SWEEP FREQUENCY RESPONSE ANALYSIS (SFRA)
A MAJOR ADVANCE
IN
TRANSFORMER CONDITION ANALYSIS

Transformer is no nuisance equipment. It is a static equipment and it works reliably unless it is abused. Transformers do not develop fault within itself, if maintained periodically as per manufacturer's recommendation.

However, the same transformer when subjected to external abnormalities, it can develop fault. Some of the reasons can be,

1.0 External Short Circuit in its downstream distribution system, which exerts tremendous electromagnetic forces on transformer windings. The winding can move radially or laterally and thus it weakens the mechanical structure of transformer. This creates a possibility of fault the next time transformer is subjected to external short circuit.

2.0 The physical displacement or damages either during earthquake, lightning or other environmental events.

It is difficult to see inside the transformer to detect the problem. It is also not easy to detank the transformer for internal inspection.

In above situation, why wait for problems to develop? To DIAGNOSE the problem, prevent expensive equipment breakdown and to take control of the equipment, the **technique of "Sweep Frequency Response Analysis (SFRA)"** can be employed to detect the faults in

a. Transformer core and

b. Winding movement

The SFRA test is non-intrusive (non-destructive) test. SFRA is an OFF line testing and it can be carried out for any voltage rating of Power Transformer, Generator Transformer and Distribution Transformer. The measurement of SFRA can be a part of regular transformer maintenance. The SFR Analyzer identifies the following abnormalities in the transformer before they lead to failure,

a. Core movement.
b. Winding deformation and displacement
c. Faulty Core ground
d. Partial winding collapse
e. Hoop buckling
f. Broken or loosened clamping structures
g. Shorted turns and open winding

The Technique of SFRA is a major advance in transformer condition monitoring analysis. This is a proven technique for making accurate and repeatable measurements.

The test can be carried out,

a. First to obtain initial signature (record) of the transformer Sweep frequency response for future reference / comparison.
b. Periodical measurement as a maintenance check, once in two years.
c. Immediately after a major external Short Circuit, specially for faults electrically closer to transformer.
d. Transportation or re-location of transformer.
e. Earthquakes.
f. Pre-commissioning check.

Power-Linker group is already working for condition monitoring and diagnostic analysis of Transformers, Generators, Motors etc. for past few years. The equipment of "Sweep Frequency analyzer" of Doble USA make, Type M5200. is available with POWER-LINKER to carry out this important test to detect any abnormalities within transformer. (For more information, log on to www.doble.com/products/m5200_sfra.html)

You may write to us for any of your requirement for SFRA test. For other Condition monitoring and diagnostic tests, which are being carried out by POWER-LINKER, you may refer ANNEXURE given below.

We now look forward to receiving your enquiry, if any for SFRA measurement.

ANNEXURE

LIST OF CONDITION MONITORING TESTS CARRIED OUT

BY

POWER-LINKER

Following diagnostic test are carried out by Power-Linker,

1.0 Generator Testing:

1.1 Stator Testing :

1.1.1 Insulation Resistance & Polarization Index

1.1.2 Capacitance & Tan Delta Test.

1.1.3 DC Winding Resistance

1.1.4 Optional: ELCID (Electromagnetic core imperfection detection test). This test is ND test and preferred, as compared to 'Stator core ring full flux test' which is DTesting.

1.1.5 Partial Discharge Measurement.

1.2 Rotor Testing :

1.2.1 IR value of main field winding at low voltage

1.2.2 DC Winding Resistance

1.2.3 Winding Impedance

1.2.4 RSO (Recurrent Surge Oscillograph by Reflectometer) test for detecting rotor interturn short or rotor earth fault.

1.3 Exciter Testing :

1.3.1 IR value Measurement at Low voltage for exciter Stator + Rotor.

1.3.2 DC Winding Resistance for Stator + Rotor.

1.3.3 Winding Impedance of Stator + Rotor.

1.3.4 Checking of Diodes + fuses.

2.0 Testing of Transformers :

2.1 IR, PI value measurement.

2.2 DC winding resistance

a) Primary winding on all taps.

b) Secondary winding.

2.3 Turns ratio measurement

2.4 Capacitance, tan delta measurement for

a) Primary winding.

b) Secondary winding.

c) Bushings.

2.5 Magnetic balance check.

2.6 SFRA: Sweep Frequency Response Analysis.

3.0 Testing of Motors :

3.1 Insulation Resistance & Polarization Index Measurement.

3.2 D.C. Winding Resistance Measurement

3.3 Partial Discharge Measurement

3.4 Capacitance Measurement & Tan Delta Measurement

3.5 RTD Checks.

4.0 Lightning Arrester :

On line checking of Lightning Arresters for 3rd harmonic current resistive component measurement.

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