QAM-I-111

Operation and Calibration Of the Conductivity Meter

Revision 12

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1.0 Applicability and Purpose

i. This procedure applies to the operation and calibration of the YSI Model 3200 conductivity meter. This procedure is performed prior to any analysis using this meter. By performing the calibration procedure, the technician reduces anomalies due to instrument sensitivity fluctuations. The operation of this instrument allows the analyst to determine the level of specific conductance of water samples received by the TIAER chemistry laboratory.

2.0 Definitions

i. Conductivity- A measure of the ability of an aqueous solution to carry an electric current. This ability depends on the presence and concentration of ionic species and the temperature of the measurement. Conductivity is customarily reported as Specific Conductance at 25ºC in micromhos per centimeter squared (μmho/cm^2) or microSiemens per centimeter (μS/cm), where 1μS/cm = 1 μmho/cm^2.

ii. Automatic temperature compensation- internal temperature sensors in the conductivity cell are read by the meter and the analysis reading is adjusted for any difference between the sample temperature and standard operating conditions. This is normally turned off during operation and compensation is mathematically performed (See SOP-C-113, "Determination of Specific Conductance").

iii. Conductivity cell- probe attached to conductivity meter containing platinum electrodes used by the instrument to measure ability of the sample to carry an electrical current.

iv. Standard QA/QC definitions may be found in QAM-Q-101, "Laboratory Quality Control".

3.0 Equipment and Reagents

i. Equipment
   a. YSI Model 3200 Conductivity Meter or equivalent
   b. YSI Model 3200 Flow-Thru Conductivity Cell or equivalent with associated tubing and/or funnel connected
   c. YSI Model 3256 Immersible (dip) cell or equivalent

d. Class A volumetric flasks

ii. Reagents

a. Deionized water (DI)- water that has passed through ion exchange resin and meets Type II criteria (specific conductance < 1.0 µS/cm).

b. Standards

i. 0.01M KCl Standard Reference Solution. Dry several grams ACS grade or better KCl at 104°C overnight and cool in a desiccator. Dissolve 0.7456 grams KCl in deionized water and dilute to 1000 ml in a class A volumetric flask. This solution has a conductivity of 1412 µS/cm at 25ºC.

4.0 Procedure

i. Instrument Set Up

a. Ensure that conductivity cell is aligned with arrow for proper connection.

b. When turned on, meter is in Conductivity mode (uS/cm displayed). If not, then press the CELL key to enter the cell menu. Then press the CONFIGURE key to enter the configuration menu. Press the UP or DOWN keys until the correct mode is displayed on the meter screen.

ii. From the Cell menu, press the [CAL K] soft key to enter the Calibrate K menu. This menu is used to measure the cell constant (K) of the current cell and store it in the currently selected configuration. The cell constant can be measured at a single point using a single standard solution or at multiple points using different value standard solutions.

iii. Calibration: to calculate and store the cell constant (K) at a single point:

a. From the Calibrate K menu, press the [SINGLE PT] soft key.

b. Clean the container and cell (and temperature probe, if used) with deionized water.

c. Rinse the cell (and temperature probe, if used) with at least 3 portions of the standard solution.

d. Place the cell (and temperature probe, if used) in the standard solution and wait for the temperature reading and measured K value to stabilize.

e. Using the [UP], [DOWN] and [DIGIT] soft keys, enter the value of the standard solution at the current temperature. Temperature compensation is OFF during cell calibration. Example: YSI 3161 Conductivity Calibrator is 1000uS at 25°C, but at 23°C you would enter 961uS.

f. Press [ENTER] to store the current cell constant (K). Press [MODE] three times to exit.

g. Remove the cell (and temperature probe, if used) from the solution and rinse with deionized water.

h. Measure samples or standards as described below. Laboratory Control Samples or Initial and Continuing Calibration Verification standards are required when reporting data.

i. Correct the reading to the conductivity at 25°C, using the following formula:

$$\text{Specific Cond. Corrected} = \frac{\text{Specific Cond. measured}}{1 + 0.0191\,(T - 25)}$$

j. If the corrected specific conductance is 1412 +/- 71 (1341-1483) the instrument is calibrated within specifications and may be used.

k. Record the measurement and calibrations in the Specific Conductance Logbook (E-log).

l. Rinse cell thoroughly with DI water.

iv. Sample Measurement

a. Make sure meter is setup to read conductivity in the correct units of µS/cm and that automatic temperature compensation is off.

b. <u>Slowly pour at least 3 portions of sample</u> through flowcell taking care not to introduce bubbles into the stream, allowing time for the reading to stabilize and for the cell to rinse with sample (about 300 mL). For

the dip cell, rinse with the sample in a container, then refill the container. Place the dip cell in the container.

c. Read the value displayed on the meter screen and record conductivity in µS/cm (µmho/cm^2) and temperature in ºC. Make corrections for temperature as appropriate.
d. Rinse the cell with DI before analyzing the next sample.
e. Refer to SOP-C-113, "Determination of Specific Conductance" for measurement and conversion of conductivity in water.

5.0 Quality Control and Safety Aspects

i. All aspects of this procedure comply with QAM-Q-101, "Laboratory Quality Control", and QAM-S-101, "Laboratory Safety".

ii. When measuring conductance below 10uS (resistance above 100KΩ), the insulation resistance of the cell leads may be a source of error. This error may be greatly reduced by allowing the 3200 to calculate and store a zero offset value. To measure and store the offset for the current cell in the currently selected configuration, connect a clean, dry cell to the 3200, then, press the [MEASURE] soft key. The current offset is displayed on the screen. To remove a stored offset (set the offset to zero), press the [REMOVE] soft key. From the Calibrate K menu, press the [OFFSET] soft key to enter the Offset menu.

iii. The cell is cleaned and rinsed thoroughly with DI water prior to and following use.

iv. The accuracy and precision of sample measurements are dependent upon a stable reading. Introduction of bubbles into the cell flow and major changes in flow velocity are avoided.

v. Visually inspect flow path to ensure there are no obstructions, which may alter sample/standard solution flow.

vi. Record all standards in the Standards Logbook (E-log).

vii. The analyst consults the MSDS files if he/she has any question as to the safe handling of any reagent required by this procedure for analysis.
viii. Safety glasses, at a minimum, are worn at all times when performing this procedure.
ix. A declining drift in standard measurement over a period of time may indicate that the cell needs to be replatinized. Follow manufacturer's recommendation and redetermine the cell constant when complete.

6.0 References

i. YSI Model 3200 Operations Manual, Revision F, YSI Incorporated, April 1999, Yellow Springs, Ohio, ITEM# 003224.
ii. Standard Methods for the Examination of Water and Wastewater, Washington D.C., Methods 2020, 2510 B (approved 2017).
iii. The National Environmental Laboratory Accreditation Conference Institute (TNI) standard, 2016.

7.0 Attachments

None