

Method for specifying the

Performance of electrical and electronic measuring equipment

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Equipment Standards Policy Committee (EEL/-) to Technical Committee EEL/8, upon which the following bodies were represented:

- British Telecommunications plc
- Department of Trade and Industry, National Physical Laboratory
- Department of Trade and Industry, National Measurement Accreditation Service
- Electricity Supply Industry in England and Wales
- Electronic Engineering Association
- GAMBICA (BEAMA Ltd)
- ITV Association
- Independent Broadcasting Authority
- Institution of Electronic and Radio Engineers
- International Association of Broadcasting Manufacturers
- Ministry of Defence
- Telecommunication Engineering and Manufacturing Association

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Foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and forms a revision of BS 4889:1973 which is withdrawn. It is technically equivalent to IEC Publication 359 “*Expression of the performance of electrical and electronic measuring equipment*” published in 1987 by the International Electrotechnical Commission. The difference between the two standards lies in the omission in BS 4889 of subclause 3.5 of IEC Publication 359. This subclause contains a statement to the effect that the manufacturer is not responsible for injury or defect arising from excessive operating and worst-case errors. Such a statement has no validity in the United Kingdom where Statute Law prohibits the exclusion of liability for death or personal injury. For ease of production, the IEC text has been retained.

Cross-references

International Standard	Corresponding British Standard
	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 1 <i>Terms common to power, telecommunications and electronics</i>
IEC 50 Chapter 131:1978	Group 01:1983 <i>Fundamental terminology</i> (Technically equivalent)
IEC 50 Chapters 301, 302, 303	Group 04:1986 <i>Measurement terminology</i> (Technically equivalent)
IEC 68	BS 2011 <i>Environmental testing</i>
IEC 529:1976	BS 5490:1977 <i>Specification for classification of degrees of protection provided by enclosures</i> (Identical)
	BS 5967 <i>Operating conditions for industrial-process measurement and control equipment</i>
IEC 654-1:1979	Part 1:1980 <i>Specification for temperature, humidity and barometric pressure</i> (Identical)
IEC 654-2:1979	Part 2:1980 <i>Specification for power</i> (Identical)
IEC 654-3:1983	Part 3:1984 <i>Methods for assessing degree of immunity of systems or parts of systems when subjected to mechanical influences</i> (Identical)
	BS 6253 <i>Electrical measuring transducers for converting a.c. electrical quantities into d.c. electrical quantities</i>
IEC 688-1:1980	Part 1:1982 <i>Method for specifying general purpose transducers</i> (Identical)
IEC 816:1984	BS 6662:1985 <i>Guide to methods of measurement of short duration transients on low voltage power and signal lines</i> (Identical)

The Technical Committee has reviewed the provisions of IEC 51, IEC 160 (1963), IEC 258 (1968), IEC 484 (1974), IEC 555-1 (1982), IEC 551-2 (1982), IEC 551-3 (1982), IEC 721-3 (1984), IEC 725 (1981) to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

There are no equivalent British Standards for the latest editions of IEC 51. These, however, are to be implemented by the revision of BS 89:1977. There are also no equivalent British Standards for IEC 160 (1963), IEC 721-3 (1984), IEC 555-1 (1982), IEC 555-3 (1982) and IEC 725 (1981).

NOTE *Typographical errors.* The following typographical errors have been noted in the IEC text. In the title of 4.8, for “Influence qunatity” read “Influence quantity”. In the note to 4.13, the words “of use” following “nominal range” should be included within the quotation marks.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, 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.

Introduction

Relationship to existing methods of specification

1) The two limits of error of the value of a performance characteristic appearing in a technical specification should not be exceeded in spite of all specified changes in the environment, in the supply source, and in any other performance characteristic, and these changes should simulate the probable working conditions. This is so that, knowing the permissible overall error of a process or system, a measuring instrument or system may be chosen having adequate accuracy.

2) In the field of electronic measuring equipment, the first edition of IEC Publication 359 (1971) recognized the concept of intrinsic error and influence errors, and used the system of specifying the operating error. This error is valid under the least favourable combination of values of influence quantities within their ranges, which are specified along with operating groups referring to severities of environment.

This system has been found useful for equipment which measures several parameters of one phenomenon. However, the determination of the most unfavourable combination of influence conditions and the production of combinations of conditions for testing are difficult and uneconomic.

3) In the field of electrical measuring instruments, IEC Publication 51, for example, recognizes the concept of intrinsic error and variations, and uses the system of specifying accuracy classes. These classes relate to ranges of influence quantities prescribed in IEC Publication 51, but not in relation to particular environments. This system has been found useful from the viewpoints of both manufacturers and users, particularly for economic reasons.

Intrinsic errors are moderately easy to determine and they are useful for acceptance testing and referee testing; however, they provide no information about any worsening of performance which may take place under the less favourable conditions of actual use. Nonetheless, the system provides some hints about the operating error by determining the change in error (the variation) produced by each influence quantity separately when it is changed from its reference value to one or the other of the limits of a range prescribed in the IEC product standard covering the particular kind of instrument. However, since all the other influence quantities are kept at their reference values, no information is determined about the effect of several influence quantities which simultaneously depart from their reference values.

4) In the field of analysing equipment, no fixed system prevails at present. In the field of process control equipment, the concept of intrinsic error and variations is basically adopted. Influence quantities other than those recognized for measuring equipment are of major importance.

5) It is impossible for a manufacturer to comply with conflicting requirements which the different disciplines of his various purchasers may have, and so it has become indispensable to introduce a single general concept of errors which is appropriate to the different applications in the extensive fields of measurement.

6) Reference documents:

a) *The following IEC publications dealing in detail with subjects related to performance and errors:*

50:	International Electrotechnical Vocabulary, (IEV).
51:	Direct Acting Indicating Analogue Electrical Measuring Instruments and their Accessories.
68:	Basic Environmental Testing Procedures.
160 (1963):	Standard Atmospheric Conditions for Test Purposes.
258 (1968):	Direct Acting Recording Electrical Measuring Instruments and their Accessories.
484 (1974):	Indirect Acting Electrical Measuring Instruments.

- 529 (1976): Classification of Degrees of Protection Provided by Enclosures.
- 654: Operating Conditions for Industrial-process Measurement and Control Equipment.
- 688: Electrical Measuring Transducers for Converting A.C. Electrical Quantities into D.C. Electrical Quantities.
- 721-3 (1984): Classification of Environmental Conditions, Part 3: Classification of Groups of Environmental Parameters and their Severities.
- b) *IEC publications dealing with disturbances on supply networks:*
- 555: Disturbances in supply systems caused by household appliances and similar electrical equipment.
- 555-1 (1982): Part 1: Definitions.
- 555-2 (1982): Part 2: Harmonics.
- 555-3 (1982): Part 3: Voltage fluctuations.
- 725 (1981): Considerations on reference impedances for use in determining the disturbance characteristics of household appliances and similar electrical equipment.
- 816 (1984): Guide on methods of measurement of short duration transients on low voltage power and signal lines.

c) Those which measure non-electrical quantities using electrical means, excluding any parts, such as transducers, which provide an electrical analogue of the non-electrical quantity; and provided that there exists no IEC product standard relating to the equipment or its electrical or electronic parts which has requirements that contradict this standard. The expression of performance covers only the electrical or electronic part.

2 Object

This standard provides methods for ensuring uniformity in the specification and measurement of errors of equipment within its scope. All other necessary requirements have been reserved for dependent IEC product standards pertaining to particular types of equipment which fall within the scope of this standard.

For example: the selection of performance characteristics and their measuring ranges, and influence quantities and their specified operating ranges, is reserved for IEC product standards.

3 Quantities, values and ranges to be stated and measured

3.1 In the manufacturer's technical specification for measuring equipment, the quality of performance is defined by statements on the limits of error of the performance characteristics.

A specification of limits of error provides one of the following kinds of information:

- Limits of intrinsic error and variations.
- Limits of operating error, calculated from a) above, using statistical methods.
- Worst-case error, calculated from a) above.

3.2 A reference value or reference range and an operating range are defined for each influence quantity which the manufacturer takes into account. It is also useful to specify the limiting conditions and storage and transport conditions of each influence quantity.

3.3 Determination of limits of error is based on the measurement of intrinsic errors and variations, followed by any necessary calculations.

3.4 Where limits of operating error are specified, the recommended method of measurement and calculation provides a probability of 95 % that the error will remain within the limits during use within the rated operating conditions. See Appendix A.

Section 1. General principles

1 Scope

This standard applies to the specification of the performance of the following kinds of electrical and electronic equipment and instruments and the accessories used with them:

- Those which measure electrical quantities (indicating and recording instruments).
- Those which supply measured electrical quantities (supply instruments), such as signal generators and some power supplies.