Application of louvres to support ventilative cooling

9 December 2020, Webinar – Resilient Ventilative Cooling in practice

VENTILATION – SUNPROTECTION - OUTDOOR

ivan.pollet@renson.be

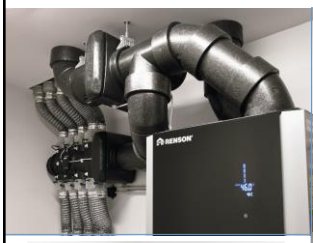
About Renson

Belgian family business

- 111 years
- Headquarters in Waregem
- Team of 1200 enthousiastic men & women
- 224 Mio € turnover
- Core business: ventilation, sunprotection & outdoor

VENTILATION – SUNPROTECTION - OUTDOOR

Products







VENTILATION

Louvres

Louvres: characteristics, testing and regulation



Louvres: simplicity + multi-functionality

Simplicity

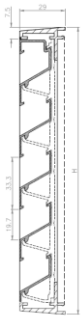
Number of horizontal or vertical fixed or adjustable blades (alu/wood)

Multi-functionality

- → Ventilative cooling (renewable)
- → Solar shading
- → Insect-proof
- → Rain-tightness
- → Persons from outdoors (burglary) or indoors (fall-through)
- → Fire/smoke control
- → Noise insulation
- → Outdoor pollution control (?)
- → Opportunities for creativity, integration, accents, ...

Louvres: flow resistance ↑ + usage of VC potential ↑

Resistance



Reduction of air flow rate

~ 50%

Guarantee on higher usage time

Fully openable windows (90°) instead of tilted (10%)

More operated during night and absence

~ higher utilization factor

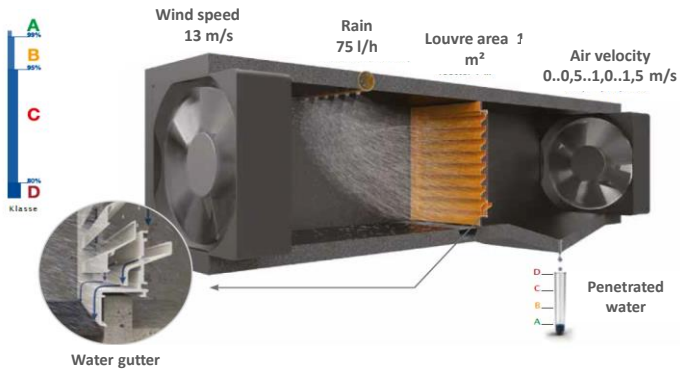
On average, net effect of louvres on air exchange rate is mostly limited

Ventilative cooling: quick design, rules of thumb

- Available natural pressure difference: **Δp ~ 1 to 2 Pa**
- Required air exchange rate: **q_v = 4 to 8 volumes/h**
- Air flow rate through opening: $q_v = A\sqrt{\frac{\Delta p}{0{,}6\,K}}$
- Cooling capacity: **~ 5 W/m²/air exchange rate**
- Temperature reduction during night in case of at least 10°C ΔT between max indoor T and min. outdoor T : **~ 0,75 to 1 °C/(vol/h)**

Testing and optimization of louvres performance

Aerodynamic and rain tightness characteristics (EN13030)



Water tightness and air flow rate

Table 3 — Penetration classes

Class	Effectiveness ε	Maximum allowed penetration of simulated rain $l \cdot h^{-1} \cdot m^{-2}$
A	1 to 0,99	0,75
B	0,989 to 0,95	3,75
C	0,949 to 0,80	15,00
D	Below 0,8	Greater than 15,00

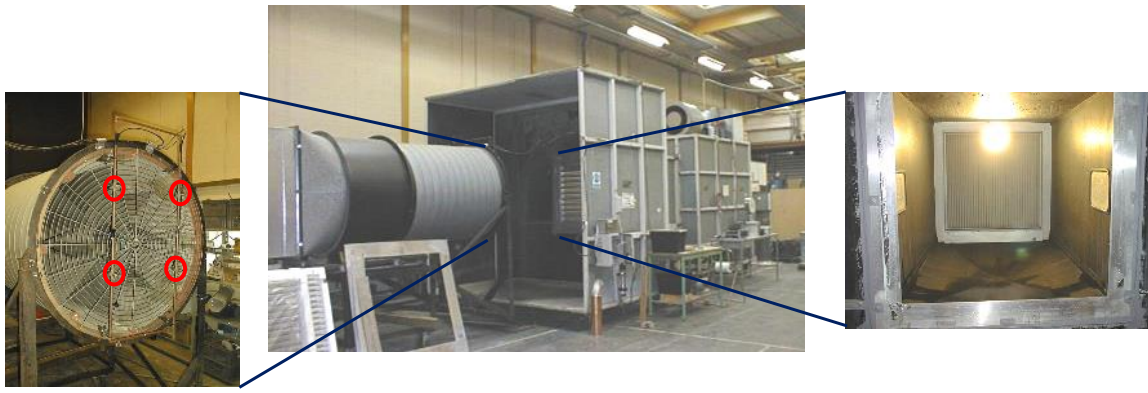
Table 4 — Discharge loss coefficient classification

Class	Discharge loss coefficient
1	0,4 to 1,0
2	0,3 to 0,399
3	0,2 to 0,299
4	0,199 and below
NOTE The above classes also apply to entry loss coefficient.	

$$q_v = C_d A\sqrt{\frac{2\Delta p}{\rho}}$$

Testing and optimization of louvres performance

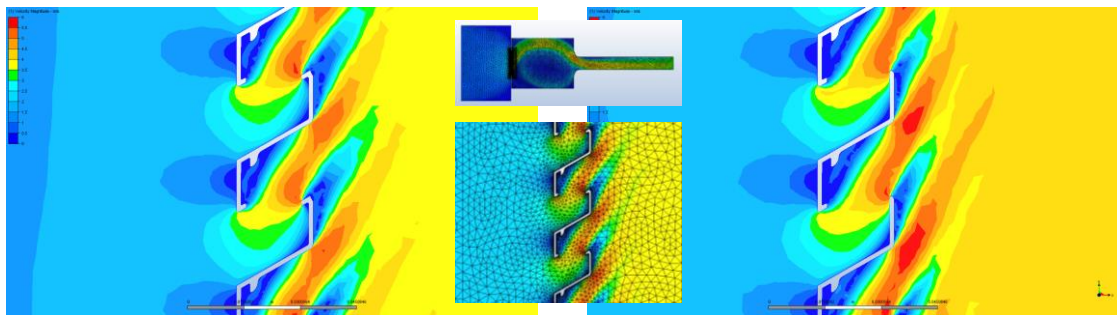
Aerodynamic and rain tightness characteristics (EN13030)



Testing and optimization of louvres performance

$$q_v = C_d A \sqrt{\frac{2\Delta p}{\rho}}$$

Optimization based on CFD: air flow resistance ↓ and/or water tightness ↑



Testing and optimization of louvres performance

Burglary resistance of window openings (~ building assurances)

7 Mechanical strength .....
7.1 Static loading.....
7.2 Dynamic loading in resistance classes 1, 2 and 3.....
8 Manual burglary attempts .....

8 Manual burglary attempts

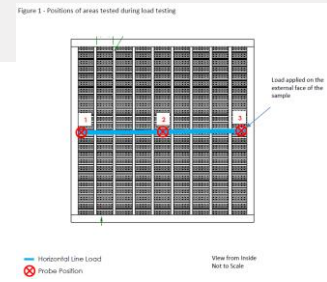
When tested in accordance with prEN 1630 using the tool sets and times specified in Table 6, the test specimen shall not fail at the resistance class claimed. For construction products of resistance class 1 no manual test will be carried out. The tool set A1 is intended for preparation of the test specimen.

Table 6 — Tool sets and resistance time

Resistance class	Tool set (see prEN 1630:2009, Clause 7)	Resistance time min	Maximum total test time min
1	A1	–	–
2	A2	3	15
3	A3	5	20
4	A4	10	30
5	A5	15	40
6	A6	20	50

Testing and optimization of louvres performance

Barrier load testing / Fall prevention safety (EN13049)



RENSON
Creating healthy spaces

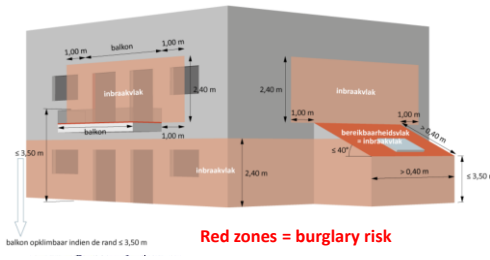
VENTILATION – SUNPROTECTION - OUTDOOR

Integration of VC louvres within EPBD regulation

Impact of VC on overheating risk and PE consumption depending on:

Belgium (residential)

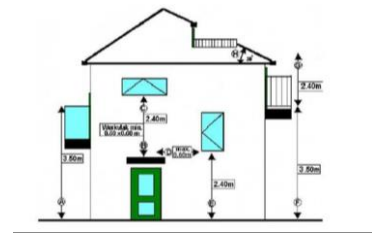
- Physical free area of VC openings
  (≥ 6,4% of room net floor area)
- Accessibility/burglary resistance
  (location, max opening, resistance class ≥ 2)
- Control possibilities



Red zones = burglary risk

The Netherlands (all buildings)

- Physical free area of VC openings
- Accessibility/burglary resistance
  (location, max opening, resistance class ≥ 2)
- Control possibilities
- Insect-proof requirement
- Rain tightness requirement (louvre, sensor)



Louvres applications in-situ

Schools (Gent, Belgium)

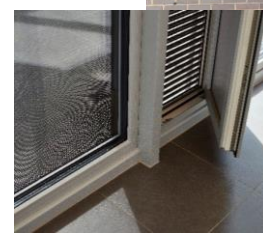
Passive cooling measures, no active cooling, small or no occupation in summer

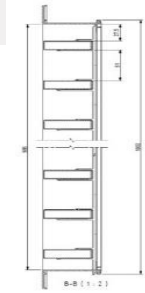
Schools (Gent, Belgium)

Student homes (Bournemouth University, Southern England)

Burglary resistance, fall prevention safety, daylight

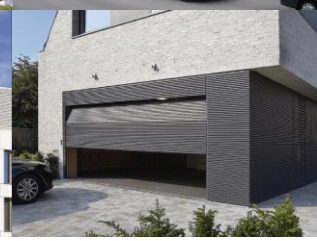
Different shapes and colors
> attractive façade





17

Continuous louvre systems as façade cladding



Integrated architectural design with shapes and colours

18

Continuous louvre systems as façade cladding

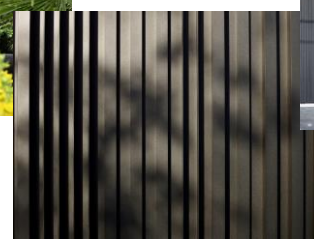
International Lyceum > Luxembourg

19

Private houses (Belgium)

Vertical blades, integration in façade/LED-lighting

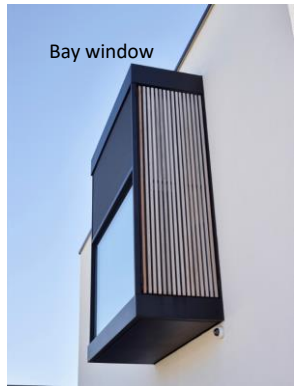
Privacy ↔ daylight



20

Concept home of Renson (Waregem, Belgium)

Vertical blades, integration in façade



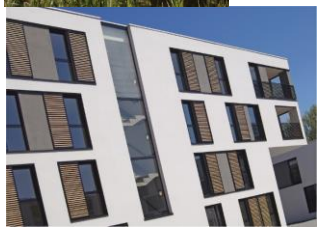
Privacy ↔ daylight

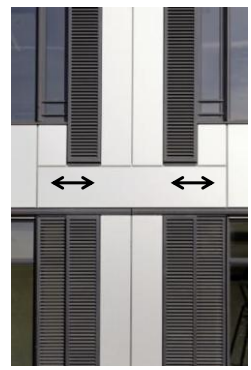
RENSON
Creating healthy spaces

VENTILATION – SUNPROTECTION - OUTDOOR

Louvre: movable/adjustable versus fixed

Movable/sliding louvre panels





Green office (Paris – France, 2011)

Adjustable/orientable blades

Apartments (Weinfelden, Switzerland)

Personalization

Connected smart systems > servitization

Services

Data analysis

Connectivity

Actuators/sensors

+

+

+

Combination of ventilative cooling and solar shading

Screens and awning

Screens on roof windows

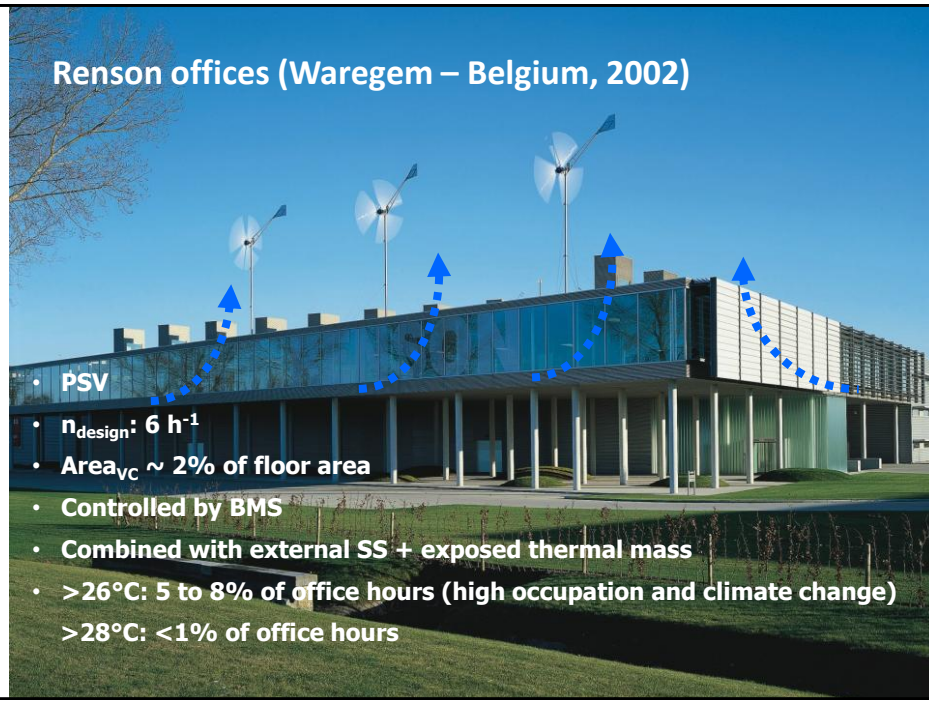
Integrated screens

RENSON Creating healthy spaces

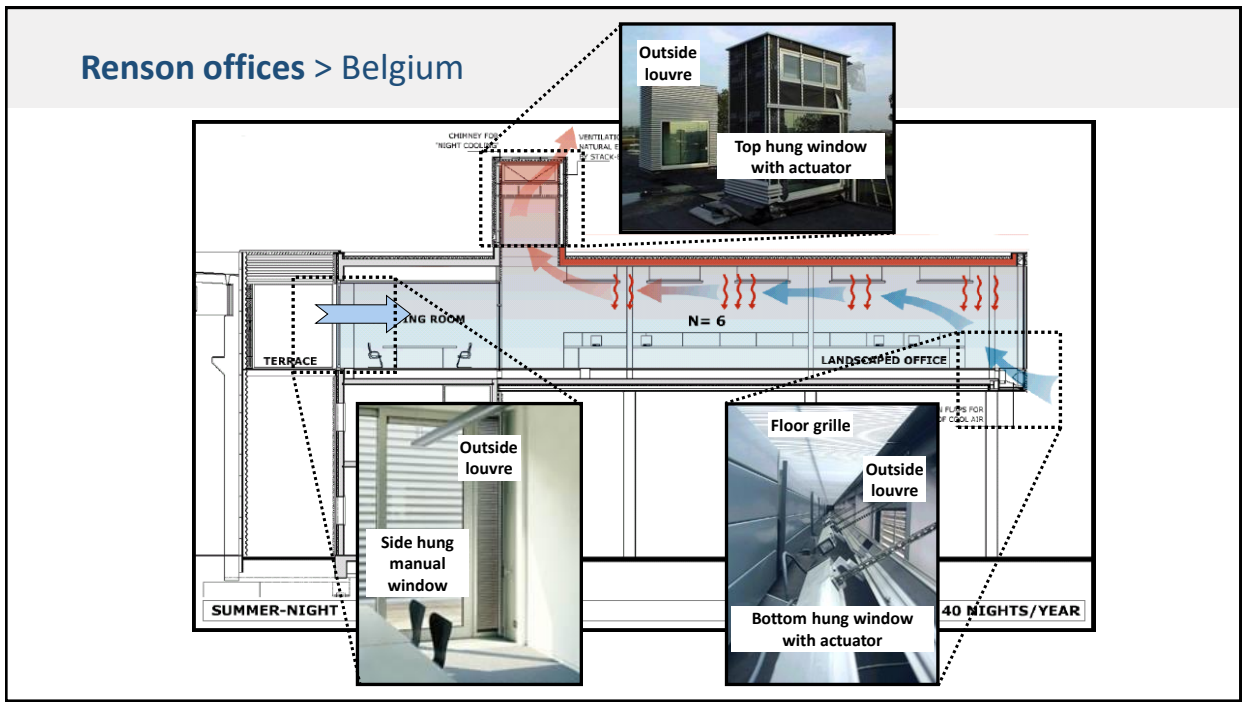
VENTILATION – SUNPROTECTION - OUTDOOR

Renson offices/showroom (Waregem, Belgium, 2002)

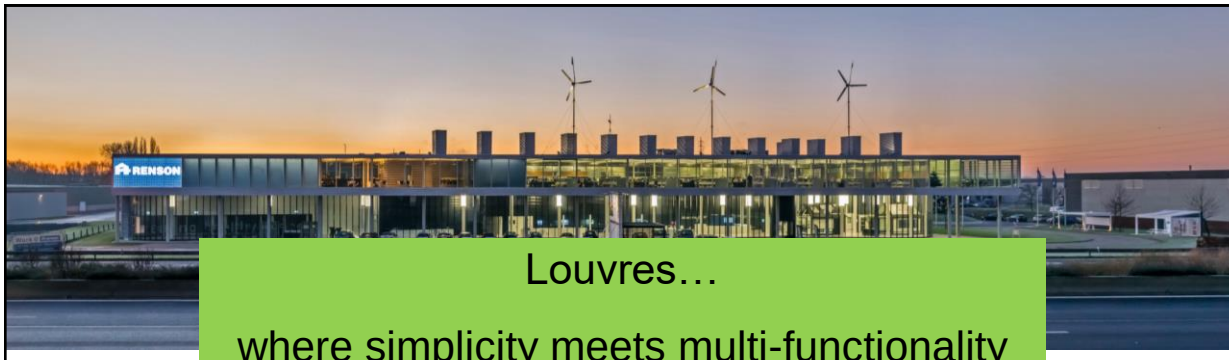
Designed 20 years ago as an example of bioclimatic architecture, and still contemporary


Renson offices (Waregem – Belgium, 2002)
• PSV
• n_{design}: 6 h^{-1}
• $Area_{VC}$ ~ 2% of floor area
• Controlled by BMS
• Combined with external SS + exposed thermal mass
• >26°C: 5 to 8% of office hours (high occupation and climate change)
>28°C: <1% of office hours

27


Renson offices > Belgium
Outside louvre
Top hung window with actuator
N= 6
TERRACE
LANDSCAPED OFFICE
Outside louvre
Side hung manual window
Floor grille
Outside louvre
Bottom hung window with actuator
SUMMER-NIGHT
40 NIGHTS/YEAR

28



Louvres…

where simplicity meets multi-functionality

9 December 2020, Webinar – Resilient Ventilative Cooling in practice

VENTILATION – SUNPROTECTION - OUTDOOR

ivan.pollet@renson.be