TECHNICAL MANUAL

INSTRUMENT CALIBRATION PROCEDURE

AC DIELECTRIC TEST SETS

HIPOTRONICS
705–1 AND 710–1

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LIST OF EFFECTIVE PAGES

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NOTE: On a revised page, with the exception of the Title, the A, and the i pages, the technical changes are indicated by a vertical line in the outer margin of the page.

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SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 This procedure describes the calibration of the Hipotronics 705–1 and 710–1 AC Dielectric Test Sets. The instrument being calibrated is referred to herein as the TI (Test Instrument).

1.2 All comments concerning this procedure should be directed to Navy Measurement Science Directorate, Naval Warfare Assessment Station, P.O. Box 5000, Corona, CA 91718–5000.

1.3 This procedure includes tests of essential performance parameters only. Any malfunction noticed during calibration, whether specifically tested for or not, should be corrected.

Table 1. Calibration Description

TI Characteristics	Performance Specifications	Test Method
Voltmeter	Ranges: 705–1; 0 to 1, 0 to 2.5, and 0 to 5 kV ac 710–1; 0 to 2.5, 0 to 5 and 0 to 10 kV ac Accuracy: ±2% fs	System tested with a high voltage divider and an alternating voltmeter.
Current meter	Ranges: 705–1; 0 to 40, 0 to 80 and 0 to 200 mA ac 710–1; 0 to 100 mA ac Accuracy: ±2% fs	System tested with a shunt and an alternating voltmeter.

SECTION 2

EQUIPMENT REQUIREMENTS

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the using laboratory. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

The instruments utilized in this procedure were selected from those known to be available at Navy calibration facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in this procedure.

Table 2. Equipment Requirements

Item	Minimum Use Specifications	Calibration Equipment
2.1 Alternating voltmeter	Range: 0 to 1.0 V ac Frequency: 60 Hz Resolution: 0.1 mV ac Uncertainty: ±0.29% Impedance: 1 MΩ	Fluke 931BOPT001 or 931AB
2.2 Alternating voltage source	Voltage Range: 0 to 1000 V ac Frequency: 60 Hz Resolution: 1 V ac Uncertainty: ±0.5%	Fluke 5102BOPT003, 005
2.3 High voltage divider	Range: 1 to 10 kV ac Frequency: 60 Hz Ratio: 10,000 to 1 into 1 MΩ Uncertainty: ±0.35% iv	Fluke 80E–10
2.4 Adapter	BNC male to dual banana jacks	Stock item or Pomona Electronics 1296
2.5 Load resistor	Impedance: 100 Ω Uncertainty: ±1% Current rating: 0.2 A Non–inductive	Stock item
2.6 Shunt	Resistance: 0.1 Ω Uncertainty: ±0.29% Current rating: 0.2 A ac	Leeds and Northrup 4360 or 4221B

SECTION 3

PRELIMINARY OPERATIONS

3.1 Ensure that all power switches are set to off, and set all auxiliary equipment controls as necessary to avoid damage to the equipment and so that dangerous voltages will not be present on output terminals when the power switches are turned on.

3.2 Connect the equipment and TI to the appropriate power source.

3.3 Turn all equipment power switches on, and allow a sufficient warm up time for the equipment.

3.4 Zero the TI Volt and Current Meters with the front panel meter zero adjust screw.

SECTION 4

CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

4.1 VOLTMETER MEASUREMENT

4.1.1 High Voltage Divider Calibration

WARNING

THE 80E−10 VOLTAGE DIVIDER'S METER DOES NOT INDICATE AC VOLTAGES. ALWAYS ENSURE THAT ALL TI OUTPUTS ARE SET TO MINIMUM BEFORE CONNECTING OR DISCONNECTING CABLES TO THE VOLTAGE DIVIDER.

4.1.1.1 Connect the equipment as shown in Figure 1.

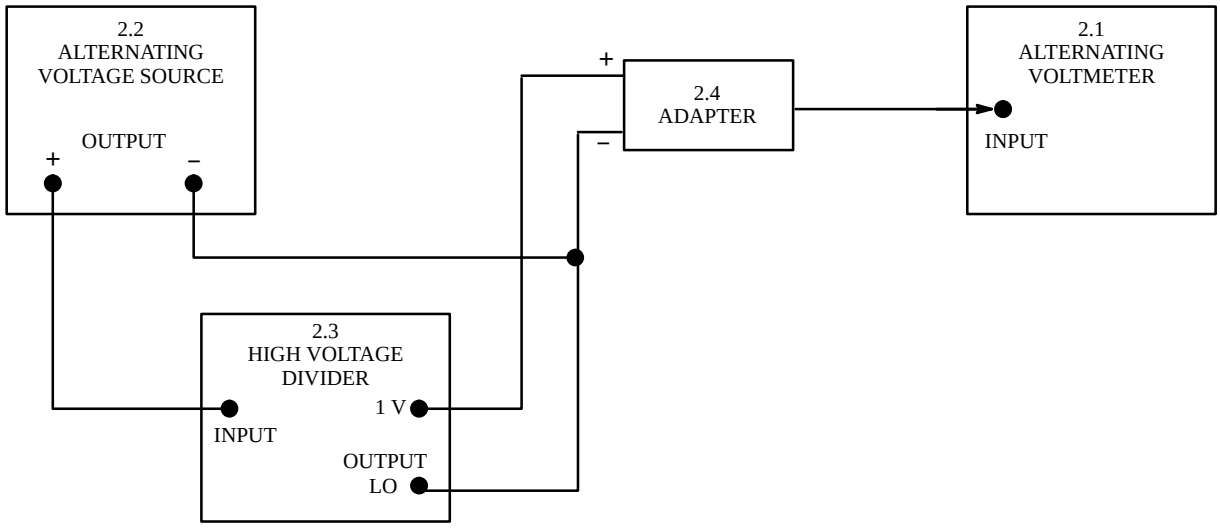

Figure 1. High Voltage Divider Calibration Test Configuration

4.1.1.2 Set the alternating voltmeter (item 2.1) controls to measure 0.1 V ac.

4.1.1.3 Adjust the alternating voltage source (item 2.2) controls for a 60 Hz 1000 V ac output.

NOTE

The ratio of the high voltage divider is determined by the input impedance of the alternating voltmeter versus the impedance of the high voltage divider. The high voltage divider is 10,000 MΩ and the alternating voltmeter is 1 MΩ making a ratio of 10,000 to 1 and therefore the alternating voltmeter will indicate approximately 0.1 V ac per 1 kV of the high voltage divider voltage input.

4.1.1.4 Note the alternating voltmeter indication and calculate the correction factor with the following formula:

$$\frac{\text{(theoretical indication)} - \text{(alternating voltmeter indication)}}{\text{theoretical indication}} \times 100 = \%\ \text{correction factor}$$

$$\text{Example}: \frac{(0.1000\ \text{V ac}) - (.099\ \text{V ac})}{0.1000\ \text{V ac}} \times 100 = \frac{0.001}{0.100} \times 100 = .01 \times 100 = +1\%$$

4.1.1.5 Adjust the alternating voltage source controls for minimum output and disconnect the equipment from the TI.

4.1.2 Voltmeter Calibration

WARNING

LETHAL VOLTAGES ARE PRESENT ON THE TI OUTPUT TERMINALS WHEN THE VOLTAGE AND/OR CURRENT TESTS ARE BEING PERFORMED. ENSURE THAT ALL TI OUTPUTS ARE SET TO MINIMUM BEFORE CONNECTING OR DISCONNECTING EQUIPMENT FROM THE TI.

4.1.2.1 Connect the equipment as shown in Figure 2.

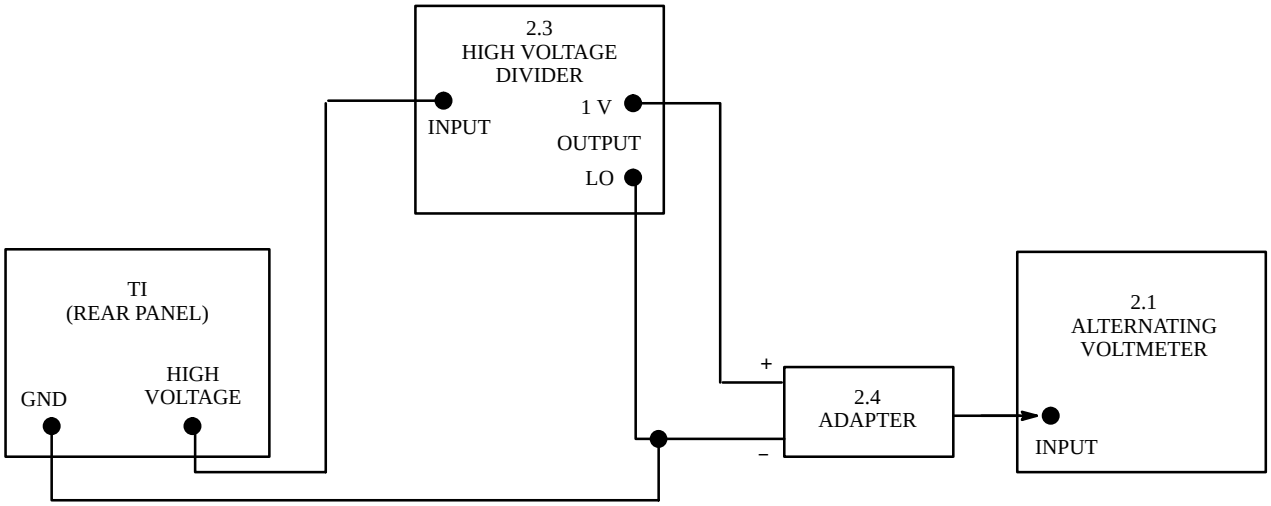

Figure 2. Voltmeter Measurement Configuration

4.1.2.2 Set the TI MAIN POWER and BACKUP breakers to ON.

4.1.2.3 Adjust the TI SENS controls to MIN and ensure that the TI RAISE VOLTAGE control is adjusted for minimum TI output voltage.

4.1.2.4 Depress the TI HV ON pushbutton switch.

NOTE

If a breakdown occurs, the TI overload circuit will trip instantaneously, lighting up the failure light. To reset unit, depress the TI RESET pushbutton switch. Check the TI BACKUP overload breaker to see if it is tripped, if so, reset it. Adjust the TI RAISE VOLTAGE control for minimum output and depress the TI HV ON pushbutton switch.

4.1.2.5 Set the alternating voltmeter controls to measure 0.2 V ac.

4.1.2.6 Set the TI VOLTAGE RANGE switch to LOW.

4.1.2.7 Calculate the alternating voltmeter indication for a high voltage divider output voltage of 1.0 kV ac, model 705−1, or 2.0 kV ac , model 710−1, for use in step 4.1.2.8 (refer to step 4.1.1.4).

4.1.2.8 Adjust the TI RAISE VOLTAGE control for the alternating voltmeter indication calculated in step 4.1.2.7.

4.1.2.9 Verify that the TI voltmeter indication is within the tolerance limits listed.

4.1.2.10 Set the TI VOLTAGE RANGE switch to MED.

4.1.2.11 Adjust the TI RAISE VOLTAGE control for a 2.0 kV ac, model 705−1, or a 4.0 kV ac, model 710−1, TI Voltmeter indication.

4.1.2.12 Verify that the corrected alternating voltmeter indication is within the tolerance limits listed.

4.1.2.13 Set the TI VOLTAGE RANGE switch to HIGH.

4.1.2.14 Adjust the TI RAISE VOLTAGE control for a 4.0 kV ac, model 705−1, or 8.0 kV ac, model 710−1, TI Voltmeter indication.

4.1.2.15 Verify that the corrected alternating voltmeter indication is within the tolerance limits listed.

4.1.2.16 Adjust the TI RANGE VOLTAGE control for minimum TI output voltage and disconnect the equipment from the TI.

4.2 CURRENT METER MEASUREMENT

4.2.1 Connect the equipment as shown in Figure 3.

4.2.2 Set the alternating voltmeter controls to measure 10 mV ac.

4.2.3 Depress the TI HV ON pushbutton switch, adjust the TI RAISE VOLTAGE control for the alternating voltmeter indication as listed in the checklist, model 705−1, or a 9.8 mV ac alternating voltmeter indication, model 710−1.

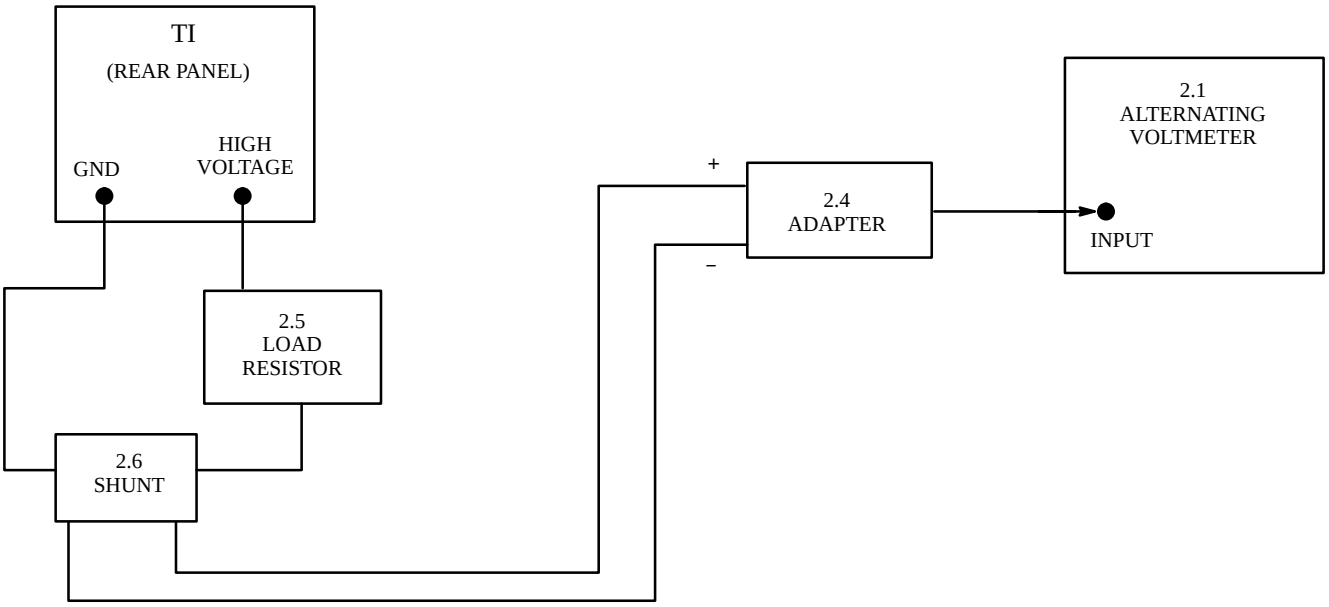

Figure 3. Current Meter Measurement Configuration

4.2.4 Verify that the TI Current Meter indication is within the tolerance limits listed.

4.2.5 Adjust the TI RAISE VOLTAGE control for minimum TI output voltage.

4.2.6 If no other measurements are to be performed, set all power switches to OFF or standby and secure the equipment.

CALIBRATION CHECKLIST

TEST INST (S) Hipotronics 705–1 AC Dielectric Test Set

PROC. NO. NA 17–20AE–148 MFG. MODEL SER. NO.

PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.1	Voltmeter Measurement					
4.1.1	High Voltage Divider Calibration					
4.1.1.4	Error	—	ck ( )			Calculate corr. factor
4.1.2	Voltmeter Calibration	(kV ac)	(kV ac)			(kV ac)
4.1.2.9	LOW Range	1.0				0.98 to 1.02
4.1.2.12	MED Range	2.0				1.95 to 2.05
4.1.2.15	HIGH Range	4.0				3.90 to 4.10
4.2	Current Meter Measurement	(mA ac)	(mA ac)			(mA ac)
4.2.4	LOW Range (4.0 mV ac)	40				39.2 to 40.8
”	MED Range (8.0 mV ac)	80				78.4 to 81.6
”	HIGH Range (10.0 mV ac)	100				96 to 104

CALIBRATION CHECKLIST

TEST INST (S) Hipotronics 710–1 AC Dielectric Test Set

PROC. NO. NA 17–20AE–148		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.1	Voltmeter Measurement					
4.1.1	High Voltage Divider Calibration					
4.1.1.4	Error	—	ck ( )			Calculate corr. factor
4.1.2	Voltmeter Calibration	(kV ac)	(kV ac)			(kV ac)
4.1.2.9	LOW Range	2.0				1.95 to 2.05
4.1.2.12	MED Range	4.0				3.9 to 4.1
4.1.2.15	HIGH Range	8.0				7.8 to 8.2
4.2	Current Meter Measurement	(mA ac)	(mA ac)			(mA ac)
4.2.4	100.0 mA ac	98.0				96.0 to 100.0