



**US Environmental Protection Agency  
Office of Pesticide Programs**

**Standard Operating Procedure for  
Calibration of Thermometers**

**Date Revised: 02-21-08**

EPA/OPP MICROBIOLOGY LABORATORY  
ESC, Ft. Meade, MD

Standard Operating Procedure  
for  
Calibration of Thermometers

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1.0 SCOPE AND APPLICATION:

1.1 This protocol describes the procedure used to point-check the accuracy of laboratory thermometers.

2.0 DEFINITIONS:

2.1 NIST = National Institute of Standards and Technology.

2.2 Correction Factor = the difference in the NIST traceable thermometer and the Observed Temperature measured by the NIST traceable thermometer. This is calculated and reported during the annual certification of the thermometers.

3.0 HEALTH AND SAFETY:

3.1 In the event that a mercury thermometer (section 7.3) breaks, evacuate the laboratory and call the SHEM manager (or contact security at extension 2600 if SHEM manager cannot be reached) immediately for assistance. Analysts are not to attempt to clean up the spill.

4.0 CAUTIONS: None

5.0 INTERFERENCES:

5.1 Allow the thermometer to equilibrate with the solutions before taking the temperature reading.

6.0 PERSONNEL QUALIFICATIONS:

6.1 Personnel are required to be knowledgeable of the procedures in this SOP. Documentation of training and familiarization with this SOP can be found in the training file for each employee.

7.0 SPECIAL APPARATUS AND MATERIALS:

7.1 NIST traceable thermometer (ERTCO, serial number 1294) calibrated annually by ThermoFisher Scientific, an ISO17025 accredited vendor.

7.2 NIST traceable thermometer (ERTCO, serial number 3321) calibrated annually by ThermoFisher Scientific.

7.3 NIST traceable Kessler maximum registration thermometers (ERTCO, mercury-containing/Teflon-coated, serial numbers 3302, 3306, 3400, 4265, 4315, 4330, 5129, and 7141) certified annually by ThermoFisher Scientific at 121EC.

Thermometers are used to verify autoclave temperatures.

- 7.4 NIST traceable digital thermometers for freezers: 1) Fisher Scientific, model No. 06-664-23, serial number 240106521, 2) Fisher Scientific, model No. 15-077-14, serial number 230317798, and 3) Fisher Scientific, model No. 15-077-14, serial number 41299983. Thermometers are calibrated annually by Control Company, an ISO 17025 accredited laboratory.
- 7.5 Thermometers used to measure the temperature of water baths, incubators, refrigerators, and freezers, including FRIO-Temp Precision Thermometers. To determine which thermometers are currently in use in the laboratory, refer to the Point Check Calibration of Laboratory Thermometers Record Book.

#### 8.0 INSTRUMENT OR METHOD CALIBRATION:

- 8.1 All thermometers are checked for accuracy using a NIST traceable thermometer. The NIST traceable thermometers are certified annually by an ISO 17025 certified vendor.

#### 9.0 SAMPLE HANDLING AND STORAGE: Not applicable

#### 10.0 PROCEDURE AND ANALYSIS:

- 10.1 Annual Thermometer Calibration Reports for NIST traceable thermometers (sections 7.1, 7.2, 7.3, and 7.4) are stored in the Thermometer and Hygrometer Calibration Certificates notebook.
- 10.2 Once a year, all of the thermometers falling under section 7.5 of this SOP are checked at operating temperatures against one of the NIST traceable thermometers (sections 7.1 and 7.2).
- 10.3 To point-check the accuracy of FRIO-Temp Precision Thermometers, place a flask of de-ionized water or ethanol next to the thermometer in the incubator, refrigerator, or freezer. Place the NIST traceable thermometer into the flask of de-ionized water or ethanol. Once the de-ionized water or ethanol has reached the temperature of interest, conduct the accuracy check. The NIST thermometer must be suspended in the liquid in the flask, not resting on the bottom of the flask.
- 10.4 A water bath is used, where applicable, to check the temperature of the thermometers (excluding the FRIO-Temp Precision Thermometers) by simultaneous immersion of the NIST traceable thermometer and the thermometer to be calibrated into the water bath at the temperature of interest. Otherwise, point checks are taken by simultaneous immersion of the thermometers in a flask

of de-ionized water or ethanol and then placing the flask containing both thermometers in the instrument being monitored until the de-ionized water or ethanol reaches the temperature of interest.

- 10.5 Any difference in temperature readings between the NIST traceable thermometer and the laboratory thermometer is recorded on the Point-Check Calibration of Laboratory Thermometers Record Form (see 16.0).
- 10.6 A label displaying the date of calibration and correction factor (even if it is zero), is placed around the top of the corresponding thermometer.
- 10.7 Digital thermometers are calibrated against NIST traceable instrumentation and are indicated to be within tolerance. No correction factor is indicated (see certificates of NIST traceability).

#### 11.0 DATA ANALYSIS/CALCULATIONS:

- 11.1 The Check Point for both the NIST thermometer and the thermometer being calibrated is the reading on the NIST thermometer during the point check process. The temperature reading on the NIST thermometer must be within the range at which the thermometer to be calibrated will be used or is being used (see SOP QC-05, Monitoring Temperatures, for acceptable temperature ranges for equipment).
- 11.2 The Observed Temperature is the temperature reading of the thermometer during the check point process.
- 11.3 The correction factor for the NIST thermometer is determined by the certified company that performs the calibration verification for this thermometer. The True Temperature measured by the NIST traceable thermometer = the Observed Temperature of the NIST traceable thermometer plus its correction factor.
- 11.4 The correction factor for the laboratory thermometer that is being calibrated against the NIST traceable thermometer is calculated by subtracting the Observed Temperature of the laboratory thermometer from the True temperature of the NIST traceable thermometer.
- 11.5 The True Temperature measured by the laboratory thermometer = the Observed Temperature plus the correction factor for that thermometer.

#### 12.0 DATA MANAGEMENT/RECORDS MANAGEMENT:

- 12.1 Data will be recorded promptly, legibly and in indelible ink on the Point Check

Calibration of Laboratory Thermometers Record Form. Completed forms are archived in the Point Check Calibration of Laboratory Thermometers Record Book. Annual Thermometer Calibration Reports for NIST traceable thermometers (sections 7.1, 7.2, 7.3, and 7.4) are stored in the Thermometer and Hygrometer Calibration Certificates notebook. The books are kept in a secured file cabinet in the file room D217. Only authorized personnel have access to the secured files. Archived data are subject to OPP=s official retention schedule contained in SOP ADM-03, Records and Archives.

13.0 QUALITY CONTROL:

- 13.1 The OPP Microbiology laboratory conforms to 40 CFR Part 160, Good Laboratory Practices. Appropriate quality control measures are integrated into each SOP.
- 13.2 Thermometers are point-checked once a year either in the laboratory or by a company certified to perform calibration verification of thermometers.
- 13.3 For quality control purposes, the required information is documented on the appropriate form(s) (see 16.0).

14.0 NONCONFORMANCE AND CORRECTIVE ACTION:

- 14.1 When routinely recording temperatures for the laboratory, laboratory equipment, media etc., the observed temperature reading of the thermometer read plus the correction factor for that specific thermometer must be recorded.
- 14.2 On occasion, thermometers must be discarded (e.g., broken columns, unreasonably large correction factor). Contact the facility Safety, Health, and Environmental Management Program Manager for proper disposal procedures.

15.0 REFERENCES: None

16.0 FORMS AND DATA SHEETS:

- 16.1 Point-Check Calibration of Laboratory Thermometers Record Form

Point Check Calibration of Laboratory Thermometers Record  
OPP Microbiology Laboratory

Date	Initials	Thermometer Type	Serial #	Check-point†	Observed Temp.††	Correction Factor *	True Temp. **
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Date	Initials	Thermometer Type	Serial #	Check-point†	Observed Temp.††	Correction Factor *	True Temp. **
		NIST Traceable					
Comments							

Date	Initials	Thermometer Type	Serial #	Check-point†	Observed Temp.††	Correction Factor *	True Temp. **
		NIST Traceable					
Comments							

Date	Initials	Thermometer Type	Serial #	Check-point†	Observed Temp.††	Correction Factor *	True Temp. **
		NIST Traceable					
Comments							

† Reading on the NIST thermometer during the point-check process. The temperature reading on the NIST thermometer must be within the range at which the thermometer to be calibrated will be or is being used (See SOP QC-05, Monitoring Temperatures, for acceptable temperature ranges for equipment).

†† Temperature reading of thermometer during the point-check process.

\* Correction factor for NIST Thermometer determined by the Certification company.

Correction factor for the thermometer being calibrated is calculated by subtracting its observed temperature from true temperature of NIST Thermometer .

\*\* True Temperature of NIST Thermometer = Observed Temp.+ Correction factor :

True temperature of Thermometer being Calibrated = Observed Temp. + Correction Factor for that thermometer.