

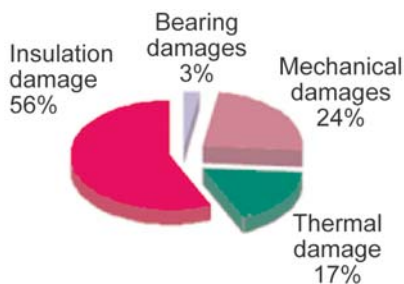
Corona On Rotating Electrical Machines

Where & why corona is present?

Corona is present in high-voltage rotating electric machines such as turbine generators, water wheel generators and large motors. Corona is caused by electric field being high enough to locally break down the gas that is adjacent to the solid insulation. The effect is mainly presented in a coil or winding as outcome of insulation deterioration.

Why corona inspection?

Industry statistics by IEEE and EPRI indicate that approximately 40% of all air-cooled high voltage motors and generators failures occur due to insulation. Supporting it, the survey of 1199 hydro generators carried out by the CIGRE study committee SC11, EG11.02 present the insulation damage as the main factor in hydro generators failure mechanism.



Why corona camera

Corona discharge emits radiation in the ultraviolet (UVc) spectral range which is invisible to the human eye. By pinpointing and visualizing the corona phenomena the exact corona source location is revealed, its severity is identified and potential failure evidence can be saved by a still picture or video. The UVc radiation is an early sign to coming failure to be stopped on time.



Which corona camera?

UVollé-SV, a compact bi-spectral video and stills recording camera for detecting corona and arcing discharge under full light working conditions.



What are the benefits?

- Lower the risk of in-service failures
- Increase overall safety within a plant
- Extend the time between major outages by on-line assessment of the rotating machine's condition
- Identify specific failure mechanisms to determine the appropriate corrective action prior to a forced outage.
- Ensuring the effectiveness of corrective maintenance, like cleaning and re-wedging by having "before" and "after" corona inspection visualize findings.
- Find problems on new machines that may still be under warranty



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Case study:

Detection of high voltage leakage between phases on large AC generator (1000 Mega Watt) stator using corona cameras

The Hi-Pot High Voltage leakage test increases the test voltage in increments. The test voltage is applied to each of the winding phases in sequence and the voltage and the leakage current are read and stored in the computer program used for the test. The maximum test voltage is typically 1.5 to 1.6 times the rated voltage of the generator. The rated voltage on this generator is 22 kV.

The inspected generator used water cooled windings and was found to have some water leakage that resulted in low Megger readings. Repair of the affected windings was performed and the Megger readings showed one phase to be perfect but two others to be on the low side. It was decided to use the Ofil corona camera during the Hi-Pot test to find the location on the windings with leaky insulation.

With the start of the test and increasing the test voltage on one of the phases to some 30 kV, corona was seen on a part of the winding. As the voltage was increased a neighboring location on the winding also showed corona and indicated insulation fault. The location of the fault area was marked for investigation. As the next suspect phase was tested and after increasing the test voltage on this phase to some 36 kV, corona was seen on a part of the winding close to the previous winding. When the voltage was increased, a neighboring location on the winding also showed corona and indicated insulation fault. As the voltage was further increased high intense corona and arcing was seen and the insulation was burnt. The location of the fault area was marked for investigation.

The affected part of the insulation was removed and revealed water and other contamination in this part of the winding. The part of the winding with insulation removed was temporary insulated and a new Megger test was performed. It read much improved values but not as good as the OK winding. It was again decided to use the Ofil corona camera during the next Hi-Pot test to find other locations on the windings with leaky insulation.

With the start of the test and increasing the test voltage on one of the phases to some 38 kV, weak corona was seen on a part of the winding at a different location on the stator compared to the first finding. As the voltage was increased severe corona and arcing and eventually smoke indicated insulation fault. The location of the fault area was marked for investigation. The affected part of the insulation was removed and revealed contamination in this part of the winding.

JEA, USA, case study

