

PASSIVE FIRE & SMOKE CONTAINMENT AND CONTROL

By John Rakic



For the HVAC&R Industry



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FOR THE HVAC&R INDUSTRY

INTRODUCTION

Our commercial and multiple story residential buildings are a spider web of ducts, pipes, cables and other services providing HVAC&R (Heating, Mechanical Ventilation, Air Conditioning and Refrigeration) for comfort, safety, and overall amenity of occupants.

With the increased scrutiny of energy conservation with escalating power costs and the very real need to be more sustainable and reduce our carbon footprint, creating many new and modern-day challenges for so called passive fire protection.

We will discuss old and more recent challenges for different HVAC&R systems, both components, and some advances in fire stopping & fireproofing materials and Trafalgar's Fire systems available to designers and building service engineers.

DEFINITIONS

PASSIVE FIRE PROTECTION

The division of buildings in fire and/or smoke containment compartments is designed to limit the spread of fire and/or smoke from one part of a building to another. It consists of fire and/or smoke barriers such walls, floors, ceilings and riser shafts which have a Fire Rating (FRL) or a Smoke Containment requirement.

By necessity, these fire and/or smoke barriers have many ducts and services in the context of HVAC&R that need to pass through them. The challenge for building services engineers is to ensure that these ducts and services do so without compromising the fire and smoke movement for both life safety of occupants and fire fighters, but for reduction on damage to the building and the business in the advent of a serious fire.

FIRE STOPPING

The correct protection of openings for services (& movement joints) to maintain the FRL of the fire and/or smoke barriers. Under the National Construction Code / Building Code of Australia (NCC/BCA) this requires fire test to AS1530 Part 4 – 2014 to achieve system FRL's.

FIREPROOFING

For the purposes of this document, fireproofing relates to fire protection of ductwork required under AS/NZS1668.1 for fire and smoke control purposes.

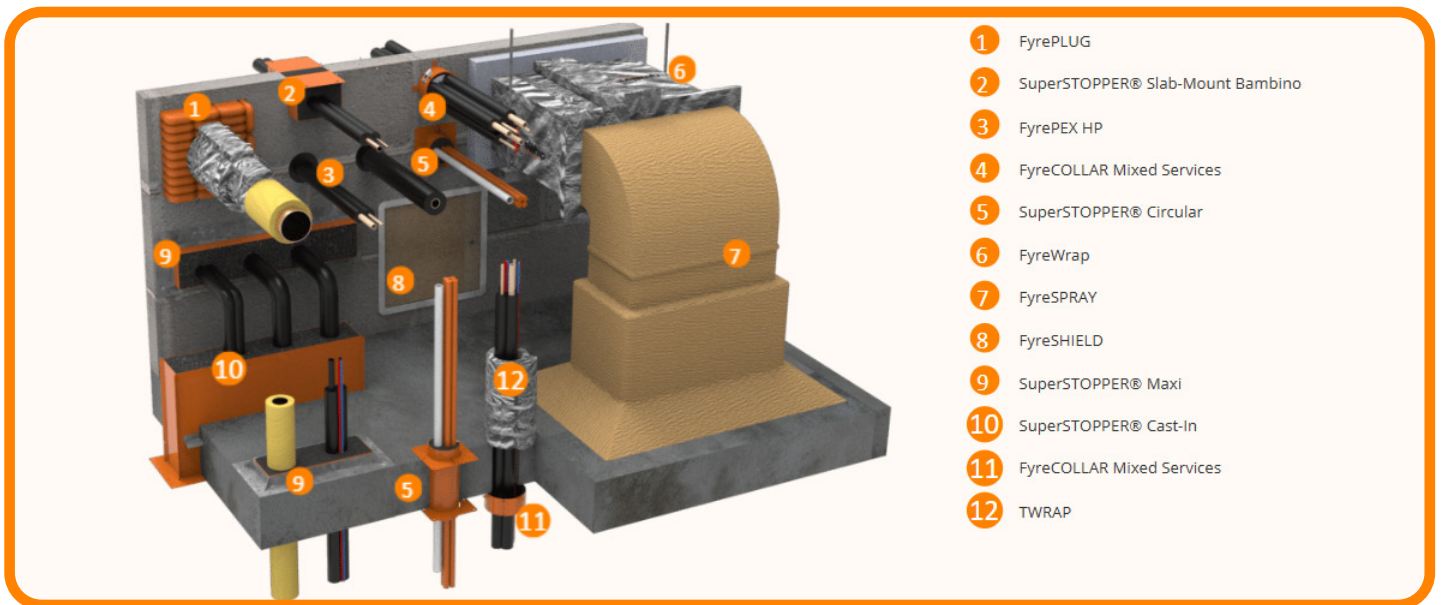
In my own personal definition, it would also include fireproofing of structural steel elements in a building.

SMOKE CONTAINMENT & SMOKE STOPPING

Smoke walls are often required in hospitals and aged care facilities and openings for services (& movement joints) such like fire stopping require smoke stopping.

At present the NCC/BCA do not quantify these in terms of smoke ratings for systems under smoke or air leakage testing akin to fire ratings and FRL's.

THE PLETHORA OF HVAC&R DUCTS AND SERVICES IN OUR BUILDINGS



This diagram is from part of one of our Trafalgar Fire HVAC&R trade specific technical manual for passive fire and smoke containment. It is available for FREE download on this web site link; <https://tfire.com.au/hvacr/>

You can see ducts passing through **fire and/or smoke barriers** in both a vertical run and horizontal run; along with many different pipes; many of which under today's regulations are lagged with thermal insulation for conservation of energy. These might be insulated copper for example, but with the price of copper being so high, we are seeing some shifts to steel, thinner gauge stainless steel and plastic material, again with applied lagging. In many cases electrical cables also are passed through the same opening, and we see the requirement to provide fire stopping for so called pair coil bundles for example, one or more passing through the same opening in a **fire and/or smoke barrier**.

DUCT WORK OR DUCTING

Over the last 20 or so years, I have seen confusion, non-compliances pertaining to ducts, and associated fire and smoke dampers.

If one understands the basic design principles, one can easily navigate what might look very confusing and complicated.

The key is to answer the following question:

[What is the duct used for in the building?](#)

HEATING & AIR CONDITIONING?

Most duct work will be for **heating & air conditioning systems** and moving air from one area to another for the comfort of the occupants. In winter we want it warmer and in our hot summers, we want it colder and some “aircon” at play.

Without over complicating things, this ductwork needs to turn off automatically when a building is in fire mode. This is to stop the **heating & air conditioning system** from spreading smoke to all parts of the building.

Where the ductwork passes through a fire barrier, there is a requirement for a fire damper. A fire damper is a failsafe means of protecting these openings where the ducts are passing vertically or horizontally through a fire barrier. These fire dampers can be mechanical and incorporate a fusible link or intumescent. When the heat in the duct during a fire increases, the fusible link melts and the mechanical damper closes, or the intumescent slats swell up and close of the opening in the duct.

ACTIVE SMOKE CONTROL MEASURES?

These ducts form part of complicated smoke control measures used for fire protection purposes in a building. For me I try and simplify things into those that blow, and those that suck (no pun intended).

A more engineering definition is **pressurisation systems that blow air & exhaust systems that suck air**.

These smoke control duct systems cannot and **do not have fire dampers in the opening through fire barriers** as these would render the pressurisation or exhaust system inactive.

For this reason, these ducts need to be fire rated and therefore will typically have an applied fireproofing material and requisite fire rating & FRL. AS/NZS1668.1 is where all the design criteria for fire & smoke control systems live.



FyreWrap®

What are the fireproofing options?

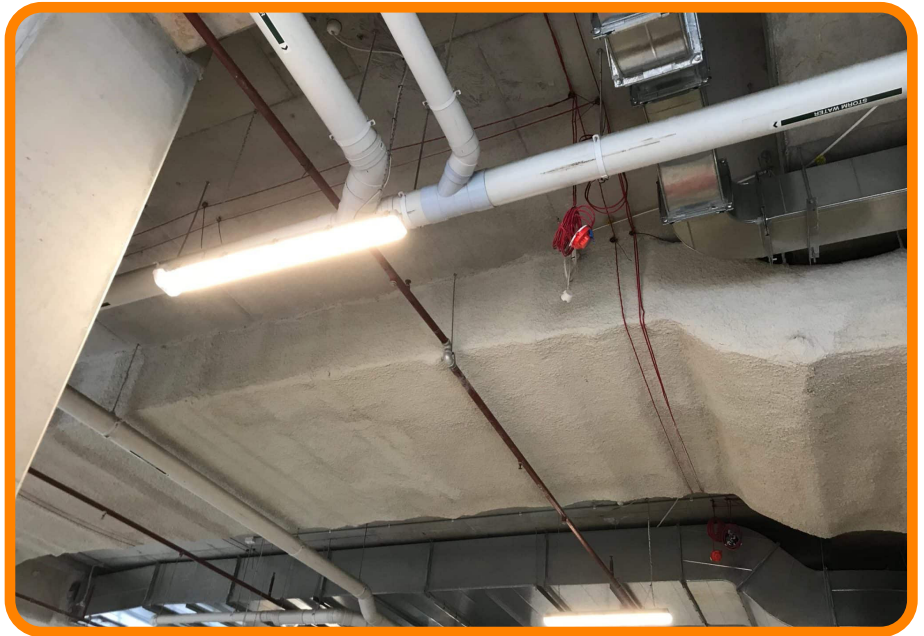


Trafalgar FyreWrap® is the leading passive fire protection solution for commercial ductwork. The lightweight bio-soluble and totally safe Insulfrax core ensures high temperature insulation and performance. Each roll is fully encapsulated in aluminum foil which includes a fiberglass reinforced scrim proving a clean and professional look, tear-resistance, and antibacterial resistance.

Trafalgar FyreWrap® is ideal for off-site fabrication and fire protection of fire-rated ductwork systems and has a patent fire-rated access panel system to augment the overall fire-rated duct system.

Learn more here: <https://tfire.com.au/product/fyrewrap-fire-wrap/>





Trafalgar MONOKOTE® fire spray is the leading passive fire protection solution for commercial ductwork. Trafalgar Monokote fire spray systems offer full compliance pathways for ducts & fan enclosures, and many other specialized system details. Fire testing allows for unprotected suspension systems so threaded rods do not need fire spray to be used.

Learn more here: <https://tfire.com.au/product/fyrespray-for-duct-protection-monokote/>

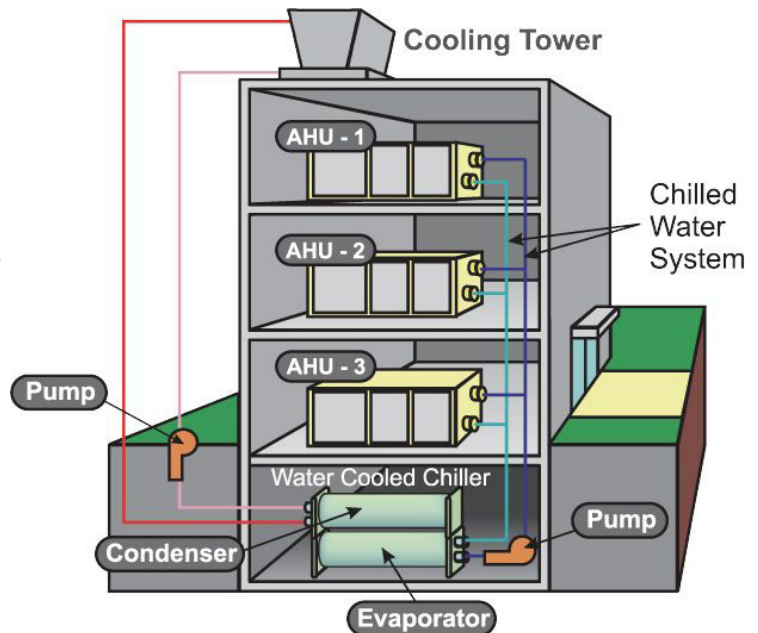


LARGE DIAMETER CHILLER PIPEWORK

Australia has long and hot summers and very large air conditioning systems are typically necessary. This can result in very large diameters of insulated pipe work.

In many cases this very large diameter insulated pipe work needs to pass through a fire barrier and the fire rating or FRL needs to be maintained.

This creates a big challenge for fire stopping as we typically want to maintain continuous insulation through the opening.



Historically, Rockwool lagging is used in the opening due to the non-combustible and excellent fire stopping properties, but relatively speaking it is not a great insulation material as it causes condensation and dripping water damage.

A relatively new innovative fire stopping system, co-developed by Trafalgar and world leading insulation manufacturer Armacell Group, sees the introduction of Trafalgar Armacell Protect.

Armacell Protect is a graphite impregnated foam insulation material, that allows through penetrations of large chiller pipes, to maintain the fire rating or FRL of the openings for these chiller pipes with no compromise on thermal performance and no condensation to occur.



ArmaFlexProtect



Trafalgar Armaflex Protect is an all-in-one flexible pipe lagging with patent graphite impregnated intumescent technology for fire barrier penetrations of hot and chilled- water services.

Trafalgar Armaflex Protect allows pipes to pass through fire barriers without loss of thermal efficiencies, or risks of condensation caused by typical fire stopping systems which may require lagging to be stripped through fire barrier penetrations. Solutions for all R-Values on a range of services up to 300mm diameter pipes.

Armaflex Protect has been fire tested at thicknesses specifically designed to comply with Section J of the NCC for thermal efficiency.

Used in conjunction with FyreBATT & FyreFLEX, ArmaFlex Protect can be used for chilled or hot water pipes through all common barriers, for FRL's up to -/240/240.

Learn more here: <https://tfire.com.au/product/armaflex-protect/>



SuperSTOPPER

HVAC&R sees a prevalent use of insulated copper; often in large bundles in very close proximity to each other. When they pass through a fire barrier, they create a difficult fire stopping challenge.

Trafalgar Fire has been at forefront of creating a full range of fire, smoke and acoustic and (as required) airtight systems for openings in fire barriers that we call our SuperSTOPPER® range of characteristic orange boxes.

The multifaceted performance requirement led us to change their name from a fire rated box to a SuperSTOPPER box.

Systems are available for retrofitting over existing or already reticulated banks of insulated copper.

Learn more here: <https://tfire.com.au/product/superstopper-maxi-orange-box/>



Retrofittable
Trafalgar
SuperSTOPPER
Maxi variant
being installed
to 3 banks of
insulated
copper pipes!



 SuperSTOPPER
MAXI

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SuperSTOPPER MAXI

NEW BUILD OPTIONS:

For new builds, we see a huge take for the cast-in variants for integrating into concrete slabs when being poured; or slab mounted installed prior to a fire wall or shaft being constructed.



[See More](#)

Cast-in situ Trafalgar SuperSTOPPER Maxi variant – allows for insulated copper and associated cables in one opening!

SuperSTOPPER CAST-IN

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Slab Mount Trafalgar SuperSTOPPER variant – installed under soffit of slab and allows services to be run prior to fire wall installation; note double stacked variant above.

<https://tfire.com.au/product/trafalgar-superstopper-slab-mount-fire-box/>



FyreBOX SLAB-MOUNT

SMALLER HVAC&R SERVICE PENETRATION QUANTITIES OR BUNDLES

As discussed earlier, HVAC&R sees a prevalent use of insulated copper and so-called pair coils; many of these are in small to medium quantities passing through one common hole in the fire barrier, and of course some are single services passing through one small hole.

Trafalgar offers **many different fire tested system options** for all budgets and systems that allow for easier adds, moves and changes through the life of the building.

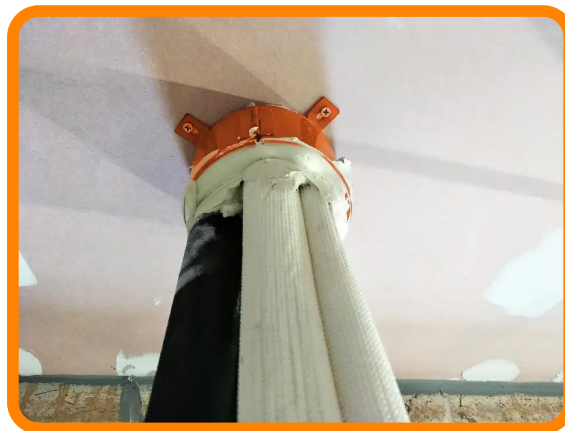
We are seeing more and more demand for visible and easier compliance from the certification and maintenance (ongoing inspection of testing) of existing building stock which has led us to visible compliance using our trustworthy orange systems in many cases.



FyrePLUG



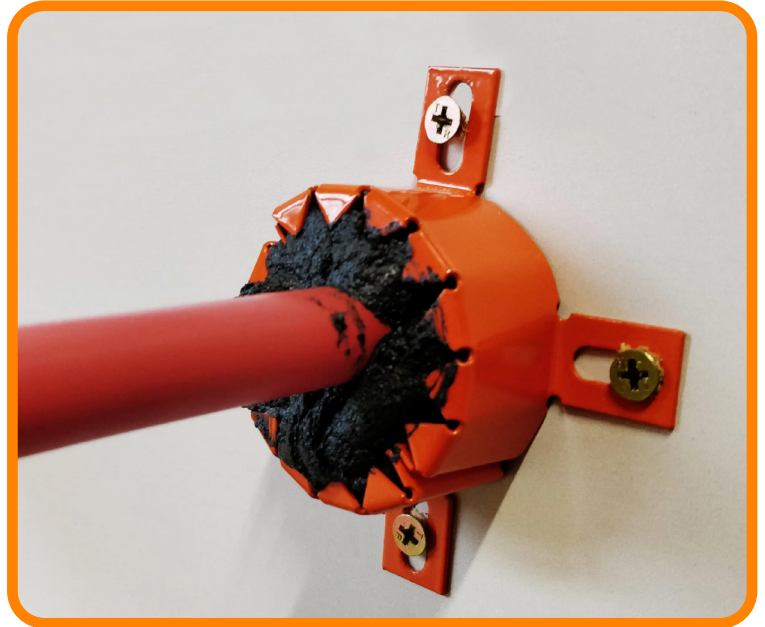
FyreSHIELD



FyreCOLLAR

FyrePEX^{HP}

Trafalgar FyrePEX high performance graphite sealant is sold in large quantities due to its extensive fire tested and well documented system approvals.



The fire barrier type, orientation, size of opening and quantity and types of service(s) govern the suitability of FyrePEX and any other look-a-like black graphite HP sealant or mastic.

Trafalgar Fire has a FyrePEX technical guide specifically for HVAC&R that can be **downloaded here:**

<https://tfire.com.au/product/fyrepep-hp-fire-rated-sealant/>



For design and checking compliance follow this routine:

1. Use the Trafalgar Fire Barrier Selector

Access the Trafalgar Fire Barrier Selector to quickly identify the suitable fire barrier for your project: Fire Barrier Selector.

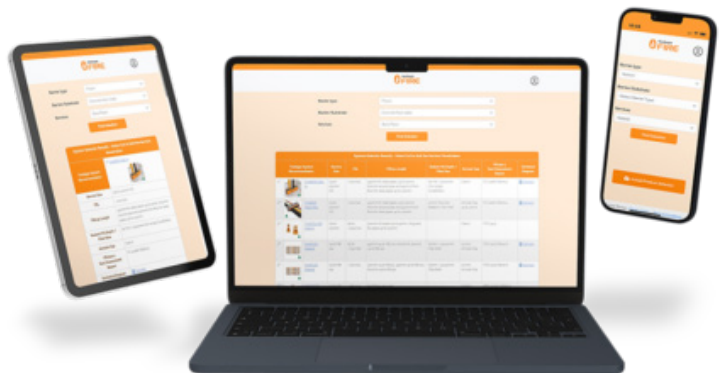


2. Review or Download the Relevant Technical Manual

Once you've selected the appropriate fire barrier, you can view or download the corresponding technical manual for detailed specifications and installation guidelines.

Additionally, Explore our FREE System Selector Tool!

Take advantage of our free System Selector to simplify your selection process and ensure compliance with your specific requirements.



[Download](#)



Trafalgar has a very large range of system fire tests across most commercially available fire barriers including floor/ceiling systems with the additional requirement for **Resistance to Incipient Spread of Fire, RISF** in the ceiling plenum or cavity space.

One important point of difference is we have fire tested with the addition of Trafalgar FyreFLEX acrylic fire sealant to provide necessary smoke stopping and air leakage characteristic along with the fire stopping attributes.

Trafalgar Fire is proud of our Mixed Service Fire Collar system approvals for HVAC&R penetrations with our Premium Retrofit Mixed Service fire collar. Treat multiple sets of pair coil plus their cables, insulated pipes and drain lines all through one penetration, making HVAC&R penetrations fast, clean and easy.



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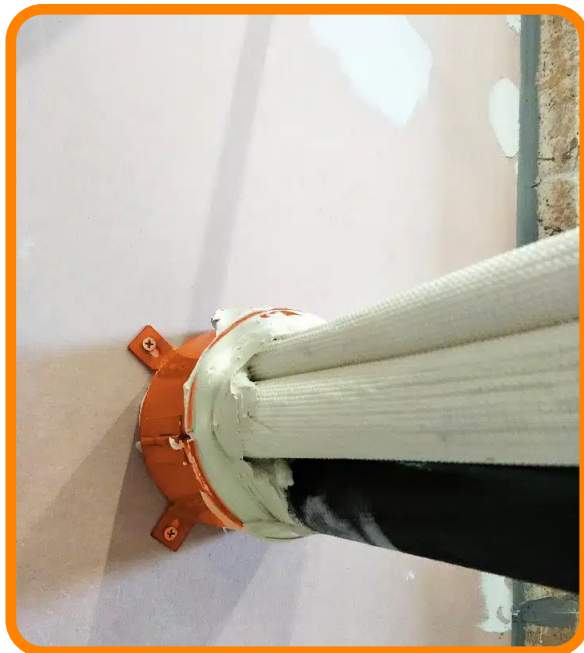
HVAC&R pipes require thermal insulation to maintain the thermal efficiencies required to run air-conditioning and refrigeration services.

However, these thermal insulation materials will quickly burn away in the high temperatures of an AS1530.4 fire test, which makes passive fire penetrations of HVAC&R services more complicated i.e when compared to bare metal pipe penetrations.

FyreCOLLAR Mixed Service fire collars are lined with an intumescent material that expands with the heat of a fire to close off the gaps around services inside of a fire collar, filling up the spaces left by the burning/melted thermal lagging to tightly seal around the copper pipes.

The high-grade intumescent material is strong enough to crush off pair coil insulation and form a tight seal around the cables, so all of these services can be bundled together to make passive fire protection of HVAC&R services fast and easy.

<https://tfire.com.au/product/fyrecollar-mixed-services-fire-collar/>



 **Fyre COLLAR MIXED SERVICES**

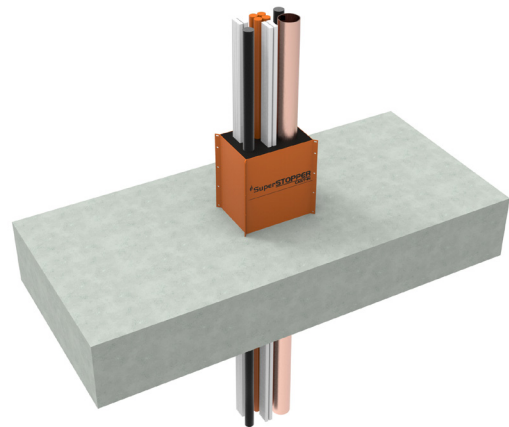
SuperSTOPPER

Trafalgar Fire are the market leader in medium sized openings for HVAC&R services offering systems for well organised, and forward-thinking HVAC&R contractors on NEW construction projects; and we also offer systems for projects where forward planning has not been possible.

Some of our offerings are summarised here:

NEW CONSTRUCTION

We offer a bambino or trade specific cast-in situ SuperSTOPPER for HVAC&R services and one for slab or soffit mounting and reticulation of services prior to fire wall or shaft being erected.



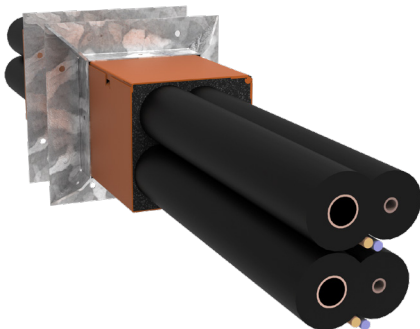


[Click here to learn more!](#)

SuperSTOPPER SLAB-MOUNT

The Trafalgar SuperSTOPPER Mini range allows for retrofit applications and incorporates a hinge that can be opened and re-closed around pre-run services or existing services alike and slotted in the opening.

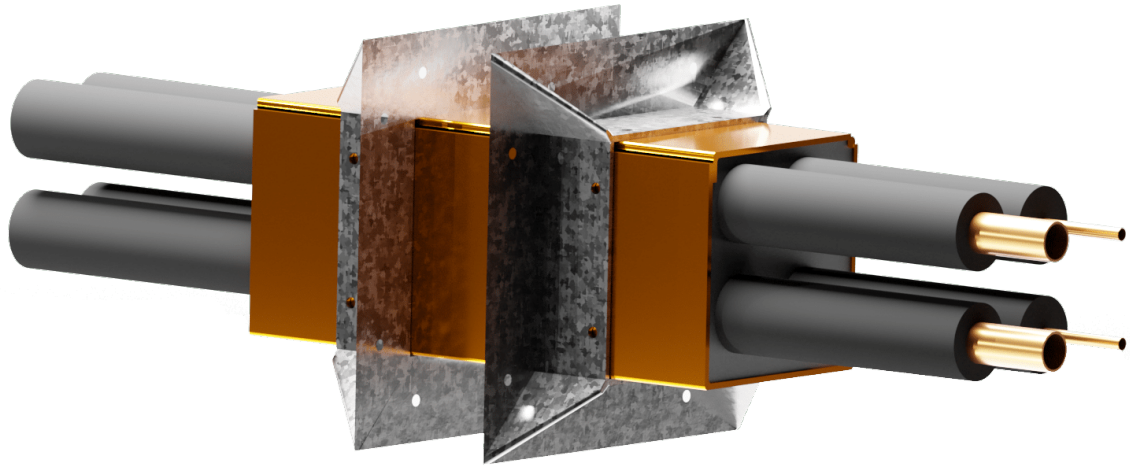
For over sized or irregular openings; the opening can be made smaller to suit the size of the SuperSTOPPER in question using Trafalgar FyreBOARD Maxilite material.



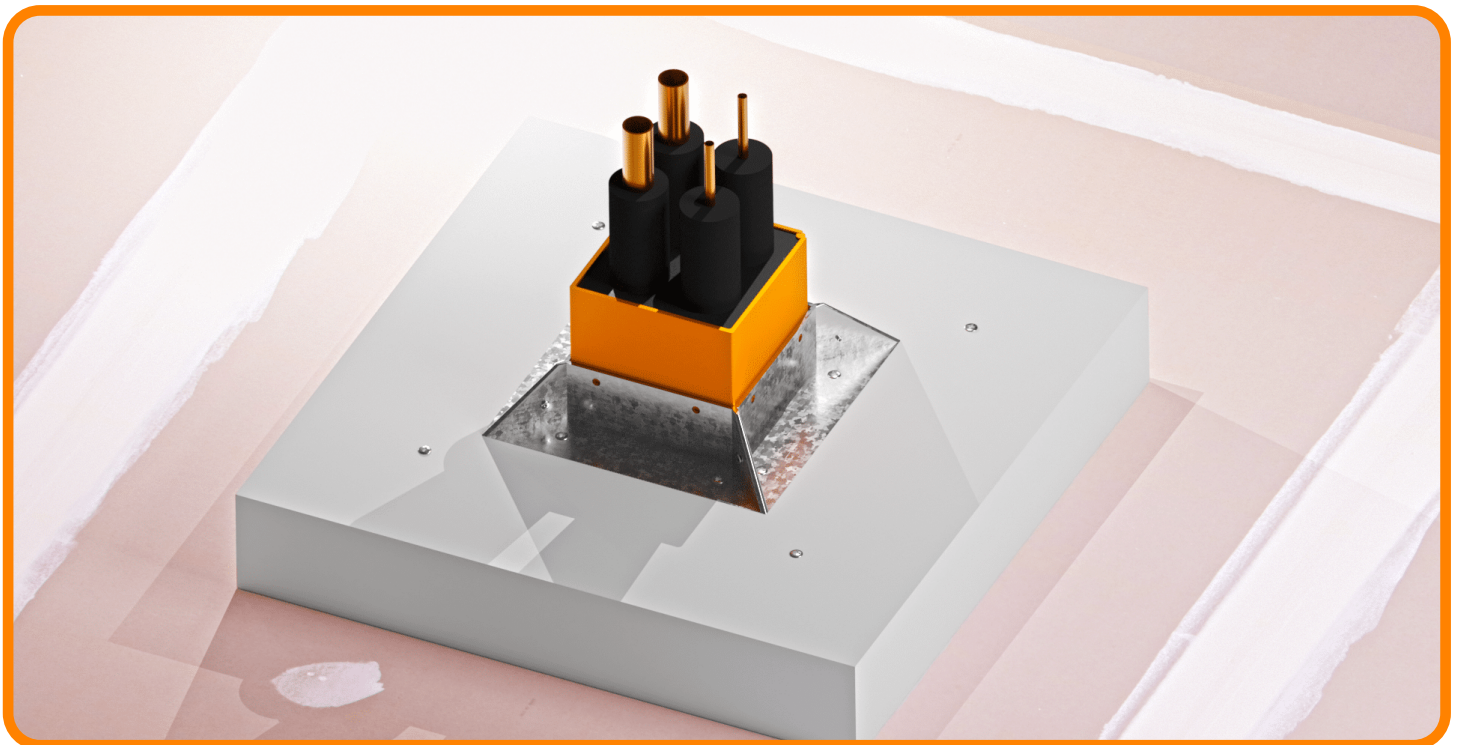
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By far the most popular in the SuperSTOPPER range for smaller and medium sized openings is the SuperSTOPPER Round models as it is easier to drill a round hole than form or make a square/rectangular hole.



 **SuperSTOPPER**
SQUARE MINI

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We urge those designing or using our Trafalgar Fire products to take heed of the fire tested systems which provide the requisite FRL.

We have technical manuals for every fire barrier, service type and configuration and FRL in the marketplace!



View Technical Manuals

SYSTEMS TO BE MORE MINDFUL OF

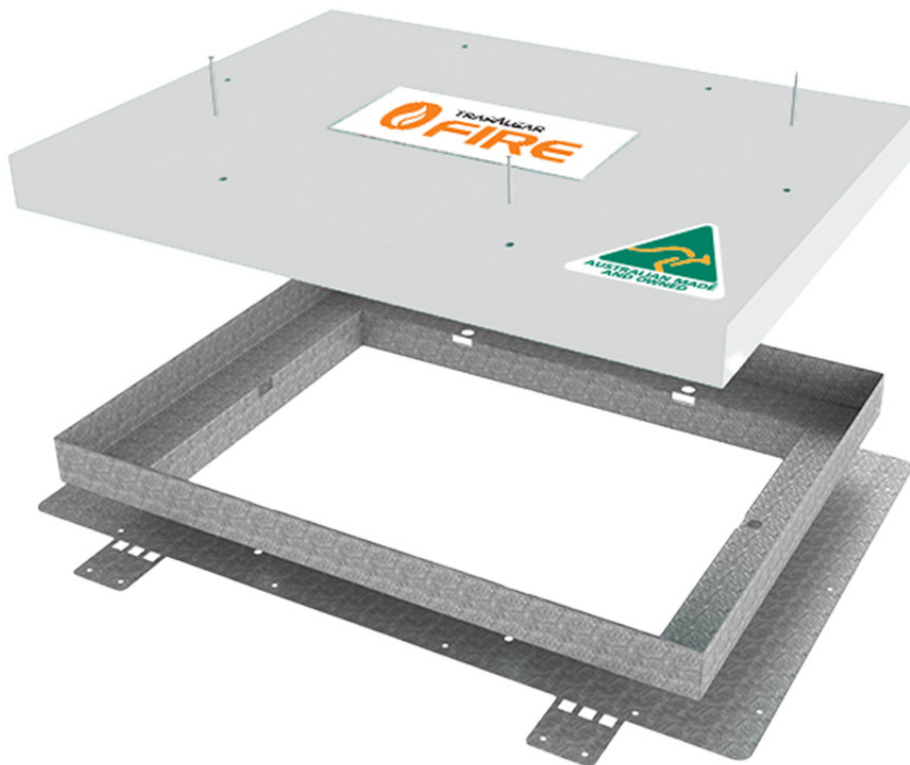
I have included this section for ducts as these are pain points for many projects which can easily be avoided with the correct budget and forward planning:

Fire rated duct access panels

The fire rated duct work used for smoke control purposes and for kitchen exhaust grease duct systems will typically need access panels for regular maintenance of equipment and cleaning for example.

Their access panels must be fire tested as part of the overall fireproofing duct system or assembly.

Trafalgar offer FyreDUCT access panels system compatible with Trafalgar FyreWRAP and Trafalgar Monokote duct fireproofing systems.

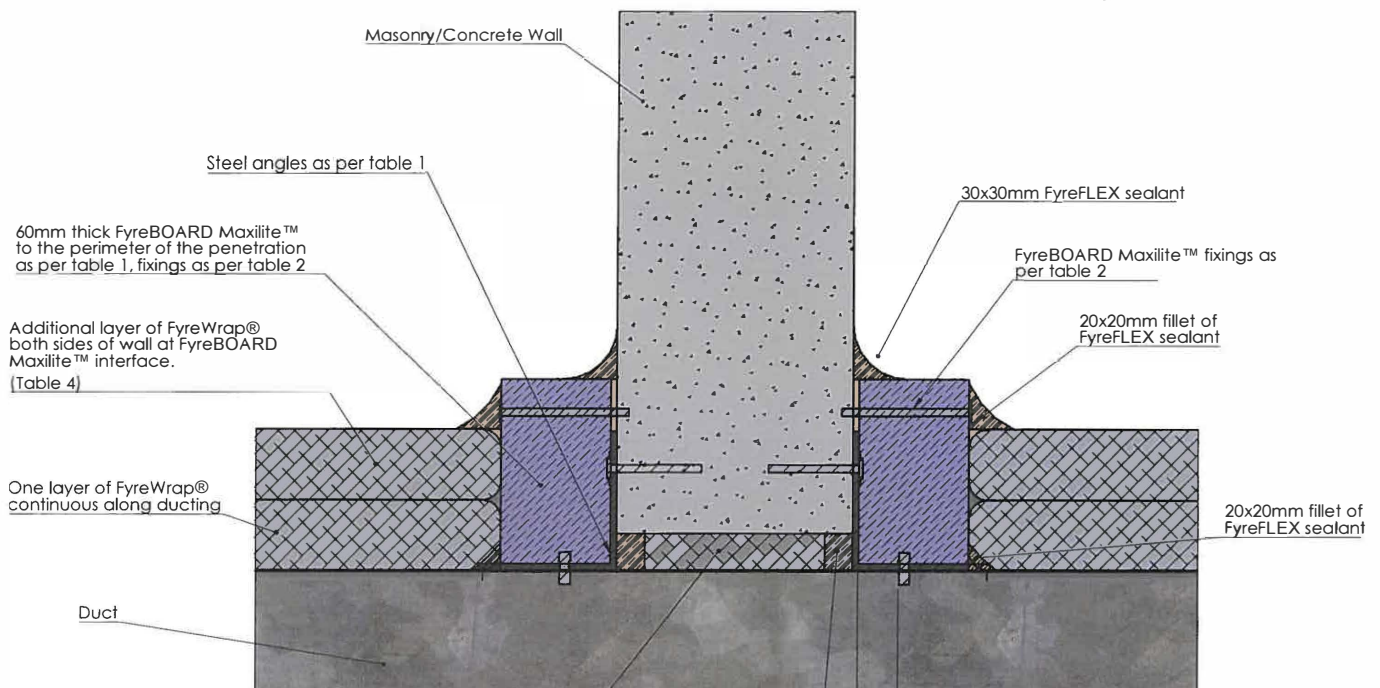


 **Fyre DUCT**
Access Panel

Fire rated ducts passing through openings in fire barriers

The penetration detail for where the duct passes through an opening in a fire barrier is also part of the overall fire tested system. Please detail these correctly in your designs!

Trafalgar Fire offer all the system components to make it easier for the trained and approved network of installation contractors.



In-line Duct Fans & Fire Protection Requirements

Please detail these correctly and do not let over-zealous vermiculite spray companies spray them.

Fans require maintenance and experience vibration and axial movement. They are equipped with flexible bellows to accommodate this axial movement effectively.

Building an entire fan enclosure around the fan assembly is overkill and extremely expensive.

The most cost effective and sensible method is to wrap the fan, connections, and maybe the silencer with Trafalgar FyreWrap®. If the size of the job and budget requires fire spray on the rest of the ducts, Trafalgar Monokote fire spray has fire tested and approved interfaces with Trafalgar FyreWrap®.

