Aerodynamic tests of natural smoke and heat exhaust ventilators (NSHEV) and parameters having a positive / negative effect on the test result according to EN 12101 - 2, Annex B

In practice, we often encounter questions from our customers who ask for an explanation why their product does not reach the results like competitive products even though their product is almost identical. Therefore, we decided to write a guide that would help our customers to better understand the issue of NSHEV and its testing which is the result of many years of our experience and practical knowledge about this issue and to propose solutions that affect the result of the aerodynamic test.

Abbreviations:

Cv - discharge coefficient (overall result of the aerodynamic test)
C_{v0} - discharge coefficient without side wind influence
C_{vw} - discharge coefficient with side wind influence

Test procedure:

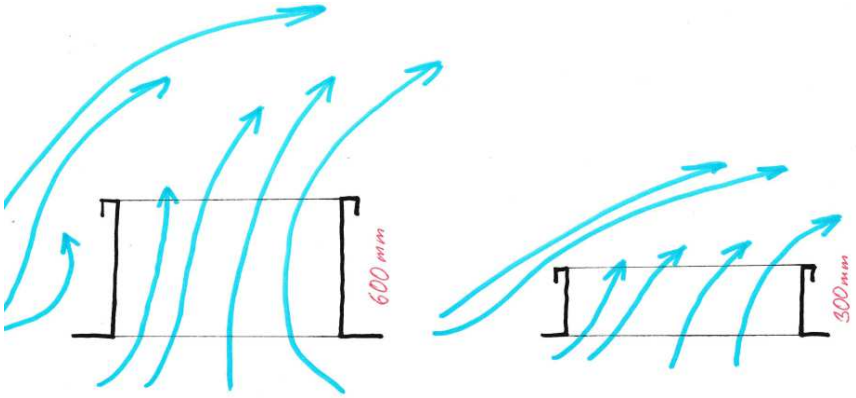
The test itself is performed on a test chamber, indoors under normal conditions by use of air. Thermal energy of smoke is simulated by increasing of air pressure in the chamber. At first the "C_{v0} value" is measured, then the "C_{vw} value". The final test result – "C_v value" is determined as lower value of "C_{v0}" and "C_{vw}".

Influences:

Key parameters are: the shape and the height of the upstand, dimensions and number of fitted opening mechanisms (incl. actuator), the opening angle of a flap (flaps) as well as its (their) shape, wind deflectors and inlet deflectors which are used more often recently.

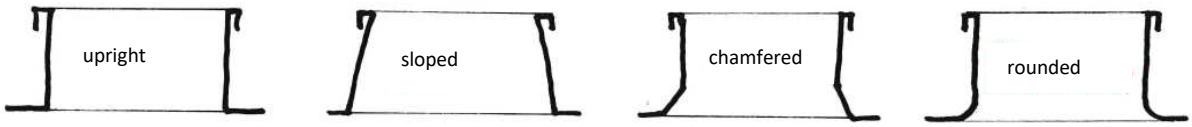
Upstand height:

It affects the flow around the test specimen but also inside it. Basically, the higher the upstand the better C_{vo} value. However, it should be taken into account that the smaller ventilators have better C_v value than larger ventilators. The "C_v value" is gradually decreased with increasing of geometric area of NSHEV.



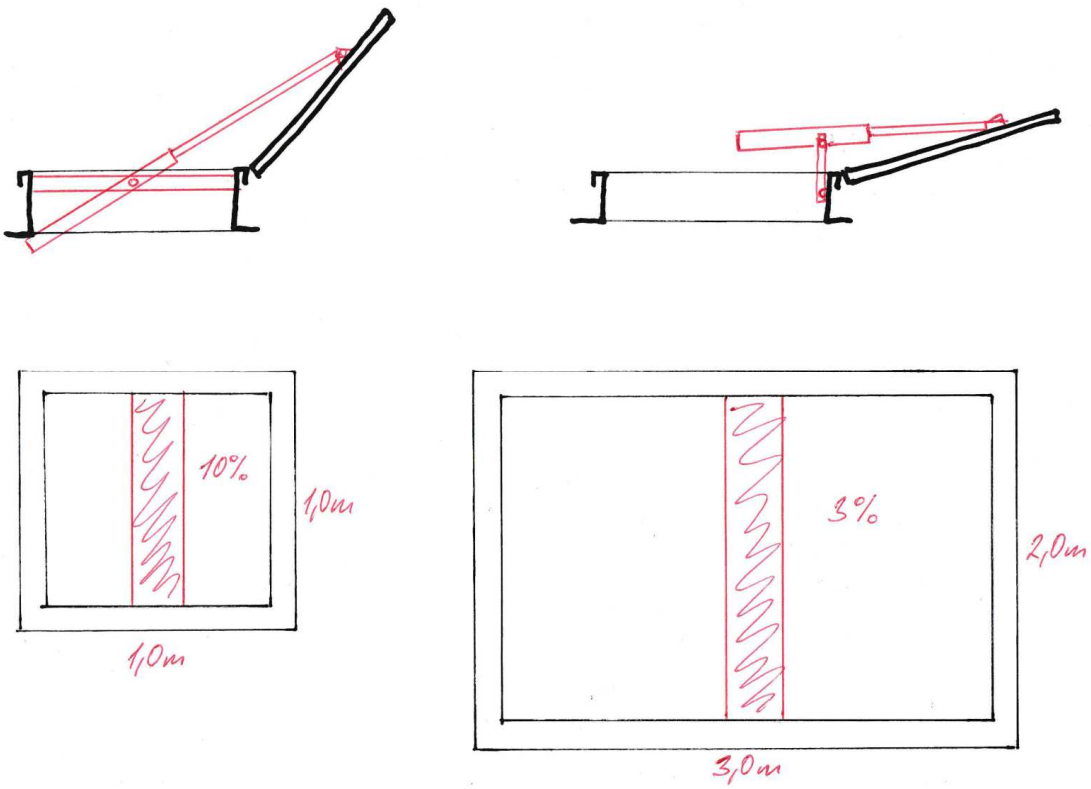
Upstand shape:

The upright upstand is still good, its efficiency can be improved by using the inlet deflectors. The chamfer at the bottom of the upstand improves the flow efficiency for "Cv0" but at the same time it worsens the value of "Cvw" measured for NSHEV without the wind deflectors. The chamfer angle is very important to achieve the best possible result. Remember that the chamfer cannot be too big because geometric area of NSHEV will increase. As consequence of it, "Cv" value will be reduced. The same principle applies to the upstand with radius in its bottom part.



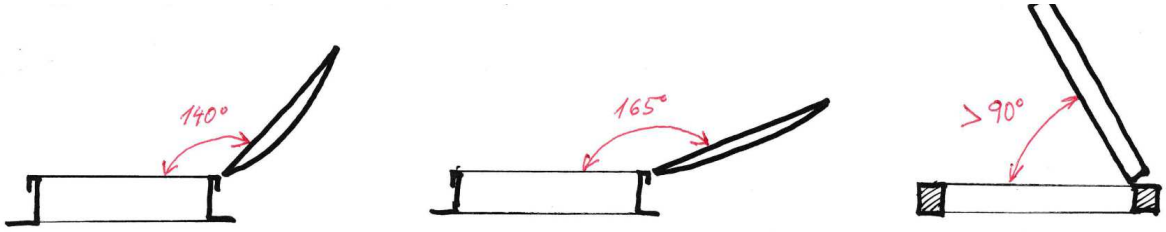
Opening mechanism:

Its construction, dimensions, various reinforcements, traverses and their number as well as various covers represent an obstruction in the NSHEV opening which reduces the flow and also reduces the "Cv" result. Therefore, the most suitable for aerodynamics are tiltable mechanisms which do not interfere in the outlet opening of the NSHEV. The blockage by the mechanism is manifested differently in the NSHEV of minimum dimensions and NSHEV of maximum dimensions. In case of NSHEV with minimum dimensions, the opening mechanism covers a larger area by a percentage in the NSHEV opening.

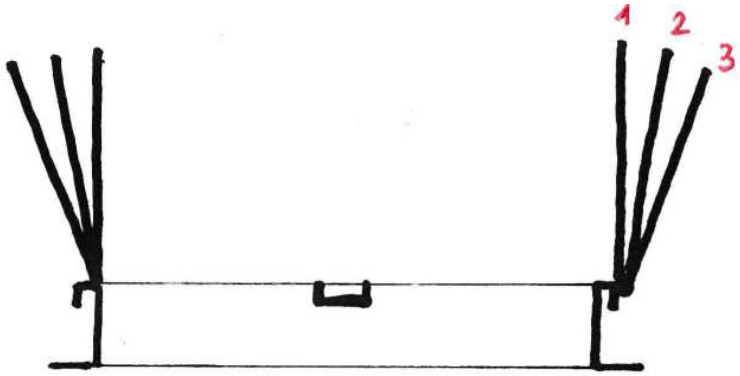


Flap opening angle:

The key parameter which has significant influence on aerodynamic test result (C_v) is flap opening angle. In case of single-flap NSHEV, the most effective angle is 165°. It does not make sense to deal with larger opening angles. The problem is the NSHEV with an opening angle smaller than 140 ° (e.g. roof windows) where turbulence is greatly increased which ultimately complicates the measurement itself and in some cases the measured values are so low that in practice such devices have no relevance and use.

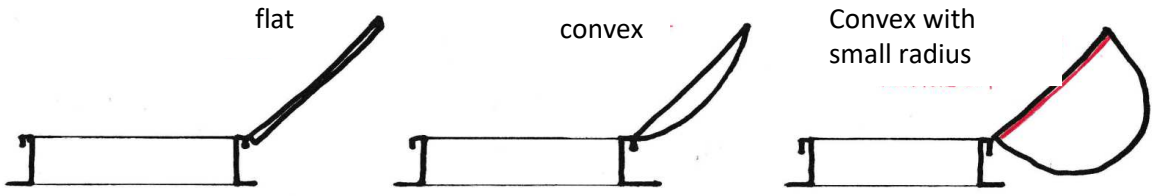


In case of double-flap NSHEV, the final C_v value can also be slightly increased by setting the opening angle correctly.



Flap shape:

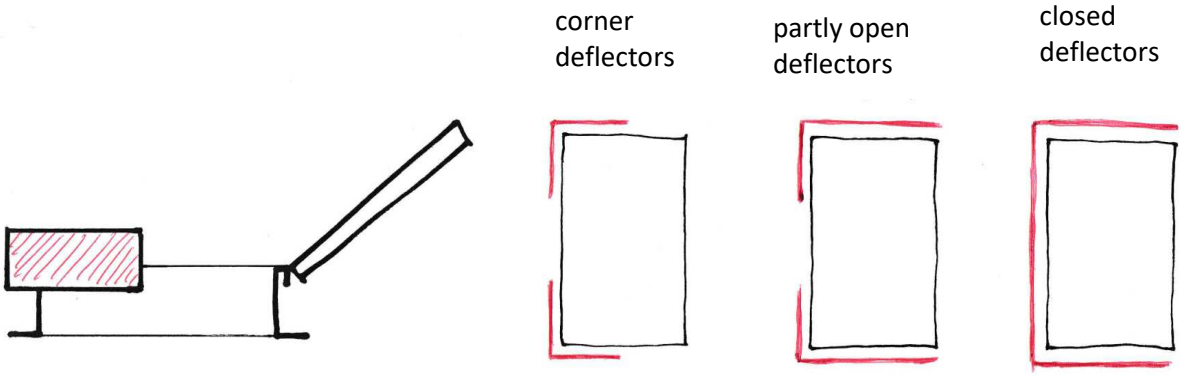
It affects the "Cv" result. This is mainly about the dome shape for the single-flap NSHEV opened into 140° and double-flap NSHEV with small radius of dome. In these cases, strong turbulence rises above the outlet NSHEV opening and smoke exhaustion gets worse.



Wind deflectors:

Their effect on the aerodynamic characteristics of the NSHEV is important. Wind deflectors increase the "C_{vw}" value. It is necessary to deal with the shape, side lengths and height of wind deflectors. Wind deflectors shall be firmly attached to the NSHEV to meet the requirements of the vibration test according to EN 12101-2, clause 7.4.3.

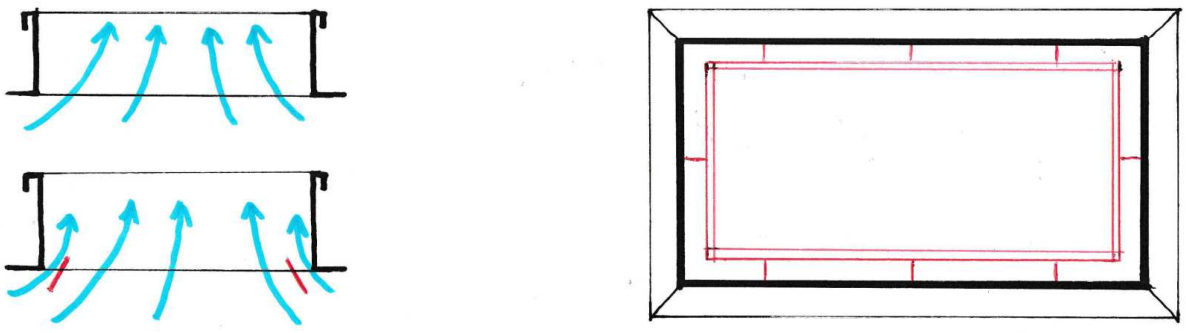
Of course, if the deflectors are used during the aerodynamic free area test, they must be fitted to the NSHEV when installed on/in building. Smoke exhaustion efficiency is significantly reduced if wind deflectors are not used. In some cases, NSHEV without wind deflectors is not able to exhaust the smoke.



Inlet deflectors:

They improve the flow inside the device which increases its efficiency and increases the value of "Cv0". They are suitable to be used in an NSHEV with an upright upstand where their influence is the most significant. In case of chamfered/rounded upstand, the effect of inlet deflector is minimal.

Be aware, even though the "Cv0" value will be increased by using inlet deflector, at the same time you will have to increase the height of the wind deflectors. This may subsequently cause a problem in sufficient mounting of wind deflectors to the upstand or disrupt the overall NSHEV design.



Conclusion:

Despite everything we've described in this article the combinations of improvements aren't always definite and we've been surprised by the results several times. What seemed like a very good solution at the beginning turned out to be insignificant after the test or it even worsened the result. It would be helpful if you could realize informative aerodynamic test for each product variant.

We believe that this article will help you to understand the field of aerodynamic free area tests. We will be happy if you contact us in the future with new construction solutions of your NSHEV. We would be pleased to have an opportunity to work with you.