

ENERGY IN BUILDINGS 2022

SESSIONS

- 1) ENERGY SAVINGS IN COMMERCIAL BUILDINGS
- 2) ENERGY SAVINGS IN INDUSTRY
- 3) GREEN CERTIFICATIONS
- 4) GREEN FUNDINGS
- 5) TRAINING/MAINTENANCE/OPERATIONS
- 6) CASE STUDIES
- 7) DIGITALIZATION
- 8) DECARBONIZATION

SATURDAY DECEMBER 10, 2022 @ 9:00-18:30

@ WYNDHAM GRAND ATHENS HOTEL

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Design and Comparison of AHUS and DOA

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 - ASHRAE Society HVAC Trainer
 - ASHRAE Region XIV MP Chair



Casing's characteristics are measured and separated in 4 categories.



Deflection [mm/m]: The largest deformation of the sides of the unit under pressure, positive or negative, given as a difference in distance from a reference plane outside the unit to the external unit surface with and without test pressure. The deflection, related to the span, defines the casing strength.



Air leakage factor [$\text{l.s}^{-1}.\text{m}^{-2}$]: The air leakage in volume per unit of time, related to the external casing area.



Thermal transmittance [$\text{W.m}^{-2}.\text{K}^{-1}$]: The heat flow per area and temperature difference through the casing of the air handling unit.

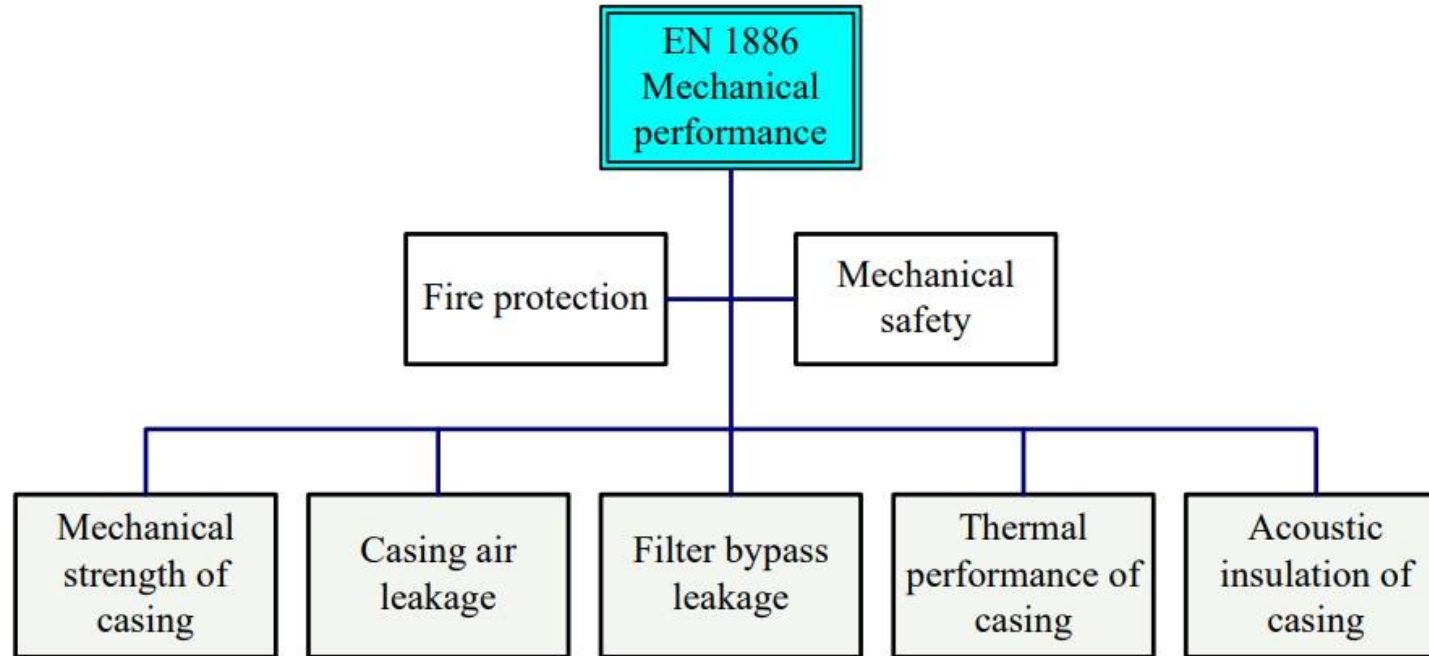


Thermal bridging factor [-]: The ratio between the lowest temperature difference between any point on the external surface and the mean internal air temperature and the mean air-to-air temperature difference.



Insight:
Technology in detail

EN 1886



This standard sets minimum requirements and ratings for components inside the AHUs

Classification of The casing Mechanical Strength class . Minimum Recommended is D2.

Classification according to EN 1886 (1000 Pa)		
Classification	Max. relative deflection [mm/m]	Explanation
D1	4	Robust construction of the panel itself, small deflection in relation with the size of the panel and the pressure inside
D2	10	Minimal recommendation for an air handling unit. Normal deflection of the panel
D3	>10	Not recommended. High deflection of the panel by high pressure.

Leakage classes at negative pressure of -400 Pa (EN 1886:2007)

Classification according to EN 1886 (-400 Pa)		
Classification	Max. leakage rate [l · s ⁻¹ · m ⁻²]	Explanation
L1 (R)	0,15	Leak-proof unit. Max. leakage very low at under pressure: a very small amount of air enters the unit through the casing.
L2 (R)	0,44	Minimal recommendation for an air handling unit. Acceptable amount of air enters the unit through the casing.
L3 (R)	1,32	Large amount of air enters the unit through the casing. It can influence the air quality in the unit and contaminate the treated air going in the building.

The external leakage rate influences different characteristics of the air handling unit. It reduces the useful airflow rate, can have a negative impact on air quality and can decrease the performance of the heat recovery system. The unit should therefore be as airtight as possible.

External leakage can occur by each opening in the unit's surface (e.g. doors, sections, etc.), as well as on the panel sealings and panel screws. The higher the pressure difference between the inside and outside of the unit, the higher the leakage rate. EN 1886:2007 fixes two standard pressures to measure leakages: -400 Pa and +700 Pa.

Leakage classes at negative pressure of +700 Pa (EN 1886:2007)

Classification according to EN 1886 (+700 Pa)		
Classification	Max. leakage rate [l · s ⁻¹ · m ⁻²]	Explanation
L1 (R)	0,22	Leak-proof unit. Max. leakage very low at over pressure: a very small amount of air exits the unit through the casing. The impact on the air is negligible.
L2 (R)	0,63	Minimal recommendation for an air handling unit. Acceptable amount of air exits the unit through the casing.
L3 (R)	1,90	Large amount of air exits the unit through the casing. It can influence the volume airflow supplied by the unit. The desired quantity of air for the room may not be delivered.

As the minimum casing air leakage class, it is recommended L2

Thermal transmittance class according to EN 1886:2007

Thermal transmittance class according to EN 1886	
Classification	Thermal transmittance (U) [W/m ² K]
T1	≤ 0,5
T2	0,5 - 1,0
T3	1,0 - 1,4
T4	1,4 - 2,0
T5	> 2

Thermal transmittance

The thermal transmittance class (T) indicates the energy loss of the casing per square meter per 1K difference between the temperature inside and outside the unit. This means that this is a direct energy (heat) loss of the unit.

Comparison of Eurovent

- The impact of the U- value is illustrated in Table 6, which gives the expected heat losses over two winter months for an outdoor unit with an external surface of 20 m² and an average temperature difference of 25K that can typically occur during the two coldest winter months in a cold climate at continuous operation. In practice, the energy losses may vary because a real unit differs from a model box for which the T-value is determined.

U -value [W/m ² K]	Heat loss [W]	Energy loss over 2 months [kWh]
0,5 (lower range value for T1)	250	360
1,0 (lower range value for T2)	500	720
1,4 (lower range value for T3)	700	1000
2,0 (lower range value for T4)	1000	1440

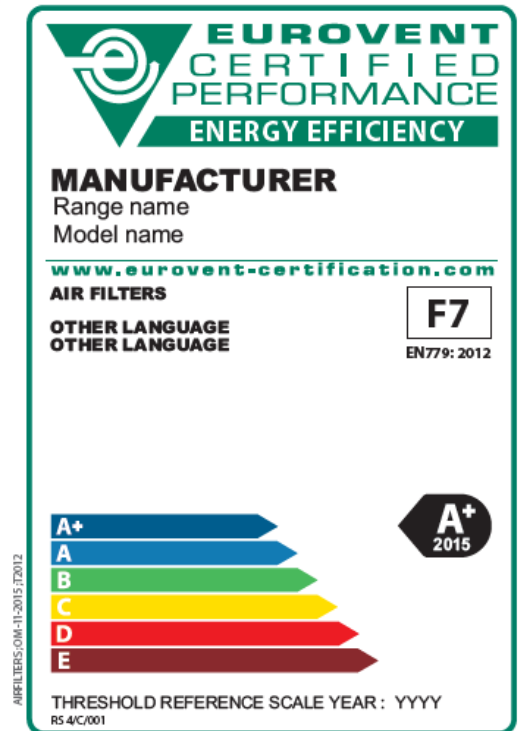
Thermal bridging factor (TB) – Condensation!!!

Thermal bridging class according to EN 1886	
Classification	Thermal bridging factor (k_b)
TB1	0,75 - 1
TB2	0,6 - 0,75
TB3	0,45 - 0,6
TB4	0,3 - 0,45
TB5	< 0,3

Thermal bridging factor (TB) is a more critical value compared to the above-mentioned T-value, particularly for the suction intake chamber and parts of casing downstream the cooler. The TB value is an indication when condensation can be expected on the outer skin of the unit. It is only an indication because a real unit will differ from a model box from which the TB-value is derived. Although the TB value is meant to determine the temperature on the outer surface of the unit, based on the TB value, the internal temperature and the ambient temperature, the TB value can also be used as an approximate indicator when to expect condensation on the inside of the unit at low ambient temperature.

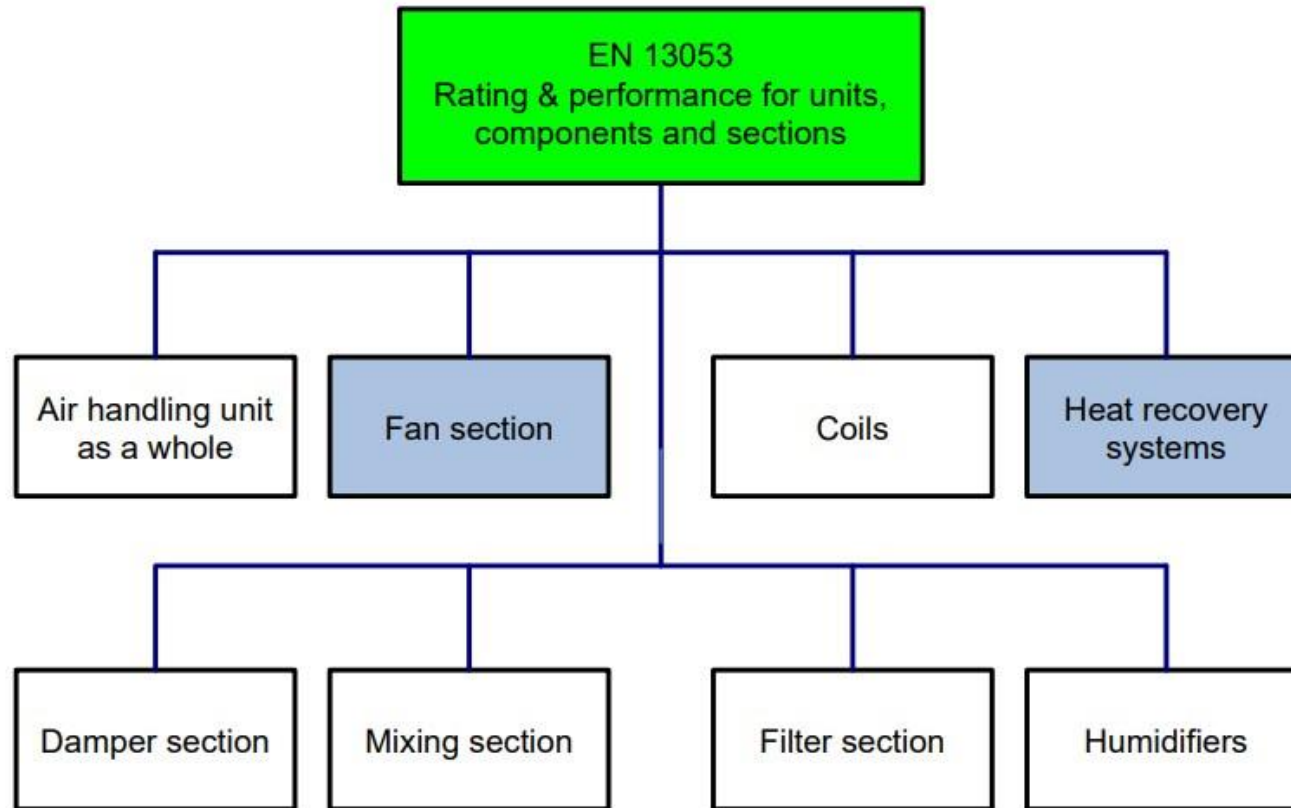
Energy efficiency of filters

In addition to efficient particle separation, filters play an essential role in energy consumption and have a significant impact on the overall energy efficiency of the AHU. This is because the average pressure difference of filters over their service life accounts for an increasing share of the total pressure drop in air handling units and HVAC systems. A high energy efficiency filter will not reach the final pressure drop recommended in EN 13053 when it needs to be changed for hygienic reasons (typically after one or two years). Obviously, the lower the final pressure drop of a filter at the moment of its replacement, the lower the energy consumption of the unit.



DOAS Design Considerations for EU

EN 13053



DOAS Design Considerations for EU

Class	Air velocity [m/s]
V1	$\leq 1,6$
V2	$1,6 < v \leq 1,8$
V3	$1,8 < v \leq 2,0$
V4	$2,0 < v \leq 2,2$
V5	$2,2 < v \leq 2,5$
V6	$2,5 < v \leq 2,8$

DOAS Design Considerations for EU

Class	$P_m \text{ max [kW]}$
P1	$\leq P_{m_{ref}} \times 0,85$
P2	$\leq P_{m_{ref}} \times 0,90$
P3	$\leq P_{m_{ref}} \times 0,95$
P4	$\leq P_{m_{ref}} \times 1,00$
P5	$\leq P_{m_{ref}} \times 1,06$
P6	$\leq P_{m_{ref}} \times 1,12$

DOAS Design Considerations for EU

Class	η_t	Δp_{HRS} [Pa]	ϵ	η_e
H1	0,75	2 x 280	19,5	0,71
H2	0,67	2 x 230	21,2	0,64
H3	0,57	2 x 170	24,2	0,55
H4	0,47	2 x 125	27,3	0,45
H5	0,37	2 x 100	26,9	0,36

DOAS Design Considerations for EU. EN 16798-3

Category	P_{SFP} in (W/(m ³ /s))
SFP 0	< 300
SFP 1	≤ 500
SFP 2	≤ 750
SFP 3	≤ 1 250
SFP 4	≤ 2 000
SFP 5	≤ 3 000
SFP 6	≤ 4 500
SFP 7	> 4 500



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