Chapter 5: The Saga of the Hurricane Furnace

Our grandson has the nickname of “Hurricane Henri” because he is always here there and everywhere but never doing quite what you expect. I doubt International Thermal Research Company (ITR) (http://itrheat.com/products/hurricane-heating-systems/ ) had quite the same reason for naming their hydronic heating boiler a Hurricane but it has seemed to us to do everything except what we expected until recently.

Perhaps this saga deserves a chapter of its own if for no other reason than to help non-boat people understand the challenges that boat systems provide.

First a definition:

> **Hydronic heat system:** Think of the heater in an automobile. Heat from the engine travels via heated water through hoses until it reaches a mini radiator where a fan helps transfer the heat into the cabin of the vehicle. A marine hydronic heating system typically not only uses engine “waste” heat to warm the water based heat transfer fluid but also has a small diesel fired boiler.

Salish Aire came to us with an older Hurricane brand hydronic heat system. During the pre-sale survey the system would not fire up properly and this was appropriately noted. We were just happy that with her history of being a warm water boat that she had a system installed as we would expect to spend about $10,000 (AKA “ten boat units”) if we had to install a system from scratch.

Even though Salish Aire arrived in June, we wanted to make sure that the Hurricane system was up to the task of heating the boat in case the reverse cycle air conditioners (3) that we usually use for heat ran into trouble as the water under the boat got colder during the winter (they “extract” heat from the water and move it into the cabin) or we lost dock power or were at anchor (we can run them off of the generator but not the battery / inverter system). I started by reading back through the previous owners extensive notes about the challenges he had had with the system when it was still relatively new. I quickly came to understand that in order to get a lot of heat out of a very compact product, all marine hydronic boilers tend to be very finicky.

I find the system used by ITR to atomize the diesel and get it burning to be very elegant from an engineering stand point. Keep in mind that diesel does not vaporize at room temperature which makes it a much safer fuel than gasoline but a bit of a pain to ignite (although once ignited it has a lot more btu’s /quantity than many other common fuels). Previous diesel heaters we have owned used a drip system where the diesel was fed into a burn pan and once the pan warmed up it made for a very stable flame source. The issue with these systems is that they take a long time to reach operating temperature and are smelly as they heat up. Another system that I have not worked on uses a very small orifice and high pressure diesel to spray the fuel into the combustion chamber. I understand that these systems go through nozzles on a regular basis. ITR uses a system where they take a European racing car zero pressure fuel regulator (it stops the fuel until a very tiny suction is applied which then causes the fuel to flow) and compressed air to basically suck the fuel into the combustion chamber using a venture effect nozzle assembly . The result is that the fuel enters the chamber as a cloud that ignites to full flame as soon as it hits the heated igniter element. There is virtually no odor outside of the boat when it is operating correctly (although, like all of the systems it is fairly noisy with a forced air exhaust system).

So once I understood the design of the system, I took on the challenge of making it work correctly. I think the goal eventually became a virtual vendetta of me vs the furnace.

Now a very positive comment about the ITR Company and its service employees: Curiously the furnace is made about 100 miles north of us in Burnaby British Columbia, Ca. The USA service location is about 200 miles south of us in Vancouver Washington, USA. The guys in Vancouver are virtually on a first name basis with me after multiple phone calls asking for help and parts (always in my mailbox by the next day). They also get the concept of an owner who has a philosophy of "if it quits in the middle of the Atlantic, I want to know what to do" (this is very different than an experience I had while volunteering in Belize and could not get HP to send me a very small printer part because "it is not listed as a user serviceable part" – they couldn't understand that I could not get the printer from a Central American jungle location to an HP service center! – sorry, I diverge from our topic).

So here is what happened:

1. I learned from the old logbook notes that if the furnace hadn't been used for some time, the first steps should include making sure that the fuel lines were clear of **ANY** (and I really mean **ANY** air). The furnace had been designed with a tiny bleed screw on top of the case to clear air out through. At first I used the typical plan of trigger the start cycle and open the bleed valve and see if you can clear the air before the start cycle cancels because no flame has been detected by the electric eye. This got old really quickly since I had LOTS of air leaks in the original fuel system.
    a. MODIFICATION: I noticed on-line that the newer furnaces have a bleed valve rather than a tiny screw. This allows the fuel to be run through a tube into a receptacle while clearing the lines.
    b. MODIFICATION: to get past the issue of the short start cycle time, I wired a momentary contact switch to supply 12 V to the fuel pump. Now I can pump a lot of fuel through a semi clear drain tube and watch to see if the air clears.
2. PROBLEM: the furnace still would not light. In reading the old documentation I learned that the compressor has a set screw that is notorious for coming loose. With some coaching from ITR, I ended up putting on a complete new compressor head.
3. RESULT: The furnace would finally light up but only for a short time until the next air bubble arrived in the fuel.
    a. MODIFICATION: After a lot of frustration I figured out that as long as the fuel was pulled from the main diesel distribution manifold, I would get too much air for the burner to tolerate (ITR and other knowledgeable folks have since confirmed that manifolds and diesel furnaces are a very troublesome mixture). I ended up bringing a 5 gallon can of diesel into the engine room and pulling directly from it until I was able to confirm that the heater itself was OK. (In the end, I re-plumbed back into one of my main tanks but the "T" is just after the line comes out of the tank and long before the troublesome manifold).
4. PROBLEM: The compressor failed again, this time it was completely replaced. The furnace ran longer (up to 20 minutes) and had a very blue colored flame (the guys at ITR kept telling me that the flame should be bright white/yellow but we couldn't figure out where the problem lie).
5. TRIALS and TRIBULATIONS: Parts we tried replacing included, the afore mentioned pressure regulator (European race car parts don't come cheap), a fuel safety shut-down solenoid (really my fault, I tore it apart and broke the magnet wires and couldn't get them back together again), the nozzle assembly (this seemed to help, ITR tells me that I made a big mistake in using a wire to "floss" out the orifice – apparently they are easily damaged – someday I'll put the original

back in now that everything else is working). (In case you're wondering, brake cleaner solvates the nozzle clean in seconds without mechanical effort other than blowing and wiping.)

So it is seven long months later and I finally plan to throw in the proverbial towel. I go to the Seattle Boat Show fully expecting to find out the information I need so I can move toward purchasing an alternate brand of boiler (est $4500). After talking to a couple of dealers that sell both Hurricane boilers and the other brand it becomes clear that my installation would need to be changed radically to accommodate the competitor. The recommendations are consistent that I should stay with the Hurricane brand even if I get a new furnace (and they of course entice me with comments about how many improvements have been made since our furnace was manufactured). This led to a long email asking the guys in Vancouver for recommendations.

Instead of the Vancouver guys calling, I heard from Marcello from the factory in Burnaby. I suspect he is "the old guy" who is most familiar with the older systems. He immediately concentrated on my description of the "blue flame". "That's just not right, the older electric eye flame sensors will not be able to see it and it will shut down, your flame is much to lean." In the end he sent me to look for a tiny fuel filter shoved inside a ¼ inch pipe elbow that he recalled were used in the early systems – " pull it out it you find it, it is likely fouled and limiting the fuel flow!" (In fact the filter had never been removed – taking it out helped a bit). Next he asked if I could feel some bleed air from the new compressor, ("the newer compressors move too much air for the older units, we have to open a bleed hole, you should feel the air moving!") I didn't have a bleed hole so I put an experimental hole in the air hose leading from the compressor – WOW, the flame looks like ITR keeps telling me it should look for the first time!

About this time we also found a fluid leak from one of the heat radiators. Marcello made sure the Vancouver team knew which bleed fitting I needed and they sent it along with a new radiator. After 7 months of trying to seal air and water leaks in the system, the answer turned out to be it needed a hole.

As the past two weeks the system has been working great and making lots of cozy heat. Tonight we are out and about and without shore power but we are happily comfy and warm thanks to a tamed Hurricane furnace.