# Quality Certificate

## VWR® TRACEABLE® CONDUCTIVITY CALIBRATION STANDARDS (CRM)

As per the manufacturer, the below product meets the following criteria:

| | |
|---|---|
| **North American Catalog No:** | 23226-651 |
| **Lot Number:** | CC19034 |
| **Description:** | VWR Standard Condt 100UMHO PK6 |
| **Expiration Date:** | September 27, 2020 |
| **Certified Value:** | 99.30 µS/cm U = ±2.1 µS/cm (k=2) at 25°C |
| **Derived Values:** | 99.30 micromho/cm, 10070.49 ohm-cm, 66 PPM D.S. |

Certification measurements are performed under ISO guide 34, A2LA accreditation no. 1750.02 and are traceable to recognized national and international standards via an unbroken chain of comparisons. Electrical conductance is the reciprocal of electrical impedance. The International Systems of Units (SI), derived unit of conductance, is Siemens (S), also referred to as (mhos) the reciprocal of ohms. The certified value is expressed in microsiemens per centimeter (µS/cm).

**MEASUREMENT:** Ten (10) 100 ml samples were measured from this lot. The conductivity of each sample was derived from a measurement of the impedance of the solution using a conductivity meter and calibrated cell. The cell and sample were temperature controlled by submersion in a water bath at 25ºC±0.015ºC.

**UNCERTAINTY:** The certified value is given as the average of the measured samples. The reported expanded uncertainty (U) is determined from the measurement variation from sample to sample; change due to shelf life, and from the uncertainty of the measurement process. The value of uncertainty is multiplied by k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. Uncertainty is calculated in accordance with the ISO “Guide to the Expression of Uncertainty in Measurement” (GUM).

**METHOD:** The certified reference material is prepared and analyzed by the manufacturer. The certified reference material consists of a mixture of a dilute solution of less than 0.01% (by mass) potassium chloride (KCL), 25% to 32% (by mass) propanol, and 68% to 75% (by mass) deionized water in equilibrium with atmospheric carbon dioxide. Mixing was performed by circulation utilizing a propriety method.

**Traceability: Standards and Equipment Used**

| Description | Serial Number | Due Date | Traceable Reference |
|---|---|---|---|
| Digital Thermometer | 111879346 | 04 Jan 2020 | 4000-10071054 |
| Conductivity Probe/Meter | 12325-F04 | 14 Nov 2019 | TC30-10401068 |
| Conductivity/pH Meter | 696R059N003 | | |
| Temperature Calibration Bath | B5C477 | | |

**Laboratory Environment Conditions: 38.00%RH 25.40°C 1013mBar**

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**PACKAGING:** This material is available in both a 460 ml bottle and a 100 ml One-Shot™.

**INTENDED USE:** The certified reference material is intended for the calibration of conductivity cell constants, for conductivity measurement, for the validation of analytical methods, and for the preparation of working reference standards

**INSTRUCTIONS FOR USE:** The certified reference material should be open for the minimum time. Rinse the cell in a small amount of the certified reference material and discard. The recommended sample size for measurement is 100 ml. Discard the standard after use and under the following circumstances: if the expiration date is past due, four months after opening, or if any color, turbidity, or visible microbiological growth become evident. Standards, which have been opened, are not protected from growth. Do not return used solution to this standard. Contaminants and evaporation have a significant effect on conductivity. Keep the standard closed. Keep the standard stored at a stable temperature. Select a standard as near as possible to that of the unknown solution to be measured. Do not standardize at 10,000 uS and then measure unknown at 100 uS. Reference any accompanying instructions with this product.

Temperature has a significant effect on conductivity. For measurements at a temperature other than 25°C, refer to the temperature correction table provided. The product should be used as near as possible to 25°C.

**HOMOGENEITY:** Ten (10) 100 ml samples were selected for analytical control. Results from different samples showed no statistically significant differences, nor was there any correlation between values obtained and the bottling sequence. Bottle-to-bottle (One-Shot™ to One-Shot™) variations of the samples measured are included as a part of the calculated measurement uncertainty stated on page 1 of this certificate. A minimum sample size of 100 ml should be used to maintain the certified value and the associated statement of uncertainty. This standard as formulated is considered infinitely soluble

**STABILITY, SHELF LIFE:** The expiration date stated on page 1 indicates the period of time, which the certified reference material in a properly packaged, unopened, unused, and stored under environmentally controlled and monitored conditions remains within the specified uncertainty range.

**EXPIRATION DATE:** The date after which a certified reference material should be discarded.

**STORAGE:** Store below 40°C and above 0°C.

**SHIPPING:** Ship below 50°C and above 0°C.

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**QUALITY STANDARD DOCUMENTATION:**

ISO 34:2009 General Requirements for the Competence of reference Material Producers, accredited A2LA certificate number 1750.02

ISO Guide 31:2000 Reference Materials - Contents of Certificates and Labels.

ISO Guide 35:2006 Certification of Reference Materials - General and Statistical Principals.

ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories, accredited A2LA.

ANSI/NCSL Z540-1:1994 Calibration Laboratories and Measuring and Test Equipment-General Requirements.

ISO 9001:2015 Quality Management System.

**SUPPORTED METHODS:** This certified reference material meets test requirements for Federal, State, and local agencies, CAP, CLSI, ACS, and CLIA. Traceable Certified Reference Material complies with and is essential for use in these official methods: AOAC 973.40, EPA 120.1, Standard Method 2510 (APHA, AWWA, WEF), ISO 7888, DIN 38404, ASTMD 1125 USGS 1-1780, USP 645, OIML R56, IUPAC, and for A2LA/NVLAP accreditations /ISO 9000 certifications. Material may be used to calibrate all conductivity meters and to determine all conductivity cell constants.

**Temperature Correction Information:** 1.883 %

If your conductivity meter allows you to set a temperature coefficient (temperature correction) then the underlined number shown above is the best approximation for this specific analysis for this specific Traceable® Certified Reference Material. For more precise measurements, use the chart. Use the chart below only if you are making absolute measurements. That is, measurements without any automatic temperature correction (temperature coefficient set to 0). The chart below displays derived values.

Using a thermometer, measure the temperature of this certified reference material. Shown on the chart is temperature (in the far left column) in whole degrees. Shown across the top row is temperature in tenths of a degree. Locate the measured temperature in whole numbers on the far left column, and then follow across the row to the temperature in tenths of a degree. At the intersection is the certified reference material value at that specific temperature. Standardize your meter using that value. Example: Measured temperature is 20.4°C. Find 20°C in the far left column; find the row 0.4°C. Where 20°C and 0.4°C intersect, read the value in microsiemens/cm.

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Temperature Correction Chart in micromhos/cm

| °C | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 81.3 | 81.4 | 81.6 | 81.8 | 81.9 | 82.1 | 82.3 | 82.5 | 82.6 | 82.8 |
| 16 | 83.0 | 83.1 | 83.3 | 83.5 | 83.7 | 83.8 | 84.0 | 84.2 | 84.4 | 84.5 |
| 17 | 84.7 | 84.9 | 85.0 | 85.2 | 85.4 | 85.6 | 85.7 | 85.9 | 86.1 | 86.3 |
| 18 | 86.4 | 86.6 | 86.8 | 87.0 | 87.2 | 87.3 | 87.5 | 87.7 | 87.9 | 88.0 |
| 19 | 88.2 | 88.4 | 88.6 | 88.8 | 88.9 | 89.1 | 89.3 | 89.5 | 89.7 | 89.8 |
| 20 | 90.0 | 90.2 | 90.4 | 90.6 | 90.7 | 90.9 | 91.1 | 91.3 | 91.5 | 91.6 |
| 21 | 91.8 | 92.0 | 92.2 | 92.4 | 92.6 | 92.7 | 92.9 | 93.1 | 93.3 | 93.5 |
| 22 | 93.7 | 93.9 | 94.0 | 94.2 | 94.4 | 94.6 | 94.8 | 95.0 | 95.2 | 95.3 |
| 23 | 95.5 | 95.7 | 95.9 | 96.1 | 96.3 | 96.5 | 96.7 | 96.8 | 97.0 | 97.2 |
| 24 | 97.4 | 97.6 | 97.8 | 98.0 | 98.2 | 98.4 | 98.5 | 98.7 | 98.9 | 99.1 |
| 25 | 99.3 | 99.5 | 99.7 | 99.9 | 100.1 | 100.3 | 100.5 | 100.7 | 100.8 | 101.0 |
| 26 | 101.2 | 101.4 | 101.6 | 101.8 | 102.0 | 102.2 | 102.4 | 102.6 | 102.8 | 103.0 |
| 27 | 103.2 | 103.4 | 103.6 | 103.8 | 104.0 | 104.2 | 104.4 | 104.6 | 104.8 | 105.0 |
| 28 | 105.1 | 105.3 | 105.5 | 105.7 | 105.9 | 106.1 | 106.3 | 106.5 | 106.7 | 106.9 |
| 29 | 107.1 | 107.3 | 107.5 | 107.7 | 107.9 | 108.1 | 108.3 | 108.5 | 108.7 | 109.0 |
| 30 | 109.2 | 109.4 | 109.6 | 109.8 | 110.0 | 110.2 | 110.4 | 110.6 | 110.8 | 111.0 |
| 31 | 111.2 | 111.4 | 111.6 | 111.8 | 112.0 | 112.2 | 112.4 | 112.6 | 112.8 | 113.0 |
| 32 | 113.2 | 113.5 | 113.7 | 113.9 | 114.1 | 114.3 | 114.5 | 114.7 | 114.9 | 115.1 |
| 33 | 115.3 | 115.5 | 115.7 | 116.0 | 116.2 | 116.4 | 116.6 | 116.8 | 117.0 | 117.2 |
| 34 | 117.4 | 117.6 | 117.8 | 118.1 | 118.3 | 118.5 | 118.7 | 118.9 | 119.1 | 119.3 |
| 35 | 119.5 | 119.8 | 120.0 | 120.2 | 120.4 | 120.6 | 120.8 | 121.0 | 121.3 | 121.5 |

**Signed:**

Jamie Ethier
VP Global Quality
VWR, Part of Avantor

**Date:** January 13, 2020