OAKTON® TECH TIPS

Calibration Procedure for TDSTestr™ 1 and TDSTestr™ 2 with ATC

Tech Tip #1 ©1997

CAUTION

Even though the TDSTestr 1 and TDSTestr 2 are factory calibrated, it is still necessary to check the calibration against an appropriate standard solution and recalibrate as needed. This is because physical handling, temperature changes and the time elapsed since the factory calibration make it impossible to guarantee the calibration still holds.

The TDSTestr 1 and TDSTestr 2 are like all other dissolved solids testers in that they use the detected conductivity of a solution to give a direct reading in ppm (parts per million) or ppt (parts per thousand) of total dissolved solids (TDS). The relationship between conductivity and TDS is greatly affected by the types of dissolved solids or salts present in the solution. It is **absolutely necessary** to use a calibration solution similar in dissolved solids content to the solution to be tested in order to get acceptable accuracies. Also, it is strongly recommended that the calibration solution be at the same temperature as the test solution to minimize temperature effect errors.

Factory Calibration

Since there are many different types of dissolved solids solutions that can be tested, and since each type has its own "conductivity to ppm of TDS" correlation, TDSTestr 1 and TDSTestr 2 have been factory calibrated to selected TDS formulations known as 442 formulations. The 442 formulation closely approximates naturally occurring water from lakes, wells and rivers. This factory calibration is not appropriate for all possible applications and it also is not possible to guarantee the calibration will hold after the tester ships to the user. All that can be guaranteed is that the TDSTestr 1 and TDSTestr 2 can be calibrated to most of the more commonly used TDS calibration standards which are within the measurement range of these models.

Therefore, it is necessary to re-calibrate the TDSTestr 1 and TDSTestr 2 with an appropriate calibration solution before using it in test solutions. Options for obtaining an appropriate TDS standard calibration solution are discussed at the end of these instructions.

NOTE: Before the first use of the TDSTestr series, it is necessary to soak the electrodes in alcohol for three (3) minutes to remove oily residues. **Do not immerse the TDSTestr into any liquid above the brown colored band**.

Instructions

1. The TDSTestr 1 and TDSTestr 2 are automatically temperature compensating (ATC), however, it is strongly recommended that the TDS standard calibration solution be at the same temperature as the solution to be tested so as to minimize errors from the temperature effect.

2. Pour enough TDS standard calibration solution into a clean and dry vessel so that there is at least one inch of liquid.
3. Remove the protective end cap from the TDSTestr, exposing the stainless steel electrodes.
4. Turn the TDSTestr on with the ON-OFF switch located on the front of the tester.
5. Dip the TDSTestr electrodes one inch into the TDS standard calibration solution. **Make sure not to trap any air at the electrodes or this causes errors in the readings.** Tap the tester gently on the bottom of the vessel to loosen trapped bubbles.
   Caution: Do not immerse the TDSTestr into any liquid above the brown colored band.
6. Allow the TDSTestr electrodes to remain in the TDS standard calibration solution until the reading stabilizes.
7. Adjust the calibration trimmer on the back of the TDSTestr so that the digital display reading indicates the same value as the TDS standard calibration solution value.
8. Rinse the TDSTestr's electrodes with a portion of the liquid to be tested, taking care not to use this rinse portion as a test sample. This technique minimizes any carry over contamination from the calibration solution and eliminates the need to dry the TDSTestr's electrodes. If this is not practical, rinse the electrodes with distilled water and air dry or blot dry using a clean wipe.
9. The TDSTestr is now calibrated and ready to measure the TDS of your test solution.
10. Repeat this procedure periodically to insure calibration.

NOTE: Increases in temperature of the sample solution increases conductivity readings. The opposite effect is true for decreases in temperature. The ATC feature reduces this type of error so it is not as significant. The TDSTestrs will compensate for the difference in temperature between your calibration solution and the test solution with a coefficient of 2% per ºC (1.11% per ºF) and will adjust the displayed readings up or down accordingly.

Selecting Total Dissolved Solids Standard Calibration Solutions

A total dissolved solids (TDS) standard calibration solution should contain the same types of dissolved solids known to be in the test solution. Failure to do so will result in significant discrepancies between the ppm or ppt reading and the actual ppm or ppt of TDS in the test solution.

The easiest way to obtain a total dissolved solids standard calibration solution is to use a ready-made standard solution that has the same types of dissolved solids as the solution to be tested. These ready-made solutions offer convenience and accuracy. They are commonly formulated with either KCl, NaCl, $CaCO_3$ or a 442 natural water formulation (40% sodium sulfate, 40% sodium bicarbonate and 20% sodium chloride) to meet the majority of applications. Choose a ready-made calibration solution according to the following guidelines:

1. Choose a TDS standard calibration solution that contains the same types of dissolved solids to be tested.

2. Choose a TDS standard calibration solution that has a ppm or ppt value as close as possible to the value of the solution to be tested. If this is not reasonable because of the variations in the test solution, it is best to calibrate the TDS indicator with a TDS standard that has a ppm or ppt value in the upper one-third of the TDS indicator's measurement range.
3. The following is a list of ppm TDS standard calibration solutions available for OAKTON Instruments, with their contents and applications described. Standardization values of the calibration solutions are based on conditions of 25ºC.

Application	Calibrating Standard Solution part number	Use With:	Adjust display to:
TDS of KCl solutions, brines, general purpose TDS measurements	WD-00653-20	TDSTestr 1	1380 ppm 1 pt.
TDS of lake, stream, well waters, boiler and cooling tower feed waters, general water treatment	WD-00653-47	TDSTestr 1	330 ppm (442*) 220 ppm (NaCl for brines) 1 pt.
TDS of lake, stream, well waters, boilers and cooling tower feed waters, general water treatment, rinse water and brines	WD-00653-27	TDSTestr 1	1500 ppm (442*) 1040 ppm (NaCl) 1 pt.
TDS of lake, stream, well waters, boiler and cooling tower waters, general water treatment, waste water and brines	WD-00653-89	TDSTestr 2	7.61 ppt (442*) 7.23 ppt (NaCl) 1 pt.

*442 is a formulation of 40% sodium sulfate, 40% bicarbonate and 20% sodium chloride that is used as a TDS Standard for testing natural waters (i.e. lakes and streams) and boiler and cooling tower waters.

It is possible that the above list will not contain a calibration solution appropriate for some applications. One solution to this problem is to have "tailor-made" ppm TDS standard calibration solutions. This is done by formulating a mixture of salts in relative proportions that simulate the solution to be tested, then dissolving this mixture into distilled water. This should be performed according to the formula:

1 mg salt mixture/liter of distilled water = 1 ppm TDS or, in other words
X ppm TDS = X mg of salts + one liter of distilled water

Remember that "X" mg of salts is the number of milligrams of a mixture of salts that's proportions simulate your test solution, NOT "X" milligrams of each salt in the mixture.

An appropriate value for "X" is determined by the following rule:

> Try to choose a ppm or ppt for a calibration solution as close as possible to the expected ppm or ppt values of the test solutions. If the test solution's TDS value is expected to vary a great deal, it is best to choose a ppm or ppt value for the calibration solution that is in the upper one-third of the TDS indicators measurement range.

"Tailor-made" solutions such as these are common and can be made by the operator of the meter or they can be purchased at a local testing laboratory.