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# Fire assessment report

## Service penetrations protected with BOSS FireMastic - HPE sealant

Sponsor: Boss Products Australia Pty Ltd

Report number: FAS190335 Revision: R1.1

Issued date: 7 July 2023 Expiry date: 31 July 2028

# Quality management

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# Executive summary

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various combustible pipes, insulated metal pipes, cables, cable bundles, and Heating, Ventilation and Cooling (HVAC) bundles penetrating wall and floor separating elements protected by BOSS FireMastic – HPE sealant. This assessment is conducted in accordance with AS 1530.4:2014 and, in general accordance with AS 4072.1:2005.

The analysis in sections 5 to 8 of this report found that the proposed systems, together with the described variations, are expected to achieve the FRLs as shown in Table 1 in accordance with AS 1530.4:2014.

**Table 1 Assessment outcomes**

| Item | Proposed system | Assessment outcome |
|---|---|---|
| 1. | Assessment outcome of combustible pipes installed in flexible wall systems | Table 11 |
| 2. | Assessment outcome of combustible pipes in rigid wall systems | Table 13 |
| 3. | Assessment outcome of combustible pipes in CLT walls | Table 15 |
| 4. | Assessment outcome of combustible pipes in Masonry wall with double layer of 50 mm thick “BOSS Fire Batt” aperture – Factory applied “BOSS Ablative Coating” to both faces and PS coating to exposed face. | Table 17 |
| 5. | Assessment outcomes of Insulated metal pipes fitted in minimum 116 mm thick flexible wall | Table 19 |
| 6. | Assessment outcome of insulated metal pipe penetrating double layer of 50 mm thick BOSS fire batt installed in a minimum 116 mm flexible and rigid walls | Table 21 |
| 7. | Assessment outcome of combustible pipes in 235 mm thick plasterboard ceiling system | Table 23 |
| 8. | Assessment outcome of combustible pipes in AAC floor system | Table 25 |
| 9. | Assessment outcome of insulated metal pipes in concrete slab | Table 27 |
| 10. | Assessment outcome of cables in 90 mm flexible or rigid wall | Table 31 |
| 11. | Assessment outcome of cables in 116 mm flexible or rigid wall | Table 33 |
| 12. | Assessment outcome of cables in rigid wall | Table 35 |
| 13. | Assessment outcome of cables in ceiling system | Table 37 |
| 14. | Assessment outcome of cables in AAC floor | Table 39 |
| 15. | Assessment outcome of cables in concrete | Table 41 |
| 16. | Assessment outcome of HVAC services in 90 mm flexible wall system | Table 46 |
| 17. | Assessment outcome of HVAC services in 116 mm flexible wall system | Table 48 |
| 18. | Assessment of HVAC services in AAC wall system (double mesh) | Table 50 |
| 19. | Assessment of HVAC services in CLT wall | Table 52 |
| 20. | Assessment of HVAC services in ceiling system | Table 54 |
| 21. | Assessment outcome of HVAC services in concrete slab | Table 56 |
| 22. | Assessment outcome of HVAC service penetration in ComFlor60 | Table 58 |

The variations and outcome of this assessment are subject to the limitations and requirements described in sections 2, 3 and 9 of this report. The results of this report are valid until 31 May 2028.

# Contents

# 1. Introduction

This report documents the findings of the assessment undertaken to determine the expected fire resistance level (FRL) of various combustible pipes, cables, cable bundles, Heating, Ventilation and Cooling (HVAC) bundles and insulated metal pipes penetrating wall and floor separating elements protected by BOSS FireMastic – HPE sealant. This assessment is conducted in accordance with AS 1530.4:2014[1] and, in general accordance with AS 4072.1:2005[2].

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

This assessment was carried out at the request of Boss Products Australia Pty Ltd.

The sponsor details are included in Table 2.

**Table 2 Sponsor details**

| Sponsor | Address |
|---|---|
| Boss Products (Australia) Pty Ltd | Unit 1, 16 Atkinson Road,<br>Taren Point, NSW 2229 |

# 2. Framework for the assessment

## 2.1 Assessment approach

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

No specific framework, methodology, standard or guidance documents exists in Australia for undertaking these assessments. We have therefore followed the ‘Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence’ prepared by the Passive Fire Protection Forum (PFPF) in the UK in 2021[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 – eg size or configuration – it is not possible to subject a construction or a product to a fire test.

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

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

[1] Standards Australia, 2014, Methods for fire tests on building materials, components, and structures – Part 4: Fire-resistance tests for elements of construction, AS 1530.4:2014, 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, Standards Australia, NSW.
[3] Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

This assessment 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.

## 2.2 Compliance with the National Construction Code

This assessment report has been prepared to meet the evidence of suitability requirements of the NCC 2022[4] under A5G3 (1) (d). It references test evidence for meeting deemed to satisfy (DTS) provisions of the NCC under A5G5 for fire resistance level that apply to the assessed systems based on Specifications 1 and 2 for fire resistance for building elements.

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

## 2.3 Declaration

The 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal on 1 March 2023, Boss Products Australia Pty Ltd confirmed that:

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

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 4.1
- This report details the methods of construction, test conditions and assessed results expected in accordance with AS 1530.4:2014.
- This assessment applies to floor/ceiling systems exposed to fire from below in accordance with the requirements of AS 1530.4:2014, where horizontal elements must be exposed to heat from the underside only.
- This assessment applies to wall systems exposed to fire from each side/one side in accordance with the requirements of AS 1530.4:2014, where vertical elements must be exposed to heat from the direction required to resist fire exposure.
- The FRLs achieved can be extended to timber framed walls. For timber framed walls, it is required that no part of the penetration seal is closer than 100 mm to a stud, the cavity is closed between the penetration seal and the stud.
- This report is only valid for the assessed system/s and must not be used for any other purpose. Any changes with respect to size, construction details, loads, stresses, edge or end conditions – other than those identified in this report – may invalidate the findings of this assessment. If there are changes to the system, a reassessment will need to be done by an Accredited Testing Laboratory (ATL) that is accredited to the same nominated standards of this report.
- Support of services in walls and floors must be maintained as per AS 1530.4:2014 and AS 4072.1:2005 requirements.

[4] National Construction Code Volumes One and Two - Building Code of Australia 2022, Australian Building Codes Board, Australia

- While it is recommended that the elastomeric pipe insulation be classified B-s3, d0 in accordance with EN 13501-1[5] as tested, the achieved results can be extended to cover an insulation material not deemed combustible as determined by AS 1530.1:1994 if they meet this classification.
- The documentation that forms the basis for this report is listed in Appendix A.
- This report has been prepared using 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 have been incorporated into this report as a result.
- This assessment is based on the proposed systems being constructed under comprehensive quality control practices and following appropriate industry regulations and Australian Standards on quality of materials, design of structures, guidance on workmanship and expert handling, placing and finishing of the products on site. These variables are beyond the control and consideration of this report.
- Where rigid walls reference FRL -/120/120 outcomes, FRL -/30/30, FRL -/60/60 and FRL -/90/90 also apply.
- Where concrete floor slabs reference FRL -/120/120 outcomes, FRL -/30/30, FRL -/60/60 and FRL -/90/90 also apply.
- Where concrete floor slabs reference FRL -/240/240 outcomes, FRL -/30/30, FRL -/60/60 and FRL -/90/90, FRL -/120/120, FRL -/180/180 also apply.
- In all cases, the FRL of the assessed service is limited to the FRL of the separating element.

# 4. Description of the specimen and variations

## 4.1 Description of assessed systems

The systems assessed in this report include various services protected by BOSS FireMastic-HPE sealant. BOSS FireMastic-HPE sealant is an intumescent, high-pressure exerting fire sealant (graphite based) used to close the gaps formed by the melting of the services that penetrate walls and floors to maintain the integrity and insulation performance of the seal.

The intended use of BOSS FireMastic HPE sealant is to reinstate the fire resistance performance of flexible wall, rigid wall and floor constructions where they are penetrated by services. Table 3 and Table 4 show the details of the vertical and horizontal separating elements considered in this assessment.

It is also noted that FireMastic-300 sealant is used on certain systems. FireMastic-300 is an acrylic intumescent sealant that has fire resistant properties while also being flexible.

The services considered in this assessment are pipes, cables and Heating, ventilation and air-conditioning (HVAC). The type of pipes include Unplasticized polyvinyl chloride pipe (UPVC), High density polyethylene pipe (HDPE), Polypropylene pipe (PP), Polyethylene pipe (PE), Polyethylene/aluminum/cross-linked polyethylene composite pressure pipe (PEX-AL-PEX), Crosslinked polyethylene PEX-A, Crosslinked polyethylene PEX-B, Chlorinated polyvinyl chloride (CPVC), Acrylonitrile Butadiene Styrene (ABS), insulated copper and steel pipes.

The cables considered in this assessment include fire alarm cable, RG6 Coax, CAT6, Core security cables, 2C+E TPS, ELV extra low voltage alarm cable, 2C+E, TPS and Power cable-3 core. The assessment includes the cables referenced in EN 1366-3:2009 and listed in Table 28.

The assessment also includes HVAC services, which are a combination of pipes and cables.

The specific elements of construction that the system may be used to provide a penetration fire seal for are as follows:

- Flexible walls must have a minimum thickness as tested, and the construction of the wall should consist of steel studs lined on both faces with two layers of fire rated plasterboard.

[5] European Committee for Standardization, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests, EN 13501-1, European Committee for Standardization, Brussels, Belgium.

Unless otherwise specified, the cavity of flexible walls must be filled with R2.0 Glasswool Batt insulation, filled up to the aperture of the service. For services tested in walls with two layers of 13 mm thick fire rated plasterboard on both faces, single layer walls are permitted provided that the area around the penetration is built Up with an additional layer of fire rated plasterboard, and must extend at least 100 mm in all directions from the aperture.

- FRLs assessed for flexible walls can be applied to the same services penetrating through rigid walls and having the same or greater thicknesses (or localised increased thickness), as applicable, with an established FRL as required, as tested or assessed by an ATL.
- Timber walls: The wall must have a minimum thickness of 100 mm and consist of solid wood or cross-laminated timber (CLT). The density must be minimum 510 kg/m³ and the adhesive used must be in the family of heat-resistant melamine-urea-formaldehyde. The outer lamella thickness on either side must be equal to or greater than 33 mm.
- Rigid walls must be minimum 75 mm thick and must be Autoclave Aerated Concrete (AAC) wall, concrete or solid masonry. Thinner rigid walls must be built Up on either one or both sides to achieve the minimum thickness required as assessed for the required FRL. The build-Up could be fire-rated plasterboard, calcium silicate board, MGO board or BOSS batts and must extend at least 100 mm in all directions from the aperture.
- FRLs assessed for AAC blockwork walls, Hebel walls and Speedpanel walls can be applied to the same services penetrating through rigid walls having the same or greater thickness, as applicable (including concrete, solid masonry, Speedpanel, Hebel and Korok) with an established FRL as required, tested or assessed by an ATL.
- Rigid floors: The floor must have a minimum thickness of 150 mm and comprise AAC or concrete with a minimum density of 650 kg/m³. Floor elements are required to be otherwise tested or assessed by others for the required fire resistance period.
- Results obtained in 150 mm AAC floors can be extended to floors systems of greater thickness and density in accordance with section 10 of AS 1530.4:2014, which describes permissible variations. Therefore, minimum 150 mm thick AAC or normal weight concrete floor slabs with a minimum density of 650 kg/m3 are expected to achieve the same fire resistance performance as observed for the tested 150 mm thick AAC floors.
- Where outcomes reference minimum 150 mm thick concrete floor slabs, this needs to incorporate localised thickening in the form of build-up applied with a minimum 100 mm overlap from the aperture in all directions using BOSS Batts, to the top or bottom side of the concrete slab. The FRL of the service will be limited by the FRL of the separating element.
- Where cable and pipe penetrations reference minimum 75 mm thick AAC or fire rated plasterboard with minimum 2 layers of 13 mm fire rated plasterboard for -/120/120 applications, the performance can be applied to single 13 mm and 16 mm fire rated plasterboard walls. This service needs to incorporate localised thickening in the form of localised build-up with a minimum 100 mm overlap from the aperture using fire rated plasterboard, to both sides of the wall. The FRL of the service will be limited by the FRL of the separating element, either -/60/60 or -/90/90.
- Where concrete floor slabs reference FRL -/120/120 outcomes, FRL -/30/30, FRL -/60/60 and FRL -/90/90 are also applicable, provided that, the sealant configuration is maintained.
- Where concrete floor slabs reference FRL -/240/240 outcomes, FRL -/30/30, FRL -/60/60, FRL -/90/90, FRL -/120/120 and FRL -/180/180 are also applicable, provided that, the sealant configuration is maintained.
- Applicability of FRLs to thinner concrete slabs of a minimum thickness of 120 mm is permissible. The insulation performance of the system will be governed by the concrete slab thickness, as stated in AS/NZS 3600:2018. The overall FRL of the system will be governed by the FRL extracted from AS/NZS 3600:2018.
- For timber framed walls, no part of the penetration seal may be closer than 100 mm to a stud; the cavity must be closed between the penetration seal and the stud; and a minimum 100 mm of insulation confirmed to be deemed non-combustible in accordance with AS 1530.1:1994 must be provided within the cavity between the penetration seal and the stud.

- Wall and floor elements are required to be otherwise tested or assessed by others for the required fire resistance period. In cases where the FRL of the wall or floor is less than that of the penetration, the FRL will be derated accordingly.
- Test results for cables remain valid if the diameter of a single cable is reduced and/or the number of cables in a bunch is reduced, provided that the overall diameter of the bunch of any individual cable is not greater than that tested.
- The test results obtained with the standard configuration cover all types of insulated cables with copper or aluminium conductors, fibre optic cables and bundled communication cables, except hollow cables.
- Results obtained from tests where the supports pass through the seal are applicable to those situations where the support is not continued but not vice versa.
- The total number of cross sections of services (including insulation) should not exceed 60% of the penetration area. The test results obtained using standard configurations for cable penetration systems are valid for:
  - All types of steel cable trays and ladders.
  - Any cable penetration size equal to or smaller than that tested, provided the total amount of cross sections of the cables (core and insulation) does not exceed 60% of the penetration.
  - Support for services in walls and floors must be maintained as per AS 1530.4:2014 and AS 4072.1:2005 requirements.
- Results obtained in minimum 235 mm thick ceiling or ceiling-floor systems – as tested in FRT180474 R1.0 – can be applied to ceiling or ceiling-floor systems of greater thickness of the same construction, as tested with 2 layers of 13 mm fire-rated plasterboard on the exposed face.
- Where specified, services penetrating double layers of 50 mm thick BOSS batts are protected with BOSS FireMastic-HPE sealant installed on both faces. The BOSS batts may be pattress fitted overlapping (minimum 100 mm overlap) the separating element or friction-fitted in the aperture bedded with BOSS FireMastic-HPE sealant. The maximum aperture size in walls is 600 mm × 600 mm.
- If pattress fitted, the batts must be fixed using 6 × 80 mm steel screws and washers at 300 mm centres or at batt corners. If friction-fitted and bedded within the aperture, the overall size of the batts may be made of cut batt sections butt jointed together and fitted after the pipes are installed. Sealant must be used to bed the cut batts together and to seal the edges of the batt with the separating element and with the pipe. The BOSS batts must be coated on both faces with an ablative coating. Additionally, each vertical and horizontal cut of the batt must be sealed with BOSS FireMastic-HPE sealant at the interface between the batts and the service and between the batt and the separating element.
- FRLs assessed in flexible walls and rigid walls are applicable to the same services penetrating a large aperture fitted with two layers of 50 mm thick BOSS Batts friction-fitted or pattress fitted on either side, provided that the Batts have been tested or assessed in this configuration to have the minimum established FRL by an ATL.
- The HVAC bundle services outlined in the outcome tables represent the maximum number of services, and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet, if applicable) are maintained.
- Where used, non-fire rated pipe lagging can be substituted for fire rated lagging.

**Table 3 Separating elements – Walls**

| Item number | Thickness | Description | Framing thickness | Insulation |
|---|---|---|---|---|
| 1. | 144 mm | Minimum two layers of 13 mm thick fire rated plasterboard. | 92 mm steel framing | Fletcher Insulation Pink Partition 14 R2.2 or equivalent. |

| Item number | Thickness | Description | Framing thickness | Insulation |
|---|---|---|---|---|
| 2. | 156 mm | Minimum two layers of 13 mm thick fire rated plasterboard on one side and 25 mm shaftliner on the other | 102 mm steel framing | Fletcher Insulation Pink Partition 14 R2.2 or equivalent. |
| 3. | 130 mm | Minimum two layers of 13 mm thick fire rated plasterboard | 75 mm steel framing | - |
| 4. | 128 mm | Exposed side - 25 mm thick fire rated shaftliner board<br>Unexposed side - two layers of minimum 13 mm thick fire rated plasterboard | 102 mm steel framing | 75 mm thick Earthwool |
| 5. | 116 mm | Both sides - two layers of minimum 13 mm thick fire rated plasterboard | 64 mm steel framing | - |
| 6. | 100 mm | Both sides - two layers of minimum 12.5 mm thick fire rated plasterboard | 50 mm steel framing | 50 mm thick mineral wool |
| 7. | 90 mm | Both sides - one layer of 13 mm thick Gyproc Fireline plasterboard | 64 mm steel framing | - |
| 8. | 200 mm | 150 mm AAC wall with single 50 mm Fire Batt to the unexposed side | - | - |
| 9. | 150 mm | AAC wall | - | - |
| 10. | 75 mm | 75 mm thick double mesh CSR Hebel | - | - |
| 11. | 137mm | CLT wall - The outer lamella thickness must be equal to or greater than 33 mm | - | - |
| 12. | 130 mm | CLT wall- The outer lamella thickness must be equal to or greater than 33 mm | - | - |

**Table 4 Separating elements – floors**

| Item number | Thickness | Description | Framing | Type |
|---|---|---|---|---|
| 1. | 235 mm | Exposed side - two layers of 13 mm thick GIB Fyreline plasterboard<br>Unexposed side – one layer of 19 mm thick particleboard flooring | MGP10, 190 45 mm timber framing | Ceiling |
| 2. | 125 mm | Concrete slab | - | Floor |
| 3. | 150 mm | Concrete slab | - | Floor |
| 4. | 150 mm | AAC | - | Floor |
| 5. | 70-130 mm | Composite floor system of ComFlor 60 deck cast with concrete | - | Floor |

## 4.2 Referenced test data

The assessment of the variation to the tested systems and the determination of the expected performance are based on the results of the fire tests documented in the reports summarised in Table 5. Further details of the tested systems are included in Appendix A.

**Table 5 Referenced test data**

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| WF 329129 | FSi Limited | 16 September 2013 | Warringtonfire, UK |
| EWFA 2891600b.3 | Brookfield Multiplex Constructions P/L | 25 September 2013 | Warringtonfire, Aus |
| WARRES 334037-A | FSi Limited | 25 November 2013 | Warringtonfire, UK |

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| WARRES 334037-D | FSi Limited | 28 November 2013 | Warringtonfire, UK |
| WARRES 342026 iss2 | FSi Limited | 5 August 2014 | Warringtonfire, UK |
| WARRES 342025 | FSi Limited | 23 September 2014 | Warringtonfire, UK |
| FSP 1734 | BOSS Fire and Safety Pty Ltd -Australia | 9 December 2015 | CSIRO |
| WARRES 359902 FR | FSi Limited | 15 December 2015 | Warringtonfire, UK |
| WARRES 359904 Issue 2 | FSi Limited | 15 December 2015 | Warringtonfire, UK |
| WARRES 371239 | FSi Limited | 28 September 2016 | Warringtonfire, UK |
| EWFA 54783400.2 | Multiplex Australasia | 26 April 2018 | Warringtonfire, Aus |
| EWFA55693000.2 | BOSS Fire (Australia) Pty Ltd | 6 August 2018 | Warringtonfire, Aus |
| CHILT/RF 12089A AR5 | BOSS Fire and Safety Pty Ltd -Australia | 6 August 2018 | Exova Warringtonfire Chiltern House, High Wycombe. |
| FRT180137.2 | BOSS Fire and Safety Pty Ltd -Australia | 7 March 2019 | Warringtonfire, Aus |
| FRT180472.1 | BOSS Fire and Safety Pty Ltd -Australia | 8 March 2019 | Warringtonfire, Aus |
| FRT180473.1 | BOSS Fire and Safety Pty Ltd -Australia | 12 March 2019 | Warringtonfire, Aus |
| FSP 2073 | Knauf Plasterboard Pty Ltd | 13 January 2020 | CSIRO |
| FRT 180474.3 | BOSS Fire and Safety Pty Ltd -Australia | 17 January 2020 | Warringtonfire, Aus |
| FP 10422-002 issue 2 | The Insulation Contractors Association of Australia Queensland Inc –<br>c/o B and D Insulation Contracting | 22 May 2019 | BRANZ |
| FP 10422-001 issue 2 | The Insulation Contractors Association of Australia Queensland Inc –<br>c/o B and D Insulation Contracting | 24 May 2019 | BRANZ |
| FSP 2084 | Knauf Plasterboard Pty Ltd | 12 February 2020 | CSIRO |
| FRT 210330 R1.0 | BOSS Products (Australia) Pty Ltd | 24 June 2020 | Warringtonfire, Aus |
| FRT 220049 R1.0 | BOSS Products (Australia) Pty Ltd | 27 June 2020 | Warringtonfire, Aus |
| FSP 2191 | BOSS Products (Australia) Pty Ltd | 2 January 2021 | CSIRO |
| FRT 210322.1 | BOSS Products (Australia) Pty Ltd | 18 January 2022 | Warringtonfire, Aus |
| FRT220141 R1.1 | BOSS Products (Australia) Pty Ltd | 15 July 2022 | Warringtonfire, Aus |
| FSP 1791 | BOSS Products (Australia) Pty Ltd | 14 March 2017 | CSIRO |

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| FSP 1833 | BOSS Products (Australia) Pty Ltd | 20 June 2017 | CSIRO |
| FSP 2084 | Knauf Plasterboard Pty Limited | 6 May 2020 | CSIRO |
| FSP 2053 | Knauf Plasterboard Pty Limited | 23 April 2020 | CSIRO |

## 4.3 Variations to the tested systems

The tested systems and variations to those tested systems – together with the referenced standard fire tests – are described in Table 6.

Figure 1 to Figure 10 depict schematic drawings illustrating the construction details for the proposed services. These drawings provide a visual representation of the various generic installations and serve as a helpful reference for understanding fire protection.

**Table 6 Variations to tested systems**

| Reference tests | Description | Variations |
|---|---|---|
| All test reports referenced in Table 5. | Various combustible pipe penetrations, insulated metal pipes, cables, cable bundles and HVAC bundles protected with BOSS FireMastic-HPE sealant were tested in accordance with BS EN 1366-3:2009[6] and AS 1530.4:2014. | It is proposed to assess:<br>• The expected fire resistance in accordance with AS 1530.4:2014.<br>• All tested penetrations, including intermediate sizes, were tested to determine their expected FRL across the separating elements as defined in Table 3 and Table 4 |

[6] European Committee for Standardization, 2009, Fire resistance tests for service installations. Penetration seals, BS EN 1366-3:2009, European Committee for Standardization, Brussels, Belgium.

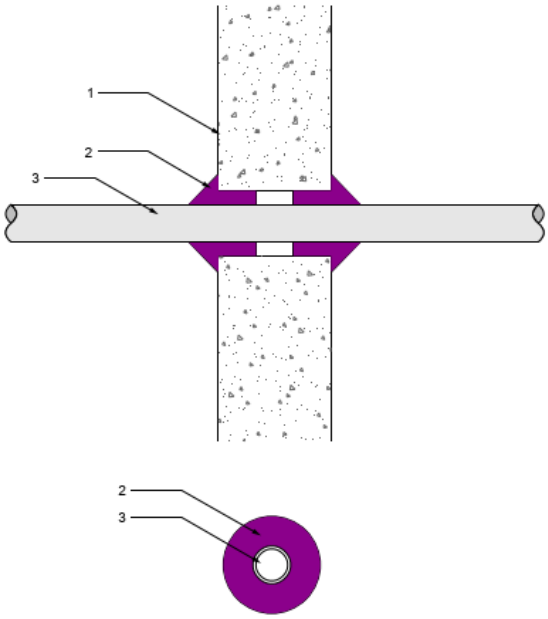


**Figure 1** **2hr 75 mm AAC/Hebel wall FRL -/120/120 and rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of combustible pipes protected with BOSS FireMastic-HPE sealant finished with fillet of sealant.**

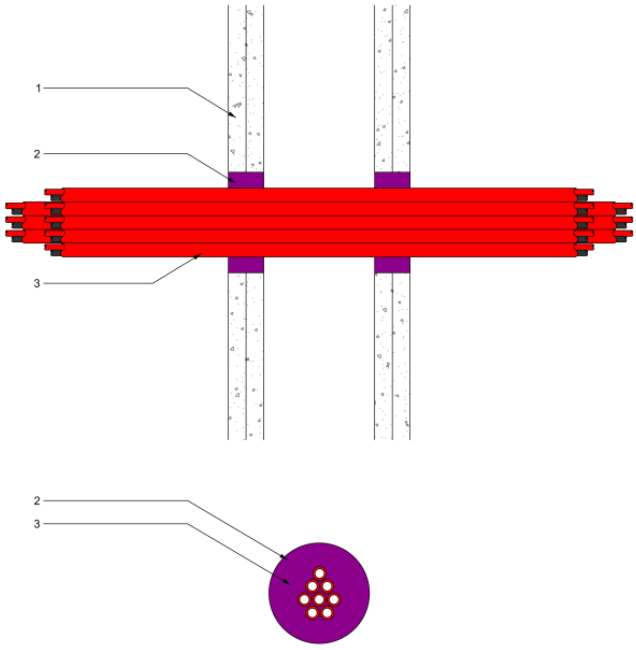


**Figure 2** **2hr minimum 116 mm flexible wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of cables protected with BOSS FireMastic-HPE sealant finished flush with the wall (for 60 mins applications, the wall shall have minimum of 1 layer of 13 mm or 16 mm fire rated plasterboard)**

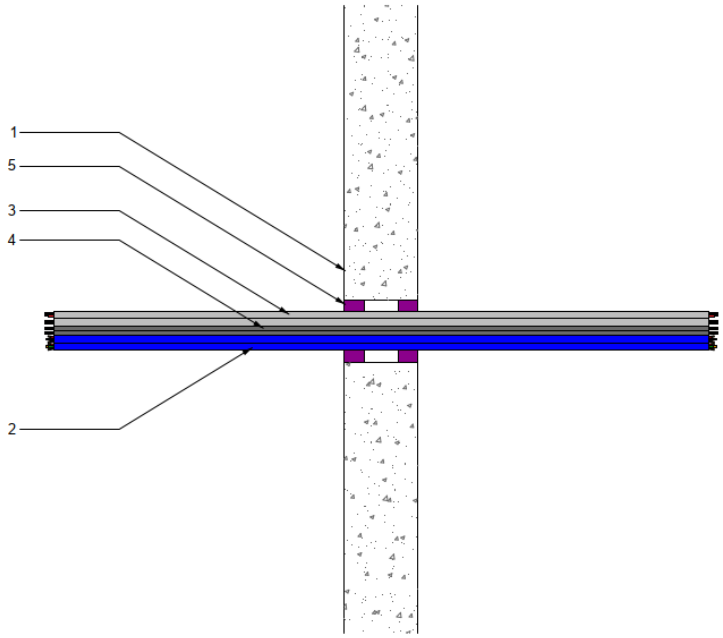


**Figure 3** **2hr 75 mm AAC/Hebel wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of cables protected with BOSS FireMastic-HPE sealant finished flush with the wall**

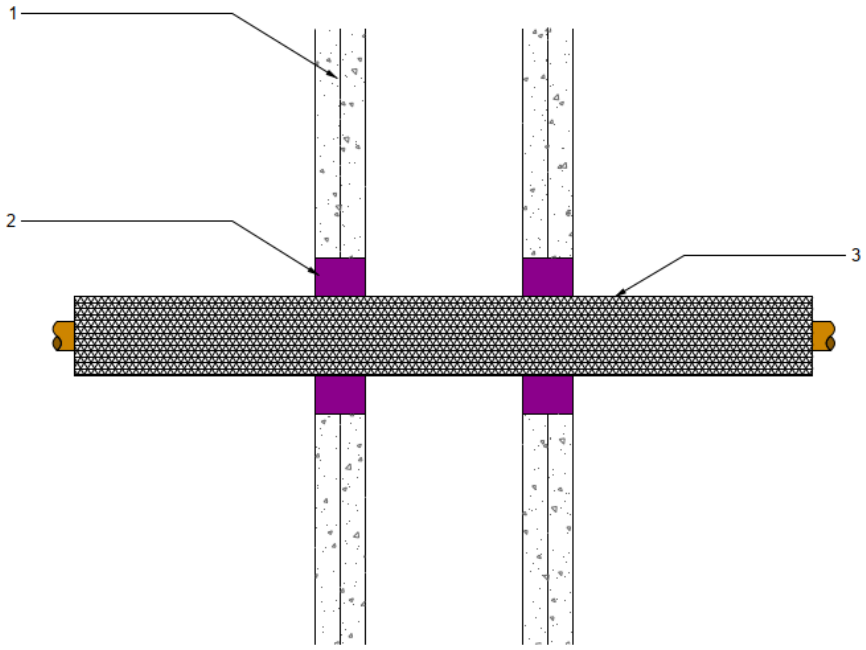


**Figure 4** **2hr minimum 116 mm flexible wall FRL -/120/120 and Rigid walls FRL - /120/120 and FRL 120/120/120. Typical arrangement of insulated metal pipes protected with BOSS FireMastic-HPE sealant finished flush with the wall**

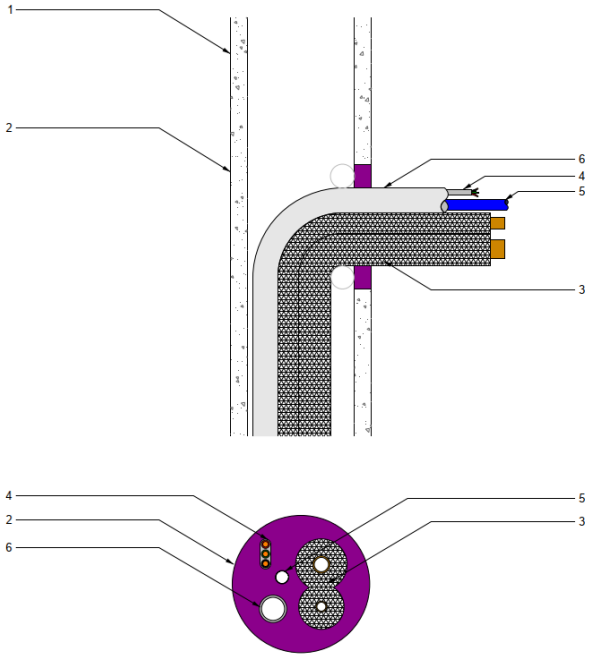


**Figure 5** **2hr minimum 116 mm flexible wall, minimum 2 layers of fire rated plasterboard either side, FRL -/120/120 and Rigid walls FRL - /120/120 and FRL 120/120/120. Typical arrangement of one-sided penetration of HVAC services protected with BOSS FireMastic-HPE sealant finished flush with the wall (please note that the drawing is just for illustration purposes, wall make up shall be as wall shown in Figure 8)**

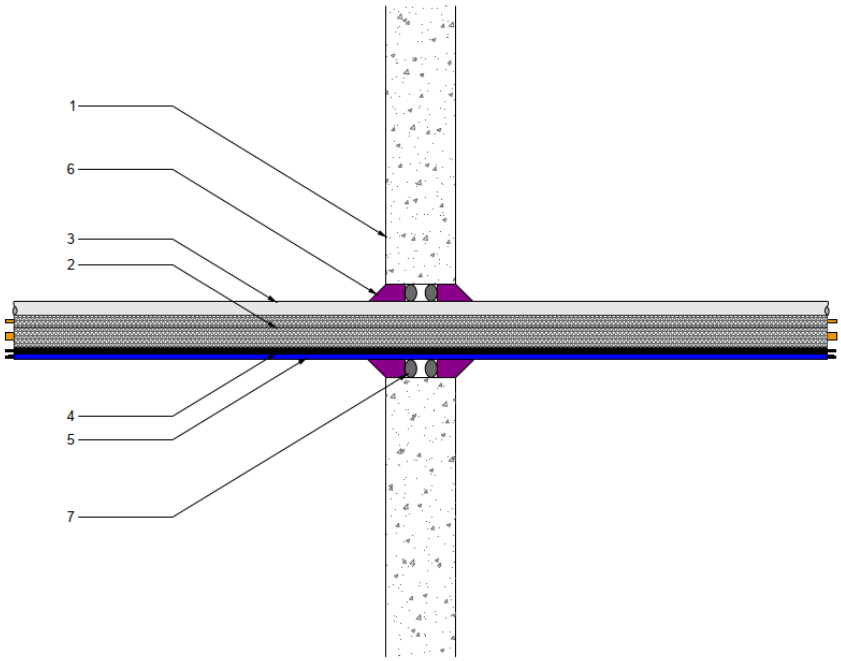


**Figure 6** **2hr 75 mm AAC/Hebel wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of HVAC services protected with a backing rod and BOSS FireMastic-HPE sealant finished with a fillet of sealant**

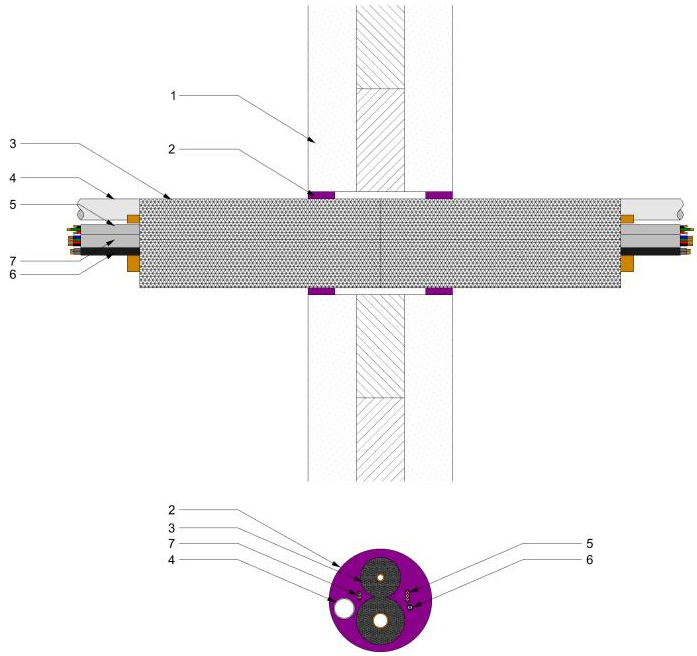


**Figure 7** **Minimum 130 mm thick CLT wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of HVAC services protected with a backing rod and BOSS FireMastic-HPE sealant finished flush with the wall**

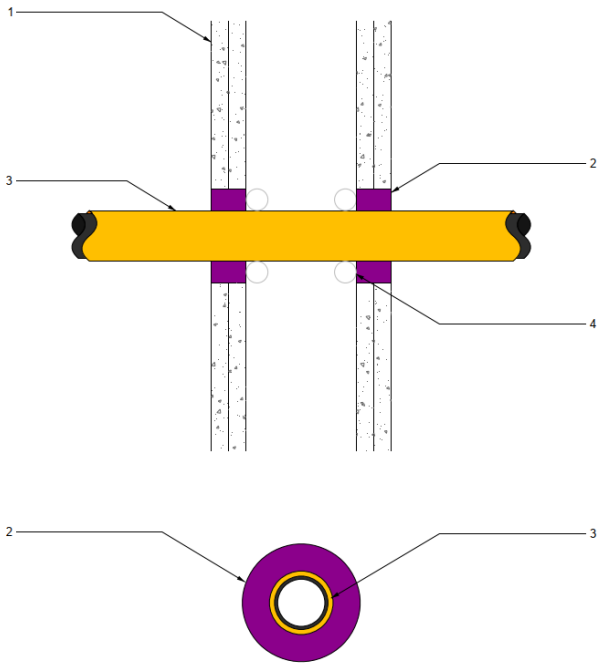

**Figure 8** **2hr minimum 116 mm flexible wall FRL -/120/120 and Rigid walls FRL - /120/120 and FRL 120/120/120. Typical arrangement of penetration of PEX pipe protected with backing rod and BOSS FireMastic-HPE sealant finished flush with the wall**

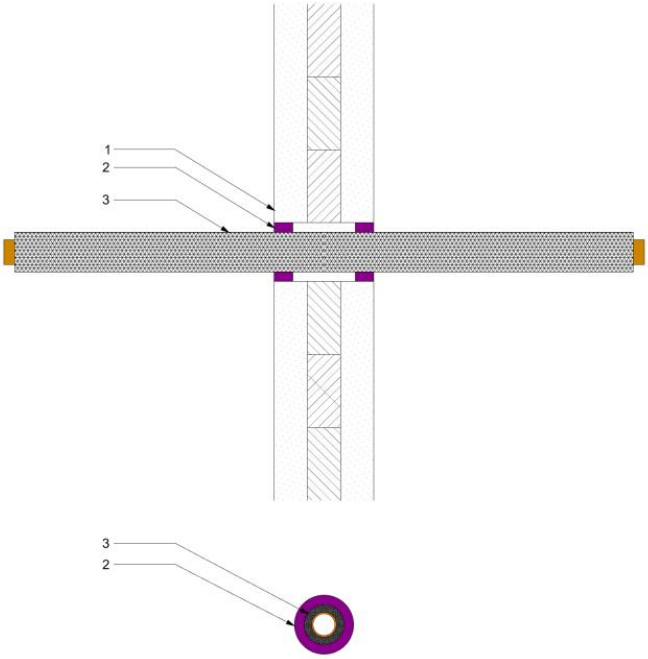


**Figure 9** **Minimum 130 mm thick CLT wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of Kelox pipe protected with BOSS FireMastic-HPE sealant finished flush with the wall**

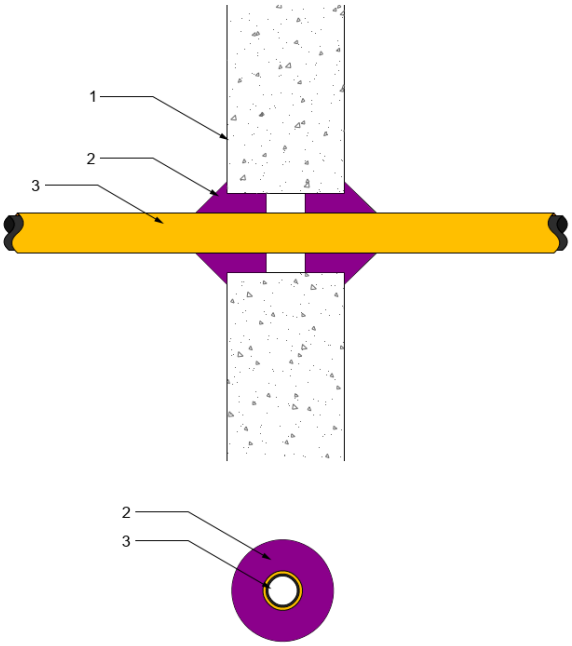


**Figure 10** **2hr 75 mm AAC/Hebel wall FRL -/120/120 and Rigid walls FRL -/120/120 and FRL 120/120/120. Typical arrangement of PEX pipe protected with BOSS FireMastic-HPE sealant finished with a fillet of sealant**

# 5. Relevance of EN 1366-3:2009 test data with respect to AS 1530.4:2014

## 5.1 Description of variation

The fire resistance tests WARRES 359904, WARRES 342025, ChiltRF12089A, WARRES 334037-D and WARRES 334037-A were conducted in accordance with EN 1366-3:2009[7] and EN 1363-1:1999[8]. This standard differs from AS 1530.4:2014 and the significance of these differences is discussed below.

## 5.2 Methodology

The method of assessment used is summarised in Table 7.

**Table 7 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Intermediate assessment |
| Type of assessment | Qualitative |

## 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 1363-1:1999.

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and EN 1363-1:1999 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 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 thermocouple specified in EN 1363.1:1999 is made from a folded steel plate that faces the furnace chamber. A thermocouple is fixed to the side of the plate facing the specimen, with the thermocouple hot junction protected by a pad of insulating material.

The plate part is to be constructed from 150  1 mm long by 100  1 mm wide by 0.7  0.1 mm thick nickel alloy sheet strips.

The measuring junction is to consist of nickel chromium/nickel aluminium (Type K) wire as defined in IEC 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath of a nominal diameter of 1 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 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  1 mm by 97  1 mm by 10  1 mm thick with a density of 280  30 kg/m$^3$.

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

The relative locations of the furnace thermocouples for the exposed face of the specimen – for AS 1530.4:2014 and EN 1363-1:1999 – are 100 mm  10 mm and 100 mm  50 mm, respectively.

The furnace control thermocouples required by EN 1363-1:1999 are less responsive than those specified by AS 1530.4:2014. This variation in sensitivity can produce a potentially more onerous heating condition for specimens tested to EN 1363-1:1999, 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 accordance with both EN 1363-1:1999 and AS 1530.4:2014.

### 5.3.4 Furnace pressure

For services penetrating vertical and horizontal separating elements, the furnace pressure conditions are very similar between EN 1366-3:2009 and AS 1530.4:2014.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and EN 1363-1:1999 are also not appreciably different.

### 5.3.5 Performance criteria

AS 1530.4:2014 specifies the following performance criteria for building materials and structures:

- structural adequacy (not relevant to the referenced test).
- integrity.
- insulation.

#### Integrity

The integrity criteria differ slightly between AS 1530.4:2014 and EN 1363.1:1999.

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

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

- 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.

Except for minor technical 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 1363-1:1999 are not appreciably different.

### 5.3.6 Specimen configuration

AS 1530.4:2014 specifies for plastic pipes that the external projection away from the furnace shall be a minimum of 2000 mm. The pipes shall be capped on the exposed side and left uncapped on the unexposed side.

EN 1366-3:2009 requires that the pipes extend on the fire side and non-fire side by a minimum of 500 mm. The plastic pipes tested in the referenced tests had both ends uncapped – thus presenting a more onerous case than that prescribed in AS 1530.4:2014.

Plastic pipes tested in the referenced fire resistance tests generally extend 500 mm on exposed and unexposed sides. This variation is addressed in the following section.

With respect to the pipe end configurations, AS 1530.4:2014 stipulates that the services end conditions shall be representative of those intended to be used in practice.

The EN standard stipulates the following field of application based on the tested pipe end configuration:

**Table 8 Field of application based on the tested pipe end configuration**

| | | Tested | | | |
|---|---|---|---|---|---|
| | | U/U | C/U | U/C | C/C |
| **Covered** | **U/U** | Y | N | N | N |
| | **C/U** | Y | Y | N | N |
| | **U/C** | Y | Y | Y | N |
| | **C/C** | Y | Y | Y | Y |
| Y=acceptable, N=not acceptable | | | | | |

Based on the review of the test data and the above field of application, it is the opinion of this testing authority that services tested with an open/open 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 is expected to record the highest temperature when compared to the rest of the pipe end configurations. Therefore, FRL achieved in the 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 requirements of AS 1530.4:2014. However, clause 10.4.5 of AS 1530.4:2014 stipulates that “service end conditions must 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.

### 5.3.7 Application of test data to AS 1530.4:2014

The variation in furnace heating regimes, furnace pressure, furnace thermocouples, and the responses of the different thermocouple types to the furnace conditions are not expected to have an overall significant effect on the outcome of the referenced fire resistance tests.

The plastic pipes tested in the reference tests extended 500 to 550 mm away from the walls and floors on the unexposed side rather than 2000 mm as required by AS 1530.4:2014.

Theoretically, this difference can affect the drawing of hot gases through the pipe by a ‘stack effect’ and can lead to high temperatures on the unexposed side of the specimen when compared to having a shorter pipe extension on the unexposed side.

The impact of the stack effect on the tested services can be significant when there are gaps at the penetrations and hot gasses are passing in the pipes, particularly for floor specimens. The longer the length of pipe above the sealing system, the greater the increase in pressure across the sealant or gap.

However, for each of the assessed plastic pipe services, the referenced test data shows that the BOSS sealing systems completely closed off the softened plastic pipe via the intumescing material such that the temperatures measured on the pipe remained steady or steadily increased without exhibiting any secondary temperature peaks. If the expanded intumescent material fully blocks the pipe aperture on the exposed side or within the aperture, then – irrespective of the length of the pipe on the unexposed side – the service is expected to perform similarly. Based on this rationale, the stack effect is not expected to be significant – even if the plastic pipe length on the unexposed side is 2000 mm. Thus, the difference in service length for plastic pipes between EN 1366-3:2009 and AS 1530.4:2014 is not expected to cause any difference in performance for the assessed services.

For walls, the stack effect is not as significant. In any case, the same rationale applied above applies.

Based on the above discussion, the referenced test data from test reports WARRES 359904, WARRES 342025, ChiltRF12089A, WARRES 334037-D and WARRES 334037-D can be used to support this assessment conducted to AS 1530.4:2014.

# 6. Assessment 1 – Pipe services protected with BOSS FireMastic–HPE sealant

## 6.1 Description of variation

It is proposed that combustible and insulated metal pipes penetrating flexible and rigid walls, ceilings and rigid floor constructions are assessed to be protected with BOSS FireMastic-HPE sealant.

In this section, the pipes considered include uPVC, HDPE, PP, PE, PEX-AL-PEX, PEX-A, PEX-B, cPVC, ABS, insulated copper, and insulated steel pipes.

The vertical separating elements considered in this assessment are given below.

- Minimum 116 mm thick flexible or rigid walls
- Minimum 75 mm thick AAC walls or rigid walls
- Minimum 130 mm thick CLT walls
- Plasterboard walls or rigid walls with double layer of 50 mm thick “BOSS Fire Batt” aperture – Factory applied “BOSS Ablative Coating” to both faces and PS coating to exposed face.

The horizontal separating elements considered in this assessment are:

- Minimum 235 mm thick ceiling system
- Minimum 150 mm AAC floor
- Minimum 125 mm concrete slab
- ComFlor® 60 – 100 mm thick floor system (Max 130 mm thick / min 70 mm thick)
- Concrete floor with double layer of 50 mm thick “BOSS Fire Batt”aperture – Factory applied “BOSS Ablative Coating” to both faces and PS coating to exposed face.

## 6.2 Methodology

The method of assessment used is summarised in Table 9.

**Table 9 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Qualitative |

## 6.3 Assessment of various combustible pipes in minimum 116 mm thick flexible wall systems or rigid walls

### 6.3.1 Proposed constructions

Table 10 lists various combustible pipes tested in FSP 2191, FSP 1734 and EWFA 55693000.2 in accordance with AS 1530.4:2014 and in ChiltRF12089A and WARRES 334037-D in accordance with BS EN 1366-3:2009 and BS EN 1366-4:2009.

In the reference test FSP 2191, a fire resistance test was conducted, which included two plastic pipe penetrations and two BOSS fire transit boxes fitted with or without services, installed in a framed plasterboard wall system. The wall system consisted of two layers of 13 mm thick CSR Fyrchek plasterboard on both sides of 64 mm steel (BMT 0.50 mm) studs with screw fixing at 300 mm centres. The wall system CSR 1078 had an established FRL of -/120/120.

In test EWFA 55693000.2, a fire resistance test was conducted on various pipes and cable services protected with various BOSS penetration protection systems in a 144 mm thick fire rated flexible wall

system. The pipes are proposed to be installed in flexible wall systems and protected with BOSS FireMastic-HPE sealant.

In test FSP 1734, a 116 mm thick steel stud framed wall lined on each side with two layers of 13 mm thick fire rated plasterboards was tested. Seven services penetrated the separating element. All services were protected with BOSS FireMastic-HPE sealant.

In test ChiltRF12089A, a 120 mm thick steel stud/plasterboard clad partition was tested in accordance with BSEN 1366-3. The supporting construction was penetrated with nine service penetrations. The penetrations were sealed with BOSS FireMastic-HPE sealant. In this section, the combustible pipes protected by BOSS FireMastic-HPE sealant are discussed.

In the reference test WARRES 334037-D, a 100 mm thick wall was penetrated with fifteen various combustible and insulated metal services. Services were protected with a sealant identical to BOSS FireMastic-HPE sealant.

**Table 10 Tested combustible pipes in flexible wall systems**

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|---|
| cPVC | EWFA 49599300.7 | 116 mm | 43 mm | 18.5 mm | 25 mm deep both sides with backing rod and 15 mm×15 mm fillet on both sides | -/120/120 |
| | EWFA 55693000.2 | 144 mm | 50 mm | 20 mm | Depth of plasterboard and finished flush on the wall surface | -/120/60 |
| uPVC | EWFA 49599300.7 | 116 mm | 20 mm | 0 mm | 15 mm fillet on both sides | -/120/120 |
| | EWFA 49599300.7 | 144 mm | 40 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | EWFA 55693000.2 | 144 mm | 50 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 C/U |
| | EWFA 55693000.2 | 144 mm | 80 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/90/90 |
| | FSP 2084 | 118 mm | 43 mm | 21.5 mm | Depth of plasterboard and finished flush on unexposed face | -/90/90 |
| PVC | WF 334037/D | 100 mm | 40 × 1.9 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | Integrity: 120 min<br>Insulation:120 min |

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|---|
| | WF 334037/D | 100 mm | 125 mm 9.2 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | Integrity: 60 min Insulation:60 min |
| | WF 334037/D | 100 mm | 125 mm 1.8 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | Integrity: 30 min Insulation:30 min |
| | FSP 2073 | 128 mm | 43 mm | 23.5 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | ChiltRF12089A | 120 mm | 125 × 4.8 mm | 16 mm | 25 mm deep × 16 mm wide on both faces | Integrity: 120 min Insulation:120 min U/C |
| | ChiltRF12089A | 120 mm | 40 × 1.9 mm | 10 mm | 25 mm deep × 16 mm wide on both faces | Integrity: 120 min Insulation:120 min U/C |
| | ChiltRF12089A | 120 mm | 40 × 3.0 mm | 10 mm | 25 mm deep × 16 mm wide on both faces | Integrity: 120 min Insulation:120 min U/C |
| | ChiltRF12089A | 120 mm | 125 × 7.4 mm | 16 mm | 25 mm deep × 16 mm wide on both faces | Integrity: 120 min Insulation:120 min U/C |
| HDPE | ChiltRF12089A | 120 mm | 90 mm | 12.5 mm | 25 mm deep both sides finished flush | Integrity: 120 min Insulation:120 min U/C and C/C |
| PP | 334037/D | 100 mm | 40 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | Integrity: 120 min Insulation:120 min U/C and C/C |
| PE | 334037/D | 100 mm | 40 mm 3.7 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | Integrity: 30 min Insulation:30 min |
| ABS | ChiltRF12089A | 120 mm | 90 mm | 12.5 mm | 25 mm deep both sides finished flush | -/120/120 U/C and C/C |
| | 334037/D | 100 mm | 40 mm | 20 mm | 25 mm deep with 10x10 mm fillet on both sides | -/120/120 |
| PEX/AL/PEX | FSP 2191 | 116 mm | 20 mm | 5 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|---|
| | EWFA 55693000.2 | 144 mm | 25 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/30 |
| PE-Xb | EWFA 55693000.2 | 144 mm | 25 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | EWFA 55693000.2 | | 25 mm | 3.5 mm | 25 mm deep to fill the gap between the collar and the pipe on both exposed and unexposed side. | -/120/60 |
| | EWFA 55693000.2 | | 32 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/0 |
| | FRT220141 | 116 | Up to 25 mm | 10 mm | Depth of plasterboard and finished flush on both sides as shown in Figure 8 | -/120/120 |
| | FRT220141 | | Up to 20 mm | 20 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| PEX-A (one sided penetration) | FSP 2073 | 128 mm shaftliner wall 1×25 mm shaftliner from one side and 2×13 mm on the other. | 20 mm | 17.5 mm | Depth of plasterboard and finished flush on the exposed side | -/120/120 |
| | FSP 2084 | 118 mm | 20 mm | 17.5 mm | Depth of plasterboard and finished flush on the unexposed face only as shown in Figure 5 | -/90/90 |

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|---|
| | FSP 2053 | 118 mm with a baffle made of 13 mm fire rated plasterboard on either side of the wall, in addition to 12 mm plywood fixed to steel angles inside the cavity on the unexposed side. | 20 mm | 55 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/60/60 |
| PVC (one sided penetration) | WF 334037/D | 100 mm | 40 × 1.9 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/120/120 |
| | FSP 2084 - Specimen 2 | 118 mm with a baffle made of 13 mm fire rated plasterboard on either side of the wall inside the cavity | 43 mm | 88 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/90/90 |
| | FSP 2073 - Specimen 2 | 156 mm with a baffle made of 13 mm fire rated plasterboard on the opposite side of the penetration, in addition to 12 mm plywood fixed to steel angles inside the cavity | 43 mm | 90 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/120/120 |
| PEX | FSP 1791 - Specimen 7 | 90 mm | 20 mm | 20 mm | Sealant is used to fill the void between the pipe and the plasterboard, creating an annular gap of 20 mm | -/60/60 |

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|---|
| | | | | | with a depth of 13 mm. It is then finished flush with the surface of the plasterboard wall on both sides. | |
| | FSP 1833<br>- Specimen 1 | 96 mm | 20 mm | 20 mm | Sealant is used to fill the void between the pipe and the plasterboard, creating an annular gap of 20 mm with a depth of 16 mm. It is then finished flush with the surface of the plasterboard wall on both sides. | -/90/90 |

## 6.3.2 Discussion

### Improvement of insulation performance

Based on available test evidence, most services achieved a fire resistance performance of -/120/120. However, some services failed insulation performance. This section will discuss the failed systems and the improvements needed to achieve an FRL of -/120/120.

In test EWFA 55693000.2, service 4, a 50 mm diameter cPVC pipe was tested in a 144 mm thick plasterboard wall. BOSS FireMastic-HPE sealant was applied to a depth of 26 mm and finished flush on the wall from both sides. The system achieved an FRL of -/120/60 as the thermocouple on the pipe, 25 mm away from the sealant recorded a temperature of 194 C°. By observing the temperature-time graph of the test, the temperature – recorded by the thermocouple that was positioned on the pipe 25 mm away from the sealant – increased from the ambient temperature to approx. 150 C° in the first 20 minutes of the test. After 20 minutes, the temperature increases slowly, which indicates that the BOSS FireMastic-HPE sealant expanded and closed off the gaps formed at the interface between the sealant and the melted pipe.

At 65 minutes, the temperature increased to 194 C °and reached approx. 400 C° at 78 minutes. This steep increase is expected to be due to the nature of the sealant material, which becomes more fluid at higher temperatures and loses its viscosity and adhesion to the substrate and the pipe. Consequently, it is expected that a gap was not closed off at the interface between the sealant and the pipe which allowed the passage of hot gases. FSP 1735, a 43 mm diameter cPVC pipe was tested in 116 mm thick plasterboard, the annular gap was 18.5 mm. The pipe was sealed with BOSS FireMastic-HPE sealant to a nominal depth of 25 mm on both sides, controlled by a backing rod and finished with 15 mm  15 mm fillet on both sides. The system achieved -/120/120. Hence, it is proposed to apply the sealant to depth of 26 mm and add 20 mm  20 mm fillet on both sides to improve the insulation performance for up to 120 minutes.

In test EWFA 55693000.2, specimen 1, a 25 mm diameter PEX/AL/PEX pipe was tested in a 144 mm thick plasterboard wall system. BOSS FireMastic-HPE sealant was applied to the depth of 26 mm and finished flush on the wall from both sides. The thermocouple on the pipe, 25 mm away from the mastic, recorded a temperature of 194 C° at 47 minutes. The thermocouple recorded a rapid increase in temperature in the first 10 minutes to approx.130 C° then the temperature decreased to below 100 C° as a result of the sealant expansion and closing off the gaps created when the pipe softened and started to melt.

At 45 minutes, the temperature started to rise and reached 450 C° at 120 minutes. When the moisture content in the sealant was driven out due to exposure to high temperatures, the polymer chain within the sealant tended to pack together and solidify, or a chemical reaction might have occurred and created new rigid bonds between the polymer chain. This solid state of the sealant conducts heat to the unexposed side and that was reflected in the uniform increase of temperature with time. In test FSP 2191, a 20 mm diameter pipe was installed in a 30 mm aperture within a 116 mm thick plasterboard wall system and sealed with BOSS FireMastic-HPE sealant to nominal depth of 26 mm on both sides and finished flush. This configuration achieved an FRL of -/120/120. Hence, it is suggested to reduce the annular gap to 11.5 mm to improve the insulation performance of the system.

In test FSP 2191, the tested 20 mm diameter PEX/AL/PEX installed within a 30 mm aperture diameter and sealed with BOSS FireMastic-HPE sealant to a depth of 26 mm on both sides achieved an FRL of -/120/120. The tested pipe contains aluminium reinforcement between the inner and outer layers which is expected to conduct more heat to the unexposed side. Given that PEX-A and PEX-B pipes do not have metal components, the outcome of this test can be extended to cover PEX-A and PEX-B pipes with diameters up to 20 mm, provided the annular gap is kept as tested.

### Assessment of intermediate pipe sizes

The outcomes of tests FSP 2191, FSP 1734 and EWFA 55693000.2 are applicable to tested sizes of the combustible pipes, aperture, and annular gap. It is proposed to assess the intermediate pipe sizes up to 120 minutes based on the test results and propose improvements to the system construction to maintain integrity and insulation performance up to 120 minutes. Based on the discussion in the previous section, Table 11 summarises the outcomes of the assessment of combustible pipes installed in flexible wall systems and protected with BOSS FireMastic-HPE sealant.

### Requirements for flexible wall systems

In light of the above discussion, flexible walls must have a minimum thickness as tested, and the construction of the wall shall consist of steel studs lined on both faces with two layers of fire rated plasterboard. Unless otherwise specified, the cavity of flexible walls must be filled with R2.0 Glasswool Batt insulation. For services tested in walls with two layers of 13 mm thick plasterboard on both faces, single layer walls are permitted provided that the area around the penetration is built Up with an additional layer of fire rated plasterboard, the additional layer must extend at least 100 mm in every direction from the edge of the aperture.

For all cases, the wall must have been tested or assessed by an accredited testing laboratory (ATL) to achieve the required FRL in accordance with AS 1530.4:2014.

### Performance of service through rigid walls

In tests, FSP 2191, FSP 1734 and EWFA 55693000.2, the combustible pipes were installed in flexible wall systems and protected with BOSS FireMastic-HPE sealant. FRLs assessed for flexible walls can be applied to the same services penetrating through rigid walls, having the same or greater thicknesses, as applicable, with an established FRL as required as tested or assessed by an ATL.

For all cases, the wall must have been tested or assessed by an accredited testing laboratory (ATL) to achieve the required FRL in accordance with AS 1530.4:2014.

### Assessment of separating element with one side penetration

In tests FSP 2084, a 20 mm diameter PEX-A pipe was tested in 118 mm thick plasterboard wall system. The pipe was fitted in a 55 mm diameter aperture and the annular gap was 17.5 mm. The annular gap was filled with BOSS FireMastic-HPE sealant to the full depth of the plasterboard wall and finished flush on both sides. PVC pipe was tested in 120 mm thick plasterboard wall system. The pipe was penetrating the wall from both sides and the 10 mm annular gap was filled with BOSS

FireMastic-HPE sealant to the full depth of the plasterboard and finished flush with the wall. The service achieved an FRL of -/120/120. The tested PVC pipe configuration was U/C. It is expected that the separating element with one side penetration is less onerous as the exposed side does not have aperture that might affect its fire resistance level. Hence, the PVC pipe is positively assessed if installed in a flexible wall with one side penetration.

### 6.3.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic HPE sealant are capable to achieve the fire resistance levels (FRL) given in Table 11 in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 11 Assessment outcome of combustible pipes installed in flexible wall systems**

| Services | Minimum wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|
| cPVC | 116 mm | Up to 32 mm (43 mm OD) | 18.5 mm | 25 mm deep both sides with backing rod and 15 mm×15 mm fillet on both sides | -/120/120 |
| | 144 mm | Up to 50 mm (60 mm OD) | 20 mm | Depth of plasterboard and finished flush on the wall surface | -/120/60 |
| uPVC | 116 mm | Up to 20 mm | 0 mm | 15 mm fillet on both sides | -/120/120 |
| | 116 mm | Up to 20 mm | 20 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| | 116 mm | Up to 32 mm | 20 mm | Depth of plasterboard and finished with 20 mm × 20 mm fillet on both sides. | -/120/120 |
| | 144 mm | Up to 40 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | 144 mm | Up to 50 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 C/U |
| | 144 mm | Up to 80 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/90/90 |
| | 118 mm | Up to 43 mm | 21.5 mm | Depth of plasterboard and finished flush on unexposed face | -/90/90 |
| PVC | 100 mm | Up to 40 × 1.9 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/120/120 |
| | 100 mm | Up to 125 mm 9.2 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/60/60 |
| | 100 mm | Up to 125 mm 1.8 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/30/30 |
| | 128 mm | Up to 43 mm | 23.5 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | 120 mm | Up to 125 × 4.8 mm | 16 mm | 25 mm deep × 16 mm wide on both faces | -/120/120 U/C and C/C |
| | 120 mm | Up to 40 × 1.9 mm | 10 mm | 25 mm deep × 16 mm wide on both faces | -/120/120 U/C |
| | 120 mm | Up to 40 × 3.0 mm | 10 mm | 25 mm deep × 16 mm wide on both faces | -/120/120 U/C |
| | 120 mm | Up to 125 × 7.4 | 16 mm | 25 mm deep × 16 mm wide on both faces | -/120/120 U/C and C/C |

| Services | Minimum wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|
| HDPE | 120 mm | Up to 90 mm | 12.5 mm | 25 mm deep both sides finished flush | -/120/120 U/C and C/C |
| PP | 100 mm | Up to 40 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/120/120 U/C and C/C |
| PE | 100 mm | 40 mm  3.7 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/30/30 |
| ABS | 120 mm | Up to 90 mm | 12.5 mm | 25 mm deep both sides finished flush | -/120/120 U/C and C/C |
| | 100 mm | Up to 40 mm | 20 mm | 25 mm deep with 10x10 mm fillet on both sides | -/120/120 |
| PEX/AL/PEX | 116 mm | Up to 20 mm | 5 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | 116 mm | Up to 25 mm | 11.5 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| | 116 mm | Up to 20 mm | 10 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| | | | 10-20 mm | | |
| | 144 mm | Up to 25 mm | Up to 20 mm | Depth of plasterboard and finished flush on both sides | -/120/30 |
| PE-Xb | 144 mm | Up to 25 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | | Up to 25 mm | 3.5 mm | 25 mm deep to fill the gap between the collar and the pipe on both exposed and unexposed side. | -/120/60 |
| | | Up to 32 mm | 20 mm | Depth of plasterboard and finished flush on both sides | -/120/0 |
| | 116 mm | Up to 25 mm | 10 mm | Depth of plasterboard and finished flush on both sides as shown in  Figure 8 | -/120/120 |
| | | Up to 20 mm | 20 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| PE-Xa | 116 mm | Up to 25 mm | 10 mm | Depth of plasterboard and finished flush on both sides as shown in  Figure 8 | -/120/120 |
| | | Up to 20 mm | 20 mm | Depth of plasterboard and finished with a 20 mm × 20 mm fillet on both sides. | -/120/120 |
| PEX-A (one sided penetration) | 128 mm shaftliner wall 1×25 mm shaftliner from one side and 2×13 mm on the other. | Up to 20 mm | 17.5 mm | Depth of plasterboard and finished flush on both sides | -/120/120 |
| | 118 mm | Up to 20 mm | 17.5 mm | Depth of plasterboard and finished flush on the | -/90/90 |

| Services | Minimum wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Local fire protection | FRL |
|---|---|---|---|---|---|
| | | | | unexposed face only as shown in Figure 5 | |
| | 118 mm with a baffle made of 13 mm fire rated plasterboard on either side of the wall, in addition to 12 mm plywood fixed to steel angles inside the cavity on the unexposed side. | Up to 20 mm | 55 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/60/60 |
| PVC (one sided penetration) | 100 mm | Up to 40 × 1.9 mm | 20 mm | 25 mm deep with 10 ×10 mm fillet on both sides | -/120/120 |
| | 118 mm with a baffle made of 13 mm fire rated plasterboard on either side of the wall inside the cavity | 43 mm | 88 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/90/90 |
| | 156 mm with a baffle made of 13 mm fire rated plasterboard on the opposite side of the penetration, in addition to 12 mm plywood fixed to steel angles inside the cavity | 43 mm | 90 mm | Depth of plasterboard (26 mm) and finished flush on the exposed side | -/120/120 |
| PEX | 90 mm | Up to 20 mm | 20 mm | Sealant is used to fill the void between the pipe and the plasterboard, creating an annular gap of 20 mm with a depth of 13 mm. It is then finished flush with the surface of the plasterboard wall on both sides. | -/60/60 |
| | 96 mm | Up to 20 mm | 20 mm | Sealant is used to fill the void between the pipe and the plasterboard, creating an annular gap of 20 mm with a depth of 16 mm. It is then finished flush with the surface of the plasterboard wall on both sides. | -/90/90 |

## 6.4 Assessment of various combustible pipes in minimum 75 mm thick rigid wall systems

### 6.4.1 Proposed construction

Table 12 lists the pipes tested in FRT210322.1, FRT220141 R1.1, FRT180473.1. in accordance with AS 1530.4:2014.

In test FRT210322.1, the tested system included 75 mm thick AAC wall system penetrated with 18 services protected with BOSS FireMastic-HPE sealant.

In test FRT220141 R1.1, the tested system included 75 mm thick AAC wall system penetrated with 9 services. The tested combustible pipes were protected with BOSS FireMastic-HPE sealant.

In test FRT180473.1, the tested system included 75 mm thick Hebel Power Panel penetrated with 13 services. The tested combustible pipes covered in this report were protected with BOSS FireMastic-HPE sealant only.

**Table 12 Tested combustible pipes in rigid wall systems**

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| PEX-A | FRT210322.1 | 75 mm AAC wall | 20 mm | 20 mm | 20 mm deep both sides with 20 × 20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | FRT220141 | | 25 mm | 11.5 mm | 25 mm deep both sides with 20 × 20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | FRT180473.1 | | 32 mm | 14 mm | 25 mm deep both sides finished flush | -/120/0 |
| PEX/AL/PEX | FRT210322.1 | | 20 mm | 20 mm | 25 mm deep both sides finished flush | -/120/60 |
| | FRT220141 | | 20 mm | 10 mm | 25 mm deep both sides finished flush | -/120/120 |
| | FRT220141 | | 20 mm | 10 mm | 25 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | FRT220141 | | 25 mm | 11.5 mm | 20 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| PEX-B | FRT210322.1 | | 20 mm | 20 mm | 25 mm deep both sides finished flush or<br>20 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | FRT220141 | | 25 mm | 11.5 mm | 25 mm depth both sides with 20×20 mm fillet on both sides as shown in Figure 10 | -/120/120 |

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| cPVC | FRT210322.1 | | 32 mm | 25.5 mm | 20 mm deep with 20 mm fillet on both sides as shown in Figure 1 | -/120/90 |
| UPVC | FRT210322.1 | | 20 mm | 2 mm | Surface seal only | -/120/120 |
| | FRT220141 | | 25 mm | 7.5 mm | 25 mm deep with 20×20 mm fillet on both sides as shown in Figure 1 | -/120/120 |
| | FRT210322.1 | | 32 mm | 2 mm | 20 mm deep with 20×20 mm fillet on both sides as shown in Figure 1 | -/120/60 |
| | FRT210322.1 | | 32 mm | 20.5 mm | 20 mm deep with 15×15 mm fillet on both sides as shown in Figure 1 | -/120/120 |
| | FRT180473.1 | | 40 mm | 2 mm | 10 mm deep with 25×25 mm fillet on both sides as shown in Figure 1 | -/120/90 |

### 6.4.2 Discussion

#### Improvements of insulation performance

Based on Table 12, most of the tested services achieved an FRL of -/120/120. However, some services failed to perform up to 120 minutes of integrity and insulation. The failed services and the required improvement to the construction to achieve an FRL of -/120/120 will be discussed in this section.

In test FRT180473.1, specimen L, a 32 mm PEX-A pipe was tested in a 75 mm thick AAC. The pipe was installed in a 70 mm diameter aperture. BOSS FireMastic-HPE sealant was applied to a depth of 25 mm with backing rod support and finished flush on both the exposed and the unexposed sides. The system achieved a FRL of -/120/0. At 13 minutes, the thermocouple positioned on the top of the PEX pipe, 25 mm away from the separating element, recorded a temperature of 201 C°. By observing the temperature-time curve, the temperature increased rapidly in the first 15 minutes and reached approx. 210 C°. After that, the temperature decreased to below 100 C° which indicates that the sealant expanded and closed off the gaps. It is expected that due to the large aperture size, the sealant took longer to close the gaps formed when the pipes softened and melted. Therefore, it is suggested to install the pipe in a 60 mm diameter aperture rather than 70 mm and for more confidence, it is suggested to add a 20 mm  20 mm sealant fillet on both sides to improve the performance up to 120 minutes.

In test FRT210322.1, service E, a 20 mm diameter PEX/AL/PEX pipe was tested in a 75 mm thick Hebel wall. BOSS FireMastic-HPE sealant was applied to a depth of 25 mm with backing rod support and finished flush on both the exposed and the unexposed sides. At 84 minutes, the system failed insulation. The thermocouple on the PEX/AL/PEX pipe, 25 mm away from the sealant, recorded a temperature of 207 C°. PEX/AL/PEX contains aluminium reinforcement between the inner and outer layers which is expected to conduct more heat to the unexposed side. As discussed above, in the first 10-15 minutes the recorded temperature reached 150C° which indicates that the melting rate of the pipe is higher than the expansion rate of the sealant. This is supported by the reduction of temperature to below 100 C° which means that the sealant closed off the gaps formed when the pipe started to melt. After 15 minutes, it is expected that the sealant moisture will have been driven out and , solidified and started to conduct meat in a more uniform manner to the unexposed side. It is recommended to add a 20 mm  20 mm cone of sealant, which will restrict the passage of the hot

gases and move the thermocouple 25 mm further from the aperture, which is expected to improve the system performance to 120 minutes.

In test FRT210322.1, service Q, a 32 mm diameter cPVC pipe was installed in an 83 mm diameter aperture in a Hebel wall. BOSS FireMastic-HPE sealant was applied to a depth of 20 mm with PE backing rod support and finished with a 15 mm × 15 mm fillet on both the exposed and unexposed sides of the separating element. At 114 minutes, the pipe failed insulation. The thermocouple positioned on the Hebel wall 25 mm from the aperture recorded a temperature of 205 C°. By analysing the temperature data of the failed thermocouple throughout the test, it can be seen that, the temperature increased gradually as a result of the whole specimen is getting heated Up. However, after 75 minutes the heat around this thermocouple started to increase in a higher rate compared to other thermocouples surrounding the specimen. This was attributed to a small gap at the interface between the sealant and the separating element, which allowed the passage of hot gases. It is recommended to increase the fillet depth to improve the system's performance for up to 120 minutes.

In test FRT210322.1, service H, a 32 mm diameter UPVC conduit was installed in a 36 mm diameter aperture within a Hebel wall. The service was protected by BOSS FireMastic – HPE sealant in the annular gap between the services and the separating element to a depth of 20 mm with PE backing rod support and finished with a 20 mm × 20 mm fillet on both the exposed and unexposed sides of the separating elements. At 86 minutes, the system failed insulation when the thermocouple positioned on the pipe, 25 mm away from the sealant recorded a temperature of 205 C°. It is expected that the pressure exerted by the amount of sealant filled in the 2 mm annular gap is not sufficient to keep the gaps sealed for the duration of the test. The temperature curve showed that the temperature increment stabilised after 15 minutes to 85 minutes which indicates that the sealant closed off the gaps formed by the melted pipe. However, the temperature increased from approx. 140 C° to 330 C° in 5 minutes which indicates failure of the sealant to keep the gaps closed. Therefore, it is proposed to increase the sealant fillet to 25 mm  25 mm to improve the system performance to 120 minutes.

In test FRT180473.1, service E, a 40 mm diameter UPVC pipe was tested in a 75 mm thick AAC wall system. The annular gap between the service and the separating element was filled with BOSS FireMastic – HPE to a depth of 10 mm and finished with 25 mm × 25 mm fillet on both the exposed and unexposed side. At 113 mm minutes, the thermocouple on the separating element, 25 mm away from the top of the sealant fillet recorded a temperature of 200 C°. For pipe sizes of 30 mm to 40 mm with 2 mm annular gap, it is suggested to build Up with at least 13 mm thick fire rated plasterboard to improve the system performance up to 120 minutes.

### Requirements for rigid wall systems

In light of the above discussion, rigid walls must be minimum 75 mm thick and must be AAC, concrete or solid masonry. Thinner rigid walls must be built Up on either one or both sides to achieve the minimum thickness required as assessed for the required FRL. The build-Up could be fire-rated plasterboard, calcium silicate board, MGO board or BOSS batts and must extend at least 100 mm on all directions from the aperture.

FRLs assessed for AAC blockwork walls, Hebel walls, and Speedpanel walls can be applied to the same services penetrating through rigid walls, having the same or greater thickness, as applicable, (including concrete, solid masonry, Speedpanel, Hebel and Korok) with an established FRL as required as tested or assessed by an ATL. For all cases, the wall must have been tested or assessed by an accredited testing laboratory (ATL) to achieve the required FRL in accordance with AS 1530.4:2014. FRLs assessed in flexible walls and rigid walls are also applicable to the same services penetrating a large aperture fitted with two layers of 50 mm thick BOSS Batts friction-fitted or pattress fitted on either side provided that the Batts have been tested or assessed in this configuration to have the minimum established FRL by an ATL.

## 6.4.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 13 in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 13 Assessment outcome of combustible pipes in rigid wall systems**

| Pipe | Nominal pipe diameter (mm) | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| PE-Xa | Up to 20 | 60 | 20 mm deep both sides with 20 × 20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | Up to 25 | 48 | 25 mm deep both sides with 20 × 20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | Up to 32 | 60 | Minimum 25 mm deep both sides finished with 20 mm × 20 mm fillet on both sides as shown in Figure 10 | -/120/120 |
| PEX/AL/PEX | Up to 20 | 60 | Minimum 25 mm deep both sides finished with 20 mm × 20 mm fillet on both sides as shown in Figure 10 | -/120/120 |
| | Up to 20 | 40 | 25 mm deep both sides finished flush | -/120/120 |
| | Up to 20 | 40 | 25 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | Up to 25 | 48 | 20 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| PE-Xb | Up to 20 | 60 | 25 mm deep both sides 20×20 mm fillet both sides as shown in Figure 10 | -/120/120 |
| | Up to 25 | 48 | 25 mm depth both sides with 20×20 mm fillet on both sides as shown in Figure 10 | -/120/120 |
| cPVC | Up to 32 | 83 | 20 mm deep with 15 mm fillet on both sides as shown in Figure 1 | -/120/120 |
| UPVC | Up to 20 | 24 | Surface seal only | -/120/120 |
| | Up to 25 | 40 | 25 mm deep with 20×20 mm fillet on both sides as shown in Figure 1 | -/120/120 |
| | Up to 32 | 73 | 20 mm deep with 15×15 mm fillet on both sides as shown in Figure 1 | -/120/120 |
| | 30-40 | 44 | 10 mm deep with 25×25 mm fillet on both sides. The wall must be built Up with at least 13 mm thick fire rated plasterboard. | -/120/120 |

## 6.5 Assessment of various combustible pipes in minimum 130 mm thick CLT wall systems

### 6.5.1 Proposed construction

Table 14 lists the pipes tested in FRT210330 and EWFA 54783400.2 in accordance with AS 1530.4:2014.

In test FRT 210330, the tested system included 130 mm thick CLT wall system penetrated with 9 services. The combustible pipes protected with BOSS FireMastic-HPE sealant are considered in this section.

In test EWFA 54783400.2, the tested system included 137 mm thick CLT wall system penetrated with various pipe and cable services and protected by various sealants and collars. The combustible pipes protected with BOSS FireMastic-HPE sealant are considered in this section.

**Table 14 Tested combustible pipes in CLT wall systems**

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| PEX-A | FRT210330 | 130 mm CLT | 20 mm | 20 mm | 20 mm deep both sides finished flush | -/90/90 |
| | EWFA 54783400.2 | | 20.4 mm | 12.3 mm | 25 mm deep both sides finished flush | -/90/90 |
| PEX/AL/PEX | FRT210330 | | 20 mm | 20 mm | 20 mm depth both sides finished flush | -/90/60 |
| Kelox plus pipe | FRT210330 | | 50 mm | 16.5 mm | 20 mm deep both sides finished flush as shown in Figure 9 | -/90/90 |

## 6.5.2 Discussion

### Improvements to insulation performance

Table 14 shows that most of the services maintain integrity and insulation for up to 90 minutes. However, one service failed to achieve 90 minutes insulation performance. In this section, failure causes and improvements will be discussed in the following sections.

In test FRT210330, service F, a 20 mm PEX/AL/PEX pipe was installed within a 60 mm diameter aperture. The annular gap size was 20 mm. The pipe was protected with BOSS FireMastic-HPE sealant, filled to a nominal depth of 20 mm on both sides, and finished flush. At 65 minutes, the thermocouple positioned on the pipe, 25 mm away from the sealant, recorded a temperature of 196 C°. The temperature-time graph showed that for 30 minutes, the sealant could close off the gaps created at the interface between the sealant and the pipe when the pipe started to melt. The temperature recorded for the first 30 minutes was below 50 C°. At approx. 32 minutes, the temperature increased rapidly and reached 196 C° at 65 minutes. This failure is expected to happen due to the metal component of the pipe, which conducts heat and does not melt to allow the sealant to close off the gap that formed when the pipe softened. Therefore, increasing the sealant depth to 25 mm and adding a 50 mm  50 mm sealant fillet will improve the performance up to 120 minutes.

Since PEX/AL/PEX is expected to be worse performing than PEX, PEX-A and PEX-B pipes due to the aluminium layer within the pipe wall. The outcomes of the assessment can be extended to include PEX, PEX-A and PEX-B pipes.

## 6.5.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 15 in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 15 Assessment outcome of combustible pipes in CLT walls**

| Pipe | Nominal pipe diameter (mm) | Maximum aperture (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| PEX-A | Up to 20 | 60 | 20 | 20 mm deep both sides finished flush | -/90/90 |
| | Up to 20.4 | 45 | 12.5 | 25 mm deep both sides finished flush | -/90/90 |
| PEX/AL/PEX and PE-Xb | Up to 20 | 60 | 20 | 25 mm depth both sides finished with 20 mm x 20 mm fillet | -/90/90 |
| Kelox plus pipe | O.D 50 mm Up to (25+ 13 mm thick insulation) | 83 | 16.5 | 20 mm deep both sides finished flush | -/90/90 |

# 6.6 Assessment of various combustible pipes in Masonry wall with double layer of 50 mm thick “BOSS Fire Batt” aperture – Factory applied “BOSS Ablative Coating” to both faces and PS coating to exposed face.

## 6.6.1 Proposed construction

Table 16 lists the pipes tested in WARRES 359904 FR in accordance with BS EN 1366-3:2009.

In test WARRES 359904 FR, a 1100 mm high by 750 mm wide aperture was sealed with a double layer of 50 mm thick “BOSS Fire Batt”. The batt was coated on both faces with ablative coating. Each horizontal and vertical cut of the batt to each substrate was sealed with a sealant identical to FireMastic 300. The services penetrated the batt were sealed with BOSS FireMastic-HPE sealant.

**Table 16 Tested combustible pipes in a masonry wall with double layer of 50 mm thick “BOSS Fire Batt” aperture**

| Services | Reference test | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| PEX | WARRES 359904 FR | masonry wall with double layer of 50 mm thick “BOSS Fire Batt” aperture – Factory applied “BOSS Ablative Coating” to both faces and PS coating to exposed face. | 40 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 |
| | WARRES 359904 FR | | 110 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| UPVC | WARRES 359904 FR | | 50 × 2.4 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| | WARRES 359904 FR | | 50 × 3.7mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| | WARRES 359904 FR | | 125 × 4.8mm | 20 mm | 25 mm deep both sides finished flush | -/120/90 U/C |
| | WARRES 359904 FR | | 125 × 7.4mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |

## 6.6.2 Discussion

### Improvements to insulation performance

Table 16 shows that most of the tested pipes penetrating masonry walls with a double layer of 50 mm thick “BOSS Fire Batt” aperture achieved an FRL of -/120/120. However, a UPVC pipe with a diameter of 125 mm installed in a 20 mm annular gap failed insulation.

### Requirements for large apertures

Where specified, services penetrating double layers of 50 mm thick BOSS batts are protected with BOSS FireMastic-HPE sealant installed on both faces. The BOSS batts may be pattress fitted overlapping (minimum 100 mm overlap) the separating element or friction-fitted in the aperture bedded with BOSS FireMastic-HPE sealant. The maximum aperture size in walls is 600 mm × 600 mm.

If pattress fitted, the batts must be fixed using 6 × 80 mm steel screws and washers at 300 mm centres or at batt corners. If friction-fitted and bedded within the aperture, the overall size of the batts may be made of cut batt sections butt jointed together and fitted after the pipes are installed. Sealant must be used to bed the cut batts together and to seal the edges of the batt with the separating

element and with the pipe. The BOSS batts must be coated on both faces with ablative coating. Additionally, each vertical and horizontal cut of the batt must be sealed with BOSS FireMastic-HPE sealant at the interface between the batts and the service and between the batt and the separating element.

FRLs assessed in flexible walls and rigid walls are applicable to the same services penetrating a large aperture fitted with two layers of 50 mm thick BOSS Batts friction-fitted or pattress fitted on either side, provided that the Batts have been tested or assessed in this configuration to have the minimum established FRL by an ATL.

### 6.6.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 17 in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 17 Assessment outcome of combustible pipes in Masonry wall with double layer of 50 mm thick "BOSS Fire Batt" aperture – Factory applied "BOSS Ablative Coating" to both faces and PS coating to exposed face.**

| Services | Wall thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| PEX | masonry wall with double layer of 50 mm thick "BOSS Fire Batt" aperture – Factory applied "BOSS Ablative Coating" to both faces and PS coating to exposed face. | Up to 40 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 |
| | | Up to 110 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| UPVC | | Up to 50 × 2.4 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| | | Up to 50 × 3.7mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |
| | | Up to 125 × 4.8mm | 20 mm | 25 mm deep both sides finished flush | -/120/90 U/C |
| | | Up to 125 × 7.4mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 U/C |

## 6.7 Assessment of insulated metal pipes in minimum 116 mm thick flexible wall system

### 6.7.1 Proposed construction

Table 18 lists the insulated metal pipes tested in FP 10422-001 issue 2 in accordance with AS 1530.4:2014 and ChiltRF 12089A and WF 334037-D in accordance with BS EN 1366-3:2009 and BS EN 1366-4:2009.

In test FP 10422-001 Issue 2, the separating element was a nominally 130 mm thick steel stud wall lined with two layers of 13 mm thick Knauf MultiShield plasterboard on each face. The wall was provided with six apertures and fitted with six pipe penetrations. Each penetration consisted of a single pipe insulated with a mineral fibre insulated pipe section. The pipes ranged in diameter from 25 mm to 324 mm OD, and the pipe materials were steel and copper. For the purpose of this assessment, insulated metal pipes that were protected with BOSS FireMastic HPE sealant will be referenced in this discussion.

In test ChiltRF12089A, a 120 mm thick high steel stud/plasterboard clad partition was built in accordance with BSEN 1366-3. The supporting construction was penetrated with nine service penetrations. The penetrations were sealed with BOSS FireMastic-HPE sealant.

In the reference test WARRES 334037/D, a 100 mm thick plasterboard wall was penetrated with fifteen various combustible and insulated metal services. The Insulated metal pipes were protected with a sealant identical to BOSS FireMastic-HPE sealant.

In test 334037/A, a 100 mm thick plasterboard wall was penetrated with fifteen various combustible and insulated metal services. The Insulated metal pipes and Uponor water valves with tap units fitted to project from one side of the partition and protected with a sealant identical to BOSS FireMastic-HPE sealant are assessed in this section.

**Table 18 Tested Insulated metal pipes tested in flexible wall systems**

| Pipe | Reference test | Wall thickness (mm) | Nominal pipe diameter (mm) | Aperture Diameter (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| Insulated Copper pipe | ChiltRF12089A | 120 mm | 15 (with 13 mm thick Armaflex insulation) | 65 | 25 mm deep finished flush on both sides as shown in Figure 4. The insulation wrapping is extended 500 mm from the exposed side and 580 mm from the unexposed side | Integrity: 120 min<br>Insulation: 120 min |
| | FP 10422-001 Issue 2 | 130 mm | 25 (with 25 mm thick insulation) | 98 | 16 mm deep with 35 mm external cone at wall junction. The insulation wrapping is extended 300 mm on the exposed side and 400 mm on the non exposed side | -/120/120 |
| | ChiltRF12089A | 120 mm | 60 (with 32 mm thick Armaflex insulation) | 164 | 25 mm deep finished flush on both sides as shown in Figure 4. The insulation wrapping is extended 500 mm from the exposed side and 580 mm from the unexposed side | Integrity: 120 min<br>Insulation: 90 min |
| | FP 10422-001 Issue 2 | 130 mm | 100 (with 50 mm thick insulation) | 224 | 16 mm deep with 35 mm external cone at wall junction. The insulation wrapping is extended 400 mm from the exposed side and 400 mm from the | -/120/60 |

| Pipe | Reference test | Wall thickness (mm) | Nominal pipe diameter (mm) | Aperture Diameter (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| | | | | | unexposed side | |
| | WF 334037/D | 100 mm | 159 (with 32 mm thick glass wool insulation) | 259 mm | 25 mm deep finished flush on both sides as shown in Figure 4. The insulation wrapping is extended 300 mm from the exposed side and 650 mm from the unexposed side | Integrity: 120 min<br>Insulation: 30 min |
| | WF 334037/D | 100 mm | 159 (with 32 mm thick Armaflex insulation) | 263 mm | 25 mm deep with 10 10 mm fillet on both sides. The insulation wrapping is extended 300 mm from the exposed side and 650 mm from the unexposed side | Integrity: 120 min<br>Insulation: 30 min |
| Steel Schedule 40 pipe | FP 10422-001 Issue 2 | 130 mm | 324 (with 75 mm thick insulation) | 486 mm | 5 mm gap between insulated pipe sections and apertures sealed on both faces | -/90/90 |
| One side penetration | | | | | | |
| Uponor water valves with tap unit fitted to project from the unexposed face of the partition | WARRES 334037/A | 100 mm | 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the exposed face of the wall | Integrity: 120 min<br>Insulation: 120 min |
| Uponor water valves with tap unit fitted to project from the exposed face of the partition | WARRES 334037/A | 100 mm | 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the unexposed face of the wall | Integrity: 120 min<br>Insulation: 120 min |
| Uponor water valves with tap unit fitted to project from | WARRES 334037/A | 100 mm | 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the unexposed | Integrity: 120 min<br>Insulation: 120 min |

| Pipe | Reference test | Wall thickness (mm) | Nominal pipe diameter (mm) | Aperture Diameter (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|---|
| the unexposed face of the partition | | | | | face of the wall | |
| Uponor water valves with tap unit fitted to project from the exposed face of the partition | WARRES 334037/A | 100 mm | 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the exposed face of the wall | Integrity: 120 min<br>Insulation: 120 min |

## 6.7.2 Discussion

### Improvements to insulation performance

Table 18 shows that some insulated metal pipes failed insulation. The failure cause and suggested improvements to the sealant configuration to enhance the insulation performance will be discussed in this section.

In test ChiltRF 12089A, specimen 21, a 164 mm diameter aperture was made in a 122 mm thick plasterboard wall system. The aperture was penetrated with 60 mm diameter copper pipe with 32 mm thick Armaflex insulation fitted around the pipe. The annular gap was filled with BOSS FireMastic-HPE sealant to a 25 mm depth and finished flush from both exposed and unexposed sides. The system maintained its integrity and insulation performance for 132 minutes and 106 minutes, respectively. The insulation failure occurred due to the thermocouple positioned on the pipe recording a temperature difference of higher than 180℃. The temperature graph shows that, at 106 minutes the service experienced a steep increase in temperature and reached approximately 250 C° at around 115 minutes. It is considered that this failure is related to the nature of the service, which will heat Up and conduct heat from the fire side to the non-fire side. In order to mitigate the expected temperature increase on the non-fire side, the service must be further wrapped with P40-MAK wrap for a length of 600 mm from the separating element on either side. Accordingly, the insulation performance can be extended to 120 minutes.

In test FP 10422-001 issue 2, service Y2, a 224 mm aperture was made in a 130 mm plasterboard wall. The hole was penetrated with 100 mm diameter copper pipe with 50 mm thick stonewool insulation. The insulation wrapping extended 400 mm from the exposed side and 400 mm from the unexposed side. The annular gap was filled with BOSS FireMastic-HPE sealant applied to a depth of 16 mm with a 35 mm external cone at wall junction. The service achieved an integrity and insulation performance of 120 minutes and 60 minutes, respectively. After review of the temperature vs time curve, it was observed that the thermocouple positioned on the pipe recorded a temperature increase of 180℃ at 62 minutes. The failure was attributed to the insufficient length of insulation wrapping. To maintain the insulation performance up to 120 minutes, it is proposed to increase the length of the insulation wrapping by an additional 200 mm for a total of 600 mm. When insulating a bigger pipe section, the thermocouple will be moved further from the hot side, and hence it is expected to record a lower temperature. As the attributed FRL is for fire exposure from either side, the wrap length extension must be identical on both sides.

In test WF 334037-D service 10, a 259 mm aperture was made in a 100 mm thick plasterboard wall system. The penetration was fitted with 159 mm diameter copper pipe with 32 mm thick foil faced glasswool insulation which extended 300 mm on the exposed side and 650 mm on the unexposed side. The annular gap was filled with a sealant identical to BOSS FireMastic-HPE sealant to a depth of 25 mm on both sides and finished with a fillet applied around the insulation to a nominal distance of 10 mm from the outer face of the wall. When tested, the service achieved an FRL of -/120/30. The service failed insulation at 43 minutes as the thermocouple placed on the bare pipe recorded a temperature increase of more than 180℃. It is proposed to increase the length of the insulation wrapping to a 1000 mm on both sides. When insulating bigger pipe section, the thermocouple will be moved further from the hot side and hence it is expected to record lower temperature.

In test WF 334037-D service 12, a 263 mm aperture was made in a 100 mm thick plasterboard wall system. The penetration was fitted with 159 diameter copper pipes with 32 mm thick Armaflex insulation extended 300 mm on the exposed side and 650 mm in the unexposed side. The annular gap was filled with sealant identical to BOSS FireMastic-HPE sealant to a depth of 25 mm applied to both sides finished with 10 mm  10 mm sealant fillet. The service achieved an FRL of -/120/30. The service failed insulation at 37 minutes as the thermocouple placed on the bare pipe recorded higher temperature than 180 C° from the ambient temperature.  It is proposed to increase the length of the insulation wrapping to a 1000 mm on both sides. When insulating bigger pipe section, the thermocouple will be moved further from the hot side, and hence it is expected to record a lower temperature.

### Assessment of various insulated metal pipe sizes

It is proposed to assess various insulated metal pipe sizes up to the tested size. It is expected that The rate of heat transfer through smaller service sizes is lower. As a result, an FRL of -/120/120 is expected to be maintained if the pipe insulation thickness remains the same and the same sealant configuration is maintained as discussed above.

### Assessment of separating element with penetration from one side

A 100 mm thick plasterboard wall was penetrated from one side with uponor water valves with tap unit and protected with a sealant identical to BOSS FireMastic-HPE sealant. The wall construction consisted of 2 layers of plasterboard fixed on both sides on 50 mm wide steel framing. The annular gap between the service and the aperture was filled with BOSS FireMastic-HPE sealant to a depth of 25 mm and finished flush with the wall. It is expected that the penetration from one side will be less onerous than from two sides. In the same test, bigger pipe diameters were tested and achieved an FRL of -/120/120. Therefore, it is expected that a valve of diameter up to 52 mm will at least perform similarly and hence achieve an FRL of -/120/120.

## 6.7.3 Conclusion

The technical review found that the insulated metal pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 19 in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 19 Assessment outcomes of Insulated metal pipes fitted in minimum 116 mm thick flexible wall**

| Pipe | Wall thickness (mm) | Nominal pipe diameter (mm) | Aperture Diameter (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| Insulated Copper pipe | 120 mm | Up to 15 (with 13 mm thick Armaflex insulation) | 65 | 25 mm deep finished flush. The insulation wrapping is extended 500 mm from the exposed side and 580 mm from the unexposed side | -/120/120 |
| | 125 mm | Up to 25 (with 25 mm thick insulation) | 98 | 16 mm deep with 35 mm external cone at wall junction. The insulation wrapping is extended 300 mm on the exposed side and 400 mm on the non exposed side | -/120/120 |
| | 120 mm | Up to 60 (with 32 mm thick Armaflex insulation) | 164 | 25 mm deep finished flush and further wrapped with P40 MAK wrap extending 600 mm from the face of the separating element on both sides. | -/120/120 |
| | 135 mm | Up to 100 (with 50 mm thick stone wool insulation) | 224 | 16 mm deep with 35 mm external cone at wall junction. Stone wool insulation must be extending from the separating element for at least 600 mm on each side. | -/120/120 |

| Pipe | Wall thickness (mm) | Nominal pipe diameter (mm) | Aperture Diameter (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| | 100 mm | Up to 159 (With 32 mm thick glass wool insulation) | 259 | 25 mm deep both sides finished flush. The insulation wrapping is to be extended 1000 mm on both sides | -/120/120 |
| | 100 mm | Up to 159 (With 32 mm thick Armaflex insulation) | 263 | 25 mm deep with 10 10 mm fillet on both sides. The insulation wrapping is to be extended 1000 mm on both sides | -/120/120 |
| Steel Schedule 40 pipe | 135 mm | Up to 324 (with 75 mm thick insulation) | 486 | 5 mm gap between insulated pipe sections and apertures sealed on both faces. The insulation wrapping is extended 300 mm on the exposed side and 400 mm on the non exposed side | -/90/90 |
| Uponor water valves with tap unit fitted to project from the unexposed face of the partition | 100 mm | Up to 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the exposed face of the wall | -/120/120 |
| Uponor water valves with tap unit fitted to project from the exposed face of the partition | 100 mm | Up to 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the unexposed face of the wall | -/120/120 |
| Uponor water valves with tap unit fitted to project from the unexposed face of the partition | 100 mm | Up to 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the unexposed face of the wall | -/120/120 |
| Uponor water valves with tap unit fitted to project from the exposed face of the partition | 100 mm | Up to 52 mm diameter | 2 no. 75 mm diameter | 25 mm deep and finished flush with the exposed face of the wall | -/120/120 |

# 6.8 Assessment of insulated metal pipes penetrating double layer of 50 mm thick BOSS fire batt installed in a minimum 116 mm flexible and rigid walls

## 6.8.1 Proposed construction

Table 20 lists the pipes tested in WF 329129 and WARRES 359904 FR in accordance with EN 1366-3:2009.

In test WF 329129, a 100 mm thick drywall construction was provided with four apertures of overall nominal dimensions of 600 mm high by 600 mm wide. The apertures were penetrated with various services and locally protected with various fire protections. In this section of the report, the insulated metal pipes protected with BOSS FireMastic-HPE sealant are discussed.

In test WARRES 359904 FR, a 1100 mm high by 750 mm wide aperture was sealed with a double layer of 50 mm thick “BOSS Fire Batt”. The batt was coated on both faces with ablative coating. Each horizontal and vertical cut of the batt to each substrate was sealed with a sealnt idneical to BOSS firemastic 300. The services that penetrated the batt were sealed with BOSS FireMastic-HPE sealant.

**Table 20 Metal pipes fitted in a double layer of 50 mm thick BOSS fire batt installed in a minimum 116 mm flexible wall**

| Pipe | Reference test | Nominal pipe diameter (mm) | Maximum aperture (mm) | Sealant configuration | Fire resistance performance |
|---|---|---|---|---|---|
| Insulated copper pipe | WF 329129 | 40 (with 20 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | Integrity: 60 min<br>Insulation: 60 min |
| | WF 329129 | 159 (with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | Integrity: 60 min<br>Insulation: 30 min |
| Steel pipe | WF 329129 | 40(with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | Integrity: 60 min<br>Insulation: 60 min |
| | WF 329129 | 150 (with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | Integrity: 60 min<br>Insulation: 60 min |

## 6.8.2 Discussion

### Assessment of Intermediate sizes

Table 20 lists the insulated metal pipes that were fitted in a double layer of 50 mm thick BOSS fire batt installed in a minimum 116 mm flexible and rigid walls. In test WF 329129, the tested specimen A was a 40 mm diameter insulated copper pipe wrapped with 20 mm thick foil faced glass wool insulation and locally protected with BOSS FireMastic-HPE sealant applied to a depth of 15 mm from the outer face on both sides. When tested, the specimen continued to maintain its integrity and insulation performance for 76 minutes and 74 minutes, respectively. The test was conducted in accordance with EN 1366-3:2009. A correlation between the test standard and AS 1530.4:2014 was established in section 5, and accordingly an FRL of -/60/60 is attributed to the 40 mm diameter insulated copper pipe.

In the same test, a 159 mm diameter copper pipe with 30 mm thick foil faced glass wool insulation was tested with BOSS FireMastic-HPE sealant applied 15 mm deep from the outer face of the batt on both sides. When tested, the specimen continued to maintain its integrity and insulation performance for 76 minutes and 59 minutes, respectively. It is considered that if the sealant depth is increased

from 15 mm to the full depth of the batt, the insulation performance is expected to improve for at least more than 1 minute. Accordingly, an insulation performance of 60 minutes can be maintained.

Moreover, it is proposed to extend the achieved FRL to cover intermediate pipe sizes. The tested specimens included diameter pipe sizes from 40 mm to 159 mm. Accordingly, it is reasonable to consider that any pipe within this diameter range is expected to achieve the FRL shown in Table 21, provided that the pipe insulation thickness remains the same as tested and the sealant configuration is as instructed in Table 21.

#### Assessment of Iron pipes

It is noted that the referenced WF 329129 test was conducted using steel pipes, and it is proposed to assess the results using pipes made of cast iron. It is understood that both materials have very similar thermal conductivity properties, as they are primarily composed of iron. The main difference is that steel is an alloy of iron and carbon. Based on the observations from the referenced test, it is considered that, due to the glasswool insulation, the impact of furnace exposure will largely remain unchanged between steel and iron. This is because the sealant will maintain contact with the pipe insulation regardless of the pipe material used when considering iron pipes.

### 6.8.3 Conclusion

The technical review found that the insulated metal pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 21, in accordance with AS 1530.4:2014, and assessed in accordance with AS 4072.1:2005.

**Table 21 Assessment outcome of insulated metal pipe penetrating double layer of 50 mm thick BOSS fire batt installed in a minimum 116 mm flexible and rigid walls**

| Pipe | Nominal pipe diameter (mm) | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| Insulated copper pipe | Up to 40 (with 20 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | -/60/60 |
| | Up to 159 (with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | -/60/30 |
| | | | Full depth of batt | -/60/60 |
| Steel or Iron pipes | Up to 40 (with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | -/60/60 |
| | Up to 150 (with 30 mm thick foil faced glass wool insulation) | 600 × 600 | 15 mm deep from the outer face on both sides | -/60/60 |

## 6.9 Assessment of various combustible pipes in minimum 235 mm thick ceiling systems

### 6.9.1 Proposed construction

Table 22 lists the pipes tested in FRT180474.3 in accordance with AS 1530.4:2014.

In the reference test FRT180474.3, a 235 mm thick ceiling system was penetrated with 10 services and protected with various local fire stopping protections. The ceiling consisted of 2 layers of 13 mm fire-rated plasterboard directly fixed to the timber framing on the exposed side using plasterboard screws at nominal 150 mm centres on the joist and 100 mm centres on the perimeter framing. On the unexposed side, particleboard flooring was fixed directly onto the timber framing. The sealant used in the ceiling system was BOSS FireMastic-HPE sealant, and the sealant used in the timber flooring system was BOSS FireMastic-300. This section will discuss the combustible pipes protected with BOSS FireMastic-HPE sealant only.

**Table 22 Tested combustible pipes in ceiling system**

| Services | Reference test | Nominal pipe | Annular gap (mm) | Sealant configuration | RISF | FRL |
|---|---|---|---|---|---|---|

| | | diameter (mm) | | | | |
|---|---|---|---|---|---|---|
| PVC | FRT180474.3 | 25 mm | 19 mm | BOSS FireMastic-HPE – applied to full depth of the plasterboard and finished flush on the exposed side.<br>BOSS FireMastic 300 to depth of board in the unexposed side | Failure at 55 minutes | -/90/90 |

### 6.9.2 Discussion

#### Assessment of various pipe sizes

In test FRT180474.3, service G, a 63 mm aperture was made in a 235 mm thick ceiling system. The aperture was penetrated with 25 mm diameter PVC pipe. The annular gap between the service and the separating element was filled with BOSS FireMastic-HPE sealant to a depth of 26 mm and finished flush on the exposed side. On the unexposed side, BOSS FireMastic 300 sealant was used to fill the annular gap to the depth of the board. The RISF thermocouple that was placed on the service at 25 mm from the aperture failed at 55 minutes. However, the service-maintained integrity and insulation performance for 90 minutes. It is proposed to assess smaller PVC sizes installed in a similar configuration. With smaller PVC pipes, it is expected that the intumescent sealant will close off the smaller pipe size quicker and, hence, restrict the passage of hot gases. Based on the above, using a smaller size service penetration is positively assessed provided that the annular gap is not increased, and the sealant configuration is maintained as tested.

### 6.9.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 23, in accordance with AS 1530.4:2014, and assessed in accordance with AS 4072.1:2005.

**Table 23 Assessment outcome of combustible pipes in ceiling system**

| Services | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | RISF | FRL |
|---|---|---|---|---|---|
| PVC | Up to 25 mm | Up to 19 mm | BOSS FireMastic-HPE – applied to full depth of the plasterboard and finished flush on the exposed side.<br>BOSS FireMastic 300 to depth of board in the unexposed side | Failure at 55 minutes | -/90/90 |

## 6.10 Assessment of various combustible pipes in minimum 150 mm thick AAC floor

### 6.10.1 Proposed construction

Table 24 lists the pipes tested in WARRES 342026 and WARRES 359904 FR in accordance with BS EN 1366-3:2009.

In test WARRES 342026, the tested floor had a dimension of 2230 mm long by 1740 mm wide by 150 mm thick and was provided with ten circular apertures of varying sizes penetrated with various services. In this section, combustible pipes protected with a sealant identical to BOSS FireMastic-HPE sealant will be considered.

In test WARRES 359904 FR, a 1100 mm high by 750 mm wide aperture was sealed with a double layer of 50 mm thick “BOSS Fire Batt”. The batt was coated on both faces with ablative coating. Each horizontal and vertical cut of the batt to each substrate was sealed with a sealant identical to BOSS firemastic 300. The services penetrated the batt were sealed with BOSS FireMastic-HPE sealant.

**Table 24 Tested combustible pipes in AAC floor**

| Services | Reference test | Floor thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | Fire resistance performance |
|---|---|---|---|---|---|---|
| PEX | WARRES 359904 FR | 150 mm AAC floor | 40 mm 4 mm | 20 mm | 25 mm deep both sides finished flush | integrity: 120 min Insulation:120 min |
| | WARRES 359904 FR | | 110 mm 10 mm | 20 mm | 25 mm deep both sides finished flush | integrity: 120 min Insulation:60 min |
| PP | WARRES 342026 | | 50 mm 2.1 mm | 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 240 min Insulation:240 min |
| | WARRES 342026 | | 110 mm 10.7 mm | 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 120 min Insulation: 120 min |
| | WARRES 342026 | | 110 mm 3.7 mm | 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 30 min Insulation:30 min |
| PE | WARRES 342026 | | 40 mm 4.1 mm | 18.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 240 min Insulation:240 min |
| | WARRES 342026 | | 125 7.6 mm | 13.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 60 min Insulation:60 min |
| | WARRES 342026 | | 125 11.4 mm | 13.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 90 min Insulation:90 min |
| | WARRES 359904 FR | | 50 mm 3.7 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | integrity: 120 min Insulation:120 min |
| | WARRES 359904 FR | | 50 mm 2.4 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | integrity: 120 min Insulation:120 min |
| | WARRES 359904 FR | | 125 mm 4.8 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | integrity: 120 min Insulation:90 min |

| Services | Reference test | Floor thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | Fire resistance performance |
|---|---|---|---|---|---|---|
| | WARRES 359904 FR | | 125 mm 7.4 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | integrity: 120 min Insulation:120 min |
| PVC | WARRES 342026 | | 40 mm 2 mm | 18.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 240 min Insulation:240 min |
| | WARRES 342026 | | 114 mm 3.6 mm | 25.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 90 min Insulation:30 min |
| | WARRES 342026 | | 114 mm 8.1 mm | 25.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | integrity: 120 min Insulation:30 min |

## 6.10.2 Discussion

### Assessment of various pipe sizes

It is proposed to assess smaller pipe sizes. It is expected that BOSS FireMastic-HPE sealant will close off the smaller pipe size quicker and more efficiently, thereby restricting the passage of hot gases – through the gaps formed when the pipe softened due to heat – at an earlier time. Therefore, using a smaller size service penetration is positively assessed provided that the annular gap is not increased and the sealant configuration is maintained as tested. Furthermore, the tested pipe configuration was uncapped from the exposed side and capped from the unexposed side (U/C); therefore, and as per the discussion provided in section 5, the achieved FRL is limited to U/C and C/C only.

## 6.10.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 25 – in accordance with AS 1530.4:2014, and assessed in accordance with AS 4072.1:2005.

**Table 25 Assessment outcome of combustible pipes in AAC floor system**

| Services | Floor thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| PEX | 150 mm AAC floor | Up to 40 mm | 20 mm | 25 mm deep both sides finished flush | -/120/120 |
| | | 110 mm 10 mm | 20 mm | 25 mm deep both sides finished flush | -/120/60 |
| PP | | UP to 50 mm | 10 to 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/240 U/C and C/C |
| | | Up to 110 mm 10.7 mm | 10 to 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/120/120 U/C and C/C |

| Services | Floor thickness | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| | | Up to 110 mm 3.7 mm | 10 to 21 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/30/30 U/C and C/C |
| PE | | UP to 40 mm | 10 to 18.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/240 U/C and C/C |
| | | Up to 125 7.6 mm | 10 to 13.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/60/60 U/C and C/C |
| | | 125 11.4 mm | 10 to 13.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/90/90 U/C and C/C |
| | | 50 mm 3.7 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | -/120/120 |
| | | 50 mm 2.4 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | -/120/120 |
| | | 125 mm 4.8 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | -/120/90 |
| | | 125 mm 7.4 mm | 20 mm | 25 mm depth both sides with backing rod finished flush | -/120/120 |
| PVC | | Up to 40 2 mm | UP to 18.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/240 U/C and C/C |
| | | Up to 114 mm 3.6 mm | 25.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/90/30 |
| | | Up to 114 mm 8.1 mm | 25.5 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/120/30 |

## 6.11 Assessment of insulated metal pipes in a minimum 125 mm concrete slab

### 6.11.1 Proposed construction

Table 26 lists insulated metal pipes tested in FP 10422-002 Issue 2 in accordance with AS 1530.4:2014 and WF 342025 in accordance with EN 1366-3:2009.

In test FP 10422-002 Issue 2, a 125 mm thick floor slab was provided with six core drilled apertures and fitted with six pipe penetrations. Each penetration consisted of a single pipe insulated with a mineral fibre insulated pipe section. The pipes ranged in diameter from 25 mm to 324 mm OD, and the pipe materials were steel and copper.

In test WF 342025, a 150 mm thick concrete floor was provided with five 200 mm by 200 mm apertures and one 50 mm by 50 mm aperture, each penetrated with various cables and services. The floor was also provided with four circular apertures, each penetrated by a range of insulated steel and copper pipes.

**Table 26 Insulated metal pipes in concrete slab**

| Pipe | Reference test | Nominal pipe | Maximum aperture (mm) | Sealant configuration | Fire resistance performance |
|---|---|---|---|---|---|

| | | diameter (mm) | | | |
|---|---|---|---|---|---|
| Insulated copper pipe | FP 10422-002 Issue 2 | 25 (With 25 mm thick insulation) | 98 mm | 16 mm deep with 10 mm external cone at wall junction | Integrity: 120 min<br>Insulation: 120 min |
| | FP 10422-002 Issue 2 | 100 (With 50 mm thick insulation) | 224 mm | 16 mm deep with 10 mm external cone at junction | Integrity: 120 min<br>Insulation: 90 min |
| | WF 342025 | 200 (With 32 mm thick insulation) | 304 mm | 25 mm depth to unexposed side backed with stonewool insulation | Integrity: 60 min<br>Insulation: 30 min |
| Blank seal | WF 342026 | NA | Aperture size of 200 mm × 200 mm | 25 mm deep sealant, applied flush with the upper face of the floor and includes a 100 mm deep infill of friction fitted rock wool insulation of density of no less than 45 kg/m3. | Integrity: 240 min<br>Insulation: 240 min |

## 6.11.2 Discussion

### Improvements to insulation performance

In test FP 10422-002 Issue 2, specimen FX2, a 100 mm diameter copper pipe was installed in a core hole of size 224 mm. 50 mm thick insulation was wrapped around the copper pipe and extended 400 mm on the exposed face and 600 mm in the unexposed face. BOSS FireMastic-HPE sealant was applied at insulation and pipe joins to a depth of 16 mm. At 115 minutes, a split in the sealant was evident, and the temperature – recorded by the thermocouple placed on the pipe – reached 180° C° and increased rapidly, and reached 300 C° at approx. 124 minutes. It is suggested to extend the pipe insulation on the unexposed side to 800 mm to improve the system insulation performance up to 120 minutes.

### Assessment of intermediate pipe sizes

In test FP 10422-002 Issue 2, service FX3, a 25 mm diameter copper pipe was installed within a 98 mm aperture. The pipe was wrapped with 25 mm thick stone wool sectional pipe insulation extended 300 mm on both exposed and unexposed sides. The annular gap between the pipe insulation and concrete slab was protected with 16 mm deep BOSS FireMastic-HPE sealant and a 10 mm  10 mm fillet at the junction. This configuration achieved an FRL of -/120/120. It is proposed to assess the intermediate pipe sizes between 25 mm and 100 mm based on the performance of the tested pipes. It is expected that the assessment of intermediate sizes can be positive if the pipe is wrapped with 50 mm thick insulation extended 400 mm on the exposed side and 800 mm on the unexposed side. A 10 mm annular gap is maintained all around the services. Additionally, a BOSS FireMastic-HPE sealant is applied to the annular gap to a depth of 16 mm on both sides, and a 10 mm  10 mm cone is added on both sides as well.

In test WF 342025, service E, a 304 mm aperture was made in a 150 mm thick concrete floor. The aperture was penetrated with 200 mm diameter by 5 mm wall thickness steel pipe, insulated with 32 mm thick Armaflex elastomeric pipe insulation (CS). The aperture was sealed using a 25 mm depth of a sealant identical to BOSS FireMastic-HPE sealant, finished flush with the upper face of the floor and include a 100 deep infill of friction fitted stone wool insulation of a measured density of 45 kg/m$^3$. The service failed integrity at 68 minutes, as a glow from within the seal was evident and the applied cotton pad was ignited. The service failed insulation at 47 minutes as a result of a separation increase of Armaflex around the pipe from the point of penetration.

It is proposed to assess the pipe sizes between 100 mm and 200 mm. The intermediate sizes must have the pipe insulation thickness maintained as tested and be wrapped with 32 mm thick insulation, and the sealant configuration must be maintained as tested.

### Assessment of different pipe material

The results of test FP 10422-002 Issue 2 and the assessment outcomes can be extended to cover insulated steel pipes. Steel has a higher melting point and thermal stability compared to copper, which keeps the system in place for a relatively longer time and allows sufficient time for the sealant to expand and close off the gaps formed when the pipe starts to deform under the effects of severe heat conditions. Additionally, copper is an excellent thermal conductor, so it conducts more heat to the unexposed side and is hence more susceptible to failing insulation earlier than steel.

## 6.11.3 Conclusion

The technical review found that the combustible pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 27 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 27 Assessment outcome of insulated metal pipes in concrete slab**

| Pipe | Nominal pipe diameter (mm) | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| Insulated copper pipe | Up to 25 (With 25 mm thick insulation) | 10 mm | 16 mm deep with 10 mm external cone at wall junction | -/120/120 |
| | 25- 100 (With insulation thickness 25 mm-50 mm) | 10 | 16 mm deep with 10 mm external cone at wall junction | -/120/90 |
| | Up to 100 (With 50 mm thick insulation) | 10 | 16 mm deep with 10 mm external cone at junction | -/120/90 |
| | 100-200(32 mm thick insulation) | 20 | 25 mm deep on unexposed only backed with stonewool insulation. | -/60/30 |
| Blank seal | NA | Aperture size of 200 mm × 200 mm | 25 mm deep sealant, applied flush with the upper face of the floor and includes a 100 mm deep infill of friction fitted rock wool insulation of density of no less than 45 kg/m$^3$. | -/240/210 |

# 7. Assessment of various cables protected with BOSS FireMastic–HPE sealant

## 7.1 Description of variation

It is proposed that cables penetrating flexible and rigid walls, rigid floors and ceiling constructions are assessed to be protected with BOSS FireMastic-HPE sealant.

In this section, cables protected with BOSS FireMastic-HPE sealant are assessed. The cables considered in this assessment include fire alarm cable, RG6 Coax, CAT6, Core security cables, 2C+E TPS, ELV extra low voltage alarm cable, 2C+E, TPS, and Power cable-3 core. The assessment includes the cables referenced in EN 1366-3:2009 and listed in Table 28.

**Table 28 Cables for the standard configuration**

| Cable | Cable type | Number of cables | Dimensions | Insulation/sheath material |
|---|---|---|---|---|
| A1 | Small sheathed | 10 | 5 mm  1.5 mm$^2$ | PVC/PVC |
| A2 | Small sheathed | 10 | 5 mm  1.5 mm$^2$ | EPR/PO |
| A3 | Small sheathed | 10 | 5 mm  1.5 mm$^2$ | XLPE/EVA |
| B | Small sheathed | 2 | 1 mm  1.5 mm$^2$ | PVC/PVC |
| C1 | Medium sheathed | 1 | 4 mm  95 mm$^2$ | PVC/PVC |
| C2 | Medium sheathed | 1 | 4 mm  95 mm$^2$ | EPR/PO |

| Cable | Cable type | Number of cables | Dimensions | Insulation/sheath material |
|---|---|---|---|---|
| C3 | Medium sheathed | 1 | 4 mm  95 mm$^2$ | XLPE/EVA |
| D1 | Large sheathed | 1 | 4 mm  185 mm$^2$ | PVC/PVC |
| D2 | Large sheathed | 1 | 4 mm  185 mm$^2$ | EPR/PO |
| D3 | Large sheathed | 1 | 4 mm  185 mm$^2$ | XLPE/EVA |
| E | Medium sheathed | 2 | 1 mm  185 mm$^2$ | PVC/PVC |
| F | Cable bundle (Telecommunication cable) | 1 tied bundle of 100 mm diameter | 20 mm  2 mm  0.6 mm screened | PE/PE |
| G1 | Non-sheathed (wire) | 1 | 4 mm  95 mm$^2$ | PVC/- |
| G2 | Non-sheathed (wire) | 1 | 1 mm  185 mm$^2$ | PVC/- |

The vertical separating elements considered in this assessment are given below.

- Minimum 116 mm thick flexible or rigid walls
- Minimum 75 mm thick AAC walls or rigid walls

The horizontal separating elements considered in this assessment are:

- Minimum 150 mm concrete slab
- Minimum 235 mm thick plasterboard ceiling system

## 7.2 Methodology

The method of assessment used is summarised in Table 29.

**Table 29 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Qualitative |

## 7.3 Assessment of various cables in minimum 90 mm flexible or rigid wall protected by BOSS FireMastic-HPE sealant

### 7.3.1 Proposed construction

Table 30 lists the proposed cables to be installed in a minimum 90 mm flexible or rigid wall and protected with BOSS FireMastic-HPE sealant. In test FSP1791, a bundle of cables was installed in an aperture in a 90 mm thick plasterboard wall system and protected with BOSS FireMastic-HPE sealant.

**Table 30 Tested cables in flexible wall system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| Single core 5 mm OD NBN cable<br>(OFS Optical cable) | FSP 1791 Specimen 5 | 8 mm | Surface seal around the cable with a 20 mm × 20 mm fillet of FireMastic-HPE intumescent sealant on the non-exposed side only. | -/60/60<br>Exposed from the non sealant side only |
| Single core 5 mm OD NBN cable | FSP 1791 Specimen 8 | 8 mm | Surface seal around the cable with a 20 mm × 20 mm fillet of | -/60/60 |

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| (OFS Optical cable) | | | FireMastic-HPE intumescent sealant on the exposed side only. | Exposed from the sealant side only |
| Bundle of 8 × 2.5 $mm^2$ 3 core TPS cables | FSP 1791 Specimen 6 | 60 mm | Depth of the plasterboard and finished flush on both sides | -/120/120 |

## 7.3.2 Discussion

### Assessment of different cable size

In test FSP 1791, specimens 5, and 8 consisted of a single core 5 mm OD NBN cable (OFS Optical cable), in specimen 5 the sealant was applied as surface seal around the cable with a 20 mm × 20 mm fillet of FireMastic-HPE intumescent sealant on the non-exposed side only, specimen 8 was the same but with the sealant applied on the opposite side (being the exposed side). An 8 mm annular gap between the service and the separating element was filled with BOSS FireMastic-HPE sealant to a depth of 13 mm and finished flush. Both services achieved an FRL of -/60/60.

Similarly, specimen 6, consisted of a Bundle of 8 × 2.5 mm2 3 core TPS cables with a 60 mm annular gap between the services and the separating element filled with BOSS FireMastic-HPE to the depth of the plasterboard (13 mm) on both sides.

Based on the test results, a smaller bundle of cables (less number of cables and smaller core size) is positively assessed, provided that the annular gap size and sealant depth are kept as tested. Additionally, the cable configuration from specimens 5 and 8 as outlined above is assessed for an FRL -/60/60, regardless the direction of the exposure compared to the side that has the sealant applied to.

### Assessment of various cables tested in Hebel wall

It is proposed to extend the use of services previously tested in Hebel wall system to minimum 90 mm thick flexible wall systems. To start with, the performance of BOSS FireMastic HPE sealant in flexible plasterboard wall systems was established through various tests of plastic, cable and insulated metal pipes. From an integrity perspective, the BOSS FireMastic HPE sealant is expected to expand and close off any gaps formed by the melted cable sheathing. Whereas, from an insulation perspective, the main mode of heat transfer is through the conduction of heat from the fire side to the non-fire side. As the proposed flexible wall system is thicker than the Hebel wall, it is reasonable to consider that the insulation performance will be similar to or better than the insulation achieved in the Hebel test. The proposed sealant configuration must include the application of the sealant to the full depth of the plasterboards on each side of the wall system.

### Assessment of various cables in rigid wall system

In accordance with the provisions in AS 1530.4:2014, the results for the test with a plasterboard lined frame wall system would be applicable for similar penetration and sealing systems installed in a concrete or masonry wall of the same or greater thickness.

## 7.3.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 31– in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 31 Assessment outcome of cables in 90 mm flexible or rigid wall**

| Cables | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Single core 5 mm OD NBN cable<br>(OFS Optical cable) | 8 | Surface seal around the cable with a 20 mm × 20 mm fillet of FireMastic-HPE intumescent sealant on the non-exposed side only.<br>Or<br>Surface seal around the cable with a 20 mm × 20 mm fillet of FireMastic-HPE intumescent sealant on the exposed side only. | -/60/60 |
| Bundle of 8 × 2.5 mm2 3 core TPS cables | 60 mm | Depth of the plasterboard and finished flush on both sides as shown in Figure 2 | -/60/60 |

## 7.4 Assessment of various cables in minimum 116 mm flexible or rigid wall protected by BOSS FireMastic-HPE sealant

### 7.4.1 Proposed construction

Table 32 lists the proposed cables to be installed in a minimum 116 mm flexible or rigid wall and protected with BOSS FireMastic-HPE sealant. In test FRT180472.1, a bundle of cables was installed in an aperture in a 116 mm thick plasterboard wall system and protected with BOSS FireMastic-HPE sealant.

**Table 32 Tested cables in flexible wall system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| Bundle of 8 × fire alarm cable. | FRT180472.1 | 70 | Depth of the plasterboard and finished flush on both sides | -/120/120 |
| 2 × RG6 Coax cables<br>2 × CAT6 cables<br>2 × 4 Core security cables (7/0.20 mm) | FRT210322.1 | 40 | 20 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| 6 × 2.5 mm² 2C+E TPS cables | FRT210322.1 | 57 | 25 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| 4 × ELV extra low voltage alarm cables (2 core round) | FRT210322.1 | 20 | 25 mm deep both sides finished flush as shown in Figure 2 | -/120/90 |
| 1 × 16 mm² 2C+E cable | FRT210322.1 | 40 | 20 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| 3/8 + 5/8 FR paircoil with 9 mm non fire rated lagging- 0.8 mm / 1.0 mm thick<br>2.5 mm² 2C+E TPS cable | FRT220141 | 80 | 25 mm deep finished with<br>20 mm×20 mm fillet on both sides | -/120/120 |
| 4 × 0.75 mm² TPS cable | FRT220141 | 30 | 25 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| Bundle of 22 × Power cable – 3 Core 2.5 mm² | FRT2180473 | 90 | 25 mm deep finished flush on both sides as shown in Figure 2 | -/120/60 |

## 7.4.2 Discussion

### Assessment of different cable size

In test FRT180472.1, service E, a 40 mm diameter bundle of 8 fire alarm cables was fitted in a 70 mm diameter aperture. A 15 mm annular gap between the service and the separating element was filled with BOSS FireMastic-HPE sealant to a depth of 26 mm and finished flush on both sides. The system achieved an FRL of -/120/120. Based on the test results, a smaller bundle of cables (less number of cables and smaller core size) is positively assessed, provided that the annular gap size and sealant depth are kept as tested.

### Assessment of various cables tested in Hebel wall

It is proposed to extend the use of services previously tested in Hebel wall system to minimum 116 mm thick flexible wall systems. To start with, the performance of BOSS FireMastic HPE sealant in flexible plasterboard wall systems was established through various tests of plastic, cable and insulated metal pipes. From an integrity perspective, the BOSS FireMastic HPE sealant is expected to expand and close off any gaps formed by the melted cable sheathing. Whereas, from an insulation perspective, the main mode of heat transfer is through the conduction of heat from the fire side to the non-fire side. As the proposed flexible wall system is thicker than the Hebel wall, it is reasonable to consider that the insulation performance will be similar to or better than the insulation achieved in the Hebel test. The proposed sealant configuration must include the application of the sealant to the full depth of the plasterboards on each side of the wall system.

### Assessment of various cables in rigid wall system

In accordance with the provisions in AS 1530.4:2014, the results for the test with a plasterboard lined frame wall system would be applicable for similar penetration and sealing systems installed in a concrete or masonry wall of the same or greater thickness.

## 7.4.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 33 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 33 Assessment outcome of cables in flexible or rigid wall**

| Cables | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Bundle of Up to 8 × fire alarm cable. | 15 | Depth of the plasterboard and finished flush on both sides | -/120/120 |
| Up to 2 × RG6 Coax cables<br>Up to 2 × CAT6 cables<br>Up to 2 × 4 Core security cables (7/0.20 mm) | 40 | 20 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| Up to 6 × 2.5 mm² 2C+E TPS cables | 57 | 25 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| Up to 4 × ELV extra low voltage alarm cables (2 core round) | 20 | 25 mm deep both sides finished flush as shown in Figure 2 | -/120/90 |
| Up to 1 × 16 mm² 2C+E cable | 40 | 20 mm deep both sides finished flush as shown in Figure 2 | -/120/120 |
| Up to 3/8 + 5/8 FR paircoil with 9 mm non fire rated lagging- 0.8 mm / 1.0 mm thick<br>Up to 2.5 mm² 2C+E TPS cable | 80 | 25 mm finished with 20 mm×20 mm fillet on both sides | -/120/120 |
| Up to 4 × 0.75 mm² TPS cable | 30 | 25 mm deep finished flush on both sides as shown in Figure 2 | -/120/120 |

| Cables | Annular gap (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Bundle of Up to 22 × Power cable – 3 Core 2.5 mm² | 90 | 25 mm deep finished flush on both sides as shown in Figure 2 | -/120/60 |

## 7.5 Assessment of various cables in minimum 75 mm rigid wall protected by BOSS FireMastic-HPE sealant

### 7.5.1 Proposed construction

Table 34 lists the tested cables in FRT210322.1, FRT220141 and FRT180473 in accordance with AS 1530.4:2014.

In test FRT210322.1, the tested system included 75 mm thick AAC wall system penetrated with 18 services protected with BOSS FireMastic-HPE sealant.

In test FRT220141 R1.1, the tested system included 75 mm thick AAC wall system penetrated with 9 services protected with BOSS FireMastic-HPE sealant.

In test FRT180473.1, the tested system included 75 mm thick Hebel Power Panel penetrated with 13 services protected with BOSS FireMastic-HPE sealant.

**Table 34 Tested cables in rigid wall system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 2 × RG6 Coax cables<br>2 × CAT6 cables<br>2 × 4 Core security cables (7/0.20 mm) | FRT210322.1 | 40 mm | 20 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| 6 × 2.5 mm² 2C+E TPS cables | FRT210322.1 | 57 mm | 25 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| 4 × ELV extra low voltage alarm cables (2 core round) | FRT210322.1 | 20 mm | 25 mm deep both sides finished flush as shown in Figure 3 | -/120/90 |
| 1 × 16 mm² 2C+E cable | FRT210322.1 | 40 mm | 20 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| 3/8 + 5/8 FR paircoil with 9 mm non fire rated lagging- 0.8 mm / 1.0 mm thick<br>2.5 mm² 2C+E TPS cable | FRT220141 | 80 mm | 25 mm deep finished with 20 mm × 20 mm fillet on both sides | -/120/120 |
| 4 × 0.75 mm² TPS cable | FRT220141 | 30 mm | 25 mm deep finished flush on both sides as shown in Figure 3 | -/120/120 |
| Bundle of 22 × Power cable – 3 Core 2.5 mm² | FRT180473 | 90 mm | 25 mm deep finished flush on both sides as shown in Figure 3 | -/120/60 |
| Bundle of 38 × CAT6 Data cable – DN50 mm | FRT180473 | 90 mm | 25 mm deep finished flush on both sides as shown in Figure 3 | -/120/60 |

### 7.5.2 Discussion

#### Improvements of insulation performance

Most of the services listed in Table 34 achieved an FRL of -/120/120. However, some cables failed to maintain their insulation performance for up to 120 minutes. In FRT210322.1, specimen N, 4 × ELV extra low voltage alarm cables (2 core round) were installed in a 20 mm diameter aperture. The cables were protected by BOSS FireMastic-HPE sealant, filled in the annular gap between the services and the separating element to a depth of 25 mm with PE backing rod support, and finished

flush to the surface on both the exposed and unexposed sides of the separating element. At 111 minutes, the thermocouple positioned on the Hebel wall recorded a temperature of 206 C°. The wall used in the test was single mesh. It is expected that, if the service is installed in a double mesh Hebel wall with an FRL of -/120/120, the FRL will be maintained.

In the reference test FRT180473.1, specimen A, an aperture of 90 mm diameter was made in 75 mm thick AAC wall system. The opening was penetrated with a bundle of 22  power cable – 3 Core 2.5 mm$^2$. The cables were protected by BOSS FireMastic-HPE sealant, applied to a depth of 25 mm and finished flush on both sides. The service penetration performed 121 minutes in integrity and 68 minutes in insulation. The test data showed that the temperature – recorded by the thermocouple positioned on the wall at 25 mm away from the service – reached 200 C° at 68 minutes. The system is positively assessed to an FRL of -/120/120 if the wall is locally built Up with a 13 mm fire rated plasterboard and the sealant is extended to the full depth of the additional plasterboard.

In test FRT180473.1, specimen H, an aperture of 90 mm diameter was made in a 75 mm thick AAC wall system. The opening was penetrated with a bundle of 38  CAT6 Data cables – DN50 mm. The cables were protected by BOSS FireMastic-HPE sealant, applied to a depth of 25 mm and finished flush on both sides. The service penetration performed 121 minutes in integrity and 69 minutes in insulation as the temperature recorded by the thermocouple placed on the wall at 25 mm from the service reached 180 C° more than the ambient temperature. The system The system is positively assessed to an FRL of -/120/120 if the wall is locally built Up with a 13 mm fire rated plasterboard and the sealant is extended to the full depth of the additional plasterboard.

### Optional installation of cables in conduits

In test FRT210330, a 32 mm diameter conduit filled with TPS cables was inserted into a 130 mm thick CLT wall system through an aperture of 70 mm diameter. The annular gap was filled with BOSS FireMastic-HPE sealant to a depth of 20 mm and finished flush with the wall. When tested, the specimen did not fail and achieved an FRL of -/90/90. It is considered that CLT as a timber-based product is more onerous than a gypsum based product because the CLT chars when it is exposed to elevated temperatures. Therefore, it is expected that, if the conduit is installed in a minimum 75 mm AAC wall, it will perform at least similarly to tested conduit in a CLT wall. Hence, it is positively assessed.

## 7.5.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 35 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 35 Assessment outcome of cables in rigid wall system**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Up to 2 × RG6 Coax cables<br>• Up to 2 × CAT6 cables<br>• Up to 2 × 4 Core security cables (7/0.20 mm) | 40 mm | 20 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| Up to 6 × 2.5 mm² 2C+E TPS cables | 57 mm | 25 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| Up to 4 × ELV extra low voltage alarm cables (2 core round) | 20 mm | 25 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| Up to 1 × 16 mm² 2C+E cable | 40 mm | 20 mm deep both sides finished flush as shown in Figure 3 | -/120/120 |
| • Up to 3/8 + 5/8 FR paircoil with 9mm non fire rated lagging- 0.8mm / 1.0 mm thick<br>• Up to 2.5 mm² 2C+E TPS cable | 80 mm | 25 mm deep finished with<br>20 mm × 20 mm fillet on both sides | -/120/120 |

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Up to 4 × 0.75 mm² TPS cable | 30 mm | 25 mm deep finished flush on both sides as shown in Figure 3 | -/120/120 |
| Bundle of Up to 22 × Power cable – 3 Core 2.5 mm² | 90 mm | Full depth of the wall and finished flush on both sides. Additionally, a build-Up of 13 mm thick fire rated plasterboard required locally around the service. | -/120/120 |
| Bundle of Up to 38 × CAT6 Data cable – DN50 mm | 90 mm | Full depth of the wall and finished flush on both sides. Additionally, a build-up of 13 mm thick fire rated plasterboard required locally around the service. | -/120/120 |
| Bundle of Up to 38 × CAT6 Data cable – DN50 mm | 90 mm | Full depth of the wall and finished with 25 mm × 25 mm fillet on both sides. | -/90/90 |
| Bundle of Up to 38 × CAT6 Data cable – DN50 mm | 90 mm | Full depth of the wall and finished flush on both sides. | -/120/60 |
| • Up to 32 mm conduit Up to 1.9 mm thick<br>• Up to 8 2.5 mm² 2C+E TPS cables inside 32 mm conduit | 70 mm | 20 mm deep both finished flush | -/90/90 |

## 7.6 Assessment of various cables in minimum 235 mm plasterboard ceiling system protected by BOSS FireMastic-HPE sealant

### 7.6.1 Proposed construction

Table 36 lists the tested cables in FRT180474.3 in accordance with AS 1530.4:2014.

In the reference test FRT180474.3, a 235 mm thick ceiling system was penetrated with 10 services and protected with various local fire stopping protections. The ceiling consisted of 2 layers of 13 mm fire-rated plasterboard was fixed directly onto the timber framing on the exposed side using plasterboard screws at nominal 150 mm centres on the joist and 100 mm centres on the perimeter framing. On the unexposed side, particleboard flooring was fixed directly onto the timber framing. The sealant used in the ceiling system was BOSS FireMastic-HPE sealant, and the sealant used in the timber flooring system was BOSS FireMastic-300. This section will discuss the cable penetrations protected by BOSS FireMastic-HPE sealant only.

**Table 36 Tested cables in ceiling system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 4 × TPS – 2.5 mm²<br>2C+E cables | FRT180474.3 | 44 | BOSS FireMastic – HPE –On the interface between the service and the fire-rated plasterboard to the full depth of the plasterboard on the exposed side and finished flush with the surface.<br>BOSS FireMastic-300 – On the interface between the service and the particleboard flooring to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface. | -/90/90 |

### 7.6.2 Discussion

#### Assessment of various cable sizes

It is proposed to extend the achieved FRL to cover TPS cables up to a bundle of 4 cables provided the annular gap and the sealant configuration is maintained. In test FRT180474.3, 4 × TPS – 2.5 mm², 2C+E cables were fitted through a 44 mm diameter aperture made in a ceiling system. The ceiling consisted of 2 layers of 13 mm fire-rated plasterboard. BOSS FireMastic-HPE sealant was applied to the depth of 26 mm on the exposed side and finished flush with the surface. On the unexposed side, a particleboard flooring was fixed directly onto the timber framing. The gap between the service and the separating element was filled with FireMastic-300 sealant to the full depth of the particleboard flooring and finished flush with the surface. The service maintained the integrity and insulation for the whole 90 minutes duration of the test. However, the RISF thermocouple that was placed on the service at 25 mm from the aperture failed at 55 minutes. As the tested specimen included a bundle of the maximum 4 TPS cables, it is reasonable to consider that a single TPS cable up to a bundle of 4 are expected to maintain the integrity and insulation for at least more than 90 minutes in accordance with AS 1530.4:2014.

### 7.6.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 37 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 37 Assessment outcome of cables in ceiling system**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL | RISF |
|---|---|---|---|---|
| Up to 4 × TPS – 2.5 mm²<br>2C+E cables | 44 | BOSS FireMastic – HPE –On the interface between the service and the fire-rated plasterboard to the full depth of the plasterboard on the exposed side and finished flush with the surface.<br>BOSS FireMastic-300 – On the interface between the service and the particleboard flooring to the full depth of the particleboard flooring on the unexposed side and finished flush with the surface. | -/90/90 | Failure at 55 minutes |

## 7.7 Assessment of various cables in minimum 150 mm thick AAC floor system protected by BOSS FireMastic-HPE sealant

### 7.7.1 Proposed construction

Table 38 lists the cables tested in WARRES 342025, WARRES 359904 FR and WARRES 342026 in accordance with BS EN 1366-3:2009.

In the reference test WARRES 342025, a 150 mm thick AAC floor system was provided with five 200 mm by 200 mm apertures and one 50 mm by 50 mm aperture, each penetrated with various cables and services. The floor was also provided with four circular apertures, each penetrated by a range of insulated steel and copper pipes. In this section, the cables protected with a sealant identical to BOSS FireMastic-HPE sealant will be discussed.

In test WARRES 342026, the tested floor had a dimension of 2230 mm long by 1740 mm wide by 150 mm thick and was provided with ten circular apertures of varying sizes penetrated with various services. In this section, the cables protected with a sealant identical to BOSS FireMastic-HPE sealant will be considered.

In test WARRES 359904 FR, a 1100 mm high by 750 mm wide aperture was sealed with a double layer of 50 mm thick “BOSS Fire Batt”. The batt was coated on both faces with ablative coating. Each horizontal and vertical cut of the batt to each substrate was sealed with a sealant identical to Boss FireMastic 300. The services penetrated the batt were sealed with BOSS FireMastic-HPE sealant.

**Table 38 Tested cables in AAC floor system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | Fire resistance performance | |
|---|---|---|---|---|---|
| Steel cable tray supporting 10 “A1”, 10 “A2”, ten “A3”, two “B”, one “C1”, one “C2” and one “C3” cables | WARRES 359904 FR | 500 mm wide with 20 mm annular space above cables and tray | 25 mm deep HPE to both faces and Firemastic 300 coatback 300 mm along the cable on the unexposed face. 500 mm wide with 20 mm annular space above cables and tray. | 500 mm perforated tray | Integrity: 120 min<br>Insulation: 120 min |
| | | | | A1 | Integrity: 120 min<br>Insulation: 120 min |
| | | | | A2 | Integrity: 120 min<br>Insulation: 90 min |
| | | | | A3 | Integrity: 120 min<br>Insulation: 120 min |
| | | | | B | Integrity: 120 min<br>Insulation: 120 min |
| | | | | C1 | Integrity: 120 min<br>Insulation: 120 min |
| | | | | C2 | Integrity: 120 min<br>Insulation: 70 min |
| | | | | C3 | Integrity: 120 min<br>Insulation: 120 min |
| C1, C2 and C3 type electric cable | WF 342026 | 200 mm × 200 mm | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | Integrity: 180 min<br>Insulation: 30 min | |
| D1, D2 and D3 type electric cable | WF 342026 | 200 mm × 200 mm | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | Integrity: 120 min<br>Insulation: 30 min | |
| A1, A2 and A3 type electric cable. | WF 342026 | 200 mm × 200 mm | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | Integrity: 180 min<br>Insulation: 30 min | |
| Telecom cables | WF 342026 | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 240 min<br>Insulation: 45 min | |

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | Fire resistance performance |
|---|---|---|---|---|
| Bundle of F type size (20 2 0.6 mm$^2$) | WARRES 342026 | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 240 min<br>Insulation: 30 min |
| Perforated steel cable tray | WF 342026 | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 120 min<br>Insulation: 30 min |
| One G1 and one G2 type electric cable | WF 342026 | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 180 min<br>Insulation: 0 min |
| One E type electric cable | WF 342026 | 50 mm× 50 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 240 min<br>Insulation: 0 min |
| PE conduit filled with electric cables; three “A1”, three “A2”, three “A3”, one “B” cables | WF 342026 | 60 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | Integrity: 120 min<br>Insulation: 90 min |

## 7.7.2 Discussion

### Improvements of insulation performance

The services listed in Table 38 failed insulation at different times. It is proposed to improve the service insulation performance. In order to mitigate the expected temperature increase on the non-fire side, the services must be wrapped with P40-MAK wrap for a length of 600 mm from the separating element on either side. Accordingly, the insulation performance can be extended to 120 minutes.

### Assessment of various cable sizes

In the reference test WARRES 342025, service B, a 200 mm  200 mm aperture was made in a 150 mm thick AAC floor. The aperture was penetrated with electric cable types D1, D2 and D3. The services were protected with a sealant identical to BOSS FireMastic-HPE sealant. The sealant was applied to 25 mm deep, finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation. The service failed integrity at 122 minutes, as the whole service had gone Up in flames. The service failed insulation at 42 minutes due to a recorded temperature increase to 200 C° on the unexposed side.

Service C, electric cable types A1, A2 and A3. The services were protected with a sealant identical to BOSS FireMastic-HPE sealant. The sealant was applied to 25 mm deep and finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation. The service failed integrity at 212 minutes as flames emitted through the char material of the seal. The service failed insulation at 40 minutes due to a recorded temperature increase to 200 C° on the unexposed side.

It is proposed to assess the cable penetrations of sizes equal to or smaller than the tested size. The positive aspect of assessing smaller cables lies in the fact that they are expected to exhibit improved fire resistance characteristics compared to larger cables. The reduced size of the conductors decreases the potential for heat conduction through the cables, limiting the spread of heat and flames from the exsposed side to the unexposed side. Therefore, the assessment of smaller cables is positive, provided that the size of the annular gap and the sealant configuration are maintained as tested.

### 7.7.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 39 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 39 Assessment outcome of cables in AAC floor**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL | |
|---|---|---|---|---|
| Steel cable tray supporting up to 10 “A1”, 10 “A2”, ten “A3”, two “B”, one “C1”, one “C2” and one “C3” cables | 500 mm wide with 20 mm annular space above cables and tray | 25 mm deep HPE to both faces and Firemastic 300 coatback 300 mm along the cable on the unexposed face. 500 mm wide with 20 mm annular space above cables and tray. | 500 mm perforated tray | -/120/120 |
| | | | A1 | -/120/120 |
| | | | A2 | -/120/90 |
| | | | A3 | -/120/120 |
| | | | B | -/120/120 |
| | | | C1 | -/120/120 |
| | | | C2 | -/120/70 |
| | | | C3 | -/120/120 |
| C1, C2 and C3 type electric cable | 200 mm × 200 mm | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/180/120 | |
| D1, D2 and D3 type electric cable | 200 mm × 200 mm | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/120/120 | |
| A1, A2 and A3 type electric cable. | 200 mm × 200 mm | 25 mm deep finished flush with the pper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/180/120 | |
| Telecom cables | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/120 | |
| Bundle of F type size (20 2 0.6 $mm^2$) | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/30 | |
| Perforated steel cable tray | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/120/120 | |
| One G1 and one G2 type electric cable | 200 mm × 200 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/180/120 | |
| One E type electric cable | 50 mm× 50 mm | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/120 | |
| PE conduit filled with electric cables; up to three “A1”, three “A2”, three “A3”, one “B” cables | WF 342026 | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/120/90 | |

# 7.8 Assessment of various cables in minimum 150 mm concrete slab system protected by BOSS FireMastic-HPE sealant

## 7.8.1 Proposed construction

Table 40 lists the cables tested in FRT220049, in accordance with AS 1530.4:2014.

In the reference test FRT220049, a 150 mm concrete floor system was tested. The slab was penetrated by 10 different services. The services were protected with various fire stopping protections. This section discusses the cable penetration protected with BOSS FireMastic-HPE sealant.

**Table 40 Tested cables in concrete floor**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 6 × 2.5 mm$^2$ TPS cable | FRT220049 | 30 | 25 mm - Both sides with backing rod Finished flush | -/240/240 |
| • 4 x RG6 Coax cables<br>• 4 x CAT 6 cables<br>• 2 x Fire alarm cables<br>• Security cable | FRT220049 | 50 | 25 mm - Both sides with backing rod Finished flush | -/240/240 |

## 7.8.2 Discussion

### Assessment of various cable sizes

In the referenced test FRT220049, specimen F, a 6 × 2.5 mm$^2$ TPS cable was installed in a 30 mm dia. aperture size in 150 mm thick concrete floor slab. The annular gap was filled with BOSS FireMastic-HPE sealant to a depth of 25 mm with backing rods from both sides and finished flush. The system performed for up to 240 minutes integrity and insulation. It is proposed to assess a smaller size of the same cable. It is expected that smaller cables have smaller conductors which will reduces the amount of heat transfer to the unexposed side and hence it is less onerous. Therefore, the TPS cable sizes up to 6 × 2.5 mm$^2$ are positively assessed provided that the size of the annular gap and the sealant configuration are maintained as tested.

In test FRT220049, specimen G, four types of cables namely 4 × RG6 Coax cables, 4 × CAT 6 cables, 2 × Fire alarm cables, security cables were fitted into a 150 mm thick concrete floor system. The annular gap was filled with BOSS FireMastic-HPE sealant to the depth of 25 mm with backing rod from both sides and finished flush. The system performed up to 240 minutes integrity and insulation. It is proposed to assess a smaller size of the same cable which is positively assessed as discussed in section 7.7.2.

### Assessment of cables tested in minimum 150 mm AAC floor

It is expected that the services tested in 150 mm thick AAC floor will behave similarly or better when installed in 150 mm thick concrete floor. Therefore, services in section 7.7 are positively assessed if installed in 150 mm thick concrete floor.

## 7.8.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 41 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 41 Assessment outcome of cables in concrete floor**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Up to 6 × 2.5 mm$^2$ TPS cable | 30 | 25 mm - Both sides with backing rod Finished flush | -/240/240 |
| • Up to 4 x RG6 Coax cables<br>• Up to 4 x CAT 6 cables<br>• Up to 2 x Fire alarm cables<br>• Up to Security cable | 50 | 25 mm - Both sides with backing rod Finished flush | -/240/240 |
| C1, C2 and C3 type electric cable | 200 × 200 | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/180/120 |
| D1, D2 and D3 type electric cable | 200 × 200 | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/120/120 |
| A1, A2 and A3 type electric cable. | 200 × 200 | 25 mm deep finished flush with the upper face of the floor and included a 100 mm deep infill of friction fitted stone wool insulation | -/180/120 |
| Telecom cables | 200 × 200 | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/120 |
| Perforated steel cable tray | 200 × 200 | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/120/120 |
| One G1 and one G2 type electric cable | 200 × 200 | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/180/120 |
| One E type electric cable | 50 × 50 | 25 mm depth finished flush on both sides. Included 100 mm deep infill friction fitted stone wool insulation | -/240/120 |

## 7.9 Assessment of various cables in minimum 130 mm CLT wall system protected by BOSS FireMastic-HPE sealant

### 7.9.1 Proposed construction

Table 42 lists the cables tested in FRT 210330 in accordance with AS 1530.4:2014.

In test FRT 210330, the tested system included a 130 mm thick CLT wall system penetrated with 9 services. The combustible pipes protected with BOSS FireMastic-HPE sealant are considered in this section.

**Table 42 Tested cables in CLT wall system**

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 32 mm conduit - 1.9 mm thick<br>• 8 × 2.5mm² 2C+E TPS cables inside 32 mm conduit | FRT210330 | 70 mm | 20 mm deep both finished flush | -/90/90 |

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 16mm² 3C+E cable | FRT210330 | 40 mm | 20 mm deep both finished flush | -/90/90 |
| • 2 ×CAT 6 cable<br>• 2 × RG6 Coax cable<br>• Security cable<br>• 1 × Fig 8 cable<br>• 2 × Fire alarm cables | FRT210330 | 40 mm | 20 mm deep both finished flush | -/90/90 |

## 7.9.2 Discussion

### Assessment of various cable sizes

In test FRT210330, specimen I, HVAC services, consists of 32 mm conduit - 1.9 mm thick, and 8 × 2.5 mm² 2C+E TPS cables inside the 32 mm conduit, placed in a 70 mm diameter aperture. The annular gap between the service and the separating element was filled with BOSS FireMastic-HPE sealant to a depth of 20 mm on both exposed and unexposed sides and finished flush with the wall. The test data showed that the temperature recorded by the thermocouple positioned on the service experienced an increase in temperature to approximately 150C° then started to reduce, which indicates closing off the gaps by the sealant. HVAC services-maintained integrity and insulation for 100 minutes.

Specimen C and Specimen D, which are 16 mm² 3C+E cable and a bundle of cables were inserted in two 40 mm diameter apertures, and the annular gaps were filled with BOSS FireMastic-HPE sealant to a depth of 20 mm and finished flush. The two services performed up to 90 minutes integrity and 90 minutes insulation. The test data showed that the recorded temperature was low, which indicates that the sealant was able to close off the gap formed when the cable sheathing or the conduit started to melt.

It is proposed to assess the cable penetrations of sizes equal to or smaller than those tested. It is expected that smaller cables will have smaller conductors, which will reduce the amount of heat transfer to the unexposed side and hence make it less onerous. Therefore, the assessment of smaller cables is positive, provided that the size of the annular gap and the sealant configuration are maintained as tested.

## 7.9.3 Conclusion

The technical review found that the cables protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 47– in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 43 Assessment outcome of cables in CLT wall system**

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 32 mm conduit - 1.9 mm thick<br>• 8 × 2.5mm² 2C+E TPS cables inside 32 mm conduit | FRT210330 | 70 mm | 20 mm deep both finished flush | -/90/90 |
| Up to 16mm² 3C+E cable | FRT210330 | 40 mm | 20 mm deep both finished flush | -/90/90 |
| • 2 ×CAT 6 cable<br>• 2 × RG6 Coax cable<br>• Security cable<br>• 1 × Fig 8 cable | FRT210330 | 40 mm | 20 mm deep both finished flush | -/90/90 |

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 2 × Fire alarm cables | | | | |

# 8. Assessment of various HVAC bundle with or without cables protected with BOSS FireMastic–HPE sealant

## 8.1 Description of variation

HVAC service is a combination of pipes, paircoils and cables services used in Heating, Ventilation and Air Conditioning.

The vertical separating elements considered in this assessment are as given below.

- Minimum 116 mm flexible wall system
- Minimum 75 mm thick AAC walls or rigid walls
- Minimum 130 mm thick CLT timber wall

The horizontal separating elements considered in this assessment are:

- Minimum 150 mm concrete slab
- Minimum 235 mm thick plasterboard ceiling system

## 8.2 Methodology

The method of assessment used is summarised in Table 44.

**Table 44 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Complex assessment |
| Type of assessment | Qualitative |

## 8.3 Assessment of various HVAC bundle with or without cables in minimum 90 mm flexible wall system protected by BOSS FireMastic-HPE sealant

### 8.3.1 Proposed construction

Table 47 lists the HVAC services tested in test reports FSP 1791 and EWFA 37995200.3.

In test FSP 1791, a 90 mm thick steel stud/plasterboard clad partition was tested accordance with AS 1530.4:214. The supporting construction was penetrated with nine service penetrations. The penetrations were sealed with BOSS FireMastic-HPE sealant. In this section, the HVAC services protected by BOSS FireMastic-HPE sealant are discussed.

In test EWFA 37995200.3. a 90 mm thick plasterboard wall system was penetrated by various services and protected with various BOSS products. In this section, the HVAC services protected with BOSS FireMastic-HPE sealant are discussed.

**Table 45 Tested HVAC bundle with or without cables in 90 mm flexible wall system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging | FSP 1791 - Specimen 3 | 80 mm | A second layer of 13 mm fire rated plasterboard 150 mm × 150 mm was placed | -/60/60 |

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable<br>• 20 mm uPVC outlet pipe. | | | over the penetration (on both sides) and secured to the wall. The edges of the plasterboard build up was coated with a 13 mm × 13 mm fillet of BOSS FireMastic-300 sealant. The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished flush with the wall. | |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable | FSP 1791<br>- Specimen 4 | 80 mm | On both sides of the wall BOSS MaxiCollar was surface mounted to the plasterboard using 3 × 25 mm plasterboard screws. There was no sealant used between the interface of the collar and the wall with the sealant attached to the plasterboard only or the pipes and the wall. The annular gap between the pipes and the collar was in-filled with FireMastic-HPE to the depth of collar and finished flush with the outer face of the collar. | -/60/60 |
| Paircoil<br>• Small copper pipe: Ø 9.5 mm OD × 0.96 mm thickness<br>• Large copper pipe: Ø 15.8 mm OD × 1.02 mm thickness<br>Lagging<br>• Small copper pipe: Ø35.5 mm OD and Ø9.5 mm ID<br>• Large copper pipe: Ø41.1 mm OD and Ø15.8 mm ID | EWFA 37995200.3<br>- Sppecimen F | 80 mm | A second layer of 16 mm fire rated plasterboard 150 mm × 150 mm was placed over the penetration (on both sides) and secured to the wall. The edges of the plasterboard build up was coated with a 16 mm × 16 mm fillet of BOSS FireMastic-300 sealant. The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished with 10 mm × 10 mm fillet with the wall. | -/90/90 |
| One sided penetration<br>• Polyaire Paircoil 6.35 mm/9.52 mm insulated copper pipes with non-rated insulation lagging<br>• 1.5 mm$^2$ 2C+E TPS power cable<br>• 16 mm$^2$ PVC flexible outlet pipe. | FSP 1791<br>- Specimen 2 | 80 mm | The annular gap around the bunch of the paircoil, conduit and cable was sealed with FireMastic-HPE sealant to a nominal depth of 13 mm controlled by foam backing rod and finished flush with the surface of the wall. | -/60/60 |

## 8.3.2 Discussion

### Assessment of various HVAC service sizes

It is proposed to assess HVAC services with a smaller size than those tested. It is considered that reducing the service size will reduce the size or number of conductors and the number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration are maintained as tested and the pipe insulation also remains as tested.

The tested services in the HVAC bundle represent the maximum number of services, and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet, if applicable) are maintained.

## 8.3.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 48 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 46 Assessment outcome of HVAC bundle with or without cables in 90 mm flexible wall system**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable<br>• 20 mm uPVC outlet pipe. | 80 mm | A second layer of 13 mm fire rated plasterboard 150 mm × 150 mm placed over the penetration (on both sides) and secured to the wall. The edges of the plasterboard build up coated with a 13 mm × 13 mm fillet of BOSS FireMastic-300 sealant. The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished flush with the wall. | -/60/60 |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable | 80 mm | On both sides of the wall BOSS MaxiCollar is surface mounted to the plasterboard using 3 × 25 mm plasterboard screws. No sealant to be used between the interface of the collar and the wall with the sealant attached to the plasterboard only or the pipes and the wall. The annular gap between the pipes and the collar in-filled with FireMastic-HPE to the depth of collar and finished flush with the outer face of the collar. | -/60/60 |
| Paircoil<br>• Small copper pipe: Ø 9.5 mm OD × 0.96 mm thickness<br>• Large copper pipe: Ø 15.8 mm OD × 1.02 mm thickness<br>Lagging | 80 mm | A second layer of 16 mm fire rated plasterboard 150 mm × 150 mm placed over the penetration (on both sides) and secured to the wall. The edges of the plasterboard build up was coated with a 16 mm × 16 mm fillet of BOSS FireMastic-300 sealant. | -/60/60 |

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Small copper pipe: Ø35.5 mm OD and Ø9.5 mm ID<br>• Large copper pipe: Ø41.1 mm OD and Ø15.8 mm ID | | The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished with 10 mm × 10 mm fillet with the wall. | |
| One sided penetration<br>• Polyaire Paircoil 6.35 mm/9.52 mm insulated copper pipes with non-rated insulation lagging<br>• 1.5 mm$^2$ 2C+E TPS power cable<br>• 16 mm$^2$ PVC flexible outlet pipe. | 80 mm | The annular gap around the bunch of the paircoil, conduit and cable sealed with FireMastic-HPE sealant to a nominal depth of 13 mm controlled by foam backing rod and finished flush with the surface of the wall. | -/60/60<br>(fire from the non penetation side) |

## 8.4 Assessment of various HVAC bundle with or without cables in minimum 116 mm flexible wall system protected by BOSS FireMastic-HPE sealant

### 8.4.1 Proposed construction

Table 47 lists the HVAC services tested in test reports ChiltRF12089A and EWFA 2897600b.3.

In test ChiltRF12089A, a 120 mm thick steel stud/plasterboard clad partition was tested in accordance with BSEN 1366-3. The supporting construction was penetrated with nine service penetrations. The penetrations were sealed with BOSS FireMastic-HPE sealant. In this section, the HVAC services protected by BOSS FireMastic-HPE sealant are discussed.

In test 2897600b.3, a 90 mm thick plasterboard wall system was penetrated by various services and protected with various sealants. In this section, the HVAC services protected with BOSS FireMastic-HPE sealant are discussed.

**Table 47 Tested HVAC bundle with or without cables in flexible wall system**

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • A1 (Small sheathed 5 mm × 1.5 mm$^2$)<br>• A2 10No. small sheathed 5 mm × 1.5 mm$^2$)<br>• A3 (10No. small sheathed 5 mm × 1.5 mm$^2$)<br>• Cable B (2No. small sheathed 1 mm × 95 mm$^2$)<br>• HDPE Pipe | ChiltRF12089A | 300 mm wide × 100 mm high | 25 mm deep applied in the voids around cables and pipe | -/120/120 |
| • Polyaire paircoil insulated copper pipe.<br>• 1.5 mm 2C+E TPS<br>• 16 mm diameter Polyaire top condition outlet pipe | EWFA 2897600b.3 | 80 mm | 13 mm deep both sides finished flush | -/60/60 |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging | FSP 1791 - Specimen 3 | 80 mm | A second layer of plasterboard 150 mm × 150 mm was placed over the penetration (on both | -/60/60 |

| Cables | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable<br>• 20 mm uPVC outlet pipe. | | | sides) and secured to the wall.<br>The edges of the plasterboard build up was coated with a 13 mm × 13 mm fillet of BOSS FireMastic-300 sealant.<br>The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished flush with the wall. | |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable | FSP 1791<br>- Specimen 4 | 80 mm | On both sides of the wall BOSS MaxiCollar was surface mounted to the plasterboard using 3 × 25 mm plasterboard screws. There was no sealant used between the interface of the collar and the wall with the sealant attached to the plasterboard only or the pipes and the wall. The annular gap between the pipes and the collar was in-filled with FireMastic-HPE to the depth of collar and finished flush with the outer face of the collar. | -/60/60 |
| Paircoil<br>• Small copper pipe: Ø 9.5 mm OD × 0.96 mm thickness<br>• Large copper pipe: Ø 15.8 mm OD × 1.02 mm thickness<br>Lagging<br>• Small copper pipe: Ø35.5 mm OD and Ø9.5 mm ID<br>• Large copper pipe: Ø41.1 mm OD and Ø15.8 mm ID | EWFA 37995200.3<br>- Sppecimen F | 80 mm | A second layer of 16 mm fire rated plasterboard 150 mm × 150 mm was placed over the penetration (on both sides) and secured to the wall. The edges of the plasterboard build up was coated with a 16 mm × 16 mm fillet of BOSS FireMastic-300 sealant. The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished with 10 mm × 10 mm fillet with the wall. | -/90/90 |

## 8.4.2 Discussion

### Assessment of various HVAC service sizes

It is proposed to assess HVAC services with a smaller size than those tested. It is considered that reducing the service size will reduce the size or number of conductors and the number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration are maintained as tested and the pipe insulation also remains as tested.

The tested services in the HVAC bundle represent the maximum number of services, and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet, if applicable) are maintained.

## 8.4.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 48 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 48 Assessment outcome of HVAC bundle with or without cables in 116 mm flexible wall system**

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Up to 10 A1<br>• Up to 10 A2<br>• Up to 10 A3<br>• Up to 2 Cable B<br>• Up to 63 mm HDPE Pipe | 300 mm wide × 100 mm high | 25 mm deep applied in the voids around cables and pipe | -/120/120 |
| • Polyaire paircoil insulated copper pipe<br>• Up to 1.5 mm 2C+E TPS<br>• Up to 16 mm diameter Polyaire top condition outlet pipe | 80 mm | 13 mm deep both sides finished flush | -/60/60 |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable<br>• 20 mm uPVC outlet pipe. | 80 mm | The resulting annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished flush with the wall. | -/60/60 |
| • Paircoil 10 mm/15 mm insulated copper pipes with non-rated insulation lagging<br>• 2.5-mm$^2$ 2C+E TPS power cable, and a 1.5 mm$^2$ 2-core data cable | 80 mm | On both sides of the wall BOSS MaxiCollar is surface mounted to the plasterboard using 3 × 25 mm plasterboard screws. No sealant to be used between the interface of the collar and the wall with the sealant attached to the plasterboard only or the pipes and the wall. The annular gap between the pipes and the collar in-filled with FireMastic-HPE to the depth of collar and finished flush | -/60/60 |

| Cables | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| | | with the outer face of the collar. | |
| Paircoil<br>• Small copper pipe: Ø 9.5 mm OD × 0.96 mm thickness<br>• Large copper pipe: Ø 15.8 mm OD × 1.02 mm thickness<br>Lagging<br>• Small copper pipe: Ø35.5 mm OD and Ø9.5 mm ID<br>• Large copper pipe: Ø41.1 mm OD and Ø15.8 mm ID | 80 mm | The annular gap around the bunch sealed on both sides of the wall with FireMastic-HPE sealant to a nominal depth of 26 mm and finished with 10 mm × 10 mm fillet with the wall. | -/90/90 |

## 8.5 Assessment of various HVAC bundle with or without cables in minimum 75 mm AAC wall system protected by BOSS FireMastic-HPE sealant

### 8.5.1 Proposed construction

Table 49 lists the HVAC services tested in FRT210322.1 and FRT220141 in accordance with AS 1530.4:2014.

In test FRT210322.1, the tested system included 75 mm thick AAC wall system penetrated with 18 services. The HVAC services protected with BOSS FireMastic-HPE sealant are discussed in this section.

In test FRT220141 R1.1, the tested system included 75 mm thick AAC wall system penetrated with 9 services. The HVAC services protected with BOSS FireMastic-HPE sealant are discussed in this section.

**Table 49 Tested HVAC bundle with or without cables fitted in AAC wall system**

| Service | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 1 × 3/8 + 3/4 FR paircoil with 19 mm thick insulation - 0.8 mm / 1.1 mm thick | FRT210322.1 | 127 mm | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/90 |
| 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | | |
| 1 × 2.5 mm² 3C+E TPS cable | | | | |
| 1 × CAT5e cable | | | | |
| 1 × 3/8 + 5/8 FR paircoil w/ 19 mm thick insulation - 0.8 mm / 1.0 mm thick | FRT210322.1 | 127 mm | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | | |
| 1 × 2.5 mm² 3C+E TPS cable | | | | |
| 1 × CAT5e cable | | | | |
| 1 × 3/8 + 5/8 FR paircoil with 13 mm thick insulation - 0.8mm / 1.0 mm thick | FRT210322.1 | 100 mm | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/90 |
| 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | | |

| Service | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| 1 × 2.5 mm² 3C+E TPS cable | | | | |
| 1 × CAT5e cable | | | | |
| 1 × 3/8 + 3/4 FR paircoil w/ 19 mm thick insulation - 0.8 mm / 1.1 mm thick | FRT210322.1 | 152 mm | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| 1 × DN32 type B copper pipe (1.2 mm thick) with Ø32 mm SUpaCell pipe lagging – 25 mm thick | | | | |
| 1 × 3/8 + 5/8 FR paircoil w/ 13 mm thick insulation - 0.8 mm / 1.0 mm thick | | | | |
| • 3/8 + 5/8 FR paircoil with 9 mm non fire rated lagging- 0.8 mm / 1.0 mm thick<br>• 20 mm condensation pipe - 1.5 mm wall thickness<br>• 2×2.5 mm² 2C+E TPS cable<br>• 2 × CAT 6 cable | FRT220141 | 80 mm | 25 mm deep both sides finished with 20 mm × 20 mm fillet as shown in Figure 6 | -/120/120 |

## 8.5.2 Discussion

### Improvements to insulation performance

In the reference test FRT210322.1, combination A, consists of 1 × 3/8 + 3/4 FR paircoil with 19 mm thick insulation - 0.8 mm / 1.1 mm thick, 1 × Ø20 mm UPVC pipe - 1.4 mm thick, 1 × 2.5 mm² 3C+E TPS cable and 1 × CAT5e cable. The services were protected with BOSS FireMastic-HPE sealant applied in the annular gap between the services and the separating element to a depth of 20 mm with PE backing rod support and finished with a 25 mm  25 mm fillet on both the exposed and unexposed sides of the separating element. The services performed 120 minutes integrity and 90 minutes insulation. The insulation failure occurred at 107 minutes. The test was conducted on a single mesh Hebel wall which has an established FRL of -/90/90. The failure on the Hebel face can be attributed to the capacity of the wall. Installation in a double mesh is expected to achieve -/120/120.

In the reference test FRT210322.1, combination K, consists of 1 × 3/8 + 5/8 FR paircoil with 13 mm thick insulation - 0.8mm / 1.0 mm thick, 1 × Ø20 mm UPVC pipe - 1.4 mm thick, 1 × 2.5 mm² 3C+E TPS cable and 1 × CAT5e cable. The services were protected with BOSS FireMastic-HPE sealant applied in the annular gap between the services and the separating element to a depth of 20 mm with PE backing rod support and finished with a 25 mm  25 mm fillet on both the exposed and unexposed sides of the separating element. The services performed 120 minutes integrity and 90 minutes insulation. The insulation failure occurred at 110 minutes. A thermocouple that was placed on the Hebel (25 mm away from the surface) recorded a temperature higher than 180C° above the ambient temperature. The test was conducted on a single mesh Hebel wall which has an established FRL of -/90/90. The failure on the Hebel face can be attributed to the capacity of the wall. Installation in a double mesh is expected to achieve -/120/120.

### Assessment of various HVAC service sizes

It is proposed to assess HVAC services with a smaller size than those tested. Reducing the service size will reduce the size or the number of conductors and number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that installing a smaller HVAC service will not detrimentally affect the system performance, provided that the annular gap size and the sealant configuration are maintained as tested.

The tested services in the HVAC bundle represent the maximum number of services, and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet, if applicable) are maintained.

### 8.5.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 50 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 50 Assessment outcome of HVAC bundle with or without cables in AAC wall system (double mesh)**

| Service | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| Up to 1 × 3/8 + 3/4 FR paircoil with 19 mm thick insulation - 0.8 mm / 1.1 mm thick | 127 | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| Up to 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | |
| Up to 1 × 2.5 mm² 3C+E TPS cable | | | |
| Up to 1 × CAT5e cable | | | |
| Up to 1 × 3/8 + 5/8 FR paircoil w/ 19 mm thick insulation - 0.8 mm / 1.0 mm thick | 127 | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| Up to 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | |
| Up to 1 × 2.5 mm² 3C+E TPS cable | | | |
| Up to 1 × CAT5e cable | | | |
| Up to 1 × 3/8 + 5/8 FR paircoil with 13 mm thick insulation - 0.8mm / 1.0 mm thick | 100 | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| Up to 1 × Ø20 mm UPVC pipe - 1.4 mm thick | | | |
| Up to 1 × 2.5 mm² 3C+E TPS cable | | | |
| Up to 1 × CAT5e cable | | | |
| Up to 1 × 3/8 + 3/4 FR paircoil w/ 19 mm thick insulation - 0.8 mm / 1.1 mm thick | 152 | 20 mm deep finished with 25 mm × 25 mm fillet on both sides as shown in Figure 6 | -/120/120 |
| Up to 1 × DN32 type B copper pipe (1.2 mm thick) with Ø32 mm SUpaCell pipe lagging – 25 mm thick | | | |
| Up to 1 × 3/8 + 5/8 FR paircoil w/ 13 mm thick insulation - 0.8 mm / 1.0 mm thick | | | |
| • Up to 3/8 + 5/8 FR paircoil with 9 mm non fire rated lagging- 0.8 mm / 1.0 mm thick<br>• Up to 20 mm condensation pipe - 1.5 mm wall thickness<br>• Up to 2×2.5 mm² 2C+E TPS cable<br>• Up to 2 × CAT 6 cable | 80 | 25 mm deep both sides with 20 mm × 20 mm fillet as shown in Figure 6 | -/120/120 |

# 8.6 Assessment of various HVAC bundle with or without cables in minimum 130 mm thick CLT timber wall protected by BOSS FireMastic-HPE sealant

## 8.6.1 Proposed construction

Table 51 lists HVAC services tested in FRT210330 in accordance with AS 1530.4:2014.

In the reference test FRT210330, the tested system included a 130 mm thick CLT wall system penetrated with 9 services. The HVAC services protected with BOSS FireMastic-HPE sealant are considered in this section.

**Table 51 Tested HVAC bundle with or without cables in CLT timber wall**

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 3/8' + 3/4' FR paircoil w/ 19 mm thick insulation - 1.4 mm / 2.8 mm thick<br>• 20 mm condensation drain pipe - 1.8 mm thick<br>• 2.5 mm² 3C+E TPS cable<br>• Instrolex control cable | FRT210330 | 121 mm | 20 mm deep both finished flush as shown in Figure 7 | -/90/90 |

## 8.6.2 Discussion

### Assessment of various HVAC service sizes

In the reference test FRT210330, specimen H, a 121 mm aperture was made in a 130 mm thick CLT timber wall system. HVAC services were placed in the aperture, and the annular gap was sealed with BOSS FireMastic-HPE sealant to a depth of 20 mm in both exposed and unexposed sides and finished flush with the wall. The tested services were 3/8 + 3/4 FR paircoil, 20 mm condensation drainpipe, 2.5 mm² 3C+E TPS cable and Instrolex control cable. The system was tested for 100 minutes. During the test, the thermocouple placed on the service and the wall at 25 mm away from the aperture recorded a lower temperature than 180 C°. The HVAC service-maintained integrity and insulation for 90 minutes.

It is proposed to assess HVAC services with a smaller size than those tested. Reducing the service size will reduce the size or number of conductors and the amount of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration are maintained as tested.

The tested services in the HVAC bundle represent, the maximum number of services, and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet, if applicable) are maintained.

## 8.6.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 52 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 52 Assessment of HVAC bundle with or without cables in CLT wall**

| Services | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Up to 3/8 + 3/4 FR paircoil w/ 19 mm thick insulation - 1.4 mm / 2.8 mm thick | 121 mm | 20 mm deep both finished flushes as shown in Figure 7 | -/90/90 |

| Services | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Up to 20 mm condensation drain pipe - 1.8 mm thick<br>• Up to 2.5 mm² 3C+E TPS cable<br>• Up to Instrolex control cable | | | |

## 8.7 Assessment of various HVAC services in minimum 235 mm thick ceiling protected by BOSS FireMastic-HPE sealant

### 8.7.1 Proposed construction

Table 53 lists the HVAC services tested in FRT180474.3 in accordance with AS 1530.4:2014.

In the reference test FRT180474.3, a 235 mm thick ceiling system was penetrated with 10 services and protected with various local fire stopping protections. The ceiling consists of 2 layers of 13 mm fire-rated plasterboard fixed directly onto the timber framing on the exposed side using plasterboard screws at nominal 150 mm centres on the joist and 100 mm centres on the perimeter framing. On the unexposed side, particleboard flooring was fixed directly onto the timber framing. The sealant used in the ceiling system was BOSS FireMastic-HPE sealant, and the sealant used in the timber flooring system was BOSS FireMastic-300. This section will discuss the HVAC services protected with BOSS FireMastic-HPE sealant.

**Table 53 Tested HVAC bundle with or without cables in ceiling system**

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL | RISF |
|---|---|---|---|---|---|
| 1 × TPS - 2.5 mm²2C+E cable<br>1 × Cat 6 cable<br>1 × Paircoil FR - Ø16 mm / 1 mm wall thickness<br>1 × 25 mm UPVC conduit – 2 mm wall thickness" | FRT180474.3 | 72 mm | HPE - On the interface between the fire collar and the service to the depth of the fire collar and finished flush with the fire collar.<br>FireMastic 300 – on the interface between the service and particleboard flooring to the depth of particleboard flooring on the unexposed side and finished flush with the surface | -/90/90 | Failure at 53 minutes |
| 2 × 25 mm UPVC conduit – 2 mm wall thickness<br>2 × TPS - 2.5 mm² 2C+E cables" | FRT180474.3 | 51 mm | BOSS FireMastic HPE – On the interface between the fire collar and the service to the depth of the fire collar and finished flush with the fire collar.<br>BOSS FireMastic 300- On the interface between the service and particleboard flooring to the depth of the particleboard flooring on the unexposed side and finished flush with the surface | -/90/90 | Failure at 24 minutes |

### 8.7.2 Discussion

#### Assessment of various HVAC service sizes

In the reference test FRT180474.3, specimen I, a 72 mm diameter aperture was made in a 235 mm thick ceiling system. The aperture was penetrated with 1 × TPS - 2.5 mm²2C+E cable, 1 × Cat 6 cable, 1 × Paircoil FR - Ø16 mm and 1 × 25 mm UPVC conduit. The services were protected with

BOSS FireMastic-HPE sealant applied on the interface between the fire collar and the service to the depth of the fire collar, and finished flush with the fire collar and BOSS FireMastic 300 applied on the interface between the service and particleboard flooring to the depth of particleboard flooring on the unexposed side and finished flush with the surface. The HVAC service failed RISF at 53 minutes. However, it maintained integrity and insulation performance for up to 90 minutes.

In test FRT180474.3, specimen J, a 51 mm diameter aperture was made in a 235 mm thick ceiling system. The aperture was penetrated with 2 × 25 mm UPVC conduit and 2 × TPS - 2.5 mm² 2C+E cables. The HVAC services were protected with BOSS FireMastic-HPE sealant applied on the interface between the fire collar and the service to the depth of the fire collar, and finished flush with the fire collar and BOSS FireMastic 300 applied on the interface between the service and particleboard flooring to the depth of the particleboard flooring on the unexposed side and finished flush with the surface. The system failed RISF after 24 minutes. However, it maintained integrity and insulation for up to 90 minutes.

It is proposed to assess HVAC services with a smaller size than those tested. Reducing the service size will reduce the size and the number of conductors and number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that, installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration is maintained as tested.

The tested services in the HVAC bundle represents the maximum number of services and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet if applicable) are maintained.

### 8.7.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 54– in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 54 Assessment of HVAC bundle with or without cables in ceiling system**

| Services | Maximum aperture (mm) | Sealant configuration | FRL | RISF |
|---|---|---|---|---|
| Up to 1 × TPS - 2.5 mm² 2C+E cable<br>Up to 1 × Cat 6 cable<br>Up to 1 × Paircoil FR - Ø16 mm / 1 mm wall thickness<br>Up to 1 × 25 mm UPVC conduit – 2 mm wall thickness" | 72 mm | BOSS FireMastic HPE – On the interface between the fire collar and the service to the depth of the fire collar and finished flush with the fire collar<br>FireMastic 300 – on the interface between the service and particleboard flooring to the depth of particleboard flooring on the unexposed side and finished flush with the surface | -/90/90 | Failure at 53 minutes |
| Up to 2 × 25 mm UPVC conduit – 2 mm wall thickness<br>Up to 2 × TPS - 2.5 mm² 2C+E cables" | 51 mm | BOSS FireMastic HPE – On the interface between the fire collar and the service to the depth of the fire collar and finished flush with the fire collar.<br>BOSS FireMastic 300- On the interface between the service and particleboard flooring to the depth of the particleboard flooring on the unexposed side and finished flush with the surface | -/90/90 | Failure at 24 minutes |

# 8.8 Assessment of various HVAC services in minimum 150 mm thick concrete slab protected by BOSS FireMastic-HPE sealant

## 8.8.1 Proposed construction

Table 55 lists the HVAC services tested in FRT220049 in accordance with AS 1530.4:2014.

In the reference test FRT220049, a 150 mm concrete floor system was tested. The slab was penetrated by 10 various services. The services were protected with different fire stopping protections. This section discusses the HVAC service penetration protected with BOSS FireMastic-HPE sealant.

**Table 55 Tested HVAC bundle with or without cables in concrete slab**

| Services | Reference test | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| • 1 1/8"" (28.6 mm) copper pipe with 25 mm thick E-Flex ST lagging - 1.2 mm wall thickness<br>• 7/8"" (22 mm) copper pipe with 25 mm thick E-Flex ST lagging - 1.6 mm wall thickness<br>• DN 18 copper pipe with 19 mm lagging - 1.3 mm wall thickness<br>• 20 mm condensation drainpipe - 1.5 mm wall thickness<br>• 2.5 mm² 3C+E TPS cable<br>• Fire alarm cable<br>• Instrolex control cable | FRT220049 | 150 mm | 25 mm - Both sides Finished flush | -/240/120 |
| • 3/8 + 3/4 FR paircoil w/ 19 mm thick insulation - 1.4mm / 2.8mm thick<br>• 2.5mm2 3C+E TPS cable<br>• CAT 6 cable<br>• Instrolex control cable<br>• 2.5mm² 2C+E TPS cable<br>• 20 mm condensation drainpipe - 1.5 mm wall thickness | FRT220049 | 100 mm | 25 mm - Both sides with backing rod Finished flush | -/240/240 |

## 8.8.2 Discussion

### Assessment of various HVAC service sizes

In the reference test FRT220049, Specimen A, a 150 mm aperture was made in a 150 mm thick concrete slab. The aperture was penetrated with the following HVAC services 1 1/8" (28.6 mm) copper pipe with 25 mm thick E-Flex ST lagging, 7/8" (22 mm) copper pipe with 25 mm thick E-Flex ST lagging, DN 18 copper pipe with 19 mm lagging, 20 mm condensation drainpipe, 2.5 mm² 3C+E TPS cable, Fire alarm cable and Instrolex control cable. The services were protected with BOSS FireMastic-HPE sealant applied to a depth of 25 mm in both exposed and unexposed sides and finished flush with the floor. The service failed insulation at 124 minutes as the thermocouple positioned on the TPS cable recorded a high temperature. However, it continued to maintain integrity performance for 240 minutes.

In test FRT220049, specimen I, a 100 mm diameter aperture was penetrated with the following HVAC services, 3/8 + 3/4 FR paircoil, 2.5 mm² 3C+E TPS cable, CAT 6 cable, Instrolex control cable, 2.5 mm² 2C+E TPS cable and 20 mm condensation drainpipe. The services were protected with BOSS FireMastic-HPE sealant, applied to a depth of 25 mm on both exposed and unexposed sides

with backing rod and finished flush with the floor. The service maintained integrity and insulation performance for 240 minutes.

It is proposed to assess HVAC services with a smaller size than those tested. Reducing the service size will reduce the size and the number of conductors and number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that, installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration is maintained as tested.

The tested services in the HVAC bundle represents the maximum number of services and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet if applicable) are maintained.

### 8.8.3 Conclusion

The technical review found that the HVAC services protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 56 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 56 Assessment outcome of HVAC bundle with or without cables in concrete slab**

| Services | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|
| • Up to 1 1/8"" (28.6 mm) copper pipe with 25 mm thick E-Flex ST lagging - 1.2 mm wall thickness<br>• Up to 7/8"" (22 mm) copper pipe with 25 mm thick E-Flex ST lagging - 1.6 mm wall thickness<br>• Up to DN 18 copper pipe with 19 mm lagging - 1.3 mm wall thickness<br>• Up to 20 mm condensation drain pipe - 1.5 mm wall thickness<br>• Up to 2.5 mm² 3C+E TPS cable<br>• Fire alarm cable<br>• Instrolex control cable | 150 | 25 mm - Both sides Finished flush | -/240/120 |
| • Up to 3/8 + 3/4 FR paircoil w/ 19 mm thick insulation - 1.4mm / 2.8mm thick<br>• Up to 2.5mm2 3C+E TPS cable<br>• Up to CAT 6 cable<br>• Instrolex control cable<br>• Up to 2.5mm² 2C+E TPS cable<br>• Up to 20 mm condensation drain pipe - 1.5 mm wall thickness | 100 | 25 mm - Both sides with backing rod Finished flush | -/240/240 |

## 8.9 Assessment of HVAC bundle with or without cables in ComFlor60 (Max 130 mm thick / min 70 mm thick)

### 8.9.1 Proposed construction

Table 57 lists the services tested in FRT180137 in accordance with AS 1530.4:2014.

In the reference test FRT180137, a composite floor system with a maximum thickness of 130 mm and a minimum thickness of 70 mm was penetrated with 9 various services. The pipe services protected by BOSS FireMastic-HPE sealant are considered in this section.

**Table 57 Tested HVAC bundle with or without cables in ComFlor60**

| Pipe | Reference test | Nominal pipe diameter (mm) | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|---|
| Pair coil copper pipe with lagging | FRT180137 | 16 and 6 | 100 mm | 25 mm deep and finished flush on the unexposed side.<br>25 mm in the recess between the batt and the service from the exposed side | -/120/120 |
| uPVC | FRT180137 | 25 | | | |

## 8.9.2 Discussion

### Assessment of various pipe sizes

In FRT 180137 R2.0, a ComFlor®60 composite floor system with a maximum thickness of 130 mm and a minimum thickness of 70 mm was tested. Specimen C was a paircoil pipe and 25 mm UPVC drain pipe in 100 mm diameter aperture. It was protected by BOSS FireMastic-HPE sealant. The sealant was applied 25 mm deep and finished flush on the unexposed side and 25 mm in the recess between the Batt and the service from the exposed side.

Specimen C achieved an integrity and insulation performance of 121 minutes with no failure for the test duration. Test photographs show that the service was installed in the top rib of the Comflor60. Therefore, it is expected that combustible and insulated metal pipes of a diameter equal to or smaller than the tested service size will achieve at least similar integrity and insulation performance as the tested size.

It is proposed to assess HVAC services with a smaller size than those tested. Reducing the service size will reduce the size and the number of conductors and number of combustible materials, such as cable sheathing. Hence, the amount of heat transferred to the unexposed side is expected to be lower when the service size is decreased. Therefore, it is expected that, installing a smaller HVAC service will not detrimentally affect the system's performance, provided that the annular gap size and the sealant configuration is maintained as tested.

The tested services in the HVAC bundle represents the maximum number of services and services are allowed to be removed from the bundle provided the annular gap and depth (and fillet if applicable) are maintained.

## 8.9.3 Conclusion

The technical review found that the pipes protected by BOSS FireMastic-HPE sealant are expected to achieve the fire resistance levels (FRL) given in Table 58 – in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1:2005.

**Table 58 Assessment outcome of HVAC bundle with or without cables penetration in ComFlor60**

| Pipe | Nominal pipe diameter (mm) | Maximum aperture (mm) | Sealant configuration | FRL |
|---|---|---|---|---|
| Pair coil copper pipe with lagging | Up to 16 and 6 | 100 mm | 25 mm deep and finished flush on the unexposed side.<br>25 mm in the recess between the Batt and the service from the exposed side | -/120/120 |
| uPVC | Up to 25 | | | |

# 9. Validity

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

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

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

The procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. The sponsor is therefore recommended that this report be reviewed on, or before, the stated expiry date.

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

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

# Appendix A Summary of supporting test data

## A.1 Test report – FSP 1734

**Table 59 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Products (Australia) Pty Ltd |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde, NSW 2113. |
| Test date | The fire resistance test was done on 9 December 2015. |
| Test standards | The test was done in accordance with AS 1530.4:2014 |
| Variation to test standards | None |
| General description of tested specimen | A specimen consists of seven services penetrating a plasterboard wall and protected by sealants. The plasterboard wall system consists of double layer of 13 mm plasterboard wall with an established FRL of -/120/120 |
| 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 60.

**Table 60 Results summary for this test report**

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| Specimen 1 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 2 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 3 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 4 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 5 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 6 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 67 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |

## A.2 Test report – Chilt/RF12089A AR5

**Table 61 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire and Safety |
| Test laboratory | Exova Warringtonfire, Chiltern House, Stocking Lane, Hughenden Valley, High Wycombe Buckinghamshire, HP14 4ND |
| Test date | The fire resistance test was done on 15 August 2012. |
| Test standards | The test was done in accordance with BSEN 1366-3:2009 and BSEN 1366-4: 2009. |
| Variation to test standards | None |
| General description of tested specimen | Nine service penetration sealing systems were installed into two flexible supporting constructions and a vertical linear joint sealing system was installed between the left flexible supporting construction and a blockwork wall.<br>Two horizontal linear joint seals, a vertical linear joint seal, and nine service penetrations were also tested, but are not subject to this report. |
| Instrumentation | The test report states that the instrumentation was in accordance with BSEN 1366-3:2009 and BSEN 1366-4: 2009. |

The test specimen achieved the following results – see Table 62.

**Table 62 Results summary for this test report**

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| Pipe 1 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 2 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 3 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 4 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe/cables 6 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 129 |
| Linear joint seal 9 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 14 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 17 | Structural adequacy | - |

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| | Integrity | 132 |
| | Insulation | 132 |
| Pipe 21 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 106 |
| Pipe 22 | Structural adequacy | - |
| | Integrity | 132 |
| | Insulation | 132 |

## A.3 Test report – FSP 2073

**Table 63 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Knauf Plasterboard Pty Limited |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde, NSW 2113. |
| Test date | The fire resistance test was done on 13 January 2020. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The specimens consisted a PE-Xa Rehau Rautitan pipe, a PVC pipe, and a bath breaching piece with two tap handles and a tap penetrating the exposed face of the Knauf shaftliner wall system. The penetrated wall consisted of 1 128 mm thick plasterboard lined framed wall system comprising a 25 mm thick Knauf shaftliner board on the exposed side and two layers of 13 mm thick Knauf Fireshield plasterboard on the unexposed side of the 102 mm 0.55 BMT CH-stud wall framing with 102 mm 0.55 BMT CH-studs. The wall cavity was filled with 75 mm thick Knauf Earthwool (density of 11 kg/m$^3$). |
| 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 64.

**Table 64 Results summary for this test report**

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| Specimen 1 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 2 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 3 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |

## A.4 Test report – FSP 2191

**Table 65 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Products (Australia) Pty Ltd |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde, NSW 2113. |
| Test date | The fire resistance test was done on 21 January 2021. |
| Test standards | The test was done in accordance with AS 1530.4:2014 |
| Variation to test standards | None |
| General description of tested specimen | Two plastic pipe penetrations and two Boss Fire transit boxes (with and without services) were installed in a framed plasterboard wall system. |
| 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 66.

**Table 66 Results summary for this test report**

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| Specimen 1 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 3 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 79 |
| Specimen 4 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |
| Specimen 5 | Structural adequacy | - |
| | Integrity | 121 |
| | Insulation | 121 |

## A.5 Test report – FRT210322

**Table 67 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Products (Australia) Pty Ltd |
| Test laboratory | Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia |
| Test date | The fire resistance test was done on 18 January 2022. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The specimen comprised of 1600 mm wide by 1600 mm high by 75 mm thick penetrated by 18 services as listed below. The tested system was restrained on all edges. |

| Penetration system | Service | Local fire-stopping protection | Main fire-stopping protection | Aperture size (mm) |
|---|---|---|---|---|
| A | 1 × 3/8 + 3/4 FR paircoil with 19 mm insulation<br>1 × Ø20 mm UPVC pipe<br>1 × 2.5 mm$^2$ 3C+E TPS cable<br>1 × CAT6 cable | BOSS FireMastic-HPE™ | - | Ø127 mm |
| B | 1 × 3/8 + 5/8 FR paircoil w/ 19 mm insulation<br>1 × Ø20 mm UPVC pipe<br>1 × 2.5 mm$^2$ 3C+E TPS cable<br>1 × CAT6 cable | BOSS FireMastic-HPE™ | - | Ø127 mm |

| Item | Information about test report | | | | |
|---|---|---|---|---|---|
| | C | 2 × RG6 Coax cables<br>2 × CAT6 cables<br>2 × 4 Core security cables (7/0.20 mm) | BOSS FireMastic-HPE™ | - | Ø40 mm |
| | D | Ø20 mm PEXa pipe | BOSS FireMastic-HPE™ | - | Ø60 mm |
| | E | Ø20 mm PE-X/AL/PE-X pipe | BOSS FireMastic-HPE™ | - | Ø60 mm |
| | F | 1 × 16 mm² 2C+E cable<br>4 × 2.5 mm² 2C+E TPS cable<br>6 × RG6 Coax cables<br>10 × CAT6 cables<br>4 × 2.5 mm² 3C+E cables<br>6 × 4 Core security cables (7/0.20 mm)<br>1 × Ø20 mm UPVC pipe<br>2 × 10 mm² 2C+E power cables | BOSS FireMastic-300™ and BOSS P40-MAK wrap | BOSS Fire Cable Transit CT120-100R | Ø105 mm |
| | G | Ø20 mm HFT LSF0H conduit | BOSS FireMastic-HPE™ | - | Ø60 mm |
| | H | Ø32 mm PVC conduit | BOSS FireMastic-HPE™ | - | 36 mm |
| | I | Ø20 mm UPVC conduit | BOSS FireMastic-HPE™ | - | 24 mm |
| | J | Ø32 mm UPVC conduit | BOSS FireMastic-HPE™ | - | Ø73 mm |
| | K | 1 × 3/8 + 5/8 FR paircoil with 13 mm insulation<br>1 × Ø20 mm UPVC pipe<br>1 × 2.5 mm² 3C+E TPS cable<br>1 × CAT6 cable | BOSS FireMastic-HPE™ | - | Ø100 mm |
| | L | DN32 mm galvanised sprinkler pipe | BOSS FireMastic-300™ | - | Ø60 mm |
| | M | 6 × 2.5 mm² 2C+E TPS cables | BOSS FireMastic-HPE™ | - | Ø57 mm |
| | N | 4 × ELV extra low voltage alarm cables (2 core round) | BOSS FireMastic-HPE™ | - | Ø20 mm |

| Item | Information about test report | | | | |
|---|---|---|---|---|---|
| | O | Ø20 mm PEXa pipe | BOSS FireMastic-HPE™ | - | Ø60 mm |
| | P | 1 × 3/8 + 3/4 FR paircoil w/ 19 mm insulation<br>1 × DN32 type B copper pipe with Ø32 mm SUpaCell pipe lagging (25 mm wall thickness)<br>1 × 3/8 + 5/8 FR paircoil w/ 13 mm insulation | BOSS FireMastic-HPE™ | - | Ø152 mm |
| | Q | Ø32 mm cPVC pipe | BOSS FireMastic-HPE™ | - | Ø83 mm |
| | R | 1 × 16 mm² 2C+E cable | BOSS FireMastic-HPE™ | - | Ø40 mm |
| 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 68

**Table 68 Results summary for this test report**

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural adequacy | Not applicable | -/120/90 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 107 minutes | |
| B | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| C | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| D | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| E | Structural adequacy | Not applicable | -/120/60 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 84 minutes | |
| F | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| G | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| | Insulation | No failure at 121 minutes | |
| H | Structural adequacy | Not applicable | -/120/60 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 86 minutes | |
| I | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| J | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| K | Structural adequacy | Not applicable | -/120/90 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 110 minutes | |
| L | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| M | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| N | Structural adequacy | Not applicable | -/120/90 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 111 minutes | |
| O | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| P | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| Q | Structural adequacy | Not applicable | -/120/90 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | Failure at 114 minutes | |
| R | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |

## A.6 Test report – FSP 2084

**Table 69 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Knauf Plasterboard Pty Limited |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde, NSW 2113. |
| Test date | The fire resistance test was done on 12 February 2020. |
| Test standards | The test was done in accordance with AS 4072.1:2005. |
| Variation to test standards | None |
| General description of tested specimen | The specimens consisted of a PE-Xa Rehau Rautitan pipe, a PVC pipe, a 3-piece tap faucet and a SHS support arm penetrating the unexposed face of a plasterboard wall protected by various fire stopping systems. The penetrated wall consisted of a single layer of 13 mm thick Fireshield plasterboard on each side of 92 mm 0.55 BMT C-studs to form a 118 mm thick wall system. The wall cavity was filled with 75 mm thick Knauf Earthwool (density of 11 kg/m$^3$). The Knauf wall system (KSW310) has an established FRL of -/60/60, as detailed in BRANZ reports FAR 3210 and FAR 3230. |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 4072.1:2005. |

The test specimen achieved the following results – see Table 70.

**Table 70 Results summary for this test report**

| Penetration system/ linear joint seal | Criteria | Results |
|---|---|---|
| Specimen 1 | Structural adequacy | - |
| | Integrity | 91 |
| | Insulation | 91 |
| Specimen 2 | Structural adequacy | - |
| | Integrity | 91 |
| | Insulation | 91 |
| Specimen 3 | Structural adequacy | - |
| | Integrity | 91 |
| | Insulation | 91 |
| Specimen 4 | Structural adequacy | - |
| | Integrity | 91 |
| | Insulation | 91 |

## A.7 Test report – FRT180474.3

**Table 71 Information about test report**

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Report sponsor</td><td>Boss fire and safety</td></tr>
<tr><td>Test laboratory</td><td>Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia</td></tr>
<tr><td>Test date</td><td>The fire resistance test was done on 17 January 2020.</td></tr>
<tr><td>Test standards</td><td>The test was done in accordance with AS 1530.4:2014.</td></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The specimens comprised of 235 mm thick ceiling system penetrated by 10 services as listed below.
<table>
<tr><th>Penetration system</th><th>Service</th><th>Local fire-stopping protection</th><th>Aperture size (mm)</th></tr>
<tr><td>A</td><td>• 4 × TPS - 2.5mm$^2$ 2C+E cables</td><td>BOSS FireMastic 300 and BOSS FireMastic HPE</td><td>Ø44</td></tr>
<tr><td>B</td><td>• 2 × TPS - 2.5mm$^2$ 2C+E cables</td><td>BOSS FireMastic 300</td><td>Ø16</td></tr>
<tr><td>C</td><td>• 7 × Cat 6 cables</td><td>BOSS FireMastic 300</td><td>Ø44</td></tr>
<tr><td>D</td><td>• 1 × 32 mm steel sprinkler pipe</td><td>Thermal defence wrap, BOSS UniWrap and BOSS FireMastic 300</td><td>Ø51</td></tr>
<tr><td>E</td><td>• 3 × Main power cable 2C+E cables</td><td>BOSS FireMastic 300</td><td>Ø51</td></tr>
<tr><td>F</td><td>• 10 × TPS - 2.5mm$^2$ 2C+E cables<br>• 10 × Cat 6 cables<br>• 1 × Paircoil FR<br>• 2 × Paircoils<br>• 1 × Copper pipe with Insulation<br>• 1 × 25 mm UPVC conduit</td><td>BOSS Fire Transit Box BFB 150 and BOSS FireMastic 300</td><td>170 mm wide × 170 mm long</td></tr>
<tr><td>G</td><td>• 1 × 25 mm UPVC conduit</td><td>BOSS FireMastic 300 and BOSS FireMastic HPE</td><td>Ø63</td></tr>
<tr><td>H</td><td>• 1 × 32 mm UPVC DWV pipe</td><td>BOSS FireMastic 300 and BOSS MaxiCollar 40 collar</td><td>Ø42</td></tr>
<tr><td>I</td><td>• 1 × TPS - 2.5mm$^2$ 2C+E cable<br>• 1 × Cat 6 cable<br>• 1 × Paircoil FR<br>• 1 × 25 mm UPVC conduit</td><td>BOSS FireMastic 300, BOSS MaxiCollar 80 collar and BOSS FireMastic - HPE</td><td>Ø72</td></tr>
<tr><td>J</td><td>• 2 × 25 mm UPVC conduits<br>• 2 × TPS - 2.5mm$^2$ 2C+E cables</td><td>BOSS FireMastic 300, BOSS MaxiCollar 65 collar and BOSS FireMastic - HPE</td><td>Ø51</td></tr>
</table></td></tr>
</table>

| Item | Information about test 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 72.

**Table 72 Results summary for this test report**

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 55 minutes | |
| B | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 36 minutes | |
| C | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 60 minutes | |
| D | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 35 minutes | |
| E | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 54 minutes | |
| F | Structural adequacy | Not applicable | -/90/60 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | Failure at 75 minutes | |
| | RISF | Failure at 40 minutes | |
| G | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 55 minutes | |
| H | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 48 minutes | |
| I | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 53 minutes | |
| J | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 91 minutes | |
| | Insulation | No failure at 91 minutes | |
| | RISF | Failure at 24 minutes | |

## A.8 Test report – FRT210330 R1.1

**Table 73 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Products (Australia) Pty Ltd |
| Test laboratory | Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia |
| Test date | The fire resistance test was done on 24 June 2022. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The specimens comprised of a wall system of dimensions 1200 mm wide by 1200 mm high by 130 mm thick penetrated by 9 services as listed below. The tested system was restrained on all edges. |

| Penetration system | Service | Local fire-stopping protection | Aperture size (mm) |
|---|---|---|---|
| A | DN 50 mm steel sprinkler pipe | BOSS FireMastic-300 | Ø73 mm |
| B | • 1 × 48.4 mm steel sprinkler pipe<br>• 2 × 22 mm stainless steel pipes with 20 mm Thermobreak 9705 lagging<br>• 2 × 25 mm Kelox plus pipes<br>• 1 × 25 mm condensation drain pipe<br>• 1 × 16 mm² 3C+E cable<br>• 1 × 50 mm² 2C+E cable<br>• 3 × fire alarm cables<br>• 4 × Cat 6 cables<br>• 1 × 2.5 mm² 2C+E TPS cable<br>• 1 × 2.5 mm² 3C+E TPS cable<br>• 2 × RG6 Coax cables<br>• 1 × Fig 8 cable<br>• 1 × Security cable | • BOSS FyreBox™ – BFB-300<br>• BOSS FireMastic-300<br>• BOSS Thermal defence wrap | 320 mm wide × 170 mm high |
| C | 16 mm² 3C+E cable | BOSS FireMastic-HPE | Ø40 mm |

| Item | Information about test report | | | |
|---|---|---|---|---|
| | D | • 2 × CAT 6 cables<br>• 2 × RG6 Coax cables<br>• 1 × Security cable<br>• 1 × Fig 8 cable<br>• 2 × Fire alarm cables | BOSS FireMastic-HPE | Ø40 mm |
| | E | 20 mm Pex-Xa pipe | BOSS FireMastic-HPE | Ø60 mm |
| | F | 20 mm Pex/Al/Pex pipe | BOSS FireMastic-HPE | Ø60 mm |
| | G | 25 mm Kelox plus pipe | BOSS FireMastic-HPE | Ø83 mm |
| | H | • 1 × 3/8" × ¾" Pair coil w/ 19 mm insulation<br>• 1 × 20 mm condensation drain pipe<br>• 1 × 2.5 mm² 3C+E TPS cable<br>• 1 × 2.5 mm² 2C+E TPS cable<br>• 1 × Instrolex control cable | BOSS FireMastic-HPE | Ø121 mm |
| | I | • 1 × 32 mm conduit<br>• 6 × 2.5 mm² 2C+E TPS cables inside the 32 mm conduit | BOSS FireMastic-HPE | Ø70 mm |
| 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 74.

**Table 74 Results summary for this test report**

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural adequacy | Not applicable | -/90/60 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | Failure at 61 minutes | |
| B | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | Failure at 94 minutes | |
| C | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | No failure at 100 minutes | |
| D | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | Failure at 93 minutes | |
| E | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| | Insulation | No failure at 100 minutes | |
| F | Structural adequacy | Not applicable | -/90/60 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | Failure at 65 minutes | |
| G | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | No failure at 100 minutes | |
| H | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | No failure at 100 minutes | |
| I | Structural adequacy | Not applicable | -/90/90 |
| | Integrity | No failure at 100 minutes | |
| | Insulation | No failure at 100 minutes | |

## A.9 Test report – FRT220049

**Table 75 Information about test report**

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Report sponsor</td><td>Boss Products (Australia) Pty Ltd</td></tr>
<tr><td>Test laboratory</td><td>Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia</td></tr>
<tr><td>Test date</td><td>The fire resistance test was done on 27 June 2022.</td></tr>
<tr><td>Test standards</td><td>The test was done in accordance with AS 1530.4:2014.</td></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The specimens comprised of a 150 mm thick floor system penetrated by 10 services as listed below.
<table>
<tr><th>Penetration system</th><th>Service</th><th>Local fire-stopping protection</th><th>Aperture size (mm)</th></tr>
<tr><td>A</td><td>• 1 1/8” copper pipe with 25 mm thick E-Flex ST lagging<br>• 7/8” copper pipe with 25 mm thick E-Flex ST lagging<br>• DN 18 copper pipe with 19 mm thick E-Flex ST lagging<br>• 20 mm condensation drain pipe<br>• 2.5 mm² 3C+E TPS cable<br>• Fire alarm cable<br>• Instrolex control cable</td><td>BOSS FireMastic-HPE</td><td>Ø150 mm</td></tr>
<tr><td>B</td><td>20 mm Pex-Xa pipe</td><td>BOSS FireMastic-HPE</td><td>Ø40 mm</td></tr>
</table></td></tr>
</table>

| Item | Information about test report | | | |
|---|---|---|---|---|
| | C | • 16 mm² 2C+E cable<br>• 2.5 mm² 2C+E TPS cable<br>• 2.5 mm² 3C+E TPS cable<br>• 20 mm Pex-A pipe<br>• 20 mm Pex/Al/Pex pipe<br>• 3/8” × ¾” Pair coil w/ 19 mm insulation<br>• DN 20 mm conduit<br>• DN 25 mm conduit<br>• Cable bundles<br>-CAT 6 cable<br>-RG6 Coax cable<br>-Fire alarm cable<br>-Fig 8 cable<br>-Security cable | • BOSS FyreBox™ – BFB-150<br>• BOSS FireMastic-300 | 180 mm wide × 180 mm long |
| | D | DN 32 mm UPVC pipe | BOSS FireMastic-HPE | Ø50 mm |
| | E | 20 mm Pex/Al/Pex pipe | BOSS FireMastic-HPE | Ø40 mm |
| | F | 6 × 2.5 mm² TPS cable | BOSS FireMastic-HPE | Ø30 mm |
| | G | • 4 × RG6 Coax cable<br>• 4 × CAT 6 cable<br>• 2 × Fire alarm cable<br>• Security cable | BOSS FireMastic-HPE | Ø50 mm |
| | H | • 20 mm Pex/Al/Pex pipe<br>• 32 mm Pex/Al/Pex pipe<br>• DN 50 mm PPR pipe<br>• DN 60 mm cPVC pipe<br>• DN 25 mm UPVC pipe<br>• 32 mm Pex-Xa pipe<br>• 20 mm Pex-Xa pipe | • BOSS FyreBox™ – BFB-450<br>• BOSS FireMastic-300<br>• BOSS Thermal defence wrap | 465 mm wide × 123 mm long |
| | I | • 3/8” × ¾” Pair coil w/ 19 mm insulation<br>• 2.5 mm² 3C+E TPS cable<br>• Cat 6 cable<br>• Instrolex control cable<br>• 2.5 mm² 2C+E TPS cable | BOSS FireMastic-HPE | Ø100 mm |

| Item | Information about test report | | | |
|---|---|---|---|---|
| | | • 20 mm condensation drain pipe | | |
| | J | 2 × DN 20 mm conduit | BOSS FireMastic-HPE | Ø50 mm |
| 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 76.

**Table 76 Results summary for this test report**

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural adequacy | Not applicable | -/240/120 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 124 minutes | |
| B | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |
| C | Structural adequacy | Not applicable | -/240/120 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 177 minutes | |
| D | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |
| E | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |
| F | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |
| G | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 241 minutes | |
| H | Structural adequacy | Not applicable | -/240/180 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | Failure at 227 minutes | |
| I | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |
| J | Structural adequacy | Not applicable | -/240/240 |
| | Integrity | No failure at 241 minutes | |
| | Insulation | No failure at 241 minutes | |

## A.10 Test report – FRT220141 R1.1

**Table 77 Information about test report**

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Report sponsor</td><td>Boss Products (Australia) Pty Ltd</td></tr>
<tr><td>Test laboratory</td><td>Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia</td></tr>
<tr><td>Test date</td><td>The fire resistance test was done on 15 July 2022.</td></tr>
<tr><td>Test standards</td><td>The test was done in accordance with AS 1530.4:2014.</td></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The specimens comprised of a 75 mm thick AAC panel wall penetrated by 10 services as listed below. The tested system is restrained on top and bottom edges.
<table>
<tr><th>Penetration system</th><th>Service</th><th>Local fire-stopping protection</th><th>Local aperture size (mm)</th></tr>
<tr><td>A</td><td>• 3/8” × 5/8” Pair coil<br>• 2C+E 2.5 mm² TPS cable</td><td>• BOSS FireMastic-HPE™<br>• 16 mm CSR GYPROCK Fyrchek plasterboard on unexposed side</td><td>Ø 80 mm</td></tr>
<tr><td>B</td><td>4 × 0.75 mm² 2C Fire alarm cables</td><td>BOSS FireMastic HPE</td><td>Ø 30 mm</td></tr>
<tr><td>C</td><td>• 3/8” × 5/8” Pair coil<br>• 2C+E 2.5 mm² TPS cable</td><td>• BOSS FireMastic-HPE™<br>• 16 mm CSR GYPROCK Fyrchek plasterboard on exposed side</td><td>Ø 80 mm</td></tr>
<tr><td>D</td><td>• 3/8” × 5/8” Pair coil<br>• 20 mm condensation pipe<br>• 2 × 2C+E 2.5 mm² TPS cables<br>• 2 × Cat 6 cable</td><td>BOSS FireMastic-HPE™</td><td>Ø 80 mm</td></tr>
<tr><td>E</td><td>25 mm Pex-A pipe</td><td>BOSS FireMastic-HPE™</td><td>Ø 48 mm</td></tr>
<tr><td>F</td><td>25 mm condensation pipe</td><td>BOSS FireMastic-HPE™</td><td>Ø 40 mm</td></tr>
<tr><td>G</td><td>25 mm Pex/Al/Pex pipe</td><td>BOSS FireMastic-HPE™</td><td>Ø 48 mm</td></tr>
<tr><td>H</td><td>20 mm Pex/Al/Pex pipe</td><td>BOSS FireMastic-HPE™</td><td>Ø 40 mm</td></tr>
<tr><td>I</td><td>20 mm Pex/Al/Pex pipe</td><td>BOSS FireMastic-HPE™</td><td>Ø 40 mm</td></tr>
</table></td></tr>
<tr><td>Instrumentation</td><td>The test report states that the instrumentation was in accordance with AS 1530.4:2014.</td></tr>
</table>

The test specimen achieved the following results – see Table 78.

**Table 78 Results summary for this test report**

| Penetration system | Criteria | Results | Fire resistance level (FRL) |
|---|---|---|---|
| A | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| B | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| C | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| D | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| E | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| F | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| G | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| H | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |
| I | Structural adequacy | Not applicable | -/120/120 |
| | Integrity | No failure at 121 minutes | |
| | Insulation | No failure at 121 minutes | |

## A.11 Test report – FRT180472.2

**Table 79 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Products (Australia) Pty Ltd |
| Test laboratory | Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia |
| Test date | The fire resistance test was done on 8 March 2019 |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The specimens consisted of 116 mm thick plasterboard wall system clad with two layer of fire rated plasterboard on either side penetrated by 10 penetration systems as listed below. |

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td></td><td>
<table>
<tr><th>Penetration system</th><th>Service</th><th>Primary local fire-stopping protection</th><th>Second local fire-stopping protection</th><th>Aperture size (mm)</th></tr>
<tr><td>A</td><td>50 mm copper pipe with lagging</td><td>BOSS 100 mm MaxiCollars™</td><td>P40 Mark Wrap with FireMastic - 300</td><td>Ø115</td></tr>
<tr><td>B</td><td>Bundle of Electric cable</td><td>FireMastic - HPE</td><td>-</td><td>Ø70</td></tr>
<tr><td>C</td><td>100 mm UPVC sandwich core pipe</td><td>BOSS UniWrap® in metal sleeve</td><td>FireMastic - 300</td><td>Ø130</td></tr>
<tr><td>D</td><td>150 mm copper pipe</td><td>FireMastic - 300</td><td>-</td><td>Ø170</td></tr>
<tr><td>E</td><td>40 mm UPVC pipe</td><td>BOSS UniWrap® in metal sleeve</td><td>FireMastic - 300</td><td>Ø60</td></tr>
<tr><td>F1</td><td>Fire rated GPO (unexposed side)</td><td>UniWrap intumescent in wallbox</td><td>-</td><td>99 × 55</td></tr>
<tr><td>F2</td><td>Fire rated GPO (exposed side)</td><td>UniWrap intumescent in wallbox</td><td>-</td><td>99 × 55</td></tr>
<tr><td>G</td><td>50 mm Galv Sprinkler pipe</td><td>FireMastic - 300</td><td>-</td><td>Ø80</td></tr>
<tr><td>H</td><td>80 mm UPVC pipe</td><td>BOSS UniWrap® in metal sleeve</td><td>FireMastic - 300</td><td>Ø102</td></tr>
<tr><td>I</td><td>50 mmUPVC pipe</td><td>BOSS UniWrap® in metal sleeve</td><td>FireMastic - 300</td><td>Ø70</td></tr>
</table>
</td></tr>
<tr><td>Instrumentation</td><td>The test report states that the instrumentation was in accordance with AS 1530.4:2014.</td></tr>
</table>

The test specimen achieved the following results – see Table 80.

**Table 80 Results summary for this test report**

| Penetration system | Service | Primary local fire-stopping protection | Second local fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| A | 50 mm copper pipe with lagging | BOSS 100 mm MaxiCollars™ | P40-Mak Wrap with FireMastic - 300 | Ø115 | -/120/90 |
| B | Bundle of Electric cable | FireMastic -HPE | - | Ø70 | -/120/120 |
| C | 100 mm UPVC sandwich core pipe | BOSS UniWrap® in metal sleeve | FireMastic - 300 | Ø130 | -/0/0 |
| D | 150 mm copper pipe | FireMastic - 300 | - | Ø170 | -/120/0 |
| E | 40 mm UPVC pipe | BOSS UniWrap® in metal sleeve | FireMastic - 300 | Ø60 | -/120/120 |
| F1 | Fire rated GPO (unexposed side) | UniWrap intumescent in wallbox | - | 99 × 55 | -/120/120 |

| Penetration system | Service | Primary local fire-stopping protection | Second local fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| F2 | Fire rated GPO (exposed side) | UniWrap intumescent in wallbox | - | 99 × 55 | -/120/90 |
| G | 50 mm Galv Sprinkler pipe | FireMastic - 300 | - | Ø80 | -/120/120 |
| H | 80 mm UPVC pipe | BOSS UniWrap® in metal sleeve | FireMastic - 300 | Ø102 | -/120/0 |
| I | 50 mmUPVC pipe | BOSS UniWrap® in metal sleeve | FireMastic - 300 | Ø70 | -/120/120 |

## A.12 Test report – FRT180137

**Table 81 Information about test report**

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Report sponsor</td><td>Boss Products (Australia) Pty Ltd</td></tr>
<tr><td>Test laboratory</td><td>Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia</td></tr>
<tr><td>Test date</td><td>The fire resistance test was done on 7 March 2019</td></tr>
<tr><td>Test standards</td><td>The test was done in accordance with AS 1530.4:2014.</td></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The specimens consisted of 70 mm – 130 mm thick composite floor system penetrated by 9 penetration systems as listed below. The tested system is restrained on all edges.
<table>
<tr><th>Penetration system</th><th>Service</th><th>Primary fire-stopping protection</th><th>Second fire-stopping protection</th><th>Aperture size (mm)</th></tr>
<tr><td>A</td><td>Bundle of TPS cables</td><td>BOSS Batt</td><td>BOSS FireMastic - HPE™</td><td>Ø76mm</td></tr>
<tr><td>B</td><td>32mm PEX-A pipe</td><td>-</td><td>BOSS FireMastic – HPE™</td><td>Ø78mm</td></tr>
<tr><td>C</td><td>Pair Coil pipe<br>25 mm UPVC Drain pipe</td><td>BOSS Batt</td><td>BOSS FireMastic – HPE™</td><td>Ø100 mm</td></tr>
<tr><td>D</td><td>100 mm UPVC DWV pipe</td><td>BOSS Batt</td><td>Boss MaxiCollar™<br>BOSS FireMastic – 300™</td><td>Ø127mm</td></tr>
<tr><td>E</td><td>Pair Coil 16mm + 10 mm lagged copper pipe<br>25 mm UPVC conduit<br>9 × TPS cables bundle<br>15 × CAT6 cable bundle</td><td>BOSS Fire box</td><td>BOSS P40-MAK Wrap<br>BOSS FireMastic - 300™</td><td>160 mm ×170 mm</td></tr>
</table></td></tr>
</table>

| Item | Information about test report | | | | |
|---|---|---|---|---|---|
| | | 15 × Firesense cable bundle<br>32mm galvanised sprinkler pipe<br>32mm copper | | | |
| | F | 32mm copper pipe | - | BOSS FireMastic – 300™ | Ø34mm |
| | G | 100 mm UPVC DWV pipe | - | BOSS Drop in Collar BOSS FireMastic – 300™ | Ø155mm |
| | H | 75mm HDPE pipe | BOSS Batt | BOSS FireMastic – 300™<br>BOSS MaxiCollar™ | Ø92mm |
| | I | 25 mm UPVC conduit pipe | BOSS Batt | BOSS MaxiCollar™<br>BOSS FireMastic - 300™ | Ø35mm |
| 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 82

**Table 82 Results summary for this test report**

| Penetration system | Service | Primary fire-stopping protection | Second fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| A | Bundle of TPS cables | BOSS Batt | BOSS FireMastic - HPE™ | Ø76mm | -/120/120 |
| B | 32mm PEX-A pipe | - | BOSS FireMastic – HPE™ | Ø78mm | -/120/0 |
| C | Pair Coil pipe<br>25 mm UPVC Drain pipe | BOSS Batt | BOSS FireMastic – HPE™ | Ø100 mm | -/120/120 |
| D | 100 mm UPVC DWV pipe | BOSS Batt | Boss MaxiCollar™<br>BOSS FireMastic – 300™ | Ø127mm | -/120/120 |
| E | Pair Coil 16mm + 10 mm lagged copper pipe<br>25 mm UPVC conduit<br>9 × TPS cables bundle<br>15 × CAT6 cable bundle<br>15 × Firesense cable bundle | BOSS Fire box | BOSS P40-MAK Wrap<br>BOSS FireMastic - 300™ | 160 mm ×170 mm | -/120/60 |

| Penetration system | Service | Primary fire-stopping protection | Second fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| | 32mm galvanised sprinkler pipe<br>32mm copper | | | | |
| F | 32mm copper pipe | - | BOSS FireMastic – 300™ | Ø34mm | -/120/30 |
| G | 100 mm UPVC DWV pipe | - | BOSS Drop in collar<br>BOSS FireMastic – 300™ | Ø155mm | -/120/90 |
| H | 75mm HDPE pipe | BOSS Batt | BOSS FireMastic – 300™<br>BOSS MaxiCollar™ | Ø92mm | -/120/120 |
| I | 25 mm UPVC conduit pipe | BOSS Batt | BOSS MaxiCollar™<br>BOSS FireMastic - 300™ | Ø35mm | -/120/120 |

## A.13 Test report – FRT180473 R1.0

**Table 83 Information about test report**

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Report sponsor</td><td>Boss Products (Australia) Pty Ltd</td></tr>
<tr><td>Test laboratory</td><td>Warringtonfire, 409-411 Hammond Road, Dandenong South VIC 3175 Australia</td></tr>
<tr><td>Test date</td><td>The fire resistance test was done on 12 March 2019</td></tr>
<tr><td>Test standards</td><td>The test was done in accordance with AS 1530.4:2014.</td></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The specimens consisted of 75 mm thick Hebel power panel penetrated by 13 services as listed below. The tested system is restrained on all edges.
<table>
<tr><th>Penetration system</th><th>Service</th><th>Local fire-stopping protection</th><th>Main fire-stopping protection</th><th>Aperture size (mm)</th></tr>
<tr><td>A</td><td>Bundle of Power cable</td><td>BOSS FireMastic – HPE™</td><td>-</td><td>Ø90 mm</td></tr>
<tr><td>B</td><td>Bundle of cables and pipes</td><td>BOSS FireMastic – 300™</td><td>BOSS Fire Box</td><td>300 mm × 80 mm</td></tr>
<tr><td>C</td><td>100 mm UPVC (Sandwich core) pipe</td><td>BOSS 100 mm MaxiCollar™<br>BOSS FireMastic – 300™</td><td>-</td><td>Ø121mm</td></tr>
<tr><td>D</td><td>Bundle of aluminium cables</td><td>BOSS FireMastic – 300™</td><td>BOSS Batt<br>BOSS Cable Transit CT120</td><td>110 mm × 110 mm</td></tr>
<tr><td>E</td><td>40 mm UPVC pipe</td><td>BOSS FireMastic - HPE™</td><td>-</td><td>Ø44mm</td></tr>
</table></td></tr>
</table>

| Item | Information about test report | | | | | |
|---|---|---|---|---|---|---|
| | F | 50 mm UPVC pipe | BOSS 50 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø76mm |
| | G | 80 mm UPVC pipe | BOSS 80 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø102mm |
| | H | Bundle of CAT6 data cable | BOSS Firemastic - HPE™ | - | Ø90 mm |
| | I | 60 mm galvanised sprinkler pipe | BOSS FireMastic - 300™ | - | Ø80 mm |
| | J | 80 mm copper pipe with lagging | BOSS P40-MAK Wrap<br>BOSS 150 mm MaxiCollar™<br>BOSS FireMastic – 300™ | BOSS Batt | Ø180 mm |
| | K | 40 mm UPVC pipe | BOSS 40 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø70 mm |
| | L | 32mm Pex-a pipe | BOSS FireMastic - HPE™ | - | Ø70 mm |
| | M | 60 mm cPVC pipe | BOSS FireMastic - HPE™ | - | Ø102mm |
| 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 60.

**Table 84 Results summary for this test report**

| Penetration system | Service | Local fire-stopping protection | Main fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| A | Bundle of Power cables | BOSS FireMastic – HPE™ | - | Ø90 mm | -/120/60 |
| B | Bundle of cables and pipes | BOSS FireMastic – 300™ | BOSS Fire Box | 300 mm × 80 mm | -/120/30 |
| C | 100 mm UPVC (Sandwich core) pipe | BOSS 100 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø121mm | -/120/0 |
| D | Bundle of aluminium cables | BOSS FireMastic – 300™ | BOSS Batt<br>BOSS Cable Transit CT120 | 110 mm × 110 mm | -/120/30 |

| Penetration system | Service | Local fire-stopping protection | Main fire-stopping protection | Aperture size (mm) | FRL |
|---|---|---|---|---|---|
| E | 40 mm UPVC pipe | BOSS FireMastic - HPE™ | - | Ø44mm | -/120/90 |
| F | 50 mm UPVC pipe | BOSS 50 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø76mm | -/120/120 |
| G | 80 mm UPVC pipe | BOSS 80 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø102mm | -/120/120 |
| H | Bundle of CAT6 data cable | BOSS Firemastic - HPE™ | - | Ø90 mm | -/120/60 |
| I | 60 mm galvanised sprinkler pipe | BOSS FireMastic - 300™ | - | Ø80 mm | -/120/90 |
| J | 80 mm copper pipe with lagging | BOSS P40-MAK Wrap<br>BOSS 150 mm MaxiCollar™<br>BOSS FireMastic – 300™ | BOSS Batt | Ø180 mm | -/120/120 |
| K | 40 mm UPVC pipe | BOSS 40 mm MaxiCollar™<br>BOSS FireMastic – 300™ | - | Ø70 mm | -/120/90 |
| L | 32mm PEX-A pipe | BOSS FireMastic - HPE™ | - | Ø70 mm | -/120/0 |
| M | 60 mm cPVC pipe | BOSS FireMastic - HPE™ | - | Ø102mm | -/120/0 |

## A.14 Test report – FP10422-001 Issue 2

**Table 85 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | The Insulation Contractor Association of Australia Queensland Inc |
| Test laboratory | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50908, Poriua 5240, New Zealand |
| Test date | The fire resistance test was done on 24 May 2019 |
| Test standards | The test was done in accordance with AS 1530.4:2014 |
| Variation to test standards | None |
| General description of tested specimen | The specimens consisted of a nominally 2200 mm high by 1000 mm wide by 130 mm thick steel stud wall lined with two layers of 13 mm thick Knauf MultiShield plasterboard on each face.<br>The wall was provided with six apertures and fitted with six pipe penetrations. Each penetration comprised a single pipe insulated with a mineral fibre insulated pipe section. The pipes ranged in diameter from 25 mm to 324 mm OD and the pipe materials were Steel and Copper. |
| 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 86.

**Table 86 Results summary for this test report**

| Penetration system | Insulation thickness (mm) | Pipe | Criteria | Fire resistance level (FRL) |
|---|---|---|---|---|
| X1 | 75 | 324 mm Ø Steel schedule 40 pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |
| X2 | 50 | 100 mm Ø Copper pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |
| X3 | 25 | 25 mm Ø Copper pipe | Structural adequacy | -/120/90 |
| | | | Integrity | |
| | | | Insulation | |
| Y1 | 75 | 324 mm Ø Steel schedule 40 pipe | Structural adequacy | -/90/90 |
| | | | Integrity | |
| | | | Insulation | |
| Y2 | 50 | 100 mm Ø Copper pipe | Structural adequacy | -/120/60 |
| | | | Integrity | |
| | | | Insulation | |
| Y3 | 25 | 25 mm Ø Copper pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |

## A.15 Test report – FP10422-002 Issue 2

**Table 87 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | The Insulation Contractor Association of Australia Queensland Inc |
| Test laboratory | 1222 Moonshine Rd, RD1, Porirua 5381, Private Bag 50908, Poriua 5240, New Zealand |
| Test date | The fire resistance test was done on 22 May 2019 |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The specimens consisted of a nominally 125 mm thick concrete floor slab. The overall thickness of the concrete floor slab was nominally 120 mm to 130 mm at its thinnest and thickest depths, respectively, and the footprint nominally measured 2200 mm high by 1000 mm wide.<br>The floor was provided with six core drilled apertures and fitted with six pipe penetrations. Each penetration comprised a single pipe insulated with a mineral fibre insulated pipe section. The pipes ranged in diameter from 25 mm to 324 mm OD, and the pipe materials were Steel and Copper. |
| 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 88.

**Table 88 Results summary for this test report**

| Penetration system | Insulation thickness (mm) | Pipe | Criteria | Fire resistance level (FRL) |
|---|---|---|---|---|
| FX1 | 75 | 324 mm Ø Steel schedule 40 pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |
| FX2 | 50 | 100 mm Ø Copper pipe | Structural adequacy | -/120/90 |
| | | | Integrity | |
| | | | Insulation | |
| FX3 | 25 | 25 mm Ø Copper pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |
| FY1 | 75 | 324 mm Ø Steel schedule 40 pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |
| FY2 | 50 | 100 mm Ø Copper pipe | Structural adequacy | -/120/60 |
| | | | Integrity | |
| | | | Insulation | |
| FY3 | 25 | 25 mm Ø Copper pipe | Structural adequacy | -/120/120 |
| | | | Integrity | |
| | | | Insulation | |

## A.16 Test report – WARRES 359904 Issue 2

**Table 89 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 24 May 2016 |
| 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 specimens were referenced as A and B for the purpose of the test, and the penetrations within the specimens were referenced as services A to I in the wall and J to R in the floor.<br>For the vertical wall specimen (Specimen A), the section of the wall had overall dimensions of 1500 mm high by 1500 mm wide by 150 mm thick, was provided with a single aperture measuring 1100 mm long by 750 mm wide and was penetrated with various plastic pipes and cables.<br>For the horizontal floor specimen (Specimen B), the section of the floor had overall dimensions of 2230 mm long by 1740 mm wide by 150 mm thick, was provided with a single aperture measuring 1100 mm long by 750 mm wide, and was penetrated with various plastic pipes and cables. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 90.

**Table 90 Results summary for this test report**

| Penetration system | Details | Criteria | Fire resistance level (FRL) |
|---|---|---|---|
| A | 500 mm perforated tray | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | A1 | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | A2 | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | A3 | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | B | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | C1 | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| | C2 | Structural adequacy | -/120/90 |
| | | Integrity | |
| | | Insulation | |
| | C3 | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| B | PEX pipe 40 mm 4 mm | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| C | Copper pipe 42 mm 1.2 | Structural adequacy | -/120/60 |
| | | Integrity | |
| | | Insulation | |
| D | PVC-u pipe, 50 mm 2.4 mm | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| E | Copper pipe 159 mm 2 | Structural adequacy | -/120/30 |
| | | Integrity | |
| | | Insulation | |
| F | PVC-u pipe, 50 mm 3.7 mm | Structural adequacy | -/120/120 |
| | | Integrity | |

| Penetration system | Details | Criteria | Fire resistance level (FRL) |
|---|---|---|---|
| | | Insulation | |
| G | PEX pipe 110 mm 10 mm | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| H | PVC-u pipe, 125 mm 4.8 mm | Structural adequacy | -/120/90 |
| | | Integrity | |
| | | Insulation | |
| I | PVC-u pipe, 125 mm 7.4 mm | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |
| Overall seal | - | Structural adequacy | -/120/120 |
| | | Integrity | |
| | | Insulation | |

## A.17 Test report – WARRES 342026 Issue 2

**Table 91 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 5 August 2014 |
| 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 section of floor had overall dimensions of 2230 mm long by 1740 mm wide by 150 mm thick and was provided with ten circular apertures of varying sizes, each penetrated with various plastic pipes and one copper pipe. There were also three square apertures of varying sizes with various services and cables passing through, and one blank seal. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 92.

**Table 92 Results summary for this test report**

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| A | Structural adequacy | -/30/30 |
| | Integrity | |
| | Insulation | |
| B | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| C | Structural adequacy | -/240/240 |
| | Integrity | |

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| | Insulation | |
| D | Structural adequacy | -/240/240 |
| | Integrity | |
| | Insulation | |
| E | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| F | Structural adequacy | -/90/90 |
| | Integrity | |
| | Insulation | |
| G | Structural adequacy | -/240/240 |
| | Integrity | |
| | Insulation | |
| H | Structural adequacy | -/90/30 |
| | Integrity | |
| | Insulation | |
| I | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| J | Structural adequacy | -/240/60 |
| | Integrity | |
| | Insulation | |
| K | Structural adequacy | -/120/90 |
| | Integrity | |
| | Insulation | |
| L | Structural adequacy | -/240/30 |
| | Integrity | |
| | Insulation | |
| M | Structural adequacy | -/240/180 |
| | Integrity | |
| | Insulation | |

## A.18 Test report – WARRES 334037-A

**Table 93 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 28 November 2013 |
| Test standards | The test was done in accordance with BS EN 1366-3:2009 |

| Item | Information about test report |
|---|---|
| Variation to test standards | None |
| General description of tested specimen | The drywall construction was of an overall dimension of 3000 mm wide by 3000 mm high by 100 mm thick. The framing comprised 50 mm wide galvanised mild steel studs, at maximum 600 mm centres, friction fitted into galvanised steel head and base channels. Each side of the stud frame was faced with two layers of 12.5 mm thick gypsum Type F plasterboard. The framework was infilled with 50 mm thick mineral wool insulation with a nominal density of 100 kg/m$^3$. The wall were provided with eight circular apertures, which was penetrated by a range of shower units. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 94

**Table 94 Results summary for this test report**

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| 13 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| 14 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| 15 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| 16 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |

## A.19 Test report – WARRES 334037-D

**Table 95 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 28 November 2013 |
| 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 drywall construction was of an overall dimension of 3000 mm wide by 3000 mm high by 100 mm thick. The framing comprised 50 mm wide galvanised mild steel studs, at maximum 600 mm centres, friction fitted into galvanised steel head and base channels. Each side of the stud frame was faced with two layers of 12.5 mm thick gypsum Type F plasterboard. The framework was infilled with 50 mm thick mineral wool insulation with a nominal density of 100 kg/m$^3$. The wall was provided with fifteen circular apertures. Twelve of the circular apertures were penetrated by a range of PVC, PE, PP and ABS pipes. The remaining three circular apertures were penetrated by an insulated copper pipe. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 96.

**Table 96 Results summary for this test report**

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| 1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| 2 | Structural adequacy | -/30/30 |
| | Integrity | |
| | Insulation | |
| 3 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| 4 | Structural adequacy | -/30/30 |
| | Integrity | |
| | Insulation | |
| 5 | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| 6 | Structural adequacy | -/30/30 |
| | Integrity | |
| | Insulation | |
| 7 | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| 8 | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| 9 | Structural adequacy | -/120/120 |
| | Integrity | |
| | Insulation | |
| 10 | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| 11 | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| 12 | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| 18 | Structural adequacy | -/120/120 |
| | Integrity | |

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| | Insulation | |
| 19 | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| 20 | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |

## A.20 Test report – WF 342025

**Table 97 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 25 June 2014 |
| 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 section of floor had overall dimensions of 2230 mm long by 1740 mm wide by 150 mm thick and was provided with five 200 mm by 200 mm apertures and one 50 mm by 50 mm aperture, each penetrated with various cables and services. The floor was also provided with four circular apertures, each penetrated by a range of insulated steel and copper pipes. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 98.

**Table 98 Results summary for this test report**

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| A | Structural adequacy | -/180/30 |
| | Integrity | |
| | Insulation | |
| B | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| C | Structural adequacy | -/180/30 |
| | Integrity | |
| | Insulation | |
| D | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| E | Structural adequacy | -/30/30 |
| | Integrity | |
| | Insulation | |

| Details | Criteria | Fire resistance level (FRL) |
|---|---|---|
| F | Structural adequacy | -/120/30 |
| | Integrity | |
| | Insulation | |
| G | Structural adequacy | -/180/0 |
| | Integrity | |
| | Insulation | |
| H | Structural adequacy | -/30/0 |
| | Integrity | |
| | Insulation | |
| I | Structural adequacy | -/0/0 |
| | Integrity | |
| | Insulation | |
| J | Structural adequacy | -/240/0 |
| | Integrity | |
| | Insulation | |

## A.21 Test report – WF 359902

**Table 99 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 25 June 2014 |
| 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 section of wall had overall dimensions of 1500 mm high by 1500 mm wide by 150 mm thick and was provided with a single aperture measuring 1100 mm long by 750 mm wide. It was penetrated by eight various pipes of various sizes and compositions and a single cable tray carrying various sizes of cables as specified in Annexe B of BS EN 1366-3:2009. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 100.

**Table 100 Results summary for this test report**

| Penetration system | Details | Criteria | Fire resistance level (FRL) |
|---|---|---|---|
| A | 500 mm perforated tray | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | A1 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |

| Penetration system | Details | Criteria | Fire resistance level (FRL) |
|---|---|---|---|
| | A2 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | A3 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | B | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | C1 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | C2 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| | C3 | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| B | PEX pipe 40 mm by 4 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| C | Copper pipe 42 mm by 1.2 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| D | PVC-u pipe, 50 mm by 2.4 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| E | Copper pipe 159 mm 2 mm | Structural adequacy | -/30/0 |
| | | Integrity | |
| | | Insulation | |
| F | PVC-u pipe, 50 mm by 3.7 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| G | PEX pipe 110 mm by10 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| H | PVC-u pipe, 125 mm by 4.8 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |

| Penetration system | Details | Criteria | Fire resistance level (FRL) |
|---|---|---|---|
| I | PVC-u pipe, 125 mm by 7.4 mm | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |
| Overall seal | - | Structural adequacy | -/30/30 |
| | | Integrity | |
| | | Insulation | |

## A.22 Test report – WF 329129

**Table 101 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | FSI Limited |
| Test laboratory | Exova (UK) Ltd, Lochend Industrial Estatee, Newbridge, Midlothian EH28 8PL United Kingdom |
| Test date | The fire resistance test was done on 25 June 2014 |
| 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 drywall construction was of an overall dimension of 3000 mm wide by 3000 mm high by 100 mm thick. The framing comprised 50 mm wide galvanised mild steel studs, at maximum 600 mm centres, friction fitted into galvanised steel head and base channels. Each side of the stud frame was faced with two layers of 12.5 mm thick Gyprock Fireline plasterboard. The framework was infilled with 50 mm thick mineral wool insulation with a nominal density of 100 kg/m$^3$. The wall was provided with four apertures, each of overall nominal dimensions 600 mm high by 600 mm wide. The aperture around specimens B and D was framed and lined with a single layer of 12.5 mm thick Gyprock Fireline plasterboard. Two of the apertures was penetrated by two cable trays and two ladders, each carrying various sizes of cables as specified in Annex B of BS EN 1366-3:2009. The apertures were sealed using a range of ablative coated batt. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 102.

**Table 102 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Specimen A | | |
| Pipe 1 | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| Pipe 2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Pipe 3 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Pipe 4 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Overall seal | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| Specimen B | | |
| Pipe 1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Pipe 2 | Structural adequacy | -/90/60 |
| | Integrity | |
| | Insulation | |
| Pipe 3 | Structural adequacy | -/90/60 |
| | Integrity | |
| | Insulation | |
| Pipe 4 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Overall seal | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen C | | |
| 350 mm ladder | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| E | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| 250 mm ladder | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D3 | Structural adequacy | -/60/30 |
| | Integrity | |

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| | Insulation | |
| 450 mm perforated tray | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| A1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| A2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| A3 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| B | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| C1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| C2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| C3 | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| 500 mm non-perforated tray | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| F | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| G1 | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |
| G2 | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| I | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| H3 | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |
| Overall seal | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |
| Specimen D | | |
| 350 mm ladder | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| E | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| 250 mm ladder | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| D3 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| 450 mm perforated tray | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| A1 | Structural adequacy | -/90/90 |
| | Integrity | |
| | Insulation | |
| A2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| A3 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| B | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| C1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| C2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| C3 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| 500 mm non-perforated tray | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| F | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| G1 | Structural adequacy | -/60/30 |
| | Integrity | |
| | Insulation | |
| G2 | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |
| I | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| H3 | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |
| Overall seal | Structural adequacy | -/60/0 |
| | Integrity | |
| | Insulation | |

## A.23 Test report – 55693000.2

**Table 103 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire (Australia ) Pty Ltd |
| Test laboratory | Warringtonfire, Unit 2, 409-411 Hammond Road, Dandenong Victoria 3175, Australia |
| Test date | The fire resistance test was done on 6 August 2018 |
| Test standards | The test was done in accordance with AS 1530.4:2014 |

<table>
<tr><th>Item</th><th>Information about test report</th></tr>
<tr><td>Variation to test standards</td><td>None</td></tr>
<tr><td>General description of tested specimen</td><td>The test specimen comprised a 92 mm thick steel frame system clad with two layers of 13 mm USG Boral Firestop plasterboard on both exposed and unexposed sides. The wall cavity was filled with Fletcher Insulation Pink Partition 14 R2.2 insulation.<br>There was a 20 mm gap between the test frame and the top edge of the plasterboard, a 15 mm gap between the test frame and the vertical edge of the plasterboard, and a 10 mm gap between the test frame and the bottom edge of the plasterboard. The gaps were protected by BOSS FM300 sealant.<br>The wall system was penetrated by 12-off various pipe services and 1-off cable services. The pipe and cable services were protected by various fire protection systems. The test assembly is summarised in the table below.
<table>
<tr><th>Service No.</th><th>Service</th><th>Service size (mm)</th><th>Core hole Size (mm)</th><th>No. of service/s</th><th>Local Fire Protection</th><th>Secondary Fire protection</th></tr>
<tr><td>1</td><td>PEX/AL/PEX</td><td>Ø25</td><td>65</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>2</td><td>PEX pipe</td><td>Ø 25</td><td>65</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>3</td><td>PEX pipe</td><td>Ø 25</td><td>32</td><td>1</td><td>BOSS 32mm MaxiCollar™</td><td>FireMastic-HPE</td></tr>
<tr><td>4</td><td>CPVC pipe</td><td>Ø 50</td><td>90</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>5</td><td>PEX pipe</td><td>Ø 32</td><td>72</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>6</td><td>UPVC pipe</td><td>Ø 40</td><td>80</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>7</td><td>UPVC pipe</td><td>Ø 50</td><td>90</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>8</td><td>Galvanised pipe</td><td>Ø34</td><td>42</td><td>1</td><td>BOSS FM300</td><td>None</td></tr>
<tr><td>9</td><td>TPS cables</td><td>12 × 5.6</td><td>30</td><td>7</td><td>BOSS FM300</td><td>None</td></tr>
<tr><td>10</td><td>UPVC pipe</td><td>Ø80</td><td>120</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>11</td><td>UPVC pipe</td><td>Ø100</td><td>110</td><td>1</td><td>BOSS 100 mm MaxiCollar™</td><td>None</td></tr>
<tr><td>12</td><td>PP-R pipe</td><td>Ø63</td><td>103</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
<tr><td>13</td><td>PP-R pipe</td><td>Ø50</td><td>90</td><td>1</td><td>FireMastic-HPE</td><td>None</td></tr>
</table></td></tr>
<tr><td>Instrumentation</td><td>The test report states that the instrumentation was in accordance with AS 1530.4:2014</td></tr>
</table>

The test specimen achieved the following results – see Table 104.

**Table 104 Results summary for this test report**

| Service | Criteria | Result |
|---|---|---|
| 1 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 47 minutes |
| | FRL | -/120/30 |
| 2 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |
| | FRL | -/120/120 |
| 3 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 78 minutes |
| | FRL | -/120/60 |
| 4 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 65 minutes |
| | FRL | -/120/60 |
| 5 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 9 minutes |
| | FRL | -/120/0 |
| 6 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |
| | FRL | -/120/120 |
| 7 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |
| | FRL | -/120/120 |
| 8 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |
| | FRL | -/120/120 |
| 9 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |
| | FRL | -/120/120 |
| 10 | Structural Adequacy | - |
| | Integrity | Failure at 113 minutes |
| | Insulation | Failure at 113 minutes |
| | FRL | -/90/90 |
| 11 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | No failure at 121 minutes |

| Service | Criteria | Result |
|---|---|---|
| | FRL | -/120/120 |
| 12 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 15 minutes |
| | FRL | -/120/0 |
| 13 | Structural Adequacy | - |
| | Integrity | No failure at 121 minutes |
| | Insulation | Failure at 10 minutes |
| | FRL | -/120/0 |

## A.24 Test report – 49599300.7

**Table 105 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss fire and safety Pty Ltd |
| Test laboratory | Warringtonfire, Unit 2, 409-411 Hammond Road, Dandenong Victoria 3175, Australia |
| Test date | The fire resistance test was done on 22 February 2019 |
| Test standards | The test was done in accordance with AS 1530.4:2014 |
| Variation to test standards | None |
| General description of tested specimen | Boss FireMastic-HPE sealant protecting PE-X, PE-X AL pipes, bundle of paircoil, cables and PVC conduit penetrations in Plasterboard lined walls, concrete, Speedpanel, 75mm Hebel reinforced AAC panel and solid or hollow masonry walls. |
| 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 106.

**Table 106 Results summary for this test report**

| | Service | Fire protection | Aperture size | Wall Separating Element | FRL |
|---|---|---|---|---|---|
| A1 | Insulated paircoil, TPS cable and data cable and Up to 20 mm OD PVC conduit | Boss FireMastic-HPE sealant to a nominal Depth of 25 mm controlled by foam backing rod. Sealant finished with a nominal 25 mm fillet. | Up to 125 mm in diameter | Fire rated plasterboard lined walls,concrete,Speedpanel, 75mm Hebel or reinforced AAC panel and solid or hollow masonry walls | -/120/120 |
| A2 | TPS cable and data cable, Up to 20 mm OD PVC conduit, 3 x Up to 20 mm insulated copper pipes | | | | |
| B | Insulated paircoil, TPS cable and data cable | | Up to 100 mm in diameter | | -/120/120 |
| C | PE-X pipes Up to 20 mm OD × 2.4mm-3.0 mm pipe wall thickness | Annular gap sealed with Boss FireMastic-HPE sealant to a nominal depth of 25 mm controlled by foam | Up to 60 mm in diameter | | -/120/120 |
| D | PE-X AL pipes | | | | -/120/120 |

| | Service | Fire protection | Aperture size | Wall Separating Element | FRL |
|---|---|---|---|---|---|
| | Up to 20 mm OD × 2.8mm-3.0 mm pipe wall thickness | backing rod. Sealant flush with the face of the wall on both sides. | | | |
| E | cPVC pipes<br>Up to 43mm OD × 3.5mm pipe wall thickness | Annular gap sealed with FireMastic-HPE sealant to a nominal depth of 25 mm controlled by foam backing rod. Sealant finished with a nominal 15mm fillet with the face of the wall on both sides. | Up to 80 mm in diameter | | -/120/120 |
| F | UPVC or 'P23 NBN' pipes<br>Up to 25 mm OD × 2mm pipe wall thickness | Gap around the pipe sealed with FireMastic-HPE sealant as possible. Sealant finished with a nominal 20 mm surface fillet with the face of the wall on both sides. | 25 mm in diameter | Fire rated plasterboard lined walls,concrete,Speedpanel, 75mm Hebel or reinforced AAC panel and solid or hollow masonry walls | -/120/120 |
| G | UPVC or 'NBN' pipes<br>Up to 20 mm OD × 2mm pipe wall thickness | Gap around the pipe sealed with FireMastic-HPE sealant as possible. Sealant finished with a nominal 15mm surface fillet with the face of the wall on both sides. | 20 mm in diameter | | -/120/120 |

## A.25 Test report – 371239

**Table 107 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss fire and safety Pty Ltd |
| Test laboratory | Warringtonfire, Unit 2, 409-411 Hammond Road, Dandenong Victoria 3175, Australia |
| Test date | The fire resistance test was done on 28 September 2016 |
| 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 section of wall had overall dimensions of 1500 mm high by 1500 mm wide by 150 mm thick and was provided with six 180 mm high by 180 mm wide apertures (Specimens A to F) and a single 50 mm high by 50 mm wide aperture (Specimen G). All the apertures were sealed using a 25 mm depth of a sealant identical to Firematsic -HPE. The sealant was applied flush with each face of the wall with a 20 mm deep Rockwool backing for Specimens A to F and a 25 mm deep Rockwool backing for Specimen G. Specimens B to G carried various sizes of cables. |
| Instrumentation | The test report states that the instrumentation was in accordance with BS EN 1366-3:2009 |

The test specimen achieved the following results – see Table 108.

**Table 108 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| A | Structural adequacy | -/240/2410 |
| | Integrity | |
| | Insulation | |
| B | Structural adequacy | -/240/90 |
| | Integrity | |
| | Insulation | |
| C | Structural adequacy | -/240/90 |
| | Integrity | |
| | Insulation | |
| D | Structural adequacy | -/180/30 |
| | Integrity | |
| | Insulation | |
| E | Structural adequacy | -/240/30 |
| | Integrity | |
| | Insulation | |
| F | Structural adequacy | -/240/60 |
| | Integrity | |
| | Insulation | |
| G | Structural adequacy | -/240/60 |
| | Integrity | |
| | Insulation | |

## A.26 Test report – FSP 1791

**Table 109 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss fire and safety Pty Ltd |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde NSW 2113 Australia |
| Test date | The fire resistance test was conducted on 24 January 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 specimens comprised eight (8) services penetrating a plasterboard wall and protected by sealants. For the purpose of the test, the specimens were referenced as Specimen 1, 2, 3, 4, 5, 6,7 and 8.<br>**Specimen 1** had a 60 mm ID opening in a 90 mm thick wall – PEX cross Linked Polyethylene plumbing pipe. The service penetrated the non-exposed side by 2000 mm and the exposed side by 500 mm.<br>**Specimen 2** had an 80 mm ID opening in a 90 mm thick wall – Bundle of paircoil, uPVC drain and Cable in a One-Sided System. The PVC pipe extends 2000 mm from the non-exposed side and all pipes and cable extend 500 mm down into the wall cavity.<br>**Specimen 3** had an 80 mm ID opening in a 90 mm thick wall – Bundle of Paircoil, Power Cable and Control Cable sealed with FireMastic-HPE. The services penetrated each side of the wall by 500 mm of PVC conduit.<br>**Specimen 4** had an 80 mm ID opening in a 90 mm thick wall – Bundle of Paircoil, Power Cable and Control PVC Cable sealed with a BOSS MaxiCollar. The services penetrated each side of the wall by 500 mm.<br>**Specimen 5** had an 8 mm ID opening in a 90 mm thick wall – Single core NBN cable – marking on heath – OFS OPTICAL CABLE IO30-001E-WDW NBN CO SMOF G.657.A2 01/2016 PC9-023162001 LSZH IEC 60332-3C IEC 61034-2. The cable penetrated each side of the wall by 500 mm.<br>**Specimen 6** had a 60 mm ID opening in a 90 mm thick wall – Bundle of eight power cables.<br>**Specimen 7** had a 60 mm ID opening in a 90 mm thick wall – PEX Cross Linked Polyethylene plumbing pipe. The service penetrated the non-exposed side by 2000 mm and the exposed side by 500 mm.<br>**Specimen 8** had an 8-mm ID opening in a 90 mm thick wall – Single core fibre optic cable 20 mm protected with a fillet of FireMastic-HPE on the exposed side only. |
| 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 110.

**Table 110 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Specimen 1 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 2 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 3 | Structural adequacy | -/60/60 |

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| | Integrity | |
| | Insulation | |
| Specimen 4 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 5 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 6 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 7 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |
| Specimen 8 | Structural adequacy | -/60/60 |
| | Integrity | |
| | Insulation | |

## A.27 Test report – FSP 1833

**Table 111 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss fire and safety Pty Ltd |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde NSW 2113 Australia |
| Test date | The fire resistance test was conducted 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 | Specimen 1 – FireMastic - HPE sealant protecting a 60 mm diameter aperture penetrated by 20 mm PEX cross linked Polyethylene plumbing pipe |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2014 |

**Table 112 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Specimen 1 | Structural adequacy | -/90/90 |
| | Integrity | |
| | Insulation | |

## A.28 Test report – FSP 2053

**Table 113 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Knauf Plasterboard Pty Ltd |
| Test laboratory | Infrastructure Technologies, 14 Julius Avenue, North Ryde NSW 2113 Australia |
| Test date | The fire resistance test was conducted on 21st October 2019 |
| Test standards | The test was done in accordance with AS 1530.4:2014 |
| Variation to test standards | None |
| General description of tested specimen | Specimen 1 – A 20 mm diameter PE-Xa Rehau Rautitan pipe incorporating an elbow joint in the wall cavity penetrating a 55 mm aperture on the exposed face protected with Fire Mastic – HPE sealant |
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2014 |

**Table 114 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Specimen 1 | Structural adequacy | -/90/90 |
| | Integrity | |
| | Insulation | |

## A.29 Test report – EWFA 37995200.3

**Table 115 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | BROOKFIELD MULTIPLEX Australasia |
| Test laboratory | Exova Warringtonfire, Unit 2, 409-411 Hammond Road, Dandenong Victoria 3175, Australia |
| Test date | The fire resistance test was conducted on 14 December 2015 |
| Test standards | The test was done in accordance with AS 1530.4:2005 |
| Variation to test standards | None |
| General description of tested specimen | Specimen F:<br>• Penetrating Service:<br>– InterLINK Fire Retardant PairCoil with 9.5 mm diameter and 15.8 mm diameter copper pipe and lagging<br>– Nexans Olex WK32 2015 V90 Electric cable<br>– Electra cables 2015 EAS7501P cable V-90 RoHS<br>• Opening: 80 mm diameter<br>• Main fire stopping system:<br>– 16 mm Knauf Fireshield board with BOSS FireMastic – 300<br>• Local fire stopping system<br>– FireMastic HPE |

| Item | Information about test report |
|---|---|
| Instrumentation | The test report states that the instrumentation was in accordance with AS 1530.4:2005 |

**Table 116 Results summary for this test report**

| Service reference | Criteria | Fire resistance level (FRL) |
|---|---|---|
| Specimen 1 | Structural adequacy | -/90/90 |
| | Integrity | |
| | Insulation | |

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