Fire Protection Association

RISCAuthority

ACTIVE FIRE PROTECTION GUIDE

WET CHEMICAL KITCHEN FIRE PROTECTION SYSTEMS

This document has been produced by the RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of Kitchen Fire Protection Systems (KFPS).

Summary

Refer to AFPG-01 *Overarching Active Fire Protection Guide - All Technologies*, and RC68: *Recommendations for fire safety in catering establishments*, and RC44: *Recommendations for fire risk assessment of catering extract ventilation*.

The term KFPS describes a suite of sub-systems that must perform as one to meet the protection ambition including, detection, alarm and activation, active protection of cooking equipment and ducts, equipment interlocks, lids, thermostats, level sensors, isolation of sources of fuel and heat, and maintenance plus full cleaning of ducts, canopies, and grease traps/filters.

Whilst some of these systems are procured and maintained separately, they must be operated within an in-house management framework that ensures the correct function of all components (correct function cannot be assured by a single quality scheme).

Effective design requires an initial risk assessment to be made as kitchen equipment varies greatly in type and risk and some specific design detailing may be required.

The performance of the system can be severely impaired by poor or neglected cleaning procedures of hoods, filters, grills and ductwork, and through unmitigated kitchen reconfiguration.

Commercial kitchens – a major business continuity and property protection risk

Commercial kitchens are an integral part of many businesses ranging from restaurants, hotels and cafes to public houses, garden centres, event venues and workplace canteens. Often located in the building's basement, even a limited kitchen shutdown can have a significant impact on the ability of a business to continue trading, with resultant loss of income, as well as posing the potential to cause catastrophic damage to, and between, buildings (spread through ductwork), and longer-term closures. Common causes of fire include operator error and faulty equipment (thermostats and level sensors). Cooking oils have a narrow margin of safety being used up to 205°C; giving rise to flammable vapours at 230°C; and spontaneously igniting around 300 to 360°C.

Types of kitchen fire protection system

Typical KFPS deliver wet-chemical agents containing potassium salts to the fire that, on contact with burning oil, grease, and fat react to form a soapy film (saponification). The soapy layer acts to cool the fire, deprive it of oxygen, and inhibit vapour release. Whilst most systems differ only in the means of detecting and applying the agent, some systems augment the cooling effect by also delivering watermist post wet-chemical discharge to enhance cooling to prevent reflash. Wet-chemical agents are non-toxic, and non-corrosive to kitchen equipment.

Commercial kitchen layouts can change regularly and alteration without reconfiguration of the fire protection system is at the heart of many failures. To address this, KFPS are often provided in two forms:

- Appliance specific – where the equipment location is known and will not change.
- Full-flood – where the equipment may be changed or moved within the protected zone.

Kitchen components requiring protection

Fire suppression systems must be designed to protect the extract system, and all cooking appliances served by it, and be capable of detecting fires initiated in any of these appliances and the extract hood. The length of ducting to be protected must be determined by an assessment of the likelihood of fire breaching other areas and to account for building construction, fire compartmentation and position of the discharge duct.

Commercial kitchen equipment is usually located under canopies designed to capture and filter out smoke, oil vapours, particulates, odours, and direct remaining air to the extract duct system. Angled mesh or baffle filter units within the canopy capture or separate out suspended grease. Where grease is separated (baffle filters), it is directed to a collection drawer that must be regularly emptied. Even with these measures, some grease will deposit in the duct system and protection, and regular cleaning is essential.

Where a hood is used, the fire protection system is normally mounted within it, directed at the principal equipment risks or in overlapping sprays for full-flood systems. Nozzles are protected from grease contamination by blow-off caps. Aside from the ventilation system, the key kitchen components requiring protection include deep fat fryers, Bratt pans, griddles, Josper ovens, rotisseries, Salamander grills, open flame grills, Henny Penny fryers, and pizza ovens which may be electrical, gas, or solid (wood and charcoal) fuelled.

In this natively hot environment, which can include open-flame cooking methods, the detection of conditions that require activation of the fire protection system can be a challenge and as such back-up manual activation control of the system, and all associated fuel interlocks at the exit door to the kitchen, is an essential component of any design.

Components of a kitchen fire protection system

The key components of a typical KFPS are:

- agent storage cylinder
- pressurised gas cylinder (or alternative pressure source)
- detection system (fusible link, electronic heat detecting cable or probes, pressurised thermal responsive tubing)
- cooker gas shut-off valve/electrical isolator
- electronic or mechanical release mechanism
- manual release mechanism switch (at door)
- manual gas/electricity isolation switches (at door)
- pipe network (or thermally responsive detector tube)
- nozzles (or thermally responsive detector tube)
- nozzle blow-off protective caps
- local alarm
- interface with building's alarm system.

Ancillary equipment: including control panel, system health notification, signage, lights and alarms.

How it works

Specific system details vary, but a typical system operates as follows:

- an unwanted fire in the cooking equipment, canopy, or duct, activates the heat detector (or the system is notified by manual release)
- stored gas (or alternative pressurisation system) pressurises the agent storage cylinder
- the wet-chemical agent is forced into the pipe network, dislodges the protective nozzle caps, and issues to protect the equipment, hood, and duct
- Simultaneously:
  - energy systems (gas/electricity) to the cooking appliances are isolated, but the ventilation is left running to support cooling and distribution of the agent within the ductwork
  - a local alarm is sounded
  - a signal is sent to the building's main alarm system.

Challenges and considerations

Duct and filter/baffle cleaning regimes: The installation of a KFPS must be accompanied by a rigorously maintained canopy, ductwork and filter/baffle cleaning regime.

Detection location and speed of response: In a hot cooking environment with open flames and sparks, fires can be of a significant size before detection. Spread past the protected zone within this time is possible if not correctly designed, or if poor cleaning regimes allow fuel build up in unprotected areas (ductwork).

Kitchen reconfiguration: Kitchen design and layouts change regularly with building reoccupation, change of use, and as menus/eating habits vary. Any re-organisation of the kitchen must be accompanied by a reassessment of the suitability of the KFPS.

Competency: KFPS can be sensitive to deviations from design. Those installing and maintaining the system should be trained by the system's OEM to a 'design-level' of knowledge to perform these tasks.

Risk assessment and training: Must be undertaken regularly and include day-to-day control of any temporary storage that may impair or obstruct agent delivery. Kitchen staff should be provided with training to ensure correct and safe operation of fire emergency procedures including fixed fire protection systems.

Extent of protection: Historic failures have been the result of fire entering the ductwork without activating, or activating too late, the KFPS. This could be the result of poor risk assessment and design (extent of protection), over-reliance on duct cleaning, incorrect duct cleaning schedule, or neglected duct and filter cleaning.

Alarm interconnect: Many KFPS are not connected to the main building's alarm system but should be. The only time electrical works can be done are in the early hours of the morning which can present an organisational challenge.

Gas/electrical supply interconnects: It is not uncommon to find that electric and gas supply systems need upgrading to current specifications before the interlocks can be installed, which can be very costly and incur significant delay.

Applicable standards

EN 16282-7 *Equipment for commercial kitchens. Components for ventilation in commercial kitchens. Installation and use of fixed fire suppression systems.*

LPS 1223 *Requirements and testing procedures for the LPCB certification and listing of fixed fire extinguishing systems for catering equipment*.

UL 300 *Fire testing of extinguishing systems for protection of commercial cooking equipment*

LPS 1263 *Requirements for the approval and listing of the fire performance of grease filters used in commercial extract systems*.

BESA *The Specification for Kitchen Ventilation Systems* (DW/172)

EN 17446 – *Fire extinguishing systems in commercial kitchens – System design, documentation, and test requirements*

Approval schemes - KFPS

BAFE SP206 Kitchen Fire Protection Systems

LPCB Approved Products and Services

Approval schemes – Duct cleaning

LPS 2084 *Requirements for the LPCB approval and listing of companies carrying out inspection, cleaning and maintenance of ductwork systems*.

TR19® - Fire risk management of grease accumulation within kitchen extract systems BESCA *Vent Hygiene Register*.

Best Practice

- Follow the requirements of RC68: Recommendations for fire safety in catering establishments, and RC44: Recommendations for fire risk assessment of catering extract ventilation
- Review KFPS test data and consider how well the test reflects the anticipated application in terms of scale, geometry, and fuels
- Ensure that in-house management frameworks consider the KFPS and ductwork cleaning regimes as connected essential components
- Gas-fired catering ranges must include gas interlock systems as required by BS 6173 – Specification for installation and maintenance of gas-fired catering appliances for use in all types of catering establishments
- Fire Services should be consulted on their requirements and necessary provisions for supporting the KFPS
- Local alarm must be linked to main building's alarm system
- Manual KFPS activation and emergency shut-off switches and valves to be provided on exit routes and made easily accessible and identifiable to all kitchen and management staff
- In circumstances where extract ductwork runs are in excess of 5m in length and/or run internally, consideration should be given to installing suppression along the entire length of the ductwork.