



Fire assessment report

Metal pipes protected with BOSS Maxi collars, UniWrap, FirePillows-240, P40-MAK wrap and FireMastic-300 to AS 1530.4:2014

Sponsor: BOSS Products (Australia) Pty Ltd

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Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of copper, steel and iron pipes penetrating various wall separating elements and concrete floors – if tested in accordance with AS 1530.4:2014 and assessed in general accordance with AS 4072.1:2005 (R2016).

BOSS Maxi collar is a pipe closure device used to form penetration seals where combustible pipes, cables and metal pipes with insulation penetrate walls and floors.

BOSS P40-MAK wrap is an insulation wrap for protecting metallic services penetrating various separating elements.

BOSS Batt is identified as a high-density mineral fibre board that has an ablative coating.

BOSS FireMastic-300[™] is identified as a flexible acrylic intumescent sealant.

BOSS FirePillows-240 consists of woven cloth fabric cases filled with fire-retardant mineral wool / rock wool and are typically used to seal large apertures with penetrating services in floor and wall systems to maintain their fire resistance.

Thermobreak Tube is a flexible closed cell, physically crosslinked polyolefin foam in tubular form, with factory applied reinforced foil facing.

The vertical separating elements may include steel framed fire-rated plasterboard lined walls, shaftliner/shaftwalls, concrete, solid or hollow masonry, AFS, AAC/Hebel walls, Speedpanel walls, Korok walls, Pronto Panel walls and Supapanel walls – provided that these separating elements have been tested to achieve the required FRL. The separating element can be built up with BOSS Batts, fire-rated plasterboard, calcium silicate board and Shaftliner as outlined in Table 1 – provided that the build-up options have been tested to achieve the required FRL.

The analyses in sections 5 and 6 of this report found that the proposed variations identified in Table 1 are likely to achieve the outcomes shown in Table 2 and Table 3, if tested in accordance with AS 1530.4:2014.

Item	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
1.	Minimum 96 mm thick flexible or rigid wall Minimum116mm thick flexible or rigid wall	32 mm–159 mm	FRT180472 R2.0 and FSP 1833	Tested system in FRT180472 R2.0 included a 50 mm diameter copper pipe with continuous Thermobreak lagging. It penetrated a Ø120 mm aperture in a 116 mm thick framed wall. The annular gap was nominally 5 mm. It was protected with the following systems.	 Copper, steel or iron pipes with continuous Thermobreak lagging may be used. The annular gap must not exceed 5 mm. The annular gap must be filled with Boss Firemastic-300 to a depth not less than 5 mm on both sides.

Table 1Variations to tested systems



ltem	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
		32 mm–159 mm		 The annular gap between the service and the separating element was filled with BOSS FireMastic-300[™] to a depth of 5 mm and finished flush on both sides. BOSS 100 mm MaxiCollar[™] Collars were installed on both sides and fixed to the separating element with screws and washers. A layer of BOSS P40-MAK wrap was wrapped around the pipe lagging and extended 300 mm from the separating element on both sides. 	 In the case of rigid walls with BOSS Batt build-up, 2 mm thick BOSS FireMastic-300[™] must be applied on the interface between the BOSS Batt and the separating rigid wall. BOSS MaxiCollar[™] must be provided on each side of the wall, fixed to the underlying wall system with screws and washers/ pig tail screws, as appropriate. BOSS UniWrap can be used as an alternative to MaxiCollar[™] for integrity performance – combined with P40-MAK wrap for insulation. For uninsulated copper, steel and iron pipes, annular gap must be filled with Boss Firemastic-300 to at least 26 mm on each side finished with a 20 mm × 20 mm fillet. P40-MAK Wrap needs to be fully pushed up to
	Rigid walls with build-up on one or both sides (Minimum thickness of 96 mm for -/90/90 and minimum thickness of 116 mm for -/120/120).		FRT180472 R2.0 and FRT180473 R1.0	Tested system in FRT180473 R1.0 included an 80 mm diameter copper pipe with continuous Thermobreak lagging. It penetrated a Ø180 aperture in a 75 mm Hebel wall. The wall was built-up with 50 mm thick BOSS Batts on either side. The annular gap was nominally 0 mm. It was protected with the following systems.	 Proference of the separating element and tied up with metal wires at 100 mm spacings. The first tie must be not more than 50 mm from the surface of the separating wall element. Pipe diameters between 32 mm ≤ D ≤ 50 mm P40-MAK Wrap must extend to a minimum distance of 300 mm from the separating element on both sides. Pipe diameters between 50 mm < D ≤ 159 mm
				 2 mm thick BOSS FireMastic- 300[™] was applied on the interface between the BOSS Batt and the separating element The annular gap between the service and the separating element was filled with BOSS FireMastic-300[™] to a depth of 5 mm and finished flush on both sides. BOSS 150 mm MaxiCollar[™] Collars were installed on both sides and fixed to the BOSS Batts with pig tail screws. 	 P40-MAK Wrap must extend to a minimum distance of 600 mm from the separating element on either side. Separating elements may include steel framed fire-rated plasterboard lined walls, shaftliner/shaftwalls, concrete, solid or hollow masonry, AFS, AAC/Hebel walls, Speedpanel walls, Korok walls, Pronto Panel walls and Supapanel walls – provided that these separating elements have been tested to achieve an established FRL of - /90/90 for pipe diameters up to 50 mm and - /120/120 for pipe diameters from 50 mm to 159 mm.



ltem	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
				 A layer of BOSS P40-MAK Wrap was wrapped around the pipe lagging and extended 300 mm from the separating element on both sides. 	 The separating element can be built up with BOSS Batts, fire-rated plasterboard, Calcium Silicate board or Shaftliner on one or both sides of the wall – provided that the build-up options have been tested to achieve a fire performance of at least 90 minutes if used with 300 mm of P40-MAK wrap on both sides of the separating element or at least 120 minutes if used with 600 mm of P40-MAK wrap on both sides of the separating element. The aperture can be protected with 2 layers of 50 mm thick BOSS Batts.
	Minimum 140 mm thick rigid wall	32 mm–100 mm	FAS190042 R1.2		• Bare metal pipes to be protected with BOSS FirePillows-240 together with P40-MAK wrap extended 300 mm from the exposed side and 600 mm from the unexposed side. The annular gap between the metal pipes and the pillow must be filled with FM-300 as assessed in FAS190042 R1.2.
2.	Minimum 150 mm thick concrete slab	32 mm-159 mm	FRT180472 R2.0, FRT180473 R1.0, and FSP 1833 and FRT180137 R2.0	 FRT180137 R2.0 included a ComFlor[®] 60 floor system. The annular gap was nominally 1 mm. The annular gap between the service and the separating element was filled with BOSS FireMastic-300[™] to a depth of 25 mm and finished with 10 mm × 10 mm fillet on both the exposed and unexposed sides. There was no BOSS P40-MAK Wrap insulation wrapping the service on the unexposed side of the floor. 	 Copper, steel or iron pipes with or without continuous Thermobreak lagging may be used The annular gap must not exceed 5 mm. The annular gap must be filled with Boss Firemastic-300TM to a depth not less than 25 mm on both sides and finished with a 10 mm × 10 mm fillet on the unexposed side BOSS Maxi collar must be provided on the bottom side, fixed directly to the concrete soffit using masonry anchors. For uninsulated metal pipes, the annular gap must be filled with Boss Firemastic-300 TM to a depth not less and finished with a 10 mm × 10 mm fillet on the separating element and tied up with metal wires at 100 mm spacings. The first tie must be not more than 50 mm from the surface of the separating wall element.



ltem	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
		32 mm-159 mm		WF 359904 issue 2 included a 150 mm thick concrete floor system. The aperture was protected by two layers of 50 mm thick batts identical to Boss batts. A 159 mm × 2mm copper was installed in the batt and gap between the copper pipe and the batt was filled with sealant identical to Boss Firemastic-300 [™] .	 For metal pipes with 32 mm diameter, the P40-MAK Wrap must extend to a minimum distance of 300 mm from the separating element on the unexposed (top) side. For metal pipes with diameter between 32 mm < D ≤ 159 mm, the P40-MAK Wrap must extend to a minimum distance of 600 mm from the separating element on the unexposed (top) side. The aperture can be protected with 2 layers of 50 mm thick BOSS Batts.
		32 mm–100 mm			• Bare metal pipes to be protected with BOSS FirePillows-240 with P40-MAK Wrap wrapped twice around the pipes, and extended 600 mm from the unexposed side, pushed up to the separating element, over the fillet of FireMastic- 300.

Table 2 Summary of assessment outcomes for Thermobreak lagged and unlagged copper, steel or iron pipes penetrating walls

Wall type	Target FRL	Minimum wall thickness required	BOSS P40-MAK Wrap length	Pipe diameter	
Framed walls or rigid walls (Rigid walls may	-/90/90	96 mm	300 mm on both exposed and	32 mm < D** ≤ 80 mm	
be with or without build-up*)	-/120/120	116 mm	unexposed sides		
Framed walls or rigid walls (Rigid walls may	-/90/90	96 mm	600 mm on both exposed and	80 mm < D ≤ 159 mm	
be with or without build-up*)	-/120/120	116 mm	unexposed sides		
Framed or rigid walls with the aperture	-/90/90	96 mm	300 mm on both exposed and	32 mm < D ≤ 80 mm	
protected with BOSS Batts	-/120/120	116 mm	unexposed sides		
Framed or rigid walls with the aperture	-/90/90	96 mm	600 mm on both exposed and	80 mm < D ≤ 159 mm	
protected with BOSS Batts	-/120/120	116 mm	unexposed sides		
Rigid walls with BOSS FirePillows-240, FireMastic-300 with radiation guard.	-/180/180	140 mm	-	32 mm < D ≤ 100 mm⁺	
Rigid walls with BOSS FirePillows-240, FireMastic-300 and P40-MAK wrap	-/180/120	140 mm	300 mm on the exposed side and 600 mm from the unexposed side	32 mm < D ≤ 100 mm⁺	



Table 3	Summary	v of assessment outcomes for	Thermobreak lagged an	d unlagged copper.	steel or iron r	pipes penetrating	a concrete floors
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Target FRL	Minimum floor thickness required	BOSS P40-MAK Wrap length on unexposed side	Pipe diameter
-/120/120	150 mm	300 mm	32 mm
-/120/120	150 mm	600 mm	32 mm < D ≤ 159 mm
-/120/120	150 mm – aperture protected with BOSS Batts	300 mm	32 mm
-/120/120	150 mm – aperture protected with BOSS Batts	600 mm	32 mm < D ≤ 159 mm
-/180/180	150 mm – with BOSS FirePillows-240, FireMastic-300 and radiation guard.	600 mm	32 mm < D ≤ 100 mm⁺
-/180/120	150 mm – with BOSS FirePillows-240, FireMastic-300 and P40-MAK wrap	600 mm	32 mm < D ≤ 100 mm⁺

*The build-up options must be tested to achieve the required FRL

**D – Outer diameter of copper pipe

⁺ 100 mm diameter metal pipe with a minimum wall thickness of 1.8 mm

Thermobreak tube thermal insulation lagging thickness to be 30 mm to 50 mm in both walls and floors.

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 7 of this report. The results of this report are valid until 30 September 2025.

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1. Introduction

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of copper, steel and iron pipes penetrating flexible and rigid walls – with and without build up – and concrete floors if tested in accordance with AS 1530.4:2014¹. The assessment is conducted in general accordance with AS 4072.1:2005 (R2016)².

This assessment was carried out at the request of BOSS Products (Australia) Pty Ltd. The sponsor details are included in Table 4.

Table 4 Sponsor detail

Sponsor	Address
BOSS Products (Australia) Pty Ltd	Unit 1, 16 Atkinson Road Taren Point NSW 2229 Australia

2. Framework for the assessment

2.1 Assessment approach

An assessment is an opinion about the likely performance of a component or element of structure if it was subject to a standard fire test.

No specific framework, methodology, standard or guidance documents exists in Australia for doing 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 2019³.

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 will 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.

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 based on the tested constructions and performances obtained. The assessment is an evaluation of the potential fire resistance performance if the elements were to be tested in accordance with AS 1530.4:2014.

This assessment has been written using appropriate test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been deemed appropriate to support the manufacturer's stated design.

¹ Standards Australia, 2014, Methods for fire tests on building materials, components and structures: Fire-resistance tests for elements of construction, AS 1530.4:2014, Standards Australia, NSW

 ² Standards Australia, 2005, Components for the protection of openings in fire-resistant separating elements: Service penetrations and control joints, AS 4072.1:2005 (R2016), Standards Australia, NSW
 ³ Passive Fire Protection Forum (PFPF) 2019, Guide to undertaking technical assessments of the fire performance of construction products

³ Passive Fire Protection Forum (PFPF) 2019, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.



2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the evidence of suitability requirements of the National Construction Code Volumes One and Two – Building Code of Australia (NCC) 2019 Amendment 1⁴ under A.5.2.(1) (d) and 2016 under specification A2.3, including amendments.

This assessment has been written in accordance with the general principles outlined in EN 15725:2010⁵ for extended application reports on the fire performance of construction products and building elements. It also references test evidence for meeting a performance requirement or deemed to satisfy (DTS) provisions of the NCC under A5.4 for fire resistance levels as applicable to the assessed systems.

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 10 August 2020, BOSS Products (Australia) Pty Ltd confirmed 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.
- 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.
- 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. Limitations of this assessment

• The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.1.

This report details the methods of construction, test conditions and assessed results that are expected if the systems were tested in accordance with AS 1530.4:2014.

- The results of this assessment are applicable to copper, steel and iron pipes only.
- For steel framed, plasterboard lined walls and rigid walls, the FRLs are prescribed for fire exposure from either side.
- For concrete floor slabs, FRL is prescribed for fire exposure from below only.
- In all cases, the annular gap between the aperture in the separating wall/floor element and the Thermobreak lagging must not exceed 5 mm.
- For steel framed, plasterboard lined walls and rigid walls, the annular gap must be protected with Boss Firemastic-300[™] to a minimum depth of 25 mm on either side.
- For concrete slabs, the annular gap must be protected with Boss Firemastic-300[™] to a minimum depth of 26 mm on either side.
- For steel framed, plasterboard lined walls and rigid walls, the outer diameter of the pipes range between 32 mm \leq D \leq 159 mm.
- For concrete slabs, the outer diameter of the pipes range between $32 \text{ mm} \le D \le 159 \text{ mm}$.
- This report is only valid for the assessed system/s for this project and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses,

⁴ National Construction Code Volume One – Building Code of Australia 2019 Amendment 1, Australian Building Codes Board, Australia.
⁵ European Committee for Standardization, 2010, Extended application reports on the fire performance of construction products and building elements, EN 15725:2010, European Committee for Standardization, Brussels, Belgium.



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).

- The documentation that forms the basis for this report is listed in Appendix B.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be 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 the expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.

4. Description of the specimen and variations

4.1 System description

4.1.1 Separating elements

The assessment addresses insulated and uninsulated metal pipes penetrating both wall and floor separating elements. With respect to walls, the following two configurations are considered.

- Minimum 96 mm thick plasterboard walls consisting at least a single layer of 16 mm thick fire rated plasterboard typical target FRL of -/90/90.
- Minimum 116 mm thick plasterboard walls consisting at least two layers of 13 mm thick fire rated plasterboard typical target FRL of -/120/120.

However, for each of the above two cases, the wall separating element used in practice must have been tested or assessed to achieve the required FRL by an accredited testing laboratory.

Rigid walls conforming to the above minimum overall wall thicknesses are also applicable. The vertical separating elements may also include shaftliner/shaftwalls, concrete, solid or hollow masonry, AFS, AAC/Hebel walls, Speedpanel walls, Korok walls, Pronto Panel walls and Supapanel walls – provided that these separating elements have been tested to achieve the required FRL.

Rigid separating elements can be built up with BOSS Batts, fire-rated plasterboard, Calcium Silicate board and Shaftliner – provided that the build-up options have been tested to achieve the required FRL.

With respect to floors, this assessment considers minimum 150 mm thick normal weight concrete floors.

4.1.2 Service penetrations

This assessment considers insulated and uninsulated copper, steel or iron pipes penetrating the separating elements specified in section 4.1.1.

- The pipe diameters considered for wall applications range between 32 mm \leq D \leq 159 mm.
- The pipe diameter considered for the floor application is $32 \text{ mm} \le D \le 159 \text{ mm}$.

4.1.3 Fire protection to the penetration seal

The proposed systems include the following products/systems for fire protection.

Metal pipes insulated with Thermobreak lagging:

- BOSS MaxiCollar[™] collars with collar diameters up to 250 mm.
- BOSS UniWrap insulation wrap
- BOSS P40-MAK Wrap either on both sides (for walls) or only on the unexposed side (for floors) with different lengths depending on the application.
- BOSS FireMastic-300[™] sealant providing protection to the annular gap.
- BOSS Batts, fire-rated plasterboard, Calcium Silicate board and Shaftliner to build up rigid walls around the aperture.

Bare metal pipes:

- BOSS FirePillows-240 with annular gap between the metal pipes and pillow filled with Boss-Firemastic 300 as assessed in FAS 190042.
- BOSS Batts, fire-rated plasterboard, Calcium Silicate board and Shaftliner to build up around the aperture.
- BOSS P40-MAK Wrap either on both sides (for walls) or only on the unexposed side (for floors) with different lengths depending on the application.

4.2 Referenced test/assessment data

The assessment of the variation to the tested system and the determination of the likely performance is based on the results of the fire tests and assessments documented in the reports summarised in Table 5. Further details of the tested/assessed systems are included in Appendix B.

Report number	Sponsor	Test/issued date	Testing authority
FRT180472 R2.0	BOSS Fire & Safety P/L	08/03/2019	Warringtonfire Australia
FRT180473 R1.0	BOSS Fire & Safety P/L	12/03/2019	Warringtonfire Australia
FRT180137 R2.0	BOSS Fire & Safety P/L	07/03/2019	Warringtonfire Australia
FSP 1833	BOSS Fire & Safety P/L	09/05/2017	CSIRO Infrastructure Technologies
WF 359904 Issue 2	FSi Limited	15/12/2015	Warringtonfire UK
R001874	FSi Limited	23/07/2019	Efectis Nederland
WF349353	FSi Limited	23/03/2015	Warringtonfire UK
WF 350178	FSi Limited	11/03/2015	Warringtonfire UK
FAS190042 R1.2	Boss Products Australia Pty Ltd	01/10/2020	Warringtonfire Australia

 Table 5
 Referenced test/assessment data





4.3 Variations to the tested systems

An identical system has not been subject to a standard fire test. We have therefore assessed the system using baseline test information for similar systems. The variations to the tested systems – together with the referenced standard fire tests – are described in Table 6.

ltem	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
1.	Minimum 96 mm thick flexible or rigid wall 32 mm – 159 mm FRT180472 R2.0 and FSP 1833 Tested system mm diameter or Thermobreak la aperture in a 11 gap was nomin following syster Minimum116mm thick flexible or rigid wall The annular separating 6 FireMastic-3 finished flus BOSS 100 n installed on separating 6	 Tested system in FRT180472 R2.0 included a 50 mm diameter copper pipe with continuous Thermobreak lagging. It penetrated a Ø120 mm aperture in a 116 mm thick framed wall. The annular gap was nominally 5 mm. It was protected with the following systems. The annular gap between the service and the separating element was filled with BOSS FireMastic-300[™] to a depth of 5 mm and finished flush on both sides. BOSS 100 mm MaxiCollar[™] Collars were installed on both sides and fixed to the separating element with screws and washers. A layer of BOSS P40-MAK wrap was wrapped around the pipe lagging and extended 300 mm from the separating element on both sides. 	 Copper, steel or iron pipes with continuous Thermobreak lagging may be used. The annular gap must not exceed 5 mm. The annular gap must be filled with Boss Firemastic-300 to a depth not less than 5 mm or both sides. In the case of rigid walls with BOSS Batt build-up 2 mm thick BOSS FireMastic-300TM must be applied on the interface between the BOSS Batt and the separating rigid wall. BOSS MaxiCollarTM must be provided on each s of the wall, fixed to the underlying wall system w screws and washers/ pig tail screws, as appropriate. BOSS UniWrap can be used as an alternative to MaxiCollarTM for integrity performance – combin with P40-MAK wrap for insulation. 		
	Rigid walls with build-up on one or both sides (Minimum thickness of 96 mm for - /90/90 and minimum thickness of 116 mm for - /120/120).		FRT180472 R2.0 and FRT180473 R1.0	 from the separating element on both sides. Tested system in FRT180473 R1.0 included an 80 mm diameter copper pipe with continuous Thermobreak lagging. It penetrated a Ø180 aperture in a 75 mm Hebel wall. The wall was built-up with 50 mm thick BOSS Batts on either side. The annular gap was nominally 0 mm. It was protected with the following systems. 2 mm thick BOSS FireMastic-300TM was applied on the interface between the BOSS Batt and the separating element The annular gap between the service and the separating element was filled with BOSS FireMastic-300TM to a depth of 5 mm and finished flush on both sides. 	 With P40-MAK wrap for insulation. For uninsulated copper, steel and iron pipes, annular gap must be filled with Boss Firemastic-300 to at least 26 mm on each side finished with a 20 mm × 20 mm fillet. P40-MAK Wrap needs to be fully pushed up to the face of the separating element and tied up with metal wires at 100 mm spacings. The first tie must be not more than 50 mm from the surface of the separating wall element. Pipe diameters between 32 mm ≤ D ≤ 50 mm distance of 300 mm from the separating element on both sides. Pipe diameters between 50 mm < D ≤ 159 mm

Table 6Variations to tested systems



Item	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations		
				 BOSS 150 mm MaxiCollar[™] Collars were installed on both sides and fixed to the BOSS Batts with pig tail screws. A layer of BOSS P40-MAK Wrap was wrapped around the pipe lagging and extended 300 mm from the separating element on both sides. 	•	 P40-MAK Wrap must extend to a minimum distance of 600 mm from the separating element on either side. Separating elements may include steel framed firerated plasterboard lined walls, shaftliner/shaftwalls, concrete, solid or hollow masonry, AFS, AAC/Hebel walls, Speedpanel walls, Korok walls, Pronto Panel walls and Supapanel walls – provided that these separating elements have been tested to achieve an established FRL of - /90/90 for pipe diameters up to 50 mm and - /120/120 for pipe diameters from 50 mm to 159 mm. The separating element can be built up with BOSS Batts, fire-rated plasterboard, Calcium Silicate board or Shaftliner on one or both sides of the wall – provided that the build-up options have been tested to achieve a fire performance of at least 90 minutes if used with 300 mm of P40-MAK wrap on both sides of the separating element. 	
					•	The aperture can be protected with 2 layers of 50 mm thick BOSS Batts.	
	Minimum 140 mm thick rigid wall	32 mm – 100 mm	FAS190042 R1.2		•	Bare metal pipes to be protected with BOSS FirePillows-240 together with P40-MAK wrap extended 300 mm from the exposed side and 600 mm from the unexposed side. The annular gap between the metal pipes and the pillow must be filled with FM-300 as assessed in FAS190042 R1.2.	
2.	Minimum 150 mm thick concrete slab	32 mm - 159 mm	FRT180472 R2.0, FRT180473 R1.0, FSP 1833 and FRT180137 R2.0	FRT180137 R2.0 included a ComFlor [®] 60 floor system. The annular gap was nominally 1 mm.	•	Copper, steel or iron pipes with or without continuous Thermobreak lagging may be used The annular gap must not exceed 5 mm. The annular gap must be filled with Boss Firemastic-300 [™] to a depth not less than 25 mm on both sides and finished with a 10 mm × 10 mm fillet on the unexposed side	



ltem	Wall system	Pipe diameter	Reference test	Description of tested specimens	Variations
		32 mm – 100 mm		 The annular gap between the service and the separating element was filled with BOSS FireMastic-300[™] to a depth of 25 mm and finished with 10 mm × 10 mm fillet on both the exposed and unexposed sides. There was no BOSS P40-MAK Wrap insulation wrapping the service on the unexposed side of the floor. WF 359904 issue 2 included a 150 mm thick concrete floor system. The aperture was protected by two layers of 50 mm thick batts identical to Boss batts. A 159 mm × 2mm copper was installed in the batt and gap between the copper pipe and the batt was filled with sealant identical to Boss Firemastic-300[™]. 	 BOSS Maxi collar must be provided on the bottom side, fixed directly to the concrete soffit using masonry anchors. For uninsulated metal pipes, the annular gap must be filled with Boss Firemastic-300 ™ to a depth not less than 25 mm on both sides and finished with a 10 mm × 10 mm fillet on the exposed side. P40-MAK Wrap needs to be fully pushed down to the face of the separating element and tied up with metal wires at 100 mm spacings. The first tie must be not more than 50 mm from the surface of the separating wall element. For metal pipes with 32 mm diameter, the P40-MAK Wrap must extend to a minimum distance of 300 mm from the separating element on the unexposed (top) side. For metal pipes with diameter between 32 mm < D ≤ 159 mm, the P40-MAK Wrap must extend to a minimum distance of 50 mm thick BOSS Batts. Bare metal pipes to be protected with 2 layers of 50 mm thick BOSS Batts. Bare metal pipes, and extended 600 mm from the unexposed side, pushed up to the separating element, over the fillet of FireMastic-300.

* The wall system must have been tested or assessed to achieve an FRL of -/90/90 in accordance with AS 1530.4:2014. A flexible wall must consist of minimum 64 mm stud cladded with at least a single layer of 16 mm fire rated plasterboard on each side.

⁺ The wall system must have been tested or assessed to achieve an FRL of -/120/120 in accordance with AS 1530.4:2014. A flexible wall must consist of minimum 64 mm stud cladded with at least two layers of 13 mm fire rated plasterboard on each side.



4.4 **Purpose of the test**

AS 1530.4:2014 sets out the methods for conducting fire tests on building materials, components and structures. Specifically, section 2 of this standard contains the general requirements for these tests. Section 10 addresses service penetrations such as pipes.

AS 4072.1:2005 (R2016) sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems.

4.5 Schedule of components

Table 7 outlines the schedule of components for the assessed systems subject to a fire test, as referenced in Appendix B.

Table 7Schedule of components of assessed wall systems (to be read in conjunction with
Figure 1 to Figure 10)

ltem	Description			
Separating e	lement			
1.	Item name	Wall separating element (no build-up)		
	Installation	For -/90/90 applications – minimum	m 96 mm thick walls	
		• For -/120/120 applications - minimum 116 mm thick walls		
		Options include flexible walls with 64 minimum one layer of 16 mm thick fire 64 mm deep stud and frame with min rated plasterboard (116 mm thick), sh solid/hollow masonry, AFS, AAC/Heb For all cases, the wall system must ha achieve the required FRL in accordan	mm deep stud and frame with e rated plasterboard (96 mm thick), imum two layers of 13 mm thick fire aftwall / shaftliner, concrete, el walls. ave been tested or assessed to ace with AS 1530.4:2014.	
2.	Item name	Wall separating element (with build-u	p)	
	Installation	Thin walls such as Speedpanel, Koro walls and Supapanel walls with build- thickness for an FRL of -/90/90 and a an FRL of -/120/120.	k, AAC/Hebel walls, Pronto Panel up to achieve a minimum 96 mm minimum of 116 mm thickness for	
Build-up on	separating element			
3.	Item name	Fire-stopping build-up		
	Product name	BOSS Bulkhead Batts, FR plasterboard, Calcium Silicate board, Shaftwall / Shaftliner		
	Size	Minimum 100 mm clearance from the perimeter of the Thermobreak lagging.		
	Nominal density	A minimum of 7 kg/m ³		
	Installation The thinner wall separating elements are to be build-up on either one both sides to achieve a minimum 96 mm thickness for an FRL of -/90 and a minimum of 116 mm thickness for an FRL of -/120/120.			
Services				
4.	Item name	Copper, steel or iron pipe		
	Pipe outer diameter (D)	For walls	32 mm ≤ D ≤ 159 mm	
5.	Item name	Pipe lagging		
	Product name	Thermobreak Tube Thermal Insulatio	n lagging.	
	Size (Lagging)	Typical thickness (t)	30 mm ≤ t ≤ 50 mm	

ltem	Description	
Wrap		
6.	Item name	Insulation wrap
	Product name	BOSS P40-MAK Wrap
	Overall size	300 mm or 600 mm wide \times 40 mm thick
		 In the case of services penetrating framed or rigid walls, the wrap is installed on both the exposed and the unexposed sides of the wall system
		 For pipe diameters (D) in the range of 32 mm ≤ D ≤ 80 mm, the length of the wrap is 300 mm.
		 For pipe diameters (D) in the range of 80 mm < D ≤ 159 mm, the length of the wrap is 600 mm.
		 For pipe diameters in the range of 32 mm <d≤159 length="" mm,="" of<br="" the="">the wrap is 600 mm.</d≤159>
	Nominal mineral fibre wool density	40 kg/m ³
	Installation	The wraps are secured with metal wire at approximately 100 mm spacing, with the first wire not more than 50 mm from the face of the separating element.
Fire-stopping	g protections	
7.	Product name	BOSS MaxiCollar [™] Collar – diameter ranging from 50 mm to 250 mm Or BOSS UniWrap [™]
	Installation	The collars are installed on both the exposed and the unexposed side of the wall system with fixings. BOSS UniWrap installed over Thermobreak lagging and flushed onto both faces of the separating element.
8.	Item name	BOSS Batt
	Product name	BOSS Bulkhead Batts
	Size	Minimum 100 mm clearance from the perimeter of the Thermobreak lagging.
	Nominal density	7 kg/m ³
	Installation	For AAC walls, the BOSS Batts are installed on both the exposed and the unexposed side of the separating wall element. They are secured by four 14-10 \times 100 mm Bugle head screw with washer.
Sealant		
9.	Product name	BOSS FireMastic-300 [™]
	Nominal density	Nominal 1560 kg/m ³
	Installation	For framed walls and rigid walls fill BOSS FireMastic-300 TM in the annular gap to a depth of 5 mm between the service and the wall on both sides. The mastic is then finished flush on both the exposed and the unexposed side.
Fixings		
10.	Item name	Collar fixing
	Product name	- For plasterboard walls, use 6 g \times 25 mm plasterboard screws with 25 mm washers or as appropriate based on the collar size
		 For rigid walls, use 14 – 10 × 65 mm Hex Head screws or as appropriate based on the collar size to direct fix the collar to the separating wall

Item	Description	
		 For rigid and plasterboard walls with BOSS Batt build-up, use Ø9 mm × 52 mm long pig tail screws to fix the collar to the BOSS Batt
	Installation	$3\times$ screws are used to secure each BOSS MaxiCollar^TM to the separating element. $4\times$ screws to be used for large collars
11.	Item name	BOSS Batt fixing
	Product name	$14 - 10 \times 100$ mm Bugle head screws with washer
	Installation	$4\times\mbox{screws}$ and washers used to secure each BOSS Batt to the separating element
Fire Pillows		
12.	Item name	Fire Pillows
	Product name	BOSS FirePillows-240
	Pillow dimensions	Type 100: 100 mm \times 200 mm \times 40 mm (Measured), Mass = 0.1295 kg
		Type 200: 200 mm \times 200 mm \times 50 mm (Measured), Mass = 0.3080 kg
		Type 300: 300 mm \times 200 mm \times 60 mm (Measured), Mass = 0.5125 kg

Table 8Schedule of components of assessed floor systems (to be read in conjunction with
Figure 11 to Figure 17)

ltem	Description					
Separating e	Separating element					
1.	Item name	Concrete slab conforming to AS 3600	Concrete slab conforming to AS 3600:2018 Incorporating Amendment 1 ⁶			
	Minimum thickness	150 mm				
	Nominal density	2400 kg/m ³				
Services						
2.	Item name	Copper, steel or iron pipe				
	Pipe outer diameter (D)	For floors	32 mm ≤ D ≤ 159 mm			
3.	Item name	Pipe lagging				
	Product name	Thermobreak Tube Thermal Insulation lagging.				
	Size (Lagging)	Typical thickness (t)	30 mm ≤ t ≤ 50 mm			
Wrap	·					
4.	Item name	Item name Insulation wrap				
	Product name	BOSS P40-MAK Wrap				
	Overall size	300 mm or 600 mm wide × 40 mm thick				
		For pipe diameters in the range of 32 mm <d≤159 600="" extended="" is="" length="" mm="" mm,="" of="" on="" side.<="" td="" the="" unexposed="" wrap=""></d≤159>				
	Nominal mineral fibre wool density	40 kg/m ³				
	Installation	The wraps are secured with metal wir with the first wire not more than 50 mi element.	e at approximately 100 mm spacing, m from the face of the separating			

⁶ Standards Australia, 2014, Concrete structures, AS 3600:2018 (Incorporating Amendment No. 1), Standards Australia, NSW

ltem	Description	
Fire-stopping	g protections	
5.	Product name	BOSS MaxiCollar [™] Collar – diameter ranging from 50 mm to 250 mm Or BOSS UniWrap [™]
	Installation	A single collar is installed on the unexposed side of the floor system with fixings. BOSS UniWrap installed over Thermobreak lagging and flushed onto both faces of the separating element.
6.	Item name	BOSS Batt
	Product name	BOSS Bulkhead Batts
	Size	Minimum 100 mm clearance from the perimeter of the Thermobreak lagging.
	Nominal density	7 kg/m ³
	Installation	For floors, the BOSS Batts are installed within the aperture of the separating floor element. They are secured by four $14-10 \times 100$ mm Bugle head screw with washer.
Sealant		
7.	Product name	BOSS FireMastic-300 [™]
	Nominal density	Nominal 1560 kg/m ³
	Installation	For concrete floors, fill BOSS FireMastic-300 [™] in the annular gap to a depth of 25 mm between the service and the floor on both sides. The mastic is then finished flush on both the exposed and the unexposed side.
Fixings		
8.	Item name	Collar fixing
	Product name	For concrete floors, use masonry anchors Ø 6 mm \times 30 mm
	Installation	$3\times$ screws are used to secure each BOSS MaxiCollar^TM to the separating element. $4\times$ screws to be used for large collars
9.	Item name	BOSS Batt fixing
	Product name	$14 - 10 \times 100$ mm Bugle head screws with washer
	Installation	$4\times\mbox{screws}$ and washers used to secure each BOSS Batt to the separating element
Fire Pillows		
10.	Item name	Fire Pillows
	Product name	BOSS FirePillows-240
	Pillow dimensions	Type 100: 100 mm \times 200 mm \times 40 mm (Measured), Mass = 0.1295 kg Type 200: 200 mm \times 200 mm \times 50 mm (Measured), Mass = 0.3080 kg Type 300: 300 mm \times 200 mm \times 60 mm (Measured), Mass = 0.5125 kg



Figure 1 to Figure 10 show the assessed systems in wall seperating elements.



Figure 1 Thermobreak lagged steel / copper / iron pipes in walls – With UniWrap and P40-MAK wrap



Figure 2 Thermobreak lagged steel / copper / iron pipes in walls – With UniWrap, P40-MAK wrap and BOSS Batt



Figure 3 Thermobreak lagged steel / copper / iron pipes in walls – With UniWrap, P40-MAK wrap and one-sided build-up



Figure 4 Thermobreak lagged steel / copper / iron pipes in walls – With P40-MAK wrap and BOSS MaxiCollar





Figure 5 Thermobreak lagged steel / copper / iron pipes in walls – With P40-MAK wrap, BOSS MaxiCollar and BOSS Batt



Figure 6 Thermobreak lagged steel / copper / iron pipes in walls – With P40-MAK wrap, BOSS MaxiCollar and build-up















Figure 9 Unlagged steel / copper / iron pipes in walls – With P40-MAK wrap and build-up



Figure 10 Unlagged steel / copper / iron pipes in walls – With P40-MAK wrap and BOSS FirePillows-240



Figure 11 to Figure 17 show the assessed systems in floor seperating elements.



Figure 11 Thermobreak lagged steel / copper / iron pipes in floors – With UniWrap



Figure 12 Thermobreak lagged steel / copper / iron pipes in floors – With UniWrap and BOSS Batt





Figure 13 Thermobreak lagged steel / copper / iron pipes in floors – With P40-MAK wrap and BOSS MaxiCollar



Figure 14 Thermobreak lagged steel / copper / iron pipes in floors – With P40-MAK wrap, BOSS MaxiCollar and BOSS Batt





Figure 15 Unlagged steel / copper / iron pipes in floors – With P40-MAK wrap



Figure 16 Unlagged steel / copper / iron pipes in floors – With P40-MAK wrap and BOSS FirePillows-240





Figure 17 Unlagged steel / copper / iron pipes in floors – With P40-MAK wrap and BOSS Batt

5. Assessment of metal pipes penetrating steel framed, plasterboard lined walls and rigid walls

5.1 Description of variation

This assessment addresses the variations to the tested systems identified below.

- Insulated and uninsulated metal pipes penetrating steel framed, plasterboard lined walls and rigid walls. Rigid walls may consist of additional build-up on one or both sides.
- The pipe material may be copper, steel or iron.
- The pipe outer diameters (D) may vary between 32 mm \leq D \leq 159 mm.
- The maximum annular gap is 5 mm. It is filled to a depth of at least 26 mm on either side using BOSS FireMastic-300[™] for uninsulated pipes and 5 mm for insulated pipes.
- Depending on the FRL and the diameter of the pipe, BOSS P40-MAK Wrap length may be either 300 mm or 600 mm and will extend on both the exposed and unexposed sides.
- UniWrap insulation wrap to be used as an alternative to BOSS MaxiCollar[™] collars for lagged/insulated pipes.
- In large apertures, uninsulated metal pipes in walls to be protected with BOSS batts or BOSS FirePillows-240 in conjunction with P40-MAK Wrap.

5.2 Methodology

The method of assessment used is summarised in Table 9.

Table 9 Method of assessment

Assessment method		
Level of complexity	Complex assessment	
Type of assessment	Qualitative and comparative	

5.3 Assessment

5.3.1 Discussion of relevant test results

Evidence from test report FRT180472 R1.0

The wall separating element in the test report FRT180472 R1.0 consisted of a 64 mm deep steel frame with two layers of 13 mm thick fire rated plasterboards on either side. Thus, the overall thickness of the wall amounted to 116 mm.

Service A in FRT180472 R1.0 consisted of a 50 mm outer diameter copper pipe with a wall thickness of 1.5 mm. It had continuous 30 mm thick Thermobreak lagging such that the overall outer diameter of the service was 110 mm. The aperture in the wall was 120 mm in diameter and the annular gap was nominally 5 mm. This annular gap was sealed with BOSS FireMastic- 300TM to the depth of 5 mm on either side. It was protected with BOSS 100 mm MaxiCollarTM collars installed on both sides and fixed to the separating element with screws and washers.

Measured temperature data from FRT180472 R1.0 showed that the thermocouples located 25 mm away from the service on the unexposed surface of the plasterboard wall, those located 25 mm away from the unexposed surface of the wall on the surface of the P40-MAK Wrap, and those located on the Thermobreak pipe lagging further away from the separating wall on the unexposed side recorded an initial temperature peak which went up to around 90°C after 10 minutes. This could be related to the shrinkage of the pipe lagging. However, the BOSS MaxiCollar[™] activated and closed off the gap formed by this shrinkage such that the temperatures soon reduced to around 40°C. After this, they showed a gradual increase with time.



None of the thermocouples located in accordance with AS 1530.4:2014 section 10, exceeded the maximum threshold for insulation failure within 120 minutes. However, it appears that the expansion of the intumescent strip within the MaxiCollarTM on the unexposed side caused the P40-MAK Wrap to slip and move away from the separating wall gradually during the course of the test. Consequently, the application of the roving thermocouple near the collar body after 104 minutes revealed insulation failure to have occurred due to exceeding the maximum threshold temperature in accordance with AS 1530.4:2014. Therefore, the tested 50 mm diameter copper pipe was assigned an FRL of -/120/90 by the test report.

FRT180472 R1.0 also consisted of a 150 mm outer diameter uninsulated copper pipe in a 170 mm diameter aperture. The pipe wall thickness was 2 mm. The annular gap amount to 10 mm. This annular gap was filled with BOSS FireMastic-300[™] to a depth of 26 mm (full depth of plasterboards) and finished with a 20 mm × 20 mm mastic fillet on either side of the wall. There was no MaxiCollar[™] or P40-MAK Wrap used as additional protection. When tested, the 150 mm diameter copper pipe maintained an integrity for 120 minutes. However, the temperatures of the pipe on the unexposed side exceeded the threshold for insulation failure after 10 minutes. Hence, an FRL of -/120/0 was assigned to the tested pipe by the test report.

Evidence from test report FSP 1833

The wall separating element in the test report FSP 1833 consisted of a 64 mm deep steel frame with a single layer of 16 mm thick fire rated plasterboard on either side. Thus, the overall thickness of the wall amounted to 96 mm.

It consisted of a 150 mm diameter uninsulated copper pipe within a 150 mm diameter aperture. The pipe wall thickness was 1.02 mm. Thus, the annular gap is likely to have been very small, possibly nearing 0 mm. Thus, no sealant was applied within the annular gap. The surface seal around the pipe was created with a 50 mm fillet of BOSS FireMastic-300[™] sealant on the exposed and unexposed faces. Two layers of BOSS P40-MAK Wrap were wrapped approximately twice around the copper pipe to a thickness of 40 mm and were secured with steel wires and foil tape. The wrap extended 300 mm from the exposed face and 600 mm from the unexposed face, flush with the FireMastic-300[™] fillets.

The tested system maintained integrity and insulation in accordance with AS 1530.4:2014 for at least 91 minutes. The test was terminated after 92 minutes. Consequently, the test report assigned an FRL of -/90/90 to the tested uninsulated 150 mm diameter copper pipe. The temperatures measured on the copper pipe 25 mm away from the wrap on the unexposed side (approximately 625 mm away from the unexposed face of the separating element) showed a peak at approximately 35 minutes. After this, the temperature dropped gradually and after around 50 minutes, it started to increase gradually till the termination of the test. It is likely that the FireMastic-300[™] sealant provided adequate protection to prevent the formation of any through gaps within the annular gap.

Evidence from test report FRT180473 R1.0

An 80 mm diameter copper pipe with 50 mm thick Thermobreak lagging, penetrating a 75 mm Hebel autoclaved aerated concrete (AAC) wall that was additionally built-up using 50 mm thick BOSS Batts fitted to either side of the separating wall element, was tested in FRT180473 R1.0. 2 mm thick BOSS FireMastic – 300[™] was applied on the interface between the BOSS Batt and the separating element. The pipe wall thickness was 1.7 mm. The thickness of the lagging was 54.5 mm. The overall outer diameter of the service was approximately 186 mm. The wall aperture was 180 mm in diameter. Given that the aperture size was almost similar to the external diameter of the insulated pipe, the annular gap was nominally 0 mm. The annular gap between the service and the BOSS Batt was filled with BOSS FireMastic-300[™] to a depth of 5 mm and finished flush on both sides. The BOSS 150 mm MaxiCollar[™] Collar had compressed the Thermobreak lagging for a total of 20 mm. A layer of BOSS P40-MAK Wrap wrapped around the pipe lagging and extended 300 mm from the separating element on both sides. This wrap was secured using steel wires at approximately 50 mm, 150 mm and 250 mm from the separating wall. The specimen tested in accordance with AS 1530.4:2014 achieved an FRL of -/120/120.



Evidence from test reports R001874 and WF 349353

In test report R001874, the test specimen consisted of a 3900 mm \times 3000 mm \times 100 mm standard lightweight plasterboard faced steel stud partition wall with an established FRL of -/90/90. There was a total of 5 penetration seals tested.

Non-combustible pipes tested included copper pipes mounted in the multiple penetration seals and in the flexible wall (single services). The services pertaining to this assessment report are 1.b, 6, 7, 8 and 9. Service 1.b, 7 and 9 had a nominal outer diameter of 159 mm whereas, services 6 and 8 had a nominal outer diameter of 42 mm.

The copper pipes were insulated with varying thicknesses of Armaflex AF and sealed with PipeBloc EL pipe wraps which has a thickness of 2 mm per layer and a depth of 40 mm. The pipe wraps were placed flush to both the exposed and unexposed sides. The pipe wraps were held in place with tie wraps during installation and were removed before the fire test. The annular space was filled with Pyrocoustic sealant. This PipeBlock EL wrap is identical to BOSS UniWrap which is installed in a similar manner. All services considered achieved an integrity performance of at least 120 minutes.

In test report WF 349353, the test specimen comprised of a 3000 mm \times 3035 mm \times 100 mm thick dry wall system. The wall incorporated sixteen circular apertures, each penetrated by a range of plastic pipes sealed utilizing two-layer pipe wrap 'PipeBloc PWP', which is identical to BOSS UniWrap. The pipe wraps were fitted so that they were flush with both the unexposed and exposed faces. A single bead of Pyrocoustic sealant was applied over the wraps to seal them in. The thicknesses of the PipeBloc PWP changed from 2 mm to 8 mm and 10 mm based on the specimen. The width of the wrap was 40 mm.

Evidence from assessment report FAS190042 R1.2

In FAS190042 R1.2, based on test evidence, a Ø100 mm copper pipe with a minimum wall thickness of 1.8 mm, penetrating a minimum 140 mm thick concrete block wall or masonry wall was assessed. The pipe penetrated a 600 mm wide (or greater) \times 400 mm high aperture and was protected with BOSS FirePillow-240 as the primary fire protection.

As a secondary fire protection, Firemastic-300 sealant was used to fix the pillows, and applied length wise along the 200 mm edge of the pillows. The sealant is also used to fix pillows to the separating element and to fill in gaps between pillows and services. The FireMastic-300 fire rated sealant must be applied to the depth of the annular gap between the service and the separating element with a 20 mm \times 20 mm fillet on both the exposed and unexposed sides as tested. This system, used together with a radiation guard, was attributed an FRL of -/180/180.

If BOSS FirePillows-240 are used in conjunction with P40-MAK wrap insulation wrap, in walls, the 100 mm diameter copper pipe must be wrapped twice around the pipes and extended 300 mm from the exposed side and 600 mm from the unexposed side, pushed up to the separating element, over the fillet of FireMastic-300. This system was attributed an FRL of -/180/120.

5.3.2 Performance of copper pipes penetrating framed, plasterboard lined walls

Overview

The 50 mm diameter Thermobreak insulated copper pipe tested in FRT180472 R1.0 failed insulation criterion after 104 minutes due to the P40-MAK Wrap on the unexposed side sliding away from the separating wall element due to the expansion of the intumescent material within the MaxiCollar[™]. It has been proposed that the P40-MAK Wraps of the proposed systems are tied down more rigidly using metal wires at a spacing of 100 mm, with the first wire spaced 50 mm from the unexposed surface of the separating wall element. This is likely to prevent the potential slipping of the P40-MAK Wrap.

Evidence from FRT180473 R1.0 shows that the improved steel wire detailing was adequate to ensure that P40-MAK Wrap remains in place, without slipping. The steel wire detailing for the proposed system is similar to that used in FRT180472 R1.0. i.e. the first wire is provided 50 mm from the surface of the wall separating element. The rest are provided at a spacing of 100 mm.



It is likely that with the proposed improvement, the 50 mm diameter insulated copper pipe tested in FRT180472 R1.0 would have maintained insulation for at least 120 minutes. Consequently, it is likely to have achieved an FRL of -/120/120. Thus, a 50 mm diameter copper pipe penetrating a steel framed plasterboard lined wall with two layers of 13 mm thick plasterboard (with an overall wall thickness not less than 116 mm), protected as described, is likely to achieve an FRL of -/120/120. It is noteworthy that the FRL of the wall separating element must have been established via testing or assessment by an accredited testing laboratory to be at least -/120/120.

In a similar manner, the same pipe penetrating a steel framed plasterboard lined wall with a single layer of 16 mm thick plasterboard (with an overall wall thickness not less than 96 mm), protected as described, is likely to achieve an FRL of -/90/90. It is noteworthy that the FRL of the wall separating element must have been established via testing or assessment by an accredited testing laboratory to be at least -/90/90. This outcome of this assessment is based on the separating wall element having met this condition.

Alternatively, the Maxi Collar[™] can be replaced with BOSS UniWrap installed over Thermobreak lagging and flushed onto both faces of the separating element.

Bare metal pipes can be protected with a conjunction of BOSS FirePillows-240, BOSS FireMastic-300[™] and P40 MAK-wrap insulation wrap, extending on both the exposed and unexposed faces in walls. Bare pipes can also be protected with BOSS Batt build-up on both sides of the wall and BOSS FireMastic-300[™]. In both cases, the FRL attributed to the systems will be limited by the established FRL of the separating element.

Pipe diameters (D) in the range of 32 mm \leq D \leq 80 mm

As discussed previously, a 50 mm diameter copper pipe was tested in the proposed seal configuration. It is likely to have achieved an FRL of -/120/120, if tested in accordance with AS 1530.4:2014, with additional steel wires as prescribed.

The available test evidence shows that the expansion of the intumescent material within the BOSS MaxiCollar[™] was capable of closing off any gaps forming due to the shrinkage of the pipes lagging installed around the 50 mm and 80 mm diameter copper pipes. Thus, an integrity failure is unlikely to occur in these pipes.

It is proposed to use UniWrap as an alternative to BOSS MaxiCollar[™] for lagged pipes. Test evidence from R001874 shows that 42 mm diameter copper pipes lagged with Armaflex AF and sealed with PipeBloc EL pipe wraps – which is identical to BOSS UniWrap – placed flush to both the exposed and unexposed sides, achieved an integrity performance of 120 minutes. In the test, the annular gap was filled with Pyrocoustic sealant and so, to achieve the same integrity performance, the annular space must be filled with a fire-rated sealant such as BOSS FireMastic-300[™].

Similar to the intumescent behaviour of BOSS MaxiCollar[™], with lagged metal pipes, the Thermobreak lagging is expected to shrink or melt slightly, resulting in gap openings. The UniWrap wrapped around the pipes is likely to expand and close off these gaps to prevent the passing of hot gasses and to maintain the integrity.

It is proposed that the thickness of the Thermobreak lagging must range between 30 mm and maximum 50 mm. In FRT180473 R1.0, an 80 mm diameter copper pipe was tested lagged with 50 mm thick Thermobreak tube thermal insulation. The test was conducted for 120 minutes and the service maintained integrity for the entire test duration. Therefore, it is not expected that the use of Thermobreak lagging with thickness between 30 mm and 50 mm will detrimentally affect the integrity performance of the pipes.

The presence of P40-MAK Wrap to a distance of 300 mm on either side of the separating wall element provides additional protection for insulation. The 300 mm distance is deemed adequate based on the test data from FRT180473 R1.0 and FRT180472 R1.0. Thus, insulation failure is also unlikely to occur.

The above outcomes are valid with respect to the two different FRL categories considered (-/90/90 and -/120/120), provided that the separating framed wall elements conform to the minimum specified requirements and have been tested or assessed to achieve the relevant FRL by an accredited testing laboratory.

Pipe diameters (D) in the range of 80 mm $< D \le 159$ mm

An 80 mm diameter Thermobreak lagged copper pipe with a higher wall thickness of 1.7 mm protected with BOSS 150 mm MaxiCollar[™] collars installed on both sides – albeit penetrating a 75 mm AAC wall with additional BOSS Batt build-up on either side – was tested in FRT180473 R1.0. This achieved an FRL of -/120/120 when tested. The available test evidence shows that the expansion of the intumescent material within the BOSS MaxiCollar[™] was capable of closing off any gaps forming due to the shrinkage of the pipes lagging installed around the 80 mm diameter copper pipes. Thus, an integrity failure is unlikely to occur in these pipes.

It is proposed that Thermobreak insulated copper pipes varying in outer pipe diameters (D) in the range of 80 mm < D ≤ 159 mm are also protected with P40-MAK wrap. However, for these large diameter pipes, the length of the P40-MAK Wrap on either side of the wall must be increased to 600 mm. FSP 1833 consisted of a 150 mm diameter uninsulated copper pipe protected with 50 mm fillets of BOSS FireMastic-300TM sealant on the exposed and unexposed faces. In addition to this, two layers of BOSS P40-MAK Wrap were wrapped approximately twice around the copper pipe to a thickness of 40 mm and were secured with steel wires and foil tape. The P40-MAK Wrap was 300 mm and 600 mm long on the exposed and unexposed sides, respectively.

In the proposed systems, Thermobreak continuous lagging is present. BOSS FireMastic-300[™] sealant is provided to only fill any annular gaps. BOSS MaxiCollar[™] collar is used on either side of the wall separating element. For large 159 mm outer diameter pipes, it is likely that larger 250 mm diameter BOSS MaxiCollar[™] collars will be used. These larger collars also consist of an increased number of intumescent layers. For instance, based on the information provided by BOSS Products (Australia) Pty Ltd, the 250 mm diameter collar consists of 12 layers of 40 mm wide, 2 mm thick intumescent layers. Thus, the additional intumescent material is likely to compensate for the larger aperture. It is likely that the copper pipes up to 159 mm, if protected using BOSS MaxiCollar[™] collars on either side of the wall, would also close-off when exposed to standard heating conditions from one side. Overall, integrity performance is unlikely to fail prior to 90 or 120 minutes, depending on the relevant separating wall system.

Copper pipes with outer pipe diameters (D) in the range of 80 mm < D \leq 159 mm (with additional Thermobreak insulation) must be wrapped with a single layer of BOSS P40-MAK Wrap to a distance of 600 mm on either side. Thus, the larger copper pipes have an additional 300 mm length protection using BOSS P40-MAK Wrap. The 150 mm diameter uninsulated copper pipe tested in FSP 1833 consisted of BOSS P40-MAK Wrap extending 600 mm from the unexposed surface. The tested service maintained integrity and insulation for a period not less than 90 minutes.

It is also proposed to use BOSS UniWrap fitted over Thermobreak lagging as an alternative to BOSS MaxiCollar[™]. In test WF 349353, several plastic pipe penetrations were sealed with two-layer pipe wrap identical to BOSS UniWrap fitted to be flush with both faces of the assembly. During the test, as the plastic pipes melted, the UniWrap was able to close off the resulting gap and maintain integrity for at least 120 minutes for PVC pipe diameters up to 160 mm.

Similar to the intumescent behaviour of BOSS MaxiCollarTM, with lagged metal pipes, the Thermobreak lagging is expected to shrink or melt slightly, resulting in gap openings. The UniWrap wrapped around the pipes is likely to expand and close off these gaps to prevent the passing of hot gasses and to maintain the integrity. However, similar to the tested specimens, the annular space must be filled with a fire rated sealant such as BOSS FireMastic-300TM.

It is proposed that the thickness of the Thermobreak lagging must range between 30 mm and maximum 50 mm. In FRT180473 R1.0, an 80 mm diameter copper pipe was tested lagged with 50 mm thick Thermobreak tube thermal insulation. The test was conducted for 120 minutes and the service maintained integrity for the entire test duration. Therefore, it is not expected that the use of Thermobreak lagging with thickness between 30 mm and 50 mm will detrimentally affect the integrity performance of the pipes.

In R001874, a 159 mm diameter copper pipe lagged with 32 mm thick Armaflex AF insulation was tested and achieved an integrity performance of 120 minutes. It is not expected that increasing the insulation thickness to 50 mm will detrimentally affect the integrity performance of the pipes. Based on the above discussion, copper pipes with pipe diameters (D) in the range of 80 mm < D \leq 159 mm which are lagged using Thermobreak insulation and protected with BOSS MaxiCollarTM collars or BOSS UniWrap and BOSS P40-MAK Wrap to a distance not less than 600 mm on either side, are likely to achieve -/90/90 or -/120/120 FRLs depending on the separating framed wall element.



The 150 mm outer diameter uninsulated copper pipe with a wall thickness of 2 mm tested in FRT180472 R1.0 achieved an FRL of -/120/0. It was protected only using BOSS FireMastic-300[™] to a depth of 26 mm (full depth of plasterboards) and finished with a 20 mm × 20 mm mastic fillet on either side of the wall. When tested, the service maintained the integrity performance for 120 minutes without any sign of gaps forming or flaming that could have initiated an integrity failure. The significance of this result is that it is an indication that the BOSS FireMastic-300[™] provided the required protection in preventing any hot gases from passing from the exposed to the unexposed sides. As the pipe was uninsulated, no insulation performance was achieved in this test. Therefore, an FRL of -/120/0 was assigned to the tested pipe by the test report. If combined with P40-MAK wrap extending 600 mm from both faces of the separating element, the insulation of the system is likely to be maintained for 120 minutes.

It is also proposed that BOSS FirePillows-240 may be used as a primary fire protection system for bare metal pipes as assessed in FAS190042 R1.2. A 100 mm diameter copper pipe with a minimum wall thickness of 1.8 mm was assessed penetrating a minimum 140 mm thick concrete block wall/masonry wall, protected with BOSS FirePillows-240 filled into an aperture with nominal dimensions of 600 mm wide (or greater) by 400 mm high. The BOSS FirePillows-240 are combined with FireMastic-300TM as a secondary fire protection and the system can be attributed an FRL of - /180/180. If the 100 mm diameter pipe is protected with BOSS FirePillows-240 and P40-MAK wrap wrapped twice around the pipes and extended 300 mm from the exposed side and 600 mm from the unexposed side, pushed up to the separating element, over a fillet of FireMastic-300TM on both faces – the system can be attributed an FRL of -/180/120.

A summary of the discussion is presented in Table 10.

5.3.3 Copper pipes penetrating rigid walls

Minimum 96 mm or 116 mm thick rigid walls - direct assessment based on framed walls

It is proposed that minimum wall thicknesses assessed for steel framed plasterboard lined walls previously are applicable for the same FRLs when considering rigid wall, provided that the same sealing system is used. Thus, the detailing must be nominally similar, with the BOSS MaxiCollar[™] collars or UniWrap fitted over the Thermobreak lagging providing primary protection, supplemented by BOSS FireMastic-300[™] protecting the annular gap and BOSS P40-MAK Wrap giving additional protection.

Typically, AAC walls with a nominal density of 510 kg/m³ are considered for such applications. Rigid walls consist of a higher thermal mass than a framed wall. Therefore, it is considered that a minimum wall thicknesses of 96 mm and 116 mm – which were prescribed earlier for steel framed plasterboard lined walls for FRLs of -/90/90 and -/120/120, respectively, would also apply to rigid walls for the same services.

BOSS P40-MAK Wrap lengths

Similar to framed walls, for pipe diameters (D) in the range of 32 mm \le D \le 80 mm, BOSS P40-MAK Wrap must extend minimum 300 mm from the separating element on either side of the wall. For pipe diameters (D) in the range of 80 mm < D \le 159 mm, it must extend minimum 600 mm from the separating element on either side of the wall. A summary is presented in Table 10.

Bare pipes in minimum 140 mm thick rigid walls

Bare pipes are to be protected with BOSS FirePillows-240 with BOSS FireMastic-300[™] and BOSS P40-MAK Wrap for insulation performance.

Rigid wall with build-up

In test FRT180473 R1.0, a minimum 75 mm thick rigid wall built with AAC with a nominal density of at least 510 kg/m³ was additionally built-up using BOSS Batts on both sides. Boss Batt is nominally 50 mm thick. Consequently, the minimum wall thickness around the service was increased to 175 mm.

It is proposed to build up rigid walls with BOSS Batts, fire-rated plasterboard, Calcium Silicate board or Shaftliner – provided that the build-up options have been tested to achieve the required FRL. The build-up may be on one or both sides of the wall. However, in order to achieve an FRL of -/90/90, the



minimum wall thickness, with or without the build-up must be at least 96 mm. To achieve an FRL of - /120/120, the minimum wall thickness, with or without the build-up must be at least 116 mm.

The build-up must extend minimum 100 mm from the edge of the aperture, overlapping with the main separating element. For instance, the overall outer diameter of an 80 mm aperture with 50 mm thick Thermobreak lagging is 180 mm (80 mm + 50 mm + 50 mm). In such a case, the BOSS Batt build up should be minimum 380 mm \times 380 mm sized with the service centred within the build-up.

The sheets used for build-up must be fixed to the separating element using bugle head screws with washers. In BOSS batts, BOSS MaxiCollar[™] collars must be fixed to the build-up using pigtail screws. Ultimately, the fixing of the collars must be suitable to the build up to ensure that the collar is fixed in place for the whole FRL period.

If a build-up, such as BOSS Batts, is used on bare metal pipes, BOSS FireMastic-300[™] must be applied to a depth of 26 mm (full depth of plasterboards as assessed for flexible walls) and finished with a 20 mm × 20 mm mastic fillet on either side of the wall. As tested in FRT180472 R1.0, the service is likely to maintain the integrity performance for 120 minutes without any sign of gaps forming or flaming that could initiate an integrity failure.

BOSS P40-MAK Wrap lengths

For pipe diameters (D) in the range of 32 mm \le D \le 80 mm, BOSS P40-MAK Wrap must extend minimum 300 mm from the separating element on either side of the wall. For pipe diameters (D) in the range of 80 mm < D \le 159 mm, it must extend minimum 600 mm from the separating element on either side of the wall. The proposed detailing is deemed adequate considering the 80 mm diameter copper pipe with Thermobreak lagging tested in FRT180473 R1.0.

A summary is presented in Table 10.

5.3.4 Steel and Iron pipes penetrating rigid walls

The reference test data for metal pipes penetrating flexible or rigid walls discussed up to this point are all related to copper pipes. It is proposed that ferrous metal pipes of similar sizes will also achieve similar FRLs to the assessed range of copper pipes, if provided with similar protection detailing.

Ferrous metal pipes included in the assessment may vary from steel to iron pipes. Generally, the melting point of ferrous metal pipes are higher than that of copper pipes. Thus, steel or iron pipes are unlikely to excessively soften or melt. Therefore, the risk of integrity failure due to the formation of through gaps, sustained flaming or the passage of hot gasses or smoke from the exposed side to the unexposed side is not increased with the use of steel or iron pipes.

The conductivity of ferrous metals is also much lower than that of copper pipes. Hence, steel or iron pipes of the same size are unlikely to heat up to the same level as a copper pipe. Therefore, the risk of insulation failure is also reduced.

Overall, it is likely that the assessment outcomes specified in Table 10 can also be applied to steel or iron pipes. The above discussion is based on the information presented and discussed in AS 4072.1:2005.

5.4 Conclusion

This assessment demonstrates that copper, steel and iron pipes ranging in diameter from 32 mm to 159 mm, lagged with continuous Thermobreak insulation or bare, penetrating framed plasterboard walls or rigid walls are likely to achieve the FRLs specified in Table 10, if they were tested in accordance with AS 1530.4:2014.

Table 10Assessment outcomes for Thermobreak lagged or unlagged copper, steel or iron
pipes penetrating walls

Wall type	Target FRL	Minimum wall thickness required	BOSS P40-MAK Wrap length	Pipe diameter
Framed walls or rigid walls	-/90/90	96 mm	300 mm on both	32 mm < D** ≤ 80 mm
(Rigid walls may be with or without build-up*)	-/120/120	116 mm	exposed and unexposed sides	
Framed walls or rigid walls	-/90/90	96 mm	600 mm on both	80 mm < D ≤ 159 mm
(Rigid walls may be with or without build-up*)	-/120/120	116 mm	exposed and unexposed sides	
Framed or rigid walls with	-/90/90	96 mm	300 mm on both exposed and unexposed sides	32 mm < D ≤ 80 mm
BOSS Batts	-/120/120	116 mm		
Framed or rigid walls with	-/90/90	96 mm	600 mm on both exposed and unexposed sides	80 mm < D ≤ 159 mm
the aperture protected with BOSS Batts	-/120/120	116 mm		
Rigid walls with BOSS FirePillows-240, FireMastic- 300 and with or without radiation guard.	-/180/180	140 mm	-	32 mm < D ≤ 100 mm⁺
Rigid walls with BOSS FirePillows-240, FireMastic- 300 and P40-MAK wrap	-/180/120	140 mm	300 mm on the exposed side and 600 mm from the unexposed side	32 mm < D ≤ 100 mm⁺

* The build-up options must be tested to achieve a fire performance of at least 90 minutes if used with 300 mm of P40-MAK wrap on both sides of the separating element or at least 120 minutes if used with 600 mm of P40-MAK wrap on both sides of the separating element.

**D - Outer diameter of copper pipe

+ 100 mm diameter metal pipe with a minimum wall thickness of 1.8 mm

Thermobreak tube thermal insulation lagging thickness to be 30 mm to 50 mm in walls

6. Assessment of metal pipes penetrating concrete floors

6.1 Description of variation

This assessment addresses the variations to the tested systems identified below.

- Metal pipes either lagged with Thermobreak or unlagged penetrating concrete floors.
- Metal pipes lagged with Thermobreak to be protected with BOSS Batt.
- Uninsulated metal pipes in floors to be protected with BOSS Batt or BOSS FirePillows-240.
- The pipe material may be copper, steel or iron.
- The pipe outer diameters (D) may vary between 32 mm \leq D \leq 159 mm.
- The maximum annular gap is 5 mm. It must be filled to a depth of at least 25 mm on either side using BOSS FireMastic 300.
- For copper pipes of 32 mm diameter, the BOSS P40-MAK wrap length on the unexposed (top) side must be 300 mm.
- For copper pipes of diameter greater than 32 mm and less than 159 mm, the BOSS P40-MAK wrap length on unexposed side is 600 mm.

6.2 Methodology

The method of assessment used is summarised in Table 11.

Table 11 Method of assessment

Assessment method		
Level of complexity	Complex assessment	
Type of assessment	Qualitative and comparative	

6.3 Assessment

6.3.1 Discussion of relevant test results

Evidence from test report FRT180137 R2.0

FRT180137 R2.0 consisted of a 32 mm diameter copper pipe without any lagging, penetrating a ComFlor[®] 60 floor system through one of its ribs. The thickness of the ComFlor[®] 60 floor system was 130 mm at the ribs and 70 mm at the recesses. The annular gap was 1 mm and it was filled with BOSS FireMastic-300TM to a depth of 25 mm and finished with 10 mm × 10 mm fillet on both the exposed and unexposed sides. There was no additional protection such as BOSS P40-MAK Wrap on either side of the slab. The tested pipe achieved an FRL of -/120/30 when tested in accordance with AS 1530.4:2014.

Evidence from test report WF359904 Issue 2

WF359904 Issue 2 included a 150 mm thick concrete floor system. The aperture was protected by two layers of 50 mm thick batts identical to Boss batts. A 159 mm × 2 mm copper pipe was installed in the batt and gap between the copper pipe and the batt was filled with sealant identical to Boss Firemastic-300[™]. A 40 mm thick insulation wrap extended from the face of the batt to a length of 300 mm on the unexposed side. The tested pipe achieved an FRL of -/120/30.

Evidence from test report WF 350178

The test specimen in WF 350178 comprised a section of floor with overall dimensions of 2230 mm by 1740 mm by 150 mm thick and was provided with nine circular apertures. Each aperture was penetrated by a range of plastic pipes which were plugged on the unexposed side. Each specimen



was fitted with two pipe wraps referenced 'PipeBloc PWP' – and identical to BOSS UniWrap - fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of 'Pyrocoustic sealant' to both sides of the floor assembly. During the test, the plastic pipes protected with PipeBloc PWP maintained integrity for at least 120 minutes for PVC pipe diameters up to 200 mm.

6.3.2 Copper, steel or iron pipes penetrating concrete floors

It is proposed that lagged or unlagged copper, steel or iron pipes with a pipe diameter (D) of 32-159 mm penetrating minimum 150 mm thick concrete slabs are protected. BOSS MaxiCollar[™] collar is provided only at the slab soffit, directly fixed into the soffit of the concrete slab using masonry anchors. The annular gap must not exceed 5 mm and it must be filled with BOSS FireMastic-300[™] to a depth of at least 25 mm on both sides. BOSS P40-MAK Wrap is provided on the unexposed side to a distance of 300 mm for the 32 mm diameter pipes and to a distance of 600 mm for larger pipes up to 159 mm diameter. It must be tied using metal wires at a spacing not more than 100 mm, with the first wire not more than 50 mm from the top surface of the concrete slab.

The 32 mm diameter copper pipe tested in FRT180327 R2.0, despite not containing a BOSS MaxiCollar[™] collar or BOSS P40-MAK Wrap, did not reach integrity failure. The tested pipe without any lagging was unable to maintain insulation performance for a prolonged duration. Overall, it achieved an FRL of -/120/30.

The 159 mm diameter copper pipe tested in WF359904 Issue 2 failed insulation when the thermocouples placed on the bare pipe exceeded a 180°C rise at 30 minutes into the test. The thermocouples placed on the insulation wrap 25 mm from the batt continued to maintain the insulation performance for the whole 132 minutes duration of the test. It is proposed to extend the length of the BOSS P40-MAK wrap to 600 mm on the unexposed side, this is considered to reduce the temperature of the part of the pipe that emerges from the insulation on the unexposed side as this will provide a long distance for the heat to conduct down the pipe to the point at which it can be measured.

In contrast, the proposed systems consist of continuous Thermobreak lagging. Based on the observations made from FRT180472 R2.0, FRT180473 R1.0 and WF359904, the BOSS MaxiCollar[™] collar on the exposed bottom side is likely to activate and close off the gap caused by the melting or shrinkage of the Thermobreak lagging. The BOSS FireMastic-300[™] provides additional protection to the annular gap, potentially limiting the passage of hot gasses and smoke. The 300 mm long BOSS P40-MAK wrap on the unexposed side of the 32 mm diameter insulated copper pipe and 600 mm long BOSS P40-MAK wrap for larger pipes ensures that if the proposed system was tested to AS 1530.4:2014, the thermocouples on the unexposed side are likely to record lower temperatures.

Based on observations made from FRT180472 R2.0, FRT180473 R1.0 and R001874, it is proposed that the thickness of the Thermobreak lagging must range between 30 mm and maximum 50 mm as discussed in section 5. It is not expected that the use of Thermobreak lagging with thickness between 30 mm and 50 mm will detrimentally affect the integrity performance of the pipes.

Based on the discussion above, 32-159 mm diameter insulated copper pipe protected with BOSS MaxiCollar[™] collar and BOSS P40-MAK Wrap will likely achieve an FRL of -/120/120, if tested in accordance with AS 1530.4:2014.

It is also proposed to use BOSS UniWrap fitted over Thermobreak lagging as an alternative to BOSS MaxiCollar[™] in floor assemblies. In test WF 350178, several plastic pipe penetrations were sealed with two-layer pipe wrap identical to BOSS UniWrap, fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of 'Pyrocoustic sealant' to both sides of the floor assembly. During the test, as the plastic pipes melted, the UniWrap was able to close off the resulting gap and maintain integrity for at least 120 minutes for PVC pipe diameters up to 200 mm.

Similar to the intumescent behaviour of BOSS MaxiCollarTM, with lagged metal pipes, the Thermobreak lagging is expected to shrink or melt slightly, resulting in gap openings. The UniWrap wrapped around the pipes is likely to expand and close off these gaps to prevent the passing of hot gasses and to maintain the integrity. However, similar to the tested specimens, the annular space must be filled with a fire rated sealant such as BOSS FireMastic-300TM.



It is proposed to build up floor systems with BOSS Batts, fire-rated plasterboard, Calcium Silicate board or Shaftliner – provided that the build-up options have been tested to achieve the required FRL.

It is also proposed that BOSS FirePillows-240 may be used as a primary fire protection system for bare metal pipes as assessed in FAS190042 R1.2. A 100 mm diameter copper pipe with a minimum wall thickness of 1.8 mm was assessed penetrating a minimum 150 mm thick concrete floor slab, protected with BOSS FirePillows-240 filled into an aperture with nominal dimensions of 600 mm wide (or greater) by 400 mm high. The BOSS FirePillows-240 are combined with FireMastic-300TM as a secondary fire protection and the system can be attributed an FRL of -/180/180. If the 100 mm diameter pipe is protected with BOSS FirePillows-240 and P40-MAK wrap wrapped twice around the pipes and extended 300 mm from the exposed side and 600 mm from the unexposed side, pushed up to the separating element, over a fillet of FireMastic-300TM on both faces – the system can be attributed an FRL of -/180/120.

With respect to steel and iron pipes, the rationale is the same used earlier in section 5.3.4. Based on this, it is likely that copper, steel and iron pipes of 32-159 mm diameter lagged with Thermobreak insulation, penetrating minimum 150 mm thick concrete floors, consisting minimum 300 up to 600 mm length of BOSS P40-MAK Wrap on the unexposed side are likely to achieve an FRL of -/120/120. A summary is presented in Table 12.

The FRL of the concrete slab must conform to specifications of AS 3600:2018 Amendment 1. Table 5.5.1 of AS 3600:2018 gives the Fire Resistance Periods (FRP) for insulation for slabs.

6.4 Conclusion

This assessment demonstrates that 32 mm diameter copper, steel and iron pipes penetrating minimum 150 mm thick concrete floors are likely to achieve the FRLs specified in Table 12, if they were tested in accordance with AS 1530.4:2014.

Table 12	Summary of assessment outcomes for Thermobreak lagged and unlagged copper,
	steel or iron pipes penetrating concrete floors

Target FRL	Minimum floor thickness required	BOSS P40-MAK Wrap length on unexposed side	Pipe diameter
-/120/120	150 mm	300 mm	32 mm
-/120/120	150 mm	600 mm	32 mm < D ≤ 159 mm
-/120/120	150 mm – aperture protected with BOSS Batts	300 mm	32 mm
-/120/120	150 mm – aperture protected with BOSS Batts	600 mm	32 mm < D ≤ 159 mm
-/180/180	150 mm – with BOSS FirePillows-240, FireMastic-300 and with or without radiation guard.	600 mm	32 mm < D ≤ 100 mm⁺
-/180/120	150 mm – with BOSS FirePillows-240, FireMastic-300 and P40-MAK wrap	600 mm	32 mm < D ≤ 100 mm⁺

Thermobreak tube thermal insulation lagging thickness to be 30 mm to 50 mm in floors



7. Validity

Warringtonfire Australia does not endorse the tested or assessed product in any way. The conclusions of this assessment may be used to directly assess fire hazard, but it should be recognised that a single test method will not provide a full assessment of fire hazard 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 information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on, or before, the stated expiry date.

This assessment represents our opinion about the performance likely to be demonstrated on a test in accordance with AS 1530.4:2014, based on the evidence referred to in this report.

This assessment is provided to BOSS Products (Australia) Pty Ltd for their own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.



Appendix A Drawings and additional information

Table 13 Details of drawing	as
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Figure No.	Source	Provided by	Additional details	
Figure 1 to Figure 17	Copper/Steel Pipe Penetrations – Floor Slab Penetration Drawing 01	BOSS Products (Australia) Pty Ltd	Updated by Warringtonfire Australia to suit the context	
	Copper/Steel Pipe Penetrations – Wall Penetration Drawing 02		of the assessment.	
	Copper/Steel Pipe Penetrations – Wall Penetration Drawing 03			

Appendix B Summary of supporting test data

B.1 Test report – FRT180472 R2.0

Table 14Information about test report FRT180472 R2.0

Item	Information abo	out test report					
Report sponsor	BOSS Fire & Sa	fety P/L					
Test laboratory	Warringtonfire A 3175, Australia.	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.					
Test date	The fire resistant	ce test was comp	pleted on 08/03/2	019.			
Test standards	The test was dor	ne in accordance	e with AS 1530.4:	2014.			
Variation to test standards	None.						
General description of tested specimen	The test specime with two layers of penetration syste	The test specimen consisted of 116 mm thick plasterboard wall system cladded with two layers of fire-rated plasterboard on either side penetrated by multiple penetration systems. Only services A and D are relevant to this assessment.					
	For service A, the annular gap between the service and the separating element was filled with BOSS FireMastic – 300 to the depth of 5 mm and finished flush on both sides. The BOSS 100 mm MaxiCollar [™] Collars were installed on both sides and fixed to the separating element with screws and washers. A layer of BOSS P40-MAK WRAP wrapped around the pipe lagging and extend 300 mm away from the separating element on both sides. For service D, the annular gap between the service and the separating element was filled with BOSS FireMastic – 300 to a depth of 26 mm and finished with 20 mm and finished with the set of						
	Penetration system	Service	Primary fire- stopping protection	Second fire- stopping protection	Aperture size (mm)		
	A 50 mm copper pipe with continuous Thermobreak lagging BOSS 100mm MaxiCollars™ P40-MAK Wrap with FireMastic- 300 [™] Ø115						
	D	D 150 mm FireMastic- copper pipe 300 [™] - Ø170					
Instrumentation	The test report s AS 1530.4:2014	tates that the ins	trumentation was	s in accordance	with		

The test specimen achieved the results shown in Table 15.

Table 15 Results summary for this test report

Service	Time	Position of failure	FRL
А	104 min 22 sec	The roving thermocouple measured 206°C on the fire collar.	-/120/90
	120 min 00 sec	Specimen maintained integrity.	
D	10 min 30 sec	Thermocouple on the pipe recorded a temperature of 205°C	-/120/0
	120 min 00 sec	Specimen maintained integrity.	

B.2 Test report – FRT180473 R1.0

Table 16 Information about test report FRT180473 R1.0

Item	Information al	pout test report					
Report sponsor	BOSS Fire & S	afety P/L					
Test laboratory	Warringtonfire 3175, Australia	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.					
Test date	The fire resista	The fire resistance test was completed on 12/03/2019.					
Test standards	The test was d	one in accordan	ce with AS 1530.4:2014	1.			
Variation to test standards	None.	None.					
General description of tested specimen	The test specin multiple service A Ø180 mm ap Batts were inst element. The E head screws w element were a applied on the Given that the insulated pipe, the service and depth of 5 mm The BOSS 150 to the BOSS B had compresse A layer of BOS 300 mm away	nen consisted of es. Only service perture was cut a alled on the expe- 30SS Batts were aligned to each of interface betwee aperture size wa the annular gap the BOSS Batt and finished flus mm MaxiCollar att with pig tail so ed the Thermobro S P40-MAK Wra from the separat	75mm thick Hebel Pow J is relevant to this ass t the centre of the BOS based and the unexpose fixed to the separating e aperture of the BOSS ther. 2 mm thick BOSS ther. 2 mm thick BOSS on the BOSS Batt and the s almost similar to the was nominally 0 mm. 1 was filled with BOSS F th on both sides. ™ collars were installed crews. The BOSS 150 eak lagging for total of a p wrapped around the ing element on both side	ver Panel pene essment. S Batt before d side of the s element with B Batts and the FireMastic – he separating external diame The annular ga ireMastic – 30 d on both sides mm MaxiColla 20 mm. pipe lagging a	etrated by the BOSS separating four bugle e separating 300 [™] was element. eter of the ap between 10 [™] to the s and fixed ar [™] Collar		
	Penetration Service Primary fire- system stopping fire- protection stopping protection						
	J	80 mm copper pipe with Thermobreak lagging	BOSS P40-MAK Wrap BOSS 150mm MaxiCollar™ BOSS FireMastic – 300™	BOSS Batt	Ø180		
Instrumentation	The test report AS 1530.4:201	states that the ir 4.	nstrumentation was in a	accordance wit	th		

The test specimen achieved the results shown in Table 17.

Table 17 Results summary for test report FRT180473 R1.0

Service	Time	Position of failure	FRL
J	120 min 00 sec	Specimen maintained integrity and insulation.	-/120/120

B.3 Test report – FSP 1833

Table 18 Information about test report FSP 1833

Item	Information abo	ut test report					
Report sponsor	BOSS Fire & Safe	BOSS Fire & Safety P/L					
Test laboratory	CSIRO Infrastructure Technologies, 14 Julius Avenue, North Rude, NSW 2113, Australia						
Test date	The fire resistanc	e test was con	npleted on 09/05	5/2017.			
Test standards	The test was don	e in accordanc	e with AS 1530.	4:2014.			
Variation to test standards	None.						
General description of tested specimen	The test specimen consisted of a plasterboard wall penetrated by multiple services. Only service 5 is relevant to this assessment The overall thickness of the plasterboard wall was 96 mm. It consisted of 16 m thick fire rated plasterboards on either side of a 64 mm deep frame. Given that the aperture diameter of 150 mm was very close to the outer diameter of the uninsulated copper pipe (150 mm), the annular gap is likely to have been very small, possibly nearing 0 mm. The surface seal around the pipe was created with a 50 mm fillet of BOSS FireMastic – 300 [™] sealant on the exposed and unexposed face. Two layers or BOSS P40-MAK Wrap was wrapped approximately twice around the copper pipe to a thickness of 40 mm that we secured with steel wire and foil tape. The						
	unexposed face, flush with the FireMastic – 300™ fillets. Penetration Service Primary fire- Second fire- Aperture system stopping size (mr						
			protection	protection			
	5	150 mm OD copper pipe with 1.02 mm wall thickness	BOSS P40- MAK Wrap BOSS FireMastic – 300™	-	Ø150		
Instrumentation	The test report sta AS 1530.4:2014.	ates that the ir	strumentation w	as in accordance	with		

The test specimen achieved the results shown in Table 19.

Table 19 Results summary for test report FSP 1833

Service No.	Time	Position of failure	FRL
5	90 min 00 sec	Specimen maintained integrity and insulation.	-/90/90

B.4 Test report – FRT180137 R2.0

Table 20 Information about test report FRT180137 R2.0

Item	Information abo	ut test report				
Report sponsor	BOSS Fire & Safe	ety P/L				
Test laboratory	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.					
Test date	The fire resistanc	e test was con	npleted on 07/03	3/2019.		
Test standards	The test was done	e in accordanc	ce with AS 1530.	4:2014.		
Variation to test standards	None.					
General description of tested specimen	I description of pecimenThe test specimen consisted of a composite floor system penetrated by multiple penetration systems. Only penetration system F is relevant to this assessment. The ComFlor® 60 floor system has a profile depth of 75 mm. The overall concrete slab had a depth of 130 mm at the ribs and 70 mm at the recesses. Service F was located completely with a rib such that the slab thickness was 130 mm all around it. The annular gap was nominally 1 mm. The annular gap between the service and the separating element was filled with BOSS FireMastic – 300™ to a depth of 25 mm and finished with 10 mm × 10 mm fillet on both the exposed and unexposed side. There was no additional insulation sleeve on the unexposed side of the floor. Thus, the thermocouples on the unexposed concrete surface.Penetration systemService stopping protectionPrimary fire- stopping protectionAperture size (mm)F32 mm conper-BOSS FireMastic-Ø34					
		pipe		300™		
Instrumentation	The test report sta AS 1530.4:2014.	ates that the ir	strumentation w	as in accordance	with	

The test specimen achieved the results shown in Table 21.

Table 21Results summary for test report FRT180137 R2.0

Service	Time	Position of failure	FRL
F	33 min 15 sec	Thermocouple on the pipe recorded a temperature of 202°C.	-/120/30
	120 min 00 sec	Specimen maintained integrity.	

B.5 Test report – WF 359904 Issue 2

Table 22 Information about test report WF 359904 Issue 2

Item	Information ab	Information about test report				
Report sponsor	FSi Limited					
Test laboratory	Warringtonfire L Warrington, WA	Warringtonfire UK (formerly Exova Warringtonfire UK), Holmesfield Road, Warrington, WA1 2DS, United Kingdom				
Test date	The fire resistance test was completed on 15/12/2015.					
Test standards	The test was do BS EN 1363-1:2	The test was done in accordance with BS EN 1366-3:2009 and BS EN 1363-1:2012.				
Variation to test standards	The test report	The test report does not specify any variations from the test standard.				
General description of tested specimen	There were two test specimens in the test. The vertical wall specimen was 1500 mm high × 1500 mm wide × 150 mm thick and contained a single aperture measuring 1100 mm long × 750 mm wide. It was penetrated by various plastic pipes and cables. Only serviced C and E are relevant to this assessment. The horizontal floor specimen was 2230 mm long × 1740 mm wide × 150 mm thick and contained a single aperture measuring 1100 mm long × 750 mm wide. It was penetrated by various plastic pipes and cables. Only serviced L and N are relevant to this assessment. In both wall and floor specimens, the apertures were sealed with two layers of 50 mm thick 'Stopseal Fire Batt' with a nominal density of 140 kg/m ³ . They were friction fitted within the aperture in horizontal rows. The batt was coated on both sides with ablative coating. Each vertical horizontal cur of the batt to each substrate					
	Penetration system	Service	Primary fire- stopping	Aperture seal	Aperture size (mm)	
	oyotom		protection	oour		
	С	Ø42 mm copper pipe with 1.2 mm wall thickness	Single layer of 300 mm wide × 40 mm thick P40/40 stonewool insulation with a measured	-	Ø42	
	E	Ø159 mm copper pipe with 2 mm wall thickness	nominal density of 40 kg/m ³ on either side	-	Ø159	
	L	Ø42 mm copper pipe with 1.2 mm wall thickness	Wrapped on the unexposed side with a single layer of 300 mm wide \times 40 mm thick P40/40	-	Ø42	
	N	Ø159 mm copper pipe with 2 mm wall thickness	stonewool insulation with a measured nominal density of 40 kg/m ³	-	Ø159	
Instrumentation	The test report s 3:2009 and BS	states that the ir EN 1363-1:2012	nstrumentation was in ac	ccordance with	BS EN 1366-	

The test specimen achieved the results shown in Table 23.

Table 23 Results summary for test report WF 359904 Issue 2

Service	Integrity (minutes)	Insulation (minutes)		
	Cotton pad	Sustained flaming	Gap gauge	
С	132*	132*	132*	67
Е	132*	132*	132*	38
L	132*	132*	132*	132*
Ν	132*	132*	132*	30

* Test duration.

B.6 Test report – R001874

Table 24 Information about test report R001874

Item	Informatio	on about test	report		
Report sponsor	FSi Limited				
Test laboratory	Efectis Nederland, 2665 ZN Bleiswijk				
Test date	The fire resistance test was completed on 23/07/2019.				
Test standards	The test w BS EN 136	as done in acc 53-1:2012.	cordance with B	S EN 1366-3:2009 and	
Variation to test standards	The test re	eport does not	specify any vari	ations from the test stan	dard.
General description of tested specimen The test was conducted on pipe closure devices, penetrating a 3900 mm × 30 mm × 100 mm standard lightweight plasterboard faced steel stud partition was an established FRL of -/90/90. There was a total of 5 penetration seals tested penetration seals consisted of Stopseal® Batt, being two layers of 50 mm fibr board, coated with FSI PS-coating 0.7 mm thick on both sides of the board. T mineral fibre boards of specimen 1, 2 and 4 were placed flush with the exposed unexposed face of the wall. There was FSI PS-coating at all edges. Specimer was placed against the flexible wall with an overlap of 30 mm, specimen 10 w overlap of 50 mm and were fixed by means of 80 mm wood screws. Non-combustible pipes tested included copper pipes mounted in the multiple penetration seals and in the flexible wall (single services). The copper pipes v insulated with Armaflex AF and sealed with PipeBloc EL pipe wraps were place flush to both the exposed and unexposed sides. The pipe wraps were held in with tie wraps during installation and were removed before the fire test. The a space was filled with Pyrocoustic sealant.				$900 \text{ mm} \times 3000$ d partition wall with n seals tested. The of 50 mm fibre f the board. The ith the exposed and les. Specimen 3 becimen 10 with an ws. the multiple opper pipes were aps which has a aps were placed were held in place re test. The annular	
	Service	Diameter	Penetration	Insulation	Pipe end
		(mm)	seal		configuration
	1.b	159	PipeBloc EL	Armaflex AF at a thickness of 20 mm and a length of 490 mm.	C/U
	6	42	PipeBloc EL single	Armaflex AF at a thickness of 6 mm in a continuous sustained configuration.	C/U
	7	159	PipeBloc EL single	Armaflex AF at a thickness of 32 mm in a continuous sustained configuration.	C/U
	8	42	PipeBloc EL single	Armaflex AF at a thickness of 32 mm in a continuous sustained configuration.	C/U
	9	159	PipeBloc EL single	Armaflex AF at a thickness of 6 mm in a continuous sustained configuration.	C/U
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366- 3:2009 and BS EN 1363-1:2012.				



The test specimen achieved the results shown in Table 25.

Table 25 Results summary for test report R001874

Service	Integrity (minutes)	Insulation (minutes)
1.b	120	45
6	120	60
7	120	60
8	120	120
9	120	30

B.7 Test report – WF 349353

Table 26 Information about test report WF 349353

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Warringtonfire Testing and Certification Limited, London, United Kingdom.
Test date	The fire resistance test was completed on 23/03/2015.
Test standards	The test was done in accordance with BS EN 1366-3:2009 and BS EN 1363-1:2012.
Variation to test standards	The test report does not specify any variations from the test standard.
General description of tested specimen	The separating element was a drywall construction with overall dimensions of 3000 mm by 3035 mm high by 100 mm thick. The framing comprised of 50 mm wide galvanized steel studs, at maximum 600 mm centres, friction fitted into galvanized steel C-section head and base track. Each side of the stud frame was faced with two layers of 12.5 mm thick Gypsum 'Type F' plasterboard. The drywall framework was infilled with a single layer of nominally 50 mm thick mineral wool insulation with a measured density of 104 kg/m ³ . The wall incorporated sixteen circular apertures, each penetrated by a range of plastic pipes sealed utilizing two-layer pipe wrap 'PipeBloc PWP'. The pipe wraps were fitted so that they were flush with both the unexposed and exposed faces. A single bead of Pyrocoustic sealant was applied over the wraps to seal them in. The thicknesses of the PipeBloc PWP changed from 2 mm to 8 mm and 10 mm based on the specimen. The width of the wrap is 40 mm.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366- 3:2009 and BS EN 1363-1:2012.

The test specimen achieved the results shown in Table 27.

Service	Description	Ir	ntegrity (minute	s)	Insulation
		Cotton pad	Sustained flaming	Gap gauge	(minutes)
A	A single PP pipe of 50 mm diameter and 2.9 mm wall thickness	132*	132*	132*	132*
В	A single PVC pipe of 50 mm diameter and 1.8 mm wall thickness	132*	132*	132*	132*
С	A single PE pipe 50 mm diameter and 2.9 mm wall thickness	132*	132*	132*	132*
D	A single PP pipe of 160 mm diameter and 4.0 mm wall thickness	132*	132*	132*	116
E	A single PP pipe of 160 mm diameter 14.6 mm wall thickness	132*	132*	132*	132*
F	A single PVC pipe of 160 mm diameter and 6.2 mm wall thickness	119#	119#	119#	119#
G	A single PVC pipe of 160 mm diameter and 9.5 mm wall thickness	132*	132*	132*	126
Н	A single PE pipe of 160 mm diameter and 4.9 mm wall thickness	17#	17#	17#	15#
I	A single PE pipe of 160 mm diameter and 9.5 mm wall thickness	100#	101#	101#	95#
J	A single PP pipe of 200 mm diameter and 4.9 mm wall thickness	132*	132*	132*	94#
К	A single PP pipe of 200 mm diameter and 18.2 wall thickness	132*	132*	132*	129
L	A single PVC pipe of 200 mm diameter and 7.7 mm wall thickness	126#	126#	126#	126
Μ	A single PVC pipe of 200 mm diameter and 9.6 mm wall thickness	132*	132*	132*	132*
N	A single PE pipe of 200 mm diameter and 4.9 mm wall thickness	15#	15#	15#	15#
0	A single PE pipe of 200 mm diameter and 18.4 mm wall thickness	132*	132*	132*	132*
Р	A single PP pipe of 250 mm diameter and 10.1 mm wall thickness	132*	132*	132*	28

Table 27Results summary for test report WF 349353

* Test duration.

Specimen blanked off to allow the test to continue



B.8 Test report – WF 350178

Table 28 Information about test report WF 350178

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian EH28 8PL, United Kingdom.
Test date	The fire resistance test was completed on 11/03/2015.
Test standards	The test was done in accordance with BS EN 1366-3:2009 and BS EN 1363-1:2012.
Variation to test standards	The test report does not specify any variations from the test standard.
General description of tested specimen	The separating element was a section of floor with overall dimensions of 2230 mm by 1740 mm by 150 mm thick and was provided with nine circular apertures, each penetrated by a range of plastic pipes which were plugged on the unexposed side. Each specimen was fitted with two pipe wraps referenced 'PipeBloc PWP', fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of 'Pyrocoustic sealant' to both sides of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 and BS EN 1363-1:2012.

The test specimen achieved the results shown in Table 29.

Table 29 Results summary for test report WF 350178

Service	Description	Integrity (minutes)			Insulation
		Cotton pad	Sustained flaming	Gap gauge	(minutes)
A	50 mm diameter by 1.8 mm wall thickness PVC pipe	132*	132*	132*	132*
В	200 mm diameter by 9.6 mm wall thickness PVC pipe	67#	68#	68#	67#
С	200 mm diameter by 7.7 mm wall thickness PVC pipe	132*	132*	132*	102
D	220 mm diameter by 4.9 mm wall thickness PP pipe	24#	24#	24#	19#
E	50 mm diameter by 2.9 mm wall thickness PP pipe	132*	132*	132*	132*
F	200 mm diameter by 18.2 mm wall thickness PP pipe	132*	132*	132*	114
G	200 mm diameter by 4.9 mm wall thickness HDPE pipe	132*	132*	132*	132*
Н	50 mm diameter by 2.9 mm wall thickness HDPE pipe	132*	132*	132*	132*
I	200 mm diameter by 11.4 mm wall thickness HDPE pipe	132*	132*	132*	132*

* Test duration.

Specimen blanked off to allow the test to continue

B.9 Assessment report – FAS190042 R1.2

Table 30 Information about assessment report FAS190042 R1.2

Item	Information about test report			
Report sponsor	Boss Products Australia Pty Ltd.			
Assessment prepared by	Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.			
Assessment issued date	R1.2 was issued on 01/10/2020.			
Assessment standards	The assessment was done in accordance with AS 1530.4:2014 and AS 4702.1:2005.			
General description of assessment	The assessment was undertaken to determine the likely fire resistance level (FRL) of BOSS FirePillow-240 fire pillows, P40-Mak Wrap insulation wrap and FireMastic-300 sealant used as primary and secondary fire protection systems around service penetrations in wall and floor systems if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.			

The assessed pipe penetrations are shown in Table 31 and Table 32.

Table 31Wall mounted specimens

Service	Separating element	Primary fire protection	Secondary fire protection	Fire Resistance Level (FRL)
None	Minimum 140 mm thick concrete block	BOSS FirePillow-240	FireMastic-300	-/180/180
100 mm diameter copper pipe with a minimum wall thickness of 1.8 mm	wall Aperture: nominal dimensions 600 mm	BOSS FirePillow-240	FireMastic-300 and radiation guard	-/180/180
	wide (or greater) × 400 mm high	BOSS FirePillow-240	FireMastic-300 BOSS P40-Mak Wrap wrapped twice around the pipes and extended 300 mm from the exposed side and 600 mm from the unexposed side, pushed up to the separating element, over the fillet of FireMastic-300.	-/180/120

Table 32Floor mounted specimens

Service	Separating element	Primary fire protection	Secondary fire protection	Fire Resistance Level (FRL)
None	Minimum 150 mm thick concrete floor	BOSS FirePillow-240	FireMastic-300	-/180/180
100 mm diameter copper pipe with a minimum wall	Aperture: nominal dimensions 600 mm wide (or greater) ×	BOSS FirePillow-240	FireMastic-300 and radiation guard	-/180/180
mm	400 mm high	BOSS FirePillow-240	FireMastic-300 BOSS P40-Mak Wrap wrapped twice around the pipes, and extended 600 mm from the unexposed side, pushed up to the separating element, over the fillet of FireMastic-300.	-/180/120



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