BOSS PRODUCTS (AUSTRALIA) PTY LTD

FIRE ASSESSMENT REPORT

Assessment of service penetrations protected with Boss PenoPatch in walls

Report number: FAS190100
Revision: R2.1
Issued date: 18 August 2025 Expiry date: 30 June 2030

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Quality management

Revision	Date	Revision Description		
R1.0	Issue: 23 Oct 2019	Report issued to Boss Products (Australia) Pty Ltd for review and comment.		
		Prepared	**Reviewed**	**Authorised**
		Imran Ahamed	Mahmound Akl	Kjetil Pedersen
R2.0	Issue: 06 Jun 2025	Report revalidated for 5 years		
		Prepared	**Reviewed**	**Authorised**
		Henry Brammer	Omar Saad	Henry Brammer
R2.1	Issue: 18 Aug 2025	Report revise for minor typographical amendments		
	Expiry: 30 June 2030	**Prepared**	**Reviewed**	**Authorised**
		Henry Brammer	Omar Saad	Henry Brammer

Jensen Hughes Fire Testing Pty Ltd
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Formerly Warringtonfire Australia Pty Ltd[1]

[1] *Warringtonfire Australia Pty Ltd was acquired by Jensen Hughes in December 2023. Jensen Hughes Fire Testing Pty Ltd is not affiliated, associated, authorised, or endorsed by Warringtonfire Australia Pty Ltd, Warringtonfire Testing and Certification Limited or its "Warringtonfire" or "Certifire" brands.*

Executive summary

This report documents the findings of the assessment undertaken to determine the fire resistance level (FRL) of various penetrations protected with Boss PenoPatch – in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

The analysis in sections 5.0 and 6.0 of this report found that the proposed systems, together with the described variations, will achieve FRLs as shown in Table 1 – in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016)

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2.0, 3.0 and 7.0 of this report. The results of this report are valid until 30 June 2030.

Table 1 Overview of variations and assessment outcome

Service	Reference test	Protection System	Evidence of suitability	Governing requirements	Wall Type	Referenced figure	FRL
Blank Seal	49527300.3	60 mm Ø Boss PenoPatch in 20 mm Ø aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation	A5G3(1)(d)	S1C2(c)	Min. 118 mm thick plasterboard wall with at least one 13 mm plasterboard on both sides. The cavity will be filled with Fletcher Insulation Pink Partition 14 (R1.3) Glasswool Batt insulation (friction fitted). Wall type can optionally be concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok provided that a minimum thickness of 118 mm is maintained around the aperture[#].	Figure 1 and Figure 5	-/120/60
16 mm PEX pipe						Figure 2	-/60/60 (as tested)
Bundle of CAT6 Data cables, fire alarm cables, security cables and COAX cables (Up to 5 cables)						Figure 3 and Figure 7	-/60/30
Bundle of CAT6 Data cables, fire alarm cables, security cables and COAX cables (Up to 3 cables)						Figure 4 and Figure 8	-/60/60
Bundle of TPS Power Cables (Up to 3 cables)		60 mm Ø Boss PenoPatch in 25 mm Ø aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation				Figure 3 and Figure 7	-/60/60

Service	Reference test	Protection System	Evidence of suitability	Governing requirements	Wall Type	Referenced figure	FRL
20 mm AL PEX	PF23020 PF23031	60 mm Ø Boss PenoPatch in 21 mm Ø aperture and 60 mm along pipe Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation	A5G3 (1)(d)	S1C2(b)		Figure 9	-/60/45 (tested)
20 mm PEX						Figure 9	-/60/30.
Blank Seal	393094	60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation	A5G3 (1)(d)	S1C2(b) and S1C2(c)	Min 100 mm thick plasterboard wall with at least two 13 mm or a combination of 13 mm and 16mm plasterboards on both sides. The cavity will be filled with mineral wool insulation (friction fitted). Wall type can optionally be concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok provided that a minimum thickness of 100 mm is maintained around the aperture#.	Figure 1 and Figure 5	-/120/60 (as tested)
Single PVC / PVC Sheathed 5 x 1.5 mm² Cable						Figure 3 and Figure 7	-/60/30
Single EPR / PO Sheathed 5 x 1.5 mm² Cable						Figure 3 and Figure 7	-/60/30
Single XLPE /EVA Sheathed 5 x 1.5mm² Cable						Figure 3 and Figure 7	-/120/60
Single PVC / PVC Sheathed 1 x 95mm² Cable						Figure 3 and Figure 7	-/120/30
Steel or Copper Pipe up to 16 mm Dia.		60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side.				Figure 2	-/120/-

Service	Reference test	Protection System	Evidence of suitability	Governing requirements	Wall Type	Referenced figure	FRL
PVC Conduit up to 16 mm Dia.		60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation				Figure 2 and Figure 6	-/60/60
Single PVC / PVC Sheathed 1 x 185 mm² Cable						Figure 3 and Figure 7	-/120/30
Blank Seal		100 mm Ø Boss PenoPatch in 50 x 50 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation				Figure 1 and Figure 5	-/60/60
Bundle of 3 PVC / PVC Sheathed 5 x 1.5 mm² Cables						Figure 3 and Figure 7	-/60/60
Bundle of 3 EPR / PO Sheathed 5 x 1.5 mm² Cables						Figure 3 and Figure 7	-/60/30
Bundle of 3 XLPE /EVA Sheathed 5 x 1.5 mm² Cables						Figure 3 and Figure 7	-/60/60
Single PVC / PVC Sheathed 1 x 95 mm² Cable						Figure 3 and Figure 7	-/60/30
Steel or Copper Pipe up to 16 mm Dia.		100 mm Ø Boss PenoPatch in 50 mm x 50 mm aperture.				Figure 2	-/60/-

Service	Reference test	Protection System	Evidence of suitability	Governing requirements	Wall Type	Referenced figure	FRL
PVC Conduit up to 16 mm Dia.		100 mm Ø Boss PenoPatch in 50 x 50 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation				Figure 2 and Figure 6	-/60/30
Single PVC / PVC Sheathed 1 x 185 mm² Cable						Figure 3 and Figure 7	-/30/30
[#] Minimum thickness stipulated in the table shall be maintained around the aperture. Build-ups using 13 mm or 16 mm fire rated plasterboard pattresses or 50 mm thick Boss Batt may be used in order to obtain the minimum thickness around the aperture. The build-up may be installed on one side of the wall or on both sides of wall as appropriate and the build-up should extend at least 100 mm from the edge of the penetration in all directions. In addition, a fire rated sealant must be applied around the edge of the plasterboard build-up part for the full height of the build-up.							

Table of contents

1.0 Introduction

This report documents the findings of the assessment undertaken to determine the fire resistance levels (FRLs) of various penetrations protected with BOSS PenoPatch in accordance with AS 1530.4:2014[2] and assessed in accordance with AS 4072.1:2015[3].

This report may be used as evidence of suitability in accordance with the requirements of the relevant National Construction Code (NCC) to support the use of the material, product, form of construction or design as given within the scope of this assessment report. It also references test evidence for meeting deemed-to-satisfy (DTS) provisions of the NCC that apply to the assessed systems.

This assessment was carried out at the request of Boss Products (Australia) Pty Ltd. The sponsor details are included in Table 2.

Table 2 Sponsor details

Sponsor	Address
Boss Products (Australia) Pty Ltd	Unit 8, 15-23 Kumulla Rd Caringbah NSW 2229

2.0 Framework for the assessment

2.1 Assessment approach

An assessment is a professional opinion about the expected performance of a component or element of structure subjected to a fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for undertaking these assessments. We have therefore followed the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2021[4].

This guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction which has already been tested
- The interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product
- Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

Assessments can vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

[2] Standards Australia (2014) Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests for elements of construction, AS 1530.4:2014.
[3] Standards Australia (2005) Components for the protection of openings in fire-resistant separating elements Part 1: Service penetrations and control joints, AS 4072.1:2005.
[4] Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

This assessment uses established empirical methods and our experience of fire testing similar products to extend the scope of application by determining the limits for the design and performance based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance of the elements in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

This assessment has been written in accordance with the general principles outlined in EN 15725:2023[5] for extended application on the fire performance of construction products and building elements: Principle of EXAP standards and EXAP reports.

The performance of the systems with the variations documented in this assessment report has been determined by assessing the performance of tested systems against the impact of each variation. The systems tested in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016), and detailed within Appendix A, are generally considered to be comparable to the listed system variations which are generally expected to yield a performance equivalent to the tested systems.

2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the evidence of suitability requirements of the NCC 2022[6] under A5G3(1)(d). It references test evidence for meeting deemed-to-satisfy (DTS) provisions of the NCC under A5G5 for fire resistance level that apply to the assessed systems based on Specifications 1 and 2 for fire resistance for building elements.

The proposed details and systems (building elements) in this report are confirmed to be assessed, without the aid of an active fire suppression system, based on prototype tests that are equivalent to or more severe than a standard fire test AS 1530.4:2014 as specified in section 4.4, in accordance with NCC 2022 S1C2(b). It is also confirmed that the differences between the proposed systems and details compared to the tested prototypes are considered minor in accordance with NCC 2022S1C2(c).

This assessment report may also be used to demonstrate compliance with the requirements for evidence of suitability under the relevant sections of previous versions of the NCC.

2.3 Declaration

The ‘Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence’ prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 11 October 2024, Boss Products (Australia) Pty Ltd confirmed that:

- To their knowledge, the variations to the component or element of structure, which is the subject of this assessment, have not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.

[5] European Committee for Standardization, 2023, Extended application on the fire performance of construction products and building elements: Principle of EXAP standards and EXAP reports, EN 15725:2023, European Committee for Standardization, Brussels, Belgium

[6] National Construction Code Volumes One and Two - Building Code of Australia 2022, Including Amendment 1, Australian Building Codes Board, Australia

- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.

3.0 Requirements and limitations of this assessment

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.3.
- This report details the methods of construction, test conditions and assessed results in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).
- This assessment applies to wall systems exposed to fire from each side in accordance with the requirements of AS 1530.4:2014, where vertical elements must be exposed to heat from the direction required to resist fire exposure.
- This assessment report has been prepared based on the fire resistance performance and condition of the systems at the time they were tested. Any deterioration of fire resistance performance due to external factors including but not limited to passage of time and exposure to elements – is not considered in this report.
- Jensen Hughes has provided this report on the fire performance of building elements in a controlled laboratory setting, strictly within the parameters allowed by the test standards and building regulations. The outcomes of this report are intended to assist in verifying the suitability of the product or system for practical use in specific applications.
- This report is only valid for the assessed systems and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL) that is accredited to the same nominated standards of this report.
- This report has been prepared using information provided by others. Jensen Hughes has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may have been incorporated into this report as a result.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

4.0 Description of the specimen and variations

4.1 Description of assessed systems

This assessment report references the fire test reports EWFA 49527300.3 and 393094, which comprise various penetrations protected with Boss PenoPatch in 118 mm and 100 mm thick fire rated plasterboard wall systems, respectively. The referenced tests EWFA 49527300.3 and 393094 were conducted in accordance with AS 1530.4:2014 and BS EN 1366-3:2009, respectively.

4.2 Referenced test data

The assessment of the variation to the tested systems and the determination of the performance are based on the results of the fire tests documented in the reports summarised in Table 3. Further details of the tested systems are included in Appendix A.

Table 3 Referenced test data

Report number	Test sponsor	Test date	Testing authority
EWFA 49527300.3	Boss Fire	12 July 2018	Exova Warringtonfire (Australia)
393094	FSi Limited	19 April 2018	Exova Warringtonfire (UK)
PF23030	BOSS Products Australia	09 January 2024	Fire TS Lab
PF23031	BOSS Products Australia	09 January 2024	Fire TS Lab

4.3 Variations to the tested systems

The tested systems and variations to those tested systems – together with the referenced standard fire tests – are described in Table 4.

Table 4 Variations to tested systems

Item	Reference test	Description	Variations
1	393094	The referenced tests were conducted in accordance with BS EN 1366-3:2009 and EN 1363-1:1999[7].	Assessment of the likely fire resistance performance of penetrations in accordance with AS 1530.4:2014.

[7] British Standards Institute (1999) Fire resistance tests, General requirements, BS EN 1363.1:1999.

Item	Reference test	Description	Variations
2	EWFA 49527300.3 and 393094	The reference tests were conducted in fire rated plasterboard wall systems. Tests included various penetrations protected using Boss PenoPatch on both exposed and unexposed sides.	Assessment of the likely fire resistance performance with following variations: + The wall type can optionally be concrete, masonry, Autoclaved Aerated Concrete (AAC), Hebel, metal clad AAC, Speedpanel or Korok wall systems. + The option of having CAT6 bundle consisting of up to 3 CAT6 cables + The option of having a blank seal protecting a 20 mm diameter aperture + Service penetrations penetrating the wall without exiting to the other side (refer to Figure 5 - Figure 8)
3	230030	The reference tests were conducted in fire rated plasterboard wall system. Tests included penetration for various pipe penetrations protected using FireMastic-HPE sealant installed around the penetrations.	Assessment of the likely fire resistance performance with following variations: + Option of having 20 mm PEX A pipe
4	230031	The reference tests were conducted in fire rated plasterboard wall system. Tests included cable penetration protected using Boss PenoPatch on both exposed and unexposed sides.	Assessment of the likely fire resistance performance with following variations: + Option of bundle of TPS Power Cables (Up to 3 cables) with up to 60 minutes insulation

4.4 Assessment standard

AS 1530.4:2014 sets out procedures and methods for fire tests on building materials, components, structures, and fire-resistance tests for elements of construction. Section 10 discusses the procedures and methods for service penetrations and control joints.

4.5 Reference standard

AS 4072.1:2005 sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems around penetrations through separating building elements that are required to have an FRL.

4.6 Schedule of components

Table 5 outlines the schedule of components for the assessed systems. We have based this schedule of component from the reference test report shown in Table 3.

Table 5 Schedule of components of assessed systems

Item	Description
Separating element	The separating wall element can be plasterboard wall, concrete, masonry, Autoclaved Aerated Concrete (AAC), Hebel, metal clad AAC, Speedpanel or Korok wall systems as shown in Table 8. For wall elements with thickness less than the tested system, the minimum thickness stipulated in the Table 8 should be maintained around the aperture using plasterboard or Boss Batt build-up. The build-up piece should extend at least 100 mm from the edge of the penetration in all directions and a fire rated sealant should be applied for at least 20 mm deep around the build-up piece.
Penetration	As specified in Table 8
Fire protection system	60 mm Ø and 100 mm Ø Boss PenoPatch.
Apart from the variations addressed in this report, all other elements should be similar to the tested systems.	

Figure 1 to Figure 9 shows the assessed and tested systems.

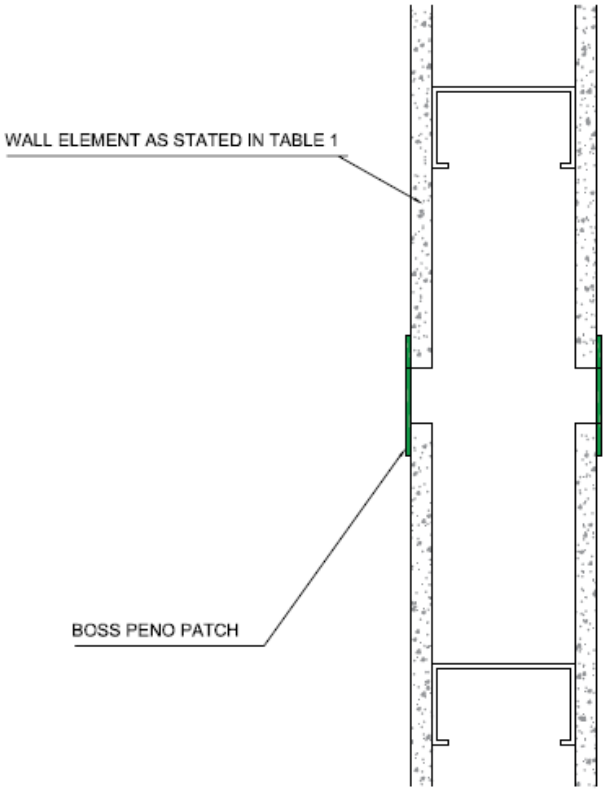

Figure 1 Blank seal

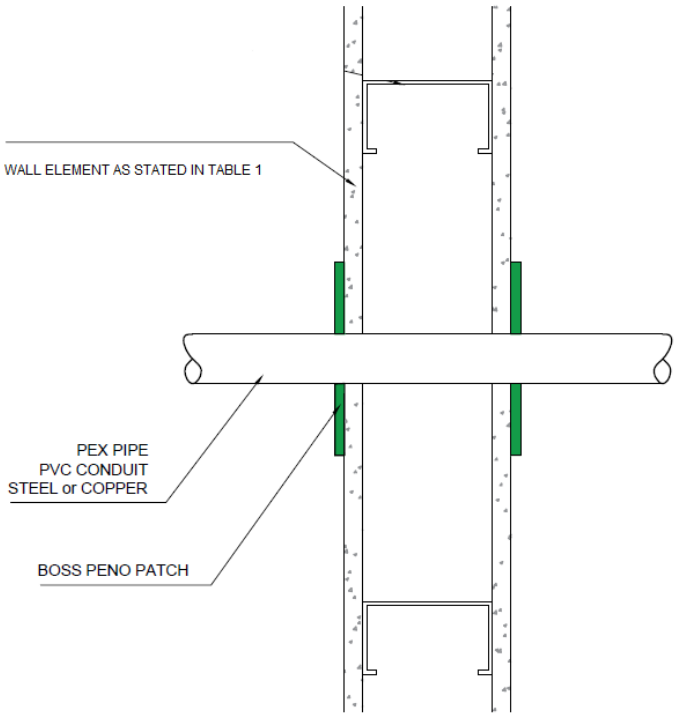

Figure 2 Pe-Xa pipe, PVC, steel or copper conduit penetrations

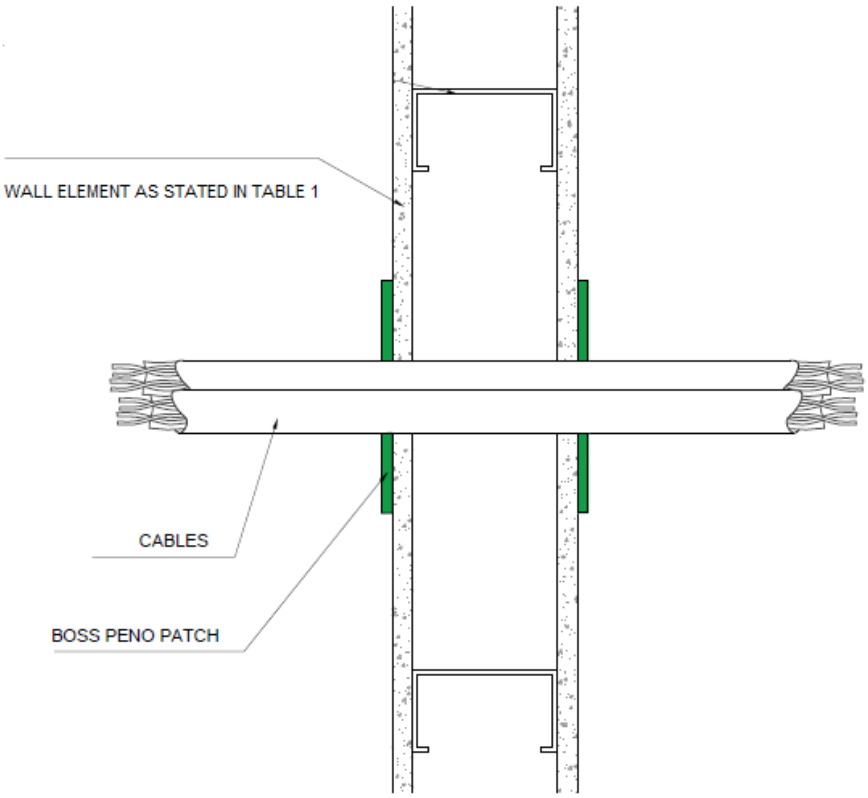

Figure 3 Cable penetrations

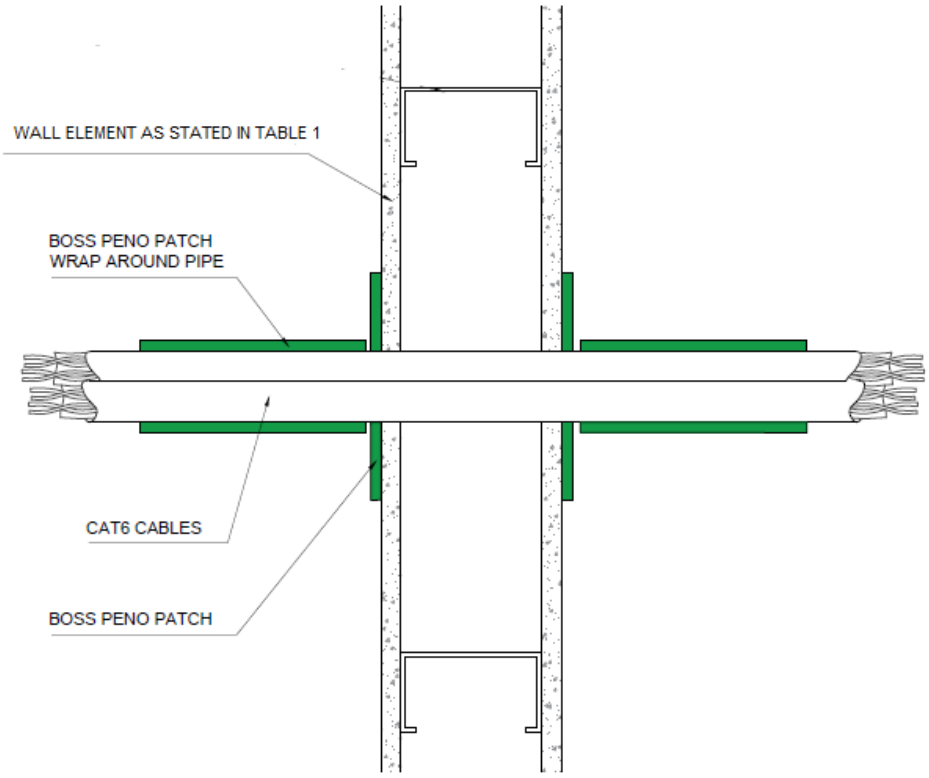

Figure 4 CAT6 cable bundle (up to 3 cables) penetration

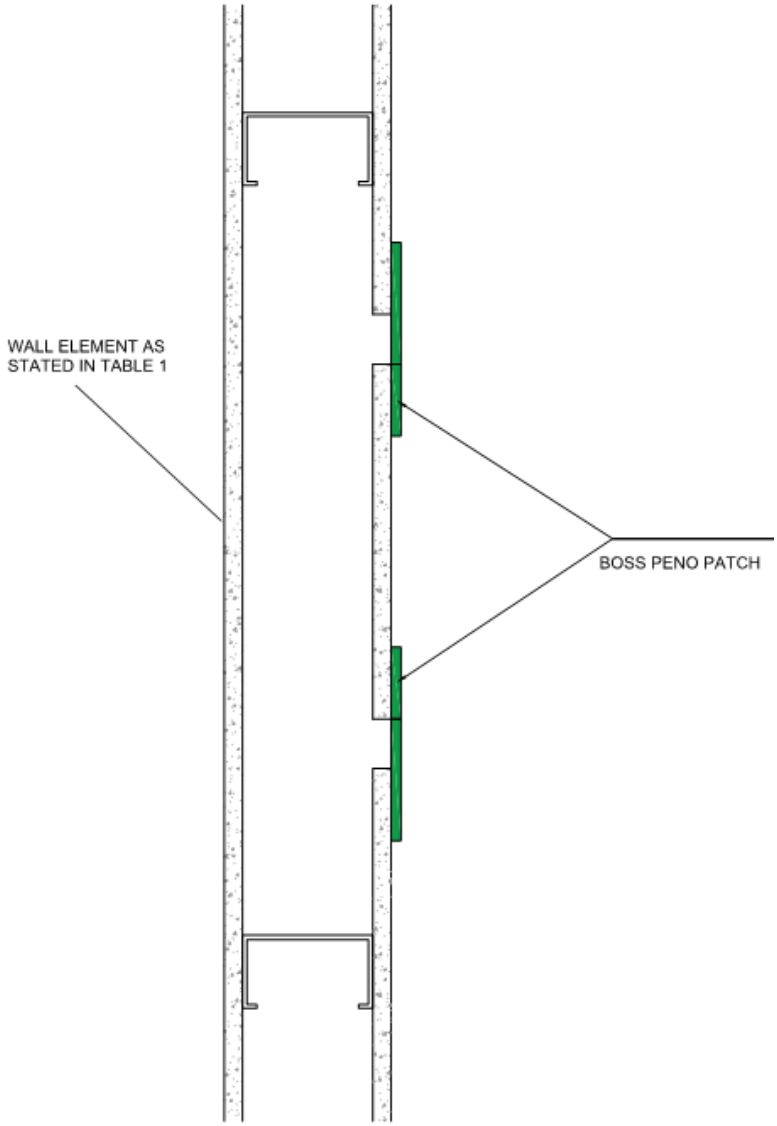

Figure 5 Blank seal on the same side of the wall

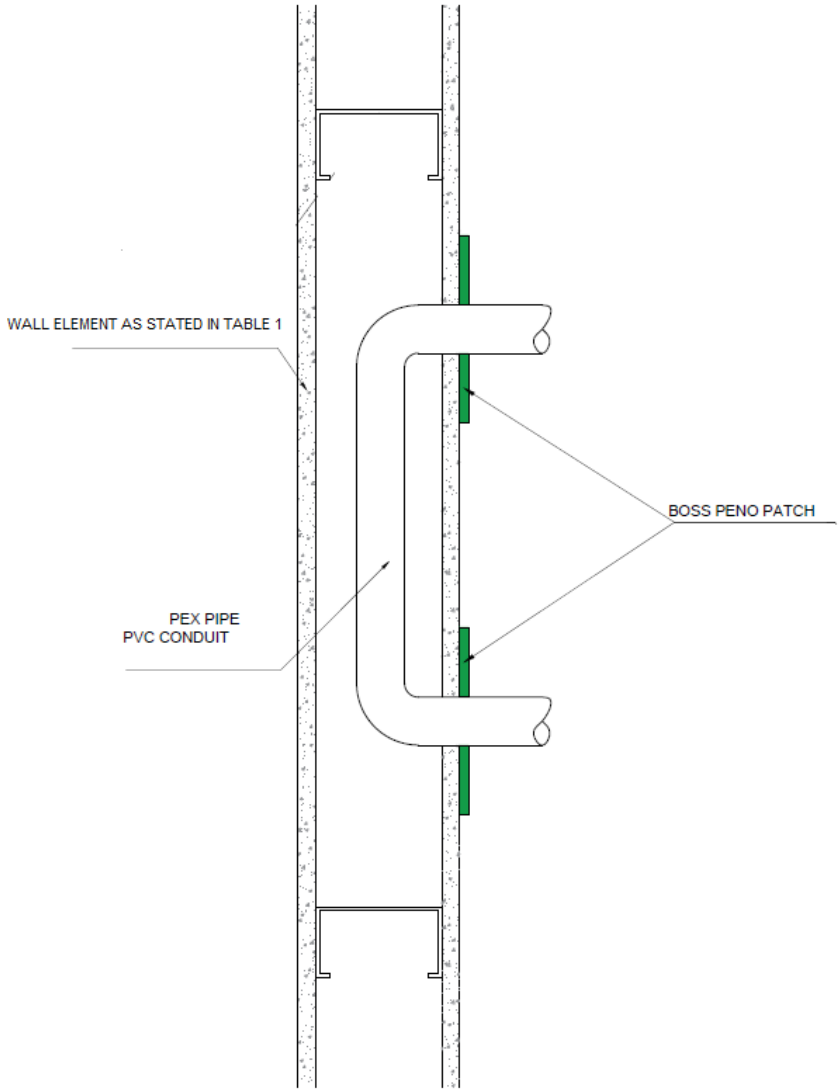

Figure 6 Pe-Xa pipe or PVC conduit penetrating the wall without exiting to the other side

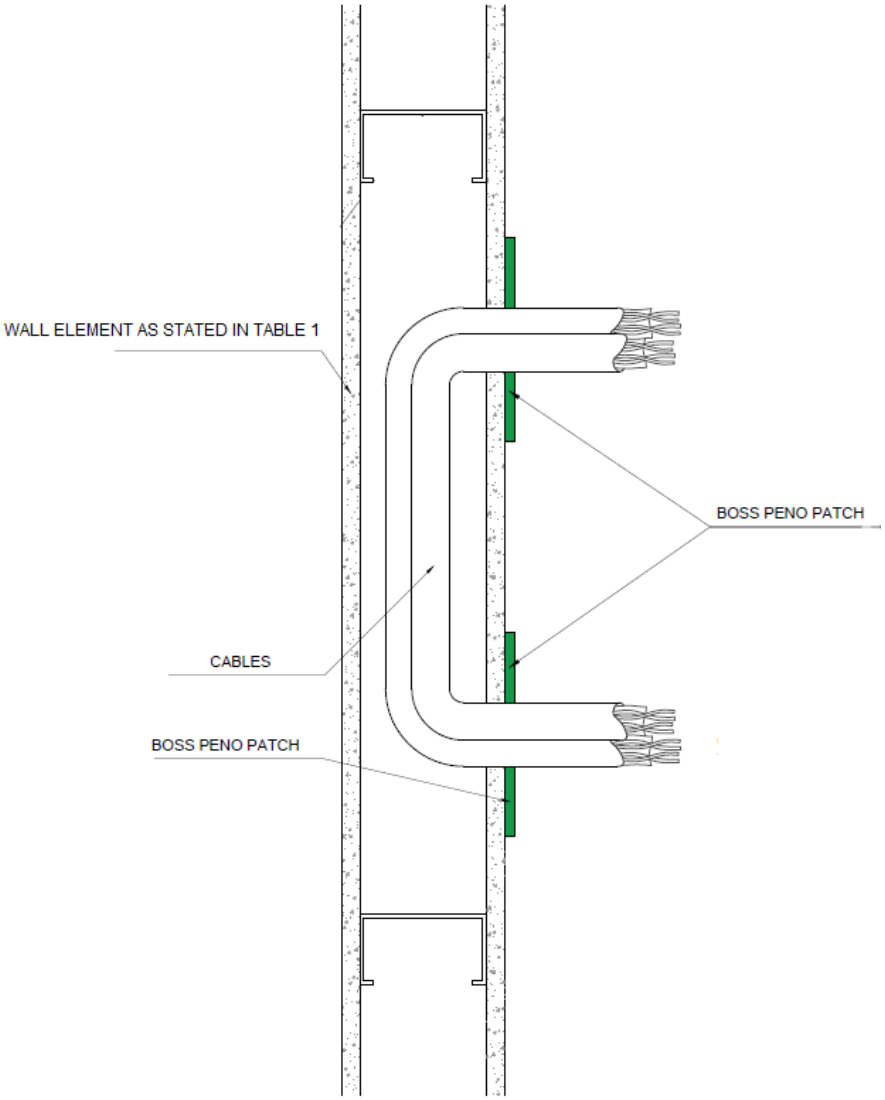

Figure 7 Cable penetrations penetrating the wall without exiting to the other side

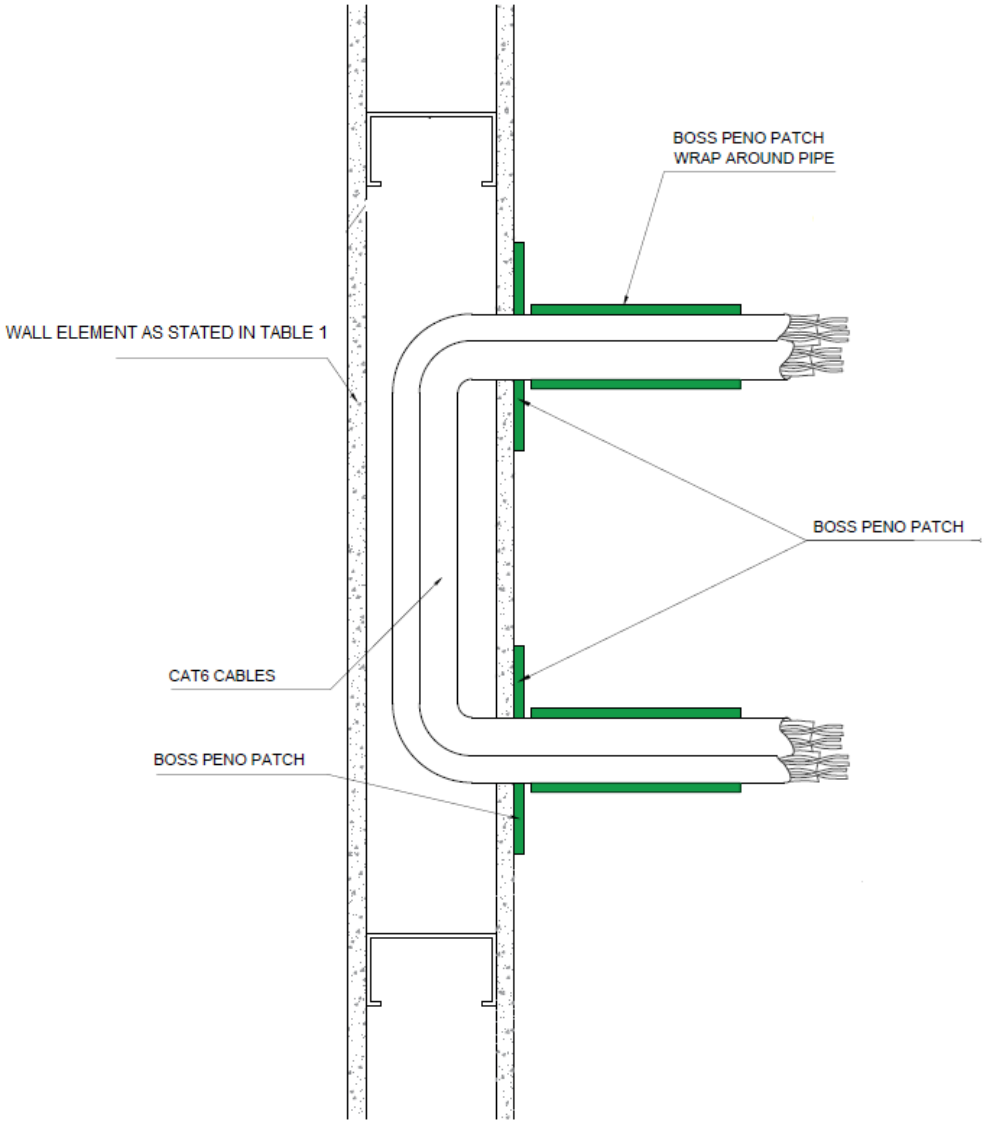

Figure 8 CAT6 cable bundle (up to 3 cables) penetrating the wall without exiting to the other side

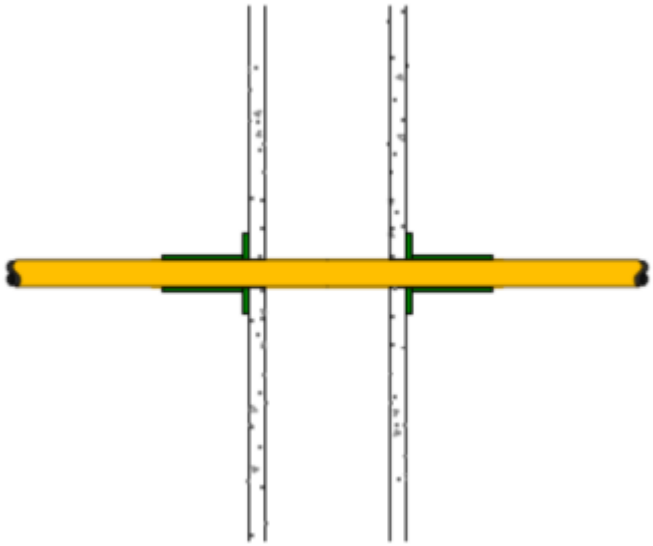

Figure 9 *20 mm PEX and PEX AL penetration*

5.0 Assessment 1 – Assessment of likely fire performance with respect to AS 1530.4:2014

5.1 Description of variation / background

Test report 393094 consisted of various penetrations protected with Boss PenoPatch penetrating a 100 mm thick plasterboard wall system. The test was conducted in accordance with BS EN 1366-3:2009 and BS EN 1363-1:1999, and it has been proposed to assess the likely fire resistance performance of these penetrations if tested in accordance with AS 1530.4:2014.

5.2 METHODOLOGY

The method of assessment used is summarised in Table 6.

Table 6 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
NCC procedure for determining FRL	An equivalent or more severe test S1C2(b)
Type of assessment	Qualitative and comparative

5.3 ASSESSMENT

5.3.1 General

Referenced fire test report 393094 was conducted in accordance with BS EN 1366-3:2009, with instrumentation and heating and furnace conditions provided in accordance with BS EN 1363-1:1999.

The requirements of these standards differ in some respects from those prescribed in AS 1530.4:2014 and AS 4072.1:2005. The effect that these differences have on the fire resistance performance of the tested linear seals is discussed in sections 5.3.2 to 5.3.7.

5.3.2 Furnace temperature measurement

The furnace thermocouples specified in AS 1530.4:2014 are type K, mineral insulated metal sheathed (MIMS) with a stainless-steel sheath having a wire diameter of less than 1.0 mm and an overall diameter of 3.0 mm. The measuring junction protrudes at least 25 mm from the supporting heat-resistant tube.

The furnace thermocouples specified in BS EN 1363-1:1999 are made from a folded steel plate that faces the furnace chamber. A thermocouple is fixed to the side of the plate facing the specimen, with the thermocouple's hot junction protected by a pad of insulating material. The plate part is to be constructed from 150 ±1 mm long by 100 ±1 mm wide by 0.7 ±0.1 mm thick nickel alloy sheet strips.

The measuring junction is made of nickel chromium/nickel aluminium (Type K) wire as defined in IEC 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath that has a nominal diameter of 1 mm, the hot junctions being electrically insulated from the sheath.

The furnace control thermocouples required by BS EN 1363-1:1999 are less responsive than those specified by AS 1530.4:2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to BS EN 1363-1:1999, particularly when the furnace temperature is changing quickly in the early stages of the test.

As required by AS 1530.4:2014, furnace thermocouples must be arranged so that they are initially 100 ± 10 mm from the exposed face of the specimen and maintained, where practicable, at a distance of 50 mm to 150 mm during the test. The furnace thermocouples are not to be installed closer than 100 mm to the furnace wall or the burner flames. For BS EN 1363-1:1999, it is required that furnace thermocouples are placed 100 ± 50 mm from the nearest point of the exposed face of the test construction, and they must be maintained at this distance during the test. In addition, thermocouples are not to be installed closer than 450 mm from any wall, floor or roof of the furnace.

With regard to the positioning of the furnace thermocouples, the differences between the standards are in the required distance from the exposed face of the specimen at the commencement of the test and the location of the thermocouples relative to the walls of the furnace. These differences are expected to delay the time taken for the plate thermocouples of BS EN 1363-1:1999 to heat and accurately measure the furnace temperature when compared to the thermocouples in AS 1530.4:2014 and therefore will likely present a more onerous condition.

The distance to be maintained from the specimen during the test is relatively the same and is not expected to affect the results obtained following the two standards.

5.3.3 Furnace pressure regime

It is a requirement of AS 1530.4:2014 that, for vertical elements with a height of more than 1 m, a furnace pressure of 20 ± 3 Pa must be established at the top of the separating element and all the penetration services must have a pressure greater than 10 Pa.

Similarly, BS EN 1366-3:2009 requires that a vertical furnace be operated so that a minimum pressure of 20 Pa is maintained at the top of the uppermost penetration seal. In addition, services shall only be included in the zone where the positive pressure exceeds 10 Pa. Therefore, penetrations in walls subjected to furnace pressure of 15 Pa as per BS EN 1366-3:2009 will be compliant with the requirements of AS 1530.4:2014.

It is a requirement of both AS 1530.4:2014 and BS EN 1366-3:2009 that for horizontal elements, a furnace gauge pressure of 20 Pa be established at a position of 100 ± 10 mm below the floor soffit level. Therefore, there are no differences between the requirements of the two standards for horizontal elements such as floors.

Furthermore, the parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and BS EN 1366-3:2009 are also not appreciably different.

5.3.4 Installation of services

BS EN 1366-3:2009 states that the services shall be installed so that it projects a minimum of 500 mm on each side of the supporting construction, of which at least 150 mm shall extend beyond the extremities of the penetration seal. In addition, any coating, wrapping or other protection to the service shall be considered part of the penetration seal. In the case of metallic services and metallic service supports that penetrate the seal the length of the unprotected part of the service / service support on the unexposed face shall not be greater than 500 mm. In the case of plastic pipes, the length of the pipe on the unexposed side may be extended to allow for collection of effluent gases.

Similarly, AS 1530.4:2014 states that the services shall be installed so that it projects a minimum of 500 mm on each side of the supporting construction, of which at least 200 mm shall extend beyond the extremities of the penetration sealing system. The penetration sealing system shall include any coating, wrapping or other protection to the services. The length of unprotected service on the unexposed face shall be not greater than 500 mm. For plastic pipes, the external projection away from the furnace shall be increased to a minimum of 2000 mm.

Therefore, the parameters for the installation of services in AS 1530.4:2014 and BS EN 1366-3:2009 are not considered to be appreciably different.

5.3.5 Integrity performance criterion

In accordance with AS 1530.4:2014, while a specimen maintains its insulation performance, the specimen shall be deemed to have failed the integrity criterion if it collapses or sustains flaming or other conditions on the unexposed face that ignite the cotton pad when applied for up to 30 seconds.

Specimens shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 when any of the following occurs:

- A gap forms that allows the passage of hot gases to the unexposed face and ignites a 100 mm × 100 mm × 20 mm cotton pad when applied for up to 30 seconds.
- Sustained flaming for 10 seconds.

BS EN 1366-3:2009 states that the integrity of the specimen must be assessed as described in BS EN 1363-1. According to BS EN 1363-1:1999, integrity performance is breached when any of the following occurs (excluding gaps that allow gap gauges to be used as applicable to this assessment):

- A gap forms that allows the passage of hot gases to the unexposed face and ignites a 100 mm × 100 mm × 20 mm cotton pad when applied for up to 30 seconds. During measurements, a clearance of at least 30 mm must be maintained between the cotton pad and the surface of the specimen that is parallel to it. There must also be at least a 10 mm clearance between the periphery of the pad and the specimen.
- Sustained flaming.

Other than the sustained flaming criterion, the requirements for integrity failure in AS 1530.4:2014 and EN 1363-1:1999 are not appreciably different. As such, BS EN 1363-1:1999 can be considered more onerous than AS 1530.4:2014 with regard to the criterion of sustained flaming, as sustained flaming of less than 10 seconds may also be captured as a failure in a test in accordance with EN 1363-1.

5.3.6 Insulation performance criterion and specimen temperature measurement

Both BS EN 1366-3:2009 and AS 1530.4:2014 denote that insulation failure is deemed to occur when a maximum temperature rise of 180ºC is recorded by the thermocouples placed on the unexposed surface of the specimen or by a roving thermocouple, or an increase in the average temperature above the initial average temperature by more than 140ºC.

The prescribed locations of thermocouples on the unexposed face of the test specimen have been outlined in sections 9.1.2 of BS EN 1366-3:2009 and section 10.5.1 and 10.5.2 of AS 1530.4:2014. The location of the thermocouples in BS EN 1366-3:2009 and AS 1530.4:2014 is not considered to be appreciably different for services; however, there is a difference for blank seals.

AS 1530.4:2014 requires that for blank penetration seals, the thermocouples must be positioned as follows:

- At least three on the surface of the seal, with one thermocouple for each 0.3 m^2 of surface area, up to a maximum of five, uniformly distributed over the area (one thermocouple being located at the centre of the seal).
- On the surface of the seal, 25 mm from the edge of the opening, with one thermocouple for each 500 mm of the perimeter.
- On the surface of the separating element, 25 mm from the edge of the opening, with one thermocouple for each 500 mm of the perimeter.

On the other hand, BS EN 1366-3:2009, specifies the following thermocouple locations:

- In the case of a penetration seal in a vertical supporting construction on the surface of the penetration seal at a distance of 25 mm from the top edge. (Section 9.1.2.3)
- In the case of a blank seal at the centre and at two of the quarter points. (Section 9.1.2.3)
- On the surface of the supporting construction, 25 mm from the top edge of the penetrations, with a minimum of one thermocouple per penetration. (Section 9.1.2.6)

The AS 1530.4:2014 locations are more onerous when compared to BS EN 1366-3:2009 for the blank seals. The assessment of the blank seals will take into account this difference between the standards on a case-by-case basis.

Apart from the discussed variation in the thermocouple location, the general insulation criteria of AS 1530.4:2014 and BS EN 1366-3:2009 are not appreciably different.

5.3.7 Restraint

The application of restraint to the test specimen in AS 1530.4:2014 and BS EN 1366-3:2009 is not appreciably different.

5.3.8 Active fire suppression

Both AS 1530.4:2014 and BS EN 1366-3:2009, which are standards for fire resistance testing of elements of building construction, do not incorporate provisions for active fire suppression systems. Consequently, the FRL achieved by the prototype was attained without the aid of an active fire suppression system.

5.3.9 Application of test data to AS 1530.4:2014

The variations in furnace pressure, furnace thermocouples, and specimen thermocouple locations are not expected to have a significant effect on the outcome of the referenced fire resistance tests as described in sections 5.3.2 to 5.3.8. Therefore, based on the above discussion and the discussions presented in sections 5.3.2 to 5.3.8, it is considered that the results relating to the integrity and insulation performance of the referenced tests, 393094, can be used as a basis to assess the FRL of the specimens in accordance with AS 1530.4:2014 and AS 4072.1:2005.

5.4 CONCLUSION / ASSESSMENT OUTCOME

This assessment demonstrates that the penetrations tested in report 393094 will achieve similar integrity and insulation performances in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016).

6.0 Assessment 2 – Performance of Boss Penopatch

6.1 DESCRIPTION OF VARIATION

The proposed construction shall be similar to the tested specimen in test reports EWFA 49527300.3 and 393094 subject to the following variations:

+ Wall type can optionally be concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok wall systems.
+ Options for the following cable penetrations:
  - Bundle of up to 5 CAT6 cables – 20 mm diameter aperture
  - Bundle of up to 5 fire alarm, security cables and COAX cables – 20 mm diameter aperture
  - Bundle of up to 3 TPS cables – 25 mm diameter aperture
  - Single PVC / PVC sheathed – 5 off 1.5 mm^2 cable in 25 mm × 25 mm aperture, 3 off 1.5 mm^2 cable in 50 mm diameter aperture
  - Single EPR / OP sheathed – 5 off 1.5 mm^2 cable in 25 mm aperture, 3 off 1.5 mm^2 cable in 50 mm aperture
  - Single ELPE / EVA sheathed – 5 off 1.5 mm^2 cable in 25 mm × 25 mm aperture, 3 off 1.5 mm^2 cable in 50 mm diameter aperture
  - Single PVC /PVC sheathed 1 off 96 mm^2 in 25 mm × 25 mm aperture and 50 mm diameter apertures.
  - Single PVC /PVC sheathed 1 off 185 mm^2 in 25 mm × 25 mm aperture and 50 mm diameter apertures.
+ Option of having a blank seal protecting 20 mm diameter aperture and 25 mm × 25 mm aperture.
+ Option of having 16mm PVC, copper and steel pipes in 25 mm × 25 mm aperture and 50 mm diameter apertures.
+ Variation to cover PEX and PEX-AL 20 mm pipes in 21 mm diameter aperture
+ Service penetrations penetrating the wall without exiting to the unexposed side (refer to Figure 5 - Figure 8).

6.2 METHODOLOGY

The approach and method of assessment used for this assessment is summarised in Table 7.

Table 7 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
NCC procedure for determining FRL	Differs in only a minor degree from a tested prototype S1C2(b) and (c)
Type of assessment	Qualitative and comparative

6.3 ASSESSMENT

6.3.1 Optional installation in various wall systems

It is proposed that the wall type can optionally be varied to concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok wall systems instead of the tested plasterboard wall systems.
AS 1530.4:2014 allows the application of test results obtained in the plasterboard lined wall systems to be applied to masonry or concrete walls of same or greater thickness for protection of penetrations.

Generally, masonry or concrete wall systems have lower total thicknesses compared to the tested plasterboard wall systems. Therefore, the insulation performance is expected to be compromised if these walls were to be penetrated with similar penetrations as tested. In order to reduce the risk of insulation failure, it is proposed to construct build-ups using 13 mm or 16 mm fire rated plasterboards around the penetration to achieve the minimum thickness stipulated in Table 8. Further, the build-up pieces are required to extend at least 100 mm in all directions from the penetration.

For metal clad AAC, Speedpanel and Korok walls, which are of irregular thickness, a fire rated sealant is required to be applied for at least 20 mm depth around the plasterboard build-up part. This will restrain hot gases escaping to the unexposed side because of the profile shape of such wall systems.

Based on the discussion presented above, the wall type can be optionally varied without detrimentally affecting the integrity and insulation performance of the penetrations, provided that the overall FRL will be governed by the established FRL of the wall.

6.3.2 CAT 6 bundle consist of up to 3 cables

With reference to test report EWFA 49527300.3, Specimen 10 consisted of five CAT6 (Ø 5.8 mm) cables protected with Boss PenoPatch on the exposed and the unexposed sides. Upon testing the CAT6 cable bundle, it was found to maintain integrity for the whole duration of the test without any signs of flaming or gaps forming at the unexposed side. However, it demonstrated insulation failure after 31 minutes as the thermocouple placed on the cable bundle 25 mm away from the separating element showed a temperature rise greater than 180˚C.

Therefore, in order to increase the insulation performance, it is proposed to reduce the number of CAT6 cables in the bundle to three cables. Confidence is gained by the results of Specimen 11 of EWFA 49527300.3 test report, where a bundle of three TPS cable penetration achieved integrity and insulation performance greater than 60 minutes. The metal conductor area of three TPS cable bundles is approximately 9 mm^2, while the three CAT6 cables could have a metal conductor area of up to 6 mm^2 depending on the gauge of the wire used. As a result, the amount of heat transfer to the unexposed side via conduction is expected to be similar if there were to be a bundle of three CAT6 cables and a bundle of three CAT6 cables protected with Boss PenoPatch considered to perform similarly to a bundle of three TPS cable penetration (Specimen 11 in EWFA 49527300.3).

To account for any additional heat transfer through the copper , the CAT6 cable will be wrapped both on the exposed and unexposed sides of the penetration with an at least 50 mm wide PenoPatch layer provided as additional protection (refer to Figure 4). This additional protection is expected to reduce the unexposed side thermocouple readings, which are to be placed on the cable penetration at 25 mm away from the additional PenoPatch wrap and on the PenoPatch wrap at 25mm away from the separating element and likely keep the temperature readings below the insulation failure limit for at least more than 60 minutes.

Based on the above discussion, it is expected that a CAT6 cable bundle comprised of up to three cables with proposed Boss PenoPatch protection will likely achieve an integrity and insulation performance of 60 minutes if tested in accordance with AS 1530.4:2014.

6.3.3 Assessment to cover fire alarm cables, security cables and COAX cables

It is proposed to assess the fire performance of similar sizes of fire alarm cables, security cables and COAX cables based on the performance of CAT6 cables in EWFA 49527300.3. It is understood that the conductor size within the cables is predominantly responsible for determining the fire performance of the cables. Hence, the test and assessment results in accordance with AS 1530.4:2014 of CAT6 cables can be extended to alternate cables including fire alarm cables, security cables and COAX cables of similar sizes.

6.3.4 The option of having a blank seal protecting 20 mm diameter aperture

With reference to the test report EWFA 49527300.3, test Specimen 9, which comprised of 16 mm Pe-Xa pipe penetration in a 20 mm aperture, was protected using Boss PenoPatch on the exposed and unexposed sides. Upon testing, the penetration was found to maintain both integrity and insulation performances for the whole duration of the test (61 minutes) without any signs of failure.

Time-temperature curve of thermocouples placed on the pipe showed that there was a significant spike in the temperature during the first 12 minutes, where it showed a maximum temperature rise of around 170˚C. This is expected during the melting phase of the pipe, as more hot gases are expected to pass through to the unexposed side until the Boss PenoPatch is fully activated. The same thermocouples showed a drop in the temperature within the next few minutes, where the recorded temperature rise after 20 minutes was around 120˚C. This is a clear indication that the Boss PenoPatch at the exposed side has fully activated and blocked any further hot gases from passing through to the unexposed side.

Based on the above discussion, it is understood that a blank seal protected using Boss PenoPatch without any penetration will achieve an FRL of at least -/60/60 if tested in accordance with AS 1530.4:2014.

6.3.5 Use of a 50 mm wide PenoPatch layer wrapped around cable penetrations

6.3.5.1 Cable A1 and A2

With reference to the test report 393094, cable penetration , single PVC / PVC sheathed 5 x 1.5mm² cable, single EPR / PO sheathed 5 x 1.5mm² cable, single PVC / PVC sheathed 1 x 95mm² cable and single PVC / PVC sheathed 1 x 185mm² cable

were protected using Boss PenoPatch on the exposed and unexposed sides. Upon testing these cable penetrations, the services were found to maintain integrity for at least 60 minutes without any signs of flaming or gaps forming at the unexposed side.

It was noted that Cables A1 and A2 failed insulation criteria after 45 and 42 minutes, respectively, where the thermocouple placed on the Boss PenoPatch 25 mm away from the penetration exceeded 180˚C. Based on this performance in test 393094 , it is considered that A1 and A2 cable bundle in a 50 mm x 50 mm aperture with above mentioned additional protection will achieve an FRL of -/60/30 in accordance with AS 1530.4:2014.

6.3.5.2 Cable B

In test 393094, it was noted that Cable B failed insulation criteria after 55 minutes, where thermocouple placed on the cable 25 mm away from the penetration exceeded 180˚C, and maintained integrity up to 180 minutes. Based on this performance, cable B will achieve an FRL of -/120/30 if tested in accordance with AS 1530.4:2014.

6.3.5.3 Cable E

The test report 393094 has deemed insulation failure in cable E because the thermocouple attached to the Boss PenoPatch 25 mm away from the cable penetration malfunctioned at 40 minutes. However, by inspecting the temperature readings up to 40 minutes, it was found that the thermocouple placed on the cable 25 mm away from the separating element yielded higher temperatures than the malfunctioning thermocouple. Therefore, it is reasonable to assume that, even if the malfunctioned thermocouple were to be active for the total duration of the test, the thermocouple placed on the cable would have governed the insulation criterion on the cable penetration.

6.3.6 Use of a 50 mm wide PenoPatch layer on PEX A pipe and wall.

With reference to the test report PF23031, the 20 mm PEX A pipe tested in specimen 4 exhibited a failure from integrity and insulation after approximately 14 and 29 minutes. The pipe was protected on both faces with a 60 mm patch applied to the wall. In the observation it was noted that the Penopatch was observed to have been cracking and detaching from the wall after 22 minutes. Specimen 9 in 495273000.3 showed that a 16 mm PEX A pipe protected in the same manner could achieve 60 minutes for both integrity and insulation where the Penopatch did not detach from the wall. The aperture size in the 16mm test was 20 mm in comparison to the 20 mm test's 21 mm aperture.

It is proposed to apply the Penopatch to both the wall and the pipe to provide additional protection around the penetration. Confidence in this arrangement is provided by the results from specimen 4 of PF23031, where a PEX AL pipe with Penopatch applied to both the wall and pipe achieved an integrity of 93 minutes and insulation of 58 minutes.

6.3.7 Service penetrations penetrating the wall without exiting to the unexposed side

As shown in Figure 5 to Figure 8, it is proposed to have plastic conduit, telecommunication and electric cable penetrations entering and exiting the wall from the same side without penetrating to the other side. The worst case is expected to be if the cable penetrations were to be on the exposed side.

When the cable penetrations are entering and exiting on the exposed side, both Boss PenoPatches (at top and bottom) are expected to fully activate in the first few minutes and cover the penetration apertures. This would likely block hot gases from passing through to the cavity and consequently to the unexposed side.

Given that there are no apertures in the unexposed side, the temperature rise on the unexposed side is expected to be predominantly governed by heat transfer via convection and radiation. As discussed above, once the apertures are blocked by the PenoPatch, the temperatures of cable penetrations within the cavity are expected to remain at low levels. As a result, unexposed side temperature increase, due to the radiation and convection heat transfer modes, is not expected to be significant, and thus, unexposed side temperatures are likely to be significantly less than the tested penetration systems.

However, the approved services shall exclude any metal pipes or metal connections in this penetration configuration as it would increase the radiation heat transfer effects, which would detrimentally affect the insulation performance of the penetration.

Penetration within the same face of the wall system must be separated from each other by a minimum of 200 mm in horizontal orientation and 600 mm in vertical orientation to prevent interaction of the penetrations.

Given that the above criterion is met, it is the opinion of the testing authority that the proposed penetration configurations are capable of achieving the same FRL obtained through the test.

6.4 CONCLUSION

Based on the above discussion, it is expected that the proposed service penetrations protected using Boss PenoPatch would achieve the FRLs given in Table 8 if tested in accordance with AS 1530.4:2014.

Table 8 Assessment summary

Service	Reference test	Protection System	Wall Type	Referenced figure	FRL
Blank Seal	49527300.3	60 mm Ø Boss PenoPatch in 20 mm Ø aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation	Min. 118 mm thick plasterboard wall with at least one 13 mm plasterboard on both sides. The cavity will be filled with Fletcher Insulation Pink Partition 14 (R1.3) Glasswool Batt insulation (friction fitted). Wall type can optionally be concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok provided that a minimum thickness of 118 mm is maintained around the aperture[#].	Figure 1 and Figure 5	-/120/60
16 mm PEX pipe				Figure 2	-/60/60 (as tested)
Bundle of CAT6 Data cables, fire alarm cables, security cables and COAX cables (Up to 5 cables)				Figure 3 and Figure 7	-/60/30
Bundle of CAT6 Data cables, fire alarm cables, security cables and COAX cables (Up to 3 cables)				Figure 4 and Figure 8	-/60/60
Bundle of TPS Power Cables (Up to 3 cables)		60 mm Ø Boss PenoPatch in 25 mm Ø aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation		Figure 3 and Figure 7	-/60/60
20 mm AL PEX	PF23020 PF23031	60 mm Ø Boss PenoPatch in 21 mm Ø aperture and 60 mm along pipe Penetrating through the wall system or penetrating without exiting to the other side.		Figure 9	-/60/45 (tested)
20 mm PEX				Figure 9	-/60/30.

Service	Reference test	Protection System	Wall Type	Referenced figure	FRL
Blank Seal	393094	60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation	Min 100 mm thick plasterboard wall with at least two 13 mm or a combination of 13 mm and 16mm plasterboards on both sides. The cavity will be filled with mineral wool insulation (friction fitted). Wall type can optionally be concrete, masonry, AAC, Hebel, metal clad AAC, Speedpanel or Korok provided that a minimum thickness of 100 mm is maintained around the aperture[#].	Figure 1 and Figure 5	-/120/60 (as tested)
Single PVC / PVC Sheathed 5 x 1.5 mm² Cable				Figure 3 and Figure 7	-/60/30
Single EPR / PO Sheathed 5 x 1.5 mm² Cable				Figure 3 and Figure 7	-/60/30
Single XLPE /EVA Sheathed 5 x 1.5mm² Cable				Figure 3 and Figure 7	-/120/60
Single PVC / PVC Sheathed 1 x 95mm² Cable				Figure 3 and Figure 7	-/120/30
Steel or Copper Pipe up to 16 mm Dia.		60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side.		Figure 2	-/120/-
PVC Conduit up to 16 mm Dia.		60 mm Ø Boss PenoPatch in 25 x 25 mm aperture. Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation		Figure 2 and Figure 6	-/60/60
Single PVC / PVC Sheathed 1 x 185 mm² Cable				Figure 3 and Figure 7	-/120/30
Blank Seal		100 mm Ø Boss PenoPatch in 50 x 50 mm aperture. Penetrating through the wall system or penetrating without		Figure 1 and Figure 5	-/60/60
Bundle of 3 PVC / PVC Sheathed 5 x 1.5 mm² Cables				Figure 3 and Figure 7	-/60/60

Service	Reference test	Protection System	Wall Type	Referenced figure	FRL
Bundle of 3 EPR / PO Sheathed 5 x 1.5 mm² Cables		exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation		Figure 3 and Figure 7	-/60/30
Bundle of 3 XLPE /EVA Sheathed 5 x 1.5 mm² Cables				Figure 3 and Figure 7	-/60/60
Single PVC / PVC Sheathed 1 x 95 mm² Cable				Figure 3 and Figure 7	-/60/30
Steel or Copper Pipe up to 16 mm Dia.		100 mm Ø Boss PenoPatch in 50 mm x 50 mm aperture.		Figure 2	-/60/-
PVC Conduit up to 16 mm Dia.		100 mm Ø Boss PenoPatch in 50 x 50 mm aperture.		Figure 2 and Figure 6	-/60/30
Single PVC / PVC Sheathed 1 x 185 mm² Cable		Penetrating through the wall system or penetrating without exiting to the other side. Where exiting the same side a minimum 200 mm separation in horizontal orientation and 600 mm in vertical orientation		Figure 3 and Figure 7	-/30/30

7.0 Validity

Jensen Hughes does not endorse the tested or assessed products and systems in any way. The conclusions of this assessment may be used to directly assess fire resistance, but it should be recognised that a single test method will not provide a full assessment of fire resistance under all conditions.

Due to the nature of fire testing and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment is based on test data, information and experience available at the time of preparation. If contradictory evidence becomes available to the assessing authority, the assessment will be unconditionally withdrawn and the report sponsor will be notified in writing. Similarly, the assessment should be re-evaluated, if the assessed construction is subsequently tested since actual test data is deemed to take precedence.

The sponsor is responsible for formally notifying Jensen Hughes of any additional testing performed on their product/system. This obligation applies regardless of where the test was conducted, the results of the test, or whether it was initially considered part of Jensen Hughes' ongoing assessment. The primary goal of this notification is to allow Jensen Hughes to review the changes and determine whether they require re-evaluation or re-testing to determine whether the changes have affected the product's performance. It is important that the client promptly notify Jensen Hughes if any such changes are implemented.

The procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement.

This assessment represents our opinion about the performance of the proposed systems that is expected to be demonstrated when subjected to test conditions in accordance with AS 1530.4:2014 and AS 4072.1:2005 (R2016), based on the evidence referred to in this report.

This assessment is provided to Boss Products (Australia) Pty Ltd for their own specific purposes. This report may be used as evidence of suitability in accordance with the requirements of the relevant National Construction Code. Building certifiers and other third parties must determine the suitability of the systems described in this report for a specific installation.

Appendix A Summary of supporting test data

7.1 TEST REPORT – EWFA 49527300.1

Table 9 Information about test report

Item	Information about test report
Report sponsor	Boss Fire
Test laboratory	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.
Test date	The fire resistance test was completed on 12/07/2018.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None
General description of tested specimen	The test specimen comprised of 92mm thick steel frame system cladded with 13mm USG Boral Firestop plasterboard on both sides. The wall cavity was filled with Fletcher Insulation Pink Partition. The wall system was penetrated with 11 different pipe and cable services. However, Service No. 9, 10 and 11, which were protected by Boss PenoPatch is referenced in this assessment report. Details of these services are given in Table 10.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

Table 10 Description of referenced test specimens

Service No.	Item	Service Installation	Protection
9	16mm Pe-Xa pipe	The pipe was installed at the centre of the core with an annular gap of 2mm. The pipe was protruded 500 mm and 2000 mm from the exposed and unexposed sides, respectively. The pipe was supported at 500 mm and 1500 mm away from the unexposed side of the wall system. The pipe was sealed on the exposed side only.	A 60 mm Ø Boss PenoPatch was applied on the surface of the wall system around the pipe on both exposed and unexposed sides.
10	Bundle of CAT 6 cables	Five cables which were held together using electrical tape was installed at the centre of the core with an annular gap of 5mm. The bundle of cables was protruded 500 mm from the exposed and unexposed sides. The bundle of cables was supported at 400 mm away from the unexposed side of the wall system.	A 60 mm Ø Boss PenoPatch was applied on the surface of the wall system around the bundle of cables on both exposed and unexposed sides.
11	Bundle of TPS cables	Three cables which were held together using electrical tape was installed at the centre of the core with an annular gap of 5mm. The bundle of cables was protruded 500 mm from the exposed and unexposed sides. The bundle of cables was supported at 400 mm away from the unexposed side of the wall system.	A 60 mm Ø Boss PenoPatch was applied on the surface of the wall system around the bundle of cables on both exposed and unexposed sides.

The test specimen achieved the results shown in Table 11:

Table 11 Results summary

Service No.	Integrity	Insulation	FRL
9	61*	61*	-/60/60
10	61*	31	-/60/30
11	61*	61*	-/60/60
*The test was terminated at 61 minutes			

7.2 TEST REPORT – 393094

Table 12 Information about test report

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire (UK), Lochend Industrial Estate, Newbridge, Midlothian EH28 8PL United Kingdom.
Test date	The fire resistance test was completed on 19/04/2018.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The test specimen comprised of 50 mm thick steel frame system cladded with two 12.5mm thick Gypsum 'Type F' plasterboard on both sides. The wall cavity was filled with 50 mm thick mineral wool insulation. Service penetrations 1 and 2, which included eight different penetration each, are referenced in this assessment report. Details of these services are given in Table 13.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

Table 13 Description of referenced test specimens

Service No.	Item No	Service Installation
1	1a	25mm × 25mm aperture filled with blank seal of 60 mm PenoPatch
	1b	25mm × 25mm aperture with a 'A1' cable penetration filled with 60 mm PenoPatch
	1c	25mm × 25mm aperture with a 'A2' cable penetration filled with 60 mm PenoPatch
	1d	25mm × 25mm aperture with a 'A3' cable penetration filled with 60 mm PenoPatch
	1e	25mm × 25mm aperture with a 'B' cable penetration filled with 60 mm PenoPatch
	1f	25mm × 25mm aperture with a steel 'H' conduit (Ø16mm with a thickness of 3.6mm) penetration filled with 60 mm PenoPatch
	1g	25mm × 25mm aperture with a PVC 'I' conduit (Ø16mm with a thickness of 1.0 mm) penetration filled with 60 mm PenoPatch
	1h	25mm × 25mm aperture with a 'E' cable penetration filled with 60 mm PenoPatch
2	2a	50 mm × 50 mm aperture with three 'A1' cable penetration filled with 100 mm PenoPatch
	2b	50 mm × 50 mm aperture with three 'A2' cable penetration filled with 100 mm PenoPatch
	2c	50 mm × 50 mm aperture with three 'A3' cable penetration filled with 100 mm PenoPatch
	2d	50 mm × 50 mm aperture with a 'B' cable penetration filled with 100 mm PenoPatch
	2e	50 mm × 50 mm aperture with filled with a blank seal of 100 mm PenoPatch

Service No.	Item No	Service Installation
	2f	50 mm × 50 mm aperture with a steel 'H' conduit (Ø16mm with a thickness of 3.6mm) penetration filled with 100 mm PenoPatch
	2g	50 mm × 50 mm aperture with a PVC 'I' conduit (Ø16mm with a thickness of 1.0 mm) penetration filled with 10 mm PenoPatch
	2h	50 mm × 50 mm aperture with a 'E' cable penetration filled with 100 mm PenoPatch

The test specimen achieved the results shown in Table 14:

Table 14 Results summary

Service No.	Item No.	Integrity Cotton pad	Sustained flame	Gap Gauge	Insulation
1	1a	132*	132*	132*	75
	1b	76	132*	132*	45
	1c	72	132*	132*	42
	1d	132*	132*	132*	60
	1e	132*	132*	132*	55
	1f	132*	132*	132*	28
	1g	77	132*	132*	68
	1h	132*	132*	132*	40
2	2a	69#	69#	69#	66
	2b	69#	69#	69#	51
	2c	69#	69#	69#	62
	2d	69#	69#	69#	52
	2e	63#	63#	63#	63
	2f	63#	63#	63#	17
	2g	63#	63#	63#	42
	2h	52	52	63#	51
*The test was terminated at 132 minutes # Specimen blanked off to allow the test to continue					