Laboratory Temperature Sensor Calibration

(mo/yr)

Revisions		Rev:	
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Used On	Contract#:		**Your Company Name**				
Prepared By:							
Originator:							
Your Dept:			**LABORATORY PROCEDURE**				
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1.0 Purpose of Process

Use the physical constants of the freezing and boiling point of distilled or deionized water to determine the accuracy of temperature sensors.

2.0 Process Definition

Determine the precise temperature of boiling water at various barometric pressures and use the bath as a calibration source; similarly, use the freezing point of water to serve as a 0°C source.

3.0 Equipment

3.1 [redacted]
3.2
3.3

4.0 Materials

4.1 [redacted]

5.0 Preparations

The hot plate must be cold for use with ice water and heated for use with boiling water.

6.0 Document Review

6.1 Calibration Policies and Procedure

7.0 Safety Requirements

7.1 Safety Equipment

The technician performing the analysis should wear the appropriate gloves, lab coat and safety glasses.

7.2 Safety Precautions

If any of the glassware breaks during the procedure, the technician should dispose of the remains in the receptacle in the lab specifically for broken glass. If the technician has any trouble or questions, he/she should immediately contact an Environmental Health and Safety representative.

8.0 Technician Responsibilities

The technician should understand how to operate all measuring devices used in this procedure. The technician should understand the calculations and ask questions if the calculations seem unclear. The technician is responsible for [redacted] The technician should have knowledge of the following documents: Calibration Policies and Procedures

9.0 Process Controls

The analysis should be performed according to the procedure described herein. Any change to this document must be approved by the lab supervisor and then the documents must be forwarded to configuration control for approval prior to application. All of the required data should be recorded and reported to the department requesting the analysis. The lab supervisor should [redacted]

10.0 Prepare 100°C±0.1°C Boiling-Point Physical Constant

10.1 Determine the Uncorrected Barometric Pressure for the Boiling-Point Constant

Call the local weather station or airport and ask for the latest *uncorrected* barometric pressure in millimeters of mercury. If they can only provide the pressure in inches of mercury then multiply the value times 25.4 to convert it to millimeters of mercury. The barometric pressure changes several times during the day, which affects the boiling point of water and requires the atmospheric pressure to be determined immediately prior to checking the accuracy of the temperature sensor.

10.2 Approximate the Boiling Point of Water

Using Table 1, find the boiling point of water based upon barometric pressure.
Example:

[redacted]

The boiling point of water is between [redacted]

10.3 Calculate the Boiling Point of Water

From Table 1:
98.4°C – 98.2°C = 0.2°C…
717.63mmHg – 712.47mmHg = 5.16mmHg…
[redacted] (in this case, there is a change in temperature of [redacted] for every [redacted])
Calculate the difference between the known barometric pressure and the lower of the two values that bracket the pressure:

[redacted]

[redacted] is the boiling point of water at a barometric pressure of [redacted]

10.3 Boil Water

Place a stir bar in a clean beaker and fill the beaker ¾ full with distilled or deionized water. Heat the water to a rolling boil on a hot plate with stirrer.

10.4 Determine Accuracy of Temperature Sensor

Immerse the temperature sensor in the boiling water and keep the sensor element at least [redacted] above the heating surface of the hot plate. Wait a sufficient time for the sensor to stabilize at the temperature of the boiling water. Calculate and record the difference between the [redacted]

11.0 Prepare 0°C±0.1°C Ice-Point Physical Constant

Note: Barometric pressure does not affect the freezing point of water. This ice-bath must not be construed as a precision triple-point of water calibration cell with 0.01°C accuracy as described by the International Temperature Scale of 1990 (ITS-90).

11.1 Prepare ice cubes using distilled or Type II deionized water.
11.2 Crack the ice cubes into small chunks – shaved ice is not acceptable.
11.3 Place a stir bar in a clean beaker and fill the beaker [redacted] full with cracked ice.
11.4 Add distilled or Type II deionized water to provide [redacted] of water below the ice.
11.5 Place the beaker on a cold hot plate with stirrer and allow water to stir for 5 minutes.
11.6 Immerse the temperature sensor to [redacted] Wait a sufficient time for the sensor to stabilize at the temperature of the ice water. Calculate and record the difference between 0°C for the ice-point water and the temperature reading of the sensor. If possible, adjust the sensor to read the ice-point of water.

Table 1: Boiling-Point of Water at Barometric Pressures

Temp	0.0°	0.2°	0.4°	0.6°	0.8°
°C	mmHg	mmHg	mmHg	mmHg	mmHg
[redacted]					