Tech Talk May 2012

Electric Motor "Hot Spots"

At the feet of this lovely lady lies the lamination stack of a 3 phase induction motor. Into this stack is inserted the ground insulation and the wire for the motor. The coils of wire are connected and the winding tied down and finally covered with varnish and baked. The stack,with winding, would then be inserted in the stator frame for later assembly with its rotor ,end bells and bearings to complete the electric motor.

Now you may look at the lamination stack and think it is a solid piece of steel. In fact this stack is made up of 100s of individual special steel laminations, called core plate, and there are approximately 45 laminations per inch of stack for 60 Hz service . Each lamination has an oxide coating and it is this oxide layer that effectively insulates each lamination from its neighbor. This oxide is imperative for the lamination stack to carry out its function. This oxide layer prevents what are called "eddy currents" from flowing. If this oxide layer is damaged and eddy currents flow, then wherever this occurs in the stack, extra heat will be developed and the efficiency of the electric motor will be reduced. This extra heat can be a big problem or a manageable problem depending on its source and extent. Wherever this excess heat is generated we call it a "hot spot" and at this place in the stack higher temperatures will be experienced, which will subject the winding at this place to this higher than designed temperature, which could lead to premature failure of the winding There are things the motor shop can do to reduce the heat where these hot spots occur but sometimes it is not economically feasible to do so. The important thing is to know if this condition is taking place.

Fortunately we have equipment, a core-loss tester, that can detect if this sort of damage has occurred. and it gives us a read-out in watts per pound (core loss). There are optimum values for this core loss which we need to have in order to have a successful long term repair.

To the left is a picture of a core loss test being carried out. The tester machine itself provides high current at low voltage to simulate operating conditions in the core. Flux, amperes and watts readings, and core dimensions are fed into the tester's computer system which calculates watts/lb (kg) of core loss (suggested maximum of 4 Watts/lb). With parameters for "bad" , "marginal" and "good" cores, the software generates a detailed printed core condition report. Localized damage is found by increasing the excitation level to reveal hot spots within the core.

Testing can occur with the winding in place or removed. Winding condition, motor flux density and lamination grade and thickness do not significantly affect the test results.
Core loss testing can be used on the core steel of stators, rotors and armatures.

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