BRITISH STANDARD

BS EN
1842 : 1997

Plastics —
Thermoset moulding compounds (SMC - BMC) —
Determination of compression moulding shrinkage

The European Standard EN 1842 : 1997 has the status of a British Standard

ICS 83.080.10

National foreword

This British Standard is the English language version of EN 1842 : 1997.

It is also for use for the revision or amendment of other national standards as practicable, but it should not be presumed to apply to any existing standard or specification which contains or makes reference to a different test method until that standard/specification has been amended or revised to make reference to this method and adjust any requirements as appropriate. Attention is drawn to the existence of BS 2782 : *Methods of testing plastics*. Part 6 : *Dimensional properties*. Method 640A : 1979 — *Determination of shrinkage of test specimens in the form of bars of compression moulded thermosetting moulding materials*, which is identical to and dual numbered with ISO 2577. The text of ISO 2577 : 1975 was used as the basis for the preparation of this European Standard.

The UK participation in its preparation was entrusted to Technical Committee PRI/42, Fibre reinforced thermo-setting plastics and prepregs, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled 'International Standards Correspondence Index', or by using the 'Find' facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 4, an inside back cover and a back cover.

This British Standard, having been prepared under the direction of the Sector Board for Materials and Chemicals, was published under the authority of the Standards Board and comes into effect on 15 November 1997

ISBN 0 580 28664 9

Amendments issued since publication

Amd. No.	Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1842

July 1997

ICS 83.080.10

Descriptors: Plastics, thermosetting resins, plastic moulding, compression moulding, tests, determination, shrinkage

English version

Plastics — Thermoset moulding compounds (SMC - BMC) — Determination of compression moulding shrinkage

Plastiques — Matières à mouler thermodurcissables (SMC - BMC) — Détermination du retrait au moulage par compression

Kunststoffe — Wärmehärtende Formmassen (SMC - BMC) — Bestimmungen der Verarbeitungsschwindung

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 249, Plastics, the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 1998, and conflicting national standards shall be withdrawn at the latest by January 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

1 Scope

This European Standard specifies a method to determine the moulding shrinkage of compression moulded test specimens of thermoset moulding compounds. It applies only to materials which exhibit no post-shrinkage after moulding such as polyester SMC (sheet moulding compound) and BMC (bulk moulding compound).

Knowledge of the shrinkage allows the construction of moulds to produce parts with accurate dimensions, as well as evaluation of the suitability of a moulding compound for this purpose.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 291 : 1977	*Plastics — Standard atmospheres for conditioning and testing*
ISO 472 : 1988	*Plastics — Vocabulary*
ISO 2577 : 1984	*Plastics — Thermosetting moulding materials — Determination of shrinkage*
EN ISO 12114	*Fibre — reinforced plastics — Thermosetting moulding compounds and prepregs — Determination of cure characteristics* (ISO 12114 : 1997)
prEN 12576	*Plastics — Fibre reinforced composites — Preparation of compression moulded test plates of SMC, BMC and DMC*

3 Definitions

For the purposes of this standard, the definitions of ISO 472 : 1988 and the following definition apply:

moulding shrinkage

the difference in dimensions between a moulding and the mould cavity in which it was moulded, both the mould and the moulding being at normal temperature when measured (ISO 2577 : 1984).

4 Apparatus

4.1 *Mould and press* suitable for moulding the test specimens specified in clause **6**. Use a mould with a plane mould cavity not smaller than 200 cm^2. This mould shall be used with punch and die being able to maintain a positive pressure on the material. It can be rectangular, square or circular or as described in EN ISO 12114 or in prEN 12576. The mould can be designed with gauge marks engraved into mould cavity near opposite ends and with or without draft angles.

NOTE. Draft angles result in the opposite ends not being parallel which can cause difficulties in length measurement (see **7.4**). In this case a reference plane at points 2 mm above the smaller surface can be used.

4.2 *Equipment* suitable for measuring the sizes of test specimens and the corresponding cavity of the mould with an accuracy of 0,01 mm.

4.3 *Non metallic cooling rack* to hold the test specimens vertically with a minimum spacing of 20 mm.

NOTE. To achieve symmetrical cooling, both outer test specimens are protected by additional protective plates.

5 Sampling and conditioning of the moulding compound

Samples shall be taken from the moulding compound after maturation within the shelf-life given in the specification. They shall be placed inside an appropriate bag to avoid loss of volatile components and moisture absorption, kept under standard atmosphere (according to ISO 291 : 1997) until equilibrium is reached and then moulded into test specimens.

6 Test specimens

Test specimens are mouldings obtained by using mould and press (see **4.1**). The thickness shall be between 3,5 mm and 5,5 mm.

7 Procedure

7.1 Measure the length of the mould cavity (see note in **4.1**), or the distance between the engraved gauge marks in the mould cavity to the nearest 0,01 mm at standard atmosphere as reference length L_0.

Record this measurement for use in the calculation of shrinkage.

NOTE. Every year it is recommended to check mould dimensions for wear.

7.2 Mould three specimens.

Unless other conditions are specified or agreed between user and supplier the following conditions apply:

– mould temperature: 140 °C ± 1 % ;

– mould coverage: not less than 90 % for SMC. Moulding compounds like BMC shall be preformed to a homogeneous charge prior to moulding;

– moulding pressure: 7 MPa ± 5 % ;

– Pressing time: 40 seconds per millimetre of thickness of moulded test specimen or for whatever longer time is necessary to ensure full cure. The mould shall be closed within 15 s after charging.

On the moulded SMC test specimens, identify the production direction and/or unidirectional reinforcement direction if applicable.

7.3 After removal from the mould, allow the test specimens to cool down to room temperature by placing them in the cooling rack (see **4.3**). Store them at standard atmosphere for a minimum of 16 h, or for a shorter time providing it has been shown that it gives the same results.

7.4 For the determination of moulding shrinkage, measure at standard atmosphere, to the nearest 0,01 mm, the length of the test specimens between opposite ends as L_1.

– With engraved gauge marks, measure the distance between the marks.

– With draft angles at the ends of the test specimens, measure the length of the reference plane (see note in **4.1**).

– Without draft angles, measure at any height the distance between opposite ends.

Carry out one measurement per test specimen.

8 Expression of results

The moulding shrinkage *MS* is given, as a percentage, by the formula:

$$MS = \frac{L_0 - L_1}{L_0} \times 100$$

where

L_0 is the reference length of the mould, in millimetres, determined as in **7.1**;

L_1 is the corresponding length of the test specimen in millimetres, according to **7.4**.

NOTE. A positive value ($L_0 - L_1 > 0$) indicates a shrinkage of the material and a negative value ($L_0 - L_1 < 0$) an expansion.

9 Test report

The test report shall include the following particulars:

a) reference to this European Standard;

b) the type and designation of the moulding compound;

c) the type and size of mould used;

d) the thickness and the moulding conditions: temperature, pressure, pressing time;

e) the moulding shrinkage, *MS*, as a percentage, stating the individual values and the average value. In case of SMC, specify the direction of measurements with respect to the direction of the SMC machine; and/or to the direction of the unidirectional reinforcement;

f) the date of the tests.

10 Precision

The precision of this method is not known because interlaboratory data are not available. When interlaboratory data are obtained, a precision statement will be added with the next revision.

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