

GUIDANCE ON THE RECOMMENDED COMMISSIONING TESTS OF TRENCH CVTS AND INTERPRETATION OF FIELD TEST RESULTS

As part of commissioning tests of CVTs Trench recommends utilities to perform measurements of **capacitance**, **power factor** and **ratio verification tests** on all CVTs before the units are put in service. The instrumentation provided by Doble is the instrumentation of preference to do these measurements.

The **capacitance** and **power factor** measurements stamped on the nameplate of the CVTs are from measurements performed at rated voltage of the CVTs typically at 800 Volts per capacitor element. When comparing **capacitance** and **power factor** measurements performed during commissioning of CVTs with the values stamped on the nameplate of the CVTs it is common for these set of measurements to differ to some extent. These discrepancies are primarily the result of differences in the calibration of instrumentation (Doble's vs Factory instrumentation) and test conditions - difference in temperature, test voltages etc.

Trench CVTs are equipped capacitor sections insulated with polypropylene film / Kraft paper and PXE synthetic oil. This insulation has its own characteristics- when tested at relatively lower voltage, which is the case with the field measurements, this insulation produces higher **power factor** measurements. This tendency is more noticeable after the CVTs have been placed in storage for a considerable amount of time. It is common for these capacitors to produce a **power factor** measurement $>0.3\%$ when tested at relatively low voltage

Interpretation of Commissioning Test Results Performed in the Field:

(1) Power factor measurements

When measuring the **power factor** of the intermediate capacitor (C2) of CVTs at 2kV, as the test voltage per capacitor element is higher than the test level per element on the C1-1 test, the **power factor** of C2 is normally lower than that of C1-1. As guidance for field testing crews, by taking into consideration the different test conditions, the measured **power factor** of C2 shall be lower than 0.35%. Trench shall be contacted if the **power factor** of C2 is higher than 0.35%

(2) Capacitance measurements

With regards to **capacitance**, Trench recommends the measurement of **capacitance** before new CVTs are put in service and use this value as a benchmark for comparison for future measurements. Subsequent **capacitance** measurements shall be within 1% from the first measurement performed during commissioning of the CVT.

As far as comparing field test measurements of **capacitance** with the **capacitance** values stamped on the nameplate of the CVT, by taking into account the different test conditions of field test vs factory tests, the field measurements shall be within 2% from the **capacitance** values stamped on the nameplate of the CVTs

(3) Ratio tests on completely assembled CVTs

The transformer **ratio** verification tests shall be done using the 10 kV Doble test set capability by applying 10 kV on the primary of CVTs and measuring the secondary voltage. The purpose of this test is to verify the continuity of the CVT circuit and it is not intended to be an accuracy test of the CVT. Based on Trench experience, it is possible to produce **ratios** which are within (+/-) 3% from **nominal ratio** of the CVT using precision instrumentation.

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