

# Fire resistance of SNAP fire collars protecting various pipe system penetrations in Firecrunch 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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# 1 Introduction

This report is an assessment of the fire resistance of a SNAP fire collars protecting various pipe system penetrations in Firecrunch 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 the purpose of meeting the evidence of suitability requirements of Specification A2.3 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.

## 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
FSV 1711	AS 1530.4-2005	Full-scale load-bearing steel-framed wall system, lined on both sides with one layer of a material stated by the manufacturer to be identical to 10-mm thick Firecrunch board.
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
FAR3929	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
FSP 1716	AS 1530.4-2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars

The reports FSV 1711 was undertaken by CSIRO and sponsored by Modakboard Australia Pty Limited. This report is owned by Firecrunch 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 and FSP 1716 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 FAR3929 and FP4874 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

The proposed construction includes the pipes and Snap collars listed in Table 1 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 and FP4874 shall be replaced with the Firecrunch wall system tested in FSV 1711b with 90mm deep studs.
- The cavity insulation shall comprise mineral wool slabs with a density of not less than 75 kg/m<sup>3</sup> and installed as a single piece to completely fill the wall void without through joints or gaps.

**Table 1 – Snap collars and Referenced Report**

Collar Name	Pipe Size	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	1
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		-

Collar Name	Pipe Size	Pipe Material	Test Report	Specimen ID	
63R	56	HDPE		-	
63R	50	HDPE		-	
50R	56	HDPE		-	
50R	50	HDPE		-	
63R	50	PPR 7.4	FAR3929, FP4874, FSP1360 and FSP1366	-	
63R	40	PPR 7.4		-	
63R	32	PPR 7.4		-	
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	IPLEX PE-AL-PE		FCO2718, FSP1339, FSP1340 and FSP1341	-
32GAS	25	IPLEX PE-AL-PE			-
50GAS	32	IPLEX PE-AL-PE			-
50GAS	40	IPLEX 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	IPLEX PE-AL-PE		2	
50GAS	40	REHAU PX-AL-PE		3	
50GAS	50	IPLEX PE-AL-PE		4	
50GAS	32	GASPEX PX-AL-PX		5	
32GAS	16	IPLEX PE-AL-PE		6	
63R	63	PPR 7.4	FSP1360	1	
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	1	
32R	20	PE 7.4		2	
63R	20	PE 7.4		3	

Collar Name	Pipe Size	Pipe Material	Test Report	Specimen ID
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
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	FSP1716	4
HP150R	150	PVC		5
HP150R	160	HDPE		1
32R	32	Pex-a		2
110R	110	Raupiano		3

## 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.
- AS4072.1-2005      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 Testing Authority 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.

**FRL -/90/90**

## 6 Direct Field of Application of Results

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



## 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> August 2022. 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 only 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. CSIRO Sponsored Investigation report numbered FSV 1711

On the 21 September 2015, this Division conducted a full-scale fire-resistance test on load-bearing steel-framed wall system, lined on both sides with one layer of a product stated by the manufacturer to be identical to 10mm Firecrunch magnesium oxide board. The specimen comprised a load-bearing framed wall system with overall nominal dimensions measuring 3000-mm high x 3000-mm wide x 110mm thick.

The steel wall frame comprised eleven (11) 90-mm x 45-mm x 1.0-mm BMT steel studs fixed into the top and bottom steel tracks with nominal dimensions of 90-mm x 45-mm x 1.0-mm BMT steel. The steel studs were spaced at nominal 300-mm centres, with two back to back (double) studs used at 600-mm centres to correspond with each of the Firecrunch board joints, as shown in drawing numbered MBA20150921, dated 21 September 2015, by Modakboard Australia Pty Limited.

Steel noggings, with nom. dimensions 90-mm x 45-mm x 1.0-mm BMT were screw fixed between the wall studs at 1000-mm vertical centres. The back to back (double) studs were first sealed at the joining faces using PROMASEAL AN acrylic sealant prior to being screw fixed together using 12-14 x 20-mm long hex head Tek screws at 400-mm centres. The remainder of the steel wall framing was screwed together using 10 gauge x 25-mm long steel screws.

The steel wall framing was lined on each face with a single layer of a product stated by the manufacturer to be identical to 10mm Firecrunch magnesium oxide boards orientated vertically. The sheets measured nominally 1200-mm wide x 3000-mm long x 10-mm thick, with a stated density of 950 kg/m<sup>3</sup>.

Prior to the wall boards being screw fixed to the wall studs, a nom. 10-mm wide x 3-mm deep bead of PROMASEAL AN acrylic sealant was applied to the flanges of the tracks and studs and left to cure overnight. The 10mm Firecrunch boards were then screwed to the wall studs using 8-gauge x 25-mm long bugle head drywall screws at 200-mm centres, through pre-drilled holes 15-mm from the board edges. All board joints were offset by 600-mm. A nominal 3-mm gap was left between all board joints which were later sealed to the full board depth using PROMASEAL An acrylic sealant, and then taped and set using a setting compound.

The wall cavity was filled with two layers of Fletcher Insulation mineral wool insulation batts. The batts had a stated density of 64 kg/m<sup>3</sup> and measured 1200-mm in length x 900-mm in width. One layer of 50-mm thick batts was laid against the exposed boards while the 40-mm thick batts were laid against the unexposed boards. Insulation strips were cut to fit within the metal studs.

A total load of 55 kN was applied to the specimen for the duration of the test.

The wall system failed with respect to insulation when the maximum temperature rise criterion of 180K was exceeded at 89 minutes on the unexposed face of the wall lining over a wall stud. The wall system maintained structural adequacy and integrity for 98 minutes at which time the test was terminated.

## A.2. 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 noggings

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 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 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 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.3. 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.4. 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.5. 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.6. 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.7. 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 six PPR 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.8. 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 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.9. 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.10. 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 AS1530.4-2005.

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.11. 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 AS1530.4-2005.

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.12. 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 AS1530.4-2005.

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 Intumesch 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 Intumesch 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 Intumesch 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 Intumesch 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 Intumesch 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 Intumesch 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.13. 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 AS1530.4-2005.

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 sheathing 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.14. Relevance of referenced test data to AS 1530.4-2014

### *General*

The fire resistance tests FSV 1711, FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658 and FSP 1716 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 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.

The rules for the application of cotton pad for tests in accordance with AS 1530.4-2005 Section 3 are different from Section 3 of AS 1530.4-2014. Based on reference to the Test FSV 1711B it is confirmed that this difference is not relevant to this test and the behaviour exhibited in the test.

### *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 Wall Construction

The proposed construction includes the pipes and Snap collars listed in Table 1 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 and FP4874 shall be replaced with the Firecrunch wall system tested in FSV 1711b with 90mm deep studs.
- The cavity insulation shall comprise mineral wool slabs with a density of not less than 75 kg/m<sup>3</sup> and installed as a single piece to completely fill the wall void without through joints or gaps.

### *Performance of Proposed Support Construction*

The wall system tested in FSV 1711 comprised steel stud and noggin wall framing (90-mm x 45-mm x 1.0-mm BMT steel studs at 300-mm centres) lined with 10-mm thick FireCrunch MBE-10 wall linings. The wall system incorporated Fletcher Insulation (MW 450) mineral wool slabs with a density of 64 kg/m<sup>3</sup> within the wall cavity.

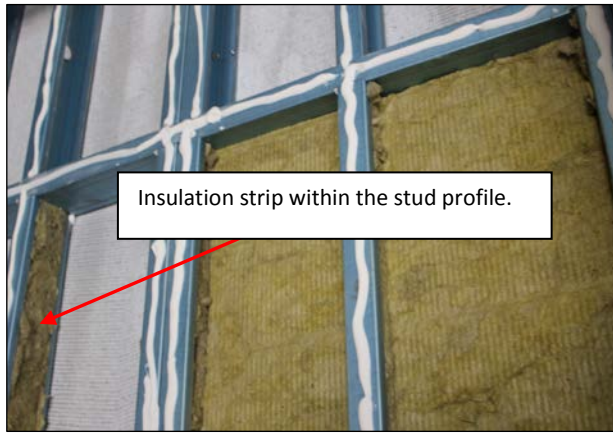
When tested the wall system maintained structural adequacy and integrity for the 98-minute duration of the test. The maximum temperature rise insulation failure criterion of 180K was exceeded at 89 minutes on the unexposed face of the specimen.

The insulation failure at this time was isolated to a single thermocouple 24 positioned on the exposed face of the wall lining over a wall stud which exceeded 203°C at 89 minutes. The ambient temperature on the day of the test was 21°C. After 95 minutes of testing a maximum temperature of 202°C was recorded adjacent to a board joint on the unexposed face of the wall system by thermocouple 21, 6 minutes after the first recorded failure.

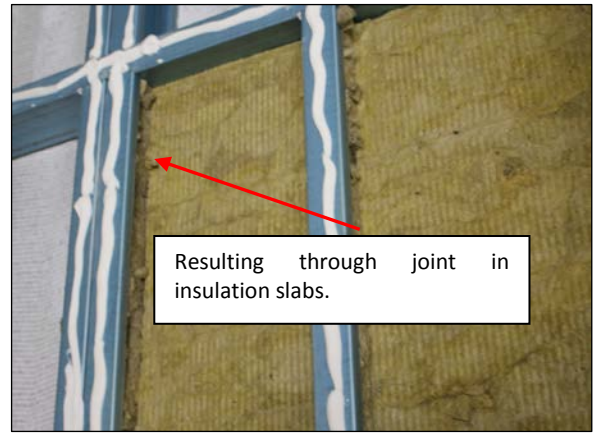
The average temperature recorded on the unexposed face of the FireCrunch MBE-10 wall lining at the time of insulation failure measured 97°C and the maximum temperature measured at the head of the specimen was 146°C. Both of these recorded temperatures are below the average and maximum temperature rise failure criterion.

During construction of the test specimen, the mineral wool slabs were installed in two layers, a 50-mm thick slab layer and a 40-mm thick slab layer installed back to back, used to fill the 90-mm deep wall cavity. An additional strip of 90-mm thick insulation material was cut to size and used to infill the steel stud frame sections (photograph 1).

The insulation installation method resulted in a through opening in the vertical joint between the mineral wool slabs at the intersection of the insulation strip used within the stud profile and insulation slabs (40-mm and 50-mm thick slabs) installed within the wall cavity (Photograph 2).



Insulation strip within the stud profile.



Resulting through joint in insulation slabs.

Photograph 1 – 90-mm thick strip of mineral wool insulation inserted within stud profile.

Photograph 2 – Vertical through joint in insulation slabs at the intersection of 90-mm thick insulation strip in wall studs and 40-mm/50-mm slabs used in the wall cavity.

The fire performance of the wall system is dependent on the exposed wall linings as well as the wall cavity insulation, which both contribute to delay the temperature rise of the wall framing and therefore the subsequent rise in temperature on the unexposed face of the specimen.

The presence of any through a gap in the wall cavity insulation will allow the flow of hot furnace gases into the wall cavity when the exposed wall lining boards crack or the exposed board joints open up due to shrinkage and/or wall deflections.

The proposed construction comprises;

- The wall cavity insulation comprises mineral wool slabs with a density of not less than 75 kg/m<sup>3</sup>.
- The wall cavity insulation is installed as a single piece to completely fill the wall void without through joints or gaps.

It is considered the insulation slabs being installed as a single piece without through joints and the increase in the density of mineral insulation used within the wall cavity will also provide additional 1-minute insulation performance.

The proposed wall construction is 1100mm wide and slightly narrower than the wall constructions tested in FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658 and FSP 1716 which were 116mm.

The proposed construction is only applicable to applications of FRL -/90/90, whereas the results of the test in wall construction of 166mm thickness were -/120/120. It is considered that a 6mm reduction in wall thickness will not reduce the FRL of the systems tested FSP 1748, FSP 1759, FAR3929, FP4874, FSP 1341, FSP 1360, FSP 1366, FSP 1634, FSP 1658 and FSP 1716 by more than 30 minutes.

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.

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