

MS "Helene Russ", a 1700 TEU (Twenty Foot Equivalent Unit) container vessel, built in 1996, inspected by Thermowind

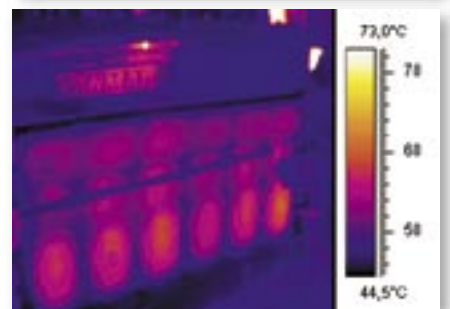
From the galley to the engine room : infrared thermography inspection of ships is gaining momentum

"In the near future, mechanical machinery onboard vessels will also benefit from thermal imaging, especially as a pre-docking strategy to identify and target equipment and systems which need attention as well as to eliminate necessary work." forecasted Lloyd's Register, the world's most important ship classification and certification body, three years ago. Nowadays, infrared thermography can do much more onboard. And FLIR Systems has worked hard to resolve the main obstacles: high camera prices and the difficulty to handle the camera in confined spaces of ships.

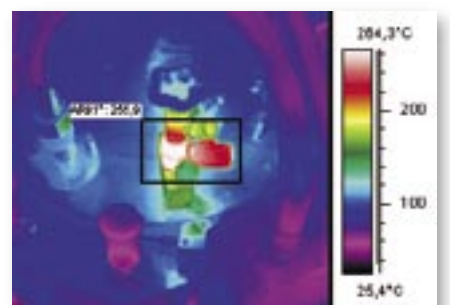
Commercial ships are rewarding objects for thermographic inspections: they have huge machinery, vast electrical installations, extended electronic systems, which can hardly be surveyed by visual inspections. Moreover, fire prevention is an important issue and relevant prescriptions are clear: according to the International Convention for the Safety of Life at Sea (SOLAS), the maximum surface temperature of machinery, parts and components in a vessel's engine room should not

rise above 220°C. In order to avoid ignition and fire development, all surfaces above 220°C are to be insulated or otherwise protected (SOLAS, Ch.II-2, reg. 15.2.10).

Statistics show that the majority of engine room fires are caused by ruptured pipes containing fuel or oil which eventually spray on adjacent hot surfaces. This does not happen often. But an engine room fire will have severe and costly



900 kW auxiliary engine



Indicator valve to measure oil level of main engine: not insulated and too hot



consequences for the ship and its cargo, its crew and last but not least for the shipping company. Smaller deficiencies are numerous, and the piping or cable insulation, as required by the SOLAS rules, often appears to be missing. Moreover, thermographic inspections with an infrared camera will instantly show the condition of electrical circuits, electronic systems and other installations and parts onboard. And in more general terms, infrared cameras allow fast and secure inspections in line with the tight loading, unloading and delivery times which currently rule the maritime trade.

FROM PYROMETERS TO INFRARED

'Thermowind' is an infrared consultancy located in the North German harbor city of Bremerhaven. It has gained a reputation as an infrared thermography consultancy for inspections on board of ships, from big commercial vessels to small private yachts.

"Marine engineers believe in pyrometers", says Marco Brinkmann, founder and General Manager of Thermowind, "but we are convincing them that you can do a lot more, and a lot faster and safer with infrared cameras", he says. "It's the only condition monitoring tool that allows to do temperature measurements of objects across their entire surface area quickly and safely. And infrared camera's show exactly what's going wrong where". Onboard inspections on commercial ships include objects like engines, compressors, boilers, pumps, or the insulation condition of elaborate steam and fuel piping systems as well as electrical switchboards; everything that can heat up and break down, from the bridge to the caboose. The results are convincing: "during our inspection rounds, tells Brinkmann, "marine engineers are appalled to see some components at a staggering 400 °C."

Thermography offers the advantage of not interfering with the vessel's operation. For good inspection conditions, the engines must work at their normal loads and temperatures. "A three-four hour trip at full speed ahead and loaded is ideal to get a clear picture of the ship's electrical and propulsion systems", says Cristian Ferber, electro technical engineer and Brinkmann's partner.

MEASUREMENT AND SEVERITY CRITERIA

Severity criteria hover around the clearly defined ship engine room maximum temperature of

220 °C. Based on this threshold, Thermowind developed its own set of severity criteria:

- Severity 0:** OK (measured temp. < 210.0 °C)
- Severity 1:** to be monitored (210.0 °C < [measured temp.] < 220.0 °C)
- Severity 2:** unacceptable deviation (measured temp. > 220.0 °C)

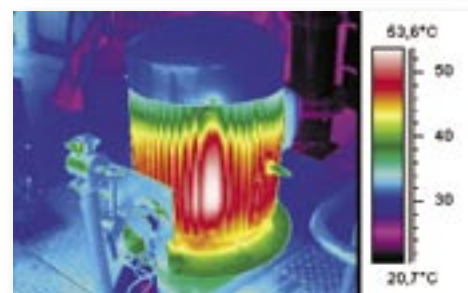
However, severity criteria are void without careful observation and knowledge of the ship's engines: "if there's some oil-piping right next to a spot detected as a class 1 spot, we give it immediate repair status, downgrading it to Severity 2" says Ferber.

Thermowind uses a FLIR Systems veteran PM280 and a FLIR Systems ThermoCAM E-Series camera for its inspections. This handheld camera is very handy to use in cramped machine room corners. Its measurement mode features, such as three movable measurement spots, and its built-in memory for 200 pictures stored in a convenient .jpg format are very useful during surveying work. And the ThermoCAM's sound and color alarm modes are a blessing for inspections based on a threshold temperature, assert both Thermowind inspectors.

Thermowind devotes considerable time to set up a customer report: "we believe that the customer has the right to get an extensive report for his money", says Ferber, "we consider it more than a business card: especially, since the Germanischer Lloyd, a leading technical service provider for the maritime sector, has certified our measurements."

Another specialty of Thermowind is yacht inspection, in particular the search of delamination on yacht's fiberglass reinforced plastic (FRP) or composite wood-FRP hulls. Delaminations can lead to harmful moisture accumulation within the vessel which destroys the material and, if present, the wooden core of the hull.

To survey these anomalies, Thermowind applies lock-in thermography, a method based on thermal wave analysis: the spotted yacht hull surface is carefully heated with lamps. The subsequent measurement of sudden changes in the thermal wave conductivity which is reflected by the heated material shows material deficiencies in the hull. Thermowind combines a specific software from a system integrator with a FLIR



electric engine driving a pump in a tanker engine room

Systems ThermoVision A40 M 320x240 pixel, fix-mounted camera to do this refined thermographic inspection method.

MORE TO INSPECT IN LESS TIME

As commercial vessel engines become more complex and get steered by a growing number of electrical or electronic components, the need for regular inspection and maintenance rises. Infrared thermography has the advantage of being a non-contact inspection and measurement tool able to display and store exact temperature values as well as visual evidence. Moreover, time-saving becomes an important asset in the shipping business; required inspections have to be done at a fast pace. And when something happens to the engines or to other vital installations, the losses by far exceed the investment in such a convincing, time-saving, and hence also affordable inspection tool as an infrared camera.

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