

Detection of hidden failures

Thermographic survey

The ABB infrared thermographic survey helps to obtain and analyze information from non-contact thermal imaging devices. Basic electrical surveys include high- and low-voltage switchgears, distribution systems, and control or instrumentation equipment. Basic mechanical surveys cover rotating machines, bearing or gear systems, insulation systems, and a wide range of production/chemical processes.

Overheating of mechanical or electrical components of a machine or system often is a symptom of malfunction. These elements can be analyzed by means of a thermographic camera. It records the infrared wavelengths emitted by an object, and transforms this information into an image, thus highlighting problems that cannot be seen in a standard visual inspection.

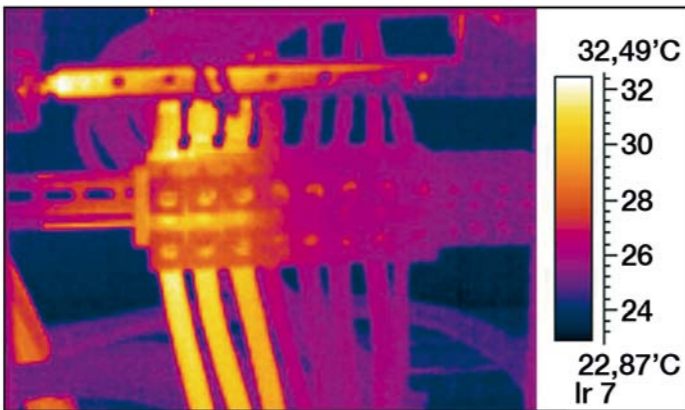
Because these tests may be performed on an existing rotating plant, or other equipment and may involve close proximity to potential voltage sources, the thermographic survey needs to be performed by a person with certification only to avoid accidents involving personnel and equipment. A medium- and high-voltage switchgear needs to have inspection hatches or windows in place if the inspection is to be completed safely and in line with requirements.

Benefits for the customer

- Minimizing the maintenance and repair costs through proactive condition monitoring
- Easier planning of preventive maintenance operations
- Gaining an excellent overview through the imaging: temperature measurements can be compared between two or a hundred points in the same thermal image.

Equipment that can be inspected

- Cables and connections
- Transformers
- Bus bars
- Switchboards
- Batteries and UPS units
- Converters
- Pumps
- Electric motors
- Shaft couplings



Contact us

- Brazil**
Phone: +55 11 3688 8294
- China**
Phone: +86 21 61 22 88 88
- Denmark**
Phone: +45 65 47 70 70
- Finland**
Phone: +358 10 22 21999
- France**
Phone: +33 4 96 15 82 49
- Germany**
Phone: +49 40 30 306 565
- Greece**
Phone + 30 6937075237
- India**
Phone: +91 8022948819
- Italy**
Phone: +39 010 2752111
- Japan**
Phone: +81 3 5784 6226
- Korea**
Phone: +82 51 621 5777
- Netherlands**
Phone: +31 10 407 8867
- New Zealand**
Phone: +64 9 356 2160
- Norway**
Phone: +47 916 17 373
- Russia**
Phone: +7 8152686534
- Singapore**
Phone: +65 9820-8018
- South Africa**
Phone: +27 11 518 9873
- Spain**
Phone: +34 91 581 05 30
- Taiwan**
Phone: +886 7 335 5931 #888
- United Arab Emirates**
Phone: +971 2 417 1333
- United Kingdom**
Phone: +44 1224 592123
- USA**
Phone: +1 954 874 47 00

www.abb.com/marine

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ABB Marine

Marine Services

Maintenance optimization through condition monitoring

Maintenance cost optimization

Condition monitoring

Condition monitoring is valuable maintenance that can be typically carried out while the equipment is running. Through periodic measurement we can observe trends. This allows overhauls to be planned well in advance at the customer's convenience.

ABB Marine Services puts a range of inspection technologies at your disposal. We monitor bearing conditions via vibration measurements and oil analysis, verify generator and motor insulation conditions, estimate generator and motor lifetime from measurements, utilize thermocameras to detect loose connections and use boroscopes to inspect places with limited access.

Implementation phases

Inspection

Condition monitoring measures are conducted at the site, also including visual inspections and observation of operation.

Analysis

Study and processing of the data gathered at the site, and generation of trend diagrams concerning efficiency and wear of the system subject to monitoring.

Report

Generation of a detailed report summarizing the condition of the system inspected, recommendations and possible critical conditions.

An ABB LEAP success story

Our ABB LEAP program began in late 2008 and was presented to our key customers in early 2009.

Recently ABB completed LEAP testing on a drilling vessel. This included six thruster motors, six diesel generators, two fire pumps and two cargo motors. ABB performed the measurements in a record 10 days while the vessel was being moved from the Ivory Coast to Ghana.

Working from ABB's LEAP measurements and the LEAP reports with additional visual inspection report, ABB was able to offer detailed short- and long-term maintenance goals to the end-user that are necessary for reliable operation of the vessel motors and generators. The vessel went in to dry dock to be repaired in accordance with our report recommendations.

Boroscopic inspection

Boroscopic inspection is a non-destructive inspection method generally applied in all marine and industrial sectors. This monitoring method is ideal for mechanical equipment that is very expensive to open and disassemble. Inspection takes place when the equipment is not operating. It is performed through small holes a few millimeters in diameter by means of a special orientable probe, which transmits images directly to an LCD monitor and can acquire video as well as still images.

The inspection work may involve high-voltages and the machines may have stored electrical/mechanical energy. Therefore, the inspection must be performed by a person with certification only, to ensure application of appropriate precautions and safe work methods.

Benefits for the customer

- Proactive minimization of maintenance and repair costs
- Advance planning of budgets for upcoming maintenance
- Extended product service life

Equipment that can be inspected

- Stator and rotor windings and air gaps
- Transformer windings
- Lubrication conduits
- Electrical machinery
- Pumps, valves, and gears
- Azipoidal/traditional propulsion bearings



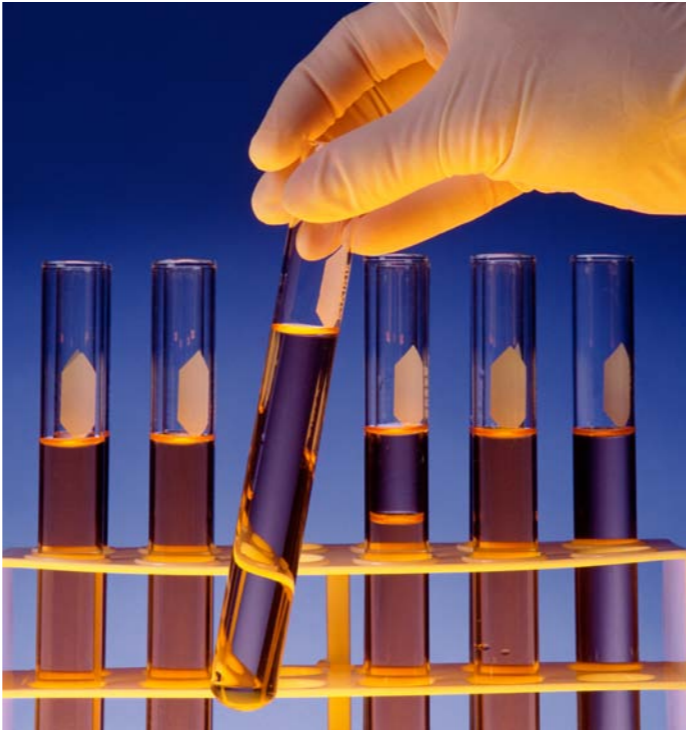
Trend monitoring for early detection of internal abnormalities

Oil analysis

The oil analysis service enables advance detection of abnormal equipment condition, allowing you to plan and schedule corrective action to minimize unplanned downtime and costly repairs. High quality, accuracy, and consistency in the oil analysis are ensured through application of the ISO/IEC 17025:2005 standard in all ABB laboratories.

ABB provides sample-based oil analysis service for evaluation of the state and condition of critical components. This comprehensive oil analysis enables monitoring of the condition and status of the critical components and aids in detecting potential failures before they affect operation. The customer regularly takes oil samples and submits them to an ABB-approved laboratory for testing and analysis. From these results, ABB provides a complete report with trend analyses and recommendations.

Samples are taken and analyzed at regular intervals. Trend monitoring enables early detection of internal abnormalities. Developments and trends can be determined through comparison of the most recent report to previous reports. Tested values that fall within acceptable limits may show a pattern of subtle variance that could signal a developing problem. Even pieces of equipment of exactly the same make and model wear and accumulate contaminants at different rates. Individual trend analyses and comparison of the results against the installed base provide the most effective method



for determining the current equipment status, which enables you to solve developing problems before they become failures.

Benefits for the customer

- Better understanding and knowledge of the 'health' of critical components
- Improved availability and safety of operation
- Optimal operation and maintenance performance
- Long-term statistics, supporting continuous development
- Minimization of operation costs
- Improved maintenance planning, and reliability of operation
- Early diagnosis and preventive measures help to avoid costly unscheduled downtime

Equipment that can be inspected

- Oil-filled transformers
- Turbines
- Bearing oils
- Gear rims
- Hydraulic steering motors and pumps

Evaluation of critical components' condition

The ABB life expectancy analysis program – LEAP

Studies have shown that the most common causes of failure in high-voltage machines with a power rating above 2,000kW involve stator windings (~60%) and bearings (~20%). ABB has developed the unique LEAP diagnostic tool for assessing the condition of the stator winding insulation in electric machines.

ABB LEAP provides information on the condition and expected life of the stator winding and enables preparation of optimal machine maintenance plans. Used in combination with estimates of the time needed to repair or replace components, ABB LEAP enables servicing to be performed during planned downtime rather than during a costly emergency.

Unlike conventional monitoring programs, ABB LEAP analysis provides precise information on the remaining life of the stator winding. It enables preparation for specific service actions, reducing unplanned shutdowns. It dramatically reduces unplanned downtime caused by predictable failures.

Benefits for the customer

- Supports efforts to extend machine lifetime, boosting return on investment (ROI)
- Facilitates decision-making for short- and long-term maintenance, and run/replace decisions
- Minimizes unplanned downtime and reduces risk levels
- Provides information for lifecycle costs' estimation

ABB MACHsense-P

ABB MACHsense was developed to address the reliability of cage induction motors, especially for lower-capacity motors with a power rating less than 2000kW, in which problems related to the bearings, rotors and other mechanical components account for more than 65 % of all failures.

ABB MACHsense provides a reliable, early-warning system for impending or incipient defects. This allows more time and greater opportunity for efficient maintenance planning in comparison to fault detection systems that use on-line, off-line-, or walk-around-type monitoring, which give a reliable warning only when a failure is imminent.

ABB MACHsense deploys a custom-developed data-collector along with unique analysis developed on the basis of intensive studies by our corporate research centers. It detects, monitors, and diagnoses electromagnetic and mechanical problems in motors. Motor condition is monitored by means of defect indices derived from a combination of electrical and vibration measurements.

Benefits for the customer

- Delivers an automated analysis and summary report to the site
- Minimizes unplanned downtime and reduces risk levels
- Provides information for estimation of lifecycle costs

Partial discharge analysis

The partial discharge analysis service is a proactive diagnostic approach that uses partial discharge (PD) measurements to evaluate the integrity of the equipment. Each discrete PD is a result of the electrical breakdown of an air pocket within the insulation. PD results enable reliable prediction of which electrical equipment will need maintenance.

In critical high-voltage equipment, the integrity of insulation is confirmed by means of PD detection equipment during the manufacturing stage as well as periodically throughout the equipment's useful life. PD prevention and detection are essential in ensuring reliable, long-term operation of high-voltage equipment used by electrical power utilities.

The most practical techniques of non-intrusive testing are based on detection of the radio frequency part of the electromagnetic spectrum and ultrasonic emissions. Acoustic emissions from partial discharge activity occur over the whole acoustic spectra. Using special instruments for detecting the ultrasonic part of the acoustic spectra provides several advantages. Instruments are far more sensitive, and are operator-independent. In addition, they are directional and operate above the frequencies audible by humans.

After analysis of the test data a full report is submitted for the customer's consideration and approval. The report contains the results of the analysis, as well as recommendations for further actions.

Benefits for the customer

- Better understanding and knowledge of the 'health' of critical components
- Improved availability and safety of operation
- Improved maintenance planning and reliability of operation

Equipment that can be inspected

- Switchgears
- Transformers
- Cables and connectors
- Insulating liquids
- Motors and generators