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IGNIS ADVISORY NOTE

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INSTALLATION APPLICATION OF HILTI CP 680 P FIRE COLLAR

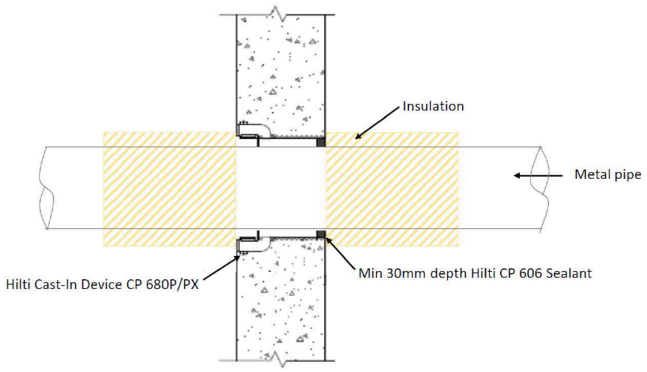
AS 4072.1-2005 ANALYSIS

1 Introduction

Ignis Labs has been engaged to evaluate the installation of the Hilti CP 680 P cast in fire collar for protection of copper, ferrous or brass metals for a Fire Resistance Level of at least -/120/120 minutes when installed within a masonry/concrete slab or wall.

The Hilti cast in fire collars were tested by Warringtonfire within fire test report FRT190095 R1.0 dated 30 May 2019 as well as fire test report FRT180461b R1.0 dated 04 March 2019.

The subject installation is detailed below where the installation is provided to a masonry/concrete slab/wall thickness of at least 150 mm. The installation is permitted to include a PVC sleeve, with additional sealant on the non collar side as well as a variation in penetrating metal pipe. The installation is to include the Hilti CP 680 P fire collar as well as pipe insulation as documented below which is reflective of the tested system.



The following table provides the resultant installation options for the subject Hilti CP680 P fire collar.

Metal pipe	Hilti collar CP 680P size	Pipe nominal diameter DN (mm)	Minimum pipe wall thickness (mm)	Allowable annular seal width (mm)	Sealant depth (mm)	Additional protection	Pipe insulation*	Insulation length	FRL
Copper, ferrous or brass	50 mm or 76 mm	23 to 65	0.91	25 mm or up to 60 mm with mineral wool infill	30	CP 680 P/PX Cast in collar	Mineral stone/rock wool insulation or performed mineral stone/rock wool insulation installed on the top side of the floor only	365	-/240/120
	76 mm, 101 mm or 152 mm	80-100	1.22					500	
Copper, ferrous (steel and iron)		100-125	1.42					600	-/120/120
	152 mm	125-150	1.63					725	

This advisory note is issued by Benjamin Hughes-Brown, Chartered Professional Engineer of Ignis Labs Pty Ltd, 3 Cooper Place, Queanbeyan, 2620, NSW for use under the Deemed-to-

Satisfy requirements of the National Construction Code Building Code of Australia Volume 1 and Volume 2 2022 (BCA). Ignis Labs holds accreditation to AS 1530.4 and AS 4072.1 with NATA. This engineering advisory note serves as a certificate from an accredited lab and a professional engineer in accordance with Clause A5G3 of the BCA.

2 Conditions of Use and Variations

The following conditions are applied to for the use of

A. Pipe insulation can either be mineral stone/rock wool with greater density and thickness that that tested, or 38 mm and 50 mm thick Bradford Fibertex 450. Moreover, any equivalent mineral fibre insulation with a minimum density of 80 kg/m3 and a minimum thickness of 38 mm can be used. Mineral stone/rock wool insulation must be overlapped by a minimum length equivalent to the pipe diameter.

B. The metal pipe installation must be positioned in the centre of the core hole such that the annular gap on all sides is maximum of 25 mm. The gap must be filled with Hilti CP 606 to a minimum depth of 30 mm backed with PE backing rod or mineral stone/rock wool. The annular gaps beyond 25 mm and up to 60 mm are permitted provided the gap is sealed with CP 606 to a minimum depth of 30 mm and backed with 33% compressed mineral wool with a minimum density of 60 kg/m^3. Where the annular gap is inconsistent around the pipe (i.e. less than 25 mm on one side and greater than 25 mm on the other side), 33% compressed mineral wool is only required in those areas where the gap is over 25 mm. The backing rod may be omitted if CP 606 sealant is applied to the full depth of the floor with a maximum annular gap of 25 mm. If the annular gap is zero, Hilti CP 606 can be applied in a 30 mm high × 5 mm thick fillet around the pipe.

C. The field of application given for copper and ferrous pipes is valid for other metal pipes with lower heat conductivity than copper and a melting point of minimum 1100°C, e.g. unalloyed steel, low alloyed steel, cast iron, stainless steels, Ni alloys (NiCu, NiCr and NiMo alloys) and Ni.

3 Code Compliance and Tested System

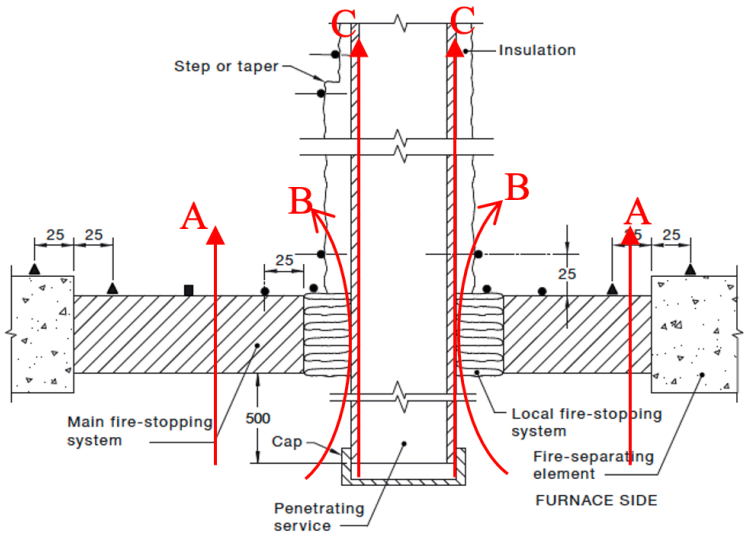
The National Construction Code 2022 (NCC) Clause A5G5 establishes that where a Deemed-to-Satisfy Provision requires a building element to have an FRL, it must be determined in accordance with Specification 1 and 2 of the NCC. Specification 1 of the NCC documents that the fire resistance of the building element meets the requirement of the NCC Specification if it is identical or differs in only a minor degree from a prototype submitted to the Standard Fire Test and confirmed in a report from an Accredited Testing Laboratory. Furthermore, NCC Clause C4D15 establishes the requirements for the opening for service installations where they are to be a tested system and where the system differs from the prototype of the service it is to be in accordance with Section 4 of AS 4072.1.

The NCC requires the subject system to be tested in accordance with AS 1530.4 and the variation assessed in accordance with AS 4072.1 Section 4.

Section 10 of AS 1530.4 provides details of how the penetration through a wall system is to be undertaken. There are three mechanisms in which fire can spread through the wall and penetration. This occurs for thermal transmission as well as through integrity failure where holes occur in the wall, penetration of the joint or via the penetrating material.

Within the following figure, failure of the fire test could occur through three points A, B or C. Failure through A occurs in failure of the wall. Failure of point B occurs in the joint between the penetration, protection medium and penetrating item. Failure of point C occurs through the penetrating material.

Point A and C is likely to have thermal failure occurring from an increase in temperature through the wall or penetrating item. Point B can include failure of both temperature (measured through a roaming thermocouple) or integrity where an opening occurs or via a cotton wool pad check ignition occurs.



Within the subject penetration installation, transmission point A is identical being at least a 150 mm masonry/concrete wall or slab. The penetration protection being point B includes a PVC sleeve as well as the Hilti CP 680 fire collar. Point B includes the variation of the collar installation to include the PVC sleeve and seal at either end. Point C considers the various types of metal pipe to penetrate and pipe insulation.

Section 4 of AS 4072 establishes the acceptable variations for the test systems which includes equivalence of the protection medium, being the Hilti CP 680 fire collar as well as differences in the metal pipe penetration.

The Hilti cast in fire collars were tested by Warringtonfire within fire test report FRT190095 R1.0 dated 30 May 2019 as well as fire test report FRT180461b R1.0 dated 04 March 2019. The tested system included a DN 15, 32, 100 and 200 copper pipe.

The Hilti CP 680 fire collar has demonstrated suitable performance within the subject fire tests completed by Warringtonfire to maintain the required Fire Resistance Level. It is permitted for the PVC sleeve to remain within the penetration.

With respect to the variation in penetrating pipe medium being Copper, Steel, Iron or Brass pipe, AS 4072.1 requires the melting point, surface area to mass ratio of the cross section area of the pipe and diffusivity of the material to be considered. The following table outlines the various melt points and diffusivity of the nominated materials as acceptable variations. The subject testing was completed with copper pipe having the lowest melt point and greatest diffusivity. The diffusivity of materials is the measure of the rate of heat transfer inside a material.

Material	Melt point (°C)	Diffusivity (mm^2/s)
Steel	1370	18.8
Copper	1085	111
Iron	1538	23
Brass	1650	30

The surface area of the materials nominated in the acceptable penetrations is less than that of the largest copper pipe size. The substitution of metal pipes as outlined above is deemed suitable given the low melt point of copper and the high diffusivity. Accordingly, each of the other materials have a higher melt point or lower diffusivity resulting in a greater performance than that of copper to a diameter up to 200 mm. It is not proposed to increase the diameter greater than 150mm and therefore the surface area to mass ratio of the cross section area of the pipe is not exceeded.

4 Conclusion

Based on the evaluation of the Hilti CP 680 fire collar, the following table provides the resultant installation options for the subject Hilti CP680 P fire collar.

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