

PASSIVE FIRE PROTECTION OF AIR CONDITIONING AND REFRIGERATION SERVICES

INTRODUCTION

Australian Building Regulations have slowly been tightening up to improve the energy efficiency of our buildings. This article will talk about what these changes mean to the services for HVAC&R pipe reticulation and the challenges this present to passive fire protection or fire stopping of opening in fire barriers where these services need to pass through.

What we see is a slow increase in the thickness of insulation required on copper pipes and pre-manufactured and insulated pair coil materials used for split system type air conditioners for example.

WHAT DOES NCC 2019 SAY REGARDING PIPE INSULATION?

For me it feels like yesterday that energy efficiency was voluntary, but with each iteration of the NCC, now every 3 years, the provisions get more stringent.

NCC, in Section J5.8 has some prescriptive requirement for energy efficiency for pipe work that carries heated or cooled fluids. These provisions require the addition of insulation materials or lagging to the pipe work. The NCC requires mandatory R values, or thermal resistance values for these insulation materials and the thickness of the material will vary depending on the insulation material used, the size of the piping and the temperatures range of the fluid they are carrying.

R-Value ($m^2 K/W$) mans the thermal resistance of a component calculated by dividing its thickness by its thermal conductivity.

J5.8 PIPEWORK INSULATION

(a) **PIPING**, vessels, heat exchangers and tanks containing heating or cooling fluid, where the fluid is held at a heated or cooled temperature, that are part of an air-conditioning system, other than in appliances covered by MEPS, must be provided with insulation.

(i) Complying with AS/NZS 4859.1; and

(ii) for piping or heating and cooling fluids, having an insulation R-Value in accordance with Table J5 8a; and

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Fluid Temperature Range	Minimum Insulation R-Value Nominal Pipe Diameter \leq 40mm	Minimum Insulation R-Value Nominal Pipe Diameter $>$ 40mm and \leq 80mm	Minimum Insulation R-Value Nominal Pipe Diameter Between $>$ 80mm and \leq 150 mm	Minimum Insulation R-Value Nominal Pipe Diameter $>$ 150mm
Low Temperature Chilled \leq 2 °C	1.3	1.7	2.0	2.7
Chilled $>$ 2°C but \leq 20 °C	1.0	1.5	2.0	2.0
Heated $>$ 30 °C but \leq 85 °C	1.7	1.7	1.7	1.7
High Temperature Heated $>$ 85 °C	2.7	2.7	2.7	2.7

Note to table J5.8a: the minimum required R-Value may be halved for piping penetrating a structural member.

WHAT DOES THAT MEAN TO PASSIVE FIRE PROTECTION?

Put simply, combustible insulation materials that provide the requisite R values are now put on all this pipe work.

These materials, provide a new challenge to passive fire protection systems, and engineered **high-performance intumescent materials** are required to quickly close-down or fill up the openings formed by the shrinkage and melting of the insulation materials in fire conditions.

Intumescent materials are materials that expand or swell rapidly in fire conditions and allow us to use plastic materials for services. The most common form of intumescent device is a fire collar, used to protect plastic plumbing pipes in fire conditions.



WHAT PIPE AND INSULATION MATERIALS ARE WE SEEING?

Most HVAC&R pipes are copper. They used to be bare copper BEFORE Section J requirements and of course now they are insulated copper pipes.

There are two main types, those being factory manufactured and supplied insulated pair coils, and copper pipes with added insulation materials.

PAIR COILS - PE and FR Insulated



Insulated Copper Pipes



FLAME SPREAD TEST VERSUS FIRE RESISTANCE TESTING

It is easy to get fooled, and I have seen many people fall this the following two card trick:

AS1530 Part 3 fire testing deals with limiting flame spread across the surface of a material, not the ability of the material to have any fire resistance, passive fire protection or fire stopping abilities.

AS1530 Part 4 fire testing on the other hand, is for fire resistance and the system under fire testing can obtain an FRL needed for passive fire protection under NCC.

FIRE RESISTANCE REQUIREMENTS FOR INSULATED COPPER PIPE PENETRATIONS

As stated earlier, high performance intumescent systems are required to close off the opening formed by shrinking and melting insulation materials on copper pipes in fire conditions.

The NCC requires full scale system fire testing to AS1530 Part 4 – 2014 to determine the FRL of a service penetration through a fire barrier. Only then can an FRL apply to the as fire tested system.

As you can imagine, there are many different fire rated wall, floor, shaft and ceiling types, a multitude of insulated copper pipe types, so many fire tests are required to provide product suitable to maintain the FRL of opening in fire barriers through which insulated copper pipes pass through.



It takes good intumescent product, a big budget, many fire test and a long period of time to develop of suitable portfolio of fire tested systems to be able to sell passive fire protection products for protection of insulated copper pipe penetrations and re-establishment of opening with a requisite FRL for certification purposes.

WHAT OPTIONS ARE AVAILABLE TO THE HVAC&R CONTRACTOR FOR FIRE STOPPING?

I will discuss Trafalgar Fire's system options as I know them well.

HIGH PERFORMANCE INTUMESCENT SEALANTS

Trafalgar Fire offer FyrePEX™ HP intumescent sealant or mastic.

This is only available in BLACK, as it has a HUGE concentration of graphite in it, which provides the high performing, rapidly expanding intumescent properties.

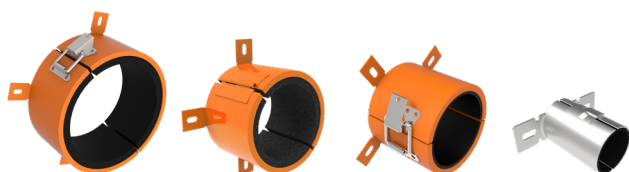
Unfortunately, acrylic sealant like Trafalgar FyreFLEX® only contain relatively speaking smaller amounts of intumescent and are not suitable for insulated copper pipes.

So, in short, if it is not BLACK, it will not work as a rule! The fire testing for material like FyrePEX™ HP intumescent sealant, require careful sizing of the annular gap around the pipe to meet the as fire tested systems. We have learnt that this can be more than problematic on site and certification can be a big issue as many have found who have not read the technical manuals and not used the correct annular gaps.



FyreCHOKE MIXED SERVICES COLLAR

The Trafalgar Multi-services fire collars are another convenient means of protecting smaller bundles of insulated copper and pair coils. Note that the image on the left was taken before TWRAP™ was applied, but TWRAP™ isn't required in all cases.



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FyreBOX MINI

FyreBOX Mini - Round or circular

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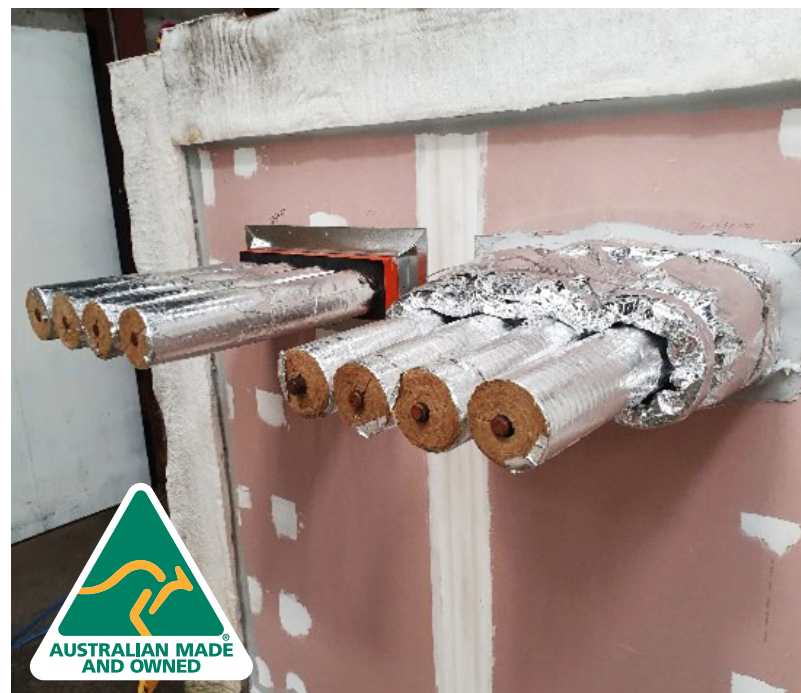
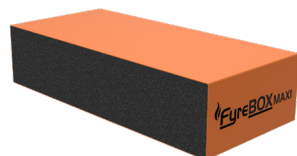


FyreBOX MAXI

These are the go-to product for large bundles of insulated copper and other service types either on a cable or services tray, or without a cable tray.

They can be installed as a retrofit unit, again being opened and closed around the services and slid into the opening. Oversized opening can be made smaller to suit the size of the FyreBOX™ Maxi using Trafalgar Maxilite board.

These have fire test approvals for most fire barrier types including fire rated ceilings.



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PATENTED VARIANTS

The slab mount FyreBOX™, is installed before the wall is erected.

The FyreBOX™ Bambino was developed for the HVAC&R trade sector, to allow HVAC&R services to pass through their own FyreBOX™. This has proven very popular, as the smart the HVAC&R trades can run all their services and not wait for all the walls in apartments to have to be in place before cutting holes, running services and then doing individual service by service fire stopping.

The FyreBOX™ Cast-In is utopia for some.

It is nailed onto formwork prior to concrete pouring and cast into the floor slab, effectively making a fire rated hole for multiple banks of insulated copper to pass through.



CHECK LIST FOR COMPLIANCE FOR HVAC&R SERVICES



This simple checklist will help you select the correct fire stopping system and/or help you ensure you have installed and can certify a compliant system.

You need the following info:

Fire barrier type ✓

FRL ✓

Opening size ✓

Pair coils ✓

Number of pair coils and any other services passing through same opening

Insulated copper ✓

Size of copper pipe

Thickness and type of insulation

Qty of pipes and proximity to each other

Trafalgar Technical Manuals to ensure you are covered ✓