Technical Specification No.8

Production of test specimens for bulk products

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1 Principle

Unlike products in panels and rolls, test specimens for bulk products require specific preparation.

For products to be blown or injected, the product is applied in a test frame adapted for the application method and described in each test procedure.

2 Common requirements for blowing and injection

2.1 Blowing or Injection Equipment

a) General Case :

The blowing (injection) must be performed using a commercial type machine in compliance with the manufacturer's instruction, (air flow, material flow).

The equipment must be periodically verified and maintained in accordance with the manufacturer's instructions so that there are no deviations due to the machine and so that there is no impact on the result.
For a given equipment, at least the following parameters must be defined, verified, and justified periodically:

- air flow
- carding machine rotation speed
- mechanical operation of the rotating parts
- conditions of the lock gate blades
- airtightness at the lock gate
- pipe condition must be verified every 500 operations, if wear is observed the pipe must be changed. Otherwise changing the pipe should be considered every 2000 operations.

Pipe:

- Flexible ringed pipe:
    - 80mm diameter, smooth inside, minimum length 40m for mineral wool.
    - 63mm diameter, rugged (ringed) inside, minimum length 30m for cellulose wadding and other products.
- All pipe fittings should be achieved using a collar in order to avoid air leak.

Equipment settings:

- Settings should be adapted in order to achieve density values within the range of declared values. Before preparing the samples, set the equipment in a way that the density range corresponding to the application technique is obtained.

Note: Equipment type, length and diameter of the pipe, and settings used to make the samples must be indicated in the test report.

b) Case of blowing with the Applicant / Holder machine for bulk cotton products

The provisions of (a) are applicable, the manufacturer must submit a technical data sheet from the machine to the pilot.

The manufacturer shall provide a test protocol specifying at least the following information:

- Method of feeding the machine. Spilled bag completely or not, manual or mechanical separation.
- Blowing distance adapted to allow a homogeneous filling of the frame
- Machine settings: air flow, speed of rotation or any other settings affecting the characteristics of the product.

In this case, the reference of the machine(s) used both for the on site application and the laboratory test is indicated on the certificate of the product.

2.2 Blowing/Injection method

The machine must be loaded with a sufficient insulating material quantity in order to ensure a regular flow during the full duration of the sample preparation.

The distance depends of the machine type and the settings. When starting the machine, the nozzle should point away from the test specimen frame. The same machine settings must be used both for the thermal properties test and the density test of the specimen.

Machine loading:

- The material should be loaded into the machine with entire bags, or if necessary by half-bags.
- For cellulose wadding products, or a product requiring such:
    - The material from first bag should be manually disaggregated to start the mixer
    - For the first bag in an empty machine, proceed with the manual disaggregation during 1 minute, while blower is off.
- During the blowing, the machine should be permanently loaded with material to ensure a regular flow as the whole sampling preparation process is carried out. Especially, for cellulose wadding products, the material level should be permanently above half of the hopper height.*

* Considering the actual laboratory equipment specification.

3 Sample preparation for blowing and injection

3.1 Blowing

In addition to conditions layed out in Annex C (§C.2.1) of NF EN 14061-1 or NF EN 15101-1 or other products not covered by a harmonized standard, sample preparation in frames are performed using the following method:

3.1.1 Preparation of the frames

3.1.1.1 General Information

The frames must be made of a rigid material, e.g. plastic cellular insulation or wood. The base of the frame must be constituted of a thin material, with a negligible contribution to the total thermal resistance, e.g. a sheet of polyethylene plastic. To obtain a flat base for the frame, a rigid panel must be placed under the plastic sheet to support it during blowing and transport.

During conditioning, the product is likely to settle. To take account of this possible settling and avoid the presence of air pockets between the surface of the insulation and the panels of the measuring device, an extra thickness of 20% of the sample height, made of rigid material, is applied (that is 20mm for a frame thickness of 100mm), is attached temporarily above the frame. The product is then blown into the cavity thus produced.

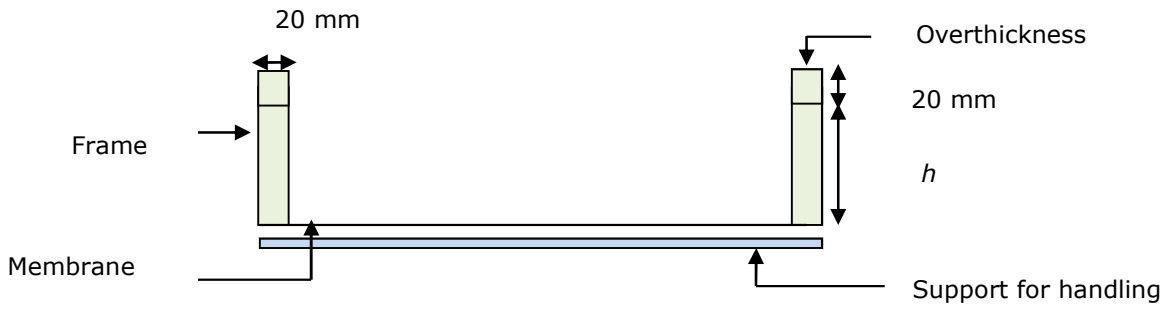

Figure 1 - Example of frame: general diagram, vertical cross-section

3.1.1.2 Specific conditions for the frame of thermal test samples

The frame has nominal dimensions equal to the test equipment requirements, and a "h" height that is compatible with the maximum thickness range of the test equipment.

Test performed by a pilot laboratory are using frames of 600x600mm dimensions, and a height of h=100mm.

3.1.1.3 Specific conditions for the frame of the density samples

The frame has inner dimensions of 2 x 1 x 0,2m.

3.1.2 Blowing Method

3.1.2.1 Common conditions for blowing of the density and thermal test samples: Blowing equipment

The frame must be placed within a few meters range facing the blowing equipment nozzle (about 2.5 meters distance)

Blowing of the product

- At start (or any re-start) of the equipment, the nozzle must be pointed away from the frame.
- After a regular material flow is observed, start filling the frame according to the method for the relevant application technique.
- Blow in a constant, regular way from one side of the frame to the other, and about 0.5m further away from the frame side each time.
- Keep the nozzle horizontal, at a heitgh of about 0,8 to 1,1m above the frame. The operator should be standing at a distance allowing the material to fall into the furthest parts of the frame (about 2,5m distance). The nozzle should not be pointed up or down during the preparation.
- Split the filling in 2 steps: When the frame is half filled, point the nozzle away from it, and turn the frame at 180°. If the equipment is stopped, restart it acc. to first point.
- After the blowing, the surface of the sample must be made even. The excess of material is removed using an appropriate tool (ruler, or brush) avoiding any additional settling.

Note: Using a stand to ensure an horizontal position and a reproductible blowing from side to side may be used to avoid discrepancies between different operators.

In the event of the blowing is performed using the equipment of the applicant/holder (for loose-filled cotton fibers products), the above method should be adapted in accordance to the method provided as indicated in §2.1.b

3.1.2.2 Specific conditions for blowing the density test samples

To determine the density of each sample, 2 test pieces are blown.

Weigh the empty frame before blowing. Take note of the weight w1 (kg).

Blowing should be made in the direction of the length. The total quantity of blown material must be limited, to avoid any excessive settling.

After the blowing, the surface of the sample must be made even. The excess of material is removed using an appropriate tool (ruler, or brush) avoiding any additional settling. The height of the sample should be identical to the height of the frame.

Thickness measurements are performed within 1mm accuracy. 8 measurements must be performed at different locations of the frame, acc. to EN 823 but using a plate of (20 ± 1,5) Pa and (200 × 200) mm.

The "d" thickness of the sample is the average of the 8 measurements.

Take note of the filled frame, w2 (kg).

$$\rho_i = \frac{w_2 - w_1}{A \times d}$$

The density of the sample (in kg/m^3) is:

Where A is the area of the frame (in m^2).

3.1.2.3 Specific conditions for blowing the thermal conductivity/resistance test samples

The test pieces are obtained using frames prepared as in §3.1.1. after density test.

The distance of blowing must be at least 2,5m of the frame side, in a way that the material may fall at the center of the frame.

The target density for thermal tests must take account of this possible settling. During blowing, the applier shall check the weight of product blown into the frame with the extension and shall deduce the density of the test specimen based on the same weight in the frame without the extension.

The target density of the thermal test samples should be within a 10% difference as compared to the density test samples.

After the blowing, the surface of the sample must be made even. The excess of material is removed using an appropriate tool (ruler, or brush) avoiding any additional settling. The height of the sample should be identical to the height of the frame.

To verify the above conditions, the weight and thickness of the thermal test samples should be checked before starting the thermal testing.

The extension must be removed during the thermal test.

3.1.3 Compliance test

The overall density of the thermal test specimen is used for verifying thermal compliance.

The insulation must have a flat surface and be evenly distributed over the test specimen. Carefully take the specimen to the thermal conductivity measuring device. Place the specimen in the device by sliding the frame and the sheet that make up the base from the carrier plate towards to the lower plate of the thermal conductivity measuring device. After measuring the thermal conductivity, the filled frame and the carrier plate must be weighed again.

3.2 Application by injection of products coming under standard EN 14064-1

The test specimens are produced according to the procedures in appendix C (§C.2.2) of standard NF EN 14064-1.

3.3 Application by injection of products covered by NF EN 15101-1 or not covered by a standard.

In application of §4.2 of Product Guidelines n°14, for a product covered by EN 15101-1, the manufacturer may request the use of the method described in the above §3.2.

3.3.1 Preparing the frames for measurement of the density

The frames can be made of polystyrene or wood according to the sketch below.

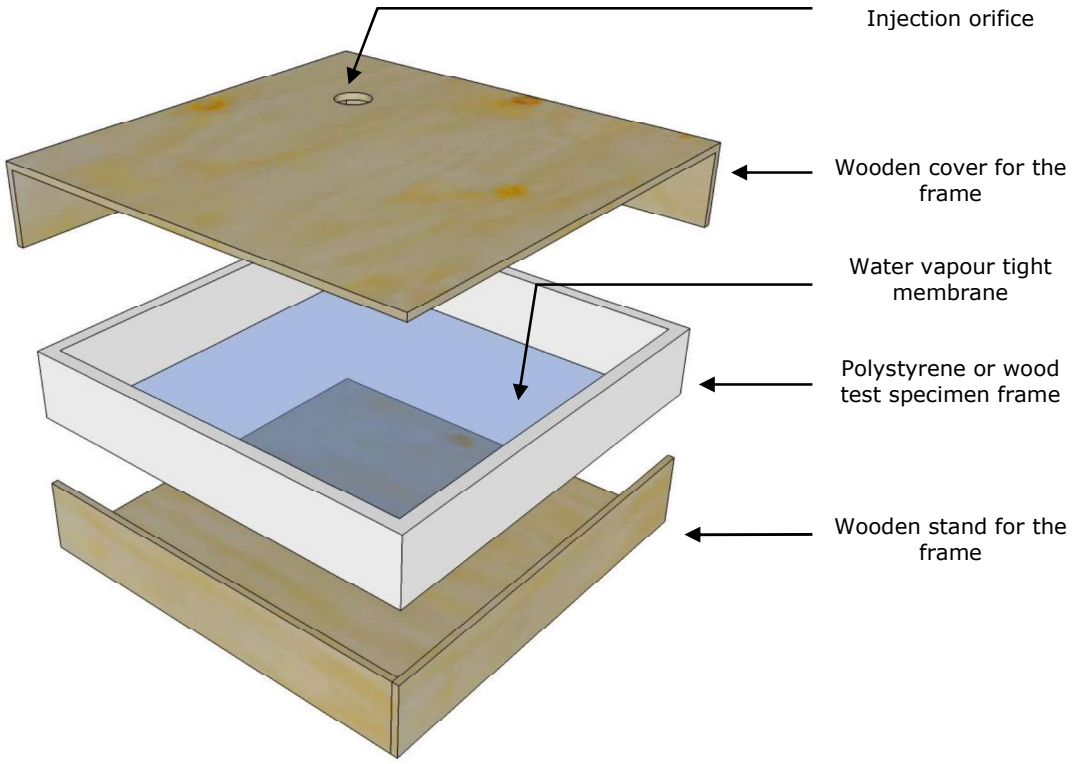

Figure 2 - Schematic diagram of a test specimen for injection

3.3.2 Application of the product by injection

Injections should be performed using a commercially available blowing equipment in accordance with the manufacturer's instructions, including the type, length and diameter of the flexible pipe, the perforation disposition and the machine settings.

- Measure the dimensions of the closed cavity and calculate its volume
- Place the wooden stand and the polystyrene frame of the test specimen on the balance
- Tare

- Close the frame using the wooden cover and tighten the assembly in order to inject the product under pressure
- Start the machine and adjust the settings
- When the flow of material is regular, place the injection head[1] into the orifice using a rotating nozzle with return air flow (the machine can be stopped temporarily to insert the head)
- Start injecting, then swivel the nozzle in order to fill the test specimen evenly.
- When the cavity is full, stop injecting.
- Remove the cover, weigh and calculate the density of the test specimen as below.
- The test specimens are then conditioned without closing the top.

When the cavity is filled, remove the total quantity of insulating material from inside, and take note of the weigh, w1.

The density of the sample (in kg/m^3) is: $\rho_i = \frac{w_1}{V}$

Where V is the volume of the closed cavity (in m^3).

3.4 Useful parameters for blown and injection applications

The performance of tests relating to the certified characteristics necessitates the use of dimensional parameters. The procedures for determining these parameters are defined in this paragraph.

3.4.1 Thickness

For products coming under standard EN 14064-1: the product standard specifies the procedures for measuring the thickness of the test specimens according to the tests in question (appendix C, J and K of the standard).

For products coming under standard NF EN 15101-1 or not covered by a standard: unless otherwise specified in the test protocol, the thickness of the specimens is determined using the following methods:

- measurement at 4 equidistant points located 100 mm from the edges of the test specimen frame and 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).

3.4.2 Length and width

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

[1] The size of the nozzle is adapted to the dimensions of the test specimen to be produced.

3.4.3 Density

The apparent density (ρ_a) of a test specimen is determined according to standard NF EN 1602 based on the weight of the product applied, the thickness measurements determined according to the method in paragraph 3.4.1 and the inner surface of the frame.

4 Application by wet spraying

This chapter is not applicable to flocking (spray coating) products.

Injections should be performed using a commercially available blowing equipment in accordance with the manufacturer's instructions and suitable for this application technique.

The equipment must be periodically verified and maintained in accordance with the manufacturer's instructions so that there are no deviations due to the machine and so that there is no impact on the result.

4.1 Preparation of the frames

The frames are prepared according to the method described in paragraph 1.1.

4.2 Application of the product by wet spraying

- Connect the wet spraying nozzle to the machine.
- Prepare the water pump and connect it to the spray nozzle.
- Place the frame and its stand on the balance and tare.
- Position the frame vertically
- Adjust the machine's settings.
- Start spraying the insulating material outside the frame.
- When the flow of material is constant, spray the product into the frame.
- When the frame is full, stop spraying.
- Remove the surplus product down to the level of the frame using the levelling device (rotating roller).
- Weigh the test specimen and calculate its density.
- The test specimens are then conditioned without closing the top.

4.3 Useful parameters for wet spraying applications

Performance of the tests regarding the certified characteristics requires the use of dimensional parameters. The procedures for determining these parameters are defined in this paragraph.

4.3.1 Thickness

Unless otherwise stated in the test protocol, the thickness of the test specimens is determined according to the following method:

- measurement at 4 equidistant points located 100 mm from the edges of the test specimen frame and 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).

4.3.2 Length and width

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

4.3.3 Density

The apparent density (ρ_a) of a test specimen is determined according to standard NF EN 1602 based on the weight of the product applied, the thickness measurements determined according to the method in paragraph 4.3.1 and the inner surface of the frame.

The density is also determined on the thermal resistance test specimens.

5 Preparation of test specimens produced by pneumatic spraying of products prepared using mineral wools with binder and additive

The test specimens are prepared at the candidate's factory. They are produced using a spraying machine on a support identified beforehand according to the following protocol:

- Arrange the stand in the same configuration as the target application.
- Connect the wet spraying nozzle to the machine.
- Prepare the water pump and connect it to the spray nozzle.
- Adjust the machine's settings.
- Start spraying the material outside the support.
- When the flow of material is constant, spray the product onto a support of dimensions 700 x 700 mm having a minimum thickness of 100 mm.
- When the support is full, stop spraying.
- The support is then sent to the lead laboratory 4 weeks after spraying to perform the tests.

5.1 Conditioning the test specimens before testing

PHASE	**CONDITIONING**
1st drying phase: Maturing of the product	conditions: 23°C / 50% RH duration: until the weight of the test specimens has stabilised (approximately 6 weeks) verification of the weight: during the first 4 weeks: Once a week; during week 5 and week 6, if necessary: Once every 24 hours weight stability: when the difference between two successive weighings made 24 hours apart is ≤ 0.05 %
2nd phase: Conventional dry state	conditions: oven at 50°C duration: until the weight of the test specimens has stabilised; about 15 days verification of the weight:

	at the end of the 1st week; during the 2nd week: Once every 24 hours weight stability: when the difference between two successive weighings made 24 hours apart is ≤ 0.05 %
3nd phase: Stabilised state at 23°C / 50% HR (termed wet state)	conditions: 23°C / 50% RH duration: until the weight of the test specimens has stabilised; about 15 days verification of the weight: at the end of the 1st week; during the 2nd week: Once every 24 hours weight stability: when the difference between two successive weighings made 24 hours apart is ≤ 0.05 %

5.2 Useful parameters

Performance of the tests regarding the certified characteristics requires the use of dimensional parameters. The procedures for determining these parameters are defined in this paragraph.

5.2.1 Thickness

Unless otherwise stated in the test protocol, the thickness of the test specimens is determined according to the following method:

- Measurement at 4 equidistant points located 100 mm from the edges of the test specimen and 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).

5.2.2 Length and width

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

5.2.3 Density

The apparent density (ρ_a) of a test specimen is determined according to standard NF EN 1602 based on the weight of product applied, the thickness measurements determined according to the method in paragraph 5.2.1 and the inside surface of the test specimen, and the weight of the product measured in the wet state.

6 Preparation of the specimens in production control for determining the density for injection applications for products coming under standard NF EN 14064-1

6.1 Direct method

Method A:

Standard EN 14064-1 provides for a direct test carried out every 3 months. Measures for preparing the test specimen are added to the recommendations in appendix J3.

The test specimen is a metal box made of metal or rigid wood with inside dimensions of 70x500x500 mm.

Three of the outer sides of the box have three 25-mm even-diameter holes along each side.

A metal mesh covers the holes on the inside so that the wool is contained in the box. One of the sides is removable and has quick-release metal openers. It also has a hole with a diameter the same size as the injection machine's nozzle.

The test protocol involves filling the entire volume of the box by injection then collecting the contents for weighing.

Operating procedure for filling the test specimen

1. The box is weighed before the test
2. The machine must be adjusted (air flow, rotation speed, type of nozzle and specified diameter, etc.)
3. The amount of wool required to completely fill the box is placed in the cavity of the machine
4. The pipe with nozzle is inserted in the hole in the box
5. The machine is turned on, injection starts until there is a backflow or until it stops automatically
6. The machine is turned off
7. The box is weighed

After the box has been weighed, the fill density in kg/m3 is calculated and compared to the value for the declared density for the application and for the declared thermal value. The test result is the average of 3 measurements.

The accuracy of the measurement is compliant with that used in measuring the specimen for thermal conductivity.

Method B:

Standard EN 14064-1 provides for a direct test carried out every 3 months. Measures for preparing the test specimen are added to the recommendations in appendix J3.

The measurement is carried out at 23°C +-2K and 50% +-5% relative humidity.

The test specimen for the settling method is modified as follows to measure the filling power:

- the ceiling panel has vents but does not have the injection hole
- the front plexiglass wall has two holes with a diameter identical to the injection tube. The holes have plugs. These holes are located 1.25 m and 2.10 m from the floor, respectively

The product quantity must be validated and verified. To this end, the casebay can be weighed before and after injection.

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 wool required to completely fill the casebay is placed in the cavity of the machine.
3. The pipe with nozzle is inserted in the lower hole of the casebay
4. The machine is turned on, injection starts until it reaches 1.25 m
5. The machine is turned off and the plug is inserted
6. The operator inserts the pipe in the upper hole and repeats the injection operation until there is a backflow. Filling stops when the entire amount has been injected
7. The casebay is weighed

After the casebay has been weighed, the fill density in kg/m3 is calculated and compared to the value for the declared density for the application and for the declared thermal value.

6.2 Indirect method

Standard EN 14064-1 provides for a direct test carried out every 3 months. The measures set out below for preparing the test specimen are added to the recommendations in appendix J3. The method is specified below:

For monitoring density, an indirect test can be carried out. The law of correlation must be established by the manufacturer and validated by the pilot body ACERMI. This indirect test is carried out once every three months.

The principle of the indirect test is to determine the compressibility of the product and to verify that the manufacturing process for the nodules is consistent. This test is used to ensure that the installed density will be effective. For this test, the blowing machine must be periodically adjusted in accordance with the manufacturer's instructions so that there are no deviations due to the machine and so that there is no impact on the result.

For information, for a given injection machine, the following parameters are defined and verified periodically:

- air flow
- carding machine rotation speed
- mechanical operation of the rotating parts
- the mass flow of the product
- the condition of the pipe (replacing the pipe must be considered every 250 blowing operations)

The test involves measuring the density of the wool after blowing and after compression under 500 Pascals to assess the wool's expansion capacity.

The equipment is as follows:

- A transparent cylinder with a bottom inside diameter of 209 ±1 mm and a height of 400 ± 5 mm, equipped with a removable lid.
- A circular compression plate with a diameter of 205 ±1 mm equipped with a graduated rod.
- A rod graduated to the nearest 2 mm is used to measure the height of the compression plate in relation to the bottom of the cylinder.
- A metal cylinder whose mass is such that the total mass for the circular plate, rod and cylinder exerts a pressure of 500 Pa on the glass wool, i.e. 1748 ± 5 grams. This mass is determined according to study CSTB E14-027 for rock wool XXXXX Pa i.e. XXXX + 5 grams. Naturally this mass is adjusted according to the product and is verified by the pilot body
- A calibrated scale accurate to 1 gram and with a minimum capacity of 3 kg

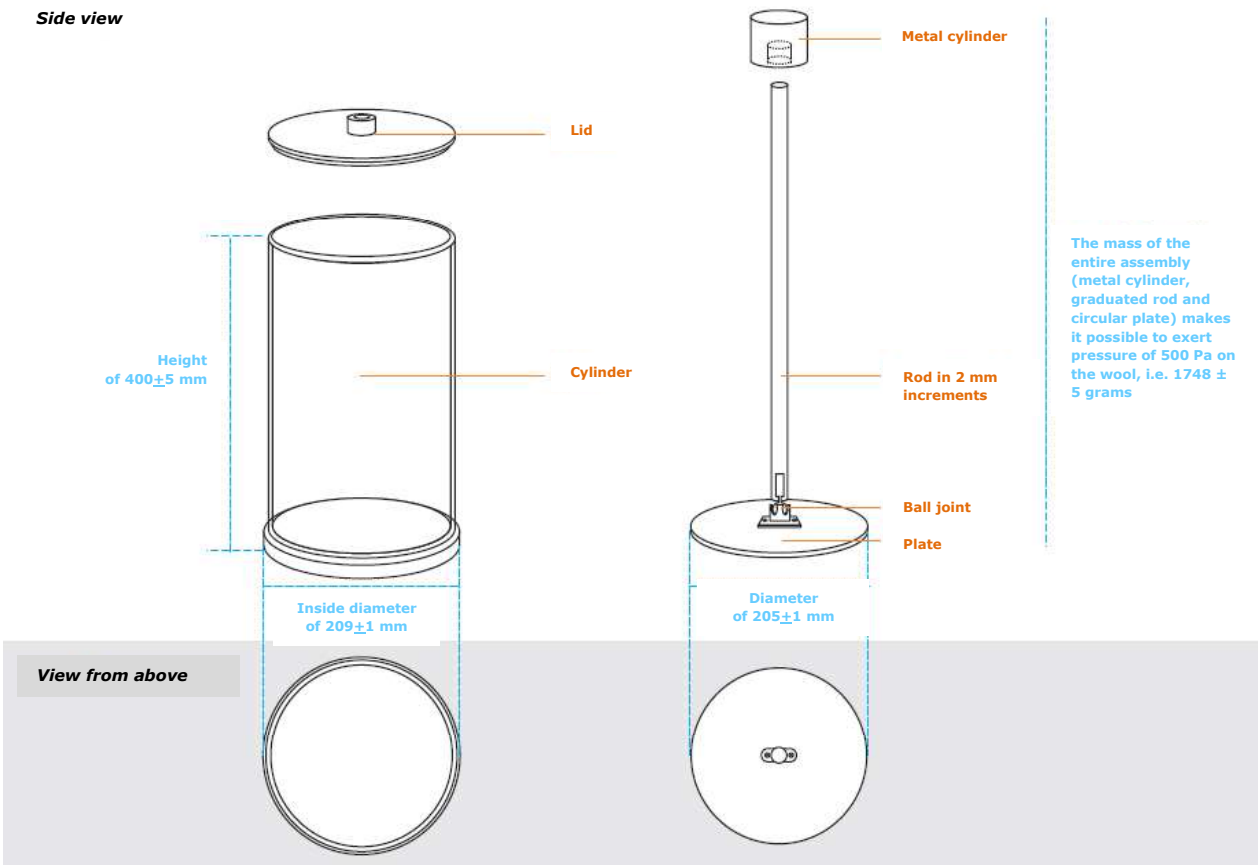

Figure 3 - Diagram of the cylinder

Method for blowing in the cylinder

The specimens are made in accordance with the method set out below:

- Use of a pneumatic blowing machine connected to a pipe with a smooth interior, length 40 m and diameter 80 mm. The machine is loaded with sufficient material to obtain an even flow during the entire duration of the blowing operation. (Supply is from bags poured out completely without separation of the clumps either manually or mechanically). The use of a machine of a different type or a pipe of a different nature or characteristics must have been validated by correlation with the machine described here.
- When the machine is started up, the nozzle (type and diameter must be specified) or the end of the pipe must be pointing away from the specimen frame.
- Once the flow of insulation stabilises, sweep evenly and slowly from one side to the other of the cylinder.
- Hold the end of the blowing pipe horizontal at a height of 0.8 m to 1.1 m. The operator must stand at a distance from the cylinder such that the insulation falls in the centre of the cylinder.

Use of a stand to hold the pipe in order to maintain an even horizontal sweep eliminates any variations attributable to the operator.

- The blowing distances (generally more than 3 m) is adjusted according to the type of machine and whether or not it has a nozzle, and must be such that most of the product is placed inside the cylinder without bouncing off the walls of the zone

Process for preparing the test specimen:

1. Place the cylinder 100 mm from the walls of the zone created by a 90-degree angle of the two walls
2. Put enough wool in the machine to fill the cavity (at least one bag of the product)
3. Blow the wool in the blowing zone for 30 seconds before directing the flow of wool horizontally to fill the cylinder.
4. When the cylinder is half full, stop the machine and turn the cylinder one half turn before filling it completely. The goal of this operation is to fill the cylinder evenly
5. No measures must be taken to remove any surplus whatsoever
6. Place the cylinder on a workbench, then put the lid and the compression plate with the graduated rod in place
7. Place the metal cylinder on the top of the threaded rod and let it drop under the specific weight of the compression plate, slowing its descent manually
8. When the plate has stabilised on top of wool, wait an additional 30 seconds before directly reading the measurement of the plate height (H) on the graduated rod. The measurement is taken at the shoulder of the lid.
9. Remove the compression plate and the metal cylinder to determine the mass of the wool (M) placed inside the cylinder by directly weighing the wool then record the 2 values, H in mm and W in grams
10. The test result is the average of these 2 measurements

Calculating and expressing the result

Calculate the compressed density D in accordance with the formula below

$$D = \frac{M(g)}{H(mm)}.29{,}15$$

Using these results, establish the law of correlation. If the manufacturer cannot establish the law of correlation, this method cannot be used.