

Recommendations for

The presentation of plastics design data —

Part 4: Environmental and chemical
effects —

Section 4.6: The thermal endurance of
plastics

IMPORTANT NOTE. Before reading this section it is essential to read the General Introduction to this series of Recommendations issued separately.

UDC 001.8:678.5/.8:620.193.94:536.495

Confirmed January 2012

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

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 and ii, pages 1 to 11 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.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 11-1999

The following BSI references
relate to work on this
Recommendation:
Committee reference PLC/36/5
Draft for comment 72/54305

ISBN 0 580 08467 1

Contents

	Page
0 Introduction	1
1 Principle	1
2 General	1
3 Special considerations for thermoplastics	2
4 Procedure	2
5 Form of presentation	3
Appendix A Example of test procedure	5
Appendix B Notes on ageing ovens	5
Appendix C Method for determining line of “best fit” (least squares method)	6
Appendix D Tables of test methods	8
Figure 1 — Example of life temperature characteristics for materials, based on flexural strength	10
Figure 2 — Example of test results from flexural strength tests for specimens aged at 170 °C	11
Table 1 — Suggested ageing intervals (days)	4
Table 2 — Model data and calculation	7
Table 3 — Suggested test methods (mainly from BS 2782)	9

0 Introduction

This section gives a basis for assessing the thermal endurance of plastics in air. A procedure for heat ageing is given, together with suggested tests for assessing changes in properties which may be affected. The section deals with a test for one property but the procedure may be repeated, if required, using tests for other properties (see Appendix D and Table 3).

The changes in properties after ageing at various temperatures are plotted and extrapolated to show the temperature at which a life of 20 000 h can be expected. This temperature is known in the electrical industry as the “temperature index” of the material and the procedure given in this section originates from that industry. This index is a good basis for the comparison of materials but the life times actually achieved in service may be affected by other factors not included in the tests.

The measurements of changes in properties are usually made at room temperature. Where the material has to remain serviceable at an elevated temperature, it is necessary to estimate the permissible change in a property at room temperature which corresponds to the limit of useful life at the operating temperature. Where appropriate, changes in properties at the service temperature may be measured at that temperature. Special effects due to contact between different materials are not considered.

The interpretation of results can often be assisted if parallel tests are carried out on a reference material whose thermal endurance in practical applications is well known.

The technique was originally developed for thermosetting materials, but its application to thermoplastics is also considered.

It should also be noted that using the same experimental data, more complete information than is given by the “temperature index” may be provided by adding to this the temperature corresponding to a measured life of 5 000 h and the temperature corresponding to the lower 95 % confidence limit on this. This form of presentation of results is called the “thermal endurance profile” and is written, for example, 139/159(154). The procedure for obtaining the temperature corresponding to the lower confidence limit is given in IEC Publication ¹⁾ “Guide for determination of thermal endurance properties of electrical insulating materials”: Part I “General procedure for determination of thermal endurance properties, temperature indices and thermal endurance profiles”, and Part II “List of materials and available tests”.

1 Principle

In this procedure, of which an example is given in Appendix A, a material is thermally aged at three, or preferably more, temperatures. The measured life of the material, i.e. the point at which the measured property has changed by a stated amount which is taken to indicate the limit of serviceability for the material, is obtained at each of these temperatures so that the results can be extrapolated to the operating temperature (see Figure 1). It is customary to quote as the “temperature index”, the temperature corresponding to an extrapolated life of 20 000 h.

2 General

2.1 The effects of ageing can be characterized by the change in any suitable property or properties; mechanical and electrical measurements are often convenient. It should be noted, however, that even for materials used for electrical applications, the end of useful life is often due to mechanical failure which may, of course, lead to an electrical failure.

¹⁾ At present in the form of a draft.