

Fire resistance of various SNAP collars with various collar fixings in accordance with AS 1530.4-2014 and AS 4072.1-2005

Assessment Report

Author: Keith Nicholls
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Inquiries should be addressed to:

Fire Testing and Assessments	Author	The Client
NATA Registered Laboratory	Infrastructure Technologies	IG6 Pty Ltd
14 Julius Avenue	14 Julius Avenue	3 Skirmish Court
North Ryde, NSW 2113	North Ryde, NSW 2113	Victoria Point QLD 4165
Telephone +61 2 94905444	Telephone +61 2 94905500	Telephone +61 7 3390 5420

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AUTHOR	REVIEWED BY	AUTHORISED BY
Keith Nicholls	Jing Xu	Keith Nicholls
		
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Contents

1	Introduction	4
2	Supporting Data	4
3	Proposed Variations	5
4	Referenced Standards	8
5	Conclusion	9
6	Direct Field of Application of Results	9
7	Requirements	9
8	Term of Validity	10
9	Limitations	10
Appendix A	Supporting Test Data	11
Appendix B	Analysis of Variations	27

1 Introduction

This report is an assessment of the fire resistance of various SNAP collars with various collar fixings in accordance with AS 1530.4-2014 and AS 4072.1-2005.

This report is prepared for the purpose of meeting the requirements of NCC 2019 Volume 1 Schedule 5 clauses 2b) and 2 c) or NCC 2022 Volume 1 Clauses S1C2 (b) and (c) as appropriate for FRL.

This report reviews and confirms the extent to which the reference fire resistance tests listed in section 2 meet the requirements of the standard fire test standards listed in section 4 of the report. The proposed variations to the tested construction presented in section 3 are subject to an analysis in Appendix B, and the conclusions are presented in Section 5 of this report. The field of applicability of the results of this assessment report is presented in Section 6. and subject to the requirements, validity and limitations of Sections 7, 8 and 9.

2 Supporting Data

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

Report Reference	Test Standard	Outline of Test Specimen
FSP 1716	AS 1530.4-2005	A fire resistance test on Snap Retrofit Fire Collars protecting an insulated 128mm thick Boral Firestop plasterboard wall system penetrated by 5 pipes.
FSP 1748	AS 1530.4-2014	A fire resistance test on Snap Retrofit Fire Collars protecting an insulated 116mm thick Boral Firestop plasterboard wall system penetrated by 9 pipes.
FSP 1759	AS 1530.4-2014	A fire resistance test on Snap Retrofit Fire Collars protecting an insulated 116mm thick Boral Firestop plasterboard wall system penetrated by 9 pipes.
FSP 1902	AS 1530.4-2014	A fire resistance test on Snap Retrofit Fire Collars protecting an insulated 116mm thick Fyrchek plasterboard wall system penetrated by 9 pipes and reporting on 7 of these penetrations.
FSP 1932	AS 1530.4-2014	A fire resistance test on Snap Retrofit Fire Collars protecting an insulated 90mm thick Boral Firestop plasterboard wall system penetrated by 9 pipes and reporting on 7 of these penetrations.
FSP 1996	AS 1530.4-2014	Pilot scale fire resistance test of a wall penetrated by five (5) services and protected by a retro-fitted Snap Fire Systems fire collar.
FSP 2090	AS 1530.4 - 2014	A fire resistance test of pipe penetrations in a 116mm thick plasterboard lined wall.
FP 4874	AS 1530.4 - 2005	Pilot-scale plasterboard lined wall including various pipe penetrations protected with various Snap fire collars

The reports FSP 1716, FSP 1748, and FSP 1759 were undertaken by CSIRO and sponsored by Snap Fire Systems, which has provided permission for CSIRO to refer to these reports on behalf of IG6 Pty Ltd. The reports FSP 1996, FSP 2090, FSP 1902 and FSP 1932 was undertaken by CSIRO and sponsored by IG6 Pty Ltd. The referenced test FP 4874 was tested at BRANZ, NZ and sponsored by SNAP Fire Systems which has provided permission for CSIRO to refer to these reports on behalf of IG6 Pty Ltd.

This assessment is based on the test data listed above and it is confirmed that the parts of these test results relied upon in this assessment are equivalent to or more severe to that required by referenced test standard in Section 4 of this report.

3 Proposed Variations

3.1 Fixings

The proposed construction includes the pipes and Snap retrofit fire collars tested in FSP 1716, FSP 1748, FSP 1759, FSP 1932, and FSP 1902 and is subject to a variation to fire collar fixings as shown in Table 1:

Table - 1 Fixing for the collar to plasterboard lined walls

Collar	Proposed Fixing
SNAP retro-fit fire collar: 32R, 50R, 63R, 65-80 R, 110R	10g x 38mm coarse thread bugle head laminating screw
SNAP retro-fit fire collar: <ul style="list-style-type: none"> • 32R, 50R, 63R, 65-80R, 110R, • GAS32, GAS50, GAS63 • HP150R 	M4 (or larger) Expandable Metal Anchors examples include Powers HWA4SL and Ramset HW13M4

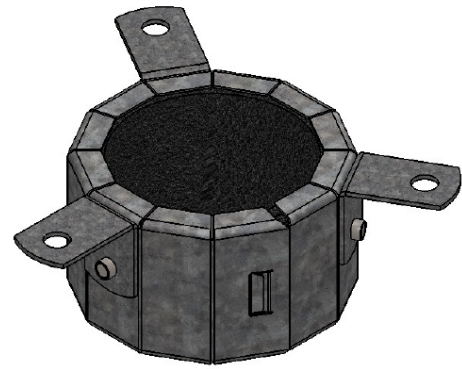
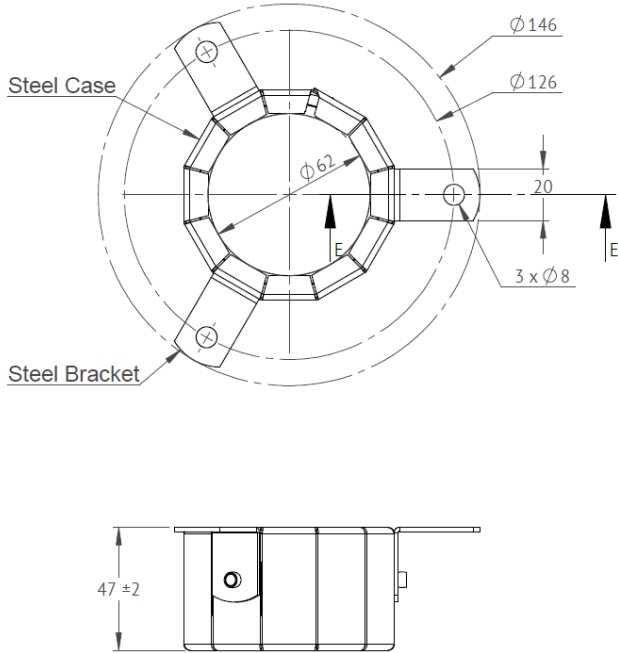
3.2 Support construction

The proposed construction shall be Snap retrofit collars tested in FSP 1716, FSP 1748, FSP 1902, FSP 1996, FSP 2090, FP 4874 and listed in Table 2, and subject to the following variations:

- The inclusion of minimum 78mm thick Speedpanel wall tested or assess for an FRL of at least - /120/120 as a support construction.
- The inclusion of plasterboard patch over a section of Speedpanel wall at the location of the penetrating PVC pipes.
- The pipe shall be protected by SNAP collars as shown in Table 2 on each side of the wall and installed as per Figures 1-5.
- Fixings for retrofit collars to plasterboard patch shall be as per Table 1
- Plastic pipes are to be supported on each side of the wall.

Table 2: SNAP 65-80R collar with PVC pressure pipes in walls

SNAP Collar	Support construction thickness (X)	Pipe material	Pipe Nominal Diameter (mm)	Pipe thickness (without fitting in collar) (mm)	Pipe thickness (with fitting in collar) (mm)
50R	78mm Speedpanel wall and tested or assessed FRL of - /120/120 as appropriate as a wall	PVC-U, PVC-O or PVC-M pressure pipes (PN12)	50	3.3	4.4
65-80R			80	4.9	5.8
110R			100	4.8	6
HP150R			150	6.7	8.2



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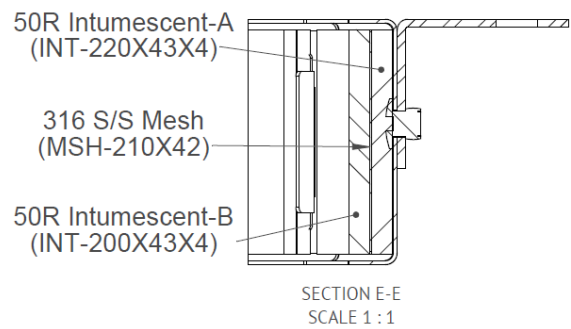
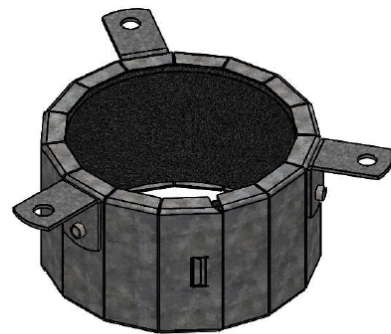
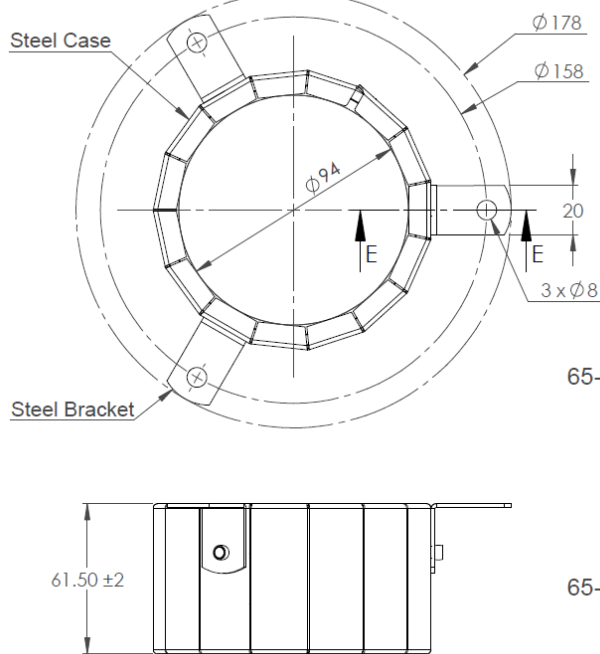


Figure 1: SNAP 50R collar



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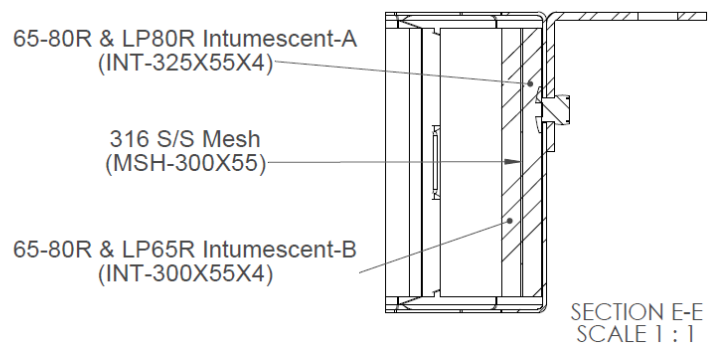


Figure 2: SNAP 65-80R collar

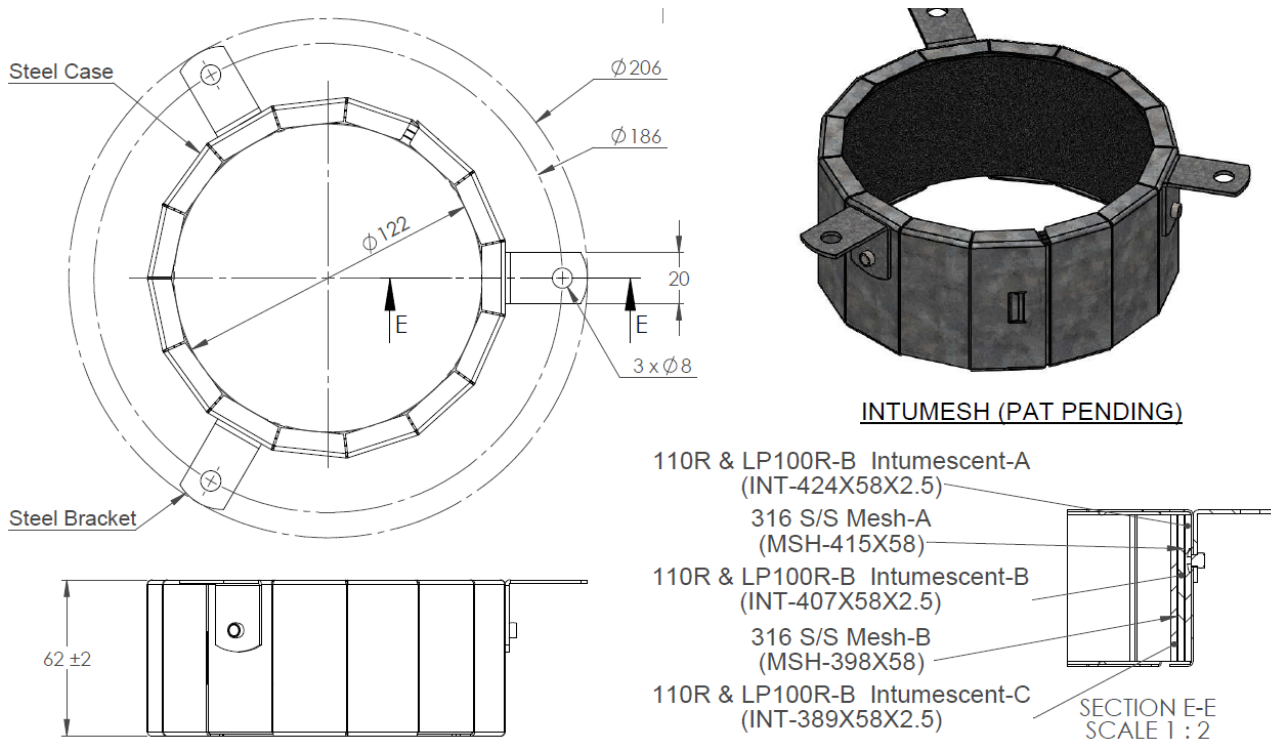


Figure 3: SNAP 110R collar

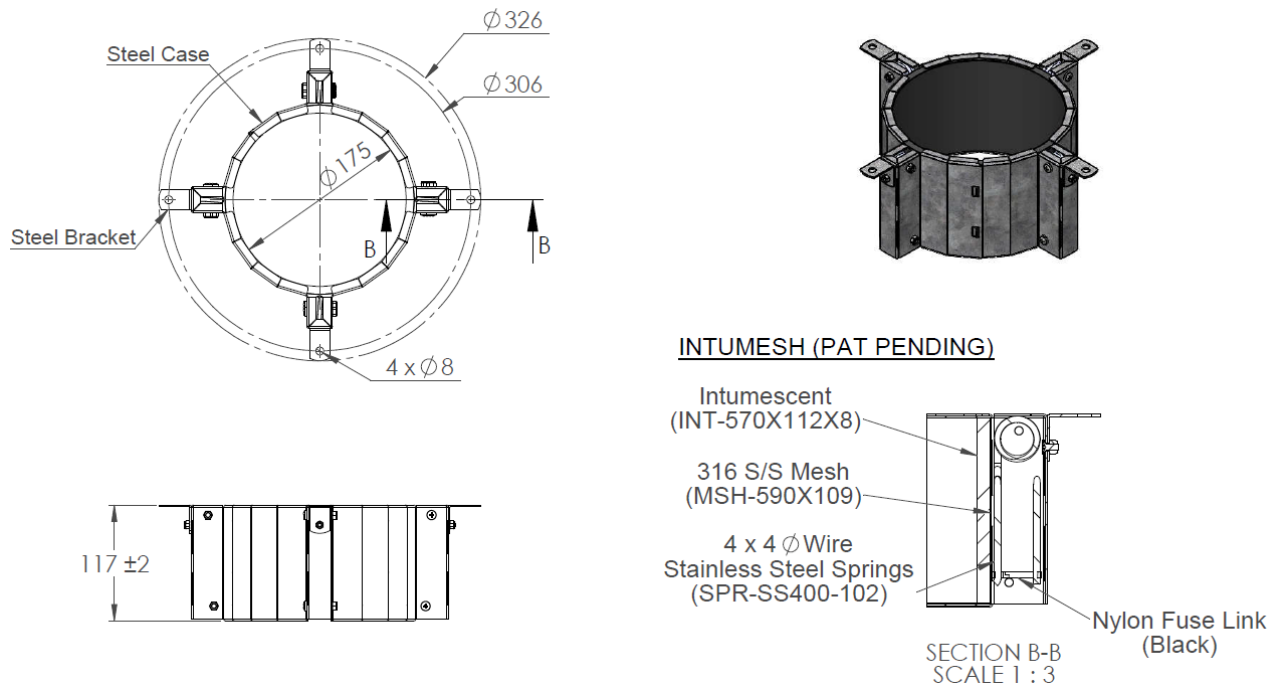


Figure 4: SNAP HP150R collar

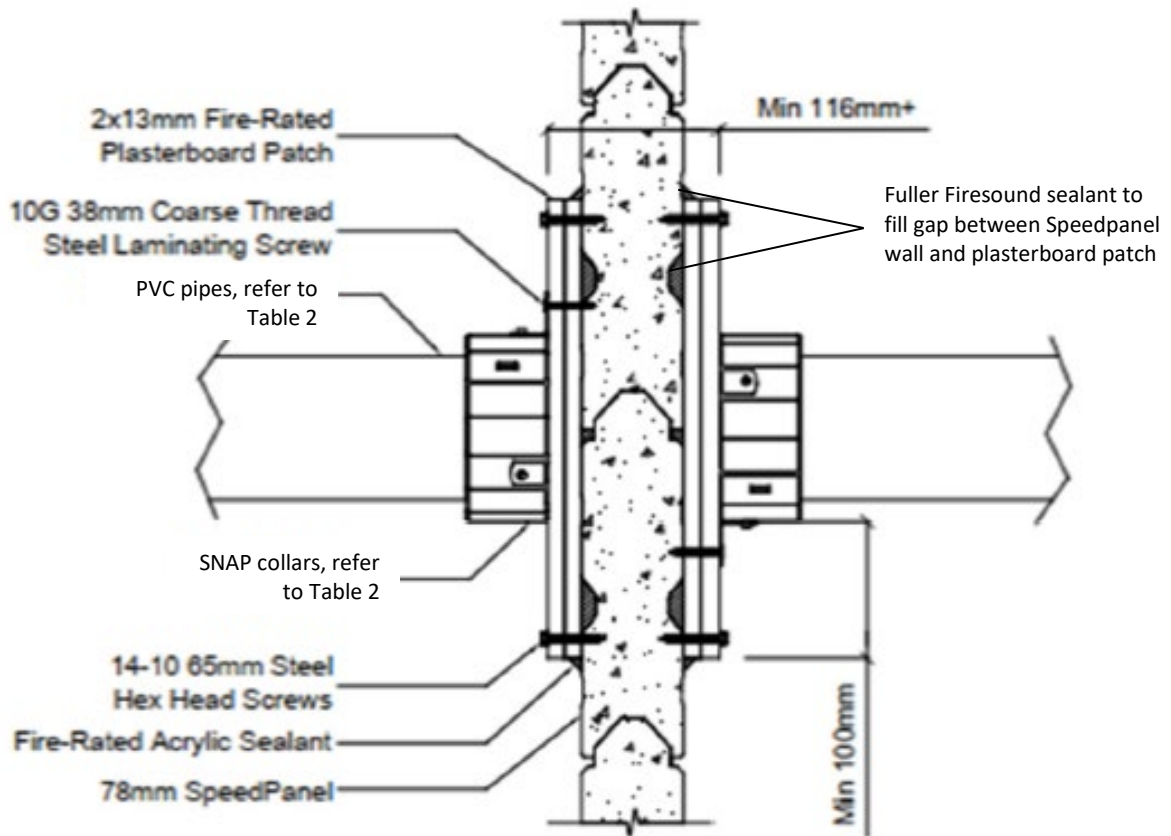


Figure 5: SNAP 65-80R collar

4 Referenced Standards

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

5 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototypes described in Section 2 when varied as described in Section 3.1 there will be no detrimental effect on the fire resistance when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of Section 7, the validity of section 8 and limitation of section 9.

On the basis of the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototypes described in Section 2 when varied as described in Section 3.2 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 4 and subject to the requirements of section 7, the validity of section 8 and limitation of section 9.

Table 3: SNAP retrofit fire collar with PVC pressure pipes in Speedpanel walls

SNAP Collars each side of the wall	Support construction thickness (X)	Pipe material	Pipe Nominal Diameter (mm)	Fitting within the body of the collar	Figures and Tables	FRL
50R	A Speedpanel wall with a tested or assessed FRL of at least - /120/120 with plasterboard patch – total thickness to be at least 116mm thick	PVC-U, PVC-O or PVC-M pressure pipe (PN12)	50	Yes	Figures 1 - 5 Tables 1, 2	-/60/60
65-80R			80			
110R			100			
HP150R			150			

6 Direct Field of Application of Results

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

7 Requirements

It is required that the supporting construction is tested or assessed to achieve at least the required FRL in accordance with AS 1530.4.

It is also required that the supporting construction be designed to include an aperture while maintaining the required FRL.

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 30th November 2028. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

9 Limitations

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

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

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced assessment can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of construction of subsequent manufacture.

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

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

Appendix A Supporting Test Data

A.1. CSIRO Sponsored Investigation report numbered FSP 1716

On 7 September 2015, this Division conducted a pilot fire-resistance test in accordance with AS 1530.4 -2005 on an insulated 128mm thick Boral Firestop plasterboard wall system comprising of each side was lined with two (2) layers of 16mm thick Firestop sheets. The wall system was constructed in accordance with Boral Firestop system with an established fire resistance level (FRL) of -/120/120. The wall was penetrated by five (5) pipes protected by a retro-fitted Snap Fire Systems fire collar.

For the purpose of the test, the specimens were referenced as Penetrations # 1, 2, 3, 4, and 5.

The SNAP retrofitted HP150R collar comprised a 0.95mm steel casing with a 175mm inner diameter and a 326mm diameter base flange. The 117mm high collar casing incorporated a strip of 570mm x 112mm x 8mm thick Intumesh intumescent material. The closing mechanism comprised four 304 stainless steel springs, with nylon fuse links, and a 596mm x 112mm stainless steel.

The SNAP Retrofit 32R fire collar comprised a 0.75mm steel casing with a 40mm inner diameter and a 106mm diameter base flange. The 32mm 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 4mm thick x 26mm wide x 135mm long, and 4mm thick x 26mm wide x 154mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135 mm long x 25mm wide with a wire mesh diameter of 0.15mm.

The SNAP 110R retrofitted fire collar comprised a 0.75mm steel casing with a 127mm inner diameter and a 214mm diameter base flange. The 62mm high collar casing incorporated three layers of 403mm x 58mm wide x 2.5mm thick Intumesh intumescent material. Between the intumescent layers, 58mm wide stainless steel mesh.

The SNAP Retrofit 50R fire collar comprised a 0.75mm steel casing with a 62mm inner diameter and a 149mm diameter base flange. The 47mm 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 4mm thick x 43mm wide x 200mm long, and 4mm thick x 43mm wide x 220mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 210 mm long x 42mm wide with a wire mesh diameter of 0.15mm.

Penetration # 1 – HP150R retrofitted fire collar protecting a nominal 160mm High-Density Polyethylene (HDPE) Pipe

One HP 150 R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 160mm nominal diameter HDPE pipe, with a wall thickness of 6.7mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 165mm diameter cut-out hole.

Penetration # 2 – 32R retrofitted fire collar protecting a nominal 16mm Pex-A Pipe

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 32mm nominal diameter Pex-a Pipe, with a wall thickness of 4.9mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 35mm diameter cut-out hole.

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

One 110R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using two (2) #427 hollow wall anchors.

The penetrating service comprised a 110mm nominal diameter Raupiano Pipe, with a wall thickness of 3.2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 113mm diameter cut-out hole.

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

One 50R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 40mm nominal diameter Raupiano Pipe, with a wall thickness of 2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 43mm diameter cut-out hole.

Penetration # 5 – HP150R retrofitted fire collar protecting a 160mm Polyvinyl Chloride (PVC) pipe

One HP 150R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 160mm nominal diameter PVC-SC Pipe, with a wall thickness of 4.05mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 165mm diameter cut-out hole.

All pipe penetrations projected horizontally, approximately 2000mm away from the unexposed face of the plasterboard wall and approximately 500mm into the furnace chamber. The pipes were supported at nominally 500mm from the unexposed face of the plasterboard wall by two support clamp brackets each and spaced apart at nominally 1000mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Kaowool) plug.

The test results are summarised in the table below:

Test Report	Specimen ID	Collar Name	Fixings	Pipe Nominal Diameter (mm)	Pipe Material	Collar Detached (Y/N)	Test Results
FSP 1716	1	HP150R	#427 Hollow Wall Anchors	160	HDPE	N	-/166/163
	2	32R	#427 Hollow Wall Anchors	16	Pex-A	N	-/181/181
	3	110R	#427 Hollow Wall Anchors	110	Raupiano	N	-/181/181
	4	50R	#427 Hollow Wall Anchors	40	Raupiano	N	-/181/181
	5	HP150R	#427 Hollow Wall Anchors	160	PVC	N	-/138/123

A.2. Applicability of AS 1530.4-2005 Test Data to AS 1530.4-2014

The fire resistance test FP 4874 and FSP 1716 was conducted in accordance with AS 1530.4-2005, which differs from AS 1530.4-2014. The variations between the two methods and their effects on the fire resistance are discussed below.

Furnace Temperature

The specifications for furnace temperature in AS 1530.4-2014 and AS 1530.4-2005 are unchanged between standards.

Furnace Thermocouple Locations

The specifications for thermocouple locations for pipe and conduit service penetrations in AS 1530.4-2014 and AS 1530.4-2005 are unchanged between standards.

Furnace Pressure

The specifications for furnace pressure in AS 1530.4-2014 and AS 1530.4-2005 are unchanged between standards.

Specimen Mounting

The specifications for specimen mounting in AS 1530.4-2014 and AS 1530.4-2005 vary in that in AS 1530.4-2014 specifies that except for multiple penetrations sealing systems, the pipe shall be tested in a circular opening with a smooth surface texture and parallel sides that run perpendicular to the plane of the separating element. The cited test reports, FP 4874 and FSP 1716 are in accordance with this specification. Then specifications for specimen mounting in AS 1530.4-2014 and AS 1530.4-2005 are otherwise unchanged between standards.

Performance Criteria – Integrity

The specifications for Integrity performance criteria in AS 1530.4-2014 and AS 1530.4-2005 remain unchanged between standards.

Performance Criteria – Insulation

The specifications for Insulation performance criteria in AS 1530.4-2014 and AS 1530.4-2005 remain unchanged between standards.

On the basis of the above discussion, it is considered that the results of the test report FSP 1716 and FP 4874 can be applied to assess integrity and insulation performance in accordance with AS 1530.4-2014.

A.3. CSIRO Sponsored Investigation report numbered FSP 1748

On 2 May 2016, this Division conducted a pilot fire-resistance test in accordance with AS 1530.4 -2014 on an insulated 116mm thick Boral Firestop plasterboard wall system comprising a wall with each side lined by two (2) layers of 13mm thick Boral Firestop sheets. The wall system as constructed in accordance with Boral Firestop system with an established fire resistance level (FRL) of -/120/120. The wall was penetrated by nine (9) pipes protected by a retro-fitted Snap Fire Systems fire collar.

For the purpose of the test, the specimens were referenced as Penetrations # 1, 2, 3, 4, 5, 6, 7, 8 and 9.

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

The SNAP Retrofit 32R fire collar comprised a 0.75mm steel casing with a 40mm inner diameter and a 106mm diameter base flange. The 32mm 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 4mm thick x 26mm wide x 135mm long, and 4mm thick x 26mm wide x 154mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135mm long x 25mm wide with a wire mesh diameter of 0.15mm.

The SNAP Retrofit 110R fire collar comprised a 0.75mm steel casing with a 122mm inner diameter and a 209mm diameter base flange. The 62mm 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 2.5mm thick x 58mm wide x 424mm long, 2.5mm thick x 58mm wide x 407mm long, and 2.5mm thick x 58mm wide x 389mm long respectively. Between the strips was a layer of 304 stainless steel mesh 415mm long x 58mm wide with a wire mesh diameter of 0.15mm, and 398mm long x 58mm wide with a wire mesh diameter of 0.15.

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

One 50R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 32mm nominal diameter Class 18 P-PVC Pipe, with a wall thickness of 3.6mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 50mm diameter cut-out hole.

Penetration # 2 – 50R retrofitted fire collar protecting a 32mm Polyvinyl Chloride (C-PVC) Pipe

One 50R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 32mm C-PVC Pipe, with a wall thickness of 3.5mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 50mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 16mm nominal diameter PVC Flexi Pipe, with a wall thickness of 1.8mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 20mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 20mm nominal diameter PVC Conduit with a 3 core cable, with a wall thickness of 1.8mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 25mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 25mm nominal diameter PVC Conduit with a 3 core cable, with a wall thickness of 2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 30mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) hollow wall anchors.

The penetrating service comprised a 25mm nominal diameter PVC Conduit, with a wall thickness of 2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 30mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) 10g x 38mm coarse thread plasterboard screws.

The penetrating service comprised a 20mm nominal diameter PVC Conduit, with a wall thickness of 2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 25mm diameter cut-out hole.

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

One 32R fire 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 15mm nominal diameter P-PVC Class 18 Pipe, with a wall thickness of 1.8mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 20mm diameter cut-out hole.

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

One 110R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) 10g x 38mm coarse thread plasterboard screws.

The penetrating service comprised a 100mm nominal diameter PVC-SC Pipe, with a wall thickness of 3.3mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 114mm diameter cut-out hole.

All pipes projected horizontally, approximately 2000mm away from the unexposed face of the plasterboard wall and approximately 500mm into the furnace chamber. The pipes were supported at nominally 500mm from the unexposed face of the plasterboard wall by two support clamp brackets spaced apart at nominally 1000mm. The pipes of Penetration # 1 - 8 were open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug. The pipe of Penetration # 9 was open at the unexposed end and capped on the exposed end with a PVC End Cap.

The test results are summarised in the table below:

Test Report	Specimen ID	Collar Name	Fixings	Pipe Nominal Diameter (mm)	Pipe Material + contents (if applicable)	Collar Detached (Y/N)	Test Results
FSP 1748	1	50R	Hollow Wall Anchor	32	Class 18 P-PVC	N	-/121/121
	2	50R	Hollow Wall Anchor	32	C-PVC	N	-/121/121
	3	32R	Hollow Wall Anchor	16	PVC	N	-/121/121
	4	32R	Hollow Wall Anchor	20	PVC + 3 core cable	N	-/121/121
	5	32R	Hollow Wall Anchor	25	PVC + 3 core cable	N	-/121/121
	6	32R	Hollow Wall Anchor	25	PVC conduit	N	-/121/121
	7	32R	10G x 38mm plasterboard screws	20	PVC conduit	N	-/121/121
	8	32R	Hollow Wall Anchor	15	Class 18 P-PVC	N	-/121/121
	9	110R	10G x 38mm plasterboard screws	100	PVC-SC	N	-/121/121

A.4. CSIRO Sponsored Investigation report numbered FSP 1759

On 20 July 2016, this Division conducted a pilot fire-resistance test in accordance with AS 1530.4 -2014 on an insulated 116mm thick Boral Firestop plasterboard wall system comprising of each side lined with two (2) layers of 13mm thick Firestop sheets. The wall system was constructed in accordance with Boral Firestop system with an established fire resistance level (FRL) of -/120/120. The wall was penetrated by nine (9) pipes protected by a retro-fitted Snap Fire Systems fire collar.

For the purpose of the test, the specimens were referenced as Penetrations # 1, 2, 3, 4, 5, 6, 7, 8 and 9.

The GAS32 Retrofit collar comprised a 0.95mm thick galvanised steel casing with a 35mm inner diameter and a 90mm diameter base flange. The 63mm high collar casing incorporated a layer of 140mm x 55mm x 4mm thick Intumescent material and a layer of 120mm x 55mm x 4mm 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 54mm.

The 32R Retrofit collar comprised a 0.75mm steel casing with a 40mm inner diameter and a 106mm diameter base flange. The 32mm 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 4mm thick x 26mm wide x 135mm long, and 4mm thick x 26mm wide x 154mm long, respectively. Between the strips was a layer of 304 stainless steel mesh 135 mm long x 25mm wide with a wire mesh diameter of 0.15mm.

The GAS50 Retrofit collar comprised a 0.95mm thick galvanised steel casing with a 57mm inner diameter and a 115mm diameter base flange. The 92mm high collar casing incorporated a layer of 215mm x 85mm x 4mm thick Intumescent material and a layer of 190mm x 85mm x 4mm 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 84mm.

The GAS63 Retrofit collar comprised a 0.95mm thick galvanised steel casing with a 67mm inner diameter and a 121mm diameter base flange. The 91mm high collar casing incorporated a layer of 265mm x 85mm x 4mm thick Intumescent material, a layer of 235mm x 85mm x 4mm thick Intumescent material and a layer of 200mm x 85mm x 4mm 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 84mm, and one layer of 316 stainless steel mesh measuring 200 x 84mm.

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

One GAS32 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 15mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 19mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 20mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.8mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 22mm diameter cut-out hole.

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

One 32R fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 15mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.3mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 19mm diameter cut-out hole.

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

One GAS32 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 20mm Valsir Px-Al-Px stack pipe, with a wall thickness of 2.9mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 22mm diameter cut-out hole.

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

One GAS32 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #427 hollow wall anchors.

The penetrating service comprised a 26mm Valsir Px-Al-Px stack pipe, with a wall thickness of 3.4mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 29mm diameter cut-out hole.

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

One GAS50 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #527 hollow wall anchors.

The penetrating service comprised a 32mm Valsir Px-Al-Px stack pipe, with a wall thickness of 3.6mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 35mm diameter cut-out hole.

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

One GAS50 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #527 hollow wall anchors.

The penetrating service comprised a 40mm Valsir Px-Al-Px stack pipe, with a wall thickness of 4mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 44mm diameter cut-out hole.

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

One GAS50 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #527 hollow wall anchors.

The penetrating service comprised a 50mm Valsir Px-Al-Px stack pipe, with a wall thickness of 4.4mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 57mm diameter cut-out hole.

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

One GAS63 fire collar was fixed to each side of the plasterboard wall in a back-to-back configuration using three (3) #527 hollow wall anchors.

The penetrating service comprised a 63mm Valsir Px-Al-Px stack pipe, with a wall thickness of 5.4mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 67mm diameter cut-out hole.

The pipes projected horizontally, 2000mm away from the unexposed face of the plasterboard wall and approximately 500mm into the furnace chamber. The pipes were supported at nominally 500mm and 1500mm from the unexposed face of the plasterboard wall by two support clamps spaced apart at nominally 1000mm. The pipe was open at the unexposed end and capped on the exposed end with a ceramic fibre (Superwool) plug.

The test results are summarised in the table below:

Test Report	ID	Collar Name	Fixings	Pipe Nominal Diameter (mm)	Pipe Material	Collar Detached (Y/N)	Test Results
FSP 1759	1	GAS32	#423 Hollow Wall Anchors	15	Valsir Px-Al-Px	N	-/181/181
	2	32R	#423 Hollow Wall Anchors	20	Valsir Px-Al-Px	N	-/181/109
	3	32R	#423 Hollow Wall Anchors	15	Valsir Px-Al-Px	N	-/181/169
	4	GAS32	#423 Hollow Wall Anchors	20	Valsir Px-Al-Px	N	-/181/176
	5	GAS32	#423 Hollow Wall Anchors	26	Valsir Px-Al-Px	Y	-/181/138
	6	GAS50	#527 Hollow Wall Anchors	32	Valsir Px-Al-Px	N	-/181/140
	7	GAS50	#527 Hollow Wall Anchors	40	Valsir Px-Al-Px	N	-/181/170
	8	GAS50	#527 Hollow Wall Anchors	50	Valsir Px-Al-Px	Y	-/181/114
	9	GAS63	#527 Hollow Wall Anchors	63	Valsir Px-Al-Px	Y	-/181/86

A.5. CSIRO Sponsored Investigation report numbered FSP 1902

On 5 April 2018, this Division conducted a full-scale fire-resistance test in accordance with AS 1530.4 - 2014 on an insulated 116mm thick plasterboard lined steel framed wall comprising of each side lined with two (2) layers of 13mm thick Fyrchek sheets on 64mm deep metal studs. The wall system has an established fire resistance level (FRL) of -/120/120 as detailed in the BRANZ report reference FAR2539. The wall was penetrated by nine (9) pipes protected by various fire stopping systems.

For the purpose of the test, the specimens were referenced as Penetrations # 1, 2, 3, 4, 5, 6, 7, 8 and 9. Seven (7) penetrations are included in this report (Penetration # 1, 2, 3, 4, 5, 6, and 9).

The SNAP Retrofit 50R fire collar comprised a 0.75mm steel casing with a 62mm inner diameter and a 147mm diameter base flange. The 47mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. Intumescent A was 4mm thick x 43mm wide x 220mm long, and Intumescent B was 4mm thick x 43mm wide x 200mm long. Between the strips was a layer of 316 stainless steel mesh 210mm long x 42mm wide with a wire mesh diameter of 0.15mm.

The SNAP Retrofit 65-80R fire collar comprised a 0.75mm steel casing with a 942mm inner diameter and a 179mm diameter base flange. The 62mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesh intumescent wraps lined within the internal circumference of the collar. Intumescent A was 4mm thick x 55mm wide x 325mm long, and Intumescent B was 4mm thick x 55mm wide x 300mm long. Between the strips was a layer of 316 stainless steel mesh 300mm long x 55mm wide with a wire mesh diameter of 0.15mm.

The 32R Retrofit collar comprised a 0.75mm steel casing with a 40mm inner diameter and a 106mm diameter base flange. The 32mm 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 4mm thick x 26mm wide x 135mm long, and 4mm thick x 26mm wide x 154mm long, respectively. Between the strips was a layer of 316 stainless steel mesh 135 mm long x 25mm wide with a wire mesh diameter of 0.15mm.

Penetration # 1 – SNAP 50R Retrofit fire collar protecting a nominal 1 ½ inch Chlorinated Polyvinyl Chloride (C-PVC) pipe

The 50R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 1 ½ inch (nom 38mm) C-PVC Pipe, with a wall thickness of 4.1mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 54mm diameter cut-out hole. The pipe was open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 2 SNAP 50R Retrofit fire collar protecting a nominal 50mm Polyvinyl Chloride (PVC) pipe

The 50R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 50mm PVC pipe and a PVC coupling with a total wall thickness of 5.2mm, fitted through the collar's sleeve and penetrating the plasterboard wall through a 54mm diameter cut-out hole. The pipe was open at the unexposed and capped with a PVC end cap on the exposed end.

Penetration # 3 – SNAP 65-80R Retrofit fire collar protecting a nominal 65mm Polyvinyl Chloride (PVC) pipe

The 65-80R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 65mm diameter PVC pipe and a PVC coupling with a total wall thickness of 5.8mm fitted through the collar's sleeve and penetrating the plasterboard wall through a 76mm diameter cut-out hole. The pipe was open at the unexposed and capped with a PVC end cap on the exposed end.

Penetration # 4 – SNAP 50R Retrofit fire collar protecting two nominal 25mm and 20mm Cross-linked polyethylene (PEX) pipes

The 50R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 20 PEX-b pipe (wall thickness of 3mm) and a 25 PE-x/Al/PE-x pipe (wall thickness of 2.3mm) were fitted through the collar's sleeve which penetrated the plasterboard wall through a 51mm diameter cut-out hole. The pipe was open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 5 – SNAP 32R Retrofit fire collar protecting a Telstra 26.75mm OD Polyvinyl Chloride – Unplasticised (PVC-U) conduit and 5 x Optical Fibres cables

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 20mm Telstra PVC conduit, with a wall thickness of 1.8mm penetrating the wall through a 32mm diameter cut-out hole. The conduit was open at the unexposed and capped with a Superwool plug on the exposed end. The conduit contained five optical fibre cables.

Penetration # 6 - SNAP 32R Retrofit fire collar protecting two cross-linked polyethylene (Pex B) nom. 20mm OD pipes

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating services comprised 2 x 20mm PEX-b pipes, with a wall thickness of 2.37mm penetrating the wall through a 44mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 9 – SNAP 32R Retrofit fire collar protecting two Cross-linked polyethylene (Pex) pipes nom. 20.2mm OD

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 20 PE-x/Al/PE-x pipe and a 20 PEX-b pipe, with a wall thickness of 2.2mm and 2.6mm respectively, penetrating the wall through a 44mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

The pipes projected horizontally, approximately 2000mm away from the unexposed face of the plasterboard wall and approximately 500mm into the furnace chamber. The pipes were supported at nominally 500mm and 1000mm from the unexposed face of the plasterboard wall.

The test results are summarised in the table below:

Test Report	ID	Collar Name	Fixings	Pipe Nominal Diameter (mm)	Pipe Material + content (if applicable)	Collar Detached (Y/N)	Test Results
FSP 1902	1	50R	10G 38mm coarse thread laminating screws	38	C-PVC	N	-/181/181
	2	50R	10G 38mm coarse thread laminating screws	50	PVC	N	-/181/181
	3	65-80R	10G 38mm coarse thread laminating screws	65	PVC	N	-/181/181
	4	50R	10G 38mm coarse thread laminating screws	25, 20 ¹	PE-x/Al/PE-x PEX	N	-/181/175
	5	32R	10G 38mm coarse thread laminating screws	26.75	Telstra PVC-U + 5x Optical Fibre Cable	N	-/181/170
	6	32R	10G 38mm coarse thread laminating screws	2x 20 ²	PEX B	N	-/181/167
	9	32R	10G 38mm coarse thread laminating screws	2x 202	PEX	N	-/181/179

A.6. CSIRO Sponsored Investigation report numbered FSP 1932

On the 14 August 2018, this Division conducted a full-scale fire-resistance test in accordance with AS 1530.4 -2014 on an insulated 90mm thick plasterboard lined steel framed wall which comprised a wall, each side lined with a single layer of 13mm thick Fyrchek sheets on 64mm deep metal studs. The wall system has an established fire resistance level (FRL) of -/60/60 as described as system SB60.1. The wall was penetrated by nine (9) pipes protected by various fire stopping systems.

For the purpose of the test, the specimens were referenced as Penetrations # 1, 2, 3, 4, 5, 6, 7, 8 and 9. Seven (7) penetrations are included in this report (Penetration # 1, 2, 3, 4, 6, 7, and 9).

The SNAP Retrofit 110R fire collar comprised a 0.75mm steel casing with a 122mm inner diameter and a 209mm diameter base flange. The 62mm high collar casing incorporated a closing mechanism that was comprised of three soft Intumesh intumescent wraps and wire meshes lined within the internal circumference of the collar. Intumescent A was 2.5mm thick x 58mm wide x 424mm long, Intumescent B was 2.5mm thick x 58mm wide x 407mm long and Intumescent C was 2.5mm thick x 58mm wide x 389mm long. Between intumescent strips, A and B was a layer of 304 stainless steel mesh 398mm long x 58mm wide and between intumescent strips B and C was a layer of 304 stainless steel mesh 398mm long x 58mm wide both had wire mesh diameters of 0.15mm.

The 32R Retrofit collar comprised a 0.75mm steel casing with a 40mm inner diameter and a 106mm diameter base flange. The 32mm 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 4mm thick x 26mm wide x 135mm long, and 4mm thick x 26mm wide x 154mm long, respectively. Between the strips was a layer of 316 stainless steel mesh 135 mm long x 25mm wide with a wire mesh diameter of 0.15mm.

The SNAP Retrofit 50R fire collar comprised a 0.75mm steel casing with a 62mm inner diameter and a 147mm diameter base flange. The 47mm high collar casing incorporated a closing mechanism that was comprised of two soft Intumesch intumescent wraps lined within the internal circumference of the collar. Intumescent A was 4mm thick x 43mm wide x 220mm long, and Intumescent B was 4mm thick x 43mm wide x 200mm long. Between the strips was a layer of 316 stainless steel mesh 210mm long x 42mm wide with a wire mesh diameter of 0.15mm.

Penetration # 1 – SNAP 110R Retrofit fire collar protecting a nominal 100mm Polyvinyl Chloride sandwich construction (PVC-SC) pipe incorporating a coupling inside the collar.

The 110R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 110mm outside diameter PVC-SC pipe with a wall thickness of 3.2mm and a PVC coupling with a total wall thickness of 6.4mm fitted through the collar's sleeve penetrating the plasterboard wall through a 114mm diameter cut-out hole. The pipe was open at the unexposed end and closed with a PVC end cap on the exposed end.

Penetration # 2 – SNAP 32R Retrofit fire collar protecting a nominal 16mm Pex-Al-Pex pipe.

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using M4 expandable steel anchors.

The penetrating service comprised a 16mm Pex-Al-Pex pipe, with a wall thickness of 2.3mm, penetrating the wall through a 20mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 3 – SNAP 32R Retrofit fire collar protecting a nominal 20mm Pex-Al-Pex pipe.

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using M4 expandable steel anchors.

The penetrating service comprised a 20mm Pex-Al-Pex pipe, with a wall thickness of 2.3mm, penetrating the wall through a 25mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 4 – SNAP 32R Retrofit fire collar protecting a nominal 16mm Pex-B pipe.

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using M4 expandable steel anchors.

The penetrating service comprised a 16mm Pex-B pipe, with a wall thickness of 2.4mm, penetrating the wall through a 20mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 6 – SNAP 32R Retrofit fire collar protecting a nominal 25mm Pex-B pipe.

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using M4 expandable steel anchors.

The penetrating service comprised a 25mm Pex-B pipe, with a wall thickness of 3.2mm, penetrating the wall through a 32mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 7 – SNAP 32R Retrofit fire collar protecting a nominal 16mm P-PVC pipe.

The 32R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 22mm P-PVC pipe, with a wall thickness of 2.0mm, penetrating the wall through a 25mm diameter cut-out hole. The pipes were open at the unexposed and capped with a Superwool plug on the exposed end.

Penetration # 9 – SNAP 50R Retrofit fire collar protecting a nominal 50mm Polyvinyl Chloride (PVC) pipe incorporating a coupling inside the collar.

The 50R fire collars were surface mounted around the pipe on both the exposed and unexposed face of the wall and fixed through three (3) mounting brackets using 38mm (10g) coarse thread laminating screws.

The penetrating service comprised a 56mm PVC pipe with a wall thickness of 2.3mm and a PVC coupling with a total wall thickness of 4.6mm, fitted through the collar’s sleeve and penetrating the plasterboard wall through a 60mm diameter cut-out hole. The pipe was open at the unexposed and capped with a PVC end cap on the exposed end.

The pipes projected horizontally, approximately 2000mm away from the unexposed face of the plasterboard wall and approximately 500mm into the furnace chamber. The pipe was supported at nominally 500mm and 1500mm from the unexposed face of the plasterboard wall.

The test results are summarised in the table below:

Test Report	Specimen ID	Collar Name	Fixings	Pipe Nominal Diameter (mm)	Pipe Material	Collar Detached (Y/N)	Test Results
FSP 1932	1	110R	10G 38mm coarse thread laminating screws	100	PVC-SC	N	-/62/60
	2	32R	M4 Expandable Metal Anchors	16	Pex-Al-Pex	N	-/62/62
	3	32R	M4 Expandable Metal Anchors	20	Pex-Al-Pex	N	-/62/62
	4	32R	M4 Expandable Metal Anchors	16	Pex-B	N	-/62/61
	6	32R	M4 Expandable Metal Anchors	25	Pex-B	N	-/62/60
	7	32R	10G 38mm coarse thread laminating screws	16	P-PVC	N	-/62/62
	9	50R	10G 38mm coarse thread laminating screws	50	PVC	N	-/62/62

A.7. Summary of test data regarding fixings

Test Report	Fire Rated Plasterboard Thickness	Nominal Diameter (mm)	Material + content (if applicable)	Fixings	Test Results	Collar Name	Collar Dislodged (Y/N)
FSP 1748 (2)	2x13mm	32	C-PVC	Hollow Wall Anchor	-/121/121	50R	N
FSP 1902 (1)	2x13mm	38	C-PVC	10G 38mm coarse thread laminating screws	-/181/181	50R	N
FSP 1716 (1)	2x16mm	160	HDPE	#427 Hollow Wall Anchors	-/166/163	HP150R	N
FSP 1902 (4)	2x13mm	25	PE-x/Al/PE-x	10G 38mm coarse thread laminating screws	-/181/175	50R	N
FSP 1902 (9)	2x13mm	20	PE-x/Al/PE-x	10G 38mm coarse thread laminating screws	-/181/179	32R	N
FSP 1716 (2)	2x16mm	32	Pex-A	#427 Hollow Wall Anchors	-/181/181	32R	N
FSP 1932 (2)	1x13mm	16	Pex-Al-Pex	M4 Expandable Metal Anchors	-/62/62	32R	N
FSP 1932 (3)	1x13mm	20	Pex-Al-Pex	M4 Expandable Metal Anchors	-/62/62	32R	N
FSP 1902 (4)	2x13mm	20	Pex-b	10G 38mm coarse thread laminating screws	-/181/175	50R	N
FSP 1902 (6)	2x13mm	2x 20	Pex-b	10G 38mm coarse thread laminating screws	-/181/167	32R	N
FSP 1902 (9)	2x13mm	20	Pex-b	10G 38mm coarse thread laminating screws	-/181/179	32R	N
FSP 1932 (4)	1x13mm	16	Pex-b	M4 Expandable Metal Anchors	-/62/61	32R	N
FSP 1932 (6)	1x13mm	25	Pex-b	M4 Expandable Metal Anchors	-/62/60	32R	N
FSP 1748 (1)	2x13mm	32	P-PVC	Hollow Wall Anchor	-/121/121	50R	N
FSP 1932 (7)	1x13mm	16	P-PVC	10G 38mm Laminating Screws	-/62/62	32R	N
FSP 1748 (8)	2x13mm	15	P-PVC Class 18	Hollow Wall Anchor	-/121/121	32R	N
FSP 1748 (3)	2x13mm	16	PVC	Hollow Wall Anchor	-/121/121	32R	N
FSP 1748 (6)	2x13mm	25	PVC	Hollow Wall Anchor	-/121/121	32R	N
FSP 1748 (7)	2x13mm	20	PVC	10G x 38mm plasterboard screws	-/121/121	32R	N
FSP 1902 (2)	2x13mm	50	PVC	10G 38mm coarse thread laminating screws	-/181/181	50R	N
FSP 1902 (3)	2x13mm	65	PVC	10G 38mm coarse thread laminating screws	-/181/181	65-80R	N

Test Report	Fire Rated Plasterboard Thickness	Nominal Diameter (mm)	Material + content (if applicable)	Fixings	Test Results	Collar Name	Collar Dislodged (Y/N)
Test Report	Fire Rated Plasterboard Thickness	Nominal Diameter (mm)	Material + content (if applicable)	Fixings	Test Results	Collar Name	Collar Dislodged (Y/N)
FSP 1932 (9)	1x13mm	50	PVC	10G 38mm coarse thread laminating screws	-/62/62	50R	N
FSP 1748 (4)	2x13mm	20	PVC + 3 core cables	Hollow Wall Anchor	-/121/121	32R	N
FSP 1748 (5)	2x13mm	25	PVC + 3 core cables	Hollow Wall Anchor	-/121/121	32R	N
FSP 1716 (5)	2x16mm	160	PVC-SC	#427 Hollow Wall Anchors	-/138/123	HP150R	Y
FSP 1748 (9)	2x13mm	100	PVC-SC	10G 38mm coarse thread laminating screws	-/121/121	110R	N
FSP 1932 (1)	1x13mm	100	PVC-SC	10G 38mm coarse thread laminating screws	-/62/60	110R	N
FSP 1902 (5)	2x13mm	25	PVC-U + 5x optical fibre cable	10G 38mm coarse thread laminating screws	-/181/170	32R	N
FSP 1716 (3)	2x16mm	110	Raupiano	#427 Hollow Wall Anchors	-/181/181	110R	N
FSP 1716 (4)	2x16mm	40	Raupiano	#427 Hollow Wall Anchors	-/181/181	50R	N
FSP 1759 (1)	2x13mm	15	Valsir Px-Al-Px	#423 Hollow Wall Anchors	-/181/181	GAS32	N
FSP 1759 (2)	2x13mm	20	Valsir Px-Al-Px	#423 Hollow Wall Anchors	-/181/109	32R	N
FSP 1759 (3)	2x13mm	15	Valsir Px-Al-Px	#423 Hollow Wall Anchors	-/181/169	32R	N
FSP 1759 (4)	2x13mm	20	Valsir Px-Al-Px	#423 Hollow Wall Anchors	-/181/176	GAS32	N
FSP 1759 (5)	2x13mm	26	Valsir Px-Al-Px	#423 Hollow Wall Anchors	-/181/138	GAS32	Y
FSP 1759 (6)	2x13mm	32	Valsir Px-Al-Px	#527 Hollow Wall Anchors	-/181/140	GAS50	Y
FSP 1759 (7)	2x13mm	40	Valsir Px-Al-Px	#527 Hollow Wall Anchors	-/181/170	GAS50	N
FSP 1759 (8)	2x13mm	50	Valsir Px-Al-Px	#527 Hollow Wall Anchors	-/181/114	GAS50	Y
FSP 1759 (9)	2x13mm	63	Valsir Px-Al-Px	#527 Hollow Wall Anchors	-/181/86	GAS63	Y

A.8. Summary of test reports for specific SNAP retrofit collars with PVC pipes

Snap retrofit collars with various pipes were tested in plasterboard lined walls. Their reports are summarised below

Summary of test reports for SNAP retrofit collars

Report	Pen. #	Collar	Element	Pipe Type	Pipe Dia. Nominal (mm)	Pipe thickness (mm)	Fitting	Integrity/ Insulation
FSP 1902	2	50R	2x13mm+ 64mm stud(116mm)	PVC	50	2.6 (total 5.2)	Y	-/181NF/ 181NF
FP 5663	6	50R	1x16mm+ 64mm stud(96mm)	PVC	50	2.4	N	-/91NF/ 75(wall)
FSP 2090	3	65-80R	2x13mm+ 64mm stud(116mm)	PVC	80	2.88 (total 5.76)	Y	-/181NF/ 150(collar)
FP 4874	9	65-80R	2x16mm+ 64mm stud(128mm)	PVC	80	3.1	N	-/185NF/ 167(collar)
FSP 1996	5	110R	2x13mm+ 64mm stud(116mm)	PVC-SC	100	3.58 (total 6.38)	Y	-/161NF/ 128(collar)
FSP 1748	9	110R	2x13mm+ 64mm stud(116mm)	PVC-SC	100	3.3	N	-/121NF/ 121NF
FSP 2090	6	HP150R	2x13mm+ 64mm stud(116mm)	PVC-SC	150	4.32 (8.64)	Y	-/181NF/ 128(collar)
FSP 1716	5	HP150R	2x16mm+ 64mm stud(128mm)	PVC-SC	150	4.05	N	-/138(cotton pad top of pipe)/ 123(collar)

Appendix B Analysis of Variations

B.1 Variation to include laminating screws

The proposed construction includes the pipes and Snap retrofit fire collars tested in FSP 1716, FSP 1748, FSP 1759, FSP 1932, and FSP1902 subject to the following variations;

- For SNAP retro-fit fire collar 32R, 50R, 63R, 65-80 R and 110R collar fixings shall be 10g x 38mm coarse thread bugle head laminating screw.

With reference to the test data summary in section A.7 of this report, it can be seen for all the test specimens that included the 10g x 38mm coarse thread bugle head laminating screw fixing met or exceeded the established FRL of the bare wall and there was no sign of failure or pull-out of the fixings from the wall.

The significance of the above finding is it demonstrates for collars with pipes that soften early do not exert high forces on the collar fixing during collar closure and minimise the amount of force the fixing needs to withstand during the fire test.

SNAP retro-fit fire collar 63R has the same geometric shape as 50R and 65-80R collars. Therefore, it is expected that its fixings will behave in a similar manner as that of 50R and 65-80R when tested.

Based on the above discussion it is considered the proposed variation will not detrimentally affect the fire resistance of the tested collars if tested in accordance with AS1530.4-2014 and AS4072.1-2005.

B.2 Variation to include M4 or larger expandable metal anchors

The proposed construction includes the pipes and Snap retrofit fire collars tested in FSP 1716, FSP 1748, FSP 1759, FSP 1932, and FSP1902 subject to the following variations;

- SNAP retro-fit fire collar 32R, 50R, 63R, 65-80 R and 110R, SNAP 65-80R, SNAP Gas32, SNAP Gas50, SNAP Gas63 and Snap retro-fit range HP150R the fixing shall vary to M4 (or larger) Expandable Metal Anchors examples include Powers HWA4SL or the Ramset HW13M4.

With reference to the test data summary in section A.7 of this report, it can be seen for all the test specimens that included the 10g x 38mm coarse thread bugle head laminating screw fixing or M4 (or larger) Expandable Metal Anchors mostly met or exceeded the established FRL of the bare wall. In some cases, there were signs of failure/pull-out of the fixings from the wall.

The significance of the above finding is it demonstrates for collars with pipes that do not soften early or include multiple springs exert higher forces on the collar fixing during collar closure and this can in some cases result in the collar to wall fixing failing.

In this assessment conservative approach has been taken to apply a requirement require for collars tested with mechanical anchors to retain those anchors though the size may increase and those tested with laminating screws may have those replaced with mechanical anchors.

SNAP retro-fit fire collar 63R has the same geometric shape as 50R and 65-80R collars. Therefore, it is expected that its fixings will behave in a similar manner as that of 50R and 65-80R when tested.

Based on the above discussion it is considered the proposed variation will not detrimentally affect the fire resistance of the tested collars if tested in accordance with AS1530.4-2014 and AS4072.1-2005.

B.3 Variation to wall construction

The proposed construction shall be Snap retrofit collars tested in FSP 1716, FSP 1748, FSP 1902, FSP 1996, FSP 2090, FP 4874 and listed in Table 2, and subject to the following variations:

- The inclusion of minimum 78mm thick Speedpanel wall tested or assess for an FRL of at least - /120/120 as a support construction.
- The inclusion of plasterboard patch over a section of Speedpanel wall at the location of the penetrating PVC pipes
- The pipe shall be protected by SNAP collars as shown in Table 2 on each side of the wall and installed as per Figures 1-5
- Fixings for retrofit collars to plasterboard patch shall be as per Table 1
- Plastic pipes are to be supported on each side of the wall.

The PVC compounds with the greatest short-term and long-term strengths are those that contain no plasticisers and the minimum of compounding ingredients. This type of PVC is known as UPVC or PVC-U. Other resins or modifiers (such as ABS, CPE or acrylics) may be added to UPVC to produce compounds with improved impact resistance. These compounds are known as modified PVC (PVC-M). Flexible or plasticised PVC compounds, with a wide range of properties, can also be produced by the addition of plasticisers. Other types of PVC are called oriented PVC (PVC-O) which is PVC-U where the molecules are preferentially aligned in a particular direction. PVC-O is identical in composition to PVC-U and their general properties are correspondingly similar. The major difference lies in the mechanical properties in the direction of orientation. The composition of PVC-M differs by the addition of an impact modifier and the properties deviate from standard PVC-U depending on the type and amount of modifier used.

In this assessment, a conservative approach has been applied to use the results of tests of UPVC with fitting included in the body of the collar to support the performance of UPVC, PVC-O or PVC-M pressure pipes of similar wall thickness (with and without fitting)

Plasterboard lined wall

50mm UPVC, PVC-O or PVC-M Pressure Pipe

The proposed construction comprises a 50R collar protecting 50mm PVC pressure pipe (PN12) when penetrating a minimum 116mm thick plasterboard lined wall.

With reference to FSP 1902 specimen 2, an 50mm PVC pipe penetrated a 116mm thick plasterboard lined stud wall and was protected on each side with a 50R collar. In the fireside collar, the PVC coupling was also installed such that the total PVC wall thickness in the collar came to 5.2mm. It was able to maintain integrity and insulation for 181 minutes without failure.

From the temperature profile of the pipe in FSP 1902 specimen 2, it is evident that the fireside collar was able to close off the pipe and the coupling within the first 5 minutes of the test.

The proposed 50mm UPVC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling has the same or less wall thickness as that of the PVC pipe and fitting tested in FSP 1902 specimen 2.

With reference to FP 5663 specimen 6, the 50R collar also demonstrated the ability to close off a 50mm PVC pipe with a wall thickness of 2.4mm for at least 60 minutes in a plasterboard lined wall.

The proposed pipe thickness with or without fitting is within the pipe thickness tested in FSP 1902 specimen 2 and FP 5663 specimen 6.

Therefore, it is expected that the 50R collar would be able to close off the 50mm UPVC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling such that the unexposed side pipe will not fail insulation for up to 60 minutes.

The non-fire side collars in and FSP 1902 specimen 2, did not activate at least for the first 90 minutes of the test. Therefore, even though the specimens are asymmetrical in that coupling was only installed on the fireside, the fire performance of the tested specimens are applicable for a symmetrical specimen with a coupling on both side of the wall for up to 60 minutes since the non-fire side collar was not involved in closing off the pipe for up to 60 minutes.

Based on the above, it is expected that the proposed construction will maintain integrity and insulation for up to 60 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

80mm UPVC, PVC-O or PVC-M Pressure Pipe

The proposed construction comprises a 65-80R collar protecting 80mm PVC pressure pipe (PN12) when penetrating a minimum 116mm thick plasterboard lined wall.

With reference to FSP 2090 specimen 3, an 80mm PVC pipe penetrated a 116mm thick plasterboard lined stud wall and was protected on each side with a 65-80R collar. In the fireside collar, the PVC coupling was also installed such that the total PVC wall thickness in the collar came to 5.76mm. It was able to maintain integrity 181 minutes without failure and failed insulation on the collar at 150 minutes.

From the temperature profile of the pipe in FSP 2090 specimen 3, it is evident that the fireside collar was able to close off the pipe and the coupling within the first 7 minutes of the test.

The proposed 80mm UPVC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling has the same or less wall thickness as that of the PVC pipe and fitting tested in specimen 3.

With reference to FP 4874 specimen 9, the 65-80R collar also demonstrated the ability to close off an 80mm PVC pipe with a wall thickness of 3.1mm for at least 60 minutes in a plasterboard lined wall.

The proposed pipe thickness with or without fitting is within the pipe thickness tested in FSP 2090 specimen 3 and FP 4874 specimen 9.

Therefore, it is expected that the 65-80R collar would be able to close off the 80mm UPVC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling such that the unexposed side pipe will not fail insulation for up to 60 minutes.

The non-fire side collars in and FSP 2090 specimen 3, did not activate until after 120 minutes. Therefore, even though the specimens are asymmetrical in that coupling was only installed on the fireside, the fire performance of the tested specimens are applicable for a symmetrical specimen with a coupling on both side of the wall for up to 60 minutes since the non-fire side collar was not involved in closing the pipe for up to 60 minutes.

Based on the above, it is expected that the proposed construction will maintain integrity and insulation for up to 60 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

100mm UPVC, PVC-O or PVC-M Pressure Pipe

The proposed construction comprises a 110R collar protecting 100mm PVC-SC pressure pipe (PN12) when penetrating a minimum 116mm thick plasterboard lined wall.

With reference to FSP 1996 specimen 5, an 100mm PVC pipe penetrated a 116mm thick plasterboard lined stud wall and was protected on each side with a 110R collar. In the fireside collar, the PVC coupling was also installed such that the total PVC wall thickness in the collar came to 6.38mm. It was able to maintain integrity for 161 minutes without failure and failed insulation on the collar at 128 minutes.

From the temperature profile of the pipe in FSP 1996 specimen 5, it is evident that the fireside collar was able to close off the pipe and the coupling within the first 9 minutes of the test.

The proposed 100mm UPVC-SC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling has the same or less wall thickness as that of the PVC pipe and fitting tested in FSP 1996 specimen 5.

With reference to FSP 1748 specimen 9, the 110R collar also demonstrated the ability to close off a 100mm PVC-SC pipe with a wall thickness of 3.3mm for at least 60 minutes in a plasterboard lined wall.

The proposed pipe thickness with or without fitting is within the pipe thickness tested in FSP 1996 specimen 5 and FSP 1748 specimen 9.

Therefore, it is expected that the 110R collar would be able to close off the 100mm UPVC-SC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling such that the unexposed side pipe will not fail insulation for up to 60 minutes.

The non-fire side collars in and FSP 1996 specimen 5, did not activate at least for the first 90 minutes of the test. Therefore, even though the specimens are asymmetrical in that coupling was only installed on the fireside, the fire performance of the tested specimens are applicable for a symmetrical specimen with a coupling on both side of the wall for up to 60 minutes since the non-fire side collar was not involved in closing off the pipe for up to 60 minutes.

Based on the above, it is expected that the proposed construction will maintain integrity and insulation for up to 60 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

150mm UPVC, PVC-O or PVC-M Pressure Pipe

The proposed construction comprises an HP150R collar protecting 150mm PVC-SC pressure pipe (PN12) when penetrating a minimum 116mm thick plasterboard lined wall.

With reference to FSP 2090 specimen 6, an 150mm PVC pipe penetrated a 116mm thick plasterboard lined stud wall and was protected on each side with a 110R collar. In the fireside collar, the PVC coupling was also installed such that the total PVC wall thickness in the collar came to 8.64mm. It was able to maintain integrity for 181 minutes without failure and failed insulation on the collar at 128 minutes.

From the temperature profile of the pipe in FSP 2090 specimen 6, it is evident that the fireside collar was able to close off the pipe and the coupling within the first 6 minutes of the test.

The proposed 150mm UPVC-SC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling has the same or less wall thickness as that of the PVC pipe and fitting tested in FSP 2090 specimen 6.

With reference to FSP 1716 specimen 5, the HP150R collar also demonstrated the ability to close off a 150mm PVC-SC pipe with a wall thickness of 4.03mm for at least 60 minutes in a plasterboard lined wall.

The proposed pipe thickness with or without fitting is within the pipe thickness tested in FSP 2090 specimen 6 and to FSP 1716 specimen 5.

Therefore, it is expected that the HP150R collar would be able to close off the 150mm UPVC-SC, PVC-O or PVC-M pressure pipe (PN12) with or without fitting/coupling such that the unexposed side pipe will not fail insulation for up to 60 minutes.

The non-fire side collars in and FSP 2090 specimen 6, did not activate at least for the first 90 minutes of the test. Therefore, even though the specimens are asymmetrical in that coupling was only installed on the fireside, the fire performance of the tested specimens are applicable for a symmetrical specimen with a coupling on both side of the wall for up to 60 minutes since the non-fire side collar was not involved in closing off the pipe for up to 60 minutes.

Based on the above, it is expected that the proposed construction will maintain integrity and insulation for up to 60 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

Speedpanel wall

The proposed construction comprises the proposed UPVC, PVC-O or PVC-M pressure pipe (PN12) as shown in Table 2 when penetrating a minimum 78mm thick Speedpanel wall and protected with the patch method as shown in Figure 5.

The proposed configuration is similar to a 116mm stud wall in that the 78mm Speedpanel act as a frame separator for the two layers of 13mm fire rated plasterboard on each side of the wall.

Therefore, it is expected that the proposed configuration will allow the collar to close the pipe in the same manner as when the two layers of 13mm fire rated plasterboard lining each aide of stud lined wall without introducing a weakness between the wall construction and the collar.

As the Speedpanel undergoes heating, there will be evaporation of free water in the Speedpanel concrete core during the first 60 minutes of the test which will result in a cooling down of the cavity temperature between the plasterboard linings.

This will intern reduce the temperature of the fire collar on the unexposed side, which may delay the activation of the non-fire side collar leading to early specimen failure.

As discussed above, the proposed SNAP retrofit fire collar on the non-fire side does not activate and thus do not contribute to the reduction of temperature of the pipe for the first 60 minutes of the test. Therefore, a reduced temperature of the non-fire side collar will not detrimentally affect the performance of the specimen for up to 60 minutes.

The proposed configuration also comprises Fuller Firesound sealant sealing off the gap between the Speedpanel and the plasterboard patch. This will stop the fluing of furnace gas leaking through the gap between the plasterboard patch and the Speedpanel wall profile, allowing the wall to maintain insulation at the location of the patch for at least 60 minutes.

Based on the above, it is expected that the proposed construction will maintain integrity and insulation for up to 60 minutes when tested in accordance with AS 1530.4-2014 and assessed in accordance with AS 4072.1 -2005.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION

Infrastructure Technologies

Keith Nicholls
Group Leader, Fire Testing and Assessments
t +61 2 94905450
e keith.nicholls@csiro.au
w <https://research.csiro.au/infratech/fire-safety/fire-testing/>

Infrastructure Technologies

Jing Xu
Fire Testing and Assessments
t +61 2 9490 8041
e jing.xu@csiro.au
w <https://research.csiro.au/infratech/fire-safety/fire-testing/>