail drive leg, blocks the free flow of cooling water to the engine, the engine will overheat. Un-blocking these intakes, usually means: slipping the boat. They cannot be cleared underwater. This issue has had serious implications for charter operators on Australia's Barrier Reef where marine growth does indeed materialize before your eyes.

By contrast, shaft drive systems have a simple mesh cooling water intake below the water line, combined with a sea water filter inside the hull. Clearing marine growth from the intake can be done quite simply underwater with a screw driver and snorkel while cleaning the filter is done from within the hull using a toothbrush (after turning the inlet valve off).

ISBN 978-0-9808173-0-0:

Rudders and steering systems: the simplest most straight-forward steering system on a yacht is a tiller attached to an outboard rudder on pintles.

Source: http://rugludallur.com

The tiller is connected to the rudder stock usually via a mortise joint. A tiller provides direct feel and ultimate simplicity. For these reasons your retro-author believes that a tiller is the only way to steer a yacht up to say 35'. This is probably a minority viewpoint. But ridiculous to my eye, is the sight of a 28-30' yacht with a steering pedestal and a large destroyer type wheel.

On older yachts rudders are usually hung from the keel or from a skeg which is an aft mounted structural fin, integral to the hull. This form of construction provides security protection for the rudder important in cruising applications in addition to 100% positive balance. More modern yachts typically have spade rudders which have no leading edge protection, are less than 100% positive balance which provides greater ease of steering and greater efficiency.

Some early versions of the spade rudder provided some angst due to bearing and shaft failures but these issues can generally be assumed to have been resolved.

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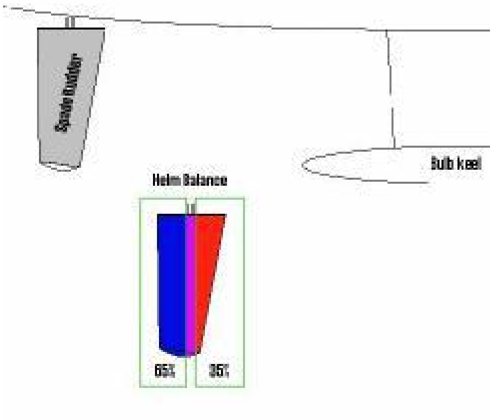
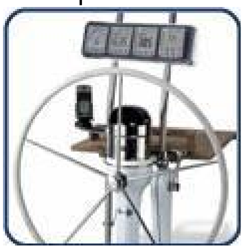


Source: http://rugludallur.com

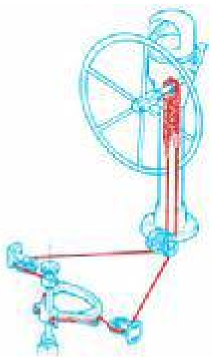
Nevertheless a spade rudder will impose significantly greater stresses on a hull than its skeg hung equivalent. On the other hand steering loads are usually far less meaning that oftentimes no more than finger tip pressure is required to steer the boat.

A spade rudder is also exposed to the possibility of damage via grounding or collision which makes this type of configuration questionable for cruising yachts. The bearing and surrounding area should be thoroughly scrutinized.

Wheel steering works either via: a hydraulic system or via wires that actuate a quadrant or, via a mechanical rack and pinion mechanism.



Source; http:/www.edsonmarine.com



Source; http:/www.edsonmarine.com

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The latter system is by far superior, but rarely found on small boats.

Problems with wheel steering systems always occur at the wrong time and usually involve cables slipping off the quadrant or breaking under load. Any slack or stiffness in a wheel steering system points to the need for servicing the cables.

Movement in the rudder stock itself is a more serious matter to resolve. It could indicate worn pintles in an externally mounted rudder. And while movement in a tiller/rudder connection or in the rudder stock itself is generally not dangerous, it is certainly annoying. If the boat in question has wheel steering, be sure that there is a usable emergency steering system available. This usually consists of a tiller that can be inserted into or onto the rudder head.

Engine cooling systems are generally either direct salt water injection, heat exchanger systems or keel cooling. Direct salt water injection systems are generally restricted to dedicated marine engines having heavier cast iron jackets and galleries to combat salt water corrosion.

Heat exchanger systems are the more prevalent and the most likely system that will be encountered in a yacht for sale. Under this arrangement salt water cools the fresh water circulating within the engine block within a heat exchanger jacket. The system operates on a similar principle to an automotive radiator. It's important to maintain proper levels of coolant within heat exchanger systems to combat a build up of salts within the galleries. Even a slight build up of salts will reduce cooling efficiency considerably and cause the engine to run hot. Heat exchangers need regular servicing but rarely do they receive adequate attention.

Among charter yachts that have been in service for any length of time it is common to discover that the boat's engine runs hot and will not achieve cruising speed without overheating. Salt build up will also occur within a heat exchanger system if not serviced regularly. Generally the heat exchanger is engineered so as to be taken apart periodically and de-scaled. Alternatively there are now available on the market proprietary fluid de-scaling systems for heat exchangers which do not require dismantling of the unit.

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Another issue is that of maintaining sacrificial engine anodes. The anode is usually of a type called a pencil anode that screws into the heat exchanger or engine block.

They are commonly overlooked during engine service with the result that the exhaust gasses quickly rot out manifolds and exhaust fittings comprised of dissimilar metals.

Rarely found on yachts but commonly seen on commercial fishing boats are keel cooling systems. Under this arrangement the fresh water and coolant circulates within a pipe system that extends outside the hull usually in the form of a long pipe exiting the hull beneath the engine going forward, around in a U-turn and back into the engine. These systems are highly efficient in terms of engine cooling but not so efficient in terms of drag.

Stanchions on a hull can be problematic and a source of on going leaks. This applies to all build media, but GRP in particular, due to the fact that there is commonly a certain amount of flex in GRP hull and deck in the region of the stanchions. Check the internal fastening of stanchion bases. Are they accessible? If no, it's a problem. Stanchions need to have well engineered broad bases, not flimsy thin plate stainless bases commonly found that flex and leak. The deck needs to be substantial enough in the vicinity of the stanchion base that it doesn't flex under load.

Bases should be bolted through the hull with adequate backing plates and a liberal application of sealant. After all the purpose of a stanchion, is to arrest the progress of your body over the side.

Sea cocks: your author was once furnished with an object lesson on the matter of sea cocks. On this occasion when deep within the bowels of a wooden cruiser, I was administering to an ancient bronze sea cock that had frozen solid. Following the application of a certain amount of 'brute force and ignorance' to the handle, I had the unpleasant experience of said item, crumbling in my hands. What followed was a violent inrush of sea water against which no wooden plug was of course available, as it should have been, to stem the flow. Consequently never again have I dared to apply anything more than gentle pressure to a frozen sea cock. Neither should you.

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Opinions seem to differ as to the best sea cocks. My own view is that the best quality marine plastic sea cocks are superior to all of the metal varieties including bronze. Bronze cocks are generally preferred by surveyors however. This may be due to their resistance to melting during a fire.

Sea cocks should be changed routinely every five years or so. Frequently they are left in place for several decades. If there is any doubt, plan on changing sea cocks at the first opportunity or ask that the owner to do so prior to purchase.

The fuel tankage arrangement needs to be understood on any boat you are considering for purchase. Fuel tanks are usually constructed from black iron, mild steel or stainless steel. In older traditional boats fuel tanks may be copper.

Ideally it will be possible to drain the low point in a fuel tank because this is the point at which water and sludge accumulate. More commonly, fuel tanks are shoe horned into exotic locations where access to the low point is impossible. If it's not possible to drain the low point then some form of fuel polishing will need to be undertaken as part of routine maintenance. The reason for this is that diesel fuel harbours organisms that grow at the point where water and fuel mix. There will always be some amount of water in a fuel tank from condensation. When these organisms die, they fall to the bottom of the tank to mix with water and form a black sludge.

Fuel tank sludge can pose a problem at the worst possible time, usually when the boat is experiencing bad weather; being tossed around and the crew is experiencing a spot of high stress. In this situation, sludge can overwhelm the filter and stop the engine. One solution is have dual filters set up in such a way that its possible to switch filters quickly if one is choked by sludge. Ninety percent of all diesel failures are caused by dirty fuel. The better course is to make sure that the fuel is maintained in good condition. Some boats are equipped with constant or on-demand fuel polishing systems; whereby the contents of the fuel tank are pumped from the low point in the tank where water accumulates through a water trap and filter, thence back into the tank. Whilst this is an excellent system, it is complicated.

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The simplest system by far is one that allows for the sludge to be drained from the low point of the tank. If this is done routinely in conjunction with the use of anti sludge additives, the fuel system should give no trouble.

Fresh water tanks are usually fabricated from either stainless steel, GRP (usually built integrally into the hull), black iron or a plastic bladder within a flexible fabric sleeve. On our boat we have flexible tanks. The first 120ltr tank purchased second hand was of French manufacture and lasted over a decade. By 2003, the replacement bladder carrying the same French brand was sourced from China. It was rubbish. If this fact wasn't immediately apparent, three bladder failures in succession sealed the deal. Determined never to touch the French brand again we this time settled upon the more expensive Turtle Pac; an Australian manufactured product which has proven to be of excellent quality.

One advantage of the flexible tank arrangement is that the tank is easily removed for cleaning. Another advantage is that the tank can be removed so as to enable access to the hull beneath the tank. Obviously with built in tanks, this is either difficult or impossible. This is not a happy situation.

A negative associated with flexible tanks is that bladders can break. As with everything else boat-wise, a bladder failure will happen at the worst possible time. While cruising we always carry about 15 percent of our water capacity in separate plastic containers so that in the event of bladder failure we don't run dry entirely.

Water makers are reverse osmosis systems that filter the salt from sea water under pressure, to produce fresh water. They range from simple manual systems, better described as survival equipment, to complex, engine driven affairs. A water maker is a great concept in theory. Having one on board liberates the cruising yacht from the need to collect and transport water to the boat. In many locations water is scarce and of variable quality. It is always difficult to transport.

ISBN 978-0-9808173-0-0:

Problems arise with water maker systems due to their inevitable complexity.

For example an engine driven system would commonly comprise the following components:

1. micro processor to send commands
2. relays to convert control voltage to motor voltage
3. timers to ensure the boost pump is on before the HP pump
4. electric solenoids and valves to control salt water
5. low pressure switch to ensure the filter isn't dirty
6. HP switch to make sure system hasn't failed
7. salinity probe connected to micro processor
8. Led screens and alarm lights

There are as a matter of a fact at least two marine maintenance businesses on Queensland's Barrier Reef dealing exclusively with water makers. As to why; its obvious from the above that while a water maker is a wonderful innovation to have aboard a boat you are considering for purchase, you need to be prepared to embrace the Zen of maintaining your system. Even then, it would be unwise to be too reliant upon the water maker in a cruising situation. It should only ever supplement reasonable storage capacity.

From the viewpoint of your pre-survey survey, the inclusion of features such as a water-maker is something that should not cause you too much excitement. It might work. It probably won't and it shouldn't even be brought into consideration in valuing the vessel.

Passive charging devices such as solar panels have become ubiquitous on cruising yachts and it is probable that in researching the boat for sale market you will encounter boats so equipped. A cruising boat has a usage requirement for amperage to drive the various systems such as lighting, refrigeration, computer, auto-pilot and navigation systems. The solar panel array is part of the other side; namely the capacity side.

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At some point as a potential owner you need to know how the boats generating capacity stands up against the usage requirements but bear in mind that these are essentially peripheral issues in so far as your pre-survey survey is concerned.

The components of the boats generating capacity start with the alternator running off the engine. But to be reliant upon this source implies that the motor must be run at intervals daily. Battery capacity in the context of usage is also relevant to how frequently you might need to run the engine. If the answer is every few hours, this might be OK in coastal cruising mode since the boat can motor-sail for a time. But offshore it is almost certainly not going to be feasible. You would probably run out of diesel. Also while at anchor, it may not be desirable to be running the engine daily.

For these reasons among others it is normal to find that the engine alternator is backed up by one or more passive generating sources. To calculate the contribution from solar panels the normal equation relevant to the tropics is to divide the panels rated amperage by half, multiplied by the hours of direct sunlight. Thus a 36 watt panel with a 3 amp output would produce 1.5 amps times ten hours of sunlight (15 amp hours) in sunny conditions and somewhat less in cloudy conditions.

Wind turbines are another source of power frequently found on cruising vessels. The theory behind wind turbines is that power output increases, as a cube of wind speed. Most of the wind turbine units on the market will produce more power than the batteries can handle. The downside of wind turbines is that they are noisy; they can be terrifying in a real blow and they can slow down a sail boat markedly to windward.

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This is not a problem for a cruising yacht because gentlemen don't sail to windward (if they can avoid it). But it might be a problem otherwise.

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GRP or Fibreglass Pre-survey Survey Tips

Fibreglass was originally invented by one Russell Slayter of Owens Corning in 1938. It was originally purposed as a material for industrial insulation. The use of glass reinforced plastic (GRP) material in boats and airplanes was pioneered during World War 2. Later during the 1940's a handful of US manufacturers began experimenting with moulding boat hulls from this material. Later, and mainly to avoid the negative connotations associated with 'plastic', the term fibreglass was substituted.

When this material first arrived on the boat scene one Francis Herreschoff, a doyen of traditional boat design, upon being asked about the future of GRP for boats replied that he didn't think 'frozen snot' was a good choice of boat building material. History has thus far proven Mr. Herreschoff a little short sighted. In another fifty years we'll know if he is ultimately proven right. Today the vast majority of production boats are manufactured using GRP material in some form or other. Fibre glass is comprised of a mat of silicon glass material in the form of woven roving and/or chopped strand, embedded in a matrix of resin.

Early boats were produced using polyester resin. Later resins such as vinyl ester are allegedly more water proof than polyester. Epoxy resin unlike polyester, is claimed to be water proof. Some surveyors question the veracity of this proposition. A possible reason for this is that the silicon glass material is actually hollow. Therefore, regardless of the properties of the resin used, if glass strands are improperly bedded in resin at manufacture and thereby exposed to water, they will absorb same and therein lies the genesis of a problem down the track.

GRP supplanted traditional wooden boat building due to economics. GRP offered standardization of product and much reduced labour costs. The un-skilled kid with his hat on backwards, supplanted the skilled shipwright who served an extensive apprenticeship and absorbed the skills and wisdom of generations before him.

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Broadly, fibre glass consists of either solid core laminates, as above or alternatively cored laminates with various forms of foam or end grain balsa forming the core.

Relatively few production boats are produced using solid core laminates these days; the majority being foam cored in some form. The more recent evolution from solid core laminates to foam cored laminates is again a function of economics. Foam cored boats are a lot cheaper to produce. They are not necessarily better.

What follows are pointers to problem areas commonly revealed on GRP boats. And while it is assumed that you will be in the market for a second hand vessel these problems are not necessarily restricted to ageing boats.

Impact gel coat cracking is typically revealed by patterned cracking in the gel coat that is indicative of a collision or impact of some kind. This is not the random fine cracking that can occur on deck and cabin top due to UV damage over time; but rather a pattern of cracking that indicates an impact.

Impacts that have been repaired may be revealed by a close check of the boat hull for fairness. Flat spots, irregularities or internal patches may be indicative of repairs, which would prompt further investigation. Impacts on cored hulls pose a more serious problem that may not necessarily be revealed visually. Inter-laminar sheer can occur quite easily on a cored hull as a result of impact. This might be revealed by a light tap in the area of impact indicated by a hollow sound.

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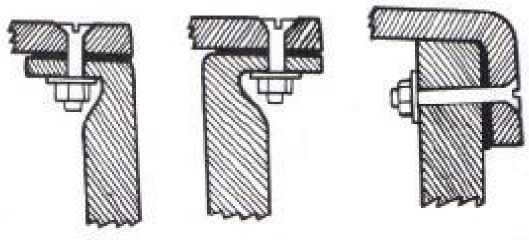
Hull to deck joints in GRP hulls are a common source of leaks. Why so… you might ask? I recall an instance a few years ago at a boat show I attended, seeing a novel display of a 40' yacht with its deck lifted off the hull. When handling the topsides glass structure at the point at which it connects to the deck via a mechanical joint, I was amazed at how thin and pliable the topsides hull laminate was.



The boat was constructed with a thicker laminate underwater reducing to a thin laminate at deck level. Problems occur when flex occurs at this point. In this case, to my stunned disbelief, I could flex the material with the fingers of one hand. The problem is that this is the point at which the builder attempts a mechanical connection and a positive water tight seal between hull and deck.

A thin hull is more prone to wracking stress and flexing, causing fastenings to move and the joint to flex with the result that water eventually gets past the sealant. With a thin hull laminate at this point, is any really permanent seal even possible?

Ideally the mechanical fastening between hull and deck should consist of 316 stainless bolts (not 304 or worse), glassed over inside and out with woven roving.

This is the ideal solution most likely to remain leak free for the life of the boat. Obviously this solution costs more in terms of materials and labour.
For this reason most hull to deck seals in practice involve some lesser form of mechanical fastening with a lesser and cheaper method of sealing the joint. Screws fastened into fibre glass will always fail. A screwed joint should be condemned. Rivets will also fail. A cheap and nasty joint here like aluminium rivets should lead you to seriously question build quality in other areas that you can't see.

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In a prior incarnation in the boat repair business I encountered a 48' glass production cruiser approximately fifteen years old. The boat was manufactured by an Australian yard with a reputation for quality vessels. Yet water had penetrated the aluminium rub rail and accumulated at the low point behind it, causing a green slime to appear on the outside of the hull. Inside, water penetration between the hull and interior lining had rotted out interior timber joinery. The source of the problem in this case and many like it, was a poorly constructed and poorly sealed, cheap mechanical connection between hull and deck; well hidden out of sight and out of mind.

The hull deck joint because it's hidden, is an area where a shoddy builder can resort to a cheap solution that will inevitably cause leaks and rot at a future time. Its worth investigating the hull deck connection in detail. Are there signs of leaks? Exactly what is the nature of the mechanical fastening? If the answer is 'cheap and nasty'; back off because there will be 101 areas of equivalent shoddy workmanship in areas that you'll never get to see until they fail.

Keel to hull joints in GRP hulls should be a focus of your attention because modern yacht design trends have imposed extraordinary mechanical stresses upon the keel hull joint. Incredibly, I have seen modern GRP production cruiser/racer hulls hauled out on a railway slip where the narrow fin keel actually distorts the bilge upwards, seemingly trying to push up through the hull.

This is a pointer to inadequate structural floors and a hull that is destined to be land fill. How long would this vessel last in the event of a grounding? Would you be brave enough to retire down below while sailing? Keels falling off GRP sail-boats are surprisingly common. The yacht Team Runnaway experienced such an event during participation in the 2005 Melbourne to Osaka race. Fortunately for the crew, the hull in this case remained intact with sufficient stub of the keel remaining that they were able to make it to the Queensland coast without further mishap.

A friend once related an incident that occurred during his days of sailing six meter racing yachts competitively.

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Their boat was leading the fleet during a windward leg off Coffs Harbour (on Australia's east coast). The boat was heeled with the foredeck crew on the windward rail when there was a sudden jolt and the fin keel fell off.

The crew watched in slow motion horror as the hull turned turtle and sank beneath them in the open sea. Fortunately the remainder of the fleet was only a short distance behind. Had they been trailing the fleet the story might have had a less happy ending.

GRP de-lamination in solid core construction is a problem in GRP boats equivalent to dry rot in wooden boats. It's less likely to be a problem in well constructed solid laminate GRP hulls.

In solid laminate hulls de-lamination is not a common occurrence in conjunction with panel deflection and stress cracking of solid laminates. Panel bending does not typically produce enough inter-laminar shear to cause ply separation, unless the panel contains defects and the bending has been very severe.

Nevertheless the presence of significant cracking in the gel coat should set off alarm bells because it may suggest an impact or structural defect. De-lamination in its terminal stages is caused by sea water penetration of the laminate material. Sea water comprises living organisms which rot and produce gas forcing apart over time the laminate structure until the point is reached where a surveyor pushes a screw driver through the hull.

Opinions differ as to its ultimate cause. However it appears that improper wetting out of the laminate material at build, is the principal culprit.

The presence of de-lamination can be detected by lightly tapping the hull to detect changes in sound from sharp report to dull thud. Any area of hull penetration by skin fittings for example should be assiduously tapped to detect de-lamination. Virtually any de-lamination in a cored hull should be treated as terminal.

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Gel coat cracking due to ‘panting’ occurs more commonly on power boats, as a consequence of the boat powering into seas that cause an improperly braced GRP panel to flex in and out. Nevertheless it has been known to occur in the forward panel area of sail-boats. Any cracking of this nature in gel coat should set off alarm bells.

De-lamination in GRP cored hull construction is a definite prima-facie cause for concern. During one of your author’s prior incarnations, I worked for a period assisting a boat builder to construct cored hulls for a catamaran. The hull structure consisted of kerfed foam core material (12mm thick), saturated with polyester resin and covered inside and out with light glass roving with extra bits around ‘stress areas’.

The structure was then bogged and painted with great attention laid upon the quality of the paint finish. I recall looking at this thing, ‘gob smacked’ in wonderment. Somewhere along the way I had obviously missed some crucial step in my nautical education. At what point did a vessel constructed from this flimsy material, get to inhabit the same universe, as a ‘boat’?

Is the boat in your line of sight a cored hull? In the worst examples, a cored hull may be evidenced by the presence of a ridge in areas where the core terminates, such as in the bow area. More commonly it won’t be in evidence at all. Ask to see core samples.

Considering the stresses that boat sail-hulls suffer for example; from rigging, from grounding, from wave impacts, not to mention even minor collisions, a cored hull must eventually suffer form stress cracking, water ingress via stress cracks and core de-lamination. And while this is your author’s jaundiced opinion, it is supported by a body of surveyor opinion.

Once water ingress occurs, the core will rot, even if the core material is guaranteed not to absorb water and not to rot.

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The why of this is easy to fathom. Sea water is comprised of living organisms! Their biological decay will itself set up a process that will eventually lead to de-lamination of the hull structure. From a buyer's viewpoint, a hull that is cored in its underwater section should be considered guilty of every imaginable sin, until proven innocent.

A Surveyor will typically declaim all knowledge of the state of the core because, inter-alia, moisture meter readings cannot reliably reveal the presence of problems below the water line. Therefore, you cannot rely upon your surveyor's professional oversight in the examination of a cored hull. It's impossible to predict a case of impending core failure.

Obviously any indication of cracking in a cored hull should be treated with the greatest alarm, but total hull failure may occur without prior warning at any time. When this occurs it's almost certainly terminal, meaning: the end of the hull. The damage is likely going to be too expensive to rectify. Where does that leave you as the owner of a destroyed hull? The answer is high and dry …somewhere up shite creek minus a paddle!

There are differing opinions on the structural integrity of cored hulls and it has to be recognized that among modern sail-boats, the majority constructed post 1995 are cored hulls. Nevertheless I would not personally buy any GRP yacht hull, having underwater sections constructed from cored material.

Weeping from a GRP hull is an indicator of problems. When a GRP boat is hauled, all signs of moisture should disappear within a couple of hours. Any sign of on-going weeping; for example on a sail-boat from the vicinity of the ballast keel, indicates water penetration of the hull surface. I have seen GRP hulls still weeping after several weeks on the hardstand. Weeping from areas of cracking around a keel to hull joint should set off fire alarm bells.

The form that ballast takes is relevant to the problem of moisture penetration of the keel area. On traditional yachts and on some GRP hulls, ballast is solid lead or iron attached by means of keel bolts to the hull via internal floor members that spread the loads across the hull.

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A variant on this traditional approach sometimes encountered on GRP yachts is where the lead has been poured into a moulded keel structure. The hull should still have adequate floor supports to transmit the load.

Alternatively, ballast on a GRP hull can comprise lead or steel punchings in sand, encased in GRP, integral to the hull. In other words there is no keel to hull connection in this case, it being all one piece. Like very many modern innovations in boat design, it's a nice idea; being cheap and quick to build …until something goes wrong; whereupon it tends to go wrong in a big way! Being out of sight you never know what is happening in there until some indicator appears.

Weeping from the keel area may indicate water penetration of the hull material. Alternatively it may mean water penetration of the encased ballast in an integral sail boat hull. Either way it's a problem. Where salt water penetrates the GRP and saturates a sand/steel punchings ballast arrangement, the problem is likely to be nasty. I strongly doubt that the problem can be resolved by simply draining the water and plugging the drain hole although this step is usually specified as a solution.

Chalking is normal in a gel coat surface after an elapse of time. This can mostly be restored by buffing with an oxide removing rubbing compound/polish. Modern two pack paint also has a tendency to turn chalky with exposure to the weather. Chalking is not a serious problem.

In its latter stages, gel coat chalking usually turns into a series of finely crazed, random cracks which require re-painting with a hi-build undercoat and re-finishing. While a surface affected in this way might look decidedly ordinary, restoration is relatively easy to achieve.

Hard points may be caused by the boat flexing on a poorly positioned bulkhead or tabbing that doesn't allow for hull movement or too much hull movement as a consequence of poor quality lay-up or inadequate stiffening.

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Hull blistering has been a source of a conundrum over the years due to the fact that two boats produced side by side using identical materials in the same shed with the same level of humidity etc can perform very differently in practice. This is because prior to the advent of modern techniques of infused resin and vacuum bagging, GRP lay up has been done by hand and there are differences in how it's done. These differences may be small but they can influence the longevity of the hull.

Hull blisters on a GRP hull are generally attributable to inadequate wetting out of the chopped strand material with polyester resin. It's almost never apparent within the woven roving material. Water wicks into the glass strands via osmosis eventually causing localized blisters in the gel coat. Pumping action of the hull in a sea way can accelerate the process. Obviously this is more common in motor boat hulls. But these localized hull blisters can in time deteriorate into de-lamination.

While the presence of a few blisters on a fibreglass hull may not be cause for concern, evidence of extensive past blister repairs is most definitely a cause for concern.

The great majority of such repair jobs are undertaken by people who are un-trained; don't understand the problem and who depend upon the sales personnel of chemical supply companies for technical advice on blister repair. This is why the majority of repair jobs eventually fail. Chopped strand material is inherently difficult to wet out in the build phase and obviously most hulls incorporate this material.

An extensive repair might entail the blistered hull being ground back (usually with a power plane and special blades), the gel coat thereby being removed, with the chopped strand substrate exposed. This should be allowed to thoroughly dry out and once dry, re-coated with an epoxy sealer which is reputedly waterproof. And although the industry perception is that this procedure will see a permanent end to hull blistering, this is not necessarily the case. The epoxy must adhere solidly to the inadequately wetted out chopped strand substrate which was the cause of the problem in the first place. Its difficult to get proper adhesion to chopped strand; end of story.

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Therefore it is more than just possible that this expensive repair will itself fail with extensive hull blistering re-appearing.

A repaired hull that subsequently fails can mean the end. Evidence of past remedial work and or hull blisters should set off alarm bells in your mind as potential buyer. It is at a minimum, good reason to seek informed technical advice before proceeding. Otherwise you may find yourself inheriting a long standing problem that has been patched over and patched up once too often. This leaves you once again stranded up that shite creek… sans paddle.

There is a great deal of experimentation happening out there unbeknown to the hapless customer.

Rotting wooden components in GRP arises from the use of poor quality wood and inadequate rot proofing and sealing of the timber against moisture ingress. Gel coat is not waterproof. Moisture that penetrates gel coat for example and wets out a gel coated wooden stringer, will cause the timber to remain saturated until the area is ground off and opened up to dry.

GRP hull structures have become more flimsy in the last decade. Hull side cracking for example is a common problem in GRP motor vessels and sometimes seen in multi-hull structures. And although hull side panting may not cause panel failure it can have collateral effects; weakening the hull deck joint for example or causing broken bulkhead tabbing.

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Steel Pre-Survey Survey Tips

Steel can be an entirely satisfactory boat building material. Its main advantage is strength. Steel has a tendency to deform under impact rather than break. In fact it has been argued that the Titanic might not have sunk had she been constructed of modern steel rather than a brittle grade of riveted iron.

Steel would have been more likely to deform in the collision with the iceberg. In more modern times, steel boats have been known to survive horrendous groundings that would crush virtually any other material.

A local fisherman in Tasmania related recently how in early 2009, his steel hulled cray boat survived a near miss on a rocky southern shore. The crew had been retrieving Cray pots previously laid quite close to dolerite sea cliffs in the vicinity of Tasman Island. There was a heavy swell running at the time, the bottom of wave troughs exposing dark heavy strands of bull kelp that can easily foul propeller or rudder. Their aim was to move in with the boat and recover the cray pots quickly; a dangerous game in any kind of swell. Indeed the boat was no sooner in position than a heavy sea dropped the boat heavily upon a kelp rock with such force that the hull lurched twenty degrees to starboard with a tremendous jarring crash.

The crew after being thrown off their feet (none fortunately being thrown overboard) by the initial impact, were able to recover as the following swell lifted the hull clear as the skipper gunned the engine and the boat escaped to fish again.

Amazingly, the vessel survived this treatment with minor deformation of the welded steel plates in the vicinity of the chine.

No other hull material would have survived such an impact. Of course even steel will eventually succumb to a serious grounding.

The main problem with steel is rust. Generally a steel hull that has been reasonably well painted will rust (if it's going to rust) from the inside out.

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Thus, your pre-survey inspection should concentrate on the likely areas where rust will occur inside the hull. Your surveyor should conduct an out of water survey of the hull exterior, checking thoroughly for thin plating and signs of corrosion.

The deck on a steel hull warrants special attention. Any material adhering to a steel deck must be suspect of harbouring rust. Don't believe claims to the contrary.

A wooden deck, while it has loads of appeal under foot, is almost always a disaster when laid onto a steel substrate. Why? No matter how well the steel is painted and no matter what material it's painted with, moisture will be trapped between the steel and the wood, leading inevitably to serious rust corrosion.

Deck tread while less of a problem, is also suspect when laid upon a steel substrate. As prosaic as it sounds, and as ordinary as it may feel under foot, the best deck material on a steel boat is deck paint, from the viewpoint of corrosion. There is no advantage having a beautifully laid wooden deck, if the wood is harbouring serious corrosion, as eventually you can be sure, it will. Bear in mind that your surveyor is not going to be able to reliably detect corrosion between the wood deck and the steel substrate. You should simply assume that such corrosion exists and will eventually produce a serious and expensive problem.

Attachments: how are the fittings like chain plates fair-leads etc attached to the deck? If they are through-bolted, the underside of the fitting around the bolt will trap moisture and form rust. Sika or 3M 5200 for example applied between the fitting and the steel deck will prevent for a time the penetration of moisture and formation of rust, but the surest solution is to weld all fittings to the deck.

If deck fittings are welded you likely have no problem. If they are bolted there's a question mark. On deck or even on the hull topsides, evidence of bubbling or lifting probably indicates moisture penetration of bog filler and underlying corrosion.

Chain lockers are another area requiring particular attention. The chain locker in the bow of the boat contains galvanized chain. Galvanizing wears off with use, particularly where the boat has been anchored in sand or coral.

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In fact the speed with which galvanizing wears off in these conditions can be quite amazing. The result of loss of galvanizing is a rusty chain which produces a shower of rust particles when the chain comes up out of the chain pipe, on its way overboard. Since the boat is usually pointing into the wind when anchoring, the shower of rust goes back over the boat.

Your author's first experience in the Whitsunday's of Northern Queensland on Australia's east coast was aboard a 43' chartered yacht sometime back in the eighties. In the course of the first twenty four hours of the two week charter holiday, we (the charter customers in this instance) discovered approximately twenty defects that rendered the vessel unsuitable for its purpose. Possibly the least of these was the fact that the anchor chain had lost the final remnant of its original galvanizing some years past.

When the chain emerged from the locker, it was accompanied by a cloud of brown-red dust that destroyed anything white, for boat lengths downwind. Predictably, the lady members of the crew had dressed for the occasion of our holiday, in gleaming white.

Frequently the chain locker on a steel boat is an area of bad news. It's also an area of common neglect being somewhat out of sight and out of mind. Problem here is that the chain comes up wet and usually having bits of other stuff attached like mud, sand, and weed. If this goes straight down into the steel hull, it will quickly cause tremendous rust not just at the bottom of the locker under the chain, but also overhead.

This is due to the fact that salt laden moisture from a wet chain, condenses overhead. Condensation will rot out the steel deck, in no less time than it takes to rot out the base of the locker.

You need to establish how this contingent problem has been addressed on the boat in question? One solution is to collect the chain securely in a plastic or fibreglass chain bin properly sealed and drained overboard.

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If this solution has been adopted, can you remove the bin in order to inspect the plating beneath? If not then, assume the worst. What is the condition of the overhead steel deck and frames? Is this area adequately ventilated?

I have seen ventilation achieved in the chain locker via a solidly constructed but hollow king post arrangement. This was an ideal arrangement but one rarely seen aboard a steel boat. If there is no venting there exists a greater danger of condensation moisture hanging around and causing corrosion.

Another issue having nothing to do with the boat's construction material but everything to do with safety, is to judge how prone the chain might be to jam. A chain jam can be a very serious problem because it will jam at the worst possible moment when you absolutely must get the anchor down. Chain will have a tendency to jam at the bottom of a fixed pipe from the deck to the chain bin. The area needs to be accessible.

Mast step areas can be problematic. There are two methods of stepping a mast. The most common method is to step the mast 'on deck'. If this is the case with the boat in question, check the structural integrity of the support arrangement. If this sounds like advice surplus to requirements; I have personally encountered half a dozen boats with structural problems on account of a poorly conceived mast support. One of these boats was steel.

And while the issue is less likely to be present on a steel boat it needs to be checked. The usual arrangement is a post support to the keel. Check for movement if it's not welded in place. Alternatively support to the mast is achieved via a bulk head arrangement usually incorporating a box section. On a mono-hull for example it's common to have an enclosed toilet arrangement on one side and locker arrangement on the other. Together and in conjunction with the main bulkhead these components constitute a strong, 'mast-partner' structure in the vicinity of the mast step.

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One advantage of a deck stepped mast on a steel boat is that the problem of water ingress via the mast is eliminated. And while a keel stepped mast is reputedly a stronger arrangement, the problem of water ingress and associated corrosion is difficult to eliminate. We assume here a hollow aluminium mast although the problem is present to a lesser extent with a wooden mast.

The mast to deck seal is usually accomplished by means of a rubber collar or mast boot. These frequently leak. But even if the mast collar achieves a perfect seal, in heavy rain an aluminium mast will always leak through the many through bolts and sundry fastening attachments aloft. How then can it be sealed so as to not leak down into the bilge at the mast step? The answer is more or less… that it can't. So it's important to check here for evidence of corrosion.

Hull access is commonly a problem on boats of modern construction; more so than older style boats. There is a tendency to build furniture fixtures and permanent cabin sole structures, so that areas of the hull cannot be accessed for inspection and maintenance. From the buyer perspective, this is a major problem.

Look at the cabin sole and access hatches. Do they allow you into every nook and cranny? If no, then be prepared for the task of creating those access hatches or having a yard do it for you.

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There can be no such thing as out of sight and out of mind on a boat.

Also insulation in areas of inevitable water penetration; like under the cabin sole in the vicinity of the bilge, will certainly absorb water if it hasn't done so already. You can bet on it! And if it absorbs water, it will rot and stink. It will also fast track corrosion.

A boat that has not been well thought out with respect to access and ventilation should give you cause for serious concern. What else is not well thought out and likely to cause future problems?

Insulation is a definite requirement on a steel boat. It's almost impossible to insulate against sound and it has to be said that a metal boat is always going to be relatively noisy in a sea way. It's also somewhat more difficult to insulate a metal boat from heat and cold compared to a wooden boat which is inherently insulated by the material itself. Insulation of a steel boat is achieved in a variety of ways. Sometimes it's achieved via a sprayed on foam type material during the construction stage. Sometimes sticky backed insulation material is merely stuck on. It matters little how the insulation is attached provided the metal is properly painted beneath the insulation material. Of course it does matter when it comes time to re-paint the inside of the hull.

I recently had a vivid illustration of the differences in heat and cold transmission between a steel yacht and one of wooden construction. During the depth of Tasmania's 2009 winter, friends arrived aboard their new yacht which although of steel construction was nevertheless nicely fitted out with teak interior furniture and trim. Mooring temporarily overnight, they tied up at the marina finger next to my own boat. I had forgotten how easy a wooden boat is to get warm and keep warm. Moving next door for dinner in shirt sleeves, their saloon felt like an icebox, so marked was the difference in temperature.

Keel attachment to the hull structure is an issue on a steel boat. If it's either a full length keel or fin keel design, it's likely that the ballast will be incorporated into the structure perhaps in conjunction with fuel/water tanks.

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The issue from the viewpoint of corrosion is to keep water out of the area, bearing in mind that it's likely to also be the lowest point of the bilge. The best way to achieve this is by means of a welded steel cover over the ballast. Alternatively it is sometimes treated with tar epoxy. Welding is best.

Ballast may consist of lead or steel punchings, sometimes encased in concrete. Sand is used for the same purpose. Tanks way down low in the hull are in principal a good idea, except that it's difficult to drain the build-up of gunk that inevitably accumulates at the bottom of tanks, particularly diesel tanks.

Bottom point drains are extremely helpful by way of keeping your diesel in good condition. They were standard fare on older boats but are almost universally absent on modern designs.

Thru-hull valves of dissimilar metals are bad news on ANY boat. Particularly, they are bad news on a steel boat. Copper or bronze in contact with steel via salt water, is a no no! Copper and bronze are way above steel on the nobility spectrum and as a consequence will set up a ferocious galvanic action if brought into contact via salt water.

First casualty will be the steel although zinc will disintegrate before steel in the event of galvanic action caused by contact with copper or bronze. Therefore the only valves that should be present on a steel boat are mild steel valves, 316 stainless or plastic valves.

My own preference is for marine grade plastic valves. So where might the issue of dissimilar metals raise its ugly head? Four possibilities: toilet valves (inlet and outlet), cockpit drain valves, the sink valve and the engine cooling intake valve. Check all four areas!

Once upon a time needing to re-trim our copper fastened, wooden yacht for a sailing trip and being perennially short of storage space, I had the bright idea of storing a quantity of brand new galvanized chain in the aft bilge just for the duration of a trip.

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I knew that it would get wet and that the copper would attack the galvanizing on the chain, but I reasoned that it was only until we got to our destination at which point I would return the chain to the chain locker and all would be well. In fact the galvanizing was trashed within a week leaving the chain without any galvanizing whatsoever in parts and prone to rust. It was an expensive lesson.

Water sometimes collects on steel hull stringers if no drains exist at low points. This will cause future problems with corrosion if it hasn't already done so.

Limber holes at the low point of boat frames; allow bilge water to flow from high points on the hull, like the chain locker, to the low point where the bilge pump should be located. Limber holes are critical to the longevity of the boat. The absence of limber holes means that water becomes trapped. The hull cannot therefore be pumped dry. Eventually this will cause corrosion on a steel boat. Limber holes of inadequate size will get blocked by bilge detritus leading again to problems of corrosion.

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Wooden Boat Pre-survey Survey Tips

Wooden boats, while they are a dying species among the mainstream boating world, largely due to the heavy input of highly skilled labour required for their construction, are experiencing something of a restoration revival among aficionados of classic boats, for whom; there is only one ‘real boat’.

A well maintained wooden boat can easily last one hundred years. There are quite a few around of that vintage. Yet in some ways this defies logic, because a conventionally build plank on frame wooden hull is totally dependent upon fastenings.

There is considerable variation in the way in which a wooden hull is constructed. It may be helpful to be aware of the differences.

Carvel construction is the most common form. Most traditional yachts are constructed in the carvel manner otherwise known as ‘plank on frame’. Framed with sawn or steam bent ribs (or sometimes a combination of both) the planks are edge butted and fastened to the ribs. Sawn frames are constructed from sections of solid timber sawn into shape in conformity with grain direction. Sawn frames are more common on English and American boats. They serve to hold their shape somewhat better than steam bent ribs. Fastenings usually consist of copper or bronze rivets but sometimes nails will be clenched over. Riveted fastenings are generally superior to clenched.

Boats fastened with iron or galvanized steel spikes (usually into sawn frames) are more common in the northern hemisphere. In warmer climates iron or galvanized fastenings deteriorate very quickly weakening the hull but also causing deterioration of wood surrounding the fastening. Iron or galvanized fastenings in warm climates are a bad idea.

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On very old wooden hulls, tree nails are sometimes found. These are wooden pegs fitted with wedges that lock the peg in place as its driven home. Tree nailed boats commonly last more than a hundred years given reasonable attention to maintenance.

Carvel built boats are caulked with oakum or cotton and rendered water tight by the swelling of planks against the caulking. While wooden boats are typically over-built, they are nonetheless totally dependent upon the integrity of fastenings. With age, fastening have a tendency to stretch and deteriorate, leading to weakening of the structure and leaking.

Double diagonal is commonly found on yachts built in New Zealand in the early part of the twentieth century. PT boats and aircraft crash boats from the WW11 era were also commonly constructed in this way. Both edges and centres of planks are usually fastened to prevent warping. Usually canvas painted with red lead was laid between the layers.

Seam batten construction is unusual although sometimes still found on smaller boats and dinghies. The seam batten which covers the seam is fastened to both edges. It’s also found on Chris Craft speed boats from the 1920’s and 30’s.

Double planking is the same as conventional carvel construction except that there is a light inner layer of planking followed by a heavier outer layer, laid in the same (parallel, longitudinal) direction. This is considered by some to be a superior method to single carvel less prone to leaking, working and fastener failure.

Bay bottom utilizes longitudinal hull side planking and transverse bottom planking. This is very common on wooden fishing boats. It is generally considered to be a cost saving method that greatly compromises vessel strength. Often this type of boat will be found to have inferior fastenings. I have seen a number of these boats being restored for the purpose of recreational use.

Cold moulded hulls usually consist of three plies of thin planks in diagonal or triagonal lay-up up with epoxy or resorcinol glue and small nails of monel, copper alloy or bronze.

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Smaller boats used staples. Sometimes staples are removed. Alternatively stainless staples are sometimes left in place. This is not normally an issue but could be an issue if water penetrates the covering sheath.

Cold moulding is a very strong method of building a boat but water penetrating voids between the layers can create problems similar to de-lamination in GRP.

Plywood has a bad reputation because of a great deal of bad design and poor quality plywood. A friend was until recently the proud owner of an 11m catamaran, cold moulded from plywood. The superstructure of this vessel was constructed from sheet ply. For fully ten years my friend was mightily engaged in the business of chasing dry rot. Not once did he take the boat sailing in that time. Just as he would complete remedial recovery of one area of rot infected ply, another would be found. Eventually he managed to sell the boat having passed the scrutiny of a marine surveyor with flying colours.

Arguably the mere presence of plywood in a boat hull should set a surveyor's alarm bells jangling loudly. Marine grade plywood is the top of the heap in terms of product quality and is priced accordingly. Construction grade uses the same waterproof glue and one might jump to the conclusion that it's OK for marine use. This is not correct. On our 10m sailboat built in 1938, there is very little plywood even in internal furniture. That which is in the boat has given no trouble. In 2004 however we installed a deck mounted electric anchor winch on a base constructed of newly purchased 12mm exterior grade ply. I thought at the time that this would be OK. And although the piece was treated with an epoxy rot treatment prior to installation and painting with marine primer and oil based enamel, it was rotten by 2009 and had to be replaced this time with solid timber. Rot appears to be attributable to the poor quality timber used in this plywood material.

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Yet it is not uncommon to find ply that is not even of waterproof grade used in boat construction. And if this strikes you as something of an obscenity, consider the fact that craft-wood turns up in boats with surprising regularity.

The bottom line with a ply boat is that although top quality marine ply can be an excellent product, the law of probabilities suggests that a ply boat is a bad bet. There is just too much uncertainty associated with the material to warrant taking a punt. You don't want to chance the prospect of years of hunting down dry rot in your ply boat.

Strip planking comprises planks glued, edge on edge and nailed around a conventional set of scantling timbers. Usually the ribs and stringers are laminated and inserted after the hull is planked up. Strip planking produces a very strong, long-lasting hull, not prone to leakage. Strip planking is sometimes combined with cold moulding in order to impart additional resistance to wracking strains. The cold moulding layers are applied over the strip planked core. As a matter of opinion, this is probably the closest thing to a 'bullet proof boat hull' that has so far been devised. GRP sheathed carvel hulls combine traditional construction with modern materials.

The problem is that timber will always move with changes to the moisture content. This is why carvel hulls simply glassed over will eventually show the planking patterning through even multiple layers of fibreglass. The issue is more serious than the appearance of the hull. With timber movement there is the possibility over time, of de-lamination of the fibreglass sheath. In this event water may penetrate the space between the sheath and planking, bringing with it the certainty of rot.

A more secure but by no means foolproof method of restoring carvel hulls adapting modern techniques and glues, is to spline the carvel hull and cold mould a double diagonal layer of say 4mm cedar over the hull. The hull needs to be completely dry for this method to be successful. Once the hull is dry the caulking between the planks is routed out or sawn using a spline saw to the dept of the plank and a softwood (say 10mm width) spline sometimes V shaped is glued in place.

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The splined hull is then faired off and cold moulded in the manner described for cold moulding with two layers of double diagonal cedar or similar timber followed usually by a layer of glass or Dynel.

Clinker or lapstrake planks are fastened overlapped, the joints between the planks being termed ‘geralds’ for what reason I know not. This form of construction is rarely found on yachts these days although wooden Folk Boats are still built in this manner. Clinker is mainly confined to small wooden hulls and dinghy construction.

A wooden hull is difficult to assess as an amateur and not all marine surveyors are competent to survey a wooden boat. Look for evidence of the following conditions:

How fair is the hull? Check for fairness; for hard points where butt-blocks (mechanical connections between short planks) may have failed. How many butt blocks are there in the hull? Are there signs of rust on the exterior planking?

Rust stains are usually indicative of iron or steel fastenings which are to be avoided in a wooden hull. A boat constructed with iron or steel fastenings will have a much shorter life than a copper or bronze fastened hull.

Hogging: signs of hogging are more obvious in a motor cruiser’s hull; that is the centre appearing to be pushed up while the fore and aft ends droop down?

Hogging is a possible pointer to light construction, advanced age, and/or deterioration in fastenings. Hogging is not a good sign and a hull so afflicted is generally to be avoided.

Sick fastenings: timber will always move to some extent in response to changes in temperature and moisture content. This is one reason why wooden hulls tend to do poorly in hot climates. Hull colour can accentuate this. A dark painted hull while it might look spectacular will attract the heat and depending upon the boats location may go so far as to destroy the hull. Visible indications that the planks are moving may be due to the influence of tropical heat or it may be due to fatigue and fastening sickness. This is can be a pointer to the need for re-fastening.

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Does the hull leak: if the hull does leak, it can be important to know: from where. The obvious start point in a yacht is the garboard plank that is the first plank set into the rabbet joint into the keel/stem. In a wooden yacht the mast is forcing the keel down and the chain-plates are pulling up, which has the effect over time of pulling the stem up from the keel and opening up the garboard seam.

This is usually why a traditional carvel built yacht may tend to leak when close hauled in a sea way.

Rigging tension: a sure sign of owner ignorance is a (traditionally constructed) wooden yacht set up for racing with a high tensioned rig. High rig tension will quickly destroy a traditional wooden yacht. If the boat has too much tension in the rig and it's not yet leaking… give it time. It will leak!

Floors: the floor components of a wooden boat are transverse members holding both sides of the hull together. They can be constructed of heavy timber or constructed in metal. Cast bronze floors are possibly the strongest and most durable solution affording also the most flexibility in the placement of the cabin sole in relation to head-room. They are also far and away the most expensive solution.

Metal floors constructed from galvanized steel are absolutely to be avoided. The most obvious problem is rust and corrosion of the metal and loss of strength in this vital area of the hull. Less obvious but possibly more insidious is the degradation of the timber around the floor fastenings caused by the galvanic action of dissimilar metals in a wet bilge.

Yachts having galvanized floors will need to have these members replaced. It's a major job.

Limber holes: while in the area of boat floors check the limber holes. These allow bilge water to move from high points in the centre of the bilge to the low point. Inadequate limber holes or limber holes that are blocked will cause problems. Unfortunately inadequate limber holes are a common problem.

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Dry rot and wet rot are the most common problems to be found on timber hulls. Dry rot being a fungus that attacks lignum needs moisture to grow. Take away the moisture and you eliminate most of the potential for rot to establish. Accordingly the biggest problems with a wooden hull are usually associated with the ingress of fresh water.

In your pre-survey inspection of the hull, try to identify areas where leaks are in evidence and follow the leaks, testing for mushy wood in any areas that look suspect.

Solid wood that has been properly dried (which eliminates much of the lumber available today) is generally less prone to dry rot than is ply wood. Then again on our boat we have a piece of 12mm ply upon which the toilet is bolted that has been damp for 30 years and never shown the slightest sign of rot.

Deck Leaks: the worst kind of deck from the viewpoint of leaks is a traditional sprung deck, which is sad because nothing looks quite so good on a traditional boat as a beautifully bleached, sprung timber deck. This form of deck construction is increasingly rare being mainly found on classic boats of the pre-war era.

The most common deck is constructed from plywood fastened over deck beams and usually sealed with a light glass cloth or Dynel. Plywood provided it is of first quality marine grade, will give satisfactory service for many years, provided the sheath remains intact and fresh water is kept out of the hull.

Once dry rot takes hold in a ply deck it tends to wick through the end grain quite quickly. Plywood cannot be resurrected from the dead, once dry rot takes hold. The only solution is to remove the deck and start again. This is going to be an expensive yard job.

Frequently a teak deck will be laid upon a ply substrate. On the face of it, this solution offers the best of both worlds, combining the waterproof qualities of plywood with the look and aesthetic appeal of timber. The problem however is that when water ingress starts to rot the ply the remedial solution becomes quite complex and even more expensive.

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Stanchions: problems with leaks occurring via stanchions tend to be less prevalent on timber boats compared to GRP boats probably because a timber boat typically offers greater deck rigidity and less tendency to flex in that area under load. Nevertheless stanchions are a common source of deck leaks. As such, the areas beneath stanchions are more likely to be prone to dry rot.

Chain Plate leaks are difficult to eliminate on a timber boat at least where chain plates are fastened inside the hull thus penetrating the deck. Obviously long term ingress of water in these areas can cause rot. Often the presence of plank movement in the vicinity of the chain plate can provide a clue.

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