Application: Cable Testing using VLF AC Hipots

All HVI Products are Made in the USA

Application Description

What are you going to use? You have to perform an **Acceptance test** on medium voltage cable. Maybe you have to **Tan Delta** or **Partial Discharge** test a group of cables. If you're unfamiliar with testing medium voltage cable, then your first lesson is this: you most likely can't use a conventional 50/60 Hz hipot. The typical AC hipot, like the 50 kVac @ 3 kVA model PFT-503CM you may have bought for testing vacuum bottles and SG, will test only about 20 feet of 15 kV cable due to the high load capacitance. A **DC voltage test is unacceptable** by most, as not only does DC tell little about the AC integrity of solid dielectric cable and its accessories, but it has been shown to program cable for failure due to its polarization of space charges. Your other, and practically speaking, only option is to use a **Very Low Frequency (VLF) AC hipot.**

What is a VLF hipot? A VLF hipot is simply an AC output instrument except that **it produces a 0.10 – 0.01 Hz output**, rather than the 50/60 Hz output of a conventional AC hipot. Why? The **lower the frequency** of the voltage applied to a capacitor the **lower the charging current** every half cycle. **VLF AC Hipots** are used when **AC testing high capacitance loads** like cables and rotating machinery. Power cables are constructed essentially like capacitors and can have a high µF rating. At 60 Hz, the cable must charge to full voltage in just **4.2 milliseconds** (0 - 90° of the sinewave.). At 0.1 Hz, it takes **2.5 seconds** to reach peak voltage, requiring **600 times less current and power than at 60 Hz.** IEEE, IEC, and other standards exist for VLF.

The Acceptance/Withstand Test

A VLF Withstand, or stress test, is a go/no-go or pass/fail overvoltage test. Can the cable hold the test voltage? **That is the point of the VLF test: let severe defects or installation errors fail during the test rather than when in-service.** To perform the test, a designated voltage is applied for a predetermined length of time. The test voltage is usually 2 – 3 times the normal operating voltage. If a defect is severe enough to begin partial discharge under the test voltage stress, it normally fails within the designated test time. That is why the test duration is set where it is. **Minor defects and areas of good insulation that are not triggered into PD under the test voltage are unaffected by the test.** The **IEEE Standard 400.2-2013,** first published in 2002, defines VLF cable testing and **VLF Tangent Delta testing**. VLF is also be used for **TD and PD diagnostic testing**.

IEEE 400.2-2013 VLF Test Voltage Levels

Cable Rating	Installation	Acceptance	Maintenance
phase to phase	phase to ground	phase to ground	phase to ground
kV rms	kV rms (kV pk)	kV rms (kV pk)	kV rms (kV pk)
5	9 (13)	10 (14)	7 (10)
8	11 (16)	13 (18)	10 (14)
15	19 (27)	21 (30)	16 (22)
25	29 (41)	32 (45)	24 (34)
35	39 (55)	44 (62)	33 (47)
46	51 (72)	57 (81)	43 (61)
69	75 (106)	84 (119)	63 (89)

VLF-200CMF 0-200 kVac
With PD & TD measurement
.75 uF @ 0. 1 Hz. thru 3.75 uF @ 0.02 Hz.

HVI VLF Products

Since 1998, HVI has offered many models of VLF Hipots, from 30 kVac peak to 200 kVac peak, in two versions: oil insulated with manual controls and solid state, wireless, computer controlled designs. Only some of the available models and shown.

VLF-30CM 0-30 kVac
0.4 uF @ 0.1 Hz

VLF "E" Series w/TD

VLF-34E 0-34 kVac
1.0 uF @ 0.1 Hz thru
5.0 uF @ 0.05 Hz

VLF-6022CM 0-62 kVac
1.1 uF @ 0.1 Hz. thru
5.5 uF @ 0.01 Hz

VLF-90CM 0-90 kVac
.5 uF @ 0.1 Hz. thru
2.5 uF @ 0.02 Hz

VLF-12011CM 0-120 kVac
1.1 uF @ 0.1 Hz. thru
5.5 uF @ 0.02 Hz