Service Note
ABB Life Expectancy Analysis Program (ABB LEAP) – Standard level for stator winding on high voltage motors and generators

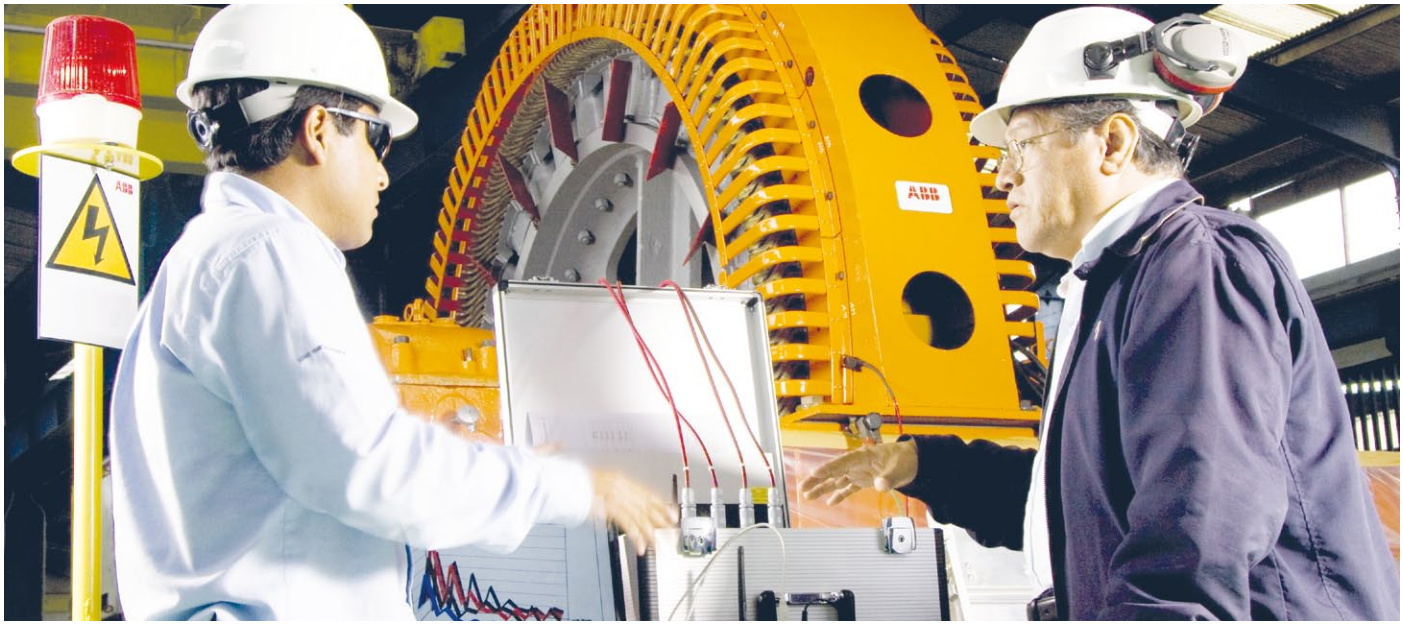


ABB Life Expectancy Analysis Program or ABB LEAP is a unique diagnostic tool for assessing the condition of the stator winding insulation in electric machines.

ABB LEAP provides information on the condition and expected life of the stator winding and enables optimized machine maintenance plans to be drawn up. When ABB LEAP is used together with estimates of the time needed to repair or replace components, it becomes possible to perform service during planned downtime rather than during a costly emergency.

ABB has developed unique analytical tools to identify, characterize and quantify defects that could be present within the insulation system. Testing and analysis are performed on a single occasion and can be combined with normal L1 to L4 maintenance.

ABB LEAP goes further than conventional health monitoring programs for rotating electrical machines, which typically use green, yellow and red LEDs, or similar to express the results. ABB has evolved this methodology to a new level: ABB LEAP analysis provides precise information on the remaining lifetime of the stator winding. Based on this, specific service actions can be planned well ahead. This method drastically reduces unplanned shutdowns caused by the failures (due to factors such as thermal, electrical, ambient, or mechanical aging), which could have been foreseen.

ABB LEAP methodology

- Data collection
  A set of measurements is performed to collect operating data, test results and machine information.

- Data analysis
  Data collected is analyzed to identify the process of insulation degradation.

- Stress calculation
  ABB Life Expectancy Analysis is performed and factors and conditions that affect lifetime are identified.

- Lifetime estimation & condition based maintenance
  The lifetime is estimated with different confidence levels depending on the ABB LEAP package used. Clear plans are drawn up for possible further inspections, maintenance, replacements or upgrades.

Benefits

- Optimizes maintenance planning for electrical machines by moving from time based to condition based maintenance
- 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 cost estimation

Measurements on site:

ABB LEAP Standard for stator windings consists of the following measurements:

DC measurements

Polarization - Depolarization Current Analysis (PDCA)
Besides leakage and absorption current, the PDCA test:

- Provides an indication of the quantity and location of charge storage within the machine
- Identifies contamination even when IR and PI values are “acceptable”
- Determines the state of the winding insulation (e.g. aging, looseness)

AC measurements

Non Linear Behavior Analysis, Tan and Capacitance Analysis, and Partial Discharge Analysis confirm the results of the DC measurements:

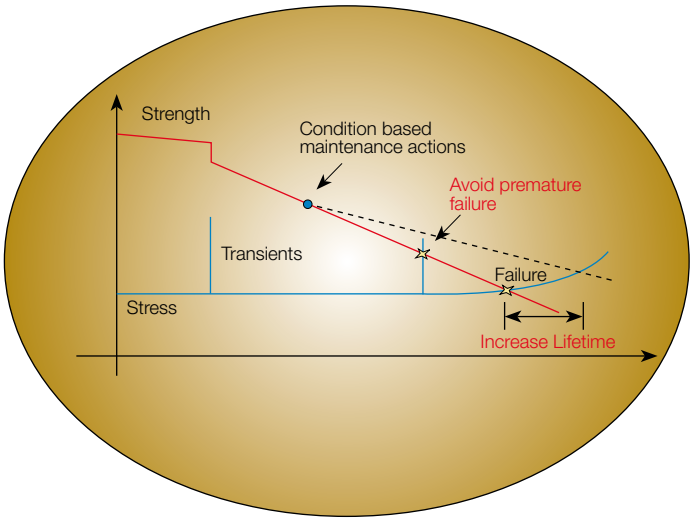
- Assessment of the condition of the corona protection shield
- Determination of the extent of de-lamination or void content in terms of the percentage of discharging air volume to insulation volume
- Assessment of the condition of the stress grading system at the slot ends
- Trend of aging effects

DC tests are sensitive to the surface condition, while AC tests provide more information on the insulation volume.

Report

The report provides the customer with information on:

- Contamination of the stator winding (increases stresses and reduces the lifetime)
- Aging of the insulation system, aging of resin, de-lamination
- Status of the stress grading system
- Status of the corona protection system in the stator slot area
- PD activity in other parts of the stator (e.g. winding overhang)
- Remaining lifetime based on information provided by the customer in combination with the measurements conducted
- Recommendations for maintenance or other action like rewinding/replacement
- Recommended time for next inspection based on operating information provided



“Insulation material in electrical machines is exposed to thermal, electrical, mechanical and environmental stresses during operation. Over time these stresses cause aging of the insulation material. Aging is represented by the red curve. Stresses from normal operation and abnormal events (such as transients) are represented by the blue curve. When the blue and red curves cross, an insulation failure will occur leading to expensive unplanned downtime.”

SM101 EN Rev B 2010

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