

PFT

SERIES

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



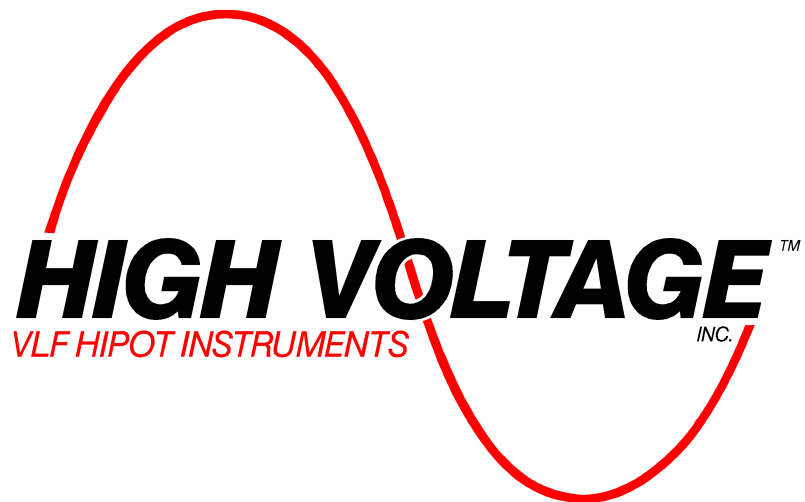
Please Refer to
Documentation
Before Operation

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.**

Operator Manual



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About the Operator Manual

Important

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

This Operator Manual is organized to provide information on the **PFT Series** of Hipots in steps that familiarize the new operator with the 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 PFT Series of AC Hipots are also discussed in the PFT Brochure available from High Voltage, Inc.

General Information

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

PFT Series of Power Frequency AC Test Sets manufactured by **HIGH VOLTAGE, INC.**

Features and Specifications

The PFT Series of AC hipot test sets provide continuously adjustable output voltages for the GO/NO-GO testing of high voltage insulation. Earlier versions of the PFT Series were equipped with operator controlled capacitive compensation switches to minimize input primary currents. The new simplified controls incorporate this feature transparently.

Standard features of the PFT Series of include:

- Continuously adjustable output voltage
- Fixed overload, factory set to 120% of variable transformer rated output current
- “Zero Start” and External Interlock provision
- Secondary connected dual-range voltmeter
- Shielded output cable (50 kV and below) precludes unnecessary insulated support of the cable
- One piece portable design (50 kV and below)
- Transit protected meters prevent meter damage between test sites
- Capacitive load compensation incorporated to allow up to 3 KVA output power with less than 15 Amperes input line current.
- Fault Burn Reactor (Optional)

PFT MODEL SPECIFICATIONS

	PFT-103	PFT-303	PFT-503	PFT-1003
<p style="text-align: center;">SEE SPECIFICATIONS ON LAST SHEET OF PARTS LIST</p>				

Table 1 *PFT Series Specifications.*

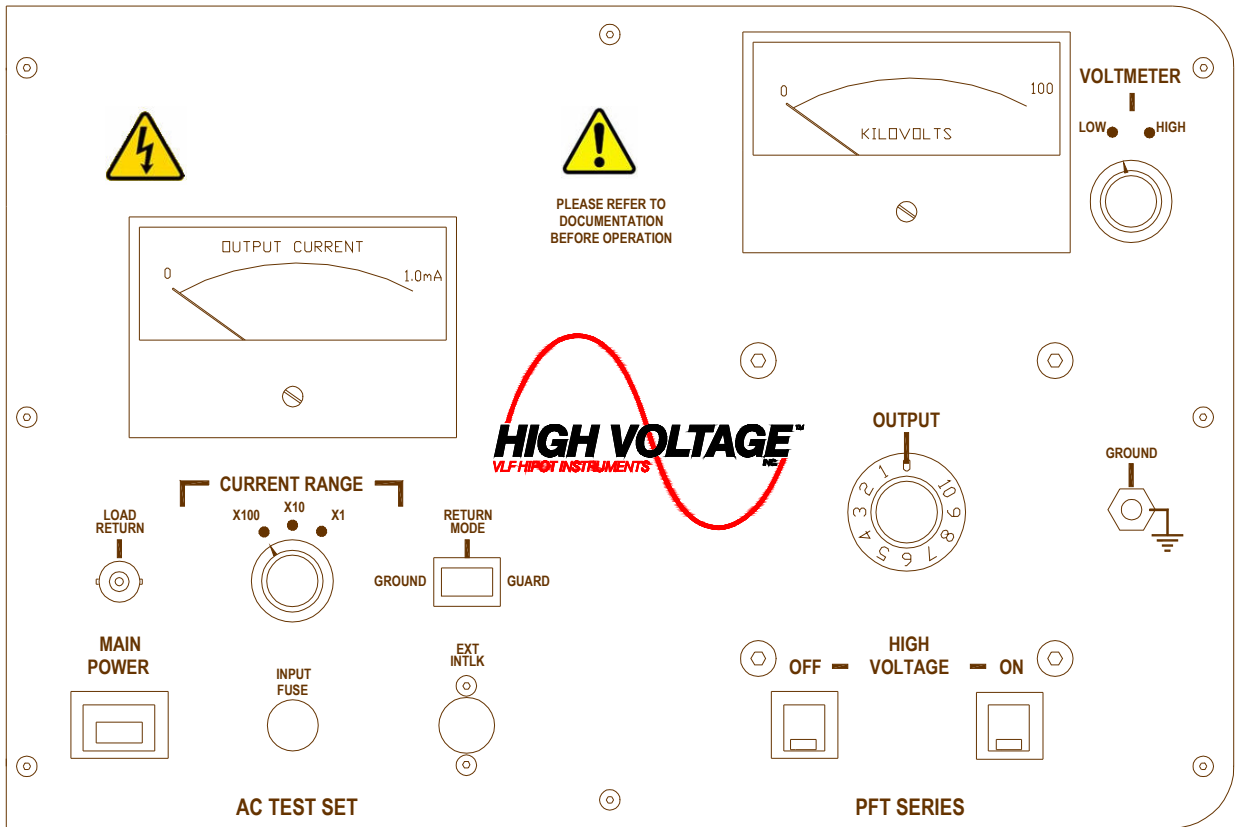


Figure 1 PFT Series front panel controls.

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 the input line cord. The **INPUT FUSE** located electrically before the **MAIN POWER** switch provides line fault 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.

HIGH VOLTAGE ON/OFF

The **HIGH VOLTAGE ON** and **OFF** pushbuttons control the high voltage power circuits. The red and green LEDs provide life long positive indication of the circuit status. The red LED lights when high voltage is energized and the green LED lights when the high voltage is de-energized.

OUTPUT CONTROL

The **OUTPUT** control variable transformer adjusts the output voltage. The 0-10 markings 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**

VOLTMETER AND RANGE SWITCH

The **KILOVOLT METER** and associated range switch allows for more 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.

CURRENT METER

The **CURRENT METER** is for accurate secondary load current readings. The range multiplier switch (X1, X10, X100) allows readings to be taken as low as .1mA (5 divisions) and up to 100mA.

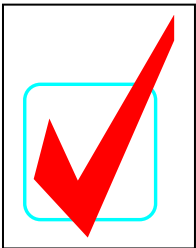
RETURN MODE

The **RETURN MODE** switch allows for accurate secondary load current readings. In the **GUARD** position, all ground currents are shunted around the meter. The load must be isolated from ground to use in the **GUARD** position. In the **GROUND** position, the return point is grounded and all currents (load and ground losses) are metered.

BURN (OPTIONAL)

The **BURN** toggle is provided for tests when the load has faulted and the insulation must be further scored to find the problem. The **BURN** feature will limit current on the output below the overload value and allow for thorough marking of the fault area.

List of included components



- Black test lead with black boot for ground connections. (2 leads for PFT-1003)
- Ext. Intlk. Jumper plug
- Attached 20 ft. X-Ray shielded output cable (50kV and below)
- Alligator and hook connections for working end of output cable (50kV and below)
- 20 ft. RG58/U coax return lead

SETTING UP THE EQUIPMENT

The setup of this equipment has been minimized by careful consideration of the operator during design. The **PFT Series'** one-piece construction (50kV and below) minimizes misplaced components while allowing for convenient portability.

1. **Select a location** for the unit that will allow easy viewing of the meters at a safe distance from the test object.
2. **Be sure that all the controls are off**, in their de-energized or fully counterclockwise position.
3. **Secure a ground test lead to the panel.** The **Ground** post on the front panel should be used for that purpose. A black test lead with black boot has been provided for the ground connection. A second ground lead is provided for two-piece units for the grounding of the high voltage section.
4. **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. Hand-held safety switches are available from High Voltage to plug directly into the **EXT INTLK** socket.
5. **If applicable, connect the interconnect cable between the control and high voltage section.**
6. The red booted alligator clamp on the output cable is used to connect the output cable to the test object. (50kV and below). Connection of the output toroid on the PFT-1003 high voltage section to the load is accomplished by using a customer provided test lead or tubing (metallic) between the toroid (HV output) and test object.

Operating the Equipment

This section provides step-by-step instruction on various test methods. Many facilities have their own in-house test procedures that should not be superseded by this manual. The purpose of this section is to explain the capabilities of this test set in real-world applications.

AC Insulation Testing

1. Ensure that all the steps listed in **Setting up the Equipment** have been accomplished. Take special note to ground the control panel to a solid earth ground using the supplied black test lead.
2. Select the desired **VOLTMETER RANGE** for the test voltage level expected.
3. *Prior* to connecting the output cable (toroid) to the test sample, be sure that the test sample is de-energized.
4. Connect the output lead to the test sample. ***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.***
5. Connect the input power cord to a grounded source (See the specification table for unit input requirements).
6. Depress the **MAIN POWER** switch to energize the control circuits.

* * * CAUTION * * *

POTENTIALLY LETHAL VOLTAGES
MAY BE PRESENT

7. With the **OUTPUT** control at zero (zero start interlock engaged), depress the **HV ON** pushbutton. The **HV ON** light will glow.

8. Increase the output by rotating the **OUTPUT** control slowly clockwise until the desired output voltage is reached.

Note: The high voltage output cable shield is grounded. This grounded shield appears as a load even under 'no load' conditions. The current on a PFT-503CM is about 18mA at full output with the RETURN MODE in the GROUND position.

9. Maintain the output voltage for the test time specified in your standard procedures.
10. After the test is complete, rotate the OUTPUT control to zero, prior to depressing the **HV OFF** pushbutton.
11. If the test sample fails during the test, the internal overload relay will de-energize the high voltage. **This relay is in the primary circuit and is sensitive to primary current overloads.** The overload is set to 120% of the rated current of the variable transformer. The use of a gapped transformer in the high voltage tank will null the primary currents (up to 1.5 KVA) and the overload will allow operation to the full output rating of 3 KVA. When testing purely resistive loads, the unit will overload above 500 VA of input power to the tank.
12. Prior to removing the output cable from the load, observe that the output voltmeter is at zero.
13. Always ground the output cable (or toroid) and test sample prior to disconnecting the test object.

Using the Guarded Return

The use of the GUARD/GROUND return feature of this test set provides for very accurate leakage current measurements if certain conditions exist allowing for the GUARD circuit to be employed. The following explanation will detail different test samples and methods that lend themselves to the use of this circuit. The same setup precautions such as proper grounding still apply to the test but the grounds will be manipulated to accomplish the test requirements.

1. **Grounded Return-** With the output return in the grounded mode, the current meter reads all current to ground, internal and external to the test set. This current might include corona, surface tracking, and any shunt resistance. The typical diagram for grounded return operation is shown in **Figure 2** below.
2. **Guarded Return-** With the output return in the guarded mode, the current meter will only read currents through the test sample. The test sample must be isolated from ground on the low side as shown in **Figure 3** below.

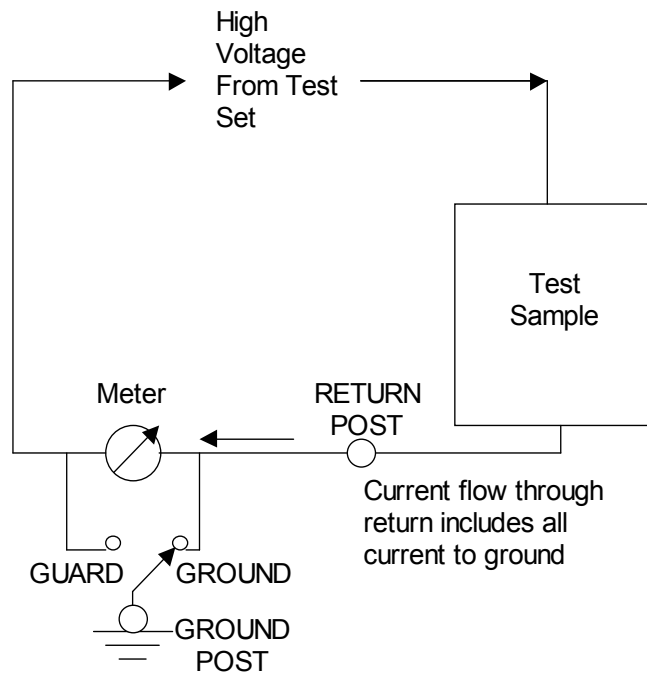


Figure 2, Grounded Return Diagram

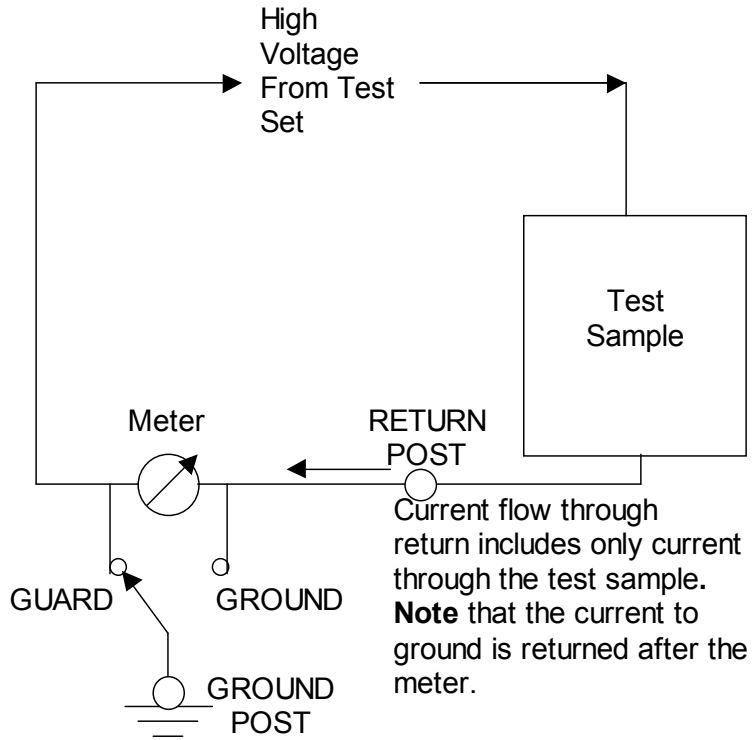


Figure 3, Guarded Return Diagram

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PERFORMING SPECIAL OPERATIONS

The following section contains information on the care and upkeep of your new PFT SERIES Power Frequency AC Test Set. 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 PFT SERIES of hipots use 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. Adjustment of potentiometer (R4) on the voltmeter and current meter 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. Locate the unit in a position that will allow easy reading of the meters.
2. Remove the panel screws and support the panel vertically to gain access to the calibration pot on the back of the voltmeter.
3. Zero the meter movement using the zero adjustment below the scale window.
4. 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.
5. Set the **VOLTMETER RANGE** to **LOW** position.
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 full scale and on the high range at both half and full scale. If the customer facility calibration certification requires more points of reference, follow those procedures instead of these.
9. Calibration must then be verified with the panel in the horizontal operating position to check for any meter balance affect on the calibration.

Current Meter Re-calibration

10. Locate the unit in a position that will allow easy reading of the meters.
11. Remove the current meter panel screws and support the panel vertically to gain access to the calibration pot on the back of the current meter.
12. Zero the meter movement using the zero adjustment below the scale window.
13. 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.
14. Set the **CURRENT RANGE** to **X1** position.
15. Connect the output cable to a calibrated reference meter with ability to read 1mA ac. Use a series resistance or capacitance to allow for precise resolution when calibrating. Be sure to connect the low side of the reference current meter to **LOAD RETURN** and place the **RETURN MODE** switch in **GUARD** position.
16. Raise the output to one half scale on the unit meter. Adjust R4 as required.
17. Check calibration at full scale. If the customer facility calibration certification requires more points of reference, follow those procedures instead of these.
18. Calibration must then be verified with the panel in the horizontal operating position to check for any meter balance affect on the calibration.
19. Check other ranges to verify accuracy. 1% range resistors should not require any adjustment on higher ranges. The output current can only be run to full output current with a capacitive load. Resistive loads are limited to about 1/2 rated current.

Oil Insulated High Voltage Tanks

The oil-filled tanks in all the PFT SERIES of hipots are field serviceable. The only requirement is that the tank must be oil filled under vacuum at re-assembly if left out of the oil for longer than 3 hours. 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 .5 inches from the lid when the oil temperature is 20°C.

Packing the Cables

The output cable will easily fit into the cable storage area next to the control panel. First, the output clip and hook terminations should be placed into the storage area. Next, care should be used to avoid damaging the output cable jacket when coiling into the compartment. As the final step, the ground lead will coil neatly inside the output cable coil.

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:

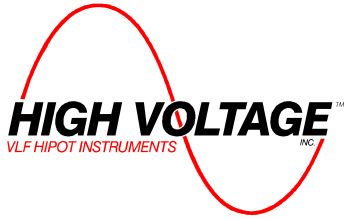
CAUSE OF DEFECT:

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 is necessary for this part number and the product model and serial number to be provided. When calling High Voltage, Inc. request the Service Department.



WARRANTY

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High Voltage, Inc. warrants to the original purchaser of any new product, purchased from High Voltage, Inc., that the product is free from defects in material and workmanship under normal use and service for a period of one year from the date of shipment. The obligation of High Voltage, Inc. under this warranty is limited and High Voltage, Inc. has the exclusive option to replace, repair, or issue credit for any materials that prove to be defective. Purchaser must comply with the stated Warranty Claim Procedure of High Voltage, Inc. in order for the Warranty to be in force.

The Warranty is valid for normal use of the equipment. Any use outside of the stated standards of operation will void the warranty. In addition, any one of the following events will serve to void the Warranty: (a) any defects due to negligence, alteration, modification, accidental or intended physical abuse, faulty installation, and/or misuse: (b) attempted or actual dismantling, service or repair by any person or firm not officially authorized in writing by High Voltage, Inc: (c) defects caused due to handling or transit, either by carrier or customer.

This Warranty only covers those parts deemed defective by High Voltage, Inc. The liability of High Voltage, Inc. is limited to only the repair, replacement, or issuance of credit for those parts deemed defective within the scope of this Warranty. Any additional costs incurred by the purchaser for labor and/or materials incidental to the inspection, repair, replacement or issuance of credit for product or materials under Warranty is the sole responsibility of the purchaser. This Warranty applies solely to products manufactured by High Voltage, Inc. It does not apply to parts, accessories, or materials not manufactured by High Voltage, Inc. If Purchaser's claim relates to materials manufactured by a supplier to High Voltage, Inc., The High Voltage, Inc. reserves the right to disclaim responsibility and liability under this Warranty and may direct the Purchaser to deal directly with the other supplier of the defective part. High Voltage, Inc. may elect to assist the Purchaser in settling and such claim against another supplier without prejudicing its position as to its own liability.

WARRANTY CLAIM PROCEDURE

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

- a) Purchaser must notify High Voltage, Inc. as soon as is reasonably possible of any alleged defect in material, workmanship, or operation of any product covered under this Warranty. High Voltage, Inc must receive any notification within twelve months after the shipment date of the equipment in question. Such notice must describe in detail the defect, any and all defective parts, and the alleged cause of the defect.
- b) At the exclusive option of High Voltage, Inc., Purchaser may be directed to dismantle the equipment at the Purchaser's cost and expense and ship the equipment prepaid to High Voltage, Inc. Refer to the Returned Material section for instructions regarding the return of any material to High Voltage, Inc. If High Voltage, Inc. elects to inspect the equipment at the Purchaser's site, and possibly repair, replace, or ship to factory the defective equipment, Purchaser, at its own cost and expense, shall provide the facilities for such work as needed to inspect and evaluate and possibly repair/replace subject equipment. If inspection discloses that the defect is not one for which High Voltage, Inc. is liable, that is, is outside the stated terms of the Warranty provided by High Voltage, Inc., then the Purchaser agrees to reimburse High Voltage, Inc. for all expenses incurred.
- c) Upon receipt of the defective material or product, or following access to the same, High Voltage, Inc. shall inspect and evaluate the material or product and determine the validity of the Purchaser's claim.

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

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED ON THE PART OF HIGH VOLTAGE, INC., INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE, AND CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH THEREOF AND HIGH VOLTAGE, INC. NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON, FIRM, OR CORPORATION TO ASSUME ANY LIABILITY OR OBLIGATION IN CONNECTION WITH THIS SALE ON ITS BEHALF AND PURCHASER ACKNOWLEDGES THAT NO REPRESENTATIONS EXCEPT THOSE MADE HEREIN HAVE BEEN MADE TO PURCHASER.