



# Passive Fire Protection

# Fire Protection - What is it?

Ensure occupants of a building are able to leave safely in the event of a fire



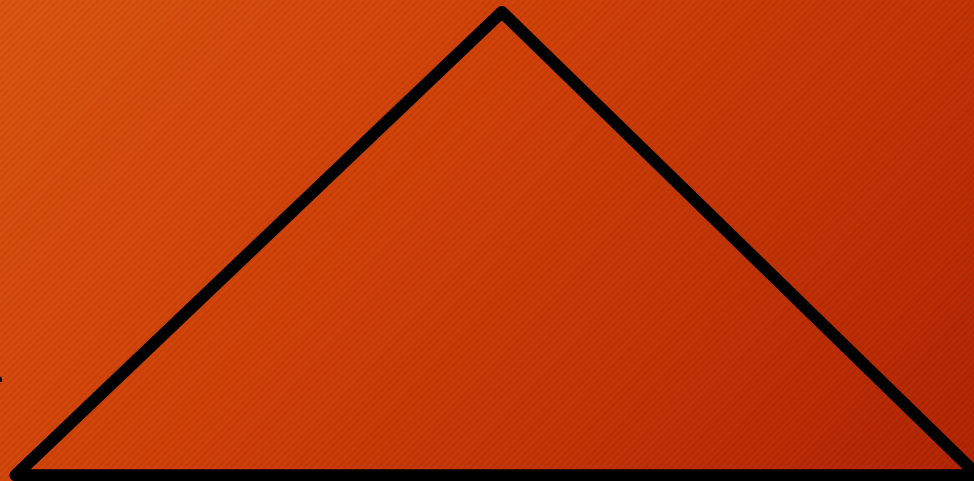
Detection



Containment



Suppression





# What is Passive Fire Protection?



Passive Fire Protection is fire protection that doesn't require electricity or water.

Passive fire protection includes:

- Penetration Management
- Cavity Barriers
- Ceiling Systems
- Compartment Walls
- Ducting
- Gap and Joint Seals
- Structural Steel Protection

# Why is it relevant?



- Allow safe evacuation
- Provides time for emergency services to arrive
- Manage the level of the repair required to the building
- Reduce spread of flame to another fire cell or building





# What standards need to be achieved?



## Test Standards:

- AS/NZS 1530 Part 4 : Methods for fire tests on building materials, components and structures, Fire-resistance test of elements of construction
- AS4072 Part 1: Components for the protection of openings in fire-resistant separating elements, Service penetrations and control joints
- BS476 Pat 20 & 22: Fire Tests on Building materials and structures. Method of test for determination of the fire resistance of elements of construction (General principles)

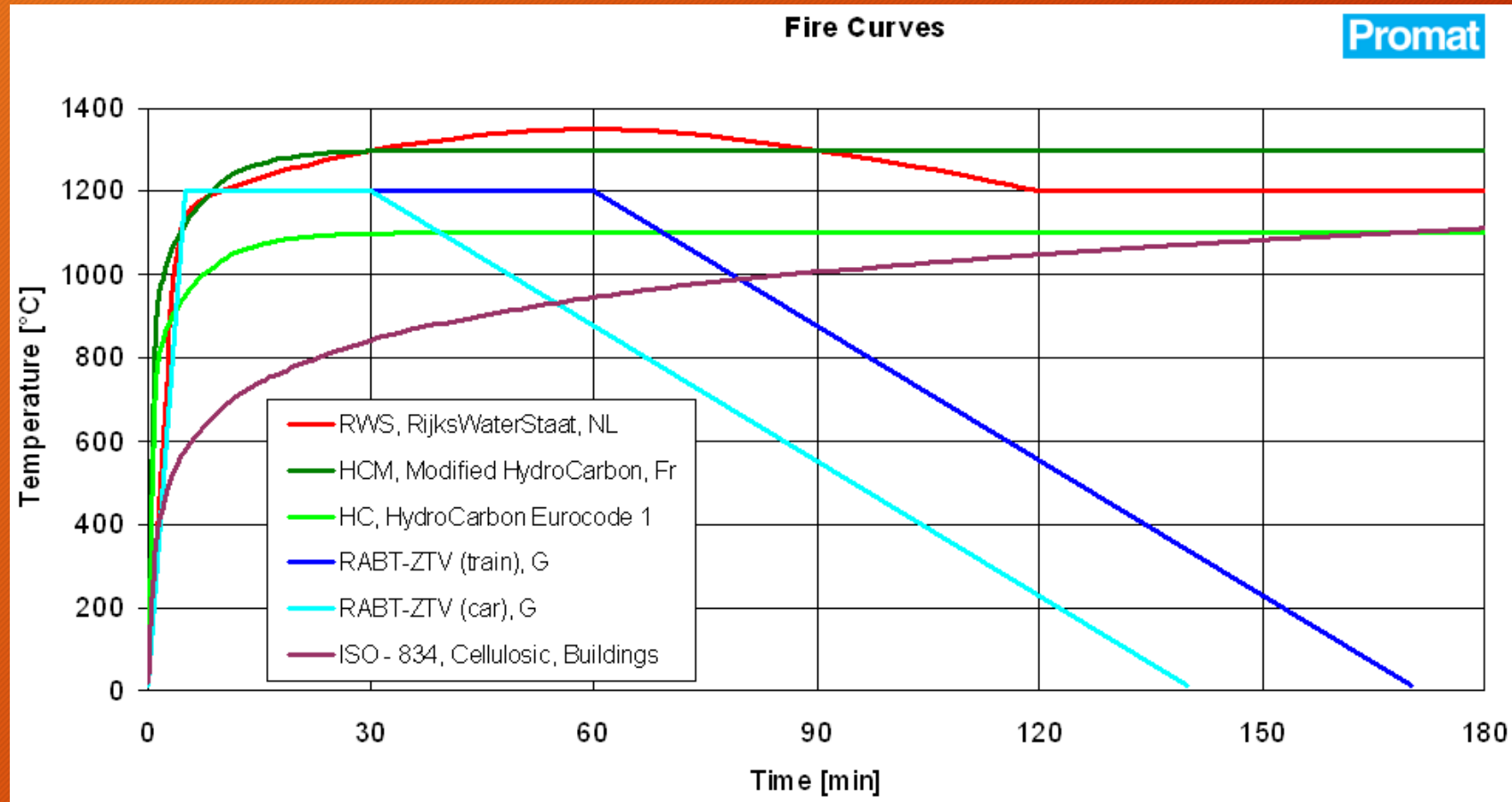
# Tested Solutions



- Fire protection products must be supported by a test report or an assessment report from an accredited testing facility
- It is important to check the performance criteria of the product and also ensure it is suitable for the application in which it is being installed
- The process of fire testing is an involved and costly process. It is important to understand that not all potential configurations to which a product or system is to be used, can realistically be re-created in a test situation



# Time Temperature Curves



# Fire testing to AS/NZS 1530.4



During Fire Test (Unexposed side)



After Fire Test (exposed Side)



# What is an FRR?



## FRR - Fire Resistance Rating

60 / 60 / 60  
Stability Integrity Insulation

Numbers relevant to achieved minutes in a test

# Structural Stability



## Structural Stability (60 / - / - )

Structural stability is a measure of a tested assembly to be load bearing (carry a predetermined load) during fire conditions.

Failure in relation to structural stability occurs when the test specimen collapses or when the maximum rate of deflection exceeds limits given in AS/NZS1530 Part 4.





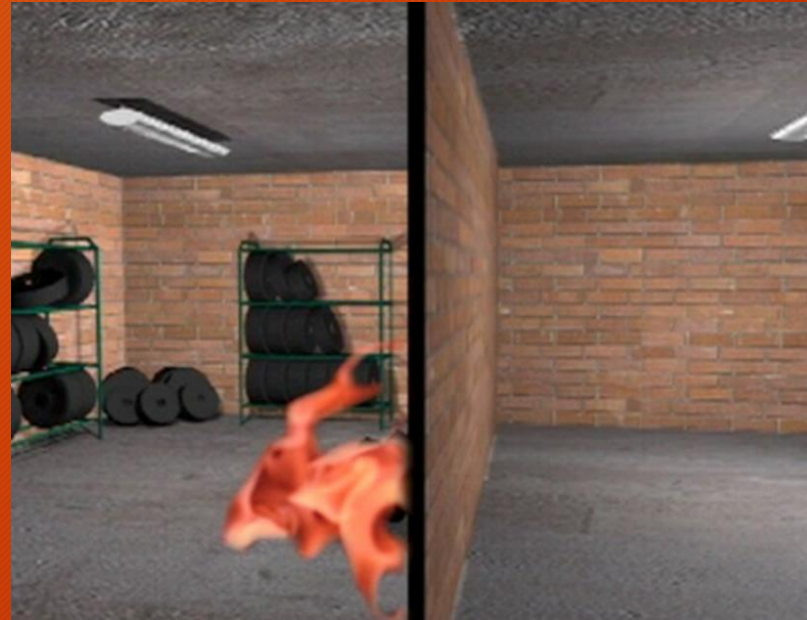
# Integrity



Integrity ( - / 60 / - )

Integrity is the measure of a test assembly to restrict the passage of flames and hot gases.

The duration of integrity, is typically the part of the FRR that is often simplified into the 'fire rating'.



# Insulation



## Insulation ( - / - / 60)

Insulation is a measure of the temperature rise on the non-fire side of a fire-resistant separating barrier.

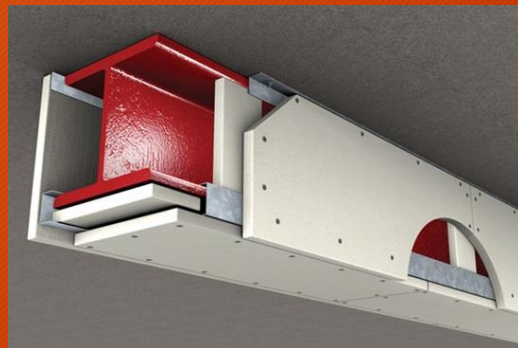
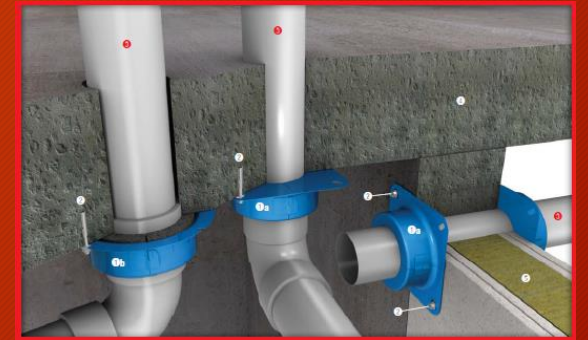
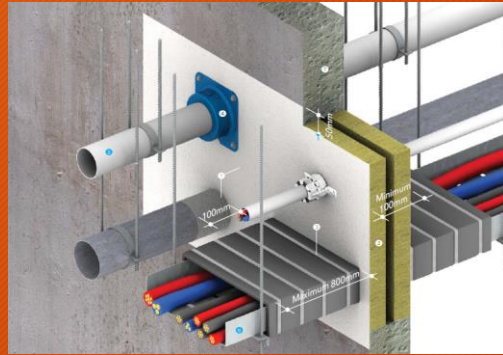
Failure in relation to insulation is deemed to have occurred when the temperature on the non-fireside exceeds:

- Average temperature rise of  $140^{\circ}\text{C}$  + ambient
- Maximum temperature rise of  $180^{\circ}\text{C}$  + ambient





# Passive Fire Protection Products





# What is Structural Steel Protection?



- Structural Steel Protection is either box protection using boards, or profile protection using Spray/Paint materials, that stop the steel member reaching a temperature of  $550^{\circ}\text{C}$  for a prescribed period of time in the event of a fire.
- The amount of protection required is dependant on the elements ability to absorb heat without the temperature reaching a point at which there is the potential for failure.
- This degree of protection requirement is determined by calculating its mass and surface area to establish the steel's Heated Perimeter/Area factor or also known as an "Hp/A factor".

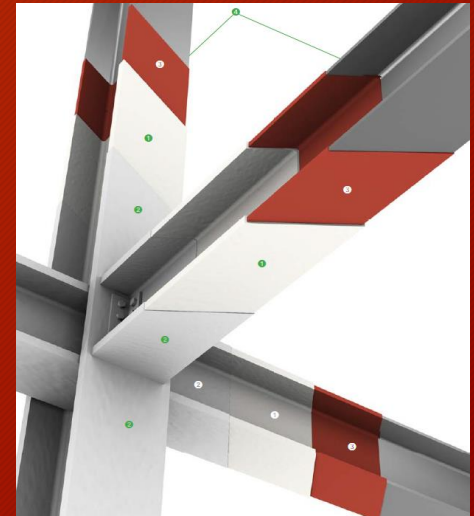


# Structural Steel Protection



## □ Intumescent or reactive paint coatings

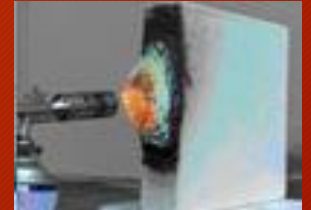
- Intumescent spray coatings are applied with several coats that consist of primer, intumescent coating(s) and a top coat.
- The steel must be blast cleaned to SA2.5 as per ISO8501-1 before the primer can be applied.
- Intumescent paint expands to protect steel.
- To allow this to occur, any steel sections that have been coated requires sufficient clearance to allow it to intumesce to the required thickness.
- Nothing can be fixed to the surface of a steel section that has been coated in Intumescent. e.g Window Frames, Wall Frames



# How Intumescent Works



- When the intumescent is heated to above 200C, the resin system will melt
- This melting allows the release of a mineral acid, which reacts with a carbon rich element in the paint
- Also released at the same time is a 'spumific', which provides a gas which expands the foam; forming a thicker layer
- As the fire progresses and time passes this layer of char grows thicker thus increasing the insulation provided
- The layer of char can be up to 50 times the thickness of the initial coat



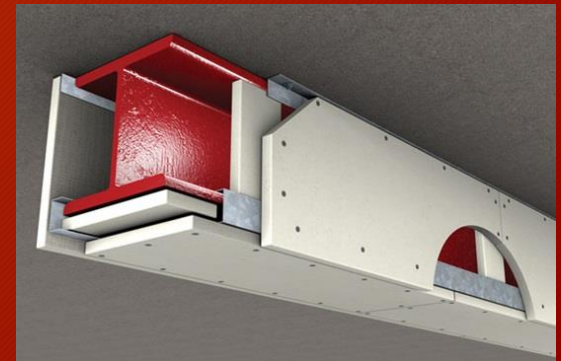


# Structural Steel Protection



## ❑ Board Casing Systems

- Unlike specialist coatings, board products can generally be installed without the preparation or priming of the structural steel element.
- Board products will also not give off toxic smoke or gases in the event of a fire.
- They can be installed using normal wood working tools and without the need to engage a specialist sub trade.



# Structural Steel Protection



- ❑ Cementitious/Vermiculite sprayed products:
  - Cementitious/Vermiculite sprays are quick to install and are cost effective for steel protection.
  - The high build coatings are applied as a wet spray, where the product is pre mixed with water, or as a dry spray, where the water is added at the nozzle.
  - As with intumescent paint coatings, the manufacturers recommendations need to be followed closely to ensure the correct installation method is used.
  - It does have a rough visual appearance, however in areas where the steel is not seen it is the most cost effective solution.





# Fire Stopping



Fire stopping materials are products that are fitted to the penetrating services through fire walls, to achieve the same Fire Resistance Rating as the substrate.

It is important for the Fire Stopping Products to be installed correctly as per the manufacturers guidelines, and the particular system that is being installed if backed by a test report that is relevant to the application.

There are various products used to seal openings and joints in fire-resistance rated walls and/or floors.

# Fire Stopping Products



## Fire Collars:

- Collars are used for plastic pipe penetrations through fire-rated walls and floors
- Fire collars are to be installed to both sides of the wall, or to the underside of the floor.
- Looking at the ISO Curve that AS/NZS1530 Part 4 tests to, uPVC will soften at around 70°C which is the same time as the Intumescent will react at 200°C





# Fire Stopping Products



## Fire Collars:

- Using a fire collar on a standard 110mm uPVC pipe, takes approx. 7minutes to fully intumesce and close off the penetration.
- Smoke seal with a Sealant before the collar is installed is good practice.
- Every size pipe and every type of plastic needs to be tested through the different substrate types



# Fire Stopping Products



## Fire Resistant Wraps:

- Installed as a retrofit solution
- Installed in applications such as the sealing around a pipe passing through a core hole in a concrete wall or floor
- They are supplied as a plastic bag of intumescent material and are simply slid into position and held in place with an intumescent sealant
- The containment of the intumescence is done by the surrounding wall of the concrete



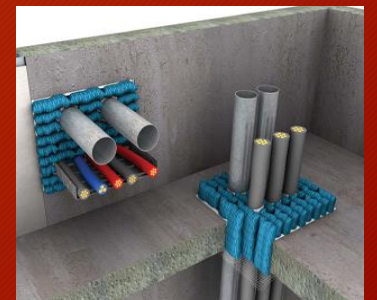


# Fire Stopping Products



## Fire Pillows:

- For smaller penetrations, such as cable trays and pipe penetrations, Fire Pillows are a suitable solution
- Filled with either Rockwool or intumescent material, fire pillows come in a range of standard sizes
- They can be compressed to fill small openings
- Sealant is used between the pillows and the surrounding substrate and also between the pillows and the pipe

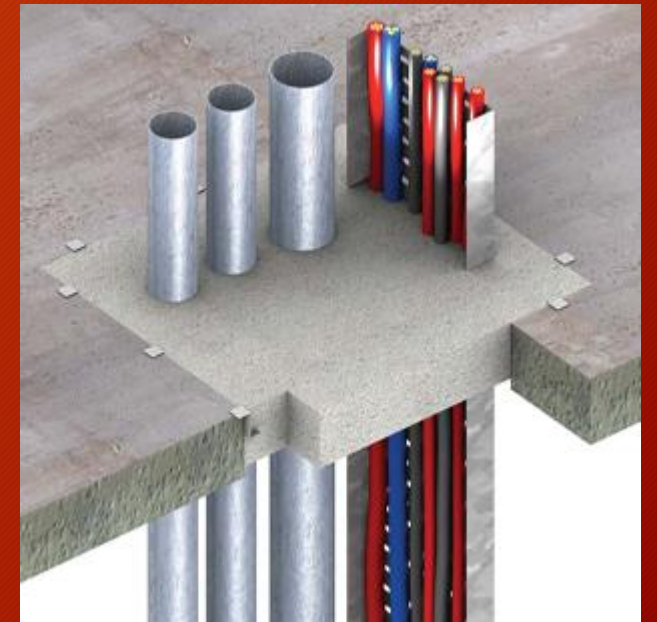


# Fire Stopping Products



## Fire Mortar:

- Cement Based
- Applications include: Metal pipes, electrical cable and cable tray penetrations seals through floor slabs and masonry walls
- Lightweight
- Up to 240minutes protection, integrity and insulation
- Limitations to the penetration size using Mortar



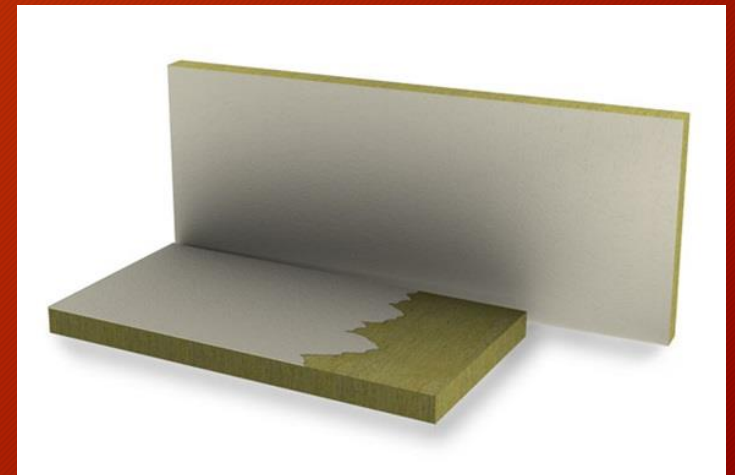


# Fire Stopping Products



## Coated Mineral Wool Board:

- High density mineral wool with an ablative coating both sides
- Applications include: Metal pipes, electrical cable and cable tray penetrations seals through floor slabs and masonry walls
- Up to 120minutes protection, integrity and insulation
- Limitations to the penetration size using coated mineral wool.
- Non-loadbearing product, not trafficable



# Fire Stopping Products



## Fire Sealants:

- Intumescent, Acrylic, Polyurethane Sealants
- Applications include: Metal pipes, electrical cable and cable tray penetrations seals through drywall or masonry
- Used alongside other fire stopping products as a System
- Can achieve up to 120minutes when used according to the correct width/depth or in conjunction with other products

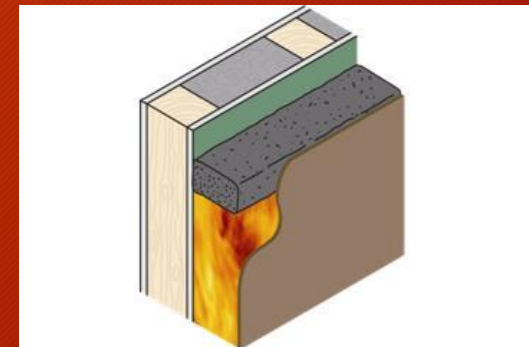
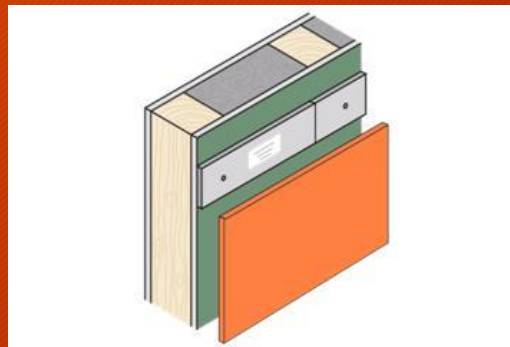




# Cavity Barriers



- One of the challenges with façade systems is that, in fire they tend to bow; particularly aluminium facade systems
- Therefore rigid board systems can either fall out, or leave a gap for the fire and smoke to break through
- The solution is an expanding system that fills the gap as it appears



# Incorrect Installation Examples

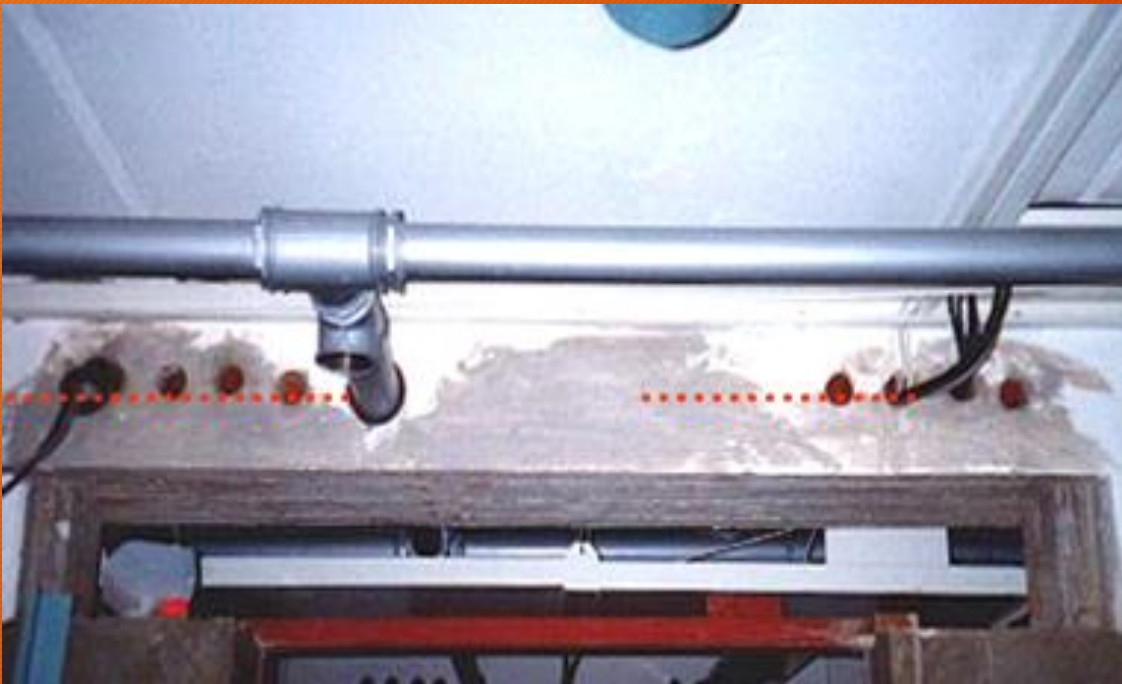




# Incorrect Installation



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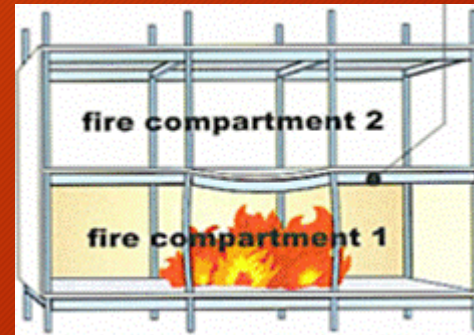




# Walls, Floors & Ceilings



- Achieving a Fire Resistance Rating in a wall, floor or ceiling means to contain the fire in a 'Fire Cell' for occupants to safely leave the building
- Fire walls, floors and ceilings are intended to ensure that the fire cannot spread horizontally or vertically through a building.
- They are used also to create a protected escape route for occupants in the event of a fire



# Walls



- Fire-resistant walls are constructed from masonry, plasterboard or calcium silicate board.
- Walls e.g masonry, can provide a fire rating by themselves, others like plasterboard provide a fire rating when installed as a tested system
- New technology boards have been created to achieve a FRR without insulation in the wall cavity, leaving it empty for Acoustic requirements

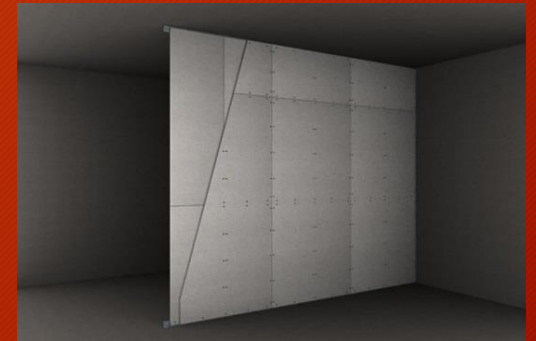


# Walls



Considerations during sign off:

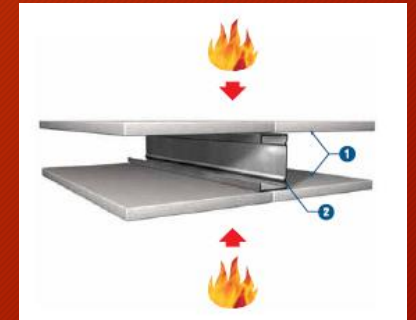
- Loadbearing / Non-Loadbearing
- Timber Stud or Steel Stud
- Access to both sides of the wall or one side only
- Solid/Frameless Partitions
- One way or two way Fire Wall



# Ceilings and Floors



- Fire-resistant ceilings and floors are constructed from concrete or sheet systems such as plasterboard and calcium silicate board
- Steel behaves differently to timber in a fire, therefore the same ceiling/floor systems for timber joists, can not be assumed to transfer to steel joists.





# Ducting



- Another significant potential source of fire spread in a building are the air conditioning ducts
- When specifying the passive fire protection of a duct you need to consider the potential location of the fire source; is the source external, internal or both?
- Consider contributing factors that may not be present at the time of design and installation; such as the build up of grease in the extraction system of a kitchen, which may alter the product specified



# Gap and Joint Seals



- An area of potential weakness in a fire cell or compartment is the gaps around wall, floor and ceiling system.
- Photo shows an ablative coated batt used in the void gaps above the wall and a blanket product used on the timber framing penetrating the wall which improves the insulation factor.





# Plenum Spaces



- There are plenty of examples of existing buildings where the fire wall only goes to the ceiling.
- To extend the fire cell to the underside of the roof, it can be difficult when using a GIB System which requires large rigid sheets and stopping.
- The alternative is a fire rated, lightweight curtain system such as Firefly, which can be easily and quickly installed with minimal disruption to tenants.
- Install process: Cut to size on ground, labelled, rolled up - passed up through the access hatch, un-rolled in the ceiling space, perimeter fixed and joined.



# Plenum Spaces

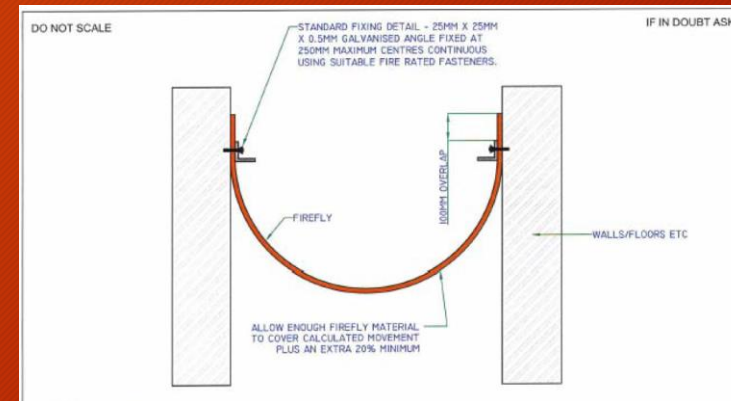
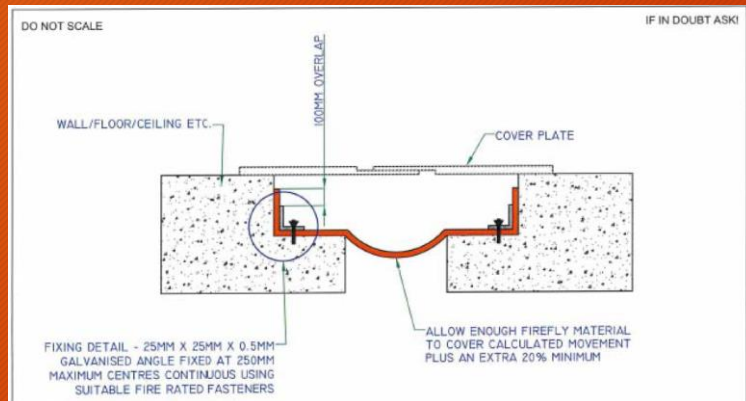




# Seismic Gaps



- With recent events in Christchurch and Wellington, the need for seismic design has become a focus. With this focus comes the need to maintain the integrity of the seismic joint.
- There are few products in the market that can maintain the required FRR and accommodate the expected movement.
- One solution is a multi-layer high temperature fabric/foil/glass blanket, which can be suspended across the gap to allow for the required movement and the fire resistance rating of up to -/120/60.



# Seismic Gaps

- Christchurch City Council Civic Building





# Forman's Passive Fire Protection Brands



Thank You for your  
time this evening,



Any Questions?