*TB 9-4920-364-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR EXHAUST GAS TEMPERATURE TESTER HOWELL INSTRUMENT, INC., MODEL BH112JA36

Headquarters, Department of the Army, Washington, DC
10 March 2004

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, US Army Aviation and Missile Command, AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use https://amcom2028.redstone.army.mil.

*This bulletin supersedes TB 9-4920-364-35, dated 13 July 1983, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Exhaust Gas Temperature Tester, Howell Instrument Inc., Model BH112JA36. The manufacturer's manual and TM 55-4920-244-14 were used as the 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. None.

b. Time and Technique. The time required for this calibration is approximately 4 hours, using the dc and low frequency 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
Potentiometer	Range: 0 to 1100°C Accuracy: ±1°C at engine operating temperature
Thermocouple	Range: 0 to 135 V ac Accuracy: ±5 V ac
EGT indicator	Range: 700°C Accuracy: ±10°C
Resistance	Range: 4.21, 8.0, and 22.0 Accuracy: ±0.25 on each position
Rpm	Range: 0 to 10,000 rpm Accuracy: ±0.1%
Insulation resistance	Range: 0 to 100,000 Accuracy: ±10%

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 Set AN/GSM-286 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. The following peculiar accessories are also required for this calibration: Level, Bench type (7902565); Pin, 1 in., number 14 or 16 gauge wire (two required, fabricate locally).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Range: 60 to 75 Hz Frequency response: ±0.25%	Boonton, Model 1121 (1121)
AUTOTRANSFORMER	Range: 105 to 125 V ac Accuracy: ±1%	General Radio, Model W10MT3AS3 (7910809)
CALIBRATOR	Range: 0.84 to 48.0 mV dc Accuracy: ±0.33%	John Fluke, Model 5720A (5700A/EP) (p/o MIS-35947)
FREQUENCY COUNTER	Range: 14.20 to 14.30 ms Accuracy: ±0.025%	Fluke, Model PM6681/656 (PM6681/656)
MULTIMETER	Range: 125 to 135 V ac; 29 mV dc Accuracy: ±1%	Hewlett-Packard, Model 3458A (3458A)
RESISTANCE STANDARD	Range: 0 to 110,000 Ω Accuracy: ±0.03%	Biddle-Gray, Model 71-631 (7910328)
THERMOMETER	Range: 70 to 85°F Accuracy: ±1%	Azonix, Model A1012 (MIS38958)

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 as 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. Additional maintenance information is contained in the manufacturer's manual and TM 55-4920-244-14 for this TI.

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

7. Equipment Setup

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.

NOTE

If TI requires adjustment, remove deck assembly from protective case and place right side up on an insulated bench. It will be necessary to remove **TEMP. REGULATOR** knob and power supply BH1766 board.

a. Level and support TI deck assembly, using level.

b. Position controls as listed in (1) through (4) below:

(1) **TEMP. REGULATOR** control fully ccw.

(2) **SELECTOR SWITCH SW-1** to **OFF**.

(3) **SW-7** switch to **OFF**.

(4) **SW-6** switch to **MECH. ZERO**.

c. Connect TI power line connector P1 to autotransformer using cable (BH499, p/o TI). Connect autotransformer to a 115 V ac source and adjust for 110 V output. Allow 1 hour for TI to warm-up.

8. Potentiometer Accuracy

a. Performance Check

(1) Connect equipment as shown in figure 1.

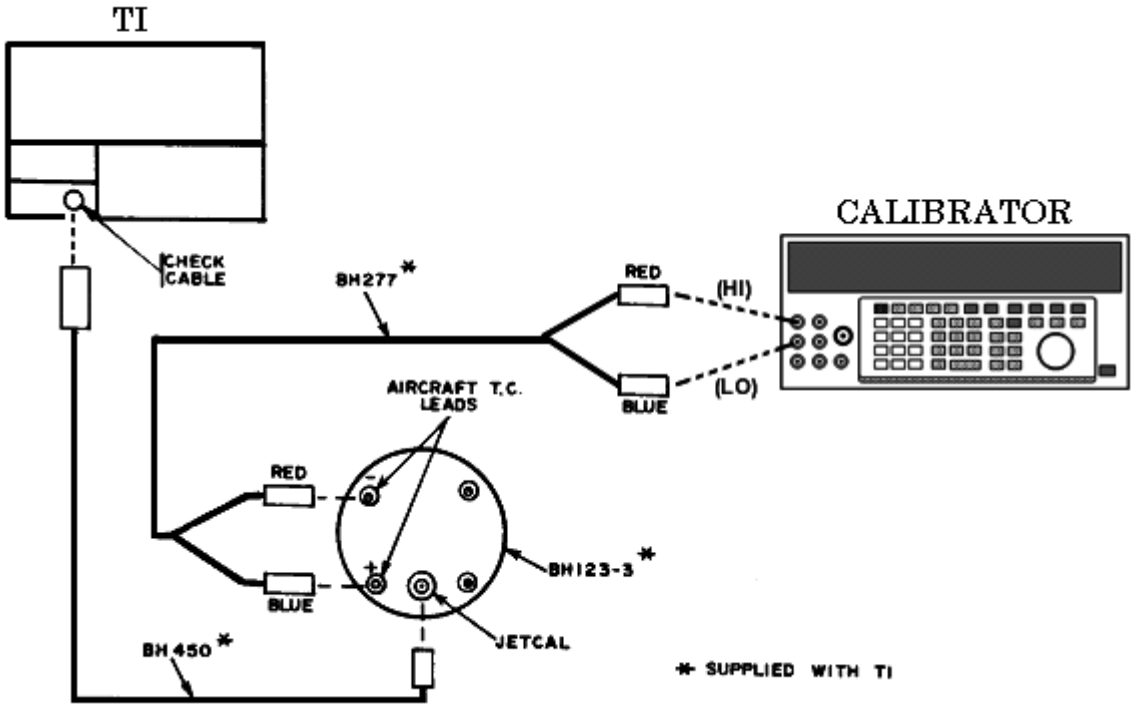

Figure 1. Potentiometer - equipment setup.

(2) Place thermometer near the output of calibrator. Wait 10 minutes and record temperature.

(3) Position controls as listed in (a) through (c) below:

(a) **SELECTOR SWITCH SW-1** to **T/C**.
(b) **SW-5** switch (located on BH 123-3) to **JETCAL**.
(c) **THERMOCOUPLE CHECK SW-2** switch to **S-2**.

(4) Adjust **GALVO-1 MECH. ZERO** control until **GALVO-1** indicates **0**. Repeat as necessary throughout procedure.

(5) Adjust **°C** control for a **0** dial indication.

NOTE

Throughout this procedure it will be necessary to constantly check the ambient temperature to assure that millivolt values in table 3 are applicable.

(6) Refer to table 3 and adjust calibrator to millivolt value corresponding to temperature recorded in (2) above.

Table 3. Ambient Temperatures Versus Millivolt Values

Degrees fahrenheit	Degrees centigrade	Millivolt values[1]
70	21.1	0.843
71	21.7	0.865
72	22.2	0.888
73	22.8	0.910
74	23.3	0.933
75	23.9	0.955
76	24.4	0.978
77	25.0	1.000
78	25.6	1.023
79	26.1	1.045
80	26.7	1.068
81	27.2	1.090
82	27.8	1.113
83	28.3	1.135
84	28.9	1.158
85	29.5	1.181

[1]From NBS standard monograph 125.

(7) Set **SW-6** switch to **RANGE**.

(8) Adjust **°C** control for **0** indication on **GALVO-1**. If TI **°C** dial does not indicate 0° ±1°, perform **b** (1) through (13) below.

(9) Set **SW-6** switch to **MECH. ZERO**.

(10) Set calibrator to standby and reverse connections at calibrator input.

(11) Adjust calibrator output to 48.462 mV less value recorded in (6) above.

(12) Adjust **°C** control until dial indicates **1190**.

(13) Set **SW-6** switch to **RANGE**.

(14) Adjust **°C** control until **GALVO-1** indicates **0**. If **°C** dial does not indicate between 1189 and 1191, perform **b** 1) through (13) below.

(15) Set **SW-6** switch to **MECH. ZERO**.

(16) Repeat technique of (11) through (14) above, using values listed in table 4. TI **°C** dial will indicate within limits specified.

Table 4. Potentiometer Range

Calibrator output (mV)[1]	Test instrument **°C** dial indication		
	Min	Initial	Max
45.108	1099	1100	1101
41.269	999	1000	1001
37.325	899	900	901
33.277	799	800	801
31.214	749	750	751
29.128	699	700	701
27.022	649	650	651

See footnote at end of table.

Table 4. Potentiometer Range

Calibrator output (mV)[1]	Test instrument **°C** dial indication		
	Min	Initial	Max
24.902	599	600	601
20.640	499	500	501
16.395	399	400	401
12.207	299	300	301
8.137	199	200	201
4.095	99	100	101

[1]Subtract millivolt value recorded in **8 a** (6) above.

b. Adjustments

(1) Set **SW-6** switch to **MECH. ZERO**.

(2) Connect equipment as shown in figure 1.

(3) Adjust **°C** control for a **0** degree indication.

(4) Repeat **a** (6) above.

(5) Set **SW-6** switch to **RANGE**.

(6) Adjust TRIMPOT B (fig. 2) until **GALVO-1** indicates **0**.

(7) Repeat (1) above.

(8) Set calibrator to standby and reverse connections at calibrator input.

(9) Adjust **°C** control to **1000** dial indication.

(10) Adjust output of calibrator to 41.269 mV, less millivolt value used in **a** (6) above.

(11) Repeat (5) above.

(12) Adjust TRIMPOT A (fig. 2) until **GALVO-1** indicates **0**.

(13) Repeat (1) through (12) above until no further adjustments are required.

9. Resistance Check

a. Performance Check

(1) Connect TI **INPUT RES. INSUL. P-2** to **HIGH** and **LOW** terminals of resistance standard using resistance check adapter (BH-485 and BH823, p/o TI).

(2) Set **SELECTOR SWITCH SW-1** to **RES**.

(3) Set **SW-6** switch to **MECH. ZERO**.

(4) Adjust **GALVO-1 MECH. ZERO** for a **0** indication on **GALVO-1**.

(5) Adjust resistance standard for 4.21 ohms.

(6) Set **RESISTANCE CHECK SW-3** switch to 4.21 ohms.

(7) Set **SW-6** switch to **RANGE**. If **GALVO-1** does not indicate **0** ±5 divisions, perform **b** below.

(8) Set **SW-6** switch to **MECH. ZERO**.

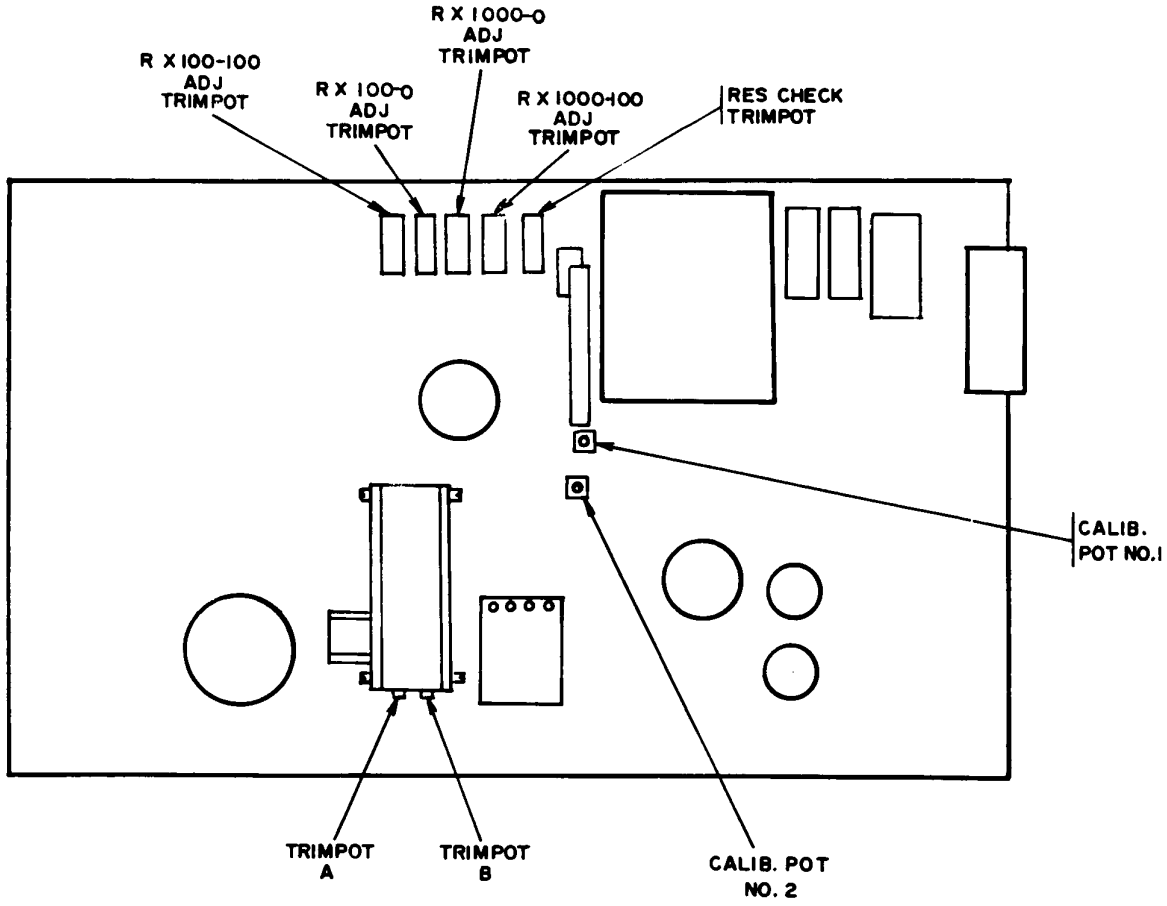

Figure 2. Adjustment locations -bottom view.

(9) Repeat technique of (4) through (7) above for each setting of **RESISTANCE CHECK SW-3** switch and set resistance standard to the value indicated on **SW-3**. TI **GALVO-1** will indicate within ±5 divisions at all **SW-3** settings.

b. Adjustments. Adjust RES CHECK TRIMPOT (fig. 2) for **0** indication on **GALVO-1** (R).

10. Insulation Resistance Check

a. Performance Check

(1) Adjust resistance standard for 0 ohms.

(2) Connect TI **INPUT RES. INSUL. P-2** to **HIGH** and **LOW** terminals of resistance standard using cables and insulation check adapter (BH485 and BH821, p/o TI).

(3) Set **SELECTOR SWITCH SW-1** to **INSUL**. and **SW-8** switch to **RX100**. If **INSULATION CHECK** meter does not indicate **0**, perform **b** (1) below.

(4) Adjust resistance standard for indication of 10,000 ohms on **INSULATION CHECK** meter. If resistance standard does not indicate between 9000 and 11,000 ohms, perform **b** (2) below.

(5) Repeat (1) above.

(6) Set **SW-8** switch to **RX1000**. If **INSULATION CHECK** meter does not indicate zero, perform **b** (3) below.

(7) Adjust resistance standard for an indication of 100,000 ohms on **INSULATION CHECK** meter. If resistance standard does not indicate between 90,000 and 110,000 ohms, perform **b** (4) below.

b. Adjustments (fig. 2)

(1) Adjust RX100 0 ADJ TRIMPOT for zero indication on **INSULATION CHECK** meter (R).

(2) Adjust decade resistor for 10,000 ohms and adjust RX100-100 ADJ TRIMPOT for **INSULATION CHECK** meter indication of 10,000 ohms (R).

(3) Adjust RX1000-0 ADJ TRIMPOT for zero indication on **INSULATION CHECK** meter (R).

(4) Adjust RX1000-100 ADJ TRIMPOT for **INSULATION CHECK** meter indication of 100,000 ohms (R).

11. Rpm Check

a. Performance check

(1) Set **SW-7** switch to **MECH. ZERO**.

(2) Adjust **GALVO-2 MECH. ZERO 4** control for **0** indication.

(3) Adjust **R.P.M**. control for **0** indication on % dial.

(4) Set **SW-7** switch to **RANGE**. If **GALVO-2** does not indicate **0**, perform **b** (1) below.

(5) Set **SW-7** switch to **MECH. ZERO**.

(6) Connect equipment as shown in figure 3.

(7) Adjust audio oscillator frequency for an indication of 14.285 ms on frequency counter.

(8) Adjust **R.P.M.** control to **100.0** as indicated on % dial.

(9) Set **SW-7** switch to **RANGE**.

(10) Adjust audio analyzer frequency for **0** indication on **GALVO-2**. If frequency counter does not indicate between 14.271 and 14.300 ms, perform **b** (2) below.

(11) Set **SW-7** switch to **OFF**.

b. Adjustments (fig. 2)

(1) Adjust CALIB. POT NO. 1 for zero indication on **GALVO-2** (R).

(2) Adjust audio oscillator for indication of 14.285 ms on frequency counter and adjust CALIB. POT NO. 2 for zero indication on **GALVO-2** (R).

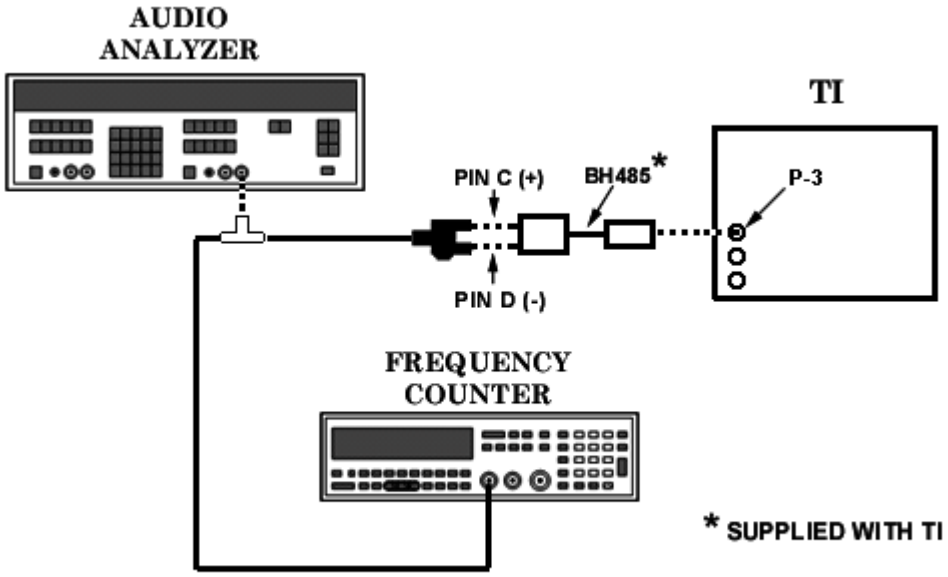

Figure 3. Rpm Check - equipment setup.

12. EGT Indicator Check

a. Performance Check

(1) Place thermometer near multimeter input terminals for 10 minutes and record temperature. (Refer to table 3. Record millivolt equivalent to the ambient temperature recorded above.)

(2) Connect **INPUT R.P.M. E.G.T. P-3** to multimeter, using adapter and cable (BH822 and BH485, p/o TI).

(3) Set **E.G.T. IND. CHECK SW-4** switch to **8 Ω**.

(4) Set **SELECTOR SWITCH SW-1** to **E.G.T**.

(5) Set **SW-6** switch to **MECH. ZERO**.

(6) Adjust **GALVO-1 MECH. ZERO** for **0** indication.

(7) Set **°C** control to **700°C** on the dial.

(8) Adjust **R-1 ADJ RHEO** control until multimeter indicates **29.128 mV dc**, minus value recorded in (1) above.

(9) Set **SW-6** switch to **RANGE**.

(10) Adjust **°C** control for **0** indication on **GALVO-1**. TI **°C** dial will indicate between 690 and 710°C.

(11) Set **E.G.T. IND. CHECK SW-4** switch to **22 Ω**. TI **°C** dial will be within limits specified in (10) above.

b. Adjustments. No adjustments can be made.

13. Final Procedure

a. Deenergize and disconnect all equipment.

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

By Order of the Secretary of the Army:

Official:

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General, United States Army
Chief of Staff

JOEL B. HUDSON
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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.