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Specification for

Glass and reference electrodes for the measurement of pH

Spécification des électrodes en verre et de référence pour la mesure du pH

Spezifikation für Glas- und Bezugselektroden zur Messung des pH

British Standards Institution

Gr 6

Contents

Foreword

This British Standard, which has been prepared under the direction of the Laboratory Apparatus Standards Committee, was first published in 1955 in an attempt to reduce differences which had been encountered in certain characteristics of glass electrodes, such as dimensions, efficiency of performance and electrical resistance. The 1965 revision and the present revision are the result of further consideration in the light of continuing developments and technological advances.

There is a variety of shapes and configurations for the pH-sensitive region of glass electrodes, appropriate to the wide range of applications in which they are used. Accordingly, unlike the previous editions, the present revision does not require adherence to specified dimensions. Manufacturers are, however, recommended to provide certain information regarding dimensions as suggested in **8.2.**

The division of electrodes into categories such as 'general purpose', 'wide range', etc. has been abandoned but, based on development of a new method of testing the performance of glass electrodes, the manufacturer should now only claim as the usable pH range of a glass electrode those limits of pH between which its performance is in accordance with the requirements of this British Standard. Furthermore, the sodium ion error of the glass electrode at selected pH values greater than 7 and the acid error at pH values less than 1 can now be readily measured by the manufacturer and checked by the user using procedures described in appendix A.

An additional important feature of this revision is the inclusion of reference electrodes. The correct functioning of the reference electrode in pH measurements is of equal importance to that of the glass electrode, although this has not always been appreciated. Tests are now incorporated, in appendix B, which enable the characteristics of reference electrodes to be assessed; these tests will aid in the selection of electrodes of proper design for particular applications.

In accordance with current practice, various types of connector to the pH meter are permitted. Standardization in this area is desirable and it is the hope of the technical committee responsible for this British Standard that the bayonet normal connector (BNC) type will be adopted internationally in the near future.

British Standard Specification for

Glass and reference electrodes for the measurement of pH

Section one. General

1. Scope

This British Standard specifies the performance requirements and other essential characteristics of glass electrodes responsive to hydrogen ions, reference electrodes and glass combination electrodes for general laboratory use.

2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purposes of this British Standard the following definitions apply.

3.1 pH glass electrode. Electrode responsive to hydrogen ions and consisting of a bulb, or other suitable form made of a special glass, attached to a stem of high resistance material, complete with internal reference electrode (see **3.9**) and internal filling solution (see **3.10**).

3.2 pH-sensitive region. Bulb, or other suitable form, of special glass composition which makes the electrode hydrogen ion responsive.

3.3 pH meter. High impedance instrument by means of which either the pH value of a solution, or the potential difference between electrodes immersed in a solution, is indicated.

3.4 screened cable. Coaxial shielded cable connecting the internal reference electrode system to a plug for input to the measuring device (pH meter).

3.5 screened (pH glass) electrode. pH glass electrode in which the screening is continued almost down the whole length of the stem of the electrode.

3.6 pH combination or dual electrode. Electrode in which a pH glass electrode and an external reference electrode system together with the liquid junction are combined in a single probe. In the usual construction of pH combination electrodes, the reference electrode is concentric with, and outside the stem of, the glass electrode, which does not require additional electrical screening.

3.7 zero point. Value of the pH of a solution which, in combination with a stated external reference electrode, gives zero e.m.f. from the cell.

3.8 slope factor. Temperature dependent factor relating potential and pH, tabulated in BS 1647*.

3.9 internal reference electrode (of pH glass electrode). Electrode, for example silver/silver chloride, terminating the screened input cable to the pH meter, and in contact with the internal filling solution.

3.10 internal filling solution (of pH glass electrode). Aqueous electrolyte solution, which may be gelled, containing a fixed concentration of hydrogen ions, i.e. a buffer solution, and a fixed concentration of the ion to which the inner reference electrode is reversible, e.g. chloride ion in the case of silver/silver chloride or calomel electrodes.

3.11 liquid junction. Any junction between two electrolyte solutions of different composition. Across such a junction there arises a potential difference, called the liquid junction potential. In the operational pH cell (see **3.12**) the junction is between the test solution, or the pH standard solution, and the filling solution of the reference electrode.

3.12 operational pH cell. Electrochemical cell which is the basis of practical pH measurements, consisting of a glass electrode and a reference electrode (see **3.13**) dipping in the test solution.

3.13 reference electrode. External electrode system which incorporates a means of forming the liquid junction (see **3.11**) such as a ceramic plug or frit. Usually, this reference electrode system has either a calomel or a silver/silver chloride inner element in contact with a concentrated solution of potassium chloride (KCl) as filling solution (see **3.17**).

3.14 isopotential method. Method of correcting for small differences in temperature between test and standard solutions, or between a glass and a remote external reference electrode at different temperature, based on the approximately linear temperature dependence of those contributions to the measured e.m.f. of the cell which are independent of the composition of the test and standard solutions.

3.15 isopotential pH point. The pH value at which the e.m.f. of a particular pH glass electrode/reference electrode pair, comprising the operational cell (see **3.12**), is independent of temperature. It is determined as the point of intersection on a graph of e.m.f. of the operational cell versus pH value for two temperatures differing by at least 20 °C.

3.16 pH glass electrode error. Deviation of a pH glass electrode from the hydrogen ion response function. An example often encountered is the error due to sodium ions at alkaline pH values, which results in a low pH value being indicated.

3.17 filling solution (of a reference electrode). Solution containing the anion to which the reference electrode of

* In course of revision.