TRAFALGAR FIRE

Specification of Passive Fire Penetration Systems

A Guide for Design and Building Practitioners

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Introduction

Buildings must be compartmented into fire rated zones using fire resistant walls, floors and ceilings to prevent the spread of fire from one compartment to the next. However building services must be allowed to penetrate these fire barriers to allow for plumbing, electricity, data, communications, air-conditioning and ventilation. Therefore, a building designer should allow for the provision of service penetrations within their building design.

Traditionally, the fire stopping of service penetrations has been left to the last minute for the service trades to run around the site sealing up the holes and gaps around their services a few weeks before the occupation certificate (OC) is issued. This lack of design and planning, coupled with an focus on building certification has lead to large numbers of defective installations due to a lack of understanding of the concept of the passive fire penetration system.

Moving forward, the construction industry across most states and territories of Australia are introducing new legislation that requires higher levels of building design prior to the Construction Certificates (CC) being issued, and therefore building designers must start planning ahead and designing for passive fire.

This specification guide provides simple 'compartment-by-compartment' design rules and examples for how this can be done in a practical way to comply against the Deemed to Satisfy provisions of the National Construction Code (NCC).

This guide applies to Volume 1 of the NCC2022 for all types and classes of construction but will place focus on class 2 residential projects for most of the case studies and examples.

This document is a guide only. All specific fire requirements for your particular project should be designed against the NCC for specific requirements for your building.

Contents

Definitions

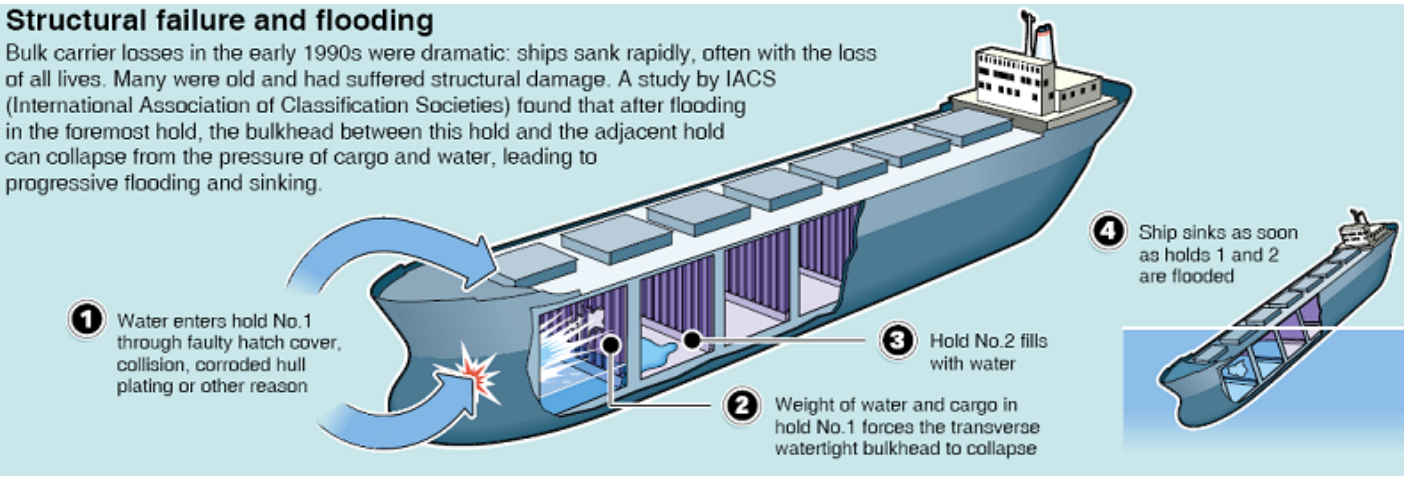
For the purposes of this document the terms used have been defined using formal definitions given in the NCC or relevant Australian Standards. Please refer to these documents for a list of definitions.

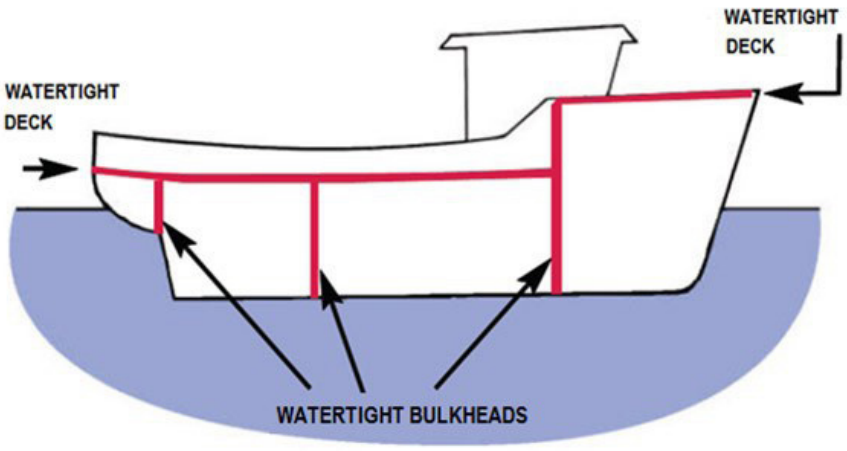
Part 1 - Passive Fire Design

This section aims to establish the 'goal posts' of best practice passive fire design.

Compartmentation

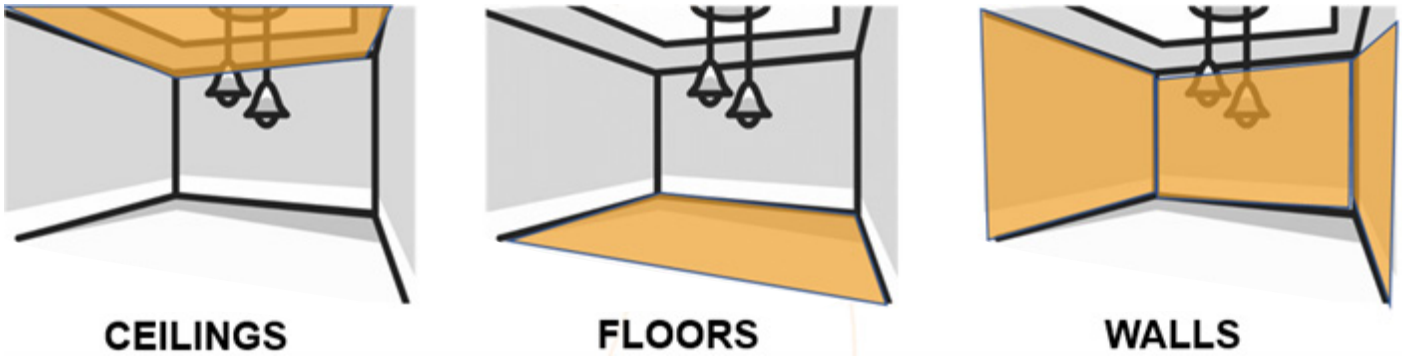
Compartmenting a building into fire zones can be visualised by thinking about a large Ship. Lets pretend that our ship has been struck with a small torpedo in the side of the hull, and has started taking on water below decks!





Luckily these ships are now divided into various 'bulkheads' that have high pressure rated doors that can be closed by the crew to prevent the water from spreading through the ship, allowing it to remain afloat.

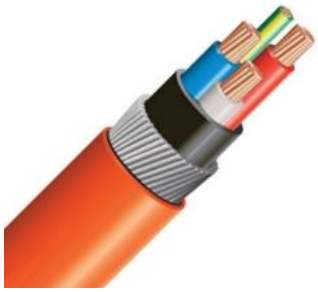
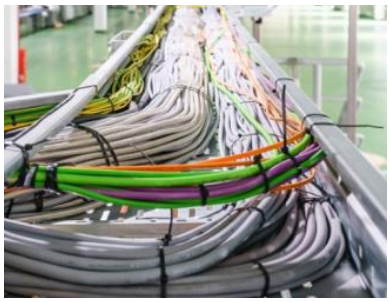
Compartmentation in a building is very similar! If a fire starts in one compartment, a good passive fire design strategy will contain the fire and prevent the spread to other compartments providing adequate time for the occupants to escape. We do this with fire rated barriers (see over page).

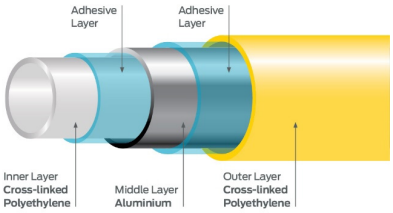
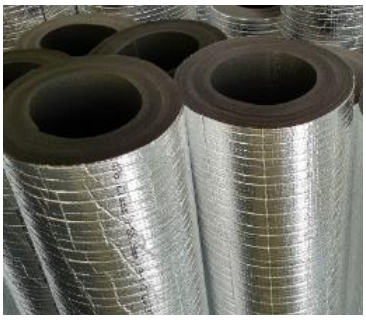


The National Construction Code sets out the requirements for where these fire barriers should be located, and what FRL they need to have based on the type, class and size of the building in volume 1 section C.

Building Services

Of course once a building is compartmented, we need to allow for provision of services and their penetrations through the various fire barriers. Designing for each specific building service penetration is not easy due to the materials used. The table below lists some common services and their specific fire stopping challenges:

Service Type	Physical Characteristics and Design Challenge	Image
Power cables	Have a large metal (copper or aluminium) conductors at their core that transfer lots of heat during a fire, and are usually covered in various flammable plastic insulations and sheathings. Often run in bundles and on large steel cable trays.	
Data and communication cables	Often have much smaller cores that might be metal or even optic fiber, but contain lots of volatile insulating materials like polyethylene, XLPE, PVC etc. These cables can be run as singles or bundles over 200x in data centres and hospitals for example.	
Metallic pipes	Copper and steel pipes are quite stable under fire exposure for up to 2 hours, but transfer lots of heat through a fire barrier that could indirectly ignite combustible materials on the other side. Copper materials will melt after 2 hours posing a huge challenge for 3-4 hour FRLs.	

Plastic pipes	Will melt away leaving large holes in the fire barriers. Different types of plastic behave very differently depending on their material properties.	
Composite pipes	Modern residential gas lines for example use a sandwich of plastic and metal materials that are hard to predict under fire conditions (eg PEX-Al-PEX pipes).	
Lagged metal pipes and CHW	Are often lagged with very combustible materials like polyethylene or polystyrene which burns away rapidly, leaving gaps. Nitrile rubber and stonewool based laggings last a lot longer in a fire but still require sealing.	
Ducting	Rigid steel ducts can allow an open path for fire to spread through the fire barriers. These require fire dampers or fire rated duct systems (FyreWraps and sprays) to prevent this mode of fire spread.	
Ventilation	Air transfer grilles are often necessary for the HVAC&R systems to operate, but we can't just leave open holes in the fire barriers. Fire dampers must be installed here and will close when exposed to fire.	

As you can see, the mix of very different materials used in building services means that there are a lot of variables that a building designer should consider when compartmenting a building. The NCC has specific requirements for treating the opening for service installations in C4D15 which are included in the next section.

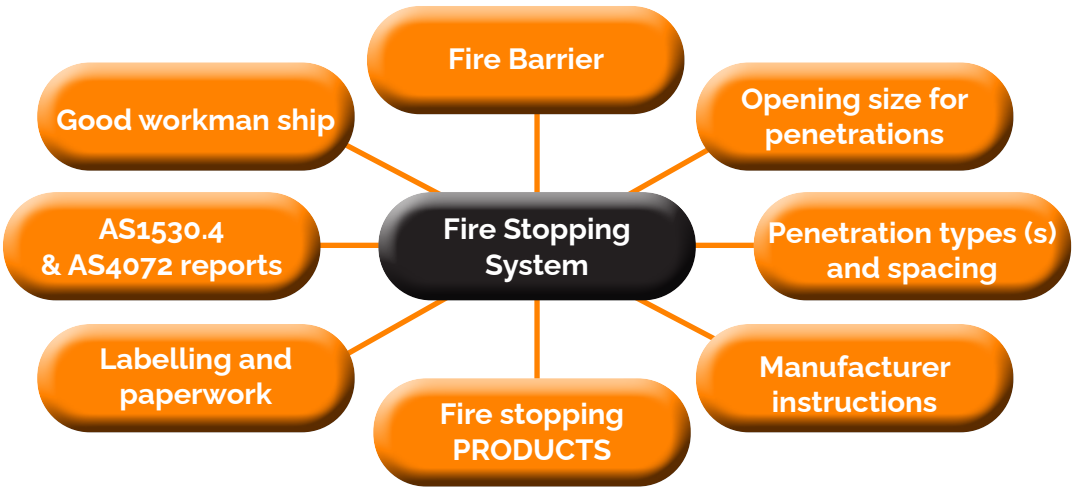
Part 2 - Building Code Requirements for Service Penetrations

The National Construction Code lays out the Deemed to Satisfy (DtS) compliance pathway for "*openings for service installations*" in clause C4D15. Whilst this clause does give a few options, the only recommended pathway for new buildings is to comply with part 2a) as well as Specification 1 of the NCC.

This clause requires service penetrations to be fire tested to AS1530.4-2014 **IDENTICALLY** to how they will be installed on site, and visa versa. This means that any installations on a site must be installed **IDENTICALLY** to how the penetration was tested in the laboratory conditions.

Minor variations to the penetration systems tested to AS1530.4 are only permitted when an accredited testing laboratory writes a formal report in accordance with AS4072.1 (referred to as 'assessment reports' or 'formal opinions').

The biggest misconception of AS1530.4 fire testing is that the test gives an inherent 'fire rating' to a product of material. This is not the case! **An FRL is assigned to the full tested system, which comprises of the following items:**



Therefore, from the very start of a building design these passive fire penetration systems should be front of mind, otherwise you risk specifying products that do not allow for a Deemed to Satisfy (DtS) penetration system to be installed which will lead to defects and potential life safety risks.

Penetration System Checklist

First and foremost, you need to understand that the products you are reviewing are not inherently 'fire rated'. The products will have been tested as a system with the service and fire barrier type, and the **FRL only applies to the assembly.** Therefore you need to look for service penetration 'systems' that have been tested for your wall, floor or ceiling, and pipe, cable or duct. To do this you can follow the following checklist:

Are copies of the test or assessment report available from the manufacturer's website?	✓
Does the report match your buildings Wall, floor or ceiling type?	✓
Does the report match your buildings fire barriers & service types and size?	✓
Does the report state the maximum sizes and how many services can be in a bundle?	✓

Penetration System Checklist (continued)

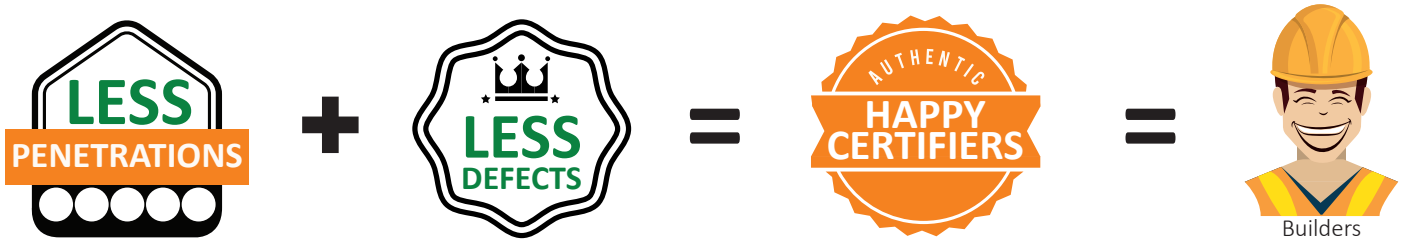
Does the report place any minimum separation distances between services.	✓
Are the reports written against AS1530.4-2014 (older versions are no longer acceptable under NCC2022).	✓
Does the report provide all clear description of the system that was tested?	✓
Does the report justify any variations that are assessed from the tested system with reference to AS4072.1, or via the AS1530.4 section 10.12 permissible variations?	✓
Does the manufacturer provide clear installation instructions and technical support for the installers?	✓

In addition to the above, as a rule of thumb the following products and systems should be avoided:

- Product manufacturer doesn't provide test or assessment reports (No reports = no compliance!)
- One-page certificates are not enough to meet NCC requirements
- Redacted reports from the manufacturer
- Snippets from reports
- British, European, American, Chinese or other international standard fire testing reports are not suitable under the NCC
- Poor installation instructions
- Lack of technical support

As you can appreciate, when this initial planning and research stage is not completed before a project starts there is a very high chance of defective or badly designed passive fire systems once the pipes and cables are installed.

When this work is done up front the designer will be able to identify and design around any barriers to specifying a Deemed to Satisfy system. Equally, if there are no available tested systems then the builders and developers can engage Fire Safety Engineers early to assist in finding an alternate solution.



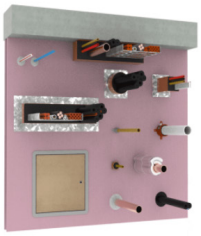
Part 3 - Design Strategies for Service Penetration Systems

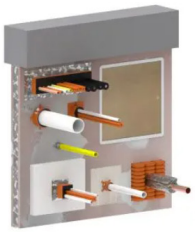
The aim for the designer should be to **reducing the number of holes in all fire barriers** to simplify the documentation, compliance, sequencing, service separation, confusion and risk if defects on site. A good building designer should consider the following strategies:

Look into the different types and brands of fire Walls/floors/ceilings before specifying, to check if the fire barrier been tested with service penetrations systems. Check out Trafalgar's Fire Barrier compatability page here: https://tfire.com.au/fire-barrier-type/.	
Explore the most efficient way to compartment the building - Do the riser shafts need to be fire rated, or can the services be sealed floor-to-floor? (see next section on 'riser shafts').	
Understand the spacings and clearance requirements between service penetration systems, to allow enough space above door headers and riser cupboards.	
Document the passive fire systems used up front by generating penetration registers, using documentation apps and platforms, using BIM and Revit models etc. This will help identify issues with the fire design early.	
Simplify the design with multi-penetration systems like the Trafalgar FyreBOX range.	

Refer to Trafalgar Fire's "Fire Barrier" web page to see if the chosen fire barrier is compatible with penetrations:

Walls


Plasterboard - Single Layer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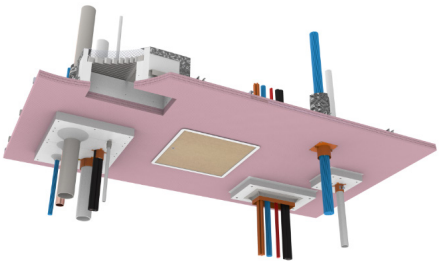
Concrete

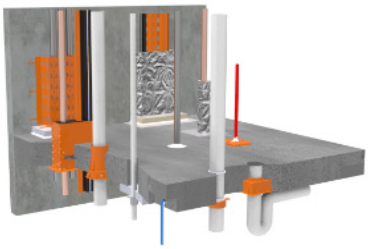

Masonry


AAC - Hebel


AAC - WALSC

Ceilings

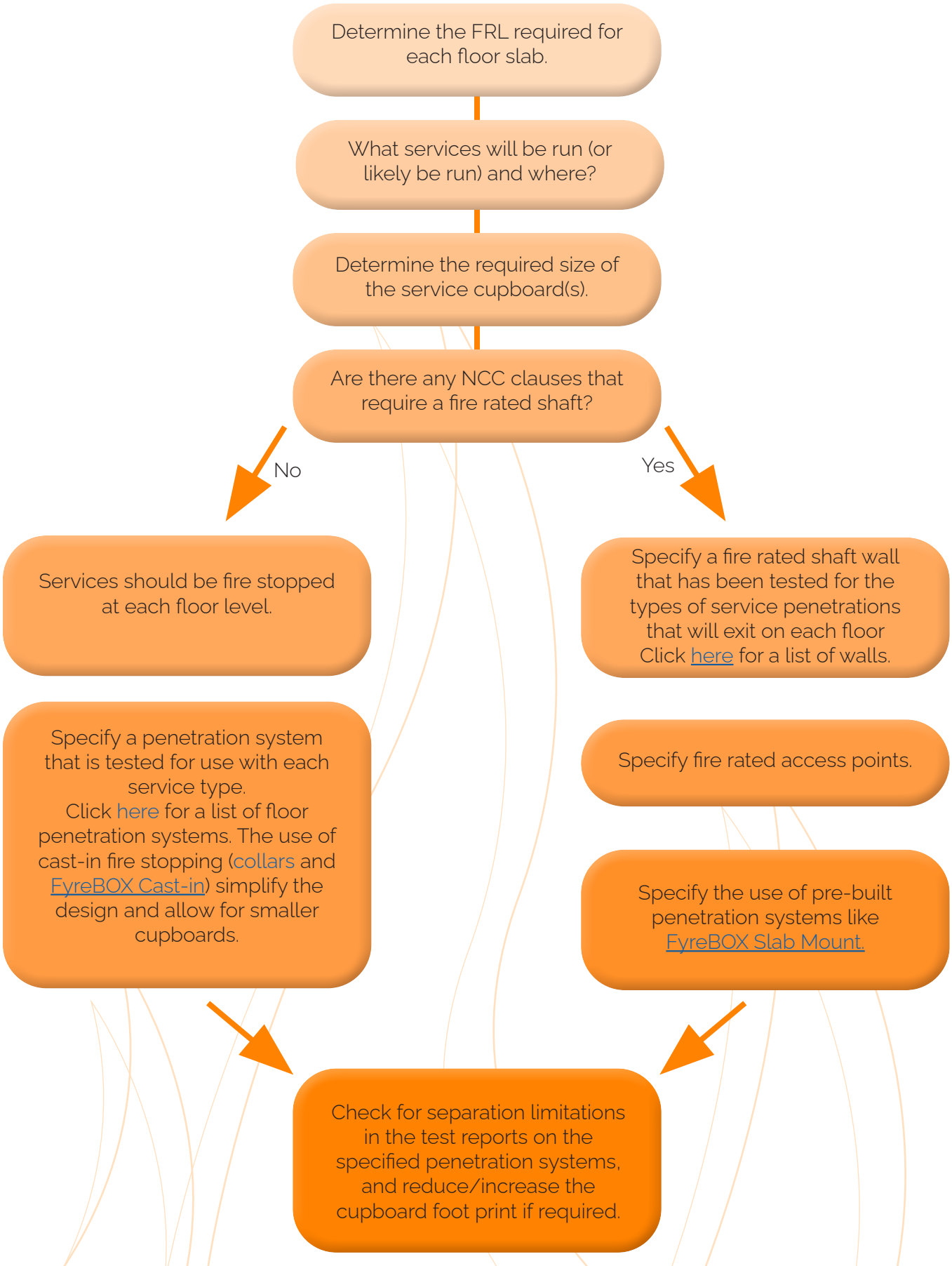




Click Here to Visit Fire Barrier Page

Design Process for Floor Penetration Systems

Various parts of the following process may require several iterations:



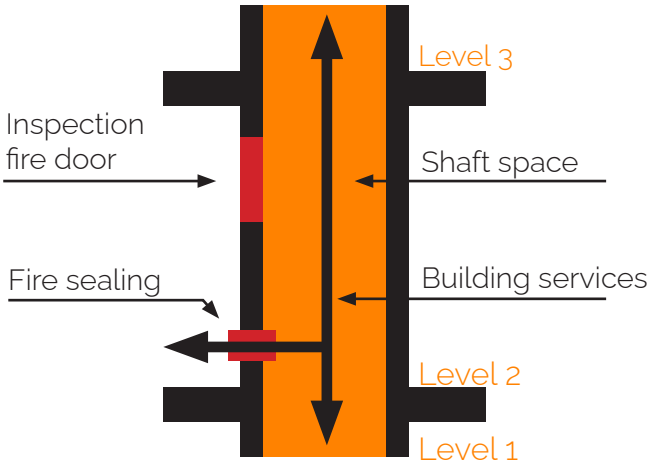
Do I Need a Fire Rated Riser Shaft?

A riser (or riser shaft) is an enclosed shaft that runs up through a building to allow services to be routed easily through the building and return to a plant room, plant equipment, vent to atmosphere or connect to the street for example. Because the riser connects various fire compartments together, care should be taken to ensure that the fire compartments are maintained and separated appropriately.

There are two ways to design for these scenarios:

1. **Floor-to-floor separation** where you fire-stop the services as they penetrate through each floor level, allowing for the riser shaft to be constructed from non-fire rated construction (cost effective, no fire doors needed etc), **or**
2. **Fire Rated Riser Shaft** which allows the services to pass through un-sealed (open) penetrations at each floor level, and encloses all services within a shaft with fire rated walls (and fire doors, access panels and garbage chutes) on each level. This is useful for large quantities of services, but note that services will still need to be sealed with a tested system as they penetrate the riser shaft walls on each level. The completion of service penetrations through shaft walls (or any walls) often requires access to both sides of the wall to install fire sealants, collars and service wraps. Provision of access is a must!

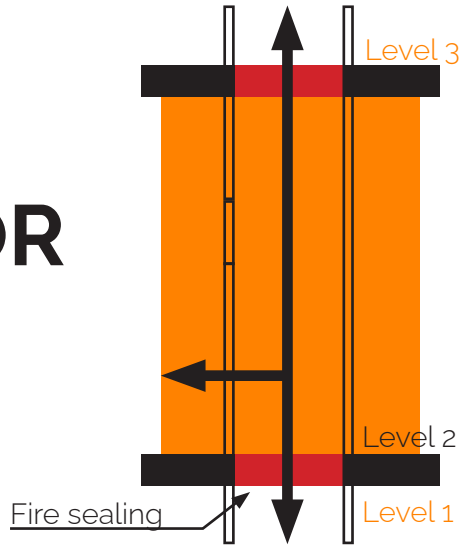
Fire rated services shaft



Each floor is fire-isolated from the shaft

OR

Floor-to-floor separation

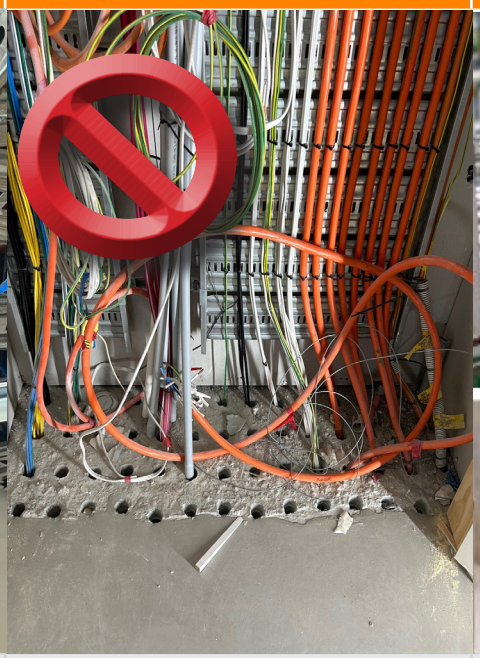


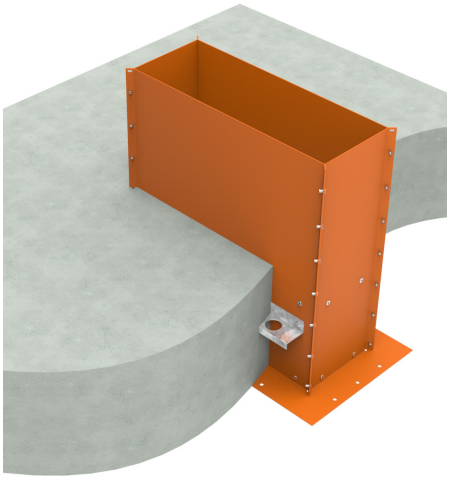
Each level is isolated by the floors

Each has their own benefits, however some Types/Classes of construction will trigger the use of a fire rated riser shaft under NCC section C.

Best Practice: Floor-to-Floor Separation

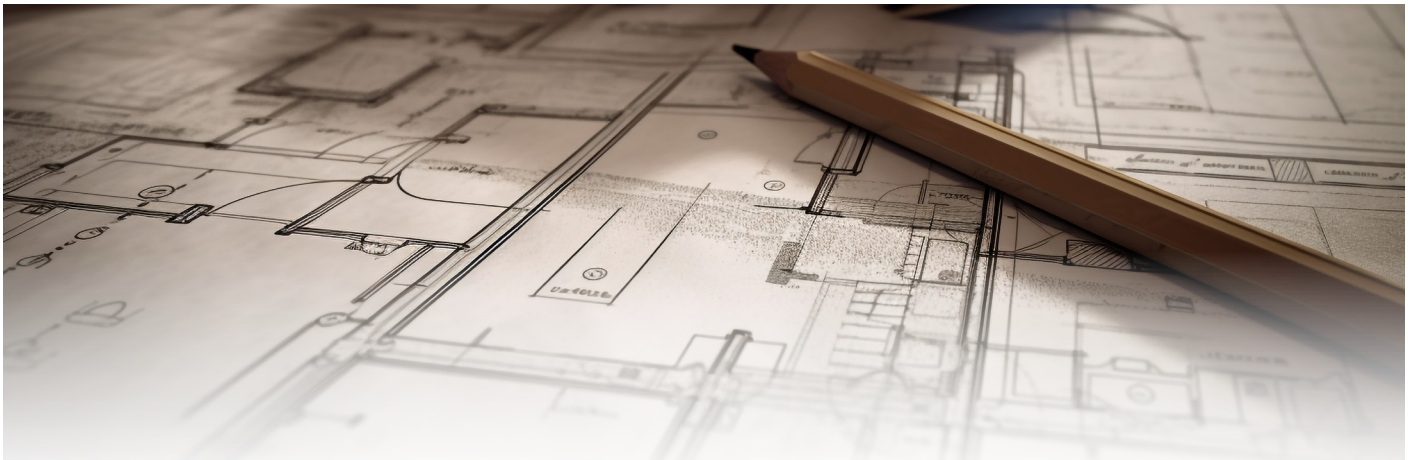
For Class 2 constructions, our recommendation is to adopt a floor-to-floor separation plan.

Common Defects Found in Fire Rated Riser Shaft Walls:	Common Defects Found in Fire Rated Riser Shaft Floors:	Cast-in Service Penetrations Systems Like the FyreBOX & FyreCOLLAR Resolve Planning Issues:
		 
Fire rated riser walls are rarely re-instated around the penetrations correctly.	High volumes of mixed services are can be tricky to plan for.	Accurately plan ahead for provision of services
Access is always required to both sides of the shaft to install fire stopping	Service separation often clash with wiring and plumbing codes	BIM models allow for easy planning and specification
Lots of services in a small footprint	Hard to estimate fire stopping costs	Reduce cupboard sizes



Top Tip:
Use of cast-in fire systems like the Trafalgar FyreBOX Cast-in can be specified onto the floor plans and reduce the overall size needed the riser cupboards and allow for large quantities of services to penetrate through a small footprint.

Part 4: Specification of Service Penetration Systems



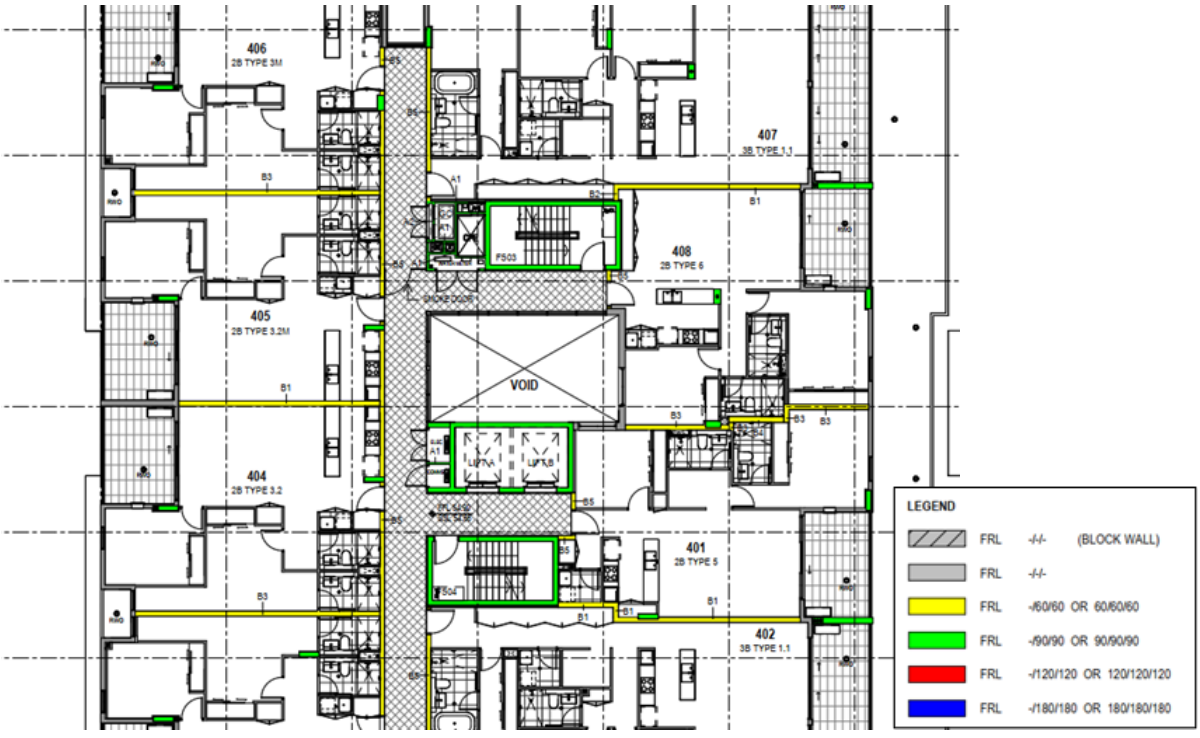
This section provides a brief description of various types of fire rated walls, floors and ceilings that will be found across a typical Australian mid-high rise building designs with recommendations on what types of passive fire penetration systems to specify.

Specification of Service Penetration Systems

The following process is one that involves marking up a set of architectural plans with the locations of the all service penetrations and adding a unique identifier that will be used to track and document the systems used down to the installation sticker placed next to the penetration. There are Apps available to automate this process, but here we will show you how to step through the manual process.

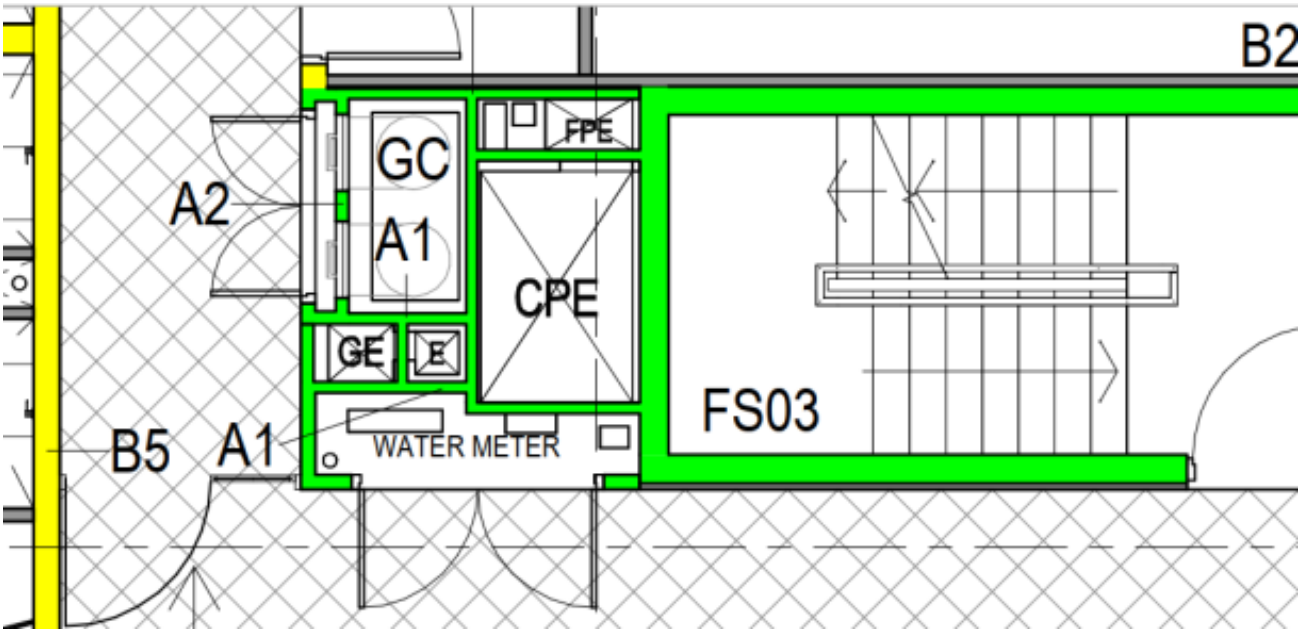
Step 1 – Fire Compartment Plans

Generate the floor plans for each level and colour code the various fire walls by their required FRL.
Most designers will also create a separate drawing with a list of the fire walls and their cross section details, wall system numbers and the AS1530.4 fire test or assessment reports for the actual wall. The compartment plans should also add the concrete slab thicknesses on each level and their required FRL.



Step 2 – Mark Up the Location of the Floor Penetrations or Fire Rated Shafts

If the riser shafts are designed to be fire rated, then the designer will need to highlight and label these as appropriate for the service trade or function of the shaft. The example below shows several fire rated shafts are marked up in green and clustered together for the garbage chutes, ducting and hydralic services:



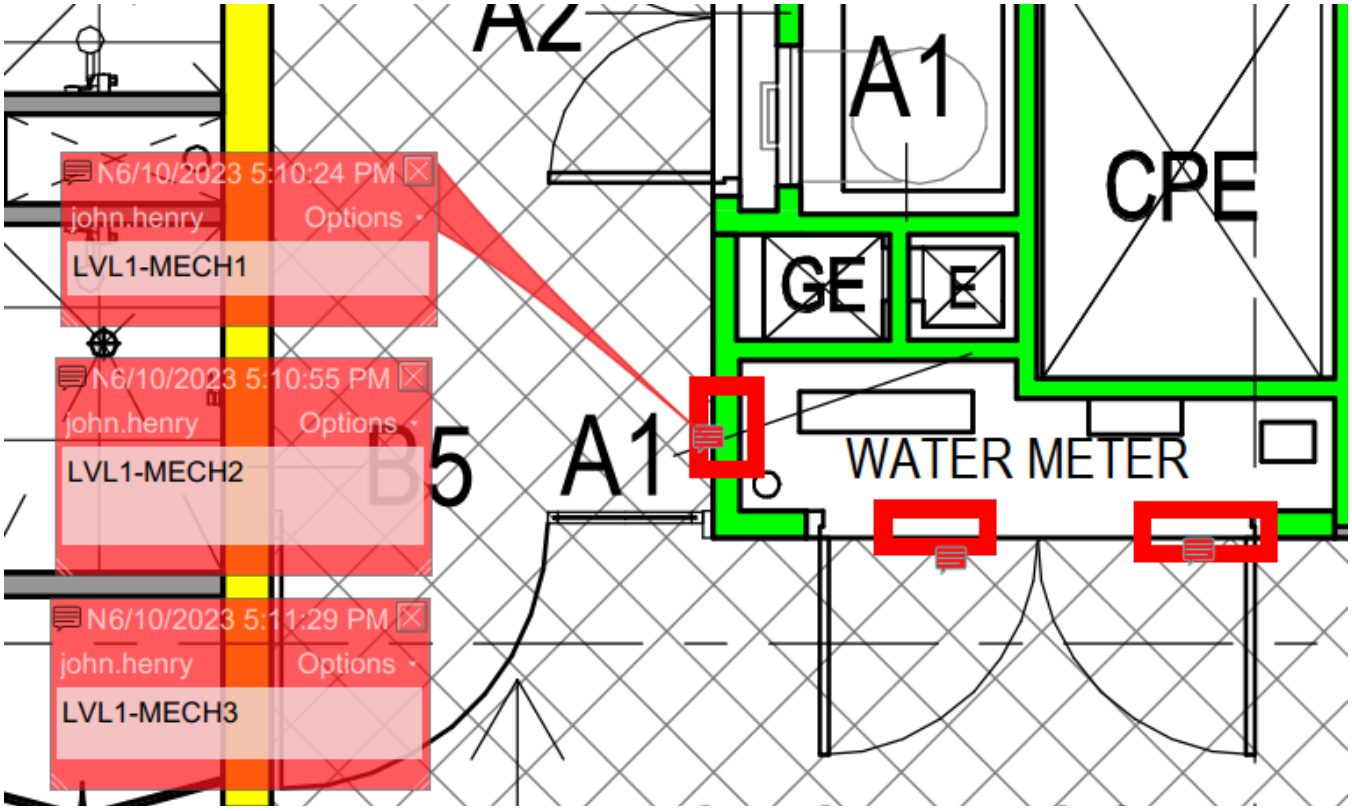
In the above example, because the walls are fire rated, no penetration systems are needed at the floor level. However there will be service penetrations above the cupboard's fire doors to allow services to pass into the corridor. Mark these locations with an approximate 'to scale' box and provide a unique penetration number for each.

Mark up all wall penetration locations with an approximate 'to scale' box and provide a unique penetration number for each.

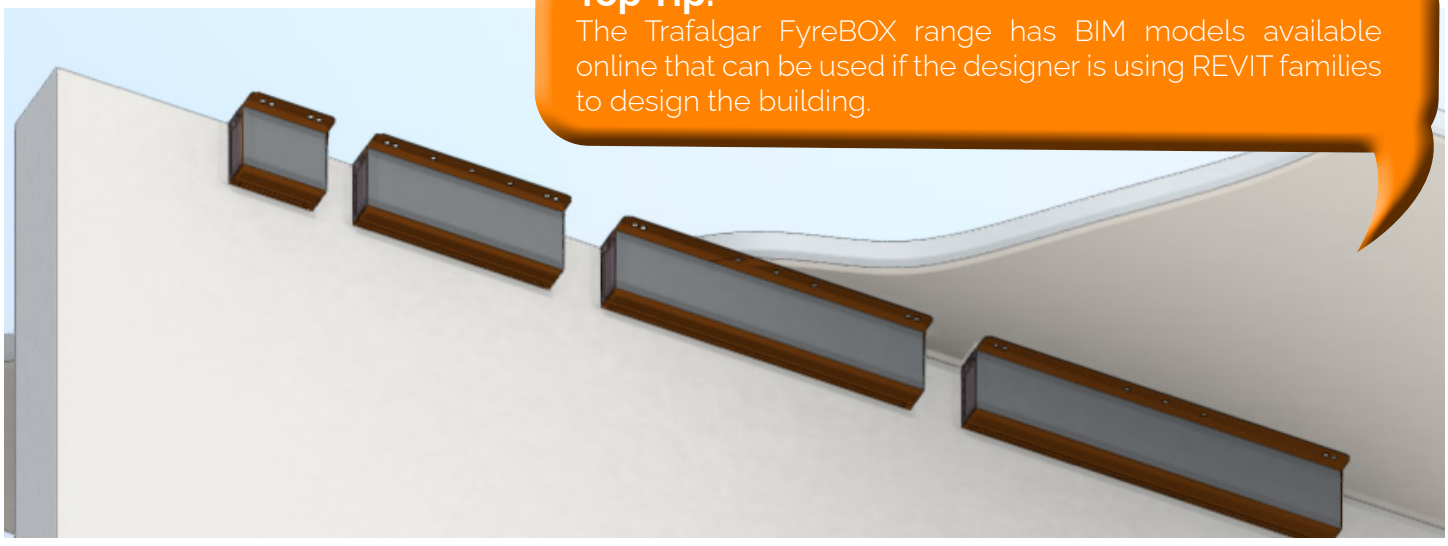
Mark up all floor penetration locations with an approximate 'to scale' box and provide a unique penetration number for each.

In this example we have marked up the locations for the mechanical service penetrations in three locations for 10x hot water PEX pipes, 10x cold water PEX pipes, and 20x pair coil HVAC&R services that all share the same cupboard.

As per the design flow chart on page 11, at this point the designer should check for clearances and separation distances between service types.



Top Tip:
The Trafalgar FyreBOX range has BIM models available online that can be used if the designer is using REVIT families to design the building.



Step 3 – Create a Penetration Register

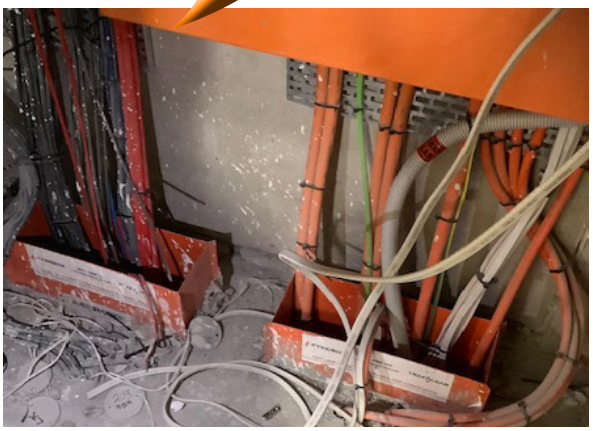
Using a simple spreadsheet or other platform, create a register of each of these penetrations. At this point you can add in additional columns that can be filled in by each service trade for each level.

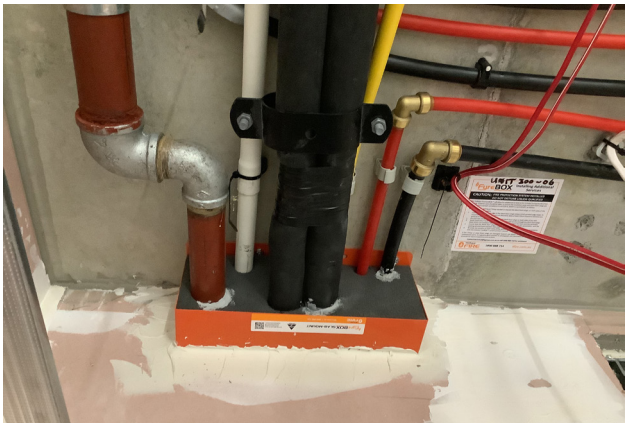
Below is an example based off the above floor plans:

No.	Service	Service Material	Pipe Size (OD)	FRL (minutes)	Separating Element	Localised Thickening	Material Identification & Product Name	"Test Report Number (NATA Approved)"	Reviewed and approved by XXXXXXXX
1	FR Lagged paircoil (10mm and 15mm copper), 12mm OD electrical cable, 6mm OD data cables with or without 20mm OD conduit	Paircoil	10mm and 15mm copper	-/120/120	Concrete min 120mm thick	N/A	Trafalgar FyrePEX HP	FAR 4849	YES 01/02/23
2	PE Lagged paircoil (10mm and 15mm copper), 12mm OD electrical cable, 6mm OD data cables with or without 20mm OD conduit	Paircoil	10mm and 15mm copper	-/120/120	Concrete min 120mm thick	N/A	Trafalgar FyrePEX HP and T-Wrap	FAR 4849	YES 01/02/23
3	FR or PE Lagged paircoil (10mm and 15mm copper), 12mm OD electrical cable, 6mm OD data cables with or without 20mm OD conduit	3x Paircoil	10mm and 15mm copper	-/120/120	Concrete min 120mm thick	N/A	FyreCOLLAR Premium Hinged retrofit collar	FC11190	YES 01/02/23
4	0-50mm OD Copper Pipe	Copper	0-50mm	-/120/120	Concrete floors min 120mm thick	N/A	Trafalgar Fyreflex Sealant and Twrap - SEALANT & WRAP	FCO 1579 Rev F	YES 01/02/23
5	50-100mm OD Copper Pipe	Copper	50-100mm	-/120/120	Concrete floors min 120mm thick	N/A	Trafalgar Fyreflex Sealant and Twrap - SEALANT & WRAP	FCO 1579 Rev F	YES 01/02/23
6	100-150mm OD Copper Pipe	Copper	100-150mm	-/120/120	Concrete floors min 120mm thick	N/A	Trafalgar Fyreflex Sealant and Twrap - SEALANT & WRAP	FCO 1579 Rev F	YES 01/02/23
7	150x100mm penetration with 100mm Cable Tray (D1 Configuration)	Copper	max size 1200x1200mm	-/120/120	Concrete floors min 175mm thick	NO	Trafalgar FyreBatt, Fyreflex Sealant and Twrap - BATT, SEALANT & WRAP	FRT180392 R1.0	YES 01/02/23

At the design stage it is unlikely that the designer will have the specific information on the services however the **more detail that gets included early will lead to a better and safer design**. The service trades can get involved to assist by populating more specific details before building commences, and the builder or designer should double check for any changes to the schedule that might clash with an existing specification.

Top Tip:
The FyreBOX Cast-in (floors) and Slab Mount (walls) allow for multiple and mixed service penetrations for virtually all of the pipes and cables that you find on a residential site. Combine your service penetrations and reduce the number of data inputs and potential risk of defects with FyreBOX.





This penetration register can also be used to link test reports directly to the documentation and form the basis of compliance for occupancy certificates later in the project, as well as long term inspection and maintenance of the building over its life.

Step 4 – Complete the Plan Markups and Registers

Once you have a format and register system that feels comfortable, continue through each level marking up the penetrations at the SOU walls, floor penetrations, ground floor retail/ commercial and basement locations. See below example line entry.

Building	Level	Location	Element	Description	FRL	Status/ Test Assessment Ref	Finishing Image Reference
Building A	Level 1	Above Door Entry-U105	Wall	• Fire seal gaps around FyreBOX-Slab-Mount both side of the wall. • Installation of intumescent foam blocks to penetration surfaces of FyreBOX-Slab-Mount. • Installation of T-Wrap to services in FyreBOX-Slab-Mount both side wall and fire mastic seal.	- /60/60	Compliant (FC10266-01-4)	

Top Tip:
Once this is done for the first time you can save this register as a template for future projects!

Summary of the Specification Process

1. Compartment plans

Label and document the fire walls, floors and ceilings and their FRL's

2. Penetration locations

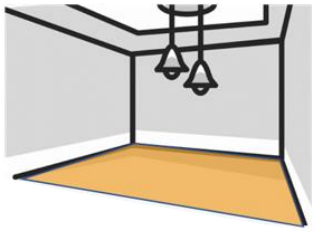
Markup locations of any service penetrations through each fire wall

3. Registers and data

Input the service penetration details and specify the penetration systems

The following pages give some more specific information to different types of fire barriers (floors, walls and ceilings) and some recommended specifications for different scenarios.

Part 5 - Recommended Specifications Floor Penetrations



Concrete floors are almost always used to provide fire separation between every floor. For residential buildings, the floor slabs are commonly used to provide an FRL of 90/90/90 between apartments, but typically will have higher FRL's (120/120/120) to separate carparks or commercial tenancies like shopfronts on the street level. It should be noted that loading docks and other special compartments (or classes/types of construction) might trigger the need for 3-4 hour FRL requirements which will require particular attention with specification and might require performance solutions to be included.

Many modern buildings now use steel decked slabs which provide a longer spans with less concrete, and provide some particular challenges when it comes to finding compatible service penetration systems.

Any penetrations and openings in the floors must be sealed in accordance with NCC C4D15 for integrity and insulation criteria of the FRL only (eg -/120/120) even if the fire barrier has an FRL with structural integrity. If the floor slab has a steel deck, consideration should be given to ensure that any passive fire penetration system specified is tested to interface with the various ribbed profiles of the deck. Traditionally the different service trades have their own dedicated riser cupboard to provide lockable, easy access for maintenance and addition of new services over the life of the building.

Floor Penetrations
Electrical & Data, Mechanical, Wet and Dry Fire Services

The FyreBOX range is multi-service penetration system that is tested for multiple and mixed service penetrations. The internal linings of the FyreBOX will swell and close off the large penetrations during a fire providing FRL's up to -/240/120. The FyreBOX range are designed specifically for designers who want to plan ahead by providing 'fire rated holes' for the service trades to utilise on site, without needing to backfill the penetrations with laboursome materials like pillows, batts and boards.

Fire Barrier:	Concrete Floors (including steel decks)
Passive Fire Stopping System:	FyreBOX Cast-in
Image:	
Size(s):	175x125, 350x125, 550x125, 650x125, 750x125, 1100x125. Custom sizes available up to 1250x125 x any height to suit slab thickness.

Floor Penetrations
Electrical & Data, Mechanical, Wet and Dry Fire services (continued)

Slab thickness:	Stock size FyreBOX will suit up to 350mm thick slabs. For thicker slabs, CUSTOM depth to be ordered to suit.
Separation between each penetration:	100mm between each FyreBOX's
Maximum FRL:	Up to - /240/120
Fire test/assessment report	BRANZ report FC10266:
Services approved for use:	Any combination and quantity of: • Power cables (copper and Aluminium core) • Data cables • Dry fire cables • Comms cables • Cable trays up to 1000mm wide • PVC conduits • PEX and PEX-AL-PEX pipes • Small CHW pipes up to DN50 copper + lagging • Pair coils • Hydrant mains up to 100mm • PVC drain/waste/vent pipes up to 80mm
Installation	FyreBOX Cast-in nailed to formwork in specified locations and sizes. Acoustic foam and TWrap to be added once services are roughed in.
BIM Models	Available as free downloads

IMPORTANT - Most service penetration systems in floors will required 450-600mm height of thermal wrap around the services to prevent heat transfer during a fire (AKA fire insulation criteria). Please locate any switchboards or valves 600mm away from the finished floor level.

Floor Penetrations
Drain/Waste/Vent Pipes

Plastic pipe penetrations should use a cast-in fire collar, where the locations must be shown on the building plans take care to:

- NOT shield the fire collars from activation by poor location control, such as above walls and other large fixtures that are located below the slab. **Fire collars should be installed 100mm away from adjacent walls.**
- Allow at least 40mm separation BETWEEN EACH FIRE COLLAR (not between each pipe)
- Clearly detail the pipe size and type of pipe (eg 100mm DWV PVC)
- Clearly identify which penetrations are for Floor Waste application (Floor Waste require a separate, spring activated fire collar – refer to the next section)

Specification Suggestion:

- Trafalgar FyreCOLLAR Cast-in Stack Fire Collar range
- BIM models available as free downloads
- Fire test reports and manuals available online at www.tfire.com.au

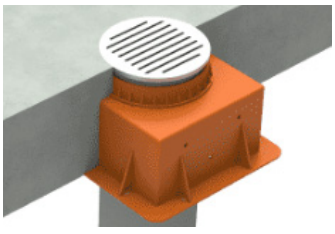
Collar Code	Pipe Size (nominal)	Outside Diameter of Fire Collar Flange	Separation Distance Between Collar Flanges	Separation Between Collars and Adjacent Walls
FyreCOLLAR CISC-L40	40mm	162mm	40mm	100mm
FyreCOLLAR CISC-L50	50mm	162mm		
FyreCOLLAR CISC-L65	65mm	162mm		
FyreCOLLAR CISC-L80	80mm	215mm		
FyreCOLLAR CISC-L100	100mm	215mm		

*Collars are also available in 'high cast' format. Refer to www.tfire.com.au for a full range of cast-in collar options including collars tested for 150mm PVC pipes.

Floor Waste Pipe Penetrations

Floor Waste pipes have a drain with a grate located at the finished floor level, and required a different type of fire collar that is spring loaded for quick activation. These pipe penetrations should be clearly shown on the building plans with care taken to:

- NOT LOCATE over walls that are located below the slab
- Allow at least 40mm separation BETWEEN EACH FIRE COLLAR (not between each pipe)
- Clearly detail the pipe size and type of pipe (eg 100mm FW PVC)
- Clearly shown as a separate item to the 'stack' fire collars



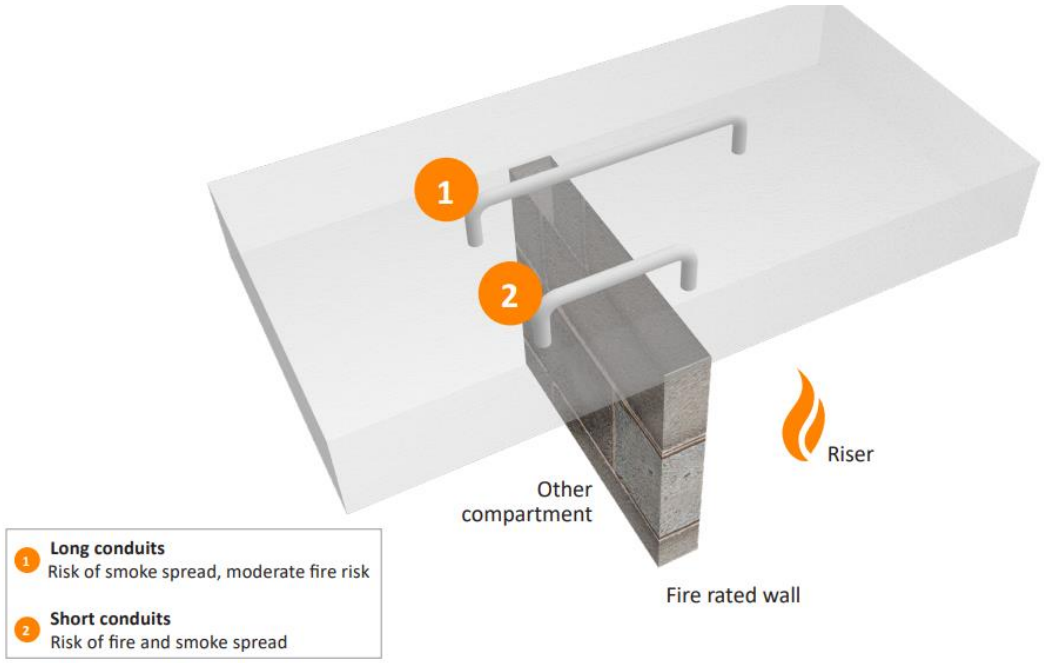
Specification Suggestion:

- Trafalgar FyreCOLLAR Cast-in Floor Waste Fire Collar
- BIM models available on www.tfire.com.au
- Fire test reports and manuals available online at www.tfire.com.au

Collar Code	Pipe Size (nominal)	Outside Size of Fire Collar Flanges	Separation Distance Between Collars
FyreCOLLAR CIFWC-100	100	220x190mm	40mm
FyreCOLLAR CIFWC-100H	100	220x190mm	40mm

Floor Penetrations
Cast-in PVC Conduits

It has become a common practice to cast PVC conduits into the concrete floors to allow cables to snake their way through a building without penetration the fire walls. This practice has a relatively low risk of fire spread but still requires a tested system to be applied at one end of the conduit, to address not just the fire but also smoke spread through the building.



Top Tip:
AS3600 does allow for PVC conduits to be cast within the concrete however they MUST be on the structural plans and separated adequately so as not to displace too much concrete in structurally critical parts of the slab design.

Suggested Specification:

- PVC conduits must be separated by 70mm (minimum) when installed within a concrete slab
- The conduits must be sealed on one end only with Trafalgar FyrePEX HP sealant, to a depth of 30mm.

Floor Penetrations
Large Lagged Chilled and Heated Water Pipes

Section J of the NCC has strict requirements on the thicknesses of pipe laggings for Chilled Water (CHW) and other thermally lagged pipes to increase the thermal efficiency of the building. However it does allow the thermal resistance (R-value) of the pipes to be halved where the pipes penetrate fire barriers.
SuperSTOPPER cast-in systems are perfect for small - medium size pipes, however large pipes need specific solutions.

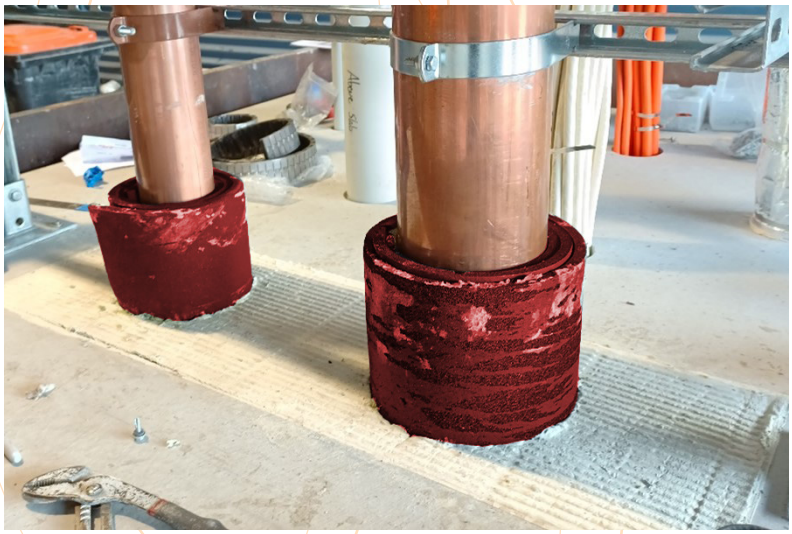
The penetration system installed should be designed and tested to allow the pipes to penetrate through the fire barrier without stripping off the thermal laggings. Flammable laggings like polyethylene and polystyrene should be replaced locally near any penetration system.

Suggested specification:

- A square or rectangular opening is to be formed in the fire barrier to allow the CHW pipes to pass through.
- Armaflex Protect should be used to lag the pipes through the penetration for 500mm total length, centred through the wall or floor
- Stonewool or Nitrile rubber laggings can be joined to the ArmaflexPretect

Armaflex Protect is an intumescent impregnated thermal lagging that can provide a high R-value when wrapped around a metal pipe as well as provide the FRL where the pipes penetrate the fire walls and floors.

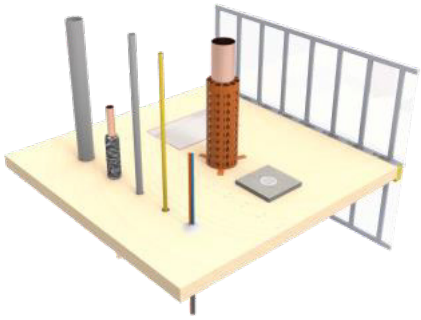
For more information please refer to:
www.tfire.com.au

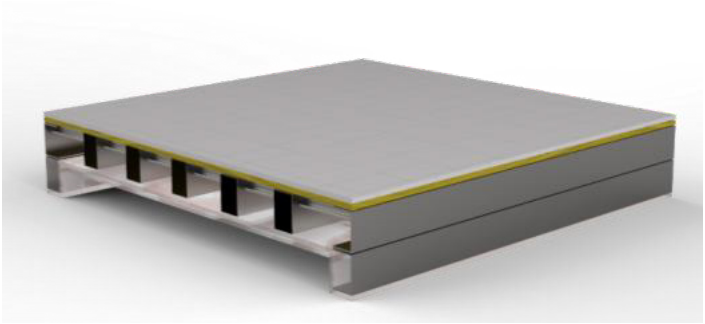


Timber Floor Penetrations
Lightweight and Modular Floors

This document doesn't include advice on how to deal with penetration systems through lightweight/ modular floor systems. For specific advice please refer to the Trafalgar Fire Barriers web page for a list of tested penetrations in these fire barriers.

Click here to access this webpage





Roof Penetrations and Purlins

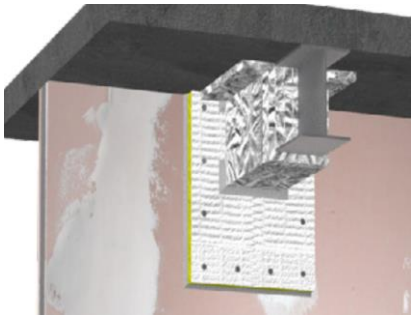
Many buildings will commonly use a concrete floor to provide the roof to cap off a building from weather and allow for heavy plant equipment to be located on the roof, however the roof of the building may not need to be a fire rated barrier, unless there is a risk of fire spread from buildings that are too close to the boundary.

It is equally common to use a lightweight roof for aesthetic finishes like corrugated steel or roof tiles, supported by timber or a steel frame. Non-fire rated roofs will not require and passive fire penetration systems to be specified.

If there are fire walls located under a non-fire rated roof that divide separate tenancies, the building designer should make careful consideration on how the fire walls can extend all the way up to the underside of the roof (as per NCC clause C3D8). For example, if there are roof purlins and steel beams that will penetrate through the fire walls then these will need to be sealed with an appropriate system.

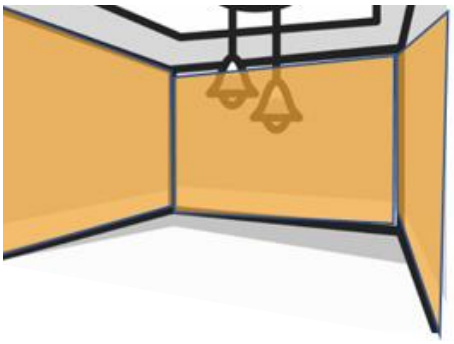
Suggested specification:

- Openings sealed with Trafalgar FyreBATT and TWrap systems as per report FAS210378. The penetration is to be sealed with 2x layers of FyreBATT and sealed with FyreFLEX sealant, before TWrap is applied to both sides of the wall to prevent thermal heat transfer during a fire.



Otherwise, a fire rated ceiling will need to be specified that can provide Resistance to the Incipient Spread of Fire (RISF) in the ceiling cavity. See below section on walls and ceilings.

Wall Penetrations

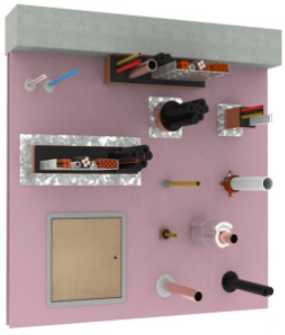


A range of different types of fire walls will be used on site to suit the requirements of the fire compartments they are creating. Traditionally concrete or blockwork are used for load bearing walls, but more modern wall types like Dincel/AFS/Ritek are used due to speed of installation. Lightweight wall constructions including the various brands of fire rated plasterboard walls, hebel and other AAC panel walls, Speedpanel and Alpha Panel walls are also popular choices for non-loadbearing fire walls.

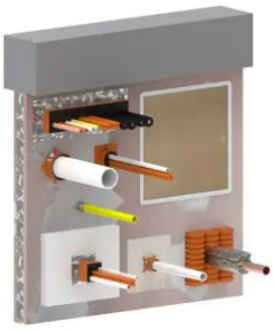
The building designers are spoilt for choice when it comes to selecting the best fire wall to specify, however **care should be taken to investigate if the wall has been tested for the correct range of services that will be penetrating them on site!**

Top Tip:
For specification assistance, refer to Trafalgar's 'Fire Barrier' penetration listings at https://tfire.com.au/fire-barrier-type/

Walls



Plasterboard - Single Layer



Plasterboard - Double Layer

Concrete

Masonry

AAC - Hebel

AAC - WALSC

Wall Penetrations (Continued)

Any penetrations and openings in these walls must be sealed in accordance with NCC C4D15 for integrity and insulation criteria of the FRL (eg -/60/60), even if the wall does have an FRL for structural adequacy.

Below are a few specific examples of where walls are used for various separation requirements in a building.

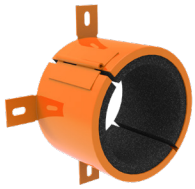
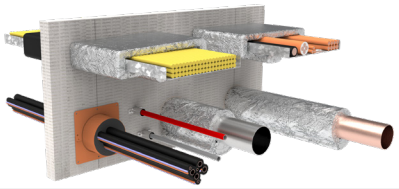
Commercial Tenancy Walls

Where a residential tower has commercial tenancies included like a shopfront on street level, the FRL of these walls is commonly -/120/120 (or 120/120/120 if they are load bearing).

Any penetrations and openings in these walls must be sealed in accordance with NCC C4D15 for integrity and insulation criteria of the FRL (eg -/120/120), even if the wall does have an FRL for structural adequacy.

Suggested Specification - FyreBOX

For most small to medium sized services, it is recommended to utilise a multiple service penetration system like the FyreBOX Maxi, Mini or Slab Mounted system. These allow for large quantities of cables, cable trays, power/data, lagged pipes, sprinkler pipes, plastic plumbing pipes etc to be consolidated down into fewer penetrations, which results in less holes cut in the walls and less building defects, simplifying penetration registers.

Suggested Specification for Single Service Pentrations:		
Plastic Pipes	FyreCOLLAR Premium Retro-fit	
Metal Pipes	FyreFLEX & TWrap	 
Power and Comms Cables	FyreFLEX & TWrap	 
Larger Oversized Penetrations	FyreBATT	

IMPORTANT: Design with 200mm of separation between each penetration, or consult the fire wall manufacturer for advice on thow close penetrations can be installed in the particular wall type.

Fire Escape Walls

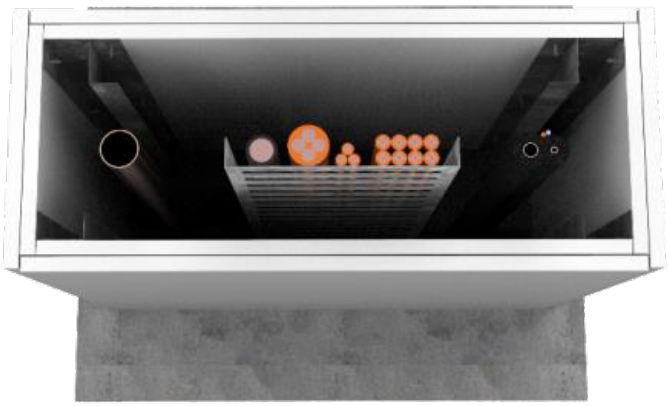
These walls must not be of lightweight construction (pink plasterboards etc) unless the wall has appropriate impact resistance (NCC C2D9), and typically require at least 2 hours of separation to ensure the fire egress is well protected (eg -/120/120). Please refer to the NCC specific requirements of your building project.

Please note service penetrations are not permitted within fire escapes unless they serve the compartment or provide a safety function in the fire stairs. Reference NCC C4D10.

Riser Shaft Wall Penetrations

Riser shafts that are fire rated are often penetrated by large quantities of services on each floor level, feeding services into the corridors. For residential construction, these walls are commonly rated to -/90/90 if they are used to enclose a fire rated shaft, or - /120/120 if it is in a commercial building.

These walls are typically lightweight construction and there are several good options available that provide a wholistic wall system like Trafalgar's Corex shaft walls. More information here.



Riser Shaft Wall Penetrations

Often a very thin wall that can be constructed from the outside only is nominated, however passive fire protection systems MUST be installed symmetrically to maintain the 2-way FRL of the wall. Therefore provision of access is required for all fire rated shaft walls so that an installer can reach into the shaft to complete the passive fire installations (and facilitate future annual inspections under AS1851). Any thin laminated or C-H stud wall specified must be tested with penetration systems or they will be useless to allow for any services to exit on that floor level.

Top Tip:
Care should be taken to investigate if the shaft wall system nominated has been tested for the full range of services that will be penetrating through these walls on site! Check out he Trafalgar Fire Barrier page for more info.


Plasterboard - Laminated Shafts


Plasterboard – CH-Stud Shaftliner


Corex - Shaft Walls


AAC - WALSC


AAC - Hebel


Speedpanel Wall

Suggested Specification for Penetration systems:

- Trafalgar FyreBOX Slab Mount penetration systems located at the head of the walls
- Other service penetrations that are approved for use with the specific shaft wall
- Refer to the Trafalgar Fire Barrier Type page for system Selection

Shaft Wall Construction

Suggested Specification for shaft walls:

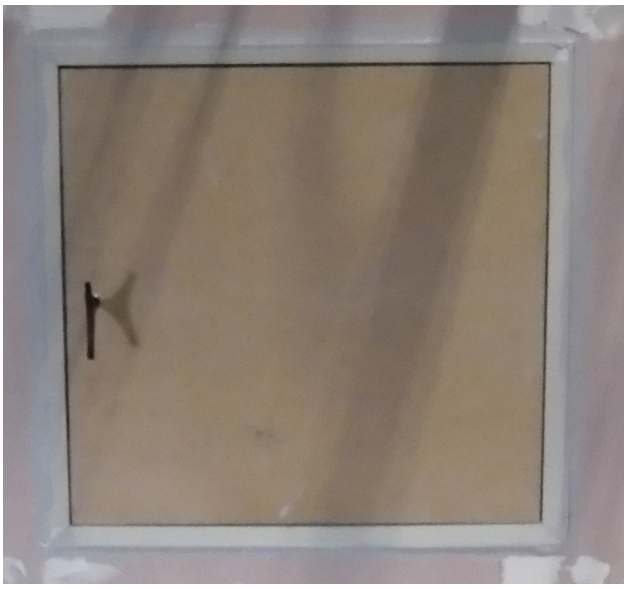
- Trafalgar Corex board riser shaft wall 2-way FRL wall systems
- 2x20mm Corex board on the outside of a 64mm steel stud (-/90/90)
- 2x25mm Corex board on the outside of a 64mm steel stud (-/120/120)

Access Panels in Shaft Walls

The NCC clause C4D14 allows for an insulation waiver on access panels and garbage chutes to reduce the heat transfer criteria to 30 minutes, regardless of what the wall FRL is. For example, a -/120/30 access panel is suitable for use in -/120/120 riser shaft wall.

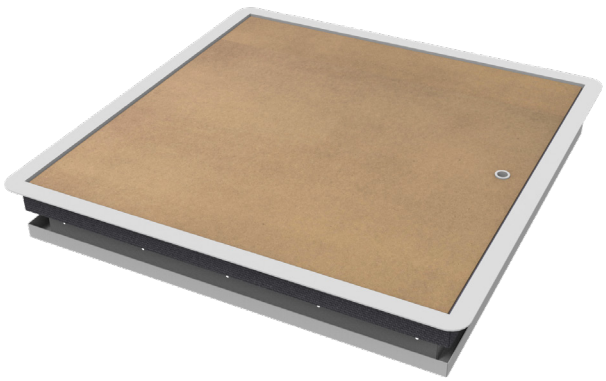
Suggested Specification:

- Trafalgar FyreSHIELD hinged 2-way FRL access panels available up to 600x600mm with a wet wall or flanged edge finish. FyreSHIELD can be painted over for aesthetics.



FyreSHIELD access panels come pre-fit in their frame with concealed hinges ready to be painted. Available with Wet Walled (WW) edge or picture framed Flaned Edge (FE) as shown above.

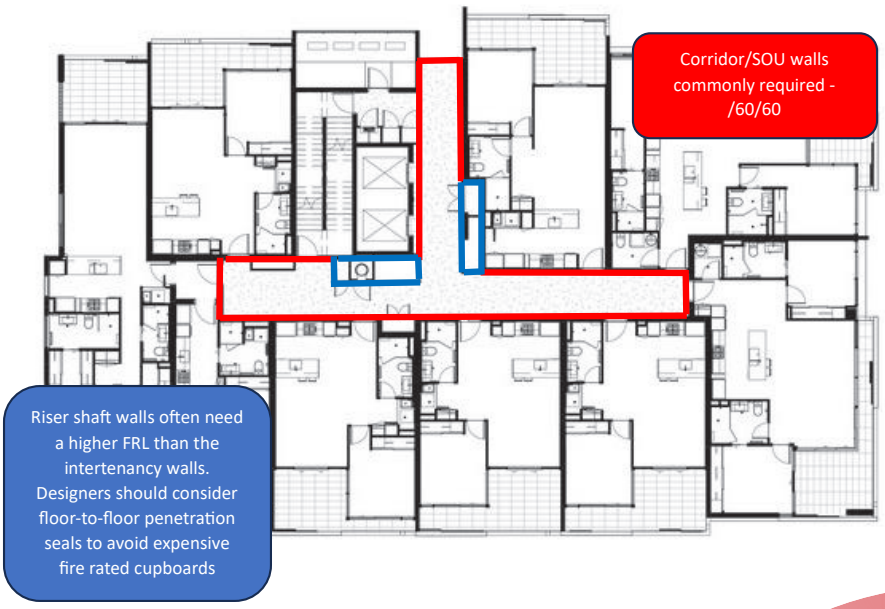
FyreSHIELD PLUS access panels are fitted with a thicker door and provide increased acoustic performance



SOU Walls – Corridor Facing walls

Sole Occupancy Units (SOU) walls are constructed along the face of each occupancy to allow for egress to the corridors and general day to day access in and out of each apartment or tenancy. For residential construction, these walls are commonly rated to -/60/60. These walls are typically lightweight construction and there are several good options available that provide a wholistic wall system not just for fire but also for acoustics and the provision of services within the wall cavities inside each apartment (see below section on "Apartment Entry Penetrations").

Care should be taken to investigate if the wall has been tested for the full range of services that will be penetrating through these walls on site!



IMPORTANT DESIGN NOTE

Avoid floor plans that have showers and plumbing fixtures located within the fire separating walls. **Most cavity walls are not tested for this, or may required local patching of plasterboard which causes aesthetic issues.** Best practice is to install a false wall over the fire wall to provide a non-fire rated cavity in the wall for services to run through, that can be tiled and plumbed easily.

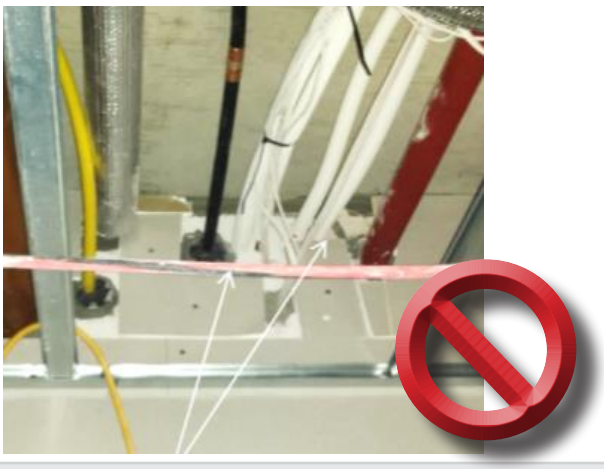
Brass fittings that connect to plastic water and gas pipes should not be insalled into fire rated walls due to the low melting points of these materials.

IntrWall and Parti-Wall style wall systems provide a good solution for running services within a fire wall, but can be limited when it comes to tested penetration systems for the apartment services that need to penetrate through from the corridor into the apartment.

Top Tip:
FyreBOX is now approved almost universally and should be considered for apartment entry service penetrations (see below section on "Apartment Entry Penetrations").

IMPORTANT DESIGN NOTE

The majority of service penetrations into/out of an apartment occurs above the fire doors leading into the corridor. Care should be taken to allow enough space to correctly separate each service penetration system. The NCC is not clear on the correct spacing requirements, however 200mm is generally quoted based on the AS1530.4 fire test clearance requirements. This is where multi service penetration systems can be used to simplify the design, such as the FyreBOX Slab Mount.

Common Defects Found in SOU/Corridor Wall Penetrations	FyreBOX Penetration Systems Eliminate Spacing Problems:
	
Poor design planning leads to defects and life safety risks	Trafalgar FyreBOX will remove clearance issues, and reduce the overall number of penetrations

SOU Wall Penetrations
Recommended Specification

The FyreBOX range is multi-service penetration system that is tested for multiple and mixed service penetrations to provide an effective seal for fire, sound and smoke. The internal linings of the FyreBOX will swell and close off the large penetrations during a fire providing FRL's up to -/240/120. The FyreBOX range are designed specifically for designers who want to plan ahead by providing 'fire rated holes' for the service trades to utilise on site, without needing to backfill the penetrations with laboursome materials like pillows, batts and boards.

Fire barrier:	**Plasterboard (single and double layer), IntRwall, Partiwall, StrataWall, Hebel, Walsc, Alphapanel, Speedpanel, Block & Concrete from -/60/60 to -/120/120**
Passive Fire Stopping System:	FyreBOX Slab Mount
Image:	
Size(s)(mm):	165x125, 350x125, 550x125, 650x125, 750x125, 1100x125. Custom sizes available up to 1250x125mm
BIM Models	Yes, available online: https://tfire.com.au/product/fyrebox-cast-in/
Separation between each penetration:	100mm between each FyreBOX's
Maximum FRL:	-/60/60 (Wrap free) -/90/90 to -/120/120 with TWrap
Fire test/assessment report	BRANZ report FC10266: https://tfire.com.au/documents/FyreBOX-Range-Test-Report
Services approved for use:	**Any combination and quantity of:** • Power cables (Copper and Aluminium core) • Data and comms cables • Dry fire cables • Cable trays up to 1000mm wide • PVC conduits • PEX and PEX-AL-PEX pipes • Small CHW pipes up to DN50 copper + lagging • Pair coils • Hydrant mains up to 100mm • PVC drain/waste/vent pipes up to 80mm
Installation	FyreBOX mounted to the slab soffit at required locations and sizes. Acoustic (Rw50) and smoke foam plugs, and TWrap to be added once services are roughed in.

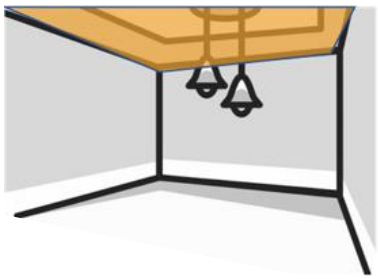
Intertenancy or Party Walls

Both residential and commercial buildings should have a fire separating wall between each occupancy to prevent spread of fire from one to the other. In residential buildings these run between each apartment and are typically required to have an FRL of -/60/60. These walls typically don't have any service penetrations in them, however as above care should be taken to ensure that the wall systems used are tested with service penetrations if necessary.

Avoid apartment floor plans that have showers and plumbing fixtures located within the fire separating walls. Most plasterboard cavity walls are not tested for this, or may required local patching of plasterboard which causes aesthetic issues. Best practice is to install a false wall over the fire wall to provide a non-fire rated cavity for services to run through.

Also note that electrical outlets that are mounted into fire rated walls need to be tested as part of the wall system and add cost to the build.

Ceiling Penetrations



For some buildings, the top level might have a roof that is not constructed out of concrete such as pitched, tiled or sheeted roof, which doesn't provide any fire separating function (no FRL) thiscan be acceptable under the NCC as long as there is no risk of fire spread from buildings too close to the boundary.

Whilst there might not be risk of fire spreading further once it hits the roof, there is definitely risk of fire spread over the top of the fire walls on that top level to adjacent compartments. To solve this, the walls must either extend up the underside of the roof sheets, or a fire rated ceiling can be introduced to prevent the incipient spread of fire (known as Resistance to the Incipient Spread of Fire or RISF).

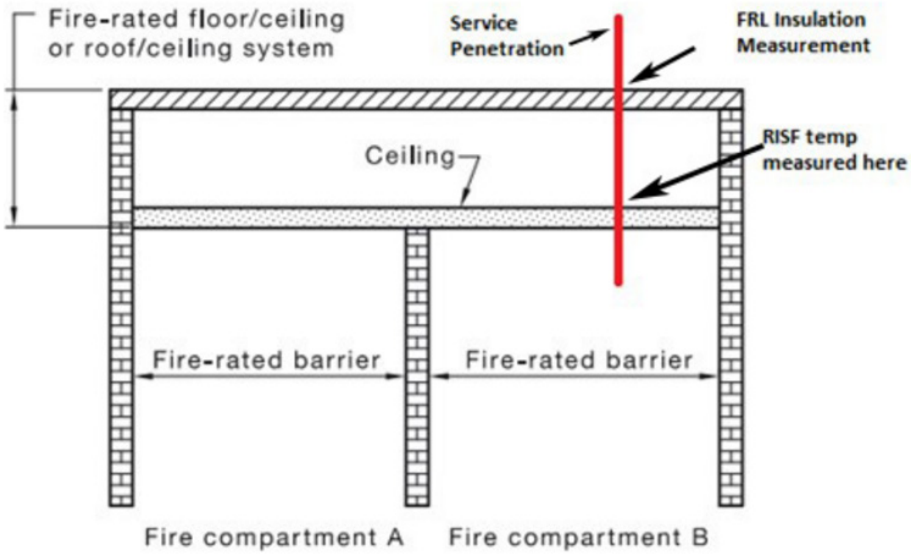


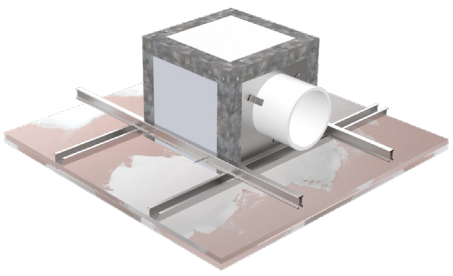
Figure 1- Resistance to the Incipient Spread of Fire rating required for this floor/ceiling system from A51530.4-2014 section 4.

Fire rated ceilings are commonly constructed of fire rated plasterboard with light gauge steel suspension and framing systems, with multiple layers of plasterboard to achieve different FRL's. Fire rated ceilings, just like any other fire barrier must have service penetrations tested in the specific ceiling configuration and achieve the FRL for integrity, insulation and have an additional criteria called RISF for at least 60 minutes – this applies to ALL ceilings under the NCC.

IMPORTANT

Any penetrations, access hatches and fire dampers installed into a fire rated ceiling need to have been tested to achieve the FRL **and the RISF rating too!**

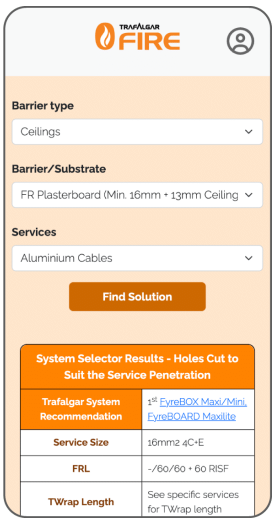
Examples of systems that have been tested for RISF and FRL in ceilings:

Maxilite penetrations	FyreSHIELD PLUS Access Panel	FyreDAMPER for exhaust fans
		

Additional Resources

The App

Introducing the T-Fire System Selector – your essential tool for simplifying compliance in the world of passive fire systems. Designed with your needs in mind, this user-friendly web-based tool is entirely FREE and also available for download on Android and iOS devices, making it accessible to you wherever you go.



The T-Fire System Selector empowers you to effortlessly discover the right fire-stopping solutions for your projects. With just a few clicks, you can filter by fire barrier type, services, and specific barrier materials, ensuring you find compliant systems that align perfectly with your requirements.

The System Selector doesn't stop at providing results; it goes the extra mile. It offers technical drawings, granting you comprehensive insights, and connects you directly to our website's product pages, where you can access test reports, installation videos, MSDS sheets, and more.

Download the App directly from selector.tfire.com.au

Technical Support

Trafalgar Group has a dedicated team of engineers that are available during business hours Monday to Friday on the technical support hotline 1800 888 714 or can be contacted at technical@tgroup.com.au. We recommend getting in touch during project design to seek advice on the best passive fire systems to use to eliminate headaches when you get to site, and/or are able to provide comment on existing penetrations for rectification work.

Passive fire training can also be provided, covering a range of topics from the NCC requirements to product specific installation training.
For more information contact Trafalgar on the below links.

Trafalgar Group

For enquiries contact:

Email: sales@tgroup.com.au

Call now: 1800 888 714

Web: www.tfire.com.au

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