

INTERNATIONAL
RECOMMENDATION

OIML R 56

Edition 1981 (E)

Standard solutions reproducing the conductivity
of electrolytes

Solutions-étalons reproduisant la conductivité des électrolythes



Foreword

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STANDARD SOLUTIONS REPRODUCING the CONDUCTIVITY of ELECTROLYTES

1. Terminology.

1.1. Standard solution reproducing conductivity

Solution having an electric conductivity (in the text : conductivity) of known value, adopted as the standard measure for the calibration of conductance cells.

1.1.1. Primary standard solution

Standard solution of which the conductivity is determined by means of the absolute method (see Vocabulary of legal metrology, point 5.2.4.).

The constant of the cell is determined according to the definition given in point 1.3. below, as a function of the geometrical characteristics of the cell, expressed in SI units, without the use of another standard solution.

1.1.2. Secondary standard solution

Standard solution of which the conductivity is determined by means of the comparison method.

The constant of the cell is determined by means of an indirect method, using primary standard solutions.

1.2. Conductance cell

Container intended for measurement of conductance.

1.3. Cell constant

Quantity characterising a container of a given form and dimensions, for a given position of the level of liquid with respect to the electrodes (geometrical characteristic of the cell).

The constant of the cell is calculated by the following formula :

$$K = \frac{\ell}{A}$$

where:

K — constant of the cell, m^{-1} ;

ℓ — distance between measurement electrodes, m ;

A — cross section of the electrolyte column situated between the electrodes, m^2 .

On account of the complexity of the accurate determination of the geometrical characteristics of the cell, the cell-constant is usually determined by means of an indirect method, using electrolytes of which the conductivities are known (standard solutions).

Using this method, the cell-constant is calculated by means of the following formula :

$$K = x \cdot R$$

where :

x — conductivity of the standard solution, S/m

R — measured resistance, Ω .

1.4. Calibration of the cell

Determination of the cell-constant by means of the absolute or comparison methods.

2. Purpose and scope.

- 2.1. This Recommendation applies to standard solutions, reproducing the conductivity of electrolytes over the range from 30 S/m to $1 \cdot 10^{-3}$ S/m.
- 2.2. The Recommendation fixes the values for the conductivity of primary standard solutions at 0 °C, 18 °C and 25 °C (Table 1) and for the conductivity of secondary standard solutions at 25 °C (Table 2).
- 2.3. Standard solutions reproducing the conductivity are intended for the calibration of conductance cells.

3. Standard solutions.

- 3.1. Solutions of potassium chloride, for which the most accurate and reliable data are available, are recommended as standard solutions.
 - 3.1.1. Solutions which follow the data of G. JONES and B.C. BRADSHAW [1] corrected in accordance with the IUPAC Recommendation [2], and reproduced in Table 1 below, are recommended as primary standard solutions.
 - 3.1.2. Solutions which follow the data of T. SHEDLOVSKY [3], reproduced in Table 2 below, are recommended as secondary standard solutions.

Table 1
Conductivity of primary standards
at 0 °C, 18 °C and 25 °C

Mass of KCl, g per 1000 g of solution	Conductivity, S/m		
	0 °C	18 °C	25 °C
71.1352	6.514	9.781	11.131
7.41913	0.7134	1.1163	1.2852
0.745263	0.07733	0.12201	0.14083

Table 2
Conductivity of secondary standards
at 25 °C

Mass of KCl, g per 1000 g of solution	Conductivity, S/m
0.37329	0.07182
0.14932	0.02916
0.07466	0.01469

When weighing, a correction is made for air buoyancy.

Standard solutions must be prepared with distilled water, the conductivity of which does not exceed 2.10^{-4} S/m.

In the case where the conductivity of the measured solution does not exceed 0.1 S/m, the conductivity of the distilled water must be taken into account.

During measurement, the temperature in the thermostat must be maintained constant to within ± 0.01 °C.

References :

- [1] G. JONES and B.C. BRADSHAW, J. Am. Chem. Soc., **55** 1780 (1933).
- [2] IUPAC Recommended Calibration and Test Materials for the Realization of Physicochemical Properties. Section XIV : Electric Conductivity of Aqueous Electrolytes. Revised by E. JUHASZ. To be published in Pure and Appl. Chem., 1981.
- [3] T. SHEDLOVSKY, J. Am. Chem. Soc., **54** 1411 (1932).

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