

Standard Tests

The following tests will be made on all Secondary Substation Transformers except as specifically stated below. All tests will be made in accordance with the latest revision of:

IEEE C57.12.00 Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

ANSI/IEEE C57.12.90 Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.

ANSI/IEEE C57.12.01 General requirements for Dry-Type Distribution and Power Transformers Including Those With Solid Cast and/or Resin-Encapsulated Windings

IEEE C57.12.91 Test Code for Dry-Type Distribution and Power Transformers.

ANSI/IEEE C57.94 Recommended Practice for Installation, Application, Operation and Maintenance of Dry-Type General Purpose Distribution and Power Transformers.

NEMA Publication TR-1, Part 9 Audible Sound Level Tests

Test equipment is periodically calibrated which can be tied to the National Bureau of Standards and Technology (NIST)

Resistance Test

This test is performed to calculate the I^2R losses of the transformer as well as assure the winding conductor sizes, cable sizes, crimps, brazes, and bolted bushing connections are correct. Resistance measurements are made on all windings connected for rated operation and on all odd numbered tap positions (must include rated and tap extremes). Current can not have been applied to the transformer for at least 6 hours prior to the test. All winding resistance measurements are corrected to a standard reference temperature of rated temperature plus 20°C.

Polarity & Phase Relation

Polarity and phase relation are of importance when paralleling or banking two or more transformers. Phase relationship tests are made to determine angular displacement and relative phase sequence. The present ANSI standard for angular displacement has the HV 30 degrees ahead of the LV, regardless of the connection.

Turn Ratio Test

Turn ratio test confirms the correct number of turns of each winding. The test is performed on the rated voltage connection and on all tap connections at no load conditions. Accuracy must be within 0.5% of nameplate markings.

No-Load Loss & Exciting Current

No load losses are the losses of a transformer when excited at rated voltage and frequency, while not under load conditions. No load losses include core loss, dielectric loss, and loss in the winding due to exciting current. The test is performed at rated voltage.

Impedance and Load-Loss Tests

A transformer under load, experiences an impedance which causes the ratio of the terminal voltages to depart from the actual turns ratio. This internal impedance consists of two components: 1) a reactance, derived from the effect of leakage flux in the winding, and 2) an equivalent resistance which represents all losses traceable to the flow of the load current (I^2R , Stray, and Eddie Loss). The voltage required to circulate rated current under short circuit conditions when connected to the rated voltage tap is the impedance voltage, and the watt loss measured is the load loss. The standard tolerances by which the impedance may vary are $\pm 7.5\%$ of specified values for two-winding transformers and $\pm 10\%$ for multi-winding, auto, or other non-standard transformers.

Dielectric Tests

Dielectric tests confirms the transformers ability to withstand the imposition of voltage associated with the specified insulation level.

Applied Potential Test

Tests are performed between each independent winding and all windings and ground. A normal power frequency of 60 Hz is used and the duration of the test is one minute at the specified voltage.

Induced Potential Test

A specified test voltage is applied between the terminals of one winding for 7,200 cycles or 60 seconds, whichever is shorter. The test applies greater than rated voltage per turn to the transformer, the frequency of the applied voltage must be high enough to prevent the core from being over-excited.

GE Quality Tests:

A Quality Control Partial Discharge Test is conducted on each Cast Coil Transformer. Information is available for review in Rome but not included on Test Reports.

A Quality Control Impulse Test for the rated BIL is conducted on all Dry-Type (Cast Coil and VPI) Transformers as a pass-fail test. No record of this test is provided on the Test Report

Optional Tests

Insulation Power Factor Test

The tests checks the condition of the insulation. The test checks the ratio of the power dissipated in the insulation in watts to the product of the effective voltage and current in volt-amperes. Comparative values of tests taken at periodic intervals are useful in identifying potential problems rather than an absolute value of insulation power factor.

Temperature Test

Tests will be made on one unit only of an order covering one or more units of a given rating. Tests will be made only when there is not available a record of a temperature test, made in accordance with ANSI Standards, on a duplicate or essentially duplicate unit. Tests, when made, will be made under conditions specified in ANSI Standards for Transformers.

Subject to the limitations of the preceding paragraph, when a transformer is supplied with auxiliary cooling equipment to provide more than one KVA rating, Temperature tests will be made on the self cooled nameplate KVA rating and the maximum nameplate rating.

The transformer will be tested under loaded conditions to produce losses as near to nameplate rating as possible. Thermocouples are installed inside the transformer. Once the thermocouples do not vary more than 2°C during a consecutive 3 hour period from ambient, the test current and voltage are removed and resistance measurements are taken from the HV and LV windings. The resistance of each of the HV and LV windings are corrected back to the instant of shutdown by plotting a time curve on one of the HV windings. The average winding temperature rise is determined by the change of resistance method from equations listed in ANSI/IEEE C57.12. 91.

This test is performed to determine the insulation resistance from individual windings to ground, or between individual windings.

Impulse Test

Lightning Impulse Test are design tests which simulates the most drastic overvoltage conditions a transformer properly protected by surge arresters is likely to encounter. The impulse tests precede the low-frequency applied and induced-voltage tests. For Dry-Type and Cast Coil transformers a 1.2x50 microsecond (μ s) wave of positive polarity is used for reduced and full-impulse tests. We apply one reduced full wave, two chopped waves, and one full wave to each of the specified HV and/or LV terminals. We compare the wave shapes of the reduced and full wave tests to confirm no possible insulation failure.

Audible Sound-Level Test

Sound level measurements are made in an environment having an ambient level of at least 5 dB below the combined level of the transformer plus ambient. Microphones are placed at half height approximately every three feet around the transformer enclosure with a minimum of eight microphones required. For transformers enclosures over eight feet in height, microphones are placed at one-third and two-thirds heights. The A-weighted sound level is determined by taking the arithmetic mean of all the sound level measurements taken.

Optional BIL Tests

Basic Impulse Level tests are performed which are greater than nameplate BIL.

Certified Test Reports

Standard ANSI format test reports will be furnished.

Insulation Resistance Test (Megger)