TB 9-4931-428-40

CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR THERMOMETER SETS 7910479 AND ASTM 80-182 (80-211-22) AND THERMOMETER ASTM 50F (7913469)

Headquarters, Department of the Army, Washington, DC
29 August 2008

TB 9-4931-428-40, 20 June 2007, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove Pages	**Insert Pages**
1 and 2	1 and 2

2. File this change sheet in front of the publication for reference purposes.

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
0819106

Distribution:
To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-4931-428-40.

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CALIBRATION PROCEDURE FOR THERMOMETER SETS 7910479 AND ASTM 80-182 (80-211-22) AND THERMOMETER ASTM 50F (7913469)

Headquarters, Department of the Army, Washington, DC
20 June 2007

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, ATTN: 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 9-431-428-50, dated 8 June 1988.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Thermometer Sets 7910479 and ASTM 80-182 (80-211-22) and Thermometer ASTM 50F (7913469). 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 among models are described in text.

b. Time and Technique. The time required for this calibration is approximately 8 hours, using the physical 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 performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument	Performance specifications
62C (7912276-1)	Range: -38° +2°C Accuracy: ± 0.1°C
63C 7912276-2)	Range: -8°C +32°C Accuracy: ± 0.1°C
64C (7912276-3)	Range: 25°C to 55° Accuracy: ± 0.1°C
65C (7912276-4)	Range: 50°C to 80°C Accuracy: ± 0.1°C
66C (7912276-5)	Range: 75°C to 105°C Accuracy: ± 0.1°C
67C (7912276-6)	Range: 95°C to 155°C Accuracy: ± 0.2°C
68C (7912276-7)	Range: 145°C to 205°C Accuracy: ± 0.2°C
69C (7912276-8)	Range: 195°C to 305°C Accuracy: ± 0.5°C
ASTM 50F (7913469)	Range: 50°F to 101°F Accuracy: ± 0.1°F
ASTM 80-182 (80-211-22)	[1]

[1]See note after table 5.

NOTE

The accuracies specified in table 1 are accuracies of thermometers without scale corrections at time of procurement. They do not require verification except for initial acceptance.

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 Reference Calibration Standards Set NSN 4931-00-621-7878. 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 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

Common name	Minimum use specifications	Manufacturer and model (part number)
RESISTANCE THERMOMETER	Range: -30°C to +260°C Accuracy: ± 0.003°C	Rosemount Aerospace, Model 162C or 162CE
SUPER THERMOMETER	Range: -38°C to +250°C Accuracy: ± 0.003°C	Hart Scientific, Model 1590

Table 3. Accessories Required

Common name	Description	Manufacturer and model (part number)
TEMPERATURE BATH No. 1	Range: -40°C to +150°C	Hart Scientific, Model 7341
TEMPERATURE BATH No. 2	Range: +20°C to +250°C	Hart Scientific, Model 6045
THERMOMETER CALIBRATION KIT		(7911944)

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 tables 2 and 3.

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 for the TI.

7. Equipment Setup

a. Remove TI from protective case.

b. Inspect TI bulb and stem for foreign matter and evidence of deterioration.

c. Hold TI in vertical position and verify that bulb and column are free from gas bubbles and stem is free from globules of liquid. If not, perform (1), (2), or (3) below as applicable.

(1) Eliminate gas bubbles in TI bulb by cooling with dry ice or equivalent coolant until liquid is drawn into bulb. Tap TI gently against pad of paper. Bubbles should rise to surface and disperse. Hold TI upright while allowing it to return to room temperature.

(2) Eliminate gas bubbles from stem of TI with expansion chambers by slowly and carefully heating bulb until bubbles are joined. Carefully tap TI against pad of paper or against palm of hand.

CAUTION

To avoid damage to TI, exercise extreme care when applying heat. Do not heat with open flame.

(3) Eliminate globules of liquid inside TI stem by carefully and slowly heating TI bulb until liquid column merges with globules.

NOTE

If globules tend to unite and reappear after bulb cools, obstructions or oxidation of mercury may be present, and TI must be rejected.

d. Prepare temperature standard for proper ice mantle formation.

8. Zero Point Temperature Check

a. Performance Check

(1) Insert TI (model 62C) into temperature standard.

NOTE

If necessary, an ice bath may be substituted for temperature standard.

(2) After at least 3 minutes, record TI temperature indication.

NOTE

To minimize, emergent stem error, observe indication through cell just above ice mantle.

(3) Repeat (1) and (2) above two times at 5 minute intervals.

(4) Average the three indications recorded in (2) above. Record zero point indication. If average indication is not within ±0.05 degree Celsius, perform **b** below.

(5) Repeat technique of (1) through (4) above for remaining TI's listed in table 4. Average indication will be within limits specified.

Table 4. Zero Point Check

Test instrument		Scale correction	Rejection tolerance
Model	Army Part No.	Tolerance (°C)	(°C)
62C	7912276-1	± 0.05	± 0.3
63C	7912276-2	± 0.05	± 0.3
64C	7912276-3	± 0.05	± 0.3
65C	7912296-4	± 0.05	± 0.3
66C	7912276-5	± 0.05	± 0.3
67C	7912276-6	± 0.1	± 0.4
68C	7912276-7	± 0.1	± 0.5
69C	7912276-8	± 0.1	± 0.6
ASTM 80-182	[1]	[1]	[1]
ASTM 50F	7913469	± 0.028 (± 0.05°F)	± 0.22 (± 0.4°F)

[1]See note after table 5.

b. Adjustments

(1) If TI indication exceeds scale correction tolerance listed in table 4, but does not exceed rejection tolerance, prepare a correction chart, specifying scale correction.

(2) If TI indication exceeds rejection tolerance limitation listed in table 4, TI will be rejected.

9. Temperature Calibration

a. Performance Check

NOTE

This procedure is to be used for initial calibration of all TI's. Thereafter the TI will be checked at **ZERO** point only. Changes in correction at **ZERO** point will be applied to all corrections. That is, if the **ZERO** point correction increases, then the increase will be added to all corrections. If the **ZERO** point decreases, then the decrease will be subtracted from all corrections. If the shift in **ZERO** point exceeds rejection tolerance specified in table 4, the TI will be replaced. TI's which do not have **ZERO** points will be tested at some other point. Testing at some temperature other than **ZERO** point requires a controlled temperature calibration bath and a temperature standard.

NOTE

Perform (1) through (14) below for initial calibration only. For subsequent calibrations perform (15) below only.

NOTE

Ensure proper coefficients are loaded into the super thermometer for the resistance thermometer being used.

(1) Ensure resistance thermometer is connected to the correct channel of the super thermometer.

(2) Prepare temperature bath No 1 and adjust for 0°C indication.

(3) Insert resistance thermometer into temperature bath No. 1.

(4) Record super thermometer indication after at least 3 minutes.

(5) Repeat (4) above three times.

(6) Determine average of indications recorded in (4) above.

(7) When calibrating thermometer set 7910479, select TI model 62C as first item to be calibrated.

(8) Adjust temperature bath No. 1 to -30°C.

(9) Lower resistance thermometer into temperature bath along with TI selected in (7) above.

(10) Allow sufficient time for TI and resistance thermometer to stabilize, and record TI temperature and temperature of resistance thermometer.

(11) Compare TI temperature with temperature of resistance thermometer recorded in (10) above. Record deviation of TI from resistance thermometer.

(12) Repeat (10) above three times at 5 minute intervals.

(13) Determine average of deviations recorded in (14) above. If average deviation is not within ±0.05 degree, perform **b** below.

(14) Repeat technique of (9) through (13) above for each TI model at temperatures listed in table 5. If average allowable deviations are not within limits specified, perform **b** below.

Table 5. Temperature Calibration

Test instrument model	Temperature bath temperature (°C)	Average allowable deviation (°C)	Rejection tolerance (°C)
62C	-30	± 0.05	± 0.30
	-20	- - -	- - -
	-10	- - -	- - -
63C	10	± 0.05	± 0.30
	20	- - -	- - -
	30	- - -	- - -
64C	30	± 0.05	± 0.30
	40	- - -	- - -
	50	- - -	- - -
65C	55	± 0.05	± 0.30
	65	- - -	- - -
	75	- - -	- - -
66C	80	± 0.05	± 0.30
	90	- - -	- - -
	100	- - -	- - -
67C	105	± 0.10	± 0.40
	125	- - -	- - -
	150	- - -	- - -
68C	150	± 0.10	± 0.50
	170	- - -	- - -
	200	- - -	- - -
69C	210	± 0.30	± 2.0
	230	- - -	- - -
	250	- - -	- - -
ATSM 50F	21.1 (70°F)	± 0.028 (± 0.05°F)	± 0.22 (± 0.40°F)
	26.7 (80°F)	- - -	- - -
	32.2 (90°F)	- - -	- - -
ATSM 80-182	[1] [2]	[1]	[1]

[1]This thermometer set may be calibrated to the same accuracy as thermometer set 7910479 using same technique. This set is graduated to the Fahrenheit scale. Therefore, conversion to the equivalent Celsius value of this table is necessary. The temperature conversion formulas below may be used.

°F = (°C X 1.8) + 32

°C = (°F - 32) ÷ 1.8

[2]Procedure limitation. ASTM 70F is beyond the range of temperature bath.

(15) If **ZERO** point correction recorded in **8 a** (4) above has changed from initial calibration correction chart, apply **ZERO** point correction to each scale point listed on correction chart.

Example:

Initial Calibration

Indication (°F)	Correction (°F)
-20	+0.6
32	+0.4
80	+0.2
100	0.0

At the end of calibration interval, TI is checked at **ZERO** point with the following result: New correction = +0.3. The change in **ZERO** point is -0.1. This decrease is applied to correction chart from initial calibration to produce the following:

New correction chart based on zero point

Indication (°F)	Correction (°F)
-20	+0.5
32	+0.3
80	+0.1
100	-0.1

b. Adjustments

(1) If TI indication exceeds scale correction tolerance listed in table 5, but does not exceed rejection tolerance, prepare a correction chart, specifying scale correction.

(2) If TI is out-of-tolerance according to both average allowable deviation and rejection tolerance columns of table 5, TI must be rejected.

10. 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:

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

Official:

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

0711511

Distribution:

To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-4931-428-40.

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.