

General Motor Knowledge
Part 10

Leakage Current and Breakdown

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We have discussed hipot testing as a high voltage "proof-test" of our motors. During the discussion, we mentioned two terms "Leakage" or leakage current and "Breakdown". These terms are often loosely used and need to be examined further. The following is taken from the book, "Basic Facts About High Voltage Testing" written by Elmer C. Slaughter.

"LEAKAGE" is a flow of current, and some leakage exists in any motor for two reasons. First, every motor, by virtue of the fact that it is made of metal with windings in close proximity, exhibits what is called an "inherent capacity effect." This is actually a capacity and can be measured like any capacitor. If we apply AC voltage to a capacitor, current will flow. Second, additional leakage exists simply because no insulating material is perfect. This is generally referred to as resistive leakage as opposed to the leakage resulting from the inherent capacity of the motor.

Capacitive leakage is an inherent characteristic of a motor controlled primarily by design details. The resistive leakage is determined by the insulating materials used. Both vary with the test voltage applied, increasing as the voltage increases. In an average motor, leakage current due to inherent capacity is usually greater than the leakage current due to the high resistance of the insulating system.

Leakage becomes significant under two conditions. Any increase in resistive leakage is a "red flag" indicating that the quality of insulating materials has in some manner deteriorated. The total leakage, resistive plus capacitive, becomes significant if it reaches such a level that it can be felt by the user of the equipment.

"BREAKDOWN" is also a flow of current. However the term is used to denote an actual insulation failure. It is readily distinguishable from Leakage because the current does not vary with the applied voltage, but instead rises suddenly when the critical or "BREAKDOWN" voltage is reached. Often arcing is associated with breakdown but not always.

During our manufacturing process both "LEAKAGE" and "BREAKDOWN" tests are used. Next month we will discuss the differences and how these two tests can be combined.