

Single and Three Phase Transformer Testing; Using Static Motor Circuit Analysis Techniques

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Introduction

Field and shop testing of pole and pad mount transmission and distribution (T&D) transformers can be costly and time consuming. With the onset of utility generation deregulation across the country, T&D becomes a greater issue due to varying power demands and power quality. A simple test method for quickly and accurately testing the condition of T&D equipment is a necessity as, if a transformer fails, both the end user and generating facility will complain. Through the use of an existing technology, originally designed for motor winding testing, an initial transformer evaluation can be performed.

For conceptual reasons, consider that an AC induction electric motor is a transformer with a rotating secondary. In this way, the capabilities that static Motor Circuit Analysis (MCA) provides an electric motor can be extended to a transformer. These include detecting winding shorts, high resistance connections, open windings and insulation to ground fault detection as well as preliminary internal circuit impedance balance. Specific information on the transformer is not required for most applications of MCA because the test equipment is used as a winding comparator.

An MCA device which provides readings of resistance, impedance, inductance, phase angle and a special test called current/frequency response (I/F) has been applied to transformers, for the purposes of this paper. Because the test method is off-line, the MCA device generates its own voltage and frequency output. Therefore, the ALL-TEST IV PRO™ motor circuit analyzer (ATIV) was selected (*Editor- ALL-TEST PRO 5 is the recommended replacement for the ATIV*). This unit weighs less than 2 lbs, is handheld, and has a proven track record with AC/DC motors and generators from fractional to over 10 MW.

The first set of transformers tested included pole and pad mount transmission and distribution transformers from a few kVA to over 2500 kVA with primary voltage ratings of 480 Volts to 28.8kV. Following initial testing and analysis, procedures were developed to allow for general testing of any type of pole and pad mount transformer with a simple resistance greater than 0.001 Ohms. The results included the capability of testing the primary and secondary of any type of transformer in about 5 to 10 minutes with a greater than 99% success rate on either wet or dry-type transformers.

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