*TB 9-4931-426-40

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR THERMOELECTRIC ICE POINT, KAYE MODEL RCS1-SP

Headquarters, Department of the Army, Washington, DC
20 May 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.

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*This bulletin supersedes TB 9-4931-426-50, 3 February 1975, including all changes.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Thermoelectric Ice Point, Kaye Model RCS1-SP. 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. The number of reference wells, well depth, and unit dimensions may vary among models.

b. Time and Technique. The time required for this calibration is approximately 3 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 applications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Power input requirements[1]	115 vac ±20%, 60 Hz, approx 150 w
Reference temperature	0°C ± 0.03° C
Reference temperature stability	±0.01°C (short-term peak-to-peak combined)
Environment[1]	Operable between ambiance of 35° and 110° F
Continuous duty	Once turned on, will maintain 0° C reference continuously

[1]This specification is for information only and is not verified in this bulletin.

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment used in this calibration procedure. This equipment is issued with the 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 accuracy ratio between the standard and TI. Where the four-to-one ratio cannot be met, the four-to-one 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)
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
TRIPLE POINT OF WATER CELL	Set point: 0.0100°C Accuracy: 0.0005°C	Invensys Systems, Model 5901A or 5901B

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.

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 this TI.

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

7. Equipment Setup

a. Ensure that reentrant well of TI is filled with mineral oil.

b. Turn TI **ON-OFF** power switch to **ON**, and allow 45 minutes for unit to cycle (blinking of pilot light).

c. Remove triple point of water cell rubber well insert, drain water residue, and pre-cool complete cell assembly by refrigeration for at least 12 hours.

NOTE

Make sure that pre-cooling does not freeze water in glass cell.

d. Dry triple point of water cell carefully, particularly thermometer well, and replace in insulating jacket.

e. Place triple point of water cell in vertical position and fill well with pulverized dry ice (fine snow to $^{1}/_{16}$ inch particles), using plastic funnel. Replenish as necessary until ice mantle forms.

f. Allow ice mantle to form and completely envelop well; mantle must not touch outer glass wall. When satisfactory mantle is formed, pour out dry ice.

g. Insert small piece of rubber into well to protect glass bottom.

NOTE

Follow normal precautions when using thawing rod.

h. Insert triple point of water cell thawing rod (supplied with unit) in well until ice mantle is free from well. When ice mantle is free, it will remain stationary when cell is quickly rotated.

NOTE

If ice mantle re-freezes, insert thawing rod for a few seconds to free it.

i. After ice mantle is free, replace top on triple point of water cell.

j. Verify that pilot light on TI is alternately blinking on and off, and then allow 15 to 20 minutes for stabilization.

CAUTION

Do not allow heavy ice crust to form across surface of water in glass of triple point of water cell.

k. Establish reference temperature in accordance with (1) through (7) below:

(1) Verify that pilot light on TI is cycling on and off.

(2) Check triple point of water cell for good ice mantle. If necessary, insert thawing rod into reentrant well until ice mantle is free.

(3) Chill resistance thermometer for 5 minutes and insert into reentrant well of triple point of water cell.

(4) After at least 3 minutes record super thermometer indication.

(5) Repeat (4) above three times.

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

NOTE

The average value of resistance recorded is for 0.01°C and must be corrected to 0°C.

(7) Refer to the calibration table for the resistance thermometer and determine by interpolation the table resistance ratio value for 0.01°C. Divide the resistance obtained in (6) above by the resistance ratio for 0.01°C. Record value as R_o.

8. Ice Point Accuracy

a. Performance Check

(1) Fully insert resistance thermometer into TI reentrant well and allow 30 minutes for unit to stabilize.

NOTE

TI should be in operation 1 hour before any readings are taken.

(2) Repeat technique of paragraph **7 k** (4) through (6) above until four readings are obtained.

(3) Average the resistance value of (2) above and record as R_t.

(4) Divide R_t by R_o (paragraph **7 k** (7). Refer to table supplied with resistance thermometer and obtain set-point temperature for TI.

(5) Select the next ratio lower than the calculated resistance ratio in (4) above. Determine the difference in the resistance ratio.

(6) Multiply the difference obtained in (5) above by the next higher inverse difference to find °C.

(7) Algebraically add °C to the temperature equal to the lower resistance ratio used in (5) above. Value obtained will be within ±0.03 °C of 0 °C.

b. Adjustments. No adjustments can be made.

9. 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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Distribution:
To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-4931-426-40.

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.