
**Building and civil engineering
sealants — Determination of resistance
to prolonged exposure to water**

*Mastics pour bâtiments et ouvrages de génie civil — Détermination
de la résistance à une immersion prolongée dans l'eau*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 8, *Sealants*.

This second edition cancels and replaces the first edition (ISO 13638:1996), which has been technically revised.

The main changes compared to the previous edition are as follows:

- The title of the document has been modified.
- The requirements of apparatus, preparation of test specimens and failure criterion have been modified in accordance with other revised ISO standards.
- The minimum times of repetition of the water immersion and cyclic movement procedures have been defined.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Building and civil engineering sealants — Determination of resistance to prolonged exposure to water

1 Scope

This document specifies a method for the determination of the ability of sealants to resist differing degrees of exposure to water under conditions of service.

The method assesses the effects of water immersion, for specified durations of time, on the ability of the sealant to fulfil its essential functions, principally to withstand joint movement.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6927, *Buildings and civil engineering works — Sealants — Vocabulary*

ISO 9046, *Building construction — Jointing products — Determination of adhesion/cohesion properties of sealants at constant temperature*

ISO 9047, *Building construction — Jointing products — Determination of adhesion/cohesion properties of sealants at variable temperatures*

ISO 11600, *Building construction — Jointing products — Classification and requirements for sealants*

ISO 13640, *Buildings and civil engineering works — Sealants — Specifications for test substrates*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6927 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Principle

Test specimens are prepared in which the sealant to be tested adheres to two parallel contact surfaces. After immersion of the test specimens in water under defined conditions, they are subjected to repeated extension and compression movements in a suitable device, at an amplitude which is 50 % of that used in the test to assess the respective movement accommodation factor. This procedure is repeated a number of times, or until failure of one or more test specimens is observed. The number of repetitions of water immersion followed by extension/compression movement is related to the expected water resistance in service.

Water immersion may be carried out either at ambient temperature (23 °C), or at elevated temperature (40 °C or 50 °C) to accelerate the influence of the exposure to water.

5 Apparatus

5.1 Substrate materials, used for the preparation of test specimens, which shall be as defined in ISO 13640. The substrate materials shall be selected from mortar and/or anodized aluminium and/or glass. Other substrate materials may be used as agreed by the parties concerned.

For each test specimen, two substrate pieces of the same material are required with a cross section of dimensions as shown in [Figures 1](#) and [2](#). Test substrates of other dimensions may be used, but then the dimensions of the sealant bead and the area of adhesion shall be the same as those shown in [Figures 1](#) and [2](#).

5.2 Spacers, of cross section (12 mm × 12 mm), with anti-adherent surfaces, for the preparation of the test specimens (see [Figures 1](#) and [2](#)).

5.3 Anti-adherent substrate, for the preparation of test specimens, for example, polytetrafluoroethylene (PTFE) or polyethylene (PE) film, preferably according to the advice of the sealant manufacturer.

5.4 Ventilated convection-type oven, capable of being maintained at $(70 \pm 2) ^\circ\text{C}$, for conditioning according to method B (see [7.3](#)).

5.5 Container, for immersing test specimens in distilled water (conditioning method B).

5.6 Container with heating device, of not less than 10 litre capacity, for immersing the test specimens in water maintained at $(23 \pm 2) ^\circ\text{C}$, $(40 \pm 2) ^\circ\text{C}$ or $(50 \pm 2) ^\circ\text{C}$.

5.7 Test machine with a recording device, capable of executing extension/compression cycles and extension at a rate of $(5,5 \pm 0,5) \text{ mm/min}$.

5.8 Separators for extension, of appropriate dimensions to hold the test specimens extended to 6,25 %, 10 % or 12,5 % of the original width or any other width agreed between the parties concerned.

5.9 Clamps for compression, capable of holding the specimens at a compression of 6,25 %, 10 % or 12,5 % of the original width, or any other compression agreed between the parties concerned.

5.10 Measuring device, scaled in intervals of 0,5 mm.

6 Preparation of test specimens

Condition the substrate material and supplies of the sealant in the original closed container(s) for a minimum of 16 h at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 10) \%$ relative humidity. Prepare five test specimens for each substrate material to be used at the same time.

Assemble for each test specimen, two substrates ([5.1](#)) and two spacers ([5.2](#)) according to [Figures 1](#) and [2](#) and place them on the anti-adherent substrate ([5.3](#)).

Follow the instructions of the sealant manufacturer concerning, for instance, whether a primer is to be used and the mixing procedure for multi-component sealants.

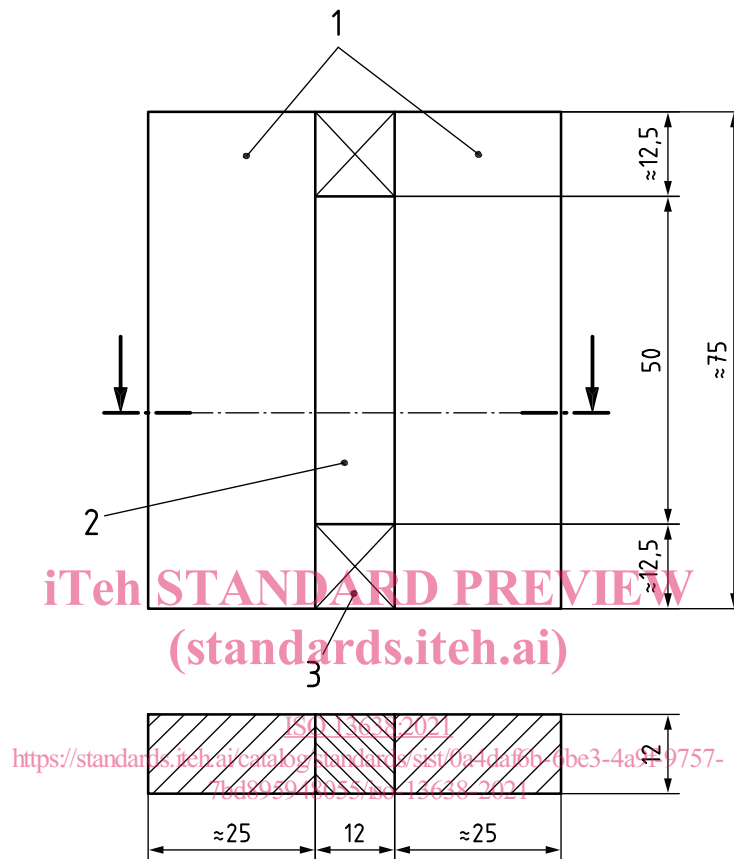
Fill the hollow volume formed by the substrates and spacers with the sealant. Take the following precautions:

- a) avoid the formation of air bubbles;
- b) press the sealant on the inner surfaces of the substrates;

c) trim the sealant surface so that it is flush with the faces of the substrates and spacers.

Set the test specimens on the edge of one of the substrates and remove the anti-adherent substrate as soon as possible. Let the specimens rest in this position to allow curing or optimum drying of the sealant. Maintain the spacers in place during conditioning.

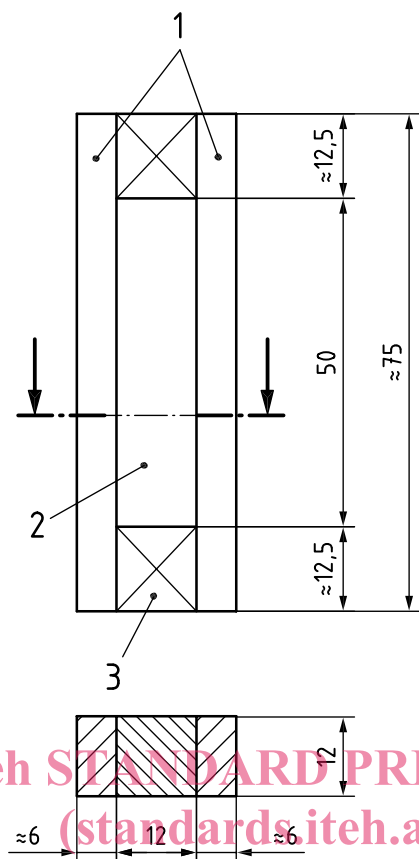
Dimensions in millimetres



Key

- 1 mortar substrates
- 2 sealant
- 3 spacer (5.2)

Figure 1 — Test specimen with mortar substrates

**Key**

- 1 aluminium or glass substrates
- 2 sealant
- 3 spacer (5.2)

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Figure 2 — Test specimen with anodized aluminium or glass substrates**7 Conditioning****7.1 General**

Condition the test specimens in accordance with either method A or method B, as agreed between the parties concerned.

7.2 Method A

Condition the test specimens for 28 days at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 10) \%$ relative humidity.

7.3 Method B

Condition the test specimens according to method A and then subject them three times to the following storage cycle:

- a) 3 days in the oven (5.4) set at $70 ^\circ\text{C}$;
- b) 1 day in the container (5.5) filled with distilled water maintained at $23 ^\circ\text{C}$;
- c) 2 days in the oven (5.4) set at $70 ^\circ\text{C}$;

d) 1 day in the container (5.5) filled with distilled water maintained at 23 °C.

Alternatively, this cycle may be performed in the order c), d), a) then b).

NOTE Method B is a commonly used conditioning procedure using the influence of heat and water. It is not suitable for giving information on the durability of the sealant.

8 Procedure

8.1 Water immersion

After conditioning, remove the spacers and store the test specimens for 3 weeks in the container (5.6) filled with distilled water maintained at 23 °C, 40 °C or 50 °C. At the end of the period of immersion, remove the test specimens from the water and store them for 1 h at (23 ± 2) °C and (50 ± 10) % relative humidity.

8.2 Cyclic movement

The movement accommodation factor for the sealant shall be determined by the method of ISO 9046 or ISO 9047, as appropriate by reference to ISO 11600.

The amplitude of the extension/compression cycle in the test machine (5.6) shall be 50 % of the movement capability classification according to ISO 11600.

The speed of extension and compression used in the cyclic test procedure shall be $(5,5 \pm 0,5)$ mm/min and the amplitude $\pm 6,25$ %, ± 10 % or $\pm 12,5$ % of the nominal width, or as required. The procedure shall be carried out at (23 ± 2) °C and (50 ± 10) % relative humidity.

First extend the test specimens by the requisite amount and maintain this extension for 24 h. Then release the extension and compress the test specimens to the requisite amount. Maintain this compression for 24 h.

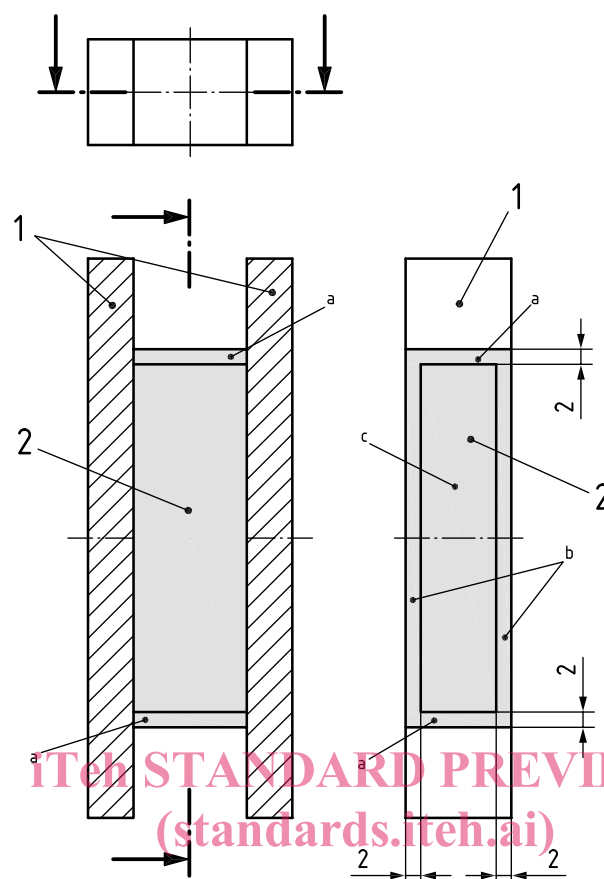
Repeat this extension/compression procedure twice. At the conclusion of the third cycle, release the compression and allow the specimens to recover for 1 h in air at (23 ± 2) °C.

8.3 Visual inspection

Carefully examine the test specimens for any loss of cohesion or adhesion. Measure the depth of any adhesive or cohesive failures using a suitable measuring device (5.10) capable of reading to 0,5 mm.

Because of the excessive stress experienced by the sealant near the ends of the test specimens, during both the preparation and testing, loss of adhesion or cohesion observed within the excluded volume $2 \text{ mm} \times 12 \text{ mm} \times 12 \text{ mm}$, at either or both ends of the sealant, shall not be reported as a failure (see Figure 3).

If loss of adhesion or cohesion in the depth of the sealant exceeds 2 mm, anywhere on the sealant surface, the sealant test specimen has failed (see Figure 3).



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Key

- 1 substrates
- 2 sealant
- a Zone A: Failure in the excluded volume 2 mm × 12 mm × 12 mm is allowed and not reported.
- b Zone B: For Subclass E sealants, failure ≤ 2 mm is allowed, but reported with the test results.
- c Zone C: For Subclass E sealants, failure extending from the sealant surface into this region (i.e. > 2 mm deep) is not allowed. The test specimen fails and the failure is reported with the test results.

NOTE Loss of adhesion or internal voids observed solely in Zone C (e.g. as seen through a glass substrate) are not reported in the test report as failures, but mentioned as general observations with the test results.

Figure 3 — Sections through sealant test specimen

8.4 Repeat of water immersion and cyclic movement

If none, or only one, of the five specimens shows loss of adhesion or cohesion in the depth of the sealant exceeding 2 mm, all the specimens shall be returned to storage in distilled water at the same temperature as for the first immersion. Then repeat the procedures described in 8.1 to 8.3 and record the results of the visual inspection.

This procedure shall be repeated at least 3 times and as many times as agreed between the parties concerned, or until two or more specimens show loss of adhesion or cohesion in the depth of the sealant exceeding 2 mm, after repetition of the water immersion and cyclic movement procedures.