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Beaumont

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Document Contact	Kelly Sartor
Area	Laboratory-Blood Bank
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Standardization and Calibration of Thermometers - Dearborn Blood Bank

Document Type: Procedure

I. PURPOSE AND OBJECTIVE:

This document provides procedure and guidance for the standardization and calibration of liquid-in-glass thermometers and digital thermometers.

II. POLICIES:

A. Thermometers used during laboratory testing, processing, and storing of reagents, supplies and blood components will be calibrated and standardized to ensure accurate indication of temperatures.

B. Calibration will be performed at temperatures close to the temperature at which the thermometers will be used.

C. Each thermometer will be calibrated before initial use and annually thereafter, as well as any time there is reason to suspect change or damage.

D. Additional calibrations are not required for new thermometers (if there is proof of calibration performed by the manufacturer) until after the calibration expiration date.

III. DEFINITIONS / ACRONYMS:

A. **NIST:** National Institute of Standards and Technology.

B. **Sub-Zero Thermometer Containers:** Thermometer containers that are filled with sand (or an equivalent material) and used in environments that are too cold to use water or glycerol as a temperature buffer.

IV. EQUIPMENT / SUPPLIES:

A. NIST-Certified thermometer or thermometer with NIST-Traceable Calibration Certificate.
B. Thermometers to be calibrated.
C. A suitable container to hold water.
D. A suitable container to place digital thermometers.
E. 37°C water bath.
F. 37°C incubator.
G. Water.
H. Crushed ice.
I. Dry ice.
J. Isopropyl alcohol.
K. Temperature-buffered medium (i.e., glycerol, sand, or equivalent material).

V. EQUIPMENT / MAINTENANCE:

Recertification of NIST-Certified thermometers and thermometers with NIST-Traceable Calibration Certificates will be done on an annual basis by an outside source.

VI. PROCEDURE:

A. Before proceeding:
    1. Inspect all liquid-in-glass thermometers for any split in the column that may cause inaccurate readings. Acceptable appearance is an intact column of liquid.
        a. When separation in an indicator column is noticed, the thermometer cannot be used until it is resolved and there is no longer a separation. If separation occurs at the upper portion of the thermometer, heat the bulb slowly until the separated segments and a portion of the main intact column enter the expansion chamber, the liquid should rejoin. Examine the column as it cools and retracts to be sure it is intact. Be careful not to overfill the expansion chamber.
        b. When separation is in the lower portion of the thermometer, cool the bulb in a mixture of dry ice and isopropyl alcohol so that the column retreats slowly into the bulb. Cool the bulb only. Continue until the main column and the separated portion retreats into the bulb. Remove and swing the thermometer in a short arc, forcing all the liquid into the bulb. Allow the bulb to come to room temperature and examine the column as it warms to confirm there is no separation.
        c. Document the separation repair in the *Corrective Action* section of the *Thermometer Calibration Log*. After the corrective action, verify the calibration of the thermometer using this procedure and record the *Thermometer Calibration Log*.

2. Inspect all digital thermometers and make sure the display is clear and free of obstructions. Replace the batteries within the digital thermometer if the display appears weak or inconsistent.
3. Follow the manufacturer's instructions for proper immersion of liquid-in-glass thermometers in use.
4. When using a NIST-Certified thermometer, read and follow the applicable notes. Be sure to include any correction factors noted on the certificate for the NIST-Certified thermometer and apply them in calculations.
5. Be sure that the NIST certification has not expired.

B. Group the thermometers together based on what temperature they are used for.
    1. Some thermometers may be calibrated at multiple temperature points, such as room temperature and 37˚C.

C. Record each thermometer's manufacturer serial number (or assigned number if no manufacturer serial number is available) on the *Thermometer Calibration Log*.

D. Verify the certification of the NIST-Certified thermometer being used for calibration is not expired. Document the NIST-Certified thermometer's serial number on the *Thermometer Calibration Log* as well as its certification expiration date.

E. Perform the thermometer calibration based on the temperature in which it is being used:
    1. **For calibration of liquid-in-glass thermometers at 1-6˚C, 20-24˚C, or 37˚C:**
        a. Place the NIST-Certified thermometer and all thermometers that are being calibrated into a container filled with water that is a similar temperature to the intended calibration temperature (e.g., 1-6˚C, 20-24˚C, 37˚C).
            i. For 1-6˚C calibrations, fill the container with a mixture of water and crushed ice.
            ii. For 20-24˚C calibrations, fill the container with room temperature water.
            iii. For 37˚C calibrations, use a 37˚C water bath or 37˚C incubator.
        b. Make sure the bulbs of all thermometers are properly immersed and at the same level within the water.
            i. If the thermometers are being calibrated at 1-6˚C, ensure the thermometer bulbs are kept in the liquid and not in the upper layer of ice.
        c. Stir the water to become a uniform temperature and allow the thermometers to equilibrate for approximately 5-15 minutes.
        d. Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the *Thermometer Calibration Log*.
    2. **For calibration of sub-zero liquid-in-glass thermometers (-20˚C and below):**
        a. Place all thermometers that are being calibrated into the appropriate freezer along with the NIST-Certified thermometer.

b. Allow the temperature of the thermometers that are being calibrated and the NIST-Certified thermometer to equilibrate.
    i. If the thermometers are kept in a temperature-buffered medium (i.e. glycerol, sand or equivalent material), it may take a prolonger period of time to equilibrate.
c. Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the *Thermometer Calibration Log*.

3. **For calibration of digital thermometers:**
    a. Place all digital thermometers that are being calibrated in a container along with the NIST-Certified thermometer.
        i. The intention of this container is to prevent air flow over the thermometers that may cause erratic fluctuations in temperature.
    b. Allow the thermometers to equilibrate for approximately 5-15 minutes.
    c. Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the *Thermometer Calibration Log*.

F. Verify the thermometers being calibrated and the NIST-Certified thermometer is in agreement within 1°C (after correction factors are applied).
    1. If the difference between thermometers being calibrated and the NIST-Certified thermometer is greater than 1°C, the thermometer that was being calibrated must be retired or returned to the supplier.
    2. Retired thermometers will be given to a Lead Medical Technologist or supervisor for disposal.
        a. The Safety Data Sheet (SDS) requirements and regulations for disposal will be followed.
        b. Non-mercury glass thermometers that are deemed environmentally safe will be discarded in a standard laboratory sharps container.

VII. NOTES:

A. Mercury glass thermometers are no longer approved for use in the Dearborn Laboratory. If a mercury glass thermometer is discovered it will be turned over to laboratory safety officer such that all SDS requirements and regulations for the safe disposal of hazardous waste are followed.

VIII. REFERENCES:

1. Barnstead/ERTCO Thermometer, package insert: Instructions for Reuniting Separated fluid column of your Spirit Filled Barnstead/Ertco Thermometers 08/03.

Attachments

Thermometer Calibration Log

Approval Signatures

Step Description	Approver	Date
	Jeremy Powers: Chief, Pathology	6/7/2022
Policy and Forms Steering Committe (if needed)	Kelly Sartor: Supv, Laboratory	5/31/2022
Policy and Forms Steering Committe (if needed)	Gail Juleff: Project Mgr Policy	5/31/2022
	Kimberly Geck: Dir, Lab Operations B	5/30/2022
	Kelly Sartor: Supv, Laboratory	5/27/2022
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Thermometer Calibration

Date	TECH	Thermometer Serial#	Thermometer Location	NIST Thermometer °C	Thermometer being tested °C	Satisfactory/ Unsatisfactory* (S / U)	Appearance** (OK/NOT OK or NA)	Corrective Action

NIST Thermometer being used: _____ thermometer

NIST Thermometer Recalibration due: _____

Reviewed by: _____ **Date:** _____

* Less than or equal to **1°C** between the NIST and testing thermometer is considered satisfactory.

Appearance is OK when column liquid is observed to be intact and **not split.

Standardizing and Calibrating Thermometers.
05/22/2022