*TB 9-6625-1918-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR WATTMETERS AN/URM-98( ), TS-779( )/U HEWLETT-PACKARD MODELS 430C AND 430CR; AND GENERAL MICROWAVE MODEL 451: BOLOMETER (THERMISTOR) MOUNTS MX-2144( )/U, AND HEWLETT-PACKARD MODELS 477( )

Headquarters, Department of the Army, Washington, DC
25 March 2008

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

*This bulletin supersedes TB 9-6625-1918-35, dated 20 July 1979, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Wattmeters AN/URM-98( ), TS-779( )/U, Hewlett-Packard Models 430C and 430CR, and General Microwave Model 451: Bolometer (Thermistor) Mounts MX-2144( )/U, and Hewlett-Packard Models 477( ). The manufacturer's manuals were used as prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Variations among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 2 hours, using the microwave technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Frequency Range	 10 MHz to 10 GHz
Power Range Accuracy	 0.01 to 10 mW ±6% FS[1]
Input power	105 to 125 V ac

[1]RF measurement capability certified only to ±10%.

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-287 or AN/GSM-705. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUTOTRANSFORMER	Range: 105 to 125 V ac	Ridge, Model 9020A (9020A)
MULTIMETER	Range: 0 to 255 V dc 0 to 3 V ac Accuracy: ±1%	Fluke, Model 8840A/AF05 (AN/GSM-64D)
POWER METER	Range: 0 to 10 mW Accuracy: ±6%	Agilent, Model E12-432A (MIS-30525) w/thermistor mount, Agilent, Model 478A-H75 (7915907) or 8478B (8478B)
POWER SPLITTER	Range: DC to 18 GHz	Weinschel, Model 1870A (7916839)
SYNTHESIZED SIGNAL GENERATOR	Range: 10 MHz to 10 GHz	Anritsu, Model 68369NV (68369NV)

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name and listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure.

d. When indications specified in paragraphs **8** and **9** are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs **8** and **9**. Do not perform power supply check if all other parameters are within tolerance.

e. Unless otherwise specified, all controls and control settings refer to the TI.

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance check where applicable.

7. Equipment Setup

a. Position controls as listed in (1) through (5) below:

(1) **BOLO TEMP COEF** (**COEF** on TS-779/U) switch to **NEG**.

(2) **BOLO RES** (**RES** on TS-779/U) switch to **200**.

(3) **RANGE** (**POWER RANGE** on some models) switch to **1.0 MW**.

(4) **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-779/U) switch to **OFF**.

(5) **ZERO SET COURSE** and **FINE** controls fully ccw.

b. Remove TI cover and connect TI to autotransformer.

c. Connect thermistor mount (supplied with TI) to TI.

d. Connect autotransformer to a 115 V ac (volt alternating current) power source and adjust for a 115 V ac output.

e. Set power switch to **ON**.

f. Energize equipment and allow at least 15 minutes for equipment to warm up and stabilize.

8. Voltmeter Zero and Full Scale Circuits

a. Performance Check

(1) Connect multimeter to TI **G** (ground) (fig. 1) and **CAL**, connectors.

(2) Adjust **ZERO SET COURSE**, and **FINE** controls fully cw.

(3) Advance **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-779/U) switch until TI meter pointer swings cw.

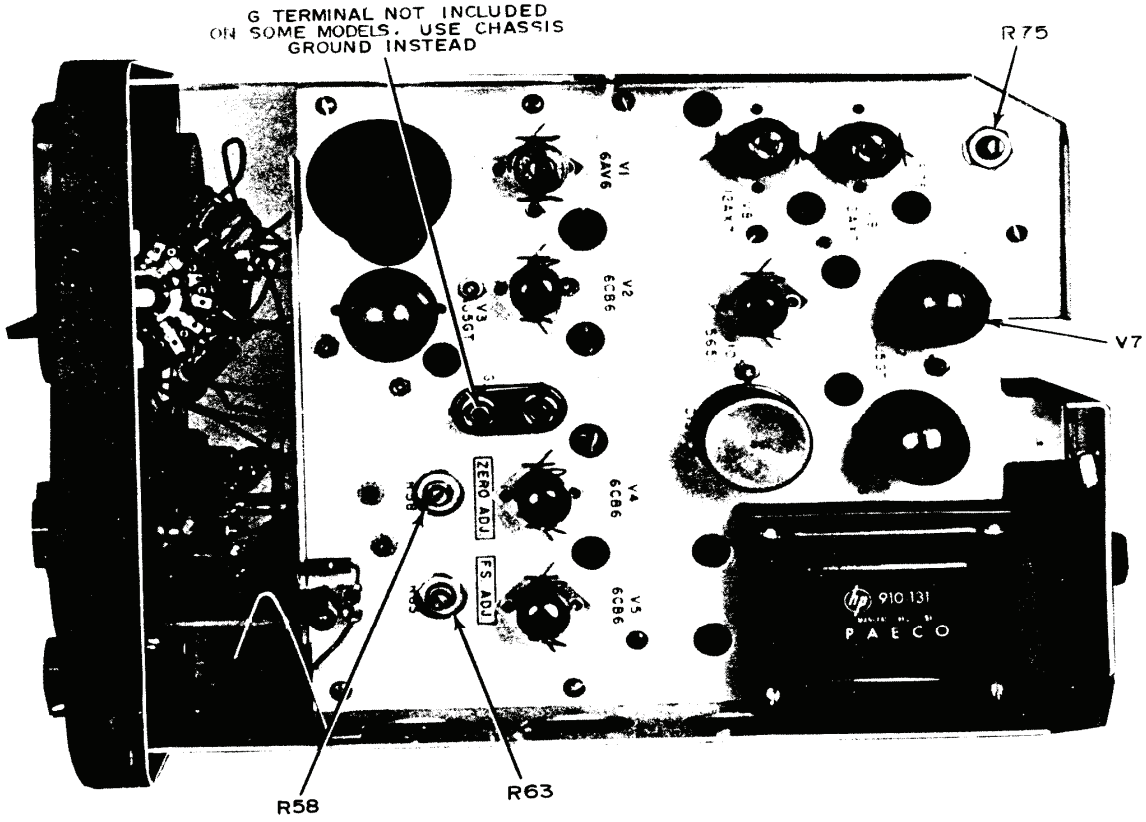

Figure 1. Test instrument - right side view.

(4) Adjust **ZERO SET COARSE** and **FINE** controls until TI meter indicates 0 (zero). If multimeter does not indicate between 0.460 and 0.470 V ac, perform **b** (1) and (2) below.

NOTE

In the following step, it may be necessary to advance **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS779/U) switch to obtain a full-scale indication with **ZERO SET COARSE** and **FINE** controls.

(5) Adjust **ZERO SET COURSE** and **FINE** controls until TI meter indicates full scale. If multimeter does not indicate between 0.188 and 0.192 Vac, perform **b** (3) and (4) below.

b. Adjustments

(1) Adjust **ZERO SET COARSE** and **FINE** controls for a 0.465 Vac indication on multimeter.

(2) Adjust R58 ZERO ADJ (fig. 1) for a 0 (zero) indication on TI meter (R).

(3) Adjust **ZERO SET COARSE** and **FINE** controls for a 0.190 Vac indication on multimeter.

(4) Adjust R63 FS ADJ (fig. 1) for a full-scale indication on TI meter (R).

9. Bridge Balance

a. Performance Check

(1) Connect multimeter between TEST POINT 1 (fig. 2) and chassis ground. For TS-779B/U and General Microwave Model 451, connect multimeter to junction of R2 and S1 and terminals 4 and 5 (fig. 3).

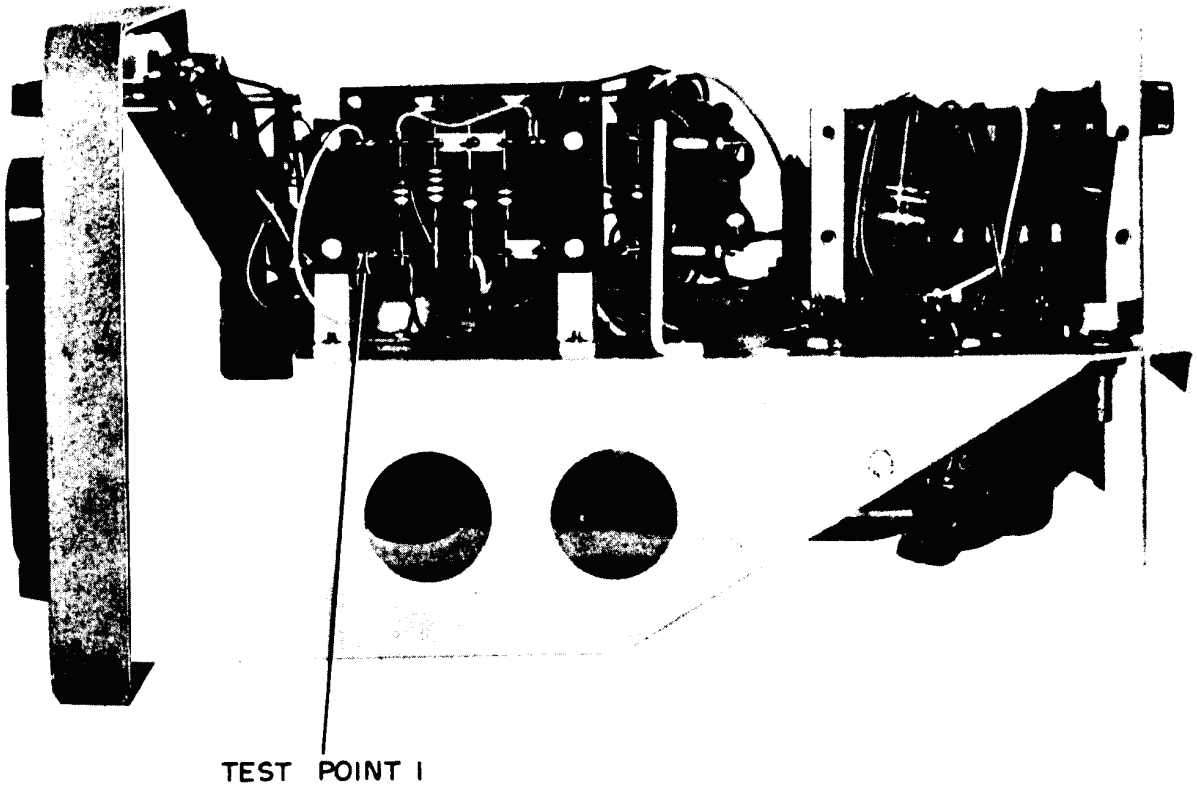

Figure 2. Test instrument - top view.

(2) Set **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-779/U) switch and adjust **ZERO SET COARSE** and **FINE** controls for a 3.0 V ac indication on multimeter.

(3) Connect multimeter between bolometer and TI **BOLOMETER** connector. If multimeter does not indicate between 0.98 and 1.02 V ac, perform **b** below.

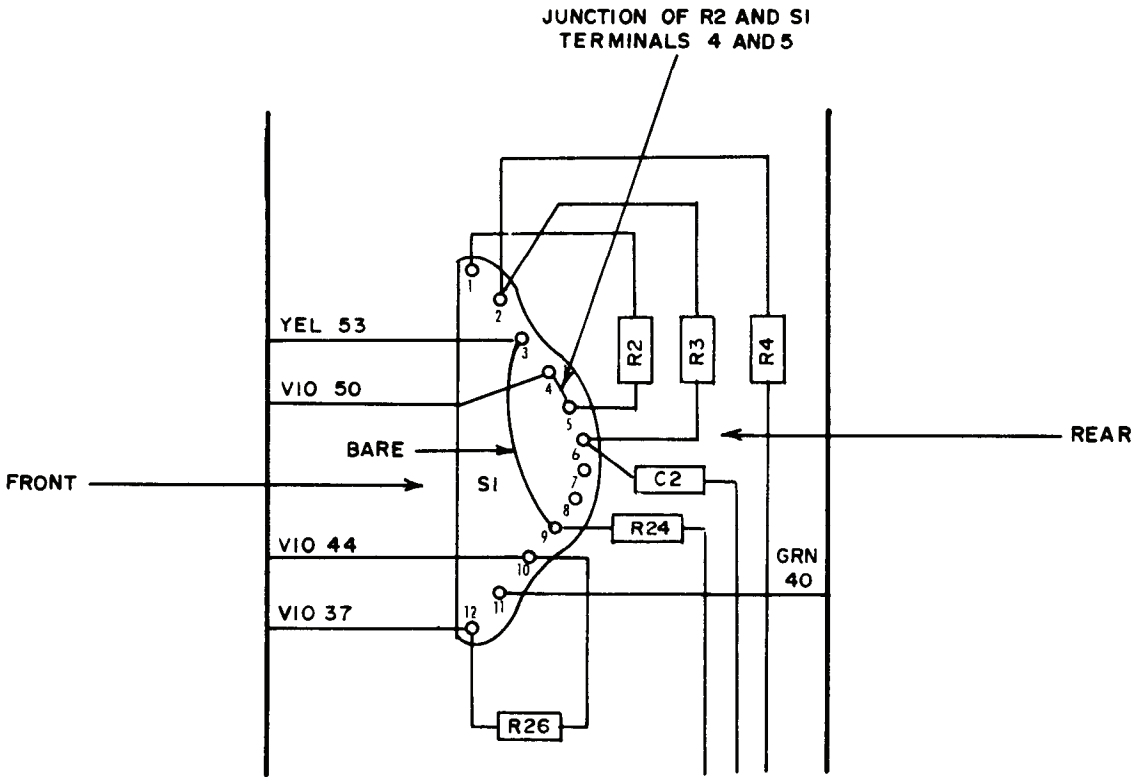

Figure 3. Wattmeters TS-779B/U and Model 451 BOLO RES switch S1 test point location - right side view

b. Adjustments

(1) Set **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-779/U) switch to **OFF**.

(2) Rotate **ZERO SET COARSE** and **FINE** controls fully cw.

(3) Rotate R8 (fig. 4) fully cw and then one eighth turn ccw.

(4) Connect multimeter to TEST POINT 1 (fig. 2). For TS-779B/U and General Microwave Model 451, connect multimeter to junction of R2 and S1 terminals 4 and 5 (fig. 3).

(5) Change **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-779B/U) switch positions until multimeter indicates 2.5 V ac.

(6) Adjust **ZERO SET COARSE** and **FINE** controls for a 3.0 V ac indication on multimeter.

(7) Connect multimeter between bolometer and TI **BOLOMETER** connector.

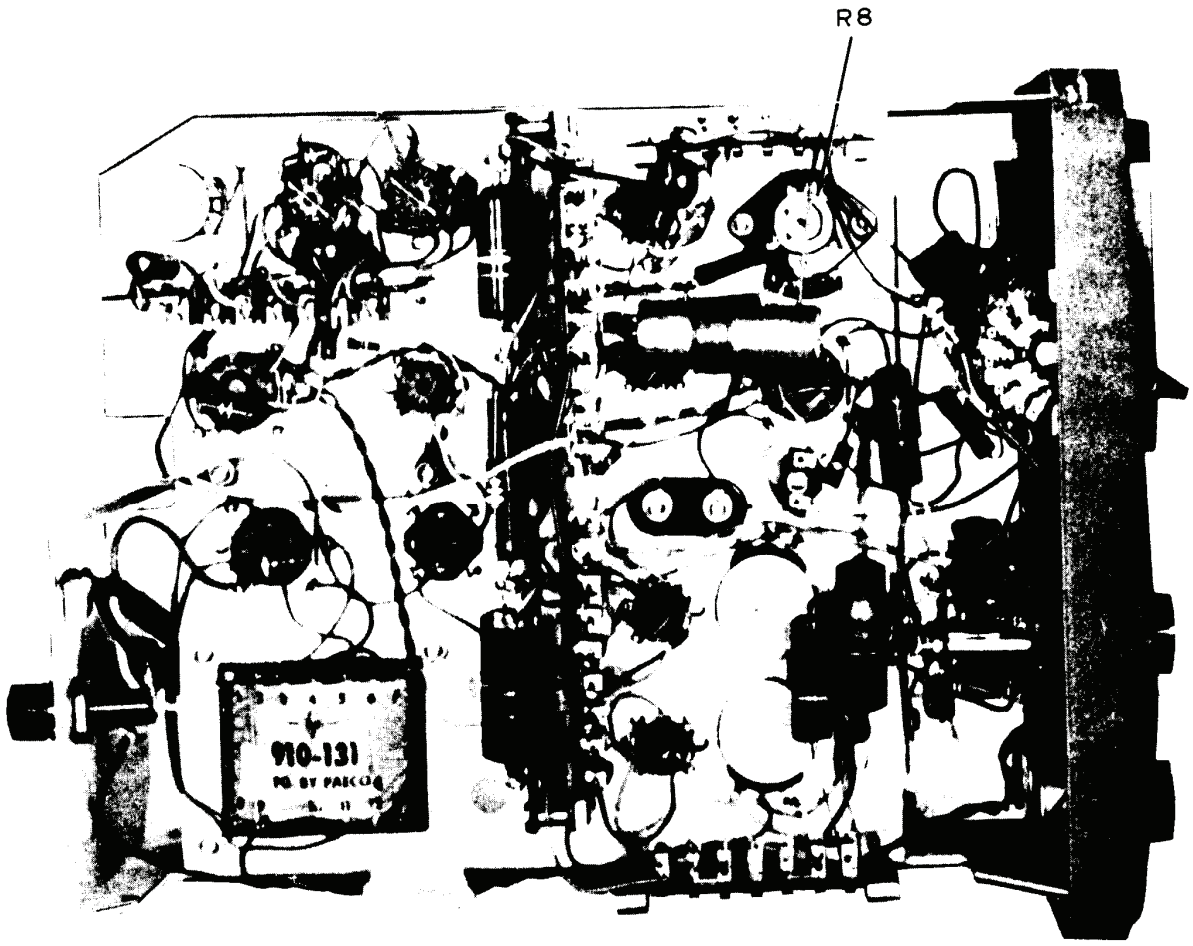

Figure 4. Test instrument - left side view.

(8) Note error from 1.0 V on multimeter and adjust R8 (fig. 4) to double the error. (For example, if multimeter indicates 0.9 V, adjust R8 until multimeter indicates 0.8 V.) (R).

(9) Repeat (4) through (8) above until no error is present.

10. Bolometer (Thermistor) Mount

a. Performance Check

(1) Set **POWER RANGE** (**RANGE** on some models) switch to **1.0 MW** and zero the TI meter, using **BOLO BIAS CURRENT** (**BIAS CURRENT** on TS-799/U) switch and **ZERO COARSE** and **FINE** controls.

(2) Connect equipment as shown in figure 5.

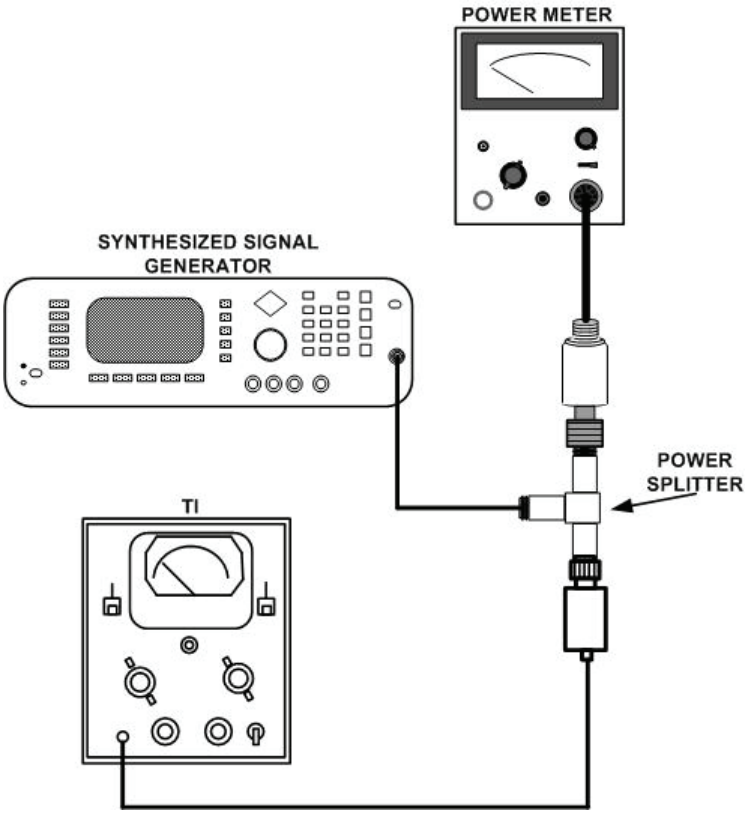

Figure 5. Thermistor mount - equipment setup.

(3) Adjust synthesized signal generator frequency for a 10 MHz output and output level for a full-scale indication on TI meter.

NOTE

If % efficiency chart is provided for TI, check only at frequencies indicated on chart and consider indicated efficiency when calculating measurement results.

(4) Power meter will indicate between 0.9 and 1.1 mW.

(5) Repeat technique of (3) and (4) above with a synthesized signal generator output of 480 MHz, 5 GHz, and 10 GHz. Power meter will indicate between 0.9 and 1.0 mW.

b. Adjustments. No adjustments ran be made.

11. Power Supply Check

NOTE

Do not perform power supply check if all other parameters are within tolerance.

a. Performance Check

(1) Connect multimeter between pin 3 of V7 and chassis ground (fig. 1).

(2) Adjust autotransformer output for 105, 115, and 125 Vac. If multimeter does not indicate between 247.5 and 252.5 Vdc at each output, perform **b** below.

b. Adjustments. Adjust R75 (fig. 1) for a 250 Vdc indication on multimeter (R).

12. Final Procedure

a. Deenergize and disconnect all equipment and reinstall TI protective cover.

b. Annotate and affix DA label/form in accordance with TB 750-25

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0802817

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342144, requirements for calibration procedure TB 9-6625-1918-24.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.