

rugged

# **CDS Series** Cable Fault Locators Thumpers - Surge Generators

*HVI offers the most complete fault locator packages available for primary cable.*

*HVI offers the only VLF Thumper combination – ideal for cables up to 25kV.*

*HVI can offer more for fault location and cable testing than any other.*

*HVI can match a VLF hipot to our thumper for total cable care.*

**Get More from HVI:**

- Three Fully Variable Hipot Outputs
- Three Full Energy Discharge Outputs
- The Highest Burn Current Available
- Only VLF Thumper Available
- TDR/Radar Ready
- Rugged Design



dependable

[www.hvinc.com](http://www.hvinc.com)



## HVI – The Cable Testing & Fault Locating Company

HVI has extensive knowledge and field experience in fault locating and cable testing along with the best tools for the job. Fault locating requires more than just a thumper. Efficient fault locating requires the convergence of knowledge, methodology, and the right hardware. A total approach is needed to get the job done quickly to minimize customer outage time and damage to the cable system. This includes knowledge of the cable systems design, construction, and history, accurate maps, proper fault locating procedures, the right thumper, some cable burn down method, use of tdr/radar, and a top level acoustical & electromagnetic listening device. HVI can assemble the best system and approach possible to meet all needs from 5kV – 230kV cable.

### Q. Why Choose HVI Thumpers? A. HVI Thumpers Offer All the Features Needed.

When fault locating, remember this: **do no harm**. Don't harm you insulation and accessories by thumping your 15kV cable at 25kV for hours looking for a fault. Use proper methods and technologies. The goal should be to thump at the lowest possible voltage yet deliver the highest possible energy to find the fault. Locate the fault without making more. To do this you need a thumper with a **variable hipot output, multiple full energy discharge outputs, and ample burn current** to condition a fault to arc at a lower voltage. HVI thumpers offer all the features and power necessary: many others don't. **Don't handicap your fault finding efforts by spending the same or more for ½ a thumper. HVI thumpers provide all the tools needed.**

- **Fully Variable Hipot Output On All Three Voltage Settings**

Needed to identify faulted cable, show breakdown voltage to help choose tap, burn fault, hipot cables after repair

- **Highest Burn Current**

Burns down faults to permit thumping at lower, less damaging voltage levels. Some vendors offer no hipot/burn

- **Three Output Voltage Taps All At Full Energy**

Allows thumping at lower voltages. Noise of maximum joules @ 5kV = noise of maximum joules @ 20kV

- **Variable Discharge Rate:** 6 – 10 second discharge/thump rate. Faster and slower discharge rates are not advisable

- **TDR/Radar Ready**

Use your old TDR or buy a new one. A separate TDR box is advantageous over a TDR built-in to the thumper: greater flexibility, versatility, ease in service, use without thumper, take to office for downloading and training, etc.

- **Battery Operation**

HVI thumpers are *not* battery operated. Thumpers of this class that are battery operated must sacrifice other necessary features, like variable hipot outputs and cable burning, missing half of what a thumper should be. In addition, some have a long 15 seconds between discharges, greatly slowing the fault locate. Also, battery charge times are short, assuming that you remembered to keep it charged between uses. To get battery operation is not worth the sacrifice.

## Controlled Energy Thumpers With Burn Capability a Necessity

Due to the known problems associated with DC cable testing, most utilities worldwide have abandoned DC testing of solid dielectric cable (many have switched to VLF AC testing), or greatly reduced their test voltage levels, yet they then thump cables at voltages of 2 – 3 times normal line-to-ground voltage. They find the fault but make more in the process. This is avoided by using HVI thumpers with three output voltage taps, and high burn currents used to reduce fault impedances to permit lower voltage thumping. HVI thumpers can thump at voltages below normal line-to-ground voltage yet still deliver maximum joules, thereby minimizing damage to the cable system while delivering full energy to the fault needed for rapid location.

$$\text{Energy} = \text{Watt Seconds} = \text{Joules} = \frac{1}{2} CV^2 = \text{Fault Arc Intensity} = \text{Noise} = \text{Electro-Magnetic Discharge}$$

**Problem:** To deliver the full joules of energy possible to a fault, the capacitors within a thumper must be charged to the maximum voltage. With the wrong thumper, this often results in thumping a cable at an excessive voltage, causing significant damage to insulation and accessories. Since the applied voltage is a square function ( $\frac{1}{2} CV^2$ ), if the thumper is at  $\frac{2}{3}$  voltage, only 45% of the joules are delivered to the fault. At half voltage only 25% energy is delivered, making the fault hard to hear. Either fault locating takes far longer than necessary or the crew gets impatient and turns the voltage all the way up to get the loudest bang. The fault is found but more are made. This practice can and should be avoided.

**Solution:** Use a multi-tapped, "controlled energy" thumper like those from HVI. With three output voltage taps and ample burn current to condition faults, thumping can be performed at voltages far lower than before. Find your fault quickly while avoiding damage. Wouldn't you rather thump at 5kV instead of 20kV, as long as the discharge energy, or noise, was equal? **The measure of a good thumper is not the maximum voltage it can discharge, but the minimum voltage still capable of delivering the full energy. For instance, our 5/10/20 kV output model is a far better choice than the 12.5/25kV model from others.**

## Model CDS-2010U & CDS-2010UF

<b>Input:</b>	CDS-2010U: 120 V, 60 Hz, 25 A CDS-2010UF: 230 V, 50/60 Hz, 15 A
<b>Hipot Output:</b>	0 – 5/10/20 kVdc
<b>Hipot Burn Current:</b>	400/200/100 mAdc
<b>Discharge Output:</b>	1000 Joules at each output voltage
<b>Discharge Rate:</b>	6 – 10 seconds
<b>TDR Interface:</b>	Arc Reflection & Current Impulse
<b>Size:</b>	27" w x 27" d x 48" h 686 mm w x 686 mm d x 1219 mm h
<b>Weight:</b>	260 lbs/118 kgs
<b>Cable Outputs:</b>	50' HV, return, & ground
<b>Other Features:</b>	Rugged, transit protected meters External Interlock Emergency OFF mushroom switch Internal heater to limit condensation

With its 20kV output, the CDS-2010U is good for fault locating cables rated up to 35kV, having a line to ground voltage of 20kV. The high burn current of 400mA can be used to condition a fault to reduce its arc over voltage to permit thumping at a lower and less damaging voltage level, yet still at full energy. The CDS-2010U can thump a cable at just 5kV yet deliver 1000 joules. Find your fault without making more.

There is no better thumper. The CDS-2010U offers the complete package: three full joule output voltages, three variable hipot outputs, the highest burn current, rapid discharge rate, tdr/radar ready, and its rugged design holds up to years of use. Another plus: all HVI Thumpers use EPR high voltage output cable rather than XLPE. EPR stays flexible in cold weather. HVI thought of everything.

Ideal for Coops, Small Municipals, IOU URD and Industrials



## CDS-3616U(F) & CDS-3632U(F) - The Network Systems Thumper



<b>Input:</b>	CDS-3616U/3632U:	120 V, 60 Hz, 25 A
	CDS-3616UF/3632UF:	230 V, 50/60 Hz, 15 A
<b>Hipot Output:</b>	0 – 9/18/36 kVdc	
<b>Hipot Burn Current:</b>	280/140/70 mAcd	
<b>Discharge Output:</b>	CDS-3616U(F): 1600 Joules at each output voltage CDS-3632U(F): 3200 Joules at each output voltage	
<b>Discharge Rate:</b>	6 – 10 seconds	
<b>TDR Interface:</b>	Arc Reflection & Current Impulse	
<b>Size:</b>	25" w x 29" d x 44.5" h (30" w with attached cable reel) 635 mm w x 737 mm d x 1130 mm h	
<b>Weight:</b>	1600J model: 375 lbs/170 kgs 3200J model: 450 lbs/204 kgs	
<b>Cable Outputs:</b>	100' HV, return, & ground	
<b>Cable Reels:</b>	100' HV & return cable reel	
<b>Optional</b>	100' ground cable reel Thumper equipped with 10' output cable with MC connection to reel	
<b>Other Features:</b>	Rugged, transit protected meters External Interlock Emergency OFF mushroom switch Plexiglas panel to view grounding solenoid Internal heater to limit condensation	

### CDS-3616U(F) & CDS-3632U(F) (suffix F for 230 V 50/60 Hz models)

These two models are ideal for Network Systems or other situations where cables are rated up to 69kV, oil insulated cables, and/or long cable lengths are encountered. The powerful 3200 joule pulse makes fault locating easier using acoustical and electro-magnetic detection devices. With 280 mA of burn current, faults can be rapidly reduced to low voltage levels, permitting thumping at lower and less damaging voltage levels. The CDS-3632U can thump at 9kV, 18 kV, or 36 kV yet deliver 3200 joules.

There is no better thumper. The CDS-3616/32U offers the complete package: three full joule output voltages, three variable hipot outputs, 280 mA burn current, variable discharge rate, tdr/radar ready, and its extremely durable design holds up to years of use. Another plus: all HVI Thumpers use EPR high voltage output cable rather than XLPE. EPR stays flexible in cold weather. HVI thought of everything.

### Thumper Specification Review

Don't handicap your fault finding efforts by buying a thumper with only half the features necessary.

For the same money, you can buy a full featured thumper. When specifying, require:

- At least two full joule output voltage settings, preferably three, and with at least 1000 joules of energy
  - A variable hipot output with high burn current of at least 200mA
  - Variable discharge rate from 6 – 10 seconds
- A remote TDR/radar, not one built-in, for flexibility, versatility, ease in service, and ease in use

#### Compare HVI Features and Specifications to Any Other – Why Utilities Choose HVI

Features	CDS-2010U	CDS-3616U	CDS-3632U
Output Voltages	0 – 5/10/20 kV	0 – 9/18/36 kV	0 – 9/18/36 kV
Joules	1000 @ 5/10/20 kV	1600 @ 9/18/36 kV	3200 @ 9/18/36 kV
Constant Energy	Yes. On all taps	Yes. On all taps	Yes. On all taps
Variable Hipot	Yes. On all taps	Yes. On all taps	Yes. On all taps
Hipot/Burn Rating	400 mA	280 mA	280 mA
Discharge Rate	6 – 10 seconds	6 – 10 seconds	6 – 10 seconds
TDR/Radar Ready	Yes	Yes	Yes

**HVI Offers the Complete Package – Don't Buy Less**

## VLF Thumper Combination - VT33(F)

### VT33 - Complete Cable Care For 5 – 25kV Cable

With cable diagnostic testing becoming more common, the need for fault locating will rise. If a cable cannot withstand the test voltage, failure will occur, requiring fault locating. If you're in the market for a thumper, why not get one with a VLF hipot built-in to test the AC integrity of the cable following repair. The VT33 incorporates a powerful VLF hipot, a VLF Burner that rapidly reduces a faults impedance (arc-over voltage), TDR/radar capability, and continuous discharge for pinpointing the fault. Suitable for cables up to 25 kV. HVI puts all the tools needed in one box.

- VLF test cables per IEEE400.2, VDE 0276, CENELEC, etc.
- Pre-locate faults using a connected TDR/radar
- VLF Burn faults to lower arc-over voltage
- Pinpoint fault with continuous thumping

<b>Input:</b>	VT33: 120V, 60 Hz, 10A VT33F: 230V, 50/60 Hz, 5A
<b>VLF Hipot Output:</b>	0 – 33 kVac peak @ 0.1 Hz
<b>Load Capability:</b>	1 $\mu$ F or more than 1 mile of 15kV cable
<b>Discharge Output:</b>	0 – 13 kVdc @ 760 joules
<b>Discharge Rate:</b>	Every 8 seconds
<b>VLF Burner:</b>	Arcs cable every few seconds
<b>TDR Interface:</b>	Arc Reflection & Current Impulse
<b>Size &amp; Weight:</b>	28" w x 26" d x 44" h, 245 lbs. 711mm w x 660mm d x 1118mm h, 111kg
<b>Cable Outputs:</b>	50' (15m) shielded HV cable & ground

## Very Low Frequency (VLF) AC Cable Testing

Most of the world has quit testing cables with DC voltage. It is well known that testing cables at the historically applied 4 – 5 times normal voltage causes solid dielectric cables to fail prematurely. Also, DC leakage currents tell little about the true condition of a cable's insulation and even less so about its accessories. With DC out of favor, something else had to be found. Enter **VLF withstand, VLF Tan Delta, and VLF Partial Discharge testing.**

A VLF AC test set is just an AC hipot but with an output frequency of 0.1 Hz or lower, rather than 50/60Hz. The lower the frequency the lower the current and power required to apply an AC voltage to a high capacitance load like cable. It requires 600 times less power to AC hipot a cable at 0.1 Hz as at 60Hz. With the present day VLF products available from HVI, it is now possible to AC hipot a cable to verify its integrity. The VLF hipot enables users to AC test long cables in the field with relatively portable and affordable equipment. There is no better way to verify the integrity of a cable following repair than to apply 2 – 3 times normal AC voltage for a period of time. The other methods used don't get the job done: DC hipotting, a 5kV megohmmeter test, hot stick adaptors that apply far less than the cables operating voltage, and/or a soak test. Don't be back in the same neighborhood a week after a repair because of additional damage resulting from the original in-service failure, damage to adjacent cables, damage inflicted to the repaired cable by over voltage thumping for hours, or because of a faulty repair. VLF it before re-energizing for the maximum assurance that the cable is healthy.

HVI offers VLF products from 28kV to 200kV. Let us help you with all your cable test and fault location needs. In addition to using the VLF to proof test a cable, add a Tan Delta and Partial Discharge accessory to perform cable diagnostic testing. HVI is the cable test company.

## MV & HV Cable Fault Locating & VLF Testing

### VLF + Thumper = Ease In Fault Locating HV Cables

#### 5 kV – 25 kV Cable Systems

The VT33 VLF Thumper Combination is the best approach: VLF test cables, use VLF output for diagnostic cable testing, use VLF Cable Burner to reduce fault voltage, fault locate with 13 kV @ 760 joules, use TDR/radar for sectionalizing and for pre-locating faults. If a conventional thumper is desired, the CDS-2010U is the most complete and full featured device available.

#### 35 kV Network Systems

For 35 kV cable, solid or fluid filled, a popular combination of products is the VLF-6022CM VLF hipot and the CDS-3632U Thumper. Cable reels containing high voltage, return, and ground cables are also supplied, with various MC connector attachments. The VLF-6022CM is designed to VLF hipot cable rated up to 35kV. It can also be used as a voltage source for **Tan Delta and Partial Discharge** cable diagnostic testing. The CDS-3632U, with its 3200 joule discharge energy, offers the power needed to make good use of electro-magnetic and acoustic detection devices as well as work very effectively for Current Impulse locating on PILC.



**VLF-6022CM**

0-60kVac peak @ 0.1 – 0.02 Hz  
Load rated to 5.5  $\mu$ F

#### 69 kV - 230 kV Cable Fault Locating

For high voltage cable fault locating on cables up to 230 kV, there are not many options. One very good approach is to use a Very Low Frequency AC hipot and the CDS-3632U. The VLF is used to burn down the cable fault to a voltage arc-over level less than the discharge rating of the surge generator. Once a fault is made to arc over at less than ~30kV, then the 36kV @ 3200 joules discharge of the CDS-3632U is sufficient to find the fault. The VLF hipot can then be used to perform a VLF AC withstand test after the repair to verify the AC integrity of the cable and the repair. Either a 120kV or 200kV VLF can be used.

Using a VLF hipot designed for **cable burning** is the most effective means of reducing the impedance of a fault to reduce its arc-over voltage to enable the use of smaller and more conventional thumpers. A combination of VLF, needed for AC hipotting the cable and as a voltage source for tan delta and partial discharge testing, and our CDS-3632U is the best way to go. In the VLF Burn Mode, the VLF applies its output voltage to the cable. The VLF voltage rises until the cable arcs. The VLF continues to operate, causing the cable to arc in the other polarity. This continued arcing in successively opposite polarities rapidly burns down the fault. The arc current of the VLF combined with the stored energy of the cable dumped into the fault every half cycle gets the job done far faster than DC burn down sets.

69kV cable

69kV – 138kV cable

138kV – 230kV cable



**VLF-90CM**

0 – 90 kVac @ 0.10 – 0.02 Hz  
Load rated to 2.75  $\mu$ F



**VLF-12011CM**

0 – 120kVac @ 0.10 - 0.01 Hz  
Load rated to 5.5  $\mu$ F



**VLF-200CMF**

0 – 200kVac @ 0.10 - 0.02Hz  
Load rated to 3.75  $\mu$ F

Other VLF models are available, as well as Tan Delta and Partial Discharge test equipment.

## ACCESSORIES

HVI can provide all the accessories needed to put together a complete fault locating system. Fault locating is an approach, not just a thumper. Don't spend a lot of money on a thumper but not the extra few thousand for a top level listening device to make it most effective. Don't thump for hours wasting time and damaging your cable when a TDR trace can show you the fault location in two minutes, quickening sectionalizing and repair. Consult with HVI on the accessories most appropriate for your situation. We have our favorites but can supply anything needed. For a TDR, nearly any model now available works great.

### Cable reels



### Acoustical/Magnetic listening devices



### Accessories with MC Connectors for Thumper and VLF HV output



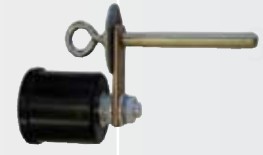
Fitted with 12" of cable and female MC connector



Hot Line clamp  
Hotstick compatible



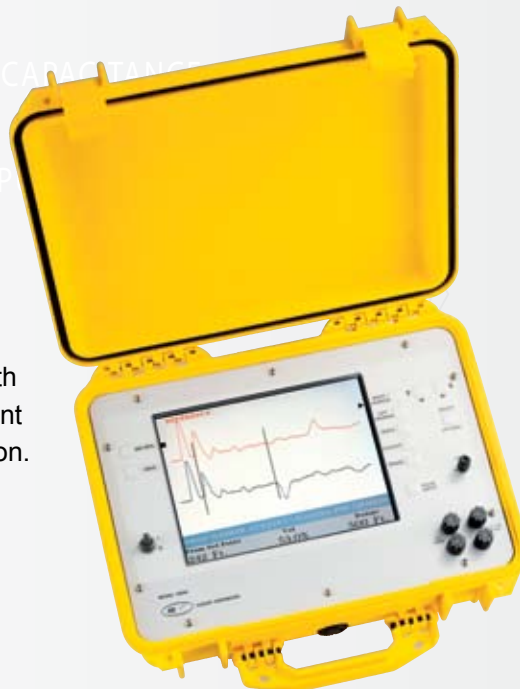
MC vise grip



15kV & 25kV  
probe for bushing.  
Hotstick compatible

### TDR/Radar

All HVI Thumpers offer both the arc reflection and current impulse method of fault location.



All HVI Thumpers offer both a signal and remote trigger TDR connection to accommodate all types of TDR designs.

## Products from High Voltage, Inc.

HVI can serve your needs for testing all types of substation apparatus, aerial lifts, and cable. Our VLF technology, AC and DC Hipots, Oil Testers, and Fault Locators, all offer superior design and features not found elsewhere. HVI offers the smallest, lightest, and most economical high voltage test equipment available.

SCOPE



### Very Low Frequency (VLF) AC Hipots

Used for high voltage AC field-testing of cables and generators/motors

- Models from 28 kVac – 200 kVac
- Load ratings from 0.4 $\mu$ F – 50  $\mu$ F
- Sine wave output
- Tan Delta and Partial Discharge diagnostics
- Years of proven design experience



### VLF CableCheck URD Verification tool



### DC Hipot/Megohmmeter

*Twice the power and features – smaller size – lower cost*

- 10 mA continuous duty
- Built in HV megohmmeter
- +/- 1% input line regulator
- Anti-static meters
- Transit protected meters
- Durable packaging
- 37.5 kVdc – 300 kVdc



### Thumpers & Radar

- 3 output taps
- 5/10/20 kV
- 9/18/36 kV
- 1000 joules
- 1600 joules
- 3200 joules
- 400 mA burn
- Radar
- Built in arc reflection filter



### VLF Thumper for 5-25 kV cable Complete Cable Care for URD VLF hipot, fault locate, tdr/radar



### Aerial Lift Tester 60/120 kVac @ 7 kVA

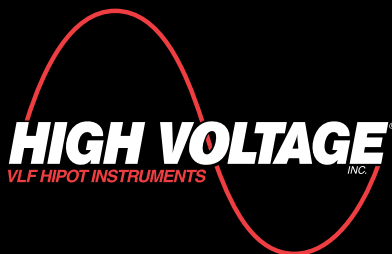


### AC Hipots

- Nearly half the size of others
- One piece cable output to 50 kV
- Most rugged design
- Guard/Ground circuit
- Anti-static meters
- 10 kVac – 300 kVac



### Oil Dielectric Testers 60 kV & 100 kV



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