

Calibration of rubber and plastics test equipment

Part 3. Calibration schedules

Section 3.3 Mechanical properties of plastics

ICS 83.200

Committees responsible for this British Standard

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

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Foreword

This Section 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 British Standard will encourage proper calibration and make it possible for all users and calibration laboratories to work to common procedures.

BS 7825 will comprise the following three Parts:

Part 1	<i>Principles and general requirements</i>
Part 2	<i>Calibration procedures</i>
Part 3	<i>Calibration schedules</i>

Part 3 will comprise 13 Sections, each of which will provide calibration schedules for specific areas of rubber or plastics testing, as follows:

Section 3.1	<i>Thermal properties</i>
Section 3.2	<i>Electrical properties</i>
Section 3.3	<i>Mechanical properties of plastics</i>
Section 3.4	<i>Mechanical properties of rubber</i>
Section 3.5	<i>Optical and weathering properties</i>
Section 3.6	<i>Dimensional properties</i>
Section 3.7	<i>Rheological properties</i>
Section 3.8	<i>Degradation and environmental properties</i>
Section 3.9	<i>Flammability characteristics</i>
Section 3.10	<i>Conditioning, sample and test piece preparation</i>
Section 3.11	<i>Rubber polymer identification and chemical properties</i>
Section 3.12	<i>Chemical properties of plastics</i>
Section 3.13	<i>Chemical properties of resins</i>

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 and ii, pages 1 to 20, an inside back cover and a back cover.

1 Scope

This Section of BS 7825 provides schedules for the calibration of a range of methods of test used for the evaluation of the mechanical properties of plastics.

2 References

2.1 Normative references

This Section 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 19. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the publications apply to this Section 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.

2.2 Informative references

This Section 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.

3 Definitions

For the purposes of this Section 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.

4 Inspection

Before any calibration is undertaken, the condition of the items to be calibrated shall be ascertained by inspection and recorded on any calibration report or certificate. It shall be reported whether calibration is made in the 'as-received' condition or after rectification of any abnormality or fault.

It shall be ascertained that the apparatus is generally fit for the intended purpose, including any requirements specified as approximate and hence not formally calibrated. If such parameters could change, then the need for periodic checks shall be written into the detailed calibration procedures.

5 Schedules

The calibration schedules given in this Section of BS 7825 have been compiled by listing all of the parameters specified in the relevant test method cited, together with the specified requirement. A parameter and requirement may relate to the main test apparatus, part of that apparatus or to an ancillary apparatus necessary for the test. In some cases tolerances not given in the test method standard have been added.

For each parameter a calibration procedure is indicated by reference to Part 2 of BS 7825, to another publication or to a procedure particular to that test method which is detailed.

The verification frequency for each parameter is given by a code letter. The code letters used in the schedules are:

Procedure:	P	Particular procedure
	R	Use of certified reference material
	C	Requirement to be confirmed but no measurement
Requirement: *		Tolerance not specified in the test method standard
Verification:	N	Initial verification only
	S	Standard interval as given in Part 1 of BS 7825
	P	Particular interval given in the standard
	U	In use

In use checks additional to the schedule are listed separately.

A list of reference materials is given either required by the calibration schedule or otherwise required by the test method.

Reagents, including cleaning materials, are listed. In some cases a reagent may be considered as a particular type of reference material.

In addition to the items listed, some standards assume the use of 'normal' laboratory apparatus, e.g. timers, beakers etc. These may need calibrating in accordance with the appropriate procedure given in Part 2 of BS 7825. Also, there may be items specified in the relevant cited standard which have a dimension, for example a 250 ml flask. Where the size has no particular significance, other than convenience of use, these items will not require to be calibrated.

Most standards for the testing of materials require the test piece to be conditioned. This implies the use of a thermometer and possibly a hygrometer, both of which will require calibration. Conditioning and test temperatures and humidities cited in the relevant standards have not been repeated.

Test piece dimensions are usually specified. This implies the use of dimensional measuring instruments which will require calibration. Test piece dimensions cited in the relevant standards have not been repeated.

6 Calibration schedules for individual test methods

The calibration schedules relating to this Section of BS 7825 are listed below in the numerical order of the international standard to which they relate:

BS 2782 :	<i>Methods of testing plastics</i>	ISO 4137 : 1978	<i>Plastics — Determination of modulus of elasticity by alternating flexure</i>
BS 2782 : Part 3 :	<i>Mechanical properties</i>	BS 2782 :	<i>Methods of testing plastics</i>
BS 2782 :	<i>Determination of flexural properties</i>	BS 2782 : Part 3 :	<i>Mechanical properties</i>
Method 335A : 1993	(Identical with ISO 178 : 1993)	BS 2782 :	<i>Determination of tear resistance of plastics film and sheeting by the trouser tear method</i>
BS 2782 :	<i>Determination of Charpy impact strength</i>	Method 360B : 1991	(Identical with ISO 6383-1 : 1983)
Method 359 : 1993	(Identical with ISO 179 : 1993)	BS 2782 :	<i>Determination of tear resistance of plastics film and sheeting by the Elmendorf method</i>
BS 2782 :	<i>Determination of Izod impact strength</i>	Method 360A : 1991	(Identical with ISO 6383-2 : 1983)
Method 350 : 1993	(Identical with ISO 180 : 1993)	BS 2782 :	<i>Determination of multi-axial impact behaviour by the falling dart method</i>
BS 2782 :	<i>Determination of tensile properties. General principles</i>	Method 353A : 1991	(Identical with ISO 6603-1 : 1985)
Method 321 : 1994	(Identical with ISO 527-1 : 1993)	BS 2782 :	<i>Determination of multi-axial impact behaviour by the instrumented puncture test</i>
BS 2782 :	<i>Determination of tensile properties, test conditions for moulding and extrusion plastics</i>	Method 353B : 1991	(Identical with ISO 6603-2 : 1989)
Method 322 : 1994	(Identical with ISO 527-2 : 1993)	ISO 7765-1 : 1988	<i>Plastics film and sheeting — Determination of impact resistance by the free falling dart method — Part 1: Staircase methods</i>
BS 2782 :	<i>Determination of compressive properties</i>	BS 2782 :	<i>Methods of testing plastics</i>
Method 345A : 1993	(Identical with ISO 604 : 1993)	BS 2782 : Part 3 :	<i>Mechanical properties</i>
BS 5961 : 1980	<i>Method for determination of coefficients of friction of plastic film and sheeting for use as electrical insulation</i>	BS 2782 :	<i>Determination of tensile-impact strength</i>
BS 2782 :	<i>Methods of testing plastics</i>	Methods 354A and 354B : 1991	(Identical with ISO 8256 : 1990)
BS 2782 : Part 3 :	<i>Mechanical properties</i>	ISO 8295 : 1990	<i>Plastic pipes for the transport of water intended for human consumption — Extractability of constituents — Test method</i>
BS 2782 :	<i>Determination of indentation hardness by means of a durometer (Shore hardness)</i>	BS 2782 :	<i>Methods of testing plastics</i>
Method 365B : 1992	(Identical with ISO 868 : 1985)	BS 2782 : Part 3 :	<i>Mechanical properties</i>
BS 2782 :	<i>Determination of hardness by the ball indentation method</i>	BS 2782 :	<i>Determination of resistance to wear by abrasive wheels</i>
Method 365D : 1991	(Identical with ISO 2039-1 : 1987)	Method 370 : 1990	(Identical with ISO 9352 : 1989)
BS 2782 :	<i>Determination of Rockwell hardness</i>		
Method 365C : 1992	(Identical with ISO 2039-2 : 1987)		
BS 2782 : Part 8	<i>Other properties</i>		
BS 2782 :	<i>Determination of water vapour transmission rate (dish method)</i>		
Method 820A : 1992	(Identical with ISO 2528 : 1974)		

Table 1. BS 2782 : Method 335A : 1993 (Identical with ISO 178 : 1993)				
Parameter	Requirement	Procedure	Verification frequency	Notes
Testing machine:	Comply with ISO 5893	10.1	S	—
indicated loads	$\pm 1 \%$	3.4	S	—
indicated deflections	$\pm 2 \%$	—	—	—
Weighing mechanism at full load:				
movement	$< 2 \text{ mm}$	3.2	N	Recommended
radius of loading nose	$5 \text{ mm} \pm 0.1 \text{ mm}$	3.3	S	—
radius of supports	$0.5 \text{ mm} \pm 0.2 \text{ mm}$	—	—	—
relative to specimen	$\leq 3 \text{ mm}$	3.2	S	—
thickness	$2 \text{ mm} \pm 0.2 \text{ mm} > 3 \text{ mm}$	3.2	U	—
length of span	within 0.5%	—	—	—
Relative rate of movement V	According to 6.3	12.4	U	—

Table 2. BS 2782 : Method 359 : 1993 (Identical with ISO 179 : 1993)				
Parameter	Requirement	Procedure	Verification frequency	Notes
Charpy impact machine	Properly constructed and calibrated corrected for friction and air resistance loss	10.5	S	—
Mass of foundation	$> 40 \times$ heaviest pendulum	11.2	N	—
Striking edge of pendulum	Angle $30^\circ \pm 1^\circ$ radius $2 \text{ mm} \pm 0.5 \text{ mm}$	3.9, 3.3	S	—
Midway between supports:	$\pm 0.2 \text{ mm}$	3.2	S	—
alignment	Contact across full width of specimen	3.9	S	—
Line of contact:	$\pm 2^\circ$ of perpendicular	3.9	S	—
clause 5.1.5	$\pm 1 \%$	3	N	—
clause 5.1.6	1 in 200	3.9	S	—
Shape of blocks	As figure 1	3.9/3.2	S	—
Separation of blocks	In accordance with table 2 of ISO 179	3.2	U	—
Means of centring test specimens	$0 \text{ mm} \pm 0.5 \text{ mm}$	—	—	—
Condition of cutter	In accordance with table 3 of ISO 179	3.9/3.2	P after 500 notches	—
Micrometer and gauges	—	3.1	S	—

Table 3. BS 2782 : Method 350 : 1993 (Identical with ISO 180 : 1993)				
Parameter	Requirement	Procedure	Verification frequency	Notes
Izod impact machine	Properly constructed and calibrated	—	—	—
Energy scale	Corrected for friction and air resistance	10.5	S	—
Mass of foundation	≥ 40 heaviest $\times$ pendulum	11.2	N	—
Orientation of striker	In accordance with 5.1.4 of ISO 180	3.9/3	S	—
Striking edge of pendulum	Hardened steel radius $0.8 \text{ mm} \pm 0.2 \text{ mm}$	3.2	S	—
Rotation/ Percussion	$\pm 1 \%$ in accordance with clause 5.1.5 of ISO 180	3.11	N	—
Parallel jaws	Within 0.025 mm	3.9	S	—
Radii of edges	$0.2 \text{ mm} \pm 0.1 \text{ mm}$	3.3	S	—
Top plane of vice	Within 0.2 mm of plane bisecting angle of notch	3.9	U	—
Orientation of vice	In accordance with 5.1.6 of ISO 180	3.9/3.2	S	—
Clamping force	Monitored with a torque wrench	10.4	S	—
Condition of cutter	In accordance with table 3	3.9/3.3/3.2	P after 500 notches	—
Micrometer and gauges	—	3.1	S	—