Commercial Kitchens - Extract Systems and Cooking Ranges

Introduction

Commercial kitchen ranges and their integral extract ducting are present in many buildings such as restaurants, hotels, airports, fast food outlets and shopping centres. They provide a number of fire hazards including:

- The use of heated cooking oils/fats
- Heat sources such as electrical plates or elements, flames or hot gases
- Cooking equipment left unattended during operation
- Cooking equipment thermostat failure
- Extract ducting which can be extensive and circuitous in design, before exiting the building
- Accumulation of combustible fat deposits in extract ducting

Association of British Insurer's (ABI) statistics indicate that approximately 25% of all commercial fires are kitchen-related, with most occurring within the extract ducting, suggesting that a poor duct cleaning regime was a significant contributory factor to these losses. Inadequate kitchen cleaning procedures, the lack of fixed fire protection for the cooking range and extract ducting, and ineffective compartmentation provides an environment for fires to start and quickly spread. An organisation's Fire Risk Assessment should consider the hazards posed by the presence of a commercial kitchen, to ensure that appropriate controls and procedures are in place.

It is crucial that organisations have a good culture of housekeeping and maintenance as part of an overall risk management strategy, to help reduce the potential for fires and losses within establishments that have commercial cooking facilities.

Causes of Kitchen-Related Fires

Most kitchen-related fires originate within the extract ductwork and are primarily due to the build-up of combustible cooking oil deposits and fats that accumulate over a period of time. Fires also occur in the kitchen itself, either on the cooking range or within adjacent cooking equipment such as deep fat fryers. Provided these fires do not spread to the extract ducting, they are generally easier to contain and deal with, especially if there are automatic fixed fire suppression systems in place, along with trained personnel who are able to use fire blankets and manual fire extinguishers designed for tackling fires involving hot cooking oils and fats.

The main causes of fires within commercial kitchens are as follows:

- Spontaneous combustion of fats that have built-up within the extract filter and/or ductwork
- Short circuit of an electrical appliance (e.g. a fan) in the extraction network causing a spark to ignite any grease/fat build-up within the extract filter and/or ductwork
- A spark, flame or hot gas that travels from the cooking range into the extract filter and/or ductwork and ignites any fat build-up
- Overheating and spilling of oils either on the cooking range or deep fat fryer

Fire Protection and Methods to Reduce the Incidence of Kitchen Fires

The singularly most important factor in reducing kitchen fires is to prevent the build-up of combustible fat-contaminants within the non-combustible extract ductwork. There are a number of methods that can aid this objective, the most important being an effective deep clean of the whole extraction system by a specialist contractor, such as those who are members of the Building and Engineering Services Association (B&ES). The frequency of cleaning should be based on a risk assessment, which will measure the quantity of fat contaminants deposited on the duct surface and establish the rate of build-up, taking into consideration the type of cooking plus the number of hours that cooking is carried out. Further guidance in this document provides information as to how often this cleaning should be completed.

There are a number of other practices which will help to eliminate or reduce the severity of fires, such as:

- As a minimum extract ducts should be constructed from non-combustible materials such as galvanised or stainless steel, with consideration given to routing and appropriate fire compartmentation.
    - Regular cleaning of all equipment including deep cleaning of the entire extract ductwork, based on a risk assessment
    - Ductwork should have adequate access panels at approximately 2-metre spacing to allow a full deep clean to all areas of the extraction network
- Regular servicing and maintenance of all cooking equipment/appliances and electrical installations as part of a preventative maintenance programme
- Suitable automatic fire detection in every room/area
- Automatically and manually actuated safety interlocks to isolate power and/or fuel supplies to the cooking range and extraction network (cooking ranges should not be able to operate without the extract system being fully operational)
- Appropriate thermostat controls to be fitted to equipment such as deep fat fryers
- Cooking oils and fats should be regularly changed
- Cooking equipment, especially deep fat fryers, should not be left unattended
- Fixed, approved automatically and manually actuated fire suppression (e.g. Ansul R-102, Amerex KP, Nobel K-Series)
- Formal emergency procedures
- Appropriately trained employees
- Adequate and suitable manual fire extinguishers
- Fire blankets
- UV filtration
- Negative Pressure fan extraction

Fire Compartmentation, Fire-Resistant Ducting and Ducting Exit Point

There should be a thorough understanding of the fire compartmentation of the site, including the routing or proposed routing of the extraction ductwork network (including any changes in direction/bends,) and what fire compartment walls (if any) it passes through. Additionally there should be a full understanding of the exit point/location of the extract ducting and what this exposes, e.g. combustible construction, yard storage etc.

Recognised fire-resistant ducting should be installed within all fire compartments to limit fire and smoke spread throughout the building. Where the ducting passes through any fire compartment walls this vulnerability should be assessed and appropriate protection provided.

The number of bends/changes in direction of the extract ducting should be kept to a minimum and should ideally be zero, as such changes in direction causes the entrained fat droplets to be deposited on the duct wall.

The point where the ducting exits a building should be fully assessed. This should include an assessment of the wall or roof construction and in particular any combustible construction or combustible exposure. A fire in the ducting will exit at this point and could ignite the construction or combustible exposure. This exit point should be regularly reviewed to monitor fat/grease deposits and cleaned. Where the ducting passes through any combustible construction, the construction needs to be protected from excessive heat and the ducting encased in materials affording at least 1 hour fire-resistance.

Case Study: *A fast food restaurant in a London airport had a fire involving the kitchens extract duct that was not fire rated or located in a fire compartment. This resulted in extensive fire and smoke damage to the restaurant and parts of the terminal building, leading to the temporary closure of the airport's terminal building for clear-up/cleaning.*

Staff Training

All kitchen staff (covering every shift) should receive suitable formal and recorded training each year, and/or when changes to staff occur, covering the:

- Risks involved in the cooking area, including that within the ducting network
- Automatic fire detection system
- Automatic power and/or gas safety interlocks
    - and their manual activation devices
- Fire suppression system
    - and its manual activation devices
- Use of fire blankets
- Use of manual fire extinguishers etc.

Fire Suppression Systems and Safety Interlocks

Commercial kitchens should be fitted with a fire suppression system. Appropriately listed/approved automatically and manually actuated fire suppression systems should be designed and installed by listed/approved specialist companies that are acceptable to insurers and other interested authorities (e.g. certified to LPS 1223 'Requirements and testing procedures for the LPCB certification and listing of fixed fire extinguishing systems for catering equipment'). The system should be installed to protect the cooker hood/cooking range below, filter section and extract ducting. The length of ducting protected should be based on the exposure/risk, the fire compartmentation, the building construction, the discharge point, etc.

The system should actuate automatically based on an appropriate fire signature automatic fire detection device, e.g. heat detection, frangible bulb and fusible element. There should also be at least one manual activation device located in a readily accessible and safe location, ideally on an emergency exit route from the cooking area.

Heat sensitive fusible link valve located in extract plenum which activates suppression system

Fire suppression systems should be regularly serviced and maintained under contract with an approved company, with a minimum of six-monthly service intervals.

Automatic and manually actuated safety interlocks need to be in place, to shut down the:

- Extract fan
- Cooking appliances by isolating the gas and/or power supplies

As with the fire suppression system, the manually activated device to isolate the power and/or gas supplies should be located in a readily accessible and safe location, ideally on an emergency exit route from the cooking area.

The safety interlocks and emergency stops should be serviced, maintained and tested to ensure they work correctly, on a regular basis by specialist contractors.

Deep Cleaning and Frequency

The build-up of fat deposits can affect the efficiency of the extraction system. It is essential that all parts of the extraction ducting are easily accessible including any motors and fans. An inspection of the system by a specialist cleaning company engineer should be undertaken to confirm that suitable access is available to the entire duct network. Deep cleaning frequency of the entire extract duct, fan and motors should be based on a risk assessment. Specialist engineers contracted to complete the cleaning should provide a:

- Completion certificate(s)
- Written report which includes photographic evidence before and after cleaning

Reports need to be compared with previous reports to ensure compliance and to identify and help resolve problem areas. Formal records of all inspections and cleaning schedules should be maintained.

Cookers hoods, filters and grease traps should also be cleaned on a regular basis. Further details regarding cleaning are provided in separate documents such as those available in the UK from the Fire Protection Association; RC16B '*Recommendations for fire safety in commercial kitchens*' and RC44 '*Recommendations for fire risk assessment of catering extract ventilation*; and B&ES DW/172 '*Specification for Kitchen Ventilation Systems'* and TR/19 '*Guide to Good Practice – Internal Cleanliness of Ventilation Systems*'.

The thickness of fat deposits within the extract ductwork can be measured using either the Wet Film Thickness Test (WFTT) or Deposit Thickness Test (DTT). The suggested frequency of cleaning is shown below:

- Cooker hoods, filters and canopies – cleaned weekly
- Extraction ducting, fans etc.:
    - 12-16 hours cooking per day – cleaned every 3 months
    - 6-12 hours cooking per day – cleaned every 6 months
    - Up to 6 hours cooking per day – cleaned every 12 months

Fan Extraction

Typically there are two methods of fan extraction, these being 'positive' and 'negative':

- Positive pressure - fans are installed at the lower end or start of the extract ducting network and 'push' the air and extracted fat particles up through the ducting. This causes the fat particles to stick more easily to the sides of the ducting, resulting in a faster and greater build-up within.
- Negative pressure - fans are installed at the end of the ducting network, effectively 'sucking' the extracted air and fat deposits up. This results in the fat being less likely to stick to the sides of the ducting.

UV (Ultraviolet) Filtration

UV filtration technology is rapidly improving and is now a recognised method of reducing fat deposit build-up within the extract ductwork and related parts. Simply put, it mixes the fat particles with ozone, making them lighter and enabling them to be extracted at a faster speed, meaning they do not stick to the sides of the ducting, fans etc. as easily. The subsequent fat build-up within the network is lower and therefore the deep cleaning costs may either reduce due to the shorter time taken to clean, or, in some cases (subject to approval) the frequency of the deep clean may be extended. An added environmental benefit is that the odour emissions at the extract outlet are reduced. UV filtration systems require more frequent servicing and maintenance in accordance with the manufacturer's recommended guidance. Servicing and maintenance of such systems also requires specialist trained engineers.

Wood-Fired Ovens, Barbecues and Biomass Water Heaters

Where wood-fired bakery ovens, barbecues fired with charcoal or wood, and water heaters fired with biomass are provided as part of a commercial kitchen fit-out, a smoke, grease and soot filtering and spark arrestor system should be provided. The system should be an extract hood cold water mist/water wash based system located directly at the point of extract from the source within the extract hood. It should be fitted with automatic water flow control to minimise water consumption when not required.

A Carbon Monoxide (CO) sensing system should be installed in the kitchen/restaurant space local to the charcoal/wood/biomass fired equipment. This sensing system should enable the ventilation system in the space, to ensure that no build-up of CO gases occurs during unoccupied and occupied periods.

Ideally wood-fired operations or barbecues should not be undertaken internally within buildings.

Checklist

A generic Commercial Kitchens Extract Systems and Cooking Ranges Checklist is presented on the following pages which can be tailored to your own organisation.

Further risk management information can be obtained from Aviva at:

Aviv Risk Management Solutions

Appendix 1 – Commercial Kitchens - Extract Systems and Cooking Ranges

Location	
Date	
Completed by (name and signature)	

	Kitchen Extract Systems and Cooking Ranges	Y/N	Comments
1.	Is the building fire compartmentation fully understood and documented?		
2.	Is the cooker extract ducting route fully understood and documented?		
3.	Is the construction of the building walls, floors and/or roof where the extract ducting passes through and finally exists the building known and fully documented? Is any of this construction considered combustible? If construction is combustible what protection measures have been provided?		
4.	Does the cooker extract ducting pass through any fire compartment walls? If yes: • What additional fire compartment protection measures are provided within the duct? • Is the extract duct suitably fire-stopped around the ducting passing through the fire compartment wall? Is the fire compartment strategy integrity inspected and maintained? • Is this included in the management of change process?		
5.	Is the extract ducting constructed of fire-resistant materials?		
6.	Is there a risk assessment in place for the cooking and extraction activities? Does this include the actual exit point of the extract ductwork?		
7.	Is the area close to the extract duct exit point clean and clear of combustible materials?		
8.	Is there suitably designed automatic fire detection in every room/area and is the system serviced, maintained and tested?		

	Kitchen Extract Systems and Cooking Ranges	Y/N	Comments
9.	• Is there an approved automatically and manually actuated fire suppression system (e.g. Ansul R-102, Amerex KP, Nobel K-Series) protecting the cooker hood/filter/ entire cooking range, (including any adjacent items e.g. deep fat fryer) extract ducting? Are the manually actuated devices in readily accessible and safe locations?		
10.	Are the discharge nozzles to the fire suppression system provided with protective caps and are they all in place?		
11.	Is the fire suppression system serviced and maintained at least every six months by an approved company?		
12.	Does actuation of the fire suppression system automatically actuate interlocks that automatically shut down the: • Extract fan? • Power supplies and/or gas supplies to the cooking range equipment?		
13.	Are the interlocks tested to ensure correct operation as part of the servicing and maintenance of the fire suppression system?		
14.	Are there manually activated emergency isolations for any gas and electricity supplies? Are these clearly labelled and located in safe and readily accessible locations on exit routes?		
15.	Is there regular servicing and maintenance of all cooking equipment/appliances and electrical installations as part of a preventative maintenance programme?		
16.	Are procedures in place to ensure power and fuel supply to the kitchen is shut-off outside working hours?		
17.	Is any deep fat fryer fitted with an automatic high temperature shut-off and is it serviced and maintained?		
18.	Are all fat fryers fitted with dual safety temperature shut-off devices which automatically shut down the fryers in the event that the main temperature thermostat fails?		
19.	Is the oil used in any fat fryer changed regularly (frequency dependant on usage and risk assessment)?		

	Kitchen Extract Systems and Cooking Ranges	Y/N	Comments
20.	Are there accessible, clearly positioned and suitably maintained fire extinguisher(s) within the kitchen? Are individuals trained in their use?		
21.	Are there accessible, clearly positioned and suitably maintained fire blanket(s) within the kitchen? Are individuals trained in their use?		
22.	Are all kitchen staff competent and formally trained in understanding the: • Risks present including within the ductwork? • Use of all fire safety equipment? • Manual isolation and interlocks provided? • Emergency procedures?		
23.	Have written risk assessments been completed by specialist cleaners? Is there a frequency of extract duct cleaning and associated intervals?		
24.	To ensure the interior of the duct is kept clean and free of fat deposits, is there a deep cleaning contract in force and is it carried out at appropriate frequencies?		
25.	Are there adequate access panels in the extract ducting to enable a full deep clean to be carried out of the entire length of the duct? • Spaced at approximate 2-metre intervals?		
26.	Has the extract duct cleaning contractor issued: • Completion certificate(s) • Written reports that include photographic evidence of before and after cleaning?		
27.	In addition to duct deep cleaning, are the cooker hoods, canopies, filters and grease traps cleaned on a weekly basis?		
28.	Is there any form of UV filtration and is it regularly cleaned and serviced by specialist engineers?		

	Kitchen Extract Systems and Cooking Ranges	Y/N	Comments
29.	If there are any wood-fired operations or barbecues, is it ensured they are undertaken externally? If internal are the following provided: • A spark arrestor system? • A Carbon Monoxide (CO) sensing system and interlocks to enable the ventilation system in the space?		
30.	Additional comments:		