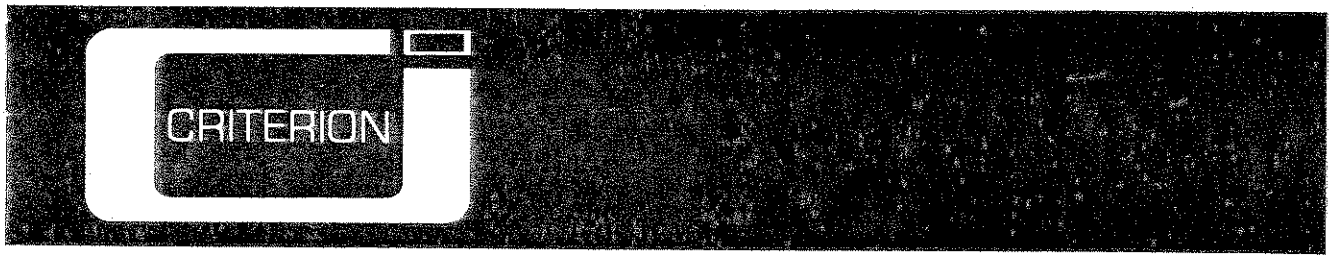
INSTRUCTION MANUAL

FOR

DIELECTRIC STRENGTH TESTERS

MODELS AVC-25V AND AVC-25VA



WARNING

THIS EQUIPMENT PRODUCES POSSIBLY LETHAL VOLTAGES! IT SHOULD BE USED ONLY BY PROPERLY TRAINED PERSONNEL.

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READ THE INSTRUCTION MANUAL COMPLETELY AND CAREFULLY BEFORE OPERATING THIS EQUIPMENT.

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NOTE: FOR SAFETY, AN INSPECTION AND CALIBRATION SHOULD BE CARRIED OUT ON THIS EQUIPMENT AT LEAST TWICE A YEAR, OR AS REQUIRED, BY A QUALIFIED ELECTRICAL TECHNICIAN WELL EXPERIENCED IN HIGH-VOLTAGE OPERATION. IF YOU WISH, IT MAY BE RETURNED TO CRITERION INSTRUMENTS LIMITED FOR THIS SERVICE.

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AVERTISSEMENT

CET ÉQUIPEMENT PEUT PRODUIRE DES TENSIONS MORTELLES! IL DEVRAIT ÊTRE UTILISÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ.

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LISEZ LE MANUEL D'INSTRUCTIONS EN ENTIER ET ATTENTIVEMENT AVANT METTRE L'ÉQUIPEMENT EN MARCHE.

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NOTE: PAR MESURE DE SÉCURITÉ, CET ÉQUIPEMENT DEVRAIT FAIRE L'OBJET D'UNE INSPECTION ET D'UN ÉTALONNAGE AU MOINS DEUX FOIS PAR ANNÉE PAR UN TECHNICIEN EN ÉLECTRICITÉ AYANT UNE BONNE EXPÉRIENCE DES APPAREILS À HAUTE TENSION. CRITERION INSTRUMENTS LIMITED SE CHARGERA DE CE TRAVAIL SI VOUS LUI EXPÉDIEZ L'ÉQUIPEMENT.

INSTRUCTION MANUAL
FOR
DIELECTRIC-STRENGTH TESTERS
MODELS AVC-25V AND AVC-25VA

DANGER!
READ INSTRUCTION MANUAL
THOROUGHLY BEFORE USING
THIS INSTRUMENT!

Manufactured by
Criterion Instruments Limited
Scarborough - Ontario - Canada

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1. INTRODUCTION

The Criterion Instruments Limited Models AVC-25V and AVC-25VA Dielectric-Strength Testers are specialized high-voltage power supplies designed especially for measuring dielectric strength or breakdown (often called the "HIPOT" test) as required by many CSA and UL specifications for both qualification and production testing.

2. SPECIFICATIONS

Input:	120 V, 60 Hz, single phase, approx 2.5 A peak
HV Output:	0-2500 V ac This test set has a 500-VA rating and is suitable for testing equipment having a capacitance not exceeding 0.1 μF between live parts and non-current-carrying parts. In general this is considered equivalent to a motor rated at 75 hp or a transformer rated at 50 kVA.
Trip Current:	Factory set at 95 mA
Meters:	Voltmeter (2500 V ac full scale) (voltage measured directly at output test probe) Milliammeter (100 mA ac full scale) (on Model AVC-25VA only) Accuracy ±2% of full scale
Controls:	Power on, voltage adjust, reset
Indicator Lamps:	Power on, line fault, high voltage on, fault
Size:	28W x 20H x 22D cm (approx) (11W x 8H x 8.5D in)
Weight:	9.1 kg (20 lb) (approx)

3. INSTALLATION

(a) The instrument is supplied completely wired and ready for operation without special installation. Merely plug the line cord into any convenient 120-V ac line outlet.

Note that a 3-wire U-ground outlet is necessary to ensure good grounding of the instrument cabinet. This instrument incorporates a special ground sensor. Unless the outlet into which it has been plugged is correctly wired and has a good ground, the test set will not operate, and a small red pilot lamp (LINE FAULT) will light, warning the operator that the

wiring in his building is faulty. A momentary flicker of this lamp is normal when the power is turned on. If the lamp remains on there is a wiring fault, which must be corrected before proceeding. It is dangerous to operate any equipment when there is a line fault, particularly so if there is a defective ground.

(b) It is EXTREMELY IMPORTANT that the electrical ground is a good one. An extra GROUND terminal is provided at the rear of the cabinet, and it is recommended that this be connected to a separate good ground, using wire of AWG #14 or larger.

(c) WARNING: Be sure that the instrument is grounded. The GROUND terminal on the rear should be connected directly to some metal conduit or structure known to be a good ground.

4. OPERATING PROCEDURE

WARNING: Read the Testing Precautions in Section 5.

(a) Be sure the POWER switch on the test set is turned OFF before starting.

(b) Be sure the VOLTAGE ADJUST control is at the zero-voltage position, fully counterclockwise.

(c) Connect together all the supply leads or terminals on the item under test in accordance with the specifications for this test.

(d) Turn on all power switches, if any, on the item under test.

(e) Connect the black-wire ground clip to an exposed metal part of the item under test.

WARNING: Alligator clip must be connected to ground ONLY! and it must be connected first and removed last.

ALSO, THE OPERATOR MUST NEVER HOLD IT BY HIS HAND WHILE APPLYING HIGH VOLTAGE TO THE UNIT UNDER TEST!

(f) Turn the test set power switch ON. The green POWER lamp and the amber FAULT lamp will now both be lit.

(g) Press the RESET button momentarily. The FAULT lamp will go out, and the red HIGH VOLTAGE lamp will come on.

(h) Touch the high-voltage test probe to the terminal being tested (eg, ac line input prongs on a typical small appliance). Push plastic screw-head on side to extend probe.

(i) Turn the VOLTAGE ADJUST control clockwise until the voltmeter reads the desired test voltage, and hold it there for the specified time, usually one minute or one second. In model AVC-25VA the leakage current will be indicated on the milliammeter. Return the voltage to zero. Remove the probe.

OPTIONAL: You may keep the voltage at the set value for production testing when using the probe, but you must be very careful! This can be dangerous. Be sure the retractable probe is in good condition and the operator is standing on a clean rubber mat, with dry hands! Also the terminals to be tested on the unit under test must not be connected to a capacitor, transformer or suppressor. Otherwise you must start the test at zero voltage and increase the voltage to the desired value, as described in the preceding paragraph.

(j) If the leakage exceeds the set value of the trip current, the high voltage will be immediately turned off and the FAULT lamp will come on. Otherwise the item being tested is "good".

(k) Press the RESET button to turn off the FAULT lamp and turn on the high voltage, if necessary.

(l) Restart from (h) to repeat a test on the same unit. Otherwise turn the test set OFF, remove the ground wire and go back to (c).

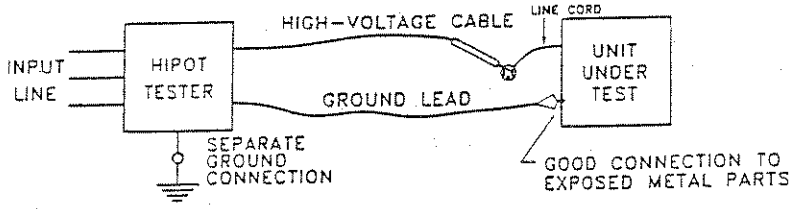
NOTE: Do not use the dielectric test when there is a low-resistance load between the terminals to be tested or terminals to ground. An insulation-resistance test is recommended. (A dielectric test is nearly always with a capacitive load.)

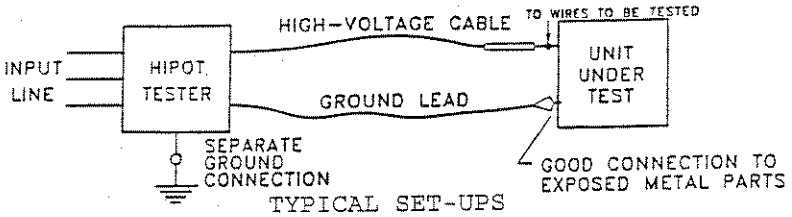
DANGER: DO NOT **EVER** ALLOW THE OUTPUT VOLTAGE TO COME IN CONTACT WITH A PERSON! A LETHAL SHOCK WILL PROBABLY RESULT EVEN AT RELATIVELY LOW OUTPUT VOLTAGE!

Suggested Check Procedure

We recommend that you test the unit at least once a day as follows. Turn VOLTAGE ADJUST to zero, and with the main power off, short the high-voltage output to the ground clip. Turn on the power and high voltage and increase the voltage very slowly. If the unit is working well, it will trip off at a very small voltage.

Because of the inherent resistance in the secondary winding of the transformer, the 95 mA cannot be achieved at a voltage lower than about 250 V.





TYPICAL SET-UPS
(HIGH-VOLTAGE TEST ONLY)

5. TESTING PRECAUTIONS

The relatively high voltages used in dielectric-strength testing are dangerous to life, and the utmost care should be taken in conducting such tests.

The following are considered to be the minimum precautions that should be taken and, if observed, should ensure a reasonable degree of safety.

(a) Test areas should be fenced in or completely surrounded by partitions, or portable barriers painted red. Use a safety cage wherever possible.

(b) Only trained and authorized personnel should be permitted in test areas.

(c) Never handle electrical equipment when hands, feet, or body are wet or perspiring, or when standing on a wet floor. The use of high-voltage gloves is recommended under conditions of high humidity, or under unusual circumstances such as a corrosive atmosphere or where there are high levels of solvents in the air. [see also (h)]

(d) With high voltages, regard all floors as conductive and grounded unless covered with well-maintained dry rubber matting of a type suitable for electrical work. This is for the operator to stand on for safety.

(e) Several permanent and prominent signs should be placed around the test areas warning against the danger of high voltage and prohibiting admittance of unauthorized personnel into the test area. Red warning lights should be turned on when the high voltage is on.

(f) Only one person at a time should perform a high-voltage test because a second person may be touching the equipment when the first person turns on the high voltage. On the other hand an operator should never be entirely alone. Help must be instantly available in an emergency.

(g) Never touch the tip of the test clips when high voltage is on.

(h) High-voltage gloves must also be worn if the tester is used as a portable unit (moved from one place to another for doing a test, not in a fixed area and well grounded).

(i) When testing a capacitor or a cable be sure that the capacitor or cable is *completely* discharged at the end of the test. Momentary shorting of the terminals is not good enough. If you leave the terminals shorted for, say, ten seconds, and then remove the short, you will nearly always find a voltage reappearing at the terminals a short time later. This is caused by dielectric absorption.

6. MAINTENANCE AND CALIBRATION

Maintenance, repair and calibration of a high-voltage test set is NOT for the do-it-yourselfer! The voltages involved are dangerous, and the calibration of both the voltmeter and the trip current is critical when testing to CSA or UL certification specifications. Special expertise and test equipment are required to do the job properly.

It is recommended that your test set be returned to Criterion Instruments Limited for a check of its operation and calibration at least once a year, more often if the equipment is in frequent use, and very promptly if a malfunction is observed or suspected.

Trip Current (and Milliammeter) Calibration

Invariably ac dielectric-strength testers are used with a capacitive load. Therefore we recommend that they be tested with a capacitive load. Some standards insist on this. A 0.25-μF capacitor with an *ac* voltage rating of at least 5 kV can be used for a load.

The trip current sensitivity may be checked as follows. Connect the capacitor in series with an ac standard (traceable if required) milliammeter where the test sample would normally be (from the high-voltage output to ground; connect the milliammeter in the grounded side of the circuit). The capacitor and the meter *must* be sitting on a well-insulated surface.

Be sure the VOLTAGE ADJUST control is at zero (fully counter-clockwise).

Turn on the POWER switch on the tester. Push the RESET button.

Now turn the VOLTAGE ADJUST control very slowly clockwise, watching the milliammeter (ignoring the voltmeter reading). Note the current at which the cut-out operates. Repeat two or three times to confirm a consistent value. This should be 95.0 to 97.5 mA. If there is an internal milliammeter (Model AVC-25VA), check that it reads the same as the external standard.

If the trip current is incorrect, adjust the trip current relay circuit. The new testers have a small adjustable resistor on the circuit board for making current trip adjustments, while the old testers have a Sigma relay, which has a screw head on the side for making the adjustment.

Voltmeter Calibration

Connect a traceable high-voltage voltmeter to the output leads and compare the reading with the internal voltmeter. The recommended method is to use an electrostatic voltmeter.

DO NOT UNDER ANY CIRCUMSTANCES REPLACE THE PLASTIC SCREW IN A RETRACTABLE HIGH-VOLTAGE PROBE WITH A METAL SCREW!

The fuse is a type MDL-3A (or MDX-3A) (**SLO-BLO** - Do not use an ordinary fuse!). DO NOT OVERFUSE! If the fuse blows repeatedly for no apparent reason, the instrument is faulty and should be returned promptly for repair.

WARNING: NEVER REPLACE ANY PART OR COMPONENT WITH ONE THAT IS NOT SPECIFIED BY CRITERION INSTRUMENTS LIMITED.

APPENDIX
AN INTRODUCTION TO
DIELECTRIC-STRENGTH TESTING

The following brief notes are intended to describe a few of the characteristics of dielectric-strength testing so that the operator will better appreciate the significance of the test. A thorough analysis would take a book. No attempt will be made to determine specific test voltages or currents; these must be part of the testing specifications, such as are established by CSA or UL.

What is dielectric strength?

Dielectric strength is defined as the voltage rating at which electrical failure or breakdown occurs. It usually depends on the frequency of the applied voltage, the temperature, the surrounding medium, and how the voltage is applied.

Is this a destructive breakdown?

The standard CSA test applicable to most appliances and small equipments requires a current of 95 mA. Such a breakdown is intended to be destructive so that the point of failure can be found and the reason for failure may be determined. For some applications a lower current, say 5 mA, is specified, which will probably not be destructive.

Should the test voltage be ac or dc?

The regulatory authority will state which must be used in a particular circumstance. AC is most often used, but it must be remembered that the capacitance to ground of a large motor or transformer will cause a significant current to flow. For example, at 2500 V, 60 Hz, and a capacitance of 0.01 μF, the reactive current will be 9.4 mA. This problem of course does not exist with dc, but the voltage must be applied gradually.

What is the distinction between trip current and current limit?

"Current limit" is the maximum current that the high-voltage power supply can provide. The "trip current" is the value of current at which the internal circuit breaker will turn off the high voltage and indicate a failure. Obviously the "current limit" must be greater than the "trip current" or a failure cannot be detected. The "trip current" is often adjustable.

What is the relationship between dielectric strength, insulation resistance and leakage current?

Insulation resistance is nearly always measured with dc, and at a voltage much less than the "breakdown" voltage. Its value is determined by the characteristics of the material, and most often also by the surface conditions - dirt, moisture etc. The measured value of insulation resistance will usually depend on voltage and time, but it will not change rapidly with either. As the voltage is increased, the most likely occurrence will be a very large and rapid increase in current when dielectric breakdown takes place.

Leakage current, as defined by CSA and ANSI, is the current that flows "from the power supply of equipment to exposed non-current-carrying parts, and thence to ground". It is affected largely by the insulation resistance but also by any existing capacitance, intentional or otherwise.

It is sometimes necessary to make all three of these tests independently on a piece of equipment.