

ARTICLE: ELECTRICAL SERVICES PASSING THROUGH FIRE RATED BARRIERS

By John Rakic



Fire Stopping Works Are Being Closely Scrutinised Now

We have all heard all the fuss about so called combustable cladding on buildings here in Australia, and some of us would have seen the tragic events unfold at Grenfell in England, and our own near misses here with the Lacrosse Towers and New 200 Apartments fires. You might be thinking, what does that mean to me as an Electrician?

The court ruled on the Lacrosse Towers, that Architects, Certifiers and Engineers, as well as Government were culpable for their actions for not providing a high level of skill and ensuring all building materials and installations are designed, installed and commissioned in accordance with the strict requirements of our National Construction Code, NCC.

This all has resulted in a big shift in attitude from the insurance industry, which has many service providers seeing huge increases in their insurance policies and some being uninsurable.

Let me start right back at basics. The Building Regulations require larger buildings to be divided into so-called fire compartments, which are bound by fire rated walls, fire rated floor slabs and in some cases fire rated ceilings. There are also service riser shafts, which are like fire rated chimneys that run vertically up high rise apartment buildings for example.

All of these fire rated walls, shafts, floors and ceilings are required under the NCC to have a fire rating, known as the FRL (Fire Resistance Level). This form a compartmentalisation of buildings is known as passive fire protection or fire containment.

It follows that any openings for services in these a barrier requiring an FRL, such as electrical cables for example need to effectively penetration seal or “fire stopped” to ensure the FRL is maintained.



Fire Testing of Service Penetrations in Fire Barriers

The NCC requires that all openings for services are fire tested to Australian Standard, AS1530 Part 4, and comply with AS4072 Part 1, which provides design, installation and certification advice.

Only from these fire tests, can an FRL be achieved for openings for services and passive fire protection products.

It is an expensive, but sound means to ensure the fire containment efficacy of our building stock, by using proven systems which have achieved the required FRL.



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Important Distinction Relating to Products and Fire Ratings

Fire stopping products themselves do not have a so-called fire rating. You might ask yourself, how can that make sense? I am sure I have seen product literature from manufacturers saying for example, a 4 hour fire rating or up to 4 hours in their product literature and on product labelling.

The truth is the FRL applies to a SYSTEM, not a product.

Only when the product in question is installed correctly in a particular configuration does the FRL apply.

Understanding an FRL Designation

For fire stopping of service penetrations, only two of the three criteria which make up the FRL designation are important.

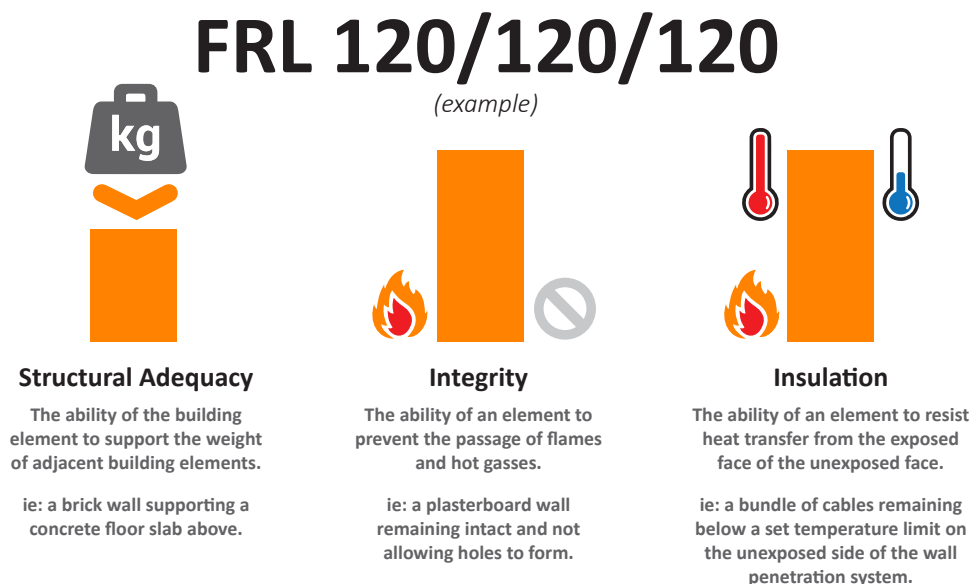
These are the two last criteria, which are defined as integrity and insulation.

Without getting too technical, the integrity is the ability of the fire stopping SYSTEM to resist the passage of flames and hot gases, whilst insulation is the ability of the fire stopping SYSTEM to maintain a temperature on the non-fire side below acceptable temperature limits; that is to avoid excessive heat conduction through the opening.

One can imagine that a cable tray, or a larger cable with a reasonable size copper core for example, will conduct heat along its length. For these service types, it is often a requirement to add some insulation wrap to the services adjacent to the fire stopping. All this is determined from fire testing of the SYSTEM to AS1530 Part 4.

Fire Rating – How is Fire Performance Measured?

An FRL (fire resistance level) is a handy way of summarising the performance of a building element. It consists of 3 numbers, all given in minutes:



Penetrations are not required to have a Structural Adequacy rating and is usually expressed as a dash. For example, a penetration through a 2-hour load bearing wall would be written as -/120/120.

A Layman's Guide to Determining the Correct Fire Stopping System

Remembering that the FRL applies to the as fire tested system, and not to the product, we must know from the manufacturer or supplier of the products, how and exactly what has been fire tested and what makes up the system for the FRL.

Historically, manufacturers and suppliers have not provided much information. This, as you can now understand, does not make it easy for an electrical contractor.

So here is my **RAKIC Checklist** for you as an electrical contractor to help you get it right the first time; thus allowing you to know that if you are sealing a penetration that you are in fact complying with your legal requirements.

1. Fire barrier type the opening is being made in, eg 60 minute (-60/60) plasterboard wall.
2. FRL
3. Opening size
4. Service type(s), quantity and proximity to each other; remember there may be some services other than electrical cables sharing the opening with you!

Once you know the answers to these 4 questions, you can then select some fire stopping products which make up the as fire tested SYSTEM.

Some Typical Electrical Service Types and some Solutions

Let's start quite simple and then get a little more complex to demonstrate so you understand how to apply the checklist and then select some products and approved SYSTEMS. I am going to use Trafalgar Fire products and systems here as I know these well and for each example, I am going to assume it is a 60 minute or FRL-/60/60 plasterboard wall.

Cables Going through a Plasterboard Wall without a Cable Tray

Depending on the FRL and the number and type of cables, this can be protected using FyreFLEX sealant with or without the need for TWRAP insulation wrap material.

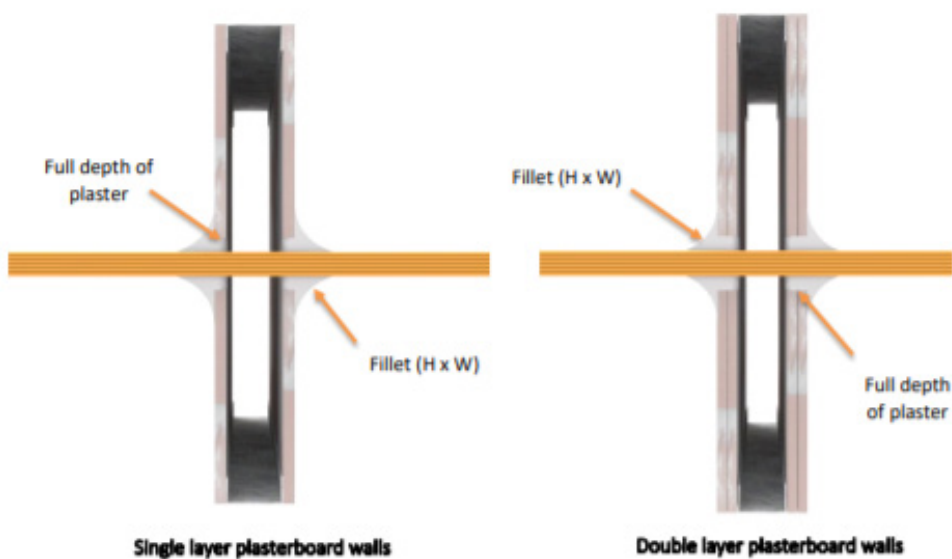
A fillet of sealant will be required for wrap free solutions; this is a cone of sealant. Insulation criteria cannot be maintained with just filling the opening flush with the wall.

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Cable Penetrations

CABLE PENETRATIONS THROUGH PLASTERBOARD WALL SYSTEMS – APPROVALS



Small cable bundles don't require additional TWrap



TWrap for insulation performance – refer to page 23 for installation details

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Plastic Conduits

Plastic conduits need a higher expansion intumescent solution, and FyreFLEX acrylic sealant is not suitable, like for cables in the example above.

An intumescent material expands in a fire, and the material will close off the conduit, with or without cables inside it in the event of a fire. You will find that there are often several options available to you for the same scenario, and you can pick the ones that suit you and your budget.

Option 1 – FyrePEX and FyreSHEATH

FyrePEX is a black high performance intumescent sealant. For conduits, it can be applied into a face fixed FyreSHEATH to maintain the FRL for conduit passing through the plasterboard wall.

These are proving very popular, as the one sheath size can be used on all conduit sizes, negating the need to have the correct size conduit collar for the job in your van.

Remember for walls, you MUST protect on both sides of the wall.

PLASTERBOARD 60MIN

Single-Layer plasterboard walls
min 13mm FR plasterboard each side
64mm Stud systems

Service Specification		Installation Method	Hole Size	Fill Depth	FRL
PEX-A PEX-B PEX-AI-PEX	16mm	Locally Thickened Wall Fill (each side of wall)	60mm	Depth of plaster (26mm)	-/60/60
		50mm diam. Sheath Fill (each side of wall)	25mm	Depth of sheath (25mm)	
PEX-A PEX-B PEX-AI-PEX	20mm	Locally Thickened Wall Fill (each side of wall)	60mm	Depth of plaster (26mm)	-/60/60
		65mm diam. Sheath Fill (each side of wall)	30mm	Depth of sheath (25mm)	
PEX-A PEX-B	25mm	Locally Thickened Wall Fill (each side of wall)	65mm	Depth of plaster (26mm)	-/60/60
PEX- AI-PEX	25mm	Locally Thickened Wall Fill (each side of wall)	65mm	Depth of plaster (26mm) Sealant finished with 25mm fillet	-/60/60
PVC Conduit*	up to 40mm	Locally Thickened Wall Fill (each side of wall)	20mm annular gap	Depth of plaster (26mm)	-/60/60

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Option 2 – FyreCHOKE Conduit Fire Collar

The Trafalgar FyreCHOKE conduit collars are another viable option.

With these you need to order and install the correct size collar for the conduit you have.

Remember for walls, you MUST protect on both sides of the wall.

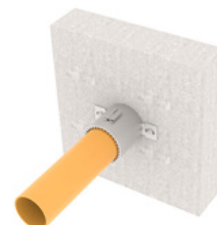
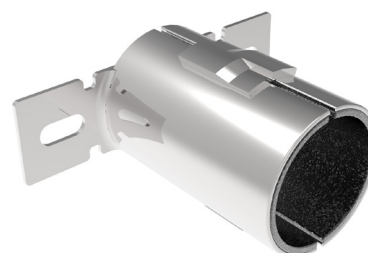


TABLE 1: FyreCHOKE Conduit Collars

Product Code	Collar Size	Max Hole Size
FR Collar-25	25mm	40mm
FR Collar-32	32mm	47mm
FR Collar-40	40mm	55mm



Barrier	Test / Specimen	Service	Hole size (mm)	Collar size (mm)	FRL
Single layer plasterboard	FSP 1729A/1	20 mm PVC conduit with fibre optic cables	30	25	-/120/120
	FSP 1801/2b	40 mm PVC conduit with two power cables	45	40	-/90/60
	FSP 1801/2c	16 mm PVC conduit with fibre optic cable	20	25	-/90/60
	FSP 1801/3	A/C Pair coil (PE) with 2 x TPS power cables & 2 x CAT6 cables	75	80	-/90/30
	FSP 1801/4	50 mm PVC conduit with two power cables	60	50	-/90/60

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Bigger Openings with Cable Trays and Larger Cables

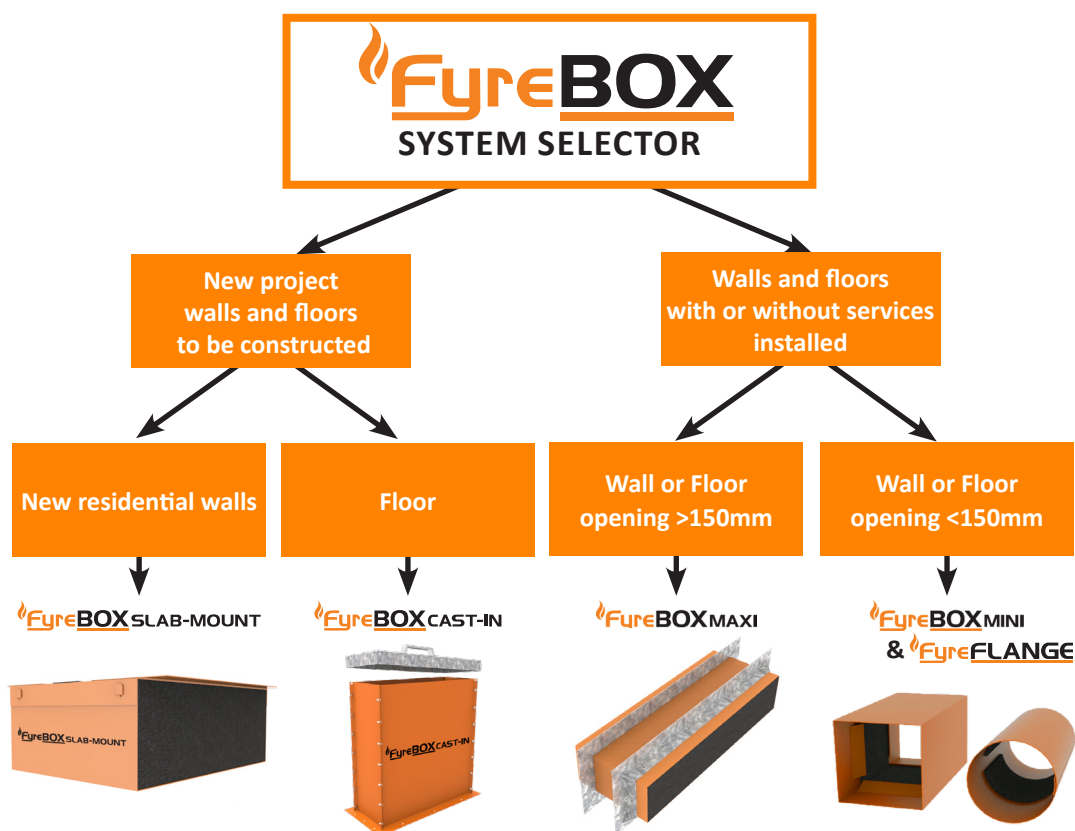
These cable tray and larger cables as discussed earlier conduct heat through both the fire barrier and the fire stopping and are more of a technical challenge for manufacturers when doing fire testing and SYSTEM development.

Option 1 – FyreBOX Multi-Service Transit Boxes

FyreBOX is one of my favourite products as it has so many used and so many fire tested SYSTEMS.

It comes in a few product designs:

- The FyreBOX Mini range are available in small rounds and squares, ideal for large cluster of cables and particularly data cables – these can be installed after the cable are in situ and they are hinged.
- The FyreBOX Maxi range are larger and rectangular, designed specifically for cable trays; again they are hinged and can be installed if need be.
- The FyreBOX Slab-Mount allow services at the head or top of a wall, to be installed prior to the wall being erected. The FyreBOX Slab-Mount Bambino is trade specific and more and more trades are seeing the benefits and using these on new builds.
- The FyreBOX Cast-In range, are large rectangular FyreBOX systems designed for casting directly into concrete slabs. They are placed on the formwork prior to concrete being poured and make provision for a fire rated floor slab opening.



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For the FyreBOX Maxi, can be used for cable trays with all cable configurations but will require the addition of TWRAP once the FyreBOX has been correctly installed.

FyreBOX are all 125mm high, and the width varies from 125mm wide, all the way up to 1000mm wide. The opening is made to suit a standard FyreBOX, for example 350x125mm, 550x 125mm and 650 x 125mm or example.

If there is an oversized opening, it can be made smaller by using FyreBOARD Maxilite™ but this work is best done by a specialist passive fire protection contractor.

The FyreBOX is slid into the opening and the mounting flanges installed. Then the intumescent foam blocks are cut to suit the profile of the services and slid into place.

Table 6: Penetration summary for FRL -/60/60 walls

Service	Fyrebox FRL		TWrap FRL
	Group 1	Group 2	
Plastic pipes			
Rigid or flexible uPVC conduits up to 32 mm OD (with or without cables).	-/60/30	-/60/60	-/60/60
PEX pipes up to 20 mm OD	-/60/30	-/60/60	-/60/60
PEX pipes up to 32 mm OD	-/60/30	-/60/60	-/60/60 [^]
PEX pipes up to 32 mm OD insulated with E-Flex ST insulation 19 mm thick	-/60/30	-/60/60	-/60/60
GasPEX (PEX-AL-PEX) up to 20 mm OD	-/60/30	-/60/60	-/60/60
GasPEX (PEX-AL-PEX) up to 25 mm OD	-/60/30	-/60/60	-/60/60
GasPEX (PEX-AL-PEX) 32 mm OD	-/60/0	-/60/0	-/60/60 [^]
GasPEX (PEX-AL-PEX) 32 mm OD insulated with E-Flex ST insulation 19 mm thick	-/60/30	-/60/60	-/60/60
cPVC sprinkler pipes up to 40 mm OD	-/60/0	-/60/0	-/60/60
cPVC sprinkler pipes up to 60 mm OD	-/60/30	-/60/60	-/60/60
Metal pipes			
Copper up to 32 mm OD	-/60/0	-/60/0	-/60/60
Copper 32 mm to 50 mm OD	-/60/0	-/60/0	-/60/60
Steel pipes up to 60 mm OD	-/60/30	-/60/60	-/60/60
Metal pipes insulated			
Copper pipe up to 50 mm OD with PE insulation up to 20	-/60/30	-/60/30	-/60/60
Copper pipe up to 50 mm OD with FR insulation	-/60/30	-/60/60	-/60/60
Copper pipes up to 20 mm with Rockwool-type insulation	-/60/30	-/60/60	-/60/60
Paircoil pipes (up to 9.5 mm and 19 mm) with up to 13 mm	-/60/30	-/60/60	-/60/60
Paircoil pipes (up to 9.5 mm and 19 mm) with up to 20 mm	-/60/30	-/60/60	-/60/60
Power cables			
12 x TPS	-/60/30	-/60/60	-/60/60



Cable Trays

FRL of -/120/120 with TWrap / FyreWrap system*

The image above shows the installation of a FyreBOX Maxi, prior to the TWRAP being installed.

Service	Fyrebox FRL		TWrap FRL
	Group 1	Group 2	
Appendix D1 Group A power cables	-/60/30	-/60/30	-/60/60
Comms cables			
Appendix D2 Group B comms cables	-/60/30	-/60/60	-/60/60

* TWrap is to be installed up to at least 450 mm from the surface of the wall on each side.

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Option 1 – FyrePLUG Fire Pillows

One might think of the old, trusty, tried and proven fire pillows for a larger opening and for a cable tray and larger cables.

This is a good example, to demonstrate the requirement to check the wall type and FRL before using a product.

Here are the current approvals for Trafalgar FyrePLUG Fire Pillows:



Image shows: Metal Pipes up to 100mm, unwrapped bundles of small cables and cable trays

Fire Barriers	78mm Speedpanel walls	75mm Hebel Walls	2 Hour Plasterboard and Shaft Walls	2 Hour Concrete and Masonry Walls	3 Hour Concrete and Masonry Walls
Max Opening Size	350w x 450h	350w x 450h	600 x 600	800 x 600	800 x 600
FRL	-/120/120	-/90/90	-/120/120	-/120/120	-/180/180
Services	TWRap lengths required per service:				
Power cables on cable trays 350 wide (Appendix D1)	300mm, both sides of the wall				N/A
Comms/data cables on 350mm wide trays (Appendix D2)	300mm, both sides of the wall				N/A
Up to 50mm copper & steel pipes	300mm, both sides of the wall				600mm
Up to 100mm copper & steel pipes	1st layer: 600mm, both sides of the wall 2nd layer: 200mm, both sides of the wall				N/A
Small cable bundles*	No TWRap needed				300mm
25mm PVC conduit	No TWRap needed. Conduit installed with FyrePEX HP sealant and a pipe former. Refer to page X for specific installation requirements.				
Unpenetrated	No TWRap needed				

*Small cables bundles include any mix of cables of up to 20x CAT6 data or TPS fire or TPS power or fibre cables.

They are not currently approved for the one hour plasterboard wall, but I would expect most of these services to typically run through a 2 hour wall in any case.

Shown are some pictures from some recent fire testing of the Trafalgar FyrePLUG pillow systems. They “PLUG” holes in openings and services.

You will note that these are installed very tight in the openings and that FyreFLEX white sealant form part of the fire tested SYSTEM and for cable trays and large cables, there is a requirement to wrap the cable tray / services with TWRAP material, the foil encapsulated high temperature insulation wrap.

