Application Note

Why Do We Test OLTCs?

What is an On-Load Tap changer (OLTC)?

Tap changer is a device fitted to power transformers for regulation of the output voltage to required levels.

This is achieved by changing the ratio of transformers on the system by altering the number of turns in one winding of the appropriate transformer. Tap changers provide variable control to keep the supply voltage within limits. On-load tap changers generally consist of a diverter switch and a tap selector operating as a unit to effect transfer current from one voltage tap to the next.

The on-load tap changer (OLTC) allows change of the ratio while the transformer is in the service. This means that the transformer ratio can be changed while the transformer is still delivering power. The de-energized tap changer (DETC), also called off-load, requires that the tap changer is de-energized or disconnected during tap changes. In order to change taps, the transformer has to be taken out of service.

Why is It Necessary to Test OLTC?

On-load tap changer (OLTC) is a mechanical switching device which is the most expensive and vulnerable part of the power transformer. They cause more failures and outages than any other component of power transformers.

Failures are categorized as electrical, mechanical and thermal. Most of the failures are mechanical at the beginning and develop into electrical faults, mainly occurring due to contacts problems, transition resistors, and insulation breakdown. Repair or replacement of tap changer is very expensive. Therefore, they should regularly be tested in order to track their status and discover malfunctions in a timely manner.

What is the Reason for Static and Dynamic Resistance Measurement?

Static Resistance represents the sum of resistances of all internal contacts (diverter switch contacts + tap selector switch + connection clamps) + the winding resistance. By measuring the static winding resistance over all taps, up- and down, it is possible to detect defective contacts of the OLTC. Dynamic resistance represents the change of resistance during the transition from one position of tap to another (from tap to tap). The DVtest (dynamic resistance measurement) is the test current measured and recorded with high sampling rate during transitions and displayed as a graph.

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Two relevant factors which describe dynamic resistance are test current ripple and transition time. The current ripple is the current change which occurs during the transition from one tap position to another. The transition time is the total duration of the tap transition.

How is the OLTC Analysis Performed?

It is possible to detect tap changer switching problems by analyzing a graph which represents dynamic resistance during tap changes when the RMO-T device is controlled by the DV-Win software. The transition time from one position of tap changer to another (from tap to tap) is displayed on the horizontal axis of the DVtest diagram. The test current is shown on the vertical axis. Important parameters which can be obtained from the graph using markers provided are the transition time and difference between test currents (current ripple between two transitions). It is possible to magnify a part of the graph of interest to be analyzed.

One major advantage of using the RMO-T for OLTC testing is the fact that the transformer does not need to be charged and then discharged for each tap position. This significantly reduces the measuring time necessary for the tap changer test.

How are the Results Interpreted?

Comparison with ‘’fingerprint’’ results, which were taken when the unit was in a known (good) condition, and comparing with other phases, allows for an efficient analysis. The shape of the DVtest graph depends on a particular transformer and OLTC design, so it is always recommended to compare results obtained from the same unit with previous measurements.

It is also possible to compare the graphs of individual transitions to each other and among different phases and to look for significant deviations.

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