



**HVI - The World's Source for  
High Voltage Test Equipment**

Advanced test equipment for high voltage proof and preventive maintenance testing of electrical apparatus [www.hvinc.com](http://www.hvinc.com)

## Application: Wind or 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 installed improperly, damaged during installation, improperly assembled, etc. The VLF Hipot 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.

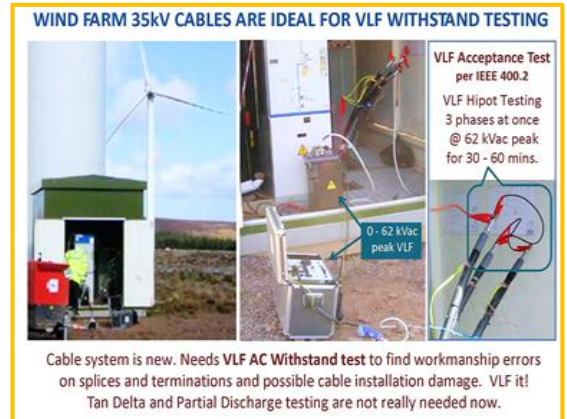
The most common test is the **VLF AC Withstand** test. This is a **pass/fail over voltage stress test** performed to ensure that the cable insulation, attached accessories, and the terminations are all sound with no damage from installation errors or factory material defects. Since the whole system is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

Usually the **IEEE 400.2-2012 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, any defect severe enough to be driven into a partial discharge condition will have enough time to grow and penetrate through the insulation, causing a failure. Find the fault, fix it, and retest.

**Test 1) VLF Withstand Testing.** A VLF AC hipot is needed, rated for the test voltage requirements and the  $\mu F$  capacitance of the load. The test voltage needed is known, but the  $\mu F$  rating of the cable load, hence the VLF, can be a problem determining. Perhaps frequency outputs from the VLF must decrease to accommodate very long cables with many  $\mu F$ '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.

**Test 2 & 3) Diagnostic Testing.** Using a 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, the two commonly performed diagnostic tests apply slight over voltages for short duration to gather the results. Both tests are useful and measure different data sets about the cable. A **Tan  $\delta$  (Delta) test**, also known as Dissipation Factor or Loss Angle, measures the degree of insulation deterioration over the entire cable length. This offers an excellent way of comparing many cables to help prioritize injection/rejuvenation, replacement, or other testing methods that may be beneficial. Refer to **IEEE 400.2-2012** 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 400.3-2012** 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.

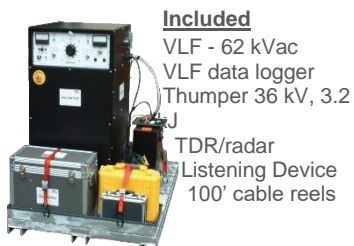
HVI produces products for **VLF Withstand, Tan Delta, and Partial Discharge** testing. HVI also offers **high voltage, high energy thumpers** needed for efficient fault finding. **AC or DC output hipots** can also be supplied for testing substation apparatus and other gear. HVI can supply all these devices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



**SKD Series** Custom Packages  
Cable Testing & Fault Locating

**CDS Series** Thumpers/Surge  
Generators 0-5/10/20 kV & 9/18/36 kV,

**VLF E Series & TD Series**  
0 - 34 & 65 kVac @ 0.1 Hz.  
VLF Withstand & Tan Delta



**Included**  
VLF - 62 kVac  
VLF data logger  
Thumper 36 kV, 3.2  
TDR/radar  
Listening Device  
100' cable reels



**VLF Series**  
VLF-6022CMF  
0 - 62 kVac, < 5.5  $\mu F$



**VLF Series** VLF-65CMF  
0 - 65 kVac, 2.2  $\mu F$  - 22  $\mu F$



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