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# Fire assessment report

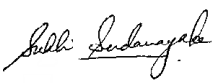
## Fire resistance performance of services protected with BOSS FirePillow 240 in accordance with AS 1530.4:2014

Sponsor: BOSS Fire & Safety Pty Ltd

Project reference number: FAS190042 Revision: R1.0

Issue date: 21 May 2020 Expiry date: 31 May 2025

# Amendment schedule

| Version | Date | Information relating to report | | | |
|---|---|---|---|---|---|
| R1.0 | Issue: 21/05/2020 | Reason for issue | Report issued to Boss Fire & Safety Pty Ltd for review and comment. | | |
| | | | Prepared by | Reviewed by | Approved by |
| | Expiry: 31/05/2025 | Name | Sukhi Sendanayake | Mahmoud Akl | Omar Saad |
| | | Signature |  |  |  |

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# General conditions of use

The data, methodologies, calculations, and results documented in this report specifically relate to the tested/assessed specimen/s and must not be used for any other purpose.



All work and services carried out by Warringtonfire Australia are subject to and conducted in accordance with our standard terms and conditions. These are available on request and at https://www.element.com/terms/terms-and-conditions.

# Executive summary

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of BOSS FirePillow 240  P40-Mak Wrap insulation wrap and FireMastic-300 sealant used as primary and secondary fire protection systems around service penetrations in wall and floor systems if tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1-2005.

The analysis conducted in section 5 to section 6 of this report found that the proposed variations are likely to achieve the fire resistance levels (FRL) shown in Table 1 and Table 2, if tested in accordance with AS 1530.4:2014.

**Table 1 Fire resistance levels of assessed systems – wall mounted specimens**

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| None | 140 mm thick concrete block wall<br>Aperture: nominal dimensions 600 mm wide (or greater) × 400 mm high | BOSS FirePillow 240 | FireMastic-300 | -/180/180 |
| 100 mm diameter copper pipe with a wall thickness of 1.8 mm | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |
| Standard configuration electrical cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |
| 50 pair 0.5 PVC indoor telephone cables | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |
| Metallic damper and duct work | Concrete wall system with an FRL greater than -/90/90 | BOSS P40-Mak Wrap | FireMastic-300 | -/90/90 |

**Table 2 Fire resistance levels of assessed systems – floor mounted specimens**

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| None | 150 mm thick concrete floor slab<br>Aperture: nominal dimensions 600 mm wide (or greater) × 400 mm high | BOSS FirePillow 240 | FireMastic-300 | -/180/180 |
| 100 mm diameter copper pipe with a wall thickness of 1.8 mm | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| Standard configuration electrical cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 | -/90/30 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |
| Standard configuration telecommunication cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 | -/120/60 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |
| Metallic damper and duct work | Concrete floor system with an FRL greater than -/120/120 | BOSS P40-Mak Wrap | FireMastic-300 | -/120/120 |

The variations and outcome of this assessment are subject to the limitations and requirements described in section 2, 4 and 7 of this report. The results of this report are valid until 31 May 2025.

# Contents

# 1. Introduction

This report documents the findings of the assessment undertaken to determine the likely fire resistance level (FRL) of BOSS FirePillow 240 fire pillows, P40-Mak Wrap insulation wrap and FireMastic-300 sealant used as primary and secondary fire protection systems around service penetrations in wall and floor systems if tested in accordance with AS 1530.4:2014[1] and assessed in accordance with AS 4072.1-2005[2]. This assessment was carried out at the request of BOSS Fire & Safety Pty Ltd. The sponsor details are included in Table 3.

**Table 3 Sponsor details**

| Sponsor | Address |
|---|---|
| BOSS Fire & Safety Pty Ltd | Unit 1,<br>16 Atkinson Road,<br>Taren Point,<br>NSW 2229,<br>Australia |

# 2. Framework for the assessment

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

No specific framework, methodology, standard or guidance documents exists in Australia for doing these assessments. Therefore, we have followed the Guide to Undertaking Assessments In Lieu of Fire Tests prepared by the Passive Fire Protection Federation (PFPF) in the UK[3].

This guide provides a framework to undertake 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*
- *Interpolation or extrapolation of results of a series of fire resistance tests, or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product*
- *Where, for various reasons – eg size or configuration – it is not possible to subject a construction or a product to a fire test.'*

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

## 2.1 Limitations of assessment

- This report is only valid for the assessed systems. Any changes with respect to size, construction details, fixings, restraints, and other configurations may invalidate the findings of this assessment.
- The supporting wall or floor construction shall be capable of providing effective support of the proposed construction for the required fire resistance period (FRL).

[1] AS 1530.4:2014: 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] AS 4072.1:2005: Standards Australia 2005, *Components for the protection of openings in fire-resistant separating element Service penetrations and control joints*, AS 4072.1:2005, Standards Australia, NSW

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

## 2.2 Declaration

The guide to undertaking assessments in lieu of fire tests prepared by the PFPF in the UK requires a declaration from the client. By accepting our fee proposal dated 22 April 2020, BOSS Fire & Safety Pty Ltd confirmed that

- To their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test by a test authority in accordance with the standard against which this assessment is being made and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information, they agree to ask the assessing authority to withdraw the assessment.

# 3. Description of the specimen and variations

## 3.1 System description

BOSS FirePillow 240 consist of woven cloth fabric cases filled with fire-retardant mineral wool / rock wool and are typically used to seal apertures with penetrating services in floor and wall systems to maintain their fire resistance. They can be used to protect a range of services such as pipes, telecommunication cables and electrical cables in cable trays and cable bundles. They are suitable for permanent or temporary fire protection as the pillows can be removed and repacked, as necessary. All fire pillows referred to as Thermachek pillows in the tests referenced for this assessment report are re-named as BOSS FirePillow 240.

According to FSP 1833, P40-Mak Wrap is a mineral fibre lagging which is 38-mm thick with a density of 40 kg/m$^3$ and foil lining on one side, typically used to enhance the insulation performance of service penetrations. Also, according to FSP 1833, BOSS FireMastic-300 sealant is an intumescent fire-rated one-part acrylic emulsion sealant.

Referenced test reports in details the fire resistance performance, in terms of integrity and insulation failure criteria, of various services (including metal pipes, Group A and B standard configurations of electrical and communication cables secured in cable trays and cable bundles) penetrating a range of fire-rated floor and wall separating elements protected by BOSS FirePillow 240, P40-Mak Wrap and FireMastic-300 sealant, amongst other fire protection systems. These reference tests are used as the basis for this assessment report.

## 3.2 Referenced test data

The assessment of the variation to the tested system and the determination of the likely performance is based on the results of the fire tests documented in the reports summarised in Table 4. Further details of the tested system are described in Appendix B.

**Table 4 Referenced test data**

| Report number | Test sponsor | Test date | Testing authority |
|---|---|---|---|
| WFRA F91876 | Budget Fire Systems Pty Ltd | 24 April 2001 | Warringtonfire Australia |
| WFRA F91879 | Budget Fire Systems Pty Ltd | 25 May 2001 | Warringtonfire Australia |
| EWFA 39693400.1 | Nilsen (NSW) Pty Ltd | 19 February 2016 | Warringtonfire Australia |
| FSP 1833 | Boss Fire & Safety Pty Ltd | 09 May 2017 | Infrastructure Technologies, CSIRO |
| FRT 180472 1.0 | Boss Fire & Safety Pty Ltd | 08 March 2019 | Warringtonfire Australia |
| EWFA 34923800.2 | Boss Fire & Safety Pty Ltd | 04 June 2015 | Warringtonfire Australia |
| FRT 180137 R2.0 | Boss Fire & Safety Pty Ltd | 07 March 2019 | Warringtonfire Australia |
| FRT 190428 R1.0 | BOSS Products (Australia) Pty Ltd | 12 December 2019 | Warringtonfire Australia |
| EWFA 55693000.2 | BOSS Fire (Australia) Pty Ltd | 06 August 2018 | Warringtonfire Australia |
| FSV 1731 | H. B. Fuller Company Australia Pty Ltd | 16 December 2015 | Infrastructure Technologies, CSIRO |
| WFRC 141438 | Firestopit.com limited | 06 October 2004 | Warringtonfire Australia |

## 3.3 Variations to tested systems

An identical system has not been subject to a standard fire test. We have therefore assessed the proposed systems using baseline test information for similar systems. The variations to the tested systems - together with the referenced baseline standard fire tests – are described in Table 5.

**Table 5 Variation to tested systems**

| Section | Reference tests | Description | Variations |
|---|---|---|---|
| 6.3.1 | WFRA F91876<br>WFRA F91879<br>EWFA 39693400.1 | In WFRA F91876, the test assembly comprised of a 140 mm thick concrete block wall with an opening of nominal dimensions 600 mm × 400 mm. In WFRA F91879, the test assembly comprised of a 150 mm thick concrete floor slab with an opening of nominal dimensions 600 mm × 400 mm. Within both apertures were an OD 100 mm copper pipe with a wall thickness of 1.8 mm, 2 of 50 pair 0.5 PVC indoor telephone cables, and a cable tray supporting the standard configuration of electrical cables. BOSS FirePillow 240 was used to protect the services. Tyco FS33 fire rated sealant was applied over the perimeter of the BOSS FirePillow 240 and the adjacent concrete element and between adjacent infill rows of BOSS FirePillow 240. The systems were attributed an FRL of -/180/180. In EWFA 39693400.1, the test specimen comprised of Group A and B standard cable configuration penetrations through a nominal 150 mm reinforced concrete floor system with a lengthwise 600 mm × 400 mm rectangular cavity. The cable trays were protected with BOSS FirePillow 240 and a sealant, Promaseal ® AN fire rated sealant. The systems were attributed FRLs of -/90/30 (Group A) and -/120/90 (Group B). | Increase in width of aperture (extended sideways), in wall and floor systems penetrated by various services and protected with BOSS FirePillow 240. |
| 6.3.2 | | | Use of alternative material to encase the core insulating material of the BOSS FirePillow 240. |
| 6.3.3 | | | Use of BOSS FirePillow 240 to protect penetrations in conjunction with other pre-existing pillow systems. |

| Section | Reference tests | Description | Variations |
|---|---|---|---|
| 6.3.4 | FSP 1833<br>FRT180472 R1.0<br>FRT180137 R2.0<br>FRT190428 R1.0<br>FSV 1731 | In test FSP 1833, P40-Mak Wrap insulation wrap and FireMastic-300 sealant were used as fire protection systems for a 19 mm diameter copper pipe, 150 mm diameter copper pipe, 32 mm diameter copper pipe, power cable, 150 mm cable tray and 300 mm wide cable tray with cable bundles penetrating a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard .The systems achieved an FRL of -/90/90 as the test was discontinued after 91 minutes.<br>In test FRT180472 R1.0, BOSS P40-Mak Wrap was wrapped around a 50 mm diameter lagged copper pipe (service A) on both the exposed and the unexposed side in conjunction with FireMastic-300 sealant. The separating element in the tested system was a 116 mm thick plasterboard wall system clad with two layers of fire-rated 13 mm CSR Fyrchek plasterboard on either side. The attributed FRL was -/120/90.<br>In test FRT180137 R2.0, the P40-Mak Wrap was wrapped around a pair Coil 16 mm + 10 mm lagged copper pipe, 25 mm uPVC conduit, 9 × TPS cables bundle, 15 × CAT6 cable bundle, 15 × Firesense cable bundle, 32 mm galvanised sprinkler pipe, and a 32 mm copper pipe protruding from a BOSS FyreBox. The test specimen consisted of a composite floor system penetrated by 9 penetration systems in total. The attributed FRL was -/120/60.<br>In FRT190428 R1.0, 150 mm diameter copper pipe was protected by 1 × 325 mm high × 360 mm wide × 50 mm thick BOSS Bulkhead Batt on the unexposed side. BOSS P40-MAK Wrap was installed on both the exposed and unexposed side. The attributed FRL was -/120/45.<br>In FSV 1731, the separating element is a 78 mm thick Speedpanel wall system, with an established FRL of -/120/120. The penetrating services were cable arrangements Group A and Group B cables in cable trays wrapped with Boss P40-Mak Wrap blanket which extended 300 mm from each side of the wall. The attributed FRLs were -/120/120 for both penetrations. | Use of BOSS P40-Mak Wrap insulation wrap to protect metallic service penetrations, ductwork and dampers in wall and floor separating elements, in conjunction with BOSS FirePillow 240. |
| 6.3.5 | WFRC 141438<br>EWFA 55693000.2<br>EWFA 34923800.2<br>FSP 1833<br>FRT180472 R1.0 | In WFRC 141438, the fire resistance test was conducted to assess the ability of eight specimens of a linear gap sealing system to reinstate the fire resistance of blockwork wall and pre-cast aerated concrete floor constructions. The floor specimen had overall nominal dimensions of 1200 mm × 1200 mm × 250 mm and was penetrated with four linear joints (specimens A to D). The wall specimen had overall nominal dimensions of 1000 mm × 1000 mm × 250 mm and was provided with four linear joints (specimens E to H). The sealant used is a pyrocoustic intumescent and acoustic sealant which is a water based acrylic sealant (with intumescent and fire-retardant properties).<br>In EWFA 55693000.2, Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboard separating element) and finished off with a 50 mm fillet on both exposed and unexposed side of the galvanized pipe penetration | The use of BOSS FireMastic-300 as a fire protecting sealant to be applied at service penetrations in wall and floor systems, in conjunction with BOSS FirePillow 240. |

| Section | Reference tests | Description | Variations |
|---|---|---|---|
| | | service (service 8). Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboards) and finished off with a 30 mm fillet on both exposed and unexposed side of the Bundle of TPS cable penetration service (service 9).<br>In EWFA 34923800.2, the specimen comprised of a 78 mm thick Speedpanel panels vertically oriented to form a vertical wall system. The wall system was penetrated by 5-off different service penetrations protected with various BOSS Collars and Mastic. The gap between the perimeter track and the Speedpanel on the bottom edge was sealed with BOSS FireMastic HPE mastic on the unexposed side and BOSS FireMastic-300 mastic on the exposed side. The gap between the perimeter track and the Speedpanel on the top edge was sealed with BOSS FireMastic-300 mastic. BOSS FireMastic-300 was used to protect the interface between the panel and the perimeter blockwork.<br>In test FRT180472 R1.0, Boss FireMastic – 300 sealant was used in the annular gap at 5 mm depth between the service and the wall and finished flush on both the exposed and the unexposed side in service A, in the annular gap at 26 mm depth (thickness of the plasterboards) between the service and the wall and finished with 50 mm × 50 mm fillet on both the exposed and the unexposed side in service G, in the annular gap at 26 mm depth (thickness of the plasterboards) between the service and the wall and finished with 20 mm × 20 mm fillet on both the exposed and the unexposed side in service D, applied as a smoke seal, finished flush on both the exposed and the unexposed side in services C,E,H and I and on the joints between the plasterboards and the concrete blockwork. | |

## 3.4 Purpose of the test

AS 1530.4:2014 sets out the methods of testing to determine the fire resistance of elements of construction when subjected to standard fire exposure conditions. Section 10 of AS 1530.4:2014 sets out the procedure to test service penetrations and control joints to assess -

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

It is not the intention of the test to provide quantitative information on the rate of leakage of smoke and/or hot gases or on the transmission or generation of fumes. Such phenomena are only to be noted in describing the general behaviour of specimens during the test.

AS 4072.1-2005 sets out the minimum requirements for the construction, installation and application of fire resistance tests to sealing systems around penetrations through building elements that are required to have a fire resistance level (FRL) or, if applicable, a resistance in the incipient spread of fire. The Standard is to be applied in conjunction with AS 1530.4:2014 which provides the applicable test methods.

## 3.5 Schedule of components

Table 6 and Table 7 outline the schedule of components for the assessed system/s subject to a fire test, as referenced in Appendix A.

**Table 6 Schedule of components of assessed systems for BOSS FirePillow 240 (test report EWFA 39693400.1)**

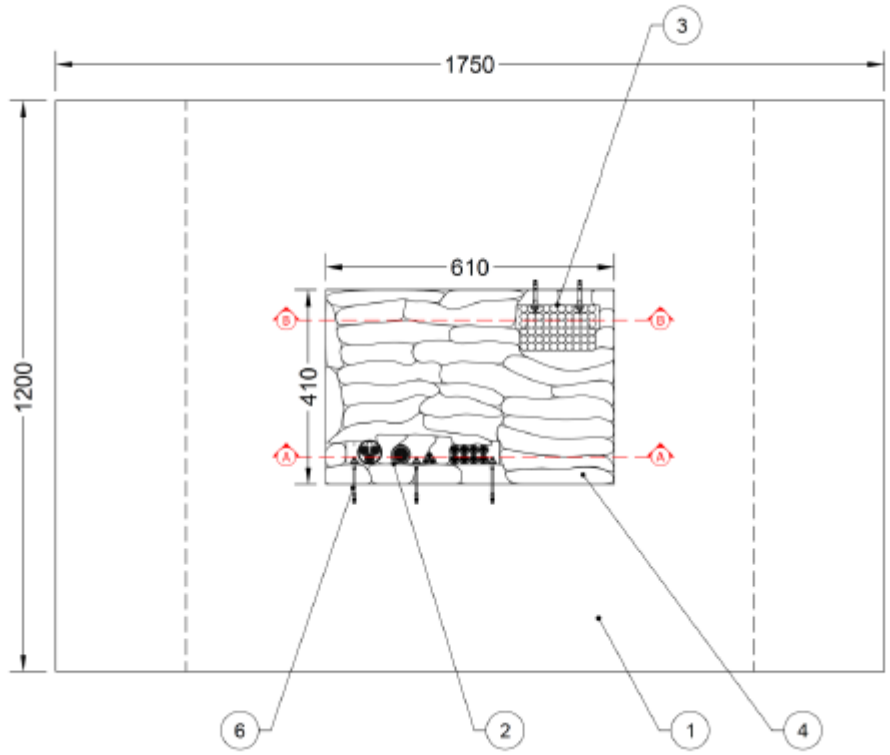
| Item | Description | |
|---|---|---|
| **Separating element** | | |
| 1. | Product name | 150 mm thick steel reinforced concrete floor slab with 600 × 400 mm aperture at the centre of the slab |
| | Density | 2400 kg/m$^3$ |
| **Services** | | |
| 2. | Item name | Group A – Standard configuration Electrical Cable Tray |
| | Product name | Cable tray used is EZY STRUT ET3-300-3 |
| 3. | Item name | Group B – Standard configuration Communications Cable Tray |
| | Product name | Cable tray used is EZY STRUT ET3-150-3 |
| **Fire-stopping protections** | | |
| **Fire Pillow** | | |
| 4. | Product name | Thermachek pillows (also known as BOSS FirePillow 240) |
| | Pillow dimensions | Type 100: 100 mm × 200 mm × 40 mm (Measured), Mass = 0.1295 kg<br>Type 200: 200 mm × 200 mm × 50 mm (Measured), Mass = 0.3080 kg<br>Type 300: 300 mm × 200 mm × 60 mm (Measured), Mass = 0.5125 kg |
| **Sealant** | | |
| 5. | Product name | Promaseal® AN Fire Rated sealant |
| | Installation | Sealant was used to fix the pillows, and applied length wise along the 200 mm edge. The sealant was used to fix pillows to the separating element and to fill in gaps between pillows and services. |
| | **OR** | |
| | Product name | BOSS FireMastic – 300™ |
| | Installation | Sealant was used to fix the pillows, and applied length wise along the 200 mm edge. The sealant was used to fix pillows to the separating element and to fill in gaps between pillows and services. |
| **Fixings** | | |
| 6. | Product name | Dynabolts – SA10075 |
| | Size | 75 mm × 10 mm diameter Dynabolts |

**Table 7 Schedule of components of assessed systems for P40-Mak Wrap insulation wrap (test report FSP 1833)**

| Item | Description | |
|---|---|---|
| **Separating element** | | |
| 1. | Product name | 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides. |
| | FRL | -/90/90 |
| **Sealant** | | |

| Item | Description | |
|---|---|---|
| 2. | Product name | BOSS FireMastic – 300™ |
| | Installation | Sealant was used to fix the pillows, and applied length wise along the 200 mm edge. The sealant was used to fix pillows to the separating element and to fill in gaps between pillows and services. |
| **Services** | | |
| 3. | Item name | Copper pipe with an OD of 19.05 mm |
| | **OR** | |
| | Item name | Bundle of 60 cables (each 14 mm in diameter) secured on a 150 mm cable tray |
| | **OR** | |
| | Item name | Copper pipe with an OD of 150 mm |
| | **OR** | |
| | Item name | Three and eight bundle of cables on a steel cable tray |
| | **OR** | |
| | Item name | Copper pipe with an OD of 31.75 mm |
| **Wrap** | | |
| 4. | Item name | Insulation wrap |
| | Product name | BOSS P40-MAK Wrap |
| | Overall size | 300 mm wide × 38 mm thick |
| | Mineral fibre wool density | 40 kg/m$^3$ |
| | Installation | The wrap is wrapped around services on both the exposed and unexposed sides in wall systems and on the unexposed side in floor systems. The wrap is secured with metal wire at approximately 50 mm and 250 mm from the separating element. |

Figure 1 to Figure 9 shows selected tested systems.




1: Steel reinforced concrete slab

2: Group A – Electrical cable tray

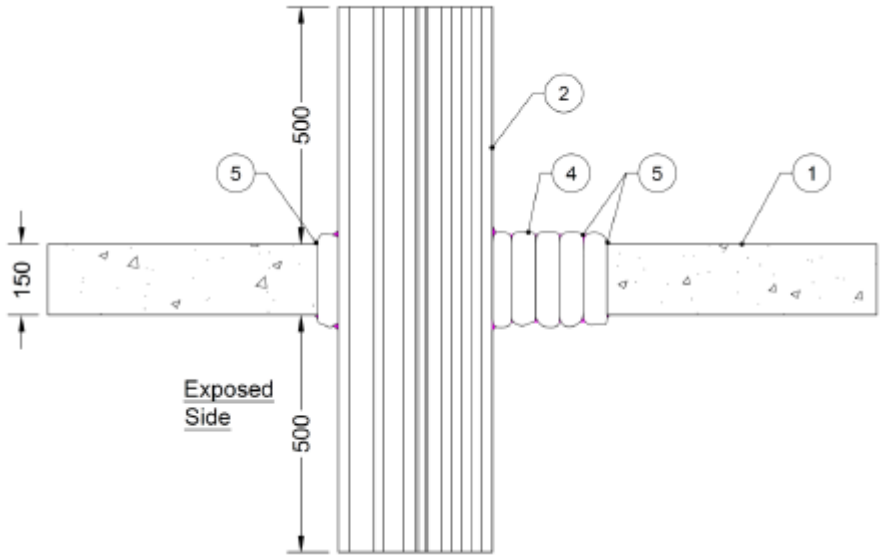
3: Group B – Communications cable tray

4: Thermachek – P4 fire pillow (also known as BOSS FirePillow 240)

5: Promaseal® AN fire rated sealant

6: Dynabolt fixings (SA10075)

**Figure 1 Plan view of tested system in EWFA 39693400.1 with Thermacheck fire pillow (also known asBOSS FirePillow 240) arranged longitudinally protecting Group A and Group B cable penetrations**




1: Steel reinforced concrete slab

2: Group A – Electrical cable tray

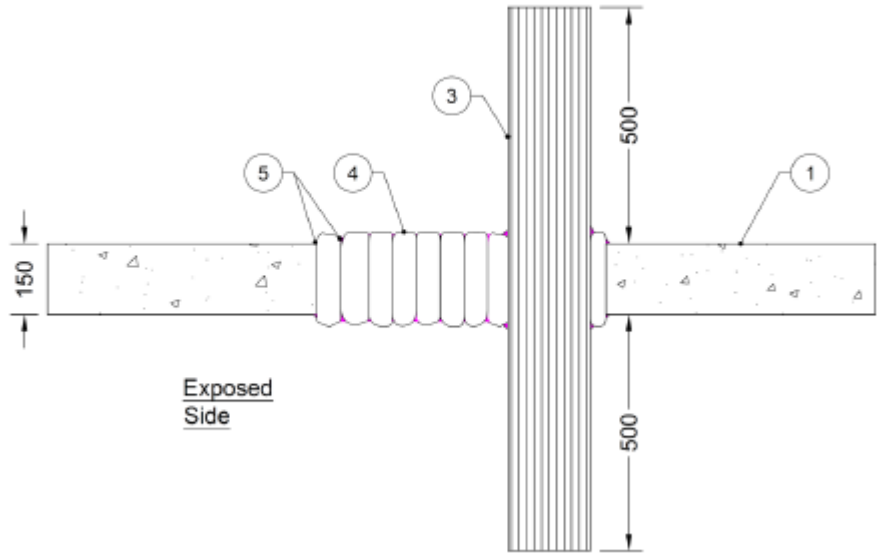
3: Group B – Communications cable tray

4: Thermachek – P4 fire pillow (also known as BOSS FirePillow 240)

5: Promaseal® AN fire rated sealant

6: Dynabolt fixings (SA10075)

**Figure 2 Section A-A of tested system in EWFA 39693400.1 with Thermacheck fire pillow (also known as BOSS FirePillow 240) arranged longitudinally protecting Group A and Group B cable penetrations**




1: Steel reinforced concrete slab

2: Group A – Electrical cable tray

3: Group B – Communications cable tray

4: Thermachek – P4 fire pillow (also known as BOSS FirePillow 240)

5: Promaseal® AN fire rated sealant

6: Dynabolt fixings (SA10075)

**Figure 3 Section B-B of tested system in EWFA 39693400.1 with Thermacheck fire pillow (also known asBOSS FirePillow 240) arranged longitudinally protecting Group A and Group B cable penetrations**

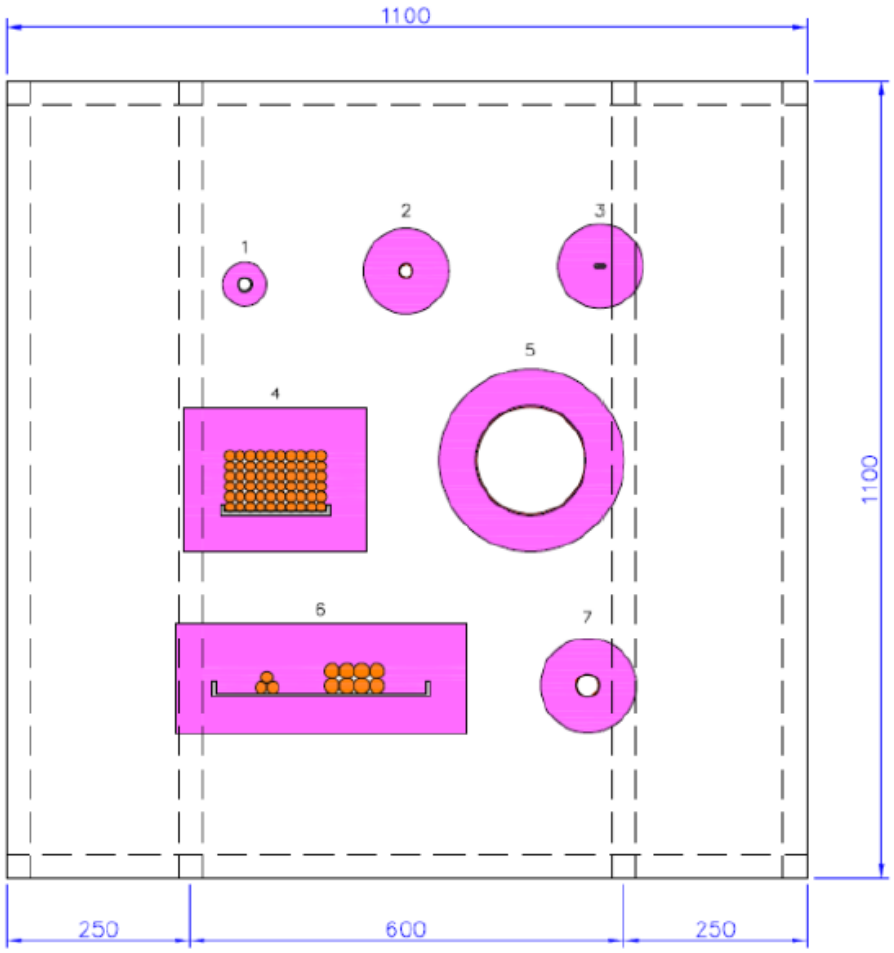



**Figure 4** **Plan view of service penetrations in test report FSP 1833. Specimens 2, 4, 5, 6 and 7 were installed with the BOSS P40-Mak Wrap**

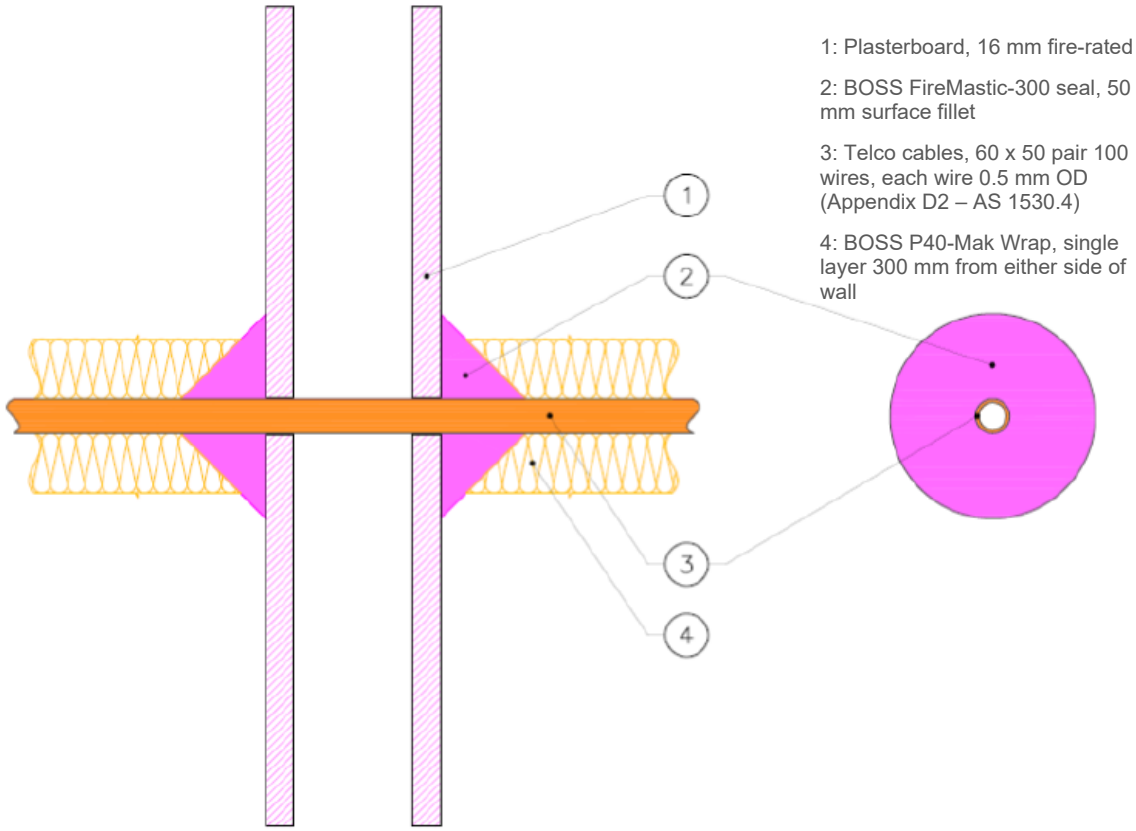



**Figure 5** **Specimen 2 in test report FSP 1833 - copper pipe with an OD of 19.05 mm penetrating a plasterboard wall system**

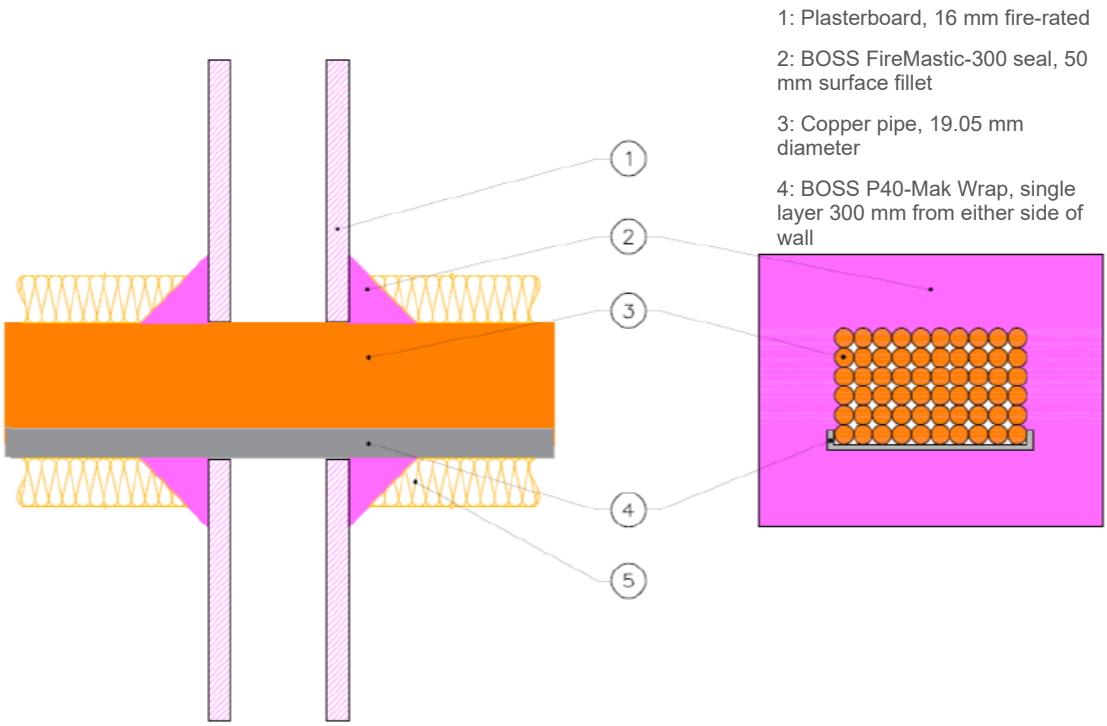



**Figure 6** **Specimen 4 in test report FSP 1833 - a bundle of 60 cables (each 14 mm in diameter) secured on a 150 mm cable tray penetrating a plasterboard wall system**

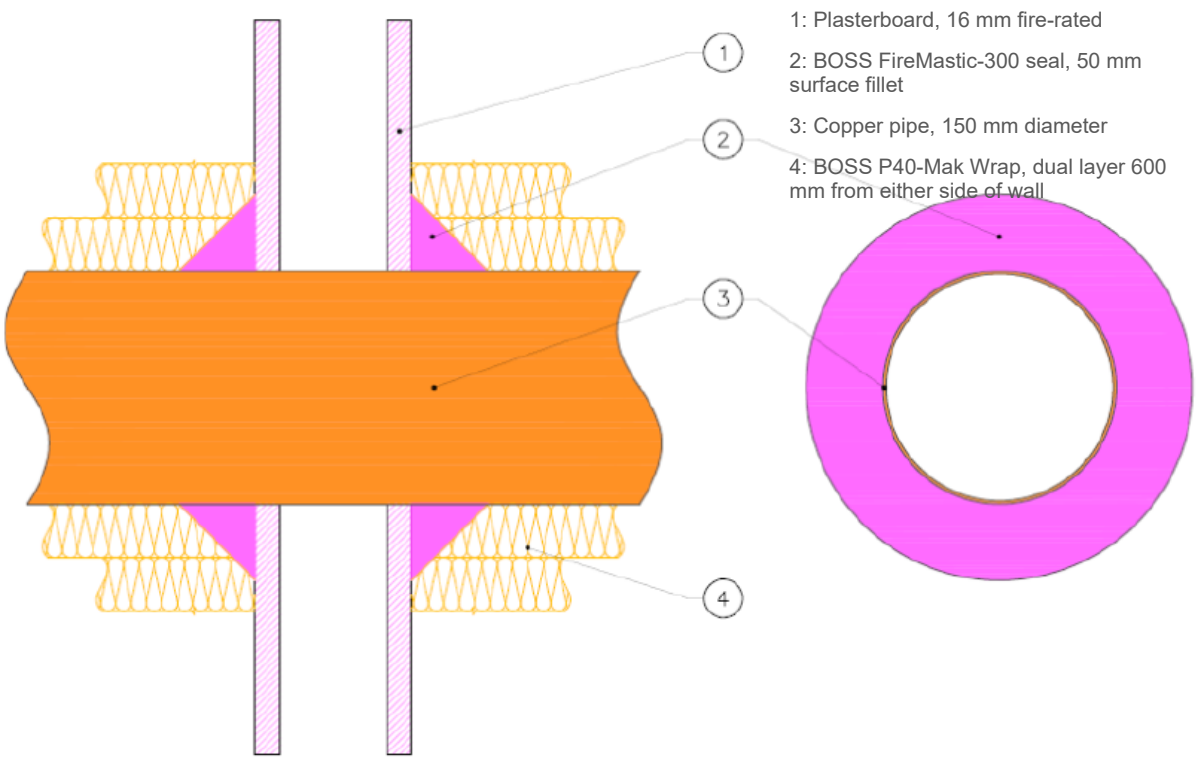



**Figure 7** **Specimen 5 in test report FSP 1833 - 150 mm OD copper pipe penetrating a plasterboard wall system**

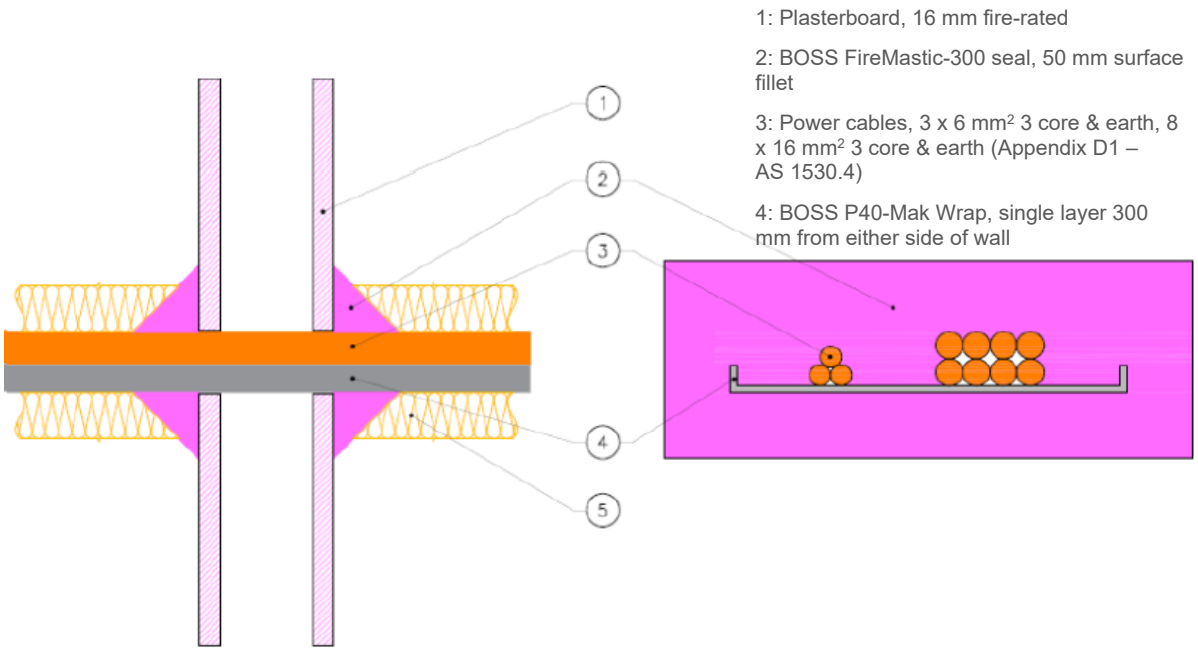



**Figure 8** **Specimen 6 in test report FSP 1833 - a set of three and eight bundle of cables on a steel cable tray penetrating a plasterboard wall system**

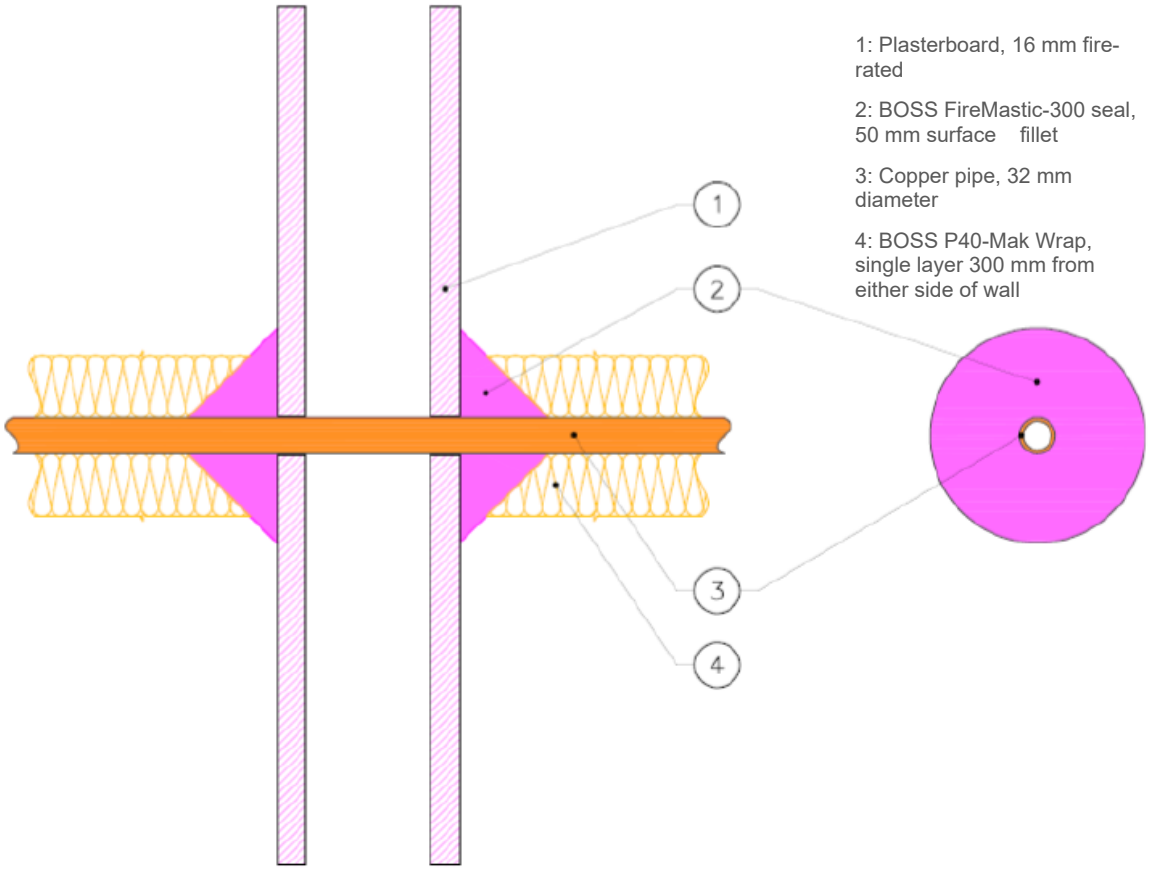



**Figure 9 Specimen 7 in test report FSP 1833 - 31.75 mm OD copper pipe penetrating a plasterboard wall system**

# 4. Scope, objective and assumptions

- The scope of this report is limited to an assessment of the variations to the tested systems described in section 3.3.
- This report details the methods of construction, test conditions and assessed results that would have been expected if the specific elements of construction described here had been tested in accordance with AS 1530.4:2014.
- The results of this assessment are applicable to penetration systems for similar methods of construction as tested in accordance with AS 1530.4:2014 and assessed in accordance with AS 4072.1-2005.
- This report is only valid for the assessed system/s. 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 be needed to verify consistency with the assessment in this report.
- The data, methodologies, calculations and conclusions documented in this report specifically relate to the assessed system/s and must not be used for any other purpose.
- The drawings and information that forms the basis for this report is listed in Appendix A.
- This report has been prepared based on information provided by others. Warringtonfire has not verified the accuracy and/or completeness of that information and will not be responsible for any errors or omissions that may be incorporated into this report as a result.

# 5. Assessment 1 – Applicability of test data in accordance with AS 1530.4:2014

## 5.1 Description of variation

The tests referenced for this assessment report are detailed in Appendix B. In particular, tests described in test reports WFRA F91876 and WFRA F91879 were conducted in accordance with AS 1530.4:1997 while test reports EWFA 39693400.1, EWFA 34923800.2 and EWFA 55693000.2 were based on AS 1530.4:2005. The test in WFRC 141438 was conducted in accordance with BS 476.20:1987.

The proposed variations in this assessment report are assessed to determine their likely fire resistance performance if tested in accordance with AS 1530.4:2014. Since the above-mentioned standards differ from AS 1530.4:2014, the effect these differences have on the fire resistance performance of the test specimens and the applicability of the test data in accordance with AS 1530.4:2014 are discussed below.

## 5.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 8.

**Table 8 Method of assessment**

| Assessment method | |
|---|---|
| Level of complexity | Intermediate assessment |
| Type of assessment | Comparative between test standards |

## 5.3 Relevance of AS 1530.4:1997 test data to AS 1530.4:2014

### 5.3.1 Furnace temperature regime

AS 1530.4:2014 specifies furnace temperature to follow the following trend:

$$T_{AS153.04-2014} = 345log_{10}(8t + 1) + 20$$

Where T = furnace temperature at time *t*, in degrees centigrade

t = time into the test, measured from the ignition of the furnace, in minutes

AS 1530.4:1997 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-1997} = 345log_{10}(8t + 1) + T_0, 10°C \leq T_0 \geq 40°C$$

Where T = furnace temperature at time *t*, in degrees centigrade

$T_0$ = initial furnace temperature, in degrees Celsius, not less than 10°C nor more than 40°C

t = time into the test, measured from the ignition of the furnace, in minutes

The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and AS 1530.4:1997 are not appreciably different.

### 5.3.2 Furnace pressure regime

AS 1530.4:2014 specifies that a pressure of 20 ± 3 Pa shall be maintained in the horizontal plane 100 mm below the underside of the slab for horizontal elements and that a pressure of zero is established at a height of 500 mm above the notional floor level for vertical elements.

In test WFRA F91879, the furnace pressure was measured at a position approximately 100 mm below the slab soffit and it was maintained at approximately 20 Pa above the laboratory atmospheric pressure for the duration of the test.

In test WFRA F91876, the pressure was maintained at approximately 15 Pa above the laboratory atmospheric pressure at the underside of the cable tray (services D - G) which is approximately 550 mm from the notional floor level. This is potentially more onerous than the pressure conditions recommended in AS 1530.4:2014 and so the tested specimens will perform more favourably if retested with AS 1530.4:2014.

### 5.3.3 Specimen temperature measurement

AS 1530.4:2014 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless-steel sheaf, having a wire diameter not exceeding 0.5 mm and an overall diameter of 3 mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12 mm diameter × 0.2 mm thick copper disc. The disc shall be covered by 30 ± 0.5 mm × 30 ± 0.5 mm × 2.0 ± 0.5 mm thick inorganic insulating pad with a density of 900 ± 100 kg/m³.

AS 1530.4:1997 specifies specimen thermocouples as Type K, MIMS thermocouples with a stainless-steel sheaf, having a wire diameter not exceeding 0.5 mm and an overall diameter of 3 mm. The thermocouples shall be supported by a heat-resisting tube with the measuring junction protruding a minimum 25 mm. Each thermocouple shall have the tail of its measuring junction soldered to the centre of a 12 mm diameter × 0.2 mm thick copper disc. The disc shall be covered by an oven-dry pad, no less than 30 mm square, made from material of a value √(kpc) not greater than 600 at 150°C, and of such thickness as to give a thermal resistance (R = t/K) of 0.015 K/W – 0.025 K/W at 150°C.

For control joints installed in horizontal separating elements, AS 1530.4:2014 requires thermocouples to be located as follows:

- At least three on the surface of the seal with one thermocouple for each 0.3 $m^2$ of surface area, up to a maximum of five uniformly distributed over the area (one thermocouple being located at the centre of the seal).
- On the surface of the seal 25 mm from the edge of the opening, with one thermocouple from each 500 mm of the perimeter.
- Thermocouples used for the evaluation of the insulation performance of control joints shall be positioned on the unexposed face of the sealing system and the separating element, except where the unexposed face of the seal is recessed within the separating element. Where this occurs, thermocouples shall only be fitted to the seal when the joint width is greater than or equal to 12 mm. Under these circumstances, the size of the pad may be reduced to facilitate the fitting of the thermocouple.

AS 4072.1-2005 requires thermocouples used for the evaluation of the insulation performance of control joints shall be positioned on the unexposed face of the sealing system and adjacent separating element, except where the unexposed face of the seal is within the separating element. Where this occurs, thermocouples shall only be fitted to the seal when the joint width is greater than the distance of the seal from the non-fire side of the specimen.

Based on the above discussion, it is considered that the insulation performance of specimens tested in WFRA F91876 and WFRA F91879 can be used to assess the performance in accordance with AS 1530.4:2014.

### 5.3.4 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

AS 1530.4:2014 deems integrity failure to have occurred upon collapse, sustained (10 seconds) flaming, ignition of an applied cotton pad or if a 6 mm gap gauge can protrude into the furnace and can be moved 150 mm along the gap, or if a 25 mm gap gauge can protrude into the furnace.

AS 1530.4:1997 deems integrity failure to occur upon collapse, the development of cracks, fissures, or other openings through which flames or hot gases can pass. Apart from the above variation, the failure criteria for integrity in AS 1530.4:2014 and AS 1530.4:1997 are not appreciably different.

According to reported observations in WFRA F91876, at around 148 mins, the outer sheath of services G, E and F near the PVC cable tie closest to the fire pillows melted and a gap of approximately 20 mm was created exposing the conductor core and smoke was emitted from this region. The smoke may have been a product of the reaction due to the expansion of the intumescent sealant to fill in the created gap and would not have warranted the application of a cotton pad. Further confidence is reached due to the insulation performance of the specimen being maintained until the end of the test with no peaks in any specimen thermocouples. This means that the gaps formed did not extend from the exposed side and does not indicate an integrity failure. There were no other observations made for the specimen relevant to this assessment in WFRA F91876 and WFRA F91879 which are considered likely to have warranted the application of a cotton pad.

#### Insulation

The insulation criteria specified in AS 1530.4:2014, the same as those specified in AS 1530.4:1997.

### 5.3.5 Discussion

With regards to the relevance of test data obtained in accordance with AS 1530.4:1997, the minor variations in furnace heating regimes and specimen thermocouple specifications in comparison to AS 1530.4:2014 are not considered likely to significantly affect the behaviour of the specimens relevant to this assessment, based on the discussions provided.

## 5.4 Relevance of AS 1530.4:2005 test data to AS 1530.4:2014

### 5.4.1 Furnace temperature regime

The furnace heating regime in fire resistance tests conducted in accordance with AS 1530.4:2014 follows a similar trend to that in AS 1530.4:2005. The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.4.2 Furnace pressure regime

The furnace pressure conditions for single and multiple penetration sealing systems in AS 1530.4:2005 and AS 1530.4:2014 are not appreciably different.

The parameters outlining the accuracy of control of the furnace pressure in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.4.3 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

AS 1530.4:2014 stipulates in addition to the 20 mm thick × 100 mm × 100 mm cotton pads, additional cotton pads shall be provided with a reduced 30 mm × 30 mm × 20mm with additional wire frame holder and shall be used to determine integrity failure.

Apart from the above variation, the failure criteria for integrity in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

#### Insulation

The positions of thermocouples and failure criteria for insulation in AS 1530.4:2014 and AS 1530.4:2005 are not appreciably different.

### 5.4.4 Discussion

Based on the above discussion and in absence of any foreseeable integrity and insulation risk, it is concluded that the results relating to the integrity and insulation performance of the specimens tested in accordance with AS 1530.4:2005 can be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

## 5.5 Relevance of BS 476.20:1987 test data to AS 1530.4:2014

### 5.5.1 Furnace regime

The furnace temperature regime for fire resistance tests conducted in accordance with AS 1530.4:2014 follows a similar trend to BS 476.20:1987. The parameters outlining the accuracy of control of the furnace temperature in AS 1530.4:2014 and BS 476.20:1987 are not appreciably different.

### 5.5.2 Furnace thermocouples

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

The furnace thermocouple types in BS 476.20:1987 shall be one of the following two types:

- Bare nickel chromium/nickel aluminium wires – 0.75 mm to 1.5 mm in diameter – welded or crimped together at their ends and supported and insulated from each other in a twin bore porcelain insulator. However, for 25 mm approximately from the weld/crimp, the wires shall be exposed and separated from each other by at least 5mm (to be replaced or recalibrated after six hours of usage).
- Nickel chromium/nickel aluminium wire contained within mineral insulation in a heat resisting steel sheath of diameter 1.5mm; the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall project 25mm from a porcelain insulator. The assembly shall have a response time on cooling in air, not greater than 30 seconds.

The relative distance of the furnace thermocouples from the exposed face of the specimen – for both AS 1530.4:2014 and BS 476.20:1987 – is 100 mm + 10 mm.

### 5.5.3 Furnace pressure

It is a requirement of AS 1530.4:2014 that for vertical elements a furnace gauge pressure of zero (0) Pa is established at a height 500 mm above the notional floor level. For horizontal elements a furnace pressure of 20 Pa is established at 100 mm below the underside of the test specimen.

For BS 476.20:1987 – for vertical elements – the neutral axis is maintained at a height of 1000 mm. For horizontal elements the pressure is 20 Pa at a point 100 mm below the soffit of the floor assembly.

Therefore, based on an average pressure gradient of 8.0 Pa/m, at a particular height above the notional floor level, AS 1530.4:2014 requires the pressure to be approximately 4 Pa higher than BS 476.20:1987 for vertical elements.

### 5.5.4 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

For uninsulated specimens – or for specimens that have exceeded their insulation criteria performance – the specimen shall be deemed to have failed the integrity criterion in accordance with AS 1530.4:2014 if it sustains flaming for 10 seconds, if a gap forms that allows the penetration of a 25 mm diameter gap gauge anywhere on the specimen, or if a gap forms that allows a 6 mm × 150 mm gap gauge to penetrate the specimen anywhere on the specimen.

The integrity criteria for BS 476.20:1987 are similar.

#### Insulation

The thermocouple locations for measuring insulation in AS 1530.4:2014 and BS 476.20:1987 are different. AS 1530.4:2014 specifically nominates positions for maximum temperature rise of the thermocouple, though this allows the application of a roving thermocouple anywhere on the specimen. In BS 476.20:1987, there is a requirement to measure temperatures at specified minimum number of locations, with additional thermocouples fitted at the discretion of the laboratory. Similarly, a roving thermocouple can be applied at any location.

The failure criteria for insulation in AS 1530.4:2014 and BS 476.20:1987 are not appreciably different except for the positioning of thermocouples as noted above.

### 5.5.5 Discussion

With regards to the relevance of test data obtained in accordance with BS 476.20:1987, the variations in furnace heating regimes, 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 test.

The variations in furnace pressure conditions can theoretically be more onerous and could affect the performance of the test specimens. In particular, the upper area of the specimen after the formation of gaps, cracks or fissures. As no gaps formed in the specimen described in test WFRC No. 141438 prior to 300 minutes, it is considered in this case that the difference in furnace pressure would not have a significant effect on the test results until that time.

## 5.6 Conclusion

Based on the above and in absence of any foreseeable detrimental effects it is considered that the results of the referenced test can otherwise be used to assess the integrity and insulation performance in accordance with AS 1530.4:2014.

Therefore, based on the above, it is considered that the integrity and insulation behaviour of the specimens tested in the tests referenced in Appendix B can be used to assess the likely performance of the proposed systems if the specimens were tested in accordance with AS 1530.4:2014.

# 6. Assessment 2 – Assessment of specific variations

## 6.1 Description of variation

This assessment was undertaken to determine the likely performance of the system with the proposed variations based on the tests referenced in Appendix B, if tested in accordance with AS 1530.4:2014 sections 2 and 10.

The variations to the tested systems are:

- Increase in width of aperture (extended sideways), in wall and floor systems penetrated by various services and protected with BOSS FirePillow 240.
- Use of alternative material to encase the core insulating material of the BOSS FirePillow 240.
- Use of BOSS FirePillow 240 to protect penetrations in conjunction with other pre-existing pillow systems.
- Use of BOSS P40-Mak Wrap insulation wrap to protect metallic service penetrations, ductwork and dampers in wall and floor separating elements, in conjunction with BOSS FirePillow 240.
- The use of BOSS FireMastic-300 as a fire protecting sealant to be applied at service penetrations in wall and floor systems, in conjunction with BOSS FirePillow 240.

All fire pillows referred to as Thermachek pillows in the referenced tests are re-named as BOSS FirePillow 240.

## 6.2 Methodology

The approach and method of assessment used for this assessment is summarised in Table 8.

**Table 9 Method of assessment**

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

## 6.3 Assessment

### 6.3.1 Increasing the width of the aperture in the separating element

The proposed construction shall be as tested in WFRA F91876, WFRA F91879 and EWFA 39693400.1 with the aperture width proposed to be extended greater than the 600 mm tested.

In WFRA F91876, the test assembly comprised of a nominal 1300 mm wide × 1350 mm high × 140 mm thick concrete block wall with an opening of nominal dimensions 600 mm × 400 mm. In WFRA F91879, the test assembly comprised of a nominal 1750 mm long × 1200 mm wide × 150 mm thick concrete floor slab with an opening of nominal dimensions 600 mm × 400 mm. Within both apertures were an OD 100 mm copper pipe with a wall thickness of 1.8 mm, 2 of 50 pair 0.5 PVC indoor telephone cables, and a cable tray supporting the standard configuration of electrical cables recommended by AS 4072.1-1992. Thermachek fire pillows, also known as BOSS FirePillow 240 (of three dimensions: 300 × 200 × 55 mm; 200 × 200 × 35 mm and 200 × 100 × 30 mm) were used to protect the aperture and were laid longitudinally across the long direction of the opening and aligned in rows. The cable tray and copper pipe were provided with 0.5 mm thick steel radiation guards that were offset 50 mm from their respective services. Tyco FS33 fire rated sealant is applied at a nominal depth of 2 mm over the perimeter of the Thermachek fire pillows (BOSS FirePillow 240) and the adjacent concrete element. The voids between adjacent infill rows of Thermachek fire pillows (BOSS FirePillow 240) were backfilled with Tyco FS33 sealant to a depth of nominally 25 mm, flush with the concrete block surface. The systems were attributed an FRL of -/180/180.

In EWFA 39693400.1, the test specimen comprised of Group A and B standard cable configuration penetrations through a nominal 1750 mm × 1200 mm × 150 mm reinforced concrete floor system with a lengthwise 600 mm × 400 mm rectangular cavity. The cable trays were protected by a layer of Thermachek – P4 fire pillows (BOSS FirePillow 240) and a sealant. Three pillow dimensions were used: 100 × 200 × 40 mm, 200 × 200 × 50 mm, and 300 × 200 × 60 mm. The pillows were used to fill remaining space in aperture. Promaseal ® AN fire rated sealant was applied between pillows, along the 200 mm edge and it was used to fix the pillows to the concrete slab all around the perimeter of the cavity. Sealant was also used to fill in gaps between pillows and cable trays. The system was attributed FRLs of -/90/30 and -/120/90 for the Group A and Group B cable penetrations respectively. According to observations and temperature measurements, the main failure in the Group A specimen occurred on the cables. Considering thermocouples 041, 042 and 043 on the Thermachek pillows (BOSS FIrePiloow 240), it can be seen that the temperatures did not exceed a rise of more than 80°C and the temperature curves plateaued after about 40 minutes with no further increase. Also, no gaps, fissures or smoke emittance from the fire pillows were observed. This, and evidence from WFRA F91876 and WFRA F91879 suggests that the fire pillows can sustain a higher fire resistance performance in a service penetration system with a higher FRL.

When fire pillows are packed between a service penetration and the separating element, the gap remains sealed due to the compression between the fire pillows. Therefore, widening the aperture to greater than the 600 mm tested would not affect the fire protection provided by the BOSS FirePillow 240, provided that the required pillow compression can be maintained, by increasing the number of pillows of appropriate size inserted into the aperture laid longitudinally across the long direction of the opening and aligned in rows, similar to as tested. The additional fire pillows should not be oriented differently to the originally inserted fire pillows as that may result in unsealed gaps that can lead to early integrity failure. A fire-rated sealant with an established FRL, similar to the tested Tyco FS33 or Promaseal ® AN, should be applied to over the perimeter of the BOSS FirePillow 240 and the separating element, around any voids or recesses around the penetrations and to any gaps between the fire pillows to a depth of nominally 25 mm, flush with the surface of the concrete element. Such a fire protection system can, therefore, be attributed an FRL of -/180/180.

### 6.3.2 The use of an alternative material to encase BOSS FirePillow 240

It is proposed to use an alternative material to encase the core insulating material of the BOSS FirePillow 240. According to test EWFA 39693400.1, the Thermachek fire pillows (also known as BOSS FirePillow 240) are comprised of woven cloth fabric cases filled with mineral wool. The original material used in the tested specimens was plain calico or unbleached cotton. It is proposed to replace this with 100% cotton drill and PVC coated polyester material.

Both plain calico and cotton drill materials allow the flow of air around the fabric which result in high flammability and their reaction to fire on the exposed side will be similar. When exposed to fire, the proposed cotton casing will burn while the PVC coated polyester material will melt and contribute to the burning. However, the protection of the service penetrations will continue with the encased insulating material and the sealing of the voids, gaps or recesses by the adequate type and amount of fire-rated sealant. Therefore, changing the encasing fabric to 100% cotton drill and PVC coated polyester material would not detrimentally affect the FRL attributed to the fire pillows as tested.

### 6.3.3 Use of fire pillows in conjunction with existing pillow systems

BOSS FirePillow 240 used in conjunction with pre-existing pillow systems may achieve the same FRL as the tested systems referenced in WFRA F91876, WFRA F91879 and EWFA 39693400.1, provided that the existing pillow systems have an established FRL that is the same or greater than the FRL obtained for BOSS FirePillow 240. This applies to additional fire pillows are inserted in the same orientation as the pre-existing pillows and packed so as to maintain the compression forces between the pillows with all gaps sealed with a fire-rated sealant with an established FRL, similar to the tested Tyco FS33 or Promaseal ® AN, applied over the perimeter of the BOSS FirePillow 240 and the separating element, around any voids or recesses around the penetrations and to any gaps between the fire pillows to a depth of nominally 25 mm, flush with the surface of the concrete element. All gaps between pillows should be minimized as gaps can cause hot gasses to escape and result in the specimen failing in integrity earlier.

### 6.3.4 P40-Mak Wrap insulation wrap for metallic services

#### Discussion

In test FSP 1833, P40-Mak Wrap insulation wrap and FireMastic-300 sealant were used as fire protection systems for a 19 mm diameter copper pipe, 32 mm diameter copper pipe, 150 mm diameter copper pipe, , power cable, 150 mm cable tray and 300 mm wide cable tray with cable bundles penetrating a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. The 32 mm and 150 mm copper pipes were lagged with Boss P40-Mak Wrap, wrapped twice around the pipes, and extended 300 mm from the exposed side and 600 mm from the unexposed side, flush with the FireMastic-300. The other penetrations (19 mm copper pipe and cable bundles secured on a cable tray) were wrapped twice with the insulation wrap and extended out 300 mm from the FireMastic-300 on both sides of the wall. The systems achieved an FRL of -/90/90 as the test was discontinued after 91 minutes during which no sign of gaps formation or flaming was observed which could have caused an integrity or insulation failure. The significance of this test result is that it indicates that the integrity and insulation performances of P40-Mak Wrap and FireMastic-300 sealant in this test are likely limited by the established FRL of the 96 mm thick plasterboard wall system.

In test FRT180472 R1.0, BOSS P40-Mak Wrap was wrapped around a 50 mm diameter lagged copper pipe (penetration system A) on both the exposed and the unexposed sides in conjunction with FireMastic-300 sealant. The main fire protection was provided by a BOSS 100 mm MaxiCollar™ Collar. The separating element in the tested system was a 116 mm thick plasterboard wall system clad with two layers of fire-rated 13 mm CSR Fyrchek plasterboard on either side. The attributed FRL was -/120/90. According to observations, the insulation failure occurred on the collar body with a temperature of 206°C measured with a roving thermocouple. All other thermocouples placedon the specimen showed no failure in insulation in accordance with AS 1530.4:2014. According to the temperature vs time profiles plotted in the test report for FRT180472 R1.0, the temperature did not rise by more than approximately 80°C in any specimen thermocouple. This is especially evident on and around the insulation wrap. In this test, the insulation failure of the fire collar is likely to have contributed to the insulation failure in the entire tested specimen without any detrimental effects measured or observed due to the P40-Mak Wrap. No integrity failure was observed throughout the test.

In test FRT 180137 R2.0, Penetration system E consisted of a 150 mm wide × 150 mm high × 270 mm deep BOSS Fire Multi-Service Cable & Pipe transit (BOSS FyreBox) which was inserted into the aperture and secured to the separating element (composite concrete floor) with 20 mm × 40 mm angle on the unexposed side. The annular gap between the BOSS FyreBox and the separating element was filled with BOSS FireMastic – 300. The P40-Mak Wrap was wrapped up to 300 mm from the separating elements on the unexposed side around a pair Coil 16 mm + 10 mm lagged copper pipe, 25 mm uPVC conduit, 9 × TPS cables bundle, 15 × CAT6 cable bundle, 15 × Firesense cable bundle, 32 mm galvanised sprinkler pipe, and a 32 mm copper pipe protruding from the BOSS FyreBox. The test specimen consisted of a composite floor system (1830 mm × 1590 mm × 130 mm) penetrated by 9 penetration systems. The attributed FRL was -/120/60. TC 040 on the separating element recorded a temperature of 204°C exceeding the initial temperature by more than 180°C. The graphs of the temperature profiles with time of the specimen thermocouples on the BOSS FyreBox, P40-Mak Wrap and all included services showed maximum temperatures well below the maximum rise of 180°C with no peaks. Therefore, it is evident that the insulation criteria of the tested specimen failed due to limitations in the fire resistance performance of the separating element and not of the BOSS FyreBox or the P40-Mak Wrap. No integrity failure was observed throughout the test. Therefore, it is likely that the BOSS FyreBox, with the services wrapped with P40-Mak Wrap insulation wrap can be attributed an FRL of - /120/120 if tested in a separating element with a greater FRL.

According to test report FRT190428 R1.0, a 150 mm diameter copper pipe was protected by one 325 mm high × 360 mm wide × 50 mm thick BOSS Bulkhead Batt on the unexposed side. BOSS FireMastic-300 was applied on the interface between the batt and the copper pipe on both the exposed and the unexposed sides. A 10 mm bead of mastic was applied on the perimeter of the batt as a smoke seal. BOSS P40-Mak Wrap was installed on both the exposed and unexposed sides. The wrap extended to 600 mm on both sides and it was secured using steel cable ties. The attributed FRL was -/120/45 with TC021 on top side of copper pipe specimen recording a temperature of 200°C and causing the specimen to fail in insulation at minutes. No integrity failure was observed throughout the test. The thermocouples, 019 and 020, placed on the P40-Mak Wrap (25 mm from the wrap edge) showed that the temperatures measured on the insulation wrap was significantly less than the temperatures measured on all other specimen components with the maximum temperature being approximately 85°C.

In test report FSV 1731, the separating element consisted of a 78 mm thick Speedpanel wall system, with an established FRL of -/120/120. A 300 mm × 250 mm opening in the wall was lined with 83 mm wide × 58 mm high × 1.2 mm thick Speedpanel C-track. The penetrating services were cable arrangements Group A and Group B as specified in AS 1530.4 Appendix D2 on a metal cable tray. The cables and the cable tray were wrapped with Boss P40-Mak Wrap blanket which extended 300 mm from each side of the wall. The attributed FRLs were -/120/120 for both penetrations. No integrity failure was observed throughout the test.

### P40-Mak Wrap used for ductwork and dampers

Test FRT180137 R2.0 showed that, on the BOSS FyreBox, P40-Mak Wrap and all included services, the maximum temperatures well below the maximum rise of 180°C with no peaks and no integrity failure observed throughout the test. Due to similarities in composition and configuration, the performance of the BOSS FyreBox can be used to assess the performance of a tested damper with duct work of maximum dimensions 150 mm wide × 150 mm high × 270 mm deep. It is assumed that the damper must be tested and have an established FRL greater than or equal to -/120/120.

An FRL of -/120/120 can be attributed to floor mounted dampers with the ductwork wrapped with P40-Mak Wrap and an FRL of -/90/90 can be attributed to wall mounted dampers with the ductwork wrapped with P40-Mak Wrap. The insulation wrap must extend at least 300 mm from the separating element and all gaps should be sealed with a fire-rated sealant.

### P40-Mak Wrap used for service penetrations in walls and floors

The above results and discussions suggest that the use of P40-Mak Wrap wrapped around metallic services to a thickness of approximately 40 mm and extending greater than 300 mm from both exposed and unexposed sides in wall systems and unexposed sides in floor systems (as tested), in conjunction the FireMastic-300 fire-rated sealant, will likely be able to provide a fire resistance period of up to 120 minutes in integrity and 120 minutes in insulation, provided that the separating element has an established FRL that is equal or greater than -/120/120.

### P40-Mak Wrap used in conjunction with BOSS FirePillow 240

Based on the assessed FRL of service penetration systems protected with P40-Mak Wrap, if it is used in conjunction with BOSS FirePillow 240, and FireMastic-300 sealant applied as tested, the systems will likely achieve an FRL of -/120/120. This is provided that the P40-Mak Wrap is wrapped twice around the services (applicable to services such as copper pipes, Group A and B standard configuration cable trays, and cable bundles) and extend more than 300 mm from both the exposed and unexposed sides of a concrete or masonry wall separating element (with a thickness equal to or greater than 140 mm) and more than 300 mm on the unexposed side of a concrete or masonry floor separating element with a thickness equal to or greater than 150 mm). The separating elements must have an established FRL greater than -/120/120.

### 6.3.5 BOSS FireMastic-300 fire-rated sealant

#### Discussion

In WFRC 141438, the fire resistance test was conducted to assess the ability of eight specimens of a linear gap sealing system to reinstate the fire resistance of blockwork wall and pre-cast aerated concrete floor constructions. The floor specimen had overall nominal dimensions of 1200 mm × 1200 mm × 250 mm and was provided with four linear joints (specimens A to D). The wall specimen had overall nominal dimensions of 1000 mm × 1000 mm × 250 mm and was provided with four linear joints (specimens E to H). The sealant used is a pyrocoustic intumescent and acoustic sealant which is a water based acrylic sealant (with intumescent and fire-retardant properties), similar to BOSS FireMastic-300. PE open cell foam backing rods were used to control the application of the sealant. The results showed that the fire-rated sealant was able to achieve an integrity performance of up to 300 minutes (until the termination of the test) in both the floor mounted and wall mounted specimens.

In EWFA 55693000.2, the separating element is a 13 mm fire rated plasterboard (USG Boral Firestop) with 92 mm steel frame and Fletcher Insulation Pink Partition 14 R2.2 insulation. Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboards) and finished off with a 50 mm fillet on both exposed and unexposed side of the galvanized pipe penetration service (service 8). Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboards) and finished off with a 30 mm fillet on both exposed and unexposed side of the Bundle of TPS cable penetration service (service 9). No failure in either insulation or integrity was observed at 121 minutes (when the test was terminated) and the systems were attributed FRLs of -/120/120. This indicates that the integrity and insulation performances of FireMastic-300 sealant in this test was limited by the established FRL of the wall system and would have achieved a greater FRL had the test continued.

#### Use of FireMastic-300 sealant in service penetrations

Considering further test evidence in tests EWFA 34923800.2, FSP 1833 and FRT 180472 R1.0, it is evident from the test observations and the FRLs attributed to the service penetrations that, with the FireMastic-300 sealant, the integrity of the systems were maintained throughout the tests duration.

Therefore, based on the above discussed referenced test results, it is evident that the integrity performance of the BOSS FireMastic-300 is limited, primarily, by the fire resistance performance and established FRLs of the separating elements, services and other fire protection systems. As demonstrated by WFRC 141438, the sealant would be able to achieve an integrity performance of up to 300 minutes in both the floor and wall specimens as a self-contained fire protection system, and would achieve the same integrity performance when used in conjunction with P40-Mak wrap insulation wrap and BOSS FirePillow 240 fire pillows.

## 6.4 Conclusion

This assessment demonstrates that the proposed systems are likely to achieve the fire resistance levels given in Table if tested in accordance with AS 1530.4:2014.

**Table 10 Fire resistance levels of assessed systems – wall mounted specimens**

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| None | 140 mm thick concrete block wall<br>Aperture: nominal dimensions 600 mm wide (or greater) × 400 mm high | BOSS FirePillow 240 | FireMastic-300 | -/180/180 |
| 100 mm diameter copper pipe with a wall thickness of 1.8 mm | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300<br>BOSS P40-Mak Wrap | -/120/120 |

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| Standard configuration electrical cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 BOSS P40-Mak Wrap | -/120/120 |
| 50 pair 0.5 PVC indoor telephone cables | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 BOSS P40-Mak Wrap | -/120/120 |
| Metallic damper and duct work | Concrete wall system with an FRL greater than -/90/90 | BOSS P40-Mak Wrap | FireMastic-300 | -/90/90 |

**Table 11 Fire resistance levels of assessed systems – floor mounted specimens**

| Service | Separating element | Primary fire protection | Secondary fire protection | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| None | 150 mm thick concrete floor slab<br>Aperture: nominal dimensions 600 mm wide (or greater) × 400 mm high | BOSS FirePillow 240 | FireMastic-300 | -/180/180 |
| 100 mm diameter copper pipe with a wall thickness of 1.8 mm | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 BOSS P40-Mak Wrap | -/120/120 |
| Standard configuration electrical cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 | -/90/30 |
| | | BOSS FirePillow 240 | FireMastic-300 BOSS P40-Mak Wrap | -/120/120 |
| Standard configuration telecommunication cable tray as per AS 1530.4:2014 Appendix D | | BOSS FirePillow 240 | FireMastic-300 and radiation guard | -/180/180 |
| | | BOSS FirePillow 240 | FireMastic-300 | -/120/60 |
| | | BOSS FirePillow 240 | FireMastic-300 BOSS P40-Mak Wrap | -/120/120 |
| Metallic damper and duct work | Concrete floor system with an FRL greater than -/120/120 | BOSS P40-Mak Wrap | FireMastic-300 | -/120/120 |

# 7. Validity

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

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

This assessment is based on information and experience available at the time of preparation. The published procedures for the conduct of tests and the assessment of test results are subject to constant review and improvement. It is therefore recommended that this report be reviewed on or, before, the stated expiry date.

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

This assessment is provided to the BOSS Fire & Safety Pty Ltd for its own purposes and we cannot express an opinion on whether it will be accepted by building certifiers or any other third parties for any purpose.

# Appendix A Drawings and information

| Drawing title | Dwg no | Date | Drawn |
|---|---|---|---|
| Figure A1.1: Plan | - | 19/02/02016 | Anthony Rosamilia |
| Figure A1.2: Section A-A | - | 19/02/02016 | Anthony Rosamilia |
| Figure A1.3: Section B-B | - | 19/02/02016 | Anthony Rosamilia |
| Test specimen | CSIRO 0517-01 | 26/05/2017 | SL - CSIRO |
| Copper pipe penetrating 90min wall | CSIRO 0517-03 | 26/05/2017 | SL - CSIRO |
| Telco cables penetrating 90min wall | CSIRO 0517-05 | 26/05/2017 | SL - CSIRO |
| Copper pipe penetrating 90min wall | CSIRO 0517-06 | 26/05/2017 | SL - CSIRO |
| Power cables penetrating 90min wall | CSIRO 0517-07 | 26/05/2017 | SL - CSIRO |
| Copper pipe penetrating 90min wall | CSIRO 0517-08 | 26/05/2017 | SL - CSIRO |

# Appendix B Summary of supporting test data

## B.1 Test report – WFRA F91876

**Table 12 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Budget Fire Systems Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 24/04/2001. |
| Test standards | The test was done in accordance with AS 1530.4:1997 and AS 4072.1-1992 as applicable. |
| Variation to test standards | None |
| General description of tested specimen | The test assembly comprised of a nominal 1300 mm wide × 1350 mm high × 140 mm thick concrete block wall with an opening of nominal dimensions 600 mm × 400 mm. Within the aperture were a OD 100 mm copper pipe with a wall thickness of 1.8 mm (service A), 2 of 50 pair 0.5 PVC indoor telephone cables (services B and C), and a cable tray supporting the standard configuration of electrical cables recommended by AS 4072.1-1992 (services D-G). Thermachek fire pillows (25 of dimensions 300 × 200 × 55 mm, 2 of 200 × 200 × 35 mm and 9 of 200 × 100 × 30 mm were used to protect the aperture and were laid longitudinally across the long direction of the opening and aligned in rows. Tyco FS33 fire rated sealant is applied at a nominal depth of 2 mm over the perimeter of the Thermachek fire pillows and the adjacent concrete element. The voids between adjacent infill rows of Thermachek fire pillows were backfilled with Tyco FS33 sealant to a depth of nominally 25 mm, flush with the concrete block surface. The cable tray and copper pipe were provided with 0.5 mm thick steel radiation guards that were offset 50 mm from the respective services. All services extended nominally 100 mm on the exposed side and 500 mm on the unexposed side. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:1997 and AS 4072.1-1992 as applicable. |

The test specimen achieved the following result:

**Table 13 Results summary for this test report**

| Test specimen designation | Structural adequacy | Integrity (minutes) | Insulation (minutes) | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| Services A-G | N/A | No failure at 181 minutes | No failure at 181 minutes | -/180/180 |

## B.2 Test report – WFRA F91879

**Table 14 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Budget Fire Systems Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 25/05/2001. |
| Test standards | The test was done in accordance with AS 1530.4:1997 and AS 4072.1-1992 as applicable. |
| Variation to test standards | None |

| | |
|---|---|
| General description of tested specimen | The test assembly comprised of a nominal 1750 mm long × 1200 mm wide × 150 mm thick concrete floor slab with an opening of nominal dimensions 600 mm × 400 mm. Within the aperture were a OD 100 mm copper pipe with a wall thickness of 1.8 mm (service A), 2 of 50 pair 0.5 PVC indoor telephone cables (services B and C), and a cable tray supporting the standard configuration of electrical cables recommended by AS 4072.1-1992 (services D-F). Thermachek fire pillows (14 of dimensions 300 × 200 × 60 mm, 6 of 200 × 200 × 50 mm and 9 of 200 × 100 × 30 mm were used to protect the aperture and were laid longitudinally across the long direction of the opening and aligned in rows. Tyco FS33 fire rated sealant is applied at a nominal depth of 2 mm over the perimeter of the Thermachek fire pillows and the adjacent concrete element. The voids between adjacent infill rows of Thermachek fire pillows were backfilled with Tyco FS33 sealant to a depth of nominally 25 mm, flush with the concrete block surface. The cable tray and copper pipe were provided with 0.5 mm thick steel radiation guards that were offset 50 mm from their respective services. All services extended nominally 100 mm on the exposed side and 500 mm on the unexposed side. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:1997 and AS 4072.1-1992 as applicable. |

The test specimen achieved the following result:

**Table 15 Results summary for this test report**

| Test specimen designation | Structural adequacy | Integrity (minutes) | Insulation (minutes) | Fire Resistance Level (FRL) |
|---|---|---|---|---|
| Services A-F | N/A | No failure at 181 minutes | No failure at 181 minutes | -/180/180 |

## B.3 Test report – EWFA 39693400.1

**Table 16 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Nilsen (NSW) Pty td |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 19/02/2016. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None |
| General description of tested specimen | The test specimen comprised of Group A and B standard cable configuration penetrations through a nominal 1750 mm × 1200 mm × 150 mm reinforced concrete floor system with a length-wise 600 mm × 400 mm rectangular cavity. The assembly was asymmetric due to the cable trays being supported on the unexposed side only. The cable trays were bent at the end on the unexposed side to accommodate their fixing to the support. The cable trays were installed vertically through the hole with the tray protruding 500 mm either side of the concrete slab. The cable trays were protected by a layer of Thermachek – P4 fire pillows and a sealant. Three pillow dimensions were used: 100 × 200 × 40 mm, 200 × 200 × 50 mm, and 300 × 200 × 60 mm. The pillows were used to fill remaining space in aperture. Promaseal ® AN fire rated sealant was applied between pillows, along the 200 mm edge and it was used to fix the pillows to the concrete slab all around the perimeter of the cavity. Sealant was also used to fill in gaps between pillows and cable trays. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2005. |

The test specimen achieved the following result:

**Table 17 Results summary for this test report**

| Test specimen | Specimen description | Structural adequacy | Integrity (minutes) | Insulation (minutes) | Fire Resistance Level (FRL) |
|---|---|---|---|---|---|
| Service A | Electrical cable tray | N/A | Failure at 113 minutes | Failure at 32 minutes | -/90/30 |
| Service B | Communications cable tray | N/A | Failure at 135 minutes | Failure at 68 minutes | -/120/60 |

## B.4 Test report – FSP 1833

**Table 18 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire & Safety Pty Ltd |
| Test laboratory | Infrastructure Technologies, CSIRO, 14 Julius Avenue, North Ryde, NSW 2113, Australia |
| Test date | The fire resistance test was completed on 09/05/2017. |
| Test standards | The test was done in accordance with AS 1530.4:2014 and AS 4072.1-2005 as applicable. |
| Variation to test standards | None |
| General description of tested specimen | Penetration 1 consisted of a 20 mm OD PEX cross linked polyethylene plumbing pipe penetrating a 60 mm diameter aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. It was supported at approximately 500 mm and 1500 mm away from the wall on the unexposed face. FireMastic-HPE sealant was applied at the annular gap between the pipe and the plasterboard on both the exposed and unexposed faces to a depth of 16 mm, finished flush with the wall surface.<br>Penetration 2 consisted of a copper pipe with an OD of 19.05 mm, extending 800 mm from the unexposed side and 500 mm from the exposed side of a plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. It was supported at approximately 500 mm and 1500 mm away from the wall on the unexposed face. FireMastic-300 sealant was used to create a surface seal around the pipe with a 50 mm fillet on the exposed and unexposed faces. The pipe was lagged with Boss P40-Mak Wrap, wrapped twice around the pipe, and extended out 300 mm from the FireMastic-300 on both sides of the wall.<br>Penetration 3 consisted of 2.5 $mm^2$2C+E TPS power cable penetrating through a 13 mm diameter aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. Supports were provided approximately 500 mm away from the wall on the exposed face. FireMastic-300 sealant was used to create a surface seal around the cable on the exposed and unexposed faces.<br>Penetration 4 consisted of a bundle of 60 cables (each 14 mm in diameter) secured on a 150 mm cable tray. The services penetrated a 150 mm wide by 100 mm high aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. FireMastic-300 sealant was used to create a surface seal around the cable tray with a 50 mm fillet on the exposed and unexposed faces. The cable tray was lagged with Boss P40-Mak Wrap, wrapped twice around, and extended out 300 mm from both sides of the wall, flush with the FireMastic-300.<br>Penetration 5 consisted of a 150 mm OD copper pipe that extended 500 mm on the exposed side and 1100 mm on the unexposed side penetrating a 150 mm diameter aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. Supports were provided approximately 500 mm from the wall on the unexposed face. FireMastic-300 sealant was used to create a surface seal around the pipe with a |

| Item | Information about test report |
|---|---|
| | 50 mm fillet on the exposed and unexposed faces. The pipe was lagged with Boss P40-Mak Wrap, wrapped twice around the pipe, and extended out 300 mm from the exposed side and 600 mm from the unexposed side, flush with the FireMastic-300.<br>Penetration 6 consisted of a set of three and eight bundle of cables on a steel cable tray penetrating a 300 mm wide by 49 mm high aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. Supports were provided approximately 500 mm from the unexposed side. FireMastic-300 sealant was used to create a surface seal around the cable tray with a 50 mm fillet on the exposed and unexposed faces. The cable tray was lagged with Boss P40-Mak Wrap, wrapped twice around, and extended out 300 mm from both sides of the wall, flush with the FireMastic-300.<br>Penetration 7 consisted of a 31.75 mm OD copper pipe that extended 500 mm on the exposed side and 800 mm on the unexposed side penetrating a 32 mm diameter aperture in a 96 mm thick plasterboard wall system with Boral Firestop 16 mm plasterboard on both sides and an established FRL of -/90/90. Supports were provided approximately 500 mm from the wall on the unexposed face. FireMastic-300 sealant was used to create a surface seal around the pipe with a 50 mm fillet on the exposed and unexposed faces. The pipe was lagged with Boss P40-Mak Wrap, wrapped twice around the pipe, and extended out 300 mm from the exposed side and 600 mm from the unexposed side, flush with the FireMastic-300. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2014. |

The test specimen achieved the following result:

**Table 19 Results summary for this test report**

| Test specimen | Specimen description | Structural adequacy | Integrity (minutes) | Insulation (minutes) | Fire Resistance Level (FRL) |
|---|---|---|---|---|---|
| Penetration 1 | 20 mm PEX pipe sealed with FireMastic-HPE in a 60 mm diameter aperture | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |
| Penetration 2 | FireMastic-300 sealant protecting a 19 mm diameter aperture penetrated by a 19 mm diameter copper pipe lagged with Boss P40-Mak Wrap | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |
| Penetration 3 | FireMastic-300 sealant protecting a 13 mm diameter aperture penetrated by a single power cable | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |
| Penetration 4 | FireMastic-300 sealant protecting a 150 mm wide cable tray lagged with Boss P40-Mak Wrap | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |
| Penetration 5 | FireMastic-300 sealant protecting a 150 mm diameter aperture penetrated by a 150 mm diameter copper pipe lagged with Boss P40-Mak Wrap | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |
| Penetration 6 | FireMastic-300 sealant protecting a 300 mm wide cable tray with a set of 3 | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |

| Test specimen | Specimen description | Structural adequacy | Integrity (minutes) | Insulation (minutes) | Fire Resistance Level (FRL) |
|---|---|---|---|---|---|
| | and 8 bundle cables lagged with Boss P40-Mak Wrap | | | | |
| Penetration 7 | FireMastic-300 sealant protecting a 32 mm diameter aperture penetrated by a 32 mm diameter copper pipe lagged with Boss P40-Make Wrap | N/A | No failure at 91 minutes | No failure at 91 minutes | -/90/90 |

## B.5 Test report – FRT180472 R1.0

**Table 20 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire & Safety Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 08/03/2019. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | The separating element in the tested system was a 116 mm thick plasterboard wall system clad with two layers of fire-rated 13mm CSR Fyrchek plasterboard on either side.<br>Boss FireMastic – 300 sealant was used in the annular gap at 5 mm depth between the service and the wall and finished flush on both the exposed and the unexposed side in service A, in the annular gap at 26 mm depth (thickness of the plasterboards) between the service and the wall and finished with 50 mm × 50 mm fillet on both the exposed and the unexposed side in service G, in the annular gap at 26 mm depth (thickness of the plasterboards) between the service and the wall and finished with 20 mm × 20 mm fillet on both the exposed and the unexposed side in service D, applied as a smoke seal, finished flush on both the exposed and the unexposed side in services C,E,H and I and on the joints between the plasterboards and the concrete blockwork.<br>BOSS P40 MAK-Wrap (insulation wrap) was wrapped around the lagged copper pipe (in penetration system A) on both the exposed and the unexposed side. The wraps were secured with metal wire at approximately 50 mm and 200 mm from the separating element. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2014. |

The test specimen achieved the following result:

**Table 21 Results summary for this test report**

| Penetration system | Service | Primary local fire-stopping protection | Second local fire-stopping protection | Aperture size (mm) | Fire Resistance Level (FRL) |
|---|---|---|---|---|---|
| A | 50 mm diameter copper pipe with lagging | BOSS 100mm MaxiCollars™ | P40-Mak Wrap with FireMastic -300 | Ø115 | -/120/90 |
| B | Bundle of Electric cable | FireMastic -HPE | - | Ø70 | -/120/120 |

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

## B.6 Test report – EWFA 34923800.2

**Table 22 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire & Safety Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 04/06/2015. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | The pressure for the 5-20 minute period was above the limits prescribed in AS 1530.4:2005 by 11 Pa. This exceeded the pressure requirement of the standard and was therefore more severe than required by the standard. The furnace pressure was below the limits stated by 9 Pa between 230-240 minutes due to deterioration of the specimen. Due to the state of the lowest penetration at that time, the reduction in pressure is unlikely to have invalidated the result. During these intervals, the furnace temperature deviation was within the limits and the specimen temperature curves did not exhibit unexpected variations. Hence this pressure behaviour is not likely to affect the performance of the pipe systems. |
| General description of tested specimen | The specimen comprised of a 78 mm thick Speedpanel panels vertically oriented to form a vertical wall system. The wall system was penetrated by 5-off different service penetrations protected with various BOSS Collars and Mastic. The gap between the perimeter track and the Speedpanel on the bottom edge was sealed with BOSS FireMastic HPE mastic on the unexposed side and BOSS FireMastic-300 mastic on the exposed side. The gap between the perimeter track and the Speedpanel on the top edge was sealed with BOSS FireMastic-300 mastic. BOSS FireMastic-300 was used to protect the interface between the panel and the perimeter blockwork. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2005. |

The test specimen achieved the following result:

**Table 23 Results summary for the floor mounted specimens**

| Specimen | Penetration service | Structural adequacy | Integrity | Insulation | Fire Resistance Levels (FRL) |
|---|---|---|---|---|---|
| A | 100 mm uPVC<br>Fire protection on the unexposed side – BOSS MaxiCollar<br>Fire protection on the exposed side – BOSS MaxiCollar | N/A | No failure at 240 minutes | Failure at 81 minutes | -/240/60 |
| C | 100 mm uPVC<br>Fire protection on the unexposed side – None<br>Fire protection on the exposed side – BOSS FireMastic HPE | N/A | Failure at 161 minutes | Failure at 10 minutes | -/120/0 |
| E | 160 mm PVC-C<br>Fire protection on the unexposed side – BOSS MaxiCollar<br>Fire protection on the exposed side – BOSS MaxiCollar | N/A | No failure at 240 minutes | Failure at 120 minutes | -/240/120 |
| F | Head detail<br>Fire protection on the unexposed and exposed sides – BOSS FireMastic-300<br>Fire protection inside the top perimeter track – 2 × intumescent strips | N/A | No failure at 240 minutes | Failure at 80 minutes | -/240/60 |

## B.7 Test report – FRT180137 R2.0

**Table 24 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Boss Fire & Safety Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 07/03/2019. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None. |
| General description of tested specimen | The test specimen consisted of composite floor system (1830 mm × 1590 mm) penetrated by 9 penetration systems.<br>The composite floor comprised of three composite floor deckings jointed together at the bottom with a concrete layer on the top. The concrete was reinforced by a steel reinforcement grid. The nominal dimensions of the composite floor system are 1830 mm × 1590 mm × maximum thickness 130 mm or minimum thickness 70 mm.<br>The main fire protection systems used included BOSS FireMastic – 300, BOSS FireMastic – HPE, BOSS 32 mm MaxiCollar, BOSS 75 mm MaxiCollar, BOSS 100 mm MaxiCollar, BOSS Drop in collar, BOSS P40-MAK Wrap, BOSS Batt, BOSS FyreBox. |

| | |
|---|---|
| | Penetration system E consisted of a 150 mm wide × 150 mm high × 270 mm deep BOSS Fire Multi-Service Cable & Pipe transit (BOSS FyreBox) which was inserted into the aperture and secured to the separating element with 20 mm × 40 mm angle on the unexposed side. The annular gap between the BOSS FyreBox and the separating element was filled with BOSS FireMastic – 300. A 20 mm × 20 mm BOSS FireMastic -300 fillet was applied around the BOSS FyreBox on the unexposed side. The gap between the separating element and the BOSS FyreBox was filled with BOSS FireMastic – 300 and finished following profile of the composite floor deck on the exposed side. The P40-Mak Wrap was wrapped around the services on the unexposed side and extended 300 mm away from the separating elements. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2014. |

The test specimen achieved the following result:

**Table 25 Results summary for the floor mounted specimens**

| Penetration system | Service | Primary fire-stopping protection | Second fire-stopping protection | Aperture size (mm) | Fire Resistance Level (FRL) |
|---|---|---|---|---|---|
| A | Bundle of TPS cables | BOSS Batt | BOSS FireMastic - HPE™ | Ø76 | -/120/120 |
| B | 32mm PEX-A pipe | - | BOSS FireMastic – HPE™ | Ø78 | -/120/0 |
| C | Pair Coil pipe<br>25 mm uPVC Drain pipe | BOSS Batt | BOSS FireMastic – HPE™ | Ø100 | -/120/120 |
| D | 100 mm uPVC DWV pipe | BOSS Batt | Boss MaxiCollar™<br>BOSS FireMastic – 300™ | Ø127 | -/120/120 |
| E | Pair Coil 16 mm + 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<br>32 mm galvanised sprinkler pipe<br>32 mm copper pipe | BOSS Fire box | BOSS P40-MAK Wrap<br>BOSS FireMastic - 300™ | 160 × 170 | -/120/60 |
| F | 32 mm copper pipe | - | BOSS FireMastic – 300™ | Ø34 | -/120/30 |
| G | 100 mm uPVC DWV pipe | - | BOSS Drop in collar<br>BOSS FireMastic – 300™ | Ø155 | -/120/90 |
| H | 75 mm HDPE pipe | BOSS Batt | BOSS FireMastic – 300™<br>BOSS MaxiCollar™ | Ø92 | -/120/120 |
| I | 25 mm uPVC conduit pipe | BOSS Batt | BOSS MaxiCollar™<br>BOSS FireMastic - 300™ | Ø35 | -/120/120 |

## B.8 Supplementary test data – FRT190428 R1.0

**Table 26 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | BOSS Products (Australia) Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 12/12/2019. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |
| General description of tested specimen | Penetration B: Ø150 Copper pipe installed in a 152 mm diameter aperture and protruded nominally 800 mm on the exposed and the unexposed sides. The pipe was capped with copper cap on the exposed side.<br>The service was supported on the unexposed side at nominal 500 mm from wall on the wall C-channel with pipe clamp. The service was protected by 1 × 325 mm high × 360 mm wide × 50 mm thick BOSS Bulkhead Batt on the unexposed side. The batt was installed on top of the main fire protection and secured with pigtail screws at nominal 50 mm in from the edges on four sides.<br>BOSS FireMastic-300 was applied on the interface between the batt and the copper pipe on both the exposed and the unexposed sides with 20 mm wide and 15 mm high fillet. A 10 mm bead of mastic was applied on the perimeter of the batt as a smoke seal. BOSS P40-MAK Wrap was installed on both the exposed and unexposed side. The wrap extended to 600 mm on both the exposed and the unexposed sides and wrap was secured using steel cable ties. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2014. |

The test specimen achieved the following result:

**Table 27 Results summary for this test report**

| Penetration system | Service | Local fire-stopping protection | Main fire-stopping protection | Pattress board | Aperture size (mm) | Fire resistance level (FRL) |
|---|---|---|---|---|---|---|
| B | Ø150 Copper pipe | Ablative coating, BOSS FireMastic 300, BOSS P40-MAK Wrap and BOSS Bulkhead Batt | BOSS Bulkhead Batt | Unexposed side | Ø152 | -/120/45 |

## B.9 Supplementary test data – EWFA 55693000.2

**Table 28 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | BOSS Fire (Australia) Pty Ltd |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 06/08/2018. |
| Test standards | The test was done in accordance with AS 1530.4:2014. |
| Variation to test standards | None |

| | |
|---|---|
| General description of tested specimen | The separating element is a 13 mm fire rated plasterboard (USG Boral Firestop) with 92 mm steel frame and Fletcher Insulation Pink Partition 14 R2.2 insulation.<br>Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboards) and finished off with a 50 mm fillet on both exposed and unexposed side of the galvanized pipe penetration service (service 8).<br>Boss FireMastic-300 was inserted into the annular gap at 26 mm depth (thickness of plasterboards) and finished off with a 30 mm fillet on both exposed and unexposed side of the Bundle of TPS cable penetration service (service 9). |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2014. |

The test specimen achieved the following result:

**Table 29 Results summary for this test report**

| Service | Description | Criteria | Result |
|---|---|---|---|
| 8 | Galvanized steel pipe of 42 mm diameter installed at the centre of a 42 mm diameter core hole with a 4 mm annular gap. The pipe protruded 500 mm from the exposed side and 500 mm from the unexposed side. The main penetration protection was the use of Boss FireMastic-300 sealant. | Structural adequacy | N/A |
| | | Integrity | No failure at 121 minutes |
| | | Insulation | No failure at 121 minutes |
| | | Fire Resistance Level (FRL) | -/120/120 |
| 9 | The bundle of TPS cables was installed at the centre of the core hole (30 mm diameter) with an approximately 3.5 mm annular gap. The cable bundle protruded 500 mm from the exposed side and 500 mm from the unexposed side of the wall system. The main penetration protection was the use of Boss FireMastic-300 sealant. | Structural adequacy | N/A |
| | | Integrity | No failure at 121 minutes |
| | | Insulation | No failure at 121 minutes |
| | | Fire Resistance Level (FRL) | -/120/120 |

## B.10 Supplementary test data – FSV 1731

**Table 30 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | H. B. Fuller Company Australia Pty Ltd |
| Test laboratory | Infrastructure Technologies, CSIRO, 14 Julius Avenue, North Ryde, NSW 2113, Australia |
| Test date | The fire resistance test was completed on 16/12/2015. |
| Test standards | The test was done in accordance with AS 1530.4:2005. |
| Variation to test standards | None |
| General description of tested specimen | The separating element is a 78 mm thick Speedpanel wall system, with an established FRL of -/120/120. A 300 mm × 250 mm opening in the wall was lined with 83 mm wide × 58 mm high × 1.2 mm thick Speedpanel C-track. The penetrating services were cable arrangements Group A and Group B as specified in AS 1530.4 Appendix D2 on a metal cable tray supported at approximately 100 mm and 500 mm away from the wall. The C-track lined |

| | |
|---|---|
| | opening was sealed with one layer of Boss batt, friction fitted flush with the exposed side of the wall. A second batt was fitted around the cable tray and fixed to the unexposed side of the wall. The cables and the cable tray were wrapped with Boss P40-Mak Wrap blanket which extended 300 mm from each side of the wall. |
| Instrumentation | The instrumentation was provided in accordance with AS 1530.4:2005 |

The test specimen achieved the following result:

**Table 31 Results summary for this test report**

| Service | Description | Structural adequacy | Integrity | Insulation |
|---|---|---|---|---|
| 15 | Cable arrangement Group A – one single core 630 $mm^2$ cable, one three core 180 $mm^2$ cable, bunch of three 6 $mm^2$ cables - mounted onto a 470 mm wide cable tray extending 700 mm away from the wall and 500 mm into the furnace wrapped with P40-Mak Wrap and protected with two layers of Boss Batt. | N/A | No failure at 121 minutes | No failure at 121 minutes |
| 16 | Cable arrangement Group B – 60 × 15 mm OD telecommunication cables - mounted onto a 180 mm wide cable tray extending 700 mm away from the wall and 500 mm into the furnace wrapped with P40-Mak Wrap and protected with two layers of Boss Batt. | N/A | No failure at 121 minutes | No failure at 121 minutes |

## B.11 Supplementary test data – WFRC 141438

**Table 32 Information about test report**

| Item | Information about test report |
|---|---|
| Report sponsor | Firestopit.com limited |
| Test laboratory | Warringtonfire Australia, Unit 2, 409-411 Hammond Road, Dandenong, Victoria 3175, Australia. |
| Test date | The fire resistance test was completed on 06/10/2004. |
| Test standards | The test was done in accordance with BS 476: Part 20:1987 |
| Variation to test standards | None |
| General description of tested specimen | The fire resistance test was conducted to assess the ability of eight specimens of a linear gap sealing system to reinstate the fire resistance of blockwork wall and pre-cast aerated concrete floor constructions. The floor specimen had overall nominal dimensions of 1200 mm × 1200 mm × 250 mm and was provided with four linear joints (specimens A to D). The wall specimen had overall nominal dimensions of 1000 mm × 1000 mm × 250 mm and was provided with four linear joints (specimens E to H). The sealant used is a pyrocoustic intumescent and acoustic sealant which is a water based acrylic sealant (with intumescent and fire-retardant properties). PE open cell foam backing rods were used to apply the sealant. |
| Instrumentation | The instrumentation was provided in accordance with BS 476: Part 20:1987. |

The test specimen achieved the following result:

**Table 33 Results summary for the floor mounted specimens**

| Specimen | Gap face material combination | Seal Width / Depth (mm) | Backing material | Integrity (minutes) | Insulation (mins) |
|---|---|---|---|---|---|
| A | Aerated concrete / Aerated concrete | 30/15 | PE open cell foam | 300 | 66 |
| B | Aerated concrete / Aerated concrete | 20/10 | PE open cell foam | 300 | 133 |
| C | Aerated concrete / Aerated concrete | 10/10 | PE open cell foam | 300 | - |
| D | Aerated concrete / Aerated concrete | 50/25 | PE open cell foam | 300 | 214 |

**Table 34 Results summary for the wall mounted specimens**

| Specimen | Gap face material combination | Seal Width / Depth (mm) | Backing material | Integrity (minutes) | Insulation (mins) |
|---|---|---|---|---|---|
| E | Aerated concrete / Aerated concrete | 30/15 | PE open cell foam | 300 | 91 |
| F | Aerated concrete / Aerated concrete | 20/10 | PE open cell foam | 300 | 300 |
| G | Aerated concrete / Aerated concrete | 10/10 | PE open cell foam | 300 | - |
| H | Aerated concrete / Aerated concrete | 30/15 | PE open cell foam | 300 | 215 |