

Switching Impulse Test of the Transformer



Switching Impulse Test of the Transformer (on photo Mississippi State University High Voltage Laboratory as University Research Center)

Purpose of the Test

The switching impulse test is applied to confirm the ***withstand of the transformer's insulation*** against excessive voltages occurring during switching. During switching impulse voltage test, the insulation between windings and between winding and earth and withstand between different terminals is checked.

The purpose of the switching impulse test as **special test** is to secure that the insulations between windings, between windings and earth, between line terminals and earth and between different terminals withstand the **switching overvoltages**, which may occur in service.

The switching impulse voltage is generated in conventional impulse voltage generators at the laboratories.

The polarity of the voltage is negative and the voltage waveform should normally be $T_1/T_d/T_220/200/500 \mu\text{s}$ (figure 2) according to **IEC 60076-3**.

Due to over-saturation of the core during switching impulse test, a few low amplitude, reverse polarity (e.g. positive) impulses are applied after each test impulse in order to reset the transformer core to its starting condition (demagnetised). By this way, the next impulse voltage waveform is applied. The tap position of the transformer during test is determined according to test conditions.

The **on-off impulse voltages** are applied to each high voltage terminal sequentially.

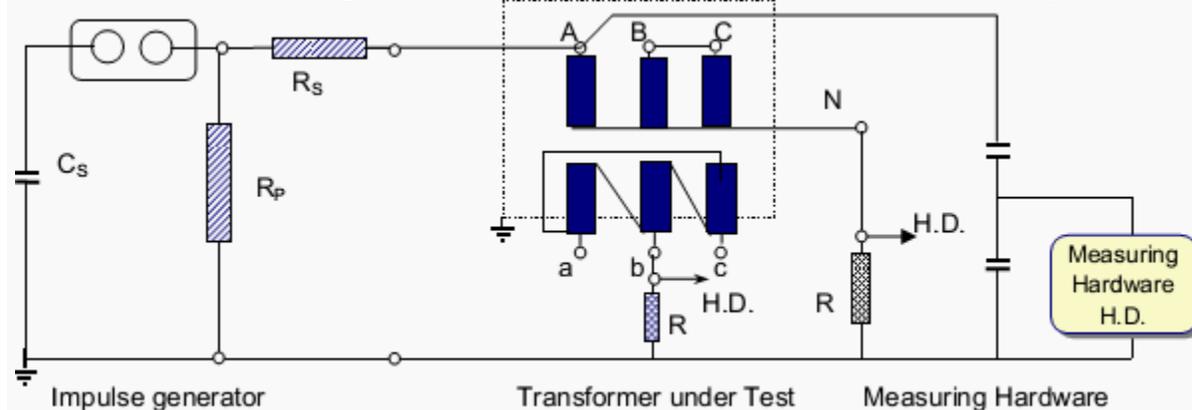


Figure 1 - Switching on-off impulse test connection diagram

Meanwhile, the neutral terminal is earthed. The windings which are not under test are left open (*earthed at one point*). This connection is similar to the induced voltage test connection. The voltage distribution on the winding is linear like the induced voltage test and the voltage amplitudes at the un-impulsed windings are induced according to the turn ratio.

Meanwhile, necessary arrangements should be made since the voltage between phases will be **1,5 times the phase-neutral voltage**.

The test circuit connections of three phase transformers depend on; **structure of the core** (*three or five legged*), the voltage level between phases and the open or closed state of the delta winding (*if any*). At first, a voltage with 50 % decreased value is used at the tests, then impulse voltages at full values and at numbers given in standards are used. The peak value of the voltage is measured.

The change of the voltage waveform and winding current are measured with a special measuring instrument and recorded. The negativities in the transformer during the test are determined by comparing the voltage and current oscillograms.

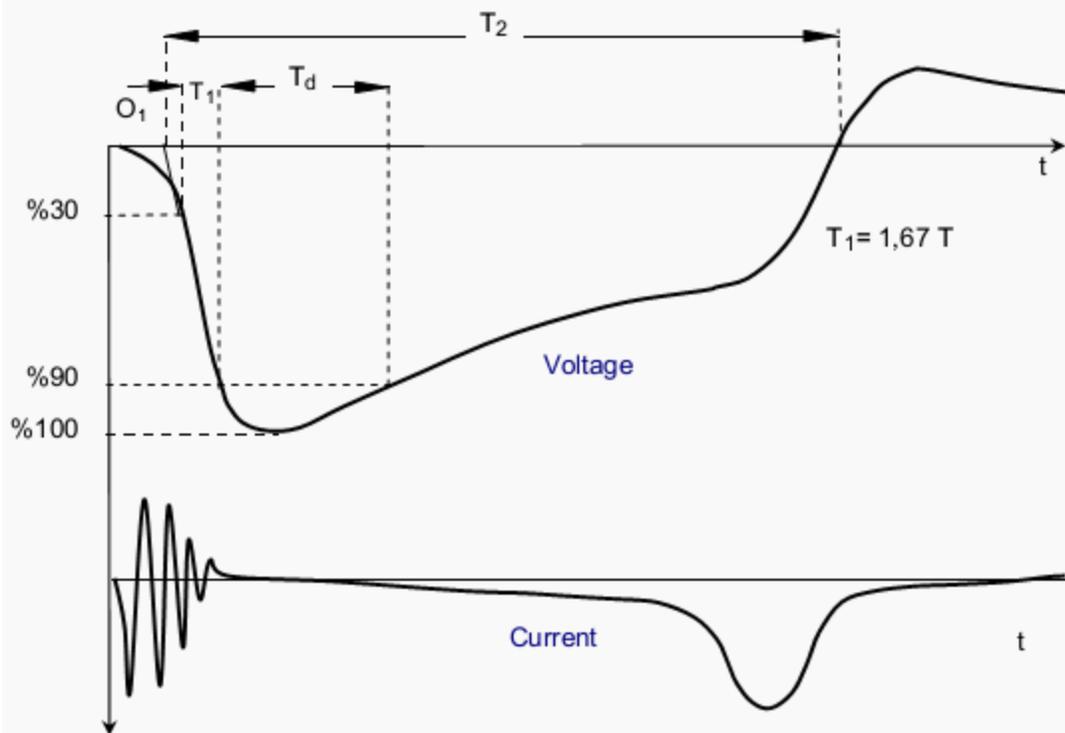


Figure 2 - Switching impulse voltage waveform

The sudden collapses of the voltage ([surges](#)) and abnormal sounds show deformation of the insulation in the transformer. The deformation of the voltage waveform and increase in noise due to magnetic saturation of the core should not be considered as fault.

The test voltage values, impulse shapes, and number of impulses at different voltage levels must be stated in the report.

Switching Impulse Voltage Waveform :

Front : $T_1 \geq 100 \mu S = 1,67 T$

90% value : $T_d \geq 200 \mu S$

Time for cutting the axis : $T_2 \geq 500 \mu S$

Resource: Transformer tests – BALIKESİR ELEKTROMEKANİK SANAYİTESİSLERİA.Ş.

Source:

<http://electrical-engineering-portal.com/switching-impulse-test-of-the-transformer>