This is a **REPRINT** including Change 1.

*TB 9-6515-200-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR DEFIBRILLATOR ENERGY TESTER NEURODYNE-DEMPSEY MODELS 429, 429 MOD1, and 429B MOD1

Headquarters, Department of the Army, Washington, DC
6 November 1981

REPORTING OF ERRORS

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SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Defibrillator Energy Tester, Neurodyne - Dempsey Models 429, 429 MOD1, and 429B MOD1. The manufacturer's manual was used as the prime data source in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Variations are indicated in text.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc and low frequency technique.

2. DA Form 2416 (Calibration Data Card)

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25-1. DA Form 2416 must be annotated in accordance with TB 750-251 for each calibration performed.

b. Adjustments to be reported on DA Form 2416 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.

*This bulletin supersedes TB 9-6515-200-35, 5 August 1980.

Table 1. Calibration Description

Test instrument parameters	Performance specifications		
	Model 429	Model 429 MOD1	Model 429B MOD1
Regulation	Voltage remains the same at any line voltage between 105 to 125 V ac	Voltage remains within ±0.015 V at any line voltage between 105 to 125 V ac	Voltage remains within ±0.015 V at any line voltage between 105 to 125 V ac
Squaring circuit	±5% linearity of input (TP-4) to output (TP-5) voltages	±5% linearity of input (TP-4) to output (TP-5) voltages	±5% linearity of input (TP-4) to output (TP-5) voltages
Integrator	Range: 0-400 Ws[1] in 3 ranges Accuracy: ±2% FS	Range: 0-400 Ws in 3 ranges Accuracy: ±2% FS on 0-40 range; ±3% FS on 0-100 range; ±3.5% FS on 0-400 range	Range: 0-1000 Ws[2] in 3 ranges Accuracy: ±2% FS on 0-40 range; ±3% FS on 0-100 range; ±3.5% FS on 0-400 range; ±3.5% FS on 0-1000 range
Load resistance	50 ±0.5%	50 ±0.5%	50 ±0.5%
Attenuation	———	±0.5% of computed attenuation ratio	±0.5% of computed attenuation ratio

[1]Not checked above 100 Ws.
[2]Not checked above 400 Ws.

SECTION II
EQUIPMENT REQUIREMENTS

4. **Equipment Required.** Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Sets AN/GSM-286 and AN/GSM-256, and is to be used in performing this procedure. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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.

5. **Accessories Required.** The accessories listed in table 3 are issued as indicated in paragraph 4 above and are used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)	
			AN/GSM-286	AN/GSM-256
A1	AC/DC VOLTMETER	Range: −15.15 to +15 V dc and 4.242 to 10 V ac Accuracy: ±0.1%	Hewlett-Packard, Model 3490A (7912606)	Hewlett-Packard, Model 3490AOPTION060
A2	AUTOTRANSFORMER (TRANSFORMER, VARIABLE POWER)	Range: 105 to 125 V ac Accuracy: ±3%	General Radio, Model W10MT3AS3 (7910809)	General Radio, Model W10MT3AS3 (7910809)

Table 2. Minimum Specifications of Equipment Required — Continued

Item	Common name and/or (official nomenclature)	Minimum use specifications	Manufacturer, model, and (part number)	
			AN/GSM-286	AN/GSM-256
A3	DC POWER SUPPLY	Range: 10 V dc	NJE Corp, Model CS36CR30 (7907346-2)	John Fluke, Model 760A (760A)
A4	DC VOLTAGE STANDARD (CALIBRATOR, VOLTAGE)	Range: −10 to +10 V Accuracy: ±0.1%	John Fluke, Model 332BAF (332BAF)	John Fluke, Model 760A (760A)
A5	FREQUENCY COUNTER	Range: 2 to 10 ms Accuracy: +0.1%	Hewlett-Packard, Model 5345A (MIS-28754)	Hewlett-Packard, Model 5245L (5245L)
A6	OSCILLOSCOPE	Range: 2 to 10 V 2 to 10 ms Accuracy: ±3%	Tektronix, Model 5440 w/5A48 and 5B42 (P/O MIS-28706)	Hewlett-Packard, Model 180DOPT017 w/1805A and 1825A
A7	PULSE GENERATOR	Range: 2 to 10 ms pulses, 4.242 to 10 V	Hewlett-Packard, Model C38-214A (MIS-10355TYPE1)	Hewlett-Packard, Model C38-214A (MIS-10355TYPE1)
A8	RESISTANCE BRIDGE	Range: 49.75 to 50.25 Ω Accuracy: ±0.125%	ESI, Model 230B (7912150-2) w/ESI 801MOD (7912151-2)	ESI, Model 250 DER

Table 3. Accessories Required

Item	Common name and/or (official nomenclature)	Description and (part number)
B1	ADAPTER	BNC plug to banana jacks (MS90578-1441)
B2	ADAPTER	BNC jack to double banana plugs (7907592)
B3	CABLE	36-in., RG-58/U; BNC plug to alligator clips (7909410)
B4	LEAD[1] (PROBE, TEST HOOK)	32-in., miniature test hook (7916122)

[1]Four required.

SECTION III
PRELIMINARY OPERATIONS

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 item identification number as listed in tables *2* and 3. For the identification of equipment referenced by item numbers prefixed with A, see table 2, and for prefix B, see table 3.

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.

NOTE

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. Additional maintenance information is contained in the manufacturer's manual for this TI

NOTE

When indications specified in paragraphs 8 through 10 are not within tolerance, perform the power supply check prior to making adjustments. After adjustments are made, repeat paragraphs 8 through 10. Do not perform power supply check if all other parameters are within tolerance.

NOTE

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

7. Equipment Setup

a. If TI meter pointer does not indicate on dot located at extreme left on meter face, remove meter and adjust pointer to dot by turning adjustment screw located below meter face. Reinstall meter.

b. Remove bottom cover of TI.

c. Connect TI to autotransformer (A2).

d. Connect autotransformer to 115-V ac source and adjust controls for a 115-V ac output.

e. Set power switch to ON and allow at least 10 minutes for warmup.

8. Regulation

a. Performance Check

(1) Connect ac/dc voltmeter (Al) plus terminal to TP2 (fig. 1) and minus terminal to TPl (fig. 1), using two leads (B4).

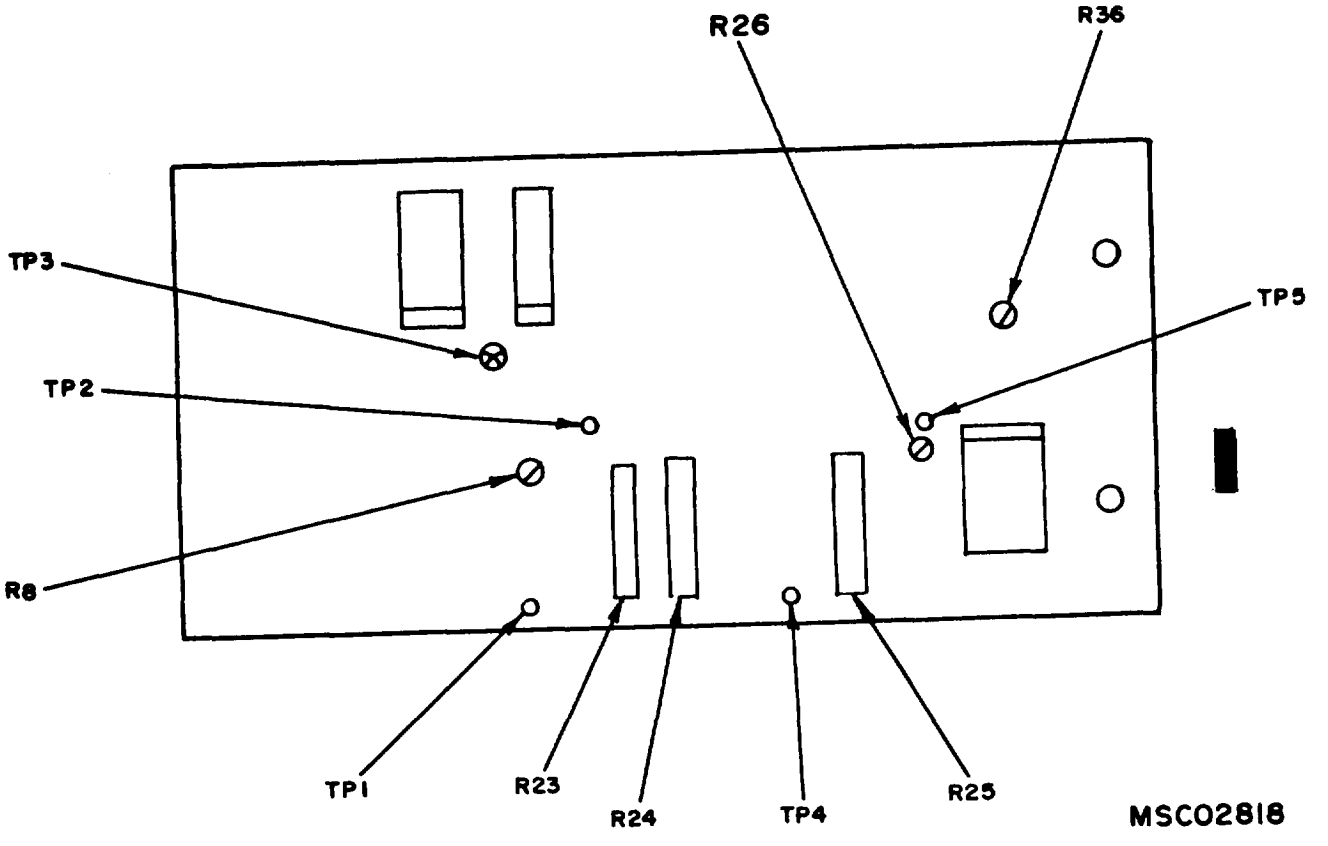

Figure 1. Defibrillator energy meter main circuit board-bottom view.

(2) Record ac/dc voltmeter indication.

(3) Adjust autotransformer (A2) between 105 and 125 V ac. Ac/dc voltmeter indication will remain within ±0.015 V of value recorded in (2) above. (Indication will not change for Model 429.)

(4) Adjust autotransformer to 115 V ac output.

b. Adjustments. No adjustments can be made.

9. Squaring Circuit

a. Performance Check

(1) Connect ac/dc voltmeter (Al) plus terminal to TP5 (fig. 1) and minus terminal to TP1 (fig. 1), using two leads (B4).

(2) Connect dc voltage standard (A4) high side to TP4 (fig. 1) and low side to TPl, using two leads (B4).

(3) Set RANGE switch to 100 Ws.

(4) Adjust dc voltage standard output to 0 (zero). If ac/dc voltmeter does not indicate between +0.01 and -0.01 V, perfor, b(1) below.

(5) Adjust dc voltage standard output to 10.000 V. If ac/dc voltmeter does not indicate between -9.95 and -10.05 V, perform b(2) below.

(6) Adjust dc voltage standard output to -10.000 V, by reversing connections on dc voltage standard. If ac/dc voltmeter does not indicate between -9.95 and -10.05 V, perform b(3) and (4) below.

(7) Adjust dc voltage standard to values (plus and minus) listed in table 4. If ac/dc voltmeter does not indicate within limits specified, perform b(4) below.

Table 4. Squaring Circuit

Dc voltage standard output (V dc)	Ac/dc voltmeter indications (V dc) [1]	
	Min	Max
±9.000	8.050	8.150
±8.000	6.350	6.450
±7.000	4.850	4.950
±6.000	3.550	3.650
±5.000	2.450	2.550
±4.000	1.550	1.650
±3.000	0.850	0.950
±2.000	0.350	0.450
±1.000	0.050	0.150

[1]All indications are negative.

b. Adjustments (fig. 1)

(1) Adjust R24 until ac/dc voltmeter indicates 0.00 V (R).

(2) Adjust R25 until ac/dc voltmeter indicates -10.00 V (R).

(3) Adjust R23 until ac/dc voltmeter indicates -10.00 V (R).

(4) Repeat a(1) through (6), and if required, readjust R23, R24, and R25 as required for best in-tolerance condition. The three adjustments are interacting.

10. Integrator

a. Performance Check

(1) Set RANGE switch to TRAPEZOID 40 Ws.

NOTE

In the following check, pulses of various widths and amplitudes are required. The output of pulse generator (A7) is not calibrated. The pulse width must be measured and adjusted as necessary, using frequency counter (A5). The pulse amplitude must be measured and adjusted as necessary by comparison with the output of dc voltage standard (A4), using oscilloscope (A6). The comparison should be repeated as necessary to ascertain the most accurate comparison.

(2) Adjust pulse generator controls to produce a2 ma pulse width at 8 V amplitude as measured on oscilloscope, using dc voltage standard and frequency counter.

(3) Connect pulse generator between TP1 and TP4 (fig. 1), using adapter and two leads (Bl and B4).

(4) Adjust pulse generator to manual trigger mode.

(5) Apply a single pulse to TI by depressing pulse generator manual pushbutton. Adjust R36 (fig. 1) for minimum drift.

(6) Repeat technique of (1) through (5) above, using values listed in table 5. If TI meter does not indicate within limits specified, perform appropriate adjustments.

Table 5. Integrator

Applied pulse		Test instrument				
Width (ms)	Amplitude (V)	RANGE switch positions	Meter indications (Ws)			
			Model 429		Models 429 MOD1 and 429B MOD1	
			Min	Max	Min	Max
8	10.000	400	—	—	386	414[1]
2	10.000	100	98	102[2]	97	103[2]
2	8.944	100	78	82	77	83
2	7.746	100	58	62	57	63
2	6.325	100	38	42	37	43
2	4.473	100	18	22	17	23

[1]If out of tolerance, perform *b*(1).
[2]If out of tolerance, perform *b*(2).

b. Adjustments

(1) Adjust R108 (429B MOD1) or R106 (429 MOD1) on range board until TI meter indicates 400 Ws when pulsed (R).

(2) Adjust R110 (429B MOD1), R108 (429 MOD1), on range board or R26 (429) (fig. 1) until TI meter indicates 100 Ws when pulsed (R).

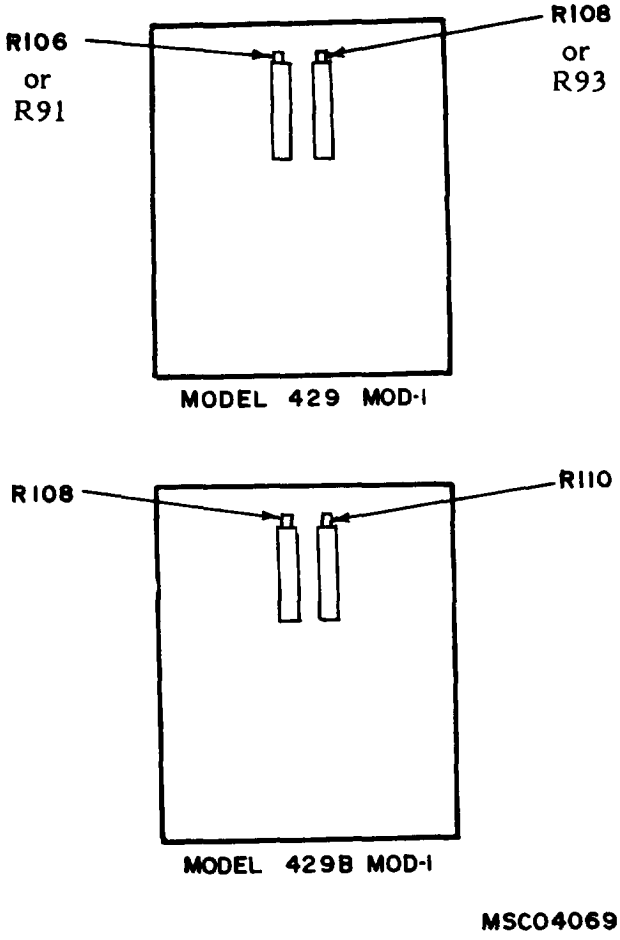

Figure 2. Defibrillator enemy meter range circuit board — bottom view

11. Load Resistance

a. Perormance Check

(1) Connect resistance bridge (A8) across end caps of 50 OHM LOAD, using leads supplied with resistance bridge.

(2) Measure resistance. Resistance bridge will indicate between 49.75 and 50.25 ohms.

b. Adjustments. No adjustments can be made.

12. Attenuation (Models 429 MOD1 and 429B MOD1 only)

a. Performance Check

(1) Set TI POWER switch to OFF and RANGE switch to LOWN 40 Ws.

(2) Connect dc power supply (A3) between paddle contacts of 50 OHM LOAD, using adapter and cable (B2 and B3).

(3) Connect ac/dc voltmeter (Al) between paddle contacts of 50 OHM LOAD, using two leads (B4).

(4) Adjust dc power supply output to 10.00 V as indicated on ac/dc voltmeter.

(5) Connect ac/dc voltmeter to TP4 and TPI (fig. 1) of TI, using leads (B4). Ac/dc voltmeter will indicate between 0.0995 and 0.1005 V.

(6) Repeat technique of (5) above at TI switch positions listed in table 6. Ac/dc voltmeter will indicate within limits specified.

Table 6. Attenuation

Test instrument RANGE switch LOWN positions	Ac/dc voltmeter indications (mV)	
	Min	Max
100 Ws	62.97	63.61
400 Ws	31.49	31.80
1000 Ws[1]	19.90	20.10

[1]Model 429B MOD1 only.

b. Adjustments. No adjustments can be made.

13. Power Supply

a. Performance Check

NOTE

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

(1) Connect ac/dc voltmeter (Al) between TP1 and TP3 (fig. 1), using leads (B4).

(2) Measure voltage. If ac/dc voltmeter does not indicate between -14.85 and -15.15 V, perform *b* below.

b. Adjustments: Adjust R8 (fig. 1) until ac/dc voltmeter indicates 15 V (R).

14. Final Procedure

a. Reenergize and disconnect all equipment and reinstall protective cover on TI.

b. When all parameters are within tolerance, annotate and affix DA Label 80 (US Army Calibrated Instrument). When the TI receives limited or special calibration, annotate and affix DA Label 163 (US *Army* Limited or Special Calibration). When the TI cannot be adjusted within tolerance, repair the TI in accordance with the maintenance manual. When repair is delayed for any reason or the TI cannot be repaired with local resources, annotate and affix DA Form 2417 (US Army Calibration System Rejected Instrument) and inform the owner/user accordingly in accordance with TB 750-251.

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