



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



© HIGH VOLTAGE, INC.
31 County Route 7A
Copake, N.Y. 12516
Phone 518/329-3275 • Fax 518/329-3271
<http://www.hvinc.com>
E-mail: factory@hvinc.com

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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 (3kVA rating excludes PFT-652 which is 2kVA)
- Fault Burn Reactor (Optional)
- PFT-652 and PFT-1003 are CE Marked

PFT MODEL SPECIFICATIONS

	PFT-103	PFT-303	PFT-503	PFT-652	PFT-1003
	SEE SPECIFICATIONS ON LAST SHEET OF PARTS LIST				

Table 1 *PFT Series Specifications.*

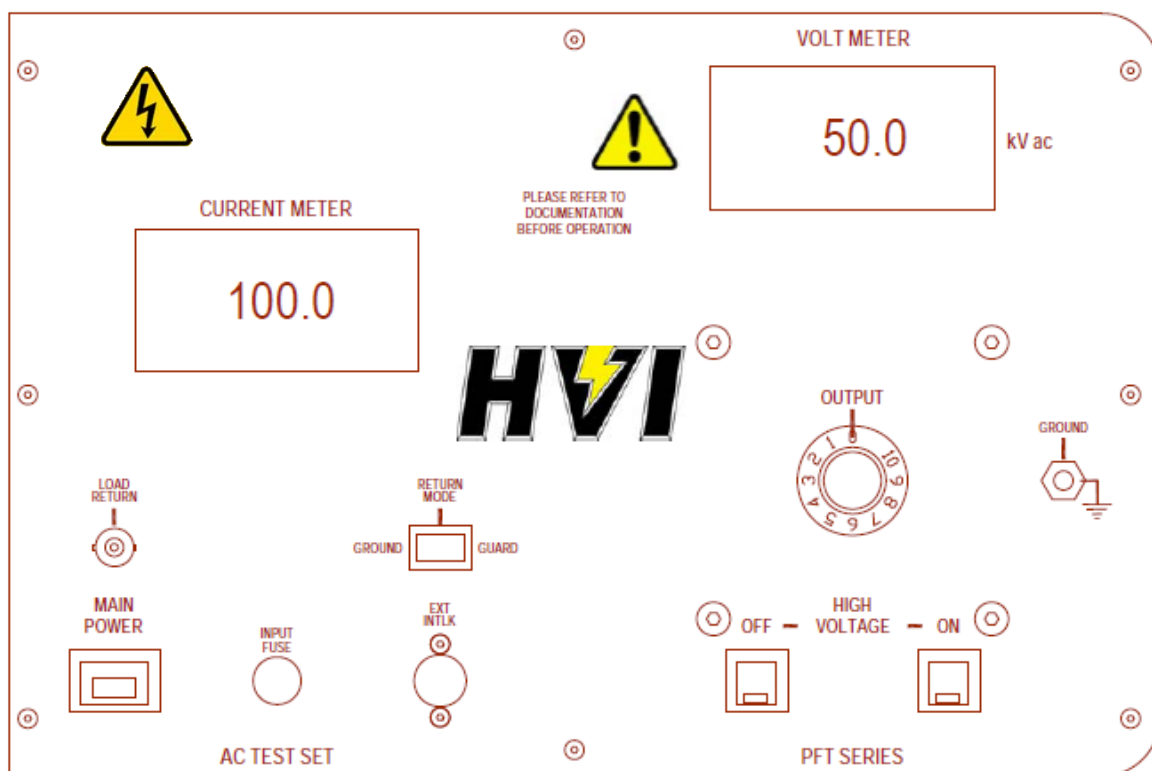


Figure 1A PFT DIGITAL Series front panel Controls

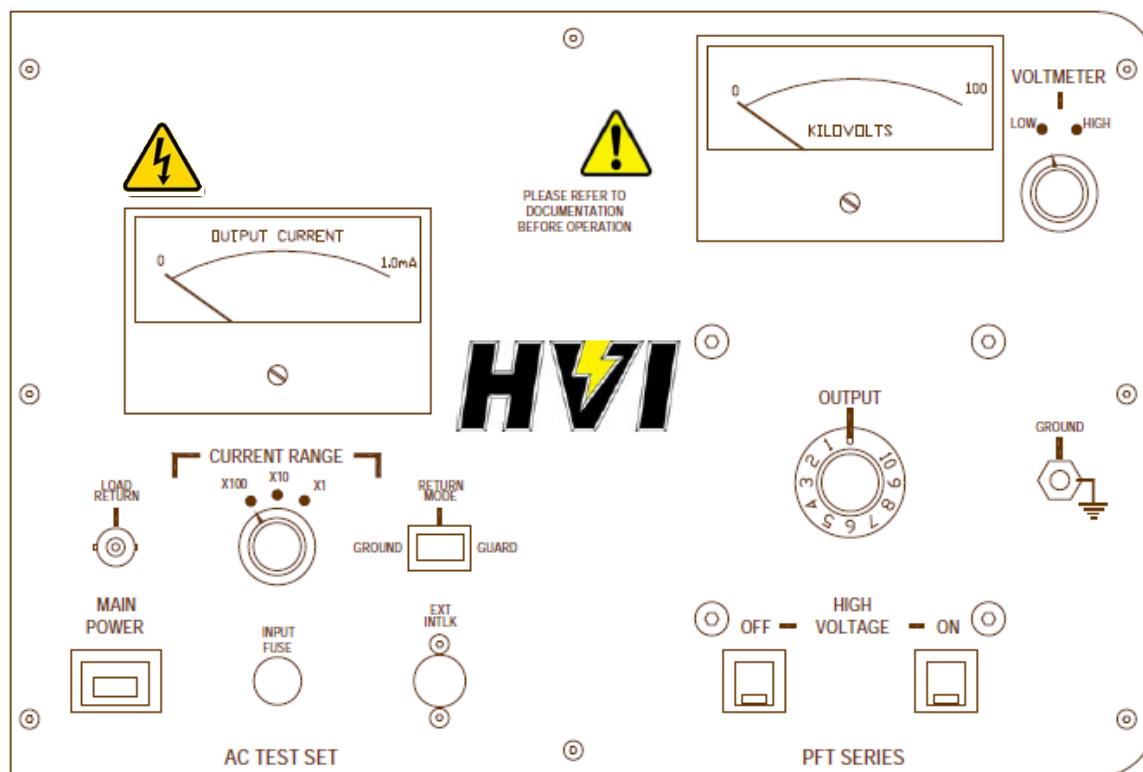


Figure 1B PFT ANALOG Series front panel controls.

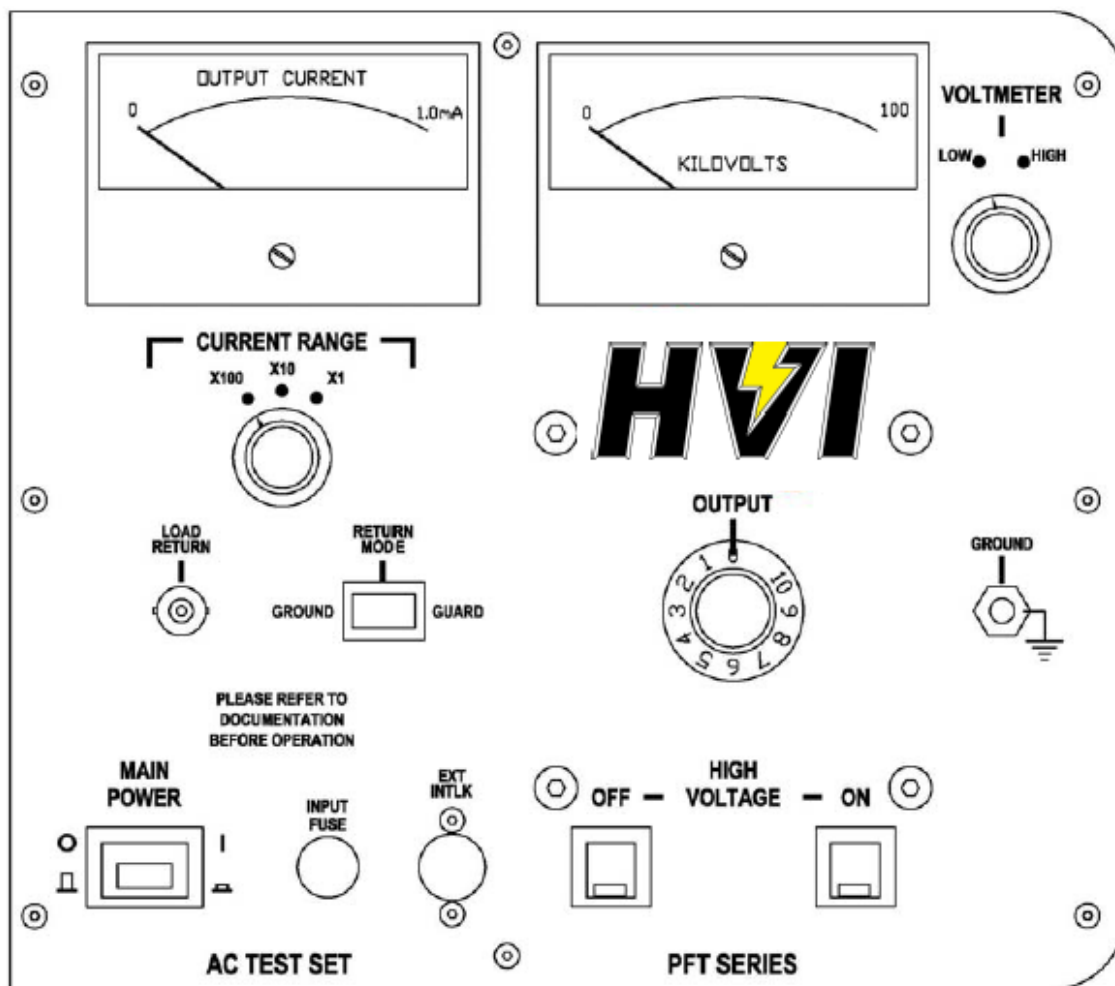


Figure 1C PFT-652/1003 Series front panel controls (Two Piece).

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

ANALOG 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.

DIGITAL VOLTMETER (OPTIONAL)

The LED 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.

ANALOG 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.

DIGITAL CURRENT METER (OPTIONAL)

The LED CURRENT METER is for accurate secondary load current readings up to 100.0mA.

LOAD RETURN CONNECTOR

The LOAD RETURN connector is for the low side of the test load. It connects to the shielded return lead for more accurate load current readings.

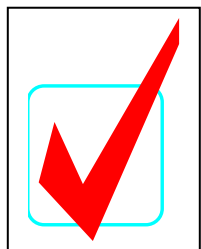
RETURN MODE

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, PFT-652)
- ☐ Ext. Intlk. Jumper plug
- ☐ Attached 20 ft. X-Ray shielded 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-652 and 1003 high voltage section to the load is accomplished by using a Customer Supplied 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 (or toroid) to the test sample, be sure that the test sample is de-energized.
4. Connect the (*Customer Supplied for PFT-652 and 1003*) 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. Return the low side of the test sample to the *LOAD RETURN* connector using the supplied shielded return lead. See the GUARD/GROUND explanation (pp. 11, 12) for direction on which mode may be appropriate for your testing requirements.
6. Connect the input power cord to a grounded source (See the specification table for unit input requirements).
7. Depress the MAIN POWER switch to energize the control circuits.

*** CAUTION ***

POTENTIALLY LETHAL VOLTAGES
MAY BE PRESENT

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

9. 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.

10. Maintain the output voltage for the test time specified in your standard procedures.
11. After the test is complete, rotate the OUTPUT control to zero, prior to depressing the HV OFF pushbutton.
12. 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 1500 VA of input power to the tank.
13. Prior to removing the output cable from the load, observe that the output voltmeter is at zero.
14. 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.

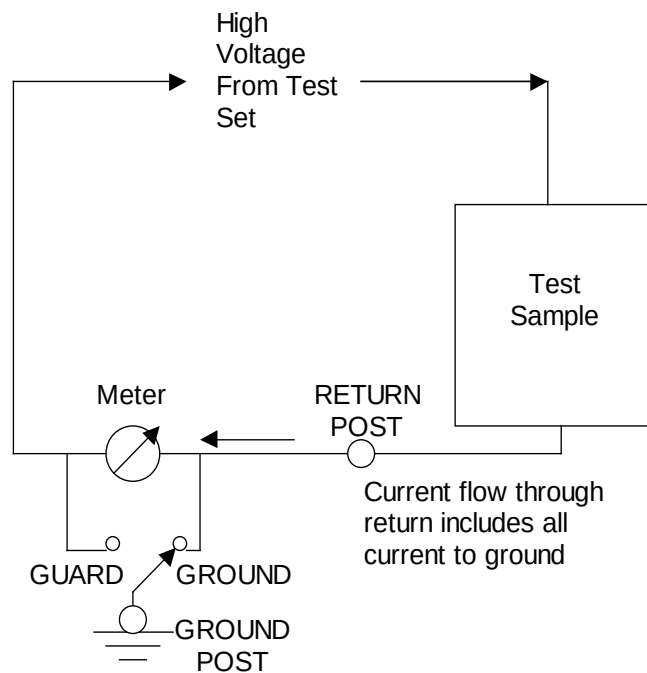


Figure 2, Grounded Return Diagram

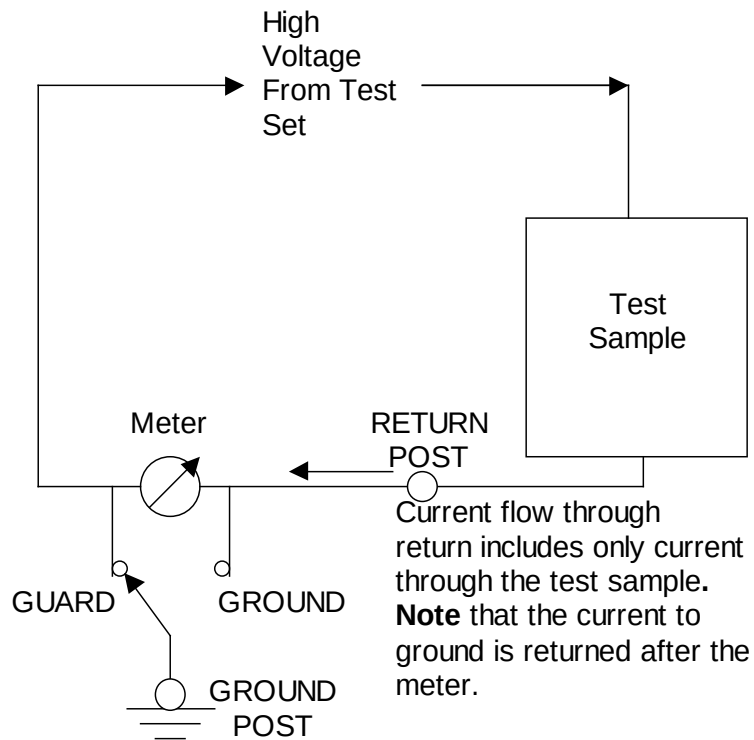


Figure 3, Guarded Return Diagram

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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. Care should be used to avoid damaging the output cable jacket when coiling into the compartment. As the final step, the ground and return leads 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.

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 subject 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]

