



**SLOVENSKI STANDARD**  
**SIST ISO 2440:1996**

**01-januar-1996**

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**Penjeni polimerni materiali - Mehke pene - Preskus s pospešenim staranjem**

Polymeric materials, cellular flexible -- Accelerated ageing tests

Matériaux polymères alvéolaires souples -- Essais de vieillissement accéléré

**Ta slovenski standard je istoveten z: ISO 2440:1983**

[SIST ISO 2440:1996](https://standards.iteh.ai/catalog/standards/sist/844a66e0-922d-4661-a7f5-70b9ddf21c2b/sist-iso-2440-1996)

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Penjeni polimeri

Cellular materials

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# International Standard



# 2440

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

## Polymeric materials, cellular flexible — Accelerated ageing tests

*Matériaux polymères alvéolaires souples — Essais de vieillissement accéléré*

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UDC 678.4/.8 : 620.199.91

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Descriptors : cellular materials, cellular plastics, elastomers, natural rubber, synthetic elastomers, foam rubber, accelerated tests, ageing tests (materials), tests.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2440 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*.

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This second edition was submitted directly to the ISO Council, in accordance with clause 6.11.2 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2440-1972), which had been approved by the member bodies of the following countries :

Austria	Italy	Sri Lanka
Canada	Netherlands	Switzerland
Czechoslovakia	New Zealand	Turkey
Egypt, Arab Rep. of	Poland	United Kingdom
France	Portugal	USA
Germany, F. R.	Romania	USSR
Hungary	South Africa, Rep. of	Yugoslavia
India	Spain	

No member body had expressed disapproval of the document.

# Polymeric materials, cellular flexible — Accelerated ageing tests

## 1 Scope

This International Standard specifies laboratory procedures which are intended to imitate the effects of naturally occurring reactions such as oxidation or hydrolysis by humidity. The physical properties of interest are measured before and after the application of the specified treatments.

## 2 Field of application

At present, test conditions are only given for open cellular latex and polyurethane foams. Conditions for other materials will be added as required.

The effect of the ageing procedures on any of the physical properties of the material may be examined, but those normally tested are either the elongation and tensile properties, or the compression or indentation hardness properties.

These tests do not necessarily correlate either with service behaviour or with ageing by exposure to light.

## 3 Reference

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

## 4 Apparatus

### 4.1 For heat ageing

**Oven**, with forced circulation, capable of maintaining the required temperature to within  $\pm 1$  °C.

NOTE — It is recommended that a device be used to record the temperature, preferably continuously.

### 4.2 For humidity ageing

The ageing apparatus shall be of such a size that the total volume of test pieces does not exceed 10 % of the free air space, and such that the test pieces are free of strain, freely exposed to the ageing atmosphere on all sides and not exposed to light.

**4.2.1 Steam autoclave** or similar vessel, capable of maintaining the required temperature to within  $\pm 1$  °C and of withstanding absolute pressures up to 300 kPa.

**4.2.2 Glass vessel**, with a suitable closure, and a **water-bath** or **drying oven** for heating the vessel, capable of maintaining the required temperature to within  $\pm 1$  °C.

### 4.3 For physical property measurements

Apparatus appropriate to the measurements of the physical property to be examined.

## 5 Test pieces

### 5.1 Number, size and shape

The number, size and shape of the test pieces shall be appropriate to the property being examined, and shall be prepared, before ageing, to the dimensions used in the particular test.

### 5.2 Conditioning

Test pieces shall not be tested for at least 72 h after manufacture. Prior to the test, the test pieces shall be conditioned for at least 16 h at either  $23 \pm 2$  °C,  $50 \pm 5$  % relative humidity, or  $27 \pm 2$  °C,  $65 \pm 5$  % relative humidity, in accordance with ISO 471.

This period may form the latter part of the 72 h following manufacture.

NOTE — It is recommended that for reference purposes the test be performed 7 days or more after the cellular material has been manufactured.

## 6 Procedure

After conditioning, the test of the required physical property shall be performed and the test pieces shall be brought rapidly to the ageing condition. If the test to be performed is destructive, for example the examination of tensile properties, it is recommended that the tests on both reference and aged

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material be performed at the same time, that is after the exposure of the latter to the ageing conditions.

The ageing conditions shall be chosen from the following alternatives which should be appropriate to the material under test. It is recommended that materials differing in chemical composition should not be aged in the same enclosure.

## 6.1 Dry heat ageing

### 6.1.1 Temperatures

Latex : 70 °C or 100 °C

Polyurethane : 125 °C or 140 °C

with a tolerance of  $\pm 1$  °C.

NOTE — The use of the non-standard temperature of 140 °C is required for the following technical reason : the temperature of the ageing test should be as high as possible to enable results to be obtained in the minimum time, but above this critical temperature the changes which occur when polyurethane foam is tested are not those which are found in service, so that the ageing test will no longer discriminate between foams of different behaviour in service.

### 6.1.2 Duration of ageing

16, 22, 72, 96, 168, 240 h, or some multiple of 168 h with a tolerance of  $\pm 5$  % but not more than  $\pm 4$  h.

## 6.2 Humidity ageing

### 6.2.1 Humidity

100 % relative humidity or saturated steam.

### 6.2.2 Temperatures and duration of ageing

Material	Conditions
Polyurethane (all types)	85 °C for 20 h or 105 °C for 3 h
Polyurethane (Polyether only)	120 °C for 5 h

Tolerance on temperature :

$\pm 1$  °C

Tolerance on duration of ageing :

$\pm 5$  % but not more than  $\pm 2$  h, the time being measured from the time when the air in the vessel has been replaced by water vapour or steam.

NOTE — In this test for resistance to hydrolysis the use of the non-standard temperatures of 105 °C and 120 °C is required for the following technical reasons : 105 °C is used because this temperature requires the use of a closed vessel so that control of the conditions is better than at the alternative of 100 °C; 120 °C is used because much

experimental evidence has been accumulated at this temperature, but little or none at the alternative of 125 °C. Until these background data are collected it is not considered possible to change to 125 °C.

## 6.3 Reconditioning

After exposure to the ageing conditions, test pieces undergoing humidity ageing shall be dried at  $70 \pm 2$  °C for 3 h per 25 mm of thickness, subject to a minimum of 3 h. The humidity aged test pieces shall then be reconditioned in the atmosphere specified in 5.2 for 3 h per 25 mm of thickness. Dry heat aged test pieces shall merely undergo the reconditioning procedure.

After reconditioning, the properties of the aged test pieces shall be tested.

## 7 Expression of results

### 7.1 Calculation

The percentage change in the property being examined is given by the formula

$$\frac{\bar{x}_a - \bar{x}_o}{\bar{x}_o} \times 100$$

where

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$\bar{x}_o$  is the average value of the property before ageing;

$\bar{x}_a$  is the average value of the property after ageing.

### 7.2 Format

The value of the percentage change shall be stated, followed by the test condition in parentheses, in the order time, temperature and method.

Example :

Value % (16 h, 70 °C, dry heat).

## 8 Test report

The test report shall contain the following information :

- a reference to this International Standard;
- description of the material;
- procedure and conditions used;
- the average final value of the property;
- percentage change in property expressed as indicated in clause 7;
- date of test.