Using Conductivity Standard Solutions

Technical Note TN-0119

Conductivity standard solutions provide a way to verify or calibrate the conductivity sensor cell constant after the period of initial calibration has expired. Thornton conductivity sensors are factory calibrated with traceability to ASTM and NIST and are certified for a period of one year from installation under normal operating conditions. Where QC requirements call for verification or recalibration after this time, there are three options:

1. Return the sensor to the factory for recalibration. (Thornton CAL-2X Sensor Calibration Service)
2. Compare measurements with a recently calibrated plant standard system such as the Thornton1885 Portable Conductivity/Resistivity Calibration System.
3. Verify and/or calibrate in a conductivity standard solution. (Thornton 58 078 00X-series Conductivity Standards) Conductivity standard solutions are provided for this third option with the following specifications.

<table>
<thead>
<tr>
<th>Conductivity Standard</th>
<th>Accuracy</th>
<th>Shelf Life</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 µS/cm, 500 mL, HCl</td>
<td>± 3%</td>
<td>6 mo</td>
<td>58 078 001</td>
</tr>
<tr>
<td>100 µS/cm, 500 mL, KCl</td>
<td>± 1%</td>
<td>12 mo</td>
<td>58 078 002</td>
</tr>
<tr>
<td>1000 µS/cm, 500 mL, KCl</td>
<td>± 1%</td>
<td>12 mo</td>
<td>58 078 003</td>
</tr>
<tr>
<td>10,000 µS/cm, 500 mL, KCl</td>
<td>± 1%</td>
<td>12 mo</td>
<td>58 078 004</td>
</tr>
<tr>
<td>100,000 µS/cm, 500 mL, KCl</td>
<td>± 1%</td>
<td>12 mo</td>
<td>58 078 005</td>
</tr>
</tbody>
</table>

Used open to the atmosphere between 20 and 30 °C.
Storage temperature: 5 to 50 °C
Note that conductivity standard solutions are more vulnerable to contamination and dilution than pH buffer solutions. The buffering capacity of pH standards tends to resist pH change and makes them much more forgiving of mishandling. Conductivity standards on the other hand are directly affected by dilution or contamination and their values will change readily, especially the lower conductivity standards. During conductivity sensor calibration or verification, special care should be taken to establish accurate measuring conditions. The following procedure is recommended.

Verification/Calibration Procedure

Keep the standard solution bottle capped tightly except when dispensing it to prevent contamination and preserve its integrity throughout the shelf life.

1. If the sensor has been dry, first soak it in clean water for 2 hours before proceeding. Thoroughly rinse the sensor and the container that will hold the standard solution several times with deionized water to remove any process solution and suspended solids and then shake off any leftover droplets.

2. Rinse the sensor and container with a small amount of the standard solution and discard it.

3. Immerse the sensor in the standard solution to cover the active measuring area of the sensor and eliminate all air bubbles from that area by agitating or tapping the sensor on the container. With all 2-electrode sensors, the vent holes in the side must be completely covered. With 50 cm-1 constant sensors, the active measuring area also includes the space 1 inch (25 mm) below the bottom surface of the probe. With 4-electrode sensors it is also necessary to leave an open solution space 1 inch (25 mm) below it.

IMPORTANT: 4-electrode and 50 cm-1 constant sensors must be suspended 1 inch (25 mm) above the bottom of the container while measuring and calibrating to obtain valid results.

4. Measure the conductivity and the temperature of the standard, allowing time for both readings to reach equilibrium. Stirring can help to reach equilibrium sooner but must not generate any bubbles.
   a. If temperature compensation is active then compare the conductivity reading directly to the certified value of the standard solution.
   b. If the reading is not temperature compensated, then apply the 2%/°C temperature correction to the certified value of the standard and compare that to the reading. For example, if the certified standard value is 100.43 μS/cm at 25 °C and the measured temperature is 23.2 °C then the certified value at that temperature is calculated as:

   \[
   100.43 \times [1 + [0.02 \times (23.2 - 25.0)]] = 96.81 \text{ μS/cm}.
   \]

5. Perform a sensor calibration on the instrument according to its instruction manual.

Pure Water Verification/Calibration

The 25 μS/cm standard with ± 3% accuracy is intended only for verification of a measurement near the pure water range. For best accuracy of calibration, the 100 μS/cm standard which has ±1% accuracy should be used. The consistent linearity of Thornton measuring systems between 100 μS/cm and pure water provides much better accuracy than is typically obtained using standards below 100 μS/cm.