ASSESSMENT REPORT

The likely fire resistance performance of Cables and metal pipes when penetrating concrete floors and protected with HB-Fuller FIRESOUND sealant if tested in accordance with AS1530.4-2014 and assessed in accordance with AS4072.1-2005

EWFA Report No:

27001-03

Report Sponsor:

H/B Fuller Australia Company Pty Ltd
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1 INTRODUCTION

This report presents an assessment of the likely fire resistance performance of cables and metal pipes when penetrating concrete floors and protected with HB-Fuller FIRESOUND sealant if tested in accordance with AS1530.4-2014 and assessed in accordance with AS4072.1-2005

The tested systems are described in Section 2 and are subject to the proposed variations described in Section 3 if tested in accordance with the referenced test method described in Section 4. The conclusions of the report are summarised in Section 5.

The validity of this assessment is conditional on compliance with Sections 7, 8 and 9 of this report.

Summary of the test data on which this assessment is based is provided in the Appendix together with a summary of the critical issues leading to the assessment conclusions including the main points of argument.

2 TESTED PROTOTYPES

For the purpose of this report, data from full scale fire resistance tests WFRA 40869 and WFRA 41257.2 were considered.

The test specimen reported in WFRA 40869 comprised a 120mm thick concrete floor slab incorporating various control joints protected with HB Fuller FIRESOUND Sealant and tested in accordance with AS1530.4-1997 Sections 2, 4 and 10 and AS4072.1-1992 as appropriate.

The test specimen reported in WFRA 41257.2 comprised a 150mm thick CSR Hebel Powerpanel^{TM} wall incorporating cable, metal pipe and control joint penetrations, PROMASEL® Pillows and HB Fuller FIRESOUND acrylic sealant, tested in accordance with AS1530.4-2005 and AS4072.1-2005 as appropriate.

Both tests were sponsored by HB-Fuller Australia Company Pty Ltd and were conducted by Warrington Fire Research Aust. Pty Ltd.

3 VARIATION TO TESTED PROTOTYPES

The proposed construction shall be tested in WFRA 41257.2, and subject to following optional variations:

- Consideration given to the likely performance if tested in accordance with AS1530.4-2014.
- The penetrations are to be installed in normal weight concrete or lightweight concrete floor constructions with minimum thickness of 150mm or 120mm with 30mm thick topping.
- The penetration systems are to include those tested in WFRA 41257.2 (except Service A).
- Sealant applied to both above and below sides of floors.

The service penetrations are summarized in Table 1 below:

Table 1: Schedule of Penetration Components

Item	Description	
1	**Name**	**Sealant**
	Material	HB Fuller FIRESOUND – Fire Rated Acoustic Sealant, Grey
	Installation	Used on both exposed and unexposed sides of floor and applied around the annular gap to the backing rod
2	**Name**	**Foam Backing Rod**
	Material	A density of approximately 20kg/m^3
	Installation	Positioned in the annular gap with a nominal depth back from the slab surface.
3	**Name**	**Floor Construction**
	Material	Normal weight or lightweight concrete
	Size	Minimum thickness of 150mm or 120mm with 30mm thick topping.
	Installation	The aperture shall be cut or formed, if very smooth, the surface can be roughed to improve the key of the sealant to the side of the aperture.
4	**Name**	**Primer**
	Material	Express 290D primer
	Installation	Pained on the inside of the hole and up to 30mm around the opening on both faces prior to sealing
5	**Name**	**Telecommunication Cables (Bundle)**
	Material	PVC insulated copper cables
	Size	AS1530.4-2014 Appendix D2 (Standard Configuration)
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 50mm × 50mm. The service is supported at 150mm and 600mm from the unexposed side
6	**Name**	**Telecommunications Cable (Single)**
	Material	PVC insulated copper cable
	Size	A single 50 pair telecommunications cable, with each of the 100 wires in the cable having an outside diameter of 0.5mm.
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 30mm × 30mm. Supported at 500mm from the exposed and unexposed side
7	**Name**	**Sprinkler Pipe**
	Material	Mild Steel
	Size	Ø22mm (ID-measured) × 3.0mm (measured) wall thickness
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 30mm × 30mm. Supported at 150mm and 600mm from the unexposed face and capped on the exposed side with ceramic fibre wool
8	**Name**	**Sprinkler Pipe**
	Material	Mild Steel
	Size	Ø32mm (ID-measured) × 3.0mm (measured) wall thickness
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 50mm × 50mm. Supported at 150mm and 600mm from the unexposed face and capped on the exposed side with ceramic fibre wool

Item	Description	
9	**Name**	**Metal Pipe**
	Material	Copper
	Size	Ø100mm (ID-measured) × 2.0mm (measured) wall thickness
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 50mm × 50mm. Supported at 150mm and 600mm from the unexposed face and capped on the exposed side with ceramic fibre wool
10	**Name**	**Sprinkler Pipe**
	Material	Mild Steel
	Size	Ø80mm (ID-measured) × 4.0mm (measured) wall thickness
	Installation	Installed in the aperture and sealed with backing rods and HB Fuller FIRESOUND sealant with a fillet of 50mm × 50mm. Supported at 150mm and 600mm from the unexposed face and capped on the exposed side with ceramic fibre wool
11	**Name**	**Power Cables**
	Material	PVC insulated copper cables
	Size	AS1530.4-2014 Appendix D1 (Standard Configuration)
	Installation	Installed in the aperture and sealed with HB Fuller FIRESOUND sealant with a fillet of 50mm × 50mm. The service is supported at 150mm and 600mm from the unexposed side
Note: Items 1 to 11 are shown in Figures 1 to 7		

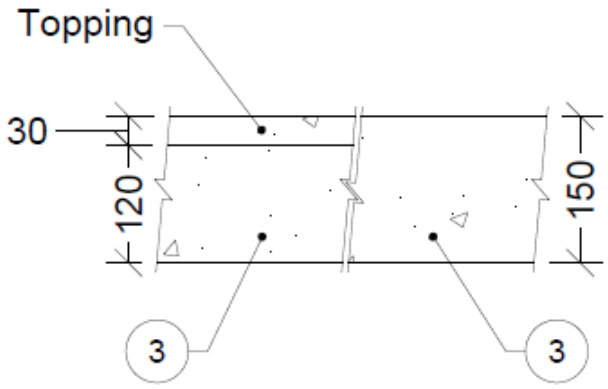

Figure 1 – Floor Construction Alternations

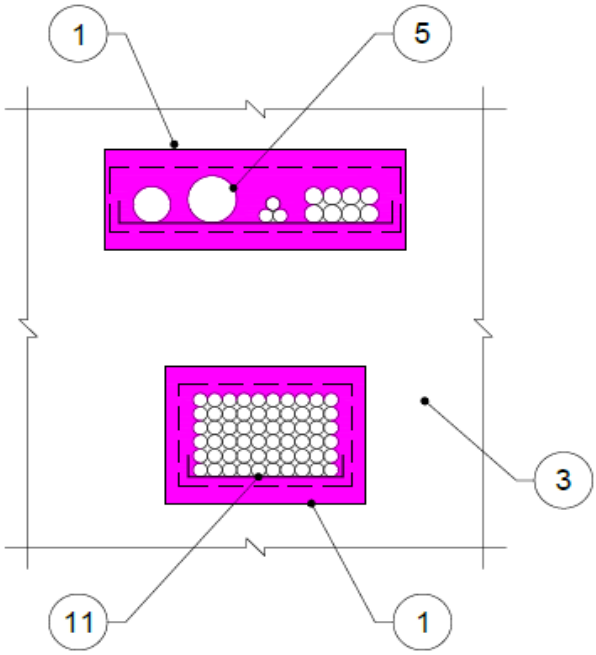

Figure 2 – Plan view of D1 and D2 Cable Services in Floor

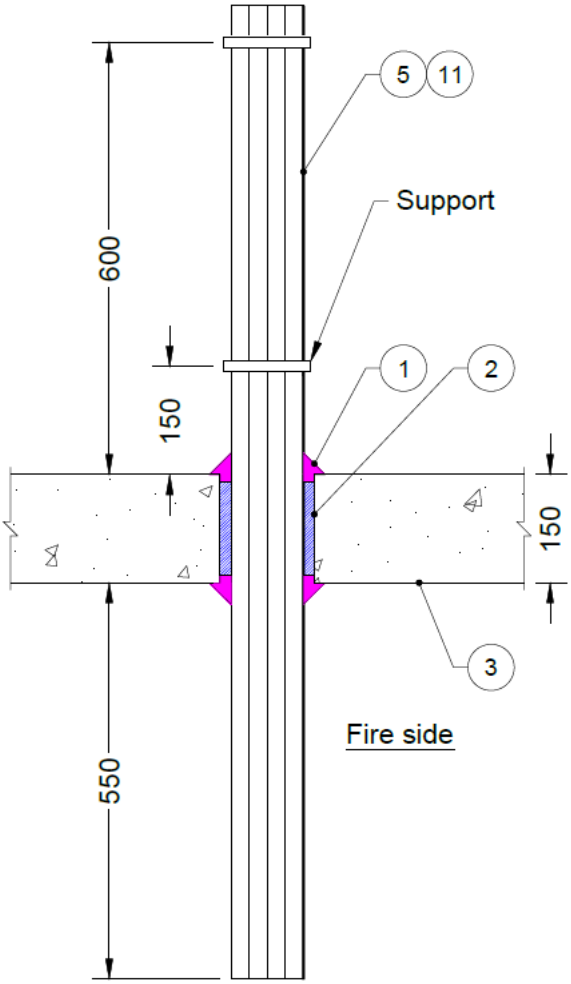

Figure 3 – Elevation View of D1 and D2 Cable Services in floor

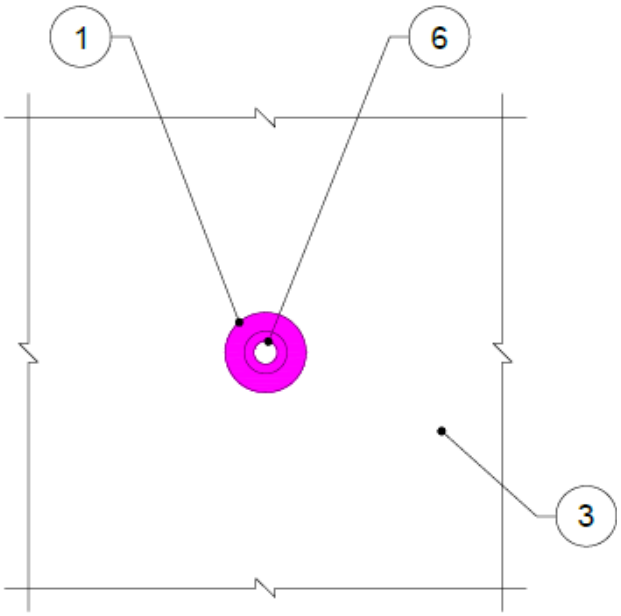

Figure 4 – Plan View of Single Communication Cable in Floor

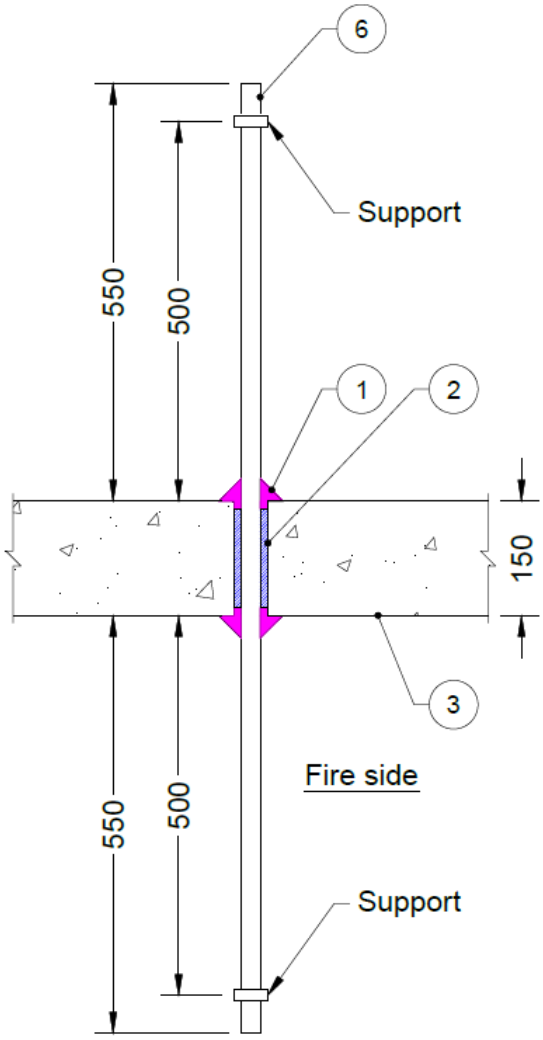

Figure 5 – Elevation View of Single Communication Cable in Floor

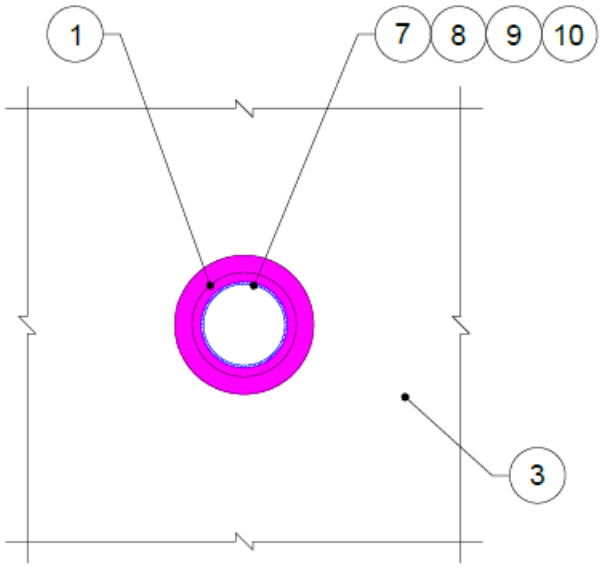

Figure 6 – HB Fuller FIRESOUND Sealant System with Metal Pipes in Floor

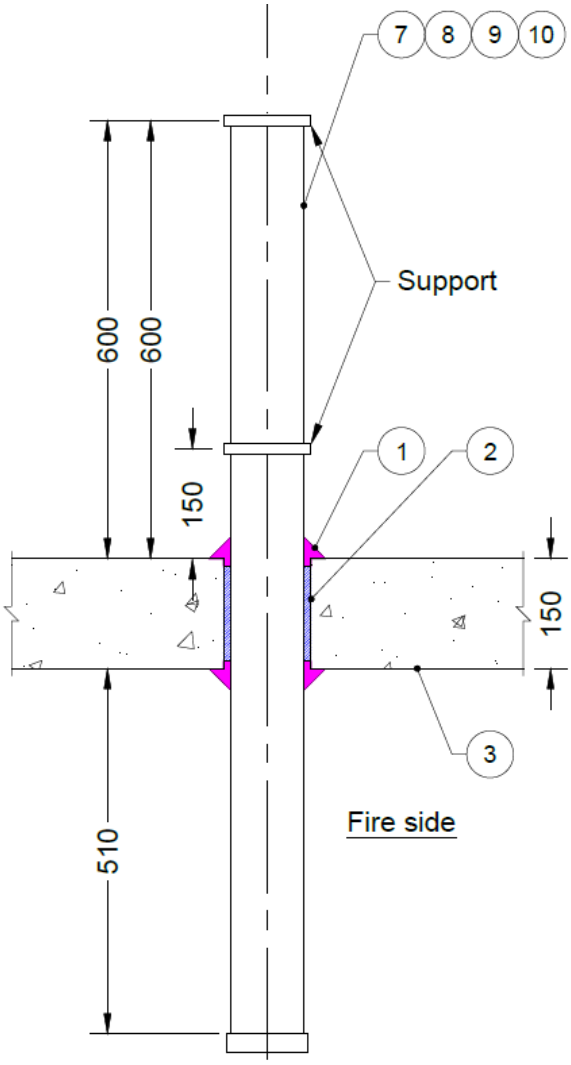

Figure 7 – Elevation View of Metal Pipes in Floor

4 REFERENCED TEST PROCEDURES

This report is prepared with reference to the requirements of AS1530.4-2014 and AS4072.1-2005 as appropriate.

5 FORMAL ASSESSMENT SUMMARY

Based on the discussion presented in this report, it is the opinion of this testing authority that if the tested prototype described in Section 2 had been modified within the scope of Section 3, it would be likely to achieve the fire resistance as stated below in Table 2 if tested in accordance with the test method referenced in Section 4 and subject to the requirements of Section 7.

Fire Resistance Service Penetrations in Concrete Floor Slab protected with HB Fuller FIRESOUND Sealant

Description	Construction Detail	FRL
AS1530.4-2014 Appendix D2 cable	Refer to figure 1 & 2	**-/180/120**
PVC insulated copper cables	Refer to figure 3 & 4	**-/180/180**
Steel Sprinkler Pipe Ø22mm(ID) × 3.0mm	Refer to figure 5 & 6	**-/180/180**
Steel Sprinkler Pipe Ø32mm(ID) × 3.0mm		**-/180/180**
Copper Pipe Ø100mm(ID) × 2.0mm		**-/180/-**
Steel Sprinkler Pipe Ø80mm(ID) × 4.0mm		**-/180/30**
AS1530.4-2014 Appendix D1 cables	Refer to figure 1 & 2	**-/180/90**

6 DIRECT FIELD OF APPLICATION

The application of the results of this assessment is for control joints and service penetrations in concrete floor slab exposed from underside of the floor slab only.

7 REQUIREMENTS

This report details the methods of construction, test conditions and assessed results that would have been expected had the specific elements of construction described herein been tested in accordance with AS1530.4-2014.

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

It is required that the support construction have sufficient fire resistance to provide support to the penetration seals for the required FRL period.

8 VALIDITY

This assessment report does not provide an endorsement by Exova Warringtonfire Aus Pty Ltd of the actual products supplied.

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.

Because of 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.

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

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 the subject of constant review and improvement and it is recommended that this report be reviewed on or, before, the stated expiry date.

The information contained in this report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

9 AUTHORITY

9.1 APPLICANT UNDERTAKINGS AND CONDITIONS OF USE

By using this report as evidence of compliance or performance the applicant(s) confirms that:

- to their knowledge the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the Standard against which this assessment is being made, and
- they agree to withdraw this assessment from circulation should the component or element of structure be 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, and
- they are not aware of any information that could adversely affect the conclusions of this assessment and if they subsequently become aware of any such information, agree to ask the assessing authority to withdraw the assessment.

9.2 GENERAL CONDITIONS OF USE

This report may only be reproduced in full without modifications by the report sponsor. Copies, extracts or abridgments of this report in any form shall not be published by other organisations or individuals without the permission of Exova Warringtonfire Aus Pty Ltd.

9.3 AUTHORISATION ON BEHALF OF EXOVA WARRINGTONFIRE AUS PTY LTD

Prepared by:

K. G. Nicholls

Reviewed by:

D. Nicholson

9.4 DATE OF ISSUE

11/03/2016

9.5 EXPIRY DATE

31/03/2021

APPENDIX A SUMMARY OF SUPPORTING DATA

A.1 TEST REPORT – WFRA 40869

A.1.1 Report Sponsor

A.1.1.1 HB Fuller Australia Company Pty Ltd, 16-20 Red Gum Drive, Dandenong South VIC 3175.

A.1.2 Test Laboratory

A.1.2.1 Warrington Fire Research (Aus) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong South, Victoria, 3175.

A.1.3 Test Date

A.1.3.1 The test was conducted on 21st August 2001.

A.1.4 Test standards prescribed

A.1.4.1 The test was conducted in accordance with AS1530.4-1997 and AS4072.1-1992 as appropriate for control joints.

A.1.5 General description of tested specimens

A.1.5.1 The sealant manufacturer and test sponsor has confirmed in writing that the formulation of the tested sealant is identical to PROMASEAL® FA.

A.1.5.2 The specimen comprised a 120mm normal weight concrete slab incorporating four control joints protected by the sealant. For the purpose of this assessment, the control joints designated Control Joints 2 and 3 are relevant and described below.

No	Description
2	20mm wide x 10mm deep bead of sealant on fire and non-fire exposed sides
3	50mm wide x 20mm deep bead of sealant on fire and non-fire exposed sides

A.1.6 Instrumentation

A.1.6.1 This was accordance with AS1530.4-1997 and AS4072.1-1992 as appropriate for control joints.

A.1.7 Test Results

No	Description	Integrity	Insulation
2	20mm wide x 10mm deep bead of sealant on fire and non-fire exposed sides	No failure at 241 minutes	145 Minutes on Sealant
3	50mm wide x 20mm deep bead of sealant on fire and non-fire exposed sides	No failure at 241 minutes	166 Minutes on slab No failure at 241 minutes on Sealant

A.1.7.1 The test was discontinued after a period of 241 minutes.

A.1.7.2 The ambient air temperature was around 15°C with no significant variations during the test period. The calculated pressure in the furnace was 20Pa at 100mm from the soffit of the slab.

A.2 TEST REPORT – WFRA 41257.2

A.2.1 Report Sponsor

A.2.1.1 HB Fuller Australia Company Pty Ltd, 16-22 Red Gum Avenue, Dandenong South, VIC 3175

A.2.2 Test Laboratory

A.2.2.1 Warrington Fire Research (Aus) Pty Ltd, Unit 2, 409-411 Hammond Road, Dandenong, VIC, 3175.

A.2.3 Test Date

A.2.3.1 The fire resistance test was conducted on 11th October 2006.

A.2.4 Test Standard

A.2.4.1 The test was conducted in accordance with AS1530.4-2005 and AS4072.1-2005.

A.2.5 Variations to Test Method

A.2.5.1 None stated.

A.2.6 General Description of Tested Specimen

A.2.6.1 The supporting construction comprised a nominal 1300mm wide × 1250mm long × 150mm thick steel reinforced CSR Hebel Powerpanel™ wall system.

A.2.6.2 Several penetrations were included within the wall system. All the service penetrations except Service A are relevant to this assessment, the details of which are provided below:

ID	Description	Protection	Support
B	Electrical cable tray	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 150mm and 600mm from the unexposed face.
C	Single PVC insulated copper telecommunication cable	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 500mm from the exposed and unexposed faces.
D	22mm × 3mm steel sprinkler pipe	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 150mm and 600mm from the exposed and unexposed faces and was capped on the exposed side with ceramic fibre wool.
E	32mm × 3mm steel sprinkler pipe	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 150mm and 600mm from the exposed and unexposed faces and was capped on the exposed side with ceramic fibre wool.
F	100mm × 2mm steel copper pipe	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 150mm and 600mm from the exposed and unexposed faces and was capped on the exposed side with ceramic fibre wool.
G	80mm × 4mm steel sprinkler pipe	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both	Supported at 150mm and 600mm from the exposed and unexposed faces and was capped on the

ID	Description	Protection	Support
		sides and was applied around the annular gap to the backing rod.	exposed side with ceramic fibre wool.
H	Cable tray	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	Supported at 150mm and 600mm from the exposed and unexposed faces and was capped on the exposed side with ceramic fibre wool.
-	Control joint	Foam backing rod was positioned in the annular gap a nominal 10mm back from both sides of the wall face. HB Fuller FIRESOUND sealant was used on both sides and was applied around the annular gap to the backing rod.	-

A.2.7 Instrumentation

A.2.7.1 The test was performed in accordance with the requirements of AS1530.4-2005 Section 2 and 10, and AS4072.1-2005.

A.2.8 Variations to Test Method

A.2.8.1 The average pressure over a 5 minute period at various times during the test exceeded the maximum variation of ± 3Pa, the running average of pressure at all times during the test remained within the specified limits of variance, this variation is considered slightly more onerous than that required by the test standard and not considered to significantly affect the results of the test.

A.2.8.2 Upon commencement of the fire resistance test it had become evident that some thermocouples had become faulty, causing some services not comply with the thermocouple locations specified in AS1530.4-2005. The remaining thermocouples did however cover at least one point of the thermocouple locations specified in AS1530.4-2005. Roving thermocouple readings were taken where possible. This variation in not considered to significantly affect the results of the test.

A.2.9 Test Results

A.2.9.1 The test duration was 181 minutes.

A.2.9.2 The specimens achieved the following performance when evaluated against the failure criteria of AS1530.4-1997:

ID	Integrity	Insulation
B	No failure at 181 minutes.	149 minutes, by exceeded 180K rise limit on the cables, 25mm from the sealant.
C	No failure at 181 minutes.	No failure at 181 minutes.
D	No failure at 181 minutes.	No failure at 181 minutes.
E	No failure at 181 minutes.	No failure at 181 minutes.
F	No failure at 181 minutes.	14 minutes, by exceeded 180K rise limit on the pipe 25mm from the sealant
G	No failure at 181 minutes.	41 minutes, by exceeded 180K rise limit on the pipe 25mm from the sealant
H	No failure at 181 minutes.	100 minutes, by exceeded 180K rise limit on the single core cable 25mm from the sealant.
Control Joint	No failure at 181 minutes.	No failure at 181 minutes.

APPENDIX B – ASSESSMENT OF SPECIFIC VARIATIONS

B.1 RELEVANCE OF WFRA 41257.2 TEST DATA TO AS1530.4-2014

B.1.1 General

B.1.1.1 The fire resistance test WFRA 41257.2 was conducted in accordance with AS1530.4-2005 and AS4072.1-2005, which differs from AS1530.4-2014.

B.1.1.2 The differences in test method considered capable of significantly altering specimen performance are discussed below,

B.1.2 Furnace Temperature Measurement

B.1.2.1 The specification for furnace thermocouples in AS1530.4-2014 are the same as those specified in AS1530.4-2005.

B.1.3 Furnace Temperature Regime

B.1.3.1 AS1530.4-2005 and AS1530.4-2014 specify furnace temperature to follow the following trend:

$$T_{AS1530.4-2014} = 345\log_{10}(8t+1)+20$$

B.1.3.2 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2014 and AS1530.4-2005 are not appreciably different.

B.1.4 Furnace Pressure Regime

B.1.4.1 AS1530.4-2014 and AS1530.4-2005 specifies that a pressure of 15 ± 3Pa shall be established at the centre of the lowest penetration service.

B.1.5 Specimen Temperature Measurement

B.1.5.1 The specification and location for specimen thermocouples in AS1530.4-2014 are the same as those specified in AS1530.4-2005.

B.1.6 Integrity Performance Criteria

B.1.6.1 The integrity criteria specified in AS1530.4-2014 are the same as those specified in AS1530.4-2005.

B.1.7 Insulation Performance Criteria

B.1.7.1 The insulation criteria specified in AS1530.4-2014 are the same as those specified in AS1530.4-2005.

B.1.8 Application of Test Data to AS1530.4-2014

B.1.8.1 The average pressure over a 5 minute period at various times during the test exceeded the maximum variation of ± 3Pa, the running average of pressure at all times during the test remained within the specified limits of variance, this variation is considered slightly more onerous than that required by the test standard and not considered to significantly affect the results of the test.

B.1.8.2 Upon commencement of the fire resistance test it had become evident that some thermocouples had become faulty, causing some services to not comply with the thermocouple locations specified in AS1530.4-2014. The remaining thermocouples did however cover at least one point of the thermocouple locations specified in AS1530.4-2014. Roving thermocouple readings were taken where possible. This variation in not considered to significantly affect the results of the test.

B.1.8.3 In light of the above, it is considered that the integrity and insulation behaviour of the specimens tested in WFRA 41257.2 can be used to assess the likely performance if the specimens were tested in accordance with AS1530.4-2014.

B.2 RELEVANCE OF WFRA 40869 TEST DATA TO AS1530.4-2014

B.2.1 General

B.2.1.1 The fire resistance test WFRA 40869 was conducted in accordance with AS1530.4-1997 and AS4072.1-1992, which differs from AS1530.4-2014.

B.2.1.2 The differences in test method considered capable of significantly altering specimen performance are discussed below,

B.2.2 Furnace Temperature Measurement

B.2.2.1 The specification for furnace thermocouples in AS1530.4-2014 and AS1530.4-1997 are not appreciably different.

B.2.3 Furnace Temperature Regime

B.2.3.1 AS1530.4-2014 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-2014} = 345\log_{10}(8t+1)+20$$

B.2.3.2 AS1530.4-1997 specifies furnace temperature to follow the following trend:

$$T_{AS1530.4-1997} = 345\log_{10}(8t+1)+T_o \quad 10^oC \le T_o \le 40^oC$$

B.2.3.3 The parameters outlining the accuracy of control of the furnace temperature in AS1530.4-2014 and AS1530.4-1997 are not appreciably different.

B.2.4 Furnace Pressure Regime

B.2.4.1 AS1530.4-2014 specifies that a pressure of 20 ± 3Pa shall be maintained in the horizontal plane 100mm below the underside of the slab.

B.2.4.2 Test report WFRA 40869 confirms that the pressure condition adhered to that prescribed by AS1530.4-2014.

B.2.5 Specimen Temperature Measurement

B.2.5.1 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 3mm. 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 12mm diameter x 0.2mm thick copper disc. The disc shall be covered by 30 ± 0.5mm x 30 ± 0.5mm x 2.0 ± 0.5mm thick inorganic insulating pad having a density of 900 ± 100kg/m3.

B.2.5.2 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 3mm. 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 12mm diameter x 0.2mm thick copper disc. The disc shall be covered by an oven-dry pad, not less than 30mm square, made from material having a value √(kρc) not greater than 600 at 150℃, and of such thickness as will give a thermal resistance (R = t/K) of 0.015 K/W – 0.025 K/W at 150℃.

B.2.5.3 For control joints installed in horizontal separating elements, AS1530.4-2014 requires thermocouples to be located as follows:

a) At least three on the surface of the seal, with one thermocouple for each 0.3m^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).

b) On the surface of the seal 25mm from the edge of the opening, with one thermocouple from each 500mm of the perimeter.

c) On the surface of the separating element 25mm from the edge of opening, with one thermocouple for each 500mm of the perimeter.

d) 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 12mm. under these circumstances, the size of the pad may be reduced to facilitate the fitting of the thermocouple.

B.2.5.4 AS 4072.1-1992 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.

B.2.5.5 Specimens 2 and 3 in test WFRA 40869 were sealed on the both sides of the wall separating element and the thermocouples were positioned in such a manner that they meet the requirements of AS1530.4-2014.

B.2.5.6 Based on the above discussion, it is considered the insulation performance of specimens tested in WFRA 40869 can be used to assess the performance in accordance with AS1530.4-2014.

B.2.6 Integrity Performance Criteria

B.2.6.1 AS1530.4-2014 deems integrity failure to have occurred upon collapse, sustained (10 seconds) flaming, ignition of an applied cotton pad or if a 6mm gap gauge can protrude into the furnace and can be moved 150mm along the gap (not applicable at the sill), or if a 25mm gap gauge can protrude into the furnace.

B.2.6.2 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.

B.2.6.3 By inspection of test observation of test WFRA 40869, the sealant along Control Joints 2 and 3 was changing shape from concave to convex whereas there were no splits in the material at 120 minutes and both control joints were intact with no gaps or cracks visible at 240 minutes.

B.2.6.4 It was observed that no sealant fell from the joints and it remained firmly in contact with the edges of the concrete section for the 241 minutes test duration. Data collected from thermocouples located on the seals indicate that surface temperatures did not exceed 275 degrees which is not considered sufficient to cause flaming of a cotton pad.

B.2.6.5 There were no observations made for the specimen relevant to this assessment in WFRA 40869 which are considered likely to have warranted the application of a cotton pad.

B.2.7 Insulation Performance Criteria

B.2.7.1 The insulation criteria specified in AS1530.4-2014 and the same as those specified in AS1530.4-1997.

B.2.8 Application of Test Data to AS1530.4-2014

B.2.8.1 The minor variations in furnace heating regimes and specimen thermocouple specification are not considered likely to significantly affect the behaviour of the specimens relevant to this assessment.

B.2.8.2 In light of the above, it is considered that the integrity and insulation behaviour of the specimens tested in WFRA 40869 can be used to assess the likely performance if the specimen was tested in accordance with AS1530.4-2014.

B.3 CABLES SERVICES IN FLOORS

B.3.1 Proposal

B.3.1.1 It is proposed that the cable penetrations tested in WFRA 41257 protected with HB Fuller FIRESOUND Sealant shall be installed in a 150mm thick normal weight concrete floor slab.

B.3.2 Discussion

General

B.3.2.1 The test assembly in test WFRA 40869 consisted control joints protecting with HB Fuller FIRESOUND sealant in a 120mm thick concrete floor.

B.3.2.2 The performance of control joints protected with HB Fuller FIRESOUND Sealant on both sides are summarised below:

Control Joint Ref.	Description of fire protection system	Structural Adequacy	Integrity (minutes)	Insulation (minutes)
Joint 2	20mm wide x 10mm deep bead of sealant on fire and non-fire sides	N/A	No failure at 241	145
Joint 3	50mm wide x 20mm deep bead of sealant on fire and non-fire sides	N/A	No failure at 241	166[1]

1 - Recorded on the unexposed slab surface – no failure recorded on sealant material for the duration of the test.

B.3.2.3 With reference to WFRA 40869, Control Joints 2 and 3 with sealant on fire and non-fire sides both satisfied the integrity failure criteria for a period of 241 minutes.

B.3.2.4 By inspection of test observation of test WFRA 40869, the sealant along Control Joints 2 and 3 was changing shape from concave to convex whereas there were no splits in the material at 120 minutes and both control joints were intact with no gaps or cracks visible at 240 minutes.

B.3.2.5 It is observed that no sealant fell from the joints and it remained firmly in contact with the edges of the concrete section for the 241 minutes test duration.

B.3.2.6 HB Fuller FIRESOUND Sealant has intumescent properties and demonstrated these in the above test.

B.3.2.7 The test assembly in test WFRA 41257.2 consisted of cable and metal pipe penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.3.2.8 With reference to WFRA 41257.2, all the service penetrations when tested achieved an integrity performance for a period of 181 minutes

B.3.2.9 Upon inspection of test observations smoke was emitted from the sealant/penetration surface during the test though no glowing or flaming that would warrant application of a cotton pad for the duration of the test

B.3.2.10 It is observed for Service F, seal around the pipe had begun to swell but still remained in place for the period of 181 minutes.

B.3.2.11 The significance of the above observed behaviour is that the sealant appeared to exhibit good fire side integrity performance limiting the exposure to the non-fire side. The fire side seal expanded and in all cases remained in place for a period of 180 minutes.

B.3.2.12 Based on above discussion, it is expected the penetrations tested in WFRA 41257.2 subjecting to be tested in a horizontal orientation with the services supported in similar manner the intumescent seal would swell between the sealant and services in a similar manner to that in 41257.2.

B.3.2.13 Further confidence in the ability to remain in place is provided by reference to WFRA 40869, where the sealant satisfactorily remained in place as a control joint 20mm wide in a horizontal application.

B.3.2.14 In light of the discussion above, it is considered reasonable the integrity performance of penetrations systems tested in WFRA 41257.2 will not have a detrimentally significant effect if installed in a horizontal orientation if tested in accordance with AS1530.4-2014.

AS1530.4-2014 Appendix D2 –Telecommunication Cables

Integrity

B.3.2.15 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall system.

B.3.2.16 By inspection of test observations, for the tested cable service, a greater increase in smoke emissions from the cable and seal interface had become evident and material had also become evident dripping from the service at 160 minutes.

B.3.2.17 There were no sustained flaming occurred on the unexposed surface for greater than 10 seconds during the test period and the service continued to maintain integrity in accordance with AS1530.4-2014 at 181 minutes.

B.3.2.18 Based on the discussion presented in above, it is expected that there is no detrimentally significant effect on the integrity performance of tested specimen if tested in a horizontal orientation.

B.3.2.19 In light of above discussion, it is considered that the proposed AS1530.4-2014 Appendix D2 cable service system protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity by some margin if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Insulation

B.3.2.20 For tested AS1530.4-2014 Appendix D2 cable, the insulation failure in accordance with AS1530.4-2014 was recorded by the thermocouple located 25mm from the sealant on the cables by exceeding the initial temperature by more than 180K at 149 minutes.

B.3.2.21 It is therefore considered that the proposed AS1530.4-2014 Appendix D2 cable service system protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for at least 120 minutes if tested in a 150mm thick concrete floor if tested in accordance with AS15304.-2014.

Single PVC Insulated Telecommunication Cables

Integrity

B.3.2.22 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.3.2.23 The proposed PVC insulated copper cable consisted a single 50 pair telecommunication cable, with each of the 100 wires in the cable having an outside diameter of 0.5mm

B.3.2.24 Upon inspection of test observations, for the tested cable service, a greater increase in smoke emissions from the cable and seal interface had become evident and material had also become evident dripping from the service at 160 minutes.

B.3.2.25 There were no sustained flaming occurred on the unexposed surface for greater than 10 seconds during the test period and the service continued to maintain integrity in accordance with AS1530.4-2015 at 181 minutes.

B.3.2.26 Based on the discussion presented above, it is expected the integrity performance services tested in WFRA 41257.2 would perform similarly if exposed to fire from below.

In light of above discussion, it is considered that the proposed single telecommunication cable service protected with HB Fuller FIRESOUND Sealant would achieve 180 minute integrity by some margin if tested in a 150mm concrete thick floor if tested in accordance with AS1530.4-2015.

Insulation

B.3.2.27 Upon inspection of test results for the single telecommunication cable, the maximum temperature on the unexposed surface at 180 minutes was 118℃ that was record 25mm from the sealant on the cable.

B.3.2.28 This specimen therefore demonstrated a 91℃ margin over the maximum insulation limit of 180K rise at 180 minutes.

B.3.2.29 It is therefore considered that the proposed single telecommunication cable service protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for at least 180 minutes if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

AS1530.4-2014 Appendix D1 - Power Cables

Integrity

B.3.2.30 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.3.2.31 Upon inspection of test observations, for the tested Appendix D1 cable service, smoke emissions had continued from the tray and cable interface and darkening of the seal had become evident on the west edge of the tray at 84 minutes.

B.3.2.32 There were no sustained flaming occurred on the unexposed surface for greater than 10 seconds during the test period and the service continued to maintain integrity in accordance with AS1530.4-2014 at 181 minutes.

B.3.2.33 Based on the discussion presented above, it is expected the integrity performance services tested in WFRA 41257.2 would perform similarly if exposed to fire from below.

B.3.2.34 In light of above discussion, it is considered that the proposed AS1530.4-2014 Appendix D1 cable service system protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity if tested in a 150mm thick floor if tested in accordance with AS1530.4-2014.

Insulation

B.3.2.35 For tested AS1530.4-2014 Appendix D1 cable, the insulation failure in accordance with AS1530.4-2014 was recorded by the thermocouple located 25mm from the sealant on the single core cable by exceeding the initial temperature by more than 180K at 100 minutes.

B.3.2.36 It is therefore considered that the proposed AS1530.4-2014 Appendix D1 cable service system protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for at least 90 minutes by a reasonable margin if tested in a 150mm thick concrete floor if tested in accordance with AS15304.-2014.

B.4 METAL PIPES IN FLOORS

B.4.1 Proposal

B.4.1.1 It is proposed that the steel pipe penetrations protected with HB Fuller FIRESOUND Sealant as tested in WFRA 41257.2 shall be installed in a 150mm thick normal weight concrete floor slab.

B.4.2 Discussion

Ø22mm (ID) × 3.0mm Steel Sprinkler Pipe

Integrity

B.4.2.1 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.4.2.2 The proposed steel pipe as tested in WFRA 41257.2 has an inside diameter of 22mm and pipe wall thickness of 3.0mm.

B.4.2.3 By inspection of test observations, minimal smoke emission evident from the service was observed during the test period.

B.4.2.4 There was no integrity failure in accordance with AS1530.4-2014 was recorded during the test period, and it is therefore considered the steel pipe continued to maintain integrity if tested in accordance with AS1530.4-2014 at 181 minutes

B.4.2.5 Based on the discussion presented above, it is expected the integrity performance services tested in WFRA 41257.2 would perform similarly if exposed to fire from below.

B.4.2.6 In light of above discussion, it is considered that the Ø22mm (ID) ×3.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Insulation

B.4.2.7 With reference to WFRA 41257.2, the maximum temperature recorded on the pipe 25mm from sealant was 158℃ at 180 minutes.

B.4.2.8 The maximum cold face temperature therefore demonstrated a 51℃ margin over the insulation failure criteria of 180K rise limit.

B.4.2.9 It is therefore considered that the Ø22mm (ID) ×3.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for at least 180 minutes if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Ø32mm (ID) × 3.0mm Steel Sprinkler Pipe

Integrity

B.4.2.10 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.4.2.11 The proposed steel pipe as tested in WFRA 41257.2 has an inside diameter of 32mm and pipe wall thickness of 3.0mm.

B.4.2.12 By inspection of test observations, minimal smoke emission evident from the service was observed during the test period.

B.4.2.13 There was no integrity failure in accordance with AS1530.4-2014 was recorded during the test period, and it is therefore considered the steel pipe continued to maintain integrity if tested in accordance with AS1530.4-2014 at 181 minutes

B.4.2.14 Based on the discussion presented above, it is expected the integrity performance services tested in WFRA 41257.2 would perform similarly if exposed to fire from below.

B.4.2.15 In light of above discussion, it is considered that the Ø32mm (ID) ×3.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Insulation

B.4.2.16 With reference to WFRA 41257.2, the maximum temperature recorded on the pipe 25mm from sealant was 202℃ at 180 minutes.

B.4.2.17 The maximum cold face temperature therefore demonstrated a 7℃ margin over the insulation failure criteria of 180K rise limit.

B.4.2.18 It is therefore considered that the Ø32mm (ID) ×3.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for 180 minutes with some margin if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Ø80mm (ID) × 4.0mm Steel Sprinkler Pipe

Integrity

B.4.2.19 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.4.2.20 The proposed steel pipe as tested in WFRA 41257.2 has an inside diameter of 80mm and pipe wall thickness of 4.0mm.

B.4.2.21 By inspection of test observations, minimal smoke emission evident from the service and swelling of the seal had become evident at 49 minutes. The sealant around the pipe had continued to swell at 65 minutes.

B.4.2.22 There was no integrity failure in accordance with AS1530.4-2014 was recorded during the test period, and it is therefore considered the steel pipe continued to maintain integrity if tested in accordance with AS1530.4-2014 at 181 minutes

B.4.2.23 Based on the discussion presented above, it is expected the integrity performance services tested in WFRA 41257.2 would perform similarly if exposed to fire from below.

B.4.2.24 In light of above discussion, it is considered that the Ø80mm (ID) ×4.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity if tested in a 150mm thick floor if tested in accordance with AS1530.4-2014.

Insulation

B.4.2.25 For proposed metal pipe as tested in WFRA 41257.2, the insulation failure in accordance with AS1530.4-2014 was recorded by the thermocouple located 25mm from the sealant on the pipe by exceeding the initial temperature by more than 180K at 41 minutes.

B.4.2.26 It is therefore considered that the Ø80mm (ID) ×4.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would maintain the insulation performance for at least 30 minutes with some margin if tested in a 150mm thick concrete floor if tested in accordance with AS15304.-2014.

Ø100mm (ID) × 2.0mm Copper Pipe

Integrity

B.4.2.27 The test assembly in test WFRA 41257.2 consisted penetrations protected with HB Fuller FIRESOUND Sealant through a 150mm thick wall construction.

B.4.2.28 The proposed copper pipe as tested in WFRA 41257.2 has an inside diameter of 100mm and pipe wall thickness of 2.0mm.

B.4.2.29 By inspection of test observations, minimal smoke emission evident from the service and swelling of the seal had become evident at 14 minutes. The sealant around the pipe had continued to swell at 65 minutes.

B.4.2.30 There was no integrity failure in accordance with AS1530.4-2014 was recorded during the test period, and it is therefore considered the steel pipe continued to maintain integrity if tested in accordance with AS1530.4-2014 at 181 minutes

B.4.2.31 Based on the discussion presented in Section B1, it is expected that there is no detrimentally significant effect on the integrity performance of tested specimen if tested in a horizontal orientation.

B.4.2.32 In light of above discussion, it is considered that the Ø100mm (ID) ×2.0mm copper pipe protected with HB Fuller FIRESOUND Sealant would achieve 180 minutes integrity if tested in a 150mm thick concrete floor if tested in accordance with AS1530.4-2014.

Insulation

B.4.2.33 For proposed metal pipe as tested in WFRA 41257.2, the insulation failure in accordance with AS1530.4-2055 was recorded by the thermocouple located 25mm from the sealant on the pipe by exceeding the initial temperature by more than 180K at 14 minutes.

B.4.2.34 It is therefore considered that the Ø100mm (ID) ×2.0mm steel sprinkler pipe protected with HB Fuller FIRESOUND Sealant would not maintain the insulation performance if tested in a 150mm thick concrete floor if tested in accordance with AS15304.-2014.