INTERNATIONAL STANDARD

ISO 3386-2

Second edition
1997-06-15

Flexible cellular polymeric materials — Determination of stress-strain characteristics in compression —

Part 2:
High-density materials

Matériaux polymères alvéolaires souples — Détermination de la caractéristique de contrainte-déformation relative en compression — Partie 2: Matériaux à masse volumique élevée

Reference number
ISO 3386-2:1997(E)

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.

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.

International Standard ISO 3386-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

This second edition cancels and replaces the first edition (ISO 3386-2:1984), of which it constitutes a minor revision (in clause 4, second paragraph, the accuracy required for measurement of the test piece thickness has been changed from 0,02 mm to 0,1 mm).

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

Flexible cellular polymeric materials — Determination of stress-strain characteristics in compression —

Part 2:
High-density materials

1 Scope

This part of ISO 3386 specifies a method for the determination of the compression stress-strain characteristics of flexible cellular polymeric materials of density greater than 250 kg/m^3.

The compression stress-strain characteristic is a measure of the load-bearing properties of the material, though not necessarily of its capacity to sustain a long-term load.

The compression stress-strain characteristic differs from the indentation hardness characteristics (as determined in accordance with ISO 2439) which are known to be influenced by the thickness and the tensile properties of the flexible cellular material under test, the shape of the compression plate, and the shape and size of the test piece.

ISO 3386-1 specifies a method for low-density flexible materials, and differs from Part 2 in the following ways:

- Part 1 is concerned with materials of density up to 250 kg/m^3, whilst Part 2 is mainly concerned with materials of density above 250 kg/m^3;
- compression stress values have been deleted from Part 2;
- Part 2 does not allow the use of a cylindrical test piece.

This part of ISO 3386 is a general method for testing denser flexible cellular materials (i.e. expanded cellular rubbers), measurements being made on one of more points on the steeply rising part of the stress-strain curve. The shape factor of the test piece is important and comparative test results can only be obtained on test pieces having the same shape factor.

NOTE 1 For comparison purposes, the method may be used for material of 150 kg/m^3 density or greater.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1923:1981, *Cellular plastics and rubbers - Determination of linear dimensions.*

ISO 2439:---[1], *Flexible cellular polymeric materials - Determination of hardness (indentation technique).*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 compression stress-strain characteristic (CC): The stress, expressed in kilopascals, required to produce a compression, at a constant rate of deformation during the fourth loading cycle of the test specified in this International Standard, expressed as a function of the compression.

NOTE 2 Stresses are usually quoted at compressions of (25 ± 1) %, (40 ± 1) %, (50 ± 1) % and (65 ± 1) %, being designated CC25, CC40, CC50 and CC65 respectively.

3.2 shape factor: The ratio of the area of one applied force bearing face of the test piece to the sum of the areas of the four perpendicular sides of the test piece.

4 Apparatus

The apparatus comprises a test machine capable of compressing the test piece by means of a compression plate moving at a uniform rate of (5 ± 1) mm/min. Autographic recording of the stress-strain values is preferred.

The compression plate shall be maintained parallel to the base plate. The testing machine shall have means of measuring the test piece thickness under load to an accuracy of ± 0,1 mm. It shall be capable of maintaining the specified degree of compression for the period specified by the procedure appropriate to the material under test.

[1] To be published (Revision of ISO 2439:1980).

The test machine shall be capable of measuring the force to produce the specified compression with an accuracy of ± 2 %.

The test piece shall be supported on a smooth, flat and rigid surface larger than the test piece.

The compression plate may be of any convenient size or shape provided that it overlaps the test piece in all directions. The surface of the compression plate shall be smooth but not polished.

5 Test piece

5.1 Dimensions

The test piece shall be a right parallelepiped with square load-bearing surfaces of side 40 mm minimum with a shape factor of unity. Therefore the width to thickness ratio shall be 4 : 1.

5.2 Preparation

The opposing square faces shall contain the moulded surfaces. The edges of the test piece shall be cleanly cut perpendicular to the moulded surfaces and shall expose cell structure. Thin sheets may be plied-up to achieve the required thickness, such sheets being cut to identical shapes and sizes, provided that a minimum of 10 cell diameters is included in the thickness of one ply.

5.3 Samples showing orientation

If the products show an orientation of the cellular structure, the direction in which the indentation is to be carried out shall be agreed upon between the interested parties. Normally, testing is carried out in that direction in which the finished product will be stressed under service conditions.

5.4 Number of test pieces

Three test pieces shall be tested.

5.5 Conditioning

Samples shall not be tested less than 72 h after manufacture. They shall be conditioned immediately before testing for a period of not less than 16 h at either:

a) a temperature of 23 °C ± 2 °C and a relative humidity of (50 ± 5) % for use in temperate climates; or

b) a temperature of 27 °C ± 2 °C and a relative humidity of (65 ± 5) % for use in tropical climates.

The conditioning may form the latter part of the 72 h following manufacture. The tests shall be carried out at a temperature of 23 °C ± 2 °C or 27 °C ± 2 °C as appropriate.

6 Procedure

Measure the dimensions of the test piece using the appropriate procedure described in ISO 1923 and calculate the area of the load-bearing face.

Insert the test piece in such a way that the force acts along the centre line of the test machine and compress it at (5 ± 1) mm/min by means of the compression plate until the compression strain applied equals that specified in the material specification. Then decompress the test piece at the same rate until the separation between the compression plate and the base plate is equal to the initial test piece thickness.

Immediately repeat this procedure three times and on the fourth compression cycle read the force, in newtons, at the specified strain.

NOTE 3 If measurements are required at multiple compression strains on a test piece, it is unnecessary to allow recovery time or to repeat the pre-loading procedure between the readings at each strain provided that measurements are taken in order of increasing magnitude of strain.

7 Expression of results

The compression stress-strain characteristic, expressed in kilopascals, at the specified strain, is given by the formula

$$CC_{xx} = 1\,000 \frac{F}{A}$$

where

CC_{xx} is the compression stress-strain characteristic at a strain xx;

F is the force, in newtons, at the specified strain;

A is the area, in square millimetres, of the test piece.

8 Repeat tests

For repeat tests on the same test piece, a minimum recovery period of 16 h shall be observed.

9 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) a description of the material;

c) the temperature and humidity at which the test piece was conditioned;

d) the dimensions of the test piece used and (if applicable) the number of plies;

e) the compression stress-strain characteristics for individual test pieces and their median, and/or the compression stress-strain values for individual test pieces and their median;

f) other relevant information.

NOTE 4 An example of how to express the compression stress-strain characteristics briefly is as follows

ISO 3386-2 CC_{25}
23 °C/50 % relative humidity
(individual results)
médian kPa

ICS 83.100

Descriptors: cellular materials, cellular plastics, foam rubber, flexible cellular materials, tests, compression tests, determination, compressive stress.

Price based on 5 pages