HEAT EXCHANGER MAINTENANCE

Engine and generator cooling systems are among the most common points of failure. It's no wonder, when one considers the environment of pressurized coolant and sea water and extreme temperature differences, coupled with severe vibration, dissimilar metals, flexible impellers, and service intervals that are frequently, well, infrequent. As a result, after electrical problems, cooling systems are among the most likely to go awry. The results of such a failure can range from chronic, where the temperature gauge creeps slowly into the red at higher loads, to the acute, when the engine *and exhaust system* overheat, damaging both severely, causing the vessel to lose power.

A few months ago I received an email from a client indicating that he was suffering from chronic overheating on both engines. He took his boat into a yard where a mechanic inspected the three-year-old engines and determined that the heat exchangers on both engines were seriously fouled with debris and scale. The proposed solution involved removing them from the engines, disassembling, chemically and mechanically de-scaling them, reassembling, and reinstalling—all at significant cost. Hold that thought. I'll come back to this case in a moment.

Have You Cleaned Your Heat Exchanger Lately?

This scenario, the fouling part at least, is more common than you might suspect. Roughly two-thirds of the heat exchangers whose guts I inspect are seriously occluded and are thus in need of cleaning. In most cases, when I ask boat owners or sellers when the last time the heat exchangers were opened and cleaned, the response is a blank stare—they have no idea. The insidious part of the problem is, because so many vessels are overpowered, or depending on your point of view, chronically underloaded, overheating doesn't manifest itself until the load is increased. Cruising along at a fuel-efficient 30-percent throttle, which is not uncommon, means that the engine can be, and often is, easily cooled with only a fraction of its cooling capacity. It's only when the load is increased that the coolant temperature gauge begins to head for the red.

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Top: There's an alternative to costly heat exchanger disassembly for cleaning purposes. Above: Heat exchangers are prone to fouling, which leads to overheating; however, the problem often goes unnoticed until it becomes critical.

You might be thinking at this point, "I've never run my engines that hard and never intend to, so why should I worry about the heat exchangers now? I'll wait until I start seeing overheating at my usual operating rpm before I take any action." You might be forgiven for arriving at such a conclusion if it were not for the marine version of Murphy's Law: "Whatever can go wrong will, *and it will go wrong at the most inopportune time*."

I've run aground and any cruiser that tells you he never has is either in denial or he hasn't cruised very much. If you are unfortunate enough to do so on a falling tide, in a region where tidal range is significant (I have), then you will quickly appreciate how important it is to extricate yourself as rapidly as possible. It is at times like these that you may push your engine to deliver every ounce of power possible, and overheating at a moment like this would be inconvenient at best.

Trust, But Verify

If you never or infrequently operate your engine at higher loads, do so from time to time, at least once a season. Run at 80 or 90 percent rpm for 10 minutes while keeping a close eye on the temperature gauge. If it stays in the green, it's likely, although not a guarantee, that your cooling system is clean and in good working order.

If, on the other hand, the temperature steadily rises, it's likely that it will continue to do so until the engine overheats. That's your cue to take action. The most common causes of overheating of this sort are, in their order from most to least likely, a clogged raw-water intake seacock or strainer; an occluded heat exchanger; a damaged impeller or worn raw-water pump; or a restricted exhaust water injection spray ring. The easiest to check are, of course, the impeller and raw-water pump components such as the cam and cover plate. In my book, the impeller should be replaced seasonally or every 250 hours, whichever comes first. While there, check the condition of the other components. If they show any signs of *palpable* wear, i.e., if you can feel grooves in the cover plate or irregularity in the cam, they should be replaced. A rough rule

of thumb is, cams and cover plates wear at a rate of three to one, that is, for every three impellers (at the above replacement rate) the cam and cover plate are probably in need of replacement. Monitor and keep track of yours to determine their wear rate.

Inspect And Clean

If all is well in the water pump, then it's time to have a look in the heat exchanger. If you've owned the vessel for more than two years and it's new, or if it's used and the heat exchanger has never been inspected during your ownership, it's time to have a look in any event. Accessing the heat exchanger for end cap removal and inspection on most engines and generators is typically *not* a daunting task. If, when opened, it's found to be clogged with depleted pencil zinc anodes, crustacean shells, sea grass, impeller parts, etc., then a thorough cleaning is in order. How you go about this can vary in both effort and cost.

Let's return to the client's vessel I mentioned at the beginning of the column, the one with the scaled, three-year-old heat exchangers. Ultimately, rather than undergo the trauma and expense of a major disassembly, I recommended instead that the raw-water loops on the engines' (and generator's) heat exchangers be flushed using a proprietary de-scaling solution. (The end caps should still be removed to conduct a visual inspection and to remove parts that a de-scaling solution will not affect, especially rubber impeller components). The de-scaling product and circulating pump system that I prefer is made by Trac Ecological (www.trac-online.com). It's straightforward and easy to use and it works well on engines and generators as well as air conditioning systems. The solution is safe for all of the metals and gaskets used in the cooling system.

Unless the heat exchanger is corroded or damaged in some way, removal for cleaning (and repair) simply isn't necessary in most cases. Ultimately, the de-scaling that takes place using the disassembly method is no different than the en-suite approach, with one exception: the labor cost of the latter is significantly less.

After de-scaling, this vessel went on its way with temperature gauges once again operating in the green. More important, the impact to the owner's cruising kitty went from potentially traumatic to more than reasonable.—Steve D'Antonio