

## INTRODUCTION

We, Lafire Asia Pte Ltd, understand the importance of fire protection systems in a building. Besides saving lives in the event of fire outbreak, it also reduces the rising cost of insurance policies, protects capital investments and reduces the possible risk to the fire fighters.

The level of fire protection required and the effectiveness of the protective measures are of major concerns in today modern building design. To address this, after years of research and development, we have developed **INGEBORG®**. It is a high performance fire rated calcium silicate board serves as one of the alternatives to other fire rated board protection system in the building industry; technically the best system as compared to the spray system and the intumescent system available in the market.

**INGEBORG®** is made mainly from pure quartz powder, lime, Portland cement, cellulose and selected mineral additives, formed into wet sheets and cured through advance technology of autoclave process under high temperature and pressure for more than 10 hours to produce the final product.

It is a non combustible, engineered calcium silicate board. There is no asbestos, brucite and meerschaum added in the production of **INGEBORG®**.

## ADVANTAGES / BENEFITS:

- High fire proof temperature of up to 1200°C.
- Durable, does not degrade, rot and deteriorate physically.
- It is fire proof, anti fungus and antiseptic and does not promote mould growth.
- Low density, light structure, easy to use.
- Resistant to insect and rodent attack.
- Resistant to chemical corrosion.
- High strength. The lowest strength(parallel) is  $\geq 5.5\text{Mpa}$ , while the highest (across) is  $\geq 7\text{Mpa}$ .
- Good thermal insulation property, decreases the cost of indoor energy consumption.
- Dry operating, quick and convenient installation.
- Smooth surface finish. Suitable for paint works.
- Non combustible, meeting requirement of BS476.
- Moisture has no permanent effect on the mechanical and fire resistant properties.
- Good resistance to airborne noise when use in acoustic applications.
- Easy to store and transport, packed in palletise form.
- No special maintenance required after installation.



## APPLICATION

**INGEBORG®** calcium silicate board is recommended for applications where it is essential to meet high standard of performance conforming to the fire regulation requirement by the relevant building and fire authority. Such applications would include non-loading system of partition and ceiling, ventilation, smoke extract and kitchen exhaust duct.



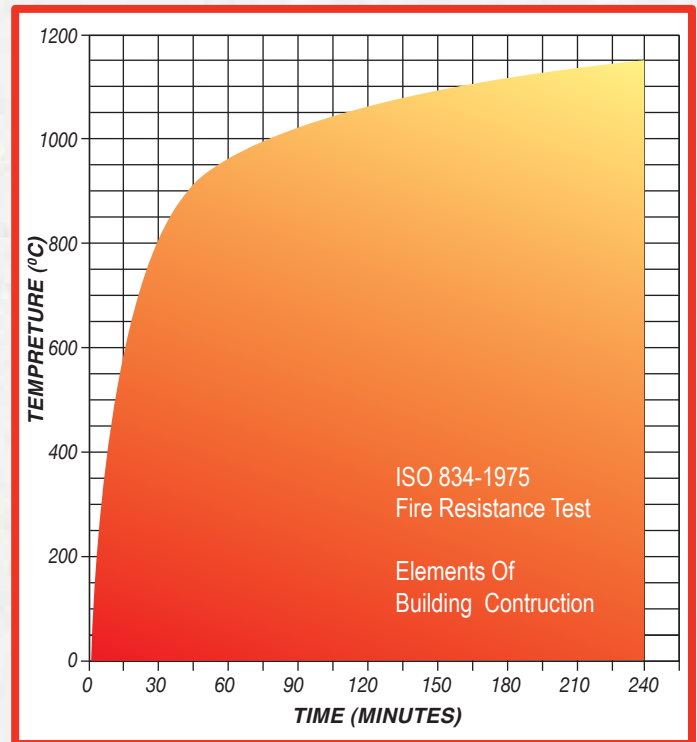
## FIRE RESISTANCE TEST STANDARD

Fire resistance test standard on ventilation ducts are carried out in accordance with BS 476: Part 24 (ISO 6944). This standard specifies a method of vertical and horizontal ventilation ducts under standardized fire conditions. The general purpose of the test is to measure the ability of a representative duct or duct assembly to resist the spread of fire from one compartment to another. The test is conducted without the involvement of fire dampers. It is applicable to vertical and horizontal ducts, with or without branches, taking into account joints, air supply and exhaust openings, as well as suspension devices and penetration seals.

The performance of the duct assembly is measured in terms of its ability to withstand exposure to high temperatures by setting criteria by which the resistance to collapse ensuring the duct is able to fulfill its intended function (STABILITY), the fire containment (INTEGRITY) and the thermal transmittance (INSULATION) functions can be judged. The standard temperature/time fire exposure specified in BS 476: Part 20 is representative of only one possible fire exposure condition at the fully developed fire stage.

The method of test does not quantify the behavior of a duct for a precise period of time in a real fire situation but can be used directly to show compliance with fire resistance requirements in regulations or other safety specifications, enables comparisons to be made between constructions.

## STANDARD TIME / TEMPERATURE CURVE



The specimen which is subjected to the fire test must be designed and constructed to be representative of how it would be constructed on site. Two ducts are tested, one with fire outside only (Duct A) and one with fire on the inside (Duct B).

## PERFORMANCE CRITERIA: BS476 PART 24: 1987 (ISO 6944)

The tested duct assembly is judged against three performance criteria as follows:

### STABILITY:

Stability failure shall be deemed to have occurred in Duct 'A' within the furnace and in Duct 'A' and Duct 'B' outside the furnace when the duct collapses in such a manner that the duct no longer fulfils its intended function. Included in this is the ability of a smoke extract duct to retain at least 75% of its cross-sectional area.

### INTEGRITY:

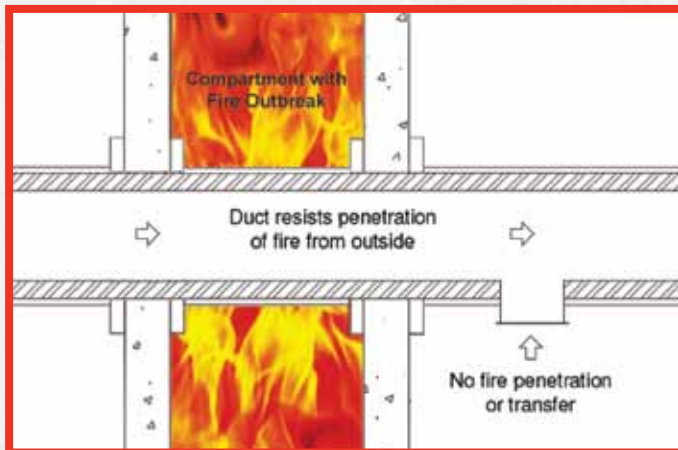
The presence and formation in the test specimen of cracks, holes or other openings outside the furnace through which the flames or hot gases can pass shall constitute integrity failure.

### INSULATION:

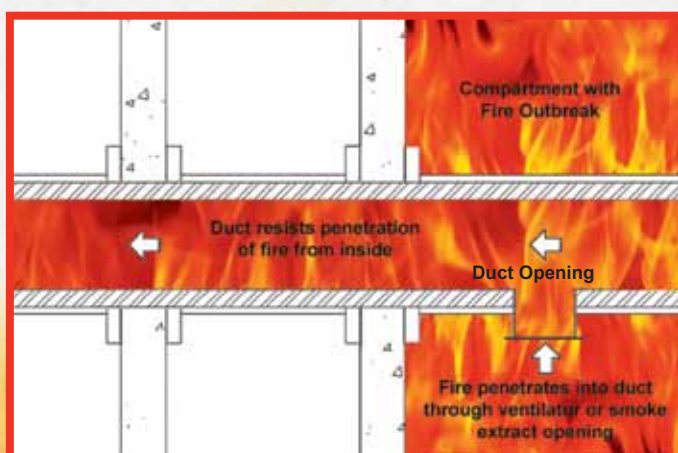
Insulation failure shall be deemed to have occurred when temperature rise above initial ambient temperature in the laboratory on the unexposed surface of the test specimen outside the furnace exceeds either:

- 140°C as an average value.
- 180°C as a maximum value read by any surface thermocouple.

### DUCT A (Fire outside)



### DUCT B (Fire inside)





## APPLICATIONS FOR DIFFERENT DUCKWORK AND FUNCTIONS

### MECHANICAL VENTILATION SYSTEM

Mechanical ventilation systems are used to extract vitiated or polluted air from a building and to supply replacement fresh or conditioned air. The necessary fans and conditioning equipment are generally located in separate plant rooms, often in a basement or on the roof. The distribution of the air involves ductwork which may be very large, extend throughout the building, penetrate compartment walls and/or floors and have openings in every space through which it passes. Without suitable fire precautions, therefore, ventilation ductwork can provide a route by which fire, smoke and toxic gases are enabled to spread rapidly through a building.



### SMOKE EXTRACTION SYSTEM

Smoke extraction is the evacuation from a building of products of combustion, such as smoke and toxic gases, which could otherwise reduce visibility and impair human functions. This facilitates the escape of the building occupants and assists fire fighters in locating the seat of the fire and extinguishing it.

In situations where smoke clearance by natural ventilation through windows or other openings may be difficult (e.g. in large or deep basements or in high rise buildings without openable windows) ductwork is required to extract the smoke to a suitable outlet from the building. In cases where the natural buoyancy of the combustion products is not adequate to ensure the required smoke extraction rate through the ductwork, fan assisted systems are used. It may also be necessary to install ducted air inlets as part of the smoke extraction scheme, in order to provide the replacement air.



If the ductwork incorporated in a smoke extraction system is wholly contained within the fire compartment, it must at least be capable of resisting the anticipated smoke temperatures generated during the development of a fire. These will generally be lower than the temperatures specified in BS 476: Part 24, which are intended to represent a fully developed fire. However, if the ductwork penetrates a fire resisting barrier, it must also be capable of providing the relevant fire resistance in a test to Part 24. In view of the importance of maintaining the design extraction rates during a fire, Part 24 also imposes an additional requirement on smoke outlet ductwork (i.e. the retention of at least 75% of its original cross sectional area during the test).

### DUAL VENTILATION /SMOKE EXTRACTION SYSTEM

These systems serve as a conventional ventilation system under normal conditions, but are converted to a smoke extraction system in the event of fire, thus providing an economical dual system.

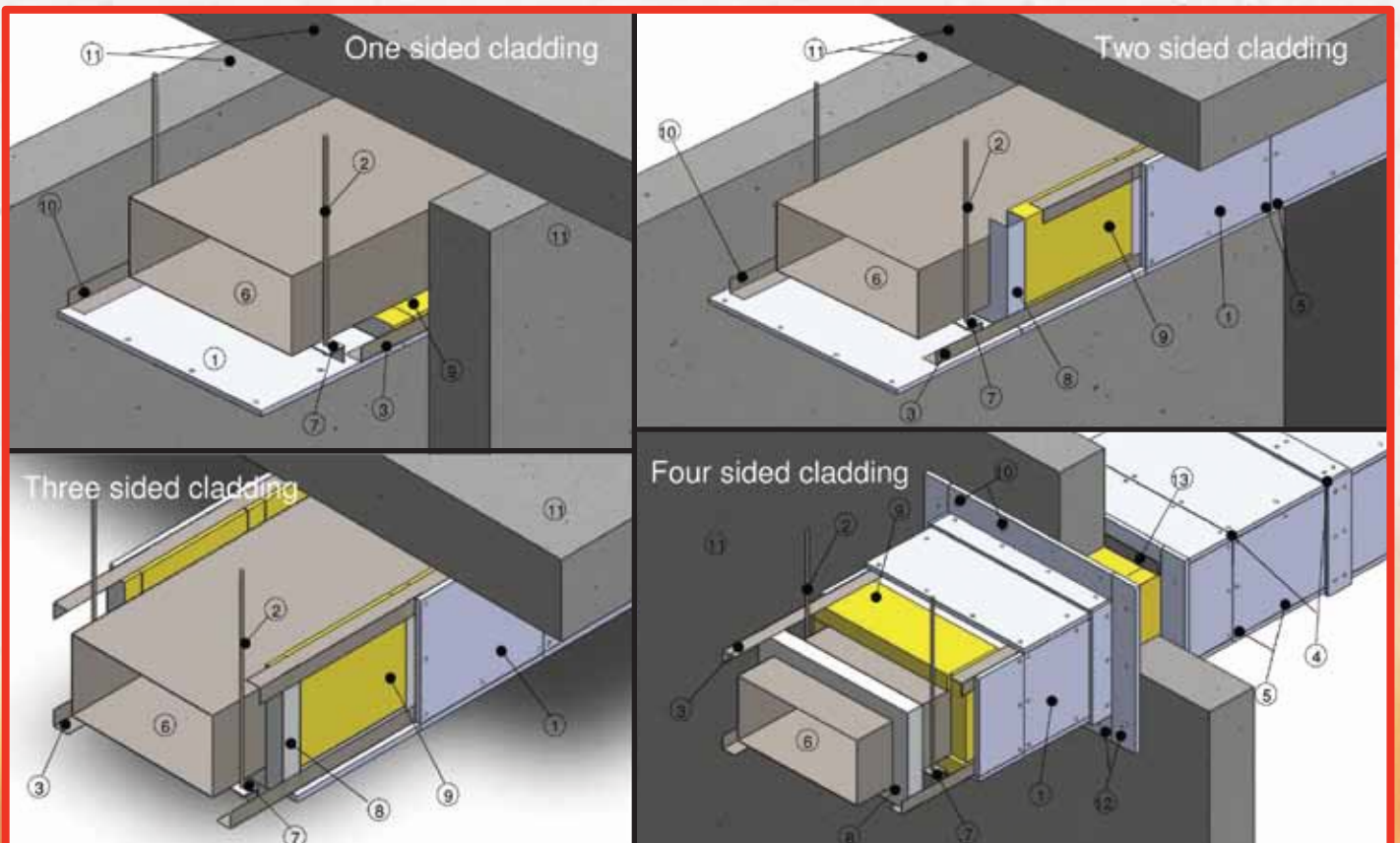
### KITCHEN EXHAUST SYSTEM

Kitchen exhaust ductwork presents a particular hazard, in that combustible deposits such as grease are likely to accumulate on its internal surfaces, and may spread fire if ignited. A fire in a kitchen may spread to other areas of the building by way of the kitchen extract ductwork and may also prejudice escape routes.

The exhaust duct where it runs outside the kitchen shall either be enclosed in a structure or be constructed to give at least the same fire rating as the kitchen or that of the room through which it traverses, whichever is higher. The rating shall apply to fire exposure from both internal and external of the duct or structure. Where the duct riser is required to be enclosed in a protected shaft constructed of masonry or drywall complying with C1.3.8.9(a), it shall be compartmented from the rest of the shaft space containing other ducts or services installations; and no fire damper shall be fitted in kitchen exhaust ducts.

## GENERAL CONSTRUCTION DETAILS

<p>1. <b>INGEBORG®</b> Calcium Silicate Board unsupported board area &lt; 1.5m<sup>2</sup></p> <ul style="list-style-type: none"> <li>• 15mm thick for 2 hour fire rating.</li> <li>• 24mm thick for 4 hour fire rating.</li> </ul>	<p>8. Steel C-channel around duct, spaced at centres in accordance to the width of duct ensure a maximum unsupported area not exceeding 1.5m<sup>2</sup>.</p> <ul style="list-style-type: none"> <li>• Channel thickness @ 0.6mm, C- 50 x 50 x 50mm for 2 hour fire rating.</li> <li>• Channel thickness @ 0.6mm, C- 100 x 50 x 100mm for 4 hour fire rating.</li> </ul>
<p>2. Steel threaded rod spaced max at 2.5m intervals and/or size according to permissible tensile stress</p> <ul style="list-style-type: none"> <li>• &lt; 10N/mm<sup>2</sup> for 2 hour fire rating.</li> <li>• &lt; 6N/mm<sup>2</sup> for 4 hour fire rating.</li> </ul>	<p>9. Mineral wool</p> <ul style="list-style-type: none"> <li>• 50mm x 100kg/m<sup>3</sup> for 2 hour fire rating.</li> <li>• 2 x 50mm x 100kg/m<sup>3</sup> for 4 hour fire rating.</li> </ul>
<p>3. Continuous L-angle 40mm to 50mm at</p> <ul style="list-style-type: none"> <li>• Thickness 0.6mm thick for 2 hour and 4 hour fire rating.</li> </ul>	<p>10. M6 Anchor @ 300mm.</p>
<p>4. Treatment at board joints.</p> <ul style="list-style-type: none"> <li>• Fire rated sealant for min. gaps is (&lt;4mm)</li> <li>• 100mm x 9mm cover strip for large gaps is (≥4mm)</li> </ul>	<p>11. Masonry wall/ceiling.</p>
<p>5. M4 self-tapping screw at nominal 200mm centres</p>	<p>12. <b>INGEBORG®</b> L-Collar at wall penetration minimum 150mm wide.</p> <ul style="list-style-type: none"> <li>• 15mm thick for 2 hour fire rating.</li> <li>• 24mm thick for 4 hour fire rating.</li> </ul>
<p>6. Existing sheet metal duct (by Contractor).</p>	
<p>7. Supporting bracket for duct.</p>	<p>13. G.I L-angle minimum 50 x 50 x 0.6mm thick.</p>





## CERTIFICATION & PROCESS

**INGEBORG®** have been tested to meet the standards required by the FSSD for regulated products. It is now approved and certified by an internationally recognized testing and certified body, TÜV SÜD PSB (PSB), and is listed in their Products Listing Scheme (PLS) Class 1A. This scheme entails safety and performance testing of products in accordance with the international standards.

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PSB Singapore

### CERTIFICATE OF CONFORMITY

Product Listing Scheme® : Class 1A

This Certificate is issued to  
**Lafire Asia (Pte) Ltd**  
 101 Pioneer Road  
 Singapore 639581

**FOR**

Product: Fire Rated Duct System  
 Brand: Ingeborg  
 Model: IB-120  
 Country of Origin: NA

Product Details: Stability: 120mins; Integrity: 120mins; Insulation: 120mins  
 Refer to appendix issue 2 (1 page) for details  
 Board: Ingeborg  
 Wool: SRP or CSR

which has complied with the requirements of the scheme and based on the following:

<b>Standard(s)</b> British Standard 476 Part 24:1987	<b>Test Report(s)</b> BRANZ Test no. FR 4408 & 4482
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Vice President (Certification Department)  
  
 TUV SÜD PSB

Certificate No: 012575  
 Date of Original Issue: 10/05/2011  
 Date of Last Revision: 22/09/2011  
 Date of Expiry: 09/05/2014



\* All products listed under Class 1A/1B must have this mark affixed / printed on them.  
 Failure to comply with this requirement may result in revocation of this certificate.



This Certificate is part of a full report and should be read in conjunction with it. This Certificate remains the property of TÜV SÜD PSB Pte Ltd and shall be returned upon request. The use of this Certificate is subject to the terms and conditions of the Product Listing Scheme. The manufacturer is solely responsible for compliance of any product that has the same designation as the product type-tested. Persons relying on this Certificate should verify its validity by checking TÜV SÜD PSB's website at [www.tuv-sud-psb.com](http://www.tuv-sud-psb.com).

TÜV SÜD PSB Pte Ltd • 1 Science Park Drive • Singapore 118221



## DECLARATION OF COMPLIANCE

Site surveillance will be conducted upon successful installation of the **INGEBORG®** system by the purchaser. A site audit report will then be submitted to PSB for approval prior to issuance of the Declaration of Compliance (DOC). The DOC is a project based document that is given to each individual project.

This will provide a confidence to our customer that the fire protection system has been properly installed.

## CERTIFICATE OF CONFORMITY

Products listed in the PLS will be granted a Certificate of Conformity (COC) by PSB. This is a product based certificate that is given to each individual project.

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PSB Singapore

### PRODUCT LISTING SCHEME

#### APPENDIX

TO CERTIFICATE OF CONFORMITY NUMBER: 012575

Issue Number : 2  
 Date of Issue : 22/09/2011  
 Issued To : Lafire Asia (Pte) Ltd  
 101 Pioneer Road  
 Singapore 639581

Product Details :

Horizontal ventilation and smoke outlet ducts

Duct Type	Board - Ingeborg	Mineral wool	Stability (mins)	Integrity (mins)	Insulation (mins)
A	15mm x 1	15.8kg/m <sup>2</sup>	50mm x 1	100kg/m <sup>2</sup>	120

Refer to BRANZ FR 4408 for details

Horizontal ventilation, smoke outlet and kitchen extract or ducts containing combustible linings

Duct Type	Board - Ingeborg	Mineral wool	Stability (mins)	Integrity (mins)	Insulation (mins)
B	15mm x 1	15.2kg/m <sup>2</sup>	50mm x 1	100kg/m <sup>2</sup>	120

Refer to BRANZ FR 4408 for details

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Amendments or additions to this appendix other than those authorized by TÜV SÜD PSB Pte Ltd render the appendix invalid.

TÜV SÜD PSB Pte Ltd • 1 Science Park Drive • Singapore 118221

Signed:   
 Vice President (Certification Department)  
 TÜV SÜD PSB



S/N: 123456



PSB Singapore

### Declaration of Compliance

This declaration is issued in accordance with the requirements of TÜV SÜD PSB Product Listing Scheme (PLS). It confirms that the defined project coverage area which has been completed, having full regard to the requirements of the appropriate product specifications, and the installation and / or application instructions, and that the claimed performance is substantiated by test and / or assessment evidence.

**Building Plan Ref:** AXXXX-XXXX-XXXX Audit Ref: 0000

This declaration is issued by the PLS listed company named below, who is responsible for the installation process as shown in the table below.

**Installer :** CCA METAL WORKS PTE LTD  
**Company :** LAFIRE ASIA PTE LTD

**Project :**

Product Description	COC no.	Brand / Model	Area of coverage (m <sup>2</sup> )	Location
2 hrs fire rated Ingeborg duct protection	012575	Ingeborg / IB-120	210.56	1 <sup>st</sup> storey, COY3-COY6 / DOA2-DOA8

I, hereby declare that the recorded information above are consistent with the information submitted to TÜV SÜD PSB in the 'Declaration of Compliance (DOC) Request Form'.

  
 Subscribed signature

Alan Chang C. K. (Site Auditor)

Name & Designation of Subscribed signature

DD-MM-YYYY  
 Date



Company's Stamp



Your Local Supplier:

SPECIFICATION		
ITEM	INDEX	
GENERAL :		
Dimension	2440mm x 1220mm	
Thickness	9mm, 12mm, 15mm & 24mm	
Density	950 kg/m <sup>3</sup>	
Thermal conductivity (k) at mean temperature	≤0.20 W/mK	
Moisture content	≤10 %	
Moisture movement	≤0.25%	
FIRE PERFORMANCE :		
Combustibility test to BS 476 : Part 4 : 1970	Non Combustible	
Fire propagation test: BS 476 : Part 6 : 1969	Index (I)	
Surface spread of flame : BS 476 : Part 7 : 1987	Class-1	
Bending strength oven dry:		
Cross	≥7.0 Mpa	
Parrallel	≥5.5 Mpa	
MANUFACTURING TOLERANCE :		
Length :	-0, +4mm	
Width :	-0, +4mm	
Thickness :	±0.5	
Edge straightness (mm/m)	≤2	
Squareness (mm/m)	≤3	
Surface uneven (mm/m)	≤3	
Thickness uneven (%)	≤6	
SAFETY CAPACITY		
Asbestos	100% Asbestos Free	Safe for application
Radioactive	< 1Ra	Safe for application
	< 1r	Safe for application

The information listed in the brochure are the tested figures under prescriptive conditions. It has no legal bindings, and the information such as the technical indices are subject to the purchase contract. **Lafire Asia Pte Ltd** will update the index and applications of the products according to the technological progresses, providing our users the latest information. Please contact us for any enquiry.



P R O T E C T P A N

Calcium Silicate Board



***Lafire***  
A S I A

**Lafire Asia Pte Ltd**

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P R O T E C T P A N

## Calcium Silicate Board



**Fire Protection System tested in accordance with  
BS 476 : Part 24 :1987 ISO 6944-1985  
Exposed to internal and external  
fire rating up to 2 and 4 hours**

**Stability**  
**Integrity**  
**Insulation**

### **DUCTWORK APPLICATIONS:**

**Mechanical Ventilation System**

**Smoke Extraction System**

**Kitchen Exhaust System**

**Dual Ventilation / Smoke Extract System**

**100% Asbestos Free**

***Lafire***  
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