LEARNING CENTER

VLF / AC / RESONANT / DC

IEEE 433-2022 Std. & 0.10 Hz. VLF AC Testing

AC Overvoltage Withstand, Tan Delta, & PD Testing

IEEE Std 433™- 2022

(Revision of IEEE Std 433-2009 & 433-1974)

KNOW THE NEW STANDARD

VLF = VERY LOW FREQUENCY

0.10 Hz. AC HIGH VOLTAGE

IEEE Recommended Practice for Insulation Testing of AC Electric Machinery with High Voltage Ratings up to 30 kV at Very Low Frequency.

Developed by the Electric Machinery Committee of the IEEE Power and Energy Society

Approved 9 February 2022 IEEE SA Standards Board

IEEE Recommended Practice for Insulation Testing of AC Electric Machinery with High Voltage Rating up to 30 kV at Very Low Frequency IEEE Std 433-2022

IEEE400.2-2019 Standard for MV Cable Testing, Including Tan Delta.

VLF TESTING MOTORS & GENERATORS

Voltages: 50/60 Hz. vs. DC vs. 0.01 Hz.

Test Voltages for DC & VLF ≠ 50/60 Hz. Levels

IEEE Standard 433-2013 permits the use of VLF 0.10 Hz. voltage for testing coils if the peak test voltage is **63% higher (1.63x)** than the 50/60 Hz. rms levels now in use. This ensures equal test voltage stresses at the different frequencies.

50/60 Hz. rms x 1.63 = 0.10 Hz. VLF peak Test Voltage

V_{rms} x 1.414 = V_{peak} x 1.15 (extra VLF voltage needed) = 1.63 x V_{rms}

V_{rms} x 1.63 = V_{peak} equivalent test voltage @ ≤ 0.10 Hz.

Example for a 6000 V coil

50/60 Hz. test voltage = 2Uo + 1 kV = 13 kVac for new coil; ~ **10 kVac** for rewind.

Using VLF: 10 kVac rms x 1.63 = **16.3 kVac** peak test voltage @ 0.1 Hz.

Capacitance of load must be known to size the tester's power rating.

Table A.1 (433-2022) High voltage withstand test for 1 min.

	50/60 Hz. rms	DC	0.10 Hz. (crest)
Test voltage	V	1.7 V	1.63 V
End turn stress	Little of end turn stressed	Most of end turn stressed	Intermediate between 60 Hz and DC
# of bursts of ionization (in voids)	7200	Few	12

Note: Most VLF instruments display the peak voltage output, not rms

VLF 0.10 Hz. HIGH VOLTAGE TESTING MOTORS / GENERATORS / CABLES

IEEE 433-2022

Defines VLF AC 0.10 Hz. Testing For Rotating Machinery up to 30 kVac

IEEE 400.2-2013

Defines VLF AC 0.10 Hz. Testing For MV Shielded Power Cable up to 69 kVac

OFF-LINE, OVER-VOLTAGE AC TESTING

- Off-Line Withstand/Proof Testing
- Partial Discharge Testing
- Tan Delta (TD)/Dissipation Factor Testing

"If You Really Want to Know Your Insulations Condition"