VLF-30CM

SERIES

Safety, Operation, and Procedure Instructions for the VLF Series of AC Hipots

Please Refer to Documentation Before Operation

Danger- Lethal Voltages:

Equipment to be used by trained personnel only

This Operator Manual contains instructions for the operation of a High Voltage power source. The operator of this equipment must use good judgement and follow all safety precautions noted in this guide to ensure the protection of himself and others in close proximity to the test area. Failure to follow the instructions could result in injury or death. Proper grounding of the test set must be done prior to connecting this unit to a power source.

VLF Operator Manual

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Table of Contents

About the Operator Manual

Important

This Operator Manual describes the features and safe operation of a High Voltage AC Test Set. The instructions are intended to be clear and simple, but the operator must be trained and qualified according to the customer's established procedures for the use of this type of equipment.

This Operator Manual is organized to provide information on the VLF Series in steps that familiarize the new operator with the entire scope of operation of this test set.

Section 1: Specifications and Controls.

Section 2: Setup and Operation.

Section 3: Performing Special Operations.

The Functions, Features, and Specifications of the VLF Series of AC Hipots are also discussed in the VLF Brochure available from High Voltage, Inc.

SECTION

1

General Information

This section familiarizes the operator with the features and specifications of the

VLF-30CM AC Hipot manufactured by HIGH VOLTAGE, INC.

Features and Specifications

The VLF-30CM hipot test set provides true sine wave AC output voltage for the test of 15 kV Class high voltage cables (0.4 uF (up to 4000 ft.)) and other capacitive loads.

Standard features of the VLF-30CM AC Hipot

- Sine wave output, 0.1Hz frequency standard.
- Continuously adjustable output voltage
- Continuous duty rating
- Fixed thermal circuit breaker overload
- "Zero Start" and External Interlock provision
- Single-range voltmeter
- Single -range Current meter
- One piece portable design
- Transit protected meter prevents damage between test sites
- Internal output limit resistor
- 10 ft. input line cord
- 20 ft. RG-8/U output cable
- Alligator clip type output connector
- Safety Ground Stick w/20ft. cable and ground clip

WARNING

DO NOT OPERATE THE VLF HIPOT SET IF THE UNIT IS 15° OR MORE FROM LEVEL.

IF THE UNIT IS OPERATED OUT OF LEVEL, OVERHEATING AND INTERNAL ARCING MAY OCCUR.

DO NOT STORE OR TRANSPORT VLF UNIT

ON IT'S SIDE

Operating Environment

Indoor/Outdoor-fair weather

Altitude: 100% of rating;Sea-level, up to 5000ft.(approx.1500M). The output power is de-rated 10% above 5000 ft. altitude, 20% above 12,000 ft.(approx. 3600M), and 30% above 15,000 ft.(approx. 4500M)

Storage Temperature: -20°C to 70°C(-4°F to 158°F)

Operating Temperature: -5°C to 45°C(22°F to 113°F) Output power is de-rated linearly by 15% from 30 to 45°C ambient.

Maximum Relative Humidity: 80% up to 31°C(88°F), decreasing linearly to 50% at 40°C(104°F)

Mains supply fluctuation: +/-10% of rated voltage

Installation: Category II

Pollution: Degree 2

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Safety Symbol Identification

Warning! Please refer to documentation before operation

Protective Earth Terminal

Warning: Hazardous Voltage

MODEL VLF-30CM AC HIPOT SPECIFICATIONS

	VLF-30CM(F) (30 kV,0.4 μF) Part No. VLF-1436S(120V) Part No. VLF-1437S(230V)
Input	120 V, 50/60 Hz, 7A Sinusoidal Power Required for full output 230 V, 50/60 Hz, 3A
Output	Sinusoidal 0-30 kVac peak, 0.1Hz frequency
Duty	Continuous
Test Capacitance (Ins. Res. < 10GΩ)	0.4μF @ .1 Hz Minimum capacitance to achieve full output- .005μF
Kilovoltmeter	3.5 in. , -30/0/+30 PEAK KILOVOLTS 2% FS Accuracy
Current/uF Meter	3.5 in. 0-50 PEAK MILLIAMPS 2% FS Accuracy
Control Case Size High Voltage Tank size	14.25w x 11.25d x 21.75 high Included in Control
Weight	85 lbs. (39kg) Accessory Bag 8 lbs. (3.6kg)
Output cable length	RG8/U 20 ft.

Table 1 *VLF-30CM Specifications*.

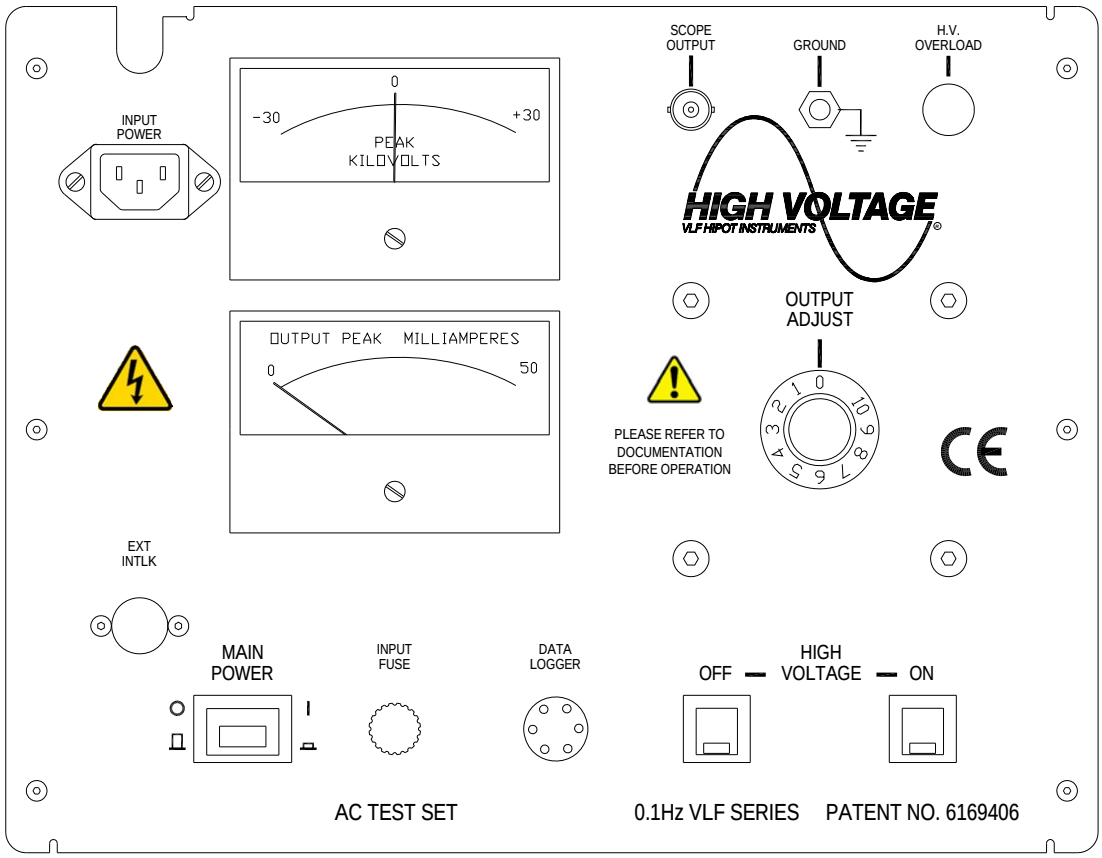

Figure 1 *VLF-30CM front panel controls.*

MAIN POWER

The MAIN POWER pushbutton switch provides the power to the control and power circuits. The neon lamp in the switch will light when the power is on and voltage is available through input line cord. The INPUT FUSE located electrically before the MAIN POWER switch provides input line protection for the unit.

EXT.INTLK (EXTERNAL INTERLOCK)

The Ext. Intlk. connector is provided to allow for a normally open safety interlock switch to control the energizing of the high voltage output.

HV OVERLOAD

The HV OVERLOAD circuit breaker protects the variable transformer output control brush. Its thermal characteristics allow for the short term overload of the variable transformer while still providing proper protection.

HIGH VOLTAGE ON/OFF

The HIGH VOLTAGE ON (OFF) pushbuttons activate (de-activate) the high voltage power circuits. The LED indicators provide long life positive indication of the circuit status. The RED (ON) LED lights when high voltage is energized, the GREEN (OFF) LED lights when the high voltage is de-energized.

OUTPUT CONTROL

The OUTPUT control variable transformer adjusts the output voltage. The 0-10 markings(0-100 on CM units) on the knob indicate the low to high setting. The control must be at ZERO (0) to energize the high voltage circuits. The output control must always be returned to zero at the completion of testing, prior to de-energizing the output , allow the unit to cycle for 60 seconds to assure full discharge of the load.

VOLTMETER

The KILOVOLT METER allows for accurate output voltage readings. 1-% precision resistors minimize the need for re-calibration due to aging shift. See Voltmeter Re-calibration in Section 3 for details on calibration. The center null meter indicates the polarity and amplitude of the output simultaneously for convenience of operation.

CURRENT METER

The CURRENTmeter provides for accurate output current monitoring. The CURRENT portion of this circuit is for observing the charge and discharge currents in the cable load. 1% resistors minimize the need for re-calibration due to aging shift.

Note: The current meter on the VLF Series of AC hipot is for reference readings of current draw. The current reading is affected by both frequency and cable length and as such is not appropriate for use in trending or leakage measurements.

SCOPE OUPUT

The SCOPE OUTPUT allows for accurate output voltage monitoring. This connector can be fed into an oscilloscope for the looking at the actual output wave shape. The peak to peak voltage representing 30 kVac is 6 volts peak/peak.

DATA LOGGER

The DATA LOGGER connector is for the external ADL-1 Data Logger option.

List of included components with the VLF-30CM Hipot

- ☐ Ext. Intlk. jumper plug
- ☐ 20 ft. long output cable RG8/U
- ☐ 6 ft. BNC to BNC scope to panel interconnect coax cable
- ☐ 20 ft. 2AWG clear jacketed ground lead

- ☐ Safety Ground Stick w/ 20ft. ground cable and clip

SECTION

2

SETTING UP THE EQUIPMENT

The setup of this equipment has been minimized by careful consideration of the operator during design. The VLF-30CM single-piece construction and light weight lends itself to convenient portability for AC testing in the field.

Select a location for the unit that will allow easy viewing of the control panel at a safe distance from the test object (within 20 ft.) on a level area. The meters should horizontal during use. A maximum angle for correct operation is 15°. Blocking the unit to a near level condition is acceptable.

1. Be sure that all the controls are off, in their de-energized or fully counterclockwise position.

2. Secure a ground test lead to the panel. The Ground post on the front panel should be used for that purpose.

   Note: A 2 AWG lead is provided for the 'live' load return ground, which will also connect to the GROUND stud on the front panel.

3. Connect the safety ground stick to a solid earth ground.

4. Remove the coaxial output cable in the top lid storage and stretch out for later connection to the test cable or load.

5. Insert the EXT INTLK plug into the socket on the panel. The plug may also be wired to a normally open contact of a safety switch for added protection.

The setup of the VLF AC Test Set does not address the need for proper safety grounding of the load (test sample or cable). The grounding requirements vary for different types of tests. Please consult the local codes where applicable or reference the guidelines for grounding found under OPERATING THE EQUIPMENT.

WARNING

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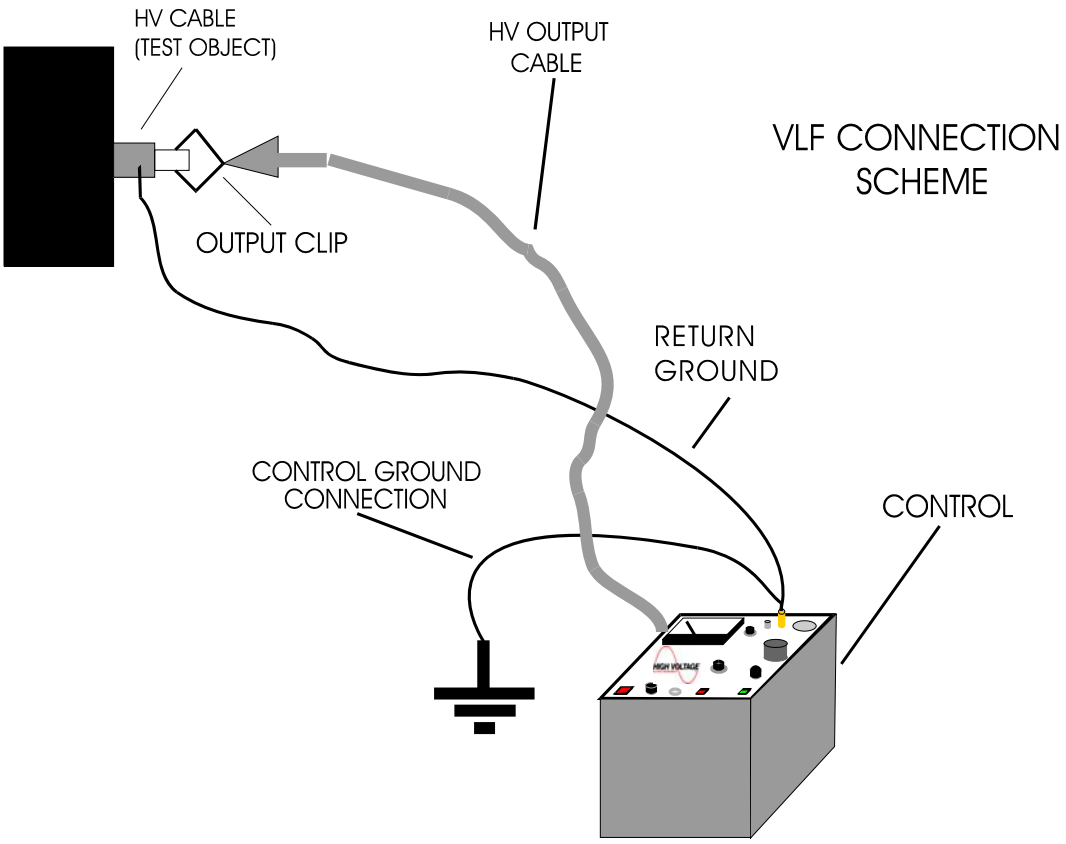
DO NOT STORE OR TRANSPORT VLF UNIT

ON IT'S SIDE



This section provides step-by-step instruction on various test methods. Many facilities have their own in-house test procedures, and this manual is not to supercede these. The purpose of this section is to explain the capabilities of this test set in real-world applications. ***Only trained personnel should attempt to operate this equipment.***

Dangerous voltages and currents are produced during the testing of cables, only trained individuals should operate this type of equipment and access to the test area must be restricted during testing to avoid endangering others.

When testing cables, either single or three phase, there are certain extra steps that must be observed to ensure safe operation.

It should be noted that the VLF series test sets are not intended to be used on vacuum bottles or switchgear without cables connected. The VLF-30CM requires a minimum of .005uF load capacitance to achieve full output. If the capacitance of the load is too low, the kilovolt meter will not read the actual peak output and damage to the unit (and/or load) may result.

AC Testing of High Voltage Cables

1. Ensure that all the steps listed in Setting Up the Equipment have been accomplished. Take special note to ground the test set to a solid earth ground.

Caution!!

Before making any cable connections, ensure that the cable being tested has been properly identified, de-energized, and grounded!

2. Make sure that all insulators, stress cones, and pot heads are clean and free of moisture. This will prevent flashover and minimize leakage.

Note: Be aware that any lightning arrestor or transient suppressing device must be disconnected if the clamping voltage is below the test voltage being performed. Failure to clear these devices from the cable may result in inappropriate failure indication of the test cable.

3. Isolate the far end of the conductors under test for the test voltage; that may mean separating some of the conductors in a multi-conductor cable from each other *and* their shields.

The shields of all cables must be securely tied to ground at the nearest end of the cable.

4. Any conductors or wires in the cable or the vicinity not being tested must be grounded to avoid a buildup of charge and possible shock hazard.

5. Voltage must be applied according to specifications from the cable manufacturer or any other applicable test standards

6. Prior to connecting anything to the test sample, be sure the test sample is identified, de-energized and grounded until ready to test.

7. Connect the input power terminal block to a grounded, 50/60 Hz source as noted in Table 1 Specifications. A generator is an acceptable power source.

8. Turn on the MAIN POWER switch. The MAIN POWER light will illuminate.

A minimum load capacitance of 0.005µF is required to achieve full output of the VLF-30CM unit.

It should be noted that the VLF series test sets are not intended to be used on vacuum bottles or switchgear without cables connected. The VLF-30CM requires a minimum of .005uF load capacitance to achieve full output. If the capacitance of the load is too low, the kilovolt meter will not read the actual peak output and damage to the unit (and/or load) may result.

9. An oscilloscope (optional) can be connected to the SCOPE OUTPUT on the control for wave shape monitoring. The oscilloscope should be properly grounded and the input should be set to 1 volt/ division, the time base should be 5 seconds/division and the trigger should be set to roll display to view the wave shape. An oscilloscope with signal memory display is best used for this application. A BNC to BNC shielded jumper should be used for connection between the SCOPE OUTPUT and the oscilloscope. A digital meter can be used to monitor this connector. The voltage feedback calibration for this connector is 1 volt for 10 kV of output.

CAUTION

POTENTIALLY LETHAL VOLTAGES MAY BE PRESENT

STORED ENERGY LEVELS IN THE CABLE GREATLY INCREASE THE RISK OF FATAL INJURY IF CONTACT IS MADE WITH THE LOAD WHILE AT ANY VOLTAGE.

10. Connect the output lead to the test sample. On the VLF-30CM, the limit resistor is internal to the high voltage section unlike the larger models where the resistor is external. Be sure that there is enough clearance to grounded objects for the expected test voltage. The minimum clearance in air is 10 kV ac/inch.

11. Be sure to clear the test area of unauthorized personnel and use safety barricades to warn others of potential danger during the high voltage test .

Note: The current meter on the VLF Series of AC hipot is for reference readings of current draw. The current reading is affected by both frequency and cable length and as such is not appropriate for use in trending or leakage measurements.

12. With the OUTPUT control at zero (zero start interlock engaged), depress the HV ON pushbutton. The HV ON light will glow. Increase the output by operating the OUTPUT control slowly clockwise until the desired output voltage is reached. Raising the output too fast with large capacitive loads may trip the output overload. Observe the Kilovolt meter to set voltage. Please recognize that the output cycle is 10 seconds for a full sine wave @ .1 Hz. . To set the output voltage you may need more than one cycle to read the output accurately. ***A minimum load capacitance of 0.005µF is required to achieve full output of the VLF-30CM unit.***

13. Maintain the output voltage for the test time specified in your standard procedures.

Note: Full scale current readings at the polarity reversal (zero crossing) of the output sine wave indicates an excessive load. Reduce the cable capacitance by isolating the test section from other branches. Observe the next cycle and repeat cable load reduction if necessary

The limiting factor in the VLF unit is the wave shaping discharge resistors. An excessive capacitance will not fully discharge before the next half cycle starts and causes a discharge at zero crossing through the high voltage circuit.

Excessive loads can damage the VLF test set.

14. After the test is complete, rotate the OUTPUT control to zero, allowing the load to return to zero and the unit to cycle for about 60 more seconds prior to depressing the HV OFF pushbutton. Allowing the unit to cycle for some time allows for the complete discharge of the load and avoiding the normal self re-charge that capacitive loads will exhibit.

15. If the test sample fails during the test, the overload circuit will de-energize the high voltage. Should an overload occur, the normal sine wave cycle is interrupted and the load may bleed down much more slowly than when the unit is cycling normally.

From time to time, the input fuse may blow during a fault on the cable load, be sure to replace the fuse with a slo-blo (TYPE T/time delay) fuse of the proper amperage.

The thermal overload may not trip below 20% of full output. Due to thermal characteristics and high voltage circuit impedance, the current peaks are not enough to trip the overload. Above 20%, the overload reliably trips at the peak of the output wave.

16. Prior to removing the output cable from the load, observe that the output voltmeter is at zero, and then use a SAFETY GROUND STICK to positively ground the test sample.

Note: Cables exhibiting high failure rates (greater than 4 times in 18 months) should be investigated further to determine the age and likelihood of continuing problems. Replacement may be indicated.

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SECTION 3

PERFORMING SPECIAL OPERATIONS

The following section contains information on the care and upkeep of your new VLF-30CM AC Hipot. There are some notes on troubleshooting and service, which will save much time and money over the life of the unit.

Meter Re-calibration

The VLF-30CM AC hipot uses precision metal film resistors for measurement and calibration of the voltmeter. The use of these resistors in both the high voltage tank and the metering circuits has minimized circuit drift due to aging and temperature. But, a potentiometer (R4) on the voltmeter PCB can be used to correct for movement changes from the aging of the meter.

The certification of meters on a yearly basis is recommended to ensure accurate test results.

Voltmeter Re-calibration

1. Remove the entire chassis assembly from the case. There are six screws securing the chassis. Two under each lifting handle, and two screws through the base of the case.

2. Once removed from the case, locate the unit in a position that will allow easy reading of the meters.

It is necessary to stop the VLF action of the output for calibration. To do this, first isolate the output cable from ground. Second, energize the output and raise the output control to '2' on the dial. When the output reaches a peak reading, turn off the MAIN POWER switch. Lastly, remove the yellow/black lead from the variac motor where it plugs onto the variac. This disables the heart cam drive and allows a dc calibration to take place. Continue with the calibration at this time.

3. Remove the panel screws and slide the panel out from chassis(one set of holes) to gain access to the calibration pot on the back of the voltmeter.

4. Zero the meter movement using the zero adjustment below the scale window.

5. Perform the steps in Setting up the Equipment at the start of SECTION 2. Be sure to ground the front panel to a solid earth ground using the supplied black ground test lead prior to connecting the unit to input power.

6. Connect the output cable to a calibrated reference meter with ability to read to the full output voltage of the unit. Be sure to ground the low side of the meter.

7. Raise the output to one half scale on the unit meter. Adjust R4 as required.

8. Check calibration at both half and full scale. If the customer facility calibration certification requires more points of reference, follow those procedures instead of these.

9. Change the polarity by manually operating the latching relay on the heart cam assembly and check the other polarity.

Miscellaneous

Note: During normal operation, the control panel will heat due to the variable transformer output control. The heat exhibited is normal and does not affect the operation of the test set at all.

Replacing the Output Cable

The output cable can easily be replaced if it becomes damaged. The tank connection is a dry well fitting. To replace the cable:

1) Locate a suitable work surface that allows the control panel to be accessed.
2) With input power removed, remove the six (6) screws securing the control panel.
3) Remove the strain relief holding the cable in the panel. Lift the panel towards a vertical position to access the top of the high voltage tank.
4) Disconnect the output cable at the tank and feed the cable backwards through the panel.
5) Install a replacement cable by reversing the steps above.

Oil Insulated High Voltage Tanks

The oil-filled tanks in all the VLF SERIES of hipots are field serviceable. The only requirement is that the tank must be oil filled under vacuum at re-assembly. The parts to service the tank are available from HIGH VOLTAGE, INC. at the address noted on the inside front cover of this manual.

The oil level in the tank should be .50 - .75 inches from the lid when the oil temperature is 20°C.

RETURNED MATERIAL

If for any reason it becomes necessary to return any equipment or materials to High Voltage, Inc., the Service Department of High Voltage, Inc. must be notified, and authorization received, prior to the shipment of the equipment. When notified, the following information must be provided:

MODEL:
SERIAL NO:
PART NO:
REASON FOR RETURN:
SUSPECTED DEFECT:
CAUSE OF DEFECT:

With the above information provided, High Voltage, Inc. will determine if the return of the equipment is appropriate. If deemed appropriate, a Return Authorization Number will be issued. At that time, the Purchaser will be instructed how to mark and return the equipment.

The above procedure must be adhered to in order to ensure prompt service. No equipment should be returned without the prior knowledge and authorization of High Voltage, Inc.

REPLACEMENT PARTS ORDERING

To order replacement parts, first refer to the Parts List for the product in question. Every part is issued a part number. It will be necessary for this part number and the product model and serial number to be provided. When calling High Voltage, Inc. request the Service Department.

TERMS AND CONDITIONS AND LIMITED WARRANTY Rev. 102113

High Voltage, Inc., 31 County Route 7A, Copake, NY USA 12516
Phone: (518) 329-3275 Fax (518) 329-3271 E-mail: factory@hvinc.com

THESE TERMS AND CONDITIONS OF SALE AND LIMITED WARRANTY OF HIGH VOLTAGE, INC. ("High Voltage") SHALL BE GOVERNED BY AND CONSTRUED ACCORDING TO THE INTERNAL LAWS OF THE STATE OF NEW YORK, USA, WITHOUT GIVING EFFECT TO ITS CONFLICT OF LAWS PROVISIONS. THE RIGHTS AND OBLIGATIONS OF ALL PARTIES AND ALL PERSONS OR ENTITIES CLAIMING HEREUNDER SHALL NOT BE GOVERNED BY THE PROVISIONS OF THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS.

1. **ACCEPTANCE.** All orders become effective only when accepted by High Voltage's written order acknowledgment at Copake, New York, USA. Unless modified in writing by an authorized representative of High Voltage, or modified in High Voltage's Quotation or order Acknowledgment, these Terms and Conditions and Limited Warranty shall solely control Purchaser's order. High Voltage expressly rejects any additional or different provisions, terms or conditions proposed by Purchaser at any time.

2. **SCHEDULING.** High Voltage's shipping date specified in High Voltage's quotation or purchase order acknowledgment is approximate and High Voltage shall use reasonable commercial efforts to effect timely shipment. Furthermore, High Voltage shall not be liable for any delay in the performance of orders or contracts or in the delivery or shipment of goods or for any damages suffered by Purchaser by reason of such delay when such delay is, directly or indirectly, caused by, or in any manner arising from Purchaser's fault, fires, floods, accidents, riots, acts of God, war, governmental interference or, embargoes, strikes, labor difficulties, shortage of labor, fuel, power, materials or supplies, transportation delays, or any other cause or causes (whether or not similar in nature to any of these hereinbefore specified) beyond the control of High Voltage.

3. **CANCELLATIONS.** Prior to shipment, Purchaser may request cancellation or delayed delivery of an order or part thereof, but such shall be conditioned upon written consent of High Voltage and upon payment to High Voltage of cancellation or delayed delivery charges to be determined by High Voltage.

4. **SALE AND DELIVERY.** Unless otherwise agreed in writing, sale and delivery of the goods hereunder shall be made EXW or FCA (Incoterms® 2010) at High Voltage's option, High Voltage's dock at Copake, New York, USA, at which time all risk of loss or damage shall pass to Purchaser. All shipments and packaging shall be made in the manner determined by High Voltage, unless otherwise requested by Purchaser, in which case any resultant additional changes and expenses shall be paid by Purchaser.

5. **TAXES.** Any and all sales, use, excise and similar taxes, and duty and all other charges levied or imposed by governmental authority, foreign and domestic, upon any goods sold or contracted to be sold shall be paid by Purchaser and added to the purchase price unless appropriate tax exemption certificates are supplied to High Voltage in form satisfactory to High Voltage.

6. **PAYMENTS.**

a. All payments shall be in US Dollars without discount unless otherwise specified in High Voltage's order acknowledgment. Credit card payments are accepted only if specified in High Voltage's order acknowledgment.

b. Terms of payment are net thirty (30) days from date of invoice, unless otherwise agreed by High Voltage in its order acknowledgment. Delinquent payments are subject to a service charge on the unpaid balance from invoice date equal to the lower of 1-1/2% per month or the maximum rate permitted by law until all amounts are paid in full. If the financial responsibility of Purchaser becomes unsatisfactory to High Voltage for any reason, or if Purchaser has been in default to High Voltage under any order, High Voltage may require full payment in cash before shipment of goods.

c. If Purchaser so requests and makes arrangements prior to shipment which meet High Voltage's full satisfaction, High Voltage in its discretion may accept irrevocable letters of credit in its favor issued by a United States bank which is satisfactory to High Voltage.

7. **INFRINGEMENT, ETC.** On goods manufactured to Purchaser's specifications, Purchaser shall and does indemnify and hold High Voltage harmless against any claims, damages, liabilities, costs and expenses (including attorneys' fees) arising out of or resulting from actual or alleged infringement of patent, copyright, trademark or other proprietary rights, or claim of unfair trade or unfair competition arising from or occasioned by the use, possession, sale or delivery of any such goods sold by High Voltage.

8. **REPRODUCTION RIGHTS.** Drawings, specifications, reports, photographs and other data relating to all orders and all proprietary rights and interests therein and the subject matter thereof shall be and remain the property of High Voltage. Purchaser agrees that it shall not use High Voltage's drawings, specifications or other materials covered by this order, or any similar article from any other source, or reproduce the same or otherwise appropriate them, without the prior written authorization of High Voltage.

9. **LIMITED WARRANTY.**

a. High Voltage warrants to the original Purchaser of any new goods that the goods are free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment by High Voltage. The obligation of High Voltage under this Limited Warranty is limited, in High Voltage's exclusive option, to repair, replace with new or reconditioned parts or issue credit for goods, parts or materials which prove to be defective. Costs incurred by Purchaser for labor or other expenses to repair or replace such goods, parts and/or materials shall be the sole responsibility of Purchaser. High Voltage shall not be responsible for any damage or lack of performance resulting from: (i) defects due to accident, negligence, alteration, modification, faulty installation, abuse or misuse, whether by Purchaser, Purchaser's agents or employees, or by others than High Voltage (ii) attempted or actual dismantling, disassembly, service or repair by any person, firm or corporation not specifically authorized in writing by High Voltage, or (iii) defects caused by or due to handling by carrier, or incurred during shipment, transshipment or other move.

b. High Voltage expressly disclaims any warranty whatsoever of (i) consumables, and of (ii) parts, components, software (including but not limited to object code and source code and software user instructions), accessories, and materials not prepared, compiled or manufactured by High Voltage, and Purchaser must deal directly with such other supplier. High Voltage may elect to assist Purchaser in settling such claim against such other supplier, but any such assistance shall not prejudice High Voltage's position as to its own liability.

c. Compliance with the following Limited Warranty Claim Procedure is a condition precedent to the obligation of High Voltage under this Limited Warranty:

i. Purchaser must notify High Voltage in writing as soon as is reasonably possible, but within the applicable warranty period, of any alleged defect in material, workmanship, or operation of any goods covered under this Limited Warranty. Such notice must describe in detail the defect, any and all defective parts, and the alleged cause of the defect. No goods may be returned to High Voltage without High Voltage's prior written permission, which permission may be withheld by High Voltage in its sole discretion.

ii. At the exclusive option of High Voltage, Purchaser may be directed in writing to dismantle the goods at the Purchaser's cost and expense and ship the goods prepaid to High Voltage (refer to "Returns" Section 10 for provisions regarding the return of any goods to High Voltage). If High Voltage elects to inspect the goods at Purchaser's site, and to repair, replace,

[Section 9.c.ii. continued on page 2]

or ship the defective goods to High Voltage's factory, Purchaser, at its own cost and expense, shall provide the facilities for such work as needed to inspect and evaluate and possibly repair/replace the goods. If inspection discloses that the defect is not one for which High Voltage is liable, then Purchaser shall promptly reimburse High Voltage for all expenses incurred.

iii. Upon receipt of the defective goods, or following access to the same, High Voltage shall inspect and evaluate the goods and determine the validity of Purchaser's claim.

iv. The validity of any warranty claim, Purchaser's compliance with the Limited Warranty and Limited Warranty Claim Procedure, and the obligation to replace, repair, or issue credit for any goods are solely and exclusively to be determined by High Voltage and any determination shall be final and binding.

d. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, STATUTORY OR EXPRESSED OR IMPLIED ON THE PART OF HIGH VOLTAGE, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT; FURTHERMORE, HIGH VOLTAGE MAKES NO WARRANTY REGARDING NON-INTERRUPTION OF USE OR SOFTWARE FREEDOM FROM BUGS. HIGH VOLTAGE NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON, FIRM, OR CORPORATION TO ASSUME ANY LIABILITY OR OBLIGATION IN CONNECTION WITH THIS SALE OR LIMITED WARRANTY ON HIGH VOLTAGE'S BEHALF AND PURCHASER ACKNOWLEDGES THAT NO REPRESENTATION EXCEPT THOSE MADE HEREIN HAS BEEN MADE TO PURCHASER.

10. **RETURNS.** No goods may be returned to High Voltage without High Voltage's prior written permission, which permission may be withheld by High Voltage in its sole discretion. Any request for return authorization must be in writing and include, as applicable, model number, serial number, part number, reason for return, alleged defect, and apparent cause of alleged defect. Except as specifically provided in Section 9 Limited Warranty, if High Voltage consents to return of goods: (a) all return shipments are to be via prepaid freight and with all other charges prepaid, (b) if goods are returned to High Voltage within sixty (60) days from the date of original shipment for reasons other than an error by High Voltage in filling the Purchaser's order, Purchaser shall only be entitled to receive a credit in an amount equal to the payment received by High Voltage for the goods minus (i) handling charges, and (ii) a restocking fee determined solely by High Voltage which shall not exceed twenty five percent (25%) of the invoiced amount, and (c) if goods are returned to High Voltage after sixty (60) days from the date of original shipment for reasons other than an error by High Voltage in filling the Purchaser's order, Purchaser shall only be entitled to receive a credit in the amount equal to the payment received by High Voltage for the goods minus (x) a handling fee, and (y) a restocking fee in excess of twenty five percent (25%) which shall be determined by High Voltage.

11. **SECURITY INTEREST.** In order to induce High Voltage to ship goods without full payment, Purchaser grants a security interest to High Voltage in any and all of Purchaser's right, title and interest in the goods, and Purchaser agrees to comply with any reasonable request of High Voltage to perfect such security interest. Purchaser hereby further authorizes High Voltage to perfect High Voltage's security interest in said goods and consents to filing one or more financing statements without the signature of Purchaser.

12. **ARBITRATION.** Any controversy arising out of or relating to this document, or any breach thereof, including, without limitation, any claim that this document is voidable or void, shall be submitted to final and binding arbitration before, and in accordance with, the Commercial Rules of the American Arbitration Association then in effect, and judgment upon the award may be entered in any court have jurisdiction thereof; provided, however, that this clause shall not be construed to limit any rights which High Voltage may have to apply to any court of competent jurisdiction for equitable, injunctive or provisional relief. This arbitration provision shall be deemed self-executing, and in the event that either party fails to appear at any properly noticed arbitration proceeding, an award may be entered against such party notwithstanding said failure to appear. Such arbitration shall be conducted before a single arbitrator under the aegis of the American Arbitration Association in Columbia County, State of New York. The arbitrator shall have the authority to award expenses to the successful party.

13. **LIMITATION OF LIABILITY.** TO THE MAXIMUM EXTENT PERMITTED UNDER APPLICABLE LAW, AND NOTWITHSTANDING ANYTHING ELSE IN THIS DOCUMENT OR OTHERWISE, INCLUDING THAT HIGH VOLTAGE WAS WARNED THAT DAMAGES WOULD OCCUR OR WERE LIKELY TO OCCUR, HIGH VOLTAGE SHALL NOT BE LIABLE WITH RESPECT TO ANY SUBJECT MATTER OF THIS DOCUMENT UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR (i) ANY AMOUNTS IN EXCESS IN THE AMOUNT PAID TO HIGH VOLTAGE FOR THE PARTICULAR GOODS OR PART THEREOF WHICH GAVE RISE TO THE APPLICABLE CAUSE OF ACTION OR CLAIM, OR (ii) ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST OR CORRUPTED DATA, OR (iii) COST OF PROCUREMENT OF SUBSTITUTE GOODS, SOFTWARE, TECHNOLOGY OR SERVICES. HIGH VOLTAGE SHALL HAVE NO LIABILITY FOR ANY FAILURE OR DELAY DUE TO MATTERS BEYOND ITS REASONABLE CONTROL.

14. **SEVERABILITY.** These Terms and Conditions and Limited Warranty are the entire understanding between Purchaser and High Voltage with respect to the subect matter hereof and supersede all prior agreements, dealings and negotiations. No modification, alteration or amendment shall be effective unless made in writing and signed by a duly authorized representative of High Voltage. No waiver of any breach hereof shall be held to be a waiver of any other or subsequent breach. Nothing contained in this document shall be construed as requiring the commission of any act contrary to law. Whenever there is any conflict between any provision of this document and any present or future statute, ordinance or regulation contrary to which the parties have no legal right to contract, the latter shall prevail, but in such event the provision of this document thus affected shall be curtailed and limited only to the extent necessary to bring it within the requirements of the law. In the event that any part, article, section, paragraph, sentence or clause of this document shall be held to be indefinite, invalid or otherwise unenforceable, the entire document shall not fail on account thereof, and the balance of the document shall continue in full force and effect. If any arbitration tribunal or court of competent jurisdiction deems any provision hereof (other than for the payment of money) unreasonable, said arbitration tribunal or court may declare a reasonable modification thereof, and this document shall be valid and enforceable, and the parties hereto agree to be bound by and perform the same as thus modified.

15. **BASIS OF BARGAIN**. Each party recognizes and agrees that the warranty disclaimers and liability and remedy limitations in this document are material, bargained for bases of their agreement and that they have been taken into account and reflected in determining the respective obligations of the parties.

[End]

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Two Testers in One

AC Hipots - Field Portable

Built for Field Use
Portable
Affordable
Rugged & Reliable
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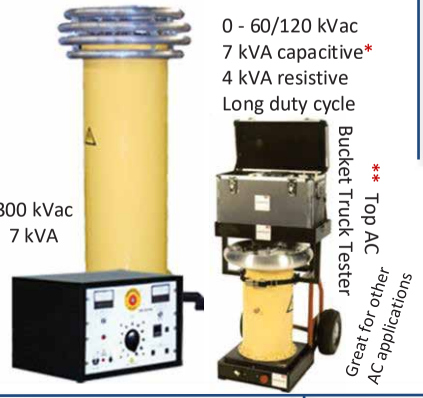

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60 kVac & 100 kVac models

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Fully Programmable
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0.1 – 0.02 Hz to 2.75 uF

30 kVac
0.4 uF

Many more models avail.

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0.1 – 0.01 Hz to 5.5 uF
Wind Farm Model

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34 kV peak - sine wave
0.1 – 0.01 Hz to 7 uF

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PD <10 pc

5 kVac @ 1 A
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Concentric Neutral Resistance Tester

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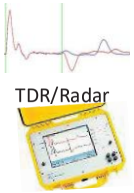
Three Full Joule Outputs – VLF/Thumper Combo

Models for URD & Network Systems



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