



**SLOVENSKI STANDARD**  
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Structural Adhesives - Determination of the pot life (working life) of multicomponent adhesives

Strukturklebstoffe - Bestimmung der Topfzeit (Verarbeitungszeit) von Mehrkomponentenklebstoffen

Adhésifs structuraux - Détermination de la durée de vie en pot (délai d'utilisation) des adhésifs multicomposants

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EUROPEAN STANDARD

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## Structural Adhesives - Determination of the pot life (working life) of multicomponent adhesives

Adhésifs structuraux - Détermination de la durée de vie en  
pot (tempos de travail) des adhésifs multicomposants

Strukturklebstoffe - Bestimmung der Topfzeit  
(Verarbeitungszeit) von Mehrkomponentenklebstoffen

This European Standard was approved by CEN on 1 August 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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## Contents

page

Foreword.....	3
1 Scope .....	4
2 Normative references .....	4
3 Terms and definitions.....	4
4 Typical purposes for the test methods.....	4
4.1 Method 1: Determination by means of change in apparent viscosity (rotating viscometer).....	4
4.2 Method 2: Determination by means of a change in extrusion rate.....	5
4.3 Method 3: Determination by means of manual application.....	5
4.4 Method 4: Determination by means of surface contact.....	5
4.5 Method 5: Determination by means of exothermic reaction temperature .....	5
5 Limits of the test methods .....	5
6 Safety .....	5
7 Determination.....	5
7.1 General.....	5
7.2 Method 1: Determination by means of a change in apparent viscosity (rotating viscometer or oscillating rheometer) .....	5
7.3 Method 2: Determination by means of a change in extrusion rate.....	6
7.4 Method 3: Determination by means of manual application.....	8
7.5 Method 4: Determination by means of surface contact.....	8
7.6 Method 5: Determination by means of exothermic reaction temperature .....	9
8 Expression of results .....	10
9 Test report .....	11

## Foreword

This document (EN 14022:2003) has been prepared by Technical Committee CEN /TC 193, "Adhesives", the secretariat of which is held by AENOR.

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 March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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**EN 14022:2003 (E)****1 Scope**

This European Standard specifies means of determining in appropriate ways the variable property known alternatively as useable working life and pot life.

This standard specifies five methods for the determination of the time available for use, each of which is related to specific circumstances; particularly important being the rheology of the adhesive concerned and its rate of reaction.

NOTE 1 For the purposes of simplification the term "pot life" is deemed to have the same meaning as "working life" and will be used to represent both throughout this standard.

NOTE 2 This European Standard can also be used for assessing non-structural adhesives.

NOTE 3 Because of the different properties of the individual multicomponent systems, like rheology or viscosity, respectively velocity of hardening, etc. not all methods can be applied to each multicomponent system with the same suitability.

**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 (including amendments).

EN 923:1998, *Adhesives – Terms and definitions*.

EN 1066, *Adhesives – Sampling*. <https://standards.iteh.ai/catalog/standards/sist/1bd0f7be-f7fd-4cc2-80a2-00f7211959d3/sist-en-14022-2003>

EN 1067, *Adhesives – Examination and preparation of samples for testing*.

EN 12092, *Adhesives – Determination of viscosity*.

**3 Terms and definitions**

For the purposes of this European standard the terms and the definitions given in EN 923:1998 and the following term and definition apply.

**3.1****pot life**

working life

period of time during which a multi-part adhesive can be used after its component parts have been mixed

NOTE The pot life of any reacting adhesives is affected by the rate at which the heat energy generated by the reaction is dissipated. The rate of dissipation depends significantly upon the volume and temperature of the mixed adhesive and the ambient temperature. The term "pot life" is also used to describe the period during which hot-melt adhesives remain fit for use when kept at their normal operating temperatures.

**4 Typical purposes for the test methods****4.1 Method 1: Determination by means of change in apparent viscosity (rotating viscometer)**

This test method provides a means of measuring a pot life greater than 5 min; where pot life is quantified by means of a specified increase in the viscosity of the reacting adhesive.

#### 4.2 Method 2: Determination by means of a change in extrusion rate

This test method provides a means of measuring a pot life (for paste-like adhesives) greater than 5 min; where pot life is quantified by means of a specified decrease in the weight of reacting adhesives extruded, in unit time, under standard conditions.

#### 4.3 Method 3: Determination by means of manual application

This generally applicable method provides a means of measuring a pot life of any duration; where pot life is quantified as the time by which a reacting adhesive can no longer be spread by hand.

#### 4.4 Method 4: Determination by means of surface contact

This test method provides a means of measuring a pot life; where pot life is quantified as the time by which the surface of a reacting adhesive is no longer tacky i.e. it is "touch dry". It is particularly suited to the assessment of the more rapidly setting epoxide and polyurethane-based adhesives though it can be used to measure a pot life of any duration.

#### 4.5 Method 5: Determination by means of exothermic reaction temperature

This test method provides a means of measuring a pot life which can be used for any reactive multicomponent system; where pot life is quantified as the time by which a batch of the reaction product reaches a defined temperature, the so-called critical temperature (e.g. 40 °C). For products producing less than 40 °C exothermic reaction heat in the defined batch, the maximum temperature is taken as criteria.

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### 5 Limits of the test methods

While the described test methods are suitable for assessing multicomponent epoxide or polyurethane-based adhesives, they are not suitable for some acrylic based adhesives.

### 6 Safety

Persons using this standard shall be familiar with normal laboratory practice. This standard does not purport to address all safety problems, if any, associated with its use. It is the responsibility of the user to establish safety and health practices and to ensure compliance with any European and national regulatory conditions.

### 7 Determination

#### 7.1 General

The adhesive to be tested, by any one the five given test methods, shall be sampled, prepared and examined according to EN 1066 and EN 1067. For any method chosen, at least three samples shall be evaluated and the mean determined.

#### 7.2 Method 1: Determination by means of a change in apparent viscosity (rotating viscometer or oscillating rheometer)

##### 7.2.1 Principle

A multicomponent adhesive is mixed and its pot life established by measuring the time taken for its viscosity to change by a specified amount.

This method is not suitable for the determination of pot lives that are shorter than 5 min in duration.

**EN 14022:2003 (E)****7.2.2 Apparatus**

**7.2.2.1 Balance**, capable of weighing up to  $(500 \pm 0,2)$  g.

**7.2.2.2 Beaker**, squat form, capacity 400 ml, made of an unreactive material with adhesive, whose wall thickness does not exceed 1 mm.

**7.2.2.3 Spatula** made of a non reactive material with adhesive and with an angular, not circular end.

**7.2.2.4 Viscometer**, any suitable means of measuring the viscosity of the adhesive (rotating viscometer or oscillating rheometer) may be selected. See EN 12092, Method 1, for the viscosity measurement with rotating viscometer.

**7.2.2.5 Stopwatch**, with a limit deviation of  $\pm 1$  s.

**7.2.2.6 Test enclosure**, capable of being maintained at the test temperature and if necessary at a relative humidity of  $(50 \pm 5)$  %.

**7.2.3 Procedure**

Both components of the product shall be maintained separately at  $(23 \pm 2)$  °C. The single components shall be weighed into the beaker (see 7.2.2.2) according to the mixing ratio specific for the product, with the preferred mass of the batch of the products being 200 g.

Other masses can also be used.

Start the stopwatch (see 7.2.2.5) and mix the batch with an angular, not circular end of a spatula (see 7.2.2.3) for more than 1 min. Take care that also the areas within the angle between side and bottom of the beaker are well mixed.

It is also allowed to determine a pot life of a batch which was produced with the help of a static or dynamic mixer, which has to be defined specifically.

Immediately after mixing measure the viscosity with a viscometer (see 7.2.2.4) of the freshly prepared adhesive.

Record the first data after having finished mixing as the starting viscosity point. Continue the measurement in intervals dependent on the pot life expected.

NOTE 1 The number of measurements as well as the extent of shear at mixing of the components and the measurement itself can have an influence on viscosity and pot life. Therefore, it is recommended to fix the intervals of measurements as well as mixing, shear speed and rotational speed specific to the adhesive.

The pot life of the adhesive is the difference between time at the end of mixing and the time when a fixed agreed viscosity is reached. Usually the fixed agreed viscosity is double the starting viscosity.

**7.3 Method 2: Determination by means of a change in extrusion rate****7.3.1 Principle**

A multi-component adhesive is mixed and its pot life established by measuring the time taken for there to be a specified decrease in the quantity of adhesive extruded through a calibrated orifice, in unit time, under standard conditions.

This method is not suitable for the measurement of pot lives that are shorter than 5 min in duration.



### 7.3.2 Apparatus

**7.3.2.1 Cartridge**, plastic disposable cartridge of 47 mm internal diameter and 210 mm length, fitted with an appropriate piston; both components being made from a non-reactive material.

**7.3.2.2 Balance**, capable of weighing up to  $(500 \pm 0,2)$  g.

**7.3.2.3 Stirrer**, rigid, helicoidal steering spindle made from non-reactive material suitable for use in conjunction with the adhesive being assessed.

**7.3.2.4 Motor**, an electrically or pneumatically powered stirrer motor whose speed can be regulated between  $0 \text{ min}^{-1}$  and  $1\ 000 \text{ min}^{-1}$ .

**7.3.2.5 Nozzle**, calibrated made from non reactive material, capable of being screwed onto the end fitting of the cartridge (see 7.3.2.1). The diameter of the nozzle's extrusion orifice shall be suitable for dispensing the mixed adhesive. An orifice diameter of 2 mm to 4 mm is recommended for evaluation.

**7.3.2.6 Extrusion gun**, air pressurised extrusion gun suitable for use with the cartridge described in 7.3.2.1.

**7.3.2.7 Pressure gauge**, air pressure gauge capable of measuring air pressure up to 500 kPa with a precision of  $\pm 10$  kPa.

**7.3.2.8 Stopwatch**, with a limit deviation of  $\pm 1$  s.

**7.3.2.9 Dishes**, of suitable capacity, pre-weighed, aluminium foil dishes.

**7.3.2.10 Bath**, capable of being maintained within  $\pm 0,1$  °C throughout a temperature range between 15 °C and 30 °C.

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**7.3.2.11 Test enclosure**, capable of being maintained at the test temperature and if necessary at a relative humidity of  $(50 \pm 5)$  %.

### 7.3.3 Procedure

By using the bath (see 7.3.2.10) and the enclosure (see 7.3.2.11), ensure that all the components are maintained at an agreed, uniform temperature;  $(23 \pm 2)$  °C is commonly used.

Prepare a sample of the adhesive in accordance with the manufacturer instructions, by weighing the components directly into the cartridge (see 7.3.2.1) prior to mixing them, in situ, at a speed of  $(600 \pm 100) \text{ min}^{-1}$  for  $(60 \pm 10)$  s.

NOTE 1 The preferred amount of adhesive is 200 g, however other quantities can also be used.

It is also allowed to determine a pot life of a batch which was produced with the help of a static or dynamic mixer, which has to be defined specifically.

As quickly as practical, remove the seal from the threaded end fitting of the cartridge, screw on the calibrated nozzle (see 7.3.2.5), insert the piston and fix the cartridge in the gun (see 7.3.2.6).

As quickly as practical, set the required extrusion pressure.

Rapidly extrude, into one of the foil dishes (see 7.3.2.9), a sufficient quantity of adhesive to ensure the removal of any air trapped in the cartridge together with any unmixed material that can have been retained in the end fitting during stirring.

Note the time and then extrude the freshly, and thoroughly, mixed adhesive at the required pressure for the required period of time. Weigh and note the amount extruded.