

Program: IESVE

Development and maintenance: IES

How can WindowMaster's IESVE guide help you?

IESVE has several excellent user guides, so the purpose of this document is to add information on how to include natural ventilation in an IESVE simulation.

Our experience is that the systems used for analyzing natural and hybrid ventilation in IESVE are both user-friendly and well-tested.

Often it is only necessary to create models for two or three rooms (thermal zones), e.g. one typical room and one worst-case room. However, at other times, it is necessary to create models for nearly all rooms if the internal loads, usage, orientation etc. of the rooms differ markedly.

You will only get one operative temperature per zone. Hence, a room needs to be divided into more zones if, for instance, the exposure from the sun varies greatly in different areas in the room.

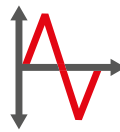
For more advanced simulations and/or control strategies there might be some limitations in IESVE. In these cases our team of engineers at WindowMaster's Ventilation Institute can assist you with your project, from simple advice to detailed simulations of the indoor climate. Our team has many years of experience in designing both new-build and refurbishment projects across the world.

MacroFlo input

After switching to MacroFlo in the application tab you should do the following three steps when doing a calculation of natural ventilation:

- Apache profile database manager
- Macroflo openings database manager
- Edit selection set opening types

Apache profile database manager



The control sequences and setpoints for a natural ventilation system is normally depending on the season of operation. Hence, you should consider new daily profiles which contains a strategy for:

- Summer, winter and fall / spring
- Day and night

These sequences should include parameters like:

- Room CO₂ levels
- Room dry resultant temperature or air temperature (T_{dr} & T_a)

Examples of profiles

The graphic on the right contains recommended values for temperatures (air temperature or dry resultant temperature can be used) and CO₂ levels. The values can be set according to the requirements in the room/building.

In the cases where hybrid ventilation/mixed mode ventilation strategy is utilized (e.g. including cooling from mechanical ventilation or other cooling technologies). Parameters like relative humidity, outdoor temperature etc. could be included in the control sequences. The important is at the first place to avoid that the two systems run in parallel, and make sure that the systems e.g. falls back to the natural ventilation mode after being in mechanical mode if the conditions are in favor and also avoiding internal condensation risk by control after relative humidity or similar.

Summer, day

$\text{ramp}(ta,22,0,28,1) \ \& \ \text{gt}(ta,to,1) \ |$
 $\text{ramp}(co2,700,0,1000,1)$

The window will not open based on temperature when the outdoor temperature exceeds the indoor temperature. However, the window will always open based on air quality.

Fall / Spring

Outdoor temperature > 18°C
 $\text{ramp}(ta,22,0,28,1) \ \& \ \text{gt}(ta,to,1) \ |$
 $\text{ramp}(co2,700,0,1000,1)$

Outdoor temperature < 18°C
 $\text{ramp}(ta,22,0,26,1) \ |$
 $\text{ramp}(co2,700,0,1000,0.6)$

Mix of summer and winter profile. For the winter profile a higher max openable area can be set to e.g. 60% (0.6).

Winter

$\text{ramp}(ta,22,0,26,1) \ |$
 $\text{ramp}(co2,700,0,0,1000,0.3)$

The intention with the CO₂ ramp function is to minimize the max openable area to e.g. 30% (0.3).

Summer, night

$\text{ramp}(ta,20,0,22,1) \ \& \ \text{gt}(ta,to,1)$

The minimum temperature can be adjusted to meet the requirements.

MacroFlo openings database manager



One new opening type should be made if there are different openings types (e.g. bottom hung-, side hung-, parallel opening windows) and/or different opening angles and sizes (resulting in different openable areas).

MacroFlo Opening Types

MacroFlo Opening Types

XTRN0000	External window opening
XTRN0001	Automated operable windows
XTRN0002	Manuel operable windows
XTRN0003	Automated operable windows North
XTRN0004	Manuel operable windows North
XTRN0005	Automated operable windows Exhibition
XTRN0006	Manuel operable windows Exhibition

Reference ID: XTRN0001

Description: Automated operable windows

Exposure Type: 01. exposed wall

Opening Category: Window - btm hung

Openable Area %: 63

Max Angle Open °: 25.00

Proportions: 1 =< Length/Height <2

Equivalent orifice area: 32.008 % of gross

Crack Flow Coefficient: 0.150 $l/(s \cdot m \cdot Pa^{0.6})$

Crack Length: 0 % of opening perimeter

Opening threshold: 0.00 °C

Degree of Opening (Modulating Profile): Auto NV Office

Include effects of wind turbulence?

OK Cancel Save

Exposure Type

IESVE uses default wind pressure coefficients for simple building geometries. However, for more advanced building geometries extra investigation may be required. The wind pressure coefficients is defined based on the selected exposure type for each opening type.

Opening Category

IESVE uses default discharge coefficients based on the selected opening category.

Openable Area

The “Openable Area %” is equal to the area of which can be opened of the given surface. See examples on the right.

Bug screens or similar can be accounted for by reducing the openable area accordingly. It needs to be considered whether building elements, solar shading or similar block the airflow, and therefore reduce the opening area.

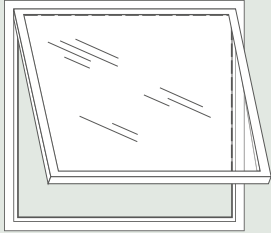
Max angle open

The following table can be used as an input for the max opening angle of an automated window:

Window height [mm]	Chain stroke [mm]	Opening angle [deg.]
300	250	40
500	250	25
500	400	40
700	400	30

1

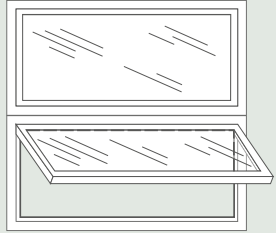
**100%
openable area**



It is recommended to subtract e.g. 10% accounting for the frame and window profile

2

**50%
openable area**



It is recommended to subtract e.g. 5-10% accounting for the frame and window profile

NB. The values in the table can be used as a default values if no other values can be found, but it should always be proven from the specific project. For the window with a height of 300–500mm a 250mm (200mm effective opening) chain length is used. For the window height in the range 500–700mm a 400mm (350mm effective opening) chain length is used.

Edit selection set opening types



Go to the “Edit selection set opening types” tab and assign the opening types to the right openings. Input data visualization (🏠) can be used to check the assigned opening types for the whole building by selecting “opening types” under variable.

How to read results from IESVE

When evaluating the results, it is recommended to look at outdoor temperature, operative temperature, wind speed and air change at the same time to see how the zones perform during the year. If using pulse ventilation during winter time you can make a separate analysis as stated earlier in the document.

WindowMaster aspires to protect people and the environment by creating a healthy and safe indoor climate, automatically ventilating spaces with fresh air through facade and roof windows in buildings. We offer the construction industry foresighted, flexible and intelligent window actuators and control systems for natural ventilation, mixed-mode ventilation, and smoke ventilation – of the highest quality.

WindowMaster employs highly experienced cleantech specialists in Denmark, Norway, Germany, United Kingdom, Ireland, Switzerland, and the United States of America. In addition, we work with a vast network of certified partners. With our extensive expertise built up since 1990, WindowMaster is ready to help the construction industry meet its green obligations and achieve their architectural and technical ambitions.

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