

Calibration of rubber and plastics test equipment

Part 2. Calibration procedures

ICS 83.060; 83.080

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Committees responsible for this British Standard

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- British Rubber Manufacturers' Association
- Department of Trade and Industry (National Physical Laboratory)
- GAMBICA (Beama Ltd.)
- Ministry of Defence
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Foreword

This Part of BS 7825 has been prepared by Technical Committee PRI/20.

In commercial practice it is necessary for the parties concerned in the manufacture or supply of materials or products to operate or agree upon specified performance requirements. Those performance requirements are verified by standardized methods of test. Test result variability is influenced by both test variability and product variability. As it is product variability which needs to be identified, test variability has to be kept to a minimum. An important element in the achievement of this reduced variability is the calibration of test instrumentation, to traceable standards, at acceptable intervals.

The use of this Part of BS 7825 will encourage proper calibration and make it possible for all users and calibration laboratories to work to common procedures.

BS 7825 is published in three Parts:

Part 1 *Principles and general requirements*

Part 2 *Calibration procedures*

Part 3 *Calibration schedules*

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

Section 1. General

1.1 Scope

This Part of BS 7825 describes methods of calibration for a range of parameters applicable to rubber and plastics test equipment.

1.2 References

1.2.1 Normative references

This Part of BS 7825 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 15. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this Part of BS 7825 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

1.2.2 Informative references

This Part of BS 7825 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

1.3 Definitions

For the purposes of this Part of BS 7825, the definitions, where relevant, given in BS EN 30012-1, BS 5233, PD 6461 : Part 1, BS 4778 and ISO Guide 30 apply.

1.4 Procedures

A calibration is carried out following a defined procedure. Each parameter of an apparatus has its own procedure, but these procedures may be combined into a single procedure for the whole apparatus. This Part of BS 7825 gives procedures for individual parameters and these procedures are cited, where appropriate, in Part 3 of this British Standard. The procedures are arranged in sections according to the type of measurement involved (e.g. force, electrical).

Each procedure includes an outline of the methodology to be used, but is not sufficiently detailed to provide work instructions for a calibration technician. Individual laboratories will have to formulate specific working procedures for the particular calibration equipment and transfer standards to be used, the method to be followed and the records to be kept.

In addition to the references given in this Part of BS 7825 to standard procedures and guidance documents, there are also references to British Standards specifications for measuring equipment and to documents published by the National Measurement Accreditation Service (NAMAS) that list criteria for performing calibrations.

The number of replicate measurements made for each calibration will depend on the particular circumstances, and has to be specified in the detailed procedures. Typically, between one and five replicates will be required. An estimate of the component of uncertainty due to the measurement process will require at least three, and preferably five, repeats, but, where this uncertainty has been estimated from a separate trial, a single measurement may be considered adequate.

Attention is drawn to the difference between calibrating a measuring instrument and verifying a quantity (e.g. the difference between a dial gauge and the specified length of a component of the test equipment). In general, the procedures given apply to measuring instruments or devices which form part of the apparatus, e.g. a voltmeter or pressure gauge; however, where appropriate, the procedure may also discuss the measurement of a quantity. A quantity is normally verified using a measuring instrument.

1.5 Expression of results

If necessary, corrections shall be applied to the readings obtained.

Where two instruments are compared, differences between the two sets of readings shall be tabulated with respect to the reading of the reference source.

If required, the differences shall be plotted to produce a calibration curve.

Where a quantity has been measured, the readings shall be recorded.

The estimate of uncertainty shall be calculated.

1.6 Calibration records

The following information shall be recorded:

- reference to this standard, i.e. BS 7825;
- a description and unique identification of the equipment calibrated;
- the parameters measured;
- the measurement procedures used;
- a unique identification of the calibration standards used;
- the date on which each measurement was completed;
- the calibration results obtained after and, where relevant, before any adjustment or repair;
- the assigned calibration interval;
- the designated limits of permissible error;
- the relevant environmental conditions and a statement of any corrections necessary;
- the estimated uncertainty of the measurement results;
- details of any servicing, adjustment, repairs or modifications carried out;
- identification of the person(s) performing the measurement;
- identification of the person(s) responsible for ensuring the correctness of the recorded information.

Section 2. Electrical measurements

2.1 Current

2.1.1 General

The measurement of current is largely confined to electrical and chemical tests. A variety of types of ammeter may be encountered and the range of current level and accuracy required is wide. In particular, some methods require the measurement of very small currents and specialist procedures and calibration standards are needed to achieve the necessary level of uncertainty.

2.1.2 Principle

The ammeter is compared to a standard instrument or to a standard current source.

2.1.3 Apparatus

2.1.3.1 *Standard ammeter or current source*, of appropriate range.

2.1.3.2 *Means of generating currents*, for comparison with the standard ammeter.

2.1.4 Procedure

Calibrate the ammeter in accordance with Parts 1, 2 and 9 of BS 89 or with BS 7194.

2.2 Voltage

2.2.1 General

The measurement of voltage is largely confined to electrical and chemical tests. A variety of types of voltmeter may be encountered and the range of voltage level and accuracy required is wide. In particular, some methods require the measurement of very small voltages and specialist procedures and calibration standards are needed to achieve the necessary level of uncertainty.

NOTE. Guidance on the calibration of digital voltmeters is given in NIS 4181.

2.2.2 Principle

The voltmeter is compared to a standard instrument or to a standard voltage source.

2.2.3 Apparatus

2.2.3.1 *Standard voltmeter source*, of appropriate range.

2.2.3.2 *Means of generating voltages*, for comparison with the standard voltmeter.

2.2.4 Procedure

Calibrate the voltmeter in accordance with Parts 1, 2 and 9 of BS 89 or with BS 7194.

2.3 Frequency and bandwidth

2.3.1 General

The usual situation involving frequency is where a frequency generator requires verification; however, it may also be necessary to calibrate a frequency meter. The principle is the same in both cases.

2.3.2 Principle

The frequency generator or meter is compared to a standard frequency meter.

2.3.3 Apparatus

2.3.3.1 *Standard frequency meter*.

2.3.3.2 *Frequency generator* (for meter calibration).

2.3.4 Procedure

Calibrate in accordance with Parts 1, 4 and 9 of BS 89 or BS 7194.

2.4 Resistance

2.4.1 General

The measurement of resistance is largely confined to electrical tests. The usual situation is that a resistor or resistor network requires verification, which is achieved using a calibrated resistance meter. As an alternative to using a resistance meter, the resistance may be measured by means of standard resistors in a bridge circuit.

2.4.2 Principle

The resistance meter is compared with standard resistors.

2.4.3 Apparatus

2.4.3.1 *Standard resistors*.

2.4.4 Procedure

Calibrate the instrument in accordance with Parts 1, 6 and 9 of BS 89.

2.5 Wattage

2.5.1 General

Power consumption is occasionally required in testing, but is more commonly used to monitor processing equipment. As an alternative to using a watt or watt hour meter the voltage and current may be measured.

2.5.2 Principle

The wattmeter is compared to a standard instrument.

2.5.3 Apparatus

2.5.3.1 *Standard wattmeter*.

2.5.3.2 *Means of generating voltages and currents*, for comparison with standard wattmeter.

2.5.4 Procedure

Calibrate the wattmeter in accordance with Parts 1, 3 and 9 of BS 89.

