APPLICATION NOTE

Offline Dry-type Transformer Testing

Note 0602

Description

This application note is for general offline dry-type transformer testing using the MCEMAX. Tests are first performed on the high voltage side of the transformer (high side) and then performed on the low voltage side of the transformer (low side). This procedure is recommended for transformers that are about to be installed, warehoused, or removed from service. It is not recommended for transformers that have to be de-terminated (since connection issues are a leading cause of transformer failures), unless de-termination is standard practice for the facility incorporating this procedure. Should this procedure be incorporated for installed transformers, a method of completely isolating the transformer shall be considered a minimum requirement. Please refer to IEEE 389-1996 and ANSI C57 standards for transformer testing.

Test Considerations

CAUTION: Before proceeding with transformer testing, ensure the transformer is isolated from all components of the system. When testing on the high voltage (HV) side of the transformer, ensure all low voltage windings are shorted together (X1 to X2, etc.) and earth grounded using proper shorting strap techniques (bolted shorting straps). When testing on the low voltage (LV) side of the transformer, ensure all high voltage windings are shorted together (H1 to H2, etc.) and earth grounded using proper shorting techniques (bolted shorting straps). Failure to maintain a shorted condition while the tester is connected to the transformer may cause damage to the tester. See Table 2, Testing Different Transformer Configurations, on page 2.

Ensure the transformer temperature has stabilized. A transformer is considered stabilized when four readings taken at five minute intervals are within three degrees of each other.

For dry-type transformers, refer to manufacturer's recommendations to ensure proper drying techniques have been applied to the transformer before testing.

Procedure

1. Add the transformer to the Plant Layout as two AC Induction motors, one for the high voltage side and one for the low voltage side, giving each a unique name to identify the line and load side.
2. Using Table 1 shown on page 2, set the insulation resistance alarm level to below the recommended level for Alarm and to 1.5 times the recommended level for Caution (for example 1.5 x 5000 Megohms = 7500 Megohms).
3. Perform Standard Test using the following settings in the Test Setup:
   - Motor Test Location - Motor Leads highlighted or appropriate location
   - Low Limit Shutoff - Checked and 99 Megohms entered in text box. 99 Megohms is the highest value allowed by the WinVis software below the recommended minimum values for the KV class.
   - Appropriate winding test voltage as determined using the values from Table 1 on page 2.
   - Temperature: Enter the measured (stabilized) temperature of the transformer at the time of the test.
   - Charge time: 60 Seconds
   - Test Frequency: Start with 1200Hz. If the inductance is >250 mH, then use 300 Hz as the test frequency.
4. Perform Polarization Index (PI).
5. Perform Step Voltage test (2300V and below).
   - Step Voltage testing should immediately follow the PI test ***starting*** at the same voltage applied during the PI test.

   NOTE: After the PI or step voltage test, steps must be taken to properly discharge the circuit to ground for an extended period of time (four times as long as the previous charge time is recommended) to ensure the removal of stored energy.
6. Repeat from step 3 by highlighting the low voltage transformer side to test the other side.

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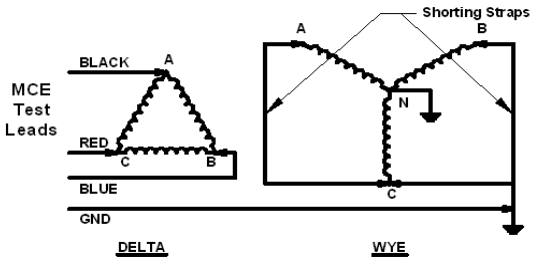
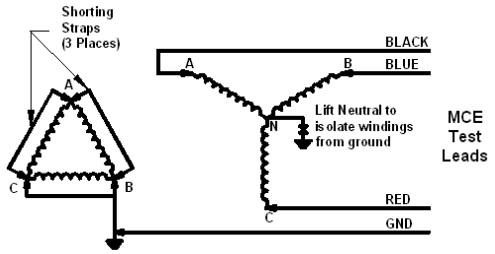
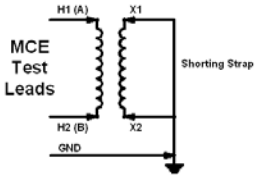
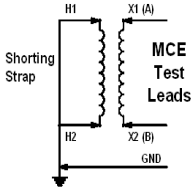
Table 1: PdMA Recommended Test Voltages and Values

Winding Voltage	DC Test Voltage	Minimum Insulation Resistance Value
<1000 Volts	500 Volts	100 Megohms
1000 to 2500 Volts	500 to 1000 Volts	5000 Megohms
2501 to 5000 Volts	1000 to 2500 Volts	5000 Megohms
5001 to 12000 Volts	2500 to 5000 Volts	5000 Megohms
>12000 Volts	5000 Volts	5000 Megohms

Table 2: Testing Different Transformer Configurations

	This figure shows the tester and shorting strap connections to make when testing a delta of a delta-wye transformer with a ground referenced neutral. In this figure, we do not show the reference to the high (HI, H2, H3) or low (X1, X2, X3) terminals because the required connections are not specific to either the high or low windings.
	This figure shows the test and shorting strap connections to make when testing a wye of a delta-wye transformer with a ground referenced neutral. In this figure we do not show the reference to the high or low terminals because the required connections are not specific to either the high or low windings.
	This figure shows the tester and shorting strap connections to make when testing the high side (H1-H2) of a single phase transformer. Note the low side (X1-X2) windings are shorted together and then to ground.
	This figure shows the tester and shorting strap connections to make when testing the low side (X1-X2) of a single phase transformer. Note the high side (H1-H2) windings are shorted together and then to ground.