Fire Resistance: Insulation ratings and Temperature rise – What on earth are we doing or thinking here in Australia and why?

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Introduction

In all developed countries there is Building Regulations and Building Codes that require effective fire compartmentalization.

So called fire compartment barriers, fire barriers, fire walls, fire rated walls, fire rated floor slabs, fire rated shafts and fire rated risers. We have all heard these terms and we all understand these to form part of what we call “Passive Fire Protection”. These passive elements of construction are designed to stop fire spreading from one part of a building to another or in some cases from one building to another.

It all sound pretty simple, build a fire wall and stop the spread of fire.

All passive fire protection items are required to be fire rated and the required fire ratings manifests themselves as FRL’s (Fire Resistance Levels) in our National Construction Code (NCC), previously known as the BCA (Building Code of Australia).

It gets a bit more complicated when we need to have openings for services to pass through these fire barriers and this is where so called “fire stopping” enters the discussion. We need to ensure that the fire barrier and its fire rating are not compromised by the services that pass through them.

When it comes to FRL’s and fire stopping, the two most important criteria are integrity and insulation and it is the latter that this article is about. The NCC at best can be described as a” “bloody mess” when it comes to the insulation criteria and the FRL of fire barriers and fire stopping of services which pass through these fire barriers.

Understanding FRL's

FRL or Fire Resistance Level is a defined term we need to live with given to us by our regulators by way of the NCC.

Let's look at the definitions from the NCC:

Fire-resistance level (FRL) means the grading periods in minutes determined in accordance with **Specification A2.3**, for the following criteria—

(a) *structural adequacy*; and

(b) *integrity*; and

(c) *insulation*, and expressed in that order.

Note: A dash means that there is no requirement for that criterion. For example, 90/–/– means there is no requirement for an FRL for integrity and insulation, and –/–/– means there is no requirement for an FRL

Structural adequacy , in relation to an FRL, means the ability to maintain stability and adequate *loadbearing* capacity as determined by AS 1530.4.

Integrity , in relation to an FRL, means the ability to resist the passage of flames and hot gases specified in AS 1530.4.

Insulation , in relation to an FRL, means the ability to maintain a temperature on the surface not exposed to the furnace below the limits specified in AS 1530.4.

Abstracts from the NCC definitions relating to FRL

Are you confused?

Well if you are, please don't feel bad as most people are!

The FRL is effectively the fire rating for the passive fire protection elements in question.

Fire ratings and FRL's are determined by subjecting prototypes or specimen elements to a standard fire resistance test, (fire test) to Australian Standard, AS1530 Part 4.

For most elements, unless they are load bearing or structural elements designed to hold up the building, we only need to worry about the integrity and the insulation criteria.

Integrity as shown above, is the ability of the fire barrier to resist the passage of flames and hot gases.

Insulation, is a terrible choice of terms and it should be called "temperature rise" because it is the ability of fire barrier to keep the non-fire side cool or below acceptable temperature rise limits as defined in AS1530 Part 4.

Note - The temperature rise needs to be maintained below the maximum increase of 180 degrees Celsius during the fire test to AS1530 Part 4.

Insulation and temperature rise for openings in fire barriers

It makes sense that if there is fire on one side of the wall, then we want the other side, known as the non-fire (effected) side to stay cool and not create temperatures which might cause ignition on the non-fire side and cause the fire to spread.

So we need walls and fire barriers made from materials that insulate the fire and keep the non-fire side cooler.

The most obvious problem is that we need to have openings in these fire barriers for access, egress, ventilation, natural lighting or of course for services passing through these fire barriers. This in layman's terms means we have doors, windows, skylights, ducting, air transfer vents or grilles and cables, pipes, conduits and other services that need to installed into all of these fire barriers.

These all need to be fire rated using so called fire rated items; so called fire doors, fire windows, fire rated service penetrations, fire rated ducts and fire dampers for example.

All of the elements need to maintain both integrity of insulation.

Insulation is the tricky one as metallic elements conduct heat readily when hot so maintaining the FRL of the fire barrier; that is keeping the temperature on the non-fire (effected) side down to acceptable limits is quite often very difficult, cumbersome and can be very expensive.

In simple terms the Regulations require the fire barrier and its FRL to be maintained. So for a so called two hour fire wall or fire rated riser whose FRL is -/120/120, the openings and services need to maintain both 120 minutes for integrity and for insulation or temperature rise.

This is seems pretty straight forward. Build a two hour fire wall and make sure all openings and services do not impair this fire rating, maintaining both integrity and insulation requirements.

NCC and insulation requirements

The NCC in terms of insulation requirements and FRL's is pathetic at best. There are inconstancies in terms of insulation or temperature rise requirements which come from concessions or relaxations given in the so called deemed-to-satisfy provision of the NCC.

You need to look back the precursor to both the NCC and BCA why this is the case.

In our old State and Territory, and in many cases in our old Local Ordinances before the advent of the first BCA in 1990, there were many concessions to account for the available technology at the time and the limited choice of passive fire protection suppliers, products and systems.

So we find a situation today in the NCC as follows:

Element	FRL	Insulation	Insulation concession
Fire wall separating apartment from corridor (Type 2 building)	-/120/120	120 minutes	No concession for wall
Fire rated riser (Type 2 building)	-/120/120	120 minutes	No concession for riser
Fire door in fire wall (unit entry door)	-/120/30	30 minutes	Concession given in Specification C3.4
Fire door in riser	-/120/30	30 minutes	Concession given in Specification C3.4
Access panel in fire wall	-/120/120	120 minutes	No concession
Access panel in riser (service shaft)	-/120/30	30 minutes	Concession given in C3.13
Non fire rated duct passing through fire wall incorporating fire damper	-/120/-	NIL insulation	Concession in AS1668 Part 1
Non fire rated duct passing through riser	-/120/-	NIL insulation	Concession in AS1668 Part 1
Service penetration in fire wall	-/120/120	120 minutes	No concession
Service penetration in riser (service shaft)	-/120/120	120 minutes	No concession
Control joint in fire wall or service shaft	-/120/120	120 minutes	No concession

So we can have a scenario as follows:

We can have a fire wall which requires an FRL of -/120/120 and it has a fire door in it requiring only 30 minutes insulation, a large duct with fire damper which requires no insulation, yet the control joints, service penetrations and access panels in the wall still require the full 120 minutes insulation.

You can see now why the title of this article asks the question; what are we doing and why? It is madness at best and in terms of fire safety and regulations we would expect better I am sure you will all agree.

An opening in a fire rated floor slab containing electrical services, protected with fire stopping solutions and with Fyrewrap insulation ensuring the requisite FRL of -/120/120 was maintained

Recent changes relating to insulation requirements and passive products

I am using “recent” quite loosely as the main changes effecting passive fire protection manufacturers and suppliers like myself are not recent at all, and were as follows:

2005

AS1530 Part 4 -2005 was a major re-write and some fire testing methods became more onerous.

Examples include fire doors and fire rated access panels require insulation measurements on door frames to be included in the determination of failure in terms of insulation and the FRL.

Cotton wool pad was introduced for determination of integrity generally speaking

Fire damper testing became a dynamic fire test measuring leakage through ducted fire dampers for the duration of the fire test.

Some relaxations occurred and one that comes to mind is external fire testing of fire rated ducts where internal duct temperatures were no longer required for determination of insulation.

2008 BCA changes to C3.15

I am pretty sure the significant changes to C3.15 pertaining to insulation occurred for the first time in 2008.

The changes tightened up what I referred to as a convenient loop-hole whereby insulation for service penetration was being waivered or conveniently ignored assuming combustibles were not (or could not?) be stored within 100mm of penetrating services.

C3.15 changed to a much stricter interpretation closing off this loop-hole almost completely.

We ask ourselves, why? If ducting with fire dampers require no insulation and fire door only 30 minutes, why are we so persistent that service penetrations and control joints for that matter require the full insulation rating?

This change to the NCC is surprisingly slow for people to grasp and as a manufacturer and supplier of fire stopping systems, we were forced to do more fire testing and development work to come up with some more modern and user friendly solutions for maintaining the insulation criteria for metallic cable trays and ductile or metal pipes for example.

Do these add any value? They do in part for us at Trafalgar because we sell more product, but does the extra sales do not justify the extra fire testing and system development, nor the staff time wasted on insulation confusion.

Do these changes make the buildings safer? In the context of the fire doors and particularly the fire dampers – then absolutely not?

Do I agree with the changes? Yes, but not if we did not tidy up other concessions aka fire doors and particularly fire dampers where insulation is low or not required at all.

So what do we all do?

Manufacturer and suppliers

We as Trafalgar can only assist in the education or what is best described as the re-education process.

For us the fact that people want full insulation of 120 minutes or more means we sell additional materials so our sales increase. However, we do recognize the inconsistencies and strongly recommend that the regulators review the requirements and make them more consistent.

We are damned if we do and damned if we do not.

Ironically we need to spend time and money continuing to develop fully insulating penetration systems knowing that one day common sense will prevail and the insulation criteria will probably be 30 minutes for all requirements, whether wall, shaft, floor, ceiling, door, access panel, window, duct or service penetration.

It is pretty bad when Building Managers or other representatives of the building owners, call us and abuse us because during their first annual AS1851 inspection, all of their penetrations are knocked backed as non-conforming due to non-conformances relating to insulation criteria.

It is a real problem that there is that much confusion regarding insulation

Fire Installation Contractors and Builders

Those doing installation of service penetrations and fire stopping need to understand the requirements for insulation. There is a role here for Fire Protection Association Australia to play here in helping with education and alerting the ABCB and Regulators to make necessary changes to the NCC.

AS1851 service providers

Those doing inspections need to understand that changes in the NCC and associated regulations are typically not retrospective and not all old fire stopping installations require the so called “insulation upgrade”; we are seeing more and more instances where people do not understand and are trying to get building owners to pay for upgrades that may very well not be required.

Certifiers & Building Surveyors

It is surprising how many certifiers are not sure themselves what the requirements are.

Manufacturers and suppliers should do presentations on this confusing area for certifiers and perhaps there is an education role here for both the AIBS and AAC, two of the peak bodies representing Building Surveyors and Accredited Certifiers alike. The AIBS and AAC can also help by alerting the ABCB and Regulators to make necessary changes to the NCC.

Developers & Fire Safety Engineers

We are seeing more developers using fire safety engineers to rationalize the requirements for insulation for their projects. The inconsistencies in the NCC make it easy to provide an Alternative Solution report for each project making the requirements clearer and more cost effective, requiring some insulation but not full insulation especially for items such as ducts, service penetrations and fire rated glazing as common examples. These Alternative Solutions do confuse subsequent AS1851 service providers as the documentation / paper trail are rarely readily accessible to the service providers or their staff are inadequately trained and cannot deal with variations to the so called Deemed-to-satisfy provision of the NCC.

Again peak bodies like the Property Council of Australia (PCA) and The Society of Fire Safety can assist with both education and helping by alerting the ABCB and Regulators to make necessary changes to the NCC.

Regulators

If the NCC was more consistent in its approach to insulation there would be no need for this article and there would be clarity for all involved.

The fact that there is insulation requirements from zero all the way up to 120 minutes or even 240 minutes for elements that all combine to provide fire containment barriers in the same building makes no sense and adds un-necessary cost and creates confusion for all involved.

It is high time this got fixed.

It is just not good enough and there are many areas where the NCC quite frankly is just not documented with the consistency, transparency and integrity one would expect for such an important document, especially in the areas covering life safety issues for our Built Environment.

Conclusions

The NCC in very inconsistent with the insulation or temperature rise requirements for passive fire protection elements.

Insulation requirements vary from requiring no insulation for ducts containing fire damper passing through fire walls, to 30 minutes for fire doors, all the way up to 120 or even240 minutes for the service penetrations passing through the same wall.

Changes to both AS1530 Part 4 in 2005 and NCC C3.15 in 2008 dealing with insulation requirements are very poorly understood and these changes did not add value in terms of life safety of our building, but added extra cost and ironically the whole holistic approach to insulation and fire resistance was not addressed and instead of improving things, we made things more inconsistent and confusing for industry at large. Not one of our best efforts!

Peak bodies, manufacturers, suppliers, installers, service providers and the rest of industry need to improve education and together we can tidy this anomaly up I would think?

PLEASE HELP US HELP YOU AND CIRCULATE THIS ARTCILE AND MAYBE IT CAN START SOME NECESSARY REFORMS REGARDING THIS CONFUSING AND ANNOYING ISSUE FOR THOSE ACTIVELY INVOLVED IN PASSIVE FIRE PROTECTION SYSTEMS.