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Uwagi dotyczące aplikacji 13.9.2022

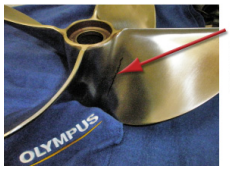
Fatigue Crack Detection in Marine Propellers

This application note explains how to detect fatigue cracks in marine propellers using eddy current testing. Learn why these cracks form and the key advantages of using eddy current testing to detect them.

Causes of Cracks in Marine Propellers

Propellers used on boats of all sizes and types undergo cyclic fatigue, which can cause cracks. These cracks can cause potentially serious consequences, including total loss of watercraft, loss of lives, or delay in time of arrival.

As a result, propellers are inspected across the maritime industry. Propellers are made from various materials, including bronze, aluminum, stainless steel, and carbon steel. All these materials are susceptible to cyclic fatigue.



Potential location of cracks forming during high performance applications

Cracks can originate at many locations on propellers. In most cases, the crack begins at points of highest stress loads associated with stress risers, such as sharp edges, thick to thin transitions, and areas where weld repair occurred. The most common point of failure on propellers is where the blade joins to the hub. Cracks occur anywhere along the axis of the blade to the hub radius.

Advantages of Eddy Current Testing for Fatigue Crack Detection in Propellers

Eddy current testing brings many benefits to propeller inspections, including:

- **On-site inspections**: can be used on large ocean-going vessels and other marine vessels that require inspections aboard the ship
- **Works on various propeller materials**: including bronze, aluminum, stainless steel, and carbon steel; when propellers are coated, the inspection can sometimes be conducted without removing the coating
- **Detect anomalies that are slightly subsurface**, such as casting imperfections
- **Depth of anomalies can be estimated** in some cases
- **Can be performed underwater**, unlike many other NDT methods
- **Faster inspections**: in larger propellers, eddy current array testing (ECA) can speed up inspection and provide a permanent record

The applicable NDT techniques for the propeller inspection depend on the construction material, type of defect, and location of the component being inspected. Magnetic particle inspection, dye penetrant, and visual inspection may also be used where applicable.

Typical Equipment Used for Fatigue Crack Detection in Marine Propellers

NORTEC™ 600 eddy current flaw detector

Pencil probe: 100–500 kHz, part number 9222164

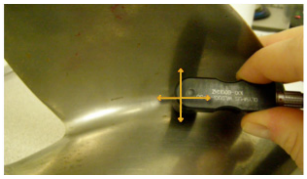
Right angle weld probe: 100–600 kHz, part number WCD90I-5-50

Eddy Current Testing Procedure to Detect Cracks in Propellers

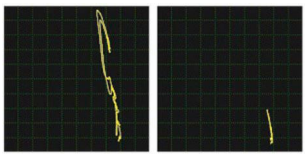
We performed an example inspection to demonstrate a typical eddy current testing procedure for fatigue crack detection in marine propellers.

To achieve optimal results, two scans using two different eddy current probes were used to complete the inspection. The first scan used a conventional pencil probe, which is commonly used to detect surface cracking.

The second scan was performed using a NORTEC weld probe, chosen due to its contoured face.



Example of scanning a propeller with eddy current testing



Comparison of a crack signal to a defect-free area using a weld probe

Fingertip probe can be used as well

Related Product

Weld Probes

Weld probes are designed to inspect ferrous welds. They provide a cost effective alternative to magnetic particle inspection, which requires the part to be prepared (cleaned) prior to inspection.
Learn More ▸ https://www.olympus-ims.com/ec-probes/weld/

Right Angle Surface Probes

90° tip, stainless-steel shaft. Designed for general surface crack detection, these probes are available in a variety of lengths, and with various coil configurations, drops, and connector options.
Learn More ▸ https://www.olympus-ims.com/ec-probes/right-angle-surface-probes/

NORTEC 600

\The new NORTEC 600 incorporates the latest advancements in high-performance eddy current flaw detection into a compact, durable unit. With its vibrant 5.7 inch VGA color display and true full-screen mode, the NORTEC 600 produces user-selectable, highly contrast eddy current signals.
Learn More ▸ https://www.olympus-ims.com/nortec600/