Technical Bulletin WHAT IS CORE LOSS?

"Core Loss is a Waster of Energy and Destroyer of Motors"

Not all power applied to an electric motor is converted to work. Principal sources of energy waste include winding loss (I^2R), windage, friction, stray load loss and loss in stator, rotor and armature cores. Studies have shown that core loss is the first or second leading cause of energy waste in rewound motors, and can account for 25% or more of motor inefficiency depending on load conditions.

LEXSECO determined that the most important indication of core steel condition is the watts of electrical energy lost per pound (kilogram) of core steel when the core is excited to operating conditions. Common electrical grades of core steel have inherent Epstein test losses ranging from 1 to 2 watts per pound (kilogram) depending upon application. This value is increased by as much as a factor of 1.5 to 2 when this steel is punched and assembled into motor cores. This increase may be attributed to a combination of lamination punching or stamping burrs, lamination thickness, lamination clamping pressure, type of insulation coating used on the steel, heat treatment process used on punched laminations, lamination assembly method, silicon content and hardness of the steel, and heavy welds across the back of the core stacking.

Watts per pound (kilogram) core losses may be divided into hysteresis and eddy current losses. All cores experience some inherent loss. Increased loss results from physical damage or overheating during use or burnout of old windings. Core loss is dissipated in the form of heat and further degrades the core, causing greater core loss and more heat – a vicious cycle of rising operational temperature and inefficiency leading to premature motor failure. In DC armatures, core loss can cause commutator sparking and spotting, further impeding motor performance.

A significant percentage of motors have core loss exceeding statistical acceptability. Some special types, such as hermetic refrigeration and traction motors, suffer especially high losses. Moreover, government efficiency mandates make detecting sources of energy loss increasingly important.

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The critical importance of core testing has been acknowledged by preeminent technical authorities, such as the Engineering Committee of the Electrical Apparatus Service Association (EASA). EASA's Guidelines for Maintaining Motor Efficiency During Rebuilding require motor repairers to "Conduct a stator core test before and after stripping [the winding]." Core Testing reveals repairable problems. Testing before stripping avoids wasting time and money on a core which should be replaced. Testing afterward verifies that the stripping did not damage the core.

Why Test for Core Loss?

Core Loss Testing provides a quick and efficient method for determining core losses found in the core steel of stators, rotors, and armatures. LEXSECO recognizes that core loss is a significant cause of wasted electrical energy that can be caused by overheating during operation or during winding burnout, as well as from physical damage. Core loss is second only to copper loss in motor windings as a cause of motor inefficiency. Core loss testing is the only method of determining if a motor is capable of operating at rated efficiency after rebuilding.

LEXSECO performed thousands of tests on a wide range of motor and core types and created an extensive empirical test database when developing the Core Loss Tester. Moreover, LEXSECO studied and incorporated the electrical steel manufacturers' data in arriving at output and performance characteristics.

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