

# Fire resistance of SNAP fire collars protecting various pipe system penetrations in Multiboard lined walls when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005

## Assessment Report

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Commercial-in-confidence

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# 1 Introduction

This report is an assessment of fire resistance of SNAP fire collars protecting various pipe system penetrations in Multiboard lined walls when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1-2005.

This report is prepared for meeting the evidence of suitability requirements of NCC 2019 Vol. 1 Schedule 5 as appropriate for FRL.

This report reviews and confirms the extent to which the reference fire resistance tests listed in section 2 meet the requirements of the standard fire test standards listed in section 4 of the report. The proposed variations to the tested construction presented in section 3 are subject to an analysis in Appendix B and the conclusions are presented in Section 5 of this report.

The field of applicability of the results of this assessment report is presented in Section 6 and subject to the requirements, validity and limitations of Section 7, 8 and 9.

# 2 Supporting Data

This assessment report refers to various test reports to support the analysis and conclusions of this report. They are listed below;

Report Reference	Test Standard	Outline of Test Specimen
WFRA 2168000.1	AS 1530.4-2005	Full-scale non-load-bearing double steel stud wall system, lined on both sides with 15mm thick (2 × 7.5mm thick) Multiboard wall cladding.
WFRA 2168001	AS 1530.4-2005	Pilot-scale stud wall lined on the exposed side with 15mm thick (2x7.5mm) Multiboard and on the unexposed side with 13mm thick Soundcheck
FSP 1748	AS 1530.4-2014	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1759	AS 1530.4-2014	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FAR 3929	AS 1530.4-2005 and AS 4072.1-2005	Assessment of the fire resistance of various pipe penetrations protected with various Snap fire collars in plasterboard lined walls.
FCO 2718	AS 1530.4-2005 and AS 4072.1-2005	Assessment of the fire resistance of various pipe penetrations protected with various Snap fire collars in concrete slabs, masonry and plasterboard lined walls.
FCO 2719	AS 1530.4-2005 and AS 4072.1-2005	Assessment of the fire resistance of various pipe penetrations protected with various Snap fire collars in concrete slabs, masonry and plasterboard lined walls.
FP 4874	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1341	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1360	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1366	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1634	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1658	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars

<b>Report Reference</b>	<b>Test Standard</b>	<b>Outline of Test Specimen</b>
FSP 1716	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars
FSP 1902	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by nine (9) pipes protected by a retro-fitted Snap Fire Systems fire collar.
FSP 1931	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by a single service and protected by a retro-fitted Snap Fire Systems fire collar.
FSP 1946	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by a single service and protected by a retro-fitted Snap Fire Systems fire collar.
FSP 1978	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by a two(2) services and protected by a retro-fitted Snap Fire Systems fire collar.
FSP 1996	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by a five(5) services and protected by a retro-fitted Snap Fire Systems fire collar.
FSP 2040	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by a single service and protected by a retro-fitted Snap Fire Systems fire collar.

The reports WFRA 2168000.1 and WFRA 2168001 were undertaken by Warrington Fire Research Aust Pty Ltd and sponsored by Multiboard (Aust.) Pty Ltd who has provided permission for CSIRO to refer to these reports on behalf of IG6 Pty Ltd.

The reports FSP 1748, FSP 1759, FCO 2718, FCO 2719, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658, FSP 1716, FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040 were undertaken by CSIRO and sponsored by Snap Fire Systems who has provided permission for CSIRO to refer to these reports on behalf of IG6 Pty Ltd.

The reports FAR 3929 and FP 4874 were undertaken by BRANZ and sponsored by Snap Fire Systems who has to provide permission for CSIRO to refer to these reports on behalf of IG6 Pty Ltd.

## 3 Proposed Variations

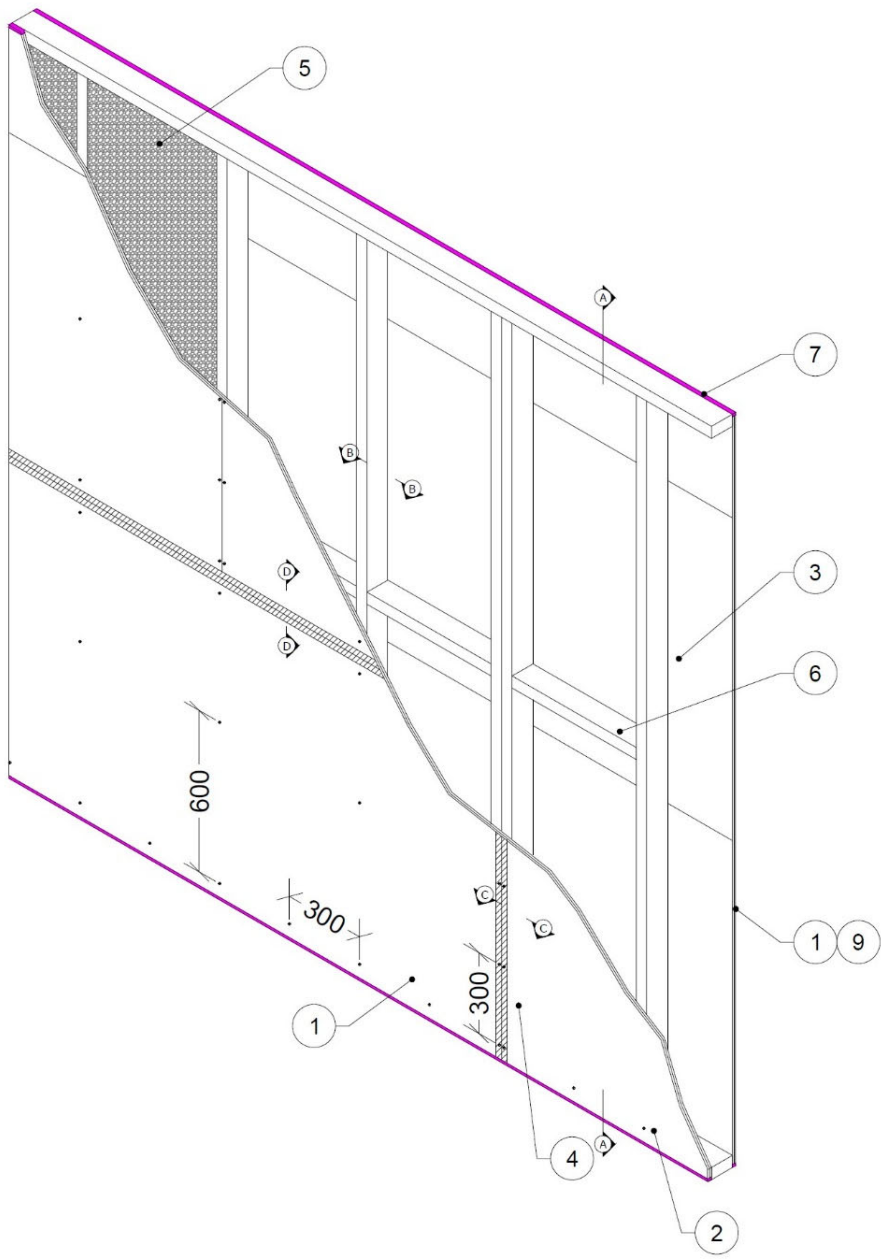
### 3.1 Wall construction

The wall construction shall be as tested in WFRA 2168000.1 subject to the following variations;

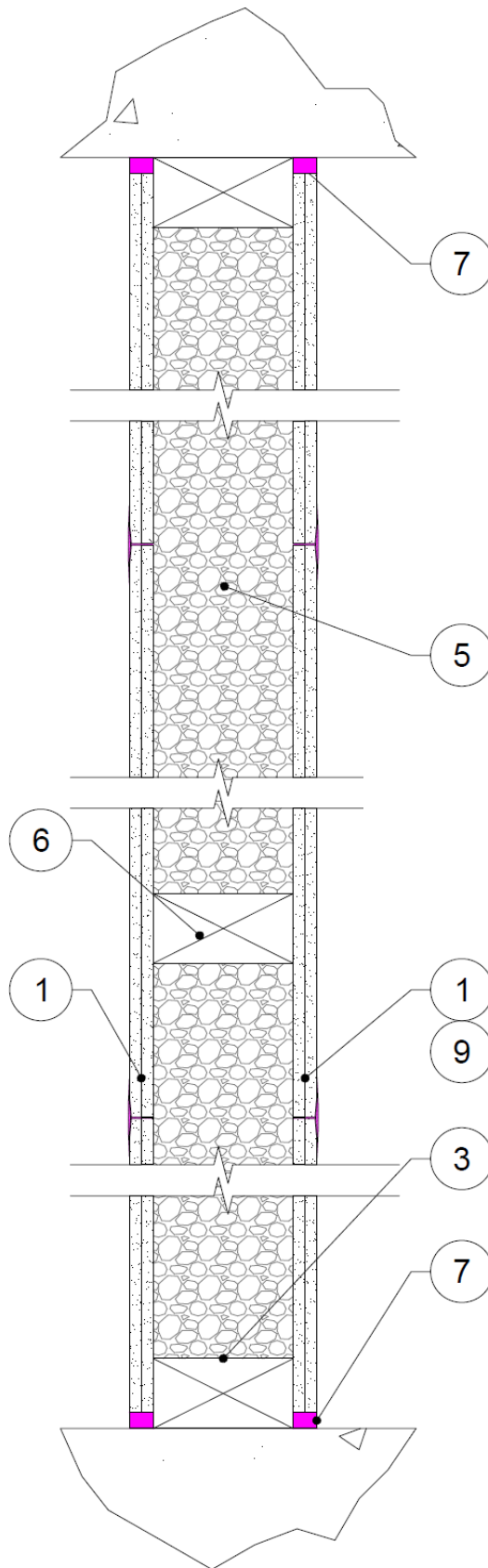
- The wall frame arrangement shall be single stud configuration in place of the double stud configuration as tested in WFRA 2168000.1.
- The Multiboard sheets shall be orientated and fixed as tested in WFRA 2168000.1 with double studs behind vertical sheet butt joints, though no framing behind horizontal joints.
- Proposed construction as shown in Table 1 and Figures 1-4

**Table 1 – Schedule of Components for Multiboard wall system.**

Item	Description	
1	<b>Name</b>	15mm Multiboard
	<b>Size</b>	2 × 7.5mm thick Multiboard boards (Nominally 1100kg/m <sup>3</sup> ) laminated with PVA glue
	<b>Installation</b>	Multiboard boards fixed to the steel framing at nominal 300mm vertical centres and nominal 600mm horizontal centres into the steel framing. Nominal 15mm wide bead of Pyropanel Multiflex applied to the face of the studs and nogging prior to screw fixing of the Multiboard boards.
2	<b>Name</b>	Board fixings
	<b>Size</b>	8g × 50mm steel self-tapping screws
	<b>Installation</b>	Multiboard linings shall be fixed to the framing at nominal 300mm vertical centres in the field and at edges of the board
3	<b>Name</b>	Wall framing
	<b>Material</b>	Steel framing designed in accordance with AS4600
	<b>Size</b>	The studs shall be at least 90mm deep
	<b>Spacing</b>	600mm maximum centres
4	<b>Name</b>	Jointing Compound
	<b>Material</b>	CSR Gyprock Base Coat 45
	<b>Installation</b>	Nominal 50mm wide perforated tape
5	<b>Name</b>	Cavity Insulation
	<b>Material</b>	50mm 16kg/m <sup>3</sup> glasswool
	<b>Installation</b>	Installed tightly between studs.
6	<b>Name</b>	Steel Framing – Nogging
	<b>Material</b>	Steel
	<b>Size</b>	90mm deep
	<b>Installation</b>	Nogging spacing to suit studs designed in accordance with AS4600
7	<b>Name</b>	Sealant
	<b>Material</b>	Pyropanel Multiflex Fire Rated Flexible Acrylic Sealant.
	<b>Installation</b>	The gap at the head and base of the wall between the boards and support construction was filled with 10mm wide sealant to the depth of the boards.

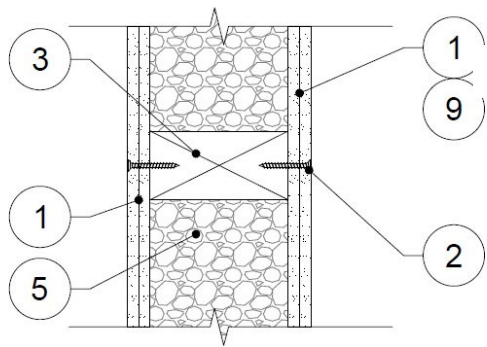


**Figure 1 – Multiboard Cladding System**

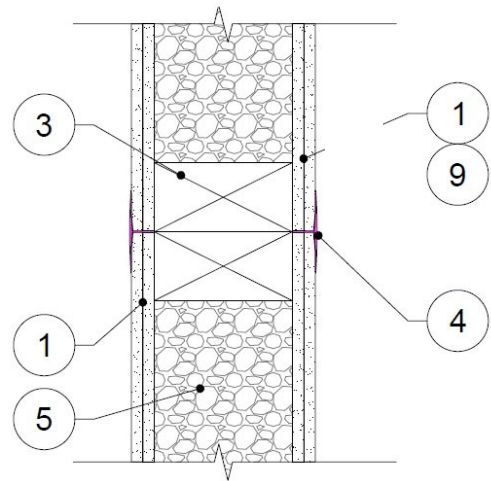


**Figure 2 – Elevation of a wall, Section A-A**



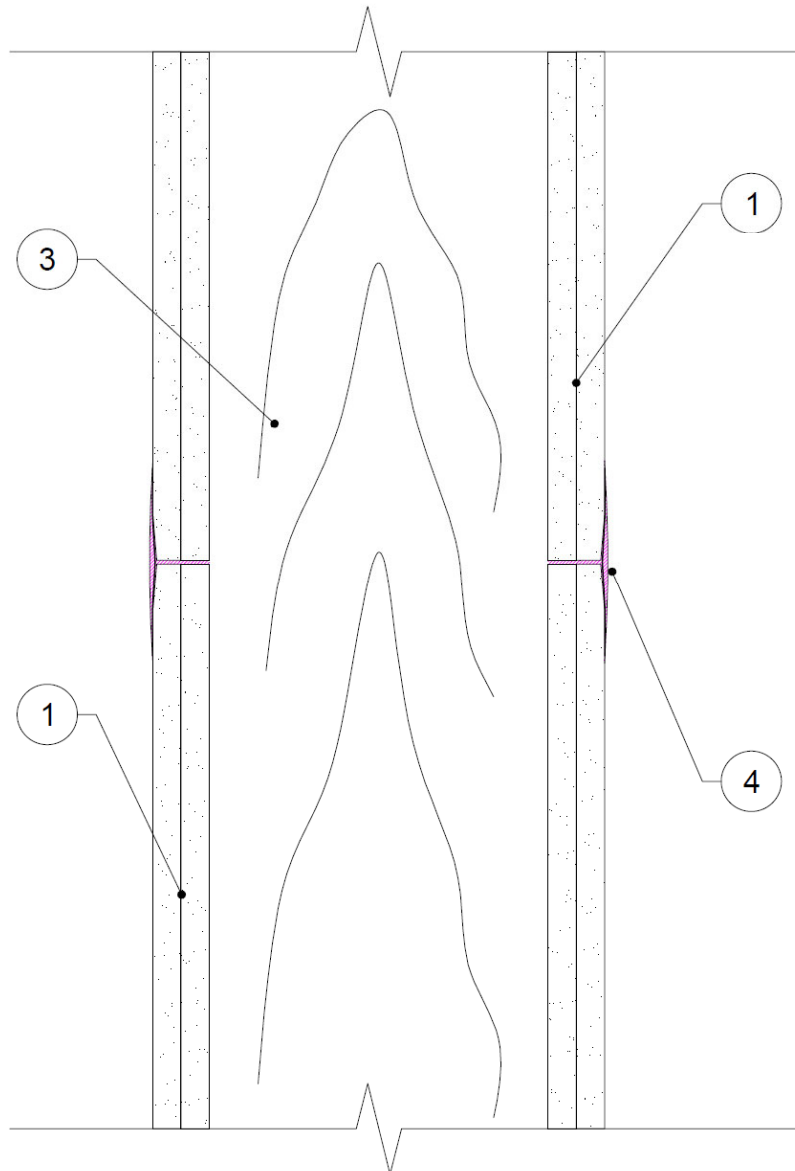


**Section B-B**



**Section C-C**

**Figure 3 – Plan Section detail through Stud**



**Figure 4 – Elevated Section at Horizontal joint in Multiboard, Section D-D**

## 3.2 Penetrations

The proposed construction includes the pipes and Snap collars listed in Table 2 installed within support wall construction as tested in referenced tests and subject to the following variations:

- The wall systems with 2 x13mm fire grade plasterboard each side of a 64mm studs tested in FSP 1748, FSP 1759 FP4874, FSP 1360, FSP 1366, FSP 1658, FSP 1716, FSP 1634, FSP 1341, FSP 1360, FP4874, FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040 shall be replaced with the Multiboard wall system tested in WFRA 2168000.1 varied with variations as described in section 3.1.
- The inclusion of 40mm to 110mm Raupiano pipes protected by Snap 50R, 65-80R and 110R collars penetrating Multiboard wall system tested in WFRA 2168000.1 varied with variations as described in section 3.1.

**Table 2 – Snap collars and Referenced Report**

Collar Name	Pipe Size (mm)	Pipe Material	Test Report	Specimen ID
50R	32	P-PVC	FSP1748	1
50R	32	C-PVC		2
32R	16	PVC (Flexi)		3
32R	20	PVC Conduit		4
32R	25	PVC Conduit		5
32R	25	PVC Conduit		6
32R	20	PVC Conduit		7
32R	15	P-PVC		8
110R	100	PVC-SC		9
32GAS	15	Pexal		FSP1759
32R	20	Pexal	2	
32R	15	Pexal	3	
32GAS	20	Pexal	4	
32GAS	26	Pexal	5	
50GAS	32	Pexal	6	
50GAS	40	Pexal	7	
50GAS	50	Pexal	8	
110R	90	PVC	FAR3929 and FP4874	-
65-80R	90	PVC		-
65-80R	80	PVC		-
65-80R	65	PVC		-
63R	65	PVC		-
63R	50	PVC		-
50R	50	PVC		-
50R	40	PVC		-
65-80R	90	HDPE		-
65-80R	75	HDPE		-
63R	63	HDPE		-
63R	56	HDPE		-
63R	50	HDPE		-
50R	56	HDPE		-
50R	50	HDPE		-
63R	50	PPR 7.4		-
63R	40	PPR 7.4	-	

Collar Name	Pipe Size (mm)	Pipe Material	Test Report	Specimen ID
63R	32	PPR 7.4	FAR3929, FP4874, FSP1360 and FSP1366	-
63R	25	PPR 7.4		-
50R	40	PPR 7.4		-
50R	32	PPR 7.4		-
50R	25	PPR 7.4		-
32R	25	PPR 7.4		-
63R	50	PE 7.4		-
63R	40	PE 7.4		-
63R	32	PE 7.4		-
63R	25	PE 7.4		-
50R	40	PE 7.4		-
50R	32	PE 7.4		-
50R	25	PE 7.4		-
32R	25	PE 7.4		-
32GAS	20	IPEX PE-AL-PE		FCO2718, FSP1339, FSP1340 and FSP1341
32GAS	25	IPEX PE-AL-PE	-	
50GAS	32	IPEX PE-AL-PE	-	
50GAS	40	IPEX PE-AL-PE	-	
32GAS	16	GASPEX PX-AL-PX	FCO2719 FSP1339, FSP1340 and FSP1341	-
32GAS	20	GASPEX PX-AL-PX		-
32GAS	25	GASPEX PX-AL-PX		-
32GAS	32	GASPEX PX-AL-PX		-
50GAS	40	GASPEX PX-AL-PX		-
50GAS	50	GASPEX PX-AL-PX		-
110R	100	PVC(SC)	FP4874	1
63R	50	PVC		4
50R	40	PVC		5
50R	40	PVC		6
110R	100	PVC(SC)		7
110R	100	HDPE		8
65-80R	80	PVC		9
50R	40	HDPE		11
32GAS	16	REHAU PX-AL-PE	FSP1341	1
32GAS	32	IPEX PE-AL-PE		2
50GAS	40	REHAU PX-AL-PE		3
50GAS	50	IPEX PE-AL-PE		4
50GAS	32	GASPEX PX-AL-PX		5
32GAS	16	IPEX PE-AL-PE		6
63R	63	PPR 7.4	FSP1360	1

Collar Name	Pipe Size (mm)	Pipe Material	Test Report	Specimen ID
32R	20	PPR 7.4		2
63R	20	PPR 7.4		3
50R	20	PPR 7.4		4
32R	32	PPR 7.4		5
50R	50	PPR 7.4		6
63R	63	PE 7.4		FSP1366
32R	20	PE 7.4	2	
63R	20	PE 7.4	3	
50R	20	PE 7.4	4	
32R	32	PE 7.4	5	
50R	50	PE 7.4	6	
32R	16	Pex-b	FSP1634	A
32R	16	Pex-a		B
32R	20	Pex-b		C
32R	20	Pex-a		D
32R	25	Pex-b		E
32R	25	Pex-a		F
32R	25	Pex-a		G
32R	32	Pex-a		H
32R	32	Pex-b		I
32R	20	Progef	FSP1658	A
32R	20	Progef		B
32R	25	Progef		C
32R	25	Progef		D
32R	32	Progef		E
32R	40	Progef		F
50R	50	Progef		G
63R	63	Progef		H
50R	40	Raupiano	FSP 1716	4
HP150R	150	PVC		5
HP150R	160	HDPE		1
32R	32	Pex-a		2
110R	110	Raupiano	3	
50R	38	C-PVC	FSP 1902	1
50R	50	PVC		2
65-80R	65	PVC		3
50R	25 + 20	Px/Al/Px + Pex-b		4
32R	20	Telstra PVC Conduit		5
32R	2 x 20	Pex-b		6
32R	20 + 20	Px/Al/Px + Pex-b	9	
HP315R	315	PVC	FSP 1931	1
HP315R	315	HDPE	FSP 1946	1
50R	50	C-PVC	FSP 1978	1
HP250R-B	225	PVC		2
110R	100	PVC-SC	FSP 1996	5
50R	40	Raupiano		3
110R	110	Raupiano		4
50R	40	Triplus		2
HP250R-B	250	HDPE	FSP 2040	1

## 4 Referenced Standards

AS 1530.4-2014	Methods for fire tests on building materials, components and structures Part 4: Fire resistance tests of elements of building construction.
AS 4072.1-2005	Components for the protection of openings in fire-resistant separating elements Part 1: Service penetrations and control joints

## 5 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototypes described in Section 2 when varied as described in Section 3 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of section 7, the validity of section 8 and limitation of section 9.

**FRL of service penetrations in Table 2: -/90/90**

**Table 3: Raupiano pipe with SNAP collars**

SNAP Collar	Supporting Construction	Pipe (mm)			FRL
		Material	OD	Minimum wall thickness	
50R	Multiboard wall system tested in WFRA 2168000.1 with and varied with variations as described in section 3.1.	Raupiano	40	2	-/90/90
50R			50	2.5	-/90/90
65-80R			75	3	-/90/90
65-80R			90	3.1	-/90/90
110R			110	3.2	-/90/90

## 6 Direct Field of Application of Results

The results of this report are applicable to walls exposed to fire from either side.

## 7 Requirements

It is required that the supporting construction is tested or assessed to achieve the required FRL up to the required FRL based on the assessed design in accordance with AS 1530.4.

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

## 8 Term of Validity

This assessment report will lapse on 31<sup>st</sup> May 2025. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

## 9 Limitations

The conclusions of this assessment report may be used to directly assess the fire resistance performance under such conditions, but it should be recognised that a single test method will not provide a full assessment of the fire hazard under all fire conditions.

Because of the nature of fire resistance 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 report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced 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 construction 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 is reviewed on or, before, the stated expiry date.

The information contained in this assessment 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.

# Appendix A Supporting Test Data

## A.1. Test report WFRA 2168000.1

On the 1 June 2007, Warrington Fire Research Aust conducted a full-scale fire-resistance test on a nominal 3000mm wide × 3000mm high non-loadbearing double stud steel-framed wall system.

The wall was constructed from 2 × 7.5mm thick Multiboard wall cladding laminated with PVA adhesive and screw and adhesive fixed to each side of double steel stud wall framing. 64mm Rondo studs and tracks were used in the construction of wall framing. Each frame was separated by 20mm and was insulated with 50mm 16kg/m<sup>3</sup> Glasswool insulation. Sheet joints were finished with CSR Gyprock Base Coat 45 with Nominal 50mm wide perforated tape.

The gap at the perimeter between the boards and concrete block surround was filled with Pyropanel Multiflex Fire Rated Flexible Acrylic sealant to the depth of the boards. The gap was nominally 5mm at the free edge and the bottom and nominally 10mm at the top.

The test was discontinued after a period of 145 minutes.

The wall system failed with respect to insulation at 96 minutes when a roving thermocouple was applied 100mm below the top horizontal panel joint at mid-width of the unexposed face of the wall and the temperature rise criterion of 180K was exceeded.

The wall system failed with respect to integrity at 144 minutes due to the formation of a gap greater in diameter than 25mm.

The exposed face had begun to fall away from the steel framing as noted at 50 minutes. A crack along the top horizontal board joint is noted at 75 minutes. A crack along the vertical joint is noted at 98 minutes. A vertical crack is noted at 114 minutes at mid height/mid-width of the 2nd row of panels. Glowing of furnace is noted at 136 minutes through 2nd horizontal joint from the bottom. Char depth behind the board and behind the joint at 60 minutes based on the depth of 300°C isotherm was 4.7mm and 4.4mm respectively.

## A.2. Test report WFRA 2168001

On the 1 June 2007, Warrington Fire Research Aust conducted a pilot-scale fire-resistance test on a specimen comprised an insulated, steel framed party wall with a 90 mm cavity that was faced on the exposed side with 15mm thick (2x7.5mm) Multiboard and on the unexposed side with 13mm thick Soundchek. Specimen comprised of timber stud on the left side and double steel stud on the right side. The test was terminated at 154 minutes.

### Relevant result data

Time	Observation
151 minutes	Time for 140°C rise in average unexposed surface area temperature
142 minutes	Time for 180°C rise in individual unexposed surface area temperature
63 minutes	Time for exposed face flange of steel stud to reach 450°C
47 minutes	Time to reach 300°C on timber stud and plasterboard interface temperature on the exposed surface
67 minutes	Time to reach 300°C on timber stud 10mm away from the exposed surface
117 minutes	Time for exposed face flange of steel stud to reach 750°C

### A.3. The relevance of AS 1530.4-2005 test data to AS 15340.4-2014

The fire resistance tests WFRA 2168000.1 and WFRA 2168001 were conducted in accordance with AS 1530.4-2005. This standard differs from AS 1530.4 2014 and the significance of these differences relevant to section 3 and is discussed below.

#### *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 specified specimen heating rate in AS 1530.4-2005 is given by

$$T_t - T_0 = 345 \log(8t + 1) + 20$$

Where

$T_t$  = furnace temperature at time  $t$ , in degrees Celsius

$T_0$  = initial furnace temperature, in degrees Celsius, such that  $t$  = the time into the test, measured in minutes from the Ignition of the furnace

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.

#### *Furnace Pressure*

The furnace pressure conditions for single and multiple penetration sealing systems in AS 1530.4-2005 and AS 1530.4-2014m 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.

#### *Performance Criteria*

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

- Structural Adequacy (not relevant)
- Integrity
- Insulation

#### *Integrity*

AS 1530.4-2014 stipulates in addition to the 20mm thick x 100mm x 100mm cotton pads additional cotton pads shall be provided with a reduced 30mm x 30mm x 20mm with additional wireframe holder shall be used to determine integrity failure. Apart from this variation, the failure criteria for integrity in AS 1530.4-2014 and AS 1530.4-2005 are not appreciably different.

Based on the reference to the tests WFRA 2168000.1 and WFRA 2168001, it is confirmed that this difference is not relevant to this test and the behaviour exhibited in the test.

#### *Insulation*

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

#### *Application of Test Data to AS 1530.4-2014.*

There is a difference in cotton pad size between standards, however, it is confirmed that the variation does not affect the integrity performance of the tested penetrations in the referenced tests for at least 120 minutes.

Based on the above, discussion and in absence of any foreseeable integrity and insulation risk, it is considered that the results relating to the integrity and insulation performance of the specimens tested in WFRA 2168000.1 and WFRA 2168001 can be used to assess the integrity and insulation performance in accordance with AS 1530.4-2014



## A.4. CSIRO Sponsored Investigation report numbered FSP 1748

On the 2nd May 2016, this Division conducted a fire-resistance test of Snap Retrofit Fire Collars protecting a plasterboard wall penetrated by five (5) PVC, two (2) P-PVC, one (1) C-PVC and one (1) PVC-SC pipe.

The wall system was constructed in accordance with Boral Firestop system with an established fire resistance level (FRL) of -/120/120. Construction comprised 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two (2) layers of 13-mm thick Boral Firestop sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The plasterboard wall thickness was 112-mm from exposed face to unexposed face. The wall was penetrated by nine (9) stack pipes protected by a retro-fitted Snap Fire Systems fire collar.

### Penetration # 1 – 50R retrofitted fire collar protecting a 32-mm Class 18 Polyvinyl Chloride (P-PVC) Pipe

The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and a 149-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 43-mm wide x 200-mm long, and 4-mm thick x 43-mm wide x 220-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 210-mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T dated 4 November 2014, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 32-mm nominal diameter Class 18 P-PVC Pipe, with a wall thickness of 3.6-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 50-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 1 – 32-mm Class 18 P-PVC Pipe – 50R Retrofit Collar", dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed and exposed end.

### Penetration # 2 – 50R retrofitted fire collar protecting a 1.25-inch Polyvinyl Chloride (C-PVC) Pipe

The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62-mm inner diameter and a 149-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 43-mm wide x 200-mm long, and 4-mm thick x 43-mm wide x 220-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 210-mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T dated 4 November 2014, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 1.25 inch C-PVC Pipe, with a wall thickness of 3.5-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 50-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 2 – 1.25 inch C-PVC Pipe – 50R Retrofit Collar", dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

### Penetration # 3 – 32R retrofitted fire collar protecting a 16-mm Polyvinyl Chloride (PVC) Flexi Pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 16-mm nominal diameter PVC Flexi Pipe, with a wall thickness of 1.8-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 20-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 3 – 16-mm PVC Flexi Pipe – 32R Retrofit Collar", dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

### Penetration # 4 – 32R retrofitted fire collar protecting a 20-mm Polyvinyl Chloride (PVC) Conduit with 3 core cable

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 20-mm nominal diameter PVC Conduit with 3 core cable, with a wall thickness of 1.8-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 25-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 4 – 20-mm PVC Conduit with 3 core cable – 32R Retrofit Collar", dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

### Penetration # 5 – 32R retrofitted fire collar protecting a 25-mm Polyvinyl Chloride (PVC) Conduit with 3 core cable

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 25-mm nominal diameter PVC Conduit with 3 core cable, with a wall thickness of 2-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 30-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 5

– 25-mm PVC Conduit with 3 core cable – 32R Retrofit Collar”, dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 6 – 32R retrofitted fire collar protecting a 25-mm Polyvinyl Chloride (PVC) Conduit

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 25-mm nominal diameter PVC Conduit, with a wall thickness of 2-mm, fitted through the collar’s sleeve and penetrating the plasterboard wall through a 30-mm diameter cut-out hole as shown in drawing titled “Test Wall W-16-A Penetration # 6 – 25-mm PVC Conduit – 32R Retrofit Collar”, dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 7 – 32R retrofitted fire collar protecting a 20-mm Polyvinyl Chloride (PVC) Conduit

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 10g x 38-mm course thread plasterboard screws.

The penetrating service comprised a 20-mm nominal diameter PVC Conduit, with a wall thickness of 2-mm, fitted through the collar’s sleeve and penetrating the plasterboard wall through a 25-mm diameter cut-out hole as shown in drawing titled “Test Wall W-16-A Penetration # 7 – 20-mm PVC Conduit – 32R Retrofit Collar”, dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 8 – 32R retrofitted fire collar protecting a 15-mm Polyvinyl Chloride (P-PVC) Class 18 Pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135-mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T

dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 15-mm nominal diameter P-PVC Class 18 Pipe, with a wall thickness of 1.8-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 20-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 8 – 15-mm P-PVC Class 18 Pipe – 32R Retrofit Collar", dated 23 May 2016, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 9 – 110R retrofitted fire collar protecting a 100-mm Polyvinyl Chloride (PVC-SC) Pipe

The SNAP Retrofit 110R fire collar comprised a 0.75-mm steel casing with a 122-mm inner diameter and a 209-mm diameter base flange. The 62-mm high collar casing incorporated a closing mechanism that was comprised of three soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 2.5-mm thick x 58-mm wide x 424-mm long, a 2.5-mm thick x 58-mm wide x 407-mm long, and 2.5-mm thick x 58-mm wide x 389-mm long respectively. Between the strips was a layer of 304 stainless steel mesh 415-mm long x 58-mm wide with wire mesh diameter of 0.15-mm, and 398-mm long x 58-mm wide with wire mesh diameter of 0.15-mm respectively as shown in drawing numbered 110R-T dated 9 October 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 10g x 38-mm course thread plasterboard screws.

The penetrating service comprised a 100-mm nominal diameter PVC-SC Pipe, with a wall thickness of 3.3-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 114-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-A Penetration # 9 – 100-mm PVC-SC Pipe – 110R Retrofit Collar", dated 9 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a PVC End Cap.

## A.5. CSIRO Sponsored Investigation report numbered FSP 1759

On the 20<sup>th</sup> July 2016, this Division conducted a fire-resistance test of Snap Retrofit Fire Collars protecting a plasterboard wall penetrated by 9 pipes

Construction comprised 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two (2) layers of 13-mm thick Boral Firestop sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The plasterboard wall thickness was 116-mm from exposed face to unexposed face. The wall was penetrated by nine (9) stack pipes protected by a retro-fitted Snap Fire Systems fire collar.

#### Penetration # 1 – GAS32 retrofitted fire collar protecting a 15-mm Valsir Px-Al-Px Pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 90-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a

black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 15-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 19-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 1, 15-mm Valsir Px-Al-Px Pipe – Gas32 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 2 – 32R retrofitted fire collar protecting a 20-mm Valsir Px-Al-Px Pipe

The 32R Retrofit collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 20-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.8-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 22-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 2, 20-mm Valsir Px-Al-Px Pipe – 32R Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 3 – 32R retrofitted fire collar protecting a 15-mm Valsir Px-Al-Px Pipe

The 32R Retrofit collar comprised a 0.75-mm steel casing with a 40-mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 15-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.3-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 19-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 3, 15-mm Valsir Px-Al-Px Pipe – 32R Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 4 – GAS32 retrofitted fire collar protecting a 20-mm Valsir Px-Al-Px Pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 90-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a

black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 20-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.9-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 22-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 4, 20-mm Valsir Px-Al-Px Pipe – Gas32 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 5 – GAS32 retrofitted fire collar protecting a 26-mm Valsir Px-Al-Px Pipe

The GAS32 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 35-mm inner diameter and a 90-mm diameter base flange. The 63-mm high collar casing incorporated a layer of 140-mm x 55-mm x 4-mm thick Intumescent material and a layer of 120-mm x 55-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 120 x 54-mm as shown in drawing numbered GAS32-T dated 14 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 26-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 3.4-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 29-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 5, 26-mm Valsir Px-Al-Px Pipe – Gas32 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 6 – GAS50 retrofitted fire collar protecting a 32-mm Valsir Px-Al-Px Pipe

The GAS50 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 57-mm inner diameter and a 115-mm diameter base flange. The 92-mm high collar casing incorporated a layer of 215-mm x 85-mm x 4-mm thick Intumescent material and a layer of 190-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 190 x 84-mm as shown in drawing numbered GAS50-T dated 16 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 32-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 3.6-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 35-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 6, 32-mm Valsir Px-Al-Px Pipe – Gas50 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 7 – GAS50 retrofitted fire collar protecting a 40-mm Valsir Px-Al-Px Pipe

The GAS50 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 57-mm inner diameter and a 115-mm diameter base flange. The 92-mm high collar casing incorporated a layer of 215-mm x 85-mm x 4-mm thick Intumescent material and a layer of 190-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 190 x 84-mm as shown in drawing numbered GAS50-T dated 16 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 40-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 4-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 44-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 7, 40-mm Valsir Px-Al-Px Pipe – Gas50 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 8 – GAS50 retrofitted fire collar protecting a 50-mm Valsir Px-Al-Px Pipe

The GAS50 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 57-mm inner diameter and a 115-mm diameter base flange. The 92-mm high collar casing incorporated a layer of 215-mm x 85-mm x 4-mm thick Intumescent material and a layer of 190-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link and a 316 stainless steel mesh measuring 190 x 84-mm as shown in drawing numbered GAS50-T dated 16 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 50-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 4.4-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 57-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 8, 50-mm Valsir Px-Al-Px Pipe – Gas50 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

#### Penetration # 9 – GAS63 retrofitted fire collar protecting a 63-mm Valsir Px-Al-Px Pipe

The GAS63 Retrofit collar comprised a 0.95-mm thick galvanised steel casing with a 67-mm inner diameter and a 121-mm diameter base flange. The 91-mm high collar casing incorporated a layer of 265-mm x 85-mm x 4-mm thick Intumescent material, a layer of 235-mm x 85-mm x 4-mm thick Intumescent material and a layer of 200-mm x 85-mm x 4-mm thick Intumescent material. The closing mechanism comprised 1 x 304 stainless steel spring bound with a black nylon fuse link, one layer of 316 stainless steel mesh measuring 230 x 84-mm, and one layer of 316 stainless steel mesh measuring 200 x 84-mm as shown in drawing numbered GAS63-B-T dated 20 September 2016, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 63-mm Valsir Px-Al-Px stack pipe, with a wall thickness of 5.4-mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 67-mm diameter cut-out hole as shown in drawing titled "Test Wall W-16-B Penetration # 9, 63-mm Valsir Px-Al-Px Pipe – Gas63 Collar, dated 19 August 2016". The pipe projected horizontally, 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm and 1500-mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

## A.6. BRANZ report numbered FAR3929

On 17<sup>th</sup> July 2015, BRANZ Ltd Laboratories NZ prepared a report that considered the fire resistance of SNAP Retro-fit collars through a steel framed plasterboard wall with an established fire resistance level (FRL) of - /120/120 when tested in accordance with AS 1530.4-2005 with reference to AS 4072.1-2005.

## A.7. CSIRO Sponsored Investigation report numbered FCO-2718

On 23<sup>rd</sup> April 2015 CSIRO prepared a report that considered the fire resistance of SNAP fire collars protecting IPLEX pipe penetrations through concrete slabs, masonry and plasterboard walls when tested in accordance with AS 1530.4-2005.

## A.8. CSIRO Sponsored Investigation report numbered FCO-2719

On 23<sup>rd</sup> April 2015 CSIRO prepared a report that considered the fire resistance of SNAP fire collars protecting GASPEX, WATERPEX, HEATPEX and CHILLPEX pipe penetrations through concrete slabs, masonry/concrete walls and plasterboard walls when tested in accordance with AS 1530.4-2005.

## A.9. BRANZ report numbered FP4874 Issue 2

On 29 May 2012 BRANZ conducted a fire test on SNAP retrofitted collars protecting a plasterboard wall penetrated by 11 plastic pipes in accordance with AS 1530.4-2005.

The wall system comprised a 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick Boral Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres.

In BRANZ pilot fire resistance test FP 4874 nine specimens were reported consisting of a mixture of PVC-U DWV and PE plastic pipes and their sealing systems penetrating a nominal 128 mm thick plasterboard steel framed wall system, were tested in accordance with AS 1530.4 – 2005.

The wall system, with an established fire-resistance level (FRL) of -/120/120, consisted of 64 mm x 0.55 mm thick steel studs with 2 x layers of 16 mm thick Boral Firestop plasterboard sheets at each face.

All of the sealing systems consisted of SNAP Retro-fit collars with intumescent wraps on the inner face. The steel collars were secured to the plasterboard with three expanding wall anchors and in one instance, specimen No. 9, with M6 threaded rod through the brackets of the respective collars passing through the cavity thereby sandwiching the wall between the collars.

Table 1: Test Result FP 4874

No.	Collar Designation	Pipe Designation	Integrity (Minutes)	Insulation (Minutes)	FRL
1	110R	100 PVC-U SC DWV* (With Elbow socket in collar)	185NF	162	-/180/120
4	63R	50 PVC-U DWV	185NF	123	-/180/120
5	50R	40 PVC-U DWV (With Elbow socket in collar)	185NF	185NF	-/180/180
6	50R	40 PVC-U DWV	185NF	168	-/180/120
7	110R	100 PVC-U SC DWV*	185NF	185NF	-/180/180
8	110R	110 mm x 4.3 mm PE100 SDR 26	185NF	140	-/180/120
9	65-80R	80 PVC-U DWV	185NF	167	-/180/120
10	84R	65 PVC-U DWV	185NF	176	-/180/120
11	50R	40 mm x 3 mm PE80 S12.5	185NF	185NF	-/180/180

NF = No failure for the duration of the test.



## A.10. CSIRO report numbered FSP1341

On 20 November 2008, this Division conducted a fire test on SNAP retrofitted collars protecting a plasterboard wall penetrated by six PPR pipes in accordance with AS 1530.4-2005.

The wall system was constructed in accordance with the CSR wall system with an established fire resistance level (FRL) of -/120/120. Construction comprised 64-mm x 0.75-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick CSR Gyprock Fyrchek plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The wall was penetrated by six gas pipes of various constructions protected by retro-fitted SNAP Fire System fire collars.

Penetrations 1, 2 and 6 were protected with SNAP 32Gas fire collars.

### Penetration 1 – Retrofit SNAP32GAS fire collar protecting a nominal 16-mm REHAU PEX-AL-PE gas pipe

The SNAP32GAS, fire collar consisted of a galvanised steel case 54-mm diameter x 63-mm high, with a single spring pocket and a 90-mm diameter base plate screw fixed to the case. The single spring is pivoted at the top of the spring cavity and restrained by a nylon fusible link with a melting temperature of 75 degrees Celsius. Two soft intumescent wraps lined the internal circumference of the collar. The wraps were 4-mm thick x 57-mm wide x 130-mm long. Between the wraps was a layer 0.15-mm thick x 57-mm wide of stainless steel mesh. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter threaded rods fixed through the wall and the holes in the base plates of the two collars and fastened with nuts.

The penetrating service comprised a nominally 16-mm REHAU PEX-AL-PE gas pipe penetrating the plasterboard wall through a cut-out hole closest in size to the size of the pipe. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

### Penetration 2 – Retrofit SNAP32GAS fire collar protecting a nominal 32-mm IPLEX PE-AL-PE gas pipe

The SNAP32GAS, fire collar consisted of a galvanised steel case 54-mm diameter x 63-mm high, with a single spring pocket and a 90-mm diameter base plate screwed to the case. The single spring is pivoted at the top of the spring cavity and restrained by a nylon fusible link with a melting temperature of 75 degrees Celsius. Two soft intumescent wraps lined the internal circumference of the collar. The wraps were 4-mm thick x 57-mm wide x 130-mm long. Between the wraps was a layer 0.15-mm thick x 57-mm wide of stainless steel mesh. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameters threaded rods fixed through the wall and the holes in the base plates of the two collars and fastened with nuts.

The penetrating service comprised a nominally 32-mm IPLEX PE-AL-PE gas pipe penetrating the plasterboard wall through a cut-out hole closest to the size of the pipe. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

The system as tested failed insulation at 172 minutes due to the maximum temperature rise of 180 deg K being exceeded on the pipe. The integrity criterion was maintained for the 181-minute duration of the test.

### Penetration 6 – Retrofit SNAP32GAS fire collar protecting a nominal 16-mm IPLEX PE-AL-PE gas pipe

The SNAP32GAS fire collar consisted of a galvanised steel case 54-mm diameter x 63-mm high, with a single spring pocket. The single spring is pivoted at the top of the spring cavity and restrained by a

nylon fusible link with a melting temperature of 75 degrees Celsius. Two soft intumescent wraps lined the internal circumference of the collar. The wraps were 4-mm thick x 57-mm wide x 130-mm long. Between the wraps was a layer 0.15-mm thick x 57-mm wide of Stainless steel mesh. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter threaded rods fixed through the wall and the holes in the base plate (collar on the unexposed face) and brackets (collar on the exposed face) of the two collars and fastened with nuts.

The penetrating service comprised a nominally 16-mm IPLEX PE-AL-PE gas pipe penetrating the plasterboard wall through a cut-out hole closest to the size of the pipe. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

## A.11. CSIRO report numbered FSP1360

On 18 June 2009, this Division conducted a fire test on SNAP Retrofitted Fire Collars protecting a plasterboard wall penetrated by six PPR pipes in accordance with AS 1530.4-2005.

The wall system, with an established fire-resistance level (FRL) of -/120/120 comprised 64-mm x 0.75-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick CSR Gyprock Fyrchek plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The wall was penetrated by six Aquatherm Fusiotherm polypropylene fibre pipes protected by retro-fitted SNAP Fire System fire collars.

### Penetration 1 – Retrofit SNAP63R fire collar protecting a nominal 63-mm PPR pipe

The SNAP63R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with a 69-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 43-mm wide and weighing approximately 50 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP63R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 63-mm OD PPR-80 fazer composite pipe of SDR7.4 with a wall thickness of 10-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

### Penetration 2 – Retrofit SNAP32R fire collar protecting a nominal 20-mm PPR pipe

The SNAP32R fire collar consisted of a 0.7-mm thick steel case, 32-mm high with a 35-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 26-mm wide and weighing approximately 23 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP32R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm PPR-80 Fazer composite pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

### Penetration 3 – Retrofit SNAP63R fire collar protecting a nominal 20-mm PPR pipe

The SNAP63R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with a 69-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 43-mm wide and weighing approximately 50 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP63R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm PPR-80 Fazer composite pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

### Penetration 4 – Retrofit SNAP50R fire collar protecting a nominal 20-mm PPR pipe

The SNAP50R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with 58-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 43-mm wide and weighed approx 45 grams each lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP50R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm PPR-80 Fazer composite pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

### Penetration 5 – Retrofit SNAP32R fire collar protecting a nominal 32-mm PPR pipe

The SNAP32R fire collar consisted of a 0.7-mm thick steel case, 32-mm high with a 35-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 26-mm wide and weighing approximately 23 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP32R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 32-mm PPR-80 Fazer composite pipe of SDR7.4 with a wall thickness of 5-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

### Penetration 6 – Retrofit SNAP50R fire collar protecting a nominal 50-mm PPR pipe

The SNAP50R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with 58-mm diameter opening. Two layers of soft intumescent wraps, 4-mm thick x 43-mm wide and weighed approx 45 grams each lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is showed in drawing numbered SNAP50R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 50-mm PPR-80 Fazer composite pipe of SDR7.4 with a wall thickness of 8-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm

into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Results

Penetration 1	-	-/120/120;
Penetration 2	-	-/120/120;
Penetration 3	-	-/120/120;
Penetration 4	-	-/120/120;
Penetration 5	-	-/120/120 and
Penetration 6	-	-/120/120.

## A.12. CSIRO report numbered FSP1366

On 11 August 2009, this Division conducted a fire test on SNAP Retrofitted Fire Collars protecting a plasterboard wall penetrated by six PE pipes in accordance with AS 1530.4-2005.

The wall system, with an established fire-resistance level (FRL) of -/120/120 comprised 64-mm x 0.75-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick CSR Gyprock Fyrchek plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The wall was penetrated by six Aquatherm Fusiotherm polypropylene fibre pipes protected by retro-fitted SNAP Fire System fire collars.

#### Penetration 1 – Retrofit SNAP63R fire collar protecting a nominal 63-mm PE pipe

The SNAP63R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with a 69-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 43-mm wide and weighing approximately 50 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP63R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 63-mm OD PE pipe of SDR7.4 with a wall thickness of 10-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Penetration 2 – Retrofit SNAP32R fire collar protecting a nominal 20-mm PE pipe

The SNAP32R fire collar consisted of a 0.7-mm thick steel case, 32-mm high with a 35-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 26-mm wide and weighing approximately 23 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP32R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm OD PE pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately

500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Penetration 3 – Retrofit SNAP63R fire collar protecting a nominal 20-mm PE pipe

The SNAP63R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with a 69-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 43-mm wide and weighing approximately 69 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP63R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm OD PE pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Penetration 4 – Retrofit SNAP50R fire collar protecting a nominal 20-mm PE pipe

The SNAP50R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with 58-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 43-mm wide and weighed approx 45 grams each lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP50R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 20-mm OD PE pipe of SDR7.4 with a wall thickness of 4-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Penetration 5 – Retrofit SNAP32R fire collar protecting a nominal 32-mm PE pipe

The SNAP32R fire collar consisted of a 0.7-mm thick steel case, 32-mm high with a 35-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 26-mm wide and weighing approximately 23 grams each, lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP32R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 32-mm OD PE pipe of SDR7.4 with a wall thickness of 5-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Penetration 6 – Retrofit SNAP50R fire collar protecting a nominal 50-mm PE pipe

The SNAP50R fire collar consisted of a 0.7-mm thick steel case, 47-mm high with 58-mm diameter opening. Two layers of soft intumescent wrap, 4-mm thick x 43-mm wide and weighed approx 45 grams each lined the internal circumference of the collar. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three 6-mm diameter bolts fixed through the wall and the holes in the brackets of the two collars and fastened with nuts. The collar detail is shown in drawing numbered SNAP50R, dated 8 May 2009, by Snap Fire Systems.

The penetrating service comprised a nominally 50-mm OD PE pipe of SDR7.4 with a wall thickness of 8-mm, penetrating the plasterboard wall through a close-fitting cut-out hole. The pipe projected horizontally, approximately 2000-mm above the plasterboard and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 1000-mm from the unexposed face of the plasterboard. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre plug.

#### Results

Penetration 1	-	-/120/120;
Penetration 2	-	-/120/120;
Penetration 3	-	-/120/120;
Penetration 4	-	-/120/120;
Penetration 5	-	-/120/120 and
Penetration 6	-	-/120/120.

### A.13. CSIRO report numbered FSP 1634

On 30 April 2014, this Division conducted a full-scale fire-resistance test on SNAP Retro-fit Fire Collars protecting a plasterboard wall penetrated by nine (9) PEX (Cross-linked polyethylene) pipes in accordance with AS 1530.4-2005.

The wall system, with an established fire-resistance level (FRL) of -/180/180 comprised a 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick Boral Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The wall was penetrated by nine (9) PEX (Cross-linked polyethylene) pipes protected by retro-fitted SNAP Fire System fire collars.

For the purpose of the test, the specimens were referenced as Penetrations A, B, C, D, E, F, G, H and I.

#### Penetration A – 32R retrofitted fire collar protecting a PEX-b (16-mm SDR 11) stack pipe (80° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.1-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

#### Penetration B – 32R retrofitted fire collar protecting a PEX-a (16-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 16-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 2.3-mm fitted through a 19-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was

supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested failed insulation at 179 minutes due to a maximum temperature rise of 180 deg K is exceeded on the unexposed face of the specimen. The integrity criterion was maintained for the 181-minute duration of the test.

#### Penetration C – 32R retrofitted fire collar protecting a PEX-b (20-mm SDR 11) stack pipe (60° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.1-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

#### Penetration D – 32R retrofitted fire collar protecting a PEX-a (20-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 20-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 3.9-mm fitted through a 23-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

#### Penetration E – 32R retrofitted fire collar protecting a PEX-b (25-mm SDR 11) stack pipe (180° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 2.6-mm fitted through the collar's sleeve. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested failed insulation at 134 minutes due to a maximum temperature rise of 180 deg K is exceeded on the unexposed face of the specimen. The integrity criterion was maintained for the 181-minute duration of the test.

#### Penetration F – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh

and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by three 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested did not fail insulation nor integrity for the 181-minute duration of the test.

#### Penetration G – 32R retrofitted fire collar protecting a PEX-a (25-mm SDR 7.4) stack pipe (60° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 60° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 25-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4-mm fitted through a 28-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested failed insulation at 97 minutes due to a maximum temperature rise of 180 deg K is exceeded on the unexposed face of the specimen. The integrity criterion was maintained for the 181-minute duration of the test.

#### Penetration H – 32R retrofitted fire collar protecting a PEX-a (32-mm SDR 7.4) stack pipe (120° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 120° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-a) pipe, with a measured wall thickness of 4.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested failed insulation at 96 minutes due to a maximum temperature rise of 180 deg K is exceeded on the unexposed face of the specimen. The integrity criterion was maintained for the 181-minute duration of the test.

#### Penetration I – 32R retrofitted fire collar protecting a PEX-b (32-mm SDR 11) stack pipe (180° brackets)

The SNAP retrofitted 32R fire collar comprised a 0.75-mm steel case with a 40-mm inner diameter and a 60-mm outside diameter. The 32-mm high collar casing comprised two layers of 4-mm thick Intumesh and a 135-mm x 25-mm stainless steel mesh as shown in drawing numbered 32R-T, dated 13 May 2014, by SNAP Fire Systems. Two collars were fixed to the wall by two 180° brackets with Hollow Wall Anchors 427.

The penetrating service comprised a 32-mm cross-linked polyethylene (PEX-b) pipe, with a measured wall thickness of 3.5-mm fitted through a 35-mm diameter hole in the wall. The pipe projected horizontally 2000-mm through the plasterboard and 500-mm into the furnace chamber. The pipe was



supported at 500-mm and 1000-mm from the unexposed face of the plasterboard wall. The pipe was open at the unexposed end and capped with kaowool plug on the exposed end.

The system as tested failed insulation at 169 minutes due to a maximum temperature rise of 180 deg K is exceeded on the unexposed face of the specimen. The integrity criterion was maintained for the 181-minute duration of the test.

## A.14. CSIRO report numbered FSP 1658

On 4 September 2014, this Division conducted a pilot-scale fire-resistance test on SNAP Retro-fit Fire Collars protecting a plasterboard wall penetrated by nine (9) PEX (Cross-linked polyethylene) pipes in accordance with AS 1530.4-2005.

The wall system, with an established fire-resistance level (FRL) of -/180/180 which comprised 64-mm x 0.55-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick Firestop plasterboard sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The plasterboard wall thickness was 128-mm from exposed face to unexposed face. The wall was penetrated by eight (8) +GF+ Georg Fischer Progef Polypropylene PP-H stack pipe protected by retro-fitted Snap Fire Systems fire collars. The pipes are stated to be manufactured in accordance with DIN 8077, DIN 8078 & EN ISO 15494.

For the purpose of the test, the specimens were referenced as Penetrations # A, B, C, D, E, F, G and H.

### Penetration #A – 32R retrofitted fire collar protecting a 20-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 20-mm nominal diameter PP-H pipe, with a wall thickness of 2.3-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 21 mm diameter cut-out hole as shown in drawing titled "Penetration #A PP-H (20-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

### Penetration #B – 32R retrofitted fire collar protecting a 20-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 7.4 PN16 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 20-mm nominal diameter PP-H pipe, with a wall thickness of 3.5-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 21-mm diameter cut-out hole as shown in drawing titled "Penetration #B PP-H (20-mm Ø SDR 7.4) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #C – 32R retrofitted fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 25-mm nominal diameter PP-H pipe, with a wall thickness of 2.9-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 26 mm diameter cut-out hole as shown in drawing titled "Penetration #C PP-H (25-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #D – 32R retrofitted fire collar protecting a 25-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 7.4 PN16 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 25-mm nominal diameter PP-H pipe, with a wall thickness of 3.5-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 26 mm diameter cut-out hole as shown in drawing titled "Penetration #D PP-H (25-mm Ø SDR 7.4) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #E – 32R retrofitted fire collar protecting a 32-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x

26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 32-mm nominal diameter PP-H pipe, with a wall thickness of 3.8-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 33 mm diameter cut-out hole as shown in drawing titled "Penetration #E PP-H (32-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #F – 32R retrofitted fire collar protecting a 40-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 2 July 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 40-mm nominal diameter PP-H pipe, with a wall thickness of 4.1-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 41 mm diameter cut-out hole as shown in drawing titled "Penetration #F PP-H (40-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #G – 50R retrofitted fire collar protecting a 50-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62 mm inner diameter and a 149-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 43-mm wide x 200-mm long, and 4-mm thick x 43-mm wide x 220-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 210 mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T dated 4 November 2013, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 50-mm nominal diameter PP-H pipe, with a wall thickness of 5.1-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 51 mm diameter cut-out hole as shown in drawing titled "Penetration #G PP-H (50-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Penetration #H – 63R retrofitted fire collar protecting a 63-mm diameter +GF+ Georg Fischer Progef Polypropylene PP-H SDR 11 PN10 stack pipe

The SNAP Retrofit 63R fire collar comprised a 0.75-mm steel casing with a 72 mm inner diameter and a 157-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. The inner and outer wraps were 4-mm thick x 43-mm wide x 230-mm long, and 4-mm thick x 43-mm wide x 255-mm long, respectively. Between the wraps was a layer of 304 stainless steel mesh 240 mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 63R-T dated 15 November 2014, by SNAP Fire Systems. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 63-mm nominal diameter PP-H pipe, with a wall thickness of 6.7-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 64 mm diameter cut-out hole as shown in drawing titled "Penetration #H PP-H (63-mm Ø SDR 11) Stack" dated 8 August 2014, by SNAP Fire Systems. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

Results

Penetration #A	-	-/180/180;
Penetration #B	-	-/180/180;
Penetration #C	-	-/180/180;
Penetration #D	-	-/180/180;
Penetration #E	-	-/180/180;
Penetration #F	-	-/180/180;
Penetration #G	-	-/180/180; and
Penetration #H	-	-/180/180.

## A.15. CSIRO report numbered FSP 1716

On 7 September 2015, this Division conducted a pilot-scale fire-resistance test Snap Cast-in Fire Collars protecting a plasterboard wall penetrated by one (1) HDPE pipe, one (1) PVC pipe, two (2) Raupiano Pipes and one (1) Pex-a Pipes in accordance with AS 1530.4-2005.

The wall system was constructed in accordance with Boral Firestop system with an established fire resistance level (FRL) of -/120/120. Construction comprised 64-mm x 0.35-mm steel studs and noggins installed at nominally 600-mm centres, lined on each side with two layers of 16-mm thick Firestop sheets. The plasterboard sheeting was screw fixed to the steel studs using plasterboard screws at nominally 200-mm centres. The plasterboard wall thickness was 128-mm from exposed face to unexposed face. The wall was penetrated by five (5) stack pipes protected by retro-fitted Snap Fire Systems fire collars.

Penetration # 1 – HP150 R retrofitted fire collar protecting a 160-mm High-Density Polyethylene (HDPE) pipe

The SNAP retrofitted HP150 R collar comprised a 0.95-mm steel casing with a 175 mm inner diameter and a 326-mm diameter base flange. The 117-mm high collar casing incorporated a strip of 570 mm x 112 mm x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four 304 stainless steel springs, with nylon fuse links, and a 596 mm x 112-mm stainless steel mesh as shown in drawing numbered HP 150 R -T dated 3 November 2014, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 160-mm nominal diameter HDPE pipe, with a wall thickness of 6.7-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 165 mm diameter cut-out hole as shown in drawing titled "Test Wall W-15-E Penetration # 1 – 160-mm HDPE Pipe – HP150R Retrofit Collar", dated 2 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

#### Penetration # 2 – 32R retrofitted fire collar protecting a 32-mm Pex-a Pipe

The SNAP Retrofit 32R fire collar comprised a 0.75-mm steel casing with a 40 mm inner diameter and a 106-mm diameter base flange. The 32-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 26-mm wide x 135-mm long, and 4-mm thick x 26-mm wide x 154-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135 mm long x 25-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 32R-T dated 12 February 2015, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 32-mm nominal diameter Pex-a Pipe, with a wall thickness of 4.9-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 35 mm diameter cut-out hole as shown in drawing titled "Test Wall W-15-E Penetration # 2 – 32-mm Pex-A Pipe – 32R Retrofit Collar", dated 2 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

#### Penetration # 3 – 110R retrofitted fire collar protecting a 110 mm diameter Raupiano pipe

The SNAP 110R retrofitted fire collar comprised a 0.75-mm steel casing with a 127-mm inner diameter and a 214-mm diameter base flange. The 62-mm high collar casing incorporated three layers of 403-mm x 58-mm wide x 2.5-mm thick Intumesh intumescent material. Between the intumescent layers, 58-mm wide stainless steel mesh was installed as shown in drawing numbered 110R-T, dated 4 November 2014, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two hollow wall anchors.

The penetrating service comprised a 110-mm nominal diameter Raupiano Pipe, with a wall thickness of 3.2-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 113 mm diameter cut-out hole as shown in drawing titled "Test Wall W-15-E Penetration # 3 – 110-mm Raupiano Pipe – 110R Retrofit Collar", dated 2 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

#### Penetration # 4 – 50R retrofitted fire collar protecting a 40-mm diameter Raupiano pipe

The SNAP Retrofit 50R fire collar comprised a 0.75-mm steel casing with a 62 mm inner diameter and a 149-mm diameter base flange. The 47-mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent strips lined within the internal circumference of the collar. The inner and outer strips were 4-mm thick x 43-mm wide x 200-mm long, and 4-mm thick x 43-mm wide x 220-mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 210 mm long x 42-mm wide with wire mesh diameter of 0.15-mm, as shown in drawing numbered 50R-T

dated 4 November 2013, by Snap Fire Systems Pty Ltd. One collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three hollow wall anchors.

The penetrating service comprised a 40-mm nominal diameter Raupiano Pipe, with a wall thickness of 2-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 43 mm diameter cut-out hole as shown in drawing titled "Test Wall W-15-E Penetration # 4 – 40-mm Raupiano Pipe – 50R Retrofit Collar", dated 2 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

#### Penetration # 5 – HP150 R retrofitted fire collar protecting a 160-mm Polyvinyl Chloride (PVC) pipe

The SNAP retrofitted HP150 R collar comprised a 0.95-mm steel casing with a 175 mm inner diameter and a 326-mm diameter base flange. The 117-mm high collar casing incorporated a strip of 570 mm x 112 mm x 8-mm thick Intumesh intumescent material. The closing mechanism comprised four stainless steel springs, with nylon fuse links, and a 596 mm x 112-mm 304 stainless steel mesh as shown in drawing numbered HP 150 R -T dated 3 November 2014, by Snap Fire Systems Pty Ltd.

The penetrating service comprised a 160-mm nominal diameter PVC-SC Pipe, with a wall thickness of 4.05-mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 165 mm diameter cut-out hole as shown in drawing titled "Test Wall W-15-E Penetration # 5 – 160-mm PVC-SC Pipe – HP150R Retrofit Collar", dated 2 October 2015, by Snap Fire Systems Pty Ltd. The pipe projected horizontally, approximately 2000-mm away from the unexposed face of the plasterboard wall and approximately 500-mm into the furnace chamber. The pipe was supported at nominally 500-mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000-mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

#### Results

- Penetration # 1 - -/120/120;
- Penetration # 2 - -/120/120;
- Penetration # 3 - -/120/120;
- Penetration # 4 - -/120/120; and
- Penetration # 5 - -/120/120;

## A.16. CSIRO Sponsored Investigation report numbered FSP 1902

On 5 April 2018, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Fyrchek plasterboard on each side of 64-mm deep metal studs, with an established FRL of -/120/120 as detailed in BRANZ report reference FAR2539. The wall was penetrated by nine (9) services and protected by various first stopping systems. For the services relevant to this assessment the construction details of the services and performance achieved is summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP1902	1	50R	C-PVC	38	181	181
FSP1902	2	50R	PVC	50	181	181
FSP1902	3	65-80R	PVC	65	181	181
FSP1902	4	50R	Px/Al/Px + Pex-b	25 + 20	181	175
FSP1902	5	32R	Telstra PVC Conduit	20	181	170
FSP1902	6	32R	Pex-b	2 x 20	181	167
FSP1902	9	32R	Px/Al/Px + Pex-b	20 + 20	181	179

## A.17. CSIRO Sponsored Investigation report numbered FSP 1931

On 26 September 2018, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Fyrchek plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. The wall was penetrated by a single service. For the service relevant to this assessment the construction details of the service and performance achieved are summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP1931	1	HP315R	PVC	315	181	179

## A.18. CSIRO Sponsored Investigation report numbered FSP 1946

On 26 September 2018, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Boral Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. The wall was penetrated by a single service. For the service relevant to this assessment the construction details of the service and performance achieved are summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP1946	1	HP315R	HDPE	315	121	121

## A.19. CSIRO Sponsored Investigation report numbered FSP 1978

On 17 January 2019, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116-mm thick plasterboard lined steel framed wall comprising two layers of 13-mm thick Firestop plasterboard on each side of 64-mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. For the services relevant to this assessment the construction details of the services and performance achieved is summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP1978	1	50R	C-PVC	50	181	157
FSP1978	2	HP250R-B	PVC	225	181	173

## A.20. CSIRO report numbered FSP 1996

On 4 April 2019, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116 mm thick plasterboard lined steel framed wall comprising two layers of 13 mm thick Firestop plasterboard on each side of 64 mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. For the services relevant to this assessment the construction details of the services and performance achieved is summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP 1996	2	50R	Polypropylene (Triplus)	40	161	134
FSP 1996	3	50R	Polypropylene (Raupiano)	40	161	123
FSP 1996	4	110R	Polypropylene (Raupiano)	110	161	159
FSP 1996	5	110R	PVC-SC	100	161	128

## A.21. CSIRO report numbered FSP 2040

On 20 August 2019, this Division conducted a fire-resistance test in accordance with AS 1530.4 -2014 on a 116 mm thick plasterboard lined steel framed wall comprising two layers of 13 mm thick Firestop plasterboard on each side of 64 mm deep metal studs, Boral reference SB120.1 with an established FRL of -/120/120. For the service relevant to this assessment the construction details of the service and performance achieved are summarised in the table below.

Report	Specimen	Snap collar on each side of the wall	Pipe Material	Nominal pipe diameter	Integrity	Insulation
FSP 2040	1	HP250R-B	HDPE	250	121	121



## A.22. The relevance of referenced test data to AS 1530.4-2014

### *General*

The fire resistance tests FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658, FSP 1716, FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040 were conducted in accordance with AS 1530.4-2005. This standard differs from AS 1530.4 2014 and the significance of these differences relevant to section 10 and is discussed below.

### *Specimen mounting*

The differences in Section 3 and Section 10 of AS 1530.4-2005 and AS 1530.4-2014 for specimen size and mounting relate to grammar and are not technically significant in the case of the referenced tests.

### *Specimen thermocouple arrangements*

The specimen thermocouple arrangements for the referenced tests are not different between AS 1530.4-2005 and AS 1530.4-2014

### *Criteria for failure*

The criteria for the referenced tests are not different for tests in accordance with Section 10 of AS 1530.4-2005 and AS 1530.4-2014.

### *Conclusion*

Based on the above it is confirmed the referenced test data in Section 2 of this report in accordance with AS 1530.4-2005 can be used to assess performance in accordance with AS 1530.4-2014.

# Appendix B Analysis of Variations

## B.1 Variation to Multiboard wall system construction

The wall construction shall be as tested in WFRA 2168000.1 subject to the following variations;

- The wall frame arrangement shall be single stud configuration in lieu of the double stud configuration as tested in WFRA 2168000.1.
- The Multiboard sheets shall be orientated and fixed as tested in WFRA 2168000.1 with double studs behind vertical sheet butt joints, though no framing behind horizontal joints.
- Proposed construction as shown in Table 1 and Figures 1-4

### *Integrity*

The specimen tested in WFRA 2168000.1 comprised a double stud non-loadbearing wall with a 15mm (2 × 7.5mm) Multiboard each side of a double stud wall. Integrity failure occurred at 144 minutes when a through gap larger than 25mm formed in the non-fire side.

At 86 minutes a muffled noise was observed coming from within the furnace and between 86 and 91 minutes the internal temperatures and non-fire side and within the wall cavity rose at an increased rate.

It is considered that the noise and increased rate of temperature rise are attributable to some falloff of the sheeting likely in the upper central part of the fireside of the specimen at or around 86 minutes.

Further confidence in the proposed construction is provided by the demonstrated behaviour of the fireside linings preventing significant gaps and cracks from forming and thus preventing the cavity temperatures from rising until 86 minutes.

With reference to WFRA 2168001, which comprised a single stud wall lined on the fireside with 15mm (2 × 7.5mm) Multiboard and on the non-fire side with 13mm CSR Soundchek. The framing comprised 90mm timber and steel framing.

The specimen achieved 150 minutes of integrity and 142 minutes of insulation. It was observed at the end of the test that the exposed side sheeting was still in place though with some cracking. Slightly thinner non-fire sheeting did not show any cracking at the end of the test. Even though results of the pilot test are not applicable to the full scale specimen but the significant margin above 90 minutes adds confidence that when tested the proposed specimen will achieve at least 90 minutes integrity.

Based on the above, it is expected that the proposed construction will maintain integrity for at least 90 minutes if tested in accordance with AS 1530.4-2014.

### *Insulation*

For the specimen tested in WFRA 2168000.1, the average and maximum temperature measured on the unexposed face of the sheets was 95°C and 111°C at 90 minutes and the rate of temperature rise remained reasonably constant between 60 minutes until after 90 minutes. After 90 minutes the temperature rose sharply until insulation failure occurred at 96 minutes.

The proposed construction is a single stud configuration which has a smaller 90mm wall cavity whereas the construction tested in WFRA 2168000.1 has a 180mm thick wall with a cavity of 148mm. A smaller wall cavity theoretically could be more severe as it could heat up more quickly.

However, the margin over insulation failure at 90 minutes is 45°C for average and 69°C for the maximum which is quite significant. The specimen, therefore, demonstrated a significant margin over the average and maximum insulation limit of 140°C and 180°C rise at 90 minutes and would also expect to demonstrate a margin, though smaller, for a 90mm wall cavity size.

Based on the above, it is expected that the proposed construction will maintain insulation for up to 90 minutes if tested in accordance with AS 1530.4-2014.

## B.2 Variation to penetrations in wall construction

The proposed construction includes the pipes and Snap collars listed in Table 2 installed within support wall construction as tested in referenced tests and subject to the following variations;

- The wall systems with 2 x13mm fire grade plasterboard each side of a 64mm studs tested in FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040, FSP 1748, FSP 1759, FP4874, FSP 1360, FSP 1366, FSP 1658, FSP 1716, FSP 1634, FSP 1341, FSP 1360 and FP4874 shall be replaced with the Multiboard wall system tested in WFRA 2168000.1 and varied with variations as described in section 3.1.

### *Performance of Proposed Support Construction*

The proposed wall system tested in WFRA 2168000.1 and varied according to section B1 comprised single steel stud and noggin wall framing (90-mm steel studs at 600-mm centres) lined with 15mm thick Multiboard (2 x 7.5mm thick Multiboard boards laminated with PVA glue). The wall system incorporated 50mm 16kg/m<sup>3</sup> Glasswool insulation within the wall cavity.

As discussed in Section B1 of this report, the proposed wall system will maintain integrity and insulation for 90 minutes if tested in accordance with AS 1530.4-2014.

The proposed wall construction is 120mm wide and slightly thicker than the wall constructions tested in FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658, FSP 1716, FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040 which were 116mm.

The proposed construction is only applicable to applications of FRL -/90/90, whereas the results of the test in the wall construction of 116mm thickness were -/120/120. It is considered that a 4mm increase in wall thickness will slightly improve the FRL of the systems tested FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658, FSP 1716, FSP 1902, FSP 1931, FSP 1946, FSP 1978, FSP 1996 and FSP 2040.

Based on the above discussion it is considered that the proposed wall construction including the pipes and Snap fire collars listed in Table 1 it will achieve an FRL of -/90/90 if tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

## B.3 The inclusion of Raupiano

The proposed construction includes the pipes and Snap collars listed in Table 2 installed within support wall construction as tested in referenced tests and subject to the following variations:

- The inclusion of 40mm to 110mm Raupiano pipes protected by Snap 50R, 65-80R and 110R collars penetrating Multiboard wall system tested in WFRA 2168000.1 varied with variations as described in section 3.1.

With reference to AS 4072.1, clause 4.6, it provides guidance on the application of the AS 1530.4 fire-resistance test data relating to plastic pipe penetrations. PVC-U DWV pipes and fittings for drain, waste and vent applications are covered under clause 4.6.3. Where a new pipe material is being assessed, this clause requires prequalification testing of nominated uPVC pipe sizes for the assessment of the variation of pipe types other than uPVC DWV pipes.

This clause requires the prequalification testing of the following uPVC pipe sizes which are required to achieve the FRL:

- 40-mm
- 50-mm
- 65-mm
- 80-mm
- 100-mm

Further to this, Clause 4.6.4 of AS 4072.1 states that for pipes other than uPVC DWV, the maximum and minimum sizes are to be tested and must achieve the required FRL in the separating element. The OD of the largest pipe must not exceed 120-mm and the OD of the smallest pipe cannot be less than 40 mm.

With reference to FP 4874, the following PVC-U DWV plastic pipes penetrated a nominal 128 mm thick plasterboard steel framed wall system:

No.	Collar	Pipe (mm)			Integrity (Minutes)	Insulation (Minutes)
		Material	OD	thickness		
6	50R	40 PVC-U DWV	43	2.2	185NF	168
4	63R	50 PVC-U DWV	56	2.5	185NF	123
10	84R	65 PVC-U DWV	69	3	185NF	176
9	65-80R	80 PVC-U DWV	82.3	3.1	185NF	167
7	110R	100 PVC-U SC DWV*	110	3.3	185NF	185NF

The reference report FP 4874 satisfies AS 4072.1, clause 4.6 for Snap R series fire collar protecting PVC pipes in 128mm plasterboard lined wall for integrity performance of at least 180 minutes and insulation performance of at least 120 minutes.

Regarding FSP 1902, the following PVC pipes penetrated a nominal 116 mm thick plasterboard steel framed wall system:

No.	Collar	Pipe (mm)			Integrity (Minutes)	Insulation (Minutes)
		Material	OD	Wall thickness		
2	50R	PVC	50	5.2	181	181
3	65-80R	PVC	65	5.8	181	181

FSP 1902 demonstrated that the 50R collar with 50mm PVC pipe and the 65-80R collar with 65mm PVC pipe can maintain integrity and insulation for up to 180 minutes.

Regarding FSP 1716, the following Raupiano pipes penetrated a nominal 128 mm thick plasterboard steel framed wall system:

No.	Collar	Pipe (mm)			Integrity (Minutes)	Insulation (Minutes)
		Material	OD	Wall thickness		
4	50R	Raupiano	40	2	180 NF	180 NF
3	110R	Raupiano	110	3.2	180 NF	180 NF

The referenced report FSP 1716 demonstrated that the maximum size of 110mm Raupiano pipe and the minimum size of Raupiano 40mm pipe can be protected by the Snap R series fire collar for integrity and insulation performance of at least 180 minutes.

The proposed intermediate Raupiano will have wall thicknesses equal or less than the pipe tested in the proposed collars in the referenced test FP 4878 and FSP 1902, which will allow the collar to shut in the same amount of time or fast than the that in the reference test FP 4878.

Also, the PVC pipes in the referenced test all have a significant margin above 90 minutes which adds confidence that when tested, the Raupiano specimen will achieve at least 90 minutes integrity and insulation.

### *Performance of Proposed Support Construction*

The proposed wall system tested in WFRA 2168000.1 and varied according to section B1 comprised single steel stud and noggin wall framing (90-mm steel studs at 600-mm centres) lined with 15mm thick Multiboard (2 × 7.5mm thick Multiboard boards laminated with PVA glue). The wall system incorporated 50mm 16kg/m<sup>3</sup> Glasswool insulation within the wall cavity.

As discussed in Section B1 of this report, the proposed wall system will maintain integrity and insulation for 90 minutes if tested in accordance with AS 1530.4-2014.

The proposed wall construction is 120mm wide and slightly thicker than the wall constructions tested in FSP 1716 and FP 4878 which were 128mm.

The proposed construction is only applicable to applications of FRL -/90/90, whereas the results of the test in the wall construction of 128mm thickness were at least -/180/120. It is considered that an 8mm increase in wall thickness will not detrimentally affect the FRL of the systems tested in FSP 1716 and FP 4878 for up to 90 minutes.

Based on the above, it is expected that the Raupiano pipes, when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005, will achieve the following FRL:

SNAP Collar	Supporting Construction	Pipe (mm)			FRL
		Material	OD	Minimum wall thickness	
50R	Multiboard wall system tested in WFRA 2168000.1 with and varied with variations as described in section 3.1.	Raupiano	40	2	-/90/90
50R			50	2.5	-/90/90
65-80R			75	3	-/90/90
65-80R			90	3.1	-/90/90
110R			110	3.2	-/90/90

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