Don’t Be Alarmed and Sea Sense

Don’t Be Alarmed

Why engine and other systems alarms are invaluable

by Steve D’Antonio

Keeping track of what is going on with your vessel’s vital systems is a crucial part of good seamanship. Alarms can alert you to abnormal conditions before they become serious.

A few weeks ago a client of mine contacted me and asked about which, if any, alarms he needed to have installed aboard his boat while it was undergoing a refit. The “Which, if any” comment caught my attention. Indeed, if there’s one thing a skipper needs while he or she is cruising, be it under way or at anchor, it’s information about the vessel, the propulsion system, generator and the integrity of the hull. A vessel that includes complete, operational systems alarms is less likely to suffer catastrophic breakdowns, flooding, fires and other seaborne calamities as well as being less expensive to operate in the long term.

If this raw water pump overheats, the attached sensor will trigger an alarm alerting you to the issue – before damage occurs to the engine.

Engines and Generators

One of the tests I carry out during a vessel inspection involves confirming that the engine's own integral alarms work. Virtually every marine diesel engine and generator includes, or included when it was originally manufactured, an alarm to alert the user to a few key events. Typically, and at the very least, these include high coolant temperature and low oil pressure annunciators. The coolant temperature alarm threshold varies from engine to engine, however, it's typically somewhere around 220°F. Oil pressure alarms also vary; their alarm set point may be as low as 8 psi. Generally, oil pressure rarely has an in between failure, either it's within specifications or it's zero. Both of these alarm scenarios call for immediate action on the part of the skipper, particularly the latter. While overheating is never desirable, depending upon the rapidity of the onset of the overheating event, it's sometimes possible to motor a short distance, to leave a busy channel for instance, before shutting down.   Loss of oil pressure, on the other hand, affords the operator no such option. If he or she ignores the alarm for more than a few seconds, the damage will have been done and motoring any distance, no matter how short, is likely to become impossible as a result of engine seizure. Pressurized lubricating oil forms a wedge of sorts between moving parts such as crankshaft journals, bearings, piston rings and cylinder walls. Four cycle internal combustion engines require this oil wedge virtually continuously in order to operate (an exception is at start up) without it, rapid wear and heat generation ensue.   I’ve seen loaded diesel engines grind to a halt, literally, within 10 seconds of a low oil pressure alarm sounding.

While having the ability to quiet an incessant alarm buzzer seems like a useful feature, a forgotten switch could lead to disaster.

The low oil pressure alarm systems on roughly half of the vessels I inspect are not operational. How do I make this determination? Easy, I turn the ignition switch or ignition circuit breaker to the “on” position (without starting the engine), if I hear no alarm then it’s likely it will not sound in the event of a genuine low or no oil pressure event. This test simply simulates a “no oil pressure” scenario by energizing the ignition system and, because the engine is not running and thus has no oil pressure, the alarm sounds – or should. Every time you start your engine, make certain the alarm sounds briefly, if it doesn’t, it’s possible it never will; troubleshoot and repair the problem immediately.   This test, by the way, is far from definitive in that it makes no determination about the overheat portion of the alarm system. This alarm can and should be tested at least once if it’s never been done and every three years thereafter.

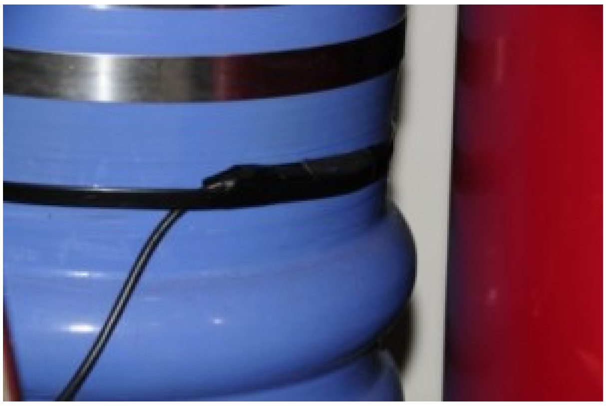
The four engine coolant temperature senders installed in this manifold provide multiple helms, gauges, and alarms with information. The wiring or senders should be clearly labeled to aid troubleshooting.

Generator high coolant temperature and low oil pressure alarms work in much the same way as those described above with one important distinction. When generators encounter either of these alarm scenarios, they automatically shut down – preventing or minimizing damage. Propulsion engine alarm systems on the other hand, rarely, if ever, will automatically initiate a shut down, although some found on modern electronically controlled diesels will reduce rpm to minimize heat generation. The logic being that a propulsion engine shutting down without notice may be more detrimental than the damage caused by overheating or low oil pressure, when docking for instance or crossing ahead of another vessel.

It wouldn't have been long before this exhaust coupling catastrophically failed. An exhaust temperature sensor could

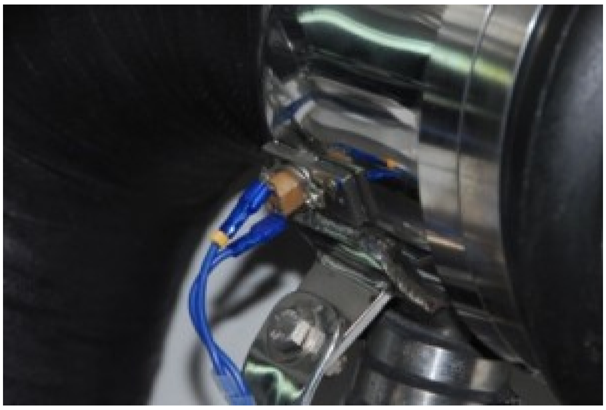
have caught the overheating issue before it reached this state.

Another alarm found on nearly all generators, but few propulsion engines, is exhaust temperature. Typically, engines overheat acutely for one of two reasons: loss of raw water or loss of coolant. In the former case, the engine will overheat, although it often takes a few minutes depending upon load. What will happen very rapidly however, is overheating of the exhaust system, which is cooled with raw water on most inboard engines. The exhaust gasses of a diesel engine can be as hot as 1000°F. At that temperature, it takes but a few seconds for damage to occur to normally water-cooled rubber and fiberglass components. Thus, exhaust temperature alarms are not only highly desirable, they are required for ABYC engine installation compliance. Exhaust temperature alarms can be easily retrofitted to nearly any generator or propulsion engine that is not already so equipped. Make certain that alarm annunciators are located at both helm locations and ensure they are loud enough to be heard under all operating conditions.



It was a good idea to install an exhaust temperature sensor on this exhaust coupling, but the execution could be better. Remember, this is a high-temperature, high-vibration environment.

A final note on exhaust alarms. They are available in several varieties, including those that are strapped to the outside of the exhaust hose, those that pierce the hose, and those that are fastened to a metallic riser or elbow. They all work, however, because of their mass and heat sink properties. Those that measure the temperature of a metallic riser are often slower to react to a temperature change than those strapped to the hose or those that actually reside in the exhaust stream by piercing the hose. The hose piercing variety has the drawback of living an especially harsh life as it's bathed in a stream of hot seawater and diesel exhaust. As a result, they tend to fail prematurely as well as leak. Thus, my preference is for those that strap to the outside of the hose. The temperature sensors associated with at least one of these alarms, those manufactured by Borel Manufacturing, www.borelmfg.com, utilizes a sensitive and quick-acting thermister and as a result it nearly always sounds *before* any damage occurs to the engine or exhaust system.



The tiny friction contacts on this exhaust temperature sensor need better support and protection. Unless you frequently inspected the sensor, you wouldn't know if it was connected when you needed it.

The hose temperature should be tested using an infrared pyrometer while the vessel is and has been at 80% power for at least 30 minutes *before* installing the exhaust alarm. Choose the highest recorded temperature location for alarm sensor placement. In my experience, many vessels' exhaust hoses already operate at the edge or in excess of their design limits (most conventional wet exhaust hose is designed to operate at no more than 200°F), and as such, installing an exhaust temperature alarm will only confirm this scenario, i.e. the alarm will sound, while proving of little operational value.

Fire and Water

There are two scenarios that rightfully strike fear into the heart of any cruiser – fire and flooding. I don't have to tell the reader that these emergency events need to be taken seriously. What's worth discussing, however, is how and when they are discovered. Because fire can spread so rapidly and because the smoke alone, even from a seemingly insignificant fire, can be deadly, it's worth doing whatever is necessary to ensure early detection. Suffice it to say, you never can detect a fire too quickly or too soon.

Related to fire is gas: LP, CNG or gasoline. If your vessel utilizes any of these fuels, it's important to monitor for the presence or accumulation of these potentially explosive vapors. Explosive fume monitoring systems are readily available and they are relatively inexpensive. They should be wired in such a way as to ensure continuous monitoring (more on the subject of 24 hour power supplies below) . After all, a leaking LP gas line or gasoline fuel filter neither knows nor cares whether you are aboard or not. If such a leak exists, you need to know as soon as possible – as soon as you set foot aboard if it occurs while the vessel is unattended and,*before* you energize any electrical equipment.

Flooding, of course, carries its own set of concerns and it too is best detected as early as possible. High water alarms are, therefore, an essential component aboard any vessel that's equipped with a bilge pump. This alarm should be energized by what's referred to in the industry as a 24-hour bus, which simply means it's always on regardless of the position of the battery switches or whether power is available to the remainder of the house loads, engines or any other equipment. In fact, this is the same power supply condition that should exist for the bilge pumps themselves, you should be able to leave the boat with all primary DC circuits de-energized and secure in the knowledge that the bilge pumps and high water alarm will operate. Automatic bilge pump and alarm power supplies should never be controlled by an ordinary circuit breaker installed on the vessels main circuit breaker panel. One approach calls for the use of a separate bus whose supply utilizes a circuit breaker that is protected from inadvertently being turned off (a fuse may also be used for this supply; however, a circuit breaker is preferred). Some proprietary high water alarms utilize an internal 9-volt (in some cases two) transistor battery. With this arrangement, there’s no concern for the high water alarm failing to sound even if the vessel’s own batteries are dead.

Knowing the frequency of bilge pump cycles is essential information many yachts lack. A simple “on/off” light might not alert you to a serious flooding problem.

The high water alarm annunciator must, by necessity, be impossible to ignore and it should be audible both in the cabin and on deck, and the alarm should be impossible to mute or silence inadvertently. The on-deck annunciator will alert those nearby to your vessel’s distress situation in the event you are not aboard. This “outside” signal approach can be taken one step further with the addition of a wireless alerting system, which can be programmed to send you an SMS text message in the event the high water or other alarm sounds.

I'm frequently surprised by the level at which high water alarm float switches are installed. I routinely encounter switches installed eight, twelve or more inches above the primary bilge pump float switch. Depending on the size of the vessel and its bilges, the difference in elevation between these two switches can represent a great deal of flood water. The alarm float switch should be installed only slightly above the standard bilge pump float switch, just high enough to prevent nuisance signals. Installing the float any higher simply represents more flood water that will accumulate before the alarm sounds.

It is a good idea to check the proper operation of your bilge pumps by actually flooding your bilges with fresh water. This yacht owner would be amazed at how much water it takes to turn on the high water alarm.

Another type of water alarm worthy of mention involves the vessel's fuel system. Water-in-fuel sensors, sometimes referred to as WIFs, and their associated alarms are a veritable prerequisite for cruising vessels. During a recent conversation with a client, he relayed to me how his *new* engines suffered several thousand dollars worth of damage as a result of water contamination. During installation of a teak deck, the fuel fill caps were not properly secured, allowing rainwater (approximately 50 gallons!) to enter the tanks. During the next sea trial, water overwhelmed the primary and secondary fuel filters, ultimately reaching the high pressure fuel injection system. The ensuing damage necessitated replacement of all fuel injectors on both engines. Had the vessel been equipped with water-in-fuel sensors in the primary fuel filters, it’s safe to say that the engines could have been shut down prior to suffering damage. Sensors should be installed in all primary filters, including tandem designs, as well as generators. It’s important that WIF sensor alarms be located at both lower and upper helm stations and they must be audible, even over wind or entertainment system noise. Some annunciators simply use an indicator light, which may be easily overlooked.

Voltage and Refrigeration

Because the role played by virtually every vessel’s battery bank is critical, it’s important to maintain a close watch on its voltage. A simple volt or amp-hour meter will of course alert the user to a condition that requires attention. However, what happens if this low voltage condition occurs in the middle of the night? While many battery bank monitoring systems can be programmed to sound an alarm in the event a low voltage threshold is reached, most that I encounter aren’t programmed and as such this valuable feature goes untapped. By the same token, what happens if your vessel’s shore power is interrupted? Depending upon the vessel, this may be a non-event or it may be catastrophic. If refrigeration equipment is running, regardless of whether it’s AC or DC, it will stop functioning. In the DC case, the batteries will carry the system for some time, however, they will eventually become depleted, at which point the refrigeration as well as the bilge pumps and high water alarms will also cease to function. Once again, if you are aboard, you can clearly deal with this issue, however, if the vessel is unattended, then there’s little hope for intervention unless an alarm that can be clearly heard outside the vessel is installed. Battery operated AC power loss alarms are available and worthy of consideration if you are concerned about power loss aboard your vessel while you are away or asleep. This is especially important for refrigeration and freezer systems that are used to store meat, if it insidiously defrosts and is then refrozen, consumers of these foodstuffs could become ill. I was carrying out an inspection aboard a vessel recently and encountered a small plastic cup that had been half filled with water and frozen. Resting atop the ice was a penny. The owner explained that this was his high tech refrigeration failure alert system. If the penny ever found its way to the bottom of the cup, it would be clear that the freezer had, at some point, thawed and this would almost certainly cause the food stored within to spoil.

These alarm panels are clearly labeled and have annunciating lights so it is easy to distinguish where the malfunction is occurring.

I recently found myself on the bridge of a 60-foot trawler during a sea trial. An alarm sounded; however, it was unclear to all aboard (the owner was not present) just what the alarm was for. There were several possibilities, including engine and generator overheat, exhaust temperature, stabilizer hydraulic fluid temperature, low voltage etc, etc. This scenario drives home the need for organization of a vessels alarm system. When an alarm sounds, it should be immediately clear what it’s telling the crew, and it should be clear to anyone operating the vessel.

At some point, with all the systems that require monitoring and all their corresponding alarms, it becomes difficult to find the dash real estate for the individual gauges and displays. Not to mention the danger of overlooking a potential fault. Manufacturers such as Krill and Maretron have designed integrated systems that offer almost limitless possibilities for vessel monitoring. These systems can be configured specifically for your boat and can offer the added benefits of remote monitoring and data logging.

Computer driven alarm systems are gaining popularity. Their advantage shows in easy to read displays with crystal-clear information, their disadvantage – cost and complexity.

It’s important to remember that systems monitoring and alarm basics must not be overlooked. The good news is, monitoring the most important systems is neither difficult nor expensive.

SDMC

Sea Sense: Developing the skills that make for competency on the water

by Ralph Naranjo

Whether passagemaking or daytripping, simply moving a boat through the water requires a set of skills that can’t be fully appreciated on land.

(The following column is an *introduction* to the ethos of seamanship. I invited the author to share this bird’s eye view with my readers, with a plan for future contributions, each of which will offer a more detailed review of specific seamanship-related topic. Steve D’Antonio)

Seamanship is a capacity, not a commodity—a talent that can’t be purchased. It’s best developed by those who get underway regularly, and it’s more akin to a tightly tucked reef than a verbatim recital of the Beaufort Scale. Seamanship refers to the manner in which a crew carries out the vital tasks that define safe, enjoyable passage making—and whether its holding course in a tight channel or anchoring securely in a South Seas lagoon, one’s seamanship ability is the underpinning of every memorable voyage.

With the freedom of seas before you, comes the responsibility of taking care of the boat and yourself. You must understand the risks and manage them competently.

One of the fringe benefits of boat ownership is the freedom it offers, and while underway, a skipper and crew certainly do have a great deal of autonomy. But, with this freedom comes an inherent price tag that's quantified in terms of personal responsibility and it's paid for with crew competency. Seamanship is the currency used to cover this transaction, and for those who sail local waters, the invoice is usually more modest than the one presented to the blue water voyager. The inshore sailor or power cruiser can get away with less of a reserve in their seamanship fund, but the open ocean passage maker is often called upon to dig deep into their stockpile of skills, and the seamanship developed prior to departure on a lengthy voyage will prove to be an annuity of significant value.

Starting early and with a small boat earns respect for and an understanding of the ways of the sea.

The acquisition of seamanship is like the creation of a good stew, both tasks are always reliant upon the quality of key ingredients, and when they are combined correctly, the result can be greater than the sum of the parts. As with all acquired talents, whether culinary or seafaring, success is best measured by evaluating the outcome. For those aboard sailboats and power cruiser this feedback loop includes things like how easily a docking maneuver plays out, how quickly a reef can be taken, and how wisely a safe anchorage can be chosen.

The incremental parts of seamanship range from a deft hand on the wheel that prevents a broach, to more nuanced talents that keep you from sailing into the wrong side of a developing weather system. Some separate mariner skills like navigation, weather assessment and vessel preparation from the core concept of seamanship. This author feels that these are essential components of the art, and he looks at seamanship as a comprehensive term aligned with its definition in the Collins English Dictionary- “skill in and knowledge of the work of navigating, maintaining, and operating a vessel.”

The captain of any vessel must have the trust of the crew. Careful navigation, competent boat handling, and an understanding of the vessel's systems and their readiness for the voyage are all keys to building this confidence.

The ideal approach to developing seamanship skills is a mixture of traditional study and practicing skills underway. Preparing to handle heavy weather by reading the accounts of those who have survived storms at sea is a sensible step one in a three tiered approach to seamanship. Step two involves implementing the lessons learned in more controlled, less than gale force conditions. The final phase includes modifying the techniques to fit your vessel and crew and tailoring them to your specific needs. Developing such an approach to seamanship often prompts a visit to a local chandlery, specifically the aisles brimming with orange colored safety gear. But it's important to keep in mind that despite the value of good equipment, safety at sea is much more than an attentive read and a shopping spree. Active seamanship is the linchpin to safety afloat, and it requires an incremental approach that focuses on the development of key boat handling skills. Through the step-by-step training alluded to above a skipper can gradually increase a crew's exposure to volatile weather. By becoming comfortable with reefing and steering in 25 knot conditions, the 35 knot borderline gale will become a manageable challenge, rather than a fear laden obstacle. After each encounter, crew feedback will help fine tuning your final heavy weather initiative.

Truth in advertising has become an overworked one-liner in the domain of the late night comedian. But for recreational boaters, the poetic license ascribed to in "nautical spin" has significant implications. The marine market place is filled with a wide range of boats and gear, some are superior products—others are not. Learning how to recognize quality, reliability and longevity is part of good sea sense, because safe and enjoyable voyaging does hinge on hardware as well as crew skills. That's why the consumer needs to keep in mind that the recreational marine industry creates many great products, but it's a loosely regulated market place focused on a financial bottom line, and advocacy has become an art form, while the emphasis on material quality has slipped.

Spending time aboard your boat during yard visits can be a useful learning experience. Knowing the boat and developing a plan for refit and maintenance are foundations for building your understanding of your boat.

In the two decades I've spent evaluating new boats for several of the nations' leading boating magazines, I've been pleased to witness the accomplishments of many manufacturers. But I've also been equally amazed at the efforts of others attempting to make accommodations appear sumptuous while hiding shoddy workmanship in less easily accessed parts of the boat. But most of all, I've been amazed at the spin tossed to perspective buyers—rhetoric with a range as extreme as the

Beaufort Scale. Some brokers offer an accurate account of a vessel’s strengths and weaknesses, while others ramble on defiant of naval architecture’s basic principals. In this blog I’ll offer insights into how a perspective boat buyer can recognize fact from fiction and make informed choices when it comes to a coastal cruiser, live-aboard sail or powerboat and what sets these apart from a vessel that’s ready to cross oceans. There is indeed reason for a buyer to beware, and the best advocate for your own boating interest is a well cultivated knowledge base.

Bio

Ralph Naranjo turned a youthful interest in water sports into a lifelong commitment.   Time spent in small boats set the stage for a family voyage around the world, and his early career as a teacher and school administrator segued into more marine oriented writing, lecturing and training.   When he and his wife Lenore set off with their two children on a five year voyage across three oceans, neither anticipated how much the experience would reshape their lives.

After the cruise Ralph managed a full service boatyard and marina, wrote Wind Shadow West, a narrative about family life and long distance passage making, and found time to become involved with US Sailing’s safety at sea training.   Later as the Vanderstar Chair at the US Naval Academy, he oversaw the sail training program and led the Academy’s effort in the development of a new fleet of Navy 44s. He’s currently, the Technical Editor for Practical Sailor magazine and the Electronics Editor for SAIL magazine. He’s finishing up a book on seamanship for McGraw Hill, and will regularly share seamanship insights on this blog site. Ralph holds a deep respect for the volatility of the ocean/air interface. He’s cruised and raced vessels made of wood, fiberglass and aluminum, labels himself more sailor than power cruiser, and is quick to point out that self-reliance is the most valuable asset found among ocean voyagers.

Ensuring your vessel is seaworthy and its systems are reliable and in good working order are essential elements of the seamanship ethos.

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