INTERNATIONAL STANDARD

ISO 75-3

Second edition
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Plastics — Determination of temperature of deflection under load —

Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics

Plastiques — Détermination de la température de fléchissement sous charge —

Partie 3: Stratifiés thermodurcissables à haute résistance et plastiques renforcés de fibres longues

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 75-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

This second edition cancels and replaces the first edition (ISO 75-3:1993), which has been technically revised.

ISO 75 consists of the following parts, under the general title *Plastics — Determination of temperature of deflection under load*:

— *Part 1: General test method*

— *Part 2: Plastics and ebonite*

— *Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics*

Introduction

In this edition of ISO 75-3, the test load is determined as a fraction of the flexural modulus of the material under test. This has the advantage that the test load is a fraction of the flexural strength of the material. The test determines the temperature-dependent decrease in the flexural modulus. Because tensile modulus and tensile strength are not necessarily related, using the flexural modulus to determine the test load leads to more readily comparable descriptions of material behaviour.

The strain increase at which the temperature of deflection under load is read has been increased from 0,1 % to 0,2 % to obtain greater commonality with ISO 75-2.

Unlike ISO 75-2, this part of ISO 75 only allows flatwise loading, as was already the case in the previous edition (ISO 75-3:1993).

In order to maintain consistency with ISO 10350-1:1998, T_f has been used as the symbol for temperature of deflection under load.

Plastics — Determination of temperature of deflection under load —

Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics

1 Scope

This part of ISO 75 specifies a method for the determination of the temperature of deflection under load of high-strength thermosetting laminates and compression-moulded long-fibre-reinforced plastics in which the fibre length is greater than 7,5 mm. The flexural stress used is not fixed, as in ISO 75-2, but is a fraction (1/1 000) of the initial (room-temperature) flexural modulus of the material under test. This allows the method to be applied to materials with a wide range of flexural moduli.

For additional information, see ISO 75-1:2004, clause 1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 75-1:2004, *Plastics — Determination of temperature of deflection under load — Part 1: General test method*

ISO 178, *Plastics — Determination of flexural properties*

ISO 295, *Plastics — Compression moulding of test specimens of thermosetting materials*

ISO 1268 (all parts), *Fibre-reinforced plastics — Methods of producing test plates*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 10724-1, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens*

ISO 14125, *Fibre-reinforced plastic composites — Determination of flexural properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 75-1 apply.

4 Principle

See ISO 75-1:2004, clause 4.

5 Apparatus

5.1 Means of producing a flexural stress

See ISO 75-1:2004, subclause 5.1.

The span (distance between the lines of contact between specimen and supports) shall be $(30h \pm 1)$ mm, where h is the thickness, in millimetres, of the specimen.

5.2 Heating equipment

See ISO 75-1:2004, subclause 5.2.

5.3 Weights

See ISO 75-1:2004, subclause 5.3.

5.4 Temperature-measuring instrument

See ISO 75-1:2004, subclause 5.4.

5.5 Deflection-measuring instrument

See ISO 75-1:2004, subclause 5.5.

6 Test specimens

6.1 General

See ISO 75-1:2004, subclause 6.1.

6.2 Shape and dimensions

See ISO 75-1:2004, subclause 6.2.

The test specimen shall have the following dimensions:

length l: at least 10 mm longer than the span;

width b: 9,8 mm to 12,8 mm;

thickness h: 2,0 mm to 7,0 mm.

6.3 Specimen inspection

See ISO 75-1:2004, subclause 6.3.

6.4 Number of test specimens

See ISO 75-1:2004, subclause 6.4.

6.5 Test-specimen preparation

Test specimens shall be produced in accordance with ISO 295, ISO 10724-1 or the relevant part of ISO 1268 (and ISO 2818, if applicable), or as agreed by the interested parties.

Ensure that all cut surfaces are as smooth as possible, and that any unavoidable machining marks are in the lengthwise direction.

In the case of compression-moulded test specimens, the width shall be perpendicular to the direction of the moulding force. For materials in sheet form, the thickness of the test specimens (i.e. the thickness of the sheet) shall be in the range 2 mm to 7 mm. For samples over 7 mm thick, reduce the thickness to 7 mm by machining one face. If the faces of the test specimen are dissimilar, report the face machined in the test report.

In view of the requirement for the span to be 30 times the test-specimen thickness (see 5.1), it may be anywhere between 60 mm and 210 mm. Some test machines have a fixed span of 100 mm, however, and can therefore only be used with test specimens up to 3 mm thick. Such a machine may be used but, if the test-specimen thickness is greater than 3 mm, it will have to be reduced by machining. As before, machine only one face and, if the faces are dissimilar, report which face was machined in the test report.

NOTE Most reinforced-thermoset laminates are anisotropic, and may be non-homogeneous across their thickness, and machining may significantly alter their properties.

6.6 Annealing

Discrepancies in test results due to variations in moulding conditions can be minimized by annealing the test specimens before testing them. Since different materials require different annealing conditions, annealing procedures shall be employed only if required by the materials standard or if agreed upon by the interested parties.

7 Conditioning

See ISO 75-1:2004, clause 7.

8 Procedure

8.1 Calculation of force to be applied

See ISO 75-1:2004, subclause 8.1.

The force applied shall be such as to generate a flexural stress σ_f equal to 1/1 000 of the flexural modulus of the material at room temperature (either determine the flexural modulus in accordance with ISO 178 or ISO 14125, as appropriate, or use the value given by the manufacturer).

The applied force can also be determined as the force required to generate an initial deflection equivalent to a flexural-strain increase $\Delta\varepsilon_f$ of 0,1 % in the test specimen [see ISO 75-1:2004, equation (5)]. This approach has the advantage of not requiring explicit knowledge of the flexural modulus to determine the force to be applied. If this approach is used, the initial deflection shall be accurate to $\pm$ 2,5 %. Inserting the flexural-strain increase $\Delta\varepsilon_f$ of 0,1 and the required span L of $30h$ in equation (5) in ISO 75-1:2004, it can be seen that the acceptable error in the initial deflection is therefore $\pm (3{,}75 \times 10^{-3})h$.

NOTE For a specimen thickness h of 4 mm, this corresponds to an acceptable error of $\pm$ 0,015 mm.

8.2 Initial temperature of the heating equipment

See ISO 75-1:2004, subclause 8.2.

8.3 Measurement

See ISO 75-1:2004, subclause 8.3.

Adjust the span L between the supports to 30 times the thickness h ($\pm$ 1 mm) of the test specimen. Place the test specimen on the supports in the flatwise position. Apply the calculated force (see 8.1) to give the required flexural stress.

Calculate the standard deflection Δs by means of equation (5) in ISO 75-1:2004, using a value of 0,2 % for the flexural-strain increase $\Delta \varepsilon_f$.

Record the temperature at which the initial deflection of the bar has increased by the standard deflection. This temperature is the temperature of deflection under load. If the individual results differ by more than 5 °C, repeat tests shall be carried out.

9 Expression of results

See ISO 75-1:2004, clause 9.

10 Precision

See ISO 75-1:2004, clause 10.

11 Test report

See ISO 75-1:2004, clause 11, omitting item h).

Amend item i) as follows:

i) the flexural stress used, indicating in addition whether

— the initial (room-temperature) flexural modulus

or

— the initial deflection corresponding to a flexural-strain difference of 0,1 %

was used;

Include the following additional information:

l) the face machined, if it was necessary to reduce the test-specimen thickness by machining.

Bibliography

[1] ISO 10350-1:1998, *Plastics — Acquisition and presentation of comparable single-point data — Part 1: Moulding materials*

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