

PROCEDURE

Corewell Health East - Standardization and Calibration of Thermometers - Blood Bank

This Procedure is Applicable to the following Corewell Health sites:

Corewell Health Beaumont Grosse Pointe Hospital, Corewell Health Beaumont Troy Hospital, Corewell Health Dearborn Hospital, Corewell Health Farmington Hills Hospital, Corewell Health Taylor Hospital, Corewell Health Trenton Hospital, Corewell Health Wayne Hospital, Corewell Health William Beaumont University Hospital (Royal Oak)

Applicability Limited to:	N/A
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Functional Area:	Clinical Operations, Laboratory
Lab Department Area:	Lab - Blood Bank

1. Principle

This document provides procedure and guidance for the standardization and calibration of liquid-in-glass thermometers, digital thermometers, data loggers, and infrared thermometers. Thermometers may also be sent to an outside company for calibration, if necessary.

- 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 at the following intervals:
 1. Prior to initial use
 - a. Note: If a new thermometer has proof of calibration performed by the manufacturer, additional calibrations are not required until the calibration expiration date.
 2. Annually thereafter
 3. Any time there is reason to suspect change or damage
 4. If requested by the laboratory section manager/supervisor

2. Responsibility

Personnel who have completed the competency requirements will perform these tasks.

3. Definitions

- 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.
- C. IR Thermometer: Infrared, non-contact thermometer
- D. Laser Thermometer: Infrared thermometer which uses a laser to help aim the thermometer

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- E. Data logger: electronic temperature data recorder used at Corewell Health Royal Oak for helicopter coolers and the Biofridge®.

4. Reagent/Equipment Needed

- 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 dry bath heat block
- G. Beaker
- H. Scrub brush
- I. Deionized Water
- J. Tap Water
- K. Crushed ice
- L. Dry ice
- M. Isopropyl alcohol
- N. Temperature-buffered medium (i.e., glycerol, sand, or equivalent material)

5. Quality Control

- A. Recertification of NIST-Certified thermometers will be done on an annual basis by an outside source or replaced if applicable.

6. Procedure

A. Thermometer Inspection and Preparation:

1. Perform a visual inspection of all thermometers and document as Satisfactory or Unsatisfactory (S/U) on the applicable attachment *Thermometer Calibration Log* (33925-1 or 33925-2).
 - a. Inspect all thermometers for cracks and/or physical damage.
 - b. Inspect the display of all electronic thermometers (digital, IR/Laser, and data loggers) to make sure it is clear and free of obstructions. Replace the battery(ies) if the display appears weak or inconsistent.
 - c. Inspect all electronic thermometers (digital, IR/Laser, and data loggers) to make sure the battery compartment is free of damage.
 - d. Inspect all liquid-in-glass thermometers for any splits or bubbles in the column that may cause inaccurate readings. Acceptable appearance is an intact column of liquid.
 - e. 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.
 - f. 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.
 - g. Document the separation repair in the Corrective Action section of the attachment *Thermometer Calibration Log* (33925-1). After the corrective action, verify the calibration of the thermometer using this procedure and record on the attachment *Thermometer Calibration Log* (33925-1).
2. Follow the manufacturer's instructions for proper immersion of liquid-in-glass thermometers in use.

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3. 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 applicable attachment *Thermometer Calibration Log* (33925-1 or 33925-2) as well as its certification expiration date.
 - a. In addition, read and follow the applicable notes on the NIST-Certification. Be sure to include any correction factors noted on the certificate for the NIST-Certified thermometer and apply them in calculations.
 4. Group the thermometers together based on what temperature they are used for.
 - a. Some thermometers may be calibrated at multiple temperature points, such as room temperature and 37°C.
 5. Record each thermometer's manufacturer serial number (or assigned number if no manufacturer serial number is available) on the applicable attachment *Thermometer Calibration Log* (33925-1 or 33925-2).
- B. Use of Thermometer Containers Containing 5% Glycerol (optional)**
1. **Preparation of a 5% Glycerol Solution for Thermometer Containers**
 - a. Measure 150 mL of glycerol into a flask.
 - b. Pour the glycerol into a clean 24-hour urine container.
 - c. Using the measurements on the side of urine container, add enough DI water to measure 3000 mL.
 - d. Label the 5% glycerol container with the following:
 - 1) 5% glycerol solution
 - 2) Tech initials
 - 3) Date the solution was made
 - 4) Expiration date, shorter of the following:
 - a) Expiration date of the glycerol
 - b) Expiration date of the DI water
 - c) One year from date the solution was made
 - e. Place the 5% glycerol into a refrigerator overnight to ensure that its temperature is between 1- 6°C.
 2. **Cleaning Thermometer Containers Containing 5% Glycerol (completed annually, and as needed)**
 - a. Take thermometer out of service (if thermometer is assigned to a cooler, also take the cooler out of service and remove the thermometer and thermometer container from the cooler).
 - b. Pour the old 5% glycerol solution from the thermometer containers down an appropriate sink for disposal and flush the containers with tap water.
 - c. Rinse the thermometer off with tap water and wipe it down with isopropyl alcohol.
 - d. Clean the inside and outside of the container and cap with isopropyl alcohol by thoroughly scrubbing with a scrub brush.
 - e. Rinse the container and cap out with tap water.
 - f. Rinse the container and cap out with isopropyl alcohol.
 - g. Allow container, cap, and thermometer to dry.
 - h. Fill the container with fresh 5% glycerol.
 - i. Put the cap back onto the container with the thermometer inside.
 - j. Make sure the thermometer container is labeled as appropriate per site-specific policy (This includes the thermometer serial number and may include a thermometer and/or cooler number to which it belongs.)
 - k. Place the thermometer into the fridge. Let the thermometer equilibrate for approximately 10 minutes until the thermometer reads at the temperature of the fridge $\pm 1^{\circ}\text{C}$.
 - l. Put the thermometer back into the appropriate storage area/cooler, as applicable, and put back into use.

- m. Record the cooler number (if applicable), thermometer serial number, date, and technologist who cleaned the container on the attachment *Glycerol Thermometer Container Cleaning Log* (33925-3).

C. Standard Thermometer Calibration

1. Perform the thermometer calibration based on the temperature in which it is being used:
 - a. For calibration of liquid-in-glass thermometers at 1-6°C or 37°C:
 - 1) 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, 37°C).
 - a) For 1-6°C calibrations, fill the container with a mixture of water and crushed ice.
 - b) For 37°C calibrations, use a 37°C water bath or 37°C incubator.
 - 2) Make sure the bulbs of all thermometers are properly immersed and at the same level within the water.
 - a) 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.
 - 3) Stir the water to become a uniform temperature and allow the thermometer(s) to equilibrate for approximately 5-15 minutes.
 - 4) Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the attachment *Thermometer Calibration Log* (33925-1).
 - b. For calibration of liquid-in-glass thermometers at room temperature (18-24°C):
 - 1) Place all thermometers that are being calibrated into a dry beaker along with the NIST-certified thermometer.
 - 2) Allow the temperature of the thermometers to equilibrate for approximately 5-15 minutes.
 - 3) Record the temperature of the NIST-certified thermometer and all thermometers being calibrated on the attachment *Thermometer Calibration Log* (33925-1).
 - c. For calibration of sub-zero liquid-in-glass thermometers (-20°C and below):
 - 1) Place all thermometers that are being calibrated into the appropriate freezer along with the NIST-Certified thermometer.
 - 2) Allow the temperature of the thermometers that are being calibrated and the NIST-Certified thermometer to equilibrate.
 - a) If the thermometers are kept in a temperature-buffered medium (i.e. glycerol, sand or equivalent material), it may take a prolonged period of time to equilibrate.
 - 3) Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the attachment *Thermometer Calibration Log* (33925-1).
 - d. For calibration of digital thermometers and data loggers:
 - 1) Place all digital thermometers that are being calibrated in a container along with the NIST- Certified thermometer.
 - a) The intention of this container is to prevent air flow over the thermometers that may cause erratic fluctuations in temperature.
 - 2) Allow the thermometers to equilibrate for approximately 5-15 minutes.
 - 3) Record the temperature of the NIST-Certified thermometer and all thermometers being calibrated on the attachment *Thermometer Calibration Log* (33925-1).
2. Verify the thermometer(s) being calibrated and the NIST-Certified thermometer agree within 1°C (after correction factors are applied).
 - a. 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.
 - b. Retired thermometers will be given to a Lead Medical Technologist or supervisor for disposal.
 - 1) The Safety Data Sheet (SDS) requirements and regulations for disposal will be followed.
 - 2) Non-mercury glass thermometers that are deemed environmentally safe will be discarded in a standard laboratory sharps container.

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D. Calibration of IR/Laser Thermometers

1. Fill a plastic container approximately 2/3 full of cold water, and add a small amount of ice so that the temperature is between 1° - 4 °C.
2. Prop/insert the NIST thermometer inside the container so that the tip of the thermometer is just below the surface.
3. Allow the NIST thermometer to equilibrate.
4. Take the temperature of the water surface with the IR (infrared) thermometer.
5. Read and record the NIST and IR thermometer temperatures for this range, on the attachment *IR Thermometer Calibration Log* (33925-2).
6. For 5 -10 °C point reading, add a small amount of warm water to allow water temperature to increase to 5° - 10 °C.
7. Repeat steps 2- 5 and record the NIST and IR thermometer temperatures for this range on the attachment *IR Thermometer Calibration Log* (33925-2).
8. For 10 -15 °C point reading, add sufficient ice/hot water to allow water temperature to increase to 10°-15°C.
9. Repeat steps 2- 5 and record the NIST and IR thermometer temperatures for this range on the attachment *IR Thermometer Calibration Log* (33925-2).
10. For 20 - 24 °C point reading, add sufficient ice/hot water to allow water temperature to increase to 20°- 24°C.
11. Repeat steps 2 -5 and record the NIST and IR thermometer temperatures for this range on the attachment *IR Thermometer Calibration Log* (33925-2).

7. Results/Interpretation

- A. Determine the calibration status of the thermometer(s).
 1. Verify the thermometer(s) being calibrated and the NIST-Certified thermometer agree within 1°C.
 - a. If the temperature readings and visual inspection are satisfactory document the calibration as Pass (P) on the applicable attachment *Thermometer Calibration Log* (33925-1 or 33925-2).
 - b. If the readings and/or visual inspection are not satisfactory document the calibration as Fail (F) on the applicable attachment *Thermometer Calibration Log* (33925-1 or 33925-2) and remove the thermometer from service until an investigation is completed and resolved.
- B. After passing calibration each thermometer should be labeled with the following information:
 1. Calibration date
 2. Tech that performed the calibration
 3. Thermometer serial number

8. Limitations

Mercury glass thermometers are no longer approved for use in the 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.

9. Revisions

Corewell Health reserves the right to alter, amend, modify or eliminate this document at any time without prior written notice.

10. Procedures Superseded and Replaced: This procedure supersedes and replaces the following procedures as of the effective date of this procedure: [33964 Corewell Health East – Calibration of the Extech IR Thermometer Model IR200 – Troy, 33810 Corewell Health East – Standardization and Calibration of Thermometers – Blood Bank – Dearborn]**11. Resources**

Entities will reference associated Documentation contained within this document as applicable
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- A. Barnstead/ERTCO Thermometer, package insert: Instructions for Reuniting Separated fluid column of your Spirit Filled Barnstead/Ertco Thermometers 08/03.
- B. Extech® Non-contact Forehead IR thermometer User's Manual, 8/13 v1.4.

12. References

- A. AABB, Technical Manual, current edition.
- B. AABB, Standards for Blood Banks and Transfusion Services, current edition.

13. Procedure Development and Approval

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14. Keywords

Not Set