

Best practice for design and operation of commercial kitchen ventilation systems: performance requirements

Extraction/Ventilation Systems

Adequate ventilation/extraction must be provided in food and drink premises to remove steam, cooking odours and grease-laden air. In most cases, natural ventilation is insufficient and an extract duct with a fan and filters is required to ventilate cooking fumes and remove odours without causing a nuisance to neighbouring properties.

Getting the right ventilation/extraction system for your needs can be rather complex, and should contact a specialist contractor who can carry out a ventilation survey for you, or advise you on a specific aspect of your requirements.

A separate Guidance Note containing contact details of companies who are able to undertake ventilation surveys is available from the Food team by using the contact details at the end of this note. Please ask for Guidance Note GN.C21. Please note, however, that the companies listed in Guidance Note GN.C21 are solely for information only. Their inclusion in the list does not form any endorsement by the Council.

Minimum ventilation rates

- An internal ambient air temperature of 28°C maximum.
- Maximum humidity levels of 70%.
- Internal noise level should be between NR40 – NR50.
- Dedicated make up air system to be approximately 85% of the extract flow rate
- Minimum air change rate of 40 per hour (bases on canopy and general room extraction)

Minimum requirements for canopy

Velocity requirements

- Light loading – 0.25 m/s (applies to steaming ovens, boiling pans, bains marie and stock-pot stoves)
- Medium loading – 0.35 m/s (applies to deep fat fryers, bratt pans solid and open top ranges and griddles)
- Heavy loading – 0.5 m/s (applies to chargrills, mesquite and specialist broiler units)

Material of construction

- A material that would comply with the food hygiene requirement is stainless steel

Grease filtration

- Have a minimum performance the same as a baffle filter
- Be easy to clean

Ducting

As a general rule, ducting should be as straight and short as possible, to ensure that fumes are discharged as effectively as possible. Care should be taken when designing the route of ducting to avoid proximity to residential or office windows on neighbouring properties, which could give rise to complaints.

Ducting systems should extend to at least one metre higher than the eaves of the property. In some cases we may ask for the top of the extract duct to discharge in a certain direction in order to minimise the likelihood of complaints. Ducting should not be routed through residential rooms.

Ductwork should be fitted with anti-vibration mountings to minimise the vibration caused by air passing through. Even if you are applying for planning permission only for external ducting, it is important to remember that vibration from the ductwork inside the building could also cause a nuisance to adjacent domestic or residential properties, particularly if ducting is fixed to a ceiling or party wall. Anti-vibration mountings should be used for all ductwork fixings.

Minimum requirements for ductwork

- All ductwork should be Low Pressure Class 'A' and constructed in accordance with HVCA Specification DW/144^[1] with a minimum thickness of 0.8mm
- Duct should be as follows:

	Supply (m/s)	Extract (m/s)
○ Mains run	6-8	6-9
○ Branch runs	4-6	5-7
○ Spigots	3-5	5-7
- All internal surfaces of the ductwork should be accessible for cleaning and inspection. Access panels should be installed at 3.0m centres and should be grease tight using a heat proof gasket or sealant.
- Duct work should not pass through fire barriers
- Where it is not possible to immediately discharge the captured air, fire rated ductwork may be required.

Minimum requirements for Odour Control

Discharge stack

- The discharge stack should:
 1. Discharge the extracted air not less than 1 m above the roof ridge of any building within 20 m of the building housing the commercial kitchen
 2. If 1 cannot be complied with for planning reasons, then the extracted air shall be discharged not less than 1 m above the roof eaves or dormer window of the building housing the commercial kitchen. Additional odour control measures may be required
 3. If 1 or 2 cannot be complied with for planning reasons, then an exceptionally high level of odour control will be required
- **Low level discharge should be avoided.**
- **Use of Chinaman's hats or other cowls is not recommended**

Filters

Various types of filters will usually be required in order to eliminate grease and odours from the cooking fumes

Grease filters

Grease filters ensure that grease is removed from the cooking fumes. This helps prevent it from building up inside the ducting, which can cause hygiene and odour problems, cause the grease to leak through joints in the ductwork, and pose a fire risk. Grease filters should be incorporated into the cooker hood and should be easily removable for cleaning before they become clogged. Proper maintenance of grease filters is essential, as grease accumulation further up the ventilation ducting can be very difficult to remove. When fitting grease filters, mesh type filters are preferable to baffle type filters as they are considered to be more effective.

Carbon and Pre-filters

Carbon filters are also required and are essential when preparing fried foods and/or foods with strong odours in a food premises close to residential or office properties. Properly maintained carbon filters can eliminate the majority of odours created when food is cooked. Carbon filters should be fitted internally to the ductwork, after the grease filters, and should be positioned so that they can easily be accessed for cleaning.

The carbon filter unit you select should include pre-filters, as these help ensure that no grease enters the carbon filters themselves. Carbon filters can be ruined by operating the extraction system without effective removal of grease. This can be very expensive and it is therefore essential to ensure that you have grease and pre-filters and that they are kept in good working order and used at all times when cooking.

Electrostatic precipitation

Electrostatic separators (ESP) are used to separate solid or liquid particles from ventilation air. The particles distributed in the gas are electrostatically charged so that they stick to collection plates.

The Main components of an ESP are the filter housing, discharge and collecting electrodes, power supply, gas guides or baffles and a rapping system for cleaning the collecting plates.

ESPs can be designed to eliminate extensive quantities of smoke however the effectiveness of an ESP is limited to removing the grease that adheres to smoke and **should not be considered to be a primary source of odour control**. Where installed, pre-filters should be fitted upstream of the ESP to provide some protection from large contaminants that may pass through the grease filters.

Where an ESP is used to treat oily fumes the collecting plates can become fouled, rendering them less effective. Weekly servicing should be the minimum requirement and they should be cleaned immediately as soon as there is any sign of deterioration in fume control.

In-line oxidation systems

Oxidation using ozone and/or activated oxygen ions has been used to treat odour emissions from commercial and industrial kitchen processes. Due consideration needs to be given to the residual ozone that may arise from these systems. Complete degradation of ozone is unlikely to take place within the duct work and therefore extraction system must discharge at high level. There will need to be restricted application of these systems in areas housing multiple commercial kitchens.

Odour neutralizing and counteracting agents

There are a number of products on the market claiming that odour emissions can be 'neutralised' by the addition of certain components into the air stream. Counteracting agents are added to the air stream and result in a reduced response to the odour by the human nose by reducing the perceived intensity. As this type of system does not remove odour the level of odour removal is likely to be negligible.

With these systems correct chemical dosing is critical as the chemical agent that is injected into the air stream can also give rise to odour annoyance. Such systems should be avoided where the dispersion of the discharging plume is severely impeded, e.g. in courtyard situations.

Minimum requirements for Odour Control

Odour arrestment plant performance

Low to medium level control may include:

1. Fine filtration or ESP followed by carbon filtration (carbon filters rated with a 0.1 second residence time)
2. Fine filtration followed by counteractant/neutralising system to achieve the same level of control as 1

High level odour control may include:

1. Fine filtration or ESP followed by carbon filtration (carbon filters rated with a 0.2-0.4 second residence time).
2. Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 1

Very high level odour control may include:

1. Fine filtration or ESP followed by carbon filtration (carbon filters rated with a 0.4 –0.8 second residence time)
2. Fine filtration or ESP followed by carbon filtration and by counteractant/neutralising system to achieve the same level of control as 1.
3. Fine filtration or ESP followed by UV ozone system to achieve the same level of control as 1.
4. Fine filtration or ESP followed by wet scrubbing to achieve the same level of control as 1.

Maintenance must be carried out to ensure these performance levels are always achieved.

Fans

A fan will be required to pull cooking fumes from the cooker hood to the point of discharge at roof height. The size of the fan motor must be adequate to ensure proper ventilation, taking into account the length and design of the ductwork and the filters used. A ventilation contractor will be able to advise you of the appropriate size of fan motor for your ducting and on the adequacy of air changes.

Fans should be located within the building wherever possible, in order to minimise the likelihood of fan noise and vibration causing nuisance. If the fan cannot be located internally, we will usually require details of the noise levels the fan makes. Even with fans located inside the building, consideration should be given to making sure that any vibration and noise from the fan will not cause a nuisance to adjacent properties.

Minimum requirements for fans

- Fans must be capable of dealing with the operating static pressure within the duct work and should be designed with a minimum 10% pressure margin.
- Backward curved centrifugal, mixed flow or axial flow impellers are preferred as they are less prone to imbalance and are more easily maintained/cleaned due to their open construction. Fixed or adjustable metal impellers with a robust and open construction should be used.
- Fan motors should be rated to IP55 with no need to mount the motor outside of the air stream. For fans that have motors within the air stream and are ventilating cooking equipment that produce high levels of temperature and humidity the specification for the motor should be upgraded to withstand more onerous conditions.

Minimum requirements for noise control

- For new premises or premises covered by planning conditions restricting the impact of noise the system should be designed to prevent an acoustic impact on the external environment and therefore harm to the amenity, as well as ensuring that noise exposure of kitchen staff does not constitute a hearing hazard.
- For existing premises not covered by planning conditions *restricting the impact of noise, the system should be designed to avoid statutory nuisance and should comply with the principles of Best Practicable Means.*
- To achieve these objectives the noise control system should include:
 - control of noise at source to the greatest extent possible
 - control of noise to the environment by taking acoustic considerations into account within the duct, grille and termination design
- The control system should meet the requirements laid down in BS4142: 1997 "Method for Rating industrial noise affecting mixed residential and industrial areas.