

## Validating Thermometers

Every year, thermometers and electronic probes should be validated against a NIST validated thermometer. This is necessary to ensure the thermometers and probes are recording accurate temperature readings. The Virginia Department of Environmental Quality (DEQ) and other organizations can assist monitoring groups in this process.

### Before You Begin

You will need the following materials.

1. Thermometer needing validating
2. NIST certified thermometer calibrated within 1 year of the date of the calibration
3. hot plate or other source for heating water
4. 2 beakers or containers of water
5. clamps to suspend the thermometers
6. stir rod

Prior to starting the calibration, you will need to adjust the temperature of the water in each beaker.

- a. For the first beaker, pour the water into the container and allow adjusting to room temperature. The temperature should be between 20-25°C. (Note: You can leave the beaker of water out overnight prior to the calibration to come to room temperature).
- b. Place the second beaker of water onto the hotplate or warm up in a microwave or similar device. The final temperature should be between 32-35°C. (Note: this may take 15-45 minutes if using a hot plate).

You can use the stir rod to mix hot water beaker to achieve a uniform temperature.

### Thermometer physical check

Perform the following checks to the thermometer prior to calibration.

- a. Check both the NIST and thermometers for nicks and scratches.
- b. Check the column of both thermometers to ensure that the column does not have breaks or separations.
- c. Observe to see if the NIST or the thermometer being validated has a solid line drawn or etched near the bottom quarter of the glass body. If so, this is a **partial immersion thermometer**. For a partial immersion thermometer, you should only submerge the thermometer to this line. If you do not see a line, the thermometer is a **full immersion thermometer**. You can submerge this type of thermometer into the water filled beakers to about one inch from the bottom.

## Calibration

### Room temperature beaker-

- Carefully remove both thermometers and place them into the beaker of water set at room temperature. Ideally, the water should be between 20-25°C.
- Allow two minutes for the thermometers to adjust to the temperature. You should observe a result between 20-25°C. Do not touch or hold the thermometer with your hands or remove the thermometer from the water. Doing this will raise the temperature and give you an inaccurate reading.
- Record the result of the NIST thermometer onto your log sheet. To read the thermometer correctly, keep it immersed in the water and look at the top of the column at eye level. Record the values to the nearest unit. Usually this is 0.2 or 0.5 °C.
- Repeat this process with the thermometer or probe needing validation.

### Hot water beaker-

- Remove the thermometers from the room temperature beaker and immerse them into the beaker of hot water. The temperature of the water should be between 32-35°C.
- Record the NIST and ACB temperatures using the same procedure outlined in the room temperature beaker.

Once you have removed the thermometers, allow them to cool down to room temperature. Do not try to cool down the thermometers quickly as it may separate the column.

Compare the results between the NIST and the thermometer. If difference of temperature is less than 1.0 °C, record the difference on the log sheet and use the correction when using the now validated thermometer. If the difference is greater than 1.0°C, retest the thermometers. If temperatures are still off by more than 1.0°C, discard and replace the thermometer.