TECHNICAL BULLETIN – FPA Australia TB-010

Fire Collars for Floor Wastes – Understanding BCA Compliance Options

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Introduction

There has been a great deal of discussion in recent times regarding fire testing requirements for fire collars for use on plastic pipes. Some warnings have been issued to Certifiers (Building Surveyors) in relation to this issue.

This Technical Bulletin was prepared by FPA Australia's Passive Fire Protection National Technical Committee (TC/18) to provide a balanced overview on the options available to Certifiers in relation to acceptance of fire collars for their project at hand.

This Technical Bulletin provides some specifics in relation to the relevant Building Code of Australia requirements (BCA), fire testing in accordance with relevant Australian Standards (AS) and some information regarding Fire Resistance Levels (FRL's).

Building Code of Australia

Since 1996, we have operated under a Performance Based Building Code (BCA). Under this regime, compliant buildings must meet the relevant performance requirements of the BCA.

Compliance can be achieved by way of an Alternative Building Solution or a Prescriptive (also known as a Deemed-to-Satisfy) Building Solution or a combination of the two.

Performance Requirements for fire collars

In terms of fire compartment barriers and fire separation, inclusive of service penetrations such as fire collars, the relevant BCA performance requirement is CP8:

> *CP8:*
>
> *Any building element provided to resist the spread of fire must be protected, **to the degree necessary**, so that an adequate level of performance is maintained-*
>
> *a) where openings, construction joints and the like occur; and*
>
> *b) where penetrations occur for building services*

Prescriptive or Deemed-to-Satisfy Requirements for fire collars

Clause C3.15 provides the relevant prescriptive provisions for fire compartment barriers, fire separation and specifically the openings provided for fire services such as fire collars.

C3.15 provides a number of alternatives for different configurations. Two relevant ones, sub clauses (a) and (b) are reproduced below:

C3.15:

*Where an electrical, electronic, **plumbing**, mechanical ventilation, air-conditioning or other service penetrates a building element that is required to have an FRL with respect of integrity or insulation, the installation must comply with one of the following:*

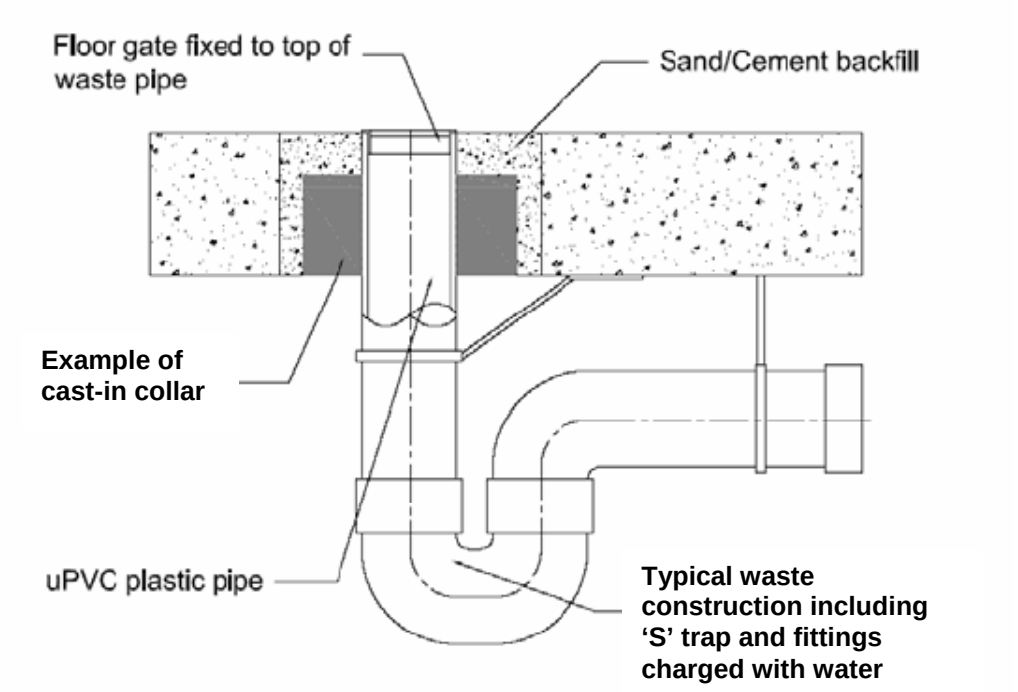
*(a) the method and materials used are identical with a prototype assembly (**see fig. 1**) of the service and building element that has been tested in accordance with AS4072.1 and AS1530.4 and has achieved the required FRL.*

(b) It complies with (a) except for the insulation criteria relating to the service if-

(i) the service is protected so that combustible material cannot be located within 100mm of it: and

(ii) it is not located in a required exit.

Figure 1



Understanding Fire Resistance Levels

A Fire Resistance Level, (FRL) is a term used in the Building Code of Australia to provide a uniform nomenclature for the "fire rating" or the prescriptive or "deemed-to-satisfy" requirements for specific element of construction.

Under the prescriptive or "deemed-to-satisfy" requirements and depending on the Class of Building (occupancy type) and Type of Construction (rise in storey), the FRL requirements are provided in non-ambiguous tabular form.

The FRL is designed to cater for structural elements and both load bearing and non-load bearing fire compartment barriers, fire separations and any openings for penetrations and services.

FRL ratings are determined by subjecting a representative test specimen to the ***standard fire test***; defined in the BCA as AS1530/4 and AS4072/1, the latter providing more detailed advice to for service penetration and control joints, complementing Section 10 of AS1530/4.

Note – At the time of writing AS1530/4 and AS4072/1 were close to republication and all the fire testing requirements will be contained exclusively in the new version of AS1530/4, leaving AS4072/1 as a product standard, to deal with design, variations for tested specimen, installation and documentation / marking; akin to AS/NZS1905/1 for fire doors.

The FRL consists of three ratings in minutes, (rounded down to the nearest 30 minute time increment), namely Structural Adequacy, Integrity and Insulation, designated in the following format:

FRL = Structural Adequacy / Integrity / Insulation. Example = 120/120/60

These ratings are determined from the standard fire test, or by way of formal opinions or assessments by Registered Testing Authorities in strict accordance with the acceptable protocols for variations to tested specimens outlined in the relevant product standard.

Note – For fire collars the variations need to be in accordance with AS4072/1.

Structural Adequacy

In terms of the standard fire test, failure for structural adequacy is deemed to have occurred when the element collapses or the rate of deflection for the element is in excess of prescribed limits

Integrity

In terms of the standard fire test, failure for integrity criteria, for elements intended to separate spaces and resist the passage of flame from one space to another, is deemed to occur when continuous flaming occurs on the non-exposed side of the tested specimen, or when cracks, fissures and other openings through which hot flames and gases can pass through are present, (the method of measurement is given in the test method).

Insulation

In terms of the standard fire test, failure for insulation criteria, again for elements intended to separate spaces and resist the passage of flame from one space to another, is deemed to have occurred when the temperature rise of the non-exposed side exceeds predetermined thresholds, typically being a temperature rise of (average) 140K and maximum 180K. For penetration seals, only the maximum failure criteria of 180 degrees is used.

FRL and Service Penetrations

Service penetrations such as fire collars are not a structural element; that is, they are typically non-load bearing. This should result in the first element of the FRL being represented as a dash, (-) or the nomenclature for Not Applicable (NA).

The only two FRL components that govern service penetrations are integrity and insulation criteria.

For fire collars the following applies:

In layman terms, applying the definition above, Integrity means the ability of the fire collar to effectively crush the plastic pipe type in question and seal the opening such that no hot flames or gases can pass through. The results are very conservative in many ways, as any visible through gap into the fire test furnace is deemed a failure, even if cotton wool pad, which is often applied by the request of the test sponsor, is not ignited when placed adjacent to the through opening in question.

Insulation is determined by placing fixed thermocouples in pre-determined positions, to measure the heat passing through the penetration and the adjacent fire-separating element (floor, wall or ceiling).

Notes

1. Often the FRL for a service penetration is incorrectly designated with the Structural Adequacy the same as Integrity, but strictly speaking this is not correct as the penetration seals are non-load bearing.

2. Often specification call for an hourly rating, such as 1 hour, which does not accurately define the integrity and insulation requirements.

Form and Composition of Tested Specimens

Generally speaking the fire-tested specimen should be representative of what would be used in the field.

The standard fire test states that:

The test specimen shall be—

(a) representative of the element of construction; and

(b) made of materials and to standards of workmanship representative of those applying in practice and as defined in relevant Australian Standards.

Fire testing is expensive, and it is not practical to test every conceivable configuration and therefore AS4072/1 provides some guidance and allows for acceptable variations to tested specimen, many of which allow Registered Fire Test Laboratories to provide formal opinions / assessments or fields of application.

For fire collars, what does this mean?

The following is a list of factors that need to be taken into consideration when assessing fire collars and their suitability for the intended application in the field.

- Separating element Pipe type (uPVC, HDPE, ABS etc)
- Pipe size (Nominal diameter of 32,40,50,65,80,100,150, 225 etc)
- Pipe wall thickness
- End conditions of pipe during test (open or closed on fire and/or non-fire sides respectively)
- Location of any fittings (within or not within the fire collar body)
- Fixing types and numbers used
- Annular space between intumescent material and outer diameter of pipe
- Annular gap between pipe and separating element
- Location of collar (cast into concrete or soffit mounted)
- Additional fire stopping materials employed (sealants, mortars or grouts)
- Type of plumbing penetration (terminating floor waste with grille or through continuous through penetration of pipe)

This list is not definitive and the reader can see that there are a number of factors that need to be considered.

Historically, this is basis for the development of AS4072/1, first published in 1992. It provides some specific advice on the requirements for fire testing and allowable variations from tested specimens.

Note – AS4072/1 in many ways is unique to Australia and does in fact require more fire testing than most other developed countries around the world.

Applicability of fire test results or FRL's to real life conditions

An important point to highlight is that FRL's are determined from a single test under one standard heating condition.

The standard test has been developed and used for Building Code requirements to help grade and qualify, compare and contrast different products against this one uniform heating regime only.

The standard fire test provides the following qualification, that needs to be understood.

Fire Hazard Assessment

The results of these fire tests may be used to directly assess fire hazard, but it should be recognized that a single test method will not provide a full assessment of fire hazard under all fire conditions.

In terms of real life fire scenarios and the validity of the results, it is highly unpredictable as to what is going to happen, as there are many different fire scenarios, which depending on the product and application in question, could yield very different performance attributes.

Insulation Waiver

The Building Code of Australia has identified that insulation waivers are often a practical and acceptable solution in terms of fire hazard.

Example 1

Clause C3.15 b, for example, allows an insulation waiver for any service penetration as long as it is not in a required exit and with some specific controls against contact by combustible materials. This exemption was probably included for metal pipes, cable trays and other ductile penetrating elements, where insulation failure in the standard fire test is expected, but fully compliant (fully insulating) systems may be impractical, add additional and restrictive costs that perhaps do not correlate with the additional level of safety or perceived hazards they are mitigating.

Example 2

All fire dampers are exempt from insulation except in specific cases only

Example 3

Fire doors are all provided with a maximum insulation requirement of only 30 minutes. Again, this is a cost effective and practical exemption, allowing cost effective and reasonable, user-friendly thicknesses of fire door leaves to be used.

Note – International requirements for insulation are often waived in Building Regulations and Building Codes

Multiple Testing of Identical Test Specimens

There have been some claims that multiple testing of identical systems is a common occurrence and that only one successful test yields a valid fire test report. FPA Australia's TC18 committee members are unaware of any evidence to support this claim. Testing laboratories with which TC18 has been in discussion refute this claim.

Laboratories have the right and have been known to withdraw test reports and assessments when new information that contradicts their findings is made available. For this reason any laboratory issued assessments are provided with expiry dates. This ensures they are reviewed in a timely manner and only re-issued if still valid to current version of the relevant Codes and Standards.

Conclusions

The Building Code is now performance based and we operate in an environment with Private Building Surveyors (Certifiers). The use of Alternative Solutions and flexibility for practicality and cost effective building solutions are prevalent. Often the prescriptive or deemed-to-satisfy requirements are bypassed. This can cause confusion, especially to those who have not been trained or do not understand the application of the "performance-based environment".

Interpretation on Regulations, Codes and Australian Standards are the responsibility of the Building Surveyor and can vary from project-to-project. Although the ABCB (for the BCA) and SA (for Australian Standards) can provide guidance and rulings, typically a Building

Surveyor (Certifier) has to make value judgements and interpretations for many aspects of deeming a total building solution acceptable. Fire resistance ratings are just one of many.

Fire resistance testing and the application of test results and the associated FRL's is a complex area, and manufacturers and suppliers, and the relevant Education Institutions and Trade Associations, need to help the Building Surveyors (Certifiers) to read, understand and interpret the validity or otherwise of fire resistance test reports.

End conditions and penetration type play a big part in the FRL achieved during standard fire testing.

Insulation waiver for penetration seals is common but some thought must go into the 'where and why'. Remember the Building Code provides the minimum requirements only, not the "be-all or end-all" and there will always be products available with superior performance and in many cases providing full integrity and insulation ratings if required for a specific application or if requested by the consultant.

Test Certificates can be misleading and if there is any doubt, the Building Surveyor should ask for a copy of the full test report or some suitable written confirmation from the manufacturer or supplier.

Independent third party certification or the use of fields of applications from Registered Fire Testing Laboratories may assist Certifiers as it is often impractical to look at multiple fire test reports for all the variations one finds in a real building application.

It is not the industry accepted practice to test multiple and identical test specimens and for laboratories to provide a test report or test certificate for the single item passed. On the contrary, it is not commonplace to retest an identical system without a full explanation of why, and laboratories can withdraw test report and assessment if new information is made known to them.

FPA Australia would be pleased to provide further information on request.

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FPA Australia, a not-for-profit member association, is Australia's major technical and educational fire safety organisation. FPA Australia was formed on 1 January 1997 when the members of two former associations, Fire Protection Industry Association Australia (Est. 1926) and the Australian Fire Protection Association (Est. 1960) agreed to amalgamate and form one representative body.

Today FPA Australia plays a pivotal role in providing authoritative advice and information on all aspects of fire safety and emergency management through a range of services to industry, commerce and the community at large. The Association also provides a forum for bringing together practitioners and professionals who deliver a broad range of products and services.

FPA Australia's prime objective is the best possible fire safety for the community. The Association also provides a wide range of services to its members and has a permanently staffed national office.

TC/18 committee covers most passive fire protection products and is represented by manufacturers, product testers, designers, consultants, contractors and product consumers. The committee is closely aligned with Standards Australia committees FP-018, FP-019, FP-020 and ME-062.