GUIDE FOR TESTING POWER TRANSFORMERS

Type test & Special test

Introduction

Type test

Unless otherwise specified, the following type tests, when required, shall be performed on one transformer for each constructional tipology :

- Lightning impulse test
- Temperature rise test

Special tests

Unless otherwise agreed, the following special tests shall be performed, when required, on one transformer for each constructional tipology :

- Measurement of sound level
- Short-circuit withstand test
- Zero-sequence impedante measurement
- Condensation test
- Condensation and humidity penetration test
- Low-temperature test
- Heating-shock test at –5°C
- Heating-shock test at –25°C

1 Type tests

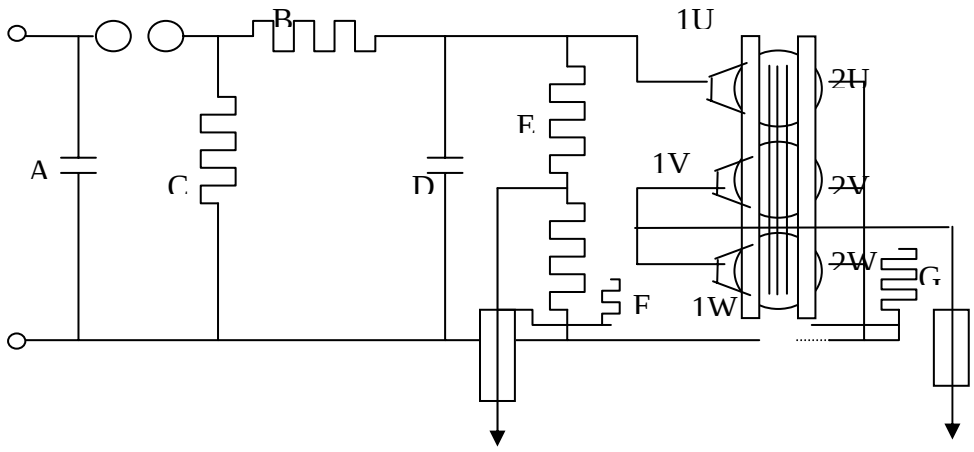
1.1 Lightning impulse test

The voltage test shall be in accordance with List 1 or List 2 of Table no.5 of IEC Standards 60076-4, depending on the insulation level of the transformer. The test impulse shall be a full standard lightning impulse :

1,2 μs ± 30% 50 μs ± 20%

The test voltage shall normally be of negative polarity. The circuit of the generator and the measuring connections must remain unchanged during calibration and during full voltage tests, The test sequence per line terminal shall be one calibration impulse at a voltage included between 50% and 75% of the full voltage, followed by three impulses at full voltage. During a test on a line terminal, the remaining line terminals are earthed (either solidly or through low impedance). During the calibration and during the tests, an oscilloscope shall clearly record the wave shape of the impulses (duration of the front, duration up to half-value). The test is successful if there are not significant differences in the records of current.

CONNECTION SCHEME



1.2. Temperature rise test

The test is for verifying whether the temperature rise limits of the windings , as agreed at the time of the enquiry, are respected. The test can be carried out by means of two different methods:

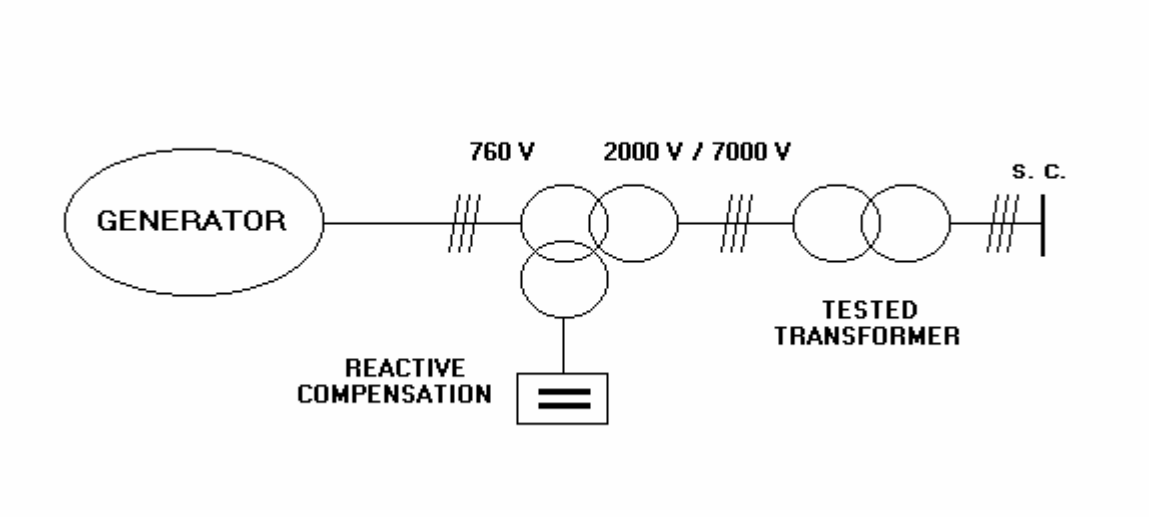
- Simulated loading method (in accordance with. IEC 60726 p.21.1.3)
- The method used is defined at the time of the enquiry.

The average temperature rise shall be determined by means of the variation of winding resistance. The core temperature rise shall be determined by use of a thermometer. All the carries at rated conditions shall be performed in accordance with IEC 60726.

Simulated loading method

Temperature rise test is made by utilising the rises obtained on two tests, one with no-load loss only, and one with load-loss only.
The no-load test, at the rated voltage and rated frequency, is continued until steady state conditions are obtained; individual winding temperature rises are then calculated by measurement of hot windings resistance, that shall be carried out as shortly as possible after disconnection. The short.circuit run with rated current flowing in one winding and the other winding short-circuited, is started immediately following the no-lpad run, and continued until steady state conditions are obtained; individual windings temperature rises are then calculated as above mentioned. The total winding temperature rise of each winding, with rated current in the winding and normal exitation of the core, shall be calculated in accordance with IEC Standards 60726.

CONNECTION SCHEME

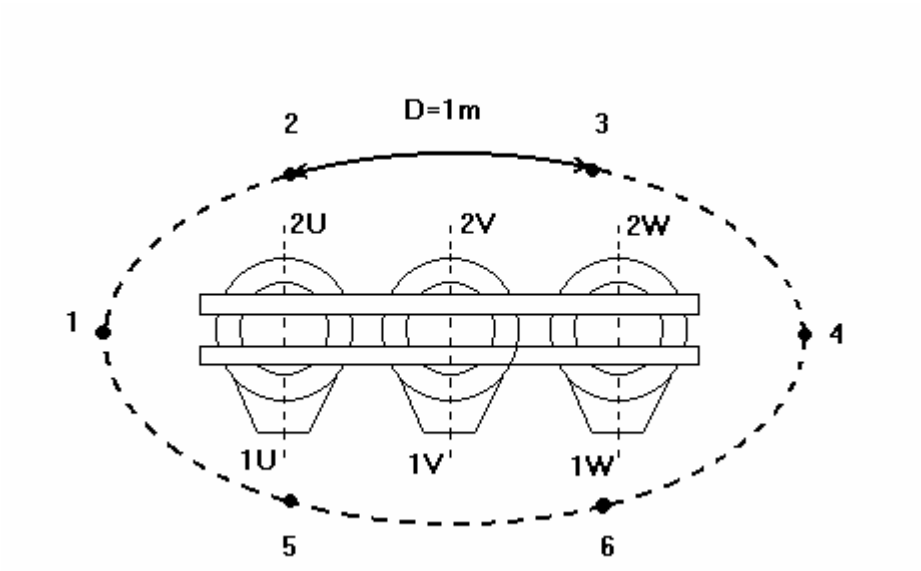


2 Special test

2.1 Measurement of sound level

The test procedure is in accordance with IEC Standard 60076-10.
At first, the background noise level shall be measured. Then, the transformer shall be powered at rated voltage and frequency under no-load conditions (with the tap-changer selected on the principal tapping), in order to carry out transformer noise level measurements.
They shall be performed in several points located around the transformer, placed at a distance of 0,3 m from the machine unless, due to safety reasons or following agreement between supplier and purchaser, the distance is increased to 1m. Measuring positions shall be spaced at a distance of at most 1 metre one from another; anyway, a minimum of 6 positions is required. The measurements shall be carried out at half the equipment height, if this does not exceed 2,5m; otherwise, they shall be performed at 1/3 and 2/3 of the component height.
After performing transformer sound level measurement, the machine is de-energised and background noise level is measured again; At the end, the final transformer sound level shall result by applying a correction by taking into account the lower background noise level. In case there is a high difference between the transformer and background noise level (>8 dB) no correction shall be applied.

CONNECTIONN SCHEME



2.2 Short-circuit withstand test

The test shall be performed in accordance with IEC Standards 60076-5 in external laboratories.

2.3 Zero sequence impedance measurement

This test can be performed if either of the windings is either star connected or zig-zag connected, with accessible neutral conductor. When the neutral is not accessible, zero sequence impedance is infinite.
In case of two windings star-delta connected , zero-sequence impedance shall be measured on the star-connected winding and it will result approximately equal to short-circuit impedance, whose determination is described in par. 5.1.3. Zero- sequence impedance shall be measured by applying a single-phase voltage at rated frequency between the terminals of the winding under test, short-circuited, and the neutral.

2.4 Condensation test

The test shall be performed in accordance with attachment ZA of HD 538 Standards in external laboratories.

2.5 Condensation and humidity penetration test

The test shall be performed in accordance with attachment ZA of HD 538 Standards in external laboratories.

2.6 Low-temperature test

The test shall be performed in accordance with attachment ZB of HD 538 Standards.

2.7 Heating-shock test (-5 °C ; -25 °C)

The test shall be performed in accordance with attachment ZB of HD 538 Standards.

2.8 Fire-behaviour test

The test shall be performed in accordance with HD 464 S1/A3, in external laboratories.