

Specification for
Laboratory pH meters

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- Imperial Chemical Industries Limited
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- Society for Applied Bacteriology
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- University of Newcastle Upon Tyne
- Individual expert

This British Standard, having been prepared under the direction of the Laboratory Apparatus Standards Committee, was published under the authority of the Executive Board on 30 June 1978

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Foreword

This British Standard, first published in 1959, has been revised under the direction of the Laboratory Apparatus Standards Committee.

The first edition specified requirements for meters of the now obsolete manually operated null or potentiometric type. This revision covers all types of laboratory pH meters in current production including the moving coil type previously specified in BS 3422 (now withdrawn), the automatic (servo-driven) potentiometric type and the more recently developed digital display type.

In this revision, the requirements are based on the electrical performance of pH meters. Although the compliance tests, given in the appendices, have been designed with typical usage for glass and reference electrodes in mind, simulated conditions are used to make the tests independent of electrode performance.

These tests are conducted by applying d.c. potential differences from a potentiometer using a high value resistor to simulate a glass electrode.

The committee undertook an examination of a range of pH meters in current production which showed that the new requirements of this British Standard are practicable. The principal cost-restricted limitations of pH meters are deflection meter linearity and scaling, input current, and dial scaling and linearity of temperature compensator potentiometers. Possible inaccuracies arising from these features can be minimized by attention to the way the pH measurements are carried out. Suitable procedures are described in BS 1647. Errors due to input current can be considerable for very high electrical resistance glass electrodes, or for electrodes with resistances in the normal range (100 M Ω to 350 M Ω) at room temperatures when used at low temperatures. Errors arising from input current are of similar origin to those described as “grid current” errors when valve electrometer tubes were employed in pH meters up to a decade ago. Unlike grid current errors, however, the input current error may be of either sign, as present day solid-state input stages may cause current to flow in either direction through the glass electrode/reference electrode pair. Furthermore, the current depends on the voltage, applied to the input stage. Input current tests are described in Appendix C.

It is not widely appreciated that the conversion of the measured potential to the indicated pH value carried out by the temperature compensator of a pH meter is an incomplete one even if isopotential control is used. Although the compensator operates according to the slope factor, corrections for smaller effects of a physicochemical origin are not fully made. Moreover, the quality of the components available and inadequacies in the scaling of the slope factor adjustment dial frequently limit the accuracy of the pH measurement. If the dial cannot be set accurately and reproducibly to a particular temperature (e.g. 25 °C) then there may even be inaccuracy in the measurement of pH values when both sample and standard buffer are temperature controlled to within ± 0.1 °C.

Because of the many designs of pH meters in current production, it has not been found possible to specify all design details, but suppliers are required to provide information on some of these in their instruction manuals.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies requirements for pH meters for 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 value

this was originally intended to represent the negative common logarithm of hydrogen ion activity in aqueous solution but this notional definition is now replaced by an operational one (as given in BS 1647) in terms of the electrochemical cell used for its measurement

3.2

laboratory pH meter

a high impedance input instrument designed for general laboratory use in conjunction with hydrogen ion responsive glass and reference electrodes (q.v.) by means of which either the pH of a solution, or the potential difference between the electrodes immersed in a solution, can be measured

3.3

hydrogen ion responsive electrode

an electrode, consisting of a bulb, or other suitable form, made of special glass, attached to a stem of high resistance glass complete with internal reference electrode and internal filling solution

3.4

reference electrode

an external electrode system which incorporates a means of forming a liquid junction such as a ceramic plug or frit. Usually this reference electrode system is either calomel (mercury (I) chloride) or silver/ silver chloride in contact with a concentrated solution of potassium chloride

3.5

range

the interval in pH or millivolts over which the instrument is usable

3.6

moving index instrument

an indicating instrument in which the index is a pointer moving over a fixed scale

3.7

scale division

the interval between two consecutive (minor) scale marks on an instrument with a scale or chart

3.8

scale interval

the value of the measured quantity corresponding to a scale division

3.9

scale spacing

the linear or curvilinear length, measured along the scale base, between the axes of two consecutive minor scale marks of a scale or chart

3.10

digital pH meter

a pH meter in which the value of the measured quantity is displayed as a group of digits

3.11

representation unit

the minimum increment between two successive output states of a digital pH meter

3.12

set buffer adjustment

a control for adjusting the pH meter to indicate the value of the pH of the standardizing solution

3.13

slope factor

the temperature dependent proportionality factor between potential and pH

3.14

slope/temperature factor adjustment

a manual control by which readings on the pH scale can be corrected for variations of temperature of the pH cell

3.15

slope factor adjustment

a manual control used in conjunction with two-point standardization procedures to correct for non-Nernstian but linear response of the electrode system

3.16

isopotential control

a control which determines the point on the pH scale where the correcting effect of the temperature compensation device is zero. This additional temperature compensating device permits a partial correction to be made for those cell potential difference changes which occur only as a result of:

- a) temperature differences between the test solution and the standard buffer solution;