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Fire assessment report

Metal pipes and cables in walls and floors protected with BOSS UniWrap, BOSS Firemastic or BOSS EMA silicone and Thermal Defence wrap

Sponsor: BOSS Products Australia Pty Ltd

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Quality management

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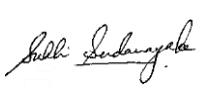
<tr><td>Signature</td><td>  </td><td>  </td><td>  </td></tr>
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Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of lagged and unlagged metal pipes and cables in walls and floors when protected with BOSS fire protection systems – if tested in accordance with AS 1530.4:2014 and assessed in general accordance with AS 4072.1:2005.

The service penetrations assessed were bare metal pipe penetrations, insulated metal pipe penetrations, and cable penetrations. The products assessed include BOSS UniWrap™ pipe wrap, BOSS Thermal Defence™ insulation wrap, BOSS FireMastic-300™, BOSS FireSilicone EMA™, BOSS Batts and BOSS FirePillows-240™.

BOSS UniWrap® Pipe Wrap has an intumescent composition designed to provide high volume expansion and pressure seal.

BOSS Thermal Defence wrap is an insulation wrap for protecting metallic and cable services penetrating various separating elements. It is an intumescent flexible insulation with an aluminium foil outer sheath.

BOSS FireMastic-300™ is identified as a flexible acrylic intumescent sealant. BOSS FireSilicone EMA™ is a one-part silicone sealant with intumescent properties.

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

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 analysis in sections 5 to 7 of this report found that the proposed variations identified in Table 1 are likely to achieve the fire resistance levels (FRL) as shown in Table 2 and Table 3, if tested in accordance with AS 1530.4:2014.

Table 1 Variations to tested systems

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
1.	Minimum 116 mm thick framed or rigid walls with an established FRL of -/120/120 Minimum 100 mm thick framed or rigid walls with an established FRL of -/90/90	• 32 mm – 159 mm diameter Copper, steel and iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Cables in general accordance with Appendix D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm^2 and 1 × 630 mm^2) Assessed cables are limited to the following: Up to 2.5 mm^2 2C+E TPS power cable Up to 60 × 50 pair, 0.5 mm (as per Appendix D2) Up to 3 × 6 mm^2 3 core and earth Up to 8 × 16 mm^2 3 core and earth	R001874 WF 355667 WF 349353 FSP 1833	In R001874, non-combustible pipes tested included copper pipes mounted in the multiple penetration seals and in the flexible wall of 100 mm thickness (single services). The copper pipes were insulated with varying thicknesses of Armaflex AF and sealed with PipeBloc EL pipe wraps with 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 and the remaining annular space was filled with Pyrocoustic sealant. In WF 355667, The tested specimen consisted of a 100 mm thick wall. The wall was provided with two apertures 1200 mm × 750 mm wide penetrated by 10 copper pipes each with 2 layers of 2 mm thick PipeBloc EL fitted to each side of the pattress. The aperture was fitted with BOSS Batts. In WF 349353, the separating element was a 100 mm thick wall with 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. In FSP 1833, seven services penetrating a 96 mm thick plasterboard wall protected with sealants was tested. Specimens 3, 4 and 6 referenced cable configurations as per Appendix D1 and Appendix D2 of AS 1530.4:2014 except the testing of 4 × 185 mm^2 and 1 × 630 mm^2 . Cables were protected with 50 mm fillet of BOSS	• Copper, steel or iron pipes with continuous Thermobreak lagging or Fibreglass/mineral wool lagging may be used. • PipeBloc EL wrap to be replaced with the identical BOSS UniWrap. • Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. • Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. • Larger apertures can be filled with two layers of 50 mm thick BOSS Batts. Sealant must be applied at each vertical and horizontal cut of the batts at the substrate. All edges of the joints of the batts must be sealed with BOSS FireMastic-300 or BOSS FireSilicone EMA. • Larger apertures can be filled with BOSS FirePillows-240. Sealant must be applied at the interface between the pillows and the substrate. • Bare copper, steel or iron pipes must be sealed with BOSS FireMastic-300 and BOSS FireSilicone EMA sealant. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. – For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant.

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
				FireMastic-300 on both exposed and unexposed faces and P40-MAK wrap wrapped twice around the cable trays.	– The applied sealant must be finished with a 20 mm × 20 mm fillet on each side. – The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240. • For the insulation performance of both lagged and unlagged metallic pipes, BOSS Thermal Defence wrap must be wrapped around the pipe and extended for the following lengths on each side from the separating element: – Ø32 mm-Ø113 mm steel and Iron pipes: 300 mm each side of the wall – Ø113 mm-Ø159 mm steel and Iron pipes: 600 mm on each side of the wall – Ø32 mm-Ø54 mm copper pipes: 250 mm on each side of the wall – Ø54 mm-Ø159 mm copper pipes: 600 mm on each side of the wall • Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240. • Cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. – For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. – The applied sealant must be finished with a 50 mm fillet on each side.
	Rigid walls built up to minimum thickness of 100 mm		WARRES 304406/A EWFA 34923800.3 WARRES 187564	In WARRES 304406/A, an autoclaved blockwork wall of 150 mm thickness was provided with a 1100 mm high × 1100 mm wide aperture into which was installed cables (in trays and ladders) and a range of insulated and uninsulated metal pipes. The apertures were lined with S-Line Fire Pillows. Thermal Defence wrap was wrapped around the services.	

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
					– The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240. • For the insulation performance of cable penetrations, BOSS Thermal Defence wrap must be wrapped around cable trays and cable services and extended for a length of 600 mm on each side from the separating element. Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240.
2.	Minimum 150 mm thick concrete floor	• 32 mm -159 mm diameter Copper, steel and iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	WARRES 350178 WF 361932 WARRES 187564 WF 412624	In WARRES 350178, the tested specimen comprised a 150 mm thick floor section. The floor had nine circular apertures, each penetrated by a range of plastic pipes. Each specimen was fitted with two pipes wraps referenced as 'PipeBloc PWP'. The PipeBloc was fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of 'Pyrocoustic sealant' on both faces of the floor assembly. In WF 361932, the test specimen comprised of a floor 150 mm thick. It consisted of twelve circular apertures, each penetrated by a range of plastic pipes plugged on the unexposed side. Each Ø50 mm service was fitted with two pipe wraps referenced as 'PipeBloc EL' and each Ø200 mm service was fitted with ten layers. The pipe wrap was adhered to the service and fitted to mid-depth of the aperture. Each annular gap was sealed with a single bead of 'Pyrocoustic sealant' to the unexposed face of the floor assembly. In WF 412624, the test specimen consisted of a 150 mm thick floor provided with nine square apertures, each penetrated by a	• Copper, steel or iron pipes with continuous Thermobreak lagging or Fibreglass/mineral wool lagging may be used. • PipeBloc EL wrap to be replaced with the identical BOSS UniWrap. • Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. • Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. • Larger apertures can be filled with two layers of 50 mm thick BOSS Batts. Sealant must be applied at each vertical and horizontal cut of the batts at the substrate. All edges of the joints of the batts must be sealed with BOSS FireMastic-300 or BOSS FireSilicone EMA. • Bare copper, steel or iron pipes may be used sealed with BOSS FireMastic-300 and BOSS FireSilicone EMA sealant.

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
				range of pipes and cables and sealed with a penetration sealing system. Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	• Cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS FireSilicone EMA. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on the unexposed side of the floor. – For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. – The applied sealant must be finished with a 50 mm fillet on the unexposed side of the floor. – The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240. • For the insulation performance of services, BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.

Table 2 Assessment outcomes for copper, steel or iron pipes and cables penetrating walls

Wall type	FRL	Minimum wall thickness required	Service	Lagged and unlagged services	Thermal Defence wrap length for lagged and unlagged services+
Framed walls or rigid walls with larger apertures protected with BOSS Batts* Or FirePillows-240 (Rigid walls may be with or without build-up**)	-/90/90	100 mm	32 mm – 159 mm diameter metal pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm	Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. Bare services and cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA.	• Ø32 mm-Ø113 mm steel and iron pipes: 300 mm each side of the wall • Ø113 mm-Ø159 mm steel and iron pipes: 600 mm on each side of the wall • Ø32 mm-Ø54 mm copper pipes: 250 mm on each side of the wall • Ø54 mm-Ø159 mm copper pipes: 600 mm on each side of the wall
	-/120/120	116 mm			
			• Cables in general accordance with Appendix D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm^2 and 1 × 630 mm^2) Assessed cables are limited to the following: Up to 2.5 mm^2 2C+E TPS power cable Up to 60 × 50 pair, 0.5 mm (as per Appendix D2) Up to 3 × 6 mm^2 3 core and earth Up to 8 × 16 mm^2 3 core and earth	• The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. • For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. • The applied sealant must be finished with a 20 mm × 20 mm fillet on each side for bare pipes and 50 mm fillet on each side for cables. • The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240.	600 mm on each side of the wall

*Two layers of 50 mm BOSS Batts

**The build-up options must be tested to achieve an established integrity performance of at least 90 minutes for an FRL of -/90/90 or at least 120 minutes for an FRL of -/120/120

+Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240™

Table 3 Assessment outcomes for copper, steel or iron pipes and cables penetrating floors

Floor type	FRL	Service	Lagged and unlagged services	Thermal Defence wrap length for lagged and unlagged services+
150 mm thick concrete floor with larger apertures protected with BOSS Batts* or FirePillows-240	-/120/120	• 32 mm – 159 mm diameter copper, steel or iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. Bare services and cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA. • The annular gap must be up to 20 mm and filled to a depth of 25 mm on the unexposed side. • The applied sealant must be finished with a 0 mm × 20 mm fillet on the unexposed side for metal pipes and 50 mm fillet on the unexposed side for cables. • The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240.	For the insulation performance of services, BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.
*Two layers of 50 mm BOSS Batts				

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 8 of this report. The results of this report are valid until 31 December 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 lagged and unlagged metal pipes and cables in walls and floors protected with BOSS UniWrap, BOSS FireMastic-300 or BOSS EMA silicone and Thermal Defence insulation wrap – if tested in accordance with AS 1530.4:2014[1] and assessed in general accordance with AS 4072.1:2005[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 details

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 2019[3].

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 – e.g. 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 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 1[4] under A5.2(1) (d) and 2016 under specification A2.3, including amendments.

This assessment has been written in accordance with the general principles outlined in EN 15725:2010[5] 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 26 August 202026 August 202026 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 4.3.
- 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.
- 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.
- For steel framed, plasterboard lined walls and rigid walls, the outer diameter of the metal pipes range between 32 mm ≤ D ≤ 159 mm.
- Maximum wall thickness for copper pipes is 1.0 mm
- Maximum wall thickness for steel/iron pipes is 4.5 mm
- For concrete slabs, the outer diameter of the metal pipes range between 32 mm ≤ D ≤ 159 mm.
- Cables assessed in walls are in general accordance with Appendix D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm2 and 1 × 630 mm2). Assessed cables are limited to the following:
  - Up to 2.5 mm^2 2C+E TPS power cable
  - Up to 60 × 50 pair, 0.5 mm (as per Appendix D2)
  - Up to 3 × 6 mm^2 3 core and earth

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

  - Up to 8 × 16 mm^2 3 core and earth

- Cables assessed in floors include maximum number of cores and maximum core diameters as outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014
- This report is only valid for the assessed systems and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL).
- The documentation that forms the basis for this report is listed in Appendix A.
- 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

The proposed construction consists of lagged and unlagged metal pipes and cables protected with BOSS UniWrap, fire rated sealant such as BOSS FireMastic-300 and BOSS EMA silicone sealant and wrapped with Thermal Defence wrap. The details of the separating elements are as follows:

- Minimum 116 mm thick framed walls that consist of 64 mm steel stud lined with two layers of minimum 13 mm thick fire rated plasterboard on each side with an established FRL of -/120/120.
- Minimum 100 mm thick framed walls that consist of 64 mm steel stud lined with one layer of minimum 16 mm thick fire rated plasterboard on each side with an established FRL of -/90/90.
- Minimum 75 mm AAC rigid walls built up to minimum thickness of 100 mm by additional plasterboards or BOSS batts.
- Minimum 150 mm thick concrete floor.

The proposed sealing system in walls are as follows:

- Large apertures can be protected by two layers of 50 mm BOSS Batts or BOSS FirePillows-240™.
- Lagged metal pipes of diameter from 32 mm – 159 mm must be wrapped with multiple layers of BOSS UniWrap placed flush to both the exposed and unexposed sides and further sealed with a fire-rated mastic sealant such as BOSS Firemastic-300 or BOSS FireSilicone EMA sealant. For the insulation performance, the services must be wrapped with Thermal Defence wrap for lengths as specified in Table 7. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm
- Unlagged metal pipes of diameter from 32 mm – 159 mm must be sealed with a fire-rated sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant to a depth of 20 mm on each side of the wall and finished with a 20 mm × 20 mm fillet. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 7. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm

- For cable services, the annular gap must be filled with fire rated sealant such as BOSS FireMastic-300 and BOSS FireSilicone EMA sealant for a depth of 25 mm on each side. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 8.

The proposed sealing system in floors are as follows:

- Large apertures can be protected by two layers of 50 mm BOSS batts or BOSS FirePillows-240™.
- Lagged metal pipes of diameter from 32 mm – 159 mm must be wrapped with multiple layers of BOSS UniWrap on the unexposed side of the floor and further sealed with a fire rated mastic sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant. For the insulation performance, the service must be wrapped with Thermal Defence wrap on the unexposed side. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm.
- Unlagged metal pipes of diameter from 32 mm – 159 mm must be sealed with a fire rated sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant to a depth of 20 mm on each side of the floor and finished with a 20 mm × 20 mm fillet. For the insulation performance, the service must be wrapped with Thermal Defence wrap on the unexposed side. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm.
- For cable services, the annular gap must be filled with fire rated sealant such as BOSS FireMastic-300 and BOSS FireSilicone EMA sealant for a depth of 25 mm the unexposed side. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 9.

4.2 Referenced test data

The assessment of the variations to the tested systems and the determination of the likely performance is based on the results of the fire tests documented in the reports summarised in Table 5.

Table 5 Referenced test data

Report number	Test sponsor	Test date	Testing authority
WARRES187564	Firestopit Limited	24 April 2009	Bodycote
WARRES 304406/A	Firestopit Limited	30 March 2011	Exova Warringtonfire
WARRES 349353 Issue 3	FSI Limited	23 March 2015	Warringtonfire
WARRES 350178	FSI Limited	11 March 2015	Warringtonfire
EWFA 34923800.3	BOSS Fire and Safety	04 June 2015	Exova Warringtonfire
WF 361932	FSI Limited	16 March 2016	Exova Warringtonfire
R001874	FSI Limited	23 July 2019	Effectis
WF 355667 Issue 4	FSI Limited	15 June 2016	Exova Warringtonfire
FSP 1833	BOSS Fire & Safety P/L	9 May 2017	CSIRO Infrastructure Technologies
WF 412624	FSI Limited	13 May 2019.	Exova Warringtonfire

4.3 Variations to the tested systems

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

Table 6 Variations to tested systems

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
1.	Minimum 116 mm thick framed or rigid walls with an established FRL of -/120/120 Minimum 100 mm thick framed or rigid walls with an established FRL of -/90/90	• 32 mm – 159 mm diameter Copper, steel and iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Cables in general accordance with Appendix D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm^2 and 1 × 630 mm^2) Assessed cables are limited to the following: Up to 2.5 mm^2 2C+E TPS power cable Up to 60 × 50 pair, 0.5 mm (as per Appendix D2) Up to 3 × 6 mm^2 3 core and earth Up to 8 × 16 mm^2 3 core and earth	R001874 WF 355667 WF 349353 FSP 1833	In R001874, non-combustible pipes tested included copper pipes mounted in the multiple penetration seals and in the flexible wall of 100 mm thickness (single services). The copper pipes were insulated with varying thicknesses of Armaflex AF and sealed with PipeBloc EL pipe wraps with 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 and the remaining annular space was filled with Pyrocoustic sealant. In WF 355667, The tested specimen consisted of a 100 mm thick wall. The wall was provided with two apertures 1200 mm × 750 mm wide penetrated by 10 copper pipes each with 2 layers of 2 mm thick PipeBloc EL fitted to each side of the pattress. The aperture was fitted with BOSS Batts. In WF 349353, the separating element was a 100 mm thick wall with 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. In FSP 1833, seven services penetrating a 96 mm thick plasterboard wall protected	• Copper, steel or iron pipes with continuous Thermobreak lagging or Fibreglass/mineral wool lagging may be used. • PipeBloc EL wrap to be replaced with the identical BOSS UniWrap. • Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. • Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. • Larger apertures can be filled with two layers of 50 mm thick BOSS Batts. Sealant must be applied at each vertical and horizontal cut of the batts at the substrate. All edges of the joints of the batts must be sealed with BOSS FireMastic-300 or BOSS FireSilicone EMA. • Larger apertures can be filled with BOSS FirePillows-240. Sealant must be applied at the interface between the pillows and the substrate. • Bare copper, steel or iron pipes must be sealed with BOSS FireMastic-300 and BOSS FireSilicone EMA sealant. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall.

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
				with sealants was tested. Specimens 3, 4 and 6 referenced cable configurations as per Appendix D1 and Appendix D2 of AS 1530.4:2014 except the testing of 4 × 185 mm^2 and 1 × 630 mm^2 . Cables were protected with 50 mm fillet of BOSS FireMastic-300 on both exposed and unexposed faces and P40-MAK wrap wrapped twice around the cable trays.	– For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. – The applied sealant must be finished with a 20 mm × 20 mm fillet on each side. – The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240.
	Rigid walls built up to minimum thickness of 100 mm		WARRES 304406/A EWFA 34923800.3 WARRES 187564	In WARRES 304406/A, an autoclaved blockwork wall of 150 mm thickness was provided with a 1100 mm high × 1100 mm wide aperture into which was installed cables (in trays and ladders) and a range of insulated and uninsulated metal pipes. The apertures were lined with S-Line Fire Pillows. Thermal Defence wrap was wrapped around the services.	• For the insulation performance of both lagged and unlagged metallic pipes, BOSS Thermal Defence wrap must be wrapped around the pipe and extended for the following lengths on each side from the separating element: – Ø32 mm-Ø113 mm steel and Iron pipes: 300 mm each side of the wall – Ø113 mm-Ø159 mm steel and Iron pipes: 600 mm on each side of the wall – Ø32 mm-Ø54 mm copper pipes: 250 mm on each side of the wall – Ø54 mm-Ø159 mm copper pipes: 600 mm on each side of the wall • Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240. • Cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. – For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
					rod must be used to back the applied sealant. – The applied sealant must be finished with a 50 mm fillet on each side. – The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240. • For the insulation performance of cable penetrations, BOSS Thermal Defence wrap must be wrapped around cable trays and cable services and extended for a length of 600 mm on each side from the separating element. Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240.
2.	Minimum 150 mm thick concrete floor	• 32 mm -159 mm diameter Copper, steel and iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	WARRES 350178 WF 361932 WARRES 187564 WF 412624	In WARRES 350178, the tested specimen comprised a 150 mm thick floor section. The floor had nine circular apertures, each penetrated by a range of plastic pipes. Each specimen was fitted with two pipes wraps referenced as 'PipeBloc PWP'. The PipeBloc was fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of 'Pyrocoustic sealant' on both faces of the floor assembly. In WF 361932, the test specimen comprised of a floor 150 mm thick. It consisted of twelve circular apertures, each penetrated by a range of plastic pipes plugged on the unexposed side. Each Ø50 mm service was fitted with two pipe wraps referenced as 'PipeBloc EL' and each Ø200 mm service was fitted with ten layers. The pipe wrap was adhered to the service and fitted to mid-depth of the aperture. Each annular gap was sealed with a single bead	• Copper, steel or iron pipes with continuous Thermobreak lagging or Fibreglass/mineral wool lagging may be used. • PipeBloc EL wrap to be replaced with the identical BOSS UniWrap. • Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. • Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. • Larger apertures can be filled with two layers of 50 mm thick BOSS Batts. Sealant must be applied at each vertical and horizontal cut of the batts at the substrate. All edges of the joints of the batts must be sealed with BOSS FireMastic-300 or BOSS FireSilicone EMA.

Item	Wall system	Services	Reference tests	Description of relevant specimens	Variations
				of 'Pyrocoustic sealant' to the unexposed face of the floor assembly. In WF 412624, the test specimen consisted of a 150 mm thick floor provided with nine square apertures, each penetrated by a range of pipes and cables and sealed with a penetration sealing system. Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	• Bare copper, steel or iron pipes may be used sealed with BOSS FireMastic-300 and BOSS FireSilicone EMA sealant. • Cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS FireSilicone EMA. – The annular gap must be up to 20 mm and filled to a depth of 25 mm on the unexposed side of the floor. – For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. – The applied sealant must be finished with a 50 mm fillet on the unexposed side of the floor. – The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240. • For the insulation performance of services, BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.

4.4 Purpose of the test

Section 10 of AS 1530.4:2014 sets out the procedure for determining the fire resistance of elements of construction penetrated by services.

The purpose of the test covering service penetrations is to assess the:

- Effect of the penetration or control joint on the integrity and insulation of the element.
- Insulation or integrity failure of the penetrating service or control joint.

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, Table 8 and Table 9 outline the schedule of components for the assessed systems.

Table 7 Schedule of components of assessed metal pipes penetrating wall/floor systems (to be read in conjunction with Figure 1 to Figure 10)

Item		Description
Separating element		
1.	Item name	Wall separating element (no build-up)
	Installation	• For -/90/90 applications – minimum 100 mm thick flexible or rigid walls • For -/120/120 applications – minimum 116 mm thick flexible or rigid walls Options for flexible walls include walls with 64 mm deep stud and frame with minimum one layer of 16 mm thick fire rated plasterboard (100 mm thick as tested), 64 mm deep stud and frame with minimum two layers of 13 mm thick fire rated plasterboard (116 mm thick). For all cases, the wall system must have been tested or assessed to achieve the required FRL in accordance with AS 1530.4:2014.
	Item name	Floor separating element (no build-up)
	Installation	150 mm thick concrete floor conforming to specifications of AS 3600:2018[6] Amendment 1.
2.	Item name	Wall separating element (with build-up)
	Installation	Walls thinner than 100 mm such as Speedpanel, Korok, AAC/Hebel walls, Pronto Panel walls and Supapanel walls with build-up to achieve a minimum 100 mm thickness for an FRL of -/90/90 and a minimum of 116 mm thickness for an FRL of -/120/120.
Build-up on vertical separating element		
3.	Item name	Fire-stopping build-up
	Product name	BOSS Bulkhead Batts or FR plasterboard
	Size	Minimum 100 mm clearance from the perimeter of the Thermobreak or Fibreglass/mineral wool lagging.
	Nominal density	A minimum of 7 kg/m^3
	Installation	The thinner wall separating elements are to be build-up on either one or both sides to achieve a minimum 100 mm thickness for an FRL of -/90/90 and a minimum of 116 mm thickness for an FRL of -/120/120. The build-up must extend minimum 100 mm from the edge of the aperture, overlapping with the main separating element on all four sides of the service.
Services		

[6] Standards Australia, 2018, Concrete structures, AS 3600:2018, Standards Australia, NSW

Item	Description		
4.	Item name	Copper, steel or iron pipe	
	Pipe outer diameter (D)	For walls and floors	32 mm ≤ D ≤ 159 mm
	Wall thickness (mm)	Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm	
5.	Item name	Pipe lagging	
	Product name	Thermobreak or Fibreglass/mineral wool thermal lagging.	
	Size (Lagging)	Typical thickness (t)	30 mm ≤ t ≤ 50 mm
Wrap			
6.	Item name	Insulation wrap	
	Product name	BOSS Thermal Defence wrap™	
	Overall size	10 mm thick insulation with 0.3 mm thick Aluminium foil	
	Installation in walls	• Ø32 mm-Ø113 mm steel and iron pipes: 300 mm each side of the wall • Ø113 mm-Ø159 mm steel and iron pipes: 600 mm on each side of the wall • Ø32 mm-Ø54 mm copper pipes: 250 mm on each side of the wall • Ø54 mm-Ø159 mm copper pipes: 600 mm on each side of the wall Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240.	
	Installation in floors	BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.	
Sealant			
7.	Product name	BOSS FireMastic-300™ / BOSS FireSilicone EMA™	
	Nominal density	Nominal 1560 kg/m^3	
	Installation	With BOSS UniWrap fitted around services, BOSS FireMastic-300™ or BOSS FireSilicone EMA must be filled in the annular gap between the service and the wall on both sides. The mastic is then finished flush on both the exposed and the unexposed side. Unlagged services must be sealed with BOSS Firemastic-300™ or BOSS FireSilicone EMA sealant to a depth of 25 mm on each side of the wall and finished with a 20 mm × 20 mm fillet. In floors, the annular gap must be up to 20 mm and filled to a depth of 25 mm on the unexposed side. The applied sealant must be finished with a 20 mm × 20 mm fillet on the unexposed side	
Fire-stopping protections			
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 and floors, 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 × 100 mm Bugle head screw with washer.	
9.	Item name	Fire Pillows	

Item	Description	
	Product name	BOSS FirePillows-240™
	Pillow dimensions	330 mm long × 50 mm wide × 20 mm thick, Mass = 50 g 330 mm long × 200 mm wide × 25 mm thick, Mass = 185 g 330 mm long × 200 mm wide × 45 mm thick, Mass = 385 g
	Installation	The pillows must be tightly packed into the aperture around the service penetrations. The pillows must be positioned centrally in the aperture.
10.	Product name	BOSS UniWrap™
	Installation	BOSS UniWrap installed over Thermobreak lagging and flushed onto both faces of the separating element.
11.	Product name	Mineral Wool/Rockwool backing
	Installation	For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant
Fixings		
12.	Item name	BOSS Batt fixing
	Product name	14 – 10 × 100 mm Bugle head screws with washer
	Installation	4 × screws and washers used to secure each BOSS Batt to the separating element

Table 8 Schedule of components of assessed cable configurations penetrating wall systems (to be read in conjunction with Figure 11 to Figure 16)

Item		Description
Separating element		
1.	Item name	Wall separating element (no build-up)
	Installation	• For -/90/90 applications – minimum 100 mm thick flexible or rigid walls • For -/120/120 applications – minimum 116 mm thick flexible or rigid walls Options for flexible walls include walls with 64 mm deep stud and frame with minimum one layer of 16 mm thick fire rated plasterboard (100 mm thick as tested), 64 mm deep stud and frame with minimum two layers of 13 mm thick fire rated plasterboard (116 mm thick). For all cases, the wall system must have been tested or assessed to achieve the required FRL in accordance with AS 1530.4:2014.
2.	Item name	Wall separating element (with build-up)
	Installation	Walls thinner than 100 mm such as Speedpanel, Korok, AAC/Hebel walls, Pronto Panel walls and Supapanel walls with build-up to achieve a minimum 100 mm thickness for an FRL of -/90/90 and a minimum of 116 mm thickness for an FRL of -/120/120.
Build-up on vertical separating element		
3.	Item name	Fire-stopping build-up
	Product name	BOSS Bulkhead Batts or FR plasterboard
	Size	Minimum 100 mm clearance from the perimeter of the aperture
	Nominal density	A minimum of 7 kg/m^3
	Installation	The thinner wall separating elements are to be build-up on either one or both sides to achieve a minimum 100 mm thickness for an FRL of -/90/90 and a minimum of 116 mm thickness for an FRL of -/120/120. The build-up must extend minimum 100 mm from the edge of the aperture, overlapping with the main separating element on all four sides of the service.
Services		
4.	Item name	Cable configurations
	Configurations in walls	Cables in general accordance with D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm^2 and 1 × 630 mm^2) Assessed cables are limited to the following: • Up to 2.5mm^2 2C+E TPS power cable • Up to 60 × 50 pair, 0.5 mm (as per Appendix D2) • Up to 3 × 6 mm^2 3 core and earth • Up to 8 × 16 mm^2 3 core and earth
5.	Item name	Cable tray
	Size	Galvanized slotted cable tray minimum width 300 mm
Wrap		
6.	Item name	Insulation wrap
	Product name	BOSS Thermal Defence wrap™
	Overall size	10 mm thick insulation with 0.3 mm thick Aluminium foil
	Installation	600 mm on each side of the wall Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240.
Sealant		
7.	Product name	BOSS FireMastic-300™ / BOSS FireSilicone EMA™

Item		Description
	Nominal density	Nominal 1560 kg/m^3
	Installation	Services must be sealed with BOSS Firemastic-300^{TM} or BOSS FireSilicone EMA sealant to a depth of 25 mm on each side of the wall and finished with a 50 mm fillet.
Fire-stopping protections		
8.	Item name	BOSS Batt
	Product name	BOSS Bulkhead Batts
	Size	Minimum 100 mm clearance from the aperture.
	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 × 100 mm Bugle head screw with washer.
9.	Item name	Fire Pillows
	Product name	BOSS FirePillows-240^{TM}
	Pillow dimensions	330 mm long × 50 mm wide × 20 mm thick, Mass = 50 g 330 mm long × 200 mm wide × 25 mm thick, Mass = 185 g 330 mm long × 200 mm wide × 45 mm thick, Mass = 385 g
	Installation	The pillows must be tightly packed into the aperture around the service penetrations. The pillows must be positioned centrally in the aperture.
10.	Product name	Mineral Wool/Rockwool backing
	Installation	For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant
Fixings		
11.	Item name	BOSS Batt fixing
	Product name	14 – 10 × 100 mm Bugle head screws with washer
	Installation	4 × screws and washers used to secure each BOSS Batt to the separating element

Table 9 Schedule of components of assessed cable configurations penetrating floor systems (to be read in conjunction with Figure 17 to Figure 21)

Item		Description
Separating element		
1.	Item name	Floor separating element (no build-up)
	Installation	150 mm thick concrete floor conforming to specifications of AS 3600:2018 Amendment 1.
Services		
2.	Item name	Cable tray
	Size	Galvanized slotted cable tray minimum width 300 mm as per AS 1530.4:2014
3.	Item name	Cable configurations
	Configurations in floors	Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014
Wrap		
4.	Item name	Insulation wrap
	Product name	BOSS Thermal Defence wrap™
	Overall size	10 mm thick insulation with 0.3 mm thick Aluminium foil
	Installation	Double wrapped around services in floors. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240.
Sealant		
5.	Product name	BOSS FireMastic-300™ / BOSS FireSilicone EMA™
	Nominal density	Nominal 1560 kg/m^3
	Installation	Services must be sealed with BOSS Firemastic-300™ or BOSS FireSilicone EMA sealant to a depth of 25 mm on the unexposed side and finished with a 50 mm fillet.
Fire-stopping protections		
6.	Item name	BOSS Batt
	Product name	BOSS Bulkhead Batts
	Size	Minimum 100 mm clearance from the aperture.
	Nominal density	7 kg/m^3
	Installation	For AAC walls and floors, 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 × 100 mm Bugle head screw with washer.
7.	Item name	Fire Pillows
	Product name	BOSS FirePillows-240™
	Pillow dimensions	330 mm long × 50 mm wide × 20 mm thick, Mass = 50 g 330 mm long × 200 mm wide × 25 mm thick, Mass = 185 g 330 mm long × 200 mm wide × 45 mm thick, Mass = 385 g
	Installation	The pillows must be tightly packed into the aperture around the service penetrations. The pillows must be positioned centrally in the aperture.
8.	Product name	Mineral Wool/Rockwool backing

Item		Description
	Installation	For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant
Fixings		
9.	Item name	BOSS Batt fixing
	Product name	14 – 10 × 100 mm Bugle head screws with washer
	Installation	4 × screws and washers used to secure each BOSS Batt to the separating element

Figure 1 to Figure 16 show the assessed systems.

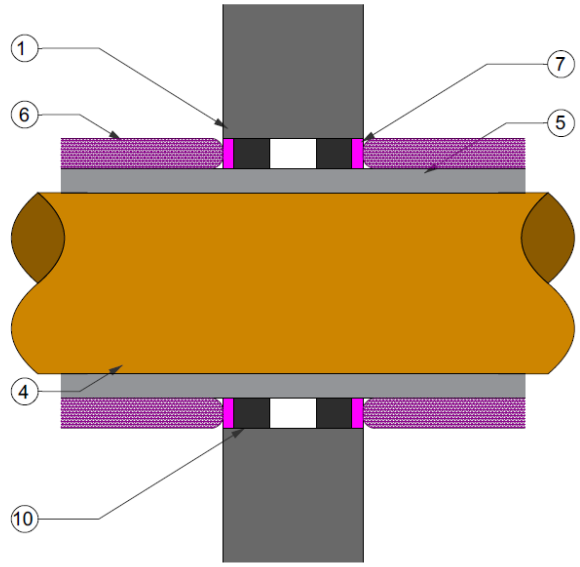

Figure 1 Lagged metal pipes in walls – with UniWrap, Thermal Defence wrap and FireMastic-300 or FireSilicone EMA

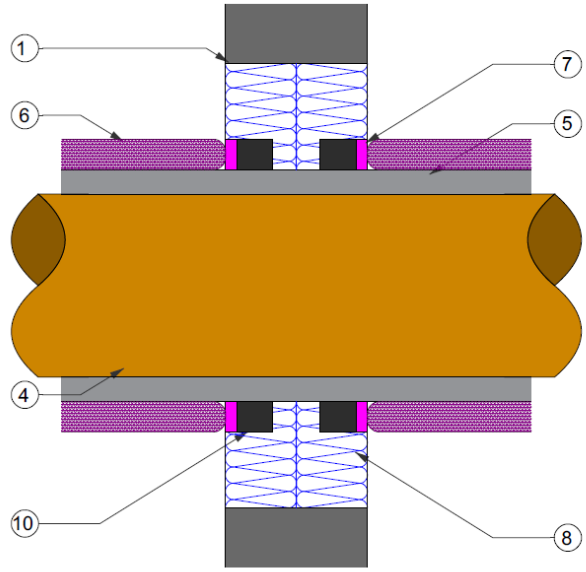

Figure 2 Lagged metal pipes in walls – with UniWrap, Thermal Defence wrap, BOSS Batts and FireMastic-300 or FireSilicone EMA

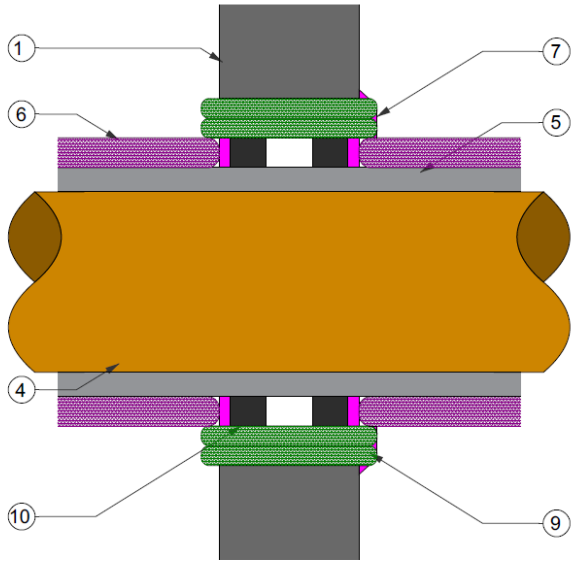

Figure 3 **Lagged metal pipes in walls – with UniWrap, Thermal Defence wrap, BOSS FirePillows-240 and FireMastic-300 or FireSilicone EMA**

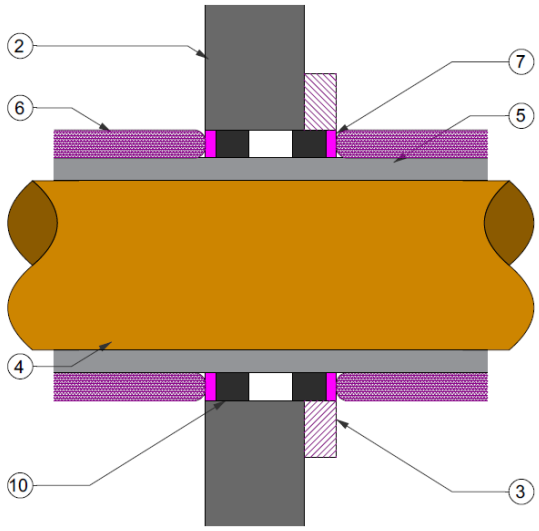

Figure 4 **Lagged metal pipes in built-up walls – with UniWrap, Thermal Defence wrap and FireMastic-300 or FireSilicone EMA**

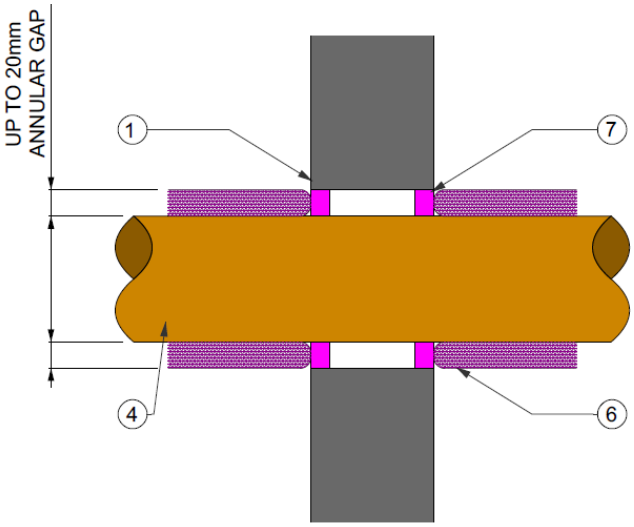

Figure 5 **Unlagged metal pipes walls – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

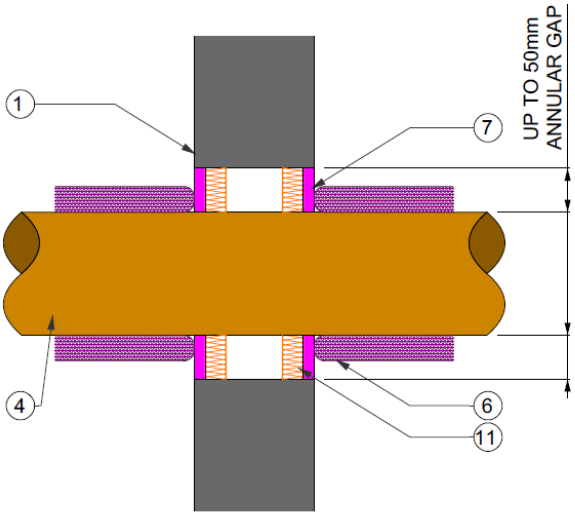

Figure 6 **Unlagged metal pipes walls – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA with mineral wool backing rod. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

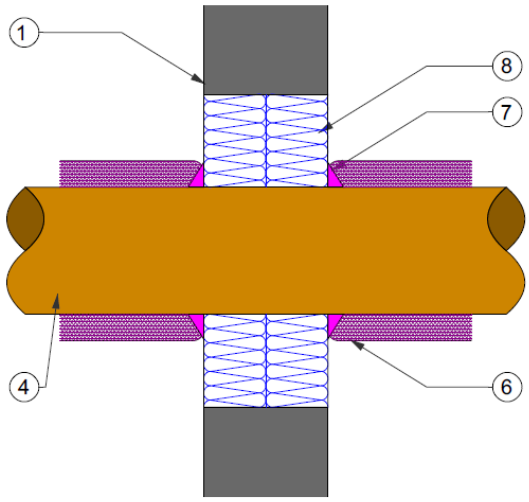

Figure 7 **Unlagged metal pipes walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

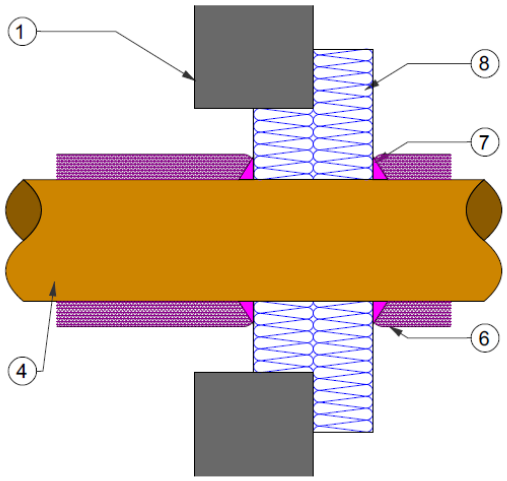

Figure 8 **Unlagged metal pipes walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

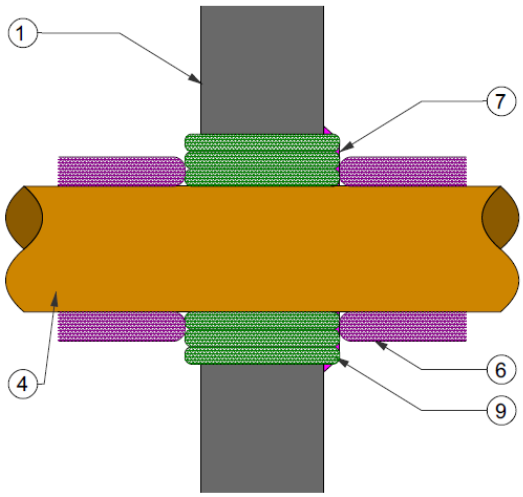

Figure 9 **Unlagged metal pipes walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS FirePillows-240. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

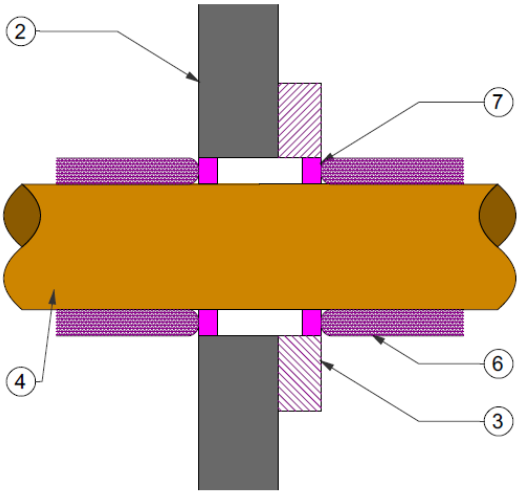

Figure 10 **Unlagged metal pipes in built-up walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.**

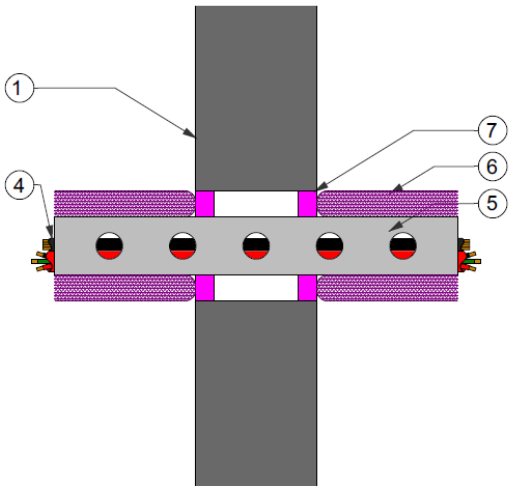

Figure 11 **Cable configurations in walls – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA. The applied sealant must be finished with a 50 mm fillet on each side.**

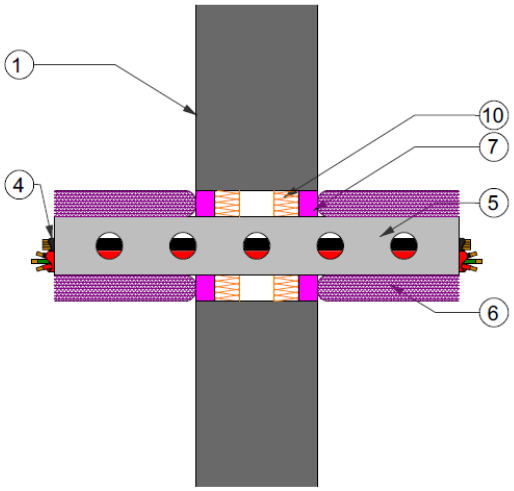

Figure 12 **Cable configurations in walls – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA with mineral wool backing rod. The applied sealant must be finished with a 50 mm fillet on each side.**

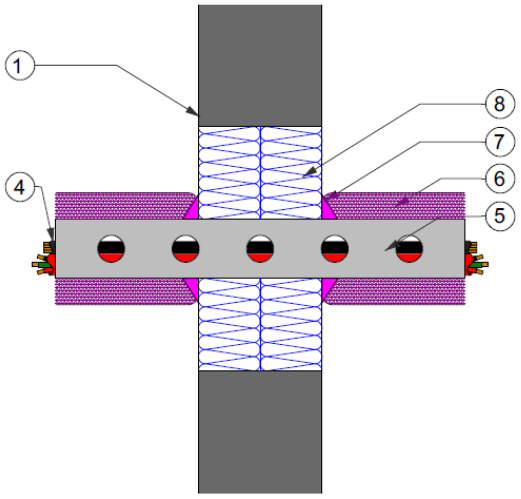

Figure 13 **Cable configurations in walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 50 mm fillet on each side.**

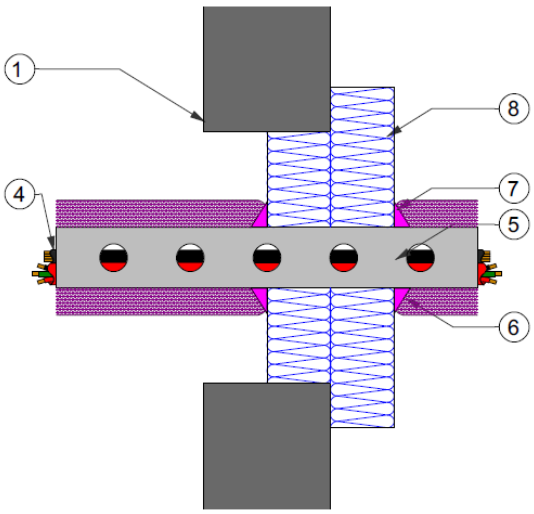

Figure 14 **Cable configurations in walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 50 mm fillet on each side.**

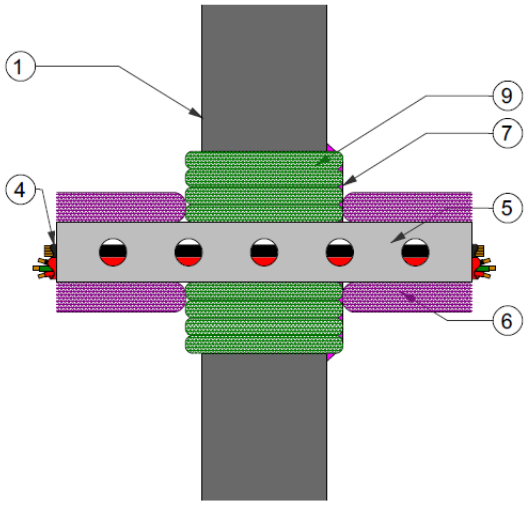

Figure 15 **Cable configurations in walls – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS FirePillows-240. The applied sealant must be finished with a 50 mm fillet on each side.**

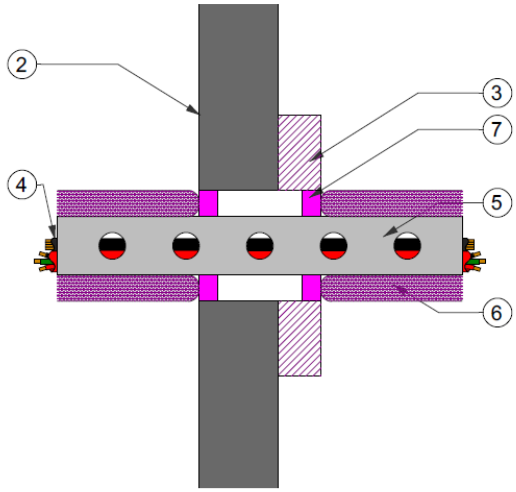

Figure 16 **Cable configurations in built-up walls – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA. The applied sealant must be finished with a 50 mm fillet on each side.**

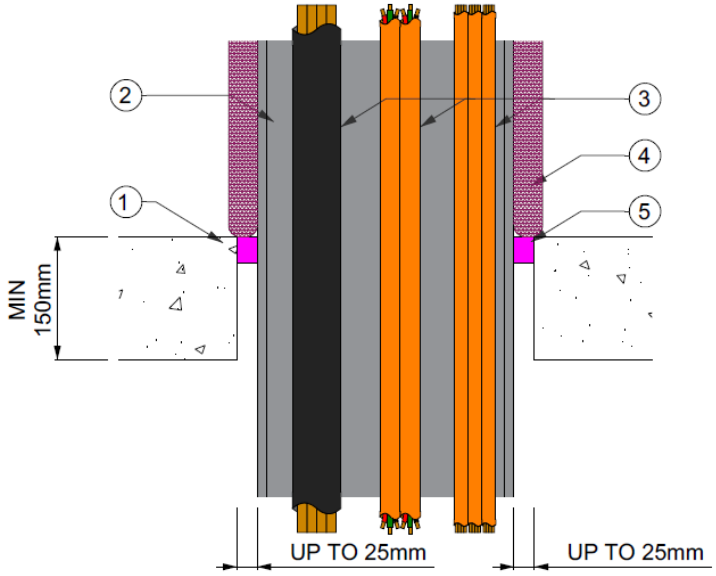

Figure 17 **Cable configurations in floors – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA. The applied sealant must be finished with a 50 mm fillet on the unexposed side.**

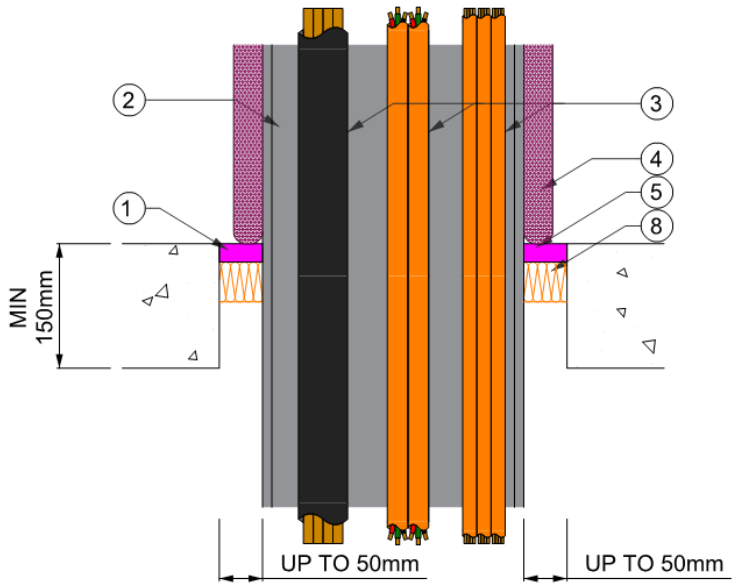

Figure 18 **Cable configurations in floors – with Thermal Defence wrap and FireMastic-300 or FireSilicone EMA applied with mineral wool backing rod. The applied sealant must be finished with a 50 mm fillet on the unexposed side.**

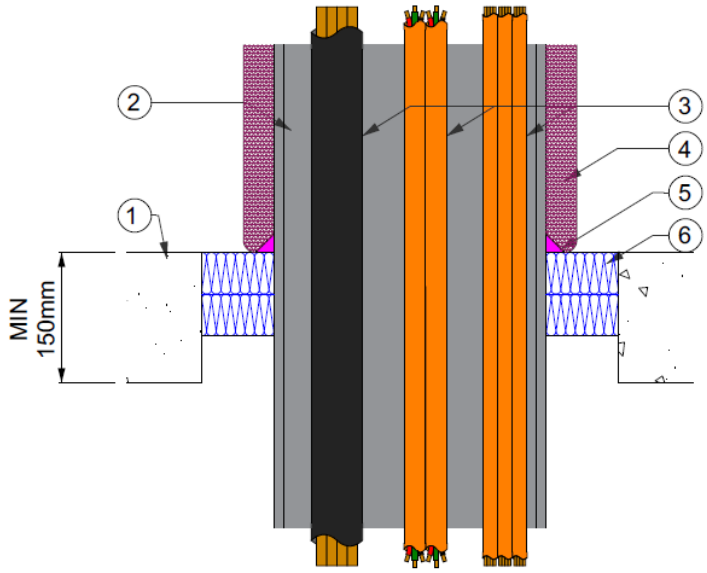

Figure 19 **Cable configurations in floors – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 50 mm fillet on the unexposed side.**

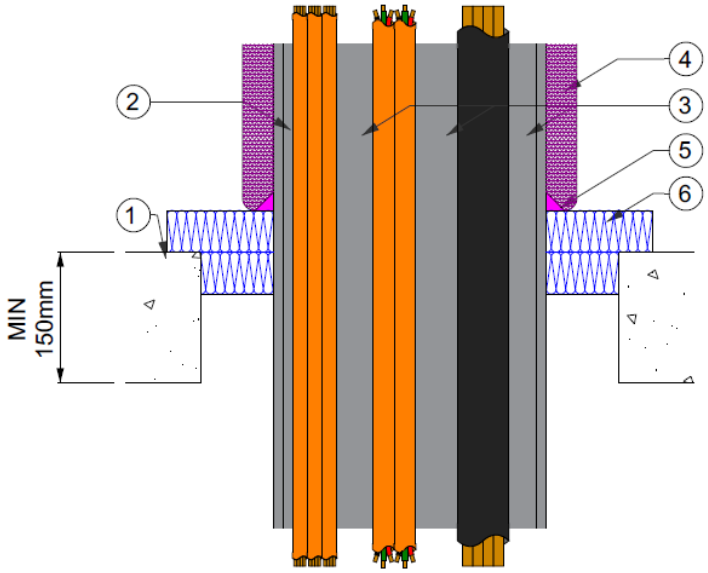

Figure 20 **Cable configurations in floors – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and BOSS Batts. The applied sealant must be finished with a 50 mm fillet on the unexposed side.**

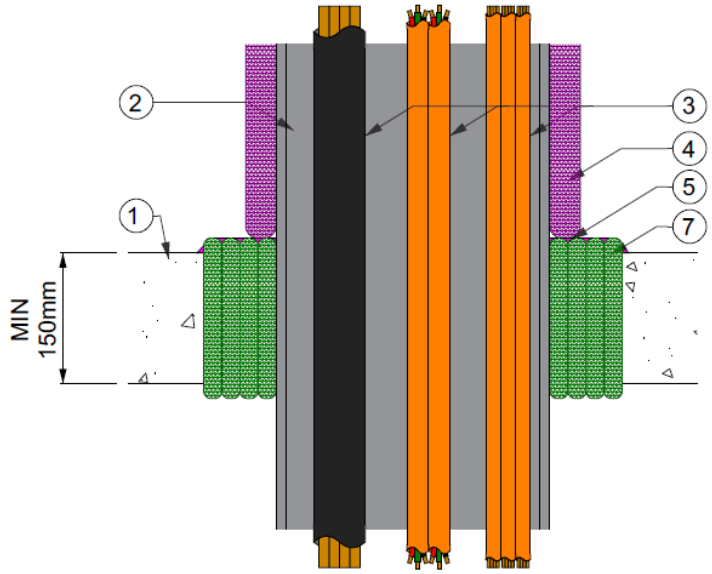

Figure 21 **Cable configurations in floors – with Thermal Defence wrap, FireMastic-300 or FireSilicone EMA and FirePillows-240. The applied sealant must be finished with a 50 mm fillet on the unexposed side.**

5. Assessment 1 – Relevance of BS EN 1366.3:2009 test data with respect to AS 1530.4:2014

5.1 Description of variation

The fire resistance tests R001874, WARRES 304406/A, WARRES 350178, WF361932, WF 355667, WF 412624 and WF 349353 were conducted in accordance with BS EN 1366-3:2009[7] and BS EN 1363-1:1999[8], where appropriate. These standards differ from AS 1530.4:2014 and the significance of these differences are discussed below.

5.2 Methodology

The method of assessment used is summarised in Table 10.

Table 10 Method of assessment

Assessment method	
Level of complexity	Intermediate assessment
Type of assessment	Comparative

5.3 Assessment

5.3.1 Temperature regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4:2014 follows the same trend as EN 1363-1:2012.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and EN 1363-1:2012 are not appreciably different.

5.3.2 Furnace thermocouples

The furnace thermocouples specified in AS 1530.4:2014 are type K, mineral insulated metal sheathed (MIMS), with a stainless-steel sheath having a wire of diameter of less than 1.0 mm and an overall diameter of 3 mm. The measuring junction protrudes at least 25 mm from the supporting heat resistant tube.

The furnace thermocouples specified in EN 1363-1:2012 are plate thermometers comprised of an assembly of a folded nickel alloy plate, a thermocouple fixed to it and insulation material. A thermocouple is fixed to the side of the plate facing the specimen, with the thermocouple hot junction protected by a pad of insulating material.

The plate is to be constructed from 150 $\pm$ 1 mm long by 100 $\pm$ 1 mm wide by 0.7 $\pm$ 0.1 mm thick austenitic nickel-based superalloy strips.

The measuring junction is to consist of nickel chromium/nickel aluminium (Type K) wire as defined in EN 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter 1 mm to 3 mm, with the hot junctions electrically insulated from the sheath.

The thermocouple hot junction is to be fixed to the geometric centre of the plate in the position by a small steel strip made from the same material as the plate. The steel strip can be welded to the plate – or may be screwed to it – to facilitate replacement of the thermocouple. The strip should be approximately 18 mm by 6 mm if it is spot-welded to the plate and nominally 25 mm by 6 mm if it is to be screwed to the plate. The screw is to be 2 mm in diameter.

The assembly of plate and thermocouple should be fitted with a pad of inorganic insulation material 97 $\pm$ 1 mm by 97 $\pm$ 1 mm by 10 $\pm$ 1 mm thick with a density of 280 $\pm$ 30 kg/m^3.

[7] European Committee for Standardization, 2009, Fire resistance tests for service installations. Penetration seals, EN 1366-3:2009, European Committee for Standardization, Brussels, Belgium
[8] European Committee for Standardization, 1999, Fire resistance tests – General requirements, EN 1363-1:1999, European Committee for Standardization, Brussels, Belgium

EN 1363-1:2012 specifies that each plate thermometer shall be at least 100 ± 50 mm from the nearest point of the exposed face of the test construction, whereas AS 1530.4:2014 stipulates a distance of 100 ± 10 mm.

The furnace control thermocouples required by EN 1363-1:2012 are less responsive than those specified by AS 1530.4:2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to EN 1363-1:2012, particularly when the furnace temperature is changing quickly in the early stages of the test.

5.3.3 Specimen thermocouples

For penetration sealing systems, thermocouples are fixed in generally similar locations on the unexposed face in both EN 1363-1:2012 and AS 1530.4:2014. These locations are on the supporting construction, the sealing system, the penetrating service adjacent at the plane of penetration, and on the penetrating service some distance from the plane of penetration.

5.3.4 Furnace pressure

It is a requirement of both AS 1530.4:2014 and EN 1363-1:2012 that for vertical elements, the furnace shall be operated so that the neutral pressure plane (a pressure of 0 Pa) is established at a height 500 mm above the notional floor level.

For wall penetrations, AS 1530.4:2014 requires that – if the separating element has a height greater than 1 m – it shall be tested with a pressure of 20 ± 3 Pa at the top of the separating element and that the horizontal penetrating services shall be included in the zone where positive pressure exceeds 10 Pa. EN 1366-3:2009 specifies that a minimum pressure of 20 Pa shall be maintained at the top of the uppermost penetration seal in a vertical supporting construction and that services shall only be included in the zone where the positive pressure exceeds 10 Pa.

Therefore, both standards require that a minimum pressure of 10 Pa be maintained at the lowest point of the lowest service.

It is a requirement of both AS 1530.4:2014 and EN 1363-1:2012 that for horizontal elements, a furnace gauge pressure of 20 Pa is established at a height 100 mm below the floor soffit level.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and EN 1363.1-:2012 are also not appreciably different.

5.3.5 Performance criteria

The performance criteria discussed – as pertaining to the current assessment – are integrity and insulation.

Integrity

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

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

- Sustained flaming for 10 seconds.
- A gap forms that allows the passage of hot gases to the unexposed face and ignites the cotton pad when applied for up to 30 seconds.
- A gap forms that allows the penetration of a 25 mm gap gauge anywhere on the specimen.
- A gap forms that allows a 6 mm × 150 mm gap gauge to penetrate the specimen anywhere on the specimen.

Except for minor variations the integrity criteria in EN 1363.1:1999 are generally applied in a comparable manner.

Insulation

The general insulation criteria of AS 1530.4:2014 and EN 1363-1:2012 are not appreciably different.

5.3.6 Specimen configuration

AS 1530.4:2014 specifies that the service(s) shall be installed so that it projects a minimum 500 mm on each side of the supporting construction, of which at least 200 mm shall extend beyond the extremities of the penetration sealing system. The penetration sealing system shall include any coating, wrapping or other protections to the services. The length of unprotected service on the unexposed face shall not be greater than 500 mm. For plastic pipes, the external projection away from the furnace shall be increased to a minimum of 2000 mm. The measurements shall not include any part of the plug or cap used to seal a pipe within the furnace. With respect to the pipe end configurations, AS 1530.4:2014 stipulates that services end conditions shall be representative of those intended to be used in practice.

EN 1366-3:2009 requires that the pipes extend on the fire side and non-fire side by a minimum of 500 mm of which at least 150 mm shall extend beyond the extremities of the penetration seal. In the case of plastic pipes, the length of the pipe on the unexposed side may be extended to allow for the collection of the effluent gases.

When pipes are to be tested, the pipe end configurations are chosen depending on the nature of the pipe material and the required field of application.

5.3.7 Applicability of test data in accordance with AS 1530.4:2014

The variations in furnace heating regimes, furnace thermocouples and the responses of the different thermocouples types to the furnace conditions are not expected to have significant effect on the outcome of the referenced fire resistance test.

Based on the review of the test data and allowable field of application stipulated in the EN standard, it is the opinion of this accredited testing laboratory that services tested with an open/open (U/U) end fire configuration are considered to be the worst-case scenario as the hot gases will have a clear path to the unexposed side. As a result, the thermocouple placed on the service will likely record the highest temperature when compared to other pipe end configurations. Therefore, FRL achieved in U/U configuration can be extended to services tested in any of the pipe end configurations.

With respect to the services tested in an open/closed configuration or closed/closed configuration, it is considered that both configurations are not in line with the general requirement of the AS 1530.4:2014. However, AS 1530.4:2014 stipulates that “service end conditions shall be representative of those intended to be used in practice”. Therefore, it is reasonable to extend the FRL achieved in both configurations provided that they are representative of the system used in practice.

With respect to the difference in the length of pipe projection from the wall separating element, it is considered that this difference will not likely introduce any detrimental effects to the wall system as the plastic pipe is expected to melt and closed off with the collar. once the fire collar is activated, this difference can be negligible.

In case of a floor system, it is argued that having a 2000 mm projection out of the floor slab at the unexposed side may have a detrimental effect due to stack effect. However, it is also argued that a 500 mm projection as stipulated in the EN standard presents a more onerous case as more hot gases are expected to pass from the exposed to the unexposed side at a faster rate, hence increasing the temperature recorded by the thermocouple placed on the service before the activation and closure of the fire collar. In conclusion, considerable amount of research and test history has showed that the extension of the pipe from the unexposed side will not likely have an impact on the performance of the plastic pipes, hence it can be positively assessed.

6. Assessment 2 – Metal pipes and cables penetrating steel framed plasterboard lined walls and rigid walls

6.1 Description of variation

The proposed construction consists of lagged and unlagged metal pipes and cables penetrating the below vertical separating elements:

- Minimum 116 mm framed walls that consist of 64 mm steel stud lined with two layers of minimum 13 mm thick fire rated plasterboard on each side for an FRL of -/120/120
- Minimum 100 mm framed walls that consist of 76 mm steel stud lined with one layer of minimum 16 mm thick fire rated plasterboard on each side for an FRL of -/90/90.
- Minimum 75 mm AAC walls built up to minimum thickness of 100 mm by additional plasterboards or BOSS batts.

Metal pipes may be lagged with Thermobreak lagging or Fibreglass/mineral wool lagging.

The proposed sealing system in walls are as follows:

- Large apertures can be protected by two layers of 50 mm BOSS Batts or BOSS FirePillows-240™.
- Lagged metal pipes of diameter from 32 mm – 159 mm must be wrapped with multiple layers of BOSS UniWrap placed flush to both the exposed and unexposed sides and further sealed with a fire-rated mastic sealant such as BOSS Firemastic-300 or BOSS FireSilicone EMA sealant. For the insulation performance, the services must be wrapped with Thermal Defence wrap for lengths as specified in Table 7. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm
- Unlagged metal pipes of diameter from 32 mm – 159 mm must be sealed with a fire-rated sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant to a depth of 20 mm on each side of the wall and finished with a 20 mm × 20 mm fillet. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 7. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm
- For cable services, the annular gap must be filled with fire rated sealant such as BOSS FireMastic-300 and BOSS FireSilicone EMA sealant for a depth of 25 mm on each side. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 8.

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 R001874

In test report R001874, the test specimen consisted of a 3900 mm × 3000 mm × 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 with 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 PipeBloc 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.

Evidence from test report WF 355667

The tested specimen consisted of a drywall construction of overall dimensions 3000 mm × 3035 mm × 100 mm thick. Each face of the wall was clad with two layers of 12.5 mm thick Gypsum Fireline plasterboard. The framework was infilled with 50 mm thick mineral wool insulation with nominal density 100 kg/m^3. The wall was provided with two apertures 1200 mm × 750 mm wide which was penetrated by 10 metallic pipes with various insulation materials wrapped around the services. The aperture was sealed with a double layer of 50 mm thick Stopseal Fire Batt with a nominal density of 140 kg/m^3. The Batts were fitted within the aperture in horizontal rows. Each vertical and horizontal cut of the batt was sealed to each substrate with ‘Pyrocoustic sealant’ which is identical to BOSS FIreMastic-300™.

The tested services comprised copper pipes with diameters ranging from 42 mm to 159 mm with various wall thicknesses. The services had two layers of 2 mm thick PipeBloc EL wrap fitted to each side of the pattress. All services, except specimen O, maintained the integrity performance for the entire test duration of 132 minutes. Even though integrity was not maintained for the entire test, Specimen O did not fail in integrity until 126 minutes which is greater than the target integrity performance considered in this assessment. All pipes less than 160 mm in diameter achieved an integrity performance of 132 minutes.

Evidence from test report WF 349353

In test report WF 349353, the test specimen comprised of a 3000 mm × 3035 mm × 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 test report EWFA 34923800.3

The test assembly comprised a nominal 1600 mm wide × 1600 mm high × 78 mm thick Speedpanel wall system with vertically orientated Speedpanels to form a vertical wall system.

It was penetrated by 5 different service penetrations which were protected with various BOSS collars and fire-rated mastic. Specimen C was a 100 mm uPVC pipe with a pipe diameter of 110 mm passing through an aperture of diameter 152 mm. 20 mm annular gap was sealed with BOSS FireMastic HPE on the exposed side. Specimen C achieved an integrity performance of 120 minutes with failure occurring at 161 minutes when a 30 second cotton pad test was carried out at the east side of the pipe resulting in flaming.

Furthermore, the gap between the perimeter track and the Speedpanel on the bottom edge was sealed with BOSS FireMastic HPE mastic on the unexposed and exposed side. The gap between the perimeter track and the Speedpanel on the top edge was sealed with BOSS FireMastic 300 mastic – this was labelled Specimen F. Specimen F achieved an integrity performance of 240 minutes.

Evidence from test report WARRES 187564

Six vertically orientated specimens and six horizontally orientated specimens of linear gap sealing systems were tested.

The section of wall had overall dimensions of 1500 mm high × 1500 mm wide × 150 mm thick and was made of aerated blockwork arranged to provide four 12 mm wide × 1000 mm long and two 30 mm wide × 100 mm long linear gaps.

Each gap was sealed with silicone based intumescent sealant referenced to as “Pyrolastic Fire Rated Silicone.” This is identical to FireSilicone EMA sealant. The wall specimens are referenced as G to L. Specimen I and J incorporated a softwood timber gap facing, specimen K incorporated a hardwood timber gap facing and specimen L incorporated a mild steel angle gap facing. All specimens achieved an integrity performance greater than 120 minutes.

Evidence from test report WARRES 304406/A

The tested autoclaved aerated wall system had overall dimensions of 1500 mm high × 1500 mm wide × 150 mm thick and was provided with a 1100 mm high × 1100 mm wide aperture, into which was installed four cable trays carrying various sizes of cables as specified in Annex B of BS EN 1366-3:2009 along with a range of insulated and uninsulated steel and copper pipes. Thermal Defence wrap was wrapped around the metal pipes for on each side of the wall. The aperture was sealed with S-Line fire pillows.

The metal pipes with diameters ranging from 48 mm to 165 mm and cable configurations on ladders and trays all achieved an integrity performance of 132 minutes. The insulation performances varied depending on the type of penetration and the length of the insulation wrap.

Assessed cables with maximum number of cores and maximum core diameters are outlined in EN 1366-3. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4.

Evidence from test report FSP 1833

In FSP 1833, seven services penetrating a 96 mm thick plasterboard wall protected with sealants was tested. Specimens 3, 4 and 6 referenced cable configurations as per Appendix D2 and Appendix D1 of AS 1530.4:2014 except 4 × 185 mm^2 and 1 × 630 mm^2 cables protected with 50 mm fillet of BOSS FireMastic-300 on both exposed and unexposed faces and P40-MAK wrap wrapped twice around the cable trays. All specimens achieved an FRL of -/90/90, maintaining both insulation and integrity for the duration of the test.

6.3.2 Performance of metal pipes penetrating framed, plasterboard lined walls

Lagged and unlagged metal pipes with diameters ranging from 32 mm – 159 mm

It is proposed that metal pipes with diameters ranging from 32 mm to 159 mm – and with continuous Thermobreak lagging or Fibreglass/mineral wool lagging – penetrating framed walls can be protected with fire protection systems such as BOSS UniWrap, fire-rated FireMastic-300™ sealant and/or BOSS FireSilicone EMA sealant and Thermal Defence insulation wrap.

Unlagged metal pipes of diameter from 32 mm to 159 mm must be sealed with a fire-rated sealant such as BOSS Firemastic-300 or BOSS FireSilicone EMA sealant and for the insulation performance, the service must be further wrapped with Thermal Defence wrap.

Integrity performance

The integrity performance achieved with BOSS UniWrap can be ascertained based on test evidence from reports R001874, WF 349353 and WF 35567.

Test evidence from R001874 shows that 42 mm and 159 mm diameter copper pipes lagged with Armaflex AF and fitted with multiple layers of 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™.

Similarly, in WF 355667, copper pipes with pipe diameters ranging from 42 mm to 159 mm and various wall thicknesses were tested. The service apertures were sealed with 2 layers of 2 mm thick PipeBloc EL – which is identical to UniWrap – flush with both the exposed and unexposed sides. In addition to the service aperture seal, the main aperture through which the services passed was also

sealed with a single or double layer of 50 mm thick “Stopseal Fire Batt” – which is identical to BOSS Batts. All tested services maintained integrity for more than 120 minutes.

In 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.

With lagged metal pipes – as the lagging is expected to shrink or melt slightly resulting in gap openings – the UniWrap fitted 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 must be noted, however, that similar to the tested specimens, the annular space must be filled with a fire rated sealant such as BOSS FireMastic-300™ to maintain the integrity. It is proposed that the metal pipes are lagged with Thermobreak lagging or Fibreglass/mineral wool lagging.

Therefore, as discussed above, the available test evidence shows that protecting apertures with BOSS UniWrap fitted around Thermobreak/Fibreglass/mineral wool lagged metal pipes is likely to help maintain the integrity performance of the system for at least 120 minutes – provided that the annular space is filled with a fire-rated sealant such as FireMastic-300™ and/or FireSilicone EMA. BOSS UniWrap must be wrapped to multiple layers around the pipe and placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side.

In addition to the integrity performance of the fire-rated pyrocoustic sealants described in the referenced tests – which have a similar performance to FireMastic-300 and FireSilicone EMA - further test evidence can be found in WARRES 187564 in which linear gap seals tested in walls showed that a sealant identical to FireSilicone EMA can maintain integrity performance for at least 120 minutes. Therefore, both bare and lagged pipes protected with FireMastic-300 or FireSilicone EMA sealant will achieve the required integrity performance of 90 minutes or 120 minutes in wall systems with an established FRL of -/90/90 or -/120/120, respectively.

As tested in EWFA 34923800.3, the FireMastic-300 and/or FireSilicone EMA must be applied to a depth of 25 mm on each side of the wall in annular gaps up to 20 mm. For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. The applied sealant must be finished with a 20 mm × 20 mm fillet on each side.

It is proposed that larger apertures in walls can be protected with BOSS Batts and/or BOSS FirePillows-240 as tested in WF355667 and WARRES 304406/A, respectively. The same ten copper pipe services were tested in a wall system with the aperture filled with a single layer and double layer of BOSS Batts. They were also fitted with PipeBloc EL wrap which is identical to the BOSS UniWrap and discussed above. All twenty services tested achieved the same integrity performance of 132 minutes (the duration of the test). In WARRES 304406/A, both steel and copper pipes penetrating S-line fire pillows – identical to BOSS FirePillow-240™ – were tested and found to maintain integrity for 132 minutes. Therefore, larger apertures can be protected with FirePillows-240 or Batts installed as tested and described above. The same sealing arrangement with FireMastic-300 and/or FireSilicone EMA must be followed for services penetrating BOSS Batts or BOSS FirePillows-240.

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.

Insulation performance

It is proposed to wrap the metal pipes with BOSS Thermal Defence wrap to maintain the insulation performance. According to results obtained from WARRES 304406/A, a 54 mm diameter copper pipe wrapped with Thermal Defence wrap to a distance of 250 mm and 48 mm and 113 mm diameter steel pipes wrapped with Thermal Defence wrap to a distance of 300 mm on each side of the wall achieved an insulation performance of 132 minutes. Even though the separating element tested was a rigid wall, this test data can be used to assess the insulation performance for 90 minutes or 120 minutes in framed walls provided that the framed separating element has an established FRL of -/90/90 or -/120/120, respectively.

Based on the test evidence, all copper pipes ranging from 32 mm to 54 mm diameter can be wrapped with 250 mm of Thermal Defence insulation wrap and all steel pipes ranging from 32 mm to 113 mm

diameters can be protected with 300 mm of Thermal Defence wrap. For all pipe sizes up to 159 mm diameter, the Thermal Defence wrap must be extended to at least 600 mm on each side of the wall to ensure that the temperatures on the pipe on the unexposed side will remain lower despite the larger diameters. Thermal Defence insulation wrap must be wrapped around the service from the separating element over the fillet of fire-rated sealant used at the aperture.

Bare metal pipes can be protected with a conjunction of BOSS FirePillows-240, BOSS FireMastic-300™ and Thermal Defence 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.

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.

6.3.3 Performance of metal pipes penetrating rigid 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 UniWrap fitted over the Thermobreak lagging providing primary protection, supplemented by BOSS FireMastic-300™ or FireSilicone EMA protecting the annular gap and BOSS Thermal Defence wrap giving insulation protection. Bare pipes must be sealed with BOSS FireMastic-300™ or FireSilicone EMA and BOSS Thermal Defence wrap must be provided as given in Table 12.

Rigid walls consist of a higher thermal mass than a framed wall. Therefore, it is considered that a minimum wall thicknesses of 100 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.

Rigid walls with build-up

Furthermore, in WARRES 304406/A, an autoclaved brickwork wall with a thickness of 100 mm (with a nominal density of 760 kg/m^3) was tested penetrated by a range of cable trays/ladders and uninsulated and insulated metal pipes and the assessed results are discussed above.

As also assessed in FAS190346 R1.2, AAC walls thinner than 100 mm must be built up on one side or both sides using fire-rated plasterboard or BOSS Batts to a thickness of minimum 100 mm for an FRL of -/90/90 and to a minimum thickness of 116 mm for an FRL of -/120/120.

The build-up must extend minimum 100 mm from the edge of the aperture, overlapping with the main separating element on all four sides of the service. 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 or FR plasterboard build up should be minimum 380 mm × 380 mm sized with the service centred within the build-up.

If a build-up, such as BOSS Batts, is used on bare metal pipes, BOSS FireMastic-300™ or FireSilicone EMA must be applied to a depth of 25 mm and finished with a 20 mm × 20 mm mastic fillet on either side of the wall.

The build-up options must be tested to achieve an established integrity performance of at least 90 minutes for an FRL of -/90/90 or at least 120 minutes for an FRL of -/120/120.

6.3.4 Steel and iron pipes penetrating walls

Except for WARRES 304406/A, all other referenced test data for metal pipes penetrating flexible and rigid walls were conducted on 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 12 can also be applied to steel or iron pipes. For steel and iron pipes, the maximum pipe wall thickness must be 4.5 mm. The above discussion is based on the information presented and discussed in AS 4072.1:2005.

6.3.5 Performance of cables penetrating flexible and rigid walls

Cable configurations in accordance with BS EN 1366-3:2009 was tested in WARRES 304406/A. In comparison of the cable configuration requirements between EN 1366-3:2009 and AS 1530.4:2014, it is identified that cables in D1 and D2 configurations can be assessed in general accordance with AS 1530.4:2014 with limitations in large single core cables above 185 mm^2 conductor area.

In FSP 1833, a 96 mm thick plasterboard wall penetrated by various cable penetrations was tested. Specimens 3, 4 and 6 referenced cable configurations as per Appendix D2 and Appendix D1 of AS 1530.4:2014 except 4 × 185 mm^2 and 1 × 630 mm^2 cables protected with 50 mm fillet of BOSS FireMastic-300 on both exposed and unexposed faces and P40-MAK wrap wrapped twice around the cable trays. All specimens achieved an FRL of -/90/90, maintaining both insulation and integrity for the duration of the test. It is likely that the FRL attributed to the cables is limited by the test duration and the established FRL of the separating element.

Therefore, based on the test evidence obtained from WARRES 304406/A, it can be considered that if the cables are installed in a separating element with the minimum thicknesses specified in Table 12 and an established FRL of -/120/120, the services will also achieved the same fire performance period.

The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. The applied sealant must be finished with a 50 mm fillet on each side of the wall. The same sealing arrangement must be followed when the services are penetrating a BOSS Batts™ and BOSS FirePillows-240™.

In order to improve the insulation performance, Thermal Defence wrap must be wrapped around the cable trays and cable services and extended for a length of 600 mm on each side of the wall.

6.4 Conclusion

This assessment demonstrates that copper, steel and iron pipes ranging in diameter from 32 mm to 159 mm – lagged with continuous Thermobreak or Fibreglass/mineral wool lagging insulation or bare – and cables penetrating framed plasterboard walls or rigid walls are likely to achieve the FRLs specified in Table 12, if they were tested in accordance with AS 1530.4:2014.

Table 12 Assessment outcomes for copper, steel or iron pipes and cables penetrating walls

Wall type	FRL	Minimum wall thickness required	Service	Lagged and unlagged services	Thermal Defence wrap length for lagged and unlagged services+
Framed walls or rigid walls with larger apertures protected with BOSS Batts* Or FirePillows-240 (Rigid walls may be with or without build-up**)	-/90/90	100 mm	32 mm – 159 mm diameter metal pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm	Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. Bare services and cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA. • The annular gap must be up to 20 mm and filled to a depth of 25 mm on each side of the wall. • For annular gaps larger than 20 mm and up to 50 mm, a mineral wool backing rod must be used to back the applied sealant. • The applied sealant must be finished with a 20 mm × 20 mm fillet on each side for bare pipes and 50 mm fillet on each side for cables. • The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240.	• Ø32 mm-Ø113 mm steel and iron pipes: 300 mm each side of the wall • Ø113 mm-Ø159 mm steel and iron pipes: 600 mm on each side of the wall • Ø32 mm-Ø54 mm copper pipes: 250 mm on each side of the wall • Ø54 mm-Ø159 mm copper pipes: 600 mm on each side of the wall
	-/120/120	116 mm	• Cables in general accordance with Appendix D1 and D2 as per AS 1530.4:2014 (except 4 × 185 mm^2 and 1 × 630 mm^2) Assessed cables are limited to the following: Up to 2.5 mm^2 2C+E TPS power cable Up to 60 × 50 pair, 0.5 mm (as per Appendix D2) Up to 3 × 6 mm^2 3 core and earth Up to 8 × 16 mm^2 3 core and earth		600 mm on each side of the wall
*Two layers of 50 mm BOSS Batts					

Wall type	FRL	Minimum wall thickness required	Service	Lagged and unlagged services	Thermal Defence wrap length for lagged and unlagged services+
**The build-up options must be tested to achieve an established integrity performance of at least 90 minutes for an FRL of -/90/90 or at least 120 minutes for an FRL of -/120/120 +Thermal Defence wrap to be installed butted against the separating element, BOSS Batts or FirePillows-240™					

7. Assessment 3 – Metal pipes and cables penetrating concrete floors

7.1 Description of variation

The proposed construction consists of lagged and unlagged metal pipes and cables penetrating 150 mm thick concrete floors. Metal pipes may be lagged with Thermobreak lagging or Fibreglass/mineral wool lagging.

Only the integrity performance of services penetrating floors was assessed. The proposed sealing system in floors are as follows:

- Large apertures can be protected by two layers of 50 mm BOSS batts or BOSS FirePillows-240™.
- Lagged metal pipes of diameter from 32 mm – 159 mm must be wrapped with multiple layers of BOSS UniWrap on the unexposed side of the floor and further sealed with a fire rated mastic sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant. For the insulation performance, the service must be wrapped with Thermal Defence wrap on the unexposed side. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm.
- Unlagged metal pipes of diameter from 32 mm – 159 mm must be sealed with a fire rated sealant such as BOSS FireMastic-300 or BOSS FireSilicone EMA sealant to a depth of 20 mm on each side of the floor and finished with a 20 mm × 20 mm fillet. For the insulation performance, the service must be wrapped with Thermal Defence wrap on the unexposed side. Maximum wall thickness for copper pipes is 1.0 mm and maximum wall thickness for steel/iron pipes is 4.5 mm.
- For cable services, the annular gap must be filled with fire rated sealant such as BOSS FireMastic-300 and BOSS FireSilicone EMA sealant for a depth of 25 mm the unexposed side. For the insulation performance, the service must be further wrapped with Thermal Defence wrap as specified in Table 9.

7.2 Methodology

The method of assessment used is summarised in Table 13.

Table 13 Method of assessment

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

7.3 Assessment

7.3.1 Discussion of relevant test results

Evidence from test report WARRES 350178

The tested specimen comprised a floor section with overall dimensions of 2230 mm × 1740 mm × 150 mm thick. The floor had nine circular apertures, each penetrated by a range of plastic pipes. Each specimen was fitted with two pipes wraps referenced as ‘PipeBloc PWP’ which is identical to BOSS UniWrap. The PipeBloc was fitted flush to the top and underside of the concrete floor assembly. Each annular gap was covered with a single bead of ‘Pyrocoustic sealant’ on both faces 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.

The plastic pipes were plugged (or capped) on the unexposed side, which is not consistent with the stipulations for pipe end configurations in AS 1530.4:2014. Therefore, the applicability of the assessment made with this test data will be for uncapped/capped pipe end configurations.

Evidence from test report WF 361932

The test specimen comprised of a floor with overall dimensions 2240 × 1735 mm × 150 mm thick. It consisted of twelve circular apertures, each penetrated by a range of plastic pipes plugged on the unexposed side. Each Ø50 mm service was fitted with two pipe wraps referenced as 'PipeBloc EL' and each Ø200 mm service was fitted with ten layers. The pipe wrap was adhered to the service and fitted to mid-depth of the aperture. Each annular gap was sealed with a single bead of 'Pyrocoustic sealant' to the unexposed face 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.

Evidence from test report WF 412624

The test specimen consisted of a floor with overall nominal dimensions 2260 mm × 1750 mm × 150 mm thick. The floor was provided with nine square apertures, each penetrated by a range of pipes and cables and sealed with a penetration sealing system. The specimens pertaining to this assessment are the cable configurations.

The cable services assessed from this baseline test data D1 and D2 configurations assessed in general accordance with AS 1530.4:2014 with limitations in single core cables up to 185 mm^2 diameter. Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C.

Evidence from test report WARRES 187564

Six vertically orientated specimens and six horizontally orientated specimens of linear gap sealing systems were tested.

The section of floor had overall dimensions of 2240 mm × 1730 mm × 150 mm thick and was made up of autoclaved aerated concrete lintels arranged to provide two 12 mm wide × 1000 mm long, two 30 mm wide × 1000 mm long and two 50 mm wide × 1000 mm long linear gaps. Each gap was sealed with silicone based intumescent sealant referenced to as "Pyrolastic Fire Rated Silicone." This is identical to FireSilicone EMA sealant.

The floor specimens are referred to as A to F and specimens D, E and F incorporated a mild steel angle gap facing. All specimens achieved an integrity performance greater than 120 minutes.

7.3.2 Integrity performance of metal pipes and cables penetrating concrete floors

It is proposed to use BOSS UniWrap fitted over Thermobreak or Fibreglass/mineral wool lagging on metal pipes in floor assemblies.

In tests WF 350178 and WF 361932, several plastic pipe penetrations were sealed with multi-layer pipe wrap identical to BOSS UniWrap, fitted flush to the top and underside of the concrete 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.

In lagged metal pipes, as 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-300™ on both the exposed and unexposed sides.

As tested in WF 412624, cables in D1 and D2 configurations were assessed in general accordance with AS 1530.4:2014 with limitations in single core cables above 185 mm^2 conductor area. Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. The tested cables, except the F, C1, C2, C3, and E cables, achieved an integrity performance of 120 minutes when the aperture was protected with 45 kg/m^3 rock fibre insulation packed to the full depth of the aperture around the service with 5 mm depth of Pyrocoustic Fire resistant sealant cartridge gunned flush with the unexposed face. Therefore, this assessment excludes cable configurations F, C1, C2, C3 and E in accordance with EN 1366-3.

In addition to the integrity performance of the fire-rated pyrocoustic sealants described in the referenced tests – which have a similar performance to FireMastic-300 and FireSilicone EMA - further test evidence can be found in WARRES 187564 in which linear gap seals tested in floors showed that

a sealant identical to FireSilicone EMA can maintain integrity performance for at least 120 minutes. Therefore, both bare and lagged pipes protected with FireMastic-300 or FireSilicone EMA sealant will achieve the required integrity performance of 90 minutes or 120 minutes in wall systems with an established FRL of -/90/90 or -/120/120, respectively. The sealant must be applied as specified in Table 14.

It is also proposed that larger apertures in floors can be protected with BOSS Batts and/or BOSS FirePillows-240 as discussed for walls in section 6.3.2. The same sealing arrangement with FireMastic-300 and/or FireSilicone EMA must be followed for services penetrating BOSS Batts or BOSS FirePillows-240.

7.3.3 Insulation performance of metal pipes and cables penetrating concrete floors

For the insulation performance of services, BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.

7.3.4 Steel and iron pipes penetrating floors

With respect to steel and iron pipes, the rationale is the same used earlier in section 6.3.4. Based on this, it is likely that copper, steel and iron pipes of 32 mm – 159 mm diameter lagged with Thermobreak or Fibreglass/mineral wool insulation or bare, penetrating minimum 150 mm thick concrete floors, and protected with BOSS UniWrap and FireMastic-300 or FireSilicone EMA sealants are likely to achieve an integrity performance of 120 minutes. For steel and iron pipes, the maximum pipe wall thickness must be 4.5 mm. A summary is presented in Table 14.

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.

7.4 Conclusion

This assessment demonstrates that copper, steel and iron pipes ranging in diameter from 32 mm to 159 mm – lagged with continuous Thermobreak or Fibreglass/mineral wool insulation or bare – and cables penetrating 150 mm thick concrete floors are likely to achieve the FRLs specified in Table 14, if they were tested in accordance with AS 1530.4:2014.

Table 14 Assessment outcomes for copper, steel or iron pipes and cables penetrating floors

Floor type	FRL	Service	Lagged and unlagged services	Thermal Defence wrap length for lagged and unlagged services+
150 mm thick concrete floor with larger apertures protected with BOSS Batts* or FirePillows-240	-/120/120	• 32 mm – 159 mm diameter copper, steel or iron pipes Maximum wall thickness for copper pipes is 1.0 mm Maximum wall thickness for steel/iron pipes is 4.5 mm • Assessed cables with maximum number of cores and maximum core diameters are outlined in Appendix C. They are not in general accordance with D1 and D2 cable configurations as per AS 1530.4:2014	Lagged services to be fitted with BOSS UniWrap wrapped to multiple layers placed flush on both the exposed and unexposed sides to a depth of minimum 40 mm on each side. Annular spaces to be filled with BOSS FireMastic-300 or BOSS FireSilicone EMA sealants. Bare services and cable penetrations are to be sealed with fire-rated sealants BOSS FireMastic-300 and BOSS Firesilicone EMA. • The annular gap must be up to 20 mm and filled to a depth of 25 mm on the unexposed side. • The applied sealant must be finished with a 20 mm × 20 mm fillet on the unexposed side for metal pipes and 50 mm fillet on the unexposed side for cables. • The same sealing arrangement must be followed when the services are penetrating BOSS Batts or BOSS FirePillows-240.	For the insulation performance of services, BOSS Thermal Defence wrap must be double wrapped around services. The first wrap must extend 600 mm from the face of the slab and a second wrap must extend 300 mm from the floor slab.
*Two layers of 50 mm BOSS Batts				

8. 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 specific purposes. Building certifiers and other third parties are responsible for deciding if they accept this assessment in a particular context.

Appendix A Drawings and additional information

Table 15 Details of drawings

Figure No.	Source	Provided by	Date of issue
Figure 1 to Figure 21	Drawing number 03 Rev 02 Steel & Copper pipes – wall penetration	BOSS Products (Australia) Pty Ltd	21/09/2020
	Drawing number 04 Rev 03 Steel & Copper pipes – wall penetration		
	Drawing number 02 Rev 02 Appendix D Cable Penetration – wall penetration		
	Drawing number 01 Rev 03 Appendix D Cable Penetration – floor slab penetration		

Appendix B Summary of supporting test data

B.1 Test report – R001874

Table 16 Information about test report R001874

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Efectis Nederland, 2665 ZN Bleiswijk
Test date	The fire resistance test was completed on 23/07/201923/07/201923/07/2019.
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 test was conducted on pipe closure devices, penetrating a 3900 mm × 3000 mm × 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. The penetration seals consisted of Stopseal® Batt, being two layers of 50 mm fibre board, coated with FSI PS-coating 0.7 mm thick on both sides of the board. The mineral fibre boards of specimen 1, 2 and 4 were placed flush with the exposed and unexposed face of the wall. There was FSI PS-coating at all edges. Specimen 3 was placed against the flexible wall with an overlap of 30 mm, specimen 10 with an 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 were insulated with 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.
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 following results – see Table 17.

Table 17 Results summary for test report R001874

Service	Diameter (mm)	Penetration seal	Insulation	Pipe end configuration	Integrity (minutes)	Insulation (minutes)
1.b	159	PipeBloc EL	Armaflex AF at a thickness of 20 mm and a length of 490 mm.	C/U	120	45
6	42	PipeBloc EL single	Armaflex AF at a thickness of 6 mm in a continuous sustained configuration.	C/U	120	60
7	159	PipeBloc EL single	Armaflex AF at a thickness of 32 mm in a continuous sustained configuration.	C/U	120	60
8	42	PipeBloc EL single	Armaflex AF at a thickness of 32 mm in a continuous sustained configuration.	C/U	120	120
9	159	PipeBloc EL single	Armaflex AF at a thickness of 6 mm in a continuous sustained configuration.	C/U	120	30

B.2 Test report – WARRES 304406/A

Table 18 Information about test report WARRES 304406/A

Item	Information about test report
Report sponsor	Firestopit Limited, Westminster Industrial Estate, Tamworth Road, Measham, DE12 7DS
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was completed on 30 March 2011.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None
General description of tested specimen	The autoclaved blockwork wall system had overall dimensions of 1500 mm high by 1500 mm wide by 150 mm thick and was provided with a 1100 mm high by 1100 mm wide aperture, into which was installed four cable trays carrying various sizes of cables as specified in Annex B of BS EN 1366-3:2009 along with a range of insulated and uninsulated steel and copper pipes. Thermal Defence wrap was wrapped around the metal pipes for 300 mm on each side of the wall.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1363-1:1999.

The test specimen achieved the following results – see Table 19.

Table 19 Results summary for test report WARRES 304406/A

Specimen	Description	Integrity	Insulation
M	Ø108 mm × 1.5 mm copper	132 minutes	95 minutes (31-33)
L	Ø 113 mm × 4.5 mm steel	132 minutes	132 minutes (28-30)
K	Ø 165 mm × 5.6 mm steel	132 minutes	26 minutes (26-27)
N	Ø 54 mm × 1 mm steel	132 minutes	132 minutes (34,35,36,37)
O	Ø 48 mm × 3.5 mm steel	132 minutes	132 minutes (71,72 & 87)
ladder	300 mm ladder	132 minutes	77 minutes
D1	1 off/4 mm × 185 mm²)- Large sheathed/PVC/PVC	132 minutes	77 minutes
E	2 off/1 mm × 185 mm²)- Large sheathed/PVC/PVC	132 minutes	132 minutes
D2	1 off/4 mm × 185 mm²)- Large sheathed/EPR/PO	132 minutes	132 minutes
ladder	200 mm ladder	132 minutes	82 minutes
D3	1 off/4 mm × 185 mm²)- Medium sheathed/EPR/PO	132 minutes	82 minutes
Tray	500 mm perforated tray	132 minutes	91 minutes
A1	10 off/5 mm × 1.5 mm²- small sheathed/PVC/PVC	132 minutes	132 minutes
A2	(10 off/5 mm × 1.5 mm²)- small sheathed/EPR/PO	132 minutes	132 minutes
A3	(10 off/5 mm × 1.5 mm²)- small sheathed/XLPE/EVA	132 minutes	132 minutes
B	(2 off/1 mm × 95 mm²)- small sheathed/PVC/PVC	132 minutes	132 minutes
C1	(1 off/4 mm × 95 mm²)- small sheathed/XLPE/EVA	132 minutes	98 minutes
C2	(10 off/4 mm × 95 mm²)- Medium sheathed/EPR/PO	132 minutes	102 minutes
C3	(1 off/4 mm × 95 mm²)- Medium sheathed/XLPE/EVA	132 minutes	91 minutes
Tray	500 mm non-perforated tray	132 minutes	108 minutes
G1	(1 off/1 mm × 95 mm²)- Non sheathed wire PVC	132 minutes	132 minutes

Specimen	Description	Integrity	Insulation
G2	(1 off/1 mm × 185 mm²)- Non sheathed wire /PVC	132 minutes	132 minutes
H1	Ø16 mm × 3.0 mm thick conduit/mild steel	132 minutes	132 minutes
H3	Ø16 mm × 3.0 mm thick Tube/copper		
I	Ø16 mm × 1.0 mm thick conduit/PVC	132 minutes	113 minutes
F	Bundle 100 mm diameter / 20 mm × 2 mm ×0.6 mm (CW1308) and 20 mm × 2 mm × 0.5 mm (CW1128/1198)- Telecommunication cables/PE/PE	132 minutes	132 minutes

B.3 Test report – WARRES 187564

Table 20 Information about test report WARRES 187564

Item	Information about test report
Report sponsor	Firestopit Limited, Westminster Ind. Est. Tamworth Road, Measham, DE 12 7 DS.
Test laboratory	Bodycote, Warringtonfire, UK.
Test date	The fire resistance test was completed on 24 April 2009.
Test standards	The test was done in accordance with BS EN 1366-4:2006.
Variation to test standards	None
General description of tested specimen	Six vertically orientated specimens and six horizontally orientated specimens of linear gap sealing systems were tested. The section of wall had overall dimensions of 1500 mm high by 1500 mm wide by 150 mm thick and was made of aerated blockwork arranged to provide four 12 mm wide by 1000 mm long and two 30 mm wide by 100 mm long linear gaps. The section of floor had overall dimensions of 2240 mm long by 1730 mm wide by 150 mm thick and was made up of autoclaved aerated concrete lintels arranged to provide two 12 mm wide by 1000 mm long, two 30 mm wide by 1000 mm long and two 50 mm wide by 1000 mm long linear gaps. Each gap was sealed with silicone based intumescent sealant referenced to as “Pyrolastic Fire Rated Silicone.” The floor specimens are referred to as A to F and the wall specimens are G to L. Specimen I and J incorporated a softwood timber gap facing, specimen K incorporated a hardwood timber gap facing and specimens D, E, F and L incorporated a mild steel angle gap facing.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-4:2006 and BS EN 1363-1:1999.

The test specimen achieved the following results – see Table 21.

Table 21 Results summary for test report WARRES 187564

Specimen	Gap width × gap depth	Integrity (mins)		Insulation (mins)
		Cotton pad	Sustained flaming	
A	12 mm × 6 mm	244	300*	122
B	30 mm × 15 mm	300*	300*	186
C	50 mm × 25 mm	246	300*	65
D	12 mm × 6 mm	300*	300*	48
E	30 mm × 15 mm	300*	300*	43
F	50 mm × 25 mm	229	300*	33
G	12 mm × 6 mm	300*	300*	300*
H	30 mm × 15 mm	300*	300*	300*
I	12 mm × 6 mm	199	199	145
J	30 mm × 15 mm	143	143	143
K	12 mm × 6 mm	208	208	208
L	12 mm × 6 mm	300*	300*	69
*the test duration				

B.4 Test report – WARRES 350178

Table 22 Information about test report WARRES 350178

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova Warringtonfire, Holmesfield Road, Warrington WA1 2DS United Kingdom
Test date	The fire resistance test was completed on 11 March 2015.
Test standards	The test was done in accordance with BS EN 1366-3:2006.
Variation to test standards	None.
General description of tested specimen	The tested specimen comprised a floor section with overall dimensions of 2230 mm long by 1740 mm wide and 150 mm thick. The floor had nine circular apertures, each penetrated by a range of plastic pipes which were plugged on the unexposed side. Each specimen was fitted with two pipes wraps referenced as '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' on both faces of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2006 and BS EN 1363-1:1999.

The test specimen achieved the following results – see Table 23.

Table 23 Results summary for test report WARRES 350178

Service	Seal type	Aperture size	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
A – Ø50 mm by 1.8 mm wall thickness PVC pipe	The penetration service was provided with two PipeBloc PWP series pipe wraps friction fitted flush to both sides of the floor.	58 mm diameter	132*	132*	132*	132*
E – Ø50 mm by 2.9 mm wall thickness PP pipe			132*	132*	132*	132*
H – Ø50 mm by 2.9 mm wall thickness HDPE pipe			132*	132*	132*	132*
B – Ø200 mm by 9.6 mm wall thickness PVC pipe	The penetration service was provided with two PipeBloc PWP series pipe wraps friction fitted flush to both sides of the floor.	224 mm diameter	67#	68#	68#	67#
C – Ø200 mm by 7.7 mm wall thickness PVC pipe			132*	132*	132*	102
D – Ø220 mm by 4.9 mm wall thickness PP pipe			24#	24#	24#	19#
F – Ø200 mm by 18.2 mm wall thickness PP pipe			132*	132*	132*	114
G – Ø200 mm by 4.9 mm wall			132*	132*	132*	132*

Service	Seal type	Aperture size	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
thickness HDPE pipe						
I – Ø200 mm by 11.4 mm wall thickness HDPE pipe			132*	132*	132*	132*
*The test duration #Specimen blanked off to allow the test to continue						

B.5 Test report – EWFA 34923800.3

Table 24 Information about test report EWFA 34923800.3

Item	Information about test report
Report sponsor	BOSS Fire and Safety, Unit 8/15-23 Kumulla Road, Caringbah, NSW 2229
Test laboratory	Exova Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia.
Test date	The fire resistance test was completed on 4 June 2015.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	The pressure for the 5-20 minute period was above the limits prescribed by AS 1530.4:2014 by 11 Pa. This exceeded the pressure requirement of the standard and was therefore more severe than required by the standard. Based on the above, the results of the test remain valid. The furnace pressure was below the limits stated in AS 1530.4:2014, clause 2.10.3.1 (c) by 9 Pa between 230-240 minutes due to deterioration of the specimen. Due to the state of the lowest penetration at that time, the reduction in pressure is unlikely to have invalidated the result. During these intervals the furnace temperature deviation was within the limits and the specimen temperature curves did not exhibit unexpected variations. Hence this pressure behaviour is not likely to affect the performance of the pipe systems.
General description of tested specimen	The test assembly comprised a nominal 1600 mm wide × 1600 mm high × 78 mm thick Speedpanel wall system with vertically orientated Speedpanels to form a vertical wall system. The wall was restrained on all four edges. The wall system was penetrated by 5 different service penetrations which were protected with various BOSS collars and mastic. The gap between the perimeter track and the Speedpanel on the bottom edge was sealed with BOSS FireMastic HPE mastic on the unexposed and exposed side. The gap between the perimeter track and the Speedpanel on the top edge was sealed with BOSS FireMastic 300 mastic. Only specimens C and F are considered in this assessment report.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 25.

Table 25 Results summary for test report EWFA 34923800.3

Service	Pipe diameter (mm)	Aperture size (mm)	Fire protection system	Annular gap (mm)	FRL
C – 100 mm uPVC	110	152	Unexposed side – None Exposed side – BOSS FireMastic HPE	20	-/120/0
F – Head detail in Speedpanel wall	-	-	Unexposed and exposed sides – BOSS FireMastic-300 Inside the top perimeter track – 2 intumescent strips		-/240/60

B.6 Test report – WF 361932

Table 26 Information about test report WF 361932

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova (UK) Ltd, Holmesfield Road, Warrington, WA1 2DS, UK
Test date	The fire resistance test was completed on 16 March 2016.
Test standards	The test was done in accordance with BS EN 1366-3:2006 and BS EN 1363-1:1999.
Variation to test standards	None
General description of tested specimen	The test specimen comprised of a floor with overall dimensions 2240 mm long by 1735 mm wide by 150 mm thick. It consisted of twelve circular apertures, each penetrated by a range of plastic pipes plugged on the unexposed side. Each Ø50 mm service was fitted with two pipe wraps referenced as 'PipeBloc EL' and each Ø200 mm service was fitted with ten layers. The pipe wrap was adhered to the service and fitted to mid-depth of the aperture. Each annular gap was sealed with a single bead of 'Pyrocoustic sealant' to the unexposed face of the floor assembly.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2006 and BS EN 1363-1:1999.

The test specimen achieved the following results – see Table 27.

Table 27 Results summary for test report WF 361932

Service	Seal type	Aperture size	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
B – Ø50 mm by 6.9 mm wall thickness PP pipe	The service was provided with a PipeBloc EL series pipe wrap self-adhered and fitted centrally in the aperture. A bead of FSi Pyrocoustic sealant was used to seal the aperture on the unexposed face of the floor.	62 mm diameter	264*	264*	264*	264*
C – Ø50 mm by 2 mm wall thickness PP pipe			264*	264*	264*	264*
F – Ø50 mm by 4.6 mm wall thickness HDPE pipe			264*	264*	264*	264*
G – Ø50 mm by 3 mm wall thickness HDPE pipe			264*	264*	264*	264*
J – Ø50 mm by 3.7 mm wall thickness uPVC pipe			264*	264*	264*	172
K – Ø50 mm by 2.4 mm wall thickness uPVC pipe			264*	264*	264*	264*
A – Ø200 mm by 18.2 mm wall thickness PP pipe	The service was provided with a PipeBloc EL series pipe wrap self-	224 mm diameter	120#	120	120	120

Service	Seal type	Aperture size	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
D – Ø200 mm by 4.9 mm wall thickness PP pipe	adhered and fitted centrally in the aperture. A bead of FSi Pyrocoustic sealant was used to seal the aperture on the unexposed face of the floor.		264*	264*	264*	264*
E – Ø200 mm by 18.2 mm wall thickness HDPE pipe			264*	264*	264*	264*
H – Ø200 mm by 4.9 mm wall thickness HDPE pipe			264*	264*	264*	264*
I – Ø200 mm by 9.6 mm wall thickness uPVC pipe			242	245#	245	185
L – Ø200 mm by 7.7 mm wall thickness uPVC pipe			70	71#	71	70
*The test duration #Specimen blanked off to allow the test to continue						

B.7 Test report – WF 355667 Issue 4

Table 28 Information about test report WF 355667

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Exova (UK) Ltd, Holmesfield Road, Warrington, WA1 2DS, UK
Test date	The fire resistance test was completed on 7 December 2015.
Test standards	The test was done in accordance with BS EN 1366-3:2006 and BS EN 1363-1:1999.
Variation to test standards	None
General description of tested specimen	The tested specimen consisted of a drywall construction of overall dimensions 3000 mm by 3035 mm by 100 mm thick. The framing comprised of 50 mm wide galvanised steel head and base channels. Each face of the wall was clad with two layers of 12.5 mm thick Gypsum Fireline plasterboard. The framework was infilled with 50 mm thick mineral wool insulation with nominal density 100 kg/m^3. The wall was provided with two apertures 1200 mm by 750 mm wide which was penetrated by 10 metallic pipes with various insulation materials wrapped around the services continuous sustained (C/S). The partition insulation around the aperture for specimen 1 was cut back 100 mm from the edge of the aperture opening.
Instrumentation	The test report states that the instrumentation was in accordance with BS EN 1366-3:2006 and BS EN 1363-1:1999.

The test specimen achieved the following results – see Table 29.

Table 29 Results summary for test report WF 355667

Item	Service	Aperture dimensions and seal type	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
A	Copper pipe, 42 mm diameter × 1.0 mm wall thickness	1200 mm high by 750 mm wide aperture. The aperture was sealed with a single layer of 50 mm thick “Stopseal Fire Batt” with a nominal density of 140 kg/m^3, which was pattress fitted over the aperture in horizontal rows. The batt is fixed to the supporting construction using 6 × 80 mm steel screws and washers at 300 mm centres or at batt corners. The batt is coated on both faces with ablative coating. Each vertical and horizontal cut of the batt to each substrate was sealed with ‘Pyrocoustic Fire Resistant sealant’. All edges and joints of the patress were finished with a trowel grade ‘Pyrocoustic Fire Resistant sealant’	132*	132*	132*	132*
B	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	132*
C	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	132*
D	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	132*
E	Copper pipe, 108 mm diameter × 1.2 mm wall thickness		132*	132*	132*	108
F	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	132*
G	Copper pipe, 108 mm diameter × 1.2 mm wall thickness		132*	132*	132*	102
H	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	71

Item	Service	Aperture dimensions and seal type	Integrity (mins)			Insulation (mins)
			Cotton pad	Sustained flaming	Gap gauge	
I	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	93
J	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	115
K	Copper pipe, 42 mm diameter × 1.0 mm wall thickness	1200 mm high by 750 mm wide aperture. The aperture was sealed with a double layer of 50 mm thick “Stopseal Fire Batt” with a nominal density of 140 kg/m^3, which was patress fitted over the aperture in horizontal rows. The batts are coated on both faces with ablative coating. Each vertical and horizontal cut of the batt to each substrate was sealed with ‘Pyrocoustic Fire Resistant sealant’. All edges and joints of the patress were finished with a trowel grade ‘Pyrocoustic sealant’	132*	132*	132*	113
L	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	118
M	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	107
N	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	99
O	Copper pipe, 108 mm diameter × 1.2 mm wall thickness		126	126	126#	85
P	Copper pipe, 42 mm diameter × 1.0 mm wall thickness		132*	132*	132*	119
Q	Copper pipe, 108 mm diameter × 1.2 mm wall thickness		132*	132*	132*	83
R	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	67
S	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	115
T	Copper pipe, 159 mm diameter × 1.2 mm wall thickness		132*	132*	132*	84

B.8 Test report – WF 349353 Issue 3

Table 30 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 23/03/201523/03/201523/03/2015.
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 following results – see Table 31.

Table 31 Results summary for test report WF 349353

Service	Description	Integrity (minutes)			Insulation (minutes)
		Cotton pad	Sustained flaming	Gap gauge	
A	A single PP pipe of 50 mm diameter and 2.9 mm wall thickness	132*	132*	132*	132*
B	A single PVC pipe of 50 mm diameter and 1.8 mm wall thickness	132*	132*	132*	132*
C	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
H	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#
K	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
M	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#
O	A single PE pipe of 200 mm diameter and 18.4 mm wall thickness	132*	132*	132*	132*
P	A single PP pipe of 250 mm diameter and 10.1 mm wall thickness	132*	132*	132*	28

* Test duration.

Specimen blanked off to allow the test to continue.

B.9 Test report – FSP 1833

Table 32 Information about test report FSP 1833

Item	Information about test report
Report sponsor	BOSS Fire & Safety P/L
Test laboratory	CSIRO Infrastructure Technologies, 14 Julius Avenue, North Rude, NSW 2113, Australia
Test date	The fire resistance test was completed on 9 May 2017.
Test standards	The test was done in accordance with AS 1530.4:2014.
Variation to test standards	None.
General description of tested specimen	The test specimen consisted of a plasterboard wall penetrated by multiple services. The overall thickness of the plasterboard wall was 96 mm. It consisted of 16 mm thick fire rated plasterboards on either side of a 64 mm deep frame. The surface seal around the services was created with a 50 mm fillet of BOSS FireMastic – 300™ sealant on the exposed and unexposed face. Two layers of 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 wrap extended 300 mm from the exposed face and 600 mm from the unexposed face, flush with the FireMastic – 300™ fillets.
Instrumentation	The test report states that the instrumentation was in accordance with AS 1530.4:2014.

The test specimen achieved the following results – see Table 33.

Table 33 Results summary for test report FSP 1833

Specimen	Service	Primary fire-stopping protection	Second fire-stopping protection	FRL
3	2.5 mm^2 2C+E TPS power cable	BOSS FireMastic – 300™	-	-/90/90
4	60 × 50 pair, 0.5 mm (as per Appendix D2)	50 mm fillet of BOSS FireMastic – 300™ on the exposed and unexposed faces	P40-MAK wrap wrapped twice around the cable tray on both sides of the wall and extended 300 mm from both sides of the wall.	-/90/90
6	3 × 6 mm^2, 3 core and earth, 8 × 16 mm^2, 3 core and earth on a 300 mm wide tray. The tested cables represent the smaller two cable bundles and arrangement as per Appendix D1 of AS 1530.4 except 4 × 185 mm^2 and 1 × 630 mm^2	50 mm fillet of BOSS FireMastic – 300™ on the exposed and unexposed faces	P40-MAK wrap wrapped twice around the cable tray on both sides of the wall and extended 300 mm from both sides of the wall.	-/90/90

B.10 Test report – WF 412624

Table 34 Information about test report WF 412624

Item	Information about test report
Report sponsor	FSi Limited
Test laboratory	Warringtonfire, UK
Test date	The fire resistance test was completed on 13 May 2019.
Test standards	The test was done in accordance with BS EN 1366-3:2009.
Variation to test standards	None.
General description of tested specimen	The test specimen consisted of a floor separating element with overall nominal dimensions 2260 mm long by 1750 mm wide by 150 mm thick. The floor was provided with nine square apertures, each penetrated by a range of pipes and cables and sealed with a penetration sealing system. The specimens pertaining to this assessment are A, D, E, G and I and are described below.
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 following results – see in Table 35.

Table 35 Results summary for test report WF 412624

Specimen	Aperture / Service / Position	Seal	Integrity (mins)		Insulation (mins)
			Cotton pad	Sustained flaming	
A	50 mm × 50 mm aperture / 1 × E cable / 0 mm from one edge	45 kg/m^3 rock fibre insulation packed to the full depth of the aperture around the service with 5 mm depth of Pyrocoustic Fire resistant sealant cartridge gunned flush with the unexposed face	264*	264*	264*
D	200 mm × 200 mm aperture / 1 × F cable bunch (approximately 100 mm diameter) 2 × H (copper) conduits 2 × I (PVC) conduits / F cable bunch 0 mm from one edge, conduits laterally 0 mm from one edge		48	48	17
E	200 mm × 200 mm aperture / 1 × C1 cable 1 × C2 cable 1 × C3 cable 1 × E cable Laterally 0 mm from one edge		117	117	50
G	200 mm × 200 mm aperture / 1 × D1 cable 1 × D2 cable 1 × D3 cable Laterally 0 mm from one edge		122	122	81
I	200 mm × 200 mm aperture / 1 × B cable 3 × A1 cable 3 × A2 cable		264*	264*	105

Specimen	Aperture / Service / Position	Seal	Integrity (mins)		Insulation (mins)
			Cotton pad	Sustained flaming	
	3 × A3 cable Laterally 0 mm from one edge				
*The test was discontinued after a period of 264 minutes					

Appendix C Cable configurations in accordance with EN 1366-3:2009 as assessed for floors

EN 1366-3:2009 (E)

BS EN 1366-3:2009

Table A.1 — Cables for the standard configuration

Cable	Cable type	Group	Number of cables	Dimensions	Designation	Standard	Insulation / sheath material	Diameter range (mm)	Nominal weight (kg/km) [a]
A1	small sheathed	1	10	5 mm × 1,5 mm^2	see Table A.3	HD 603.3	PVC / PVC [b]	14 [a, c]	300 [c]
A2	small sheathed	1	10	5 mm × 1,5 mm^2	H07RN-F 5G1,5	HD 22.4	EPR / PO [d]	11,2 – 14,4 [a, e]	186 [c]
A3	small sheathed	1	10	5 mm × 1,5 mm^2	see Table A.3	HD 604.5	XLPE / EVA [f]	13 [a, g] (≤ 14,0 [h])	230 [c]
B	small sheathed	1	2	1 mm × 95 mm^2	see Table A.3	HD 603.3	PVC / PVC [b]	18 – 21 [a, i]	1150 [c]
[redacted]									
D1	large sheathed	3	1	4 mm × 185 mm^2	see Table A.3	HD 603.3	PVC / PVC [b]	52 [a, j]	9900 [c]
D2	large sheathed	3	1	4 mm × 185 mm^2	H07RN-F 4G185	HD 22.4	EPR / PO [d]	64 – 80 [a, e]	9700 [c]
D3	large sheathed	3	1	4 mm × 185 mm^2	see Table A.3	HD 604.5	XLPE / EVA [f]	58 [a, g] (≤ 62,5 [h])	7750 [c]
[redacted]									
G1	non-sheathed (wire)	5	1	1 mm × 95 mm^2	H07V-R	HD 21.3	PVC / - [b]	14,1 – 17,1 [a, p]	980 [c]
G2	non-sheathed (wire)	5	1	1 mm × 185 mm^2	H07V-R	HD 21.3	PVC / - [b]	19,3 – 23,3 [a, p]	1890 [c]

Figure 22 Cables for the standard configuration as extracted from EN 1366-3:2009 and tested in WARRES 304406/A

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