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ML SHAW
FABRICATIONS

## Maintaining maximum system performance and energy saving efficiency

## The benefits of the IKV Intelligent Kitchen Ventilation System

This document highlights the advantages, benefits and performance efficiency of the IKV system compared with other kitchen ventilation products currently available.

CIBSE Guide TM:50 quite rightly states:-

“Demand-based, or variable air volume (VAV) ventilation, is almost certainly the single most effective means of saving energy in a commercial kitchen ventilation system.” (CIBSE TM:50 2009)

At M L Shaw Fabrications we are firmly committed to the key objective of saving energy when designing a commercial kitchen ventilation system.

However, this cannot be achieved by compromising the safety of kitchen staff to meet energy saving aspirations.

This separates our patented (IKV) system from any other product currently available on the market as we can maintain optimum performance while simultaneously operating at maximum energy efficiency.

According to DW172 the optimum velocity that air should pass through a filter is 5m/s.

***Table 13 - Types of Canopy Grease Filter and Their Main Properties***

| Type | Recommended Face Velocity | Advantages | Disadvantages |
|---|---|---|---|
| **Baffle** | **4.5 - 5.5 m/s (at slot)** | **Inexpensive Non - over Loading pressure drop** | **Higher pressure drop than mesh filters** |

(Table 13 – HVAC DW/172. 1999)

There are a number of reasons why this optimum velocity of 5m/s is important:-

1. 5 m/s is the optimum speed at which grease particles will be separated from the air within the baffle filter. Any slower and the grease molecules will potentially pass through the filter and deposit themselves within the ductwork. This will increase maintenance cleaning costs and more importantly increase the risk of fire due to grease lined ductwork.

2. The velocity is also set to enable the heat plume, smoke and cooking effluent to be safely extracted away from kitchen staff and not escape the confines of the canopy. At lower extract velocities the potential for these plumes to escape is greatly increased, dramatically reducing the air quality within the confines of the kitchen and potentially having a detrimental affect on the safety and well being of staff.

The IKV system works on the principle that air is only extracted above equipment that is in operation. This is achieved by automatically opening filters above equipment that is in use and ensuring the extract volume is adjusted to suit the number of filters open to constantly maintain the extract face velocity of 5m/s at the filter.

Without the capability to open and close filters in direct relationship with the overall extract volume, it is impossible to maintain the 5m/s through the filter therefore reducing system performance and potentially compromising the safety of staff.

As you can see from the table below we have assumed a filter bank system comprising of 10 separate baffle filters. When all 10 filters are open, the total free area available to extract air is 0.69m$^2$. In order to conform to DW172 our maximum extract volume will be 3.43m$^3$/s in order to maintain the 5m/s velocity at the filter.

IKV System - Filter Design 1

| Number of Filters Open | Total Free Area m$^2$ | Design Extract Volume m$^3$/s | Velocity m/s | Optimum Velocity Percentage | Percentage Under designed |
|---|---|---|---|---|---|
| 10 | 0.69 | 3.43 | 5 | 100 | 0 |
| 9 | 0.62 | 3.08 | 5 | 100 | 0 |
| 8 | 0.55 | 2.74 | 5 | 100 | 0 |
| 7 | 0.48 | 2.40 | 5 | 100 | 0 |
| 6 | 0.41 | 2.06 | 5 | 100 | 0 |
| 5 | 0.34 | 1.71 | 5 | 100 | 0 |
| 4 | 0.27 | 1.37 | 5 | 100 | 0 |
| 3 | 0.21 | 1.03 | 5 | 100 | 0 |
| 2 | 0.14 | 0.69 | 5 | 100 | 0 |
| 1 | 0.07 | 0.34 | 5 | 100 | 0 |

IKV System maintains maximum system performance even at lower extract volumes.

As equipment is switched off, temperature sensors mounted above each individual item of plant sense this and close the corresponding filter and reduce the fan extract volume accordingly.

As the filter closes, the free area available for the air to pass through also reduces. This therefore maintains the optimum 5m/s velocity at the open filters at reduced extract volumes.

Therefore the IKV system **ALWAYS** maintains maximum system performance and energy saving efficiency.

If we compare this to a system that can only alter the extract volume, we can compare the overall drop in system performance. This can be seen from the table below.

Other Demand Based Kitchen Ventilation

| Number of Filters Open | Total Free Area m$^2$ | Design Extract Volume m$^3$/s | Velocity m/s | Optimum Velocity Percentage | Percentage Under designed |
|---|---|---|---|---|---|
| 10 | 0.69 | 3.43 | 5 | 100 | 0 |
| 10 | 0.69 | 3.08 | 4.5 | 90 | 10 |
| 10 | 0.69 | 2.74 | 4 | 80 | 20 |
| 10 | 0.69 | 2.40 | 3.5 | 70 | 30 |
| 10 | 0.69 | 2.06 | 3 | 60 | 40 |
| 10 | 0.69 | 1.71 | 2.5 | 50 | 50 |
| 10 | 0.69 | 1.37 | 2 | 40 | 60 |
| 10 | 0.69 | 1.03 | 1.5 | 30 | 70 |
| 10 | 0.69 | 0.69 | 1 | 20 | 80 |
| 10 | 0.69 | 0.34 | 0.5 | 10 | 90 |

Other system reduce system perfomance at lower extract volumes. Not compliant to DW172 specification.

As you can see above, we have assumed a kitchen with the same 10 baffle filters and also lowered extract volumes in exactly the same steps as the IKV system. The key difference is that the free area remains the same because alternative systems do not have the capability to open and close filters.

It is dramatic how the overall system performance reduces as it lowers its extract volumes. When the extract volume is reduced from 3.43 $m^3$/s to 1.71$m^3$/s, the velocity of the air passing through the filter is around 2.5m/s. This is half the recommended velocity stipulated within the DW172 specification.

Alternative demand based ventilation systems which adjust fan speeds by monitoring the incoming gas, electricity or exhaust air temperature are also fundamentally flawed as they cannot determine which individual items of cooking equipment are being used. It is important to treat cooking appliances separately, as the recommended extract volume varies from each piece of equipment within a kitchen. For example, items such as deep fat fryers require a greater volume of extract air per $m^2$ than say a convection oven. This is because of the higher levels of grease, heat and oil molecules emitted from the fryer in comparison to a convection oven.

These systems can only proportion the fan speeds in relation to the amount of gas or electricity being used or heat being generated and this is not the correct method to determine the required extract air volume. This method of operation could potentially lead to systems extracting air below the required minimum standard set within the DW172 specification. As a result the air quality could dramatically decrease, creating an unsafe environment for kitchen staff to operate in.

The IKV system has temperature sensors mounted above each individual item of equipment. When an appliance is switched on the corresponding temperature sensor sends a signal to the processor to alter the fan speeds according to the recommended extract volume required for that item of equipment. This method of operation guarantees that the IKV system always conforms to the extract volume set within the DW172 specification. Operators are then assured that kitchen staff have a safe and compliant kitchen in which to work.

Potential issues associated with alternative energy monitoring systems include:

1. Higher rate of grease particles passing through the baffle at reduced extract volumes
2. Increased maintenance cost – Duct cleaning
3. Reduced fan efficiency – Grease laden blades.
4. Final extract velocities do not comply with DW172 specification
5. Plume capture greatly reduced.
6. No distinguishing where the heat is taking place
7. Individual cooking appliances are not identified when switched on which could potentially lead to the kitchen's extract system under performing, thus greatly reducing air quality.
8. Greater risk of fire within the duct.

Whilst accepting that alternative systems do embrace the principle of energy saving, they can often do so by reducing overall performance. The IKV system meets both criteria: energy savings with no subsequent reduction in overall performance.

**FOR MORE INFORMATION**

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