CALIBRATION OF LAB THERMOMETERS USING A CONSTANT TEMPERATURE CALIBRATION BATH

1. SCOPE AND APPLICATION

1.1. This SOP describes the use of a constant temperature calibration bath to calibrate lab thermometers. The temperature reading of a lab thermometer is compared to that of a NIST traceable, calibrated reference thermometer at a fixed temperature to determine its accuracy. This procedure is applicable to the calibration of digital thermometers with thermocouple probes, CheckPoint sensors with probes, and analog, liquid-filled glass thermometers. All thermometer calibrations are good for one year. Calibrations should be scheduled when equipment are not under test conditions. See Section 8. for exceptions.

1.2. This SOP does not apply to Infra-Red radiation thermometers (IR guns).

NOTE: Some inexpensive digital thermometers used for monitoring TDS, TSS, and microbiological tests can be exchanged with new probes that have a NIST Certificate of Calibration. These thermometers come with year-long manufacturer calibration certificates. Since these thermometers are replaced on an annual basis, they need not be independently calibrated at the lab using this bath.

2. APPARATUS AND EQUIPMENT

2.1. Fluke 7103 Temperature Calibration Micro-Bath. Temperature range: –30°C to +125°C located in Room B319 (Toxic Weighing)

2.2. Delrin Access Cover with pre-drilled holes for thermocouple probes and glass, liquid-filled thermometers.

2.3. Fisher Scientific Traceable High-Accuracy Platinum Digital Thermometer, Cat. No. 15-081-108 with a 0.2” O.D. stainless steel probe. Temperature range: –80 °C to +190°C.

3. REAGENTS AND SUPPLIES

3.1. Dow Corning Silicone Oil, Type 200.05.

3.2. *Kimwipes* paper wipes.

4. CHECKPOINT OPERATIONS

4.1. Contact supervisor or appropriate CheckPoint administrator before removing probes to calibrate. The temperature threshold must be updated to avoid unnecessary alerts for temperatures out of range during calibrations. See SOP LB-004 Monitoring CheckPoint Alerts.

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4.2. Once alert settings have been adjusted, proceed to remove the probe. The sensor and probe may be mounted together inside an appliance. (Figure 1) Ensure that the yellow sensor is labeled with the Mesa Tag number, unit location, description, calibration date, and expiration date.



4.3. Remove the probe from the glycol bottle and detach the yellow sensor from the wall of the appliance, keeping the probe and sensor plugged together.

4.4. Alternately, the sensor is mounted on the outside of the appliance and connected to the probe inside the appliance by an extension cable. (Figure 2) Remove the probe from the glycol bottle and disconnect it from the extension cable inside the appliance by pulling back the black cap.

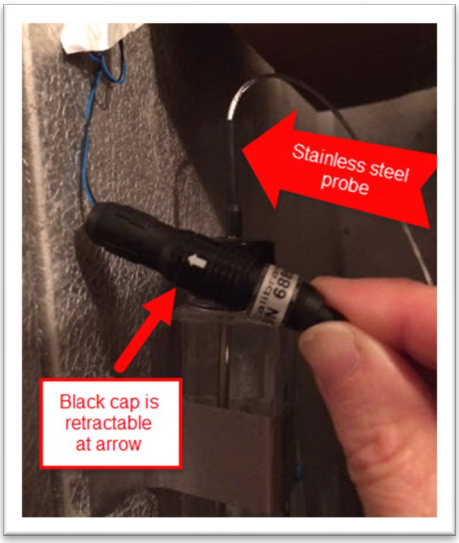


Figure 2 – Unplug probe from extension cable

CAUTION: **Do Not Twist the Cap** as this can break the connectors. Leave the extension cable in place. Carefully remove the sensor and probe from the appliance and

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immediately reconnect probe to sensor to prevent software alerts. Return to B319 with the sensor/probe. If sensor does not automatically reconnect in CheckPoint software, see SOP LB-004.

5. CALIBRATION BATH OPERATION

5.1. Lab thermometers need to be calibrated at two discrete temperatures that bracket their range of use. For exceptions, see the note below. The calibration bath can be set to heat or cool to a selected temperature (set point). The bath then heats or cools the silicone oil in the bath until it reaches equilibrium at the set point. **Do not move/relocate the calibration bath while it is on, or when the bath fluid is at an elevated temperature.**

NOTE: *If the thermometer or thermocouple is used over a range of 10°C or less (microbiology incubators for example), then a single point verification within the range of use is acceptable.*

5.2. **A Fisher Scientific NIST Traceable Platinum Reference Thermometer, (Cat. No. 15-081-108) is in the drawer next to the microbath. This thermometer may be used as the reference thermometer for the calibration of lab thermometers.**

NOTE: The calibration bath is filled with Silicone Oil bath fluid to the proper level during installation. At room temperature, the fluid level should be about 1 inch below the second ring of the probe basket. A stir bar sits in the bottom of the well for mixing the fluid and providing better accuracy, uniformity, and stability. Cooling fans in the bath turn on when the instrument is powered. The fans are quite loud.

5.3. Record your name and date in the Calibration Bath logbook beside the instrument. Add a comment in the box provided, “CheckPoint temperature range temporarily adjusted to calibration range for sensor ID XXXXX” Date and initial.

5.4. Lift the brown, plastic dust cap that covers the access cover and set it aside. The access cover is a translucent, threaded, Delrin disk that covers the well containing the bath fluid. The cover has holes for the insertion of thermocouple probes or glass, liquid-filled thermometers. Three, small, 3/16” holes are for thermocouple probes. The large 3/8” hole can accommodate an analog, glass liquid-filled thermometer. The 1/4" hole in the center can be used for either a thermocouple probe or a slim analog liquid-filled thermometer. The diameters of the holes were chosen to accommodate the diameters of probes and thermometers used in the lab.

5.5. The power switch to the bath is located at the rear of the instrument. Switch on the instrument. When the Micro-Bath is turned on, it will begin to heat (or cool) to the previously programmed temperature set-point. The front panel LED displays the bath temperature.

5.6. The control panel of the bath is shown in **Figure 3**. To set the temperature of the bath, do the following:

5.6.1. Press “SET” twice to access the set-point value.

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5.6.2. Press and hold the “UP” or “DOWN” to change the set-point value.

5.6.3. Next, press “SET” to store the new set-point value.

5.6.4. Press “EXIT” to return to the current temperature display.

5.7. When the set-point temperature is changed, the controller switches the well-heater on or off to raise or lower the temperature. The fan speed also changes accordingly. The displayed well temperature gradually changes until it reaches the set-point temperature. The well may require up to 90 minutes to reach the set-point depending on the temperature span. Another 10 to 15 minutes is required to stabilize within ±0.04°C of the set-point.



Figure 3

5.8. Once the bath has stabilized, insert the thermocouple probe of the reference thermometer and probe(s) of the lab thermometer(s) that need to be calibrated into the holes in the top of the Fluke Bath. See Figure 4. Do not submerge CheckPoint probes in the oil above the probe connector. Wait another 15 minutes for the thermometers or probes to reach equilibrium and record the readings from the reference and lab thermometer(s). If there are multiple thermometers or probes in the bath, it may take longer (20-25 min) to reach equilibrium.

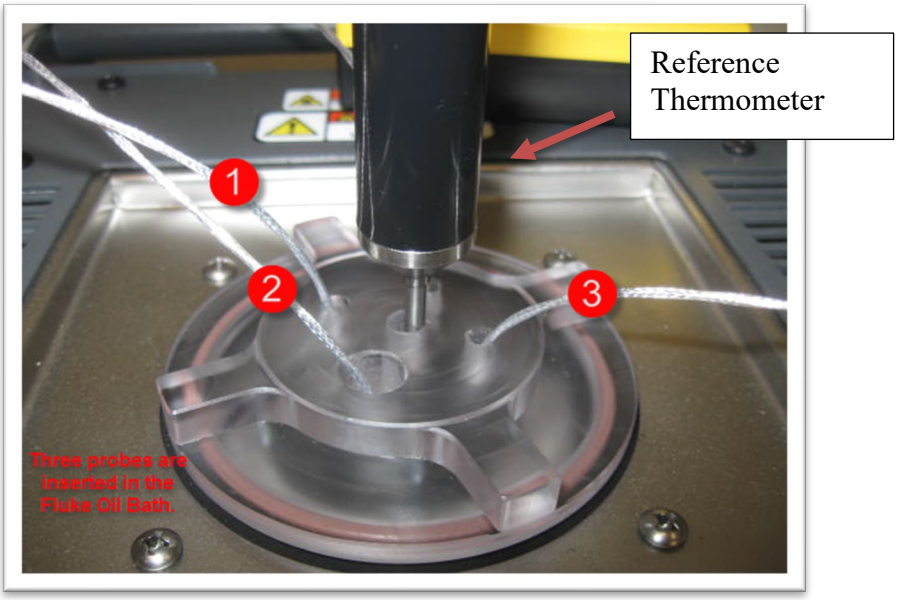


Figure 4 – Probes inserted in Fluke Oil Bath

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5.9. Once the sensor/probe temperature has stabilized, check the temperature on the reference thermometer and then immediately press the sensor button twice to send an instantaneous temperature reading to Checkpoint. Refresh Checkpoint's Equipment Screen under menu item *Status* →*Refresh* to capture the wireless data from the sensor. Repeat this step at least once to confirm readings. If not using a CheckPoint probe, check the measurement and compare to reference thermometer. Record the reference and actual temperatures in the Calibration notebook.



Figure 5 – Sensor Button

5.10. Next, change the temperature set-point to the second bracketing temperature as described in Section 5.6. and repeat the process. Suggested calibration temperature settings for thermometers used by different groups in the lab are shown in Table 1. Some thermometers, such as those used in incubators also need to be calibrated at the temperature/set-point of the incubator.

TABLE 1: Suggested Calibration Temperature Set-points for Lab Thermometers

Thermometer Application	Lower Calibration Temp* (°C)	Upper Calibration Temp* (°C)	Accuracy (°C)
Lab Refrigerators	0	10	±0.5
Lab Freezers	–15	–5	±0.5
Lab Freezers (Organic Standards)	–25	–5	±1.0
Autoclaves	50	125	±1.0
Incubators – Toxicity	10	30	±0.5
Incubators – Microbiology	Single temperature depending on test		±0.2

* The calibration bath's temperature range is –30°C to +125°C.

6. CALIBRATION BATH SHUT DOWN

6.1. After the thermometers have been calibrated, remove and wipe the probes or thermocouples with a clean *Kimwipe*.

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6.2. Reset the temperature of the bath to 25°C following the procedure in Section 5.6. Wait for 30–90 minutes for the bath to reach ambient (25°C) temperature. Turn the calibration bath off.

6.3. Wipe off any oily residue on the top surface of the access cove with a clean *Kimwipe*. Replace the dust cover over the access cover to prevent dust from entering the bath and contaminating the bath fluid.

6.4. Make sure that the instrument is switched off and the Calibration Bath logbook is initialed and dated before leaving.

7. DOCUMENTATION AND REPLACING THERMOMETERS

7.1. All thermometers must be labeled with the following: thermometer serial number, calibration, and calibration expiration date. For CheckPoint sensors also include yellow sensor module ID, probe serial number, unit location, and description.

7.2. Replace probes in appropriate equipment. See section 4.0 CheckPoint Operations to align probe extensions and connectors.

7.3. Replace the batteries in the yellow CheckPoint sensor. Remove the two screws at the top of the sensor, and carefully separate the front (yellow) plastic cover from the back (black) base. Dispose of batteries in appropriate hazardous waste and replace with new AA lithium or alkaline batteries. Press the sensor button twice and refresh the status in CheckPoint to verify that the probe is connected and in working operation. If the sensor does not automatically reconnect, see SOP LB-004.

7.4. Notify supervisor or CheckPoint Administrator when the probe has been placed back into the incubator. After the probe has stabilized, the temperature range should be adjusted back to location monitoring range according to SOP LB-004.

7.5. Final checklist

7.5.1. Have all sensors/probes been reconnected to the correct refrigerators?

7.5.2. Has the Fluke oil bath been properly shut down?

7.5.3. Have all thermometers been labeled according to section 7.1?

7.5.4. Has the temperature range of the CheckPoint equipment record been updated appropriately?

7.5.5. Have batteries of CheckPoint sensors been replaced?

8. CORRECTIVE ACTION

8.1. The temperatures must be within ± 0.5 degrees of the reference temperature to pass recalibration.

8.2. If a thermometer fails the calibration verification, remove it from service and replace with another calibrated thermometer.

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8.3. Replace damaged CheckPoint sensors and/or probes. Calibrate the new probe and sensor per section 5. Update the equipment record with the new sensor ID and/or probe. List the old sensor ID and/or probe and date replaced in the comments section. Use the correct CheckPoint sensor type for the probe to ensure a compatible reading.

8.4. If samples or organisms arrive unexpectedly while thermometers are out for calibration, an alternative thermometer appropriately calibrated to range of use can be used temporarily. Document temperatures according to TNI or method requirements.

9. REFERENCES

9.1. Fluke 7103 Micro-Bath User's Guide, December 2013

9.2. SOP LB-004 Managing Alerts from the CheckPoint Wireless Monitoring System

Appendix of Significant Changes

11/29/2016 This SOP was edited and checked for 508 compliance.

06/17/2024 Added Section 4 (CheckPoint Operations-moved from LB-004, Figures 1, 2, and 4, Section 7 (Documentation and Replacing Thermometers), and Section 8 (Corrective Action).

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