Technical Specification No.4

Determination of settling

Revision index	Effective date
B	15/02/2015

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ASSOCIATION REGISTERED (LAW OF 1ST JULY 1901) AS AN APPROVED CERTIFYING BODY NO. 19 (LAW 7823 OF 10TH JANUARY 1978)
CSTB - LNE

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1 Preamble

Settling is the term given to the loss of thickness over time in bulk products blown onto the floors of roof spaces, or the loss of potential height of products applied by injection inside walls. In the case of products blown onto the floor of roof spaces, this settling is taken into account in the calculation of thermal resistance of the procedure. For products applied by injection inside a wall, settling must be non-existent to avoid loss of insulation in the upper part.

This Technical Specification defines the methods of determining settling for these procedures.

2 Methods of determination for products applied by blowing onto the floor of the roof space

2.1 Bulk products which come under a harmonised European standard

For products coming under harmonised European standard NF EN 14064-1, settling may be determined according to one of 3 methods described in §4.2.3.2 of standard NF EN 14064-1. In the laboratory, settling is determined according to appendix K of standard NF EN 14064-1. The settling class is expressed in accordance with standard NF EN 14064-1.

For products coming under harmonised European standard NF EN 15101-1, settling may be determined according to the method described in §4.2.2 of standard NF EN 15101-1. In the laboratory, settling is determined according to appendix B of standard NF EN 15101-1. The settling class is expressed in accordance with standard NF EN 15101-1.

2.2 Bulk products which do not come under a harmonised European standard

Settling is determined by a laboratory test during which the test specimens are subject to hygrothermal change.

2.2.1 Number of test specimens

Two test specimens measuring 600 ± 10 mm by 600 ± 10 mm by 300 ± 20 mm are obtained by blowing into frames including 9 equidistant rulers graduated in 1 mm divisions, disposed vertically according to the method defined in paragraph 2.2.2, based on samples taken.

2.2.2 Preparation of the test specimens

The frames can be prepared by using prefabricated wood or polystyrene panels.

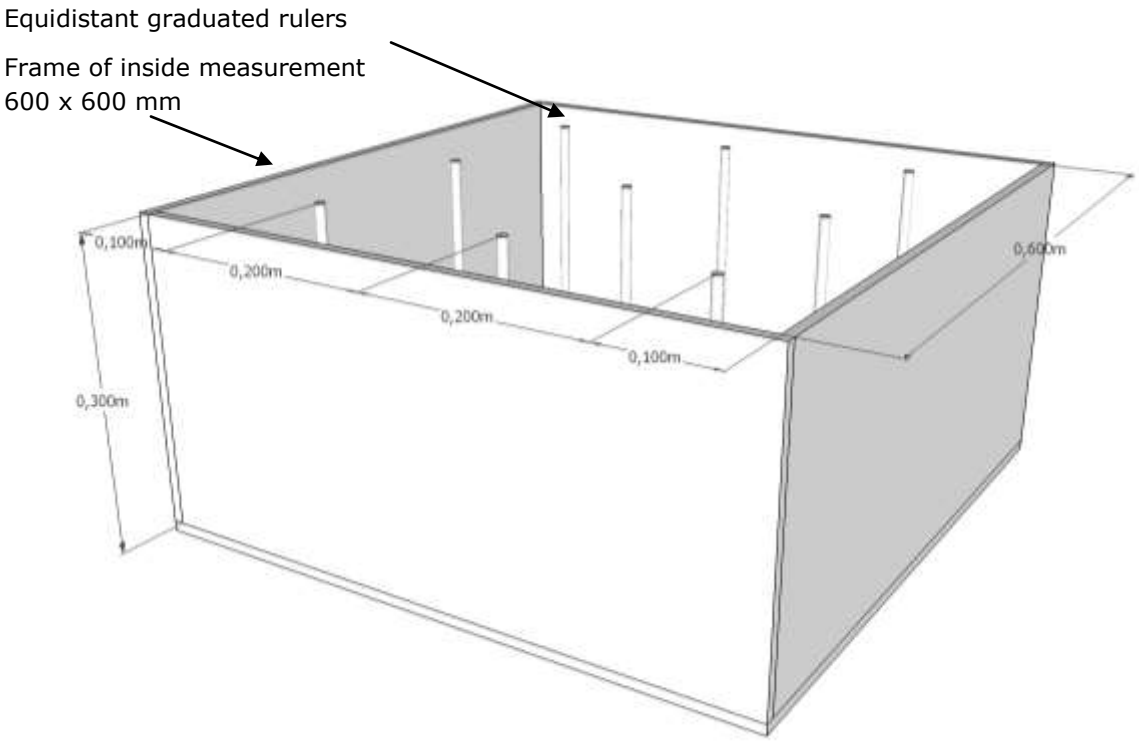


Figure 1: Basic diagram, frame for settling test specimen with cyclic dry/wet conditioning

The product is then blown into the frame using a pneumatic machine according to the recommendations in Technical Specification No.8.

2.2.3 Conditioning

The test specimens should be handled with care and moved as little as possible.

Before the test, the specimens are stored for 6 hours at 23 ± 2°C.

The specimens are then subjected to 4 28-day cycles including, for each cycle:

- 14 days at 23±1°C and 85±5% RH
- 14 days at 50±2°C and 15±5% RH

2.2.4 Measuring method

The thickness of the specimen is defined as the average of the 9 individual thicknesses measured using the graduated rulers in the specimen. These measurements are performed without pressing using the graduated rulers placed in the frames.

To determine settling, the thickness of the specimen is measured before starting the test (after the specimen has been prepared) and on the last day of each cycle, giving a total of 5 measurements.

Settling s of each test specimen is expressed as a percentage, to the nearest tenth of a percent, according to the initial thickness measured after application by the equation:

$$s\ (\%) = \frac{\Delta e}{e_i}$$

with $\Delta e = e_i - e_f$: variation of the thickness in mm

where:

- e_i (mm) is the average of the individual thicknesses of a test specimen measured after preparing the specimens.
- e_f (mm) is the average of the individual thicknesses of a specimen measured after four complete cycles.

The result of the test (settling S) is the average settling of the two specimens, rounded to the nearest percentage:

$$\text{S: Settling (\%)} = \frac{1}{2}\left(\sum \frac{\Delta e}{e_i}\right)$$

2.2.5 Expression of the results

The previous value S is used to calculate the thermal resistance.

The settling class of the product is determined according to the following table:

Class	Requirement
SH 01	No measurable settling (≤ 1%)
SH 05	$S \leq 5\%$
SH 10	$S \leq 10\%$
SH 15	$S \leq 15\%$
SH 20	$S \leq 20\%$
SH 25	$S \leq 25\%$
SH 30	$S > 25\%$

3 Methods of determination for products applied by injection inside walls

3.1 Determination of settling by vibration

3.1.1 Principle

The test is performed by applying the product by injection into a framework wall according to the application recommendations in the Technical File, the Technical Assessment or the Technical Application Document concerning walls. The specimen is subjected to a series of vibrations.

Settling is determined by measuring the height of the product in the frame before and after the series of vibrations.

3.1.2 Number of test specimens

A single specimen is tested.

3.1.3 Preparation of the test specimen

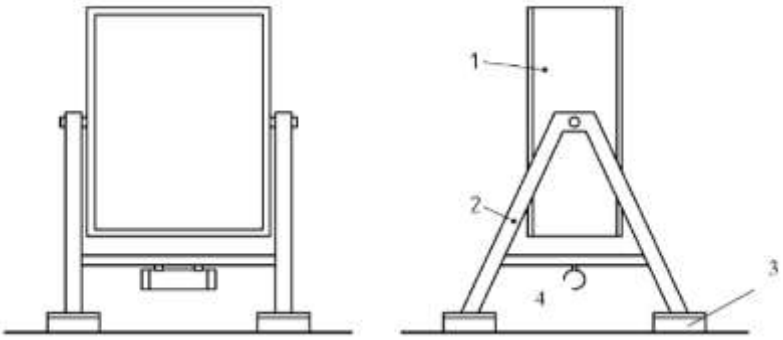
The framework for the specimen is manufactured according to standard NF EN 15101-1 appendix B §B2.

The specimen is constituted of a closed frame made of wood 16 mm thick having a height of at least 2300 mm. The depth of the frame is at least 100 mm and a maximum of the thickness stated in the Technical Assessment or Technical Application Document.

3.1.4 Test device

The test device is described according to standard NF EN 15101-1 appendix B § B2.

It consists of installing the test specimen vertically on the test device table. Vibrations are then applied to the specimen using the device (electric motor).



1. Specimen
2. Device support
3. 100 mm of acoustic insulation
4. motor

Figure 2: Example of mechanical settling device using vibrations

3.2 Determination of settling by hygrothermal variation

3.2.1 Principle

The tests are carried out according to appendix K of standard NF EN 14064-1:
On the basis of four 28-day cycles according to § K.4.

3.2.2 Creating the samples

As test specimens are not provided for in the standard, the models for the tests are created as follows:

They are made up of two identical casebays with the following dimensions and made out of the following materials:

The front walls measure at least 560 mm X 2200 mm on the inside:

- one of the walls (the rear wall) is made of aerated concrete that is 50 mm thick all the way up and includes 6 exterior reinforcements forming 5 frames

- the front wall is made of 10-mm thick translucent plexiglass Two measurement rulers with 1-mm increments are placed in the inside of the wall at a distance of 200 mm from the top of the wall and 180 mm from each edge. A line is drawn at 1% of the height of the wall indicating the settling limit S1. The side walls are made of plywood panels, at least 250 mm x 2200 mm and 30 mm thick.

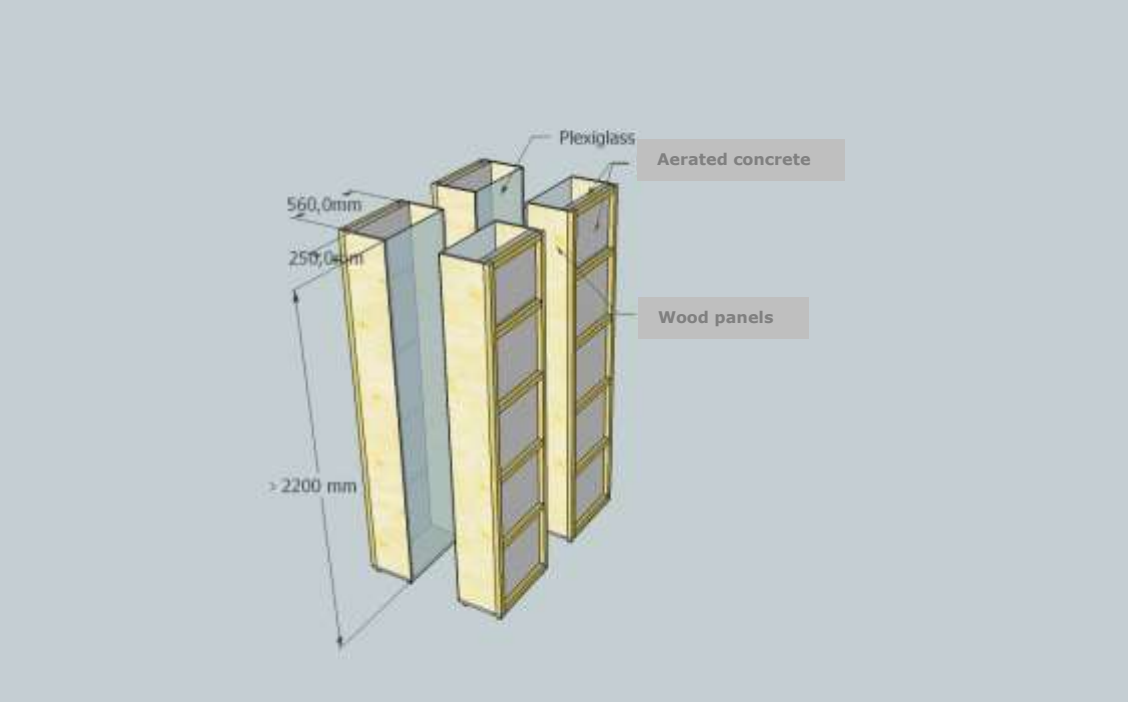
The floor panel is made of plywood panels, 250 mm x 560 mm + the thickness of the walls.

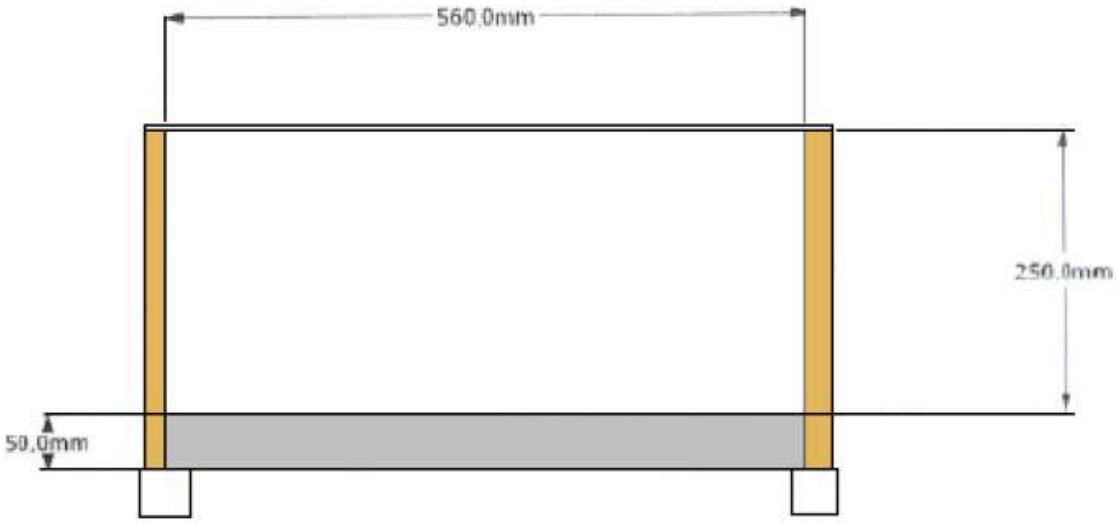
The ceiling panel is made of a perforated plywood panel (to serve as a vent) with a fine metal mesh on the inside and with a hole in the middle that is the same diameter as the injection pipe.

The walls are screwed together and the casebays can be placed on casters so that they can be moved.

The product quantity must be validated and verified. One of the methods involves weighing the casebay prior to and after injection.

See details below:





View from above

3.2.3 Operating procedure for filling the test specimen (both casebays)

1. The machine must be adjusted (air flow, rotation speed, type of nozzle and specified diameter, etc.)

2. The amount of product required to obtain the recommended density is placed in the cavity of the machine.

3. The pipe with or without a nozzle (depending on the manufacturer's instructions) is inserted towards the back of the casebay using the hole for that purpose in the ceiling panel.

4. The machine is turned on, injection begins and the operator raises the pipe slowly in 300-mm to 500-mm increments (depending on the flow rate) to ensure the right mass is put in place during the filling procedure.

5. Filling stops when the entire amount has been injected

6. The casebay is weighed (if this method is being used)

7. The settling test can start after a stabilisation period of 6 hours at 23°C +-2K and 50%RH +-5%

3.2.4 Settling measurement

The settling measurement is carried out on both casebays:

- At each cycle period, the average of the two measurements read on the rulers of each casebay is calculated.

Then after measurements have been taken for all cycles, settling is expressed as a % of the initial height installed and the value obtained is verified as being lower than the permitted maximum value.

4 Test methods for factory production control

4.1 Determination of settling by mechanical impact

4.1.1 Principle

This test is authorised for products to be used for blowing onto the floor of the roof space. The test is conducted by blowing the product into a box or frame. The specimen is subjected to a succession of impacts. The thickness is measured before and after mechanical settling.

4.1.2 Number of test specimens

A single specimen is tested.

4.1.3 Preparation of the test specimen

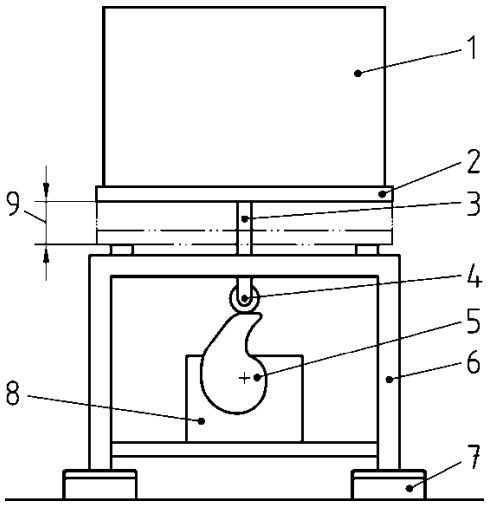
The framework for the specimen is manufactured according to standard NF EN 15101-1 appendix B §B3. The dimensions are (550 ± 5) mm x (550 ± 5) mm x (330 ± 5) mm.

A blower machine is required to blow the insulation product. Blowing is performed in the same way as for preparation of the thermal test specimens

4.1.4 Test device

The test device is described according to standard NF EN 15101-1 appendix B §B3.

It consists of installing the test specimen horizontally on the test device. 20 test cycles are then performed, each cycle consisting in lifting the specimen vertically from its horizontal position 50±5 mm upwards using the device and then allowing the specimen to fall back onto the table of the device.



1	Specimen	6	Device framework
2	Mobile metal frame	7	Shock absorber
3	Shaft	8	Height to which the specimen is lifted
4	Ball bearing	9	Device motor corole
5	Disk		

Figure 3: Horizontal mechanical settling test device

4.1.5 Thickness

The thickness of the test specimens is determined by measuring at a central point using a 20 ± 1.5 Pa pressure distribution panel of dimensions 200 mm x 200 mm fitted with a measuring device (system with a needle and graduated ruler).

4.1.6 Length and width

The lengths and widths of the samples and test specimens are equal to the lateral inside dimensions of the frames used.

4.1.7 Density

The density of a specimen is determined from the weight of product applied, measurement of the thickness before the product has been subjected to the shaking cycle, determined according to the method in paragraph 4.1.5 and the inside surface of the frame. The apparent density (ρ_a) of the test specimens is determined according to standard NF EN 1602.