**ENGINEERING BULLETIN – COMMERCIAL KITCHEN VENTILATION OF SOLID FUEL APPLIANCES**
**Date:** 15.01.2019
**Product Range:** EXHAUST HOODS / FILTRATION EQUIPMENT

The following document provides insight into the commercial kitchen ventilation of solid fuel appliances by looking into the current Australian Standards as well as referring to other international standards as well as available bibliography on the subject.
For more detailed information and information on AOM products and projects related to solid fuel appliances, please contact the AOM Australia design team directly at design@aomaus.com.au.

## 1. Australian Standard AS1668.2-2012

1.1 Australian Standard AS1668.2-2012 *The use of ventilation and air-conditioning in buildings Part 2: Mechanical ventilation in buildings* states the following:

***3.4.6 Charcoal and solid fuel appliances***

*All hoods and associated exhaust system for use over charcoal and solid fuel appliances shall be provided with separate systems and shall not be combined with a system serving grease – or oil generating or oil heating appliances.*

*Note: where the exhaust air is likely to significantly pollute the ambient air, the exhaust discharge may be required to be treated to reduce the concentration of contaminants. Reference to authorities is recommended for requirements relating to the quality and concentration of discharge contaminants.*

1.2 The Australian Standards are clear in that at no point can the exhaust from solid fuel appliances be combined with the exhaust from grease producing appliance. This implies separate exhaust hoods, ductworks and fan systems. No concessions related to level of filtration or independent testing of proposed treatment / spark arrestance / misting methods are defined meaning that at no point can exhaust systems be mixed.

1.3 The rational behind the above is tied to mitigating the risk of sparks, embers or flames reaching exhaust systems that have the capacity to accumulate high grease quantities and hence separate Ignition sources from Fuel sources. ASHRAE Technical Bulletin 2016 *Fire Safety – Kitchen Hood exhaust systems* states that:

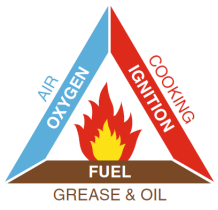

Figure 4: The Fire Triangle – fuel/heat/$O_2$ = grease/flame/air.

- *Fuel: Solid fuel cooking can create volatile gases created by incomplete combustion of the wood. These gases condense in the exhaust duct and mix with water vapour to form a tar-like creosote substance that sticks to the duct.*
- *Ignition: There are many ignition sources within commercial kitchen environments: open-flame cooking devices, flaming cooking techniques, sparks and soot from wood or charcoal burners, even the heat generated from some types of cooking appliances can provide enough energy to ignite warmed grease, which then only needs a supply of oxygen to continue burning.*

This underlines the notion that it is not only a spark that can cause a fire, but also the heat generated from solid fuel appliances.

1.4 The second key statement to be taken from AS1668.2-2012 is the need to *reduce the concentration of contaminants* if there is a risk that a discharge will *significantly pollute the ambient air*. Solid fuel exhaust is highly contaminated in particle matter. AOM research has shown that these particles are mainly in the ultra-fine and fine particle sizes and are generally grease compounds in different forms. Solid fuel appliances also generate solid particle matter from combustion processes (ash – such as fly ash from coal combustion processes) and that sizes are in the fine to large particle sizes, which are generally easier to filter than grease particles.

For more information on the most suitable filtration equipment for commercial kitchen exhaust cooking Type, please refer to *AOM Engineering Bulletin 0004 Cooking types and filtration needs.*

## 2. Australian Standard AS1668.1-2015

2.1 Australian Standard AS1668.1-2015 *The use of ventilation and air-conditioning in buildings Part 1: Fire and Smoke control in buildings* define the standards to ventilation systems and duct work requirements.

2.2 The general objective of the standard is summarised as:

***1.6 SYSTEM OBJECTIVES***

*System designed in accordance with this Standard are intended, for a single fire event, to achieve the following:*

*(…)*

*(e) Restrict the initiation of fire within ductwork.*

*(f) Restrict the spread of fire and smoke within duct work.*

This general statement is in line with the AS1668.2-2012 restrictions set up above that states that solid fuel exhaust systems are to be separated from non-solid fuel exhaust systems.

2.3 Specific to solid fuel cooking appliances:

*6.2.9 Flame and Spark Arrestance*
*Where the length of an exhaust duct within the building exceeds 10 m and where an exposed flame or embers may be present as part of the cooking process, devices that prevent the spread of flames in accordance with UL 1046 shall be incorporated into kitchen exhaust hoods (or filtration systems).*

**See the AOM Engineering Bulletin 0003 *Grease filters required to be made non combustible materials*** for an in-depth review of the impacts of this clause on the design of commercial kitchen exhaust systems.

## 3. US National Fire Protection Agency (NFPA)

3.1 The NFPA has most information available on commercial kitchen ventilation fires and the standard *NFPA 96 Ventilation Control and Fire Protection of commercial cooking operations* is the most detailed standard of its kind.

3.2 NFPA 96 adopts the same statement with regards to maintaining separate exhaust systems as AS1668.2-2012, however allows for concessions when solid fuel is used as a flavouring agent within a gas fired appliance, as opposed to a fuel source.

*Chapter 14 Solid Fuel Cooking Operations*
*14.3.3 Except as permitted in 14.3.4, exhaust systems serving solid fuel cooking equipment, including gas or electrically operated equipment, shall be separate from all other exhaust systems.*
*14.3.4* Gas-operated equipment utilizing solid fuel for flavouring that meets all the following conditions shall not be required to have a separate exhaust system:(...).*

As per AS1668.2-2012, the standard does not provide any concessions as to the mixing of a solid fuel appliance exhaust (when solid fuel is the main fuel source) with non-solid fuel appliance exhausts.

## 4. Further information regarding solid fuel exhaust systems

4.1 The risk of a fire originating from a commercial kitchen is high. The US National Fire Protection Agency (NFPA) states that:

- In eat and drinking establishments, 61% of fires originate from the cooking equipment of which 21% originated from deep fryers. (See: https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Fact-sheets/EatingFactSheet.pdf)
- The leading area of origin for structure fires in hotels and motels is the kitchen (41% of fires) (https://www.nfpa.org/News-and-Research/Data-research-and-tools/Building-and-Life-Safety/Hotel-and-Motel-Structure-Fires)

4.2 ASHRAE Technical Bulletin 2016 *Fire Safety – Kitchen Hood exhaust systems* underlines the importance of *systems needing to be designed and installed in accordance with the established rules* in order to significantly improve the impact on fire safety of commercial kitchen exhaust systems. The document also underlines insurance risks (refusal of claims) related to non-compliant exhaust systems and non compliant maintenance regimes of said systems.

4.3 Insurance companies are clearly aware of the fire risks of commercial kitchen exhaust systems. The following links offer a review of insurance requirements for commercial kitchen exhaust systems. Needless to say, non-compliant exhaust systems are at risk of potential claims being rejected.

- https://www.citycover.com.au/blog/managing-risks-commercial-kitchensrestaurants/
- https://www.hanover.com/risksolutions/commercial-cooking-fire-safety-checklist.html

## 5. Filtration and discharge of solid fuel exhaust

5.1 Overall, AOM Australia recommends that Solid Fuel exhaust systems be fully designed as per the requirements of AS1668.2-2012 and that the discharge point be located vertically and design to minimise the risk of nuisance.

5.2 The notion that an exhaust filtration plant or fire mitigation system is 100% guaranteed to function at all times needs to be challenged: solid fuel appliances produce sticky tar like residues that with time build up on the nozzles of misting systems which can significantly decrease performance is not correctly maintained; spark arrestance filters can easily be replaced by standard filters by staff who know no better; filtration systems are prone to faults. All it may take is one spark, excessive heat or a flare up for a duct fire to start and potentially run through ducting where grease build up is significant.

5.3 Experience on a project audit which was initiated after significant local complaints to a non-compliant horizontal discharge (no treatment) of a solid fuel exhaust system, underlined that in additional to non-compliance to AS1668.2-2012, the discharge was deemed to be non-compliant to Environmental Protection Act 1994 due to high levels of BTEX compounds (.e. benzene, toluene, ethylbenzene, and xylenes – chemicals found in solvents or petrochemical situations) and Carbon Monoxide which are by products to solid fuel combustion. The kitchen equipment in this case was a solid fuel pizza oven and the audit resulted in the restaurant closing down.

5.4 In this regard, AOM recommends that solid fuel appliances be filtered in order to minimise any potential local impact as per *AOM Engineering Bulletin 0004 Cooking types and filtration needs.*