

# Eliminate the air leaks of your house

**-save in the heating expenses, reduce moisture risks**

## AIR TIGHTNESS OF THE ENVELOPE IN THE ONE-FAMILY HOUSE

### What is the air leak figure?

The air leak figure (1/h) of the envelope indicates the amount of air flow through the envelope in the test condition (including pressure difference 50 Pa) in one hour divided with the volume of indoor air. Method description at the bottom of page 2.

In energy report the figure of 4 1/h (the amount of air changes 4 times per hour) required by the regulations 2011 is the required air leak figure. At the building license stage it is possible in Oulu to use a better leak figure, if the developer or the leading architect commits oneself (sign) to try to achieve the fulfillment of the following procedure and the general foreman verifies the fulfillment by answering (ticking) the questions and by his/her signature.

## CHOOSING THE AIR LEAK FIGURE WHILE APPLYING FOR BUILDING LICENSE IN OULU

**A Air leak figure 4 1/h must be used according to the regulations,** if there is no report on tightness or no verifying actions are taken.

**B Air leak figure 3 1/h can be used, if sections 1 – 6 are fulfilled.**

1. Is the formation of cracks in stone/concrete structures in expansion joints prevented and are the expansion joints sealed with elastic sealant material?....Yes  No
2. Are there airproof flanges in the lead-throughs in the points of air barriers?.....Yes  No
3. Does joint sealing paste or equivalent sealing exist in all lead-throughs and holes (windows, doors..) connected to the skeletal constructions of external walls?....Yes  No
4. Is the junction between the footing and building frame sealed with materials and solutions which stand deformation?.....Yes  No
5. Do the air barrier and tape used meet the required standards?.....Yes  No
6. Are the extension points of vapor and air barriers by a firm stiff structure whenever it is possible and is the tape carefully taped?.....Yes  No

**C Air leak figure 2 1/H can be used**

( 2 1/H is the reference level of the building code)

**if sections 7 - 11 are fulfilled in addition to the previous sections 1 - 6:**

7. Has the air barrier been perforated with screws and nails only when on both sides of the air barrier there are firm surfaces (board and building frame post).....Yes  No
8. Is the load of the air barrier prevented from, for example the isolation's or other weight?.....Yes  No
9. Are the type, the way of fastening and the location of the hooks which are fastened to the exterior walls been guided in the instructions of the building - the objective of the instructions is to protect the air barrier from breaking?.....Yes  No
10. Is the installation of the air barrier made according to the plans and the written instructions?.....Yes  No
11. Are critical sections 1-10 in regard to the air leak photographed and recorded?.....Yes  No

**D Air leak figure 1,5 1/h or a better value defined statistically in the instruction card RT 80-10974 can be used as a preset value in the energy report for building license,**

if the objective is a low-energy level and the used value is verified by measuring afterwards and the energy report is updated on the basis of the measuring in question.

**E Air leak figure 0,6 1/H ( the absolute requirement of the passive energy house) can be used as a preset value in the energy report for building license,** if the experimental building objective is a passive energy house and the used value is verified by measuring afterwards and the energy report is updated on the basis of the measuring in question.

Aimed leak figure

1/h

Date \_\_\_/\_\_\_/\_\_\_

Reached leak figure

1/h

Date \_\_\_/\_\_\_/\_\_\_

Leak figure measured   
or terms fulfilled

Developer or leading architect

General foreman

Construction project \_\_\_\_\_

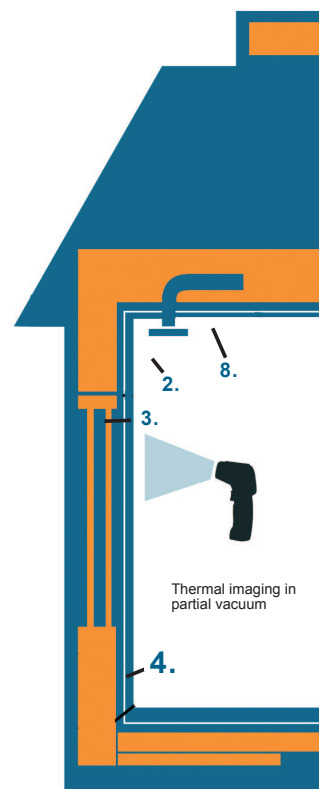
Address \_\_\_\_\_

Quarter \_\_\_\_\_ site \_\_\_\_\_ license number \_\_\_\_\_

### THE EFFECT OF THE AIR LEAK FIGURE ON THE NEED OF THE HEATING ENERGY

Tightness	Oral evaluation	Energy conservation
< 0,6	Passive house requirement	> 10 %
< 1,0	Excellent	7...10 %
1 - 2	Good	0...7 %
2	Reference level of the building code	0%
2 - 3	Satisfactory	- 0...7%
3 - 4	Poor	-7...14 %
> 4	Very bad	> -14 %

A better air tightness does not cause significant additional costs, it requires attitude and precise work.



## Measures to reach the good air tightness

(The content descriptions are only examples in principle. The designer must always draw up the project-specific solutions)

### Concrete frame

The junctions of concrete envelope structures are made with grouting or by using flexible elastic joints (by putting for example). In the roof grouted longitudinal joints between concrete and light concrete elements are sealed with air seal belts (for example bitumen membrane belts) installed over the joints.

In base floors with subfloor space, the joints between cellular plastic insulators under the elements are sealed for example with polyurethane foam.

### Wooden frame

On the warm side of the envelope with long beam structure there has to be always an air barrier which can be either film or plate type. The film type air barriers are connected to each other as a pressed joint or by overlapping and taping the film carefully with tape which has sufficient adhesiveness and long-term durability. Pressed joint has to be used whenever it is possible. Plate type air barriers can be connected to each other by foaming with polyurethane or by taping with tape which has sufficient adhesiveness and long-term durability.

The air barrier is placed in the structure so that the wall sockets and the cables can be installed without breaking the air barrier. This can be carried out by installing the air barrier, for example, at the distance of about 50 mm from the inner surface of the structure. If heat insulation is made inside the air barrier, it has to be installed in its place only after most of the construction time moisture has dried.

### Block frame

In some block structures the air tightness of the structure is based on the finishes. Both surfaces of this kind of an exterior wall with block structure have to be treated by plastering or by smoothing. In the inner surface filler is spread throughout and so that it can be functionally connected into, among others, the air-tight layers of the base floor and roof and into the windows and doors etc. The filler is always spread also for example behind the fixtures and to the upper wall part of the lowered roofs.

### Log frame

When designing the air tightness of the log buildings, also the subsidence and faulting of the log frame must be taken into consideration. At the joints between the logs and in corner junctions it is recommended to use the elastic cellular plastic seals or rubber seals. A sufficient subsidence allowance which is filled with open porous heat insulator or with elastic closed-cell insulator is left over the doors and windows. Inside the open porous insulator for example elastic air seal film is installed. The film is attached to the log frame and frame of a window/door with pressed joints or by taping the film carefully with tape which has sufficient adhesiveness and long-term durability.

*More detailed instructions for the implementation of the tightness, source: Aho, H., Korpi M. (ed.) Implementation of the air-tight structures and joints in residential buildings. Research report 141, Tampere University of Technology, Construction Engineering, Tampere. RIAL Research report 1706, pages 12-14, Tampere University of Technology, Department of Civil Engineering, Tampere.*

### General instructions concerning all the structures

The lead-throughs through the solid built-in frame or through a plate type air seal are sealed with polyurethane and by putting. The lead-throughs of the film type air seal are sealed either with the lead-through flanges or by way of collars made of boards.

The holes which are formed to the air seal are patched either by foaming or putting (solid built-in frames and boards) or with tape which has sufficient adhesiveness and long-term durability (films).

The expansion joints and other similar details between the components are made so that the movements of structures will not essentially weaken the air tightness of the joints.

The cable conduits etc. which perforate the outer wall are recommended to seal from inside the conduits.

The junctures of the windows and doors and of similar building parts to the air barrier are made with polyurethane, with elastic filling or with tape which has sufficient adhesiveness and long-term durability. The condition and operation of the seals of the window frames and door frames have also to be checked in pursuance of their assembly.

The film type air seals must not be loaded for example with the heat insulator of the roof so that the load will in the long run stretch and break the film or its extension point.

The film type air seal in the roof is attached to that kind of external wall structure in which there is not a separate film type air seal (for example a brick wall or block wall, precast concrete) by way of either pressed joint or elastic putty or by overlapping the air seal sufficiently with the structure.

The junction between a ground slab and exterior wall is sealed with bitumen membrane belt which at the same time prevents the access of radon from soil and moulds to the indoor air.

### The improvement of the air tightness reduces

energy consumption, moisture risks of the structures of the external walls and the feeling of draught. When the tightness is improved, the significance of the adjustment and regular maintenance of the ventilation installation and the securing of the necessary ventilation also in fault situations are emphasized.

### Measuring of the air tightness of the envelope

The ventilation of the building, ducts and other holes are hermetically closed. Overpressure of +50 Pa is generated inside the building and the air leak figure (1/h) is measured. This leak figure indicates the flowing air amount per hour through the envelope divided with the indoor air volume. After this, correspondingly the air leak figure is measured in the partial vacuum of -50 Pa. The final air leak figure of the envelope of the building is obtained as an average of received air leak figures.