Practical Considerations For Conductivity and TDS (Total Dissolved Solids) Measurement

When using a meter to measure either the ppm of total dissolved solids or conductivity of a liquid, it is necessary to periodically calibrate the meter using a calibration standard solution. There are, however, special considerations to be given to each type of calibration. Whereas conductivity is an absolute measurement with calibrations that are transferrable from one type of solution to another, ppm total dissolved solids calibrations are specific to one type of dissolved solids solution and must not be transferred from one type of dissolved solids solution to the next. Doing this will result in some serious errors in measurement.

Although the basis for testing ppm of total dissolved solids is the conductivity of the solution, it is not correct to assume that this measurement is absolute. It is always necessary to calibrate all total dissolved solids meters with a parts per million total dissolved solids standard calibration solution that contains the same type of salts or mixtures of salts as the solution to be tested. Failure to do this will result in serious errors in the measurement of total dissolved solids. This is because total dissolved solids meters are calibrated by correlating the conductivity of the solution to the ppm dissolved solids and this correlation varies considerably from one species of dissolved solids to the next.

One similar conclusion can be made for all types of dissolved solids. Most pre-formulated parts per million total dissolved solids standard calibrated solutions are formulated with calcium carbonate ($CaCO^3$), sodium chloride (NaCl), potassium chloride (KCl), or the 442 (40% sodium sulfate, 40% sodium bicarbonate, and 20% sodium chloride) natural water formulation. If your test solution's major dissolved solids components are the same as any of these, you may want to choose the pre-made formulation that best approximates your test solution. Generally, $CaCO^3$ is used for boiler waters, NaCl is used for brines, and the 442 formulation is used for lakes, streams, wells, and boilers. Alternatively, if the contents of the ppm standard calibration solution used for calibration are known, it is possible to cross reference from existing calibration curves to curves for different types of dissolved solids solutions. Curves and tables are available in various reference books.

The previous discussion and references are based on standard conditions of temperature (25°C). When measuring conductivity or total dissolved solids in other than standard conditions, certain corrections for these variations must be accounted for before going on to determine the final values of conductivity and total dissolved solids. Without some sort of correction for standard temperature, conductivity or total dissolved solids measurements at various temperatures are meaningless because they cannot be compared. Many meters overcome this by incorporating temperature sensing elements and temperature sensing circuitry into the meter so that the value given is corrected for standard temperature. Using a meter that does not have temperature compensation will require the operator to use look-up tables or formulas to correct for the temperature effect. A good discussion of the effect of temperature on conductivity and total dissolved solids testing can be found on pages 6 and 7 in the article "Theory and Application of Electrolyte Conductivity Measurement", Copyright 1982 by the Foxboro Company.

This discussion should prove useful to all users of conductivity and dissolved solids testing procedures. It is to be considered a "rule-of-thumb" guideline for using conductivity and dissolved solids testing equipment. Fine tuning of the standard curves and formulas for your specific application is recommended. We hope this discussion helps you better understand the process.

Conductivity Measurement Tips

1. For greatest accuracy, ensure that no particulate matter is suspended in the test solution. If necessary, filter or allow particles to settle.
2. Ensure that no air bubbles are trapped in the cell when making measurements.
3. Ensure that the cell plates are completely immersed in the test solution.
4. Do not immerse the cell to the very bottom of the sample container if there is any possibility of a sedimentary layer existing there.
5. Ensure that the cell plates are thoroughly rinsed in deionized water when the cell is removed from solution. Leaving the cell immersed in deionized water is the preferred method for short-term storage.
6. Although it is not critical to store the conductivity cell with the plates in a wetted condition, if they are allowed to dry out completely, it may take some minutes for stability to be achieved upon usage as the plates become wetted.
7. Ensure that no deposits of dried salts or particulate matter are allowed to build up around the cell plates or on the body of the cell. This may produce a conductivity path lower than that through the solution.
8. Glass bodied cells must be used for solvents and strong acid or alkaline solutions.
9. Standard units and cells are calibrated to a reference temperature of 25°C.