

A Brief Summary of “Effect of Insulation Construction Bending on Stator Winding Failure”

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In this paper the electrical breakdown of inter conductor insulation of machines will be discussed. This problem avoids us to increase the nominal voltage of electrical machines; increasing the nominal voltage is a way to improve efficiency of using electrical energy.

1. INTRODUCTION

When a fault occur in operation of an asynchronous machine the main reason is hard to find out. This problem is because of:

- 1- The over voltage and over current or differential protection is too slow or not selective.
- 2- The manufactures usually do not talk about the insulation tests or short circuit fault tests.
- 3- The places which the fault can happen most, are not accessible or observable (There are some layouts of insulation which is covered the main copper conductor).

2. THE METHOD

Some important parameters of insulation qualities are: insulation resistance, polarization index, absorption factor, loss tangent ($\text{tg } \delta$), test voltage, breakdown voltage and partial discharge.

In this paper we discuss only about the location of breakdown and the value of breakdown voltage and the partial discharge.

3. THE EXPERIMENT

Many of samples searched for weak points in inter conductor insulation along the coil of a high voltage asynchronous machine. The experiment objects have lacquer-glass-glass-lacquer conductor insulation. These samples have not any outer layout of mica-resin polyester.

By optical devices it can be find out if this breakdown was outer one, and we supposed that if it was not an outer one it's an inner one.

The partial discharge was calculated by current measuring and converting the discharge current to voltage according the IEC 60270 standard.

Measurement uncertainty was less than 5% and all measurements, calibrations and calculations according to IEC standards and ISO recommendations.

4. RESULTS AND DISCUSSION

Radiuses of curvature at the edges and the type of insulations have effect on the insulation quality.

Edges of conductor profile are usually the weakest places and more than the 70% of breakdowns accrue on this area. This problem can be solved by increasing the radius of curvature of the edges and using more insulation on the edges.

Mechanical stress has bad effect on insulation quality parameters. Electrical breakdowns are more possible to accrue on places where the windings have more mechanical stresses and the insulation get weaker in these areas.

This problem can be solved by using a better insulation and improve the way of bending conductors and be careful.

To remove the weak points of insulation we can add the insulation to conductor after forming conductors.

For impregnation we should fill the spaces between the main conductors and the round edges as much as it's possible.

In this paper a parameter named 'K' has been defined and showing us the insulation quality. And its nominal value is 10. (For a very good insulation K is about 10).

5. CONCLUSION:

In this paper we used some important parameters like the ratio of rectangular profile sides (narrow/wide), and the radius of conductor bending to find the weak points of insulation.

The important tips in technical procedure are the methods of conductor bending and impregnation. To avoid the insulation damage should do the bending carefully. But for impregnation the empty spaces should fill enough.

References:

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