Technical Pull-Out

Q&A FOR YOUR CATALINA THAT'S BEEN FACTORY APPROVED

Catalina 470

C470 Association Technical Editor
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Beckoning, #76

A Heated Issue

Our Yanmar 4JH3-TE and 4JH4-TE engines are marvels of reliability, relative simplicity and above all else, a source of propulsion when the winds are not favorable for sailing. As a fleet, I have heard of no one who takes care of their engine in anything less than stellar fashion. We change the oil and filter ahead of the required maintenance (mx) schedule which is every 150 hours. We change fuel filters, both on-engine and in the Racors, if there is the slightest doubt about their ability to allow fuel to pass thru them after required filtering. Engines in the Northeast are properly winterized and owners religiously monitor the anti-freeze mixtures to ensure proper cooling on the fresh-water side. Raw-water strainers are checked for debris and fouling; exhaust water is regularly monitored for anything unusual. Our reward for these efforts is a smooth-running engine providing proper power for normal and the occasional non-normal situation. When power is being developed, we are closely attuned to what the engine should sound like, what the gauges should read and how fast our boats should be going at a given power setting. If there are deviations from the norm we sense it almost immediately... almost. Because our engines are seldom asked to perform at maximum power, problems which will only manifest themselves during a non-normal power demand are, as one would imagine, seldom seen. If Larry Berlin, The Diesel Doctor from Union, NJ reads this he is undoubtedly thinking "I told Jim to run his engine regularly at max power to get the oil hot enough to evaporate any water in it, thus reducing the potential for the sulfur in the fuel to combine with water and produce sulfuric acid which is not good for the innards of the engine". Indeed, The Diesel Doctor DID say that (at Diesel School which I and Mike Yorke [*Certa Cito*, Hull # 108] attended several years ago) and I have done that regularly; therein, somewhat obtusely, lies the reason for this lengthy Tech article.

Heat is the bane of an engine be it reciprocating or turbine. Excessive heat will cause engine deterioration in any number of ways. Accordingly, the removal of engine-produced heat is mandatory and engineered into the engine design. On our 4JH3(4)-TE engines, heat is removed via a simple heat-exchanger system consisting of a bundle of tubes encased in a housing mounted on the upper left side. The fresh-water/anti-freeze mixture brings engine heat to the heat exchanger assembly; this mixture is circulated around the tube bundle. Raw water from the engine thru-hull/strainer is pumped thru the heat exchanger tubes; heat is then transferred to this raw water and dumped overboard along with exhaust gas. Critical to this process is the adequate flow of both fluids thru the heat exchanger at a given rate in order to carry off engine heat. That is why we check the anti-freeze level by removing the pressure cap and we check the raw water flow by monitoring the exhaust and changing the impeller regularly. A seldom thought about but equally

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critical issue is the cleanliness of the heat exchanger tubes...both inside the raw water tubes and outside the tube bundle where the fresh-water/anti-freeze fluid is circulated. If the inside of the raw-water tubes is filled with scale or other debris, raw water cannot flow properly and carry off engine heat. Similarly, if the outside of the raw water tube bundle is covered with debris, coolant (bringing engine heat to the raw water tubes for transfer) cannot contact the tubes adequately and passes thru the heat exchanger without transferring heat. This may result in an engine displaying normal temperatures under normal power demands but can result in an engine overheat situation when the engine is operated at other than normal operating rpm. The coolant HI-temp light and buzzer will sound at the helm in this situation.

For the several months prior to laying up *Beckoning*... (Hull #76) I had noticed that the engine coolant temperature would rise steadily above 190 degrees whenever the engine rpm was raised above 3000. This is not normal. However, the Chesapeake Bay routinely shows temperatures of 85-88 degrees during the summer and I thought it might be due to warm Bay water. During the fall of 2008 I was operating the boat on the Chesapeake as the water temps began to fall. When the Bay water temp hit 65 degrees there was no longer any possible reason for the engine to run above 190 degrees at any rpm if all components were mechanically correct.

Troubleshooting, whether on land, at sea or airborne, always starts out with checking the obvious, the accessible and the simple. Most of the time the reason for a non-normal issue will be found in the initial go-round of investigation. I checked the raw-water system first: the impeller was immaculate; the raw-water strainer, thru-hull, tubing, siphon loop and all fittings were in excellent condition. A scale remover was introduced into the system and allowed to work. The effluent coming out of the exhaust when the engine was restarted showed no appreciable material. That part of the problem was eliminated. The fresh water side of the system was then checked. The anti-freeze mixture, per Yanmar specs, was checked and it was spot-on. Quantity was correct and no leaks in the system were found. All fittings were clean, dry and tight. By process of elimination we arrived at the heat exchanger. The first photograph shows what we found when the heat exchanger bundle was removed. The material is a blackish-brown, sticky, oily goo!! As you can tell by photo (1), the tubes were heavily covered with it on the discharge end of the tube bundle.

The inlet end, shown in photo (2), was more lightly covered. The white area on the tube bundle (second photo) is where I rubbed the material off with my finger.

Inside the small tubes we found not the tiniest piece of scale or corrosion...nothing to reduce the raw-water flow. Indeed, the interior surfaces were mirror-like!

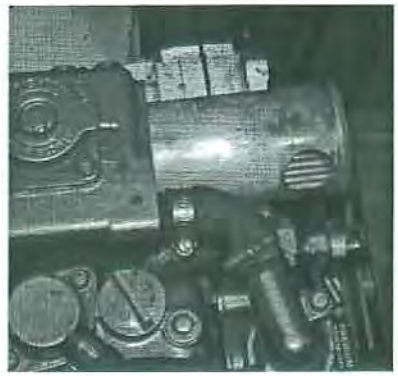
Photo (3) shows the goo on the end of a screwdriver after I gently scraped some out from between the tubes.

Needless to say, with this amount of material preventing contact of the two coolants the ability of the heat exchanger to exchange heat was greatly restricted. We had found the problem. How to clean this unknown material out of the heat exchanger bundle was the next hurdle while we attempted to find out what the material is and where it came from. My engine shop, Marine Engines Unlimited of Galesville, MD and its owner, Don Hardy were of great assistance in narrowing down the problem and then in

removing, cleaning and re-installing the heat exchanger.

Photo (4) shows the result of using Permatex Heavy Duty Radiator Cleaner (part#80030), which is primarily hydrochloric acid, and then soaking the heat exchanger in ZEP Industrial Purple Cleaner & Degreaser. The heat exchanger was soaked in each product overnight and then flushed. This procedure was not accomplished in just a few minutes!! As you can see, the heat exchanger is now clean.

The removal of the heat exchanger was not easy. At first we thought we would have to clean the oil cooler in addition to the heat exchanger. To prepare for that, the turbo-charger had to be removed and the exhaust elbow loosened then moved to the side. Cleaning of the oil cooler, after we found the heat exchanger to be the problem, was ultimately not deemed necessary. The heat exchanger can be removed from the front of the engine very easily. Removing two bolts on each end of the heat exchanger, then releasing the inlet and outlet tubes of the raw and fresh-water cooling systems frees up the heat exchanger. A gentle tap after removing the O-rings will get it moving and out it comes. One does need to lower the alternator arm on the front of the engine and after that is accomplished, the heat exchanger tube will slide right out. Photo (5) shows the clean heat exchanger tube partially inserted back into the heat exchanger housing.



It is recommended that you replace the gaskets and O-rings on this assembly with new ones when accomplishing this maintenance. They are standard Yanmar parts and available at stocking dealers.

To date, several C470s have reported this heat exchanger problem. After accomplishing the cleaning noted above, all engines have been reported able to produce full power, under load, and the coolant temperature remains steady at 190 degrees as it should.

What is the material we found and how did it get in there? As of this writing, that answer to those questions is unknown. I have sent a portion of it to a lab for analysis. The engine oil and anti-freeze have also been sent for analysis to see if any anti-freeze has leaked into the oil system or vice-versa. There is no evidence in the expansion tank of oil and the engine oil is its usual amber color. If there was water in the engine oil we would see that oil turn a milky brown. Extensive conversations with the chemical engineers of the manufacturers of the anti-freeze used (Havoline) have produced no reason to believe that the material is related to the anti-freeze. Interestingly, we found most of the "goo" in the outlet (cooler) third of the heat exchanger bundle. A thin coating was still adhering to the inlet end of the tube bundle. It appears that, over time, the material had migrated to the cooler end of the heat exchanger from the warmer end.

Don't panic!! If your engine is not able to run at full power without the engine coolant temperature tending towards an overheat, perform the basic trouble-shooting outlined above. If you get no relief from those efforts, removal of the heat exchanger bundle should be accomplished and the solution may present itself without fanfare. The use of a competent Yanmar-certified mechanic is always recommended. The lab results and all other findings will be reported to the C470 fleet in this column and the C470 Forum found on Yahoo.com.

Catalina 42

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Counter Tops

Garry,

The white counter top in the forward head is pulling away from the base and I don't know how to remedy the situation. We're the original owners and I've never caulked the seams. Everything seems OK in the aft head. Should I caulk the aft head?

I guess it started about two years ago, but can't be certain. My wife Shirley uses the forward head, and I use the aft one. She says that she dries the counter off after each use, as I do mine, so I don't know why her head has the problem.

Actually, this fall it's been pretty cool since we came down after Thanksgiving, but I'm certain it was steamy last summer, though we had a dehumidifier going most all the time. We have a man check on the boat while we're not here. *–Truman Cleverland* - Galavant *#544*

Truman,

Well, it appears that for whatever reason, the facing has separated from the base and needs to be bonded (epoxied - use a two part available at any good hardware store) back in place. The mold and mildew along the seams (where its black needs to be removed with whatever you typically use to remove that stuff. We use Amazon when we need to. Use a toothbrush to get into the corners and scrub hard. Once it is all cleaned up, I would then get some clear silicone and place a bead on all the seams to prevent any more water from infiltrating into the area again. Do all the seams on the counter and walls.

For the area under the faucet you will probably need to inject some epoxy into the opening and then place a heavy weight on top of it to keep it in place and let it set. *-Garry*

Hi Cut Genoa

Garry,

We have a Catalina 42 3-cabin pullman (hull #977) docked in Rock Hall, MD. Presently, we have a 150 Genoa. It's difficult to see under the jib when sailing to windward. We're cruisers and are ready to get a smaller genoa. Would you recommend our re-cutting the 150 or getting a 135 genoa? Is there any other option we haven't thought of?