DUKO Air tightness test on mock-up - description of method

1. Purpose

Assessment of potential on site airtightness of vapour control layer systems using accessory components.

2. References

EN 13829:2001. Thermal performance of buildings. Determination of air permeability of buildings. Fan pressurization method.

3. Concepts and definitions

Vapour control layer systems
A vapour control layer system will typically consist of installation instructions, vapour control layer membrane, vapour control layer tape, sheet adhesive, possibly primer, membrane collars, inward and outward corners and similar accessories.

DB-no.
Item number in the database "ByggeBasen" at Danish Construction Centres (DB).

GTIN
Global Trade Item Number. This number describes the supplier country of origin for an item, identifies the supplier company as well as the item reference number in the company. The last digit is a control number. GTIN is typically shown below the 13-digit EAN bar code symbol. GTIN is issued by GS1 Denmark.

Installer
Person appointed by the supplier of the vapour control layer system. Responsible for the installation of the vapour control layer system on the mock-up.

Operator
Person operating the equipment for measuring air permeability of buildings during the test. The operator must be certified in accordance with DS/SBC 13829.

Test manager
Person responsible for the test being performed. The test manager must be impartial, as described for certificate holders in DS/SBC 13829 attachment 3.

Item number
Internal number at a supplier of vapour control layer systems, identifying a product included with a vapour control layer system.

4. Principle

Determination of the airtightness of a vapour control layer system using all individual components of the system after installation on a standard mock-up acc. to installation instructions.

5. Equipment

Equipment for measuring air permeability of buildings according to EN 13829.
Smoke machine for theatrical smoke.

Modified mock-up with floor area of 12 m_2 as shown in figure 1-7 and described in table 1-2.

Figure 1. Front view 4 m. Roof surface without skylight. Collar tie in rafters 2 and 3 from the left cut off, in order to fit a vapour control layer to the ridge here. 900 mm from bottom of sole plate to top of wall plate in wall.

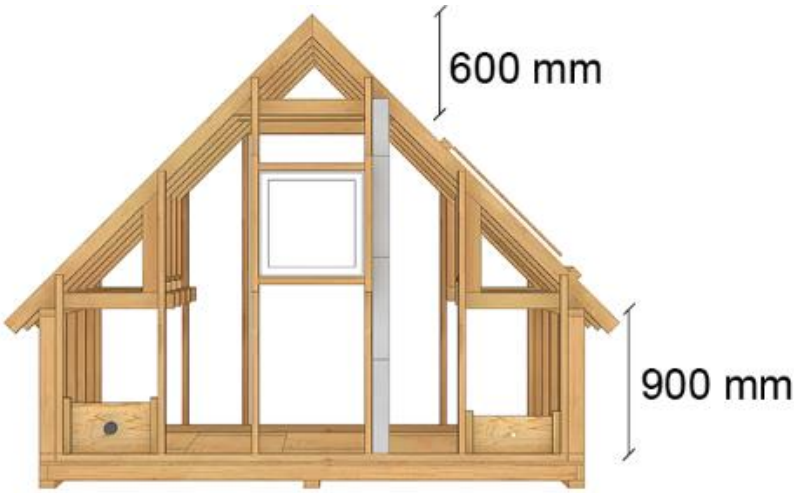

Figure 2. Gable with window and aerated concrete dividing wall. Pitch 45°. Beam ends on left go through vapour control layer 120 mm from outside of knee wall. 150 mm eaves. 600 mm from top of ridge to bottom of collar tie.

Figure 3. Front view. Roof surface with skylight.

Figure 4. Gable with 900 x 2000 mm rough opening, where the equipment for measurement of air permeability of buildings may be fitted. Beam ends on left cut flush with knee wall: 700 mm from inner side of knee wall to outer side of outer wall.

Figure 5. Bottom view of floor structure. Width 3220 mm. Length: 4000 mm.

Figure 6. The 2 rear collar ties are cut off, in order to take the vapour control layer to the ridge. Joints between floor plates to be sealed, e.g. using vapour control layer tape and membrane as necessary. The gable window is placed in a clearance, made using 95 mm battens.

Figure 7. Solid support around penetration points for PP-pipes Ø 75 mm (left) and power cable (right) respectively. The gable window is placed in a clearance, made using 95 mm battens.

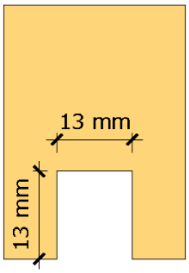

Figure 8. Groove in frame around skylight and window.

Table 1. Material description for modified RTS-mock-up.

Timber frame: 45x95 mm spruce.
Miscellaneous fittings and small strap plates.
Floor: 600 x 2440 x 18 mm spruce plywood (joints between floor plates to be sealed, e.g. using vapour control layer tape and membrane as necessary)
Solid support between rafters and around penetration points: 12 mm plywood, see figure 7.
Window in gable: 600 x 600 mm with groove in frame for fitting, see figure 8.
Skylight: 780 x 980 skylight mock-up. Fitted with a 12 mm plywood plate to the frame, which is sealed with sealant. Groove in frame for fitting, see figure 8. If a specific brand of skylight is prescribed in the installation instructions, this may be used instead when the opening frame is replaced by a 12 mm plywood plate, which is sealed with sealant and attached to the internal frame.
Cable pass-through: 1 m installation cable equivalent to 3 x 1.5 mm_2 750 V PVILD-J
Pipe: ø75 mm PP drain pipe for pass-through.
Aerated concrete dividing wall:
- wall of aerated concrete, see table 2, LxW 400 x 100 mm, height at least 2116 mm, e.g. glued blocks,
- asphalt paper between aerated concrete dividing wall and post. 100 mm width, 2 mm thickness,
- frame screws for fastening aerated concrete dividing wall.

Table 2. Requirements for characteristic material properties of aerated concrete used for dividing wall in mock-up. The aerated concrete cannot be silicone impregnated or filled with putty.

Material property	Characteristic value	Test method
Type	Masonry block category 1	DS/EN 1996-1-1
Compressive strength, medium	4.5 MPa	DS/EN 771-4
Basic compressive strength	3.5 MPa	DS/EN 771-4
Density, dry	535 kg/m^3 ± 15 kg/m^3	DS/EN 771-4
Flatness	≤ 1.0 mm	DS/EN 771-4
Parallelism	≤ 1.0 mm	DS/EN 771-4
Shrinkage	0.2 mm/m	DS/EN 680
Impregnated	No	
Filled	No	

6. Materials

Materials to be supplied by the installer include:

- 2 installation instructions: 1 for the installer, 1 for the test report,
- vapour control layer system,
- accessory parts for vapour control layer system,
- any necessary additional pieces for doors and windows,
- solid supports,
- fixing parts.

7. Test method

7.1 *Identification of vapour control layer system*

The test manager notes the system components included in the test by recording item name, DB-no./item number/GTIN-no. and quantity/pcs. for each component to be included in the test.
The test manager must ensure that the non-used system components do not disappear or "appear" to be used during the test.
The test manager will receive 1 copy of the installation instructions.

7.2 *Timed installation of the vapour control layer system*

The installers (max. 2) are responsible for the installation of the vapour control layer system on the mock-up acc. to the supplier instructions. Installation time must not exceed 360 min. incl. error correction, excl. pre-test.
The test manager must ensure that the installation is carried out acc. to the installation instructions.
The time of commencement of the installation is reported.

7.3 *Pre-testing*

Pre-testing is allowed, where the mock-up is
- fitted with equipment for measuring air permeability of buildings,
- filled with theatrical smoke, if applicable,
- placed under excess pressure, e.g. 50 Pa.

Only 1 pre-test is allowed.

7.4 *Error correction, if applicable*

The installer may plug the leaks after the pre-test is completed until the end of the 360 min.
The time of completion of error correction is reported.

7.5 *Determination of material consumption*

The test manager notes, which system components are left over after the test (item name, DB-no., GTIN and quantity/pcs.)

7.6 *Airtightness testing in fresh condition*

Airtightness testing is carried out either immediately after error correction or after the period of time (max. 24 hours) where bonding is expected to be in place acc. to the installation instructions.

Time of testing in the fresh condition is reported.

The mock-up with fitted vapour control layer system is tested for airtightness by the operator using the following course of pressure:

Excess pressure:
150 Pa, 125 Pa, 100 Pa, 75 Pa, 50 Pa

Vacuum:
25 Pa, 30 Pa, 35 Pa, 40 Pa, 45 Pa, 50 Pa.

The air permeability is recorded for each pressure value.

If the vapour control layer system collapses during vacuum testing, the highest vacuum value recorded with the vapour control layer system intact is reported.

7.7 *Airtightness testing after 7 days*

The mock-up with fitted vapour control layer system is again tested for airtightness by the operator 168 hours after installation if the system is intact after the airtightness test described in 7.6.

The vapour control layer system must remain untouched during the period between testing in fresh condition and after 168 hours .

Please note:
When testing very well sealed vapour control layer systems it may be necessary to modify the test set-up to measure at low pressure, e.g. by using a smaller fan and a calibrated measuring aperture.
Further details should be obtained, e.g. from the supplier of the equipment for measuring air permeability of buildings.

The airtightness test is performed in the following sequence:

Excess pressure:
150 Pa, 125 Pa, 100 Pa, 75 Pa, 50 Pa

Vacuum:
25 Pa, 30 Pa, 35 Pa, 40 Pa, 45 Pa, 50 Pa.

The air permeability is recorded for each pressure value.

If the vapour control layer system collapses during vacuum testing, the highest vacuum value recorded with the vapour control layer system intact is reported.

7.8 *Result processing*

The measured air permeability values in l/s m_2 floor space at 50 Pa excess pressure and vacuum are converted to the average air permeability values at 50 Pa in fresh condition and 7 days after installation.

8. Test report

The test report shall contain

a) The test laboratory name and address
b) The test report identification number
c) The name and address of the organization or person ordering the test
d) The purpose of the test
e) Identification of the tested vapour control layer system:

All components in the vapour control layer system included in the test are described by product name, item number, GTIN and/or DB-no. (components registered under pt. 7.1 minus components registered under pt. 7.5)

f) Date test was performed
g) Test method (referring to the method used, i.e., this document)
h) Test equipment
   Serial number or laboratory identification number for the equipment for measuring air permeability of buildings and mock-up
i) Name, company name, company address, ID and license no. as well as certification body for the operator of the equipment for measuring air permeability of buildings.
j) Deviations from the test method
   (When there are no deviations from the test method, please state: "No deviations")
k) The test result
   - The average air permeability values at 50 Pa in fresh condition and 7 days after installation acc. to point 7.8.
l) Test result uncertainty
m) Date and signature of the test manager
n) Attachments
   -Installation instructions
   -Measured air permeability values as a function of vacuum and excess pressure-