THE INFRARED PYROMETER AND ITS MANY USES

Since infrared pyrometers became readily available a few years ago, they've had a tremendous impact on the way boats are maintained and troubleshot. Because of their affordability, pyrometers are now accessible to everyone, from the skilled mechanic to the average weekend boater.

An infrared (IR) pyrometer uses the infrared radiation emitted by an object to determine its temperature. The variety of tasks an IR pyrometer can perform is nearly limitless. When using one, it's important that you establish a baseline on the equipment whose temperature is being measured. For instance, if you measure the oil filter housing on your engine while under way and it reads 180°F, you shouldn't be concerned, since that's within the normal range for most hardworking diesel engines. If the temperature is 220°F—still within the normal range for most engines—you'll have no way of knowing whether something is wrong unless you've kept a record of previous readings. Analyzing such temperature trends is something that can be done with the majority of gear you might read with a pyrometer.

Stuffing boxes are especially worthy of the pyrometer's quick and easy measurement abilities. Typically, conventional stuffing boxes (the type with waxed flax packing) operate between 20° and 30°F above seawater temperature, which can be measured with your pyrometer at the raw-water inlet seacock. Dripless boxes often run somewhat cooler. Thus, if the water temperature is 65°F, like it was during a sea trial I conducted recently, the stuffing box should be no hotter than about 95°. After running at 80 percent throttle for an hour, the stuffing box on the boat I was sea-trialing measured 135°. More troubling was the shaft temperature: measured where it entered the stuffing box, it was a sizzling 176°F.

Steve D'Antonio

Monitoring the temperature of a stuffing box will enable you to determine if it's being cooled and therefore working properly. Typically, stuffing boxes run about 30°F above ambient water temperature; that number may be less for dripless models, like this one.

Even before I had used my pyrometer on this assembly, I could see what appeared to be solidified wax on the hull, slung perpendicular to the shaft near the stuffing box. I didn't need trend analysis to know that something was wrong. A stuffing box's flax packing wax should never get hot enough to melt. If it does, the stuffing box has been incorrectly adjusted or is not getting enough cooling water. The pyrometer reading simply confirmed this concern.

In most other cases where an IR pyrometer might be used, there are no outwardly visible clues about what is amiss. Take, for example, an alternator installation I encountered once on a small cruising boat. As I ran my pyrometer over various parts of the engine while the vessel was under way, the temperature of the alternator seemed unusually high: over 200°F after just 15 minutes of run time. I discovered that the alternator was equipped with a unidirectional fan designed to rotate in the opposite direction from the way it was turning. Instead of drawing cool air through the alternator and expelling it, the fan was attempting, and failing, to draw air in and push it through the alternator's body. This resulted in an overheated alternator.

Every alternator can benefit from the regular attention of a pyrometer. Establishing temperature trends for the alternator's body, diodes, and bearing carrier often will alert you to an impending failure. Don't forget to measure the temperature of the pulley and belt, too.

An IR pyrometer can also be used to detect problems with your raw-water cooling system. Because of the high volume of water that's used to cool your engine, the difference in temperature between the water entering the engine and the water leaving the engine is relative small, usually on the order of 10–25°F. Measure the temperature of the raw water entering the engine, typically at the hose where it enters the raw-water pump, and again where it leaves the heat exchanger or enters the exhaust elbow—again, on the hose. If the differential is greater than 10–25°, something is probably wrong. The engine may not be overheating, but it's likely the water flow rate has been diminished because of a partially restricted intake, an occluded heat exchanger or exhaust elbow, or a damaged impeller.

Yet another area worthy of attention is the exhaust system. It's not uncommon for a vessel to suffer from an overheated exhaust system while the engine operates within the normal range. The temperature of dry diesel exhaust can be as high as 1,000°F. Any sections of the exhaust that are not water cooled must be well insulated to ensure that no exposed portion exceeds 200°F. You can use a pyrometer to test this, carefully, after the boat has been operating at 80 percent load for a minimum of one hour.

The wet portion of the exhaust should also be checked; no portion should exceed 200°F. With your pyrometer, test the entire "wet" hose section of the exhaust system, from the injected elbow to the transom, if possible. Conduct this test after the vessel has been running at cruising speed for one hour, and then at descending 200-rpm intervals, dwelling at each rpm stop for a minimum of five minutes. (Higher temperatures are often recorded at lower rpm, when less water is being pumped.) A temperature of 200° usually indicates a problem. Typically, a wet exhaust system should operate between 90° and 140°F.

When selecting an IR pyrometer, two features are essential. First, it must have a scan feature that allows you to run the tool over an object while holding the trigger. The highest temperature read will be displayed on the screen, often in smaller digits beneath the last reading taken when the trigger was released. This is an invaluable feature because the user can scan a large area and find an anomalous temperature without having to see it on the screen at the moment it's recorded. The second feature worth having is an aiming laser. When using this, it's important to understand that the area being sensed is not the size of the laser dot; it's a cone that grows as the pyrometer's distance from the target increases.

These days, for the cost, it's tough to justify *not* owning an infrared pyrometer.—Steve D'Antonio