*TB 9-6685-314-24

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SELF-INDICATING THERMOMETERS (CELSIUS AND FAHRENHEIT)

Headquarters, Department of the Army, Washington, DC
26 August 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 9-6685-314-35, dated 8 June 1988.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Self-Indicating Thermometers (Celsius and Fahrenheit). Federal Specification GG-T-336, MIL-T1344A, and NBS Monograph 150 were used as the prime data sources in compiling these instructions. The thermometers being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations. Thermometer types vary in range, accuracy, and immersion depth. This is a general procedure covering Celsius and Fahrenheit thermometers.

b. Time and Technique. The time required for this calibration is approximately 2 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 parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description Continued

Test instrument parameters	Performance specifications
Temperature (Celsius)	Range: -5°C to +100°C Accuracy: Depends on range and type
Temperature (Fahrenheit)	Range: -31°F to +212°F Accuracy: Depends on range and type

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, AN/GSM-287 and 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 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)
THERMOMETER	Range: -31°F to +212°F Accuracy: ± 0.7°F Range: -5°C to +100°C Accuracy: ± 0.5°C	Azonix, Model A1012 (MIS 38958) w/Temperature Probe. Instrulab, Model 4101-10X (7915890)

Table 3. Accessories Required

Common name	Description (part number)
CONTAINER	Approximately 6 in. in diameter and at least 8 in. in height, able to withstand 250°F (121.1°C) (6640-00-545-8512)
HOTPLATE	Approximately 6 in. in diameter having 250°F (121.1°C) temperature elements (7310-00-782-0005)
SUPPORT STAND[1]	Thermometer support

[1]Additional equipment may be required.

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

7. Equipment Setup

NOTE

Avoid unnecessary drafts on standard thermometer and TI during calibration.

a. Remove TI from protective case.

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

NOTE

Step **c** below is applicable only to liquid-in-glass thermometers.

c. Hold TI in vertical position. If bulb and column are not free from gas bubbles and stem is not free from globules of liquid, 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 or against palm of hand. Bubbles should rise to surface and disperse.

(2) Eliminate gas bubbles from stem of TI 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. Damage may result if thermometer or bulb is overheated.

(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.

8. Ambient Temperature

a. Performance Check

(1) Place TI and standard thermometer side by side in vertical position, using support stand. Allow approximately 15 minutes for TI to stabilize.

(2) Compare indication of TI and standard thermometer and record the difference.

NOTE

The temperature conversion formulas below may be used:
$F = (C \times 9/5) + 32$
$C = 5/9 \times (F - 32)$

(3) Move TI and standard thermometer to another location and repeat (1 & 2) above twice. Both should stabilize in a couple of minutes.

(4) Average the three indications recorded above. The average will not exceed a value four times greater than the accuracy of the standard thermometer, or a value greater than one scale division of the TI, whichever is greater.

b. Adjustments. No adjustments can be made. A correction chart may be prepared, if requested by the customer.

9. Boiling Point

a. Performance Check

(1) Using support stand, arrange appropriate standard thermometer and TI in vertical cal position so that each is supported in container without touching the sides or bottom.

(2) Pour water into container until water level reaches 100 °C (212 °F) graduation point or etched immersion line on stem of thermometer.

(3) Assure both thermometers are immersed to their proper depth.

NOTE

Full-immersion type thermometers will be inserted to a depth sufficient to cover 100 °C (212 °F) graduation. The mercury column must be as near liquid surface as possible. Partial-immersion type thermometers will be inserted to depth of immersion line etched on stem.

(4) Place container on hotplate. Position thermometer and TI for best advantage and energize hotplate.

(5) Heat contents to boiling point, or to desired temperature.

(6) Lift thermometer and TI slightly above waterline to check points position. Make a comparison observation of standard and TI and record difference.

(7) Repeat (5) and (6) above twice.

(8) Average the three indications recorded above. The average will not exceed a value four times greater than accuracy of standard thermometer, or a value greater than one scale division of TI, whichever is greater.

(9) Deenergize hotplate and remove thermometers.

b. Adjustments. No adjustments can be made. A correction chart may be prepared, if requested by customer.

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

0817601

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 342303, requirements for calibration procedure TB 9-6685-314-24.

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.

PIN: 084950-000