



Water in the Boat – Prevention

You have been reaching along fast, you step below after a great watch on deck, and splash, your foot goes up to the ankle in water in your boat. Oops, no one wants this scenario. Like many other emergencies, water in the boat can be minimized by proper preparation and good habits.

Other articles on the CCA Safety-at-Sea web pages deal with flooding and its consequences. This one focuses on Prevention ... minimizing the chance that water comes in the boat in the first place,

Some preparation you can apply to minimize water in the boat.

1. Check all those holes in the hull of your boat. Through-hulls and attached hoses *are* holes through your hull. You also may have several holes at the waterline, without seacocks on them. You also have stuffing boxes for shafts and rudder posts.
2. Protect against pumping water into your boat and don't leak dynamically.
3. Avoid deck leaks, anchor well and locker leaks.
4. Don't hit anything hard: stand a good watch and keep adequate sea-room.

All Those Holes in the Bottom of Your Boat

You have many holes in the bottom of your boat (look when hauled out some time).

- Under-water through-hulls for inlets for your engine(s), inlets and outlets for your heads, inlets for refrigeration and air conditioning, sink drains, inlets for wash-down pumps, etc., all of which should have seacocks.
- Outlets at the waterline for exhausts, deck drains, bilge pumps, outlets for refrigeration and A/C, and your propane locker drain. Many of these live just above the waterline ... when you are not underway and not heeled over. These may not have seacocks.
- Cockpit drains will not have seacocks, and may be underwater or at the static waterline.
- Stuffing boxes or shaft seals for your propeller shaft and rudder.

The point is, of course, each of these is a potential opening through which the ocean can flood your boat. One source^(*) reports that a two-inch hole one foot below the water allows 78 gallons per minute, increasing to 136 gallons per minute if that hole is three feet below the water. Your standard pump rated on paper at 1100 or 2000 gallon per hour will not be up to the task.

So avoid the sea coming in at all. Here are some ways to minimize that risk.

1. Close unused through-hulls. On passage you may want to close through-hulls that you will not use underway. When we are away from the boat for a week, all our through-hulls are shut (except for the main engine intake).
2. Make sure the head is left with the pump not able to leak. I once was at a dinner party on a boat when suddenly water was flowing out of the head compartment. A novice had left the pump handle up and the lever on “flush”, and there was just enough wear in the system that water started to leak into the bowl. Soon it was over the rim of the bowl (below the waterline!), and into the head area. Know how to isolate the head intake (normally lever to “dry” and pump handle all the way down). Instruct everyone to leave it that way when you train people on the use of your heads.
3. Check lee side sinks and heads when heeled over. The fixtures may have been above the waterline at rest, but now they may be underwater and flooding. Do this regularly: a check valve in one of my head sink drains acts up, so when heeled over on starboard tack that sink can be under the waterline and leaking into the boat. On some boats when underway you will want or need to close some drains unless you are actually using them.
4. Make sure your hoses do not leak, and they stay on the end of the through-hull or seacock. Feel the hoses from each through-hull; they should feel like a new hose, not mushy, crackly or with sharp points coming out. Look at each hose, as much as possible, for cracks or dried up sections; you may see these, especially at bends and at each end. Check the hose clamps on the ends. There should be two at each end, and they should not appear corroded at all. Try to screw them a bit, and see if they break. Replace any you do not trust.

Remember there are two ends to every hose. Any hose that could be below the waterline at either end, while heeled or at speed, needs to have two

clamps. (Or, you can just put two on every hose end aboard, and be simple and safe.)

5. Check your through-hulls that they are not about to break or pull off the hull. If they are “plastic”, wiggle them and work the seacock. Yes, you can lubricate plastic seacocks, and it is worthwhile. If your seacocks are metal, you not only have to lubricate them, but make sure the bonding system is working. There are many approaches to bonding underwater metal (see e.g. Nigel Calder’s *Boatowner’s Mechanical and Electrical Manual*, or other similar manuals), but whatever method you use, please follow it exactly. Make sure all bonding wires are in place and not corroded away. One of the boats with whom we were going to buddy-boat across the Atlantic noticed they had a leaky through-hull two days before departure. After a wiggle, it almost fell out of the hull, eaten away from galvanic action. If they had not found it until after departing for sea...???
6. Check how you stow goods and spares near through-hulls. Are you putting a container of heavy spares near a through-hull that will break off if it is hit by the box? Is that box tied down properly? What about your anchor and chain while racing? Will it take out a head sink drain hose? Remember, on a boat, everything can and will shift.
7. While you are there (and this is more preparation than prevention), make sure you have a soft wooden plug of the right size tied near every hole in your hull. I also keep a few extra plugs in a high spot that I could reach in flooding.
8. Again, in preparation, make sure everyone in your crew knows the location of every hole in your boat. A simple boat plan that *all crew have reviewed* is an effective way to execute this *training*. Some skippers actually label any locker doors, floorboards, etc. which have a through-hull behind them.
9. On your launch date, check for water in the boat immediately. Look around for weeping and leaks. Check whatever kind of shaft seal or stuffing box you have for your engine and rudder then too. Make sure you have maintained the proper lubrication for these devices, if any is called for.
10. Check again when you are underway at a good speed. The rudder is now farther underwater, and the seal may leak at speed but not at rest. I have three outlets in my transom (engine exhaust, genset exhaust, and one cockpit drain) which are above the water at rest, but which are several inches underwater when sailing or powering fast. Check for leaks at both speeds.

- 11.If your shaft seal goes, how will you stop the water? (Sometimes a towel works, backed up by some hose clamps, if the engine is not running.)
- 12.On some boats, the angles are right such that a loose bolt on the propeller shaft will let said shaft slip right out of the bottom of the boat, without stopping. Three things to do for this: first, have your mechanic check the bolts that hold the shaft, and have them aircraft wired to not back out; second, think about stopping the shaft from falling out – in some cases people can couple a spare zinc or a hose clamp on the shaft inside the hull to stop a total loss; and third, carry the right size soft wooden plug nearby, as the size of this hole can be big and the water will flow in fast.
- 13.Check your rudder and shaft on the hard each year to assess whether or not you have a risk of dropping the rudder at sea. It happens!

Protect Against Pumping Water into Your Boat, and Don't Leak Dynamically

Most boat have pumps, engine cooling, refrigeration, which can force water into your boat if the output is compromised. Also, seemingly innocent plumbing can become a leak when the boat is underway, especially when sailing fast or heeled.

1. Make sure all hoses on your engine and generator (if any) are fresh and well connected. Old hoses provide a way for your engine to pump sea water into the boat if there is any breach, and you are likely not to notice this at rest or under sail. Closely check the exhaust area, as many problems develop there.
2. Make sure all siphon breakers on outlet hoses are working, so you do not back-siphon your engine exhaust or head outlets. The breather is at the top of the big, inverted “U” that is above the waterline on these devices. On the engine breather, it is said one can suck on the siphon-breaker to see if it is operational. Sucking is not recommended for siphon-breakers on head outlet loops.
3. Make sure the electrical breaker for a salt-water wash-down pump is turned **off** after the washdown. If not, any breach in the hose beyond the pump, toward the spigot, will mean the wash down pump will pump water into the boat at about 40 psi! Check other systems that may “automatically” turn on and pump salt water, as they have the same issue. I have one friend who has pressure salt water to the galley for washing up during long passages. One item of crew training on that boat is: the pump breaker must be off after galley cleanup.

4. Many “waterline” through-hulls are underwater at some point of sail. Another friend had a bilge pump that exited above the waterline on the port side, about amidships. Hard on the wind on starboard tack, the outlet was under the water, and the hose had insufficient loop in it. The water would siphon back in the hose, move to the bilge where it had to be pumped out all over again. If someone accidentally had turned off the automatic bilge pump switch, the sea would just fill the bilge and then the boat. Of course, there was no seacock on a “waterline” level outlet.
5. Consider putting seacocks on all outlets at the waterline (but not on cockpit drains). I did this before going around the world, as any hose leak could quickly be shut off by anyone in the crew, and we could find and deal with the bad hose later. Of course you must not close a bilge pump outlet unless you know that is the source of a leak and you have turned the pump off.

Deck Leaks, Anchor Well and Locker Leaks

Gaps in your deck structure above the waterline may only allow water in when you are in heavier seas or beating. But the danger is high as these openings tend to be so large (measured in square feet) they can fill the boat quickly.

1. Does your anchor well drain into your bilge, or are there other openings from your anchor well to the interior of your boat? If so, make sure the door on the anchor well is in good shape, especially the hinges and latch, and any weather-stripping around the opening. If you are in heavy seas, the door could rip off, fill with water and then drain into the boat. Or a moderate leak could get significant water into the boat before you are aware.
2. Similarly, check all cockpit locker doors and lazarette hatches and make sure the hardware and seals are secure. This is a bit different than the anchor locker, as a slow leak or a loose door will drain directly into the boat. You are more likely to know about this kind of leak, but the consequences can be more severe, as they provide a larger opening.
3. You should think through how to plug a hole from a lost hatch (e.g. the foredeck hatch rips off the hinges), lost companionway boards, or blown-out cabin ports. For offshore work you need to pre-fashion plywood covers and strongbacks or other replacements. For coastal cruising, make sure you have thought through all the answers ahead of time and you have the right tools aboard (e.g. using bunk bottoms to cover large gaps).

4. Remember that you may be able to mitigate deck opening leaks by changing course, e.g. bear off to minimize the water coming over the deck and level the boat, or tack to make the other side of the boat the higher side.

Don't Hit Anything Hard

While it sounds like a funny line, it is not entirely untrue.

1. Standing a good watch means you will avoid rocks and, more likely, other vessels. Yes, you may not see every submerged container at sea, or other flotsam at night. But, you have a lot better chance of keeping your hull intact if you keep your eyes peeled. Know where you are relative to rocks and reefs, and where other vessels are. A recent tragedy was the case of a boat that drove onto a steep cliff under power in good visibility. Was the boat on autopilot with inadequate watch-standing? We do not know, as all souls were lost.
2. Keeping good sea room has come up several times in recent boat losses. Racers tend to cut corners as closely as possible, but it is more seamanlike to give good room to rocks and lee shores, both of which can hole, flood and sink a boat quicker than most of us imagine.

Like many other emergencies, the chance of “Water In The Boat” can be minimized by prevention. We urge you to read other articles on the CCA Safety-at-Sea web pages to learn how to deal with water once in the boat. But better to avoid the issue from occurring due to preventable causes!

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(*) A valuable resource on the internet is the Boat US “Online Boating Safety Study Guide”, on “Why Boats Sink Underway”, at http://www.boatus.com/foundation/guide/boat_8.html