



Application: Wind & Solar Farm Cable Testing?

If you are testing dozens of long 35 kVac cables, or any voltage rating, you will need a **VLF AC hipot** for the **Acceptance Withstand Voltage Test** and a cable fault locator, or **Thumper**, to find the locations of the cable sections and/or joints and terminations that failed the test. Perhaps 50 miles of cable was just installed along with the hundreds of accessory components. There are bound to be some locations with faulty materials used, devices installed improperly, damage during installation, etc. The VLF test will cause failures at the defect locations, requiring they be found to make repairs or replacements. Get out the thumper. Depending on the specification, **Diagnostic** cable testing may also be necessary. This would be a **Tan Delta** test and possibly a **Partial Discharge** test.

The most common test is the **VLF AC Withstand**. This is a **pass/fail over voltage stress test** performed to ensure that the cable insulation, attached accessories, and terminations are all sound with no damage from installation errors or factory material defects. Since the whole system is new, all components installed should be healthy except for those that were not installed correctly or damaged during installation. Where there is a defect, the test voltage and duration are designed to cause the defect to fail during the test, while not adversely affecting the rest of the healthy cable installation. Let the VLF expose the severe defects before energizing.

Usually the **IEEE 400.2-2013 Standard** for VLF and **Tan Delta Cable** testing is referenced. This standard dictates that for Acceptance testing cable rated for 35 kVac, a peak sinusoidal VLF voltage of **62 kVac** be applied for **30 – 60 minutes**. Based on the known electrical tree growth rate under these VLF voltage conditions, defects severe enough to be driven to partial discharge will have enough time to grow and penetrate through the insulation, causing a failure. Find the fault, fix it, and retest. Simple go/no-go hipotting adfter installation or later.

Test 1) VLF Withstand Testing. A VLF AC hipot is needed, rated for the test voltage requirements and the μF capacitance of the load. The test voltage needed is known, but the μF rating of the cable load, hence the VLF, must be determined. Often, the frequency output from the VLF must decrease to accommodate very long cables with many μF 's of capacitance. As a practical matter, a maximum of perhaps 10 – 20 miles of cable can be VLF Withstand tested, depending on the allowable frequency output, ranging from 0.1 Hz. to 0.01 Hz.

Test 2 & 3) Diagnostic Testing. Using a sinusoidal output VLF as the voltage source, two diagnostic tests are typically performed to measure the quality of the overall cable insulation and/or the locations of specific and locally located defects that are discharging PD. Unlike a VLF Withstand test, these diagnostic tests apply slight over voltages of **1.5 – 2.0 Uo** for short duration to gather the results. Both tests are useful and measure different data sets about the cable. A **Tan δ (Delta)** test, also known as **Dissipation Factor** or **Loss Angle**, measures the degree of insulation deterioration over the entire cable length, providing useful comparative data and a benchmark value for use with future testing. Refer to **IEEE 400.2-2013** standard for VLF and TD. A **Partial Discharge** test locates specific places of troublesome electrical discharges and their severity – PDIV and PDEV among others. **IEEE 400.3-2006** Standard for VLF Partial Discharge testing is referenced. Both tests are limited to ~3 miles/5-6 km of cable length, due to the gradual attenuation of the instruments' signal and the PD emission intensity.

HVI offers products for **VLF Withstand**, **Tan Delta**, and **Partial Discharge** testing. HVI also offers high voltage, high energy **thumpers** needed for efficient fault finding. **AC or DC Hipots** can also be supplied for testing substation apparatus and other gear. HVI can supply all these devices separately or designed as a custom package ready to mount. See the **SKD Series** of custom designed and produced van mount cable test & fault locate packages, for an economical, instant, convenient solution.

WIND FARM 35KV CABLES ARE IDEAL FOR VLF WITHSTAND TESTING

VLF Acceptance Test per IEEE 400.2
VLF Hipot Testing 3 phases at once @ 62 kVac peak for 30 - 60 mins.

0 - 62 kVac peak VLF

Cable system is new. Needs VLF AC Withstand test to find workmanship errors on splices and terminations and possible cable installation damage. VLF it! Tan Delta and Partial Discharge testing are not really needed now.



E-Link VLF & TD Software from HVI

SKD Series Custom Packages
Cable Testing & Fault Locating

Included

- VLF - 62 kVac
- VLF data logger
- Thumper 36 kV 3.2 kJ
- TDR/radar
- Listening Device
- 100' cable reels
- Ready to mount



CDS Series Thumpers
0-5/10/20 kV & 9/18/36 kV
1000 J – 3200 J, TDR ready



VLF Series Original Design
Field Proven for 20 years
10 models, 30 kVac – 200 kVac
0.1 Hz. – 0.01 Hz, 0.4 μF – 50 μF



VLF E Series & TD Series
0 - 34 & 65 kVac @ 0.1 Hz.
VLF Withstand & Tan Delta
Uses HVI's E-Link Software

