

Methods of testing

Plastics

Part 0. Introduction

Méthodes d'essai des matières plastiques
Partie 0. Introduction

Prüfverfahren für Kunststoffe
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Committees responsible for this British Standard

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- British Plastics Federation
- British Steel Industry
- British Telecommunications plc
- British Textile Confederation
- Department of Trade and Industry (National Physical Laboratory)
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- GAMBICA (BEAMA Ltd.)
- Ministry of Defence
- Packaging and Industrial Films Association
- PIRA
- Plastic Industrial Containers Association
- Plastics and Rubber Institute
- RAPRA Technology Ltd.
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Contents

	Page
Committees responsible	Inside front cover
Foreword	2
Introduction	
1 Scope	3
2 Informative references	3
3 Content and usage of BS 2782	3
4 Units	3
5 Apparatus and reagents	3
6 Sampling	3
7 Number of test pieces	3
8 Preparation of test pieces	3
9 Direction of testing	3
10 Test report	3
11 Standard atmospheres for conditioning and testing	3
Annexes	
A (normative) Standard atmospheres for conditioning and testing plastics	5
B (informative) List of methods in BS 2782 published separately and degree of equivalence to international standards	7
C (informative) Method 508A: Rate of burning, laboratory method (obsolescent)	20
Tables	
1 Conditioning atmospheres	4
B.1 Methods in BS 2782 and corresponding international standards	7
Figure	
C.1 Specimen under test for rate of burning	21
List of references	22

Foreword

This Part of BS 2782 has been prepared under the direction of the Plastics and Rubber Standards Policy Committee. It supersedes BS 2782 : Part 0 : 1982, which is withdrawn.

BS 2782 describes test methods currently used by the plastics industry for determining the quality of its products. It is intended that the appropriate methods be specified in all British Standards for plastics materials and products.

In many methods, the test procedures are identical with those standardized by Technical Committee ISO/TC 61, Plastics, and where this is so, the methods have been published as dual-numbered standards. These international standards are to be considered for adoption as European Standards by CEN/TC 249, Plastics.

Annex A is identical with ISO 291 : 1977, published by the International Organization for Standardization (ISO).

Annex B lists the methods in numerical order and also shows the equivalent ISO standard when appropriate.

Warning note. The methods in BS 2782 do not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions, and the methods should be operated only by trained personnel.

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

Introduction

1 Scope

This Part of BS 2782 gives a general introduction to the methods of test for plastics presented in the other Parts. Annex A gives the standard atmospheres for conditioning and testing plastics, annex B lists the individual methods and annex C describes an obsolescent method (508A), formerly given in BS 2782 : 1970 and still referred to by the Building Regulations [1].

2 Informative references

This Part of BS 2782 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 Content and usage of BS 2782

BS 2782 provides a rationalized collection of methods for testing plastics materials and includes tests that are applied to moulding and extrusion compounds, synthetic resins, reinforced plastics, semi-fabricated products such as sheet, film, rod and tube, and finished articles in the form of mouldings and extrusions. Many of the methods are restricted to one set of conditions, and are not necessarily adequate for the production of design data; attention is therefore drawn to BS 4618. The acquisition and presentation of comparable data for basic properties of plastics is given in BS 7008. Many of the methods are not suitable for cellular plastics and attention is drawn to BS 4370 and BS 4443.

4 Units

Numerical values in BS 2782 are normally expressed in the units of the *Système International d'Unités* (SI units), described in BS 5555.

5 Apparatus and reagents

Wherever possible, apparatus used should comply with the requirements of the appropriate British Standard. Reagents should be of recognized analytical reagent quality unless otherwise stated, and distilled or demineralized water should be used wherever water is specified (see BS 3978).

6 Sampling

In cases where special precautions are needed to ensure that the test pieces adequately represent the properties of the material in bulk, a sampling procedure is given in the specification for the material.

7 Number of test pieces

It is recognized that specifications for test programmes sometimes require use of different numbers of test pieces from those given in BS 2782. For example, in

production, a more informative and accurate result can be obtained if fewer test pieces are taken from one article but more articles are tested. It should be noted, however, that in general the use of fewer test pieces yields less reliable results.

8 Preparation of test pieces

Preparation of test pieces is often one of the most critical stages of the test procedure, and the specified conditions of preparation should be closely adhered to. In general the procedure adopted enables a test piece representative of the material under test to be obtained with minimal effect on the properties of the material. Test piece preparation is normally referred to in each method described in BS 2782, in some instances by reference to standards for the materials or products. BS 2782 : Part 9 describes general methods of preparation. It should be noted that where no British Standard or other recognized specification exists the procedure should be as agreed between the interested parties.

9 Direction of testing

The properties of certain types of sheet material can vary with direction in the plane of the sheet. In practice it is usual to cut two groups of test pieces with their major axes respectively parallel and perpendicular to the direction of some feature of the sheet that is either visible or inferred from a knowledge of the method of its manufacture.

For a particular test the direction of testing is the direction of the long axis of the test pieces, unless otherwise stated.

10 Test report

When referring to a test procedure it is necessary to quote the full reference by giving the number of this British Standard, the method number and the date of publication, e.g. BS 2782 : Method 354A : 1991.

11 Standard atmospheres for conditioning and testing

The properties of plastics can alter considerably with changes in temperature and relative humidity. It is usually necessary to condition test pieces before testing, in addition to controlling the atmosphere during testing, in order to improve the reproducibility of test results. As large a surface as possible of each test piece should be exposed to the conditioning atmosphere.

Where appropriate, the test method specifies the conditioning procedure. The standard atmospheres for conditioning and testing given in annex A are to be used whenever possible.

For convenience, the relevant parameters of annex A are given in table 1.

Table 1. Conditioning atmospheres			
Conditioning procedure	Temperature °C	Relative humidity %	Duration of conditioning, min. h
A. For use when control of temperature and humidity is necessary; normal tolerances	23 ± 2	50 ± 5	88
B. For use when control of temperature only is necessary; normal tolerance	23 ± 2	Ambient humidity	4
C. As A, but with close tolerances	23 ± 1	50 ± 2	88
D. As B, but with close tolerances	23 ± 1	Ambient humidity	4
E. For use when control of temperature or humidity is not necessary	Prevailing ambient atmospheric conditions		

Annexes

Annex A (normative)

Standard atmospheres for conditioning and testing plastics

NOTE. This annex is identical, except for the addition of A as a prefix to the clause numbers and A.1 as a prefix to the annex, with ISO 291 : 1977 *Plastics – Standard atmospheres for conditioning and testing* published by the International Organization for Standardization (ISO).

Wherever the words 'international standard' appear, referring to this annex, they should be read as 'annex'.

There is no corresponding British Standard to ISO 554 *Standard atmospheres for conditioning and/or testing – Specifications*, referred to in A.1. ISO 554 is, however, referred to for information only, so the validity of this annex is not affected.

A.1 Scope and field of application

This international standard sets out specifications relating to the conditioning and testing of all plastics and all types of test specimen under approximately normal ambient atmospheric conditions.

Special atmospheres applicable to a particular test or material or simulating a particular climatic environment are not included in this international standard.

NOTE. This international standard has been prepared taking into consideration ISO 554, *Standard atmospheres for conditioning and/or testing – Specifications*.

A.2 Definitions

A.2.1 conditioning atmosphere

The atmosphere in which a sample or test specimen is kept before being subjected to test.

A.2.2 test atmosphere

The atmosphere to which a sample or test specimen is exposed throughout the test.

NOTE. Both of these atmospheres are defined by specified values for temperature, relative humidity and pressure.

A.2.3 conditioning

The whole series of operations intended to bring a sample or test specimen into a state of equilibrium with regard to temperature and humidity.

The 'conditioning procedure' is defined by the 'conditioning atmosphere' and the 'period of conditioning'.

A.3 Standard atmospheres

Designation	Temperature °C	Relative humidity %	Pressure kPa	Remarks
Atmosphere 23/50	23	50	86 to 106	Recommended atmosphere
Atmosphere 27/65	27	65		For tropical countries

These atmospheres are to be used only when the properties of the samples or test specimens are influenced by both temperature and humidity.

If humidity has no influence on the properties being examined, the relative humidity may be uncontrolled. The two corresponding atmospheres are designated 'atmosphere 23' and 'atmosphere 27' respectively.

Similarly, if neither temperature nor humidity has any influence on the properties being examined, the temperature and relative humidity may be uncontrolled. In this case the atmosphere is termed the 'ambient atmosphere'.

NOTE. In the special case where the plastic material is, or has to be, used at the same time as other materials, an atmosphere of 20 °C/65 % relative humidity may be permitted to be used after agreement between the interested parties or if expressly specified.

A.4 Tolerances

Tolerances	Temperature °C	Relative humidity %
Normal	± 2	± 5
Close	± 1	± 2

NOTE 1. Usually, the tolerances are coupled as pairs, i.e. normal tolerance for both temperature and relative humidity or close tolerance on both.

NOTE 2. These tolerances apply to the working space of the test enclosure or conditioning enclosure and include both the variation with position in the enclosure and fluctuation with time.

A.5 Conditioning

The period of conditioning shall be stated in the relevant specifications for the materials.

NOTE 1. When the periods are not stated in the appropriate international standard, the following shall be adopted:

- a) a minimum of 88 h for atmospheres 23/50 and 27/65;
- b) a minimum of 4 h for atmospheres 23 and 27.

NOTE 2. For particular tests and for plastics or test specimens that are known to reach temperature and humidity equilibrium either very rapidly or very slowly, a shorter or longer time for the conditioning period may be specified in the appropriate international standard (see annex A.1).

A.6 Testing

Unless otherwise specified, the specimens shall be tested in the same atmosphere in which they have been conditioned.

In all cases, the test shall be made immediately after the removal of the test specimens from the conditioning enclosure.

Annex A.1

Attainment of equilibrium moisture absorption by plastics in a conditioning atmosphere

The amount of moisture absorbed and its rate of absorption by a test specimen conditioned in a humid atmosphere vary significantly according to the nature of the plastic material being examined.

The normal conditions for conditioning established in this international standard (see clause A.5) are generally satisfactory, with the following exceptions:

- materials that are known to reach equilibrium with their conditioning atmosphere only after a long period of time (for example, certain polyamides);
- new materials or those of unknown structure, for which neither the capacity for absorbing moisture nor the time required for reaching equilibrium can be estimated beforehand.

In the two latter cases, one may either

- a) dry the material at a high temperature, or
- b) condition the test specimens at 23 ± 2 °C and 50 ± 5 % relative humidity until equilibrium is reached.

Procedure a) has the disadvantage that certain property values, in particular mechanical ones, are different in the dry state from those obtained after conditioning in the atmosphere 23/50.

In the case of procedure b), one of the following criteria may be suitable:

- 1) constant mass is attained within 0.1 % for two determinations made at an interval of d^2 weeks (d being the thickness, in millimetres, of the test specimen);
- 2) for certain polymers, it is sufficient to prepare a mass/time curve with intervals of time much less than d^2 weeks and to consider that a practical equilibrium is reached when the slope of the curve, expressed as a percentage, is equal to 0.1.