How to specify the right weather louvres

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Whitepaper

How to specify the right weather louvres

Too often "percentage free area" appears in specifications. This tells you nothing about the actual performance of the louvre.

So, what makes for a good louvre specification?

This whitepaper explains why these things are important:

- An air flow rate and direction, and a maximum pressure loss
- A rain rejection performance or class (HEVAC test method or EN 13030)
- A structural design wind load.

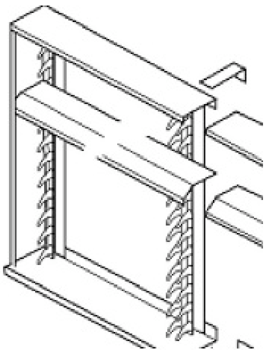
It explains the EN 13030 test standard and its limitations, and sets out what are the critical points to consider when writing an effective specification.

Definitions

Three different physical areas are commonly used to describe a louvre:

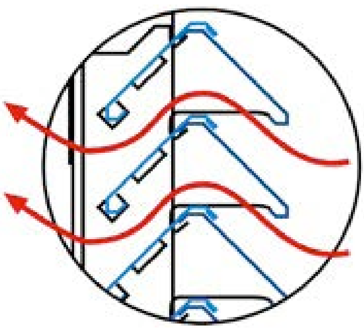
Face Area

Face area is the total area within the front frame of the louvre panel. As seen in this illustration, it is the visible louvre area.



Core Area

Core area is the total open area with the louvre blades removed. It differs from the face area in that it takes account of rear framing (which may be wider than the visible front frame) and intermediate mullions. It is almost always smaller than the face area.



Free Area

Free area is the minimum area between the louvre blades, measured in the local direction of flow. It is commonly found in specifications (typically as "50% minimum free area") but is meaningless in terms of performance.

The EN 13030 test method

The current test method in Europe is described in the European Standard EN 13030. This was developed from the HEVAC test method, which was originally established by manufacturers to help designers differentiate between louvres to suit specific applications.

The American AMCA 500 standard incorporates a simplified (and less rigorous) version of the EN13030 tests.

The test environment in the standard, at 13m/s (30mph) wind speed and 75mm/h (3 inches/h) rainfall for a period of 30 to 60 minutes, is intended to represent bad Northern European weather conditions.

Test conditions

Two performance classifications are provided; one for rain rejection effectiveness, which varies with wind and flow velocity, and one for aerodynamic performance, which is a constant.

Rain rejection tests are carried out with a simulated 13m/s (30mph) wind normal to the louvre sample and with a range of air inlet velocities between 0m/s and 3.5m/s based upon the face area. Tests are not carried out with air exhaust as the worst case then is considered to be when the system is turned off (0m/s). Simulated rainfall during the tests equates to 75l / (h.m^2) rain entry through a plain opening. Results are reported as % potential rainfall rejected by the louvre and classified in classes A-D. The air inlet velocity should always be stated with the performance or class.

Aerodynamic tests are carried out over the same air inlet velocity range and an aerodynamic coefficient is calculated based upon the face area. Results are reported as a coefficient (between 0 and 1) and classified in classes 1-4.

Although it simplifies matters to describe the results in terms of classes, the wide range of each class hides quite significant differences in performance.

Rainfall rejection	
Class	***Range***
A	≥ 99%
B	95% - 98.99%
C	80% - 94.99%
D	< 80%

Coefficient	
Class	***Range***
1	≥ 0.4
2	0.3 – 0.399
3	0.2 – 0.299
4	< 0.2

Recommendations for the selection of rain defence louvres, based on actual design inlet air velocities (for exhaust louvres take a velocity of 0m/s, representing the worst case with the exhaust system switched off) are:

Class A where excellent rain defence is required.

Class B where good rain defence is required.

Class C where reasonably good rain defence is of benefit or the louvres are in a sheltered area.

Class D where rain defence is not considered important or louvres are located in a very sheltered area.

Limitations of the tests

1. The EN 13030 tests use a louvre sample with a 1m x 1m face area.

The sample is reasonably representative of typical small louvre panels but the results cannot be directly extrapolated for large panels.

The test accurately measures the rain rejection performance of the louvre blades under the test conditions, but it cannot replicate issues such as water draining over the louvre panel from a wall above or water management and drainage within the louvre system which are critical issues for large panels.

The test also makes no assessment of the depth of water penetration. This ignores one of the major benefits of a double bank louvre which ejects water downwards and thus limits the depth of penetration.

2. The EN 13030 tests use face area

For the aerodynamic tests the major difficulty is that the coefficient is calculated based on the face area of the louvre sample, rather than on the core area. This means that the coefficient determined by the test cannot be directly used to accurately calculate the pressure loss through different sizes of louvre panel.

What is more relevant: free area, coefficient or pressure loss?

Let us first dispose of **free** area or measured free area. This is not used in EN 13030 and is not a useful predictor of pressure loss through a louvre. It has no place in specifying any louvre where the pressure loss through the louvre is important.

The aerodynamic coefficient is related to the pressure loss through a louvre by the Bernoulli equation:

$$\Delta P = 0.5\rho\frac{Q^2}{(AvCv)^2}$$

Where;
ΔP = pressure loss (N/m^2)
p = air density (kg/m^3)
Q = air flow rate through louvre (m^3/s)
Av = area of louvre (m^2)
Cv = aerodynamic coefficient

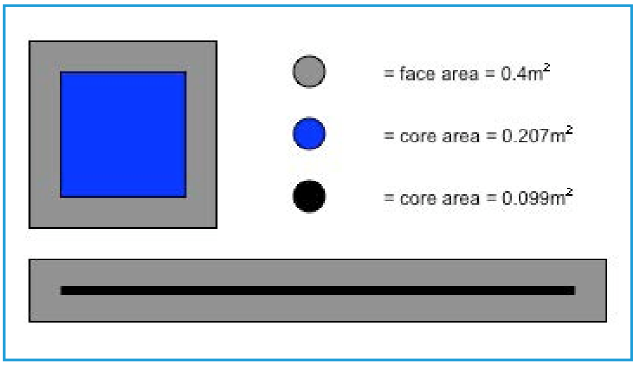
EN 13030 uses the **face** area of a louvre as the basis for the aerodynamic coefficient, so the area used for calculation (Av) is usually the face area when the Cv reported from EN 13030 is used.

A more correct method is to use the **core** area as both the basis for the Cv and as Av in project calculations.

For a 1m x 1m panel the result would be the same for either method.

However, for any other panel the ratio between the face area and the core area will be different and will be dependent upon the panel size, the aspect ratio and the mullion size and spacing. Taking an example of a panel to provide a face area of $0.4m^2$, this panel could be 635mm x 635mm or 1600mm x 250mm.

Taking a typical Colt 1UL/SH panel, which has a rear internal flange 90mm wide all round, the core area would be either 455mm x 455mm = $0.207m^2$ or 1420mm x 70mm = $0.0994m^2$. Thus two small panels with the same face area have core areas more than 2 times different. Please see the illustration above.



Taking a flow rate of $0.5m^3/s$ and the coefficient, based on core area, of 0.44, the pressure loss would be:

$\Delta P = 0.5 \times 1.2 \times 0.5^2 / (0.207 \times 0.44)^2 = 18N/m^2$ for the square panel.

$\Delta P = 0.5 \times 1.2 \times 0.5^2 / (0.099 \times 0.44)^2 = 79N/m^2$ for the long thin panel.

Taking the same flow rate and an equivalent coefficient based on face area, the predicted pressure loss would be only $10N/m^2$, significantly below the real pressure loss.

If large panels are considered, obviously the effect of the outside frame is less pronounced, but intermediate support mullions are usually required and these may be spaced at a pitch typically anywhere between 0.5m and 1.25m depending upon the mullion strength, unsupported length and design wind load. Calculation based on face area will totally ignore the effect of the mullions whereas calculation based on core area will include their effect.

It is thus clear that any calculation of pressure loss using the face area of a louvre panel and the coefficient from the EN 13030 test without modification is inaccurate and risks seriously underestimating the actual pressure loss.

On the other hand it cannot be claimed that use of the core area provides 100% accuracy either, but it does reflect the geometry of any louvre panel much better than the face area and, where it is inaccurate, it is generally conservative.

To conclude, the final pressure loss is much more important than the published aerodynamic coefficient.

Wind load: a key consideration at an early stage

As noted above, the structural design wind load at the location of the louvre on the building has a significant effect on the mullion spacing and the requirement for intermediate support steelwork. Someone somewhere must have this information but somehow it rarely gets through to the louvre supplier early enough, or even at all.

Without this information most suppliers will simply revert to a commercially attractive standard default mullion spacing and provide a qualifying statement. Later disclosure of a higher design wind load can lead to reduced mullion spacing and/or increased secondary steelwork. These will increase costs and increase the core velocity and the pressure drop through the louvre and possibly reduce the rain rejection performance as well.

Conclusion

The EN 13030 standard provides a useful method for making basic initial comparisons between the performance of different louvre systems, and the results can be used for specifications.

However the results, applied incorrectly as they often are, can lead to misleading calculation of pressure losses through installed louvre panels.

In addition, the results cannot be directly used to estimate the expected rain entry into a building through a louvre panel.

So, how can a good specification be written?

What are the critical points to consider when writing a specification?

- If using classes rather than specific values, ensure that the lowest performance in the class specified is acceptable.
- Always link rain rejection performance to an inlet velocity, or else you risk getting a louvre which only meets the required performance when no air is passing through it.
- If a specific maximum pressure drop is critical for a louvre panel then include it.
- Provide a design structural wind load.

Colt can provide assistance in preparing a specification.