



Instrument Transformers

Ratio Acceptance Testing in the Field for Medium and High Voltage Instrument Transformers

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For voltage transformers rated from 5kV to 500kV, ratio testing in the field is completed to check that the unit is labeled correctly from the supplier, and that the nameplate ratio agrees to the marked ratio on the VT body. The addition and usage of digital output TTR testers in the field has led to a misunderstanding of the TTR results between field acceptance testing and factory level routine testing.

Voltage Transformers (VTs) used in revenue metering and relay-protection applications are typically provided with 0.3% or 0.15% accuracy class. VTs are designed and routine tested at the factory for the stated accuracy class for zero- and full-burden ratings at 90%, 100% and 110% of the nominal voltage rating according to IEEE C57.13. Additionally, turns compensation methods are used during manufacturing of the VTs to compensate for expected errors at 90% and 110% ratings.

Field acceptance testing of VTs often includes a ratio test. The ratio test is completed with portable TTR equipment where the TTR applies a known voltage to the primary terminals and measures the corresponding output voltage at the secondary terminals of the VT. Typically, the TTR equipment applies 8V, 40V or 80V for the test.

The TTR applied voltage (< 100V) is not adequate enough to fully excite the VT core to verify the accuracy of the unit. More accurate results are obtained as a higher voltage is applied to the primary winding. Additionally, because the operating flux of the VT core is so low due to the low applied testing voltage, it is not uncommon to see a fairly wide variance between similar units as the core performance in this region of the B-H curve can be quite different from one unit to the next. It is not uncommon to see multiple units with different results when doing group testing in the field. It may be necessary to apply several thousand volts to obtain an accurate ratio measurement.

Ritz recommends using a tolerance of +/-3% to the marked turns ratio for field tests when using low-voltage TTR testers on VTs. The tolerance of 3% is sufficient to cover field testing of VTs up to 500kV with applied voltage below 100V.

If the desire is to perform a true accuracy test to prove that the VT is accurate to standard, then a calibrated VT accuracy lab to measure ratio and phase angle error and zero and max burden at rated 90-100-110% primary voltage would be required.