Fire Assessment Report

AR24091

Likely fire resistance of MACPRO FIRETEK AC ACRYLIC Sealant installed in various Penetration and Linear Gap systems

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Passive Fire Inspection and Test Services Limited
1/113 Pavilion Drive, Mangere, Auckland 2022, New Zealand
www.firelab.co.nz
tests@firelab.co.nz

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1.1 Document Revision Schedule

Revision #	Date	Description
1	22/07/2024	Initial issue for Client review

1.2 Signatories

Report	Name	Signature	Date
Prepared by:	Daniel De Jong		22/07/2024
Reviewed by:	Alexey Kokorin		22/07/2024
Authorised by:	Andrew Bain		22/07/2024

1.3 Contact Details

Accredited testing laboratory

Fire TS Lab - Passive Fire Inspection and Test Services Ltd

Accreditation Number - 1335

1/113 Pavilion Drive, Mangere, Auckland, 2022

New Zealand

Contact e-mail: tests@firelab.co.nz

Issued to:

Macsim Fastenings Pty Ltd

10 Wonderland Drive, Eastern Creek, NSW 2766

Australia

Contact e-mail: pdelaney@macsim.com.au

2. Introduction

The objective of the report is to assess the likely fire resistance of MACPRO FIRETEK AC ACRYLIC GREY installed in various Penetration and Linear Gap systems when tested in various vertical separating elements, if tested to AS1530.4-2014 and assessed to AS4072.1-2005.

The following variations were considered in the assessment:

- Different thicknesses of separating elements
- Different separating element types
- Maximum service dimensions

3. Test reports

The following test reports were considered in the assessment:

Test report #	Separating Element	Tested Specimens	Test Standard
PF20093	1 x 13mm FR Plasterboard Wall	2 x Linear Joints	AS 1530.4: 2014
PF21006	140mm Concrete Wall	4 x Linear Joints	AS 1530.4: 2014
PF21007	75mm Aerated Concrete Wall	4 x Linear Joints	AS 1530.4: 2014
PF21008	78mm Speedpanel Wall	6 x Penetrations	AS 1530.4: 2014
PF21009	1 x 16mm FR Plasterboard Wall	6 x Penetrations 1 x Linear Joint	AS 1530.4: 2014
PF21046	180mm Concrete Wall	1 x Penetration 3 x Linear Joints	AS 1530.4: 2014
PF22064	Two 1 x 16mm FR Plasterboard Walls	5 x Linear Joints	AS 1530.4: 2014
PF22076	2 x 13mm FR Plasterboard Wall	4 x Penetrations 1 x Linear Joint	AS 1530.4: 2014
PF22077	2 x 13mm FR Plasterboard Wall	10 x Penetrations	AS 1530.4: 2014

4. Product Summary

4.1 Sealant installation and specification

MACPRO FIRETEK AC ACRYLIC GREY (Formulation F023SDW01) is an acoustic & intumescent sealant which expands on exposure to heat to form a fire-resistant seal, preventing the spread of fire throughout a building. MACPRO FIRETEK AC ACRYLIC GREY properties are described as

- Suitable for interior/exterior use for greater versatility on site
- Fast skin formation for better rain resistance and less rework
- Excellent non-slump, tooling and finish for more effective sealing
- Green Building compliant and acoustically rated
- Faster setting so less chance of damage on site
- Superior flexibility eliminates cracking
- Non-sag formulation prevents slump and “bubbling”
- Very resistant to UV light, more so than polyurethane products.

The substrate must be clean, dry and free from dust. The substrate shall be free from large cracks, crumbling of substrate or blow-outs. Sealant shall be installed in accordance with the corresponding installation method as tested.

5. Assessment results

5.1 Linear gap seal installed in wall-wall Configuration

5.1.1 Plasterboard Wall

Separating element	Sealant Dimensions Width x Depth, mm	FRL
64mm Steel stud w/ 1x13mm FR Plasterboard each side	10 x 13	-/60/60
	20 x 13	-/60/60
2 x 64mm Steel stud w/ 1x16mm FR Plasterboard each side, R1.2 insulation in each cavity	5 x 16	-/90/90
	10 x 16	-/90/90
	15 x 16	-/90/90
	20 x 16	-/90/90
64mm Steel stud w/ 2x13mm FR Plasterboard each side	20 x 26	-/120/120

Sealant shall be installed to the depth of the plasterboard thickness on each side.

5.1.2 Rigid Wall

Sealant Dimensions Width x Depth, mm	Concrete wall	
	140mm	180mm
10 x 10	-/240/210	-/240/210
30 x 15	-/240/210	-/240/210
30 x 20	-/240/210	-/360/360
30 x 35*	-/240/210	-/360/360
50 x 20	-/240/210	-/240/210
50 x 30	-/240/210	-/360/360

*30 x 35mm seal shall be used when a stitch plate is included within the linear joint

5.1.3 Aerated Concrete Wall

Sealant Dimensions Width x Depth, mm	Minimum Thickness (T), mm
	75mm
10 x 10	-/120/90
20 x 10	-/120/90
30 x 15	-/120/120

5.2 Linear gap seal installed in wall-floor Configuration

5.2.1 Plasterboard Wall to Concrete Floor

Separating element	Sealant Dimensions Height x Depth, mm	FRL
92mm Steel stud w/ 1x16mm FR Plasterboard each side to concrete floor	40 x 16	-/90/60
2 x 64mm Steel stud w/ 1x16mm FR Plasterboard each side, R1.2 insulation in each cavity to concrete floor	40 x 16	-/90/90
64mm Steel stud w/ 2x13mm FR Plasterboard each side to concrete floor	40 x 26	-/120/120

5.2.2 Concrete Wall to Concrete Floor

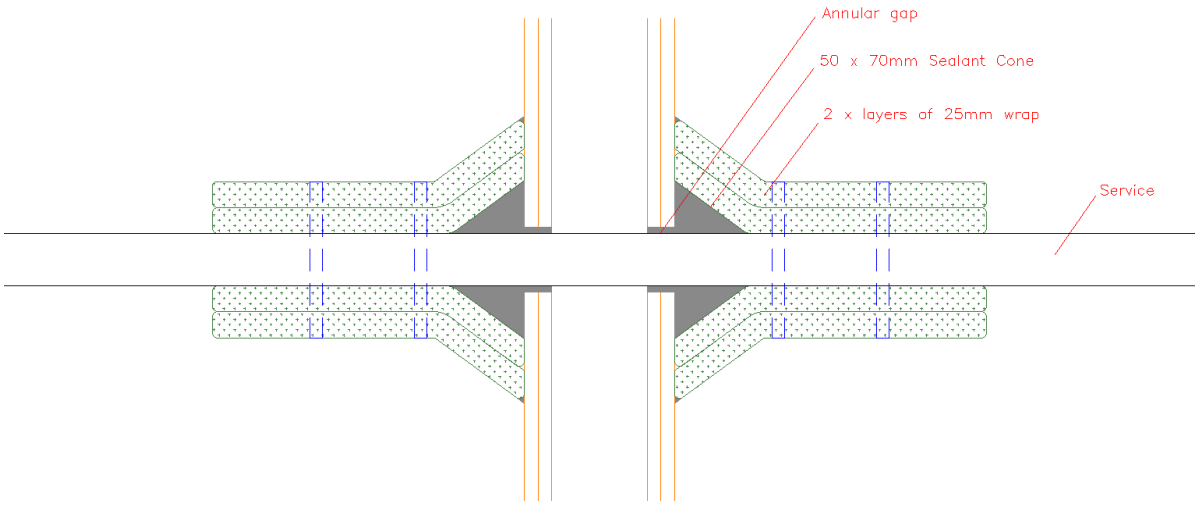
Sealant Dimensions Width x Depth, mm	Minimum Thickness (T), mm	
	140mm	180mm
20 x 10	-/240/210	-/240/210
40 x 30	-	-/360/360

5.2.3 Aerated Concrete Wall to Concrete Floor (Fire side exposure only)

Sealant Dimensions Width x Depth, mm	Minimum Thickness (T), mm
	75mm
20 x 10 (FS only)	-/120/120

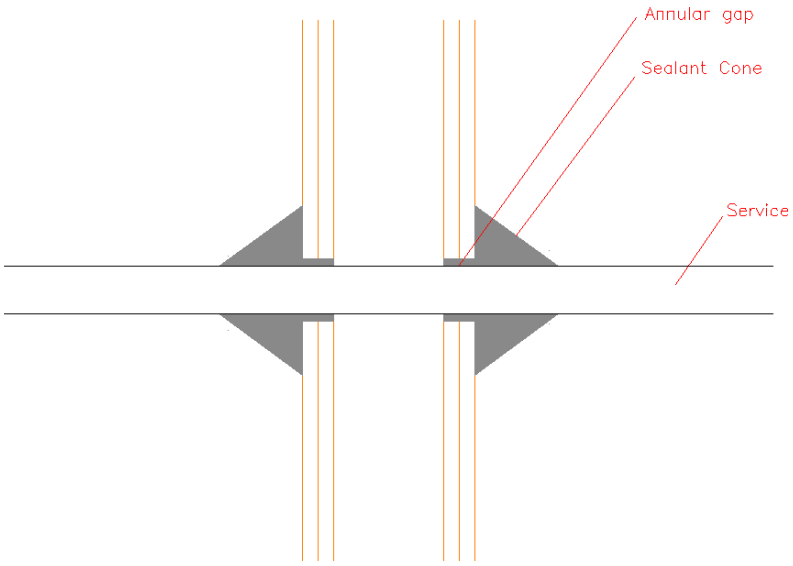
5.3 Penetrations in Vertical Separating Elements

5.3.1 Protection using sealant in annular gap with additional sealant cone and 2 x layers of wrap and 50 x 70mm



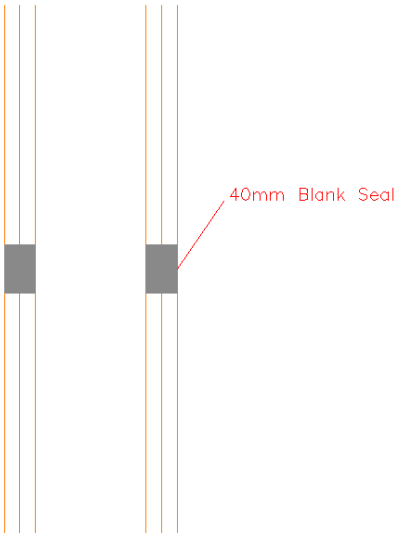
Separating element	Service Type	Service Dimension	Minimum Service Wall thickness	Minimum Wrap Length	Maximum Annular gap size	FRL
2 x 13mm FR Plasterboard + 64mm steel stud wall Minimum 116mm Concrete Wall	Steel Pipe	Up to 32NB	3.25mm	300mm	9mm	-/120/120
	Copper or Steel Pipe	Up to 32DN	1.25mm	300mm	1 mm	-/120/120
	Copper or Steel Pipe	Up to 100DN	2.25mm	300mm	1 mm	-/120/90
	Copper or Steel Pipe	Up to 150DN	2.5mm	300mm	1 mm	-/120/60
	D1 Cable Tray with Aluminium Cable	325mm x 55mm	-	300mm	63mm	-/120/120
	D2 Cable Tray	170mm x 120mm	-	300mm	20mm	-/120/120
180mm Concrete Wall	Steel Pipe	Up to 40NB	3.25mm	600mm	20mm	-/360/360

5.3.2 Protection using sealant in annular gap with additional sealant cone



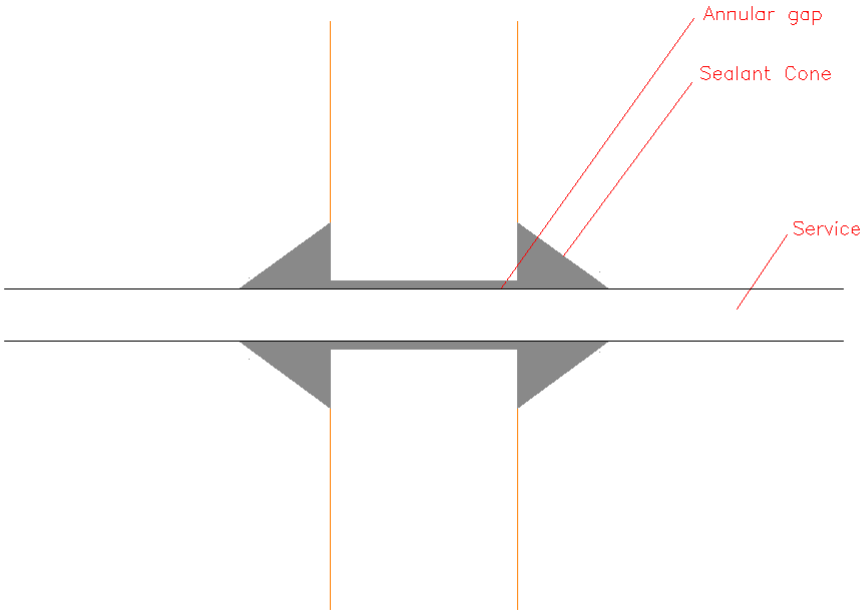
Separating element	Service Type	Service Dimension	Sealant Cone	Maximum Annular gap size	FRL
1 x 16mm FR Plasterboard + 92mm steel stud Wall Minimum 124mm Concrete Wall	Cable bundle	35mm	25 x 25mm	13mm	-/90/90
	Cable bundle	15mm	25 x 25mm	13mm	-/90/60
	PVC-U Pipe with Cables	32DN	25 x 25mm	48mm	-/90/90
	PEX Pipe	16DN	25 x 25mm	10mm	-/90/60
2 x 13mm FR Plasterboard + 64mm steel stud wall Minimum 116mm Concrete Wall	Cable bundle	Up to 35mm	50 x 70mm	15mm	-/120/120

5.3.3 Protection using sealant in annular gap



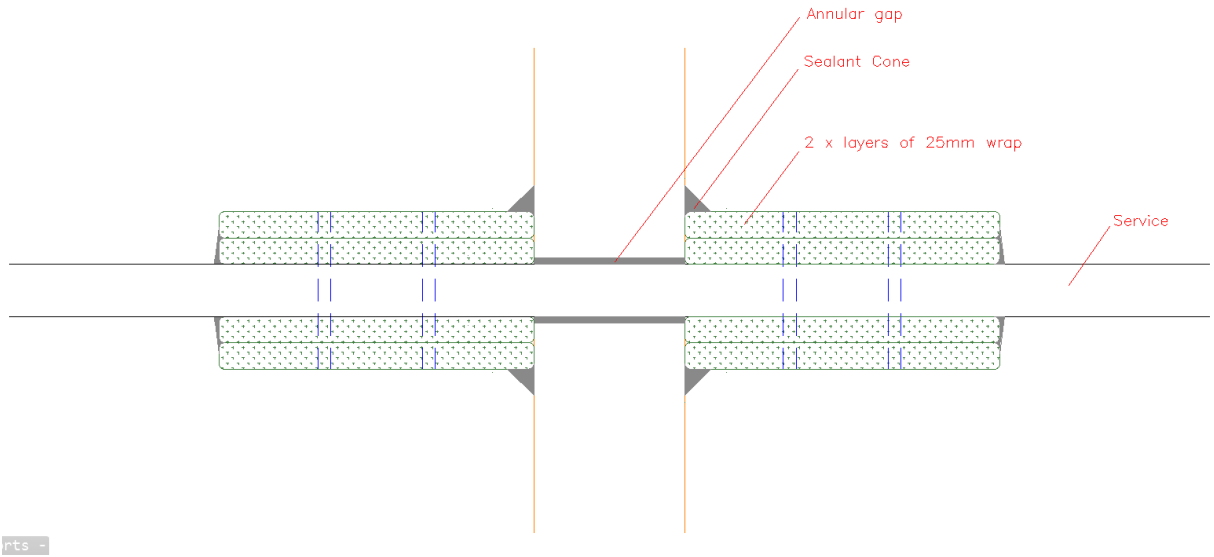
Separating element	Service Type	FRL
2 x 13mm FR Plasterboard + 64mm steel stud wall Minimum 116mm Concrete Wall	Up to 40mm Blank Seal	-/120/120

5.3.4 Protection using sealant in full depth of SE with additional Sealant Cone



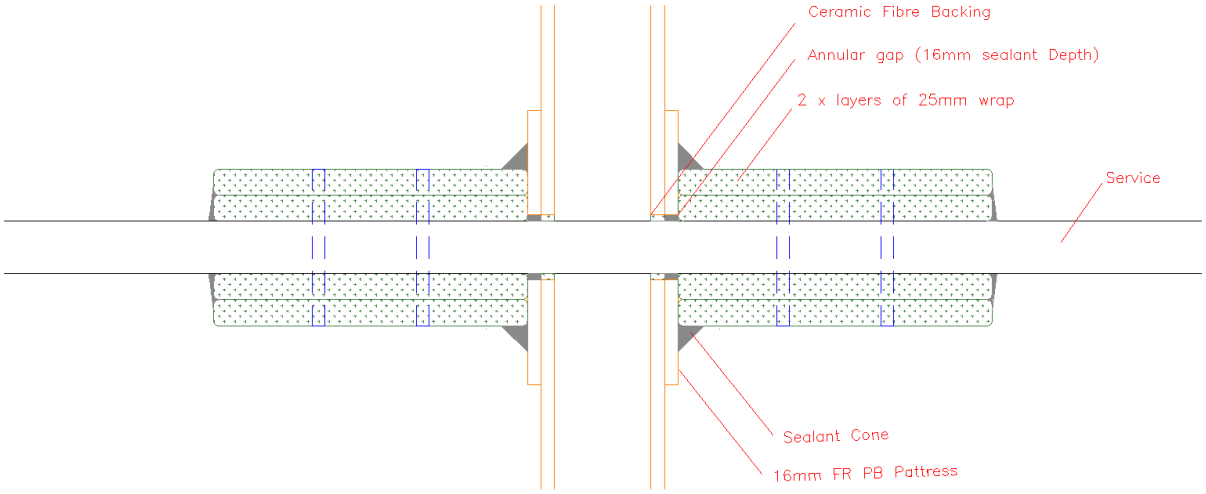
Separating element	Service Type	Service Dimension	Sealant Cone	Maximum Annular gap size	FRL
78mm Speedpanel Wall	Cable bundle	20mm	25 x 25mm	14mm	-/150/150
	PVC-U Pipe with Cables	20mm	25 x 25mm	4mm	-/150/150
	PVC-U Pipe with Cables	32DN	25 x 25mm	9mm	-/150/150

5.3.5 Protection using sealant in full depth of SE with 2x layers of wrap



Separating element	Service Type	Service Dimension	Minimum Service Wall thickness	Maximum Annular gap size	FRL
78mm Speedpanel Wall	Steel pipe	20NB	4.4mm	6mm	-/150/150
	Steel pipe	100NB	3.15mm	20mm	-/150/90

5.3.6 Protection using ceramic fibre backing, FR PB Pattress, sealant in annular gap and 2 x layers of wrap



Separating element	Service Type	Service Dimension	Minimum Wrap Length	Maximum Annular gap size	FRL
78mm Speedpanel Wall	D1 and D2 + assorted cable bundle + Pipe on Cable Tray	465mm x 115mm	600mm	60mm	-/150/120
1 x 16mm FR Plasterboard	D1 + D2 + assorted cable bundle + Pipe on Cable Tray	460mm x 110mm	600mm	60mm	-/90/90

6. Validity of the assessment

The assessment report is valid till 22/07/2029.

Any further variations with regards to size, construction details, stresses, edge or end conditions other than those identified in this report, may invalidate the conclusions drawn in this report.

This Assessment does not provide an endorsement by Fire TS Lab of the actual data provided.

The conclusions of this report may be used to directly assess the fire resistance performance under such conditions, but it should be acknowledged that a single test method will not provide a full assessment of the product under all fire conditions.

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

This Assessment can only, therefore, relate to the actual prototype test specimens, testing conditions and methodology provided in the supporting data and does not imply any performance abilities of constructions of subsequent manufacture.

This Assessment is based on the information provided and experience available at the time of writing. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement and it is recommended that this document be reviewed on or before the stated expiry date. 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 information contained in this document shall not be used for the assessment of variations other than those in the conclusions above. This document is valid providing no modifications are made to the systems described in this document.

All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

7. Authority

By using this document as evidence of compliance of performance, the applicant(s) confirms that;

• to their knowledge the component or element of structure which is the subject of this assessment has not been subjected to a fire test to the standard against which this assessment is being made, and;

• they agree to withdraw this assessment from circulation should the component or element of the structure be subject to a fire test by a recognized test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment and;

• 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 agree to ask the testing authority to withdraw the assessment.

Appendix A – Discussion

Permissible variations to the tested specimens

The following clauses from AS1530.4 are applicable to both linear joint systems and penetration systems:

- Results obtained from framed wall systems may be applied to the performance of a system in concrete, masonry or solid gypsum blocks of greater or equal thickness to that of the tested prototype. The reverse does not apply.
- Results obtained from framed wall systems may be applied to similar walls having studs of the same material with sizes greater than the tested prototype.

Throughout the range of tests, MACPRO FIRETEK AC ACRYLIC Sealant has demonstrated the ability to remain in place and maintain integrity for the duration of the test when installed in both concrete and plasterboard separating elements. It is considered reasonable to apply the results of plasterboard wall systems using MACPRO FIRETEK AC ACRYLIC Sealant to concrete separating elements. Therefore, the minimum concrete thickness for each penetration system has been included in the tables above.

The linear gap results obtained in the assessment are considered valid provided the following conditions and limitations are met.

- The concrete separating element shall be cleaned thoroughly so that there is no debris or dust prior to installation of the sealant
- There shall be no change in the cross-section of the joint over the length (that is, a single joint shall not have varying widths or varying depths of fire-stopping material)
- A facing material shall not be added to the fire-stopping system unless the facing material thickness is less than 2mm and has been subjected to a fire resistance test.
- The backing material shall not be varied from the tested fire-stopping system. Any variation shall be referred to the registered testing authority for confirmation that the backing material would not contribute to the fire resistance level of the tested system and will not reduce the fire resistance level
- Multiple seal systems shall have a spacing of not less than 200mm between seals.

Concrete wall - concrete wall linear joins

In test PF21046, a 30mm wide vertical linear joint over a stitch plate was tested. The length of the linear joint was 1200mm, with the stitch plate being located 200mm from the bottom of the linear joint. Due to the presence of the stitch plate the depth of the sealant varied along the joint. The depth of the sealant above and below the stitch plate was 20mm and 35mm ontop of the stitch plate. The thermocouples installed near the linear joint above and below the stitch plate did not exceed the insulation or integrity criteria during the test, demonstrating the sealant's ability to achieve an FRL of up to -/360/360 independent from the stitch plate. In the opinion of the laboratory the results of this specimen can be applied to 30x20mm linear joints without a stitch plate, and 30x35mm linear joints over the top of stitch plates.

In test PF21006 a range of vertical linear joints were tested installed to a 140mm concrete slab from both sides. All seals achieved an FRL of -/240/210. It is likely that an increase in sealant depth will not negatively affect the performance of the seal. The results for the 30x15mm vertical seal may be applied to 30x20mm and 30 x 35mm vertical seals in a 140mm concrete separating element. Similarly, the results for the 50x20mm vertical seal may be applied to 50x30mm.

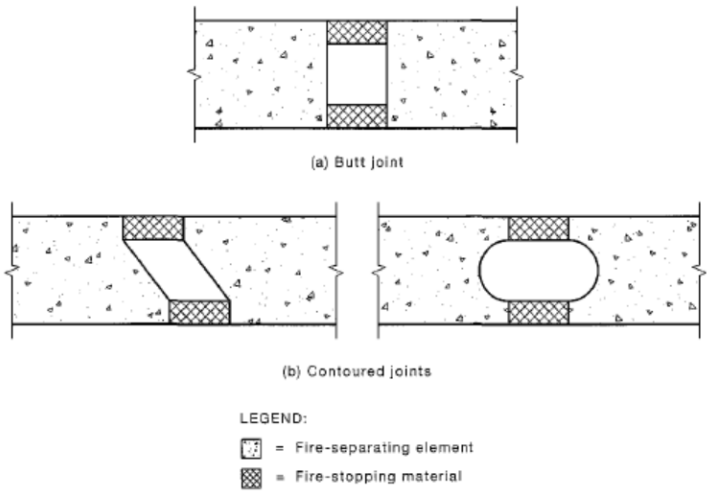
It is likely that an increase in separating thickness from 140mm to 180mm will not negatively affect the performance of the seal. The results for the 10x10mm, 30x15mm and 50x20mm linear joints installed in a 140mm concrete slab may be applied to linear joints installed in a 180mm slab.

Variation of separating element density

For elements manufactured from similar types of concrete or masonry, the result of the prototype test may be applied to materials of density within ±15% of the tested specimen. Therefore, seals may be installed in 75mm aerated concrete separating elements within the range of 433.5- 586.5kg/m3.

Application of seals in contoured joints.

AS1530.4 states the results obtained from a single test on a butt joint may be applied to contoured joints provided that the joints have equal width and equal or greater depth of sealant, and equal or greater thickness of the fire-separating element. Provided this condition is met, the joint-sealing system may be applied in the following configurations.



Blank seal in 2 x 13mm wall

In test PF22076 a 40mm blank seal was installed each side a 2 x 13mm plasterboard and steel stud wall, achieving an FRL of -/120/120. It is likely that if a blank seal was installed as a one-way system, it would also achieve an FRL of -/120/120. Furthermore, it is likely that blank seals less than 40mm diameter would also achieve an FRL of -/120/120.

Cable bundle in 2 x 13mm wall

In test PF22077 a range of cable penetrations were tested penetrating through a 2 x 13mm plasterboard and steel stud wall. All cable penetration was protected using MACPRO FIRETEK AC ACRYLIC Sealant, installed in the annular gap with a depth of 26mm (nominal). An additional sealant cone measuring 50mm x 70mm was applied between the service and separating element. The cable bundles ranged from a single cable up to a 35mm bundle. All tested cables were PVC sheathed with copper cores, with a maximum core size of 2.5mm^2. The annular gap between separating element and bundle ranged from 0mm up to 15mm. An analysis of test data revealed no significant variation in performance across the range of bundles, all of which achieved an FRL of -/120/120. Due to the amount of cable bundle combinations it is not possible to assess every possible cable bundle penetration. It is considered reasonable that single cables and bundles up to 35mm will achieve an FRL of -/120/120 if installed as tested, provided the following conditions are met:

- The annular gap shall be less than 15mm
- Each cable shall be less than 12mm diameter
- Cable shall be copper, with a maximum core size of 2.5mm^2

Metal Pipes in 2 x 13mm wall

In tests PF22076 and PF22077 a range of metal pipe penetrations were tested penetrating through a 2 x 13mm plasterboard and steel stud wall. All pipe penetrations were protected using a 50mm x 70mm MACPRO FIRETEK AC ACRYLIC Sealant cone applied between the service and separating element. If an annular gap between the pipe and the separating element was present, sealant was installed to a depth of 26mm. The pipes were then wrapped with two revolutions of 25mm ceramic wrap, overlapping itself by 150mm and extending 300mm from the separating element. A bead of sealant was applied between the wrap and the separating element.

The metal pipes tested followed the standard configuration highlighted in AS1530.4, except the 100DN brass pipe was substituted for a 100DN Copper pipe. Copper pipes of 150DN demonstrated the ability to achieve an FRL of up to -/120/60, while 100DN achieved an FRL of up to -/120/90, and DN32 Copper pipe achieved an FRL of up to -/120/120. All copper pipe penetrations had an annular gap of 0-1mm.

Additionally, a 32NB steel pipe was tested using the same installation method described above, but had an annular gap ranging from 7-9mm. The steel pipe achieved an FRL of -/120/120.

AS1530.4 states that results obtained with a penetration sealing system protecting the opening around copper or brass pipes may be applied to pipes of the same material and to ferrous metal pipes having outside diameters not greater than the tested diameter, and wall thicknesses not less than the tested thickness. Because the brass pipe was not tested in the standard configuration, test results are not applicable to brass pipes. Therefore, it is likely that copper and ferrous metal pipes can achieve FRLs in accordance with the table above.

Metal Pipes in concrete wall

In test PF21046, a 40NB steel pipe was installed penetrating through a 180mm concrete wall separating element with an annular gap ranging between 6-20mm. To protect the pipe, ceramic fibre backing was installed into the annular gap,30mm from each face. MACPRO FIRETEK AC ACRYLIC Sealant was installed on top of backing, flush with the separating element. The pipe was protected with two revolutions of 25mm ceramic wrap, overlapping itself by 150mm and extending 600mm (nominal) from the separating element. A 25mm cone of sealant was applied between the wrap and the separating element. A bead of sealant was installed between the wrap and the pipe and to any gaps in the end of the wrap. The penetration system achieved an FRL of -/360/360. In the opinion of the laboratory, it is likely that metal pipes having outside diameters not greater than the tested diameter, and wall thicknesses not less than the tested thickness will achieve an FRL up to -/360/360 if protected in the same method as tested.

Appendix B – Supporting Data

FTSL Test PF20093

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 03/12/2020. No departures from the testing method occurred.

A 92mm Steel stud and track wall, lined with 1 x 13mm FR Plasterboard was constructed to accommodate two linear gaps. Two studs were located 300mm from the edges of the refractory frame, faced back to back, and spaced 10 and 20mm apart. Plasterboard was installed over the studs on both sides of the frame, then trimmed to create 10 and 20mm gaps. PEF Rod was recessed 13mm from both sides, then filled with a bead of MACPRO FIRETEK AC ACRYLIC Sealant, flush with the surface of the plasterboard.

Specimen	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	10x13mm Vertical Control Joint	63 NF	63 NF	-/60/60
B	20x13mm Vertical Control Joint	63 NF	63 NF	-/60/60

The test was terminated at 63 minutes. No integrity or insulation failure was observed during the test.

FTSL Test PF21006

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 16/04/2021. No departures from the testing method occurred.

A 140mm concrete wall separating element was constructed using 5 concrete slabs to accommodate four linear gaps. One slab was fixed to the head of the refractory frame, with three slabs installed vertically below, creating a 10mm, 30mm and 50mm vertical linear joints, and a 20mm horizontal linear joint. Various sizes of PEF Rod were recessed into the respective joints from both sides, then filled with a bead of MACPRO FIRETEK AC ACRYLIC Sealant, flush with the surface of concrete. This resulted in 10x10mm, 30x15mm and 50x20mm vertical joints, and a 20x10mm horizontal joint

C	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	10x10mm Vertical Control Joint	244 NF	223	-/240/210
B	30x15mm Vertical Control Joint	244 NF	226	-/240/210
C	50x20mm Vertical Control Joint	244 NF	238	-/240/210
D	20x10mm Horizontal Control Head Joint	244 NF	226	-/240/210

The test was terminated at 244 minutes. No integrity failure was observed during the test.

For specimens A to D, insulation failure was recorded by thermocouples attached to the separating element, 25mm from the seal. The maximum temperature recorded in the centre of the separating element was 161 degrees at 244 minutes.

FTSL Test PF21007

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 12/04/2021. No departures from the testing method occurred.

A 75mm aerated concrete and concrete slab wall separating element was constructed using 1 concrete slab and 4 aerated concrete panels to accommodate four linear gaps. The slab was fixed to the head of the refractory frame, with three panels installed vertically below, creating a 10mm, 20mm and 30mm vertical linear joints, and a 20mm horizontal linear joint. Various sizes of PEF Rod were recessed into the respective joints from both sides for vertical joints and fire side for horizontal joints, then filled with a bead of MACPRO FIRETEK AC ACRYLIC Sealant, flush with the surface of the panels. This resulted in 10x10mm, 20x10mm and 30x15mm vertical joints, and a 20x10mm horizontal joint

Specimen	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	Symmetrical 10x10mm Vertical Control Joint	125 NF	108	-/120/90
B	Symmetrical 20x10mm Vertical Control Joint	125 NF	94	-/120/90
C	Symmetrical 30x15mm Vertical Control Joint	125 NF	125NF	-/120/120
D*	Fire side only 20x10mm Horizontal Control Head Joint	125 NF	122	-/120/120

*** - asymmetrical one-way system, the rating applied if exposed to fire as tested.**

The test was terminated at 125 minutes. No integrity failure was observed during the test.

For specimens A and B, insulation failure was recorded by thermocouples attached to the sealant.

For specimen D, insulation failure was recorded by thermocouples attached to the separating element, 25mm from the seal

The maximum temperature recorded in the centre of the separating element was 143 degrees at 125 minutes.

FTSL Test PF21008

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 04/08/2021. No departures from the testing method occurred.

A 78mm Speedpanel wall separating element was constructed using 5 Speedpanels installed into a C-channel perimeter. Once installed, apertures were cut from the separating element to accommodate a range of services, including steel pipes, PVC pipes, cable bundles and a cable tray. MACPRO FIRETEK AC ACRYLIC Sealant was installed into each aperture. Cable bundle protection included an additional cone of sealant. Steel pipe protection included ceramic fibre wrap installed around the service, extending 300mm from the separating element. Cable tray protection included a 16mm FR Plasterboard pattress and ceramic fibre wrap installed around the service, extending 300mm from the separating element. Specimens E and F were excluded from this assessment due to a product included in the penetration system being discontinued.

Specimen	Description	Actual Integrity (min)	Actual insulation (min)	FRL*
A	20mm PVC-U Pipe with Cables	172 NF	162	-/150/150
B	25DN Steel Pipe	172 NF	167	-/150/150
C	32mm PVC-U Pipe with Cables	172 NF	172 NF	-/150/150
D	100DN Steel Pipe	172 NF	107	-/150/90
G	D1 and D2 cable configuration with plastic pipe and Cable Bundle on the Cable Tray	170	137	-/150/120
H	20mm Cable Bundle	172 NF	161	-/150/150

The test was terminated at 125 minutes. Integrity failure was observed at specimen G, where an open flame was visible for > 10 seconds between the separating element and the service.

For specimen A, insulation failure was recorded by thermocouples attached to the sealant cone.

For specimen B, insulation failure was recorded by thermocouples attached to the separating element.

For specimen D, insulation failure was recorded by thermocouples attached to the steel pipe.

For specimen F, insulation failure was recorded by thermocouples attached to the PEX Pipe.

For specimen G, insulation failure was recorded by thermocouples attached to the ceramic wrap at the bottom of the cable tray

For specimen H, insulation failure was recorded by thermocouples attached to the cable bundle.

FTSL Test PF21009

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 02/08/2021. No departures from the testing method occurred.

A plasterboard and steel stud separating element was constructed using 92mm steel stud, 92mm deflection head track, 16mm USG Boral plasterboard and a 140mm concrete lintel. The concrete lintel was installed to the top of the refractory frame, then steel track was fixed to the lintel and bottom of the refractory frame. Steel stud was installed between the tracks then plasterboard was installed measuring 40mm below the lintel to form a linear gap. Once installed, apertures were cut from the separating element to accommodate a range of services, including steel pipes, PVC pipes, PEX pipes, cable bundles and a cable tray.

MACPRO FIRETEK AC ACRYLIC Sealant was installed into each aperture. Cable bundle and PEX pipe protection included an additional cone of sealant. Cable tray protection included a 16mm FR Plasterboard pattress and ceramic fibre wrap installed around the service, extending 300mm from the separating element. Specimen C was excluded from this assessment due to a product included in the penetration system being discontinued

Specimen	Description	Actual Integrity (min)	Actual insulation (min)	FRL*
A	32DN PVC-U Pipe with Cables	124 NF	95	-/90/90
B	35mm Cable Bundle	124 NF	91	-/90/90
D	32DN Pe-Xa Pipe	29	15	-/-/-
E	15mm Cable Bundle	124 NF	82	-/90/60
F	D1 + D2 + assorted cable bundle + Pipe on Cable Tray	124 NF	96	-/90/90
G	16DN Pe-Xa Pipe	124 NF	88	-/90/60
H	40mm Deflection Head Seal	124 NF	80	-/90/60

***The specimen FRL performance is limited to the -/90/90 performance of the separating element.**

The test was terminated at 124 minutes. Integrity failure was observed at specimen D, where an open flame was visible for > 10 seconds at the service next to the aperture.

For specimens A, B, E, F, G and H, insulation failure was recorded by thermocouples attached to the separating element.

For specimen C, insulation failure was recorded by thermocouples attached to the sealant cone at the bottom of the pipes.

For specimen D, insulation failure was recorded by thermocouples attached to the PEX Pipe.

FTSL Test PF21046

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 06/08/2021. No departures from the testing method occurred.

A concrete wall separating element was constructed using 4 concrete slabs to accommodate four linear gaps. A slab was fixed to the head of the refractory frame, with three slabs installed vertically below, creating 30mm and 50mm vertical linear joints, and a 40mm horizontal linear joint. Along the 30mm vertical joint, a rectangular section of the concrete slabs was removed to accommodate a 10mm steel plate held in place with M12 x 1.25 threaded rod and nuts and 35mm depth of RLA Penapatch LW Repair Mortar on both sides of the separating element. An aperture was cut from a concrete slab to accommodate a steel pipe. Various widths and lengths of polystyrene rod were recessed into the respective joints from both sides, then filled with a bead of MACPRO FIRETEK AC ACRYLIC Sealant, flush with the surface of the slabs. This resulted in 50x30mm and 30x20mm vertical joints, and a 40x30mm horizontal joint

Specimen	Description	Actual Integrity (min)	Actual Insulation (min)	FRL
A	40x30mm horizontal linear joint	360 NF	360 NF	-/360/360
B	50x30mm vertical linear joint	360 NF	360 NF	-/360/360
C	30mm vertical linear joint with stich plate	360 NF	360 NF	-/360/360
D	40DN Steel Pipe	360 NF	360 NF	-/360/360

The test was terminated at 360 minutes. No integrity or insulation failure was observed during the test.

FTSL Test PF22064

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 11/11/2022. No departures from the testing method occurred.

A concrete lintel and two separate 64mm steel stud/track wall, lined with 1 x 16mm FR plasterboard on each side was constructed below a 140mm concrete lintel. To construct each steel stud wall, 2 x studs faced back to back were installed at 250mm centres, with 5mm, 10mm, 15mm and 20mm linear gaps within the steel frame. This was repeated for both steel stud frames. Insulation was installed in each cavity, and the spacing between the two steel stud frames was 20mm. Plasterboard was installed short of the lintel, resulting in a 40mm gap between the top of the plasterboard and lintel. Plasterboard was trimmed to reveal 5mm, 10mm, 15mm and 20mm linear gaps. PEF Rod was recessed 16mm from both sides, then filled with a bead of MACPRO FIRETEK AC ACRYLIC Sealant, flush with the surface of the plasterboard.

Specimen	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	5x16mm Vertical Linear Gap seal	93 NF	93 NF	-/90/90
B	10x16mm Vertical Linear Gap seal	93 NF	93 NF	-/90/90
C	15x16mm Vertical Linear Gap seal	93 NF	93 NF	-/90/90
D	20x16mm Vertical Linear Gap seal	93 NF	91	-/90/90
E	40mm Horizontal Linear Gap seal	93 NF	93 NF	-/90/90

The test was terminated at 93 minutes. No integrity failure was observed during the test.

For specimen C, insulation failure was recorded by thermocouples attached to the linear joint sealant.

FTSL Test PF22076

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 27/02/2023. No departures from the testing method occurred.

A 64mm steel stud frame, lined with 2 x 13mm FR plasterboard on each side was constructed. Steel studs were installed to accommodate a vertical linear gap, cable trays, copper pipe and a blank seal. Two studs were installed back to back spaced 20mm apart prior to lining the wall. Plasterboard was cut out along the studs to reveal a 20mm linear gap. Additional penetrations for D1 and D2 cable tray configurations, copper pipe and blank seal were cut. All services were protected using MACPRO FIRETEK AC ACRYLIC Sealant and/or ceramic fibre blanket.

Specimen	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	D2 cable configuration	123 NF	123 NF	-/120/120
B	D1 cable configuration	123 NF	123 NF	-/120/120
C	40mm blank seal	123 NF	123 NF	-/120/120
D	DN32 Copper pipe	123 NF	123 NF	-/120/120
E	20mm Vertical Linear Gap seal	123 NF	123 NF	-/120/120

The test was terminated at 123 minutes. No integrity or insulation failure was observed during the test.

FTSL Test PF22077

The test was conducted as per AS 1530.4-2014 Section 10 – Service Penetrations and Control Joints and AS 4072.1-2005 - Service Penetrations and Control Joints on 27/02/2023. No departures from the testing method occurred.

A 64mm steel stud frame, lined with 2 x 13mm FR plasterboard on each side was constructed and installed below a 150mm concrete slab lintel. Steel studs were installed to accommodate a horizontal linear gap along the lintel, cable bundles, copper pipes and a steel pipe. A deflection head track was installed directly to the lintel and bottom of the refractory frame, with studs between. The plasterboard was trimmed and installed 40mm below the lintel, resulting in a 40mm horizontal linear gap on top of the deflection head track.

Additional penetrations for 5 x cable bundles, 2 x copper pipes and 1 x steel pipe were cut. All services were protected using MACPRO FIRETEK AC ACRYLIC Sealant and/or ceramic fibre blanket.

Specimen	Joint	Actual Integrity (min)	Actual Insulation (min)	FRL
A	40mm horizontal linear gap	123 NF	123 NF	-/120/120
B	20mm Cable Bundle	123 NF	123 NF	-/120/120
C	DN150 Copper pipe	123 NF	70	-/120/60
D	DN100 Copper pipe	123 NF	96	-/120/90
E	Single Cable	123 NF	123 NF	-/120/120
F	5mm Cable Bundle	123 NF	123 NF	-/120/120
G	35mm Cable Bundle	123 NF	123 NF	-/120/120
H	32 NB Steel pipe	123 NF	123 NF	-/120/120
I	20mm Cable Bundle	123 NF	123 NF	-/120/120
J	35mm Cable Bundle	123 NF	123 NF	-/120/120

The test was terminated at 123 minutes. No integrity failure was observed during the test.

For specimen C and D, insulation failure was recorded by thermocouples attached to the copper pipe.