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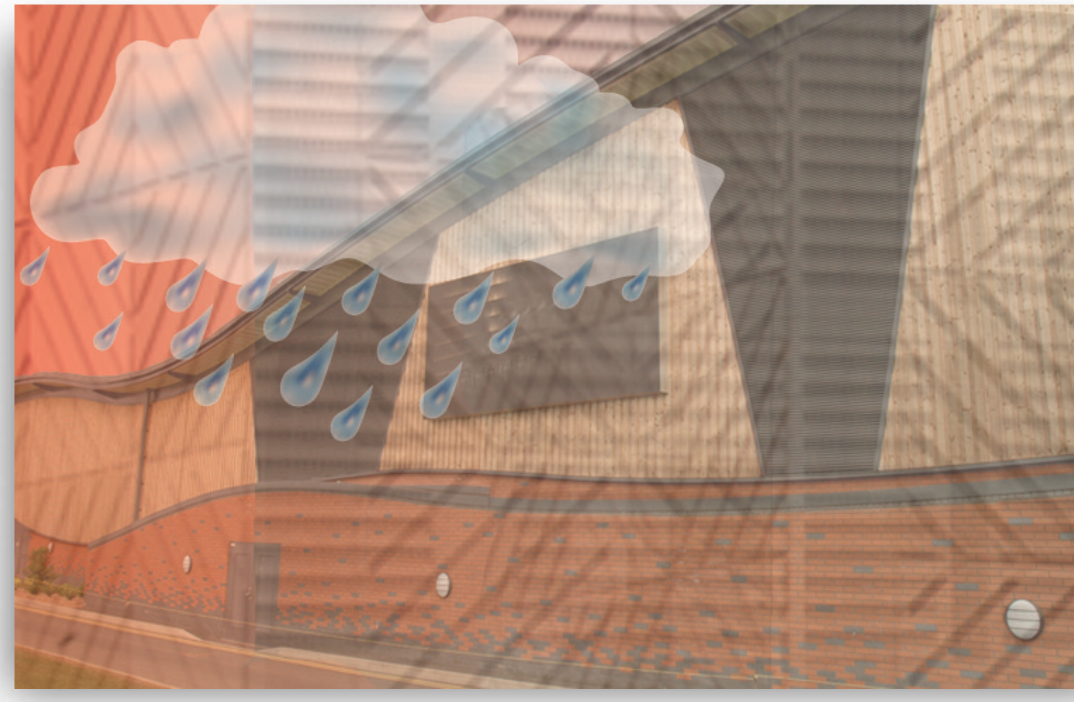
Weather Louvre Specification Guide



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1 INTRODUCTION

A weather louvre is a passive device, intended to allow the passage of air into or out of a building or ventilation system, while restricting the entry of rain.

While one louvre may look very much like another, there is far more to their design than meets the eye. Subtleties of blade profile, pitch (distance between blades) and the number of banks of blades are among many design features that deliver critical differences in performance.

Figure 1: Example of a weather louvre

Failure to understand and clearly express the performance requirement at the design or procurement stage increases the risk of the product not being fit for purpose. Further risk lies in whether the product eventually chosen will meet its promised performance. For the end user, these risks may mean unwanted water penetration or wasted energy, both of which represent unnecessary cost.

This guide has been compiled to help system designers and specifiers of weather louvres to achieve optimum performance. It explains:

- how to understand weather louvre requirements and thereby develop a specification which is both realistic and well-defined
- how to minimise whole-life costs through system design and louvre selection
- which terms to use to ensure that performance data are consistently stated when sourcing products from suppliers
- how to minimise risks associated with overstated performance claims.

2 UNDERSTANDING WEATHER LOUVRE REQUIREMENTS

A weather louvre is essentially a grille fixed over an opening, designed to let air through and keep water out. A weather louvre has no moving parts and so is designed to perform both of these functions simultaneously and continuously. A weather louvre's suitability for a particular application is determined by how effectively it achieves these functions in combination.

There are two key elements to understanding the weather louvre requirement for a particular application:

- airflow – based on the volume flow rate of air required and the size of the louvre face
- water penetration – based on how critical it is to prevent water getting beyond the louvre.

2.1 AIRFLOW

In weather louvre selection, it is the air velocity at the louvre face that is of ultimate importance. If this is not known, it can be calculated as follows:

Face velocity (m/s) = volume flow rate (m^3/s) / face area (m^2)

Watchpoint
To state the airflow performance of the weather louvre, express the required face velocity in m/s

For example, if the volume flow rate is 3 m^3/s and the face area 2 m^2 the face velocity will be 1.5 m/s.

The same weather louvre will perform differently depending on the face velocity, so knowing this value is crucial when it comes to product selection. This is explained in more detail in Section 2.3.

Energy efficiency
Decisions about weather louvre energy efficiency have more to do with product choice than system requirement. However it is important at the design stage to recognise that the ultimate efficiency of design is a combination of the louvre size (the larger area the better) and how freely it allows air (and with it water) to pass through it.

The issue of energy usage in relation to weather louvres is essentially to do with the fan power required to deliver a specified volume flow rate through the louvre. The greater the resistance to the air moving through the louvre, the greater the difference in pressure between the outside and inside of the louvre (pressure drop). The greater the pressure drop, the more fan power is required for the same volume flow rate to be achieved. Hence one should seek to minimise this pressure drop in order to minimise the energy required to move air through the louvre.

Watchpoint
In order to minimise whole-life energy costs, make the louvre face area as large as economically and practically possible. The larger the face area, the less energy is required to meet the desired volume flow rate.

The design of passive products such as weather louvres is now a focal point for designers looking to reduce the specific fan power requirement of an HVAC system. Improved efficiency of louvre design not only saves money but may assist with building regulations compliance and contribute to an improved energy rating for the building.

Blade thickness, spacing, and the aerodynamics of the blade profile will all affect resistance to airflow. Alternatively, increasing the size of the louvre at the design stage means that the same volume flow rate requirement can be met at a lower velocity. This has the effect of reducing pressure drop and hence fan power.

2.2 WATER PENETRATION

Besides allowing air to pass through the louvre, usually one also seeks to keep water out. The acceptable level of water penetration is specific to the application and how critical it is to keep the area beyond the louvre dry.

Key considerations for understanding water penetration requirements are:

- the degree of permissible water penetration
- the likely severity of weather conditions
- the position of the louvre in terms of being sheltered or exposed.

Quantifying permissible water penetration can be challenging. The test standard discussed in Section 3 helps by banding water rejection effectiveness. The simplest way to define the water penetration requirement is to consider which of these bands best suits the application.

The severity of the weather is naturally a key consideration, with both wind speed and rainfall impacting on the volume of water that will make its way through the louvre. In order to put a particular weather louvre's water penetration rating into context one should consider the likely in-situ weather conditions in comparison with the standard test conditions.

Similarly, the positioning of the louvre is important. A sheltered, urban position will be less exposed to the elements than a rural hilltop and therefore water penetration will be lower even under the same weather conditions.

2.3 BALANCING THE AIRFLOW AND WATER PENETRATION

As noted above, the better a louvre is at letting air through, the worse it is likely to be at keeping water out. This means that these two attributes must be considered together to provide a realistic and appropriate product specification.

It is also important to note that increasing the face velocity (see Section 2.1) increases the water penetration and the pressure drop, so keeping the face velocity low is beneficial both in keeping water out and minimising energy use.

Table 1: Variables affecting louvre performance (typical effect)

Action	Effect on energy efficiency	Effect on water rejection
Install more water resistant louvre	worse	better
Install lower pressure drop louvre	better	worse
Increase air velocity	worse	worse
Increase louvre face area (thus lowering required air velocity)	better	better

The degree to which these variables affect performance depends on the design of the louvre, in that the trade-off between efficiency and water rejection can be reduced to some extent through more efficient design.

It may seem logical to demand a product that has minimal pressure drop while providing minimal water penetration. However this is unfeasible as any barrier to water means some resistance to air and inevitable pressure drop.

Accepting then that there is a trade-off between efficient airflow and water rejection, it is important to recognise ways to help overcome this. Essentially this comes down to the following options:

- increase the size of the louvre face to achieve the same air volume but at lower velocity, reducing pressure drop and water penetration at the same time
- make provisions for water penetration such as drains behind the louvre in the ductwork, this widens options for weather louvres to include those with poorer water rejection properties but which allow freer passage of air
- opt for a more highly engineered product, this reduces the amount of trade-off between efficiency and water rejection.

Whether any of these options are viable, either in isolation or combined, depends on the specific application.

3 PERFORMANCE TESTING AND CLASSIFICATION

The standard performance test for weather louvres is described in *BS EN 13030:2001 Ventilation for Buildings. Terminals. Performance testing of louvres subjected to simulated rain*. A $1m^2$ sample louvre is subjected to simulated wind and rain and air is drawn through the louvre at various set volume flow rates. The test comprises two parts:

- measure of water penetration (expressed as a rating at each face velocity)
- measure of pressure drop (expressed as discharge or entry loss coefficient class).

The test standard rates the product for both aspects of performance.

Penetration classes
The simulated wind and rain that the weather louvre is subjected to under the standard test is as follows:

- fan driven wind at a speed of 13 m/s (approximately 30mph)
- water sprayed as rainfall at a rate of 75 l/h.

The amount of water collected behind the louvre is compared to that of a similar test conducted with the louvre removed completely. The effectiveness is the proportion of water rejected by the louvre.

For example a louvre with an effectiveness of 1 will have no water penetration at all under the test conditions. A louvre with an effectiveness of 0 will have the same amount of water penetration as a similar test with the louvre removed completely.

Results divide louvres into classes, with 'A' being the most effective (>98.9% of water rejected) and 'D' the least (<80%). A water penetration class is given for each of eight face velocities between 0 m/s and 3.5 m/s at 0.5 m/s increments. The meaning of each class is given below:

Table 2: Penetration classes

Class	Effectiveness	Maximum allowed penetration of simulated rain $l/h.m^2$
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

Source : *BS EN 13030:2001*

Note: The water penetration rating should always be stated in the context of the face velocity it was measured at. See Section 4.1 for further details.

Discharge or entry loss coefficient classes

The coefficient of discharge or entry (C_D) compares the performance of the louvre against an ideal louvre with minimal air resistance. It is expressed as a single class based on an average result over five air velocities. This part of the test measures the pressure differential between the outside and inside of the louvre, giving the resistance to airflow. The air resistance is rated in classes, with ‘1’ indicating the least resistance (a C_D of 0.4 or greater) and ‘4’ the most (a C_D of below 0.2).

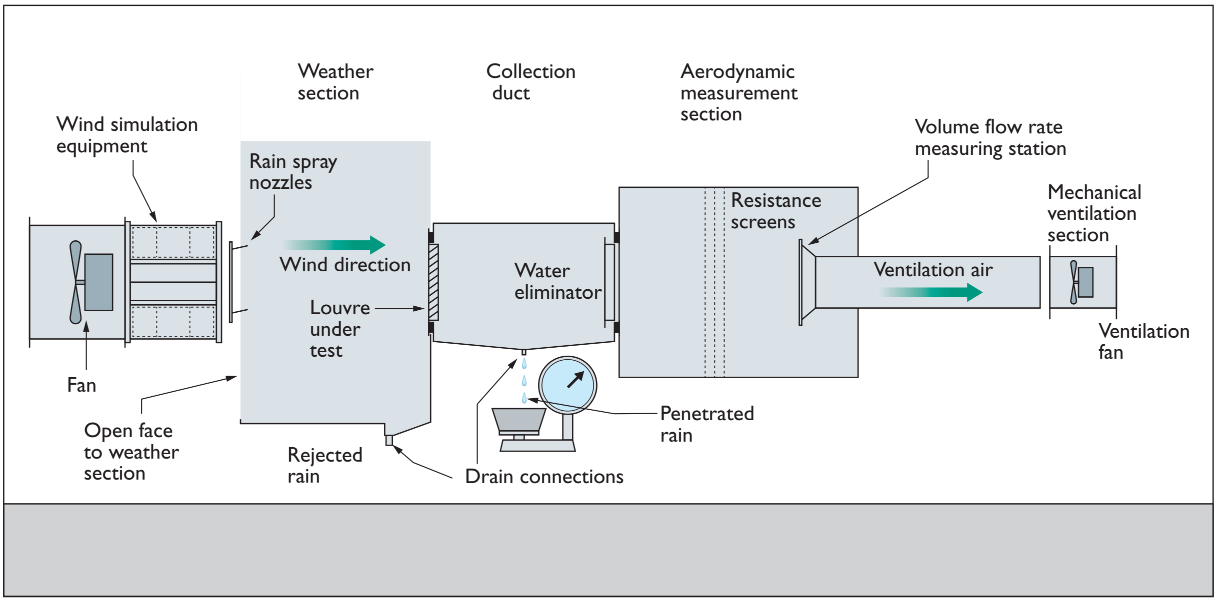
Table 3: Discharge loss coefficient classes

Class	Discharge loss coefficient C_D
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

Source : BS EN 13030:2001

Figure 2: Aerodynamic weather louvre test facility



4 SPECIFYING A WEATHER LOUVRE

To specify a weather louvre usefully requires the following elements :

- understanding of the required volume flow rate, louvre face area and subsequent face velocity
- understanding of the permissible water penetration for the application, based on the classes provided by the standard test (A-D)
- understanding of the standard test classes for discharge or entry loss coefficient (1-4) and that a higher C_D means lower energy usage.

In considering the performance requirement it is useful to note the simulated weather conditions for comparison with the specific application. For applications subject to more severe weather conditions (heavier rainfall or higher/swirling winds for example) it follows that the rating achieved under test conditions will imply better performance than may actually be achieved.

As well as bearing in mind the test's simulated weather conditions, it is important to pay attention to the test points relative to the classification. For example, a louvre rating of 'A' at 0 m/s is no guarantee that this performance will be achieved at even 0.5 m/s or any other face velocity.

Other factors which can affect performance of a weather louvre which are not accounted for by the standard test are:

- ancillaries such as bird/rodent/insect guards or eliminators (these improve water rejection but impede airflow, to varying extents)
- size
- structural elements such as mullions, joints and drains
- orientation - a weather louvre will perform differently when the blades are orientated vertically rather than horizontally
- application - for example in a penthouse application, the structure is openly exposed to multi-directional winds unlike the traditional installation which is flush with a wall (See Figure 3)
- paint finish
- site conditions - for example prevailing winds, level of exposure, rainfall and degree of shelter from surrounding buildings and geographical features.

Figure 3: Penthouse weather louvre

The exact configuration of the tested product should be stated within the test report. Insufficient data exists to usefully de-rate weather louvre classifications based on these factors. However it is important to be aware of a possible effect on performance and to discuss with the supplier where appropriate.

4.1 Speaking the supplier's language

Watchpoint
To establish the performance of the weather louvre make sure it is stated in direct relation to the required face velocity. Knowing a louvre is rated 'A' at 0 m/s is not useful if your application demands performance at 1.0 m/s.

In weather louvre selection, it is the air velocity at the louvre face that is of ultimate importance. To determine this face velocity one needs to consider the system's required airflow and the face area. Key considerations for understanding airflow requirement are, therefore:

- water penetration class A-D at face velocity 0-3.5 m/s (based on the air volume requirement and louvre face area)
- discharge or entry loss coefficient (C_D) class 1-4.

Example requirement:
A weather louvre which is class A at 1.0 m/s, C_D class 3.

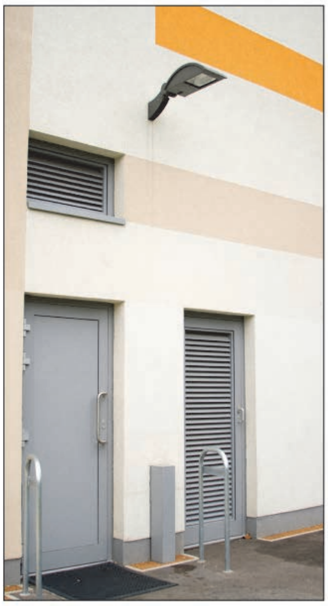
5 PRODUCT SELECTION

Having a well-defined product specification is only half the story. To ensure that the design performance requirements are met by the chosen product, it is important to select a product that lives up to the performance stated by the supplier.

The following are suggested ways to minimise the risk of procuring an under-performing weather louvre:

- ensure that the product description is accompanied by reliable performance test data, preferably from tests carried out by an independent third party
- ensure that any claimed water penetration class is accompanied by the corresponding face velocity in all cases, and focus on the face velocity that matches your application
- be aware that test data only relates to a one-off test sample[1]. Seek further assurance that weather louvres subsequently sold under the same name are produced consistently and can be linked back to the tested sample. This can be done easily through choosing a product that belongs to a product certification scheme incorporating factory production control, which goes beyond *ISO 9001* management system certification
- ensure that installation instructions are provided with the product. Incorrect installation can adversely affect weather louvre performance.

Figure 4: Different applications of weather louvres



[1] In the case of weather louvres this sample will always be prepared specifically for the test, due to the fact that weather louvres for installation are invariably larger than the 1m^2 sample used in the test. They also are not bought 'off the shelf' so random selection of test samples is not an option.

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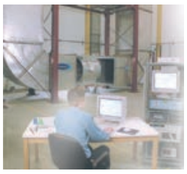

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