

Application: Motor & Generator Coil HV Testing



Application Description

Your specification says that after rewind, the coils must be hipoted, or **Withstand tested**. What is the test voltage and duration? Is it specified or is there an IEEE or ANSI standard referenced. Does the test require **DC voltage or AC voltage**? If it's a DC test you can use a 5 - 10 mA, 50 - 60 kVdc hipot. If an AC test is specified, what size hipot is needed? Do you know the current draw at the AC test voltage or the winding capacitance? **How about using VLF**? Maybe a **Power Factor** or **Partial Discharge** test is speced.

Selecting the HV Tester Needed

DC Voltage Test: If DC voltage is to be used, the selection of a hipot is easy. The test voltage should be known, to select a model that meets it, and a current rating of 5 mA or 10 mA should be adequate. For most motor shops that rewind coils up to 15 kV rating, a 60 kVdc model is fine. (**Tech Note:** DC voltage hipotting is not a very effective test on coils. The voltage does not distribute evenly across all turns and the leakage current readings do not represent the true characteristics of the coil, and other limitations.) DC is needed for **Insulation Resistance (IR)** testing, but **not for "Withstand or Hipot"** testing.

AC Voltage Test: After initial manufacture or major rewind, an **AC Withstand** test is done as a certification test of the coil. Only an AC test can truly verify the integrity of the coils as they are stressed under operating conditions. This test usually applies an over-voltage of twice the normal line to line operating voltage plus 1 kVac, or **2U + 1 kV for 60 seconds**. It is a simple **pass/fail** test, where the coil either holds the voltage or fails/arcs should there be a defect. This test is often performed during the winding of the coil and again on the finished coil to test the integrity of the stator bars insulation and other materials within.

Power Factor/Tan Delta & Partial Discharge testing: To perform these tests, an AC voltage hipot is needed to apply the over-voltage to the coil while the measurements are taken. The test voltage is usually limited to about 1.5 times the normal coil voltage.

Tech Note - AC testing: The voltage rating is known, but what is the current output needed from the hipot? The current draw by the coils must be known to size the test set. It can be very high when hipotting large, highly capacitive coils. **To find out, refer to past similar tests, or test at a lower voltage and linearly scale up the mA's, or calculate the capacitance, or if the capacitance is known, calculate the amps directly:** $Amps = 2\pi f CV$ $f = \text{frequency in Hz}$ $C = \text{load capacitance in farads}$ $V = \text{test voltage in volts}$

VLF AC Testing: Use **VLF AC hipots** when the capacitance of the load is so high that a prohibitively large, expensive, and powerful 50/60 Hz AC hipot would be needed. Operating with a **0.1 Hz output rather than 60 Hz, it takes 600 times less current** to charge the capacitance of a coil or cable. Used for cable testing for decades, VLF hipots should be used more for coil testing. A 100 lb. \$15,000 VLF unit replaces a 10,000 lb. 50/60 Hz AC test set costing \$200,000.00. Both Tan Delta and Partial Discharge testing are also performed using VLF. VLF used for rotating machinery is defined by the standard **IEEE 433-2012**, first published in 1974.

HVI Product Solutions Power Frequency AC Hipots - Very Low Frequency (VLF) AC Hipots - DC Hipots - TD/PF/PD

High Voltage, Inc. AC Dielectric Test Sets & VLF AC Technology: The models shown are designed to test motors & generators with voltages rated from 2.4 kV – 25 kV. Their load capacities are based on capacitive values commonly encountered. Many more models are available in many sizes and control configurations. Various TD and PD accessories are available. One DC hipot is shown and one **VLF model with a Tan Delta option**. All model series are available in higher voltage and power ratings.

 All HVI Products are
Made in the USA

PFT Series

Standard AC Hipots



10 - 100 kVac
1 kVA - 3 kVA

HPA Series

Up to 40 kVA - Enhanced Controls - Custom Made - Low PD Output



Test Coils Rated 15 kV
Corona <5 pc

0 - 50 kVac @ 150 mA



Traction Motor
AC Testing

0-3 kVac, 1 A
0-5 kVac, 1 A

Test Coils
Rated to 5 kV

0-10 kVac, 1 A
Auto Controls



HPA Series

Test Coils rated 25 kVac

0 - 30 kVac @ 0.67 A, 20 kVA

0 - 60 kVac @ 0.33 A, 20 kVA

Corona free



Very Low Frequency AC & Tan Delta

AC Withstand & Tan Delta/Power Factor

VLF Series

Test 15 kV coils
with VLF 0.1 Hz



TD
0 - 34 kVac VLF
0.1 Hz @ 1.0 uF
& 0 - 34 kVdc



★ **FPA Series**
Test Stator Coils
For 6 kV coil apps:
The "StatorRator12"

0-6.0 kVac @ 1.0 A
0-12 kVac @ 0.5 A

PTS Series DC Hipots

Hipot &
Megohmmeter

20 - 600 kVdc
5 - 10 mAdc

