

Control of Odour and Noise from Commercial Kitchen Exhaust Systems

Update to the 2004 report prepared by NETCEN for the Department for
Environment, Food and Rural Affairs



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Foreword

Local Authorities, commercial kitchen designers and commercial kitchen operators have a vested interest in ensuring that appropriate equipment and techniques are employed to minimise the impact of these activities. Until September 2017 stakeholders were able to rely on the original version of the “Control of Odour and Noise from Commercial Kitchen Exhaust Systems” report, at which point Defra determined that the original published in 2005 was out of date and the guidance was ‘withdrawn’.

Following Defra’s decision to change the status of the original report, EMAQ decided to survey its local authority subscribers to evaluate whether the 2005 report was still relied upon. Of the survey responses received

- *over 97% of subscribers used the 2005 report.*
- *over 96% of subscribers found the 2005 report useful.*
- *Over 83% of subscribers were aware that the 2005 report had been withdrawn*
- *About 7% of subscribers had taken steps to issue their own guidance*
- *Over 83% of subscribers were in favour of revising and updating the guidance*

On the basis of the survey responses we took the decision to amend the 2005 report to ensure that the up-to-date technical guidance remained available to our subscribers. In preparing this amended document we applied the following editorial philosophy:

- *We would rely on the original report structure and text as far as possible. The original document focused around English interpretation of relevant laws and regulations. This has continued in the amendment, however principles embodied in this document could be employed elsewhere.*
- *Where material in the original report was out of date and could not be replicated with more recent data, the original material would be removed.*
- *We would update any reference to latest legislation, standard and other technical material.*
- *We would take into account changes in cooking methods e.g. move toward wood fired cookers.*
- *Where material is available we would include additional ‘case study’ material to support the use of the guidance*

Changes made to the original document have been highlighted in italics.

As experience of using the Guidance develops, and as further improvement relating to pollution control from commercial kitchen become available, it is anticipated that revisions of this document will become necessary. EMAQ is particularly keen to hear of examples of good assessment and design practice in this area so they can be incorporated in future versions of this document. All comments and further information in relation to this topic should be sent to emaq@ricardo.com.

The EMAQ document aims to be the authoritative voice for the provision of technical guidance on various aspects of pollution management by maintaining, enhancing and promoting the highest standards of working practices in the field and for the professional development of those who undertake this work. Membership of EMAQ is mainly drawn from Local Authority professionals working within the fields of pollution science, pollution assessment and pollution management.



Dr Nigel Gibson

Best Practice for Design and Operation of Commercial Kitchen Ventilation Systems: Performance Requirements

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)
- *Extract flow rates for a commercial kitchen should be calculated using the thermal convection method only, as this overcomes heat and odour variation between different types of cooking appliances. Other less reliable methods remain available.*

Minimum Requirements for Canopy

Velocity requirements:

- Light loading – 0.25 m/s (applies to steaming ovens, boiling pans, bain maries 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)

Sizing:

- *Ideally, the plan dimensions of the canopy shall always exceed the plan dimensions of the catering equipment by a minimum of 250 mm on each free side*
- *This should be increased to 600 mm in front of combination steaming ovens to cope with the steam or fumes released when the doors of the appliance are opened. Solid fuel appliances must have an overhang of 300 mm from the door open position*

Materials:

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

Grease Separation:

- *The grease extracted by the separators shall be collected and removed so that it will not accumulate in either the canopy plenum or the ductwork system, or fall back onto the cooking surface*
- *The separator shall be constructed so that there are no sharp edges or projections and shall be easily removable for regular cleaning*
- *Primary filters that retain grease within the filtration matrix until cleaned, shall not be used (not to be confused with those designed with purpose made integral collection reservoirs)*

Minimum Requirements for Duct Work

- All duct work should be Low Pressure Class 'A' and constructed in accordance with BESA Specification DW/144 with a minimum thickness of 0.8 mm
- Duct velocities should be as follows:

	Supply (m/s)	Extract (m/s)
Main runs	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 2.0 m 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 duct work may be required

Minimum Requirements for Fans

Fans should be selected to handle the design resistance with an additional 10% airflow and 20% pressure margin allowed to suit possible extensions to the original kitchen plan.

Backward curved centrifugal, mixed flow or axial flow impellers are preferred as they are less prone to unbalance and are more easily maintained and cleaned due to their open construction. Fixed or adjustable metal impellers with a robust and open construction shall be used,

Care shall always be taken with the location of the supply and extract fans to ensure that there is sufficient space for regular cleaning and maintenance. Limited space shall not restrict selection of the correct fan.

Drain holes should be fitted.

For fans serving canopies above solid fuel burning appliances, the motor must be out of the airstream and impellers must have metal blades.

Minimum Requirements for Odour Control

Objectives

- for new premises or premises covered by planning conditions restricting the impact of odour the system shall be designed to prevent harm to the amenity.
- for existing premises not covered by planning conditions restricting the impact of odour, the system shall be designed to avoid statutory nuisance and shall comply with the principles of Best Practical Means.
- *The design of a control system should recognise that there are two phases of contamination in a kitchen exhaust; particulate (grease, smoke, hydrocarbons/VOC) and gaseous (odour). The particulate phase needs to be removed prior to dealing with the gaseous phase.*

To achieve these objectives the odour control system shall include an adequate level of:

1. *Particulate and odour control*; and
2. stack dispersion.

The overall performance of the odour abatement system will represent a balance of 1 and 2.

Discharge stack

The discharge stack shall:

1. Discharge the extracted air not less than 1 m above the roof ridge of any building within 15 m of the *vent serving* the commercial kitchen. *Additional odour control measures may still be required depending on the cooking type and frequency.*
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. *A higher level of odour control measures than those required in part 1 may be required.*
3. If 1 or 2 cannot be complied with for planning reasons, then *higher level of odour control measures than those required in part 1 or 2 may be required.*

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 of 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.

In some instances where very high levels of control are required combinations or sacrificial levels of filtration may be employed.

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

Minimum Requirements for Noise Control

For new premises or premises covered by planning conditions restricting the impact of noise the system shall 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 an occupational noise problem (see Control of Noise at Work Regulations 2005).

For existing premises not covered by planning conditions restricting the impact of noise, the system shall be designed to avoid statutory nuisance and shall comply with the principles of Best Practicable Means.

To achieve these objectives the noise control system shall include:

- control of noise at source to the greatest extent possible; and
- control of noise to the environment by taking acoustic considerations into account within duct, grille and termination design.

The control system should meet the requirements laid down in *BS4142: 2014* “Method for Rating and assessing industrial and commercial sound” or local standards where they exist (whichever is more appropriate).

Where in-line attenuators are used they shall be constructed so that there is no grease impregnation into the acoustic media. A protective membrane shall be specified for this purpose or this will reduce the design performance of the attenuator. This should be taken into account when selection is made.

It may be necessary to apply additional acoustic controls such as in line silencer or splitter attenuator after grease removal stages. Care should be taken to ensure that all such elements are capable of being accessed for cleansing purposes.

Minimum Requirements for Fire Suppression

Proprietors of commercial kitchens are under a duty to ensure that the fire precautions meet the requirements of *The Regulatory Reform (Fire Safety) order 2005*.

Minimum Requirements for Wood Burning Appliances

When serving a canopy above a wood burning appliance, the complete extract ductwork system shall be:

- *Manufactured from stainless steel*
- *Constructed to DW/144 specification*
- *Have a minimum of 2-hour fire rating, tested and assessed to the latest version of BS476 part 24*

Surface temperatures can reach in excess of 250°C so in these instances, in accordance with Building Control, the ductwork should be insulated to avoid heat transfer to adjacent combustible materials.

Solid Fuel Appliances should be considered separately when designing a safe and effective ventilation/control system.

Maintenance

Proprietors of commercial kitchens have a duty to ensure that the ventilation system serving their kitchen are maintained and operated effectively. Good maintenance is a prerequisite for ensuring that a system complies with Best Practicable Means under statutory nuisance provision and will form a key element of any scheme designed to minimise harm to the amenity under planning regulation. Good maintenance is required by the food hygiene regulations and will also minimise the risk of fire *and minimise noise*. The recommended cleaning period for grease extract system ductwork is:

<u>Grease loading</u>		<u>Daily usages</u>	<u>Cleaning interval (months)</u>
<i>Heavy use</i>	<i>Heavy/continuous grease production</i>	<i>6 – 12 hours</i>	<i>3-6 months</i>
		<i>12 -16 hours</i>	<i>2-3 months</i>
<i>Moderate use</i>	<i>Moderate grease production</i>	<i>6 – 12 hours</i>	<i>6-12 months</i>
		<i>12 -16 hours</i>	<i>3-4 months</i>
<i>Light use</i>	<i>No significant grease production</i>	<i>6 – 12 hours</i>	<i>12 months</i>
		<i>12 -16 hours</i>	<i>6 months</i>

Recommendations for maintenance of odour control system include:

- System employing fine filtration and carbon filtration
 - Change fine filters every two weeks
 - Change carbon filters every 4 to 6 months
- Use a system employing ESP and other in line abatement, typically
 - *ESP systems cleaned, and sump emptied on a four weekly basis.*
 - *UV-C systems used in line, cleaned on a four weekly basis*
 - *Side Stream UV-C systems, cleaned every 3 to 6 months.*
 - *Carbon filters with ESP pre-treatment change carbon filter every 6 to 12 months.*

These time frames may increase or reduce for extreme or very light applications.

Abbreviations Used

BCO	Building Control Officer
<i>BESA</i>	<i>Building Engineering Services Association</i>
BS	British Standard
BSRIA	Building Services Research and Information Association
CIBSE	Chartered Institution of Building Services Engineers
CIEH	Chartered Institution of Environmental Health
Defra	Department for Environment, Food and Rural Affairs
EHO	Environmental Health Officer
ESP	Electrostatic precipitator
HSE	Health and Safety Executive
HVAC	Heating, Ventilation and Air Conditioning
PO	Planning Officer
UV	Ultra Violet
<i>VOC</i>	<i>Volatile organic carbon</i>