

Airtightness, the parameter no one taught you to look at

Much of the energy in a conventional home escapes through air leaks you cannot see. This is the real size of that invisible window and how Eskimohaus houses make it all but disappear.

Many houses live with a window that no one decided to leave open. There is no visible sash, but if you add up all the small infiltrations of a poorly sealed home, badly sealed joints, gaps around frames, service penetrations, blind boxes or slab edges, the result can equal an opening of considerable size that stays open all year, 365 days, whether it is cold or hot. Unlike a real window, this one cannot be closed.

The parameter that describes this phenomenon is airtightness, and it is one of the figures that best explains why two houses of the same size can have radically different energy bills. At PAPIK Group it is part of the quality control of almost every Eskimohaus house we build, not as an administrative formality but as the check that the envelope does the job it is asked to do.

How airtightness is measured: the Blower Door test

To find the real size of that invisible window there is a test as simple as it is revealing: the Blower Door test, or pressurisation test. The entrance door is replaced by a high-flow fan, the perimeter is sealed and the fan is started to create a pressure difference between inside and outside. Under these conditions the air seeks to slip through any opening, large or small, and for about fifteen minutes the amount of air passing through every hole, joint and gap in the envelope is measured.

The result is expressed in air changes per hour at 50 pascals of pressure, and it is known as the n50 value. In practical terms, it indicates how many times all the interior air of the house would be renewed in one hour if that pressure were maintained.

- An old, poorly sealed house can have an n50 of up to 10 or more.
- The Passivhaus standard requires an n50 equal to or below 0.6 to be certifiable.
- PAPIK Group's Eskimohaus houses reach Passivhaus values, below 0.6; when certification is not required, they typically sit between 0.4 and 0.7.

Numbers, however, are hard to picture. That is why it helps to translate them into a physical image: the size of the equivalent hole.

How big the equivalent hole is

All the infiltrations of a house can be imagined concentrated in a single hole. Taking a standard home of 150 m² built, with an average height of 2.5 m and an interior volume of roughly 300 m³, the calculation makes it possible to convert the n50 value into an equivalent open surface.

Eskimohaus / Passivhaus house (n50 ≤ 0.6)

With an n50 value of 0.6, the house loses 180 m³ per hour at 50 Pa. That figure corresponds to the forced pressure of the test; under real conditions of wind and temperature difference a reduction factor of about 1/20 applies, so the real leakage sits around 9 m³ per hour. Translated to a surface, it equals a circular hole of about 4.5 cm in diameter, the cross-section of a walnut in its shell. An opening so small that, at constant temperature, its effect is barely noticeable.

Old, poorly sealed house (n50 = 10)

In Spain, the average airtightness of the built stock is around an n50 of 10. With that value, the same house loses 3,000 m³ of air per hour at 50 Pa, and the real leakage approaches 150 m³ per hour. From hidden infiltrations alone, this equals a permanently open circular hole of about 18 cm in diameter, almost the diameter of a dessert plate and some sixteen times larger than that of an Eskimohaus house. And it is a hole impossible to close without intervening on the entire envelope.

The openings the test does not count

The Blower Door seals intentional openings in order to isolate the measurement of structural infiltrations, so the extractor hood, bathroom grilles and ventilation outlets fall outside the n50 value. Those openings, however, exist, and during normal use of the house they remain active without anyone seeing them. In an Eskimohaus home, with very demanding airtightness control, they simply are not there.

To size them in a conventional house, the data of the Spanish CTE HS-3 regulation and manufacturers' technical specifications are used.

- **Kitchen extractor hood.** The standard duct is 150 mm in diameter (UNE-EN 61591 standard). Without an airtight closing damper, common in installations ten or twenty years old, it equals a direct hole to the outside of 176.7 cm².
- **Bathroom extraction grilles.** The CTE HS-3 sets a minimum of 32 cm² per bathroom. A home with two bathrooms adds a minimum of 64 cm² of permanent opening.
- **General kitchen ventilation grille.** If the kitchen runs on gas, the CTE HS-3 requires an additional general ventilation with a minimum surface of 68 cm².

An open fireplace without a closing damper would add up to 500 cm² more, a flue connecting the living room directly with the outside. We do not include it in the count because not every house has one and there are now double-flow stoves that avoid this problem, but its magnitude helps to make the whole picture visible.

The total result: the window that cannot be closed

Adding the hidden infiltrations to the intentional openings active during normal use, the result approaches 573.5 cm², equivalent to a circular hole of about 27 cm in diameter, the surface of a flat dinner plate or a DIN A4 sheet. The difference against an Eskimohaus house is not a matter of detail: this is a hole some 36 times larger in surface, active every hour of every day. When the outside temperature is extreme, near 0 degrees in winter or 40 in summer, comfort escapes through that opening constantly and inevitably.

The bill you pay without knowing it

Every volume of conditioned air that escapes through infiltrations is energy already paid for, in gas, in electricity or in biomass, that simply dissipates outside. In a conventional house, infiltration losses can represent between 20% and 40% of total heating demand. It is exactly the invisible cost we describe in the article on the [energy mortgage](#), that amount appearing each month on the bill without anyone having signed up for it. Reducing air leaks is one of the most direct ways to reduce it.

In an Eskimohaus house, thanks to a practically airtight envelope, those losses fall to become almost negligible. The energy generated stays inside and does its job.

How an airtight house is ventilated

A very airtight house is not a suffocated house. Interior air must be renewed for health, for comfort and by law, and the solution is to do it in a controlled way. Eskimohaus houses install a mechanical ventilation system with heat recovery (MVHR) that renews the air of the whole home constantly, filters it of pollen and particles and recovers up to 96% of the heat from the outgoing air to temper the clean incoming air.

The result is fresh, clean and healthy air all day, without draughts, condensation or mould, with minimal energy loss in the process. The house breathes well precisely because it is airtight: air does not enter through joints laden with dust and moisture, but through the intended point, filtered and at the right temperature.

How this airtightness is achieved

Airtightness is not a miracle solution but the result of extreme care in every construction detail, from the first drawing to execution on site.

Continuous airtightness layer

Eskimohaus houses incorporate a continuous barrier wrapping the entire habitable volume. Every joint, every service penetration and every corner is sealed, and this is not improvised at the end: it is planned from the design stage.

Passivhaus-quality windows and doors

A conventional window can be the most important leakage point of a home. The ones we integrate are certified to guarantee thermal transmittance and airtightness well above the standard.

Details without thermal bridges or gaps

Every material junction and every structural support is resolved without discontinuities, neither in the insulation nor in the airtightness layer. It is one of the criteria that guides all our construction.

Verification with the Blower Door test

Every house we build goes through the pressurisation test. It is not a formality, but the confirmation that what was designed and executed works as it should.

A note on the calculations

The figures in this article come from explicit, verifiable assumptions. The n50 value is defined by the ISO 9972:2015 and EN 13829:2000 standards; the conversion from flow to equivalent hole surface applies Bernoulli's equation for flow through an orifice, and the step from test pressure to real conditions uses a reduction factor of 1/20, a central value documented by the ASHRAE Handbook of Fundamentals and the Passivhaus Institut. The surfaces of the intentional openings are based on the CTE DB HS-3 and the UNE-EN 61591 standard. The regulatory minimums adopted are conservative: real installations usually present larger openings, so the magnitude of the contrast tends to grow, not shrink.

To understand the overall scope of building and living in a house of this kind, the article on the ecological footprint completes this reading.

An efficient house does not ultimately depend on sophisticated devices, but on not wasting what has already been paid for. Closing the invisible window properly is the first step.