FEICA The European voice of the adhesive and sealant industry

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TM 1004:2013

Determination of the Dimensional Stability of an OCF[1] Canister Foam

1. Scope

This test method describes how to determine the dimensional stability (shrinkage or expansion) of cured foam under extreme and typical conditions.

2. Short description of procedure

The foam is dispensed in the gap between two boards. After full curing, the dimensional stability of the foam is determined by measurement of the distance between the panels over several days and weeks.

3. Background and purpose

Typically OCFs tend to shrink within the first few days after curing due to gas release from the closed cells. The vanishing propellant leaves an under-pressure in the cells resulting in a shrinking of cell size, therefore the whole foam shrinks. This effect is usually compensated over several days by the slower permeation of air.

Shrinking foam can affect the sealing of joints by separation from the surfaces or deformation of the joints. The degree of shrinkage depends not only on the OCF formulation, but also on the environmental conditions like humidity.

4. Equipment

For each measurement:

- 2 wooden boards (chipboard P3 or P5 to EN 312), size 200 mm x 100 mm x 10 mm
- 2 spacers, thickness 20 mm, length 90 mm
- 2 screw clamps

Further tools:

- sharp cutter
- slide rule, accuracy 0,01 mm
- controlled climate chamber
- water bath

[1] **OCF**: Generic term for moisture-curing or physically drying foam as well as self-curing activatable foam extruded as a froth from single pressurised containers.

5. Procedure

It is necessary to carry out at least three measurements to obtain a statistically relevant mean value.

5.1 Preparation

Bring the test canister to the test temperature for at least 24 h.

The wooden boards should be stored at norm conditions (23 °C/50 % r. h.) for at least 1 week.

One setup consists of two plates and two spacers. Marks are put on the boards (Figure 1). At these marks the width will be measured (Four reading points per joint).

5.2 Experimental procedure

When pre-moistening is required, the boards are wetted abundantly (see 5.2.1).

Two component foams (or "1.5" component foams) usually don't require moisturised substrates. See 5.2.4 "storage conditions".

5.2.1 Assembling

The chipboard pieces and spacers are put together as follows:

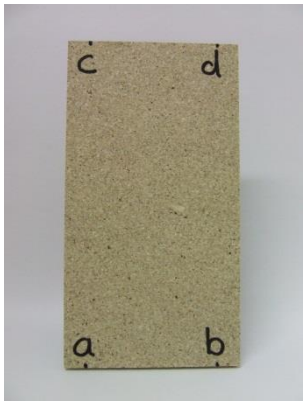


Figure 1: marking of measurement points

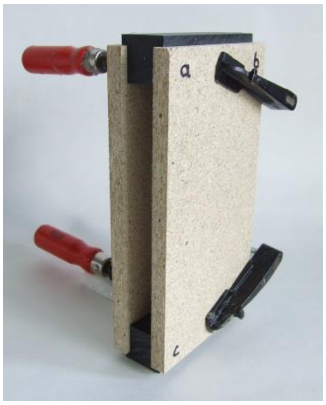


Figure 2: assembly of test plates

The spacers are placed at least 5 mm from the side of the boards to be able to put the slide rule between the boards. The clamps are used to fix the joints (positioned at each corner or in line of the spacers).

Fasten the clamps with moderate force to avoid deformation of the boards.

When pre-moistened, the clamped boards are immersed in water for 20 sec, taken out and stored horizontally for two minutes, until excess water drips off (Figure 3). The foaming must be started within the next 30 sec.

Important: Dry and pre-wetted joints are never put together in one and the same stack.

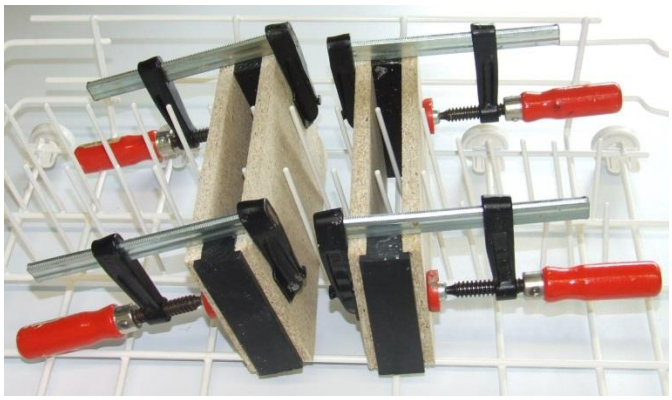


Figure 3: water drip off

Figure 4: ready specimen

5.2.2 Foaming

Shake the canister vigorously 20 times. Discard the first 50 g of foam.

The joints are filled without voids from both sides. Avoid overexpansion of cured foam and fill according to the manufacturer's instructions (typical: gun foam 70 - 80 %, straw foam 40 % – 50 % of joint height).

The stacks are kept upright (Figure 4) at normal condition (23 °C, 50 % r. h.) during the curing period.

5.2.3 Measurement

The standard fixation period (time between foaming and removing clamps) for OCF is 24 hours, for 1.5-component foams the Jig Dwell time is as specified by the manufacturers. In case no fixation time is known, a standard period of two hours is used.

After the fixation period the excess foam is cut away. Before the fixation is removed from the stack, the width of each joint is measured between the boards (inside) at the four corners, using the digital slide rule. The initial value serves as reference value $\mathbf{A_0}$ for the future measurements. In an ideal manner $\mathbf{A_0}$ is identical to the width of the spacers and their dimension can be taken over without further measurement.

The clamps and spacers are removed and the samples are put into the required climate for further storage (Figure 4.). Further measurements are taken after 1 day, 2 days, 3 days, 7 days and 14 days. If the values measured after 14 days still point to significant changes in dimensions, further measurements after 3 weeks and/or 4 weeks may be necessary. Usually the relevant values are received within the first few days as the shrinkage reaches its maximum.

Before the measurements are taken, the stacks are removed from the climate chamber and acclimatised for two hours at normal climate (if stored at different conditions).

The specimens are stored upright all the time.

5.2.4 Storage conditions

Storage conditions should reflect actual end use conditions. The conditions below are provided only as a guideline for extreme results (shrinkage / expansion):

1c foams:

Pre-moistening	Fixation time	Storage conditions
yes	24 h	23 °C/50 % rH
		5 °C or -10 °C
no		40 °C/90 % rH
		30 °C/80 % rH

1,5 and 2c foams:

Pre-moistening	Fixation time	Storage conditions
no	2 h or manufacturer's recommendations	23 °C/50 % rH
		10 °C
		40 °C/90 % rH
		30 °C/80 % rH

6. Evaluation

After each measurement at time ***n*** the mean values are calculated (***An***) and the dimensional stability is determined in reference to A_0 as follows:

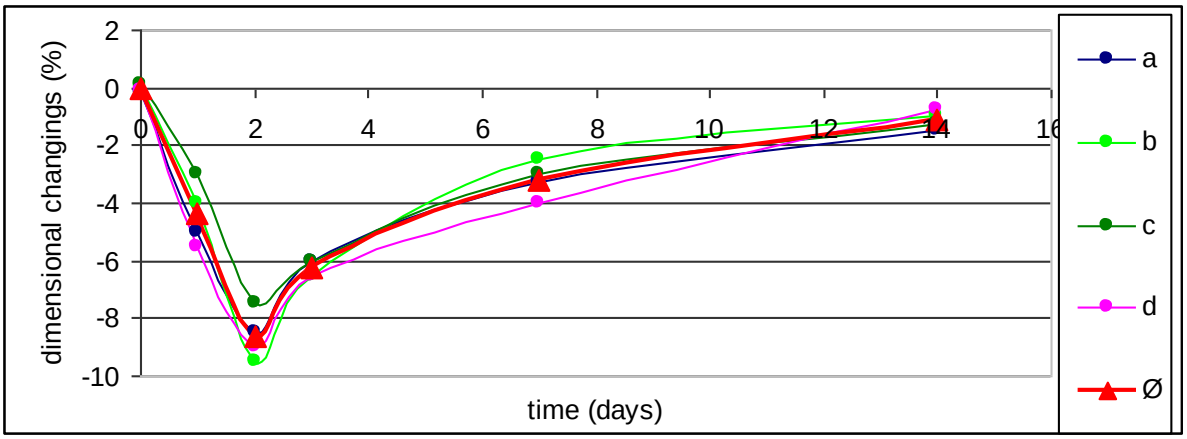
Where: DS_n is the dimensional stability at time *n*
A_0 is the initial value (with clamps still on the stack)
A_n is the value of the measurement at time *n*

From all DS-values per joint, the mean minimum and maximum value per condition is taken for reporting. Please note, that a statistical relevant number of measurements, at least of three joints, must be available to obtain informative results

$$DS_n = \frac{A_n - A_0}{A_0} \cdot 100\%$$

Example (1 joint, 1 condition)
The reported figure was -8.6 % (extreme mean value)

time		dimensional changing								
		a		b		c		d		Ø
date	days	mm	%	mm	%	mm	%	mm	%	%
18.5	**0**	20,00	**0,**	20,00	**0**	20,00	**0**	20,00	**0**	**0,0**
19.5	**1**	19,00	**-5,0**	19,20	**-4,0**	19,40	**-3,0**	18,90	**-5,5**	**-4,4**
20.5	**2**	18,30	**-8,5**	18,10	**-9,5**	18,50	**-7,5**	18,20	**-9,0**	**-8,6**
21.5	**3**	18,80	**-6,0**	18,70	**-6,5**	18,80	**-6,0**	18,70	**-6,5**	**-6,3**
25.5	**7**	19,35	**-3,2**	19,50	**-2,5**	19,40	**-3,0**	19,20	**-4,0**	**-3,2**
1.6	**14**	19,70	**-1,5**	19,80	**-1,0**	19,75	**-1,3**	19,85	**-0,7**	**-1,1**



7. Revision

Version	Date	Remarks
2	19 February 2013	Released at the OCF TTF meeting on 19 February 2013.

8. Contact

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